Susitna-Watana Hydroelectric Project Document
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Revised Study Plan

Susitna-Watana Hydroelectric Project

FERC No. 14241

Appendix 2

FERC-filed Letters Coded with Comment Identifiers

December 2012

Appendix Arrangement: Comment Letters in Appendix 2 are provided in the following order:

1. Federal Energy Regulatory Commission (FERC)
2. State of Alaska
3. United States Department of the Interior – National Park Service (NPS)
4. United States Department of the Interior – Fish and Wildlife Service (USFWS)
5. United States Department of Commerce – National Oceanic and Atmospheric Administration (NMFS)
6. United States Department of the Interior – Bureau of Land Management (BLM)
7. United States Environmental Protection Agency (EPA)
8. Cook Inlet Region, Inc. (CIRI)
9. Alaska Hydro Project (AHP), Alaska Survival (AS), Coalition for Susitna Dam Alternatives (CSDA)
10. Natural Resource Defense Council (NRDC)
11. Trout Unlimited (TU)
12. Chase Community Council (CCC)
13. Copper County Alliance (CCA)
14. The Center for Water Advocacy (CWA)
15. Talkeetna Community Council, Inc. (TCCI)
16. The Nature Conservancy (TNC)
17. Talkeetna Defense Fund (TDF)
18. Jennifer Barnett
19. Donnie Billington
20. Donnie Billington
21. Will Boardman
22. Greg Campbell
23. Shelly Campbell
24. Coalition for Susitna Dam Alternatives (CSDA)
25. Tony Crocetto
26. Davis B. Downey
27. Lara Gentzel
28. Sarah Kohe
29. Jen Latham
30. Becky Long
31. Brian Okonek
32. David and Sandra Porter
33. Denis Ransy
34. Mary L. Rachel
35. Cari Sayre
36. Douglas Smith
37. John Strasenburgh
38. Cathy Teich
39. Cathy Teich
40. Ellen Wolf
41. Ruth Wood
42. Katie Writer
43. Diane Ziegner

Comment Code, RSP Study Title, and RSP Section Number Key:

Comment Code[i]	RSP Study Title (Resource Area)	RSP Section Number
GEN	General Comment	No Particular Section of RSP
GS	Geology and Soils	4.5
WQ	Baseline Water Quality Study	5.5
WQMOD	Water Quality Modeling Study	5.6
MERC	Mercury Assessment and Potential for Bioaccumulation Study	5.7
GEO	Geomorphology Study	6.5
FGM	Fluvial Geomorphology Modeling below Watana Dam Study	6.6
GW	Groundwater Study	7.5
ICE	Ice Processes in the Susitna River	7.6
GLAC	Glacier and Runoff Changes Study	7.7
IFS	Instream Flow Study	8.5
RIFS	Riparian Instream Flow Study	8.6
FISH	Fish and Aquatic Resources	General to Section 9 of RSP
FDAUP	Study of Fish Distribution and Abundance in the Upper Susitna River	9.5
FDAML	Study of Fish Distribution and Abundance in the Middle and Lower Susitna River	9.6
ESCAPE	Salmon Escapement Study	9.7
RIVPRO	River Productivity Study	9.8
AQHAB	Characterization and Mapping of Aquatic Habitats	9.9
RESFSH	The Future Watana Reservoir Fish Community and Risk of Entrainment	9.10
PASS	Study of Fish Passage Feasibility at Watana Dam	9.11
BARR	Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries	9.12
AQTRANS	Aquatic Resources Study within the Access Alignment, Transmission Alignment, and Construction Area	9.13
GENE	Genetic Baseline Study for Selected Fish Species	9.14
FHARV	Analysis of Fish Harvest in and Downstream of the Susitna-Watana Hydroelectric Project Area	9.15
EUL	Eulachon Run Timing, Distribution, and Spawning in the Susitna River	9.16
CIBW	Cook Inlet Beluga Whale Study	9.17
WILD	Wildlife Resources	General to Section 10 of RSP
MOOSE	Moose Distribution, Abundance, Movements, Productivity, and Survival	10.5
CBOU	Caribou Distribution, Abundance, Movements, Productivity, and Survival	10.6
DALL	Dall’s Sheep Distribution and Abundance	10.7
LGCAR	Distribution, Abundance, and Habitat Use by Large Carnivores	10.8

Comment Code[i]	RSP Study Title (Resource Area)	RSP Section Number
WOLV	Wolverine Distribution, Abundance, and Habitat Occupancy	10.9
TERFUR	Terrestrial Furbearer Abundance and Habitat Use	10.10
AQFUR	Aquatic Furbearer Abundance and Habitat Use	10.11
SMAM	Small Mammal Species Composition and Habitat Use	10.12
BAT	Bat Distribution and Habitat Use	10.13
RAPT	Surveys of Eagles and Other Raptors	10.14
WTBRD	Waterbird Migration, Breeding, and Habitat Use Study	10.15
BREED	Landbird and Shorebird Migration, Breeding, and Habitat Use Study	10.16
PTAR	Population Ecology of Willow Ptarmigan in Game Management Unit 13	10.17
FROG	Wood Frog Occupancy and Habitat Use	10.18
WLDHAB	Evaluation of Wildlife Habitat Use	10.19
WHARV	Wildlife Harvest Analysis	10.20
VWHAB	Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin	11.5
RIP	Riparian Vegetation Study Downstream of the Proposed Sustina-Watana Dam	11.6
WETLND	Wetland Mapping Study	11.7
RARE	Rare Plant Study	11.8
INVAS	Invasive Plant Study	11.9
REC	Recreation Resources Study	12.5
AES	Aesthetic Resources Study	12.6
RECFLW	River Recreation Flow and Access Study	12.7
CUL	Cultural Resources Study	13.5
PALEO	Paleontological Resources Study	13.6
SUB	Subsistence Resources Study	14.5
ECON	Regional Economic Evaluation Study	15.5
SOC	Social Conditions and Public Goods Study	15.6
TRAN	Transportation Resources Study	15.7
HEALTH	Health Impact Assessment Study	15.8
AIR	Air Quality Study	15.9
FLOOD	Probably Maximum Flood Study	16.5
SEIS	Site-Specific Seismic Hazard Study	16.6

[i] Code corresponds to Appendix 2 coding of comment letters.

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426
November 14, 2012

OFFICE OF ENERGY PROJECTS

Project No. 14241-000—Alaska
Susitna-Watana Hydroelectric Project
Alaska Energy Authority

Wayne Dyok
Susitna-Watana Project Manager
Alaska Energy Authority
813 West Northern Lights Boulevard
Anchorage, AK 99503

Reference: Comments on Proposed Study Plan

Dear Mr. Dyok:

Commission staff's comments on your proposed studies are included in the attached schedule A and are based on our review of the Susitna-Watana Hydroelectric Project proposed study plan filed on July 16, 2012, participation in various work group meetings, and our review of the draft revised study plans posted on AEA's web page.

GEN-41

To avoid future coordination and reporting concerns expressed by the National Marine Fisheries Service in their October 31 filing, as well as other agency representatives during the work group meetings, we recommend that your revised study plan include a master schedule that includes the estimated start and completion dates of all field studies, when progress reports will be filed, who will receive the progress reports and in what format, and the filing date of the initial and updated study reports.

If you have any questions, please contact David Turner at (502) 202-6091 or david.turner@ferc.gov.

Sincerely,

Jennifer Hill, Chief
Northwest Branch
Division of Hydropower Licensing

Enclosures: Schedule A

cc: Mailing list
Public Files

Schedule A
Comments on Proposed Study Plan

Unless stated otherwise, our comments are based on our review of the draft revised studies posted on Alaska Energy Authority's web page (http://www.susitna-watanahydro.org/project/draft-revised-study-plan-status-listing/) as of November 7, 2012. We first address some global concerns in our general comments, then turn to study-specific needs. Please address our requests and comments in your revised study plan (RSP), which must be filed with the Commission by December 14, 2012.

General Comments

Tracking Study Disagreements

GEN-22

Section 5.11(b)(4) of the Commission's regulations states that your proposed study plan (PSP) must include an explanation for why any requested studies are not adopted. In your PSP, you state that agencies and other licensing participants made a total of 52 individual study requests. You also state that the PSP includes a proposal to undertake all but one of the requested studies, with some alterations and adjustments. Therefore, you contend that the overwhelming majority of the study requests are incorporated into the PSP.

While it is true that the PSP includes studies that address most of the resource areas that were identified in the study requests filed by agencies and other licensing participants, there are numerous instances in which components of the study requests were not adopted in the PSP, and you do not provide an explanation for why the study components were not adopted. We provide the following examples of study components that were not adopted in your PSP and no explanation as to why they were not adopted was provided: (1) the Fish and Wildlife Service (FWS) requested that you analyze the contribution of marine derived nutrients from non-salmon anadromous species, (2) FWS requested that you characterize the use of biological flow cues to complete life-history strategies, and (3) the National Marine Fisheries Service (NMFS) and FWS requested that riverine habitat be characterized for the entire project area from the mouth to the dam site.

Section 5.13 (a) of the Commission's regulations requires you to include comments on the PSP and how you attempted to resolve disagreements regarding study needs. This includes any components of the study requests that are not adopted in your RSP. We frequently heard from stakeholders during the study meetings, primarily in the aquatic working group, that it was not always possible to determine how a study request component was addressed. To ensure that all differences in perceived study needs are identified and addressed, we recommend that your RSP clearly track all differences between your study proposal and the requested studies, as well as any future comments you receive on the draft RSP. Your filing must include an explanation of why any components of the study requests are not adopted.

Adaptive Study Implementation

GEN-23

In multiple study plans, you propose to modify the methods or geographic scope of the study in response to preliminary study results (e.g., *Geomorphology* (Section 5.8), *Fluvial Geomorphology Modeling* (Section 5.9), *Water Quality* (Sections 5.5, 5.6, and 5.12), *Fish and Aquatics Instream Flows* (Section 6.5), and *Fish Distribution and Abundance* (Sections 7.5, 7.6)). For each of these studies, the RSP should clearly describe any decision-making process or schedule by which study methods would be refined or adapted in consultation with agencies and other stakeholders during the study implementation period, including any criteria that will trigger changes in the study plan.

Flow-routing Model

Numerous study plans (e.g., *Geomorphology*, *Fish and Aquatics Instream Flows, Ice Processes, etc.)* refer to development of a flow-routing model that, when completed, will be used to determine the geographic scope (i.e., downstream extent) of several other studies and modeling efforts. The flow-routing model is only vaguely defined and referenced throughout various study plans. There is no specific study plan that describes its implementation, a schedule for reporting on its results, or how or when such results would inform or result in modifications to the other study plans. You suggest that, based on the initial results of the flow-routing model, you may need to add additional transects to improve its performance between river mile (RM) 184 and RM 75, and to possibly extend the downstream extent of the model past RM 75.

IFS-035

It is important to define the flow-routing model and the downstream extent of the flow-routing model because a number of studies are dependent on its results to inform various aspects of their implementation (e.g., geographic scope, additional sampling areas if the flow-routing model indicates that project effects would occur downstream of proposed sampling areas). Therefore, please include in your RSP a description of the flow-routing model and a schedule and the specific criteria that you will use to establish the downstream extent of the flow-routing model. The RSP should clearly document: (1) the other study plans that may be modified based on the outcome of the flow-routing model; (2) how each plan would be modified; and (3) triggers for modifications to each plan.

Precedence for Multiple Models

FGM-4
ICE-06
IFS-101
RIFS-03

Several studies (e.g., *Fluvial Geomorphology Modeling below Watana Dam*, *Geomorphology*, *Ice Processes in the Susitna River*, *Instream Flow*, and *Riparian Instream Flow*) discuss hydraulic, flow-routing, habitat-specific, and sediment-transport models. Some of these studies describe the use of one-dimensional and two-dimensional models. Because the focus of each study is different, it is possible that multiple models would be used to assess conditions for a common reach of the river. Where this is the case, please describe in each of the relevant studies how the different modeling results would be used. Where a parameter is measured (or estimated using a model) in more than one study, define which value will take precedence.

Study Framework and Relationships between Studies

GEN-24

All individual study plans within your RSP should use consistent language and terminology throughout the document for terms such as: study site, intensive site, habitat type, study area, focus area, reach, and river segment.

Your RSP should provide a clear description of the relationship between studies. You provided flow charts depicting the interrelationships of the various studies. However, it is still not always clear where information is coming from or how it will be used in the various studies. Figures depicting study interdependency should refer to applicable study plan sections or subsections where appropriate, and the respective study plan sections should describe interdependencies so that the reader understands what specific information is being used in what studies, where it comes from, how results will be presented, how they will be used, etc.

IFS-014
GW-003
ICE-07
WQ-02
GEO-06
RIFS-04

Reach and Habitat Stratification and Study Site Selection and Location

Your RSP should clearly describe the exact number, location, and spatial extent of your proposed focus areas for each proposed study. In addition, the RSP should provide justification for the number of proposed sites selected for detailed 2-D hydraulic modeling and other intensive study elements. Please include criteria to be used for selecting focus areas and study-specific rationale for co-locating sites.

GEN-25
RIFS-43
RAPT-6
RIP-23
CUL-21

Integrating 2012 Study Efforts into the Project Study Plan

In some cases, you have developed plans for and are carrying out studies in consultation with stakeholders to voluntarily collect information in 2012 that will help you prepare or refine a study plan. Please describe how these 2012 efforts were or are being incorporated into the RSP.

Water Quality

Baseline Water Quality (Section 5.5)

WQ-03 In section 5.5.4.2, *Meteorological Data Collection*, please explain or address the inconsistencies between the text and Table 5.5-2 regarding river miles associated with meteorological stations.

WQ-04 In section 5.5.4.8, *Technical Report on Results*, you state that water quality conditions will be described in greater detail at the Focus Areas (section 5.5.4.5), but descriptions over shorter time intervals will not be possible for general chemistry and metals because site visits and sample collection will be limited to monthly sampling due to the remoteness of the Focus Areas. However, section 5.5.4.5 states that sampling will occur every 2 weeks for 6 weeks. Please resolve this apparent inconsistency.

WQ-05 In section 5.5.4.9, you propose to conduct a pilot thermal imagery study to evaluate the availability of thermal refugia for fish. The objective of the study is to determine whether thermal imagery can be used to identify thermal refugia throughout the project vicinity. Please clarify the criteria that would be used to make the determination on whether to expand the assessment, and provide a schedule for reporting the results of the pilot study. Your RSP should also include any alternative methods that you would use to identify thermal refugia in the event the pilot study is unsuccessful. If you do not propose any alternative methods, then please state that to be the case and provide an explanation for why no alternative methods are proposed.

WQ-06 In section 5.5.4.9.2, *Calibrating Temperature*, please describe how water temperature monitoring instruments will be calibrated, or refer to the SAP/QAPP, as appropriate.

WQ-07 Section 5.5.6, *Schedule*, presents a schematic entitled Interdependencies for Water Resource Studies and indicates that additional detail will be provided. Please provide the additional detail in your RSP.

Water Quality Modeling (Section 5.6)

WQ-08 In section 5.6.4.8, *Reservoir and River Downstream of Reservoir Modeling Approach*, you use the term "initial reservoir condition" to describe baseline conditions without the project. It would improve clarity if you removed the term reservoir and referred to a without project scenario as initial condition or existing condition.

WQ-09 It appears as though there are inconsistencies between the river miles noted in the text and those presented in Table 5.5-1; please address these inconsistencies in your RSP.

WQ-10 In section 5.6.4.8, please clarify what is meant by the statement: measuring additivity or synergism of toxics effects from multiple stressors is simplistic and is determined by identifying the single, worst, or dominant stressor (simple comparative effect model). If this statement is consistent with current scientific understanding, then please provide a citation to support the statement.

WQ-11 Section 5.6.6, *Schedule,* contains two different versions of the schematic titled Interdependencies for Water Resource Studies. Please remove the outdated version. The schematic and associated discussion also appears in sections 5.5.6 and 5.7.6. Please present the material in just one section and cross-reference to it in subsequent water quality studies.

Mercury Assessment and Potential for Bioaccumulation (Section 5.7)

WQ-12 Section 5.7.1, *General Description of the Proposed Study*, provides a general summary of the technical information presented in Section 5.7.2, *Existing Information and Need for Additional Information*, as an introduction to the key questions and study objectives. It would be helpful to include a few relevant literature citations from section 5.7.2 in this summary, particularly following the sentences beginning with “Many studies…” and “Based on several studies…”

WQ-13 Please review the list of mechanisms for mercury bioaccumulation presented in section 5.7.2., *Existing Information and Need for Additional Information*, for accuracy. Is the focus of methylmercury production on water-column bacteria rather than sediment bacteria? Are anoxic conditions always created by decay of organic material in the water column? Is inorganic mercury used by bacteria to “continue the decay process” or is its use a byproduct of cellular respiration? Do “larger predators” (please define) actually consume bacteria? What about uptake of water column methylmercury by algae and subsequent transfer to higher trophic levels? Please provide citations for the mechanistic processes you are describing.

WQ-14 In section 5.7.3, *Study Area*, please describe how construction-related impacts from road crossing sites affect mercury concentrations. This section also indicates that additional details regarding mercury sampling sites will be added in the RSP. Please provide this additional detail in the RSP.

WQ-15 Section 5.7.4.2, *Collection and Analyses of Soil, Vegetation, Water, Sediment, Sediment Pore Water, Avian, Terrestrial Furbearer, and Fish Tissue Samples for Mercury*, states that data will be collected from multiple aquatic media including surface water, sediment, avian, terrestrial furbearer, and fish tissue. This statement is not consistent with comment responses in Table 5.4-1, which indicate that the mercury study is limited to predicting impacts related to water, sediment, and fish. Sections 5.7.4.2.5, *Avian*, and 5.7.4.2.6, *Terrestrial Furbearers*, indicate that additional information will be provided in the RSP. Please provide the additional information and ensure that it is consistent with comment responses in Table 5.4-1 and addresses both NMFS' and FWS' study requests related to mercury.

WQ-16 Please clarify the reference to "sex and sexual" data collection for fish tissue in section 5.7.4.2.7, *Fish Tissue.* The reference was possibly meant to be "sex and sexual maturity."

WQ-17 The comment responses in Table 5.4-1 indicate the possible addition of macroinvertebrate sampling in section 5.5.4.7, *Baseline Metals Levels in Fish Tissue*, and section 5.5.4.7 states that macroinvertebrate sampling may occur if mercury is detected. However, this is not discussed in section 5.7, *Mercury Assessment and Potential for Bioaccumulation Study.* Please ensure that the water quality studies are consistent with one another.

GEOMORPHOLOGY

Geomorphology (Section 6.5) and Fluvial Geomorphology Modeling (Section 6.6)

GEO-07 In section 6.5.4.1, *Delineate Geomorphically Similar [Homogeneous] Reaches*, you describe using an initial geomorphic classification system containing three single channel reach types and four multiple channel reach types, based in part on their characteristic sediment storage features. Table 9.9-4 in section 9.9.5.4.2, *Characterization and Mapping of Aquatic Habitats*, describes mainstem macrohabitat types (main-channel, off-channel, and tributary) that are nested within these geomorphic reach types and are defined in part by their characteristic morphology. It would be helpful if sediment storage features characteristic of geomorphic reaches were defined or related more directly to the type of geomorphic features characteristic of the mainstem habitat types.

GEO-09 In section 6.5.4.5.1, you state that results from *Study Component 5: Riverine Habitat versus Flow Relationship Middle River* will provide the basis for macrohabitat mapping to support the Instream Flow Study. Please clarify how the results from study component 5 will be used to quantify total or usable habitat area under a range of flows as part of the instream flow study.

INSTREAM FLOW

Fish and Aquatics Instream Flow (Section 8.5)

IFS-016 In section 8.5.4.2.1.1, you indicate that the instream flow study area consists of two river segments, the Middle River (MR) and Lower River (LR) segments. You currently propose to model from the dam location downstream to RM 75. Based on the geomorphic mapping presented in the geomorphology study (section 6.5, Figure 6.5-4), RM 75 is located near the middle of Reach LR2; therefore, modeling would include all of Reach LR1, and a portion (9 of the 23 miles) of Reach LR2. Please describe how you intend to assess project effects within the Lower River segment using the proposed framework, particularly in regard to reach LR2, when your proposed modeling will encompass less than half of the LR2 geomorphic reach.

IFS-017 In section 8.5.4.2.1.2, you indicate that no focus areas were selected in reach MR3 upstream of Devils Canyon (in addition to reach MR4 Devils Canyon) due to safety concerns. Please describe the safety considerations associated with reach MR3 that would prohibit you from implementing a focus area in this reach. You should also describe how you intend to assess project effects in reach MR3 without a focus area to "provide for an overall understanding of interrelationships of river flow dynamics on the physical, chemical and biological factors that influence fish habitat" in the reach.

IFS-034 In section 8.5.4.3.1, you state that the hydraulic-routing model will extend downstream until flow fluctuations are within the range of without-project conditions. Please define this range and associated thresholds in your RSP and explain them in terms of the operational scenarios (e.g., worst-case scenario) and criteria that will be used in the decision-making process.

IFS-018 In section 8.5.4.2.1.2, you indicate that transects established for the flow-routing model were primarily located across single-thread (i.e., non-braided) sections of the river. While this is appropriate for developing the mainstem flow-routing model, the same model/transects would not adequately represent the frequency, distribution, abundance, and diversity of habitats and habitat conditions within the Middle River and Lower River segments for other study purposes. In section 8.5.4.6 (*Habitat Specific Model Development*), you indicate that additional transects will be selected to describe distinct habitat features in addition to those used for defining the mainstem flow-routing model. Presumably, the additional transects will be used to expand the model for the purpose of assessing habitat conditions in relation to flow for such features, and use the results to extrapolate conditions on a broader scale (e.g., geomorphic reach). To achieve this purpose, additional transects will likely be needed to characterize habitat conditions in the reaches being evaluated. In your RSP, please distinguish between the mainstem flow-routing model and any modified/expanded versions that may be used to describe distinct habitat features (e.g., stranding/trapping), or for purposes such as sediment transport. In addition, please describe how these 1-D models relate to focus areas and whether they overlap or will be integrated with the proposed 2-D modeling that will be implemented within some or all of the focus areas.

IFS-002
AQHAB-02
GEO-08

In section 8.5.3, *Study Area*, you describe your proposed hierarchical habitat classification system. Please ensure that the category descriptions, definitions, and terminology are consistent with those presented in the *Geomorphology Study*, *Characterization and Mapping of Aquatic Habitats Study*, and any other related studies. For example, in Table 9.9-4, you describe split-main and braided-main channel types, which are not described in section 8.5.3. Moreover, in the description of *HSC Study Site Selection,* you refer to a percolation channel, a term that is not used elsewhere.

IFS-006

In section 8.5.4.1, *IFS Analytical Framework*, you state that figure 8.5-11 depicts the analytical framework of the instream flow study commencing with the reservoir operations model that will be used to generate alternative operational scenarios under different hydrologic conditions. However, figure 8.5-11 does not provide a reference to the study plan that describes the reservoir operations model. To improve clarity of the RSP, please include in Figure 8.5-11 a cross-reference to the section of the study plan where you describe the reservoir operations model that will be used to generate alternative operational scenarios. Also, it would be helpful if you included in figure 8.5-11 a cross-reference to the section of the RSP where hydrologic elements (e.g., representative water years, seasonal storage & release, hourly dam releases, flood flows) are described.

IFS-073

In section 8.5.4.5.1.2.2, *Stranding and Trapping*, you describe some of the factors influencing stranding and trapping, and indicate that the calibrated flow-routing model will be used. In section 8.5.4.6.1.6, you indicate that a varial zone model will be used to assess stranding and trapping. It is not clear how you will use these models to assess stranding and trapping. Please include a complete description of how stranding and trapping will be evaluated. Specifically, please provide more detail on the models proposed, the extent of modeling, and whether multiple modeling approaches will be used (e.g., 1-D modeling at the reach-scale and 2-D modeling within focus areas).

Understanding the effects of load following on fish egg incubation, egg and alevin

IFS-080 survival, stranding, and entrapment will be critical to our analysis of the project. To address the potential for adverse effects from load following on fisheries resources, you propose to develop aquatic habitat models (e.g., effective habitat and varial zone modeling) to produce metrics such as frequency and duration of exposure/inundation of the varial zone at selected locations. More detail on these models is required to determine whether your approach will be sufficient to evaluate project effects. Please provide a detailed description of the proposed models, spatial extent of modeling, required input parameters, source of input parameters (e.g., literature, another model), model output, and how results will be analyzed. For all models, especially those based on values in the literature, a sensitivity analysis should be included to identify those parameters with the greatest effect on model results so that uncertainty in these critical parameters can be evaluated.

IFS-074 In section 8.5.4.6, *Habitat-Specific Model Development*, you outline a number of models and analyses. As part of these analyses, it will be important to understand how project operations will change the natural hydrograph, how project operations will change habitat availability in relation to life history timing of fish and aquatic species, and how these changes influence the spatial location of available habitat. In your proposed assessment of spawning and incubation, it will be important to understand the extent that suitable habitat shifts are expected as a result of proposed project operations. For example, if flows during the Chinook salmon spawning period are managed lower than they would be under existing conditions, certain locations currently used by Chinook for spawning may no longer be available; however, new areas not currently used but that meet the spawning habitat criteria for Chinook may become available at the lower managed flow. Such habitat shifts may result in, for example, spawning in locations that are more susceptible to scour, or spawning locations that are no longer close to suitable rearing habitats. We have similar concerns with regard to the assessment of rearing habitat under load following operations. Data developed from these studies will need to provide an understanding the spatial extent of movement required by salmon, as well as the continuity of available habitat over the range of flow fluctuations. Therefore, please specify how your data analysis and reporting will consider the spatial shifts in suitable habitat.

IFS-077 It is not clear what is being proposed and under which studies it is being proposed to assess effects of load-following operations on upwelling and groundwater dynamics related to egg incubation and emergence survival. In section 7.5.4.6, *Aquatic Habitat Groundwater/Surface-Water Interactio*ns, you indicate that work will be accomplished by the instream flow study. However, in the *Fish and Aquatics Instream Flow Study* (8.5), you no longer include a study to evaluate the effects of load-following operations on upwelling and groundwater dynamics related to egg incubation and emergence survival.

In your RSP, please describe what models are proposed; over what area they would be applied; what parameters would be modeled; how and where the parameters are derived; which parameters are based on field measurements; what assumptions will be made to determine how those conditions will change with project operations; and how the modeling will be used or integrated with other models (e.g., effective spawning and incubation) to evaluate the effects of project operation on egg incubation and emergence survival.

IFS-075 In section 8.5.4.6.1.5, you describe the effective spawning/incubation habitat analysis to evaluate the risk of dewatering and scour. The level of detail provided to address this issue is insufficient to determine the adequacy of the approach. In your RSP, please provide a detailed description of the model including the model framework, input parameters, where the input data is derived (i.e., other models or studies), the area over which the model will be applied, critical model assumptions, the output from the model, and how it will be used to inform the evaluation of project effects.

Riparian Instream Flow (Section 8.6)

RIFS-05 In general, the complexity of the *Riparian Instream Flow Study* (section 8.6) makes it challenging to follow the linkages between the study objectives, methods, and results. A table or graphic listing study objectives, the methods proposed for achieving the objectives, and expected types of results to be generated from the various study tasks would help us evaluate whether the methods contained in the RSP will be sufficient to capture the potential effects of the project on riparian resources.

RIFS-06 The study area section describes the classification scheme proposed for delineating project reaches and habitat types. Although not explicitly stated, the classification scheme appears to inform the delineation of riparian-process domains. If the classification scheme and riparian-process-domain delineation methods are linked, please describe their relationship in section 8.6.3.2, *Focus Area Selection-Riparian Process Domain Delineation*. At end of section 8.6.3.2, you state that focus areas have been selected. If that is the case, please describe the focus areas and the process and rationale that were used in site selection. Please describe the number and approximate location of focus areas, and the number of sampling transects, points, or plots that will be located in each sampling area. The study schedule indicates that focus areas will be selected by early 2013, but that field data collection will begin in 2012. Please reconcile this apparent inconsistency in the schedule and description of focus area site selection.

RIFS-07 The same description of focus area modeling is presented in several sections of the draft RSP. However, the majority of the description appears to be better suited for section 8.6.3.2, *Focus Area Selection-Process Domain Delineation* because it describes the basis for scaling the results of focus area field surveys and modeling up to process domains. Other portions of the description appear to be better suited for the work products sections under various study objectives.

RIFS-08
IFS-108

In attachment 8-1, *List of Terms and Definitions*, you identify the size classes for nine sediment types to be used in the habitat suitability curve/habitat suitability index (HSC/HIS) study, but you do not identify the methods to determine the sediment sizes. Sampling methods used to collect the bed material to be used in the sediment transport models is described in section 6.6.4.1.2.8, *Field Data Collection Efforts*. It is likely that the bed material sizes used sediment transport models would correspond to the American Geophysical Union sediment classification system, which is not equivalent to the sediment classification presented in attachment 8-1. Consequently, it is possible that the sediment types used in the HSC/HIS study would not be equivalent to sediment types used in the transport model. Because these studies are interrelated, please identify the methodology used to determine the sediment sizes presented in attachment 8-1 and describe any differences to the system used to determine the sediment sizes to be used in the transport models.

FISH AND AQUATIC RESOURCES

Fish Distribution and Abundance in the Upper Susitna River (Section 9.5), and Middle and Lower Susitna River (Section 9.6)

FDAUP-01
FDAML-03

In sections 9.5.4.1 (*Upper River*) and 9.6.4.1 (*Middle and Lower River*), you describe methods for selecting study sites for your fish distribution and abundance studies. In both sections, you propose a five-level, nested stratified sampling approach based on the following stratification scheme: (1) major hydraulic segment, (2) geomorphic reach, (3) mainstem habitat type, (4) main channel mesohabitat, and (5) edge habitat. In Figures 9.6-2 through 9.6-5, you present schematics of strata proposed for sampling in the Lower River and Middle River segments; however, you omit level 2 (geomorphic reaches) from the figures. It is unclear how you intend to describe fish distribution and relative abundance without using level 2 of your stratification scheme. Please consider revising your site selection methods to be consistent with the nested (hierarchical) approach; explain how mesohabitat units from main channel habitats will be selected to represent unique geomorphic reaches; and describe how data collected in mesohabitat units will be extrapolated to broader scales (e.g., geomorphic reach).

FDAUP-02
FDAML-04

Similarly, the *Instream Flow Study* (Section 8.5) proposes ten focus areas for intensive sampling in the middle reach. The number and location of focus areas for the Lower River and Upper River segments have not been proposed. In the *Fish Distribution and Abundance Study*, Figure 9.6-5, you propose to sample a total of 40 different habitat types (i.e., 8 each of 5 different habitat types: side slough, upland slough, side channel, beaver complex, and tributary mouth habitat types) within the 10 proposed Middle River focus areas. However, you do not describe how you will select these sites within the focus areas. In your RSP, please describe how these habitat units will be selected within the ten focus areas.

FDUAP-03

In the *Study of Fish Distribution and Abundance in the Middle and Lower Susitna River* (Section 9.6), you describe in detail in section 9.6.4.2 and Table 9.6-2 your proposed sampling frequency. However, the same level of detail on sampling frequency is not provided in your *Study of Fish Distribution and Abundance in the Upper Susitna River* (Section 9.5), and the information provided is insufficient to determine the frequency of each sampling event. Please revise section 9.5.4.2 of your RSP to include a detailed sampling schedule for the *Study of Fish Distribution and Abundance in the Upper Susitna River* (9.5) that includes the sampling frequency for each method.

IFS-035
FDAML-05

In section 9.6.4.1, *Study Site Selection*, and section 9.6.4.3.1, *Objective 1, Fish Distribution, Relative Abundance, and Habitat Associations*, you state that winter sampling sites and sampling methods will be selected based on information gathered from a pilot study in winter 2012-2013 at Whiskers Slough and Slough 8A. Please include in your RSP a detailed description of the pilot study and provide a schedule for when the results will be finalized and incorporated into your study methods for winter fish distribution sampling in 2013 and 2014.

FDAUP-04
FDAML-06

Details on the PIT-tag portion of the study were requested during the September 13, 2012, study plan meeting, including the number and species of fish to be PIT-tagged. However, this level of detail is not included in your draft RSP. The requested PIT-tagging information is needed to evaluate whether the proposed methods will be sufficient to describe life history timing, migration behavior, etc. Therefore, please include in your RSP specific information on the number and species of fish to be PIT-tagged.

FISH-06

In their May 31, 2012, study requests, FWS and NMFS requested a study to characterize the use of biological flow cues for various life-history behaviors. Neither the PSP nor the draft RSP include an approach to address this objective or provide a justification for why the requested study is not included. Please include in your RSP an approach to address the study objective, or provide an explanation for why it is not adopted in your study plan.

Salmon Escapement (Section 7.7)

In our May 31, 2012, study requests and comments, we requested that you include in your PSP the specific methods, objectives, and timing for implementing your proposed study of a system-wide Susitna River adult salmon escapement and run apportionment.[1]

ESCAPE-33 Your draft RSP provides some additional information on the proposed study. Specifically, you propose to conduct a commonly applied two-event, capture-recapture experiment for both Chinook and coho salmon. You propose to include two capture sites, one each on the Yetna River and the Susitna River, with two fish wheels deployed at each capture site. You also propose to recapture tagged fish in several tributaries and at various sites along the mainstem Susitna River. Finally, you state that fish would be tagged, but it may also be possible to use genetics to identify the spawning destination of fish captured at the fish wheels, and that studies being conducted in the summer of 2012 will determine the feasibility of using genetics to serve as an identifiable mark, thus eliminating the need to address tag loss and tagging effects associated with traditional capture-recapture models.

ESCAPE-30 The study plan identifies, in general terms, how the study would be implemented; however, it is lacking sufficient detail for Commission approval. Therefore, please include in your RSP the following additional information:

(1) a description of what is meant by a commonly applied two-event, capture recapture experiment;

ESCAPE-31 (2) the number of each species of fish that you will tag during each year of study implementation, including the number that would be radio-tagged or tagged with some other tag device, and a description of any other tag devices that would be used (e.g, spaghetti tag); and

ESCAPE-32 (3) a description of when you intend to finalize the results of the 2012 genetics study and a schedule for incorporating the 2012 study results into your study methods for the system-wide adult salmon escapement study.

RIVPRO-01 River Productivity (Section 9.8)

In section 9.8.4.1 of the *River Productivity Study*, you propose to review,

[1] The preliminary study plan only included a placeholder that did not provide any details on the proposed system-wide adult salmon escapement study.

summarize, and synthesize the literature on the impacts of hydropower development and operations, including temperature and turbidity, on benthic macroinvertebrate and algal communities in cold climates. In its May 31, 2012, study requests, the FWS requested that you develop a white paper to present the results of the literature review. In a September 7, 2012, email communication, the FWS requested clarification on whether your proposed literature review differed from its requested white paper. In your October 24, 2012, table summarizing the consultation history on the fish and aquatic resources study plans, you indicate that the literature synthesis and white paper could be considered synonymous. However, the draft RSP does not describe the form of the literature review and summary. Please describe in your RSP how the literature review will be presented (e.g., written report, annotated bibliography, etc.).

RIVPRO-02 In section 9.8.4.4, you propose to conduct a feasibility study in 2013 to evaluate the appropriateness of using reference sites on the Talkeetna River for monitoring long-term project-related change in benthic productivity. The draft RSP states that sampling results from Talkeetna River sites will be compared to results from similar sites in the Middle Susitna River Reach to evaluate whether the Talkeetna River would serve as a suitable reference site. Please clarify in your RSP the criteria that will be used to determine the suitability of the Talkeetna River as a reference site.

RIVPRO-03 In section 9.8.4.5, you propose to conduct a trophic study, using trophic modeling and stable isotope analysis, to describe food-web relationships in the current riverine community within the middle and upper Susitna River. As part of this study, you propose to develop growth-rate potential models for coho salmon, northern pike, and rainbow trout. Your draft RSP states that detailed foraging parameters and bioenergetics model parameters are available for these three species. Although fish capture methods, target numbers, and sampling schedule are not provided in section 9.8.4.5, it is apparent that you intend to capture individuals of each of these species to collect necessary data for model input. However, during the October 25, 2012, fish and aquatics study meeting, someone mentioned that it was not likely possible to collect northern pike from the Middle River and Upper River segments because the species is believed to be present only in the lower river. You therefore proposed to use another fish species, such as sculpin, instead of northern pike. Please provide an explanation in your RSP for why you have selected sculpin or another fish species instead of northern pike for development of a growth-rate potential model (i.e., clarify the species selected and identify if it is intended to be a

RIVPRO-04 replacement or a surrogate for northern pike). Please address whether sufficient information is available on the alternative species' foraging and bioenergetics parameters

RIVPRO-05 or if model parameters would need to be developed. Please also describe the methods you propose for capturing each fish species, the number of individuals required, sampling site locations, and a sampling schedule.

RIVPRO-06 In section 9.8.4.5.2, you propose to conduct a stable isotope analysis of the riverine food web. The draft RSP describes the use of stable isotopes to investigate the contribution of marine-derived nutrients from spawning salmon to freshwater ecosystems, but does not mention the potential contribution of non-salmonid anadromous species. The FWS requested that you analyze the contribution of marine derived nutrients from non-salmonid anadromous species. Please describe the fish species that will be evaluated in the marine derived nutrient, stable isotope study and provide supporting rationale for inclusion of each species. If you do not propose to include non-salmonid anadromous species in the analysis, then please provide an explanation for why FWS' requested study component is not adopted in your RSP.

RIVPRO-07 In a comment dated September 27, 2012, ARRI requested additional detail regarding locations and frequency of sampling for the fish diet analysis in section 7.8.4.7. Although the consultation table handed out at the October 24, 2012, meeting states that the requested information has been added to section 9.8.4.7, that does not appear to be the case. Please include in your RSP the frequency and timing of fish and macroinvertebrate sampling for this analysis.

RIVPRO-08 In section 9.8.4.9, you propose to estimate benthic macroinvertebrate colonization rates in the Middle Susitna River Reach to monitor baseline conditions and evaluate future changes to productivity in the Susitna River. In its May 31, 2012, study request, the FWS requested that you use a stratified random sampling approach to collect data on macroinvertebrate colonization rates in a variety of habitats (e.g., turbid vs. non-turbid, areas with groundwater upwelling vs. areas without upwelling). The draft RSP states that data will be collected in a mainstem habitat representative of the Middle Susitna River Reach to reflect typical colonization conditions, but does not specify whether the requested "variety of habitat types" will be sampled. Please include this information in your RSP, or, if you do not propose to sample a variety of habitat types, provide an explanation for not including FWS's request sampling.

RIVPRO-09 At the October 25, 2012, fish and aquatics study plan meeting, questions arose regarding whether and how macroinvertebrate sampling would be conducted during high flows. You responded that the objective is to sample in areas that have been wetted for a long enough period of time for macroinvertebrates to colonize, and that at least a month is typically required for this to occur. Please add this information, as well as specifics on timing and location of sampling, to the study description in section 9.8.4.9.

Characterization and Mapping of Aquatic Habitats (Section 9.9)

AQHAB-03 Section 9.9.5.4. *Mainstem Habitat Mapping,* indicates that habitat mapping in mainstem habitats will be limited to linear (mid-line) length estimates except for off-channel slough habitat where areas will be mapped. Please clarify whether this area polygon mapping is limited to side slough and upland slough habitats, or whether other off-channel habitats will be included. Please clarify whether measurements collected during on-the-ground truthing will be used to estimate habitat areas or conditions such as large woody debris loading and cover in reaches not ground-truthed.

A number of sections of the plan were incomplete or indicated that they will be refined in the RSP. We expect these sections to be completed in the final RSP.

Aquatic Resources Study within the Access Alignment, Transmission Alignment, and Construction Area (Section 7.13)

AQTRAN-2 In its August 31, 2012, comment letter, ADF&G requested that transmission line crossing locations be surveyed by electrofishing for a distance equal to 40-wetted stream widths, with a minimum survey length of 50 meters. In your October 24, 2012, RSP consultation table, you note that section 7.13 of the PSP provides for electrofishing a stream length of 40 wetted channel widths, up to a maximum of 400 meters; however, the PSP does not specify a minimum length for the surveys. You state in your October 24, 2012, consultation table that section 9.13 of the draft RSP was revised to propose a minimum survey length of 50 meters. Please ensure that your RSP specifies a minimum electrofishing survey length of 50 meters, or provide an explanation for why the request is not adopted.

AQTRAN-3 In its August 31, 2012, comment letter, ADF&G stated that if the Denali route is chosen, existing stream crossings on the Denali Highway would need to be improved or replaced to accommodate traffic associated with the project. ADF&G also stated that it would require a comprehensive survey of stream crossings so that stream crossings currently hindering or obstructing fish passage can be repaired or replaced with culverts or bridges. You state in your October 24, 2012, RSP consultation table that section 9.13.2 has been revised to indicate that upgrades to existing stream crossings on the Denali Highway would be necessary to accommodate project traffic, and that reviewing these crossings would be completed outside of the current assessment, when required. Because such upgrades would be part of the project proposal, we will need to evaluate the need and benefits of such measures. Therefore, please ensure that your RSP includes an evaluation of stream crossing surveys along the Denali Highway if the Denali route is chosen, and includes a detailed plan with the proposed methods and schedule for conducting the surveys.

Analysis of Fish Harvest in and Downstream of the Susitna-Watana Hydroelectric Project Area (Section 7.15)

FHARV-2
REC-18

In section 7.15, *Analysis of Fish Harvest in and Downstream of the Susitna-Watana Hydroelectric Project Area*, you propose to analyze fish harvest using data from ADF&G records of commercial, sport, personal, and subsistence fisheries. The data will be used to evaluate the potential for the project to alter harvest levels and opportunities on Susitna River-origin resident and anadromous fish. At the August 15, 2012, technical work group (TWG) meeting, it was noted that ADF&G fish harvest surveys are conducted over large areas. ARRI requested that you conduct additional fish harvest surveys to provide harvest data at an appropriate geographic scale for the proposed analysis. In response, you noted in your October 24, 2012, RSP consultation table, that no additional fish harvest surveys would be conducted because such surveys were not necessary to analyze effects of the proposed project. You provide no further explanation for why you do not intend to conduct additional fish harvest surveys. It is not clear from your response how the existing ADF&G records would be sufficient to cover a geographic area specific to the project. Please include in your RSP an explanation to support your position that the ADF&G fish harvest data are of an appropriate geographic scale to permit an analysis that meets the study objectives. If study objectives cannot be met using the ADF&G data, please include in your RSP a description of alternative data collection methods.

FHARV-3

At the August 15, 2012, TWG meeting, ADF&G requested that effects of emergency fishing closures be included in the analysis of fish harvest. Please ensure that your RSP describes the approach that will be used to analyze the effects of emergency closures on fish harvest levels and opportunities in the commercial, sport, personal, and subsistence fisheries. If you do not intend to include emergency closures in your analysis, then please provide an explanation for why it would not be needed.

Cook Inlet Beluga Whale Study (Section 9.17)

CIBW-03

In Section 9.17.4.2, *Study Methods*, you propose to use video cameras and still camera to document beluga use of the Susitna River delta. It is difficult to determine whether certain terms apply to video camera stations, still camera stations, or both (e.g., "live-feed cameras," "remote cameras," "camera systems," "camera"); please use consistent terminology to distinguish between video- and still-camera stations and be specific as to which system or systems are being referred to in the description of study methods. Further, you say "[Li]ve-feed cameras (up to four, depending on feasibility) will be established at the mouth of the Susitna River and still cameras (up to four, depending on feasibility) will be placed up to RM 10." Later you note that each camera site will have one or more cameras. Please clarify how many camera stations are proposed and how many and what type of cameras would be employed at each. Please be specific in describing the camera stations or the field of view through remote cameras in order to distinguish from language describing other study sites and areas. For example, when you say "[T]he cameras will have more than one path to allow for independent movement and view of the study area," are you referring to the fact that there is more than one camera at each site and that each can be manipulated separately? See the discussion provided under "Group Counts" for an example of the clarity desired.

CIBW-05 You say "[O]bserver monitoring shifts will be scheduled to cover up to 7 days a week with a primary focus on high-water periods." Clarify whether the term "high-water" in this context refers to high tide or high instream flows or both. Additional detail is required regarding frequency, duration, and timing of monitoring (e.g., months during which monitoring will occur, number of days per week, number of hours per day, time of day).

CIBW-06 Please clarify whether video footage of beluga observations will be digitally archived. Where you mention the potential for identifying individual animals, please describe the previously collected photo-identification information available for the beluga population.

CIBW-07 You do not propose conducting winter studies on beluga distribution or prey availability due to safety and logistical reasons, but indicate that "subsequent impact analyses will assume that whales are present year-round in the Susitna River delta and that they may be foraging" there at that time. Shelden et al. (2003) cite Rugh et al. (2000) and Hansen and Hubbard (1999) as sources of information on beluga winter habitat use in Cook Inlet. Existing information may be used to support not conducting a study. Do these reports provide additional support for not conducting surveys during the winter months? If so, please summarize their findings on winter habitat use.

CIBW-09 Goetz et al. (2012) developed predictive habitat models from beluga data collected from 1994 to 2008. Beluga presence was positively associated with fish availability and access to tidal flats and sandy substrate; group size was positively associated with tidal flats and proxies for seasonally available fish. Maps of habitat that could be integral to the sustainability and recovery of the beluga population were generated. Please summarize available models of beluga habitat for the study area and whether they may be used for assessing potential impacts. Describe any and all ongoing survey efforts by other
CIBW-10 researchers and agencies and how your efforts will compare or build upon others, where

you will collaborate with other agencies in sharing data, etc.

CIBW-11 Acoustic monitoring was brought up as a potential monitoring method for beluga (Bob Small, ADF&G, August 19, 2012, meeting), but was dismissed because it was unlikely to result in significant additional information useful to the beluga study. Please include the request and a detailed justification for not including acoustic monitoring in the RSP or your proposed methodology for conducting the study.

Wildlife Resources

Distribution and Abundance of Wolverines (Section 10.9)

WOLV-1 One of the study objectives is to describe late-winter habitat use by wolverines. This information would be used, in part, to rank levels of habitat use and assess direct and indirect loss and alteration of habitat from project construction and operation activities. In their comments on the study, ADFG stated that a single aerial survey would not be sufficient to develop habitat associations for wolverines and the objective should be eliminated. ADFG suggests that if such information is needed to assess impacts, the most effective way to obtain habitat associations is by using GIS telemetry. Your response to this concern, as described in the Table 10.4-1 (Summary of Consultation on Wildlife Resources Study Plans), indicates that you eliminated this objective from the study. However, the draft revised study plan still includes it. Your revised study plan should accurately reflect your study objectives. Furthermore, your revised study plan must explain how your study results will allow you to assess project effects on available habitat and why you are not conducting the GIS telemetry study in order to achieve the study objectives.

Bat Distribution and Habitat Use (Section 10.13)

BAT-1 The bat study has three specific objectives: (a) assess the occurrence of bats and the distribution of habitats used by bats within the impoundment zone and project infrastructure areas; (b) review geologic and topographic data to assess the potential for roosting sites and hibernacula in the study area; and (c) examine suitable geological features and human-made structures (bridges and buildings) for potential roosting sites or hibernacula. The methods discussion states that ADFG recommended documenting seasonal variation in bat occurrence and activity, expanding sampling to provide habitat-specific indices of abundance, and conducting a more thorough survey of naturally occurring roosts, maternity colonies, and hibernacula. You do not propose to conduct these efforts unless seasonal concentration areas such as roosting sites, maternity colonies, or hibernacula are located in 2013 because you agree with ADFG that anticipated effects on these species are not expected to be great. You go on to say that ground searches for these concentration areas will be done "to the extent possible" and "if suitable substrates exist." Identification of suitable natural substrates (limestone and large diameter trees) would be based on literature and land-owner information. Your statement of little adverse effects would suggest that this study is not needed. Nonetheless, it is unclear how your efforts would identify important seasonal concentration areas for further study in 2014 and why ADFG's recommendations should not be incorporated into the study plan now. Further, your revised study plan should explain what would dictate "to the extent possible."

Recreation and Aesthetic Resources

Recreation Resources Study (Section 12.5)

In section 12.5.1, *General Description*, in the second bullet, the first use of the word "future" is redundant.

REC-19 The study area map and descriptions provided in section 12.5.3, particularly the "Recreation Use Study Area," are not entirely clear. Place names used in the text should be labeled on the map.

REC-20 You propose to identify and map trails based on aerial imagery, existing GIS datasets, field identification, agency interviews, and surveys, but you do not define the scale at which these trails will be mapped and reported. To ensure sufficient accuracy for analysis, existing trails in the immediate project area should be mapped, where practical, to the 1:24,000 national map accuracy standard of +/- 40 feet.

The assessment of future recreation supply and demand does not appear to integrate relevant socioeconomic data that will be gathered or developed from other
REC-21 studies. The Study Interdependencies chart on page 12-51 illustrates this integration; please describe how and when this integration will occur in the study methods. The
REC-22 recreation demand analysis should also consider latent demand for new facilities or opportunities that could result from development of the project. For example, a large new reservoir accessible to the public could create new recreation demand (e.g., boating, fishing, sightseeing) that is not otherwise apparent in existing data.

REC-23 It appears that intercept and mail surveys are intended to provide data on guided versus unguided use (i.e., commercial outfitter/guided user vs. non-commercial independent user). However, it is not clear in the draft survey instrument how this information would be obtained. For example, the table at the top of page 12-90 combines guide/outfitter spending with transporter spending. Also some users may hire a guide for one type of activity, require transportation only for another activity, and recreate independently for another activity. The table on page 12-86 should be modified to distinguish between guided versus unguided use. If this is not practical in terms of your survey design, please explain why and provide an alternative approach to understanding commercial versus non-commercial recreational use in the project area.

Aesthetics Resources Study (Section 12.6)

AES-3 You propose to conduct a soundscape analysis to characterize ambient conditions and estimate the effects of project construction and operation. Noise from induced activities (e.g., increased non-project traffic, ATVs, snowmachines, motorized boating, float planes, etc.) and potential effects of project noise on dispersed recreation do not appear to be included in the analysis; these potential noise sources and effects should be included in the analysis so that environmental effects can be fully evaluated.

River Recreation Flow and Access Study (Section 12.7)

RECFLW-5 In section 12.7.4, *Study Methods*, in the fifth paragraph under Surveys, the text refers to the Devils Canyon stretch of Reach 1. It appears this should be Reach 2.

Socioeconomic and Transportation Resources

Regional Economic Evaluation Study (15.5)

ECON-3 One of the objectives of this study is to describe the effects of the project on the regional economy that would result from improvements in the reliability of the electrical power grid. In section 15.5.4.1, *Data Collection and Analysis*, you discuss the need to identify actions that will affect the economy of Alaska through interviews with knowledgeable individuals. The section goes on to say that "[t]he categories of persons to be interviewed and types of interview questions that will be used to develop REMI [Regional Economic Model Inc.] model assumptions are presented in the Appendix". While the appendix does include two tables that show the categories of persons that would be interviewed and topics that would be discussed, no example interview questions are provided.

ECON-4 To improve the readability and clarity of your study plan, please combine tables 1 and 2 to show what information is expected to come from each person (a similar approach was used in the HIA [Health Impact Assessment] section 15.8.2) and provide some example questions as indicated in the main body of text. In addition, please include a line item in the schedule provided in Table 15.5.1 that shows when the interviews will be completed. You should also provide an explanation on how these interviews will be documented and whether this information will be available as part of the Initial Regional Economic Evaluation Study Report, similar to what is being proposed under the HIA.

ECON-5 In addition, the forecast analysis that would be performed using the REMI model will compare with-project and without-project conditions. The without-project conditions would be defined based on a mix of electrical generation sources developed through production cost modeling with Railbelt utilities and an appropriate alternative that does not include a large hydroelectric project. Your methods do not define what utilities would be consulted, what cost data would be obtained from the utilities, how the production costs would be modeled, and, if known, what assumptions would be applied to the model.

Social Conditions and Public Goods and Services Study (15.6)

SOC-11 The last paragraph in section 15.6.2 discusses the fact that little published data are available on "non-economic, socio-cultural values, quality of life, and needs of study area residents". To fill this data gap, you are proposing a series of "informal interviews" with "community council members, residents, Real Estate professionals, MSB [MatSu Borough] officials and other knowledgeable people." It is unclear whether the use of informal interviews, as described, meets agency requests to "survey residents to evaluate potential changes in quality of life" (June 7th workgroup meeting). Please provide more detail on the number of interviews planned, how individuals will be identified and selected for interview, and the types of questions that will be asked. The interview protocol developed for the Recreation Study Plan has a similar process. Please explain why informal interviews will be successful in collecting the agency-requested information.

SOC-13 The schedule provided in Table 15.6.1 should include a line item for the informal interviews and show when they will be completed. In addition, please explain how the results will be documented and integrated into other studies and whether or not they will be provided in the Initial Social Conditions and Public Good and Services Study Report.

SOC-14 Under section 15.6.7, *Level of Effort and Cost*, there is some discussion of "the collection of secondary data for many communities that will be collected through phone calls and executive interviews." Please clarify if these are the same as the informal interviews discussed earlier in this section?

Transportation Resources Study (15.7)

TRANS-03 The schedule summarized in Table 15.7.6 should include a line item for interviews. In addition, please indicate how the results of the interviews will be documented and whether the results will be provided in the Initial Study Report.

Random Utility Model

SOC-15 In response to agency study requests, you have discussed at various times during work group meetings the possibility of using a Random Utility Model (RUM) to assess economic impacts of changing recreational activities associated with the project. Use of the RUM is not discussed in the draft revised study plan. If you plan to use RUM, you should provide an explanation of the methodology, data needs, assumptions and other aspects of the model and how it will be applied to the project. If you have decided not to use the RUM, please explain why you are not using it and how agency study requests will be accommodated by your proposed methods.

Document Content(s)

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STATE OF ALASKA

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14 November 2012

Ms. Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street
Washington D.C. 20426

Subject: **Comments on Proposed Study Plan and Scoping Document 2 for Susitna-Watana Hydroelectric Project, FERC No. 14241**

Dear Ms. Bose:

The State of Alaska comments on the Proposed Study Plan and Scoping Document 2 for the Susitna-Watana Hydroelectric Project (Project No. 14241).

The State appreciates the 30-day time extension to 14 November 2012 for submittal of comments on proposed study plan (PSP) dated 16 July 2012, and the delay of the comment deadline for the forthcoming revised study plan (RSP) to 18 January 2012. Due to complexity of the issues and the large number of proposed studies, the state supports the due diligence shown by Federal Energy Regulatory Commission (FERC) in providing the time extensions for these reviews.

The State would also like to recognize the effort the Alaska Energy Authority (AEA) has expended in holding several public technical work group meetings and providing site access in order to assist the resource agencies and other stakeholders in understanding the PSP proposed methodology and approach. Incorporating the feedback from these meetings, AEA was able to further refine the PSP and post an updated PSP (referred to as an *interim draft RSP*) on the Susitna-Watana Hydroelectric Project website shortly before the comment deadline.

While recognizing AEA had no obligation to produce an interim draft RSP, which is outside the scope of the integrated licensing process (ILP), and acknowledging a review of the interim draft RSP in any substantive manner would be challenging due to the limited time available prior to the PSP comment deadline, the FERC Project Manager indicated that the resource agencies and other stakeholders were welcome to submit comments on the interim draft RSP to FERC, even if beyond the mandated PSP comment deadline. The state resource agencies would like to commend FERC on this unique collaborative approach.

As a practical matter, many of the state resource agency reviewers providing comments herein have attended the technical work group meetings and have worked with AEA to discuss and refine the PSP, leading to the updated interim draft RSP. The attached comments, while referencing the PSP filed with FERC on 16 July 2002, which is the subject of this review period, reflects the current level of knowledge of outstanding issues and acknowledgement of issues that have been satisfactorily resolved.

The State of Alaska remains a strong proponent of timely decision-making and a collaborative working relationship among state and federal agencies for the remainder of the EIS process, as well as any subsequent permitting of the proposed project. We look forward to working with the cooperating federal agencies toward that end.

Sincerely,

Tom Crafford, Director
Office of Project Management and Permitting

cc:
Daniel Sullivan, Commissioner, Department of Natural Resources
Cora Campbell, Commissioner, Department of Fish and Game
Larry Hartig, Commissioner, Department of Environmental Conservation
Joseph Balash, Deputy Commissioner, Department of Natural Resources
Ed Fogels, Deputy Commissioner, Department of Natural Resources
Kelly Hepler, Special Projects Coordinator, Department of Fish and Game

The Alaska Departments of Natural Resources (ADNR), Environmental Conservation (ADEC), and Fish and Game (ADFG) provide the following comments on the Proposed Study Plan (PSP) and Scoping Document 2 (SD2) for the Susitna-Watana Hydroelectric Project (FERC No. 14241).

I. ALASKA DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS AND OUTDOOR RECREATION

General Comments

The Division of Parks and Outdoor Recreation (DPOR) has a vested interest in the recreation and socioeconomic research being conducted by the Susitna-Watana Hydroelectric Project and requests to be included in the distribution list for the relevant documents and data being produced by the project. It is further requested the project planners consult directly with DPOR in regards to Aesthetic and Recreational Resource study plans and activities.

At this time many of the studies occurring in or near the Denali State Park are taking place on the eastern boundary of the park, along the Susitna River. DPOR has issued permits for studies associated with hydrology and fisheries. A wide variety of recreational activities occur in the Denali State Park and the DPOR offices will be monitoring the project closely to ensure that studies related to hydro research do not displace recreational use in the park.

Comments regarding the Proposed Study Plan

<u>Identified Project Area</u>

The following comments are submitted regarding the **identified project area:**

1. Denali State Park lands have been identified and included in the project area.
2. The Susitna River flows for approximately 21 miles through the Denali State Park on its east boundary.
3. Gold Creek flows into the Denali State Park.

<u>Proposed Transmission and Road Corridors</u>

The following comments are submitted regarding the concerns DPOR has with the **transmission and road corridor study areas**:

REC-31

1. The impacts the Gold Creek and Chulitna proposed transmission and road corridors will have on Denali State Park; specifically the potential for providing unauthorized access to the park.
2. If constructed, the western end of the Gold Creek and Chulitna proposed corridors will also provide a direct access corridor to the park, increasing park access. The management

implications of this access are of concern to the Division of Parks and Outdoor Recreation.

3. Visual impacts to the aesthetic resources of the park as a result of transmission line construction.
4. Potential conflicts among recreational users during construction and maintenance of transmission line and road corridors.

The Division of Parks and Outdoor Recreation requests the Susitna-Watana Hydroelectric Project mitigate to the maximum extent possible these impacts to the Denali State Park.

DIVISION OF FORESTRY

Comments regarding the Proposed Study Plan

GEN-26 **Impoundment Area**

The Division of Forestry requests an inventory of the trees and biomass in the impoundment area and an evaluation of the potential for salvage. If viable, the project should ensure salvage is undertaken. The Division of Forestry is available to offer assistance with this assessment of the impoundment area.

OFFICE OF HISTORY AND ARCHEOLOGY

Comments regarding the Proposed Study Plan

Section 11 Cultural and Paleontological Resources

One of the deficiencies of the 1980's Susitna Project archaeological research was the lack of attention to stratigraphic markers for guiding archaeological field testing.

CUL-10 **Recommendation:** The 2013 survey will need to test multiple locations across the project area that have deep aeolian sediments, to better understand the types of soil profiles that will be encountered on the project. This testing must take place at the start of the field season, and in locations that are near sources of high aeolian sediment, namely braided locations along the Susitna River, to get good stratigraphic separation.

Benefit: These soil profiles will help inform on what soil horizons may be in the region, and may include paleosols and volcanic ash falls as well as periods of high and low sediment deposition. This testing may be profitably coupled with information on past and current caribou studies and aerial survey to put soil test locations near known or projected locations where caribou regularly cross the Susitna River.

CUL-11 **Recommendation:** All individuals on survey crews need appropriate training to adequately record and interpret the sediments they encounter. Each crew needs at least one individual with advanced training who can guide crew members on the soils and tephras that they will encounter.

Benefit: Verifiable interpretation and repeatability of data.

A second deficiency of the 1980's research was the lack of coupling of the archaeological data with paleoenvironmental data, leaving the archaeological data largely un-interpreted, and generating little explanation of lifeways or human-environmental interaction.

CUL-03 **Recommendation:** Recent concern with climate change encourages us to compare our archaeological data to past climatic conditions and fluctuations, to better understand how human societies have dealt with past climate change. Because of this need for paleoenvironmental data, lake core and bog core data should be utilized. If not already available, bog cores should be taken in the project area.

Benefit: These cores will generate chemical signatures and ages for tephras, past vegetation types and frequency through pollen data, grain size analysis for wind regimen, etc.

Probability Modeling

CUL-12 Archaeological site probability modeling is very useful for making the best use of resources when surveying large tracts of land. This modeling should explicitly attempt to address how past humans may have used of the region at different times and with different resources. Hypothesis testing should be employed, coupling the archaeological and paleoenvironmental data, to generate testable locations of where people may have lived at different times, and to get at how people lived in the past and why they utilized the locations on the landscape that they did. It is hoped that the survey planners stay abreast of the biological, ethnographic and other studies being conducted concurrently that can provide data to refine these exploratory and explanatory models.

Coupled with the model information on high and low probability areas given to the crews should be explanations of why areas are modeled high probability. Crew chiefs need to know what makes an area high probability in order to better plan survey of that area.

Probability modeling is a commonly used tool for finding the kinds of archaeological sites that we are already aware of. But in Alaskan archaeology we are regularly finding site types that we previously were unaware of: ice patches in alpine areas utilized by prehistoric caribou hunters; raised beach terraces in southeast Alaska with mid or early Holocene archaeological sites, etc.
CUL-13 Consequently, part of the Susitna survey should include use of some type of random sampling, possibly stratified random sampling, to test a variety of location types, in an attempt to insure that unknown site types are not missed.

CUL-14 **Cultural Resources Study Planning**

The Cultural Resources Study section does not mention a Programmatic Agreement (PA). Given the scope and magnitude of this complex undertaking, a PA may be an appropriate approach to dealing with the Section 106 process. As noted at 36 CFR 800.14[b][1][ii], PAs may be used 'when effects on historic properties cannot be fully determined prior to the approval of an undertaking'; and 'when nonfederal parties are delegated major decision-making responsibilities'.

CUL-02 The Cultural Resources Study section initially seems to imply that the entire APE will be intensively inventoried for cultural resources. However, the methods for identifying areas of high probability for the presence of cultural resources are then discussed later, which shows that select areas will be more intensively inventoried than others. Please clarify this earlier in this section – the Section 106 process does not require intensive (e.g., 100%) pedestrian inventory across the entire APE, but rather a "reasonable and good faith identification effort."

Additional Comments and Edits

Additional comments and edits on Section 11 Cultural and Paleontological Resources are correlated in Table 1 to the specific locations in the PSP.

Table 1 Additional Comment for Section 11 Cultural and Paleontological Resources

	Section 11.0 Cultural and Paleontological Resources	
	Sub-Section	**Comment**
CUL-15	**11.1**	Page 11-1 Introduction, first paragraph, second sentence: **Suggest slightly rewording to: "Information from these studies will be used to assist in identifying appropriate protection, *avoidance, minimization,* mitigation, and enhancement measures…"**
CUL-16	**11.1**	Page 11-1 Introduction, second paragraph, second sentence: **Recommend defining "historic properties" right up front (use definition from 36 CFR 800,16[l]). Also, it may be helpful to distinguish the difference between "cultural resources" and "historic properties" early on as they are often (and inappropriately) used interchangeably.**
CUL-17	**11.2**	Page 11-2 Header: The use of the words "Nexus" and "Existence" seems a bit odd. Is the intention to express effects throughout the life of the project (from planning through to operations and beyond?). **Suggest using the phrasing "Consideration of Immediate and Long-Term Effects on Historic Properties" or similar.**
	Section 11.5 Cultural Resources Study	
	Sub-Section	**Comment**
CUL-18	**11.5.1.1**	Page 11-7 Study Goals and Objectives: **Suggest slight rewording of the first paragraph and accompanying bulleted list. Recommended changes are highlighted below:** **The goals of the 2013-2014 cultural resources study plan are to systematically**

		inventory cultural resources within the APE (36 CFR 800.4[b]), evaluate the National Register eligibility of inventoried cultural resources within the APE that have not been previously evaluated (36 CFR 800.4[c]), and assess Project-related effects on National Register-eligible historic properties within the APE (36 CFR 800.5[a]). These goals ensure evaluation of cultural resources identified within the APE for NRHP eligibility. NRHP evaluation should not just be done for those that may be adversely affected (as this may change and assessment of adverse effects comes at the next step). If they are located within the APE, that presumes the potential for effects and cultural resources identified therein should be evaluated for NRHP eligibility. **Similar adjustments should be made to the corresponding bulleted list of items that immediately follow this paragraph.**
CUL-19	**11.5.2.1**	The bulleted second sentence on p. 11-8 was left unfinished: “document hydrological concepts embedded in place names, directional system, and landscape narratives; and…” **Please complete this sentence.**
CUL-07	**11.5.2.1**	Page 11-9 states that only a sample of sites will be dated. **It is hoped that all sites that can practically be dated, will be dated.**
CUL-20	**11.5.4.3**	This project has the potential to generate multiple products that will stand as a legacy to the all the effort and funding involved. **Hopefully NLUR will go beyond the stated goal of “Updat(ing) cultural chronology” to make sure in their final report that they generate a synthesis of regional prehistory that will be useful for workers in the region for decades to come. While this synthesis should integrate Ahtna land perspectives and Ahtna place name data, other publications should encapsulate the Ahtna data, with one or more of these written for the general public.**
	Section 11.6 Paleontological Resources Study	
	Sub-Section	**Comment**
PALEO-03	**11.6.3**	Study area for Paleontological Resources: The archaeological survey plan has included the areas along to the Susitna River between the Denali Highway and the impoundment as part of the indirect APE because of the concern for negative impacts from increased recreational traffic. **The paleontological study should include the same indirect APE for the same reason, namely concern for the unauthorized collection of these resources. The PSP mentions the 29,000 year old mammoth remains found at the confluence of the Susitna and Tyone rivers (Thorson et al. 1981), but doesn’t suggest including this area in survey. Because of this concern with unauthorized collection, Pleistocene exposures along the Susitna River should be examined for possible paleontological resources.**

DIVISION OF MINING, LAND AND WATER

Comments regarding the Scoping Document 2

Sections 4.2.6 Recreation Resources and Land Use and 4.2.9 Socioeconomic Resources

TRANS-04

Two project-specific resource issues identified in the FERC Scoping Document 2 as having potential for substantial environmental effects were: 1) Effects of altered hydrologic regimes and ice cover on timing and extent of river access and navigation within and downstream of the reservoir, and 2) Effects of altered flows and ice conditions on river-dependent transportation along or across the Susitna River.

To address these issues, the Division of Mining, Land and Water (DMLW) recommends a detailed analyses of the altered hydrologic regimes, ice cover, and ice safety be conducted for the Lower and Middle Susitna River from tide water to the bottom of Devils Canyon. This area is currently, and has historically, been utilized as a highway of commerce. The BLM determined the Susitna River navigable to Indian River based on steamship use.

Currently the Susitna River is navigated from tide water to the base of Devils Canyon for commercial purposes by a number of guides and tour operators. In the lower river, lodge owners and operators as well as fishing and hunting guides utilize the river to make their living. Boats and ice roads are utilized on the lower Susitna River from multiple locations such as Deshka Landing and Susitna Landing to transport fuel, supplies and customers for commercial lodges, homesteads, and recreational cabins.

The potential impacts of flow pulsing and other flow fluctuations on ice formation, layering and overflow to ice roads should be analyzed and solutions proposed prior to construction. DMLW requests an in-depth analysis and discussion of decreased flows to determine the impact to timing and extent of river access and navigation within and downstream of the reservoir, including, but not limited to launch sites at Deshka Landing, Susitna Landing, Susitna Bridge, and Talkeetna River.

Section 5.0 Proposed Studies

TRANS-05

Of great concern to the Alaska Division of Mining, Land and Water is the interconnected nature of the post construction ice processes on the Social and Transportation Resources as well as the Water Resources. The potential impacts to ice road formation may potentially impact the length of the river downstream of the dam, detrimentally impacting the delivery of fuel and supplies to lodges, homesteads and cabins from tidewater upstream. This would translate to increased costs of doing business and costs of living on the west side of the Susitna River downstream of the Parks Highway Bridge. The potential need to construct ice bridges over the Susitna River in response to this impact should be analyzed.

Comments regarding the Proposed Study Plan

Fluvial Geomorphology

FGM-06

Determination of the grid size spacing for the fluvial geomorphology numerical models should be determined based on the spatial resolution of available data and not on the computational run times. A statement regarding the approach used in the determination of grid size spacing should be included with the reported results.

FGM-05

There are several different numerical models being developed to gain a better understanding of processes. Will there be any cross-checking (as applicable) among the simulated results from the various models where overlap occurs? In other words, is there consensus among the simulated results (as applicable)?

FGM-03

The numerical models currently being developed are for the primary purpose of gaining a better understanding of processes. Are there plans to apply a more holistic, integrated approach during later phases of the analyses?

Instream Flow, Hydrology, Groundwater and Glacial Runoff

The following comments are submitted regarding **Surface Water Hydrology**:

1. Most surface water hydrologic aspects are covered by the plan, with a well designed network of streamflow measurements to facilitate understanding the drainage system.

RIFS-09

2. There are no large lakes in the project area but there are many wetlands and there may also be a number of smaller ponds, within the wetland areas. There does not appear to be plans for a study of wetland functioning within the study area. This would be a multi-disciplinary as aspects of both surface water and groundwater hydrology are involved.

RIFS-10
WETLND-01

3. There is no mention of the source of recharge to the wetlands that was referred to. Much of the wetland area is inundated during ice dam events, but the timing of these events are irregular in nature and the ground surface may be frozen during the events, preventing regular infiltration. While upwelling groundwater and percolating precipitation, primarily snowmelt, may account for a significant portion of the wetlands, both recharge and discharge due to river stage, i.e. potential horizontal flow to and from the wetlands, may be significant.

WETLND-02

4. During low flow periods in the river, local wetland storage of water may play a significant role in supporting the small ponds and interconnections that are typical habitat for small fish. The horizontal movement of water within the wetlands needs to be addressed as does the functioning of wetlands within the larger system.

The following comments are submitted regarding **Groundwater Hydrology**:

1. There is a plan in place to drill shallow groundwater monitoring wells and to attempt to relocate the prior set of observation wells that were drilled during the 1980's study; so, the shallow groundwater, which may be locally confined, has been addressed.

GW-004

2. While deeper wells are not common in the area and no deep observation wells are planned for studying this specific aspect of the groundwater system, other deep borings to identify fault zones and other structural features may provide insight into the deeper groundwater zones.

GW-005

3. The current monitoring phase would last for a maximum of two years. The groundwater study should be extended to better understand the interactions between groundwater and wetlands under differing hydrologic conditions, which may evolve over time periods much longer than two years, and certainly will over the life of the proposed dam.

The following comments are submitted regarding **Prior Appropriator Water Rights:**

GW-006

1. The Water Resources Management Unit is concerned with ground water connectivity to the Susitna River. Most water rights downstream of the dam site are groundwater wells which may be affected by changes in the flow regime of the Susitna River caused by this project.
2. There are several ground water wells along the Susitna River. Many of these wells are located within communities that are along the Susitna River. Many of these wells have water rights associated with them. The project's affects on lower river flows during the summer months needs to be evaluated in order to determine how this project may affect the prior appropriators' water rights.
3. Studies to determine the effect of ground water/ surface water connectivity should be preformed.

Additional Comments and Edits

Additional comments from the Division of Mining, Land and Water on Sections 5.0 Water Resources and 13.7 Transpiration Resources are correlated in Table 2 to the page locations in the PSP.

Table 2 Comments for Sections 5.0 Water Resources and 13.7 Transportation Resources

TRANS-06

Section 5.0 Water Resources Study	
Sub-Section	**Comment**
5.1	Page 5.1 "The potential effects of the Project on ice formation, surface and groundwater….." **Consideration for winter ice stability and maintenance should also be considered. The statement should state: "The potential effects of the Project on ice formation**

		and stability, surface and groundwater…" For the Susitna River to continue to be utilized as a frozen highway and bridge to the Western Cook Inlet oil and gas industry, commercial lodges and homesteads the stability of the ice is an important consideration that is not addressed in this section, the recreation section or the transportation section.
TRANS-07 SOC-23	**5.2**	Page 5.1 Changes to ice processes and flows in the Susitna River **The impacts to the flow regime and pulsing in the winter months has a strong potential to impact ice formation below the proposed dam. As the ice is utilized as road and bridge crossings the safety of the ice becomes highly important. The downstream ice processes in the lower river are important for this reason as they have the potential to impact the economic viability of lodges on the west side of the Susitna River.** **Similar impacts are possible in the summer months with boat traffic to lodges and guides utilizing the lower river for the operation of their businesses. Sufficient flows must be maintained to support these businesses which are also tied to the viability of salmon runs.**
	13.7 Transportation Resources Study	
	Sub-Section	**Comment**
TRANS-08	**13.7.2**	Page 13-14 to 13-15 Tables **The existing Mat-Su Borough Recreational Trails Plan adopted in March of 2000 is not listed in any of the tables of reviewed documents.**
TRANS-09 REC-32	**13.7.3**	Pages 13-17 For river transportation the study will evaluate non-recreation or subsistence transportation uses in the Susitna River corridor from the Denali Highway to the river mouth. **This statement should be clearer. From reading the Recreation Section the only Guide/Tour activity discussed are the tours to the base of Devils Canyon. The use of the Susitna River in the Lower Reach by Guides and Lodges during open water and ice road should be analyzed. None of the other Guides or Lodges are discussed in the recreation section.** **The US Supreme Court in PPL Montana LLC v Montana Decision upheld and supported the use of recreational use of a water body as a valid test for navigability. Therefore recreational use of the Susitna River within the entire length of the impacted portion of the Susitna River should be evaluated.**
TRANS-10 REC-33	**13.7.4**	Pages 13-18 to 13-20 Document Existing Conditions: There is no mention of tracking or documenting use of these RS2477 and easements in the study plan. **Three valid RS2477 Rights-of-Way cross or are within the Susitna River. Two of these ROW's utilize the frozen surface of the Susitna River, RST-199 Sustina-Rainy Pass and RST-200 Susitna-Tyonek. The third RST-1509 Curry Landing Strip Lookout crosses the**

	river and climbs the ridge to the lookout location. All of these RS2477 Rights-of-Way are valid interests owned by the State of Alaska. **There are also existing State and Private easements that cross or utilize the Susitna River in the lower portion such as the State owned Amber Lakes - Trapper Lake easement leaving from Susitna Landing. These easements provide access to Homesteads and commercial lodges on the West side of the Susitna River.** **There is also significant use by the Western Cook Inlet oil and gas industry for utilizing the Susitna River as an ice road in the winter. There is no mention of tracking or documenting use of these RS2477 and easements in the study plan. The potential of utilizing the frozen surface of the Susitna River post dam construction may possibly impact the ability of the river to be utilized as an ice road or crossing. The potential need for bridge crossings in the lower sections of the river should be analyzed as a possibility if flows impact the ability of the river to be used as a frozen highway.**

DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

Comments regarding the Scoping Document 2

<u>**Sections 2.2 Geology, Seismicity, and Dam Failure**</u>

SEIS-2

The Pass Creek fault, west of the dam should also be considered in seismic hazards analysis. This fault is associated with a large (~3 m) scarp that offsets latest Wisconsin-age glacial deposits. This fault is an active structure capable of producing large ground motions at the site. It is recommended that the independent consultant also consider the Pass Creek fault in addition to other sources that have already been described.

Comments regarding the Proposed Study Plan

The Division of Geological & Geophysical Surveys (DGGS) has reviewed Sections 4.5, 5.8, 5.11, 11.6, 14.5, and 14.6. DGGS comments and edits are correlated in Table 3.

Table 3 Comments for Sections 4, 5, 11, and 14.

Section 4.5 Geology and Soils Characterization Study	
Sub-Section	**Comment**
4.5	Page 4-4 **Necessary laboratory tests of physical and strength properties of rock and soil should include solubility testing of component minerals.**
Section 5.8 Geomorphology Study	
Comment	
5.8.1	Page 5-58 **It is unclear whether due consideration is being given to the Upper River and the dam's potential impact on geomorphologic conditions there.**

GS-3

GEO-09

GEO-01	**5.8.4.3.3**	Page 5-69 **Will there be an opportunity to comment on the Geomorphology report?**
GEO-10	**5.8.4.6.1**	Page 5-77 **Will the potential impact of wildfires on sediment load be factored into this study?**
GEO-11	**5.8.4.8.2.3**	Page 5-88 **Proper terminology would be 'thawing of permafrost', not 'melting of permafrost.'**
GEO-12	**5.8.4.10.2**	Pages 5-93 to 5-94 **Suggest including an evaluation of potential icings (aufeis) at stream crossing locations.**
	Section 5.11 Glacial and Runoff Changes Study	
	Comment	
GLAC-07	**5.11.1.1**	Page 5-147 P3 **While this is generally true there are situations where positive glacier net balance can be concurrent with higher water flows. For example, consider a winter of heavy snow that is followed by a summer with a lot of melting, but not enough melting to get rid of all the snow. Mass balance would be positive at the same time as there are high water flows.**
GLAC-08	**5.11.2.1**	Page 5-148 P2Definition **of 'recent period' in this context would be helpful. Accepted formal terminology prefers 'Holocene' to 'Recent' if the geologic timescale is being referenced here. If 'recent' refers simply to 'having happened, begun, or been done not long ago or not long before,' the use of 'period' after 'recent' confuses the intent because it implies the more-formal terminology. Suggest either using 'Holocene' or else more specifically defining the amount of time encompassed by 'recent' in this context (e.g., 'during the past xxx years').**
GLAC-09	**5.11.2.1**	Page 5-148 P2 **Reference needed for statement "Alaska glaciers with the most rapid loss are those terminating in sea water or lakes."**
GLAC-10	**5.11.2.3**	Page 5-149 P1 **Is it relevant to include mention of a predicted longer growing season in this section? If so, consider explaining how this is relevant to the research question.**
GLAC-11	**5.11.9**	Page 5-159 13 Fig. 5.11-1 **A directional arrow or statement of direction of view shown in photo would be helpful, especially since the caption includes reference to 'western end' of the lake.**
GLAC-12	**5.11.9**	Page 5-160 14 Fig. 5.11-3 **Suggest labeling Susitna Glacier**
GLAC-13	**5.11.9**	Page 5-161 15 Fig. 5.11-5 **Caption should read "Mean annual temperature and total annual precipitation at Talkeetna…"**

	Section 11.6 Paleontological Resources Study	
	Comment	
PALEO-04	**11.6.2**	Page 11-17 **The first sentence in this sub-section implies that the Hadrosaur fossils are Pleistocene in age, which is not the case. Suggest rewording the beginning of the sentence to "The potential for vertebrate faunal remains should be reviewed…"**
	Section 14.5 Probable Maximum Flood (PMP) Study	
	Comment	
FLOOD-1	**14.5.1.1, 14.5.4.1**	Page 14-2, 14-3 **Who comprises the Board of Consultants and how are members selected?**
FLOOD-2	**14.5.4.3**	Page 14-4 **Will the results of the glacier runoff study be included in determining the 100 year snowpack and snow water equivalent?**
FLOOD-3	**14.5.4.13**	Page 4-7 **Will the freeboard analysis be conducted using initial construction parameters only or will it also be calculated for a suite of reservoir sedimentation/infill scenarios post-construction?**
FLOOD-4	**14.5.4.13**	Page 14-7 "**The study of freeboard will take into account unusual circumstances." It would be useful to provide one or more examples of what would be considered an unusual circumstance.**
FLOOD-5	**14.5.6**	Page 14-8 **The PMP/PMF anticipated completion predates the anticipated completion of other portions of the Study Plan such as geologic mapping. Will there be any effort to update the flood model in 2014 with improved information from the ongoing studies (this may refine estimated infiltration rates, include longer stream gauge records and incorporate fluvial-geomorphic findings).**
	Section 14.6 Site Specific Seismic Hazard Evaluation Study	
	Sub-Section	**Comment**
SEIS-4	**14.6.1.1**	Page 14-9 **The components outlined are adequate and represent state of the practice for assessing seismic safety of dams.**
SEIS-5	**14.6.2**	Page 14-10 **The section clearly outlines the previous studies conducted at the site except for the seismic hazards study conducted by Fugro in Dec. 2011.**
SEIS-6	**14.6.2**	Page 14-10 **Example topics in the proposed studies do not include assessment of the Pass Creek fault. This fault should be considered. Additionally, probabilistic seismic hazards maps (Wesson 2007) should be augmented with a site specific ground motion assessment.**
SEIS-7	**14.6.3**	Page 14-10 **The Pass Creek fault should be added to the list of potential faults to study. Additionally, the relative activity of the Talkeetna Thrust and other parallel faults mapped in bedrock such as the Bull River fault, Broxson Gulch fault, and**

		Broad Pass fault should also be considered.
SEIS-9	**14.6.4.2**	Page 14-11 **Who comprises the Board of Consultants and how are members selected? We recommend that a DNR-DGGS geologist be part of the Board of Consultants review panel for seismic hazard studies**
SEIS-8	**14.6.4.4**	Page 14-11, 14-12 **Most of the proposed work has already been performed by Fugro (Dec. 2011). A notable exception is the conducting of geologic studies using the recently acquired lidar data. These data should be evaluated with a combination of field and office assessments.**

II. ALASKA DEPARTMENTOF ENVIRONMENTAL CONSERVATION

DIVISION OF WATER

General Comments

The ADEC Division of Water Quality will review the SAP/QAPP when it is published.

Comments regarding the Proposed Study Plan

The Division of Water has reviewed Section 5.5 of the Proposed Study Plan (PSP) dated 16 July 2012 and submits the following comments in Table 4 which have been correlated to the specific location in the PSP.

Table 4 Section 5.5 Baseline Water Quality Study Comments

	Section 5.5 Baseline Water Quality Study	
	Sub-Section	**Comment**
WQ-18	**5.5.4.3.1**	Page 5-14 States "Water quality parameters above that do not exceed Alaska Water Quality Standards will not be collected in succeeding months; the exception are those parameters in Table 5.5-4 associated with monthly sample collection from surface water." **Replace this language with, "Table 5.5-4 lists the water quality parameters to be collected and their frequency of collection."**

DIVISION OF AIR QUALITY

Comments regarding the Proposed Study Plan

The Division of Air Quality has reviewed Section 13.9 and submits the following comments in Table 5 which have been correlated to the specific location in the PSP.

Table 5 Section 13.9 Air Quality Study Comments

	Section 13.9 Air Quality Study	
	Sub-Section	**Comment**
AIR-03	**13.9.1.1**	Page 13-27 States the analysis will evaluate impacts from the Project and how Project emissions compare to the Without-Project alternative. **Recommend also compare to current conditions.**
AIR-04	**13.9.2**	Pages 13-27 to 13-28 The primary air quality concern in the area is particulate matter (PM10 and PM 2.5) from fugitive dust, volcanic ash, and wildfire smoke. **There are also concerns from wood-heating or wood-burning devices.**
AIR-05	**13.9.2**	Page 13-28 There are some limited data available from a site in Denali National Park. **There are two Denali monitoring sites. To which site is this statement referring?**
AIR-06	**13.9.2**	13-28A table comparing the Project emission with Without-Project alternative emissions will be generated. **Also include in table current emissions**.
AIR-07	**13.9.2**	Page 13-28 If site specific monitoring data is required… **How would the need for site specific monitoring data this be determined? What are the criteria for determining the pollutant of concern or will all pollutants be monitored? Is there a clear understanding of the cost and effort needed to collect data?**
AIR-08	**13.9.2**	Page 13-28 It is anticipated that at least one year's worth of data will be collected consistent with methods outlined in 18 AAC 50.035. **The citation should be 18 AAC 50.215(a).**
AIR-09	**13.9.2**	Page 13-28 The area is likely considered unclassifiable under18 AAC 50.015, as there may be insufficient data to determine whether it is in attainment with respect to all criteria pollutants. **The classification should not be in question. Nonattainment areas are clearly defined in 18 AAC 50.015. This area should fit either the criteria for an attainment or nonattainment area.**
AIR-10	**13.9.2**	Page 13-28 EPA maintains a list of non-attainment areas for all six criteria pollutants on their Green Book website: (http://www.epa.gov/oar/oaqps/greenbk/index.html). **The Alaska Administrative Code 18 AAC 50.015 also lists the non-attainment areas.**
AIR-11	**13.9.4**	Page 13-28 The study assumes emission estimates from the Project are expected to be below major source thresholds, therefore a PSD and Title V permit are not anticipated for the Project. **In order to construct a dam consistent with the project description provided in**

	Section 13.9 Air Quality Study	
	Sub-Section	**Comment**
		http://www.susitna-watanahydro.org/project/project-description/ , it may be necessary to build a Portland cement plant on-site. **Per 40 CFR § 51.21(b)(1)(i)(a) Portland cement plants have a 100 tpy threshold of any regulated NSR pollutant for PSD permit applicability. Additionally per 40 CFR § 51.21(b)(1)(i)(c)(iii)(c) and 40 CFR § 71.2, Portland cement plants are stationary sources whose fugitive emissions must be included in determining whether or not the plant is a PSD major stationary source or Title V major stationary source.** **Even if not subject to PSD or Title V permitting the source may be subject to minor permitting requirements under Article 5 of 18 AAC 50.** **The Division of Air Quality will need more specific information about the type(s) of operation planned before the permit requirement can be determined.**
AIR-12	**13.9.4**	Page 13-29 The air quality study will assess the existing conditions of the area against applicable state and national air quality standards and evaluate the Project's air quality impacts against these standards. The analysis will include evaluation of both short-term and long-term impacts from the Project and a comparison of Project emissions to the no-action alternative. **This can be a substantive task. What are the proposed methods to be used for this analysis and what are the criteria for determining the pollutants to be analyzed? Is there adequate meteorological data available? How will it be determined if an air quality study this extensive is needed for a hydroelectric project?**
AIR-13	**13.9.4**	Page 13-29 States the analysis will include evaluation of both short-term and long-term impacts from the Project and a comparison of Project emissions to the no-action alternative.
AIR-14	**13.9.4.1**	Page 13-29 States that once a non-attainment area meets the standards, the EPA will re-designate the area as a "maintenance area". **This brief statement is an oversimplification of the process required to develop a maintenance plan for a previously designated nonattainment region and the process should be outlined to avoid misunderstanding.**
AIR-15	**13.9.4.2**	Page 13-29 Lists fugitive *particle* matter emissions from the handling and storage of raw materials and wind erosion during construction to be quantified according to methodologies specified in EPA's Compilation of Air Pollutant Emission Factors (AP-42) or similar source of emissions factors. ***Particle* should be *particulate*.**
AIR-16	**13.9.4.2**	Page 13-29 States if a state *license* is required, air quality dispersion modeling may also be required and will be performed consistent with 18 AAC 50 dispersion

Section 13.9 Air Quality Study		
	Sub-Section	**Comment**
		modeling guidelines. ***License** should be **permit**.*
AIR-17	**13.9.4.2**	Page 13-29 States emissions from construction equipment and related activities will be estimated for comparison to appropriate state licensing criteria. **Secondary emissions do not count towards "potential to emit" per 40 CFR 51.166(b).**
AIR-18	**13.9.4.2**	Page 13-30 States if the Project generates average daily traffic volumes that exceed a state mobile source threshold for CO, PM10/PM2.5, or mobile source air toxics (MSATs) analyses, then a mobile source evaluation may be required. **There are no mobile source thresholds in permitting.**
AIR-19	**13.9.7**	Page 13-31 States existing monitoring data may not be representative of the area and a program of air quality monitoring would need to be implemented to gather baseline data. **There is no regulation that requires a program of air quality monitoring to gather baseline data. What criteria would be used to determine if baseline data is necessary?**
AIR-20	**13.9.1.1** **13.9.2** **13.9.4**	Pages 13-27 to 13-28 contains multiple citations of Alaska Administrative Code Title 18, Chapter 50, various Sections, but does not reference Alaska statutes. **Please cite the applicable Alaska Statutes in addition to the Alaska Regulations.**

III. ALASKA DEPARTMENT OF FISH AND GAME

To the best of our abilities, the 29 October 2012 draft interim Revised Study Plans were reviewed but more time will be needed to fully assess. Consequently, most of the comments reference the Proposed Study Plan and include preliminary comments on the recent Revised Study Plans when possible.

General Comments

While portions of the study plans have been developed according to criteria identified in 18 CFR 5.11, other parts of these plans lack sufficient specificity and detail. Following are general comments.

GEN-27

- Study plans need to stand alone. Methods in these plans often refer to other studies which often do not provide specific information to the topic under discussion or repeat additional information already summarized in the lead study. It is preferable that studies describe what data is needed from other studies and how it will be used without repeating the methods for obtaining the data – that information should remain within the originating study.

GEN-28
- Sampling plans need to include a thorough description of methodology, sampling and QA/QC procedures, etc. In general, more information is needed on sampling protocols, timing, location(s) and site selection criteria.

GEN-29
- Include a list of definitions of key terms for each study plan. We understand different specialties often have their own terminology and a list of definitions would help to better understand differences.

GEN-30
- Protocols for sampling methodologies should not simply reference state or federal protocols. Many of these may not exist. Citations should refer to specific scientific methods, references or manufacturer instructions.

Comments regarding the Proposed Study Plan

Section 5.5 Baseline Water Quality Study

GW-007
WQ-19
- Information is needed on preliminary results from the thermal imaging assessment that was scheduled to be conducted in the fall 2012. An assessment on the feasibility of this investigation is needed and if it is determined feasible, how additional thermal imaging data will be collected and calibrated. These comments are repeated in section 5.7. Groundwater-Related Habitat Study since the thermal imaging assessment was also described there and it is unknown who is the project lead.

WQ-20
- Information is needed on the availability of the "Sampling and Analysis Plan" and the "Quality Assurance Project Plan".

WQ-21
- All field sensors and equipment should be calibrated pre- and post-monitoring according to accepted industry or manufacturer protocols and field measurements collected for post monitoring calibration/processing.

WQ-22
- Monthly measurements will not adequately characterize water quality in the Susitna River because some parameters are highly variable. We suggest more frequent measurements of basic water quality parameters (e.g. dissolved oxygen, turbidity, conductivity, and pH) at select sites.

Section 5.7 Groundwater-Related Aquatic Habitat Study

We support the goals and general approach of the groundwater study. Information collected during this study and incorporated with other related studies will help to evaluate project effects on aquatic and terrestrial resources. Following are additional information needs.

- Information is needed on preliminary results from the thermal imaging assessment that was scheduled to be conducted in the fall 2012. An assessment on the feasibility of this investigation is needed and if it is determined feasible, how additional thermal imaging data will be collected and calibrated.

GW-008
IFS-058
- Dissolved oxygen should also be measured as a parameter for HSC and HSI development.

GW-009
- More information is needed on the monitoring strategy in focus areas. For example, how will the study assess groundwater influences over different habitat types in a focus area? An example figure/diagram showing proposed groundwater monitoring well locations in a focus area would help to better understand proposed sampling design.

Section 6.5 Fish and Aquatics Instream Flow Study

We support the goal to provide quantitative indices of existing aquatic habitats and resources that will enable an evaluation of the effects of alternative project operational scenarios. We also support close coordination and integration with related studies to provide a comprehensive evaluation.

Following is a list of information needs and comments.

IFS-066
- We support the HSC/HSI data collection objective. Information is needed for identified target species over multiple years to incorporate habitat variability associated with utilization. Further discussion is needed on the selection of these species and data needs. Site-specific HSC/HSI data is critical to obtain meaningful results and may entail consideration of alternative strategies to meet these data needs.

IFS-065
- We support the addition of lateral edge habitat evaluation for assessing aquatic resource effects in this habitat. More information is needed on the sampling approach, sampling area, equipment, etc.

IFS-076
- Information is needed on flow ranges that will be collected to evaluate flow-habitat relationships for each modeling approach.

IFS-061
- Information is needed on criteria that will be used to identify cover types and substrate sizes.

IFS-072
- For PHABSIM and similar transect-based methods, will transects be hydraulically independent, dependent or a combination and accordingly, what water surface elevation models and composite suitability index will be used?

IFS-083
- What criteria will be used to select and weight transects used to provide information for habitat-flow models?

IFS-032
- What criteria will be used to identify "a representative number" of habitat types within the description of study sites for fish passage/off-channel connectivity (§6.5.4.5.5.)?

IFS-031
- We support the hierarchical classification system for characterizing habitat categories. This system was derived from the 1980's information and provides a sound framework for designing sampling protocols and evaluating study results. Still needed is the habitat

inventory data scheduled to be collected this year and summarized according to the above classification system for future decision-making.

IFS-087
- How will the data be aggregated from the different models to evaluate single flow recommendations?

IFS-100
- A description is needed on the manner in which information will be compiled to present results (e.g. Decision Support System) including data sources that will be incorporated, geo-spatial capabilities, and product outputs.

IFS-062
- Information is needed on equipment that will be used and calibration protocols.

IFS-105
EUL-2
RECFLW-6
- For the eulachon (Section 7.16) and boating (Section10.7) studies, similar information is needed on how the flow-habitat/resource information will be collected. For example, what is the study area, what sampling strategy will be used, how many and what range of calibration-discharge sets will be collected if appropriate, and how will HSC/HSI data be developed?

IFS-082
- We support the use of varial zone modeling to assess effective spawning/incubation habitat. Modeling simulations may need smaller time steps during the analysis phase (possibly down to 15-minute increments) depending on the rate of flow change over time with proposed operation scenarios.

IFS-025
- More details are needed on sampling approaches. For example, what criteria will be used to determine how many focus areas, mesohabitats and critical area sites will be selected?

IFS-081
- We support and agree with the approach proposed for using 2-D modeling in the main channel and other areas as appropriate for sampling focus areas.

IFS-068
- Intergravel, over-winter temperature monitoring of redds should be expanded to include measurements of dissolved oxygen.

- <u>Fish Stranding and Trapping</u> – an evaluation of fish stranding and trapping is needed. Stranding typically involves the beaching of fish on low gradient shorelines as a result of declining river stage. Salmonid stranding associated with hydropower operations has been widely documented (Hunter 1992 provides a list citations). Trapping is the isolation of fish in pockets of water with no access to the free-flowing surface water (Hunter 1992). The evaluation should include, at minimum, the following information:

IFS-071
1. An analysis of natural Susitna River stage changes over the available period-of-record is needed similar to the analyses presented in Hunter (1992). At a minimum, the data should be tabulated similar to results provided in Hunter (1992), Tables 1 and 2.

IFS-056
2. An analysis is needed on Middle River areas susceptible to fish stranding and trapping. Hunter (1992) cites 2 studies that indicate stranding can occur on low gradient areas, less than 4 percent (Bauersfeld 1978) and 5 percent (Beck Associates 1989). A topographical survey of potential stranding areas is needed with modeling

at hourly time increments to assess stranding and trapping potential. Simulation should include existing and alternative operation scenarios under normal, dry and wet hydrologic conditions. Factors that may contribute to stranding and/or trapping should be considered including: aquatic species/lifestage, cover, duration of a stranding/trapping event, and time of year.

IFS-086

3. An analysis and discussion of results on how proposed operations will affect fish and other aquatic organisms including but not limited to: juvenile emigration (salmonid drift), spawning interference (conditions that may affect the ability of fish to successful complete spawning without interference/interruption from flow related effects), and effects on aquatic invertebrates.

Bauersfeld, K. 1978. Stranding of juvenile salmon by flow reductions at Mayfield Dam on the Cowlitz River. WDF, Olympia, WA, Tech. Rep. 36:36 pp.

Beck Associates, R.W. 1989. Skagit River salmon and steelhead fry stranding studies. Prepared by R.W. Beck Associates for the Seattle City Light Environmental Affairs Division, March 1989. Seattle, WA 300 pp.

Hunter, M.A. 1992. Hydropower Flow Fluctuations and Salmonids: A Review of the Biological Effects, Mechanical Causes, and Options for Mitigation. State of Washington Tech. Rep. 119. 58 pp.

Section 7.5 Study of Fish Distribution and Abundance in the Upper Susitna River

FDAUP-05

Recommend a section be included to specifically address winter sampling methods. Minnow trapping under ice should be conducted during the winter period to document fish presence and absence; we also recommend evaluating the feasibility of under ice videography.

7.5.1.1. Study Goals and Objectives (Page 7-9 & 7-10)

"The overarching goal of this study is to characterize the current distribution, relative abundance, run timing, and life history of resident and non-salmon anadromous species (e.g., Bering cisco, Dolly Varden, humpback whitefish, northern pike, and Pacific lamprey), and freshwater rearing life stages of anadromous fish (fry and juveniles) in the Susitna River above Devils Canyon."

FDAUP-06

- Fish distribution efforts should be directed at streams not already identified as supporting anadromous fishes in ADF&Gs Anadromous Waters Catalog (AWC). AWC information can be accessed through ADF&Gs online Fish Resource Monitor at: http://gis.sf.adfg.state.ak.us/FlexMaps/fishresourcemonitor.html?mode=awc

FDAUP-07
WQ-23

- Baseline metals and mercury assessment are not the same. What is being sampled and to what standards? What metals are being studied?

FDAUP-08
- Recommend to add: **8. Identify spawning locations for both anadromous and resident fish species.** The need is noted below in text but not specifically included in goals and objectives.

FDAUP-09
- Arctic grayling were listed as "believed to be" the most abundant species in the inundation zone (Delaney et al. 1981, Sautner and Stratton 1983), yet are not included in the species of interest listed above. Recommendation - Identify and list target species for this and every study. Documentation of all fish collected during sampling shall include species and length.

FDAUP-10

FDAUP-11
- Species listing in this section does not match species list on Table 7.5.9. Update table with current information.

7.5.2. Existing Information and Need for Additional Information (Page 7-11)

FDAUP-12
"Chinook salmon are the only anadromous species known to occur in the upper Susitna River and tributaries although the information on the extent of their distribution is limited."

- Dolly Varden in Alaska systems are not evenly distributed and may be found in tributaries.
- Longnose suckers are found in high densities in Upper Susitna tributaries.

FDAUP-13
7.5.4.1 Passive and Active Sampling (Page 7-13)

"nighttime sampling"

- Long daylight hours during the summer may reduce the difference between day and "night" sampling effectiveness. The periods of twilight are important sampling periods.

FDAUP-14
"and state and federal regulatory agencies will grant permission to conduct the sampling efforts"

- This statement appears to imply state and federal agencies will automatically grant permission or permits. Recommend rewording, i.e. Fish sampling will only be conducted after all required state and federal permits are obtained.

FDAUP-15
Gill Net Sampling (Page 7-13)

Identify the net information...if we know what was used in the 1980's then it should be identified. What is the depth of each net? Did they mean 7.5 ft. deep panels instead of 7.5 ft. long panels? List mesh sizes, number of panels, panel lengths and overall net length. Will small mesh ends be located nearshore or will sampling be random or reversed as to mesh size close to shore? Will surface and bottom set nets be deployed? What is the targeted time duration for each set.

Electrofishing (Page 7-13)

"Conduct monthly, boat-mounted, barge, or backpack electrofishing surveys using standardized transects."

FDAUP-16
- More detailed descriptions are needed on how catch-per-unit-effort (CPUE) will be calculated during multi-pass electro-fishing. CPUE results should provide a meaningful estimate that is not significantly biased.

FDAUP-17
- Due to the size of the area to be studied, it is not clear if monthly sampling will be adequate. Further description of the rationale for this sampling frequency is needed.

FDAUP-18
- Electrofishing should be discontinued in a sampling reach if large salmonids are encountered. Criteria should be developed to determine when or if electrofishing should be discontinued when other large fish are encountered. Rainbow trout are particularly sensitive to electrofishing. Sampling plans should include a description of electrofishing protocols.

FDAUP-19
- Electrofishing may be effective in the side channels or sloughs but may have limited success in swift or turbid waters. Suspended materials in turbid water can affect conductivity which may result in harmful effects on fish, especially larger fish due to a larger body surface in contact with the electrical field. Sudden changes in turbidity can create zones of higher amperage which can be fatal to young-of-year fish as well as larger fish. Electrofishing in swift current is problematic with fish being swept away before they can be netted. Similarly, turbidity increases losses from samples.

"In all cases the electrofishing unit will be operated and configured with settings consistent with guidelines established by ADF&G." (Page 7-13)

FDAUP-20
- ADF&G has not established SOP's related to electrofishing settings etc. Smith-Root is the manufacturer of most electrofishing equipment and boats and offers certified training in safety and use of their equipment.

FDAUP-21
- Field protocols and site selection/justification is needed. Length of transects, type of substrate, geomorphic characteristics etc. need to be identified. Block nets should be used to ensure meaningful sampling results during backpack shocking for relative abundance surveys.

Trot Lines (Page 7-14)

"Trot line sampling was one of the more frequently used methods during the 1980s and was the primary method for capturing burbot."

FDAUP-22
- Trot line sampling is terminal, recommend use of alternative, non-lethal methods of burbot sampling whenever possible.

FDAUP-23
- More information needed on site selection and rationale.

FDAUP-24
- Burbot are mass spawners and migrate and collect in large "balls" during the winter (January and February). This spawning probably occurs in slow moving side channels. Under ice video may be of some use once locations are identified.

FDAUP-25
- Recommended reference material: Paragamian, Vaughn L and David H. Bennett, 2008. Burbot: Ecology, Management and Culture. American Fisheries Society, Symposium 59, Bethesda, Maryland. AFS Stock Number 54059P, 270 pages.

Minnow Traps (Page 7-14)

FDAUP-26
- Salmon eggs are required to be sterilized or disinfected in iodine solution under conditions of ADF&G sampling permits.

FDAUP-27
- When and where will minnow traps be deployed and how will areas for deployment be selected?

FDAUP-28
- Winter deployment of minnow traps should be considered.

Snorkeling (Page 7-14)

"Two experienced biologists will conduct snorkel surveys along standardized transects in clear water areas during both day and night during each field survey effort."

FDAUP-29
- Will two or one biologist snorkel during each snorkeling survey event?

FDAUP-30
- What is the sampling schedule? When? Seasons? Site selection criteria/rational needed.

FDAUP-31
- Will block nets be used?

Fyke/Hoop Nets (Page 7-15)

FDAUP-32
- What is the mesh size, hoop size, number of hoops, length of nets, etc.?

"The nets will be operated continuously for a two-day period."

FDAUP-33
- Is this continued sampling or a single event? What time of year? How many sampling events? List protocols.

Beach Seine (Page 7-15)

FDAUP-34
- Identification of beach seines should not limit the equipment choices as to length and depth. What is the mesh size?

FDAUP-35
- Small water can be sampled using a shorter and shallower beach seine. As long as the area sampled is noted and the net is deep enough to fill the water column then comparisons can be made.

FDAUP-36
- Will different substrate types be sampled? Identify geomorphic areas to be sampled.

FDAUP-37
- Will sampling include all time periods including daylight, twilight and periods of darkness?

FDAUP-38
- Identify protocols.

Outmigrant Trap (Page 7-15)

FDAUP-39
- Identify if traps will be manned during deployment.

DIDSON and Video Cameras (Page 7-15)

FDAUP-40
- Recommend that these cameras be used to identify burbot spawning in these areas.

FDAUP-41
- Identify camera locations.

FDAUP-42
- Location of all video and DIDSON surveys should be located by GPS and identified on aerial photos and project maps.

Fish Handling (Page 7-16)

FDAUP-43
- See comments under section 7.5.4.2. regarding use of PIT tags. Describe the method to implant PIT tags and where on fish they are to be tagged. Describe anesthetic procedures that will be used. Will FLOY™ tags be used for recapture studies?

"Tissue or whole fish samples will also be collected in the mainstem Susitna River for assessment of metals concentrations (Objective 4) (see *Mercury Assessment and Potential for Bioaccumulation Study*, Section 5.12)."

FDAUP-44
- Goals for assessment of baseline metal studies and mercury studies may be vastly different and require different age classes.

FDAUP-45
- Due to subsistence uses of whole fish, whole fish samples should be processed.

FDAUP-46
- Sampling should focus on older fish initially to identify if bioaccumulation is occurring. Younger fish have lower levels of bioaccumulated metals or pollutants which may cause results to indicate lower concentrations than targeted, older ~~harvested~~ fish. If results are positive, additional sampling will be needed..

7.5.4.2. Remote Fish Telemetry (Pages 7-16 to 7-18)

FDAUP-47
- Further discussion regarding use of PIT tags has raised concern on the ability of this technology to be utilized effectively in the project area. The primary concern is that, as noted in this section, PIT tagged fish must pass in close proximity of an antenna array thereby limiting its use to sufficiently small water bodies. It is unknown how many water bodies fit this criteria and where they are located to provide a complete assessment. Further discussion is needed.

FDAUP-48
- The likelihood of unintentional human consumption of PIT tags needs to be addressed.

<u>Section 7.6 Study of Fish Distribution and Abundance in the Middle and Lower Susitna River</u>

FDAML-07

Recommend a section specifically addressing winter sampling approaches. Minnow trapping under ice should be incorporated during the winter sampling and recommend evaluating the feasibility of under ice videography and Didson technologies.

Section 7.6.1.1. Study Goals and Objectives (Page 7-23)

FDAML-08
- Fish distribution efforts should be directed at streams not already identified as supporting anadromous fishes in ADF&Gs Anadromous Waters Catalog (AWC). AWC information can be accessed through ADF&Gs online Fish Resource Monitor at: http://gis.sf.adfg.state.ak.us/FlexMaps/fishresourcemonitor.html?mode=awc

FDAML-09
- Identify target species

FDAML-10
- **Section** Is goal #1 for juveniles only?

Section 7.6.4.1.2. Outmigrant Traps (Page 7-27)

FDAML-11
- Identify locations of outmigrant traps and if traps will be manned during deployment.

FDAML-12
- Page 7-27 states "Flow conditions permitting, traps will be fished on a cycle of 48 hours on, 72 hours off throughout the ice-free period."

  Is this from ice-out to ice up? This is several months of two days on and three days off. Equivalent to 40% of all hours between spring thaw and fall freeze up. Is this really what is proposed?

Section 7.6.4.2. Remote Fish Telemetry (Page 7-27)

"However, the "re-sighting" of PIT-tagged fish is limited to the sites where antenna arrays are placed."

FDAML-13
- See comments regarding use of PIT tags in section 7.5.4.2. All fish captured by any sampling method after the first PIT tagging event will need to be checked for a PIT tag. If fish are sacrificed, the PIT tag registry must be updated as soon as possible. Checking all fish for PIT tags will prevent double tagging of a fish which could introduce error in later passive tag reading.

Section 7.6.4.2.1. Radiotelemetry (Page 7-27)

"Radio transmitters will be surgically implanted in up to 10 fish of sufficient body size of each species from five habitat types in the middle and lower river."

FDAML-14
- Identify species to be tagged.

FDAML-15
- Define surgical methods and placements of radio tags in fish. Will an exterior mark be also used to quickly identify radio tagged fish during later sampling events?

Section 7.7.4.1.1 Fish Capture, Page 7-36

- Removing fishwheels at Curry in the first week of September likely misses a substantial portion of the coho and chum runs. Should consider operating fishwheels through September into October.

Section 7.8 River Productivity Study

Overall, more information needed on sampling methodology.

Section 7.8.4.2.1.Benthic Macroinvertebrate sampling.

RIVPRO-10
- Should consider drill holes for winter macroinvertebrate sampling; probably safer than sampling winter open water sites.

RIVPRO-11
- Explain site selection and how site will be sampled at all flows. If sample sites will not be permanently wetted, how is the length of time required for colonization determined in order to sample sites that are not permanently wetted.

RIVPRO-12
- More information is needed on woody debris sampling design. Multiple sections taken from each snag would likely result in pseudoreplication issues. Recommend sampling multiple snags.

RIVPRO-13 Section 7.8.4.2.2 Benthic Algae Sampling

Describe the methods that will be used for sampling and analysis.

RIVPRO-14 Section 7.8.4.4. Surrogates for future impacts

Should assess the feasibility of establishing reference sites in adjacent systems (e.g. evaluate the Chulitna, Talkeetna, etc.).

Section 7.8.4.7 Fish Diet

RIVPRO-15
- What are the targeted species and lifestage for diet analysis? What methods will be used and what is the feasibility of non-lethal methods for juvenile salmonids?

RIVPRO-16
- What sample preservation will be used? Need to consider prey condition after flushing. To what level of taxonomic resolution will samples be identified?

RIVPRO-17 Section 7.8.4.9 Macroinvertebrate Colonization

What is the artificial substrate material and likelihood it will influence colonization results?

Section 7.17 Cook Inlet Beluga Whale Study

Three objectives have been identified for this study:

1. Document the presence of all marine mammals in the Susitna River delta, focusing on Cook Inlet Beluga whales (CIBW) distribution within Type 1 critical habitat;

2. Determine marine mammal utilization of the Susitna River, focusing on the upstream extent of CIBWs; and

3. Evaluate the relationships between potential hydropower-related changes in the lower Susitna River, CIBW in-river movements, and CIBW prey availability.

Section 7.17.4 Study Methods

The basic approach to the draft proposed CIBW study plan is to obtain additional information on CIBW distribution and group size during the months of open-water. Other studies will gain information on some open-water period prey species; i.e., eulachon and salmon.

CIBW-12 Apparently, as indicated in Section 7.17.4.3, estimated effects on CIBW will be determined through a modeling approach, incorporating results on the distribution of CIBW from this proposed study, and results from other hydrologic, prey, and habitat studies. The Project may have indirect effects on CIBW caused by changes in the distribution or abundance of some prey species, or by restricted access to prey species. The methodology should describe the general modeling approach especially as applied to objective number 3.

Section 7.17.4.1 Document CIBW and other Marine Mammal Presence within Susitna River Delta (Page 155 – 156)

CIBW-13 Section 7.17.4.1 describes the proposed methods for aerial surveys, apparently to obtain 'fine-scale' information on CIBW seasonal distribution. The specific objective of the surveys relative to distribution and abundance should be more clearly defined. If an estimate of abundance is sought, the proposed survey effort will result in minimal levels of precision and accuracy. Obtaining relative group size information appears to be more realistic, and methods other than Hobbs et al. (2011) that are more consistent with the objectives of this study should be considered.

CIBW-14 Section 7.17.4.1 describes the proposed methods using video and still cameras to determine the upstream extent of CIBWs in the Susitna River. Our preferred approach is to use satellite telemetry backed up with Passive acoustic monitoring (PAM). Satellite tags will allow estimation of the proportion of time individuals are using the Susitna as opposed to other areas. This will complement the other methods efforts to estimate spatial extent and total amount of use of the Susitna. Those efforts should include PAM for the following reasons:

- The proposed methodology (video and still cameras) will limit data collection to the day light hours, and periods of good visibility (i.e., not during heavy rain or fog). PAM should be used to collect additional information on the presence of CIBW, 24 hours per day, 7 days a week, independent of weather conditions.
- Determining if project-induced changes in prey distribution and prey habitat will affect CIBW is problematic when only knowing the distributions of CIBW and their prey. Information on when and where belugas are foraging, which can be obtained through PAM, will increase the ability to determine project-induced changes. CIBW foraging behavior is extremely difficult to identify through visual methods due to the turbidity of the water in Upper CI.

- When visual and PAM methodologies are used concurrently at the same locations, acoustic behavioral information (e.g., foraging) from those locations can be applied to acoustic datasets from areas where no visual observations are collected.
- Substantial detail is provided on video data collection, including behavior logs and group counts, yet the rationale for this level of detail to the primary objective of the study is not clear. Substantial costs will be incurred to complete the processing of large amounts of video and still imagery collected. PAM should be considered an alternative to reduce costs and obtain results more quickly and consistently (e.g. continuous sampling independently of weather and daylight). Specifically, existing software that has been used in similar river environments within Cook Inlet (i.e., Eagle River, Knik Arm) successfully detected beluga whales and provided automatically processed data, and semi-automated analysis methods have been successful at sites near Beluga River and the within the Little Susitna River. Further, based on visual vs. acoustic comparisons in Eagle River, an index to relative abundance based on acoustic data of CIBW was established. A similar index could be established for the Susitna Delta, and be applied to acoustic data in areas where visual data are not collected.

CIBW-15

- The over-winter period should not be excluded from the study. Information exists (Goetz et al. (2012) that indicates belugas may forage in this area more in winter than summer, and such over-winter foraging could potentially be very important to belugas, especially juveniles and pregnant/lactating females. If data on the presence of belugas in this area is deemed important, PAM has been used successfully to detect belugas during the overwinter period in a similar environment; i.e., outside of Beluga River, to the west of the Susitna Delta.

<u>Section 8.5 Study of Distribution, Abundance, Productivity, and Survival of Moose</u>

MOOSE-5

- ADF&G proposed this study and intends to conduct GeoSpatial Population Estimation (GSPE) in the fall of 2012. If this is not feasible due to weather or other constraint, then 2013 project will need to be amended to include a GSPE component.
- The interim draft RSP appears to adequately address concerns with the moose study plan.

<u>Section 8.6 Study of Distribution, Abundance, Movements, and Productivity of Caribou</u>

- ADF&G Division of Wildlife Conservation (DWC) proposed this study and intends to take responsibility for implementation. Except as noted below, the interim draft RSP appears to adequately address concerns with the caribou study plan.

CBOU-2

- This study was originally proposed to extend through 2016 in order to better characterize year to year variation in caribou movement patterns, but it was changed to end with the license application date of 2014. Two years of data are not expected to sufficiently characterize caribou movement patterns. This project will likely need to be extended.

Section 8.7 Study of Distribution, Abundance, and Habitat Use of Dall's Sheep

DALL-1
- DWC agreed to conduct Dall's sheep surveys of suitable sheep habitat within GMU 13E south of the Denali highway and east of the Park's highway. ADF&G submitted a revised draft study plan that describes this work.

DALL-2
- The interim draft Dall's sheep study plan appears to adequately describe the study area and methods to be employed by ADF&G during the summer count. The map still needs to be revised to reflect the redefined study area.

DALL-3
- As discussed at the October 16 Terrestrial Resources working group meeting, ADF&G believes the proposed survey work along with analysis of previous studies and site inspection of the Jay Creek and Watana mineral licks is adequate to assess sheep status. It is not necessary to intensively monitor the licks in 2013 or to place radiocollars on sheep in the study area.

Section 8.8 Study of Distribution, Abundance, and Habitat Use by Large Carnivores

LGCAR-1
- DWC agreed to conduct spatial modeling of bear density in cooperation with David Miller of the University of Rhode Island and has submitted a proposal describing the project.

LGCAR-2
- As noted in the interim draft RSP, DWC would like to be consulted during sampling design and analysis of hair samples downstream of the proposed dam for DNA and stable isotope analysis.

Section 8.9 Study of Distribution and Abundance of Wolverines

WOLV-2
- DWC agreed to conduct a Sample-Unit Probability Estimator (SUPE) survey for wolverine.
- A study plan has been submitted that deals with the issues identified in the interim draft RSP consultation table version 10/15/2012.

WOLV-3
- This proposal includes conducting occupancy modeling in 2013 and 2014 and as such is expected to provide information on habitat associations. Occupancy modeling will also provide population trend information in the future.
- The recently released interim draft RSP for Wolverines appears to adequately incorporate these changes.

Section 8.10 Study of Terrestrial Furbearer Abundance and Habitat Use

TERFUR-1
- DWC supports this project intended to assess abundance of coyote, red fox, lynx and marten with modifications to address concerns expressed here.

TERFUR-2
- DWC recognizes that objectives were edited in the interim draft RSP to reflect that DNA analysis of scats and hair will be used for markers rather than the raw sources (scat/hair)

mentioned in the PSP objectives. Similarly, the kind of snowshoe hare sign to be quantified in objective 4 was specified as pellet counts.

TERFUR-3
- To improve reliability of results the final study plan will need to address sample sizes, capture heterogeneity, and population closure for DNA mark-recapture estimates. The final study plan should also address the length of the study and sample sizes relative to estimation of vital rates and population size.

TERFUR-4
- FERC's Integrated Licensing Process legitimately seeks to document abundance of a wide variety of wildlife species prior to project approval. The limitations of abundance data for species that depend on the hare cycle and are naturally cyclic themselves must also be acknowledged. This work will likely be conducted during a low in the hare cycle, and so predator populations will likely be higher after dam construction begins despite any direct effect of the development. While the comparison to Denali National Park will help, caution is necessary.
- The interim draft RSP includes more details describing the proposed sampling design and the statistical analysis to address concerns about population closure and heterogeneity. DWC is encouraged to see these changes.

<u>Section 8.11. Study of Aquatic Furbearer Abundance and Habitat Use</u>

AQFUR-1
The interim draft RSP indicates that river otter track surveys will be conducted repeatedly 2-3 days after fresh snow fall. This approach lends itself to transect sampling. Occupancy modeling from these data may also be feasible depending on study design. DWC supports this general approach and should be consulted during study design.

<u>Section 8.12. Study of Species Composition and Habitat Use of Small Mammals</u>

SMAM-1
The idea of removing the trapping effort from the study design was discussed. The rationale for not trapping was to avoid killing a large number of small mammals known to be in the study area from previous studies.

- Small mammal populations are very dynamic and tend to be eruptive. Small mammals are very important to the prey base for mammals as well as birds, especially raptors. Long term studies are necessary to gather meaningful information.
- Given the limited opportunity to acquire the necessary long-term information, there is some justification for not engaging in a large one-time trapping effort.

<u>Section 8.13. Study of Distribution and Habitat Use of Little Brown Bat</u>

The specific objectives of the bat baseline study are to:

1. Assess the occurrence of little brown bats and the distribution of habitats used by bats within the impoundment zone and infrastructure areas for the Project;

2. Review geologic and topographic data for potential roosting and hibernacula sites; and
3. Examine human-made structures (bridges and buildings) for potential roosting or hibernacula.

- Flooding is biggest threat to hibernacula and maternity colonies. Timing of inundation could affect level of loss and therefore any necessary mitigation.

BAT-2
- Need to identify and locate geological features including any karst topography, caves or abandoned hard rock mines that could serve as maternity colonies or hibernacula.

BAT-3
- Locate any potential human-made structures within the inundation zone that could serve as maternity colonies or hibernacula.

BAT-4
- Document level of use for any maternity colonies or hibernacula identified.

Section 8.14 Waterbird Migration, Breeding, and Habitat Study

WTRBRD-03
- Harlequin duck surveys to be conducted from a R44 type helicopter along all suitable moving water bodies (i.e. rivers, streams) within study area. The interim draft RSP states that moving water bodies will be surveyed as far upstream as practical; even outside of study area. The number of moving water bodies surveyed and the extent to which they will be surveyed will become more apparent after the initial survey period. Question whether practical to follow streams all the way up into the watershed (Watana Creek has a very large watershed outside of study area).

WTRBRD-04
- DWC consulted with AEA and the USFWS and the interim draft RSP appears to adequately address concerns discussed during consultation.

WTRBRD-05
- The interim draft does not specify a minimum size for waterbodies to be surveyed. Surveyed lakes should include those surveyed previously by Kessel et al. (1982). Experienced observers should also be able to select waterbodies based on nesting habitat suitability in the immediate vicinity of the waterbody.

Section 8.16. Breeding Survey Study of Landbirds and Shorebirds

DWC has previously commented that "distance estimation techniques suggested have been recently shown to produce very problematic density estimates (Alldredge et al. 2007a, Alldredge et al. 2008, Efford et al. 2009). Detectability is notoriously difficult with auditory surveys. At a minimum a double count observer method should be employed. Differences in auditory distance estimation can still lead to profoundly unstable results (Alldredge et al. 2007b). Despite these concerns, the protocols should be compatible with Alaska Landbird Monitoring System (ALMS), and the data should be made available to USGS for inclusion in ALMS for inventory and habitat associations after completion."

To deal most effectively with these concerns, we suggest:

BREED-04
1. Establishing 3 – 4 or more distance bands instead of requiring observers to estimate actual distances.

BREED-05
2. Observers must be trained, tested and prequalified for species identification and distance before going afield.

BREED-06
3. Using double observers if densities are to be calculated. Using double observers has been the subject of debate, most recently at the Terrestrial Wildlife Working group meeting on October 15, 2012. DWC continues to recommend use of double observers as it is the best way to overcome deficiencies described above,

Alldredge, M. W., T. R. Simons, K. H. Pollock. 2007. A Field Evaluation of Distance Measurement Error in Auditory Avian Point Count Surveys. The Journal of Wildlife Management. 71(8).

Alldredge, M. W., T. R. Simons, K. H. Pollock, and K. Pacifici. 2007. A field evaluation of the time-of detection method to estimate population size and density for aural avian point counts. Avian Conservation and Ecology - Écologie et conservation des oiseaux 2(2): 13. [online] URL: http://www.ace-eco.org/vol2/iss2/art13/

Alldredge, M.W., K. Pacifici, T.R. Simons and K. H. Pollock. 2008. Blackwell Publishing Ltd. A novel field evaluation of the effectiveness of distance and independent observer sampling to estimate aural avian detection probabilities. Journal of Applied Ecology 45: 1349–1356.

Efford, M.G. and D.K. Dawson. 2009. Effect of Distance-related Heterogeneity on Population Size Estimates from Point Counts. The Auk 126(1):100–111.

Kessel, B., S. O. MacDonald, D. D. Gibson, B. A. Cooper, and B. A. Anderson. 1982. Susitna Hydroelectric Project environmental studies, Phase I final report—Subtask 7.11: Birds and non-game mammals. Report prepared by University of Alaska Museum, Fairbanks, and Terrestrial Environmental Specialists, Inc., Phoenix, NY for Alaska Power Authority, Anchorage. 149 pp.

Section 8.16.4 Study Methods (Page 8-95)

BREED-07
- DWC supports 2 sampling periods and 2 years of sampling as called for in plan.

BREED-08
- Need specific surveys to inventory shorebirds and cavity nesters in addition to raptors and water birds as proposed.

Section 8.18 Study of Distribution and Habitat Use of Wood Frogs

FROG-1
- DWC has been in consultation with AEA about wood frogs and is pleased to see the interim draft RSP for Wood Frogs. Unfortunately, we have not yet had an adequate opportunity to review the revisions and will continue to consult on study design.

Section 10. Recreation and Aesthetic Resources

REC-34 More detailed information is needed to better understand what data will be collected, and how it will be summarized, analyzed, and results generated. In particular, more information is needed on the following components:

a) Incidental Observation Survey

b) Telephone Survey of Railbelt Residents

c) Intercept Surveys and Structured Observation Visitor Counts

ADF&G recommends that AEA conduct a technical review with interested agencies on the preliminary results generated by the proposed recreation use and demand surveys noted above (after data collection and preliminary analyses) to identify possible concerns related to the detailed analyses prior to development of the final reports. It is often the case that errors in data analysis can be spotted at this phase prior to interpretation and reporting.

REC-35 Section 10.5.4 Recreation Use and Demand (pg.10-6)

Paragraph #1, Sentence #2: The sentence "visitors to the area participate in a wide variety of activities, including…" should also mention all-terrain vehicle (ATV) and/or off-road vehicle (ORV) use, hiking, and wildlife viewing. The activities noted are certainly not inclusive and more detailed lists and inclusive language are used elsewhere in this document.

REC-36 Paragraph #3, Sentence #2: "Effects of the project features (e.g. reservoir and access roads) on….." is rather non-inclusive of the various recreational activities in the project areas and the language probably should be modified. Fishing and berry picking are other "consumptive" recreation activities that should be mentioned. Bird-watching, as an example of non-consumptive use, should be broadened to wildlife-viewing.

REC-37 Paragraph #3, Sentence #4: The sentence that reads "There are also potential effects of induced recreation along the Denali Highway…." doesn't make sense. Are they trying to say "there is also the potential for induced effects on recreation from the project along the Denali Highway"? This statement should be clarified if left in the document.

REC-38
SOC-24 Paragraph #4: Regarding the reference to the Socioeconomic Resource Study and the economic contribution of recreation in the study area. AEA should be aware of the following study related to economic contributions of sport fishing to the Alaska economy.

Southwick Associates Inc. and W. J. Romberg, A. E. Bingham, G. B. Jennings, and R. A. Clark. 2008. Economic impacts and contributions of sportfishing in Alaska, 2007. Alaska Department of Fish and Game, Professional Publication No. 08-01, Anchorage.

Although the regional analysis may not provide direct estimates related to the proposed project, it is a template for estimating expenditures associated with recreation use in Alaska. This study will likely be repeated in 2014 or 2015.

REC-39 Section 10.5.4 Identification and Analysis of Salient Date from Existing Survey Research

The Alaska Visitor Statistic Program (AVSP) is a reasonable survey instrument and data source for non-resident recreation use in and around the project area. Other relevant sources of salient data for both non-resident and resident recreation use which are not noted in this proposed study plan, include:

> ***ADF&G Statewide Harvest Survey***. Annual survey of resident and non-resident sport fishing households. Survey provides annual statewide, regional and watershed estimates of sportfishing days fished by species by residency, guided/unguided. Estimates available for the past 30 yrs. Published report through 2010, available data through 2011. See:
>
> > Jennings, G. B., K. Sundet and A. E. Bingham. 2011. Estimates of participation, catch, and harvest in Alaska sport fisheries during 2010. Alaska Department of Fish and Game, Fishery Data Series No. 11-60, Anchorage.
>
> ***Alaska Resident Statistics Program (ARSP)***. Survey commissioned in 2000 to estimate Alaska resident recreation behavior patterns and preferences. See:
>
> > Fix, P. J. (2009). Alaska Residents Statistics Program Final Report. Fairbanks, Alaska: School of Natural Resources and Agricultural Sciences, Department of Resources Management, University of Alaska Fairbanks.

REC-40 Section 10.5.4 Incidental Observation Study (p.10-8)

The description of this study (IOS) states that this survey will not have statistical value, but will be used throughout the study. How will the IOS feed into other studies and decision making? Will the results of the incidental observation just be a map with points indicating observed recreation for reference, or are there some other methods that could be employed to otherwise use the results of the IOS. There should be more explanation and details on how else this information could be useful in the process.

REC-41 Section 10.5.4 Telephone Surveys of Railbelt Residents (p.10-8)

Paragraph #1, Sentence #2: The plan says that a statistical sample of 600-900 randomly-selected Railbelt residents will be drawn and later that estimates for possible sub-groups will be developed (and sample adjusted). It is our experience with public surveys that likely response rates to the survey will be relatively low (less than 40% of drawn sample), so we believe that the 600-900 sample size is probably too low to provide sufficient responses for sub-group estimates to be developed with any degree of precision. Suggest identification of sub-groups during study development and adjustment of sample size and sampling protocol as needed. Question: what are the sub-groups likely to be based on – location of residence, recreation type or mode of travel? Please explain in subsequent detailed study plan. The ARSP study plan (noted above) may provide useful background for sub-group identification.

Given that statistical estimates of resident recreational use and other recreation variables are to be developed from this study, it is recommended that a detailed study plan for the telephone survey be developed and review by relevant agencies and organizations for adherence to current social science research practices prior to implementation.

REC-42 Section 10.5.4 Intercept Surveys and Structured Observation Visitor Counts (p.10-9)

Paragraph #1. Although the list of specific recreation access modes mentioned in this paragraph does not appear to be exclusive, it seems that ATV/ORV access should be mentioned among those listed given the large number of ATV/ORV access points along the Denali Hwy south as well from the Talkeetna area. If in paragraph #2 the plan is going to mention specific mode examples, it should list an ATV/ORV major access trail as well.

It appears that this will be a non-probability sample of recreation users (paragraph #4 last sentence) - since there appears that a statistical sampling process will not be employed. Please explain how the resulting data from this particular sub-study would be summarized and integrated with other recreation data.

This concludes the current SD2 and PSP comments from the State of Alaska.

Document Content(s)

State of Alaska re FERC P-14241 PSP and SD2.PDF.......................1-37

United States Department of the Interior

NATIONAL PARK SERVICE
Alaska Region
240 West 5th Avenue, Room 114
Anchorage, Alaska 99501

IN REPLY REFER TO
L7425 (AKRO-EPC)

VIA ELECTRONIC MAIL: NO HARD COPY TO FOLLOW (FERC eFile P-14241-000)

NOV 09 2012

Kimberly D. Bose
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Subject: General and Study-specific Comments on the Draft Revised 2013-14 Study Plans (DRSP) 10.5 (Recreation Resources), 10.6 (Aesthetics Resources), and 10.7 (River Recreation Flow and Access) for the Susitna-Watana Hydroelectric Project (P-14241), Susitna River, Matanuska-Susitna Borough, Alaska

Dear Secretary Bose:

The National Park Service (NPS), Alaska Region offers the following comments in response to the Federal Energy Regulatory Commission's (FERC) Notice of Soliciting Comments on the 2013-14 Proposed Study Plans (PSP). The NPS Hydropower Recreation Assistance program consults with license applicants and stakeholders providing technical assistance in assessing impacts on public recreational resources during the FERC licensing process. The program draws its authority from the Federal Power Act and technical assistance provisions of the Outdoor Recreation Act of 1962, the Wild and Scenic Rivers Act of 1968, and the National Trails System Act of 1968.

General Comments

To date, NPS has been fully engaged with the Alaska Energy Authority (AEA) and their consultants. Our comments build on the prior comments and engagement by NPS in this process. We have commented on the Preliminary Permit Application and Pre-Application Document (PAD), submitted detailed study requests; and examined numerous preliminary study plans, including the PSPs and three DRSPs. We are encouraged that many of our comments and recommendations have been considered and adopted, and are confident that the consultant team chosen by AEA (URS, Oasis-ERM, and the McDowell Group) possesses the competence, cooperative spirit, and energy needed to ensure successful planning and implementation of the recreation and aesthetic resource studies.

In the area of Aesthetic Resources, we are supportive of the current, progressive approach being taken by AEA's consultant, URS, in using an expanded/modified version of BLM's basic Visual Resources Management method. URS's presentation during the October 3, 2012 work group meeting was highly informative and we look forward to future collaboration on this study.

To aid stakeholders and FERC in assessing progress towards agreement on the scope, design and execution of the project's recreation and aesthetics studies, AEA and its consultant team have developed a table outlining issues we and other stakeholders have raised and AEA's response. This table – Table 12.4-1 of the Recreation and Aesthetics DRSP – is a very helpful tool in support of our mutual interest in resolving outstanding study plan issues. We appreciate the work involved in producing this table, and agree with many of the applicant's responses to our questions and concerns. There remain some areas, however, where NPS continues to have concerns. Our comments, below, focus on these areas, and are based on a somewhat rushed review of the applicant's most recent versions of the various study plans and survey instruments, rather than the original PSP filed in July 2012.

GEN-01

AEA and its consultants have indicated that NPS and other stakeholders will be consulted as critical milestones approach, such as 2012 study results dissemination, further development of recreation survey instruments and methodology, and revisions to study scope or methods that may be necessary following the first field season of Integrated Licensing Process (ILP) studies in 2013. We look forward to maintaining a collaborative relationship with AEA, its consultants, and other stakeholders. We do believe, however, that AEA could be doing more to meet the requirements of 18 CFR 5.11(b)(3), which requires applicants to include, for each study in its PSP, "Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results." We understand the massive workload associated with preparing a PSP that includes 58 separate studies of a remote area where previous studies are either dated, or non-existent. The State of Alaska nonetheless chose to use the ILP in its ambitious licensing and construction schedule. Given our own capacity, it is already proving difficult for NPS to fully engage, covering technical working group (TWG) meetings that have been scheduled at short notice without first polling stakeholder availability, and with last minute agendas; and checking the project website multiple times a day to see if new documents have been posted. We have endeavored to review and respond in a meaningful manner to interim work products that have been released at, rather than prior to, workgroup meetings, but have not always been able to give these documents the level of scrutiny they deserve. We believe that better use could be made of AEA, consultant, resource agency, and other stakeholder time if individual workgroups had more autonomy to decide where and when to meet, and if meetings were timed to allow advance review of important interim work products. In addition, as we note in more detail below, we believe this project would benefit from following the Communication Protocol mentioned in the PAD and resource study specific schedules and communications plans to reduce conflicts, confusion and delays about "the manner and extent to which information will be shared."

Baseline Data and Information - In our comments on the 2012 (pre-ILP) studies, we underscored the need for baseline information on both recreation and aesthetic resources in the area potentially affected by the project. Very limited field work for these resources was compiled for the previous Watana project in the 1980s. The 2012 field reconnaissance work represents the first effort to collect data using methods consistent with current hydropower licensing requirements. However, because the results of the 2012 studies have not yet been released, NPS and other stakeholders have had to develop our recreation and aesthetic resource study requests without benefit of solid baseline resource information, e.g. without knowing for certain which recreational activities take place in the project area, or which routes and sites are particularly important to recreational users.

Our study requests reiterated the need for more detailed information concerning the Watana project area's existing recreation and aesthetics resources, as well as the likely effects of the project on these resources over a 50-year license period. Much of our subsequent agreement and confidence in the direction of the 2013-14 studies is predicated on the effectiveness of the data collection and compilation of historic information, plus the rigor of the reconnaissance effort currently underway (2012 studies).

Our concern about this issue was noted in Table 12.4-1 (see fifth comment). AEA
REC-1 summarized this concern as follows:

"According to current published schedule, agencies and stakeholders will not have results of critical 2012 reconnaissance, baselining studies that are key to determining scope, adequacy of the 2013-14 ILP studies before NPS's final opportunity to comment on ILP studies."

AEA's response is:

"AEA study teams **are using** information gathered in 2012 to inform the study plan process in those instances that such information is applicable to customize or alter specific methodologies. Much of the work being done in 2012 has to do with collection of baseline information which by itself does not necessarily alter the study methods proposed" (emphasis added).

NPS notes that no 2012 study reports have yet been released. Perhaps AEA and its consultants "are using" internal drafts of the reports to inform the DRSPs, but if so, this information is not available to resource agencies, the public, and presumably FERC. If our own analysis of the 2012 results leads us to believe that certain activities, locations, or issues may have been overlooked in the Revised Study Plans (RSP), NPS reserves the right to request amendments to the relevant study plans, even if the ILP deadline has passed. Without such amendments, data gaps may make it difficult for us develop appropriate license condition recommendations to protect, mitigate and enhance outdoor recreation resources.

While we agree that some aspects of study methodology are independent of baseline information about the spatial and temporal distribution of recreational activities in the project area, other aspects are not. For example, AEA is not currently proposing to perform intercept surveys during the coldest, darkest quarter of the year (during the three month period from mid-November to mid-February), citing contactor safety concerns and likely low numbers of recreational users at this time of year. Yet without the 2012 reconnaissance study results, we do not yet know what those numbers are. In addition, the value of a recreational resource is more than a function of the number of its users. Resources that provide rare or distinctive opportunities, e.g. viewing the Northern Lights in near complete silence on New Year's Eve from an ice-covered river accessed by dog-sled, snow machine, or ski, cannot be said to be less important than summer activities that also see low participation rates, such as paddling one of North America's few relatively accessible Class V+ rivers at 29,000 cfs.

It is possible that the 2012 reconnaissance work will tell us that some areas potentially affected by the project do see important use during this period, or are significant for aesthetic opportunities unavailable during the other nine months. We encourage the study team to consider ways to survey recreationists visiting the study area during these months that don't involve intercepts at remote locations. We remain concerned about whether this kind of 2012 survey result will be applied correctly to the ILP study plans in the absence of any involvement by stakeholders, the public, or, potentially, even FERC's own recreation specialists. Our concerns also apply to Aesthetic Resources and River Recreation Flow and Access PSPs. NPS and other resource agencies, along with the public, are effectively being asked to take AEA's word that if results of 2012 studies indicate a need to modify ILP studies, such modifications will be made voluntarily, after the ILP study plan resolution period has concluded. This points to the larger problem, unique to original projects that are being licensed using a process designed for existing projects with abundant baseline resource information (i.e., the ILP), of trying to finalize study plans for a project before reconnaissance level work is complete.

The DRSPs are replete with references to the integration of 2012 study results having been taken into consideration, using the past tense. To date, we have not seen any results from the 2012 recreation and aesthetics studies, although it appears that AEA is making progress in consolidating baseline information. At one of the workgroup meetings this fall, AEA's Project Manager suggested that 2012 preliminary results might be released for our review prior to the November 14, 2012 PSP comment deadline, provided we understood that the data were subject to change and corrections and were not ready for release to the general public. While we can appreciate that emerging data and information is being integrated into the revised study plans piecemeal, we anxiously await a report from the 2012 studies that satisfies our original request for comprehensive reconnaissance and assessment of baseline information for this project. Because we do not yet have this report, we are filing these comments without the benefit of information about recreational and aesthetics issues that the 2012 study report might contain.

We have one more opportunity under the ILP to submit formal comments about this project's study plans: comments on the applicant's RSP, which are due in mid-January. And since no workgroup meetings are planned between the release of the RSP on December 14, 2012, and the deadline for our comments on January 18, 2013, there will be no opportunity to consult with AEA and its team of specialists regarding the implications of the 2012 study reports. It is not known when these reports will be made available – possibly not until after we've written our RSP comments, which are due for internal agency processing by mid-January 2013.

Inclusion of Lower River in Recreation and Aesthetics Study Area - From the beginning of NPS's involvement in this project we have maintained that the proposed project may significantly alter the character and supply of recreational opportunities currently provided within the proposed project area. We also believe that aesthetic values (e.g., visual resources and natural sounds) will be altered. Changes in flows, channel and floodplain morphology, riparian vegetation and winter snow and ice cover downstream of the proposed project may affect recreational access to those areas, e.g., recreational boating and winter travel along and across the Susitna River. While we understand that two large tributaries to the Susitna – the Chulitna and Talkeetna rivers – contribute substantial volumes of flow and sediment to the system from Talkeetna downstream to the mouth of the Susitna River, we note that the preliminary revised study plans for ice processes, instream flows, riparian vegetation, etc. nonetheless continue to include the "lower river" (i.e. reach from Talkeetna to Cook Inlet) in their geographical scope.

For example, on pages 18-19 of the October 28, 2012 DRSP for Instream Flow, AEA states:

"The lower extent of the Project Area will be assessed by the flow routing modeling to the extent of Project operational influence. The final Lower River study area extent will be determined by examining the flow routing model results in consultation with the TWG."

REC-2
AES-1

NPS continues to question why the study area extent for recreation and aesthetics is being prematurely constrained by AEA to the upper and middle rivers when this decision is being deferred, and delegated to the appropriate TWG, for other resources. Recreation and aesthetics resources are highly dependent on biophysical conditions, such as the continued availability of sport fish, the navigability of the river in summer, the existence of sloughs and gravel bars for fishing and camping, and of course the existence of stable ice for winter travel.

NPS contends unless and until the results of these biophysical studies prove conclusively that project operations will have no significant effect on flows, sediment transport, fluvial geomorphology, water quality, sport fish migration and habitat, game and furbearer species habitat, riparian vegetation, and ice formation, the lower river should not be excluded from the scope of the recreation and aesthetics studies. While AEA has stated that, if necessary (i.e., if the flow studies etc. show that project operations will have a measureable effect on lower river conditions), recreation and aesthetics studies along this reach can be added at a future date, this means that the intercept portions of such studies would not be conducted under the same variable baseline flow, weather, fishing, etc. conditions as the proposed 2013-2014 studies. Nor would it be possible for the mail-in or executive surveys to sample the exact same population as will be surveyed in 2013-2014. From an experimental design standpoint, not including the lower river in the 2013-14 studies will unnecessarily add systematic error to the study results when, as seems likely, this area is later added and sampled in 2015 or later. This approach also risks delaying project readiness for environmental analysis.

NPS strongly recommends that baseline boating, fishing, hunting, recreational trapping, and winter use of the Susitna River corridor from Talkeetna to its mouth be assessed in order to determine the project's impacts on recreation and aesthetics. Only if studies of the river's post-project flows, morphology, ice processes, fish habitat, etc. determine that there will be no effect on relevant biophysical conditions in the river corridor downstream of Talkeetna should the recreational and aesthetics study areas be restricted to the river corridor upstream of the confluence with the Talkeetna and Chulitna rivers.

REC-3

Recreation Management Plan - We reiterate that a Recreation Management Plan (RMP) for both land and water-based use of the project area will need to be developed, as required by FERC (18 CFR 4.51(f)(5)). This plan should be developed in cooperation with NPS, BLM, other appropriate Federal and State agencies, landowners, and the public, and should include recommendations for access policies, new facilities, and safety measures. We underscore the importance of the following recreation activities and programs known to exist within the proposed project area: sport fishing and sport hunting, recreational boating, and land-based recreation.

ILP Process Plan - In our previous comments, NPS questioned elements of AEA's ILP process plan. AEA has combined a number of diverse resources under the general title of "Social Resources" and has generally scheduled all associated TWG meetings for all these resources on a single day. "Social Resources" include recreation, aesthetics, socio-economics, cultural, transportation, subsistence, and land use. NPS has previously noted, and continues to believe, that this approach is inherently unmanageable and inefficient due to the magnitude and diversity of study topics and details that must be squeezed into a seven or eight hour day. While we are pleased that AEA and its consultants have sometimes scheduled meetings focused solely on recreation and aesthetics in addition to the general work group meetings, we recommended that the Social Sciences TWG be divided into logical sub-groups so that this becomes the norm rather than the exception.

Communications Protocol - In our previous comments and on numerous occasions, NPS has requested that a formal communications protocol be developed by AEA in cooperation with stakeholders to address the communication needs. AEA continues to use a website to share documents (e.g. its own draft study requests, meeting notices, meeting agendae, meeting minutes, etc.). Currently there is no provision for automatic notifications for important new documents to allow for downloading by stakeholders, including resource agency staff, making it necessary to check the website frequently (multiple times per day in some instances) to try to ascertain if new documents are there. Due to the complexity of the project and the file naming conventions sometimes used by AEA, it can also be quite difficult to differentiate between older and newer documents.

In addition, there is no consistency in the posting of meeting minutes. Some minutes are posted almost immediately after TWG meetings, other meetings that took place months ago still have no minutes available. As a stakeholder involved in resources that are dependent on numerous other biophysical resources, NPS is interested in the TWG discussions for these other resources. We do not have the capacity to attend all Watana TWG meetings on every topic, so we rely on meeting minutes to provide an overview of important discussions. It would be extremely helpful to us, and presumably, to other stakeholders and the public, if AEA could commit to recording and posting meeting minutes within a few days of each TWG meeting.

Again, we urge AEA to explore ways to ensure that stakeholders, particularly resource agencies, receive email notices whenever materials relevant to their interests are updated. We also suggest that a full description of what each file contains be included in the file name used by AEA, e.g., version number, date, and document type. A communications protocol would help all involved in this project know what to expect, and would give stakeholders recourse for tracking down the occasional document that slips through the cracks, e.g. the 2011 Recreation Data Gap Analysis.

Tracking Interdependent Studies - NPS recognized early on in this proceeding that many of the proposed studies are related and interdependent. Various studies are scheduled within different timeframes, yet our ability to make decisions and proceed with specific inquiries is contingent on the results generated from these other studies. With limited field seasons and finite study schedules, it is imperative that such a system is developed and maintained by AEA. On October 17, 2012 AEA posted graphic illustrations of the study interdependencies with study completion dates by calendar quarter. These are also included as attachments to the DRSPs. While we believe that this process needs to be further refined, the October 2012 graphic does allow for tracking these disciplinary interdependencies.

Comments on AEA's Draft Revised 2013-14 Study Plans for Recreation and Aesthetic Resources and River Recreation Flow and Access

NPS has been encouraged by the level of effort AEA and its consultants have devoted to drafting and refining the recreation and aesthetics resource study plans. The consultants have been very responsive to our comments and interactions. On October 17, 2012 AEA posted a comprehensive table which addressed virtually all of our previous comments and concerns. We are pleased that a majority of our differences have been reconciled and are reflected in the DRSPs.

The following comments reflect a comparison of the goals and objectives from our May 2012 study requests with the most recent 2013-14 DRSPs for Recreation and Aesthetics, which were distributed on October 25, 2012. We also address instances where we still have unresolved concerns based on our read of Table 12.4-1.

DRSP 12.5, Recreation Resources - NPS's Recreation Resources Study Request stated the following goals and objectives:

"The purpose of this study is to evaluate the impacts of the proposed hydropower project on existing and potential recreation use and the quality of recreational experience provided, and to determine potential recreation mitigation, use, demand, and needs over the term of the license. The Recreation Resources Assessment should include all of the necessary components to develop a comprehensive RMP: (1) recreation impact and opportunities analysis on existing water-borne, flow dependent and snow and ice-cover dependent river experiences (including all forms of boating and fishing and winter use), and terrestrial recreation activities known to occur in the project area (including hunting, trapping, hiking, backpacking, and all forms of Off Highway Vehicle (OHV)) use; (2) current and projected recreation visitor use; (3) existing developed and dispersed recreation inventory (including access roads, trails, and developed recreation facilities) and condition assessment; (4) future and potential recreation needs assessment and analysis; (5) recreation carrying capacity; (6) economic impacts due to loss of existing and addition of new recreational opportunities."

Generally, we believe that the DRSPs address these goals and objectives.

Unresolved issues (listed by the section number from NPS's August 2012 preliminary comments on AEA's PSP):

- 10.5.2. Existing Information and Need for Additional Information – Agencies, stakeholders and the public will not have results from the "2012 data gathering efforts" until after the November 14, 2012 due date for these PSP comments.
- 10.5.4. Study Methods, Regional Recreation Analysis – 2012 information will be used to develop the RSP. Will NPS see this prior to the November 14, 2012 due date for agency and public PSP comments? If not, how will agencies and public ensure that 2012 data is applied correctly? This timing issue points to larger problem of trying to finalize study plans for a project before reconnaissance level work is compete. This also applies to Aesthetics and River Recreation Flow and Access PSPs.

REC-4

- 10.5.4. Study Methods, ID & Analysis of Salient Data from Existing Survey Research – Existing survey research appears biased towards large-scale, packaged tourism. Analysis needs to capture use by independent tourists and local (unguided AK resident) users, many of whom are able to access the area without relying on air taxis or jet boat charters. NPS continues to be concerned that because of the dispersed nature of access and recreation within the project area, and the necessary reliance by intercept surveyors on commercial service providers and outfitters, the intercept survey may under sample independent travelers by favoring packaged tours, whose guests tend to congregate in easy-to-find locations.
- AEA contends that Sections 12.5.3, 12.6.3, 12.7.3 have been revised to indicate that the study area may be changed during study implementation if specific findings from other study disciplines indicate resource effects will extend beyond currently anticipated study boundaries. We refer you back to our comment above regarding "Study Area" and ask that the recreation and aesthetics resources study area include the lower river, just as numerous other resource studies do.

REC-5
SOC-21

- NPS disagrees with Northern Economics' assumption that Susitna-Watana Hydroelectric Project will lead to "increases in visitation." Some types of uses in the baseline project area will likely decrease or disappear post-project, e.g. hunting in the area inundated by the project reservoir, floating the upper Susitna River downstream from Denali Highway, and, potentially, activities dependent on the existing amount of fish habitat and existing extent and duration of stable winter ice cover. In Table 12.4-1 AEA states that it "believes that total project area visitation will increase with the development of the Project, even if some types of users may get displaced." NPS remains interested in the experiential and activity-specific changes in recreational opportunities that will occur, not just net increases or decreases in numbers of users.

- Recreation User Intercept Survey

REC-6

  - We continue to question the value of noting "Don't Know" and "Refused" responses to every question in the survey. These responses do not appear to add value to the survey once initial testing is complete. We definitely want to see these fields eliminated from the mail/online (self-administered) survey instrument.

REC-7

  - Question 20(f) & (g) – The table should ask about need for Information and Education resources: kiosks, signage, trail information, points of interest, geologic, historic and / or cultural information. The revised question continues to limit itself to signage. We believe that users may seek a broader array of information such as boundary information, applicable rules and regulations, etc.

REC-8

  - Question 20(f) & (g) – We believe that user preference for greater management attention (level of maintenance, staff presence, security, etc.) should be added to this question.

REC-9

  - Question 21(a) – Wording is awkward. Perhaps the words "would not" could be deleted from the question, resulting in "If you were somewhat likely or not likely to return to this area . . . "

REC-10

  - Question 24. – We believe that the determination of party size should appear earlier in survey. This important recreational attribute should be captured before subjects potentially abandon the interview. This is still not adequately addressed in DRSP.

REC-11

- Mail/Online User Survey – We have not seen a draft of this survey. The original PSP stated that it would be similar to the Intercept Survey and workgroup discussions suggested the only difference would be that this self-administered survey would omit the "don't know" and "refused" options from each question. NPS would like to see the actual survey instrument.

DRSP 12.6, Aesthetic Resources - NPS's Aesthetic Resources Study Request stated the following goals and objectives:

"The overall goal of this study is to identify baseline aesthetic resources, examine the impacts of the proposed project construction and operation on these visual and auditory resources, and evaluate potential mitigation opportunities. This exceeds AEA's proposed tasks of 'identifying BLM visual resource management designations or other visual resource management plans for the Project vicinity and identifying potential key view points and key viewing areas for proposed Project facilities' which are the subject of the 2012 Aesthetic Resources Study."

Unresolved issues:

AES-2

- 10.6.4. Study Methods, Seasonal Surveys of Ambient Sound Levels – What if the results of visitor experiential surveys indicate there need to be more surveys or surveys in different locations in order to quantify baseline resources? This is another example of a situation where the lack of reconnaissance level data makes survey design a guessing game.

AES-4

- 10.6.4. Study Methods, Seasonal Surveys of Ambient Sound Levels – NPS would like to have enough advance detail to involve our specialized soundscapes staff in reviewing this methodology. The consultants indicated in the "Consistency with Generally Accepted Scientific Practice" section of the DRSP that "The sound analysis is consistent with NPS Guidelines." We would like to verify that with our soundscape specialists.

DRSP 12.7, River Recreation Flow and Access

One specific objective of NPS's original study request for recreation included an assessment of the impact of the project on flow-dependent recreation:

". . . recreation impact and opportunities analysis on existing water-borne, flow dependent and snow and ice-cover dependent river experiences (including all forms of boating and fishing and winter use)".

We consider this to be a major concern for this project. We are encouraged by the choice of Oasis/ERM to conduct this assessment and have been pleased to work with John Gangemi directly on this specific DRSP. We were first introduced to this study plan during John's presentation at the October 3, 2012 work group meeting but did not receive a draft of DRSP until October 25, only a week before these comments were prepared for agency review. Thus NPS's collaboration with AEA and its consultants on this study has not progressed as far as on the other two studies we are involved with. Nonetheless, we are pleased, at first glance, to note that several of our recommendations and interests have been adopted in this draft. While there are no more TWG meetings scheduled before FERC renders its study plan decision next February, we request the ability to work directly with John to refine this draft as soon as possible.

Unresolved issues:

RECFLW-8

- We noted that this study's title and some initial statements about its scope appear contradictory. We believe that the study goal should not merely be to contribute data concerning recreational boating and access – it is to look at all forms of recreation that could be affected by flow changes caused by project operations. This includes activities like fishing regardless of whether recreationalists are angling in a boat or from shore. We recognize that the DRSP has been modified to assess impact on most forms of flow-dependent recreation in all seasons.

RECFLW-1

- At the October 3, 2012 meeting (see p. 4 in meeting notes), NPS suggested that focus groups be used to assess optimum and acceptable flow alternatives for the project. AEA's consultant agreed that this would be beneficial but proposed to wait to convene the groups until 2014, when more information about operations alternatives would be available. The DRSP does not include focus groups. NPS hopes this omission can be rectified in the RSP.

RECFLW-2

- 10.7.3. Study Area – The following statement lacks clarity: "areas where the proposed reservoir would create the most flow changes." What is threshold for "most"? Who decides? When? Even assuming consensus on the standard to be used, how can this decision be made before the results of the instream flow, flow routing, ice processes, etc. studies are in hand? What if NPS or others disagree with AEA's geographic scope decision? This should have been determined before the DRSPs were released. We caution the applicant that it risks having to spend additional field seasons collecting baseline data if the results of these other studies, which won't be completed until 2014 or later, alter the area predicted to be affected by project operations.
- We note that the study area for this DRSP extends downstream to the Parks Highway Bridge at Sunshine. While this would include the upstream portion of the lower Susitna River, it still fails to address the rest of the river to Cook Inlet. Regardless of whether there would be detectable changes in flows, fluvial geomorphology, ice processes, and riparian vegetation in the lower river due to project operations, resources such as migratory sport fish are likely to be affected by changes in flows, habitat, and the physical barrier created by the dam in the upper and middle river. Sport fishing is a flow-dependent form of recreation known to occur throughout the lower river, as are numerous forms of winter recreation (e.g. skiing, biking, snowmachining, and mushing races crossing the river on the Iditarod Trail route) that depend on the formation of stable ice across the lower river. By excluding most of this reach from the proposed River Recreation Flow and Access study, AEA again runs the risk of having to re-do this study if the results of other studies indicate that project operations will affect resources in the lower reach.

NPS believes that the ILP requires study plans to address all areas reasonably anticipated to be affected by a project. If the Watana project involved a smaller dam that did not present a major impediment to salmon migration, and was intended to be operated in run-of-the-river mode, the decision to exclude the Lower River from the three recreation and aesthetics study areas would be more reasonable, but this is not the case. Without information about baseline recreational and aesthetics resources along the lower river, NPS will be unable to formulate recommendations for license terms and conditions to minimize or compensate for project impacts on these resources.

RECFLW-9

- Section 12.7.4, Study Methods, Winter River Recreation Preferences "The Susitna River during the winter ice period provides motorized and non-motorized winter recreation opportunities and serves as a transportation corridor for residents along the Susitna. Construction and operation of the Project may alter the timing and longitudinal extent of ice formation, and impact such uses." Under any of the currently proposed project operations scenarios, the Project will have that effect.

RECFLW-3

- 10.7.6. Schedule – We continue to maintain that one year of study is not an adequate sample size to support conclusions about important flow-dependent activities like sport fishing, and float hunting. The Susitna's flow magnitudes, timing, durations, and rates of change vary significantly from year-to-year, as do other conditions affecting recreational use and access. We note, for example, that there was an emergency Chinook closure this year. How can AEA study the most highly valued fish species in Southcentral AK if harvest is prohibited during the only year of study? Likewise, since most recreational users use the road network to get to and from the river, road closures such as the four-day Parks Highway closure at the Troublesome Creek and Chulitna bridges in 2006, and closures of the Parks and Denali Highways in September 2012, inevitably affect recreational use in the project area. Weather patterns (e.g. late break-up, early snow, persistent rain) and wildfires also affect use. One season is not enough to document baseline opportunities and experiences when they are dependent on highly variable interannual conditions.

  AEA's response to this concern is "There is a provision to capture data in 2014 in the event that unusual circumstances or events do not allow the capture of data in 2013." NPS believes that factors such as the interannual variability in the timing of Chinook salmon runs and return rates, which in turn affect sport fishing timing and level of effort, are not "unusual circumstances." They are known attributes associated with a resource having a multi-year life span and that is dependent on variable oceanographic conditions that are also poorly understood. We contend that the decision to rely on a single year of study for this complex and variable resource is not scientifically valid, and we request FERC to caution AEA that failure to document baseline resources adequately will delay initiation of the required environmental analysis of the project.

Comments on AEA's Proposed 2013-14 Study Plans for Other Resources

Socioeconomic Study - NPS was encouraged to learn about the Random Utility Model (RUM) approach to monetizing the value of recreation in the project area. We commented on our disagreement with the assumption that the project will lead to "increases in visitation." It is almost certain that there will be trade-offs in levels of participation among different types of recreation, as well as gains or losses in the value of each kind of recreational opportunity or experience even if numbers of participants remain the same.

Some kinds of baseline project area uses will likely decrease or disappear post-project, e.g. moose and caribou hunting in the area inundated by the reservoir, and float trips on the flooded portions of the Susitna downstream from the Denali Highway. Potentially, opportunities dependent on the existing amount of fish habitat and existing extent and duration of stable winter ice cover may also decrease. At our last work group meeting, we were assured that AEA will consider all changes in visitation due to the project. However, the recently released DRSP appears to return to the assumption that visitation will increase. NPS restates its concern that by treating recreation as a one-dimensional commodity, the socio-economic study risks a failure to capture the economic effects of project-related changes.

REC-2

Ice Processes – NPS is pleased to see acknowledgement of the need "to understand the potential effects of the project on winter transportation access and recreation, which depend on ice cover **on the lower Susitna River**" (Section 7.6.3.4 of Interim Draft Revised Study Plan, emphasis added). We are, however, puzzled about the inclusion of this objective for the lower river in the ice processes study but not in the River Recreation Flow and Access study (with the exception of a ten mile stretch of the lower river from Talkeetna to Sunshine). Why are the study areas for these two studies different? How will AEA understand the project's ice-cover related effects on winter transportation access and recreation if it does not collect data on winter recreation use from Sunshine downstream to Cook Inlet?

Water Quality – Again, NPS is pleased to see acknowledgement of the nexus between water quality and recreational opportunities, as stated twice on the first page of the DRSP for Water Quality. Aesthetics are, of course, also affected by changes in water quality parameters.

The NPS appreciates the opportunity to comment on the 2013-14 Draft Revised Study Plans. We look forward to working with FERC, AEA, its consultants, and stakeholders in the licensing process. If you have any questions, please contact Cassie Thomas at 907-350-4139 or Harry Williamson at 423-322-4151 with questions regarding these comments.

Sincerely,

Nancy Swanton
Interim Team Manager
Environmental Planning and Compliance

cc:
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Document Content(s)

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Anchorage Fish and Wildlife Field Office
605 West 4th Avenue, Room G-61
Anchorage, Alaska 99501-2249

November 14, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Subject: Alaska Energy Authority's Proposed Study Plans for the Susitna-Watana Hydroelectric Project No. 14241-000

Dear Ms. Bose:

The U.S. Fish and Wildlife Service (Service) has reviewed the Alaska Energy Authority's (AEA) Proposed Study Plan (PSP) for the Susitna-Watana Hydroelectric Project provided to stakeholders on July 16, 2012. This letter transmits comments provided by the Service in accordance with regulations of FERC's Integrated Licensing Process [18 CFR Section 5.12] and provisions of the National Environmental Policy Act (NEPA) of 1969 (83 Stat. 852; 42 U.S.C. 4321 et seq.), Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d), Migratory Bird Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.), Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and Federal Power Act (16 U.S.C. § 791 et seq.). The Service appreciates the opportunity to work with AEA to ensure that appropriate resource information is acquired to allow us to fulfill our statutory responsibilities.

This submission consists of two parts: (1) a cover letter with general comments and issues pertinent to AEA's Proposed Study Plan of July 16, 2012, and planning and licensing processes of the proposed Susitna-Watana (Su-Watana) Hydroelectric Project No. 14241-000 (Project); and (2) an enclosure containing comments on each of the PSPs that address the Service's 21 study requests of May 31, 2012. The PSP includes 58 individual study plans, organized into 11 natural resource sections, and by topic within each section. We found that 27 of the individual study plans from five sections address elements of the study requests that we provided and are most pertinent to the Service's resource responsibilities. The enclosure includes specific comments on the topics by PSP section number and title.

General Comments

The Service appreciates AEA's request and FERC's concurrence in granting the resource agencies a comment period extension for reviewing the PSP. The Service also greatly appreciates AEA's provision of Supporting Services to the Service and the National Marine Fisheries Service (NMFS) under the terms of our June 2012 Memorandum of Agreement among AEA, the Service, NMFS, and the Alaska Department of Natural Resources. Because of the geographic scope of the project, the inter-related complexities of the physical and temporal scale of scientific information to be collected, and the valuable fish, wildlife, and habitat resources of the Susitna River watershed, the Service has a substantial interest and responsibility in ensuring conservation of these valuable fish and wildlife resources.

The Service's comments focus on the PSP submitted by AEA on July 16, 2012. Since that time, the Service, NMFS, and our Supporting Services, have participated with AEA and their consultants in a number of technical working group (TWG) meetings to work toward understanding and consensus on sound study plans. However, not all areas of agreement have been subsequently documented. AEA began issuing draft revised study plans (RSP) October 31, 2012, which do incorporate several areas of agreement. However, there was insufficient time for the Service to adequately review all of the draft RSPs, and update our nearly complete comments on the PSP, prior to the November 14, 2012, due date for comments on the PSP. We acknowledge and appreciate AEA's efforts to maintain an iterative process while continuing to refine the PSP to meet agencies' study requests. Where possible, our comments reference agreements reached since AEA's July 16th PSP or the further details provided in the RSP.

The Service recommends future TWG meetings be more interactive and less focused on Powerpoint presentations. This would allow for effective discussions on all topics, leading to mutual understanding. We also recommend that documentation be provided for agreements reached at these meetings, so that there is a common frame of reference for all involved parties. At this time it is difficult to provide written comments on these meeting discussions without the details that a written document provides.

GEN-35

Study Plan/Study Request Crosswalk: As stated above, the Service submitted 21 study requests. AEA's PSP contained 58 individual study plans, organized into 11 natural resource sections, and by topic within each section. Following a comprehensive review of the plan, the Service found 27 of the individual study plans from 5 natural resource sections addressed elements of the study requests that we provided. It has been previously recommended that AEA provide a comparison of agency study requests and AEA proposed study plans and identify any unaddressed study request or study request components to assist our review of the PSP. FERC has affirmed AEA's need to provide this cross-walk comparison of study requests and the PSP. This study request-PSP comparison is necessary in part due to the altered organization of AEA's PSP which differs significantly in organization from the Service's study requests. The issue will gain significance as we continue our review of the draft RSP, as again, the individual study plans are reshuffled and renumbered adding more confusion about which study plans now address our study requests.

At the same time, there is a need to ensure that all study requests are integrated, with the overall findings appropriately influencing design of project alternatives.

GEN-36 Project Design and Study Inter-relatedness/Interdependency: The proposed Project is a large and complicated undertaking that will involve numerous individual studies, agencies, consultants, and individuals throughout the licensing process. Study requests were developed individually, and have not fully benefitted from consideration of how they should be integrated with other studies, including for efficiencies in time and cost of implementation. While the importance for integration may be implied within the various individual PSPs, the Project would benefit if there was a clear plan describing the strategies for information exchange and integration between the various studies and their respective Principal Investigator(s). This integration plan should discuss how model results will be documented and how the information will be provided in a format that is clear and accessible to the other studies. The plan should acknowledge the potential challenges that may be encountered and strategies for dealing with these challenges.

The PSP individual studies are numerous and complex. We recommend that AEA develop a cross-walk for all the studies to help clarify their inter-relationships, and then clearly describe how each study may depend on other studies. During the October 2012 technical work group meetings, AEA started to include helpful graphics and charts depicting study interdependencies, including interactions between different studies and how products from one study feed into another, and timelines indicating when relevant models and other products will be available. AEA will need to continue to refine this product and the Service will need to provide further review. At this stage, studies of biological resources and physical habitat parameters have not yet been interrelated with engineering studies and design considerations. Such integration and collaboration will be essential to ensure the licensing process is efficient, economical, and results in a project that best addresses environmental, economic, and power generation factors.

Many of the individual PSPs rely upon or provide data from/for other studies. Recognizing these relationships is an important part of the Integrated Licensing Process (ILP); however, the study providing the data should describe the methodology and oversee the data collection and analyses, while the study requiring the results should restrict its discussion to the types of data/results required from other PSPs. Repeating the methods in a study not responsible for the data collection and analyses is unnecessary and risks confusion if the methods differ or are inadequate in one of the studies. For example, since the Groundwater PSP 5.7 will be providing data to other studies, the Groundwater PSP should describe the methods as well as list the data/results that will be provided to other studies (e.g., 6.5 Fish and Aquatics Instream Flow, and 6.6 Riparian Instream Flow studies).

Besides interdependency figures, AEA must provide timelines showing how and when the various study components (both among major studies and within studies) will feed into other studies and study components. The Service is concerned the sequencing of some study components may be out of sync with the required products from other studies and study components.

GEN-37 Study methodologies: The study methods should be described in sufficient detail so others can duplicate the study. Citing methods from other studies or accepted industry standards is encouraged, but not in lieu of providing sufficient detail so the methods can be evaluated without having to refer to the citation. The July 2012 PSP provided few referenced methods; some methods with references lacked citations in the Literature Cited so their appropriateness could not be evaluated, and some methods lacked focus or duplicated methods from other objectives. Since the PSP, AEA hosted TWG meetings and site visits, including the most recent 24 October 2012 TWG meeting, which provided additional opportunities for discussion and clarification. We look forward to seeing these improvements in the RSP and subsequent iterations.

GEN-38 Botanical studies: There is much overlap in the methods and study areas for the Botanical Studies. This is somewhat confusing when considering these studies together, but a little less so when the studies stand alone. AEA should be concerned that they could potentially be headed toward duplicative and contradictory work, and need to consider how to coordinate the Service's study request to quantify the frequency, timing, and duration of surface and groundwater required to maintain riparian communities. The responsibility for this product seems to be scattered among at least three studies and their principal investigators (Groundwater, Riparian ISF, and Riparian Botanical). The result is a confusing strategy within the PSP; these resource questions have not been appropriately addressed in an integrated manner. The Service is unclear about how our request will be addressed, and it seems that AEA is confused about how to tackle it. To date, the TWG meetings have failed to entertain meaningful discussion on this topic. We reiterate the need for the TWG meetings to be less focused on Powerpoint presentations and more interactive which may allow for more meaningful discussions of these interrelated botanical studies and their relationship to the groundwater study.

GEN-39 Historic Data and Study Results: The Service remains concerned that AEA has not yet adequately evaluated and characterized all available historic (1980s) information relevant to the existing Project environment. As we move forward with the current study plan, lack of an evaluation of the previous studies is problematic for several reasons. First, the historic and contemporary studies have not been comprehensively synthesized, so it is difficult to fully understand where we are and where we need to proceed in evaluating this Project proposal. Second, the statistical validity of study results from the 1980s investigations remains unknown. (See our comment letter (December 20, 2011) requesting a biometric review of the data.) Third, we are concerned that the scope of studies conducted in the 1980s, when the Project design was quite different, is not adequate to assess potential environmental effects of the currently proposed Project. Past studies only concentrated on a few fish species and potential effects to their macro-habitats; additional data are needed to evaluate potential Project effects on downstream habitats. Moreover, technological advancements since the 1980s in the areas of tracking fish, genetics, and study methodologies can now be used to better understand relationships between fish and their habitats, in order to better inform the design of a Project with fewer, environmental impacts, and to better assess those potential impacts. Finally, the 1980s project studies were discontinued, therefore those study results were never evaluated or completed to develop final recommendations.

GEN-40 Integrated Licensing Process: AEA has laid out a process plan, schedule and communications protocol prescribing the specific timeframes, deadlines, and responsibilities of FERC, AEA, and other stakeholders in the ILP that extends from filing of the Notice of Intent (December 29, 2011) through filing of the application for license (anticipated September 11, 2015) (Chapter 2 of the Pre-Application Document). Adherence to this plan is essential for guiding the application development process in a collaborative, structured, complete and timely manner. Sharing that goal, the Service requests that FERC and AEA comply more fully with this plan, including maintaining and improving the Su-Watana project website and following the guidance laid out for technical work group meetings (Section 2, Pre-Application Document, December 2011).

AEA's Licensing Website (http://www.susitna-watanahydro.org/) lacks copies of written communications and other pertinent materials to date. These documents should be added and the site regularly updated. Examples of missing documents include agency and other stakeholder study requests filed by the initial May 31, 2012, due date, and any updates, as well as FERC documents (e.g., FERC Scoping Documents). A complete set of Preliminary Application Document (PAD) Reference Documents is not available; according to AEA these documents are to be distributed via the website or on the Alaska Resources Library and Information Services (ARLIS) website. There are currently few to no such documents on the website. Updates on additions of historic documents and studies as they are added to ARLIS should also be noted and linked. The Service recommends that all reference documents used by the project be distributed via the website, not just those used in the PAD. The website also lacks meeting summaries for several Technical Workgroup Meetings including those held in August.

With regard to ILP Meetings, AEA has not fully complied with the regulatory requirements for study planning meetings as described. The PAD communications protocol states AEA will: solicit input from participants on meeting dates, agenda items and objectives; notify participants of meetings at least 30 days in advance unless circumstances are unavoidable (this should be the exception not the standard); establish draft meeting agendas and post them two weeks in advance so that participants may submit comments on the agenda up to one week before the meeting; and, make available literature citations, documents and other information needed for consultation two weeks prior to the scheduled meetings. It is critical for AEA to follow the communications protocol and the ILP meeting guidance, in order for stakeholders to be able to fully and adequately participate in the study planning process.

Thank you for considering our comments and recommendations. If you have questions on these comments, please contact our Susitna-Watana Project Lead, Catherine Berg at (907)271-2787, or via email at catherine_berg@fws.gov. We look forward to working with FERC and AEA to refine, integrate, and collaborate on recommended studies and project design as more information about the project becomes available.

Sincerely,

A G Rappoport

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Enclosure

5. Water Resources

5.5. Baseline Water Quality Study

The May 31, 2012 Water Quality Study request submitted by the U.S. Fish and Wildlife Service (Service) combined baseline water quality and water quality modeling into one study. In our review of Alaska Energy Authority's (AEA) Proposed Study Plan (PSP) we will address the baseline water quality and water quality modeling study plans separately.

The baseline water quality PSP proposes: (a) to characterize baseline water quality conditions, (b) to develop a monitoring program to characterize surface water physical, chemical, and bacteriological conditions in Susitna River downstream of the project area, and (c) measure baseline metals concentrations in sediment and fish tissues.

WQ-25 In general, the PSP adequately addresses the water quality issues. The Service recommends specific improvements, as follows:

General Comments by Subtopic:

WQ-26 *Standard Operating Procedures:*
The baseline monitoring program should include a more detailed and uniform level of information concerning the approaches and techniques to be employed during water quality sampling such as a Quality Assurance Project Plan (QAPP). For example, based on the importance of mercury in the future reservoir conditions, an explicit discussion and development of standard operating protocols (SOP) for sampling low-level mercury concentrations ("Clean Hands/Dirty Hands") to limit sample contamination during collection, shipping, and handling should be included. Example SOPs for this technique can be found in EPA 1996 and Lewis and Brigham 2009.

WQ-27 *Sampling Timing and Location*
The baseline monitoring program should include sample collection efforts and dates to correspond with important climatological events which may or may not be captured in the once monthly program presented in the PSP. Events such as early summer snow melt and late season glacial melt can be associated with significant inputs of constituents (e.g., solids) which need to be incorporated in the modeling exercise.

WQ-28 For constituents that get sampled monthly, such as TSS, turbidity and some other chemical constituents, the sampling should occur in a synchronized manner across a range of habitat types (main-stem, side channel, slough, clear-water tributary, glacial tributary) at multiple sites on Susitna River between RM 0 and RM 250.

WQ-29 *Dissolved Organic Carbon*
The baseline monitoring program should consider developing an additional and detailed study of dissolved organic carbon (DOC) in addition to what is already included in the PSP. This component of water quality has a determining role in the levels of mercury methylation and in the bioavailability and toxicity of metals. Understanding and being able to predict DOC in the future river and reservoir will be a critical element of the utility and accuracy of predicting future water quality and toxicity for aquatic life, wildlife, and humans.

MERC-05 *Mercury*
Atmospheric deposition of mercury should be quantified as an additional source to the future reservoir, and as such should be included in the sampling effort associated with the meteorological stations.

WQ-30 *Water Quality Standards*
The PSP should develop and present evaluation criteria specifically protective of aquatic life, wildlife, and human fishers (recreational, commercial and subsistence), rather than just using state water quality standards that are designed to be protective of aquatic life. For example, waters complying with the Alaska Department of Environmental Conservation (ADEC) standard for the protection of human health (0.050 µg/L) could easily exceed the EPA (1997) criteria for the protection of various fish eating wildlife (kingfishers, loons, ospreys, and bald eagles) by a factor of 50-150 times (presuming that 10% of the mercury in the water column is methylated). Standards for each receptor class should be used in the evaluating the results of the baseline water quality sampling effort.

Specific Comments: Methods/Analysis Evaluation

WQ-31 *1)* Page 5-9, paragraph 3, the PSP reads: *"An initial screening survey has been proposed for several other toxics that might be detected in sediment and tissue samples (Table 5.5-4). The single surveys for toxics in sediment, tissue, or water will trigger additional study for extent of contamination and potential timing of exposure if results exceed criteria or thresholds…"*
- More detail is needed here. How many samples, at how many sites? The study plan must identify the specific comparative standards for each analyte and matrix, and get agreement on them up front.

WQ-32 2) Our study request indicated that *"Additional temperature monitoring locations will be identified in cooperation with Fish Studies, the Groundwater Study, and the Instream Flow study to identify areas of thermal refugia for fish".* This does not appear in the study plan.

WQ-33 3) We have requested water temperature data collection throughout the year. The study plan only includes temperature data collection between late June and late December of 2012, 2013 and 2014. Temperature data is critical during winter and spring seasons, as Project operations are expected to significantly alter conditions during these seasons.

WQ-34 4) There are a number of differences, both in total number and in locations, between the proposed meteorological stations specified in the study request (Table 2) and the study plan (Table 5.5-2). The Service recommends further discussion on this topic.

WQ-35 5) The Service Study Request, page 10 (compared to study plan page 5-11, paragraph 4): many of the specifics added by federal hydrologists regarding MET station placement were not included in the Study Plan.

WQ-36 6) The Service's study request included three MET station parameters which were not included in the Study Plan. These are solar radiation (long and short consistent with ice process study needs), snow depth, and evapotranspiration.

WQ-37

7) Page 5-13, paragraph 1: Our study request included a requirement for a Quality Assurance Project Plan (QAPP) for water sampling and analysis, and a requirement that all studies be conducted in accordance with applicable USGS and EPA methodology. None of this language appears in AEA's study plan, which only specifies that the analytical laboratory will be NELAP-certified.
   - Useful, quality data cannot be assured by a quality analytical laboratory alone. Other aspects of the study, including sample locations and timing, sample collection methods, sample preservation and shipping methods, etc., are critical to study plan. We reiterate our request for a project QAPP and compliance with applicable USGS and EPA methodology, as cited in our study request.

WQ-38

8) Page 5-13, paragraph 2, the PSP reads: "*The initial sampling will be expanded if general water quality, metals in surface water, or metals in fish tissue exceed criteria or thresholds."*
   - The applicable criteria and thresholds for each analyte and matrix must be specified and agreed to up front, before sampling occurs. This information should be contained in the study plan QAPP.

WQ-39

9) Table 5.5-3: AEA's study plan differs from our study request in the number of elements to be analyzed in sediment samples. AEA proposes far fewer elements; specifically barium, beryllium, cobalt, magnesium, manganese, molybdenum, nickel, thallium and vanadium are all absent from AEA's analyte list for sediment.

WQ-40

10) Page 5-13, paragraph 3, the PSP states: *"Metals monitoring for total and dissolved fractions in surface water include the full set of parameters used by ADEC in fish health consumption screening".*
   - This needs clarification: Does it refer to the elements ADEC measures in fish fillets in its Fish Monitoring Program? In that program, ADEC shares the fish tissue data with the state health department, which uses the data to develop fish consumption advice. This doesn't make sense in this context, because water levels do not relate directly to fish levels.

WQ-41

11) Page 5-13, paragraph 3, the PSP states: *"The criteria that will be used for comparison with sampling results are the drinking water primary maximum contaminant levels".*
   - That may be acceptable for the purpose of protecting human health from drinking water contaminants. But it does not address drinking water aesthetic issues (ADEC secondary standards), nor does it protect ecological receptors. Results must also be compared to NOAA SQuiRT tables for surface freshwater, to assess whether metal levels exceed acute and/or chronic toxicity benchmarks for aquatic organisms.

WQ-42

12) Page 5-14, Section 5.5.4.3.2 Sampling Protocol, paragraph 3 in total:
   - Our study request called for monthly sampling year-round. We are especially interested in winter data, and coordination with the Ice Processes study. AEA's study plan is a major departure from this recommendation, as it calls for 4 monthly samples during the summer months, and only 2 other samples collected during the winter months.

WQ-43

13) Page 5-14, Section 5.5.4.3.2 Sampling Protocol, paragraph 4 in total:
   - This paragraph calls for using specific conductance as a surrogate measure for transfer of metals from groundwater to surface water. This might have some utility for major ions

such as iron, but would be completely ineffective for toxic inorganic elements present in relatively "trace" concentrations.

WQ-44

14) Page 5-15, paragraph 2, the PSP states: *"It is possible that a flow-integrated sampling technique…..will be used".*
   - This a study plan; the plan should definitively state whether this will happen or not.

WQ-45

15) As a general note, reference to USGS guidance for conducting water quality sampling has been deleted throughout the AEA PSP.

WQ-46

16) Page 5-16, paragraph 6, the PSP states: *"Toxics modeling will be conducted to address potential for bioavailability in resident aquatic life."*
   - More detail is needed here. Which model; how?
   - Toxics modeling must also evaluate the potential for direct toxicity to aquatic life, and for mixture toxicity (the elements are not present in isolation). Metals do not have to bioaccumulate to have a toxic effect.

WQ-47

17) Page 5-16, paragraph 6, the PSP states: *"Comparison of bioaccumulation of metals in tissue analysis with results from sediment samples will inform on potential for transfer mechanisms between source and fate".*
   - AEA will not likely acquire this information from fish sampling, unless it is a very resident/non-mobile fish. Sessile organisms such as mussels or plants would be far more useful to assess transport from sediments to biota.

WQ-48

18) The Service's study request Page 19, paragraph 1, calls for sediment metal data to be compared to appropriate NOAA SQuiRT values to assess whether metal levels exceed acute and/or chronic toxicity benchmarks for aquatic organisms. This does not appear in the AEA study plan.

WQ-49

19) Page 5-17, paragraph 2 in total, the PSP states: *"Body size targeted for collection will represent the non-anadromous phase of each species life cycle (e.g., Dolly Varden; 90 mm – 125 mm total length to represent the resident portion of the life cycle.)"*
   - The Service agrees if this is limited to understanding the amount of mercury in the fish that is clearly attributed to the local environment. However, for risk assessment purposes it is also important to sample fish that are representative of those taken for consumption by humans and wildlife receptors. Specifically, large adult fish that are targeted by anglers (and bears) should also be sampled, to determine how much additional mercury can "safely" be added from the project before consumption advisories are warranted. Similarly, for ecological risk assessment purposes it is important to sample fish representative of those in the diet of avian and mammalian piscivores in the project area. Our study request (Page 19 paragraph 3) contains a more robust description of the types and sizes of fish that should be sampled.

WQ-50

20) Page 5-17, paragraph 4, the PSP states: *"Results will be reported with respect to applicable Alaska State and federal standards".*
   - The comparison values must be specified and agreed to up front. For human risk assessment purposes, US EPA guidance for fish consumption advisories is most appropriate. For ecological risk assessment purposes, risks should be interpreted using published scientific literature, based on both field observational studies and controlled

laboratory experiments, using the same or comparable piscivorous avian and mammalian species.

WQ-51

21) Page 5-17, paragraph 5, the PSP states: *"Results from fish tissue analysis will also be used as a baseline for determining how the proposed Project may increase the potential of current metals concentrations to become bioavailable".*
- Results from fish tissue analysis will be used as a baseline for fish metal concentrations prior to development. In order to understand how the Project may increase the potential for current metal concentrations to become bioavailable, AEA will need to predict how mercury methylation rates may change in response to the Project. This would entail prediction of organic carbon stores, amount of wetland or peat surface area inundated, and the pH, calcium concentration and water hardness of the reservoir…among other factors.

MERC-06

22) Page 5-17, paragraph 5, the PSP states: "*Detection of mercury in fish tissue and sediment will prompt further study of naturally occurring concentrations in soils and plants and how parent geology contributes to concentrations of this toxic (sic) in both compartments of the landscape".*
- The study of *"naturally occurring concentrations of mercury in soil and plants and how parent geology contributes to concentrations of this toxicant"* must be undertaken by AEA, regardless of whether it is currently present in fish and sediment. Vast surface areas and vegetation will be inundated, that are not currently part of the system. There is no need to prove current presence before proceeding to predict the addition from the Project. In any case, if adequate detection limits are used it is a given that fish and sediments will contain mercury, as they do everywhere. There is no reason to delay this "further study", particularly as the ILP process is so compressed. This study needs to be planned and implemented now. Likewise, macroinvertebrates need to be added to the current study plan.

MERC-07

WQ-52

23) Page 5-19, section 5.5.6 Schedule: Several needed elements are missing, including the collection of geomorphology, geology, vegetative type and quantity, etc. These parameters are necessary in estimating mercury inputs to the reservoir. Then modeling is needed to incorporate baseline conditions, estimate new mercury inputs and rates of methylation, and predict mercury levels in biota post-impoundment. Several study plans point to each other regarding this topic, but none actually undertake these tasks.

<u>Literature Cited</u>

Lewis, M.E. and M.E. Brigham. 2009. National Field Manual for the Collection of Water-Quality Data (TWRI Book 9). Chapter A5. Processing of Water Samples, Section 5.6.4.B -- Low-level Mercury (dated 10/04).

United States Environmental Protection Agency (EPA). 1996. Method 1669. Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. July 1996. U.S. Environmental Protection Agency, Office of Water, Engineering and Analysis Division (4303) 401 M Street S.W. Washington, D.C. 20460.

United States Environmental Protection Agency (EPA). 1997. Mercury Study Report to Congress. EPA-452/R-97-003, December 1997

5. Water Resources

5.6. Water Quality Modeling Study

General Comments:

The May 31, 2012 Water Quality Study request submitted by the U.S. Fish and Wildlife Service (Service) combined baseline water quality and water quality modeling into one study. In our review of Alaska Energy Authority's (AEA) Proposed Study Plan (PSP) we will address the baseline water quality and water quality modeling study plans separately.

The PSP Water Quality Modeling Study proposes to utilize the information collected from the Baseline Water Quality Study to develop a model in which to evaluate potential impacts of the proposed Project and operations on various parameters within the Susitna River watershed. In general, the PSP adequately addresses the water quality issues. The Service recommends the following improvements.

Specific Comments by Subtopic:

WQMOD-02

Water quality model selection
AEA's model selection should consider the geometric and topographic complexity of the river system for potential extension of model boundary down to the Susitna-Talkeetna -Chulitna confluence. The long downstream river has many meandering braided channels with numerous tributaries. This river system will be inundated during summer snow melting seasons. These factors will require the flexibility in model grid generation (e.g., unstructured grid model), robust wetting and drying algorithm, and computational efficiency (e.g., high resolution grid only in zone of interest, parallel computing capability, etc.) for long-term simulation of water quality. The selection of a structured grid model such as EFDC or CEQUAL-W2 may not accurately represent the complex river system. This can deteriorate the prediction capability of the model. AEA should provide an explicit plan in the worst case scenario and consider other unstructured types of models such as MIKE (hydrodynamic + water quality). Another approach to consider may be an external coupling of an unstructured grid hydrodynamic model with a similar grid frame of water quality model such as CEQUAL-ICM.

WQMOD-03

Modeling parameters
In characterizing future conditions following the construction and operation of the Susitna Watana dam, AEA's water quality modeling determination should include a separate and detailed description of the approach to be followed in parameterizing and initializing the final selected model. This should include a description of how terrestrial conditions will be used to develop boundary conditions outside of the current riverine conditions. Model initialization and calibration are important components of establishing model credibility and accuracy and as such should be described in sufficient detail to allow reviewers to evaluate the approach and water quality data needs for each model.

WQMOD-04

Model calibration
The PSP should include an explicit hydrodynamic model calibration plan to be fed for water quality modeling. The calibration against water surface elevation and velocity is a crucial and basic process for the development of baseline hydrodynamic modeling and application to the proposed condition.

WQMOD-06

Toxicity modeling

The study plan should include an explicit description of the modeling approach to be used for determining toxicity of future water quality to aquatic life, wildlife, and human fishers. This model or models should have the capability to address the toxicity of mixtures of metals, and the model determination should also include a discussion of how the potential interactions of toxins (additivity, synergism, antagonism) will be evaluated in the selected model.

The PSP should also discuss approaches to determining and evaluating the bioavailability of metals in the future reservoir and river such as use of the Biotic Ligand Model (BLM). The water quality modeling plan should consider expanding the analytes (i.e., anions and cations) to be sampled in the baseline monitoring program based on the review and utility of the BLM model in evaluating the future toxicity in reservoir and downstream rivers.

Example studies that can be evaluated in the design of modeling the toxicity of metal mixtures can be found in Altenburger et al. 2003; Borgmann et al. 2008; Jho et al. 2011; Kamo et al. 2008; Khan et al. 2011; Kortenkamp et al. 2009; Mumtaz et al. 1998; Sasso et al. 2006; Schmidt et al. 2010; Stockdale et al. 2010; Van Genderen et al. 2012; Vijver et al. 2011.

Literature Cited

Altenburger, R., M. Nendza, and G. Schüürmann. 2003. Mixture toxicity and its modeling by quantitative structure-activity relationships. Environmental Toxicology and Chemistry, 22(8): 1900-1915.

Borgmann, U., W.P. Norwood, and D.G. Dixon. Modelling bioaccumulation and toxicity of metal mixtures. Human and Ecological Risk Assessment: 14(2): 266-289.

Jho, E.H., J. An, and K. Nam. 2011. Extended biotic ligand model for prediction of mixture toxicity of Cd and Pb using single metal toxicity data. Environmental Toxicology and Chemistry, 30(7): 1697-1703.

Kamo, M. and T. Nagai. 2008. An application of the biotic ligand model to predict the toxic effects of metal mixtures. Environmental Toxicology and Chemistry, 1479-1487.

Khan, F.R., W. Keller, N.D. Yan, P.G. Welsh, C.M. Wood, and J.C. McGeer. 2011. Application of the Biotic Ligand and Toxic Unit Modeling Approaches to Predict Improvements in Zooplankton Species Richness in Smelter-Damaged Lakes near Sudbury, Ontario. Environmental Science and Technology, 46z: 1641-1649.

Kortenkamp, A., T. Backhaus, and M. Faust. 2009. State of the Art Report on Mixture Toxicity. Final Report, Executive Summary. Prepared for the European Commission, Directorate General for the Environment. December 22, 2009.

Mumtaz, M.M., C.T. De Rosa, J. Groten, V.J. Feron, H. Hansen, and P.R. Durkin. 1998. Estimation of toxicity of chemical mixtures through modeling of chemical interactions. Environmental Health Perspectives, 106: 1353-1360.

Sasso, A., S. Isukapalli, S.W. Wan, and P.G. Georgopoulos. 2006. Physiologically-based toxicokinetic models for toxic metal mixtures: Development and demonstration of a mechanistically-consistent framework. Poster presented at Society for Risk Analysis meeting, Baltimore Maryland, December 5, 2006.

Schmidt, T.S., W.H. Clements, K.A. Mitchell, S.E. Church, R.B. Wanty, D.L. Fey, P.L. Verplanck, and C.A. San Juan. 2010. Development of a new toxic-unit model for the bioassessment of metals in streams. Environmental Toxicology and Chemistry, 29(11): 2432-2442.

Stockdale, A., E. Tipping, S. Lofts, and S.J. Ormerod. 2010. Modelling multiple toxic effects in the field – evaluation of the Toxicity Binding Model (TBM). Final report to the International Copper Association (ICA). Centre for Ecology and Hydrology, Natural Environmental Research Council. February 2010.

Van Genderen, E., E. Rogevich-Garman, R. Dwyer, J. Gorsuch. 2012. Incorporating bioavailability into risk assessment for metal mixtures; results of a comparative evaluation. SETA Globe, 13(6).

Vijver, M.G., E.G. Elliott, W.J.M. Peijnenburg, and G.R. de Snoo. 2011. Response prediction for organisms water-exposed to metal mixtures: A meta analysis. Environmental Toxicology and Chemistry, 30: 1482-1487.

5. Water Resources

5.7. Groundwater-related Aquatic Habitat Study

General Comments:

GW-013 The U.S. Fish and Wildlife Service's (Service) 31 May 2012 study request entitled *Groundwater-Related Aquatic and Floodplain Habitat Study* more accurately encompasses the scope of our study request by including both aquatic and floodplain in the title. Although Alaska Energy Authority's (AEA) Proposed Study Plan (PSP) includes objectives for describing floodplain and riparian groundwater and surface-water (GW/SW) relationships, the PSP title implies only aquatic relationships will be investigated. We recommend revising the title to more accurately describe the scope of the study, and including "floodplain" as appropriate wherever the study subject is mentioned in the PSP.

GW-014 Many of the individual PSPs rely upon or provide data from/for other studies. Recognizing these relationships is an important part of the Integrated Licensing Process (ILP); however, the study providing the data should describe the methodology and oversee the data collection and analyses, while the study requiring the results should restrict its discussion to the types of data/results required from other PSPs. Repeating the methods in a study not responsible for the data collection and analyses is unnecessary and risks confusion if the methods differ or are inadequate in one of the studies. Since the Groundwater PSP will be providing data for other studies, the Groundwater PSP should describe the methods as well as the results provided to other studies (e.g., 6.5 Fish and Aquatics Instream Flow, and 6.6 Riparian Instream Flow studies).

GW-015 At the 24 October 2012 Groundwater Technical Workgroup (TWG) meeting, AEA provided a draft study interdependency figure showing which additional studies would provide data for the study, the expected information produced by the study, and which studies will rely upon output from the study. Given the complex integration of the various studies, we appreciate this figure and recommend including figures like these along with a narrative in the introduction for each study. Additionally, the main introduction covering all the PSPs should include a more general interdependency figure showing how all the various studies interrelate. We have not had time to evaluate this draft interdependency figure, but look forward to reviewing additional drafts as the study plans mature.

GW-016 Besides interdependency figures, please provide timelines showing how the various study components (both among major studies and within studies) feed into other studies and study components. The Service is concerned the sequencing of some study components may be out of sync with the required products from other studies and study components.

GW-017 The last sentence in the first paragraph of Section 5.7.1.1 suggests the Groundwater PSP is not much more than a passive summary of other studies, when in fact the Groundwater PSP is a critical input for other studies not unlike the USGS data used by other studies. The Service is concerned that relying upon a variety of investigators with their own study objective priorities risks degrading the quality and consistency of the groundwater hydrology data. The groundwater hydrology investigators should be responsible for all phases of the groundwater study, including well installation, monitoring, data reduction, and analyses.

GW-018 The methods should be described in sufficient detail so others can duplicate the study. Citing methods from other studies or accepted industry standards is encouraged, but not in lieu of providing sufficient detail so the methods can be evaluated without having to refer to the citation.

GW-019 Unlike the fisheries component of the Aquatic Instream Flow Study where potential future Susitna-Watana Hydroelectric Project (Project) impacts may be compared with other locations in the state because fish populations are routinely surveyed, evaluating potential Project impacts on riparian/floodplain resources without an "untreated" spatial reference (i.e., similar rivers without a dam) risks a significant change may be attributed to an unrelated impact. Green (1979) outlines four prerequisites for an optimal impact study design: 1) the impact must not have occurred; 2) the type, time and place of impact must be known; 3) all relevant biological and environmental variables must be measured; and 4) an area unaffected by the impact must be sampled to serve as a control. The first three prerequisites are included in the PSPs if they are designed and implemented so potential Project impacts can be evaluated by post-dam resampling. We recommend the Groundwater-related Habitat Study also include the fourth component (un-impacted rivers), otherwise AEA risks what Green (1979, p 71) refers to as "… *executing statistical dances of amazing complexity around their untestable results"* to show the Project did or did not have a potential impact on riparian/floodplain resources.

Specific Comments by Subsection:

The following review of AEA's proposed Groundwater-related Aquatic Habitat Study Plan uses the structure of the plan and compares the plan to the Service's study-request objectives to determine if our intent is met, where improvements can be made, and which requested objectives are not addressed.

AEA Study Goals and Objectives: The overall goal of the study is to understand the effects of the Project on groundwater and surface-water (GW/SW) interactions as they relate to habitat for aquatic species (e.g., fish, riparian vegetation) in the Susitna River.

GW-020 AEA's overall study goal is similar to the Service study-request goal; however, the following key phrases (underlined) are not included: *"The overall goal of the study is to understand Project effects on surface-water / groundwater interactions at multiple spatial and temporal scales as they relate to habitat for aquatic and floodplain species (e.g., fish, riparian vegetation) along the Middle and Lower Reaches of the Susitna River."* The omitted phrases help to define the scope of the study to include both landscape and local studies throughout the year, acknowledge the study will include floodplains, and limits the study to the Middle and Lower Reaches of the Susitna River.

AEA's PSP objectives are similar to the Service study-request objectives, except for some minor wording to qualify the scope of the objective. The objectives and wording will be discussed along with their methods below. For now, it's important to recognize that some objectives are really tasks (e.g., 1, 4), rather than true objectives (e.g., 5, 6).

AEA Study Area: The Susitna River from the Parks Highway bridge (RM 84, located near USGS Gage on Susitna River at Sunshine) to an area just upstream of the dam (RM 184) for detailed studies.

GW-021 The Service recognizes the downstream limit of the study area is still under discussion, and we look forward to participating in this discussion. In addition to the longitudinal dimensions of the study area, we recommend including the width of the study area. For the groundwater study, the width should be at least as wide as the expected area of groundwater influenced by Project operations, and include an additional buffer to demonstrate the adjacent groundwater behavior beyond Project influences.

AEA Objective 1 and Methods: Synthesize historical data available for Susitna River groundwater and groundwater related aquatic habitat, including the 1980s and other studies.

GW-022 Service Objective1 (meaningful differences underlined): *"Synthesize historical data for Susitna River groundwater and groundwater-dependent aquatic <u>and floodplain</u> habitat, including the 1980s studies".* "Floodplain" should be included in the objective to broaden the objective scope.

The first objective is very similar to our study request objective. The goal of our objective is to review existing information on Susitna River groundwater and groundwater-dependent aquatic and floodplain habitat, and to gain insights from other hydro projects with a focus on cold-region projects.

GW-023 Not included in AEA's methods is a review and summary of other hydro projects in cold regions and their effects on ice processes affecting surface-water / groundwater. In addition to including this review and summary, we also recommend a review and summary of the current knowledge of cold regions hydropower projects effects on ice processes and how that has altered instream flow, fluvial geomorphology, vegetation, water quality, and fish habitat. These summaries should be used to identify potential effects of the proposed Project and guide the development of methods and analyses to evaluate these effects.

AEA Objective 2 and Methods: Use available information to characterize the large-scale geohydrologic process-domains/terrain of the Susitna River (e.g., geology, topography, geomorphology, regional aquifers, shallow ground water aquifers, GW/SW interactions).

Service Objective 2 (meaningful differences - none): *"Use available information to characterize the large-scale geohydrologic process-domains/ terrain of the Susitna River (e.g., geology, topography, geomorphology, regional aquifers, shallow ground water aquifers, surface-water / groundwater interactions)."*

The second objective is identical to our study request objective. The goal of our objective is to characterize large-scale geohydrologic process-domains (Montgomery 1999) within the Susitna River Basin that influence surface-water / groundwater interactions in the Susitna River and floodplain.

GW-024 We recommend the process domain definitions (Montgomery 1999) be vetted with the resource agencies, and that all relevant information and knowledge gained from the other studies be used to assess and refine the process-domain mapping of the Susitna River basin. Since AEA is proposing to use process-domains as means to extrapolate and predict Project effects on surface-water / groundwater beyond the intensive study focus areas, we recommend an assessment of the precision and accuracy of the predicted effects.

Citing recognized methods is encouraged, such as ASTM standards D5979 and D6106, but the study plan must include enough information about the cited methods so reviewers can evaluate the appropriateness of the proposed methods without referring to the citation.

AEA Objective 3 and Methods: Assess the effect of Watana Dam/Reservoir on groundwater and groundwater related aquatic habitat in the vicinity of the dam.

Service Objective 3 (meaningful differences underlined): *"Assess the effect of Watana Dam/Reservoir on groundwater and groundwater-related aquatic and floodplain habitat in the vicinity of the dam, and the downstream extent of the reservoir's influence on groundwater."*

Although the wording of AEA's third objective differs from our request, the methods are identical to our study request. The goal of our objective is to assess the effect of the Watana Dam and reservoir on downstream groundwater-related aquatic and floodplain habitat, and to assess the downstream extent of the reservoir's influence on groundwater potentially bypassing the dam.

GW-025 In addition AEA's and Service's requested methods, we believe all stakeholders would benefit by defining the downstream extent of the reservoir's influence on groundwater potentially bypassing the dam. Adding this component would require including a description of the methods used to determine the downstream effects on groundwater.

AEA Objective 4 and Methods: Map groundwater influenced aquatic habitat (e.g., upwelling areas, springs).

GW-026 Service Objective 4 (meaningful differences underlined): *"Map groundwater influenced aquatic and floodplain habitat (e.g., upwelling areas, springs, groundwater-dependent wetlands)."*

The fourth objective is very similar to our study request objective, except we recommend including floodplain habitat as well. The goal of our study component is to map locations of surface-water /groundwater interactions at a scale relevant to riverine habitat types (as described in the Aquatic and Riparian Instream Flow, and Fluvial Geomorphology Studies). Groundwater influences floodplain habitat in addition to the aquatic habitat proposed by AEA. Groundwater-dependent wetlands and subirrigated floodplain plant communities are strongly influenced by the frequency, timing, and duration of groundwater levels.

GW-027 Terrestrial groundwater-influenced habitats are much easier to identify than groundwater-influenced aquatic habitats because they can be easily observed (e.g., springs, hydrophytic vegetation). For this objective, we recommend including a component identifying groundwater-dependent wetlands and characterizing their potential groundwater sources. Subirrigated floodplain plant communities and their potential groundwater sources should also be identified at the "reconnaissance level" as part of this objective; although we recognize the Riparian Instream Flow Study (Section 6.6) will likely provide more detailed information regarding subirrigated communities.

GW-028 Aquatic groundwater-influenced habitat on the other hand is more difficult to identify because surface water, especially if turbid or frozen, often obscures direct observation. For this reason, AEA proposed a variety of methods to identify groundwater-influenced aquatic habitat. It is unclear if the various proposed methods in Section 5.7.4.4 are adequate to capture the groundwater influence on aquatic habitats throughout the study area. These methods are a series of study components from ice processes, geomorphology, instream flow, water quality, and fish studies. We have three basic concerns: 1) the mainstem upwelling areas will not be accurately accounted for and no actual groundwater investigation focuses on the mainstem; 2) these methods are not focused on determining upwelling areas and may not capture the actual distribution of upwelling areas; and 3) the Groundwater-related Aquatic Habitat study plan is not responsible for collection of any of this data.

GW-029 There is a high likelihood that these upwelling characterization study components won't accurately capture the upwelling areas, the overall distribution of upwelling will not be accounted for, and the importance of upwelling for over-wintering fish and fish eggs will not be captured. If the pilot thermal imaging assessment successfully captures upwelling areas (with ground-truthing to assess success), then this method should be applied to the middle river from the confluence with the Talkeetna and Chulitna Rivers upstream to Devil's Canyon. The success or failure of the thermal imaging assessment must also be defined. If the trial thermal imaging study is successful how will it be expanded and used to map upwelling? If it is unsuccessful how does AEA plan on identifying the spatial distribution of upwelling? Use of open-leads during winter ice mapping alone will not demonstrate the full extent of upwelling areas.

AEA Objective 5 and Methods: Determine the GW/SW relationships of floodplain shallow alluvial aquifers at Riparian Instream Flow study sites.

Service Objective 5 (meaningful differences underlined): *"Determine the surface-water / groundwater relationships of floodplain shallow alluvial aquifers at Riparian Instream Flow Study sites, <u>including relationships with both the river and the adjacent uplands (e.g., gaining or loosing stream)</u>."*

The goal of our objective is to understand how floodplain shallow-alluvial groundwater interacts with the surface water from the Susitna River and with the adjacent upland groundwater. This study component will provide the necessary groundwater information for the Riparian Instream Flow Study to develop plant community response curves (similar to HSC), which can be used to predict the effects of Project operation on floodplain plant communities.

AEA's methods for this groundwater objective (Section 5.7.4.5) and the Riparian Instream Flow Objective (Section 6.6) confuse responsibilities and methods between the two studies. For example, the last two bulleted paragraphs in the groundwater study (Section 5.7.4.5) describe riparian methods, while Section 6.6.4.5 in the riparian study describes groundwater methods. GW-030 We recommend describing groundwater methods in the groundwater study, and describing riparian methods in the riparian study. Our comments below focus on the groundwater methods from both studies that should be included in the groundwater study.

GW-031 The suggested four to six intensive study reaches (now called focus areas) instrumented with groundwater and surface-water recording instruments may be insufficient to address this objective if plant response will be described by process-domains (see Service pseudoreplication discussion in our comments for Riparian Instream Flow Objective 2). For the focus areas where multiple study disciplines will focus and complement their work, we recommend the Groundwater-related Aquatic Habitat Study **first** develop criteria required for selecting their study sites independent of the other studies. Next, develop a list of study products from the Groundwater-related Aquatic Habitat Study that other studies require, and then work with the other studies and stakeholders to select focus areas. A master matrix of studies, data needs and data products would greatly facilitate this process and stakeholder acceptance.

GW-032 One-and-a-half growing seasons (July 2013 to September 2014) will likely provide insufficient groundwater hydrology data to fit individual species response curves (especially for annual species), and may not be enough data to reasonably predict groundwater relationships with river stage **and** to verify the model predictions with independent data. The Service recognizes that aquifer properties can be estimated by taking advantage of relatively rapid changes in river stage, but these events can be confounded by other factors such as local precipitation. Precipitation can dramatically affect transient, but critical, shallow groundwater levels (a few days to a week or more of elevated water levels), which would be difficult to evaluate with limited data. Hydrologists often recommend using at least ten years of data to reasonably extend the period of record for river stage. The study plan must define the uncertainties in groundwater hydrology different than surface-water hydrology, and must consider a reasonable period of record to verify groundwater predictions.

GW-033 The "project accuracy standards used for water-level measurements" for horizontal, vertical and temporal measurements must be defined. If MODFLOW (USGS 2005) will be used, what is the expected accuracy of the predicted water table surface? What are the model and aquifer property assumptions for using MODFLOW, and how are discrepancies addressed and the predictions affected? The difference between the water table being too deep or too shallow for some herbaceous species is as little as 20 cm or less, and for some sedge communities about 50 cm or less. If the depth-to-water will be estimated by subtracting the predicted water table (e.g., MODFLOW) from the ground surface (e.g., LIDAR), then the combined error of both the water table and the ground surface must be considered. In addition, the predicted surface-water stage and its accuracy must also be provided for emergent communities. For complex hydrologic and biotic sites such as Whiskers Slough, the density of recording wells and surface-water gages presented in the 1 October 2012 Riparian Instream Flow TWG meeting may need to be increased in both density along the transects and the total number of transects to achieve the accuracy required for the Riparian ISF study.

The products of this study objective should be sufficient to provide water-level summary statistics for each location (e.g., point, plot, transect, water-table surface) that will be used to test and fit plant response curves, such as growing season cumulative frequency, 7-day moving average, 10-day moving average, 14-day moving average, and arithmetic mean (see Henszey et al. 2004, Table 1). The Service understands that calculating these summary statistics will be the responsibility of the studies responsible for using the groundwater data (24 October 2012 TWG meeting). This is possible for individual wells, but we suspect the other studies will have some difficulty calculating these summary statistics for the water-table surface and recommend the groundwater study conduct this analysis.

AEA Objective 6 and Methods: Determine GW/SW relationships of upwelling/downwelling at Instream Flow Study sites in relation to spawning, incubation, and rearing habitat (particularly in the winter).

Service Objective 6 (meaningful differences underlined): *"Determine the surface-water / groundwater relationships of upwelling/downwelling at Aquatic Instream Flow Study sites in relation to spawning, incubation, and rearing habitat (particularly in the winter)."*

The goal of our objective is to understand how surface-water / groundwater interactions influence salmonid habitat use and biological functions, including selection of spawning and rearing habitats, egg/alevin survival, and overwintering. This goal fits in naturally with the next study objective (Objective 7) to characterize water quality and probable flow paths of groundwater for habitats where groundwater is important for fish habitat. The source and flow path of water are important factors influencing its temperature and chemistry (Johnson 2003). The flow paths of water through the subsurface as groundwater and hyporheic flow may moderate stream temperatures and provide thermal heterogeneity (Johnson and Jones 2000, Mellina et al. 2002, Moore et al. 2005, Rothwell 2005). The results of this objective should facilitate predicting Project operation effects on surface-water / groundwater interactions both temporally and spatially.

GW-034 AEA's methods for the Groundwater-related Aquatic Habitat Study plan are vague and it is unclear which study is responsible for collecting the site-specific groundwater data. We recommend the revised study plan detail the methods for collecting the groundwater potentiometric surface at each of the aquatic study sites.

GW-035 Study sites used to understand surface-water / groundwater interaction and how the process influences habitat use by anadromous fish should span all the geomorphic classification types used by anadromous species, including off channel (side channels, side sloughs, upland sloughs) and mainstem features in the middle and lower river. The methods for extrapolating surface-water/ groundwater study results from the focus areas to the river segments are unclear.

GW-036 AEA Study Objective 5 (with requests submitted above) has a more detailed study description for the floodplain alluvial aquifer than for AEA's aquatic groundwater Study Objective 6, even when considering the schematic detailing the surface-water / groundwater sampling network presented at the 16 August 2012 TWG meeting. We recommend the monitoring and modeling approach described for the floodplain be adapted and applied to the aquatic instream flow study sites and other sites of particular fish habitat importance (spawning, rearing, overwintering habitats).

The data collected for understanding the surface-water / groundwater relationship at each aquatic instream flow study site must consider all the key biologic functions and time periods (particularly in winter), as stated. The aquatic study site data will include empirical data related to surface-water / groundwater interactions (e.g., piezometers, water levels, water temperature and conductivity, tracer studies). Surface-water / groundwater interaction data will be collected at the intensive study reaches utilizing multiple transects of arrays of groundwater wells, piezometers and stage gages. The surface-water / groundwater data will be used to quantify, and model, the relationship between the shallow surface aquifers and aquatic habitat types. At each of the aquatic study sites, surface-water / groundwater interaction models will be developed to allow for temporal analysis of project operations effects on surface-water / groundwater exchange that may influence habitat utilization by aquatic species. This modeling may include the use of MODFLOW (USGS 2005 and Feinstein et al. 2012) surface-water / groundwater interaction models of floodplain shallow alluvial aquifer and surface-water relationships. MODFLOW surface-water / groundwater interaction models will be used to model surface-water / groundwater relationships using empirical monitoring data collected at intensive study reach surface-water / groundwater monitoring stations.

AEA Objective 7 and Methods: Characterize water quality (e.g., temperature, DO, conductivity, nutrients) of selected upwelling areas where groundwater is a primary determinant of fish habitat (e.g., incubation and rearing in side channels and sloughs, upland sloughs).

Service Objective 7 (meaningful differences underlined): *"Characterize water quality (e.g., temperature, DO, conductivity, nutrients) <u>and age (i.e., indication of potential source)</u> of representative upwelling areas where groundwater is a primary determinant of fish habitat (e.g., incubation and rearing in side channels and sloughs, upland sloughs)."*

The Service listed this objective separately, but chose to include the methods along with Objective 6 because the requested investigated water-quality attributes will be used to supplement Objective 6 by further refining fish habitat quality and surface-water / groundwater relationships. AEA's methods (Section 5.7.4.7) state the work for this objective will be accomplished by the Baseline Water Quality Study (Section 5.5). If this is the case, then these methods belong in that section and not in both sections. Our comments here pertain solely to the methods presented in this PSP.

Characterization of water quality must have a temporal component to assess surface water influences on groundwater quality parameters (temperature, dissolved oxygen (DO), conductivity, pH, dissolved carbon, nitrogen, phosphorous, alkalinity and hardness). This temporal component is especially important where anadromous fish species spawn and overwinter due to the effects associated with load following operations. Spatial and temporal water quality data should be collected to understand processes that contribute to river productivity, habitat quality, thermal refugia, and how surface-water / groundwater processes are influential to those processes. Additionally, we recommend the relative age of water be determined, this may be achieve through several methods that must be described in the study plan. How long the water has been underground will help identify the groundwater source, such as from the active hyporheic zone (recent groundwater) or from a potential upland source (older groundwater).

AEA Objective 8 and Methods: Characterize the winter flow in the Susitna River and how it relates to GW/SW interactions.

Service Objective 8 (meaningful differences underlined): *"Characterize how winter surface-water / groundwater interactions <u>may differ from ice-free interactions for both the existing and the projected Project Susitna River flow regimes</u>."*

The Service listed this objective separately, but chose to include the methods along with Objective 6 because the requested investigated season (winter) supplements Objective 6 by continuing the period of record throughout the year for determining fish habitat surface-water / groundwater relationships, not just during the ice-free season.

The Service agrees with the applicant that surface-water / groundwater interactions are critical to aquatic habitat functions, and the Project operations will have an impact on winter flow conditions, including surface-water / groundwater exchange effects on the habitat quality used by anadromous species. The methods associated with Objective 8 include data collection at stream gages and at specific study areas. It may be implied by this study objective, but we request that both baseline and Project-operation winter flow characterizations are necessary. This should include developing surface-water / groundwater exchange models that include winter operation scenario analyses, accounting for changes in ice thickness and cover, and changes in water quality (temperature, DO, nutrients, specific conductivity); all associated the mixing of surface-water and groundwater, and potentially affected by the proposed winter operations (either load following or baseload).

This objective should also characterize how ice formation affects surface-water and groundwater stage for both the main and off channels of the river. Our understanding of how surface ice affects the routing of surface water or how the location and thickness of ice may influence surface-water and groundwater stage in off channel locations is inadequate. This understanding must be improved, since this process can drastically alter winter fish habitat. Occasional ice-thickness measurements and 2D modeling will likely be insufficient to calibrate the model.

AEA Objective 9 and Methods: Characterize the relationship between the Susitna River flow regime and shallow groundwater users (e.g., domestic wells).

Service Objective 9: Not requested.

Although this objective does not directly relate to Service trust resources, we believe the information gained from this objective will aid in the overall understanding of the Susitna River groundwater system.

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5. Water Resources

5.8. Geomorphology Study

General Comments:

The May 31, 2012 Geomorphology Study request submitted by the U.S. Fish and Wildlife Service (Service) combined geomorphology and fluvial geomorphology into one study, as the data collected and models developed for both of these topics were directly linked to aquatic habitats in the Susitna River system. In our review of Alaska Energy Authority's (AEA) Proposed Study Plan (PSP) we will address the geomorphology and the fluvial geomorphology modeling study plans separately.

GEO-17
FGM-02

During the August 15-17, 2012 technical working group (TWG) meetings AEA described fish, instream flow, and water resource study plans. These study plans included broad statements regarding collaboration and integration of specific studies. The Service recommends that this integration be described in detail. For the geomorphology and fluvial geomorphology modeling study plans, this should include: the objectives; methodologies that address the objectives; and how the results will influence other studies. This must include data collection and model results that the geomorphology studies rely on and how these results will be applied to other studies. For example, the study plan must describe how the geomorphology study will use the fish habitat utilization data that the Service requested to improve the spatial habitat mapping, and how the results of the geomorphology study will be integrated into the instream flow study to achieve the Service's recommended objectives.

GEO-20
FGM-28

The revisions for the geomorphology and fluvial geomorphology modeling study plans should provide a description of the expected end-product, and whether these results will be sufficient to address Project effects to anadromous fish habitat. The study plan should also include a description of uncertainties associated with the studies, models, and analysis of project effects and how these uncertainties are determined.

Specific Comments by Subsection:

The following review of AEA's Geomorphology Study Plan (2012) uses the structure of the plan's stated objectives and compares them to the Service's study request objectives to determine if the intent is met, where improvements can be made, and which request objectives are not addressed.

AEA Study Objective 1. Determine how the river system functions under existing conditions.

GEO-22

This is a good overarching objective that includes several of the Service's more specific objectives. Geomorphic characterization of the Project-affected river channels should include a good understanding of the current rivers system. This will be achieved by addressing Service-specific objectives and methods, including:

- Characterize and map relic geomorphic forms from past glaciation, paleofloods and debris flow events.
- Characterize and map the geology of the Susitna River, identifying controlling features to channel and floodplain geomorphology.

- Characterize and map the fluvial geomorphology of the Susitna River.
- Describe and identify the primary geomorphic processes that create and influence fluvial geomorphic features.

If the specific objectives we recommend are recognized, including past glacial form, geology, and characterizing the fluvial forms and processes, then the study plan should provide an adequate overall understanding of the river system function. We recommend the study plan provide sufficient detail to support that each of the Service study request objectives are being achieved.

GEO-18 The Service's study request recommends specific methodologies. It is unclear in the PSP if the Service's proposed methods will be incorporated into the study plan or why other methods are adequate or better suited to achieve Service stated study objectives. Methods for channel substrate size characterization, longitudinal and cross-sectional bed profiles are not described in this proposed study plan. In the Geomorphic Characterization of the River section of the Service's study request, we recommend bed material characterization to include spatial sediment facie mapping (Buffington and Montgomery 1999), pebble counts (Wolman 1954), and bulk samples.

AEA Study Objective 2. Determine how the current system forms and maintains a range of aquatic and channel margin habitats

The applicant's second study objective relates to the Service's requests for understanding the primary geomorphic processes that create and influence fluvial geomorphic features. This information along with the delineation and characterization of riverine habitat types for the project area will provide a good understanding of which geomorphic processes create and maintain aquatic habitats. A description of how habitat utilization will inform the habitat characterization should also be included. For example the main channel is currently one of the macro-habitat classifications, but if, through utilization and fish distribution study, it is found that there are unique main channel features that are important, then the classification should identify the processes that maintain those features and substrate composition. This provides a foundation for development of operation effects to habitat, specifically the flows necessary to create and maintain habitats. GEO-26 The Service requested that correlation of geomorphic forms and processes to riverine habitat types be done for the project area, and that the project construction and operation be assessed to evaluate change to the habitat types. Additional information, such as the characterization of surface area versus flow relationships of riverine habitat types will help characterize the timing and distribution of habitat under the natural flow regime.

GEO-28 The PSP includes several locations where additional data will be collected to supplement historical data (to be performed by the USGS). These locations are on the Susitna River mainstem (near Tonsina Creek, at the Susitna River Gold Creek gage, and the Susitna River at Sunshine, the Chulitna River near the mouth). The PSP proposes to use this information with historic information to calculate the sediment input from major tributaries. The Service maintains that existing sediment transport data from the Talkeetna Rivers is insufficient to conduct a sediment budget or to empirically characterize the Susitna River sediment supply and transport conditions. Instead, we recommend that sediment transport data collection be conducted near the mouths of both the Chulitna and Talkeetna Rivers. The sediment transport data collected at the Chulitna and Talkeetna Rivers is necessary to reduce error and increase understanding of sediment transport associated with the large and small tributaries and dispersed sediment input associated with hillslope and mass wasting processes.

GEO-37 Characterization of bed material mobilization is described in the PSP. The methods include use of USGS empirical sediment rating curves, incipient motion calculations, and field observations. To achieve the objective of characterizing bed material mobilization, the bed material must be characterized as per the Service's recommendation (see our comments under the first objective).

GEO-30 An assessment of the source, transport, and storage of large woody debris in the Susitna River and the role of large woody debris in channel form and aquatic habitat is needed in conjunction with data from the studies of hydrology, geomorphology, riparian and aquatic habitat, and ice processes, in order to determine the potential effects of project operation on large wood resources. The geomorphology PSP does not specifically state that it will collect large wood information but it does state that large wood information will be used in the assessment of Project effects on geomorphology. The Service recommends that the geomorphology PSP include detail regarding which study will collect large wood information, the sufficiency of this data collection to meet the needs of other studies, and how/when will it be provided to appropriate studies.

AEA Study Objective 3. Identify the magnitudes of changes in the controlling variables and how these will affect existing channel morphology in the identified reaches downstream of the dam.

- Empirically characterize Susitna River sediment supply and transport conditions;
- Assess channel and study site stability/change (1980s versus current conditions).

This study objective is critically important to the assessment of Project operational effects on riverine habitats by assessing the potential for geomorphic change. This goal should be achieved through conceptual and numerical modeling which is further described in AEA's Fluvial Geomorphology modeling PSP and in our study request under G-7 Modeling Magnitude and Trend of Geomorphic Response.

The examination of magnitudes of change of geomorphic features should also be examined from the perspective of large wood recruitment. The study plan should explain how the geomorphology study will incorporate an understanding of geomorphic change and processes to understand large wood recruitment.

AEA Study Objective 4. Determine the likely changes to existing habitats through time and space.

This objective is similar to our request to evaluate geomorphic stability and change (objective 6 in the Geomorphology study request). All of the data collection proposed in AEA's PSP, in addition to the data we request, will be used to understand the likely changes to existing habitat. AEA proposes to calculate effective discharge for the Susitna River, similar to the methods requested by the Service. This is important as quantification of the range of flows that transport the most sediment provides useful information to assess the current state of adjustment of the channel, and to evaluate the potential effects of altered discharge and sediment delivery to channel behavior. This is a good example of study information that must be integrated with other studies, specifically instream flow, for overall project analysis.

For the lower river, the PSP describes a reconnaissance level assessment (by assessing geomorphology and habitat via aerial photography). AEA proposes that a conceptual frame work be used to assess project effects to the lower river, below the Chulitna and Talkeetna confluences. The conceptual frame work described by AEA and requested by the Service is defined in Grant et al. (2003). We recommend that the conceptual frame work be used downstream of the proposed dam location longitudinally to the downstream extent of the modeled area, and that the study area be extended if the framework calculations find influence in the lower river. This will rely on the development of the hydraulic flow routing models (see our comments on instream flow) and may require the extension of this modeling effort. The decision process and threshold to extend the mapping, models, and more qualitative assessments in the lower river must be described and should include the determining factor for extension of these study components. Also, because the habitat mapping is being done under the Geomorphology study plan, the lower extent of that component must be compared to winter operations and the potential hydraulic or water quality effects downstream. This is necessary to assess which habitats and species may be affected in the lower river.

GEO-32

The characterization of bed material mobilization will be necessary to populate sediment transport models and to assess the likely geomorphic changes associated with reducing the sediment supply, by trapping sediment behind the dam, and by altering the natural flow regime. This information will be used by the Service to make instream flow recommendations under our 10(j) authority. A critically important product listed in AEA's PSP is the calculation of effective discharge for the pre- and post-project conditions, and the likely effects on channel morphology. This is further described in section 5.8.4.4 of the PSP to assess geomorphic change in the middle and lower rivers.

<u>Literature Cited</u>

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5. Water Resources

5.9. Fluvial Geomorphology Modeling below Watana Dam Study

General Comments:

The AEA PSP stated goal for the Fluvial Geomorphology Modeling below Watana Dam Study is *"to model the effects of the proposed Susitna-Watana Hydroelectric Project on the fluvial geomorphology of the Susitna River; with the Geomorphology study to assess the impacts of the project on the dynamic behavior of the river downstream of the proposed dam, with particular focus on potential changes in instream and riparian habitat."*

AEA proposes four questions to be answered by the fluvial geomorphology and geomorphology studies:

- Is the system currently in a state of dynamic equilibrium?
- If the system is not currently in a state of dynamic equilibrium, what is the expected evolution over the term of the license?
- Will the Project affect the morphologic evolution of the Susitna River compared to pre-Project conditions?
- If the Project will alter the morphology of the river what are the expected changes over the term of the license?

FGM-29 If the system is found to be in dynamic equilibrium, the Service recommends that the geomorphology and fluvial geomorphology studies provide the magnitude and trend of geomorphic change in response to the Project, and that these changes be translated to spatial and temporal riverine and floodplain habitat changes. If the system is in disequilibrium the geomorphology studies should provide an understanding of the disequilibrium without the Project and then present the Project effects to the system and summarize the effects in a spatial and temporal riverine and floodplain habitat change analysis.

Specific Comments by Subsection:

AEA Study Objective 1. Model channel formation processes in the Susitna River downstream of the proposed Watana Dam site.

AEA describes three study components: 1) bed evolution model development and calibration; 2) model existing conditions and with-Project conditions; and 3) coordination of model outputs.

This objective will provide operating flow analysis over a range of flows to assist the Service in making recommendations regarding instream flow conditions for channel maintenance. In this study request the applicant lists three factors in choosing appropriate geomorphology models: 1) the level of detail required to meet the overall study objectives; 2) the class, type, and regime of flows that are expected to be modeled; and 3) the availability of necessary data for model development and calibration. FGM-31 The Service recommends that the model selection should be made soon to ensure adequate collection of data to populate the models as data collection can be difficult, and may require several seasons. The bed evolution modeling approach will consist of a 1D movable boundary sediment transport model to address reach-scale issues and 2D models to address local scale issues. Both of these should be tied back to effects on habitat by associated changes to geomorphic form and process. The 1D model will extend from the proposed dam downstream extent of the hydraulic flow routing (RM75, downstream of the USGS Susitna River gage near Sunshine) unless project effects are found to occur at the downstream boundary of the model.

FGM-35 One of the models proposed for 1D model selection is HEC-6T, which allows for user defined transport equations, we reiterate that this will require good sediment transport data and will require data collected on the Chulitna and Talkeetna Rivers, and may additionally need other tributary inputs in the middle reach.

FGM-37 The 2D model, used to evaluate the detailed hydraulic and sediment transport characteristics on smaller, more local scales, will likely overlap with some of the instream flow study sites. Site selection for the 2D models must consider habitat utilization by anadromous fish, importance of the habitat, and dynamic flow patterns and geomorphic processes. Sites should be selected that serve biologic functions (spawning, rearing, migration, overwintering) and with potential for change related to Project operations.

AEA Study Objective 2. Estimate the potential for channel change for with-Project operations.

The channel change associated with Project operations, assessed with the operating flow analysis, will provide the Service with data to make operational recommendations to maintain riverine habitats. AEA describes using the calibrated models to model existing and with-Project conditions (5.9.4.2). The with-Project scenarios will be evaluated over a 50 year continuous operating scenario. The scenarios should represent a variety of operational scenarios to provide the Service with the full operating range from a "no Project" scenario to the current proposal. This information must be coordinated with the other studies (see below).

Additional information should be provided with the estimate of potential channel change, including a translation to habitat change, change in large wood recruitment, change in floodplain sedimentation, and change in substrate size composition.

AEA Study Objective 3. Coordinate with other studies to provide channel output data.

FGM-14 AEA will provide an assessment of where the channel geometry and substrate will likely be affected by project construction and operations to the instream flow study to assess where the instream flow analysis assumptions may not be valid. We recommend that the geomorphology modeling results for Project operational scenarios also be presented in the instream flow study to allow for an integrated analysis of the changes to riverine and floodplain habitats influenced by Project operations. Other information that should be provided to the instream flow analysis is a change in large wood recruitment, change in substrate size composition, discharges necessary to mobilize substrate, the frequency of bed mobilization, bedload and total sediment rating curves, geomorphic response reaches and correlated habitat effects. Additional longitudinal information, such as bed elevation adjustment should be described and provided to the groundwater and instream flow studies to assess effects of geomorphic response on habitat availability and quality.

In the Service's study request the goal of the model coordination is to*: "… provide necessary output to the various other studies that will need to consider channel change. Early coordination with the Instream Flow, Instream Flow Riparian, Ice Processes, Productivity, and Fish studies will be conducted to inventory the information needed within those studies will become available* *with results of the bed evolution modeling and predicted changes in channel conditions for the various Project scenarios."*

As previously recommended in our study requests and during TWG meetings we would like to see how the results from the geomorphology study will be integrated into the instream flow study to achieve the objectives that the Service requested in both the instream flow and geomorphology study requests.

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5. Water Resources

5.10 Ice Processes in the Susitna River Study

General Comments

May 31, 2012 the U.S. Fish and Wildlife Service (Service) filed a study request with FERC titled Ice Processes in the Susitna River, with the stated goal to characterize and document ice processes of the Susitna River and to use that information to analyze project effects on ice formation, location, persistence, and spring breakup. Changes in the ice processes may directly influence instream flows, habitat availability and quality, river and floodplain morphology, vegetation, and water quality, all of which are important to fish. This study will be used to predict the project's effects on ice processes in the project area and will be integrated with other studies to assess the how these effects will alter instream flow, winter time surface water/groundwater exchange, fluvial and floodplain geomorphology and vegetation, riverine habitat and quality of that habitat, and water quality in the Susitna River ecosystem. This document is a review of the ice processes proposed study plan (PSP) provided by Alaska Energy Authority (AEA) on July 15th within their broader Water Resources study plan (AEA 2012).

ICE-31 The Service requests an analysis of the hydraulic flow routing and ice process model's abilities to assess project effects under the proposed project operations. Specifically, will the model have the ability to assess hydraulic flow routing and ice process effects at a scale relevant to fish and their habitat? What can be determined from the proposed study? How will uncertainty be determined from the study and modeling results? Additional information must be provided to the currently proposed ice process models and the winter hydraulic flow routing models in order to enable a sufficient understanding of the project effects on anadromous fish and their habitat.

During the August 17, 2012 technical working group meetings agencies and other attendees requested a more detailed study frame work; one that not only lists a range of methods but defines the specific objectives and addresses the agencies objectives and information needs, and logic for how the proposed methods would be implemented to achieve those objectives. At this meeting the applicant described two potential ice processes models, but did not describe the data necessary to populate, calibrate and validate the models. It is not known if the proposed models will have the ability to extrapolate to proposed winter operational flow conditions well outside the natural flow regime to understand the effects of the project. Regardless of the modeling method implanted, hydraulic routing and accurate determination of discharge under ice cover requires direct measurement. Winter discharge measurements are

ICE-10 needed at each of the routing cross-sections because ice thickness and roughness will greatly influence the stage-discharge relationships. We request a detailed description of the minimum number and locations of discharge measurements to be taken during winter to populate and calibrate the winter hydraulic flow routing and to be used by the winter ice process model(s).

ICE-11 The Service requested a review and summary of information from existing studies of cold-region hydropower projects around the world that describe the effects of hydro operations on ice-covered rivers. This request was meant to inform potential implications for the proposed project. The PSP provides a general overview of river ice processes that would be applicable to a typical northern river, citing textbook publications. In addition, ice observations and some key findings from the 1980s studies are listed. Further on in the PSP, five ice modeling studies are referenced and the reader may interpret that the study would only produce a white paper summarizing these five references.

We offer the following comments on the literature review:

- A general overview of river ice processes should be presented with reference to the study reach. River ice processes should be presented in a context relevant to the study reach.
- The literature review should provide more than a "white paper" summary of the five listed modeling studies (refer to PSP Section 5.10.4.6). Consider expanding the review to include international project sites (e.g. Northern European) and other large non-hydropower instream infrastructure projects.
- The review should provide greater insight into understanding river ice processes in the context of the study reach with consideration of the following:
    - Impacts of the project on river ice processes.
    - Methods of analysis and tools used to understand and assess impacts of the project on river ice processes, fish, and fish habitat.
- The study of river ice processes invokes the use of terminology that may be unfamiliar to some readers. Further, there is often a lack of consistency on the use and meaning of river ice process terminology among authors with differing areas of expertise. To illustrate, consider the following terminology: aufies and anchor ice; ice dams and ice jams; frazil, slush ice, and snow ice; shore ice, shelf ice, and border ice; and, breakup described as mild, severe, dynamic, thermal, eventful, or uneventful. The project would benefit from a consistent use in terminology and a glossary of adopted river ice process terms.

There is a strong potential that the winter physical processes models (winter hydraulic flow routing, ice processes, groundwater, and water quality models) will have large uncertainty, also it is likely that a true understanding of fish habitat utilization will not be available with only two winters of fish surveys and studies. The combined limitations of the physical processes and fish studies may present difficulties for the agencies in making recommendations regarding protection, minimization, and enhancement. Without adequate knowledge of project affects the Service will require the project to operate along the natural flow regime; this would result in recommendations that require operations to maintain stable winter flows.

ICE-12 The study plan must include a schedule to collect necessary data, prepare the model, and complete the analysis. Additionally, the plan should include enough flexibility to extend the studies if the data and modeling products are not sufficient for the Service to adequately analyze winter operation effects on anadromous fish.

<u>Specific Comments by Subsection</u>

The following review of AEA's Ice Processes Study Plan uses the structure of the plan's stated objectives and compares them to study request objectives to determine if the intent is met, where improvements can be made, and which request objectives are not addressed.

AEA Study Objective 1. Document the timing, progression, and physical processes of freeze-up and breakup during 2012-2014 between the Oshetna River confluence (River Mile [RM] 233.4) and tidewater (RM 0).

ICE-13 While all northern rivers share similar traits in terms of general river ice processes, they are all very unique. The PSP should outline how the existing regime will be characterized. By characterizing the existing regime the study team will gain valuable insights into the specific behaviors of the study reach over the ice-affected period. A proper characterization would define the key drivers behind the dominant river ice processes and describe the nexus of these dominant processes with fish and fish habitat, and other studies. The characterization should also identify the controlling factors with respect to each nexus. Characterization should consider: spatial and temporal variability; river ice evolution; annual variations; and key physical and meteorological drivers. Adequate characterization will help guide the development of a suitable framework for assessing project impacts. An important characterization task is observation. The PSP should describe the data requirements needed to support characterization of the existing ice regime.

AEA Study Objective 2. Develop a modeling approach for assessing ice processes in the Susitna River.

The proposed winter operations will be an extreme alteration of the currently existing flow regime, with associated effects to anadromous fish and their habitat. A detailed understanding of the project effects caused by winter operations is necessary. If study results are not adequate for the Service to determine project effects, then the study period will need to be extended until an adequate understanding can be gained. If this is not accommodated, then the winter project operations will need to be altered to mimic the natural flow regime (i.e. no load following and baseloads within the range of the natural flows).

ICE-14 The modeling approach must include a discussion of the selected model limitations and the limitations of the winter hydraulic flow routing models. Although the winter hydraulic flow routing model is discussed under the instream flow study plan and the model results are needed by this, among other studies, no detailed data collection for the winter hydraulic flow routing is described.

The PSP emphasizes the application of a computational river ice process model. It is expected that the adopted river ice process model will be a valuable assessment tool. However, it is important to provide context to the adopted tool and clearly set out the expectations and potential limitations of the adopted tool. It is recommended that the PSP outline the overall methodology for analyzing project impacts. There may be merit it developing a conceptual assessment framework where the model resides as a powerful tool within the framework. One role of the framework would be to enable strategies for dealing with potential limitations of the model, data, or general understanding of the nexus between river ice processes and related processes. Specifically:

ICE-15
- Previous modeling efforts using ICECAL, SNTEMP, and DYRESM are mentioned. It would be appropriate to comment more on: the key findings resulting from the application of these models (will these findings help guide the current study?); their data needs (are they similar or very different than current needs?); and, their limitations (what limitations are we overcoming with the proposed model(s)?).

ICE-16
- In section 5.10.2.2, the PSP states that additional data needs are driven by: "*1) the new proposed configuration of the Project and project operational scenarios; 2) advances in predictive models of winter flow regimes beyond what was available in the 1980s; and 3)*

the need to supplement previously documented observations of natural ice processes." The first and second factors imply that post project configurations, operation scenarios, and model data requirements will drive data needs. The PSP would benefit from outlining how data needs for these factors may be different or similar to those for the 1980s studies. Also, how portions of the 1980s data may be useful for the current study. The last factor may require clarification as it seems to read as "additional data needs are driven by the need for additional data".

ICE-17

- Towards the end of section 5.10.2.2, a fourth factor driving data needs is suggested. That is, changes in channel geometry may make certain observations from the 1980s not applicable to current conditions (e.g. locations of ice bridging, open water leads, and ice jams). Also, that the location of the frazil production varied significantly between study years. We suggest that the study team provide more discussion on how the data may be used for the current study, in spite of changes in channel geometry, and temperature variability between study years. And caution against dismissing 1980s data due to changes in channel geometry and annual climate variations.

ICE-18

- The last paragraph of section 5.10.2.2, *"Finally, updated ice processes information is needed by the fisheries, instream flow, instream flow riparian, fluvial geomorphology and groundwater studies"* requires further clarification on how it pertains to additional information needs.

The PSP proposes to use an ice process model, CRISSP1D (or equivalent), to carry out winter flow routing. Comments on the ability of this model to meet the study objectives listed above are:

ICE-19

1. The use of one model to carry out both flow routing and ice processes is recommended due to the interaction between the flow routing and ice processes. CRISSP1D can be used to carry out this modeling but should be calibrated for its flow routing functions under open water conditions before ice effects are introduced. Consideration should be given to using the winter flow model to model flows, water levels and water temperature for the entire year.

ICE-20

2. Hourly time steps are feasible with CRISSP1D and even desirable from the ice process modeling perspective due to the diurnal fluctuations in air temperature.

ICE-21

3. A one-dimensional flow model will not be able to simulate the effects of open leads if they only occupy part of a channel width. If these locations are important due to groundwater inflows, a secondary two-dimensional model should be considered to provide more detailed simulations at selected sites.

ICE-22

4. In some instances, it may be appropriate to extend the 1D model results with very judicious application to address 2D problems.

ICE-24

5. No mention is made of modeling the reservoir and upstream tributaries. Large changes in flow rates can cause changes in reservoir levels that could affect water levels in upstream tributaries. Ice process in these tributaries may also be affected by the ice conditions in the reservoir. Has modeling of flow routing and ice processes within the reservoir and upstream tributaries been considered and will it be included in the final study plan?
6. It is important to be able to model the thermal regime of the reservoir including characterization of: temperature variations; ice thickness; and ice-in / ice-out dates.

ICE-25

The PSP proposes to collect a variety of winter measurements to assist in the calibration of the winter flow routing model. Comments on the ability of this data to meet the study objective to develop a calibrated flow routing model are:

1. Generally the data collection approach is appropriate to meet the objectives.
2. Winter flow measurements should record total and submerged ice thickness and frazil slush thickness, both to assist in the roughness calibration and to provide calibration data for the ice processes.
3. Consideration should be given to collecting vertical velocity profiles using an ADCP as part of the discharge measurements. This can improve accuracy of winter flow measurement and provides additional information to determine under-ice roughness. This may also facilitate 2D model calibrations.

Review on the methodology for developing an appropriate tool or model is partially addressed in the previous section. The following review comments are offered for additional consideration. It is important to emphasize that physically-based, process models are recommended for assessing project impacts. This basic principle behind the modeling effort warrants recognition and explanation in the PSP. A valuable feature of using this approach is that, with suitable analogues of the various river ice processes, we can reasonably extend their application to assessing project impacts.

ICE-26

An effective data collection program is essential for providing the data necessary to support development, calibration, and application of the adopted model. A well-defined data collection program is warranted since a significant amount of resources are required to meet data needs and a lack of sufficient data may impact project schedule. The following discussion points are offered for consideration when drafting the revised PSP.

- The PSP puts emphasis on “what” data needs to be collected. While this is a critically important and potentially challenging task, it may prove to be more challenging to: determine how to collect data, where to collect it, and how often. The planning effort required to execute a successful field data collection program should not be undervalued.
- The field program should recognize that there may be some site-specific logistical challenges that may only be learned through experience.
- An improved understanding of the ice regime is expected as the team observes and collects data. This improved understanding may bring new insights into the data collection needs and the field program may require modification.
- It may be challenging to determine appropriate focus sites prior to gaining an understanding of the ice regime. Additional input from other study teams may impact the number and location of focus sites. Further, data needs for a particular focus site may extend some distance upstream and/or downstream from the local area.

ICE-27

The PSP would benefit from a plan outline of the proposed data collection program. The above considerations do not represent a comprehensive list to be addressed by the plan. While they should be considered, the primary intent is to illustrate the need for such a plan.
The extent of the modeled study area should be confirmed with the other discipline leads. It should be sufficient to adequately capture ice processes within the reaches of interest. For example, the effects of uncertainty on boundary conditions should be minimized through the reach of interest. The PSP acknowledges that “there are currently no accepted models for predicting dynamic ice processes on complex braided channels, such as those found in the Lower Susitna River”… “and therefore modeling will not be planned for a significant portion of the study reach”. The PSP should address how impacts of the project will be assessed through portions of the study reach that cannot be simulated by the adopted model(s). This may be included as part of the overall assessment framework, as suggested previously.

AEA Study Objective 3. Calibrate the model based on existing conditions.

We agree that each of the models must be calibrated based on existing conditions. The data necessary to adequately calibrate and test the models must be described, as discussed previously. The calibrated ice processes model review should include an assessment of the model's ability to predict changes in ice processes under the project operations at a scale relevant to fish and their habitat. Although AEA Study objective 3 is directed towards the ice processes model, the calibration of the ice processes it is also true for the winter hydraulic flow routing model. The calibration and then extrapolation of results from the ice processes model will be used to predict winter load following operations effects downstream of the dam.

ICE-28 The PSP suggests that the ice process models "*will be calibrated to the range of observed conditions".* It is recommended that the PSP discuss how the model will be applied outside the range of observed conditions. Also, will there be some form of model verification, or assessment? This discussion may relate to the benefit of applying a physically-based ice process model. Experience and specialized expertise may be required to justify application of the model outside the range of observed conditions.

ICE-29 The PSP should describe how quantitative predictions of the following (for mild, moderate, and cold climate scenarios), will meet the information requirements of the other studies:

- *"extent and elevation of ice cover downstream of the dam"*
- *"ice-cover progression"*, and
- *"timing of breakup"*.

AEA Study Objective 4. Determine the potential effect of various Project operational scenarios on ice processes downstream of Watana Dam.

ICE-30 AEA's fourth ice processes objective proposes various Project operational scenarios on ice processes downstream of the Watana Dam. This should also include the determination of the ice processes models to provide adequate data to the winter hydraulic flow routing to determine the effects of project operational scenarios on instream flows (timing, quantity, and quality) downstream of Watana Dam. An error analysis on the ice process models is necessary, because the model will be used to extrapolate the project operational flow and temperature conditions well outside of the natural regime. Also, the ice process model results will be used to populate operation scenarios (including load following fluctuations and higher than natural winter flows) for the winter hydraulic flow routing model which will also be calibrated under the natural flow regime which consists of stable winter flows.

ICE-31 As requested above, an understanding of the limitations of the models and results is necessary to determine if they are applicable to assessing project effects on fish and their habitat. An error analysis of the models and results is necessary to examine the extrapolated results from the ice processes model and in the winter hydraulic flow routing model to inform whether a true understanding of winter operations effects is achieved.

AEA Study Objective 5. Determine the extent of the open water reach; and
AEA Study Objective 6. Determine the changes in timing and ice-cover progression and ice thickness and extent.

ICE-32 The ice processes model will be calibrated by one to two winters of data collection under the natural flow regime. The model then will be used to determine the open water reaches, ice thickness, and timing and distribution of ice development under project conditions. As currently proposed the flow regime during the ice period (ice up to break-up) will be highly variable and much higher than the natural flow regime requiring extrapolation of the calibrated model. It is unknown whether the calibrated model be able to assess how load following operations will influence ice processes (destabilization of developing ice, ice jam formations, flooding, etc.) in comparison to the typically stable ice cover during winter (as discussed in She et al. 2011). An understanding of the selected ice processes model's ability to predict ice development and characteristics with the project operations and the uncertainty associated with these predictions is necessary to determine if the winter operations can be analyzed with respect to impact on fish and their habitat.

AEA Study Objective 7. Provide observational data of existing ice processes and modeling results of post-Project ice processes to the fisheries, instream flow, riparian instream flow, fluvial geomorphology, and groundwater studies.

ICE-33 The primary role of the ice process study is to provide ice processes information and effects analysis to other studies. Changes to ice processes, including the changes of timing and ice extent and thickness may alter many of the other riverine processes such as geomorphologic processes, groundwater exchange, water quality, and instream flow. The resulting modeling results of post-Project ice processes will be limited in providing analysis to the fisheries, instream flow, geomorphology, water quality, and groundwater studies; this limitation must be described.

ICE-34 The PSP clearly indicates a need for integration. The PSP does not explicitly define a plan for informing and integrating with the other studies. While the importance for integration may be implied within the various individual PSPs, the project would benefit if there was a clear plan describing the strategies for information exchange and integration between the various studies. This plan should discuss how the model results will be documented and how the information will be provided in a format that is clear and accessible to the other studies. The plan should acknowledge the potential challenges that may be encountered and strategies for dealing with these challenges.

ICE-35 In the Geomorphology (AEA 2012, 5.9.4.2.2.4) proposed study plan the applicant describes the interaction between the geomorphology studies and the ice processes study as, "*Ice processes influence both the channel morphology and riparian vegetation. For example, ice can prevent vegetation from establishing on bars by annually shearing off or uprooting young vegetation. Similarly, ice can scour vegetation from the banks, increasing their susceptibility to erosion. In both examples these influences affect channel morphology. Ice jams can also directly influence the channel morphology by diverting flows onto floodplain where new channels can form, particularly when the downstream water surface elevations are low, allowing the return flows to headcut back into the floodplain. Ice can also move bed material that would normally not be mobilized by rafting large cobbles and boulders. There will be close collaboration between the Geomorphology and Ice Process studies to identify the key physical processes that interact* *between the two. Working together to analyze the conditions at the detailed study sites will be a key part of this collaboration. A significant portion of the influences of ice processes on morphology are directly related to their effects on riparian vegetation. Additionally, influences of ice processes beyond the riparian vegetation issues that may be incorporated directly into the fluvial geomorphology modeling may include:*

- *Simulating the effects of surges from ice jam breakup on hydraulics, sediment transport and erosive forces using unsteady-flow 2D modeling with estimates of breach hydrographs.*
- *Simulating the effect of channel blockage by ice on the hydraulic and erosion conditions resulting from diversion of flow onto islands and the floodplain.*
- *Use of the detailed 2D model output to assess shear stress magnitudes and patterns in vegetated areas, and the likelihood of removal or scouring.*
- *Use of the detailed 2D model output to assess shear stress magnitudes and patterns in unvegetated areas, and the likelihood of direct scour of the boundary materials."*

But in the ice processes study plan there is no description of simulating the effects of surges from ice jam breakup; or simulating the effect of channel blockage (which would likely require two-dimensional ice process modeling); or the ability of the ice processes modeling and winter hydraulic flow routing to provide adequate data to populate the 2D geomorphic models during winter conditions.

<u>Literature Cited</u>

Alaska Energy Authority (AEA). 2012. Proposed Study Plan Susitna-Watana Hydroelectric Project FERC No. 14241. July 15, 2012.

Northwest Hydraulic Consultants Ltd (NHC). 2012. Alaska Department of Natural Resources Topic 7 Ice processes and Winter Flow Routing Study Plan Review (DRAFT October 2012).

U.S. Fish and Wildlife Service. 2012. Letter and study requests to Secretary Bose, Federal Energy Regulatory Commission. May 31, 2012.

5. Water Resources

5.11. Glacial and Runoff Changes Study

General Comments:

The U.S. Fish and Wildlife Service (Service) has adopted and presents these comments as provided by the National Marine Fisheries Service (NMFS) on the Alaska Energy Authority (AEA) proposed study plan (PSP) for glacial and runoff changes as it purports to address in part, NMFS's request for a comprehensive study of Susitna River Project effects under changing climate.

This PSP only partially addresses NMFS' request entitled "Susitna River Project Effects under Changing Climate Conditions." It does not address the main objective of NMFS' climate change study request, which is expressed more fully in §1.3.1 of the request. In brief, the objective of NMFS' request is to assess the potential Project effects combined with impacts of climate change on the Susitna watershed ecosystem in order that a project license can be properly conditioned in anticipation of these changes.

The study plan is incomplete. It addresses some elements of NMFS' study request, but other elements are not addressed in this or any of AEA's other PSPs. Because the proposed Project is designed for long-term utility and is located in an area vulnerable to continued climate change, it is necessary to understand the cumulative impacts from the project and climate change in order to develop license conditions that protect anadromous fish species and their habitat. Some climate change induced effects of the Susitna River and Susitna watershed include continued warming of stream temperatures, reduction in permafrost affecting groundwater storage and discharge and channel incision, and glacier melting and reduction of summer flow. These climate-induced and project influenced changes in habitat would affect fish in the Susitna River. Informing the likelihood of these events will allow NMFS, and the Service, to make decisions on the effects that a dam would have if it were to block the passage of fish from the upper watershed, where refugia from negative effects on habitat may persist. Thus, NMFS seeks information from their requested climate study in order to inform our decision of whether prescription of fish passage is needed. Without such an understanding of climate change, project operations mistakenly would be considered as though future conditions were to be static. The project license would be outdated from the outset.

NMFS, and the Service, seek the information specified in its climate change study request in order to analyze the project effects, in the context of variable and changing climate conditions, on NMFS and Service trust resources. As explained more fully in §1.3.4 of NMFS' request, the main reason for this analysis is to incorporate the results of current climate science into comprehensive decision making, and provide information NMFS, and the Service, can use to develop, and in turn FERC can incorporate into any license order it issues, appropriate and efficiently tailored:

- Federal Power Act (FPA) section 18 fishway prescriptions for passage of anadromous fish;
- FPA section 10(j) recommendations to protect, mitigate damage to, and enhance fish and wildlife resources; and

- FPA section 10(a) recommendations to ensure that the project is best adapted to comprehensive plans for developmental and non-developmental resources.

In order to fulfill their duties under the Federal Power Act and other relevant mandates, NMFS, the Service, and FERC must obtain and apply the best available science, data and techniques to assess the potential effects of the proposed project on riverine processes, fish, and fish habitat. Applying recent advances in climate science, including scenario analysis and projections, to project analysis will result in more accurate and informed resource decision making (Brekke, 2009; Fowler 2007; Vicuna et al., 2010; Viers, 2011).

Recent advances in climate science and its application in other hydrologic risk analyses underscore the need for FERC's licensing process to utilize accurate predictions of the effects of climate change on changes in glacial wasting and on the timing and availability of water in the Susitna River. In the past, FERC has relied on historical data to evaluate project effects; in the context of changing climate a broader approach is needed. However, the best available science now includes the presently observed and projected future impacts of climate change on water resources. Congress recently emphasized the need for a broader scope of understanding, by directing the Secretary of Interior, via the SECURE Water Act, to coordinate with NOAA and its programs to ensure access to the best available information on climate change [(§) 9503 (c)(4) of the SECURE Water Act, (Pub.L. 111-11, Title IX, § 9501 et seq., Mar. 30, 2009, 123 Stat. 1329.)] stating, in part:

> Congress finds that--
> (1) adequate and safe supplies of water are fundamental to the health, economy, security, and ecology of the United States;
>
> (2) systematic data-gathering with respect to, and research and development of, the water resources of the United States will help ensure the continued existence of sufficient quantities of water to support--
> a) increasing populations;
> b) economic growth;
> c) irrigated agriculture;
> d) energy production; and
> e) the protection of aquatic ecosystems;
>
> (3) global climate change poses a significant challenge to the protection and use of the water resources of the United States due to an increased uncertainty with respect to the timing, form, and geographical distribution of precipitation, which may have a substantial effect on the supplies of water for agricultural, hydroelectric power, industrial, domestic supply, and environmental needs.

It is now considered routine for hydropower, dam and water management projects in the United States and around the world to consider projections of climate variability and climate change in project planning and operations (Viers, 2011), and FERC should do so here. In order that FERC may fulfill its duties, AEA should provide the information NMFS has requested.

GLAC-16 FERC has also recognized that when, as is true in for this project, reasonable projections of a range of likely temperature changes are available, projections of future climate and analyses related to future reservoir levels and river flows should include a reasonable spectrum of climate change impacts. As FERC concluded in the study determination for the Toledo Bend Hydroelectric Project (FERC P-2305-020) such analyses are needed in order to reach informed judgments about likely project impacts on aquatic resources downstream of the project and on recreational resources in and around the reservoir.

FERC likewise determined in the Lake Powell Hydropower and Pipeline Project, that climate change effects on existing and future water supplies should be addressed as the availability of water for the pipeline would affect the ability of the Project to supply water and generate hydroelectric power. As with the Lake Powell project, the availability of water supply is directly related to this Project's purpose.

GLAC-17

Recent advances and applications of the science are described in detail in our study request; see, e.g., §1.3.2 of the climate change study request. FERC should incorporate these developments into the studies it approves, rather than dismiss them. NMFS has provided adequate supporting science, continued climate change scientifically accepted and continued warming is unequivocal. NMFS and the Service request that as part of the study plan determination, FERC order completion of our Comprehensive Study of Susitna River Project Effects under Changing Climate Study Request, filed with FERC on May 31, 2012 pursuant to 18 CFR Section 5.9(b).

FERC should also consider its responsibilities under the National Environmental Policy Act when determining the need for information about potential climate change. In issuing any license order, FERC should be informed about climate change's effect on the Project and its suitability, as well as how the project may affect trust resources already potentially compromised by climate change. NMFS, with support from the Service, seeks assessment of the effects of climate change on the Project and on the resources affected by the Project in order to adequately prepare and support appropriate license terms and conditions, inform the need for fishway prescription and to develop effective measures to protect, mitigate and possibly enhance resources for which we have statutory responsibilities.

NMFS' study request has demonstrated a reasonable nexus between Project operations and effects on resources resulting in cumulative effects of the Project and climate change on important habitat components such as water temperatures, groundwater patterns, timing of fish migration, spawning, hatching and food availability. But to simplify the consideration of nexus, NMFS offers this hypothetical example of a cumulative effect of the project and climate change on the Services' trust resources: Assume that, as projected, glacial recession and wastage continues to the point where summer flows from ice melt are reduced and eventually lost. Without the information NMFS has requested, FERC cannot determine to what extent the natural partial velocity barriers to upstream passage of Chinook salmon would remain barriers to fish passage, independent of the project. In other words, as glaciers melt and contribute less water to summer high flows, lower flows in Devils Canyon might naturally allow more Chinook salmon and possibly other species of salmon to swim upstream through the Canyon and access now marginal habitat. Or, as stream temperatures continue warming, current summer rearing habitat for juvenile salmon may become unsuitable causing species' range to move to higher elevations and/or further upstream. But without information about these possibilities, a license order would likely be unable to account for it. Accordingly, the project could block a natural wildlife response to climate change and create significant future effects unanticipated by a license order based on conditions as they currently appear.

AEA understands that water is the fuel for the proposed Project, and that the amount, timing and variability of flows due to changes in glacial wastage have resulted in documented climate-related changes in recent decades. Models that project future climate, and usually, change, are readily available in currently in use across Alaska and northern latitudes as described in our study request at §1.3.3 and 1.3.5.

GLAC-18 Where NMFS differs from AEA is that NMFS seeks to expand the climate study beyond simply the analysis of glacial retreat and flow into the proposed reservoir, and water quality. We request expanding the analysis to incorporate reasonably foreseeable changes in climate to assess vulnerabilities of natural resources in the project watershed. FERC must understand these vulnerabilities in order to determine how anadromous fish and their habitats may be affected by the Project, and ultimately determine if and how the Project may proceed. We suggest use of several documented methodologies, such as Bryant, 2009, and of using one of the many available and commonly used climate change vulnerability assessment processes.

In particular, we are concerned about the failure to consider the detailed content of this study request by FERC in its Scoping Document 2 (SD2), and the only partial adoption of the request by AEA. In the SD2, FERC states that its common practice is to evaluate a range of flow release alternatives that take into consideration both high and low water years and to condition any license that may be issued to adaptively manage for these variations in water years. FERC asserts that its practice sufficiently addresses NMFS concerns and study request. It does not. NMFS study request addressed the limitations of FERC's practice to analyze historic high and low water years:

> *"The concept of a stationary environmental baseline with fluctuations (high and low water years) around a relatively stationary mean (as previously used by FERC and other regulators) is an outdated concept given the current level of scientific certainty of climate change (Milly et al. 2008; Viers 2011). Given the current trends (described below in 1.3.4), there is need to document the environmental baseline of the project, and to develop a realistic projection of the range of potential future trends in order to effectively evaluate the impacts of the project on NMFS resources and allow NMFS to make accurate conservation recommendations, license terms and conditions, and to develop recommended protection, mitigation and enhancement measures to address likely project effects.*
>
> *Both precipitation and temperatures are projected to increase significantly, resulting in an increase in evaporation and evapotranspiration. In addition, rather than snowpack accumulating over the winter, increased temperatures will result in melting the snowpack "storage." The alteration of rain and snowfall timing and intensity, evapotranspiration and groundwater and surface flows, translates into changes in the annual hydrograph and potentially less water availability. Considering a static environmental baseline in project planning will not capture these projected changes. These changes need to be considered in project planning. Alaska's freshwater resources are increasingly at risk from climate change and preparing for this future is of escalating importance. Thus, studies are needed to connect the trends and projected changes in climate to variables needed for project planning."*

NMFS and the Service disagree with FERC's suggestion that adaptive management can be used for variations in water years for the reasons described in the study request and reiterated above. Adaptive management could, more appropriately, be applied to climate change.

Adaptive management is one way to address the multiple uncertainties in the future faced by the Sustina project – not only climate change. However, an adaptive management framework, including monitoring and experiments, must be built into the Project in the beginning (Gregory et al., 2006) including the issues for which adaptive management is more or less likely to be a viable option.

The Susitna project has characteristics that may make it a good candidate for using adaptive management (in fact, DOI uses the case of re-licensing of the Tallapoosa dam as a case study), but has other characteristics that may make it more difficult. In a recent review by Gregory et al (2006), challenges to an active, experimental, adaptive management approach include:

"(a) designing statistically powerful experiments capable of discerning external effects and effectively considering issues of duration (i.e., using titration designs),
(b) articulating all the costs, benefits, and risks of alternative experimental and non-experimental management plans, and again
(c) ensuring that sufficient staff capacity and institutional flexibility exist."

One of the examples presented by Gregory et al. (2006), as more complex and difficult, involves climate change and a multi-objective project of land planning. Adaptive management does not relieve the need for adequate baseline information in an original licensing proceeding - and in fact requires it. Adaptive management is a decision-making process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood.

Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a "trial and error" process, but rather emphasizes learning while doing. Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social and economic goals; increases scientific knowledge; and reduces tension among stakeholders. It is vital that adaptive management is the paradigm for both pre-licensing study plans and post-licensing conditions for long-term monitoring.

To be effective, adaptive management requires a deliberate, intentional process, including set up and iterative phases, and within these, decision making, post-decision monitoring, assessment of monitoring data, learning and feedback, and institutional learning, according to Williams and Brown (2012) in a recent DOI guidebook to adaptive management. Monitoring and experiments must be built into the project in the beginning (Gregory et al., 2006), and they lay out a set of criteria that suggest problems for which adaptive management is more or less likely to be a viable option. They also point out the dilemma of *"clearly documenting what we do not know as the basis for experimenting with valued and, in many cases, fragile ecosystems."*

The information on climate change that NMFS has requested is necessary to prior to FERC determining whether the license order should include adaptive management measures. NMFS and the Service recommend FERC order development of an adaptive management approach for all aspects of decision making associated with the proposed Study Plan and license application decisions.

Specific Comments by Subsection:

5.11.4.1. Review Existing Literature.
This literature review should be expanded to include a review of climate projections and glacial regions, permafrost changes, and other existing research relevant to the impacts of climate variability and change on the water dependent resources of the region. This is because the current literature review is limited to physical processes affected by climate change, and does not cover the reasonably foreseeable cumulative effects of those changes on the natural resources that will also be affected by project operations.

5.11.4 Study methods.
GLAC-19 NMFS and the Service appreciate that AEA will consider exploring future runoff projections available from climate models in a qualitative manner. However, the analysis of future runoff should also be assessed quantitatively. Because the PSP is confusing where it discusses study methods, NMFS and the Service request clarification or perhaps clarification of the following details.

The study proposes to analyze changes in glacial systems, temperature, and precipitation, and their impacts on watershed hydrology, including future runoff projections. The changes in runoff will be translated into time series data summarizing changed hydrology and temperature dynamics in the Susitna basin.

The study also proposes to qualitatively assess the potential effects of "climate change models."
GLAC-20 This reference is unclear – global climate models (GCMs) are used to simulate the past and project the future climate and, with greenhouse gas forcing, "change," but climate *change* models don't exist. While the glacial study plan does include an analysis of stream flow based on climate projections, it is not clear how this is being conceptualized. The revised study plan should define what is meant by "future runoff projections" as compared to "climate change models." On page 5-153, the PSP mentions, *"This will include no change from current conditions, continuation of current warming trends, and adherence to various climatological scenarios such as SNAP (2011)." "Climatological scenarios such as SNAP"* appears to refer to several downscaled climate projections based on the global climate models, but this needs clarification.

It is unclear what is meant in the PSP by a "qualitative analysis." At a minimum, potential effects of climate change should be evaluated on a relative basis (as in the Lake Powell Pipeline study), with effects on stream flow and water supply associated with climate change being applied to all interrelated and affected Susitna studies and project alternatives. For example, changes in stream flow associated with climate change should be included for each study planned for the project that would be used by NMFS and the Service in making fish passage determinations and prescriptions and its conservation recommendations pursuant to §§18, 10(a) and 10(j) of the FPA and the Essential Fish Habitat provisions of the Magnuson-Stevens Act §305(b)(2), 16 U.S.C. 1855(b)(2). This is true for each project alternative that may be assessed. Including effects of climate change in all potential studied resource areas that are likely to be affected by project construction and operations studies will result in a relative comparison between alternatives where effects of climate change apply equally to each alternative.

5.11.4.2. Develop a Modeling Framework

From the PSP, it is unclear how future hydrologic simulations will be developed. The PSP mentions forcing using *"Max Planck Institute for Meteorology ECHAM5 model (3 hour time steps) and SNAP (daily) models. The SNAP dataset includes the years 1980-2099, with data downscaled to 2 km grid cells. Future projections from SNAP are derived from a composition of the five best ranked General Circulation Models (out of 15 used by the Intergovernmental Panel on Climate Change [IPCC]) models for Alaska. Based on how closely the model outputs matched climate station data for temperature, precipitation, and sea level pressure for the recent past, their individual ranking order for overall accuracy in Alaska and the far north was as follows: 1) ECHAM5, 2) GFDL21, 3) MIROC, 4) HAD, and 5) CCCMA."* The PSP proposed to use a five-model composite from these and three emissions scenarios.

GLAC-21 Calling out the ECHAM5 model separately from SNAP is unclear – ECHAM5 is a global climate model with a large spatial scale not well suited for application at the sub-watershed level as in this Project. A 3-hour time step is mentioned, but this would also be at the large spatial scale of global climate models, ~1.9°**x**1.9° (about 210 km) in the case of ECHAM5. Daily projections from SNAP would be at a 2 km resolution downscaled from global climate models, including ECHAM5. This would be a useful level of resolution for use in this project. It is possible that the climate scientists plan to use simulations of these models of the past (e.g., since 1960 is mentioned) but the explanation of the methods is confusing and needs to be better articulated. Further on, the PSP states that *"Future simulations will be forced by a suite of downscaled IPCC AR4 projection scenarios and, if available, the newer AR5 simulations."* This does not appear to be different from the 5-model SNAP composite. An accurate explanation of the methods is needed in order for NMFS and the Service to understand, and FERC to determine, whether these methods are appropriate for gathering the information necessary to develop a license application.

GLAC-22 NMFS and the Service support the methods selected for analysis of change in stream flow on annual and seasonal basis. But we recommend clarification on how analysis at "single event timescales" could be completed. Perhaps this is an analysis of extremes in the downscaled data. More detail on methods is needed as NMFS climate scientists are unaware of how such an analysis could be made and the PSP does not explain the methodology.

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5. Water Resources

5.12. Mercury Assessment and Potential for Bioaccumulation Study

General Comments:

This Alaska Energy Authority (AEA) proposed study plan (PSP) was developed in response to the U.S. Fish and Wildlife Service's (Service) concerns about the risks posed by mercury to fish-eating wildlife in the project area, as detailed in our study request entitled, "Piscivorous Wildlife and Mercury – Risk Assessment Study". We are encouraged that AEA is planning to conduct a study to predict how project operations may affect future mercury levels in the reservoir's sediments, water and biota. AEA's PSP addresses some, but not all, aspects of our study request. In these comments we identify which study request needs have not been met, and offer suggestions for improvement of the AEA's study plan. First we present over-arching concerns, and then follow with several technical comments related to the PSP.

MERC-08

Adopt the concept of mercury with dynamic background.

The PSP needs to adopt an approach of documenting and assessing the dynamic background concentrations of mercury and methylmercury (MeHg), particularly in fish and biota over time (not just in the landscape prior to construction). In other words, it is stated that enhanced formation of MeHg in reservoirs has been documented (section 5.12.2). The PSP should acknowledge and expect that a response in fish mercury will occur. For mercury, it is not enough to rely on models for the primary method of predicting impacts (***5.6.5. "****Models will be the primary method used for predicting potential impacts to water quality conditions in both the proposed reservoir and the riverine portion of the Susitna basin.")*. Rather, the AEA plan should

MERC-09

assume the increase in fish mercury will happen and detail how this risk will be assessed, monitored, and managed as a public health issue. There will be significant concerns regarding human and ecological health and risk assessment and the proposed study needs to outline clearly how these risks will be documented, assessed, and managed.

MERC-10

Mercury modeling is essential, and is currently not addressed in any of the PSPs.

In order to determine the risk posed by project-related mercury inputs to the aquatic system, AEA must quantitatively model mercury inputs to the reservoir, the amounts and rates of mercury methylation, uptake and biomagnification of MeHg in reservoir organisms including concentrations at each trophic level, and transport of mercury downstream from the reservoir, from the date of initial flooding until 20 years post-impoundment. These mercury inputs and dynamics must be quantitated in order to predict project-related risks to ecological receptors in the project area.

MERC-11

In order to quantify new mercury inputs to the reservoir, the study must obtain information about the pre-impoundment surface area to be flooded and characterize the underlying geology, soil type and biomass types and amounts in the zone to be flooded, ***and then translate that information into quantitative amounts of mercury inputs and quantitative rates of mercury methylation using modeling***. The PSP begins to address this need, by *"gathering information"* about these factors and *"assessing mercury components"*. However, the PSP does not necessitate the following:

a) It does not attempt to quantify mercury inputs to the system.
b) It does not attempt to quantify rates of mercury methylation post-impoundment.

c) It does not attempt to quantify uptake and biomagnification of MeHg in reservoir organisms.
d) It does not attempt to quantify levels of MeHg at any trophic level of the reservoir food chain post-impoundment.

It is essential that the PSP both commit to these objectives, and also specify methodology to accomplish each of these objectives. A methodology to model mercury over time within the system must be specified, and the specific parameters needed for the model must be identified, to ensure that the necessary data are collected in an appropriate way.

MERC-12

Document mercury increases at other hydro projects in boreal forested landscapes.

Attempts at modeling mercury methylation in surface waters are constrained by numerous required assumptions (e.g. methylation and demethylation rates, carbon limitations, sulfate and sulfide limitations, microbial community dynamics, parent geology and mercury content/leachability, hydrologic controls, aerobic/anaerobic boundary layer controls, etc.). The costs associated with developing and applying a modeling framework are still met by the need to validate the model with actual site-specific field data (e.g. MeHg in fish over time). To obtain an upper-bound on what the potential increase in MeHg in fish might be as a function of reservoir formation, the resulting increases in MeHg in fish from other Hydro sites needs to be documented. This requires not only reviewing peer-reviewed literature, but contacting directly agencies such as Quebec Hydro, Manitoba Hydro, Environment Canada, and authors of noted peer-review articles on the issue of enhanced MeHg in fish from reservoir formation. These include Vince St. Louis, Mariah Mailman, Britt Hall, K. Kruzikova, Reed Harris, Carol Kelly, John Rudd, S. Castelle, Dave Krabbenhoft and Drew Bodaly among others. There have been many lessons learned on how MeHg increases in fish upon flooding and impoundment and AEA's study plan needs to demonstrate that that knowledge base has been incorporated into their plan. Additional topics that would benefit from this level of communication would be documenting whether the EFDC model (or any other model) has been developed and calibrated for mercury in the context of reservoir formation. Also, Scandinavian countries may have addressed this issue in detail and contacting the list above may provide access to individuals in Sweden, Norway, and Finland who could advance the Project's knowledge base.

MERC-13

Do not assume mercury to be a simple, conservative behaving metal.

It is known that mercury transforms into a more bioaccumulative neurotoxin, MeHg, as waters are flooded in boreal forested landscapes (St. Louis et al., 2004; Mailman et al. 2006; Porvari and Verta, 1995). Incorporating the knowledge base on the key parameters affecting methylation at high latitudes needs to be addressed in detail by AEA's study plan well before construction. The reason for this importance is that watershed-scale amendments (e.g. tree removal, vegetation burning), may be worthwhile for mitigating the MeHg risks. Mailman et al. (2004) identify several strategies that need a thorough review by the proposed study relative to MeHg formation: "Possible strategies reviewed in this article [Mailman] include selecting a site to minimize impacts, intensive fishing, adding selenium, adding lime to acidic systems, burning before flooding, removing standing trees, adding phosphorus, demethylating MeHg by ultraviolet light, capping and dredging bottom sediment, aerating anoxic bottom sediment and waters, and water level management." It is acknowledged that excluding as many wetlands from the inundated area may be a recommendation (following findings from ELA, Ontario), but that may not be possible given the site topography.

MERC-14
AQFUR-2

Baseline mercury levels should be determined in fish-eating birds from the study area, by measuring mercury in feathers. This objective is not contained within any Applicant PSP.

The Service's study request includes an objective to document baseline mercury levels in piscivorous wildlife in the reservoir area, as measured in fur (for mink and river otter) and feathers (avian piscivores). The PSP does include an objective to collect and analyze mercury levels in fur samples from river otters and mink (in PSP 8.11, "Study of Aquatic Furbearer Abundance and Habitat Use). However, it does not include this component for avian piscivores.

Bird feathers are an excellent tissue for determining mercury body burden in birds, and feathers can be collected non-invasively. Please refer to section 1.6.3 of our study request for a complete discussion of this topic. It is very important to document baseline mercury levels in fish-eating birds in the study area, for at least two reasons. First, baseline mercury levels are needed as a foundation for interpreting future feather mercury levels after project operations begin. Baseline feather mercury values are also needed to determine the degree of risk posed by additional mercury inputs to the system. Risk assessors need to know how much "assimilative capacity" exists in fish-eating birds in the project area. Are current body burdens of mercury close to levels causing toxicity, or can the birds be exposed to additional mercury inputs from the project without experiencing toxic effects?

Mercury levels should be characterized in as many piscivorous bird species as possible in the study area, with a focused effort to include representative species for all relevant guilds. Raptors such as eagles and osprey, waterfowl such as loons and mergansers, and smaller birds such as kingfishers should all be assessed. Risks posed by mercury are likely to vary among piscivorous avian species, due to different exposure and dosage rates based on diets and body sizes. There may also be differing thresholds of mercury toxicity among species based on species-specific sensitivities to mercury.

MERC-15

The PSP should perform an ecological risk assessment for mercury toxicity in piscivorous wildlife in the study area.

The AEA's PSP misses the mark in saying that *"detection of mercury in fish tissue and sediment will prompt further study of naturally occurring concentrations in soils and plants and how parent geology contributes to concentrations of this toxic (sic) in both compartments of the landscape."* Abundant scientific literature cited in our study request documents that flooding previously terrestrial environments creates conditions for substantial NEW INPUTS of mercury into the system, and NEW CONDITIONS for methylation of mercury and subsequent bioaccumulation – especially in Northern environments. Therefore, CURRENT mercury content of fish in the Susitna River is not a necessary pre-condition for the need to study future, project-specific impacts of NEW mercury inputs and dynamics.

In order to characterize the mercury-related risks to ecological receptors posed by the project, AEA must perform an ecological risk assessment for each piscivorous species in the project area. The amount of mercury ingested by individuals of each piscivorous species must be estimated based upon dietary information and modeled mercury levels in food items post-impoundment. The ingested mercury levels should be compared to toxic levels, based on species-specific data from the scientific literature, to assess project-related risks to piscivorous wildlife in the study area.

Continuous monitoring.

MERC-16 A one-time, late-summer fish survey is inadequate to monitor dynamic background mercury concentrations. Toxics modeling is cited (5.5.4.4), but this cannot be done on the basis of "…will be conducted…" The toxicity of MeHg in fish and biota must be more pro-actively addressed in terms of:

a) How much increase in MeHg in biota and fish can be expected? (i.e., what has been the range of MeHg increases at other reservoirs?)

MERC-17

b) Studies have acknowledged that MeHg toxicity may be reduced by a number of possible management strategies, many of which would need considered and implemented before construction. These need addressed.
c) How will human and ecological health be considered (i.e. maintaining public health) in light of the likely increase in MeHg in fish?

In summary, AEA's study plan must assume that there will be an increase in fish mercury concentrations as a result of the formation of the reservoir. Managing this risk, modeling it, and monitoring it should be developed in accordance with what has been found at other similar landscapes.

Specific Comments by Subsection:

MERC-18 Page 5-164, first paragraph: discussion does not make sense. The State of Alaska (SOA) measured total mercury in salmon and other freshwater fish species from the Susitna River drainage. Contrary to the discussion, the SOA does not compare fish mercury concentrations to water quality standards. Unlike some other states such as Oregon, SOA does not base mercury water quality standards on fish concentrations. Table 5.12-1 reveals mean concentrations of mercury in several fish species from the Susitna Drainage (arctic char, northern pike, pink salmon and lake trout) that are above levels deemed safe for unlimited consumption by women of childbearing age, as determined by the Alaska Division of Public Health (Verbrugge 2007).

MERC-19 Page 5-163, paragraph 5: The report states *"At Costello Creek only 0.02 percent of the mercury detected (*in what – sediments?*) was found to be methylated. This study suggests, based on limited data, that mercury concentration varies significantly between separate drainages, and that methylation is also tributary specific"*. This may be true for sediments, but is very unlikely to be true for fish. As a general rule, mercury in fish tissue is nearly 100% methyl mercury (Bloom 1992).

MERC-20 Page 5-168, Section 5.12.4.3.2 Fish Tissue: The report states, *"Body size targeted for collection will represent the non-anadromous phase of each species life cycle (e.g., Dolly Varden; 90 mm – 125 mm total length to represent the resident portion of the life cycle.)"* This makes some sense, in order to understand the amount of mercury in the fish that is clearly attributed to the local environment. However, for risk assessment purposes it is also important to sample fish that are representative of those taken for consumption by humans and wildlife receptors. Specifically, large adult fish that are targeted by anglers (and bears) should also be sampled, to determine how much additional mercury can "safely" be added from the project before consumption advisories are warranted.

MERC-21 Page 5-170, Section 5.12.4.5: *"Pathway assessment of mercury into the reservoir…"* The water quality modeling this section refers to (from Section 5.6) does not have the capacity to predict mercury inputs from inundated bedrock, soils and vegetation, mercury fate and transport, mercury methylation, or mercury uptake by biota. Studies 5.6 and 5.12 point to each other, but neither actually does this critical mercury modeling work. A concerted, specific mercury modeling component is essential and must be added.

MERC-22 Section 5.12.6 Schedule: Two additional monitoring activities needs to be added to this table and scheduled: 1) Quantitative modeling of mercury inputs, rates of methylation, and uptake by biota; and 2) Ecological risk assessment for mercury exposure to avian and mammalian piscivores in the study area

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6. Instream Flow Studies: Fish, Aquatics, and Riparian

6.5. Fish and Aquatics Instream Flow Study

General Comments:

On May 31, 2012, U.S. Fish and Wildlife Service (Service) filed a study request with FERC entitled "Susitna River Instream Flow and Habitat Utilization". The stated goals of the study request are to: *(a) characterize the existing flow regime and its relationship to riparian and aquatic habitats and organisms; (b) use this information to quantify potential changes to aquatic and riparian ecosystems due to Project operations over the initial licensing period; and (c) determine effects of the Project on fish, in order to prescribe fishways and recommend mitigation needed to conserve fish populations of the Susitna watershed.* In contrast to the Service's goal, Alaska Energy Authority's (AEA) Instream Flow Proposed Study Plan (PSP) goal is to *"provide quantitative indices of existing aquatic habitats and the effects of alternate Project operation scenarios"*. The intent of AEA's goal is not clear and the PSP lacks the specificity needed to isolate and guide the characterization of fundamental ecological relationships underpinning the river's floodplain ecosystem. Changes (losses of habitat) to the floodplain ecosystem cannot be addressed through *indices* of existing habitat. The AEA study plan must characterize the natural flow regime that creates and maintains habitats. The ability of AEA to quantitatively predict changes/ losses of habitat important to the production of species dependent upon the Susitna River floodplain ecosystem is necessary to specifically address agencies' resource management goals.

USFWS Study Request
In the Service's Instream Flow and Habitat Utilization Study submittal, we requested hierarchical habitat mapping, fish distribution surveys, the characterization of microhabitat utilization patterns, and flow-habitat modeling to predict Project impacts. The Service requested a hierarchal nested habitat mapping (e.g., Frissel et al. 1986) framework to structure fish distribution surveys, the instream flow study and physical process studies.

In addition, we requested fish distribution surveys within the habitat mapping framework to assess the full lateral and longitudinal profile of seasonal fish distribution, life stage periodicity, and identification of micro-habitat criteria that are influential in fish habitat site selection. The Service also requested that site-specific habitat criteria be evaluated in the context of the hierarchical habitat framework, such that habitat criteria are determined and evaluated in all habitats of importance to each agreed-upon target species and life stage. We stated the need to determine what criteria are important to fish habitat site/suitability and selection before we can choose an appropriate flow-habitat model.

Although the Service has participated in the AEA technical work group (TWG) sessions to work through these issues, and some accommodations have been verbally expressed to meet the Service's study request, further collaboration is needed to ensure that AEA's instream flow study plan is amenable to the Service's request. We have not yet had the opportunity to review the most recent draft revised study plan to determine if our issues have been adequately addressed.

IFS-096

Study Duration
The Service maintains that the duration of the proposed studies will not represent the range of environmental (e.g. stream flow, temperature, snow pack, icing) conditions that occur naturally.

Habitat mapping, study site selection, and habitat utilization (fish) surveys need to be conducted over all seasons and over a sufficient period of time (years) to account for intra and inter-annual variability in environmental conditions. All evidence and ecological theory supports the fact that species are locally adapted to this variability and in many ways depend upon it (Mims and Olden 2012).

IFS-093 Habitat-flow relationships should also be developed over a minimum temporal scale to address the dominant age-class of Deshka River (Susitna River tributary; approximately RM 40) Chinook salmon. On average, a five-year period of study would represent one generation of Deshka River Chinook salmon based upon available age-composition information. In some years, 4- or 6- year olds predominate (ADFG 2012; Alaska Chinook salmon GAP ANALYSIS). The Deshka River Chinook salmon stock age-composition currently represents the only one of its kind within the Susitna River basin. Salmon stock age-composition is a well-noted data gap within the ADFG Chinook stock assessment analysis for Cook Inlet. The Service supports the State of Alaska Sustainable Salmon Fisheries Policy (ADFG 2001) calling for a Precautionary Approach to managing salmon stocks and habitats in the face of uncertainty. The Precautionary Approach specifically requires action on a time scale of five years, *"…which is approximately the generation time of most salmon species"*. A minimum of five years of study also allows the developer to account for a substantial range of natural environmental variability that is critical to identify patterns of habitat availability and utilization by fish. If studies are not conducted over a sufficient period of time, the impacts of this Project cannot be adequately assessed.

Study Plan Integration

During the August 16, 2012 technical working group meeting NMFS, USFWS and other attendees requested a more detailed study frame work from AEA to gain understanding as to how the individual studies will be integrated to demonstrate baseline vs. Project- related effects. AEA has made some headway toward this issue by drafting figures depicting study plan interrelationship and interdependencies. The Service has not yet had time to fully vet these figures and cannot comment on their completeness at this time.

IFS-106 Specifically requested was a framework that not only defines and lists the individual study plan objectives, but also includes the full range of proposed study methodologies. This information was then to be further integrated with the May 31, 2012 study requests in order to assess whether or not AEA individual proposed study plans meet the intent of the Service's overall study requests.

The study plan integration should also provide details for: 1) a process schedule (timeline) and methodologies for habitat mapping; 2) selection of the proposed focus areas and study sites; 3) surveys of fish distribution and collection of microhabitat utilization [hierarchically stratified by macro- and meso-habitats]; 4) statistical testing of microhabitat variables that are ecologically relevant to habitat selection; and 5) quantification of flow-habitat relationships. Specific methodologies for surveying anadromous and resident fish distributions should also include temporal and spatial distribution of spawning, summer rearing, and overwintering sites.

Each study component should have clear objectives and methods. Along with the study integration, AEA must state what each study can and will determine, and the degree of relative associated uncertainty in each study component. In other words, AEA must demonstrate how sampling protocols will yield samples that are representative of the full diversity of aquatic habitat. Each study component should explain the expected representativeness (spatial and temporal), precision, and accuracy of data results and model output calculations. If the study component is dependent on, or supplies another study then the uncertainty analysis must take that into context to report cumulative uncertainty statistics. For example, an assessment of Project operational effects on overwintering fish will rely on an understanding of winter habitat utilization and variables that influence habitat utilization (biologic understanding) and on the winter hydraulic flow routing and water quality models, which will rely on results from ice process modeling. It is unclear how the associated additive and cumulative error of each of these study components is proposed to be quantified. Also unclear, is the degree of certainty surrounding the analysis of the resulting integration of Project-effects.

Alternative Instream Flow Tools/Methods

IFS-042 In addition to AEA's proposed use of the Indicators of Hydrologic Alterations (IHA) and Range of Variability models (TNC 1997; Richter et al. 1996; Richter et al. 1997), we recommend using the concept of natural flow regime (and variation) to maintain biodiversity and ecosystems and to identify ecologically relevant hydrologic indices that characterize the natural flow regime (Henriksen et al. 2006; Olden and Poff 2003; Poff et al. 1997).

The requested natural flow regime characterization is necessary to consider the ecological consequences of altering one or more flow parameters under the Project's proposed operating schedule (Richter et al. 1998). If the inter annual variability of the hydrograph is eliminated or altered, the ecological function of the Susitna River is invariably altered (Trush et al. 2000). The general and specific characterization is critical as the proposed operations may effectively reverse the natural hydrograph of the Susitna River substantially increasing winter base flows, and reducing summer flows.

Existing hydrologic data for the Susitna Watershed has been summarized by MWH (2011), including results from stations operated by the USGS in the Susitna River watershed. Historic, current, and proposed Susitna River watershed gages are summarized in (Table 1) of MWH (2011). The USGS has used these gages with the adjoining Little Susitna watershed, to generate a combination of measured and synthetic streamflows for a 63 year period from 1949 through 2011 (USGS, *in press* 2012).

The characterization of the Susitna River period of record will use the existing data, updated annually with the addition of new information and gages. The characterization of the natural flow regime (Lytle and Poff 2004; Poff et al. 1997) of the Susitna River should include the magnitude, frequency, duration, timing and rate of change of hydrologic conditions; including large and small floods, and high and low flows (Assani et al 2010; Bragg et al. 2005). High, median, and low flow year statistics should be summarized. This characterization will provide baseline conditions and form the basis for setting flow regime targets (Bragg et al. 2005) and resource management objectives.

IFS-045 The following comments are related to the use of Richter's concepts (1996; 1997) and USGS software (Henriksen et al. 2006) to characterize the natural flow regime, and the use of Matthews and Richter (2007) to characterize and isolate ecological flow components of the Susitna River's flow regime. The life histories of floodplain fishes are adapted to the Susitna's flow regime and their seasonal patterns of habitat use require natural flow variability (Mimms and Olden 2012). Mapping of the diversity of aquatic habitats and surveys of seasonal fish distribution within these habitats is needed to identify ecological flow components necessary to maintain fish production.

The use of environmental flow methods that are based on the attribution of seasonal ecological flow components and statistical analysis of the natural flow regimen requires the assessment of fish habitat utilization and hydrologic connectivity. Some aquatic habitats important to fish are seasonal and some are perennial. Interactive use of thresholds of hydrologic connectivity and statistical characterization of the natural flow regime can yield the creation of seasonal habitat series.

IFS-079 Thresholds of lateral connectivity need to be identified and monitored through the use of remotely sensed media and local instrumentation. Aerial and satellite photography can be utilized from a range of seasonal flow conditions (Benke et al. 2000) to assess patterns of hydrologic connectivity across the Susitna River floodplain. LiDAR data can be used interactively with hydraulic modeling to model patterns of hydrologic connectivity with even greater resolution.

IFS-044 Local instrumentation (pressure transducers/depth sensors) is also needed to assess hydrographic relationships between primary and off-channel habitats (sloughs and floodplain ponds/beaver ponds). Since the hydrography of off-channel habitats is primarily a function of discharge in the Susitna's mainstem, instrumentation of these relationships is needed to quantify patterns of lateral connectivity and, through interaction with USGS gages on the Susitna, identify critical thresholds of lateral hydrologic connectivity through surface and groundwater interaction. Local instrumentation of wells and perennial sloughs and ponds is needed throughout the study area in habitats that represent a statistically valid sample of the global distribution of habitats utilized by fish.

<u>Specific Comments by Subsection:</u>

AEA Study Objective 1. Map the current aquatic habitat in mainstem and lateral habitats of the Susitna River affected by Project operations.

The initial subdivision of habitat mapping proposes to occur at a macro-habitat level consistent with those of the 1980s studies. Further refinement and definition of these habitat divisions are described in this study plan and in the Fish and Aquatic Resources study plan (7.9) and in the Geomorphology study plan (5.8).

IFS-023 In the proposed PSP and through subsequent meetings, presentations, and field trips, AEA's focus appears to be limited to study sites used in the 1980's, when this Project was first evaluated. This falls short of AEA's commitment to use a hierarchical method, dividing the study area into reaches by hydrology, then geomorphology, and then by macro-habitat types. The study sites focused on, thus far are representative of side sloughs of the Middle Susitna River. Although these may be good study sites for side sloughs, they only represent one macro-habitat type and were selected without regard to hydrology or geomorphology.

During the September 14, 2012 TWG meetings, an approach to instream flow site selection was presented by AEA. In AEA's PSP for instream flow the idea of "intensive study reaches" (now referenced as "focus areas") was proposed conceptually to examine physical processes at "representative" habitats" (referenced on page 8 of this same document for the list of representative habitats). The intended purpose of selecting specific sites for focused and overlapping studies is to gain an understanding of physical processes at "representative" locations, allowing for covariant analysis of Project-effects on these processes and subsequently on fish and their habitats. During the TWG meeting, selected sloughs from the

1980s studies were proposed by AEA as focus areas. The Service expressed concern with the proposed approach to study site selection. The 1980s approach did not use the hierarchical nesting of habitats and therefore, did not determine the habitat criteria influential to fish habitat site selection. During the 1980s studies, only utilization functions for water depth and velocity, or depth and substrate were captured. Current scientific understanding of criteria influential to fish habitat site selection warrants a more comprehensive consideration of variables. We maintain that the use of hierarchically nested habitats and metrics influential to fish habitat site-selection (micro –habitat) is at a scale more relevant to fish.

IFS-015

IFS-030

Secondly, we are concerned that the 1980s studies focused (sampling bias) on side slough macro-habitats where spawning salmon were observed. This is narrowly limited to habitats with poorly documented high fish density. In our study request, we recommended selection of sites both occupied and unoccupied by fish for assessment to best inform the criteria influential to fish distribution and habitat site selection.

Fish and aquatic instream flow study sites should be selected to be representative of the physical processes that are related to instream flow important to the formation of fish habitat, including habitat-flow relationships, surface/groundwater exchange, geomorphic processes, and ice processes. In other words, selection based on the nested hierarchy of habitats, studied at multiple scales, including macro-, meso- and micro-habitat scale.

IFS-012

AEA has proposed using a hierarchical method, dividing the study area into reaches by hydrology, then geomorphology, and then macro-habitat types. Each geomorphic reach is proposed to include an intensive study site (focus area) with a minimum of one instream flow reach containing all of the representative meso-habitats available in that reach. The Service recommends that AEA proceed further in its classification to include a detailed discussion of micro-habitats with reference to classifications of ecological significance.

This will entail delineation of each of the geomorphic reaches, as well as delineation and spatial mapping of the macro-habitats types, as described at the TWG meetings. Geomorphic reaches are identified as those used in the 1980s studies, but no information regarding how they were delineated during that time have been provided. This remains a concern for the overall Project design and statistical representation of the Susitna River.

We encourage AEA continue to work in collaboration with agencies and stakeholders to develop a scientifically robust study site selection methodology that addresses resource concerns.

AEA Study Objective 2. Select study sites and sampling procedures to measure and model mainstem and lateral Susitna River habitat types.

IFS-027

The objective should be stated more specifically to address the characterization and quantification (i.e. mapping) of the habitat types of the Susitna River at multiple scales. The general process for habitat-specific model development is to use the spatial habitat mapping effort to select transects/study segments with representative habitat conditions based on channel morphology and major habitat features. AEA also proposed selecting additional study “focus areas” to describe distinct habitat features such as groundwater areas, spawning and rearing habitats, overwinter habitats, distinct tributary mouths/deltas, and potential areas vulnerable to fish trapping/stranding (AEA 2012, 6.5.4.5).

IFS-021

Focus area site selection should be representative of the physical processes that are related to instream flow, including habitat-flow relationships, surface/groundwater exchange, geomorphic processes, and ice processes. AEA has proposed using a hierarchal method, dividing the study area into reaches by hydrology, then geomorphology, and then macro-habitat types. Each geomorphic reach would have a site that contained at least one instream flow reach that contained all of the representative meso-habitats available in that reach. During the October site visit, we learned that some of the micro-habitat sites for HSC development are proposed to be within the proposed focus areas of the 1980's slough sites. An additional unknown number of sites for HSC development will be identified outside of the focus areas. This unstructured approach is inadequate to address our study request and the fundamental biological questions contained within. Lacking adequate fish distribution and utilization data, we recommend that 1) study sites be selected randomly within representative delineations; 2) that the delineations be reproducible, 3) that enough sites are selected to capture the variability of each macro-habitat for each geomorphic reach and to allow for sufficient replication. This will require, at a minimum, mapping of the macro-habitat types and delineation of each of the geomorphic reaches.

IFS-088

Study efforts at the focus areas should provide a greater understanding of potential Project-effects on riverine processes. The site extrapolation methods should allow for extending the understanding from the selected reaches to the overall Project area. These methods should be defined prior to selecting focus areas to ensure that focus areas are selected that will work for extrapolation.

IFS-011

Additional sites should be selected that are not necessarily representative of overall riverine processes, but are significant because they support disproportionate or important biologic functions. Potential candidates for this may include Kosina Creek, and Portage and Indian Creeks. Additional site selection should be made using information on species and life stage distribution and aquatic and riparian habitat quantification. Site selection should rely on an understanding of habitat from multiple consecutive years of utilization information starting in 2012. This will likely require additional sites to be selected at the conclusion of the 2013 studies to be implemented in 2014.

AEA Study Objective 3. Develop a hydraulic routing model that estimates water surface elevations and average water velocity along modeled transects on an hourly basis under alternate operational scenarios.

NMFS submitted an independent study request for hydraulic flow routing because the routing model and associated data is the basis for cohesive understanding of many of the instream flow modeling efforts. The Service supports NMFS in the study request for flow routing, and the specific objectives contained within. An understanding of Project operation effects on instream flow from the dam downstream is necessary to understand Project impacts to habitat of fish and other aquatic organisms within the river system. NMFS May 31, 2012 study request, Susitna River Flow Routing Study Request, has four objectives:

1. collect instream flow data throughout all seasons to characterize instream flow and develop a flow routing model;
2. develop and calibrate an ice free period flow routing model that is capable of modeling a range of operating conditions and scales (hourly, daily, weekly, seasonally);
3. develop and calibrate a winter flow routing model that incorporates ice effects that is capable of modeling a range of operating conditions and scales (hourly, daily, weekly, seasonally); and

4. inform and integrate with other studies the Project operation effects on instream flow in the reservoir and downstream of the Project.

Currently, the number of discharge measurements and location of discharge measurement to develop and calibrate the winter hydraulic flow routing model is not well described within AEA's PSP. The natural winter flow regime is stable after ice-up until break-up with very little flow fluctuation relative to the ice-free period. Winter hydraulic flow routing efforts will rely on the ice processes study to incorporate changes to ice cover under Project operations. A detailed description of how that data will be delivered and incorporated into the hydraulic flow-routing analysis is still needed. Also needed is an analysis of the applicability of winter hydraulic flow routing to assess effects of Project operations to fish and their habitat. Winter ice cover and ice processes are significant regulators of winter habitats. Because ice cover and thickness will affect the hydraulic roughness and discharge in the river, it is necessary that discharge measurements appropriately replicate a number of the cross-sections used in the hydraulic flow routing models and over a range of flows to allow for development of winter ice processes and flow routing models that will be relevant to assess Project effects on overwintering fish and their habitat. Additional discharge measurements may be necessary at the USGS gage locations. Model sensitivities, assumptions and limitations should be thoroughly described to allow transparency and accuracy of results. A sensitivity analysis should also be conducted (Turner et al. 2001; Steel et al. 2009).This is important because model results may be used to inform Section 18 (Federal Power Act) decision-making processes related to potential Project impacts to fish and wildlife resources and their habitats. The winter hydraulic flow routing will also incorporate a water quality component that will project downstream changes to flow (timing, quantity, and water quality).

AEA Study Objective 4. Develop seasonal, site-specific Habitat Suitability Curves (HSC) and Habitat Suitability Indices (HSI) for species and life stages of fish selected in consultation with licensing participants. Criteria will include observed physical phenomena that may be a factor in fish preference (e.g., depth, velocity, substrate, embeddedness, proximity to cover, groundwater influence, turbidity, etc.). If study efforts are unable to develop robust site-specific data, HSC/HSI will be developed using the best available information and selected in consultation with licensing participants.

IFS-064

We recommend AEA assess patterns of habitat utilization within each macro-habitat to identify the appropriate tools for assessing flow-habitat relationships. This is necessary to identify the micro-habitat variables that control the distribution of fish. Habitat availability and patterns of habitat utilization have not yet been systematically assessed in a statistically valid manner in the Susitna River floodplain. It is inappropriate to develop habitat suitability criteria (HSC) without first assessing which habitat criteria influence the distribution of fish. AEA should provide a detailed process for assessing fish species habitat utilization and influential habitat variables that will then inform Project-effects on fish and their habitat.

The objective of the HSI and HSC (micro-habitat utilization) study component is to develop robust site-specific criteria related to fish habitat site-selection. Habitat suitability indices (HSI) and criteria (HSC) should come from an assessment of environmental criteria (physical, chemical, and biological) that are influential to fish distribution in the Susitna River for each species and life stage. Fish surveys need to be conducted throughout their spawning distribution and well outside their spawning distribution (Connor et al 2003) in order to assess the ecological relevance of criteria. Once the relevance of the criteria is demonstrated, curve development may proceed. The Service considers the assessment of habitat influential to fish habitat site-selection, to be a specific and necessary objective of the Instream Flow and Habitat Utilization study request.

For example, some fish species demonstrate significant population variability in response to environmental heterogeneity. Ruff et al (2011) showed that thermal heterogeneity in an Alaskan sockeye stream promotes spatial and temporal variability in spawning sockeye populations. Because such spatial and temporal variability is also accompanied by variability in traditional habitat suitability criteria (e.g. water depth and velocity; substrate size), it is important that all the environments supporting each target species and life stage are surveyed. This is necessary for statistical discernment of habitat criteria that are influential to habitat selection.

Some fish are known to move great distances or utilize specific habitats on a seasonal basis. As an example Alaskan burbot *(Lota lota)*, in glacial systems, can move extreme distances in association with spawning (Breeser et al 1988). Juvenile salmon that seasonally inhabit shallow margin and off-channel floodplain habitats, where they find important access to terrestrial inputs (Eberle and Stanford 2010), serve as another important example of seasonal movements and habitat use patterns. It is important that surveys be conducted with sufficient replication in both space and time, such that the seasonal distributions of important species and life stages are adequately surveyed. Assessment of criteria influential to habitat selection must also be conducted in all seasons and at all representative flow levels.

IFS-097

With an understanding of fish habitat utilization and the site-specific environmental variables (micro-habitat) that influence fish-use of habitat, variable inputs and model selection will be at a scale relevant to fish habitat. The Service maintains that this understanding can occur with multiple years of assessment and habitat utilization (fish distribution) that allow for detection of patterns in habitat usage with respect to hydraulics, substrate, and cover- all of which are flow dependent (Holm et al 2001). As such, the ecological relevance of criteria must be assessed over a period of multiple years to account for variability in habitat selection as a function of natural variability in environmental flow conditions; as well as reduce the error surrounding these measurements. Multiple years of data will also allow for assessment validation of associated fish abundance (occupied versus unoccupied), seasonal movement and distribution surrounding flow-habitat relationships within selected study sites.

The AEA study plan describes an *order of preference* for information used to develop HSI/HSC (micro-habitat utilization):

1. new site specific data collected for selected target species and life stages (seasonally if possible (e.g., winter));
2. existing site specific data collected from the Susitna River during the 1980s studies;
3. site specific data collected from other Alaska rivers and streams; and
4. HSC curves, data and information from other streams and systems outside of Alaska.

IFS-055

AEA should provide detailed methods on how it proposes to develop site-specific habitat suitability indices/criteria for each species and life stage. Micro-habitat utilization directly informs the ISF decision-making process. To gain understanding of the micro-habitat utilization we request the use of criteria developed specifically for the Susitna River or regional rivers with similar habitats (for example the Talkeetna, Chuitna, Matanuska Rivers). Micro-habitat utilization criteria developed outside of the Susitna River and/or other large south central rivers is not acceptable due to differences in species adaptation to specific riverine habitats and flow regimes. Furthermore, there is a general lack of micro-habitat utilization criteria development for glacial systems like the Susitna River. Any criteria used from other sites or from 1980s literature must include all likely variables that influence the utilization of the habitat. These variables should include at a minimum water quality (dissolved oxygen, turbidity, and temperature), habitat spatial structure (distance to cover, large wood, bank and bedform characterization), and groundwater upwelling or downwelling in addition to the typical hydraulic variables (flow, depth, substrate).

In addition to collecting environmental information it is necessary to consider behavioral habitat-use strategies of juvenile fish used to minimize risk of predation. Behavioral studies are becoming increasingly important in assessing impacts to aquatic species as a result of proposed hydro projects in both the marine and freshwaters. Lovtang (2005) found that juvenile Chinook would rarely be found in mid-channel during the day but would be found in mid-channel at higher abundance at night, independent of water temperatures, suggesting that the fish were using a strategy to minimize predation. The tendency for salmon to return to their natal site for breeding leads to reproductive isolation, in space and time. It also leads to local adaptation to the local spawning and incubation environment (Doctor and Quinn 2009). More specifically, spawning salmon are thought to select redd sites based on physical variables important to the completion of their intra-gravel life stages (Montgomery et al. 1996; Quinn 2005). Temperature during incubation has been demonstrated as one variable that is important to the distribution of spawning salmon (Connor et al. 2003). In fact, variability in temperature, even within the same stream can lead to genetically distinct populations that spawn in distinct physical environments (Ruff et al. 2011). Habitat utilization functions are not transferrable between these populations because the variability in spawning sites is too great.

IFS-063 The Service's study request specified the need for habitat specific criteria for each species and life stage. If guilds are proposed the habitat utilization data must be shown to support this method. A list of criteria to collect at fish sampling locations and at the focus areas should include hydraulic information, water quality parameters, groundwater information, substrate, spatial structure and arrangement of the habitat, cover availability, and indicators of productivity, etc. The data must be collected at all macro-habitat habitat types, with meso-habitats represented in each macro-habitat with replication. This will result in seasonal curves for each species or subset of species and life stages for each macro-habitat. Criteria to be used must be developed over a range of representative habitats for which they will be used. Also, criteria used in flow habitat analysis of Project effects must be demonstrated to have a statistically significant relationship to habitat utilization for the time of year, life-stage, and habitat for which it will be used.

AEA Study Objective 5. Develop integrated aquatic habitat models that produce a time series of data for a variety of biological metrics under existing conditions and alternate operational scenarios. These metrics include (but are not limited to):

- *water surface elevation at selected river locations;*
- *water velocity within study site subdivisions (cells or transects) over a range of flows during seasonal conditions;*
- *varial zone area;*
- *frequency and duration of exposure/inundation of the varial zone at selected river locations; and*
- *habitat suitability indices.*

IFS-078 The Service agrees that properly chosen, integrated aquatic habitat models can be informative, and with relevant site-specific data this component of operational instream flow analysis can be biologically meaningful. However, AEA's selection of a traditional hydraulic habitat model to assess the instream flow objectives for this Project may be premature. Environmental criteria that influence patterns of habitat utilization within the greater distributions of target species and life stages need to be identified first. This procedural pre-requisite may demonstrate that hydraulic habitat modeling is not the appropriate tool for use in forecasting the environmental impact of the proposed Project.

For example, burbot *(Lota lota)* is an important sport and subsistence fish species inhabiting the main channel of the Susitna River. Burbot are known to spawn in association with undercut and hollow banks, and the hydraulic micro-habitat associated with these habitat features, where it has been studied, has been demonstrated to be of no relevance to the selection of these features for spawning (Mouton et al 2012). If this general pattern holds true for burbot spawning in the Susitna River, traditional hydraulic habitat modeling (i.e., PHABSIM) will not be an appropriate model to forecast burbot habitat associations brought about by the proposed Project. Similarly, hydraulic habitat data collected by USGS on side sloughs of the nearby Matanuska River (Curran et al 2011) demonstrate that sockeye and chum salmon select spawning sites without regard to water depth and velocity. This would make PHABSIM, or any other traditional hydraulic habitat modeling approach an inappropriate tool for these settings.

IFS-085

Instead we recommend the use of lateral hydrologic connectivity modeling (e.g. Benke et al 2000) in combination with hydrologic-based methods, such as USGS's HIP model, to quantitatively inform natural patterns of hydrologic connectivity with habitats known to be important for target species and life stages.

We also question whether the two-year study period is adequate to develop robust models with relevant site-specific data. The purpose of this objective should be to represent the analysis of Project effects on ecological relevant metrics for fish and aquatic ecosystems.

IFS-089

The Service appreciates the plan to use integrated aquatic habitat models that produce a time series of data for a variety of biological metrics. AEA lists several of these metrics; and each of these should be clearly linked to ecological significance. The Service requested both biologically relevant instream habitat models and spatial scaling of study sites; both the model and study sites should be selected with a thorough understanding of anadromous and resident fish distribution in the Susitna River system, including life history strategies, habitat utilization, and interannual variability. Related to this objective AEA describes an Instream Flow Study analytical framework (AEA, 6.5.4.1). This frame work will result in the development of a series of flow sensitive models that will be able to translate effects of Project operations on the riverine processes and biological resources.

IFS-009

In our study request (May 31, 2012), the Service outlined an integration framework to include all riverine study components. This integration of the following components is necessary for resource management agencies to assess Project-effects on fish and their habitat:

1. Instream Flow routing – The foundation of riverine processes studies depends on the Susitna River flow routing models (HEC-RAS, CRISSP1D) that will provide hourly flow and water surface elevation data at numerous locations longitudinally distributed throughout the length of the river extending from RM 184 downstream to RM 75 (about 23 miles downstream from the confluence with the Chulitna River).

2. Water Quality – This model/study, incorporating flow routing, will provide analysis on flows necessary to maintain stream temperature, turbidity, and other water quality indices within a biologically relevant range for aquatic species, using the baseline information as targets.

3. Geomorphology – Model/study will provide analysis/constraints on flows important to geomorphic processes that form/maintain fluvial morphology and vegetation (including riparian, floodplain and woody debris recruitment functions).

4. Riparian/floodplain function – This model/study will provide an analysis of flows necessary to maintain floodplain function and riparian plant community composition. This study will be directly informed by both the instream flow and groundwater studies.

5. Surface/groundwater interaction – This study/model will analyze the effect of Project operations on the exchange timing, quantity, and quality. This will inform/analyze the instream flow needs to sustain groundwater interaction necessary to sustain habitat quality and quantity.

6. Ice processes – This model/study will provide analysis and identify constraints on flows important to ice freeze-up, ice thickness, persistence, and breakup. The results will inform other studies and winter time instream flow needs, including a description of winter time load following effects.

7. Aquatic habitat models - As described in study component ISF-6. If specific habitat models are not successful in identifying Project effects on habitat and suitability for specific species, then alternative methods may need to be considered including studies of population dynamics and river productivity.

8. Passage/connectivity – This study will encompass accessibility of flow-dependent riverine habitat types throughout the Project area, including tributary confluences; and Devil's Canyon and above.

9. Climate – The framework will incorporate climate variability and climate change projections to assess the cumulative effects of Project operations in consideration of PDO and ENSO climate variation and longer term climate change (the anticipated life of the project – at least 100 years) that are expected to continue to change the hydrograph and water quality, among the many variables influenced by climate change.

10. Biological Cues – Behavioral, population, community, and ecological studies relative to fish distribution, relative abundances, timing, river productivity, and the trophic interactions of the biotic and physical environment.

IFS-047

We also recommend a flow operations analysis that will consist of a range of conditions from baseline (no Project/natural hydrograph) to various proposed scenarios (as described in the PAD), and alternatives suggested by AEA and agencies in a working group setting. The results of the operations analysis will be used in the comparative framework to inform the effects on the natural riverine system and will allow agencies to assess operating conditions and to make recommendations and mandatory conditions on the final license application.

After model selection, population, calibration and scenario runs, a variety of post-processing comparative analyses derived from the output metrics estimated under the habitat specific aquatic habitat models would be provided to resource agencies. These include:

- comparisons of habitat quantity and quality (e.g., habitat exceedance plots)
- ramping rates (e.g., changes in flow versus time);
- juvenile fish stranding/trapping;
- habitat sustainability (effective habitat analysis); and
- distribution and abundance of benthic macro-invertebrates under alternative operational scenarios.

The Service recommends that AEA develop integrated aquatic habitat models that produce a time series of data for biological metrics under existing conditions and alternate operational scenarios. These metrics include:

- water surface elevation at selected river locations;
- water velocity within study site subdivisions (cells or transects) over a range of flows during seasonal conditions;
- varial zone area;
- frequency and duration of exposure/inundation of the varial zone at selected river locations; and
- habitat suitability indices.

AEA Study Objective 6. Evaluate existing conditions and alternate operational scenarios using a hydrologic database that includes specific years or portions of annual hydrographs for wet, average and dry hydrologic conditions and warm and cold Pacific Decadal Oscillation (PDO) phases.

The Service appreciates the work product *"tabular summaries of selected IHA-type statistics"* and looks forward to working with AEA to develop this list relevant to Susitna River hydrography. The Service's study request includes objectives to characterize the natural flow regime of the Susitna River and tributaries in the Project area and to identify, characterize, and integrate the timing, quantity and function of instream flow to riverine processes. This will require characterization of the relationship between the Susitna River flow regime and climatic PDO. The Service appreciates the description of the various IHA statistics proposed, and emphasizes the need to examine hourly rate and frequency of change for winter flow conditions, to compare to the proposed operations.

AEA Study Objective 7. Coordinate instream flow modeling and evaluation procedures with complementary study efforts including riparian (Section 6.6), geomorphology (Section 5.8 and 5.9), groundwater (Section 5.7), water quality (Section 5.5), fish passage (Section 7.12), and ice processes (Section 5.10). If channel conditions are expected to change over the license period, instream flow habitat modeling efforts will incorporate changes identified and quantified by riverine process studies.

IFS-007

We recommend that the instream flow modeling demonstrate complete integration of the riverine process analysis (groundwater, instream flow, geomorphology, ice processes, biological response to flow changes), not simply coordinate with the other study areas. The results of an integrated riverine processes analysis should provide an understanding of instream flow changes induced by Project operations and fish behavior as it relates to the associated changes in quality and quantity of fish habitat. The intent of our request is for the flow analysis to be used to assess Project-effects on anadromous and resident fish and their habitat. This analysis will be used to make specific conservation recommendations by the Service under our applicable authority of Section 10(j) of the Federal Power Act. To facilitate our understanding of the specifics of the study integration, the Service requires a degree of certainty that each of the riverine process components are adequately addressed along with levels of precision and accuracy of overall model integration results. This will become evident with more detailed study plans that refine overall approach, schedule, methods, and contingencies if necessary site-specific information is not collected.

AEA Study Objective 8. Conduct a variety of post-processing comparative analyses derived from the output metrics estimated under aquatic habitat models. These include (but are not limited to):

- *juvenile and adult rearing;*
- *adult holding/adult in-river residence time;*
- *habitat connectivity;*
- *spawning and egg incubation;*
- *juvenile fish stranding and trapping;*
- *ramping rates; and*
- *distribution and abundance of benthic macro-invertebrates.*

This objective should provide a comparative temporal and spatial analysis of riverine process studies and model results for a range of alternative operations. But it is unclear which studies would develop the habitat utilization data proposed for comparative analysis, specifically for the juvenile and adult rearing and egg incubation. AEA's study plan includes riverine processes in its proposal but it is unclear how they will be integrated and at what habitat scale. The issue of scale is of critical relevance to fish and fish habitat

IFS-057 Biological cues are not addressed in AEA's proposed instream flow study. The Service's study request included a component to investigate flow dependent biological cues, which will rely on the detailed study of seasonal habitat utilization by anadromous species and resident fish throughout their life history. Our request included an examination of instream flows that may correlate with historical escapement indices, run timing and seasonal water temperatures and associated biological responses. A periodicity chart for each of the anadromous species should was identified as an information gap related to fish species of the Susitna River. This information should be presented in table form and include the corresponding macro-habitat and hydrologic conditions. We acknowledge that a preliminary periodicity chart was provided to attendees of the October 4th site visit to the Susitna River, and appreciate AEA's effort of to provide the requested information. We look forward to working with AEA to expand the scope and detail of the periodicity chart.

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6. Instream Flow Studies

6.6. Riparian Instream Flow Study

General Comments:

RIFS-14 The U.S. Fish and Wildlife Service's (Service) 31 May 2012 study request entitled *Instream Flows for Floodplain & Riparian Vegetation Study* resembles Alaska Energy Authority's (AEA) Proposed Study Plan (PSP) title, except "floodplain" is included in our study-plan title. Riparian areas and floodplains are often the same; however, many people visualize riparian areas as a narrow band immediately adjacent to streams and rivers. We envision this study including the entire floodplain, and not simply a narrow zone along the Susitna River. To help minimize this potential misconception, we recommend revising the study plan title to include the word "floodplain."

Many of the PSPs rely upon or provide data from/for other studies. Recognizing these relationships is an important part of the Integrated Licensing Process (ILP); however, the study providing the data should describe the methodology and oversee the data collection and analyses, while the study requiring the results should restrict its discussion to the types of data/results required from other PSPs. Repeating the methods in a study not responsible for the data collection and analyses is unnecessary and risks confusion if the methods differ or are inadequate in one of the studies. Since the Riparian Instream Flow Study will rely upon data from the Groundwater Study, among other studies, the Riparian Instream Flow Study Plan should describe only the results required from the Groundwater Study, and then describe how those results will be used in the Riparian Instream Flow Study (e.g., 5.7 Groundwater PSP should be the only study describing groundwater methods). This applies to other studies, such as the habitat mapping studies, providing data for the Riparian Instream Flow Study Plan.

At the 24 October 2012 Riparian Instream Flow Technical Workgroup (TWG) meeting, AEA provided a draft study interdependency figure showing which additional studies would provide data for the study, the expected information produced by the study, and which studies will rely upon output from the study. Given the complex integration of the various studies, we appreciate
RIFS-15 this figure and recommend including figures like these along with a narrative in the introduction for each study. Additionally, the main introduction covering all the studies should include a more general interdependency figure showing how all the various studies interrelate. We have not had time to evaluate this draft interdependency figure, but we look forward to reviewing additional drafts as the study plans mature.

RIFS-16 Besides interdependency figures, please provide timelines showing how the various study components (both among major studies and within studies) feed into other studies and study components. The Service is concerned the sequencing of some study components may be out of sync with the required products from other studies and study components.

The methods should be described in sufficient detail so others can duplicate the study. Citing methods from other studies or accepted industry standards is encouraged, but not in lieu of providing sufficient detail so the methods can be evaluated without having to refer to the citation. The July 2012 PSP provided few referenced methods, some methods with references lacked citations in the Literature Cited so their appropriateness could not be evaluated, and some methods lacked focus or duplicated methods from other objectives. Since the PSP, AEA hosted TWG meetings and site visits, including the most recent 24 October 2012 TWG meeting, which provided additional opportunities for discussion and clarification. We look forward to these improvements in the Revised Study Plan (RSP).

RIFS-17 Unlike the fisheries component of the Aquatic Instream Flow Study where potential future Susitna-Watana Hydroelectric Project (Project) impacts may be compared with other locations in the state because fish populations are routinely surveyed, evaluating potential Project impacts on riparian/floodplain resources without an "untreated" spatial reference (i.e., similar rivers without a dam) risks a significant change may be attributed to an unrelated impact. Green (1979) outlines four prerequisites for an optimal impact study design: 1) the impact must not have occurred; 2) the type, time and place of impact must be known; 3) all relevant biological and environmental variables must be measured; and 4) an area unaffected by the impact must be sampled to serve as a control. The first three prerequisites are included in the PSPs if they are designed and implemented so potential Project impacts can be evaluated by post-dam resampling. We recommend the Riparian Instream Flow Study also include the fourth component (un-impacted rivers), otherwise AEA risks what Green (1979, p 71) refers to as *"… executing statistical dances of amazing complexity around their untestable results"* to show the Project did or did not have a potential impact on riparian/floodplain resources.

Specific Comments by Subsection:

The following review of AEA's proposed Riparian Instream Flow Study Plan uses the most recent structure of the plan (24 October 2012 TWG meeting), which closely resembles the Service's study request structure. AEA's original PSP included objectives that were wholly, or at least partially, the objectives for other PSPs, and did not address all our study request objectives. This new study plan structure and proposed methods are based on a combination of both AEA's and the Service's proposed methods, as well as additional insights gained during the TWG meetings and site visits. Although some of these improvements have not yet been fully documented, our review below is based on the expectation they will be included in the RSP, and what we believe will be carried forward from the original PSP requiring additional revision.

RIFS-18 *AEA Study Goals and Objectives*: The Service requested a specific goal that includes quantifying the frequency, timing and duration of surface-water and groundwater levels required to establish, maintain, and promote floodplain and riparian plant communities. Two ancillary goals were also requested: 1) to quantify the frequency and rate of sediment deposition required to promote soil development; and 2) to quantify the effect of river ice on the establishment and persistence of riparian plant communities. Although the text of AEA's draft revised goal was not presented at the 24 October 2012 TWG meeting, we expect the RSP will include a goal similar to ours. While goals can be very general in nature, the specifics in our goal sets the stage for a rigorous study plan designed to evaluate potential Project effects on floodplain plant communities.

AEA Study Area: The study area includes the Susitna River active valley that would be affected by the operation of the Project downstream of Watana Dam. The active valley is the geographic area that is flooded with a frequency and duration corresponding with current unregulated conditions.

The Service recognizes the downstream limit of the study area is still under discussion, and we look forward to participating in this discussion. In addition to the longitudinal dimensions of the study area and the width of surface-water flooding, we recommend including the area of groundwater potentially influenced by Project operations. For the riparian study, the width should be at least as wide as the expected area of groundwater within the maximum depth of all plant roots and influenced by Project operations.

RIFS-19

AEA & Service Objective 1 and Methods: Synthesize historical physical and biological data for Susitna river floodplain and riparian vegetation, including the1980s studies and other hydro projects that may provide insights for project operation.

The goal of this objective is to review existing information on physical and biological data (e.g., seedling establishment requirements, effects of river ice, relationship between sediment deposition and plant succession, and required surface-water / groundwater regime) for Susitna River floodplain and riparian vegetation. Although this is really a task rather than a research objective, this is still an important study component. We also appreciate AEA honoring our 11 September 2012 email recommendation to include a review of relatively undisturbed riverine systems.

AEA & Service Objective 2 and Methods: Select and design study sites.

The goal of this objective is to select sites necessary for this study, and to ensure these sites will also complement and take advantage of the information from the other studies (e.g., flow routing, groundwater, fluvial geomorphology, and ice processes). For the focus areas where multiple study disciplines will focus and complement their work, we recommend the Riparian Instream Flow Study **first** develop criteria required for selecting their study sites independent of the other studies. Next, develop a list of study products from the Riparian Instream Flow Study that other studies require, and then work with the other studies and stakeholders to select focus areas. A master matrix of studies, data needs and data products would greatly facilitate this process and stakeholder acceptance.

RIFS-20

Riparian Instream Flow study sites should reflect the full range of riparian and floodplain plant communities along the Susitna River. The Riparian Botanical Resources (Mapping) Study (PSP Section 9.6) will likely need to be substantially completed before the Riparian Instream Flow study sites can be selected with confidence that the full range of plant communities are studied. Similarly, the process-domains (Montgomery 1999) should be defined before focus areas are selected. The range of plant communities and process-domains should be part of the master matrix mentioned above for selecting focus areas.

RIFS-21

Study sites should include areas where Project operation is expected to cause early channel bed degradation or aggradation (11 September 2012 Service email request). AEA has since proposed to select focus areas between the dam and Devils Canyon; the river segment most likely to experience channel bed degradation. Focus areas should also be located in areas likely to experience channel bed aggradation.

RIFS-22

The number of study sites should provide sufficient replication to address the needs of the objectives (11 September 2012 Service email request). AEA's TWG meeting response (24 October 2012) that *"Focus Areas will be **representative** (emphasis added) of specific riparian process domains and their channel / floodplain characteristics (ice process domains,*

RIFS-23

channel plan form, channel slope, channel confinement)" does not address our concern about pseudoreplication (Hurlbert 1984). Study sites are typically the experimental unit where replication is used for true statistical analysis. All other sampling (e.g., within the study site) is really subsampling used to obtain a better average value for that one replicate. As envisioned by many of the PSPs, the "representative" focus areas are really only one replicate for each process-domain. If transects within the focus areas will be used as the experimental unit, then the focus areas should be large enough to assure at least minimal dispersion of transects representing the river segment, and all stakeholders will need to be comfortable with the focus areas "representing" the river segment. AEA's Response 3 (TWG meeting 24 October 2012) that the Riparian Botanical Resources (Mapping) Study (Section 9.6) will provide additional dispersion of sample sites outside the focus area is an important addition to the focus areas, but only for the study products that rely on these additional field data. One of the most important contributions of the riparian mapping study includes using these data to help upscale predicted Project-related plant community responses.

AEA & Service Objective 3 and Methods: Characterize seed dispersal timing, water-level regime required for establishment, and frequency of establishment, and then predict potential plant community change resulting from project operations.

The goal of this objective is to characterize the seed dispersal timing, the required water-level regime for establishment, and the frequency of establishment for dominant riparian species (e.g., balsam poplar, willows). This objective has two primary components. The first is to characterize the requirements for seedling germination and establishment, and the second is to characterize the frequency of survival and recruitment into the plant community. The methods for the second component (recruitment into the population) were sufficiently described in the PSP.

RIFS-24

In an email (11 September 2012), the Service asked the following questions relating to seedling germination and establishment. How will the Susitna River bimodal peak flows be addressed? How will the fate of "second peak" seedlings be addressed? How will the role of precipitation in maintaining favorable soil moisture conditions be evaluated? Will soil texture be considered? If so, how will the soil profile be described? AEA responded (TWG meeting 24 October 2012) with the following replies. Bimodal peak flows will be addressed by measuring and modeling such flows at each Focus Area. "Second peak" seedling fate will be assessed in the seedling recruitment plot study by aging woody seedlings and quantifying these "recruitment flow regime" characteristics. The role of precipitation in maintaining favorable soil moisture conditions will be evaluated by measuring precipitation at each Focus Area meteorological station and soil surface moisture at each Focus Area. Further methodological details will be provided in the Groundwater Study RSP Sec 7.5. Soil texture will be considered by sampling, measuring and describing soil stratigraphy using standard NRCS soils survey protocols (Field Book for Describing and Sampling Soils by Schoeneberger, Wysocki, Benham, and Broderson, 2002). These are appropriate responses; however, the Service believes following the fate of a cohort of second-peak germinated plants will likely be more sensitive than aging woody seedlings and attempting to relate their survival to past bimodal peaks. Aging woody seedlings is likely more appropriate for mature plants where past flow regimes are the only option for estimating recruitment and not establishment. We also are concerned that a two-year study will likely be insufficient to determine the survival after germination, since three years is often considered necessary to evaluate successful survival and recruitment into the reproductive population.

RIFS-25

For seedling germination and establishment, the Service is concerned the groundwater model MODFLOW is not sensitive enough to quantify hydroperiod relationships for seedlings (11 September 2012 email). We also asked what other metrics will be used to quantify/separate surface water, groundwater, soil moisture, precipitation, and other potential hydrological process supporting seedling establishment and recruitment? AEA responded (TWG meeting 24 October 2012) with the following replies. Seedling plot groundwater regime will be both modeled with MODFLOW and a subset of wells will be located within seedling areas allowing for groundwater seedling response curves to be developed to check precision of MODFLOW results with local well data. Detailed groundwater / surface water modeling metrics necessary to assess seedling establishment and recruitment conditions will be provided in the Groundwater RSP. Metrics will include: met stations at each Focus Area to measure local precipitation, and measurements of the height of the capillary fringe relative to the groundwater surface at well points to measure effective soil pore water availability to seedlings. The Service is satisfied that wells will be located within the seedling areas. We believe MODFLOW is much less accurate than onsite wells equipped with recording pressure transducers for detailed studies such as seedling germination. MODFLOW for this study component would only be required if the germination sites are located some distance from the river and the groundwater connection to the river may be questioned.

RIFS-29

The Service also asked how the results from this objective will be used to predict potential Project-related changes in seedling establishment and recruitment into the population (11 September 2012 email). AEA responded (TWG meeting 24 October 2012) with the following satisfactory response, and we look forward to the details in the RSP. Natural seed dispersal hydro and sediment regime relationships will be measured in the field (individual studies). Project operational changes to the natural hydro and sediment regimes will be assessed and changes to the natural seedling recruitment and establishment "physical template" will be assessed. Potential Project-related changes to seedling recruitment and establishment sites will be compared first at the Focus Area sites and then throughout the Project Area to model potential Project-related changes in the recruitment "safe site" conditions (Harper, J. 1977. Population Biology of Plants), as described in draft RSP Sec 8.6.3.5 and Sec 8.6.3.7.

RIFS-26

The Service has the following outstanding questions from PSP Section 6.6.4.3.1.4 relating to this objective, and we expect they will be addressed in the RSP:

- Is "abundance" density appropriate or will some other metric be applied?
- What is the "elevation" reference: ASL, an arbitrary datum, or some elevation that can be linked to the local river or groundwater stage (keep in mind the river drops downstream, so that must be accounted for also)?
- Is there a citation for others using 2-meter square plots?
- What is the shape of these plots? A square plot may not be appropriate for a narrow band of seedlings along a specific elevation in the gradient above the river.

AEA & Service Objective 4 and Methods: Characterize the role of river ice in the establishment, survival and recruitment of dominant riparian species, and then predict potential plant community change resulting from project operations.

The goal of this study objective is to characterize the role of river ice in the establishment (colonization), survival (first 3 years) and recruitment (into the future reproductive population;

RIFS-27

Rood et al. 2007) of dominant riparian species (e.g., balsam poplar, willows). The discussion in the PSP on ice processes (Section 6.6.4.4.1) was unfocused, and essentially provided no discernible methods: *"Final details of the geomorphology and ice processes modeling … will be developed as the 2012 studies are obtained."* AEA provided a substantial update for the proposed draft RSP methods at the 24 October 2012 TWG meeting. The steps proposed by AEA are:

1. One goal of this study will be to characterize the role of river ice in establishment, survival and recruitment of dominant riparian species. There has been limited research into this question on boreal rivers: Engstrom et al., Effects of River Ice on riparian vegetation. (Freshwater Biology 2011, 56: 1095-1105).

2. A similar study approach and methods will be developed and is presented in the RSP.

3. The magnitude, frequency and longitudinal distribution of ice events affecting riparian species/communities will be assessed by a combination of on-the-ground surveys of tree ice scar distribution (mapping and aging with dendrochronology) and the results of the ice processes modeling.

4. A geospatial analysis of the modeled, and empirically mapped, locations of ice floodplain interactions will be conducted.

5. Tree ice scars will be used to map ice floodplain interaction zones along the river.

6. Ice process modeling will also be used to identify the vertical and lateral extent of ice floodplain vegetation interaction zones.

The Service believes this is a reasonable approach for characterizing the role of river ice in plant communities. We look forward to the RSP also describing how the role of river ice will be used to predict the potential plant community change resulting from project operations.

AEA & Service Objective 5 and Methods: Characterize the role of sediment deposition in the formation of floodplain and riparian soils, and then predict potential plant community change resulting from project operations.

The goal of this study objective is to characterize the role of sediment deposition in the formation of floodplain and riparian soils, and how sediment deposition affects the rate and trajectory of plant community succession.

RIFS-28

The proposed soil sampling techniques are included in PSP Section 6.6.4.3.1.5, but based on these techniques it is unclear how our requested objective to characterize the role of sediment deposition in the formation of floodplain and riparian soils will be met, and how sediment deposition affects the rate and trajectory of plant community succession (email 11 September 2012). This objective should investigate the rate of deposition, depth of sediment, and soil profile development required for natural floodplain plant community succession, and then use the predicted sediment deposition characteristic from the Fluvial Geomorphology Study to predict the effects of Project operation on floodplain plant communities.

AEA provided the following response to our concern (TWG meeting 24 October 2012), which we find satisfactory for now and look forward to the details in the RSP. The characterization of the role of sediment deposition in the formation of soils will be conducted in three ways:

1. Sediment rates will be determined throughout the project area by dating floodplain sediments to determine rates of sedimentation.

2. Sediment dating techniques will include dendrochronology (tree age of alluvial surface), and sediment isotopic analyses (Cs^{137}, Pd^{210}), and soil stratigraphic descriptions and vertical profile measurement.

3. Probabilistic models will be developed characterizing the relationship between plant community successional stage, soil type and sediment depositional history.

Additional details provided by AEA include stratified random sampling in the focus areas and entire project area, excavating soil trenches from surface to gravel (historic channel bed), and describing soil stratigraphy and grain size by sieve analysis for the entire sediment profile. The fluvial geomorphology 2-D sediment transport models will be used to predict the effects of Project operations on sediment transport and depositional patterns. The rate of deposition, depth of sediment, and soil profile development required for natural floodplain plant community succession will be characterized, and then the predicted sediment deposition characteristics from the Fluvial Geomorphology Study will be used to predict the effects of Project operation on floodplain plant communities.

AEA & Service Objective 6 and Methods: Characterize the water-level regime required to maintain floodplain and riparian plant communities, and then predict potential plant community change resulting from Project operations.

RIFS-44

The goal of this study objective is to characterize the relationship between floodplain water levels (surface-water and groundwater) and floodplain plant communities, and then use this understanding to predict Project-operation effects on floodplain vegetation. This is a critical objective that has not been sufficiently discussed in past workgroup meetings, possibly due to lack of time, and the PSP methods are insufficient to evaluate if the Service's requested objective will be met. In our 11 September 2012 email we suggested discussing this objective near the beginning of future meetings to allow sufficient time for discussion. At the 24 October 2012 TWG meeting, however, this objective was again discussed last and with insufficient time to discuss the topic. Although this may be listed as the last objective, this is not the least important objective. The health and survival of plants is likely to express a response to Project-regulated flows long before the other objectives such as succession and sediment deposition changes are observed. For example, the preliminary estimated three to four foot decrease in peak growing season river stage near Gold Creek due to Project-regulated flows (AEA 2012) could potentially cause a substantial change in plant community composition and/or landform position if the change in plant-community water levels (surface-water and groundwater) respond similar to river stage and the herbaceous species respond similar to other regulated rivers (e.g., Henszey et al. 2004).

Objective 6 combines hydrologic information from the groundwater study (PSP 5.7) and the plant community information from this study (PSP 6.6) and possibly the habitat mapping studies (PSPs 9.6 and 9.7) to produce plant species/community response curves. Our Objectives 3 to 5 target critical stages in plant community succession, while Objective 6 targets critical instream flows required for maintaining plant communities as succession progresses (i.e., both succession and maintenance are important).

RIFS-45

Although this objective relies on groundwater information, the groundwater methods described in the Riparian Instream Flow study plan belong in the Groundwater methods study plan (PSP 5.7). AEA plans to comply with our request (11 September 2012 email) and move the groundwater methods to the Groundwater Study Plan (24 October 2012 TWG meeting). We have not discussed the surface-water component of floodplain "water levels," but the surface-water information will be required for communities that experience flooding and for wetland communities where the water-levels routinely cycle between surface-water and groundwater.

At the 1 October 2012 Riparian Instream Flow Study TWG meeting, we briefly discussed potential methods for developing plant community water-level response curves, but the notes for this meeting have not been posted on AEA's website and this portion of the objective was not discussed in the more widely attended 24 October 2012 TWG meeting. We understand methods similar to Henszey et al. (2004) will be employed, and we look forward to seeing these methods in the RSP. PSP Section 6.6.4.7 (Succession Models and Flow Response Guilds) appears to potentially address our Objective 6. The concept of response guilds is similar to our request to develop plant community response curves, but the PSP methods are insufficient to evaluate if our requested Objective 6 will be met. We requested evaluating specific water-level summary statistics (e.g., growing season cumulative frequency, 7-day moving average, 10-day moving average, 14-day moving average, and arithmetic mean) with a rigorous curve-fitting technique similar to Henszey et al. (2004). The methods should provide sufficient detail to construct quantifiable (not qualitative) hydrologic (surface-water and groundwater) gradients showing the optimum and range of favorable water levels required for maintaining floodplain species/communities.

It may also be possible to pool results across process-domain focus areas (i.e., increased sample size) if there is no statistical difference between response-curve coefficients (e.g. Henszey et al. 2004), potentially producing more broad-based response curves. Hydrology is likely the most dominant physical factor influencing floodplain plant communities across the various process-domains, and baring some other dominant physical factor (e.g., soil parent material, ice scour, etc.) it may be possible to use data from additional sample areas to build response curves (see Henszey et al. 2004, Figure 7 for an indication of the number of data points required to build a response curve).

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7. Fish and Aquatic Resources

7.5. Study of Fish Distribution and Abundance in the Upper Susitna River

General Comments:

The overall stated goal of Alaska Energy Authority's (AEA) Fish Distribution and Abundance Proposed Study Plans (PSP) is to characterize the current distribution, relative abundance, run timing, and life history of resident and non-salmon anadromous species (e.g., Bering cisco, Dolly Varden, humpback whitefish, northern pike, and Pacific lamprey), and freshwater rearing life stages of anadromous fish (fry and juveniles) in the Middle and Lower Susitna River, as well as the Upper River, above Devils Canyon.

The creation of a reservoir when full will inundate 39 miles or more of the Susitna River and tributary streams. This will directly affect the abundance of fish residing in flowing waters. The reservoir could inundate important spawning habitat for resident fish, and Chinook salmon and other anadromous fish that currently migrate through Devils Canyon. Alternately, the reservoir could provide rearing habitat for resident Arctic grayling, which often migrate downstream from spawning areas to low velocity habitats for rearing. The quality of this reservoir habitat is unknown, particularly during the winter. Creation of a reservoir could provide habitat for lake trout—a predatory species that could affect the abundance and distribution of other resident fish.

FDAUP-49

Upper River fish studies should be directed toward quantifying the total amount of tributary habitat that will be converted to a reservoir. Information regarding the population or relative abundance of selected fish species within the inundation zone should be obtained to determine the significance of direct effects. Lower tributary reaches, tributary mouths, and mainstem locations within the inundation zone may provide important seasonal habitat for resident and anadromous species. For example, resident Dolly Varden and grayling overwinter in the mainstem Susitna River and tributary mouths may provide important Dolly Varden summer habitat. Studies should be developed to determine how the inundation will affect the suitability of these locations for spawning and rearing. Studies should determine if the remaining stream reaches will continue to support resident fish populations. The U.S. Fish and Wildlife Service (Service) recommends that the Upper River study objectives be refined to reflect specific information needs for evaluating potential Project effects to the fish community.

FDAUP-50

Specific information needs include:

- Proportion of juvenile and adult salmon populations produced upstream of the proposed dam site;
- Timing of juvenile salmon and resident fish migration from Upper river tributaries and main channel habitats to downstream of the proposed dam site;
- Proportion of fish populations (e.g., Dolly Varden and Arctic grayling) in the Upper reach contributing to populations in downstream reaches;
- Location, life cycle, and species of resident fish and non-anadromous salmon within the Upper reach;
- Distribution and availability (quantity and quality) of habitats for juvenile and adult resident and non-salmon anadromous fish upstream and within the proposed reservoir.

Specific Comments by Subsection:

AEA Study Objective 1. Describe the seasonal distribution, relative abundance (as determined by CPUE, fish density, and counts), and fish-habitat associations of resident fishes, juvenile anadromous salmonids, and the freshwater life stages of non-salmon anadromous species;

This objective is broad suggesting that methods will be developed to quantify the seasonal distribution, relative abundance, and fish habitat associations of all fish within the Upper River study area. Seasonal distribution as stated in the objective will be determined by catch per unit of effort (CPUE), density and counts. The need for this information and the purposes of these studies is not provided. The primary objective of Upper River studies should be to determine resident and anadromous fish use of the inundation zone for key life history periods (i.e., spawning and overwinter). Documenting Chinook salmon spawning and rearing habitats is especially important. Determining fish-habitat relationships will require analyses of fish community metrics (e.g., relative abundance, growth rates) as a function of physical, chemical, and biological habitat characteristics. However, methods to accomplish this objective are not provided.

The PSP provides only a brief review of previous studies conducted on fish species likely to be observed within this river segment and its tributaries. Study methods including sample collection, sampling locations, sample timing and frequency do not support the stated objective. The PSP does not identify collection methods for selected fish species or life stages. Data analytical methods and the statistical design are not provided. It is unclear how the results of these studies will be used to evaluate or mitigate potential impacts to the Upper River fish community.

FDAUP-51

The study plan does not identify which species will be targeted for sampling. Resident species within the Upper River include Dolly Varden, rainbow trout, Arctic grayling, Chinook salmon, humpback whitefish, burbot, longnose sucker, and lake trout. Except for lake trout, most of these species are thought to use the mainstem Susitna and lower tributary reaches within the inundation zone for some portion of their life cycle and could be affected by Project construction and operation. Life histories and habitat requirements vary among these species. Species-specific sampling methods will need to be developed. Fish collection methods vary for each species and life stage, and appropriate sampling is needed to provide useful information.

FDAUP-52

The PSP describes a plan for eight tributary streams to be sampled during 2013 and 2014. These will be chosen with a focus on Chinook salmon distribution, selecting all tributaries in which Chinook salmon juveniles or adults were observed previous. Studies found Chinook salmon in four tributaries: Fog Creek (RM 173.9), Kosina Creek (RM 202.4), Tsusena Creek (RM 178.9), and the Oshetna River (RM 226.9) (Buckwalter 2011). The remaining four tributaries for the current study are to be selected, as described in the PSP, at random. Within each selected tributary, up to three meso-habitat types (pool, riffle, backwater) will be selected at random for sampling, and physical habitat measurements of length, width, and habitat type will be collected.

FDAUP-53

Sample timing and frequency should be developed to support the Upper River study objective. In 1981 and 1982, peak juvenile Chinook salmon abundance in Middle River tributaries was from June through August. For example, in Portage Creek few juvenile fish were captured in June, with peak Chinook salmon catches occurring in August (ADF&G 1981). Tributary catches decreased in August and September and mainstem juvenile Chinook salmon abundance increased. Therefore, Middle River juvenile Chinook salmon likely overwinter in the mainstem and thus sample timing and frequency should be developed to determine if this same movement pattern is observed in the Upper River.

FDAUP-54

Sampling locations should be selected to address specific questions for fish species and life stages and to evaluate potential Project effects. For example, sample site selection to document the distribution of burbot will likely be different than site selection to document the distribution of Dolly Varden. Additionally, by choosing sites based on suitability for Chinook salmon, the plan may bias the capture of different species, relative to the degree of sympatry among species. The PSP does not appear to be designed to document the distribution or abundance of the resident fish species. Lake trout, for example, will probably not be found near the mouths of these tributaries, but they have been found in Sally Lake and Deadman Lake (ADF&G 1981a). If sites similar to these lakes are not sampled, this study could miss a species that potentially could move or be transported into a reservoir (functionally a large lake) and could have a large effect on the potential reservoir fish community.

FDAUP-55

The PSP for the Lower and Middle river (Section 7.6) describes sampling efforts in the mainstem, tributary mouths, side sloughs, upland sloughs, and side channels. Sloughs and side channels may not be as common in the Upper River as they are in the Middle River. Off-channel habitat, which provides rearing habitat in the Upper River, should be sampled to evaluate the relative importance of these locations to Upper River fish communities. Additionally, because tributaries in the impoundment zone have the potential to be affected miles upstream of their current mouths, we recommend including tributary-sampling efforts up to and above the predicted elevations of inundation to determine the availability, quality, and type of habitats that would be altered, and those habitats that will be unaltered, by permanent reservoir-filling.

FDAUP-56

The PSP states that sampling will be based on Chinook salmon distribution, with surveys above the 2,200-foot elevation focusing on locating Chinook salmon, and studies above the 3,000-foot elevation only conducted at sites where Chinook salmon were found. It is unclear if there will be any habitat measures associated with sampling the streams to be inundated. This is necessary in order to measure fish habitat lost to reservoir-creation and to measure habitat alternatives. Schmidt and Stratton ADF&G (1984) found that inundation would remove some passage barriers, such as Deadman Creek falls. Additionally, fish and habitat sampling efforts should be conducted in the many small lakes and ponds in the Upper River drainage to look for anadromous salmon and resident fish overwintering habitat.

FDAUP-57

Proposed fish collection methods are similar to the Middle and Lower river resident fish study (Section 7.6), with monthly sampling from May to September (and two events in August), no sampling October-November, and two sampling events between December and April. As with Section 7.6, methods will involve active and passive capture methods and biotelemetry, to identify seasonal timing, distribution, and abundance of fish. This section will also determine the effect of fluctuating reservoir levels on fish movement into and out of tributaries.

A combination of gill netting, electrofishing, angling, trot lines, minnow traps, snorkeling, outmigrant traps, beach seines, fyke nets, DIDSON, and video camera techniques will be used to sample or observe fish. The level of effort, water temperature, and DO at sampling locations will be recorded. All captured fish will be identified to species, measured, weighed, and scanned for a PIT tag. Comments on general methods for each species are described below (Section 7.6, Objective 2).

As described in the PSP, sampling methods do not include measurement of habitat variables to determine fish distribution among sites and among sampling events. A general classification of "pool, riffle, or backwater" will likely not provide enough information to characterize fish-habitat relationships or to evaluate potential Project effects. Determining Dolly Varden, Artic grayling, or burbot spawning habitat characteristics and their distribution relative to the inundation zone will be important for the evaluation of potential Project effects. This will likely require more information than differences in water velocities. Other habitat variables that may explain resident fish distribution, and should be measured concurrent with fish sampling, include water velocity, discharge (of the mainstem and sampled tributaries), turbidity, availability of cover, pH, conductivity, groundwater, and invertebrate drift and productivity.

FDAUP-58

This study plan also does not describe how it intends to determine effects of fluctuating reservoir levels on fish passage between tributaries and the mainstem Susitna River. It is unclear if this will be based on data collected during this study, or as part of another study, such as the Study of Fish Passage Barriers (Section 7.12). As there are no methods described as to how this objective will be accomplished, we are assuming that it will be part of Study Section 7.12. We recommend the Upper River resident fish study coordinate with the fish passage barriers study to determine which species will likely be affected by passage barriers, and what the physical limits are to passage for each migrating life stage and species.

FDAUP-59

Sampling methods, site selection, and sampling timing and frequency should be developed based on the life history of fish species and potential Project effects. The PSP provides little information on the methods that will be used to determine winter habitat selection by resident and anadromous fish in the Upper River. The primary Project effect will be the inundation of the mainstem and lower reaches of tributary streams. Project effects are likely to be greatest to those fish that spawn or overwinter within these reaches. Tributaries at this elevation may freeze to the stream bed requiring fish migration to overwintering locations. Many resident fish present in the Upper River (e.g., Dolly Varden, Arctic grayling, whitefish), migrate to the mainstem of larger rivers to overwinter. Therefore, methods should be developed to determine if resident and anadromous fish migrate to the mainstem in late fall and the overwintering habitat provided in tributary streams. The only winter sampling methods proposed in the Upper River are the use of DIDSON and video cameras. Surveys will be conducted in 10 "selected" sloughs and side channels. These proposed sampling methods and proposed locations are not likely to provide the necessary information to document overwintering habitats or potential Project effects to overwintering fish.

AEA Study Objective 2. Determine whether Dolly Varden and humpback whitefish residing in the upper river exhibit anadromous or resident life histories;

The PSP states that otoliths will be collected from Dolly Varden and humpback whitefish >200 mm to test for marine derived elements indicative of an anadromous life history pattern (Objective 2) with a target of 30 for each species.

FDAUP-60

The methods do not describe which marine derived elements will be tested for, or methodology for sample collection and analyses. It is our understanding that this a stable isotope study, but this needs to be clarified and more detail provided. Analyses of stable isotopes in tissue samples and otoliths are known to be effective methods for determining anadromy in salmonids and other fishes (Kline et al. 1998; Limburg 1998; Doucett et al 1999; Zimmerman 2005).

Zimmerman (2005) found that strontium (Sr) or strongtium-to-calcium (Sr:Ca) ratios in otoliths are linearly correlated to salinity and environmental Sr concentrations. This method is sensitive enough to discriminate between fresh water, brackish water, and seawater life stages, but Sr uptake is species-specific and possibly population-specific. Testing of otoliths can provide information on the timing of transitions between fresh water and salt water, and distinguish between sympatric populations of anadromous and nonadromous fishes (Thibault et al. 2010). If testing for Sr or ratios of Sr:Ca, then ratios should be compared to known resident upper river fish and known marine species. Larger individuals of each species are most likely to exhibit anadromous life-stages and should be selected for sampling as proposed.

FDAUP-61

In contrast to testing otoliths for marine derived elements, samples could also collect non-lethal tissue samples or fin clip effects. Kline et al. (1998) and Doucett et al. (1999) looked at stable carbon isotopes in tissue samples and compared them to samples collected from other fish known to be resident in fresh water or resident in the marine environment. Fish known to be resident and marine should be sampled to provide values for comparison. By using a non-lethal sampling approach, more samples could be collected, which would provide a more thorough test for anadromy in fish populations in the Upper River. Tissues are analyzed for carbon isotope ratios (Kline et al. 1998; Doucett et al. 1999). Non-lethal sampling methods should be considered, if they can provide valuable data for assessing anadromy in these populations. If redd sites are located for Dolly Varden and humpback whitefish, newly-emergment fry can also be tested for marine-derived elements. The tissue of juveniles will be composed mainly of elements in their yolk sac (Doucett et al. 1999). This method requires sampling before fresh water feeding dilutes the marine-derived elements.

AEA Study Objective 3. Collect tissue samples to support the Genetic Baseline Study for Selected Fish Species (Section 7.14);

See comments on Section 7.14 Genetic Baseline Study for Selected Species.

AEA Study Objective 4. Determine baseline metal concentrations in fish tissues for resident fish species in the mainstem Susitna River (see Mercury Assessment and Potential for Bioaccumulation Study, Section 5.12);

See Comments on Section 5.12 Mercury Assessment and Potential for Bioaccumulation Study.

AEA Study Objective 5. Use biotelemetry (PIT and radio tags) to describe seasonal movements of selected fish species (including rainbow trout, Dolly Varden, whitefish, northern pike, burbot, and Pacific lamprey if present) with emphasis on identifying spawning and overwintering habitats within the hydrologic zone of influence upstream of the project;

This objective was developed to provide an understanding of the seasonal migration patterns of resident fish species found in the Upper River. Specifically, studies should determine migration timing and locations of spawning and overwintering. However, the PSP does not describe how this will be accomplished. Sampling methods have not been developed based on what is currently understood about the migration patterns and life histories of the selected fish species, but appear to be a by-product of other study plans. The study plans contain no information on how the efficiency of the study methods will be evaluated. PIT tagged fish often pass antennae arrays without being detected (Bryant et al. 2009) and an array can detect a tagged fish in close proximity that may not be moving into or out of a study location. There is no discussion of the study statistical design or how migration data will be analyzed or applied to evaluating or

FDAUP-62 mitigating (i.e., avoiding or minimizing) potential Project effects. Understanding resident fish use of the impoundment zone, and affected tributaries for critical life stages including spawning and overwintering is an essential information need. The distribution of these habitats, relative to permanent and seasonal inundation zones, is necessary to evaluate effects to the Upper River fish community.

The PSP states that all captured fish will be identified to species, measured, weighed, and scanned for a PIT tag, with crews installing PIT tags in all untagged fish >60 mm. Antenna arrays will be installed at up to six sites, shortly after ice-off in 2013, and three swim-over arrays will be installed prior to ice-over on an experimental basis. Radio tags will be surgically implanted in up to 30 individuals of each species. Locating radio tagged fish will be via fixed receiver stations and aerial surveys, with up to four fixed receivers established at tributary mouths along the mainstem of the Upper Susitna River and serviced in conjunction with the Salmon Escapement Study (July through October). The Salmon Escapement Study will provide weekly aerial surveys. At other times of the year, the frequency of aerial surveys of the study area will be at least monthly.

FDAUP-63 The Upper River study proposes to radio tag up to 30 individuals of each species, whereas the Middle and Lower river study (Section 7.6) proposes to tag up to 10 of each species. It is unclear what species will be tagged, what age class, where or when fish will be captured for tagging and how selection of age class, tagging location, and timing of tagging would be selected to identify movement or migration patterns. The PSP does not identify why more fish will be tagged in the Upper, compared to the Middle and Lower River sites.

FDAUP-64 With a sampling schedule based on the timing of anadromous salmon spawning, July through October; the study likely will miss movements of resident fish species. Spring migration from overwintering locations or to spawning sites have been predicted or observed for many of the Susitna River resident species, including rainbow trout, Arctic grayling, round whitefish, and longnose suckers (ADF&G 1981b, 1983). If receivers are not operational until July, resident spring migrations will be missed in the first study year. Monthly measures may not be frequent enough to document seasonal migration patterns and will not assess movements during winter months. Tracking fall movement is necessary to identify Dolly Varden spawning locations, and winter movement is to identify burbot spawning locations, or early spring migrations that often occur under the ice.

AEA Study Objective 6. Document the timing of downstream movement and catch for fish species via outmigrant traps;

FDAUP-65 This objective addresses the migration of fish past the dam site, but limits quantification of downstream movement to one method. This is a modification of the Sevice requested objective that stated, "*Document the timing of downstream movement and catch for all juvenile fish species, and outmigration timing for anadromous species*". The PSP does not provide a purpose or information need for this objective. Methods are limited to one trap and one trap type which may or may not be sufficient, depending upon the purpose of the study. The PSP contains no description of the effectiveness of the methods at capturing fish that may be migrating downstream at this location. There is no description of data analyses or a discussion of how the results will be applied to Project operation.

FDAUP-66 The construction and operation of the proposed Project would potentially create a migration barrier, modify downstream migration rates, or result in increased fish mortality. Determining species outmigration and timing is an important Upper River objective. Sample methods, location, timing and frequency of sampling for upstream and downstream movements may be different for each fish species under investigation. We recommend the use of mark-recapture methods to determine the total number of migrating fish or determine the accuracy of "catch" at estimating total migrating population by species. The study plan should clearly identify how the data will be analyzed and used. Migrant traps can miss some species depending on when they are deployed, their location relative to spawning sites, and proximity to the shore (Thedinga et al. 1994). Therefore, the absence of fish cannot be used to indicate that a given fish species or life stage is not migrating unless a study is designed to determine the probability of fish capture by life stage.

AEA Study Objective 7. Document the presence/absence of northern pike in all samples.

FDAUP-67

This objective is unclear, and the reason for its inclusion is not identified. The PSP already states that all captured fish will be identified to species, measured, and weighed. Therefore, the inclusion of this study objective implies that independent methods will be developed to determine the presence or absence of northern pike within the Upper River.

It is possible that northern pike have already been introduced to shallow lakes or streams along the Denali Highway and within the Upper Susitna River drainage. Increased access following Project construction along with the creation of a reservoir could result in the introduction or increased distribution of pike. If pike are not currently present, pike found in post-Project monitoring could be due to Project construction. Determining if pike are present may be a necessary objective and appropriate sampling methods should be developed.

FDAUP-68

To our knowledge, intensive sampling for northern pike within this segment of the Susitna River has not been conducted. We recommend working with the Alaska Department of Fish and Game (ADF&G) to develop a sampling plan that identifies Upper River sampling locations, sample timing and frequency, and collection methods to determine if northern pike are present. Analytical methods should calculate the probability of pike presence even if not captured given the level of sampling effort.

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7. Fish and Aquatic Resources

7.6. Study of Fish Distribution and Abundance in the Middle and Lower Susitna River

General Comments:

This individual Alaska Energy Authority (AEA) proposed study plan (PSP) addresses parts of several U.S. Fish and Wildlife Service (Service) study requests related to anadromous and resident fish, fish distribution and juvenile fish, that we provided to FERC, May 31, 2012. The overall stated goal of AEA's Fish Distribution and Abundance PSP is to characterize the current distribution, relative abundance, run timing, and life history of resident and non-salmon anadromous species (e.g., Bering cisco, Dolly Varden, humpback whitefish, northern pike, and Pacific lamprey), and freshwater rearing life stages of anadromous fish (fry and juveniles) in the Middle and Lower Susitna River, as well as the Upper River, above Devils Canyon. However, for the distribution and abundance of fish in the Middle and Lower River, the PSP is not yet sufficiently developed for all seasons, species and life stages to reflect the effort that will be directed and is needed for these studies.

The Service maintains that documenting juvenile anadromous fish-habitat and resident fish-habitat relationships is one of the most important Project-related studies. The proposed Project can directly and indirectly affect the fish community through multiple pathways. Understanding how the proposed Project may alter the fish community is essential to developing protection, mitigation, and enhancement measures.

Although progress has been made in AEA's technical work group (TWG) meetings, since the July 16th filing of the PSP, in fully addressing our study request, several study methods are still not sufficiently developed to meet the intent of the Service's objectives, and appropriate study designs have not been fully established. For instance, a one-year pilot study to assess winter fish sampling methods has been proposed, but does not appear adequate to address sampling of post-emergent fish less than 60 mm, which as stated in our study request is a critical period in the life history of salmonid populations. In addition to missing or not collecting potentially important information on a critical life stage, the pilot study essentially eliminates a year of study under the Integrated Licensing Process (ILP) timeframe. There is also only minimal review of related species-specific or site-specific studies and in many cases species life history information is not included in the proposed study. General fish sampling techniques are listed but specific methods that will be used to sample different species or life stages are not presented.

Sampling locations refer to the different geomorphic classification types but there is only recent indication at the October TWG meetings that sampling locations may be selected in proportion to the distribution of classification types and that sample locations will be randomly selected among all available sites with similar classification types. There is no mention of variability in sampling efficiency among habitat types and how this variability will be accounted when evaluating differences in fish distribution or habitat associations. Monthly sampling and, more recently, some semi-monthly sampling is proposed, but this sampling frequency may not be adequate to address many of our study request objectives. There is no indication of how habitat characteristics will be measured or the metrics that will be used to evaluate causal factors influencing habitat selection and habitat quality. The analytical methods have not been provided to date, so it is not yet clear which statistical tests, if any, will be applied to determine if there are differences in fish community metrics between geomorphic classification types. There is no indication of how the data from these studies will be used to evaluate potential project effects.

The Service recommends AEA provide more detailed information on the development of the Habitat Suitability Curves (HSC). Instream flow analysis of habitat suitability is proposed as the analytical method to be applied. This requires development of species and life-stage specific habitat suitability curves. The development and application of habitat suitability curves has been a subject of debate since publication of the instream flow increment methodology (Mathur et al. 1985, Kondolf et al. 2000). However, the methods that will be used to develop HSC and how they will address the limitations of this methodology are not provided. There is mention of HSC in Study 6.5, but the study request objective is not addressed in the Upper, Middle, or Lower River studies for juvenile salmonids, resident fish, and non-salmonid anadromous fish. It is still unclear how HSC information will be collected, particularly in winter for post-emergent fish up to 60 mm when fish would be most vulnerable to load-following operations (stranding and trapping). There are no empirical studies described to evaluate potential Project effects or for inclusion in habitat modeling efforts. There is also a general reference to developing HSC models in Study 6.5 for these species and life stages, but the source of that information is unclear.

The study area for the Middle and Lower River fish studies in the PSP is from the Watana Dam site downstream to river mile 28. However, during a fall TWG meeting, it was suggested that the study area could initially be limited to the downstream extent of estimated flow effects as determined through the flow-routing studies. Limiting the studies based on estimated extent of flow modification would ignore potential indirect Project effects. The Service and National Marine Fisheries Service (NMFS) believe that Lower River fish studies are necessary to evaluate potential biotic effects due to species displacement from Middle River habitats and to document the relative contribution to fish production and use between these two river segments. It would also provide replicate measures of fish-habitat relationships and provide information for post-project comparisons and monitoring.

Habitat quality and differences in growth rates or fish condition among habitats can be related to fish density. Higher fish densities can increase intra- and inter-specific competition. Project operations, like winter load-following operations, could displace Middle River fish thereby increasing fish densities at Lower River sites. Higher fish densities in the Lower River could exceed available resources thereby reducing fish fitness and survival. Similarly, concentrations of transported organic matter or macronutrients may differ between the Susitna, Talkeetna, and Chulitna Rivers, and changes in Susitna River concentrations could extend Project-related effects downstream. The differences in dissolved and transported matter between the Susitna, Talkeetna, and Chulitna Rivers should be determined to see if Project effects beyond flow and sediment would change Lower River habitat quality.

Lower River fish and aquatic studies are necessary to documents the relative importance of these two stream segments. Differences in chemical and physical water characteristics could result in differences in habitat quality. For example, in the 1980s greater numbers of juvenile Chinook salmon were found overwintering within the Middle River compared to Lower River sites; even though total available habitats were more limited (ADF&G 1981).

Lower River sampling may be necessary to provide adequate replication of macrohabitats to determine fish-habitat relationships. Tributary mouths have been identified as one of the geomorphic classification types that may provide important juvenile salmon overwintering habitat. However, there are considerable biological, water quality, and physical differences among tributaries. For example, Whiskers Creek is a moderately sloped stream characterized by low pH, high dissolved carbon, coho spawning, and coho and Chinook overwintering habitat. However, it is the only Middle River tributary with these characteristics. Therefore, replication of this tributary type will require selection of similar Lower River sites (e.g., Trapper Creek, Cache Creek, Rabideux Creek, Moose Creek, Greys Creek, or Kroto Creek/Deshka River) to determine if the characteristics of these tributary mouths are important components of fish habitat. A similar discussion could be applied to Indian River and Portage Creek, which together accounted for most of the Chinook salmon spawning in the 1980s, but these would provide only two sample replicates of this stream type. Additional replicate sites could be found in the Lower River including Montana Creek, Willow Creek, Sheep Creek, and possibly the Kashwitna River.

Proposed study plans for post-Project monitoring are not provided. However, Lower River sites could be selected as long-term monitoring locations. Lower River sites may have many of the same biological, chemical, and physical characteristics as Middle River locations. Lower River sites could be used to differentiate between changes in relative abundance due to escapement or marine survival and Project-related effects. Without pre-Project Lower River studies, any post-Project changes in Susitna River fish and aquatic resources may be assumed to be due to Project construction and operation. Without pre-Project Lower River studies, decisions regarding Project mitigation including hydropower operations would need to be made with little or no information on fish and aquatic resources in the Lower River.

Specific Comments by Subsection:

AEA Study Objective 1. Describe the seasonal distribution, relative abundance (as determined by CPUE, fish density, and counts), and fish-habitat associations of juvenile anadromous salmonids, non-salmonid anadromous fishes and resident fishes;

FDAML-19

This study objective is broad and includes the spatial and temporal distribution of multiple fish species with different life histories, their relative abundance, and factors influencing habitat associations. The purpose of this study objective is only briefly defined by AEA. There is only a cursory review of existing information and methods have not been developed for specific study objectives. Proposed sampling frequency and potential locations are provided but may not be appropriate for the study objective. The study does not include an evaluation of sampling efficiency, accuracy, precision, or representativeness. There is also no description of how the study results will be analyzed or the metrics used to evaluate potential Project effects.

The Service recommends the methods include three study components for each fish species. The first is to describe the seasonal distribution of juvenile anadromous salmonids, non-salmonid anadromous fishes, and resident fish. The second study component is to describe the relative abundance of fish species, and the third is to describe the fish-habitat associations. Methods for all three of these study components can vary among species and their life stages and with environmental conditions. The stated purpose for this study in the PSP is to support the physical modeling and provide supporting information for the instream flow modeling study. Therefore, specific detailed quantitative information is necessary for all three study components. In addition, this objective should characterize all factors that influence the seasonal distribution and abundance of juvenile anadromous and resident fish and not simply support physical and instream flow modeling.

Juvenile Salmon Seasonal Distribution

FDAML-20

It is important to understand the distribution of fish species by life stage both spatially and temporally. The direct effects of the construction and operation of the proposed Project will be limited to those fish species present within the affected area. The Project could also indirectly affect fish species by altering the physical, chemical or biological habitat characteristics. However, identification of the seasonal distribution of fish species is presumed to be related to direct Project effects. Direct Project effects can vary over time based upon different operational scenarios, and the response to those effects can vary by fish species and life stage. In addition, the magnitude of Project effects likely will decrease with distance from the dam site, and among different geomorphic reaches and physical habitat types.

The change in the spatial and temporal distribution of fish is due to movements or migration of fish among habitats during different life stages which can be influenced by environmental variables. Adult resident and anadromous fish migrate to spawning areas, and juvenile fish emerge and migrate to seasonal summer, fall, and winter rearing areas. These movement patterns often are influenced by environmental factors. Adult salmon migration can be influenced by water temperatures or flows (Macdonald et. al. 2000; Torgersen et. al. 1999). Embryo development and fry emergence is dependent on thermal energy (Murray et. al. 1988; Wangaard et al. 1983) but can be influenced by flows (Milner 1985), and juvenile migration to winter habitats and smolt outmigration can be related to changing flows or light (Bustard and Narver 1975, McDonald 1960). The temporal distribution of fish may vary from year to year due to environmental conditions which can be influenced by Project operations. Therefore, we not only need to understand the spatial and temporal distribution of fish species by life stage, but also those factors than initiate and modify movement or migration rates.

The seasonal distribution of adult anadromous salmon and salmon eggs will be determined through the Adult Escapement Studies (Section 7.7). However, the temporal distribution of salmon fry will be influenced by egg development rates. The presence of chum, sockeye, or other salmon fry within the Susitna River or off-channel habitats will depend upon egg development and emergence timing. The Service's request for the evaluation of spawning and egg development is not addressed in the PSP and has not been fully addressed in subsequent TWG meetings, but is the subject of multiple agency study plan objectives outlined below.

Juvenile Salmon Distribution and Movement from Spawning to Rearing Locations

FDAML-21

Understanding the timing and influence of environmental variables on juvenile salmon migration from spawning to rearing habitats is critical to the Service's evaluation of the Project. Newly emergent salmon fry are weak swimmers and the availability and access to low velocity nearshore habitats and off-channel locations can be affected by changing flows. The distribution of resident fish species and other predators may be due to the presence of migrating salmon fry. Understanding the seasonal distribution of juvenile salmon will likely require multiple sampling methods, sampling locations, and sampling frequency for different species.

Environmental conditions such as temperature, discharge and water velocity influence the timing of sockeye and chum migration to sea or Lower River rearing habitats. Studies have shown a stronger positive response to discharge by sockeye and chum fry compared to Chinook and coho fry (Hoar 1954). Chum had the highest correlation (r=0.89) with discharge in the 1980s studies at mainstem inclined plane trap locations (Roth et al 1986). Less is known about juvenile river-rearing sockeye and their dependence on discharge ,but results from 1980s studies suggest that large numbers of age 0+ sockeye migrated out of the Middle River in late May and June coinciding with high spring time flow. The percentage of migrants travelling to

Cook Inlet or to Lower River rearing habitats was not known (Schmidt et al 1985). The PSP does not indicate where fyke nets or other migrant traps should or will be used to capture migrating juvenile salmon. Migrant traps such as fyke nets and inclined plane traps should be used with a sufficient level of effort and frequency to determine the timing and conditions (e.g., water temperature and flow) of chum and sockeye migration.

The Service recommends that placement of migrant traps (i.e., fyke nets, screw or incline plane traps) occur near adult salmon spawning locations in such a manner as to document timing of fry migration relative to environmental conditions, the size class distribution of migrating fry, and abundance estimates to evaluate potential spawning success (i.e., fry per spawning female x fecundity). The use of migrant traps for sockeye salmon fry may be preferable to other sampling methods (electrofishing, beach seines, and minnow trapping) based on results of 1980s studies. The results of proposed adult salmon spawning and potential incubation, and emergence studies should be used to identify sampling locations and the timing of migrant trap operation.

Migrant traps near the confluence of tributaries or near other identified spawning areas and Susitna River should be used with other methods to document juvenile Chinook and coho salmon movement from spawning to rearing areas. In addition to providing detailed run timing information, migrant traps could allow for population estimates (if needed) using mark-recapture methods and provide a method to calculate spawning success in tributary streams.

FDAML-22

Juvenile Salmon Distribution among Summer Rearing Habitats

The seasonal distribution of juvenile salmon within the Middle and Lower Susitna River during summer rearing likely will be determined using the relative abundance or catch per unit effort (CPUE) among sampling locations. Our understanding of the distribution of juvenile salmon among habitats can be influenced by the locations sampled, when samples are collected, the frequency of sampling, and differences in catchability due to sampling methods. The Service recommends that timing and frequency of sampling, sample locations, and sampling methods be appropriate to species life histories and to address specific project-related questions.

Sampling locations should be stratified among physical geomorphic classification types including turbid mainstem and side channels, and off-channel sloughs and tributaries. However, sampling locations should also consider the relationship to spawning areas and microhabitat characteristics as well as the timing of fry movement from spawning to rearing areas. Sampling mainstem habitats immediately upstream and downstream of spawning areas before or after fry move from spawning to rearing areas would result in substantial differences in CPUE. Similarly, if salmon spawning locations are predominantly on one bank (e.g., Slough 8A and Slough 11), then salmon fry CPUE may differ considerably between samples collected on the left or right bank. If these two locations are treated as replicate mainstem habitats then CPUE will be highly variable and would be less likely to determine differences among habitat types. Whereas, if these were discrete sampling areas based upon a stratified sampling approach, it would provide a much better understanding of salmon fry distribution among mainstem habitat locations. At the October 2012 TWG meetings, a stratified random approach was outlined and an initial schedule presented for fish sampling. However, a description of the methods, the link from methods to the study objectives, the analytical approach, and the metrics used for the analysis are still unknown and should be described in the revised study plan.

FDAML-23

Specific sampling locations among macrohabitat types, should also consider microhabitat variability within a habitat type (e.g., woody debris, substrate size, bank cover, riparian cover, temperature). For example, juvenile fish CPUE likely may vary considerably among mainstem sampling locations adjacent to point bars, along outside bends, or within the mid-channel (Beechie et. al. 2005). Similarly, CPUE from samples collected at or near the confluence of sloughs and the mainstem could be different from those collected greater distances up sloughs due to variable water quality or physical conditions. Microhabitat sampling locations should be identified to interpret sample results designed to evaluate the temporal distribution of juvenile salmon among macrohabitat types.

FDAML-24

A similar process should be applied to identifying sampling locations for tributary spawning species. As mentioned previously, Chinook spawning in the 1980s occurred primarily in two right bank tributary streams in the Middle Susitna River: Indian River and Portage Creek (upstream of River Mile 138). Whereas, coho salmon spawning occurred primarily in tributaries near below river mile 110. Thus, early season sampling in locations closer to tributaries used by spawning adults would likely have higher CPUE values. Therefore, the Service recommends that sampling locations for juvenile salmon be stratified spatially and temporally by proximity to spawning areas including river mile and bank (i.e., left or right), geomorphic classification types, and then meso-habitat characteristics (see comments on habitat classification) to understand the seasonal distribution of juvenile salmon within the Middle and Lower Susitna River.

An alternate approach would be to develop specific hypotheses regarding distribution and develop a sampling approach to test these hypotheses. For example, studies could address whether juvenile sockeye salmon use mainstem habitats in summer for rearing or use mainstem habitats primarily as a transportation corridor from spawning to rearing habitats (*sensu* Galat and Zweimuller 2001). Studies could determine if there is a difference in juvenile sockeye salmon residence times among macrohabitat locations, and if there is a difference in juvenile sockeye salmon abundance between left and right bank macrohabitats.

The timing and frequency of sampling can also influence our understanding of juvenile salmon distribution within the Susitna River and should be specific for each species or for specific Project-related objectives. For example, if the objective is to determine when and how long juvenile sockeye salmon are present in mainstem habitats, then sampling could be initiated in early June, and weekly or semi-weekly sampling may be necessary to document sockeye salmon residence times within mainstem habitats. For Chinook and coho salmon, sampling of mainstem habitats could also begin in June, with initial monthly sampling, but more frequent weekly or semi-weekly sampling in August and September to determine if mainstem habitats are migration corridors or are important fall and winter rearing areas.

FDAML-25

It may also be necessary to develop a sampling frequency that is linked to changes in chemical or biological characteristics, or otherwise relevant to proposed Project operations. If juvenile salmon distribution is related to changes in turbidity because of seasonal increases in flow from glaciers, then sampling frequency should provide measurements over a range of mainstem conditions. Similarly, if mainstem turbid waters provide cover (Gregory and Levings 1998, Ginetz and Larkin 1976) and influence fish distribution in sloughs as water levels rise, then sampling locations and frequency should provide measures that encompass these changes in habitat characteristics. The direct effects of the Project on fish will likely vary under different operational scenarios. At a minimum, sampling frequency should provide a measure of fish distribution when Project effects are expected to be greatest. For example, if changes in flow are expected to influence fish movements, then sampling frequency should document fish movement prior to, during, and following similar natural variations in flow.

Juvenile Pacific Salmon Migration to Overwintering Habitats

FDAML-26

The objective for the distribution of juvenile salmon during winter should determine if fish maintain site fidelity from summer through winter, or if and when they emigrate from summer rearing locations, and the locations that they select for overwintering. PIT tagging of salmon juveniles in tributaries with stationary antennae arrays near the Susitna confluence could be used to determine the portion of fish migrating out of these streams as water temperatures and light levels declined or in response to fall storms. PIT tags could also be used to determine site fidelity within upland and side sloughs with tag detection at stationary arrays near the slough mouth.

Based upon 1980s Susitna River sampling, juvenile salmon in winter were found in tributary mouths, mainstem, and off-channel habitats. Monthly winter fish sampling at sites randomly stratified by geomorphic classification types could be used to identify distribution during winter. However, a variety of sampling methods are likely needed to infer differences in relative importance of overwintering habitat locations. The use of video and PIT tagging may be useful to document the presence or absence of juvenile salmon at multiple sampling locations, but it is unknown whether video observations of fish are proportional to fish densities or would otherwise provide useful quantitative information.

Juvenile salmon emigrate from summer rearing to fall and winter rearing habitats. Juvenile sockeye, Chinook, and coho salmon overwinter in the Susitna River and associated off-channel habitats. Juvenile salmon may move to winter rearing locations or remain in summer rearing locations if characteristics are favorable in winter. Migration is often associated with declining water temperatures but may be linked to changes in discharge or light levels (Bjorn 1971, McMahon and Hartman 1989). Movement from summer rearing areas may be initiated by low flows in fall, winter freshets, or the loss of open water as small tributaries freeze to the bottom (Prowse 1994). Juvenile salmon generally select winter habitats with cover, low water velocity, and relatively warmer water due to springs or upwelling groundwater (Giannico and Hinch 2003, Hillman et al. 1987, Cunjak 1996). Winter habitat selection is based on the need to minimize energy expenditure and avoiding adverse physical or chemical conditions (e.g., anchor ice, floods, low oxygen) (Cunjak 1996).

Chinook and coho salmon likely prefer different winter habitats, but little is known about winter habitats used by stream-type sockeye salmon. Substrate with interstitial spaces that provide cover and lower water velocities may be important for overwintering Chinook salmon (Hillman et al. 1987, Bjorn 1971). Bjorn (1971) found fewer juvenile Chinook salmon migrated out of streams with large cobble substrates than those with gravel or finer substrates. Juvenile Chinook salmon were found in association with macrophytes and undercut banks during winter and the addition of cobble substrate increased overwinter abundance (Hillman et al. 1987) in the Lemhi River (Northern Idaho). Juvenile steelhead and Chinook were found overwintering in deep pools and the interstitial spaces of riprap cover in a large river in British Columbia (Swales et al. 1986). Bustard and Narver (1975) found juvenile coho salmon and steelhead trout in waters less than 0.15 cm/s when water temperatures were below 8°C whereas Hillman et al. (1987) found Chinook salmon in water velocities less than 20 cm/s during winter with larger fish using higher water velocities.

Seasonal Distribution of Resident Fish

See comments under AEA Objective 2 of Section 7.6.

FDAML-27

Relative Abundance

The use of relative abundance data are not explained in the PSP, but differences in CPUE could be used to identify important fish habitat characteristics and may also be used to develop habitat suitability criteria for instream flow analyses. However, relative abundance for juvenile salmon in particular, can vary with proximity to spawning areas, catchability among habitat types, and with differences in flow, and should be considered when evaluating habitat quality.

Underwater video could potentially have less sampling bias based on flow, cover or depth, but could be affected by poor visibility from turbidity and may be limited to providing only qualitative information such as fish presence/absence, fry emergence times, or diel fish activity. However, the sampling methods for underwater video are only mentioned for winter use in the PSP (detailed in Mueller et. al. 2006). Use of video during the open water season in clear water sloughs or tributaries could also provide an additional method for observing juvenile sockeye salmon that may not otherwise be captured using other gear types.

FDAML-28

Juvenile Salmon Habitat Associations

Determining habitat characteristics that are important for fish species in the Susitna River and evaluating how construction and operation of the proposed Project may alter those habitat characteristics is a fundamental purpose of the proposed studies. The development and completion of extensive studies to measure and model geomorphological changes, ground water flow paths, productivity, and water quality may have little utility if a relationship between physical and biotic processes and fish habitat characteristics is not clearly understood.

One PSP objective is to describe fish-habitat relationships for juvenile anadromous, non-salmonid anadromous, and resident fish species. However, the PSP does not outline how these data would be used, how habitat characteristics would be measured, or how statistical methods would be used to determine the relationships between fish and characteristics of their habitats. Therefore, critical evaluation of the PSP is difficult. As potential habitat suitability criteria and indices have not been identified, there is no indication of what parameters may be included to develop weighted usable area for instream flow analyses.

The Service recommends that AEA review the numerous published studies available to determine the characteristics that define habitat quality from egg deposition through juvenile summer and winter rearing for most fish species present in the Susitna River (See summaries in Bjorn and Reiser 1991, Quinn 2006). There are few studies that evaluate juvenile salmon and resident fish-habitat characteristics in large glacial rivers (Murphy et al. 1989). Although these sources may not provide the information necessary to define fish-habitat associations, they can provide an understanding of those parameters that should be incorporated into the revised study plans.

The important characteristics of fish-habitat relationships can be physical, chemical, or biological. Physical, chemical and biological characteristics used to define fish-habitat relationships should be measured and not obtained from model estimates. Fish-habitat characteristics should define conditions when fish are sampled at the microhabitat scale (m2); however, sampling frequency and locations should be based upon the variability of the measured parameter. For instance, channel geometry will not likely change within a season so annual measures should be adequate; however, water velocity and water depth, and most water quality parameters should be measured at the same time as fish sampling. Similarly, sample locations should be representative of the physical habitat sampled for fish.

AEA Study Objective 2: Describe seasonal movements of selected fish species such as rainbow trout, eulachon, Dolly Varden, whitefish, northern pike, Pacific lamprey, and burbot) using biotelemetry(PIT and radio-tags) with emphasis on identifying foraging, spawning and overwintering habitats within the mainstem of the Susitna River and its associated off-channel habitat;

This PSP study objective partially addresses the Service's study requests for resident fish species. Our study objectives for resident fish included the following:

1. *"Characterize the seasonal (spring, summer, fall, winter) distribution, relative abundance, and habitat utilization in the Susitna River mainstem (RM 0-RM 233) for all life stages of non-salmon anadromous, resident, and invasive fish species. [Documenting both hierarchal nested habitat type and use-type as described in the resource agency Instream Flow Study and Habitat Utilization Study Request].*
2. *Characterize the seasonal (spring, summer, fall and winter) movement patterns of all subject fish species and life stages as they relate to foraging, spawning, rearing and overwintering habitats. The characterization of seasonal movements includes run timing (immigration and emigration) and extent (periodicity) of non-salmon anadromous species in the Susitna River (RM 0-RM 233) and movement into and out of tributary streams. [Interface with resource agency Instream Flow and Habitat Utilization Study Request hierarchal nested habitat types and habitat mapping].*
3. *Characterize the flow-related or synchronized life history strategies (migration, movement, spawning, rearing, hatching, emergence) of non-salmon anadromous, resident and invasive species, and their biological behavorial response (e.g., potential for false attraction, delayed migration or increased holding time, synchrony of spawning, relative hatching and emergence timing) to Project-affected flow alterations (flow, temperature, habitat, water quality).*

This study objective also only partially addresses the Service's study requests for juvenile anadromous, and juvenile resident fish. Our study objectives for juvenile fish included the following:

FDAML-29

1. Describe the seasonal movements and migratory patterns of juvenile anadromous and resident juvenile fish species among mainstem habitats and between tributaries and mainstem habitats with emphasis on identifying foraging and overwintering habitats.. [Enclosure 13: Early Life History and Juvenile Fish Distribution and Abundance in the Susitna River].

The PSP objective is to characterize seasonal distribution, relative abundance, and habitat associations of resident fish and their migration. However, PSP methods do not support the intent of the Service's study request. The PSP has not been developed to characterize flow-related, or synchronization of resident fish migration and life histories to other physical, chemical, or biological environmental variables. Specific methodologies will need to be designed to accomplish these objectives. Incidental catches of fish through seasonal samples will not be sufficient, nor will the resulting data be useful for evaluating Project effects.

The fish collection methods do not appear to be related to this project objective, but are merely a list of sampling techniques. The objective states that biotelemetry and tracking of PIT tagged fish will be used to document migration patterns of resident fish. The specific methods should clearly identify how target species are to be captured for tagging or for the recapture of tagged fish (although this is not discussed). For example, trot lines can result in high fish mortality for some species, therefore, it may not be an appropriate method to collect fish for tagging and tracking.

The PSP study methods do not clearly identify those species that will be evaluated. However, a partial list of potential species is provided, which, in part is covered under other study objectives (i.e., seasonal movement of northern pike). The PSP provides only cursory information on the general life-history patterns of the potential fish species and does not include any site-specific information. Study methods do not adequately identify when, where, or how specific fish species will be captured. The location and operation of receivers does not appear to consider the life history patterns for many species. PIT tagging is identified in the study objective, but the limitations on installation and operation of arrays could limit the results. PIT tagging is also limited to fish >60 mm, and therefore, will not provide any information on the early life stages that will be most vulnerable to Project operations. The study does not identify any of the other biological, chemical, or physical characteristics that may explain movement patterns. There is also no description of how the analyses of the data obtained from this study will be conducted to meet the study objective.

FDAML-30

The methods described to address this objective include using biotelemetry to identify seasonal movements of juvenile anadromous and resident fish; however, it is not clear how this will relate to the habitat characterization studies or the instream flow models. Methods mention ways biotelemetry can be used to measure growth rates and calculate population estimates, but there is no objective that describes why these data will be collected or how it will be used. It is assumed that growth rates and abundances will be used to characterize preferred seasonal habitats for each species, which might then be combined with instream flow analyses to determine how these habitats might change thereby quantifying effects to fish populations. However, there is no description of whether physical (depth, velocity, temperature), chemical (pH, conductivity, dissolved oxygen), or biotic variables (primary and secondary productivity) will be measured in conjunction with fish capture and tracking efforts, particularly if spawning or overwintering habitats are located outside the reaches included in habitat characterization or river productivity studies. Without accompanying measures of fish-habitat characteristics or parameters influencing fish movement, it is unclear how distribution trends can be estimated or extrapolated out to similar, non-sampled areas. Presence/absence information is not sufficient to provide necessary information to make decisions on how a hydroelectric project could influence fish survival and distribution or movement among foraging, spawning or overwintering habitats.

FDAML-31

Sampling habitats based on equally measuring the “major habitat [geomorphic classification] types” assumes that the distribution of geomorphic habitats is equal throughout the drainage. Many factors, such as water chemistry and productivity will also influence the distribution of fish among these sites, beyond this geomorphic characterization. Classifying fish as preferring side channels versus side sloughs may miss the habitat variables influencing fish distribution. Therefore, it is important to measure habitat variables at each sample site and event to determine if use of macrohabitats is in proportion to availability when evaluating fish distribution and abundance.

FDAML-32

The number of fish to be tracked in the PSP may not be sufficient to document spawning migration patterns, summer foraging areas, and overwintering habitats to meet the study objective. The use of radio receivers has not been designed to track resident species. Radio transmitters are proposed to be *“surgically implanted in up to 10 fish of sufficient body size of each species from five geomorphic types in the Middle and Lower River.”* The description of methods in the PSP is not detailed enough for the Service to provide meaningful evaluation. More information is needed regarding: which fish species will be tagged; what determines "sufficient" sizes for radio transmitters; and how movements of smaller, juvenile fish (<60 mm) will be monitored. If fish selection is stratified equally among five different habitat types, this would only provide information on movements for two fish from each habitat type below Devils Canyon. It is unclear if this level of effort will be sufficient to understand general movements and seasonal habitat utilization by species. The plan to maintain fixed receiver stations during July through October, to coincide with adult salmon migrations will miss fish species movements or migrations that occur in the spring. If the objective for the biotelemetry studies is to include tracking seasonal movements of resident and non-salmonid anadromous fish, the observation period should not be based solely on adult salmon migration periods. Monthly winter and spring aerial surveys have the potential to miss movements and migration timing from spawning areas to juvenile fish rearing habitats. Therefore, more frequent surveys are likely needed. In addition, because radio-tagging can have high failure rates from tagging-induced mortality, expulsion of tags, or tag malfunction (Chisholm and Hubert 1985; Ridder 1998), tagging 10 or fewer fish may be an inadequate sample size.

FDAML-33

The PSP maintains that up to 10 sites will be selected for deploying PIT tag antenna arrays to detect movements into or out of selected sites and will be deployed shortly after ice-off in 2013. Additionally, swim-over antennas are planned to be deployed at five sites prior to ice-over, on an experimental basis. The target species in this study and the criteria used for site selection of antenna arrays has not been clearly defined. Information on large and fine scale movements of fish will be dependent on site selection for antenna arrays and tagging sites. There is a large sample area to cover with only 10 or fewer observation sites, especially considering that it will only register movements into and out of relatively small tributaries and sloughs.

AEA Study Objective 3: Document the timing of downstream movement and catch for all fish species using outmigrant traps;

FDAML-34

This study objective is broad, with no stated purpose, and is limited to a single method. One purpose could be to document outmigration timing and abundance of anadromous salmon smolt from the Susitna River. However, "all fish species" are listed as the study objective. The PSP states that sites within side channels that are open continuously throughout the ice-free season will be selected for outmigrant traps and traps will be operated for 48 hours off. As described, it appears that two traps will be deployed and all captured fish will be recorded, but there is no discussion of how these data will be used.

Although we agree that documenting the timing of downstream movement of fish should be a study objective, the objective should be expanded and the purpose clarified. This will ensure that appropriate methods are selected and avoid collecting data that cannot be used in the evaluation of Project effects. For example, salmon smolt migration is likely different than downstream movement of emergent fish to rearing locations. Also, the velocities used by out-migrating smolt may be species specific. Therefore, the timing and location of out-migrant traps will depend upon specific study objectives.

AEA Study Objective 4: Characterize the age structure, growth, and condition of juvenile anadromous and resident fish by season;

An understanding of the seasonal age structure, growth, and condition of anadromous and resident fish is needed by the Service to provide baseline information and to evaluate or monitor potential Project effects.

FDAML-35

The PSP does not provide information on why age structure, growth rates, or condition factors are being collected or calculated, or how these metrics will be used in Project evaluation. The recapture of PIT-tagged fish is the only method that is suggested for measuring growth rates. Specific objectives will affect study design, sampling locations and frequency, the sample size and data analyses. Therefore, specific study objectives must be identified with appropriately selected sampling and analytical methods. For example, flow fluctuations and the potential for stranding may vary in relation to proximity to the dam site and channel morphology. A Project objective may be to determine if there are longitudinal differences in juvenile salmon growth rates. Study designs could be developed to test for differences in growth rates or condition factors among groups of different geomorphic classification (i.e., mainstem, sloughs, side channels, and tributaries). In this case, growth rates will need to be calculated for each of these replicate locations. Growth rates and condition factors are an indication of habitat quality, thus regressions with habitat characteristics will require measuring growth rates at locations with variable habitat characteristics. Growth during winter may be an important measure of habitat quality and differences in growth and condition among overwintering sites should be determined at multiple replicate locations throughout the winter. In addition, growth rates may be used in addition to juvenile salmon density or relative abundance when determining weighted usable area for instream flow analyses (Beecher et al. 2010).

In collaboration with the Services, AEA should identify the specific objectives and information needs that require juvenile anadromous and resident fish growth rates. Based upon these objectives, study designs should be developed to document the species, locations, and methods that will be used to calculate growth rates and the analyses that will be applied to the data. Site selection and the use of growth rates without considering data analyses and application likely will not result in useful data.

AEA Study Objective 5: Document the seasonal distribution, relative abundance, and habitat associations of invasive species (northern pike);

FDAML-36

This AEA objective is directed toward any invasive species but refers specifically to northern pike, therefore, it is unclear whether other invasive species are anticipated or should be considered in the evaluation of this objective. If the intent is to document the seasonal distribution, relative abundance, and habitat associations of other invasive species, then detailed procedures should be provided on how this would be accomplished.

The PSP does not describe the purpose for this objective or how the proposed Project may influence the distribution or relative abundance of northern pike (or other invasive species). The PSP states only that northern pike have been observed in the Lower River, but does not provide a synopsis of known distribution, relative abundance where present, or known habitat associations. The study plan should review information on northern pike and habitat associations and identify how the proposed Project may affect current distribution, relative abundance, and available habitats. The PSP should outline the limitations of our current understanding of northern pike distribution within the Susitna River drainage and how the proposed study will build upon this information.

FDAML-37

The PSP provides no description of the sampling locations, timing, frequency, or methods (passive or active) that will be used to document northern pike (or other invasive species) distribution, relative abundance, or habitat associations. A review of methods employed previously by Alaska Department of Fish and Game (ADF&G) should be provided and a description of how and where these methods would be used to accomplish the stated objective.

FDAML-38

The PSP does not provide information on data analyses or how information on northern pike would be incorporated into the evaluation of potential Project-related effects. It appears that evaluation of northern pike distribution, relative abundance, and habitat associations will consist of reporting when and where there are incidental catches of northern pike through other sampling efforts.

FDAML-39

A clear understanding of the distribution of northern pike is important for the interpretation of biotic effects to the distribution and abundance of juvenile salmon and other resident salmonid and non-salmonid anadromous species. This may be of particular importance for lower gradient streams that have similar physical characteristics to those where northern pike are currently present. These could include tributaries that will likely be influenced by Project operations including Whiskers Creek, Birch Creek and slough, Trapper Creek, Cache Creek, and Rabideux Creek, that provide spawning and rearing habitat for Chinook and coho salmon and rearing habitat for Chinook, coho and sockeye salmon. In addition, as pike distribution increases, the importance of moderate-sloped clear water tributaries to glacial rivers may become more important for salmon as locations where pike are absent. The Middle Susitna River provides important rearing and overwintering habitat for Chinook salmon and displacement of these fish due to Project operations could make them more susceptible to predation by northern pike. Similarly, flow fluctuations during winter could displace overwintering fish from mainstem habitats to backwater locations and increase risk of pike predation. The loss of flushing flows due to Project operations could increase physical habitat characteristics that give northern pike a competitive advantage.

AEA Study Objective 6: Collect tissue samples from juvenile salmon and opportunistically from all resident and non-salmon anadromous fish to support the Genetic Baseline Study.

The evaluation of the effectiveness of the PSP in meeting this objective is discussed in section 7.14: Genetic Baseline Study for Selected Species.

Related USFWS/NMFS (Services) Study Objectives

Services Study Request Objective 7. Evaluate salmon incubation (embryo development, hatching success, and emergence times) and monitor associated water quality conditions (e.g., temperature, DO, pH) at existing spawning habitats (slough, side channel, tributary, and mainstem) in areas with and without groundwater upwelling in the middle and lower reaches of the Susitna River.

FDAML-40

This Study Request Objective was not addressed in the PSP, but has been discussed at TWG meetings. The Services anticipate that most portions of this objective will be included in the Revised Study Plan as part of the Instream Flow Study, however we cannot comment on the details of what this may entail at this time. Characteristics of suitable spawning habitat vary by species but include water depth, velocity, temperature, flow, space, upwelling and downwelling, substrate size, and percent fine sediment (see review in Bjornn and Reiser 1991). Habitat characteristics that affect incubation (rates and success) and emergence (dates and times) include dissolved oxygen, water temperature, biochemical oxygen demand, substrate size, percent fines, channel gradient, water depth, flow, velocity, stream bed porosity, and velocity of water through the redd (Bjornn and Reiser 1991). An evaluation and monitoring of spawning and incubation habitat as described below in the *Services' Study Request Objective 9* will be included in the intragravel study. The evaluation of existing emergence times is still being developed and may include the use of migrant traps in areas with open leads and possibly with the use of video. Although some discussion of the methods has occurred, detailed methods should be provided in the methods of the Instream Flow Study.

Services Study Request Objective 8. Evaluate the potential for stranding of juvenile fish and stranding mortality under proposed operational conditions.

FDAML-41

Although stranding (and trapping) of juvenile fish is mentioned in the Instream Flow Study, this objective was not addressed in the PSP. This objective has been presented and discussed at subsequent TWG meetings and there has been a commitment by AEA to include this in the Habitat Specific Varial Zone modeling. There has also been some discussion at TWG meetings and during the October 2012 site visit of empirically evaluating juvenile fish stranding and trapping under natural flows. Because fish stranding was observed during our October 2012 site visit, the Service maintains there is a need for more detailed discussion of empirically evaluating stranding and trapping in relation to assessing pre- and post-Project effects.

Agency Study Request Objective 9. Measure intragravel water temperature in spawning habitats and winter juvenile fish habitats at different surface elevations and different depths to determine the potential for freezing of redds, freezing of juvenile fish, and their habitats.

FDAML-42

This Study Request Objective was not addressed in the PSP, but has been presented at recent TWG meetings and will be added in the Revised Study Plan as part of the Instream Flow Study. Although some discussion of the methods has occurred, more detailed methods should be provided in the revised Instream Flow Study.

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7. Fish and Aquatic Resources

7.7. Salmon Escapement Study

General Comments:

ESCAPE-13

The U.S. Fish and Wildlife Service's (Service) 31 May 2012 study request entitled Adult Salmon Distribution, Abundance, Habitat Utilization and Escapement in the Susitna River is addressed in part by Alaska Energy Authority (AEA) Proposed Study Plan (PSP), Section 7.7 Salmon Escapement Study. The purpose of the Salmon Escapement Study, as proposed by AEA, is to assess the current run timing and distribution of each of the five species of salmon among different habitat types in the lower and middle Susitna River, with emphasis on the middle reach. As previous studies have been unsuccessful in consistently measuring spawning in the mainstem channel, this objective should be considered a priority for this study plan. Additionally, habitat characteristics such as water chemistry and physical habitat measurements will be important for determining factors influencing current salmon spawning distribution patterns. This information will be necessary for evaluating the potential for post-Project effects on distribution patterns, availability of spawning habitat, and access to spawning sites.

Specific Comments by Subsection:

AEA Study 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 and coho salmon in the lower Susitna River.

ESCAPE-24

The Service recommends that AEA provide additional detail in describing methods for selecting fish for tagging and how the tagging effort will be stratified throughout the migration/spawning season. Since fish wheel captures may not be representative of migrating populations (e.g., larger individuals may be less likely to be captured), we recommend that tagging efforts be non-random in order to selectively tag fish that are not equally represented.

ESCAPE-08

Additionally, it is unclear why only Chinook and coho salmon will be tagged in the lower Susitna River, whereas all five salmon species will be tagged at Curry Station (RM 103). There should to be justification for what appears to be unequal sampling and tagging efforts among species.

AEA Study Objective 2: Characterize the migration behavior and spawning locations of radiotagged fish in the lower, middle, and upper Susitna River.

ESCAPE-11

The methods proposed here will miss fish migrating to spawning sites within the Middle River that are downstream of the Curry Station (RM 103) sampling site. Whiskers Creek (RM 101.4) is a major spawning location for coho salmon, with some spawning by Chinook and chum salmon as well (Barrett et al. 1985), but this tributary will be missed or minimized due to the location of the tagging site 20 miles upstream. Thompson et al. (1986) found that only a portion of fish that spawned downstream of Curry reached this station during milling, and this proportion was directly related to the distance from Curry Station. The further downstream of Curry that spawning areas were located, the fewer fish from these lower river spawning areas were captured by the fish wheels at Curry. Chinook salmon spawn in three tributaries in the Middle River downstream of Curry Station (RM 103); coho salmon spawn in seven downstream tributaries; pink salmon spawn in seven downstream sloughs and 12 downstream tributaries; chum salmon spawn in five tributaries and 8 sloughs downstream; and sockeye salmon spawn in 7 sloughs downstream of Curry Station (Barrett et al. 1985). For Chinook, chum, and sockeye salmon, these sloughs and tributaries did not make up a substantial portion of their total escapement to the Middle River, but roughly 78% of the Middle River coho and 28.3% of pink salmon escapements to tributaries were downstream of Curry Station.

ESCAPE-34

There is no description of methods to test for effects of radio tagging on fish survival and behavior. Radio tags can potentially have lethal effects or non-lethal behavioral effects on tagged fish, which could lead to changes in speed or direction of movements (e.g., Yanusz et al. 2011, Keefer et al. 2010). A portion of fish above the radio-tagging goals will also be spaghetti-tagged, including all Chinook and coho captured. This less-intrusive tagging method is proposed to provide additional movement data beyond the radio-tagged fish movements, but it is not clear if it can be used to test the effects and accuracy of radio tagging efforts. Fish movements observed with both methods should be compared to make an assessment of radio tag effects. However, even spaghetti tags can be stressful to the fish, causing altered migration patterns due to stress (Thompson et al. 1986).

ESCAPE-06

ESCAPE-10

It is unclear why coho and Chinook salmon will be tagged more intensively than other species. It is mentioned that additional marking of sockeye and chum with spaghetti tags could be useful for this study. If these fish will be tagged to determine if fish wheel captures are random, then this needs to be described in a revised study plan. The number of tagged fish necessary to address these concerns needs to be identified to provide a clear objective.

The 1985 salmon escapement study found that fish captured and tagged at the fish wheels were non-random, and thus non-representative of the population (Thompson et al. 1986). Data were stratified for the escapement estimates at the Flathorn Station due to recapture of numbered tags, but estimates for the other stations did not have enough data for this approach. This can greatly bias escapement estimates to the Middle River. Thompson et al. (1986) suggests that length data be collected for individuals (as compared to a subsample of each days catch) to stratify by size groups because larger fish are less susceptible to fish wheel capture.

AEA Study Objective 3: Characterize adult salmon migration behavior and timing within and above Devils Canyon, and AEA Study Objective 4: If shown to be an effective sampling method during the 2012 study, and where feasible, use sonar to document salmon spawning locations in turbid water in 2013 and 2014.

Tiffan et al. (2004) described DIDSON as a useful tool for identifying fall Chinook salmon redds in the Columbia River, but stated that this method is unable to detect smaller redds and may mis-identify bottom features other than redds if the river bottom is not generally smooth. In that study, they were able to verify results with video, a method not feasible in the highly turbid Susitna River mainstem. The Columbia River mainstem and Susitna River, are very different, and may reduce the effectiveness of sonar surveys for spawning locations. Even when conditions are good, this method could miss large portions of present spawning populations. Additionally, it is not clear if this method can accurately provide results by species or simply give a count of total fish in an area. The study plan must define how DIDSON results will be verified for accuracy, and how this method be assessed for use in 2013 and 2014. If this method is determined ineffective, an alternative method should be proposed for sampling the turbid mainstem for spawning aggregations.

ESCAPE-28

AEA Study Objective 5: Compare historical and current data on run timing, distribution, relative abundance, and specific locations of spawning and holding salmon, and AEA Study Objective 6: Generate counts of adult Chinook salmon spawning in the Susitna River and its tributaries.

ESCAPE-22

It is unclear how the aerial counts conducted for this study will be used to obtain escapement numbers. The Service recommends that ground surveys or fish sampling methods be conducted to ground-truth these counts or to determine if sites were spawning or holding sites. Accuracy and precision of aerial counts varies with conditions, reducing counts in areas with high turbidity or depths or overhanging riparian vegetation. Additionally, smaller individuals, such as "jacks" are more difficult to see with aerial surveys, due to their size and lighter coloration (Neilson and Geen 1981). AEA does not provide sufficient justification regarding why this methodology has been developed to count Chinook salmon and not the other four species of Pacific salmon spawning throughout the Susitna River drainage.

AEA Study Objective 8: Estimate system-wide Chinook and coho salmon escapement to the Susitna River and the distribution of those fish among tributaries of the Susitna River.

ESCAPE-20

The methods described do not address this objective. There is no clear description of how many weirs will be operated for this study, or how locations for these weirs will be chosen. Looking at mark-recaptures in a few tributaries does not address distribution throughout the Susitna River and its tributaries. Observations, through weirs, foot surveys, or fish sampling methods should be conducted at more tributaries than this study describes. Additionally, no weirs are located within the Middle River. As this section of the river has the greater potential for impact by a hydroelectric project than the Lower River, it is important to know the distribution and escapement of salmon into these Middle River tributaries.

The Service recommends that AEA expand this objective to include all five species of salmon.

ESCAPE-16

To determine run apportionment, all macrohabitat types used for spawning (mainstem, tributaries, and sloughs) will also need to be included, not just select tributary counts.

ESCAPE-27

Capture methods for tagging, through fish wheels, may be non-random and disproportionally capture fish of certain sizes or from certain populations (Thompson et al. 1986).

Related USFWS/NMFS Study Objectives not addressed by the PSP

Measure critical habitat characteristics (e.g., channel type, flow, substrate, and groundwater) at reaches used for spawning and compare these characteristics with those in adjacent reaches that do not contain spawning adults.

ESCAPE-18

This study request objective is not addressed in the PSP nor is any objective that looks at characterizing use, availability, or quality of potential spawning habitats. There appears to be no empirical baseline information being collected; only semi-quantitative surveys to determine distribution and potential abundance of redds. Also, there is a reference to studies evaluating potential dewatering or scouring of redds in Section 6, but no empirical baseline information to assess the potential for daily load-following operations to cause redd dewatering or freezing. At recent TWG meetings, a habitat quality component was added in Section 6, but it is still unclear if or how areas without spawning will be characterized.

Determine the availability and accessibility of spawning habitats by adult salmon to mainstem and tributary locations based upon flow regime.

ESCAPE-14

It is unclear if this specific objective is being addressed anywhere in the PSP. It will be important to identify potential barriers to spawning habitats at current flow regimes and how access might change with a modified flow regime. Successful migration into tributaries can be strongly related to water levels at the mouths of the tributaries, with high rates of stranding mortalities in years of low water (Carlson and Quinn 2007). As the proposed flow regime is for increased base flows and increased fluctuating flows during winter months and reduced flows during summer months, when adult salmon are migrating and spawning, stranding mortality could become an important factor in spawning success. This concern needs to be addressed in the study plan. Flows necessary for salmon access into tributaries, sloughs, and side channels needs to be determined for each of the five species.

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7. Fish and Aquatic Resources

7.8. River Productivity Study

General Comments:

Although this Proposed Study Plan (PSP) has the same title as the U.S. Fish and Wildlife Service's (Service) 31 May 2012 study request, it does not adequately address river productivity as a whole but is primarily limited to addressing macroinvertebrates and algal abundance. Studies that document the variability in the sources of carbon and energy transfer to higher trophic levels are the most important for understanding fish distribution and production, and are most likely to be directly affected by project construction and operation. Within-stream primary production, organic matter from terrestrial plants, and adult salmon carcasses provide the food base for all aquatic life within the Susitna River. There is a substantial body of literature directed at understanding factors influencing primary productivity, the delivery, storage, and processing of organic matter, and the influence of carbon sources and production on macroinvertebrate community composition, production, and density.

Over the past 30 years, there has been an increasing number of studies documenting a shift in our understanding of fish distribution from one based solely on reducing energy costs (habitat based on water temperature, and velocity) and avoiding predation (proximity of cover), and competition, toward one that maximizes food intake while minimizing energy lost and the risk of predation (Dill and Fraser 1984, Fausch 1984, Dolloff 1987, Duncan et al. 1989, Adams and Breck 1990). In some cases the abundance of macroinvertebrate drift alone has explained the distribution and growth of salmonids (Lovetang 2005, Urabe et al. 2010). Food availability can affect the depths and velocities selected by drift-feeding fish which has implications toward the validity of habitat suitability indices based on these parameters (Rosenfeld et al. 2005, Rosenfeld and Taylor 2009).

Primary productivity, benthic organic matter, and macroinvertebrate abundance can be modified by hydroelectric development and, therefore, should be addressed by Alaska Energy Authority (AEA) as part of the Federal Energy Regulatory Commission (FERC) license application. Suspended sediment can limit light available for primary production (Davis-Colley et al. 1992, Lloyd et al. 1987) particularly in turbid glacial rivers (LaPerriere et al. 1989, Davis et al. 2009). Sediment storage within a reservoir can reduce turbidity and increase primary productivity immediately downstream (Blinn et al. 1998); however, even in clear water, nutrients can be lost within the reservoir through biotic uptake or adsorbed to sediment and deposition thereby limiting downstream productivity (Snyder and Minshall 1995). Primary productivity can vary with changes in water depth (Bensen et al. 2012) or be reduced due to varial zone flow fluctuations (Binn et al. 1998). Transported organic matter is retained within reservoirs reducing downstream carbon availability (see below) and transport and storage can be further affected by flow modifications. The macroinvertebrate community can be altered due to modifications in food sources or food availability or directly through changes in flow and habitat modification.

Primary productivity and benthic organic matter provide the energy base for stream ecosystems. Macroinvertebrates transfer energy from autotrophs or heterotrophs to higher fish and other secondary consumers. Macroinvertebrate drift densities play a large role in fish habitat selection and production and can modify the use different water velocities and depths. Hydroelectric development can directly or indirectly modify productivity rates, organic matter input and storage, and macroinvertebrate production (Gislason 1985), particularly in a glacial system where suspended sediment plays such a large role in species distribution and abundance. If we are to make informed decisions regarding this proposed project, understanding these relationships should be a priority.

Specific Comments by Subsection:

AEA Study Objective 1: Synthesize existing literature on the impacts of hydropower development and operations (including temperature and turbidity) on benthic macroinvertebrate and algal communities.

RIVPRO-18

This objective should include a literature review and annotated bibliographies of hydropower development and operation on benthic and transported organic matter, and ecosystem productivity, not just algal biomass. The study plan should outline the steps that will be used to accomplish this task (i.e., data base searches, key words, resulting product). The literature review should result in annotated bibliographies. All data bases searched and key words should be listed. The bibliography should contain the author's abstract as well as AEAs interpretation of the study relative to the proposed project. Electronic copies of all publications should be provided along with the annotated bibliography. The AEA synthesis should identify all potential project effects and show how AEAs study plans have been developed to adequately evaluate and monitor these potential Project effects on the Susitna River.

AEA Study Objective 2: Characterize the pre-project benthic macroinvertebrate and algal communities with regard to species composition and abundance in the lower, middle and upper Susitna River.

As stated in the PSP and above, ecosystem productivity from autochthonous or allochthonous derived organic matter, along with import of marine nutrients, provides the energy sources for the productivity of all other upper trophic levels. Macroinvertebrates transfer energy from primary producers or heterotrophic communities to fish and other secondary consumers. Variability in macroinvertebrate abundance in the drift can be directly linked to the distribution and production of drift-feeding fishes. In addition, macroinvertebrate community composition on the benthos or in drift has been used to evaluate changes in water quality, biotic communities, and physical habitats.

Measures of macroinvertebrate emergence timing and biomass among macrohabitat locations have been suggested by AEA as an additional project objective. As invertebrate development and emergence is influenced by water temperature and emergence and survival of juvenile fry are linked to this food source, this appears to be a useful addition to this study sections. More information will need to be provided on insect emergence sampling methods, design, and data analyses.

Sampling Locations

The PSP states that benthic and algal samples will be collected at 9 mainstem and 18 off channel habitats above and below the proposed dam site, stratified by geomorphic reach and macro-habitat classification, side channel, side slough, upland slough, tributary, and tributary mouth [study plan only identifies mainstem, side channels, and sloughs]. Six replicates will be collected at each sampling location, and samples will be collected on three sampling dates from April through September. "Woody snags" would be removed from the stream and invertebrates collected from the snags and identified. Measures of depth, water velocity, turbidity, and substrate would be collected at all algal sampling locations. Samples would be collected on three sampling events for two years.

RIVPRO-19

Sampling locations should be selected to obtain replicate measures documenting the range of project effects among main channel and off-channel locations and in order to evaluate the influence of macroinvertebrate and algal abundance on fish distribution and production. The PSP has located 3 of the proposed 9 mainstem sampling locations within and just above the inundation zone. Project effects are likely to be greatest within the tributaries above the inundation zone, where current resident fish populations will be concentrated into a smaller area potentially exceeding production capacity. In addition, these streams will be providing a large portion of the food resources to the fish community likely to develop within the reservoir. Determining the area and quality of remaining stream habitat following project construction is an important project objective. Quantifying macroinvertebrate and algal production and invertebrate drift relative to the abundance of resident fish in tributaries above the inundation zone should be an additional objective and the site of Upper River sampling locations.

RIVPRO-20

Three of the remaining mainstem sites are located below the dam site, but above Devils Canyon. The purpose for selecting these locations is unclear, although likely to characterize distinct geomorphic reaches. Project effects likely will be greatest within these reaches, but they do not overlap with known fish distribution. We agree that documenting changes in the biotic community immediately below the dam is an important objective; however, the PSP should expand upon the reasons sites were selected within this reach, and how these sites be used to determine mainstem and off-channel effects. The PSP should identify the number of sites and replicates that are needed for the statistical design and how the analyses will be conducted.

RIVPRO-21

Most resident and anadromous fish spawning and rearing locations and the areas for greatest potential project impacts are between Portage Creek and the three-rivers confluence near Talkeetna. However, AES has identified only one mainstem and two associated off-channel sampling locations to “characterize” the macroinvertebrate and algal communities within this ~60 miles of river. The Service recommends sampling locations be selected in proportion to the distribution of main channel and off-channel habitats and micro-habitats within these areas. Sampling locations should be selected so that they can be used to evaluate Project effects and fish distribution and abundance, and growth rates. Sampling locations should be located above and below major tributaries to evaluate tributary influence on local invertebrate communities and their contribution to total invertebrate drift. We recommend a minimum of 10 mainstem sampling sites between the Indian River and Talkeetna. Additional mainstem sampling sites should be selected to replicate the meso- and microhabitat within the main channel. These meso- and microhabitats should represent differences in substrate (woody debris, boulder/cobble, cobble/gravel, sand/silt), proximity to vegetated banks, point bars, and velocities. Extrapolation of habitat values to upper classification levels will require sampling relative to, or quantification of, the abundance of these habitat characteristics within each macro-habitat.

RIVPRO-22

A similar thought process should be applied to the selection of sites to adequately characterize off-channel habitats. The PSP is currently classifying 4 different off-channel habitats: tributaries, tributary mouths, side sloughs, and upland sloughs. However, there is considerable differences in the productivity among sites of the same classification (i.e. the relative contribution of invertebrate drift to the main channel from the Indian River compared to Whiskers Creek likely is large). Obtaining 3 replicates of these off-channel sites would result in 12 off-channel sampling locations and a minimum of 5 replicates is recommended. Replicate sampling within these locations to document differences in invertebrate abundance among different meso-habitats including variations in flow, substrate, depth, and velocity, and macrophytes beds, all of which can be modified by Project operation (e.g., flushing flows), would require additional sampling effort.

RIVPRO-23 Algal sampling locations within the Middle River, including meso- and microhabitats should be selected independent of macroinvertebrates, as algae respond to different environmental variables and project effects will vary. However, results should be able to provide information that can be used to evaluate macroinvertebrate and fish distribution as a function of algal abundance, and sampling locations may overlap. Algal growth will vary with differences in light availability (turbidity), water velocity, and nutrient concentrations. Algal biomass likely will vary considerable between tributaries, the main channel, and clear off-channel habitats. Nutrient concentrations could be very different below sloughs and tributaries compared to upstream locations, and nutrients and light can vary within a slough as turbid mainstem water levels increase and decrease with stage height.

RIVPRO-24

RIVPRO-25 In order to calculate the production potential within sampling locations, samples also must be stratified by meso- and microhabitats. For example, collection of algal samples only on cobbles within Slough 8A would overestimate the productivity of that location. Samples will need to be collected on different substrate types and then the relative abundance of those habitat types determined in order to estimate production potential for that location. This goes beyond measuring water depth, velocity, and substrate at sampling locations, but requires selecting sampling locations based upon the distribution of water velocities, depths, and substrates. Similarly, Slough 6A (below the beaver dam) more closely resembles a small lake, and phytoplankton (and zooplankton) may explain the apparent high productivity and quality of fish habitat at that location. Measures of ecosystem metabolism may be a simpler and more direct approach (Young et al. 2008) and should be considered as a method to measure differences in productivity.

RIVPRO-26 Many of the concerns addressed previously apply to site selection in the Lower River below the three-rivers confluence. Sampling to explain fish habitat distribution should consider previous comments. However, an important Lower River objective is to determine the current and post-Project contribution of Benthic Organic Matter (BOM) and invertebrate drift to Lower River sites. Current and post-Project productivity could be much different in the Susitna River than in the Chulitna River due to differences in channel form, substrate, nutrient concentrations, temperature, and turbidity. Therefore, current and post-Project changes in organic matter and invertebrate drift to the Lower River could extend Project effects downstream. The Service recommends a sampling plan be developed around this objective, which will require sampling locations in the Chulitna and Talkeetna Rivers as well as Susitna River sites below the confluence.

Sample Timing and Frequency

Benthic macroinvertebrate sampling for monitoring purposes is generally conducted in early spring prior to emergence and in late fall to allow for summer growth. Summer sampling will be used to estimate differences in food availability among locations, which is important for understanding the distribution of juvenile bottom-feeding resident fish (e.g. burbot and longnose suckers). Additional sampling would be necessary to measure secondary production or to determine if there are multiple cohorts in a season. Sample collection frequency should document potential project effects, particularly changes in flow and temperature. Sampling prior to and following storm events could be used to evaluate the response of the community to the flow regime.

RIVPRO-27

Algal sample timing and frequency should be developed to evaluate changes relative to parameters that influence growth. The availability of solar energy and nutrients is greater in early spring. Turbidity is lower during the early spring, increasing with the contribution of glacial flow. Solar input is greater prior to leaf-out and nutrient concentrations often are higher due to reduced uptake by terrestrial vegetation. The Service recommends that algal sample timing begin in early spring with frequent sample collection in order to measure the change in biomass relative to changing solar radiation, turbidity, and nutrient concentrations. This information will be important for the evaluation of post-Project effects as project construction likely will alter all three of these variables. Water depth and storm flows are the other two variables that can influence algal sloughing and production, and should be accounted for when selecting sample timing and frequency. Sample locations at multiple depths across the channel could be used to estimate changes in algal biomass due to seasonal or project-related changes in water depth. Algal biomass will vary considerably before and after flushing flows, so samples must be collected prior to and following storm events. Reduced turbidity in the late fall may also provide a brief period of algal production. The Service recommends that algal sampling be collected in the fall to document this period of potential increased production. As an alternative, AEA should consider seasonal measures of ecosystem metabolism that integrate the effects of multiple different parameters influencing algal productivity.

Sampling Methods
The PSP states that benthic macroinvertebrates will be collected from riffles within each macrohabitat unit. Samples will be collected with a Hess, Surber, or Slack sampler. Six replicates will be collected at each sampling location.

RIVPRO-28, 60

The Service does not agree that sample collection of riffle habitats only is adequate. As stated previously, this represents only one meso-habitat and will bias characterization of invertebrate communities. In addition, most of the locations referenced do not contain riffles to sample.

RIVPRO-29, 61

Sampling methods should be used that are quantitative and appropriate for fine and coarse substrates. Alaska Stream Condition Index (ASCI) methods (Major and Barbour 2001) are based upon a composite of 20 samples collected in proportion to habitat availability (including woody debris, roots, and macrophytes beds) using a “D” frame kick net. Mesh size is important as the community is made up of many small organisms (~300 μm mesh is standard). This methodology; however, does not allow for determining invertebrate density which is an important metric. One possibility would be supplementing benthic samples using a Hess sampler with qualitative samples of unique habitats. Multiple samples at one sampling site should not be considered replicates of that habitat type, but metric means calculated (or samples composited) to obtain one value for that site, unless they are replicating mesohabitats within a site. Field sorting of macroinvertebrates is not recommended. Any proposed sub-sampling method should be included in the study plan.

RIVPRO-30, 62

The PSP does not provide any details on algal sample collection methods or sample handling and processing. Stating that methods will follow unspecified state protocols and a list of citations is not sufficient for evaluating the proposed PSP methodology. The methods should describe how samples will be collected from the multiple different available substrates, including:

- Sample substrate must be based upon predetermined criteria;

- Determine whether entire substrate be cleared of algae or a portion of the substrate delineated for sampling;
- Define measurements for the area to be sampled;
- Address duplicate sampling from the same substrate to allow for species identification, AFDM, and chlorophyll-*a* analyses;
- Describe field sample be preservation methodologies, i.e., avoid degrading chlorophyll-*a*;
- Describe replicate sampling representative of each site and each meso-habitat within each site;
- Provide procedures that will address patchy distribution of algae within a macro-habitat;
- Describe procedures for laboratory sub-sampling occurring prior to algal species identification.

AEA Study Objective 3: Estimate drift of benthic macroinvertebrates in habitats within the lower, middle and upper Susitna River to assess food availability to juvenile and resident fishes.

A large number of studies have shown the importance of macroinvertebrate drift in explaining the distribution, abundance, and growth of drift-feeding fishes including most salmonids. Project operations including direct effects of variable flows and indirect effects on primary production and organic matter storage can influence invertebrate drift density. Therefore, understanding the relationship between Project operations, drifting invertebrates, and fish distribution is an important project objective.

RIVPRO-31

The AEA study objective, to “estimate” drift of benthic macroinvertebrates, does not reflect the importance of this topic in understanding project effects to the biotic community. Sampling locations, timing and frequency should be selected to quantify differences in drift among habitats and be used to evaluate seasonal and spatial fish distributions and differences in potential project effects. We believe that documenting invertebrate drift in tributaries above the inundation zone may be important to evaluate food available to the resident and anadromous fish remaining in these reaches and as a contribution to the reservoir.

Sampling Locations

RIVPRO-32

A single sampling location for invertebrate drift between Devils Canyon and Talkeetna will be inadequate for accomplishing study plan objectives. Invertebrate drift sampling locations should be adjusted to coincide with juvenile and resident fish sampling. Mainstem sampling locations should be located above, within, and below major tributaries. These sampling locations will be used to document the contribution of tributaries to mainstem drift and to determine if food availability is related to rearing-fish abundance at these locations. Macroinvertebrate drift (or plankton tows) should be replicated at all macro habitat locations concurrent with fish sampling. Replicate samples should be collected within each macro-habitat; however, drift abundance does not likely vary with the same meso-habitat characteristics that influence benthic macroinvertebrate distribution. Terrestrial invertebrates in the drift likely vary with proximity to riparian vegetation and must be considered when sampling locations are selected (Johansen et al. 2005). Macroinvertebrate drift should be measured in the Chulitna and Talkeetna Rivers near the confluence to determine the relative contribution of the Susitna River to downstream food resources.

Sample Timing and Frequency

RIVPRO-33

Drift sample timing and frequency should be based upon life history and habitat use of drift-feeding fish and to evaluate potential Project effects. For example, AEA should evaluate drift density during sockeye fry migration from spawning locations to summer rearing habitats. Tributary drift should be measured to account for relative productivity among sites during summer and to determine if changes coincide with late summer Chinook and coho salmon migrations. Invertebrate drift should be used to document summer rearing and overwintering habitat quality for juvenile salmonids. Sample collection should occur in the early morning and evening to document densities during peak fish feeding activity.

RIVPRO-34

Drift sampling should be conducted in a manner to inform potential Project effects. Variations in flows and flows that breach the upper end of side sloughs alter macroinvertebrate drift densities. Flood flows may capture many terrestrial insects and result in increases in invertebrate drift. The PSP should reflect a review of relevant literature to determine other potential Project effects on invertebrate drift and incorporate this information into the study design.

RIVPRO-35

Sampling Methods

Methodologies for macroinvertebrate drift sample collection, preservation, and processing should be fully described in the study plan. Mesh size, area of sampler, and sample depth (surface and depth) can influence the composition of drift. Mesh size should be fine enough to capture *Chironomids* and early instars of other taxa. Mesh size of approximately 300 µm is recommended. Due to the high concentration of fines within the mainstem, drift nets could clog within minutes resulting in the loss of samples. Therefore, samplers should be monitored during sample collection. Multiple samples may need to be collected in order to get an accurate measure of drift abundance (portion of day sample represents). Measures of water velocity when installing and removing the nets (along with the area of the net opening) will not provide an accurate measure of the volume of water flowing through the net as changes in velocity during this time may not be linear; the use of flow meters (e.g., General Oceanics) within the net opening that document total flow would provide greater accuracy.

RIVPRO-36

Stream water turbidity and inorganic suspended sediment should be measured concurrent with fish and drift sampling. Changes in visibility caused by sediment can reduce fish capture efficiency and should be accounted for in analyses relating fish distribution with invertebrate drift abundance among macro-habitat types.

RIVPRO-37

The methods for sample storage, preservation, sorting, and identification should be fully described. Drift samples should not be subsampled for identification. Weight and length/weight relationships should be obtained for all taxa and instars so that the biomass of drift can be calculated. Invertebrate biomass data will be necessary for analyses of fish feeding studies and trophic analyses if mass-balance methods are used.

RIVPRO-38

Data Analyses

The PSP does not provide sufficient information on drift data analysis, statistical design, or use of the data to assess differences in fish distribution and production or in evaluation of potential Project effects.

AEA Study Objective 4: Conduct a literature/data search to identify existing river systems that could act as surrogates in evaluating future changes to productivity in the Susitna River.

RIVPRO-39

The Service recommends that sampling locations, including replicate macro and micro-habitat types, be identified on the Talkeetna River and be used to provide reference data for post-

Project evaluation. AEA should develop a study plan for post-Project monitoring that includes an assessment of Susitna River productivity.

AEA Study Objective 5: Conduct a review on the feasibility of a trophic analysis to describe potential changes in the primary and secondary productivity of the riverine community following Project construction and operation;

Hydroelectric facilities have the potential to reduce the carbon food base which effect fish production. Dam effects to the organic matter base have been found to be responsible for the decline in Kootenai River sturgeon (Perry and Perry 1991, Snyder and Minshall 2005) and in productivity in the Colorado River (Minkley 1991, Blinn et al. 1999). Pre- and post-Project trophic analyses would provide a method to evaluate potential Project effects to the Susitna River. We believe that a thorough review prior to developing monitoring plans would be beneficial. All of the information requested under Study Objective 1, should be provided as a product of this review.

RIVPRO-40

AEA Study Objective 6: Generate habitat suitability criteria (HSC) for Susitna River benthic macroinvertebrate and algal habitats to predict potential changes in these habitats downstream of the proposed dam site.

RIVPRO-41

The Service believes that the PSP does not provide enough information to evaluate whether the stated objective will be met. The PSP states that habitat suitability criteria would be determined concurrent with macroinvertebrate and algal sampling at the 27 sampling locations above and below the dam stratified by macrohabitat type and collected three times from April to September. HSC would be determined from measures of water velocity, substrate, and depth concurrent with macroinvertebrate and algal sampling.

As stated previously, the level of effort (sampling locations, replication among macro and meso-habitats, and sampling frequency) described within the PSP is insufficient to provide an adequate HSC. The sampling plan needs to be more developed to evaluate the response of the macroinvertebrate community to changes in these three parameters and to include, and control for, the numerous other parameters that influence invertebrate community composition, richness, or diversity.

Macroinvertebrate communities are composed of multiple different species that occupy areas of variable velocity and depth. Within the Susitna River, tolerance for highly turbid waters or differences in dissolved oxygen could result in shifts in macroinvertebrate habitat preferences. Diet preferences of target fish in the Susitna River should be used to determine macroinvertebrate species for HSC in order to determine changes to food availability for fish. Macroinvertebrates in the diet of burbot and longnose suckers and juvenile whitefish are likely much different than those selected by drift-feeding fishes. The portion of terrestrial invertebrates also will vary among drift-feeding fishes (e.g., juvenile sockeye salmon versus Dolly Varden).

HSC for fish are generally not transferable among stream locations (Persinger 2003, Guay et al. 2001) and this generalization is likely true for macroinvertebrates as well, particularly when there are large differences in physical and chemical stream characteristics. The HSC objective should be modified to define the purpose for HSC development in relation to macroinvertebrates and algae, and provide methods on field site selection, sampling timing and frequency that will be used to meet this objective. Water velocity at 0.6 x water depth is unrelated to the velocity, sheer stress, and boundary conditions experienced by macroinvertebrates. Therefore, methods to measure velocity at scales applicable to organisms under investigation should be established. Alternately, Froude number or sheer stress could be used to represent stream bed flow conditions

AEA Study Objective 7: Characterize the benthic macroinvertebrate compositions in the diets of representative fish species in relationship to their source (benthic or drift component).

RIVPRO-42

This study objective differs from the Service's study objective to: *"Characterize trophic interactions using seasonal diets (stomach content analysis) of all age classes of non-salmon anadromous, resident and invasive fish species."*

The importance of this objective is to determine the food resources used by fish within the Susitna River. The Service recommends that the study plan methodology select sampling locations based upon the objective rather than in association with sampling conducted to meet other objectives. Target fish species and life stages should first be identified. These should include all age-classes of non-salmon anadromous, resident, and invasive fish species as proposed by the Service. Fish sampling locations should represent the macrohabitats used by the target fish species and life stage. An appropriate sample size should be determined *a priori*. Sampling methods for each species and life stage should be identified, along with sample handling, preservation, and analyses. Invertebrate weight data should be used to determine biomass in addition to numbers of each species consumed. The analytical methods should be described as well as how the results will be applied to evaluating potential Project effects.

AEA Study Objective 8: Characterize organic matter resources (e.g., available for macroinvertebrate consumers) including course particulate organic matter, fine particulate organic matter, and suspended organic matter in the lower, middle, and upper Susitna River.

Benthic organic matter is likely the most important source of carbon within the Susitna River. Bacterial colonization increases the nutrient content and quality of BOM and initiates decomposition thereby facilitating macroinvertebrate ingestion and metabolism. Construction and operation of hydroelectric facilities can influence the transportation, storage, and processing of BOM through multiple different pathways.

RIVPRO-43

A partial review of the literature raises a number of questions that should be addressed through studies being developed and implemented in support the FERC license application.

1. What is the current change in concentrations of BOM in the mainstem from the dam site to the confluence?
2. Are there significant differences in BOM among and within macro-habitat sites and is this related to the adjacent plant community?
3. How does the magnitude of overtopping flows affect BOM storage within side channels and side sloughs or the flushing of organic matter?
4. How important are beaver and woody debris dams on the retention of organic matter in side channels, side sloughs, and upland sloughs?
5. How will variable ramping rates influence the transport (flushing) of organic matter from upland and side-sloughs?
6. Is there a relationship between BOM, macroinvertebrates density, and rearing juvenile fish abundance or distribution?

7. How does the variation in water temperatures and water chemistry among macro-habitats influence BOM decomposition rates? Will these rates change with different plant species?
8. Could high concentrations of BOM result in anaerobic conditions in sloughs during winter?
9. How important are flood flows for the accrual of BOM relative to other lateral inputs and the total carbon budget?
10. What role do tributaries play in the delivery of organic matter to the Susitna River?

The PSP states that in order to quantify the amounts of organic matter available in the Susitna River for river productivity, Coarse Particulate Organic Matter (CPOM) to Fine Particulate Organic Matter (FPOM) (specifically FBOM) will be collected concurrently with all benthic macroinvertebrate sampling (Objective 2, Section 7.8.4.2.1). Suspended FPOM (Seston) [27 locations 3 times from April through September] will be collected at same time and alongside invertebrate drift sampling (Objective 3, Section 7.8.4.3). Organic matter collection will be conducted using methods compatible with other Alaska studies, to allow for comparable results. State and federal protocols will be considered as study plans are developed, in consultation with resource agencies.

While perhaps not all of the list of questions raised in regard to BOM can be addressed, it is unclear how the PSP will address any of them. The purposes for BOM sampling are not clear, nor are the reasons behind the selection of sampling locations, sample timing, or sampling frequency. Sample collection methods and analyses are not provided and there is no discussion on how the resulting data would be used to evaluate Project effects.

RIVPRO-44

Many of these questions regarding Project-effects could be addressed through careful site selection, sample timing and frequency. Sample sites located in the mainstem above and below major tributaries and within those tributaries could evaluate mainstem longitudinal changes and, along with measures of Transported Organic Matter (TOM) and tributary discharge, the role of tributaries in the organic matter budget. Replicate seasonal samples within each macro-habitat and at replicate macro-habitat locations could be used to test for significant differences among sites and between seasons. BOM and TOM sample collection at select sites prior to and following storm events along with data from flow routing studies (over topping flows) and geomorphology studies (bed sheer stress) could be used to test for flow-effects on organic matter retention in sloughs. Sites with and without beaver dams and quantification of debris dams could help identify the influence of these structures on organic matter retention. TOM sampling at the mouth of upland sloughs following storms could be used to estimate the effects of ramping rates on BOM flushing.

The use of leaf packs to measure organic matter processing at sloughs is a standard method (Young et al. 2008) that could be used to evaluate influences of temperature and nutrient concentrations on food processing. Alternately, measures of ecosystem respiration relative to BOM standing stocks and TOM could be used to assess organic matter processing and carbon spiraling lengths (Thomas et al. 2005).

BOM and TOM collection methods need to be described. The methods should identify the number of replicate samples at each site. Mesh sizes (Ultrafine Particulate Organic Matter (UPOM), FPOM, and CPOM) and whether nets will be nested should be clarified. The methods should state whether benthic samples will be open to transported material during sample collection. Methods should describe the depth the substrate will be disturbed and how sample loss will be avoided in cobble and boulder substrate. Methods for collecting samples in fine substrate without measureable velocity should be provided. Organic matter deposition can be patchy, so the process for selecting a site to place the sampler or to deal with unequal distribution of organic matter within a habitat should be explained. How samples will be preserved, stored, processed, and analyzed should be described.

AEA Study Objective 9: Estimate benthic macroinvertebrate colonization rates in the middle and lower reaches to monitor baseline conditions and evaluate future changes to productivity in the Susitna River.

Project operations will modify the daily and seasonal hydrograph. Flow fluctuations will be greatest during winter periods of load-following. Dewatering of substrates can result in the loss or reduction of macroinvertebrate density (Perry and Perry 1986, Hunter et al. 1992). The effects of flow fluctuations will vary with differences in channel morphology. Determining colonization rates is an important objective and colonization time lags have been incorporated into instream flow analyses (Hardy and Addley 2003).

Using a stratified sampling approach, a field study proposed to be conducted by AEA will estimate potential benthic macroinvertebrate colonization rates for different seasons in the Susitna River. Sets of three to five preconditioned artificial substrates will be deployed incrementally for set periods of colonization time (e.g., 12, 8, 6, 4, 2, and 1 weeks) and then pulled simultaneously at the conclusion of the colonization period. Artificial substrates will be deployed at three depths at fixed sites along the channel bed. Benthic macroinvertebrate colonization rates may be conducted in a variety of habitats (e.g., turbid vs. non-turbid areas, groundwater upwelling areas vs. areas without groundwater upwelling). Benthic macroinvertebrate processing protocols would be identical to those used in sampling.

RIVPRO-45

The study plan currently does not provide enough information to determine how proposed methods would allow for “monitoring baseline conditions” or “changes in productivity.” While the overall approach appears sound, site selection and the disturbance regime should more closely resemble potential Project effects. The effects of dewatering and recolonization will be much greater during the winter when load following is proposed. Short-term exposure to temperatures well below freezing may result in macroinvertebrate mortality. Effects will vary by species and frequency and duration of exposure. Exposure duration may not mimic currently operational flows that may dewater a site twice a day throughout the winter. Project effects and varial zone area will change with distance from the dam and channel geomorphology. Therefore, sampling locations should be selected to evaluate different levels of potential Project effects.

RIVPRO-46

Unaddressed Service objective

An additional benthic resource that the PSP does not yet address is the primary food source, *Macoma balthica*, of overwintering Rock Sandpipers in the Susitna River Flats. While most shorebirds migrate outside of Alaska for the winter, the intertidal habitats of Upper Cook Inlet, and chief among them the Susitna River Flats area, support virtually the entire population (ca. 25,000 birds) of the nominate race of the Rock Sandpiper (*Calidris ptilocnemis ptilocnemis*) during the winter (Gill et al. 2002). Because of its highly restricted distribution (breeding and wintering), this subspecies is listed as a species of high conservation concern in both the U.S. Shorebird Conservation Plan (Brown et al. 2001) and the Alaska Shorebird Conservation Plan (Alaska Shorebird Group 2008), and is one of only three ‘red list’ North American shorebird species of global conservation concern in the National Audubon Society’s Watchlist program

(Butcher et al. 2007). It is also listed as a Bird of Conservation Concern by the Service (U.S. Fish and Wildlife Service 2008).

The food supply that supports this unusual overwintering population is the bivalve *Macoma balthica*. Gill and Tibbitts (1999) suggest that these birds prefer the Susitna River Flats because of the overall high densities of clams, with tidal currents in this part of the Inlet affecting benthic community productivity through ice scour. They have found densities of 2,000-3,000 clams per square meter in the area. Any Project operations that were to adversely impact this population of bivalves, whether via changes in sedimentation patterns or other effects, could have substantial adverse impacts on this important migratory bird population. Therefore, it is an important objective of the Service's to study potential Project impacts to the *Macoma balthica* population of the Susitna River Flats.

The Service recommends that AEA develop a study plan to:

- survey *Macoma balthica* in the Susitna River Flats,
- better understand the factors influencing their abundance, distribution, and availability for overwintering shorebirds (e.g., ice, wind, and tidal conditions), and
- determine how Project operations may affect their abundance and distribution.

To aid in this, we suggest consultating with local Rock Sandpiper experts including Bob Gill and Dan Ruthrauff of the U.S. Geological Survey's Alaska Science Center, and literature reviews of potential impacts of hydro-electric dam operations on downstream populations of *Macoma balthica.*

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7. Fish and Aquatic Resources

7.9. Characterization of Aquatic Habitats in the Susitna River with Potential to be Affected by the Susitna Watana Project

General Comments:

The goal of this Alaska Energy Authority (AEA) proposed study plan (PSP) is to *"characterize all aquatic habitats with the potential to be altered and/or lost as the result of reservoir filling, hydropower operations, and associated changes in flow, water surface elevation, sediment regime, and temperature"* for the Susitna Watana Hydroelectric Project (Project). Due to the size of the study area, the PSP proposes to use different data collection methods at different locations, based upon the degree of potential impact and hence, differences in data quality. Study objectives subdivide the study area into mainstem and tributary habitat in the middle and the lower river (River Mile (RM) 28), the reservoir inundation zone, and the upper river tributary and lakes upstream from the dam site to the Oshetna River currently accessible to fish or that will be accessible from the reservoir.

AQHAB-04

In general, the U.S. Fish and Wildlife Serve (Service) is concerned with AEA's approach of using geomorphic and hydrologic classifications as a means of defining "fish habitat". Although the Service is not opposed to the geomorphic and hydrologic classification of the Susitna River and its tributaries, it should be clear that the relationship between these classification types and the distribution or abundance of any fish species has not been established. For example, classification of a site as a side slough does not imply that these sites provide unique fish habitat characteristics. It should be clear that the classification of these sites is based upon the degree of connection to the main channel. This will have some effect on fish habitat characteristics within this classification type, but by no means defines fish habitat and should not be referred to as a "habitat classification".

Initial habitat classifications have been based upon descriptions developed previously by the Alaska Department of Fish and Game (ADF&G) including main channel, side channel, off-channel, tributary mouth, and tributary (in AEA Table 7.9.1, but not in Figure 7.9.10). Off-channels would be further classified as side sloughs, upland sloughs, and other off-channel types in Figure 7.9.10, but subdivided differently in the Table, with three types of "other off-channel types" listed.

The difference and importance of differentiating between main channel and side channel is not defined, but is presumed to be due to the portion of flow in each. Similarly, the differences between side sloughs, upland sloughs, and other off-channel habitat are not defined, but may be retaining the initial ADF&G system and be based upon a connection to the main channel at a defined flow or stage. To this point, the classification is based upon differences in geomorphic and hydrologic process and to some extent water quality (portion of main channel turbid flow). All of these locations provide habitat for different fish species and life stages, and should not be used as a "habitat" classification for any given species. Fish distribution at this scale is likely more related to different levels of tolerance to turbid water, which varies among these locations but also seasonally within the main channel. Upper River tributaries are not further classified geomorphically based on slopes, confinement, width/depth, or substrate (*sensu* Rosgen 1994) or by stream order or link (Strahler 1957).

AQHAB-05 The next level of classification is defined as "meso-habitat" and the PSP argues that meso-habitat classification is important because, *"it is at this level that fish selectively use different habitats to support different life stages and functions,"* and it is at this level that Project effects will be evaluated. The PSP further splits the classification is into fast versus slow water. Fast water includes riffles and runs, and slow water includes pools, which are further subdivided. There is no indication that this classification based on water velocity is related to fish habitat selection. This classification of flow types may be applicable to Upper River tributaries, but is not applicable to most of the other classifications. That is, it is not applicable to classify main-channels, side channels, tributary mouths, or upland sloughs into riffles runs or pools. Classification to this level is likely unrelated to "mesohabitats" selected by fish within the Susitna River.

AQHAB-06 The Service recommends AEA develop a series of definitions for river habitat classifications (geomorphic, hydrologic, and fish-related) that will be used consistently within and across all individual studies throughout the PSP. The classification approach outlined in this PSP is considered totally different from meso- and microhabitat classification to be used in the instream flow analyses. The distribution of meso- and microhabitats used in instream flow analyses and developed from fish-habitat relationships is described in our comments on the Instream Flow Study Plan. Since the distribution of meso- and microhabitats is unrelated to AEA's proposed geomorphic classification type (i.e., main channel, side-slough, upland slough, etc.), measures of microhabitat or Weighted Useable Area (WUA) within a geomorphic type cannot be extrapolated to represent all similar geomorphic classification types and summed to obtain a value for the Middle River. Thus, the proposed classification is unrelated to environmental variables relevant to fish distribution and habitat site-selection.

AQHAB-07 Although aerial video may be useful for habitat mapping, the scale of delineation must be described in order to determine its usefulness in conjunction with ground surveys. The frequency and number of sites surveyed on the ground will also be determined by the objective's definition of scale.

AQHAB-08 The remote imagery will only be used to cover the mainstem channel and larger tributaries. It is unclear whether an attempt will be made to cover sloughs and side-channels off the mainstem with remote imagery even if there is sufficient open canopy. In addition ground surveys in the upper reach will only be conducted on the mainstem and tributaries. It is again unclear what is meant by mainstem, does this include sloughs and side-channels in the Upper River? The accuracy and statistical significance of the data collected for habitat mapping would be compromised if some habitats are missed due to the inability of aerial imaging to capture them.

AQHAB-09 Ground surveys will be an important supplement to aerial video mapping. Not only will ground surveys provide data for habitats unidentifiable by aerial video mapping (due to vegetative cover) but they will also be useful in evaluating video mapping accuracy. Although it is mentioned in the methodology that a subset of sites will be used to refine video mapping and verify its accuracy, a standard of accuracy is not specified. A standard of accuracy must be set before initiation of sampling that determines the amount of ground-truthing data that must be collected. Ground-truthing must also be conducted during a similar flow as when the video was obtained or else it may show more inaccuracies than actually exist.

AQHAB-10 It is most concerning that the video mapping data will only be collected in mid to late September when flows are expected to be low and waters relatively clear. Although these conditions may be the best for image quality (lack of vegetative cover), sampling only during these conditions will alter the classification results. Inundated habitats that are only present during high flow would not be properly classified. A classification scheme should be designed to be flow independent and have sampling that occurs at both high and low flows. This is especially important if these data are to be combined with data from other studies to assess project effects on aquatic habitat.

Specific Comments by Subsection:

AEA Study Objective 1: Characterize the existing upper mainstem Susitna River and tributary habitat within the proposed inundation zone.

AQHAB-11 AEA's purpose in applying this classification method to Upper river tributaries and mainstem locations within the inundation zone is unclear. Once fish-habitat associations are understood, it will be important to map the distribution of those habitats to determine the percent of total available habitat lost due to the impoundment. However, this may be at a larger scale. The proportional distribution of fish habitat for different life stages within or out of the inundation zone would be more important, as this is the scale of impact, as opposed to impacts that may modify reach-level habitat characteristic (i.e., pools/riffles, undercut banks, w:d ratios, LWD, etc.)

The objective only addresses the mainstem and tributaries of the upper reach. It is unclear whether off-channel habitats will be further characterized by aerial methods as side sloughs, upland sloughs, backwaters, ponds, or relic channels (as listed in table 7.9-1 of AEA's PSP) or if they will be further classified into meso-habitats. If off-channel habitats are not being further delineated and mapped, then the reasons for this limitation within the objective must be detailed. Although there may be a limited number of off-channel habitats compared to the middle reach they may contain unique and abundant suitable habitat for a variety of species and should be addressed. Previous impoundment studies in the upper river have caught burbot, longnose suckers and round whitefish in backwaters and sloughs off the main channel (ADF&G 1983).

The PSP does not contain any review of the time-based frequency method proposed.

AEA Study Objective 2: Characterize the middle (RM 98 to RM 184) and the lower (RM 28 to RM 98) mainstem Susitna River channel margin and off-channel habitats using the Susitna-Watana Project habitat classification system and standard USFS protocols, with modifications to accommodate site-specific habitats.

AQHAB-12 The Fish and Aquatics Technical Work Group (TWG) is developing a Susitna River classification system based on the U.S .Forest Service (USFS) Aquatic Habitat Surveys Protocol (USFS 2001). The Service previously recommended the use of habitat classifications for large rivers, such as Beechie (2005). Although this habitat classification scheme will be useful for a possible framework, the uniqueness of the Susitna River system must be kept in mind. The USFS habitat classification is based on data collected from Southeastern Alaskan streams (USFS 2001) and will likely require many modifications to be suitable for the Susitna River, its associated tributaries, and off-channel habitats.

If AEA's objective is to apply a classification method that can be used to describe the distribution of fish, then other criteria must be considered. Sources of water and water quality appear to be important characteristics of fish distribution in glacial rivers (Curran et al. 2011, Murphy et al. 1989, Lorenz et al. 1989). Classification of main channel, tributary, and off-channel locations should be used as a macro-habitat level classification, as described in Service-recommended hierarchal nested habitat table. Differences in spawning locations are primarily clear-water tributaries, groundwater dominant side channels, and the mainstem (including side channels dominated by turbid mainstem water). Spawning is limited within the mainstem, presumably due to high turbidity and high percent fines, when spawning gravels are present. Similarly, mainstem rearing increases in the winter months when turbidities are low. Summer juvenile rearing occurs in tributaries and off-channel habitats with surface-water connections. Tributaries could be further classified using traditional geomorphic methods but could include water quality measures to separate out lower-sloped stream with high dissolved carbon and more moderate sloped clear-water streams. Moderate slope clear-water tributaries (Indian, Portage, and Gold Creek) have much higher specific conductivity and dissolved oxygen concentrations and are important Chinook spawning streams. Brown-water tributaries which drain wetland soils with much lower conductivity and high dissolved carbon concentrations, and lower pH and dissolved oxygen, are warmer and support coho spawning and rearing and some Chinook rearing.

A well-defined, lateral main-channel habitat classification may be most important for characterizing the distribution of fish. Juvenile salmonid abundance is likely greater along the stream margins than in mid-channel, and greater along vegetated banks with a complex distribution of velocities and depths than adjacent to unvegetated point bars. Fish use of off-channel habitats appears to vary with water source. Groundwater dominated side sloughs support sockeye and chum salmon spawning, side sloughs and upland sloughs with a surface water connection appear to provide important rearing habitat, while upland sloughs habitat quality may vary with concentration of dissolved oxygen.

Lastly, State and Federal agencies have resource responsibilities and authorities that extend below RM 28. These include, but are not limited to the aquatic resources within the Susitna Flats State Game Refuge, beluga whales and their habitats, and anadromous and resident fish and their habitats. The Service remains concerned with the stunting of the proposed Project-effects boundary at RM 28. AEA refers to RM 28 as the *“potential zone of Project hydrologic influence”* without adequate documentation of this claim. The Service recommends that this be confirmed through study prior to finalizing this characterization.

AEA Study Objective 3: Characterize the tributary and lake habitat upstream from the proposed Watana Dam site to the Oshetna River (RM 184 to RM 233.4) that is currently accessible to fish from the Susitna River or that would be accessible due to inundation of existing fish passage barriers after the reservoir is filled.

AQHAB-13

AEA’s purpose for pursuing this objective is unclear and should be provided for adequate evaluation of the proposed methodologies, data collection, and analysis.

The level of classification includes main channel and side channel, tributaries, off-channel locations and lakes. Classification of lakes is not provided but should include lake surface area, perimeter, bathymetry and whether or not there is a surface water connection to Susitna River tributaries. As with the Middle River, we recommend initial classification of tributaries using the Rosgen Classification method (Rosgen 1994), similar to the USFS Tier II habitat classification described. This level of classification will be more useful than classification of flows types. More specific habitat classification should be based upon characteristics of fish-habitat relationships important for fish within these tributaries. The purpose and applicability for Tier III classification for Susitna River tributaries should be clarified.

AQHAB-14

Related USFWS/NMFS Study Request Objectives

This PSP for aquatic habitat survey and characterization is insufficiently designed to account for the basic ecology of floodplain fishes or the diversity of aquatic habitats in the Susitna River, or any large floodplain system at these latitudes. These systems are characterized by a dynamic ground and surface water hydrology and geomorphology that interact with cold climates. Upon these fundamental layers of complexity, the distributions of fish species shift seasonally between ground and surface water dominated habitats and between channel networks of the primary and off-channel environments. Surveys and classifications (characterizations and delineations) of these seasonal distributions and habitats should pursue a strict hierarchical habitat classification that allows for the separation and comparison of the basic physical drivers of habitat selection.

AEA proposes to characterize (delineate and map) habitats of the project area by mesohabitats and states that fish distributions are primarily structured at this level. This is not entirely correct for large floodplain systems at these latitudes. Mesohabitat delineation is based on the hydraulic continuum of a channel's riffle-pool sequence. Characterization of habitat, at this level, ignores the fundamental influences of ground and surface water exchanges and the dramatic differences in habitat that are found amongst the various macro-habitats of the river's floodplain. It is at this level, that the distributions of fish are primarily structured (e.g., spawning in side sloughs, overwintering in the mainstem). Within these macro-habitat levels, the distributions of fish are responsive to mesohabitats, but perhaps of greater importance are the local manifestations of hydrology and geomorphology at the microhabitat level. The Service finds that a systematic assessment of the ecological relevance of local variables requires a hierarchical characterization of habitat. We recommend the habitat be characterized through the following hierarchy:

1. **Geomorphic units:** Large-scale geomorphic and hydraulic controls.
   a. Bedrock controlled single-channel units with shallow hyporheic exchange and thermal homogeneity.
   b. Unconfined, multiple channel floodplain units with expansive hyporheic exchange and thermal heterogeneity.
2. **Macrohabitats**: Primary, flood, and spring channel networks.
   a. Primary channels—Perennial channels.
   b. Flood channels—seasonally connected channels.
   c. Spring channels (clear water)—Disconnected sloughs that discharge groundwater.
   d. Floodplain ponds—Ponded spring channel networks.
   e. Tributary mouths
3. **Mesohabitats:** Bed and bank morphological controls; hydraulic features.
   a. Riffle-pool sequences—Run, riffle, pool, glide, tailout.
   b. Backwaters, alcoves, shallow meander margins.
4. **Microhabitats:** Hydraulics, water quality, substrate, cover.
   a. Water depth, velocity, bulk flow characteristics (e.g., Reynolds and Froude #'s).
   b. Vertical hydraulic exchange (ground and surface water exchange).
   c. Bed, or intragravel temperature and dissolved oxygen.
   d. Substrate size, heterogeneity.
   e. Elements of wood, vegetation, and rock structure.

The PSP states that the mesohabitat scale is the most meaningful to fish and that macro-habitat delineations will only be considered to perform *"some level of comparison over time"*. Though we agree that the mesohabitat level is indeed important to fish, exchanges of ground and surface water operating at the macrohabitat scale, and manifesting themselves locally at the microhabitat scale, should not be ignored and habitat mapping should occur pursuant to the necessary hierarchical model we have proposed.

The habitat hierarchy referred to in the PSP is inconsistent with the text of the PSP and was seemingly developed for high-gradient forested streams of the temperate coastal region. It confuses scales of organization (e.g., refers to beaver complexes and ponds as meso-habitats and uses a different hierarchy than that referred to in the PSP. It contains meso-habitats that are not well represented, or absent in large floodplain systems (e.g., pools and cascades), and omits those that are (e.g., glides and tail-outs), but it contains habitat categories that aren't relevant to a large floodplain systems. AEA needs a habitat hierarchy that is developed for large northern floodplains and directs the systematic characterization of habitats important to the distributions and life history patterns of fishes of the Susitna River. The Service recommends that AEA adopt the hierarchical model developed and supported by the agencies.

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7. Fish and Aquatic Resources

7.11. Study of Fish Passage Feasibility at Watana Dam

General Comments:

On September 24 and 25, 2012, the National Marine Fisheries Service (NMFS) convened Fish Passage meetings and began to informally resolve study issues with Alaska Energy Authority (AEA) and other state and federal agencies, including U.S. Fish and Wildlife Service (Service), and stakeholders per Section 5.11 of the Federal Energy Regulatory Commission (FERC) Integrated Licensing Process (ILP). This process is ongoing. On October 31, 2012, AEA posted a draft Revised Study Plan (RSP) on its website. A cursory review of the draft RSP indicated that AEA has revised their July 2012 Fish Passage Feasibility Proposed Study Plan (PSP). Notably, the PSP has been revised to include development of three conceptual alternatives for fish passage. This fish passage consideration and evaluation process that has begun is nearly a year earlier than AEA had initially proposed. However, the Service has not yet had sufficient time to review the draft RSP that was provided less than two weeks before comments on the PSP are due to FERC. Thus, our comments are based upon AEA's July 16, 2012, PSP and how well they address the goals and objective of the May 31, 2012, Fish Passage study request.

While efforts have been made to mention some of the revisions developed at and since our September Technical Work Group (TWG) meetings, the Service is adhering to the FERC mandated ILP process. Cursory review of the draft RSP indicates that AEA is referring to results from some of the 2012 fisheries studies. These reports have not yet been provided to the Service for review. Lacking these reports limits our ability to begin adequate review of the RSPs.

The Fish Passage Feasibility PSP proposes to address information needs for the Service to determine the feasibility of developing mandatory fishway prescriptions. This differs from the Service's objectives in the Fish Passage Study Request which also includes, if warranted, developing preliminary fishway prescriptions, as described in the Interagency Guidance for the Prescription of Fishways Pursuant to Section 18 of the Federal Power Act (USFWS and NMFS 2002).

Section 18 of the Federal Power Act (FPA) states that FERC *"shall require the construction, maintenance, and operation by a licensee at its own expenses of such…fishways as may be prescribed by the Secretary of the Interior or the Secretary of Commerce, as appropriate (16 U.S.C. § 811)."* Section 18 authority is delegated to the NMFS within the Department of Commerce and to the Service within the Department of Interior. For resources under its jurisdiction, the Service may prescribe fishways as necessary to maintain all life stages impacted by the project. Congress has provided guidance that fishway prescriptions are limited to physical structures, facilities, or devices necessary for such protection; and project operations and measures related to structures, facilities, or devices necessary to ensure effectiveness. Pub. L. 102-486, title XVII, § 1701(b), Oct. 24, 1992, 106 Stat. 3008. The Commission shall incorporate these mandatory conditions in a hydropower project license, or the Services may reserve their authority to include a fishway prescription in the future.

Discussion

The central features of the proposed project are the 750 foot high dam at river mile 184 and the reservoir extending about 43 miles upriver of the dam. The dam as proposed would block the upstream and downstream passage of Chinook salmon (*Oncorhynchus tshawytscha)*, possibly other salmon species and resident fish that migrate through and use the proposed Susitna-Watana dam site; and upstream habitat in the river and its tributaries. The reservoir would inundate some tributary spawning habitat, alter or remove rearing habitat, affect migration both up- and down-stream for juveniles and adults, isolate tributaries from the mainstem as water levels rise and fall, and change the bioenergetics, temperatures, turbidity and physical and biological characteristics of the river below the dam as the natural hydrograph is altered by project operations.

Chinook salmon are known to migrate to the Upper Susitna River as far above the proposed dam site as the Oshetna River and to successfully spawn and presumably rear there. The upstream extent of Chinook migration is not known definitively, nor is use of tributary or mainstem habitats. It is unknown but suspected that some Chinook salmon that are spawned in the upper river migrate downstream and rear in the middle river. Little else is known about anadromous species use above the dam site in either the Susitna River or its tributary streams. The Service adopted AEA's 2012 baseline data collection study objectives for the distribution of Chinook salmon and other fish species above Devils Canyon in its study request for fish passage. This baseline data collection effort is planned as a multi-year fish study that includes data collection beginning in 2012 as pre-ILP studies, with two additional years proposed by AEA under the ILP study process.

The Service requested the following modifications to the 2012 and ILP baseline data collection study objectives:

- Fish surveys should be conducted for at least one average life span of each salmon species, which is an average of five years for Chinook salmon (range to seven years). This is necessary to obtain the minimum amount of biological information about the population to develop and design mitigation, and determine the need for fish passage.
- Fish surveys should be designed and conducted to determine the occurrence and timing of all species and life stages of anadromous and resident fish that migrate both upstream and downstream of the proposed dam site. Data without all species and life-stages is insufficient to inform passage due to the variability in year-class strength as evidenced by the recent Alaska-wide downturns in productivity and abundance of Chinook salmon stocks.
- Genetic samples collected from Chinook salmon should be analyzed to assess the genetic makeup and viability of this population, and thus inform the need for fish passage of Chinook salmon for this project. It is necessary to collect and analyze sufficient numbers of genetic samples from Chinook salmon adults and juveniles from tagging sites, spawning sites and rearing sites to determine if they are differentiated from other Susitna Chinook salmon populations. It is unknown whether fish migrating into the upper river are genetically distinct from fish spawning elsewhere in the Susitna watershed. It is also unknown if fish spawned in the upper river rear in the upper river habitat or migrate downstream to rear in the middle or lower river areas. Collection and analysis of genetic material from these fish is needed for the Service to determine the contribution of upper river Chinook salmon to the Susitna River populations.

PASS-04 The Service provided generic guidance on methodology and information needs for determining fish passage feasibility and design from NMFS's Anadromous Salmonid Passage Facility

Design document (NMFS 2011). Given the height of the proposed dam however, we advised it would be prudent to involve resource agencies fish passage engineers directly in determining the feasibility of fish passage at the Susitna-Watana dam. NMFS and the Service offered to be available to discuss the criteria in general and in the context of the specific site. AEA was encouraged to initiate coordination with NMFS fish passage specialists early in the development of the preliminary design to facilitate an iterative, interactive, and cooperative process.

NMFS and the Service requested that feasibility planning for fish passage facility design begin with early coordination with resource agencies Fish Passage Engineers, starting with site reconnaissance and review of preliminary engineering designs. Collection of baseline biological information, site information, and project operations information essential to determine the need to prescribe fish passage for the proposed project was described and requested as follows:

Design Development Phases:

1) Conduct a reconnaissance study - An early investigation of one or more options for project design, siting and suitability of the proposed project design and construction of some type of fish passage facility.
2) Conceptual alternatives study - List the types of facilities that may be appropriate for accomplishing objectives at the proposed project site. It should result in a narrowed list of alternatives that merit additional assessment or explain the need for development of a novel alternative.
3) Feasibility study - An incrementally greater amount of development of each design concept (including a rough cost estimate), which enables selection of a most-preferred alternative.
4) Preliminary design - Additional and more comprehensive investigations and design development of the preferred alternative, and results in a facilities layout (including some section drawings), with identification of size and flow rate for primary project features. Cost estimates are also considered to be more accurate. Completion of the preliminary design commonly results in a preliminary design document that may be used for budgetary and planning purposes, and as a basis for soliciting (and subsequent collating) design review comments by other reviewing entities. The preliminary design is commonly considered to be at the 20% to 30% completion stage of the design process.
5) Detailed design phase - Use the preliminary design as a springboard for preparation of the final design and specifications, in preparation for the bid solicitation (or negotiation) process. Once the detailed design process commences, the Service must have the opportunity to review and provide comments at least at the preliminary design, 30%, 60% and 90% design completion stages. If substantial changes are still needed beyond the 90% stage, the Service will review and comment on these as well. These comments usually entail refinements in the detailed design that will lead to operations, maintenance, and fish safety benefits. Electronic drawings accompanied by 11 x 17 inch paper drawings are the preferred review medium.

Preliminary Design Development – Required Site Information:

1) Functional requirements of the proposed fish passage facilities as related to all anticipated operations and river flows. Describe median, maximum, and minimum monthly flow rates through the planned hydro facility, plus any special operations (e.g., use of flash boards, seasonal storage or drawdown etc.) that modify forebay or tailrace water surface elevations or river flows. Identify proposed project operational information that may affect fish migration (e.g., powerhouse flow capacity, period of operation, etc.).
2) Site plan drawing showing potential location and layout of the proposed downstream and upstream passage facilities relative to planned project features facilities.

3) Topographic and bathymetric surveys, particularly where they might influence locating fishway entrances and exits, and personnel access to the site.
4) Drawings showing elevations and a plan view of planned flow diversion structures, including details showing the intake configuration, location, and capacity of project hydraulic features.
5) Basin hydrology information, including daily and monthly streamflow data and flow duration exceedence curves at the proposed fish passage facility site based on the entire period of available record. Where stream gage data is unavailable, or if a short period of record exists, appropriate synthetic methods of generating flow records may be used.
6) Project forebay and tailwater rating curves encompassing the entire operational range.
7) Predict river morphology trends. Because the fish passage facility is proposed at a new diversion, describe the potential for channel degradation or channel migration that may alter stream channel geometry and compromise fishway performance. Use results from the instream flow and geomorphology studies to describe whether the stream channel is stable, conditionally stable, or unstable. Estimate the rate of lateral channel migration and change in stream gradient that has occurred over the last several decades. Describe what effect the proposed fish passage facility may have on existing stream alignment and gradient and the potential for future channel modification due to either construction of the facility or continuing natural channel instability.
8) Special sediment and/or debris problems. Describe conditions that may influence design of the fish passage facility, or present potential for significant problems, such as glacial silt loads.
9) Provide other site-specific or species-specific information that will inform the fishway designs and operations, such as accretion, earthquake fault zones, and permafrost conditions.
10) Derive hydrographs showing daily average river flow over the entire period of record for the proposed project area extrapolated for future projected change in hydrology.
11) Measure and report the stream bed profile (feet per mile) and composition, including the river from its mouth (River Mile (RM) 0) to the proposed project site for each species listed above. In the vicinity of the proposed project impoundment, provide three-dimensional topography/bathymetry including proposed location of the dam (spillway, power intakes, non-flow areas) and reservoir up to the maximum inundation expected.

Preliminary Design Development – Required Biological Information:
1) Identify each species and life stages to be passed downstream.
2) For each downstream migrating species and life stage, estimate the start and end date of the downstream migration. Identify how future project operations (reservoir storage, powerhouse flow and spillway flow) may alter migration timing. Identify effects of future project features, such as altered prey or predator concentrations, temperature changes, lighting changes, flow alteration and other physical, chemical and biological parameters.
3) For each downstream migrating species and life stage, determine the range of fish size, swimming ability (darting, sustained and cruising speeds) over the range of environmental conditions, run size, operational conditions and behavioral constraints to downstream fish passage.
4) Derive the standard downstream fish passage design flows for the passage season by calculation of the 5% (high design flow for fish passage) and 95% (low design flow for fish passage) exceedence flows (based on daily average flow) for the downstream passage season for each species and life stage.
5) Identify each species and life stages to be passed upstream.
6) For each annual upstream migrating species/life stage, determine the start and end date of the upstream migration.

7) For each upstream migrating species and life stage, determine the range of fish size, swimming ability (darting, sustained and cruising speeds) over the range of environmental conditions, run size, operational conditions and behavioral constraints to upstream fish passage. Identify spawning location for each salmonid species present at the site.
8) Identify other anadromous species and their life stages that are present at the proposed project site that also require intermittent passage.
9) Identify predatory species (avian, terrestrial, and aquatic) that may be present and prey on juvenile or adult anadromous species, and describe how the proposed project could affect populations or concentrations of these predators.
10) High and low design passage flow for periods of upstream fish passage. Derive the upstream fish passage design flows for the passage season by calculation of the 5% and 95% exceedence flows (based on daily average flow) for the passage season for each species and life stage to be passed upstream.
11) Identify any known behavioral factors that might affect salmonid passage. For example, most salmonid species pass upstream through properly designed orifices, but other species that are unable to pass through orifices may impede salmonid passage. In addition, some salmonid species may not pass through orifices. Other examples of behavioral factors that should be considered include schooling behavior, migration depth, preferred water temperatures, potential reaction to natural and artificial vertical structure and cover, reaction to lighting, diel passage patterns, reaction to flow velocity gradients and others.
12) Identify what is known and what needs to be researched about upstream and downstream fish migration routes approaching the proposed project.
13) Compile available information on the minimum and maximum streamflow that will allow upstream migration up to the proposed project.
14) Describe the degree of activity (fishing/bears/otters) in the area of the proposed project and the need for measures to reduce or eliminate fishing activity.
15) Identify water quality factors that may affect fish passage at the site. For each species/life stage migration, estimate the start and end date of the migration and assess the potential variation in migration season based on environmental factors (e.g., Changes in water temperature, impoundment effects, forebay delay, water temperature (average and reservoir profile), egg hatch timing, dissolved oxygen, low river flow, high river flow, etc.). Fish may not migrate if water temperature and quality are marginal, and may instead seek holding zones until water quality conditions improve.

Assessment of Operational Impacts on Fish Passage for the proposed project will require the following project-specific information:

1) Forebay rating curve - Provide the expected operation of the forebay for the migration season for each species and life stage to be passed downstream. Include expected operations for future years given the climate forecasting hydrology study results (snow pack, stream gaging, glacial meltwater). The rating curve should display day of year as the independent variable and forebay elevation as the dependent variable, and should also include appropriate bands identifying each migration season.
2) Tailwater rating curve - Provide the expected tailwater operation for the extent of the upstream migration season. The rating curve should display day of year as the independent variable and tailwater elevation as the dependent variable, and should also include appropriate bands identifying each upstream migration season.
3) Turbines - Turbine design should maximize fish survival through the turbine, and minimize turbulence and total dissolved gas uptake in the tailrace. Derive the expected effects of passage through turbines for the range of sizes of fish expected in the project forebay. Include blade strike, scraping of fish (between the blades and hub and between the blade tips

and turbine housing), the pressure change within the turbine, and the pressure profile from fish migration depth through the turbine intake, through the turbine, through the draft tubes and into the tailrace.

4) Draft tube velocity - Calculate draft tube velocity range for all standard operations, including turbine up ramp rates and turbine shut down rates. Identify turbine intake locations, in elevation relative to the range of forebay elevation. Identify draft tube discharge depth and locations in relation to tailrace.
5) Sediment capacity - By collection of stream samples over the entire range of expected stream flows, model the change in reservoir bathymetry over a 50-year period in annual increments.
6) Reservoir hydraulics - By computational fluid dynamic model, demonstrate the reservoir velocity contours in increments of 0.01 feet/second (or as appropriate) for each forebay level expected over the downstream migration season, in five foot increments. Include powerhouse flows, spillway flows and seasonal flow storage volumes. Include the entire reservoir, but data is most important and therefore should be the most detailed around the dam structure.
7) Flow continuation - Identify means of providing continuous instream flow if turbine and/or spillway becomes inoperable.
8) Upstream passage flows downstream of the project – Identify minimum instream flow that will provide optimal upstream passage up to the proposed project, including habitat impacts from proposed project revising the flow regime downstream of the project.
9) Describe range of forebay fluctuation, relative to preliminary plans for power operations.
10) Describe range daily tailrace fluctuation, relative to preliminary plans for power operations.
11) Describe river ramping rates, relative to preliminary plans for power operations.
12) General layout of planned hydro project. Include dam layout (in plan, elevation and typical cross sections), flow direction (for the entire operational scenario), powerhouse location, spillway location, top, submerged spill routes (include longitudinal profile and cross sections of conveyance structures) and any appurtenant structures.
13) General operating plan. Identify expected power production on an annual basis, based on the expected water use for power production and spill. For the spillway, derive from flow records the expected frequency, duration and seasonal occurrence of spill. For the powerhouse, derive the hourly and seasonal operation schedule, in terms of flow used for power production. For the reservoir, based on the expected operation schedule, identify daily and seasonal changes in storage.
14) Describe design capacities for hydraulic conveyance structures.

The PSP does not address the Service's study request and information needs in sufficient detail to determine what parts of our study request are adopted, what parts are not, and if not, why not. The Service recommends AEA identify the differences between our study request and their PSP and provide an explanation where, and why, they did not address our request.

<u>Specific Comments by Subsection:</u>

7.11.1.1 Study Goals and Objectives

The study plan articulates fish passage study goals and states *"A variety of engineering, biological, sociological, and economic factors may need to be considered."* The study plan further indicates that feasibility analysis of fish passage alternatives (last bullet under first paragraph in 7.11.4 page 7-92) will be conducted. This section also states that AEA will "generally follow" NMFS 2011 guidance in the Anadromous Salmonid Passage Facility Design document.

With regard to *"economic factors,"* the referenced NMFS guidance document states: "*Instances will occur where a fish passage facility may not be a viable solution for correcting a passage impediment, due to biological, sociological, or economic constraints. In these situations, removal of the impediment or altering operations may be a suitable surrogate for a constructed fish passage facility. In other situations, accomplishing fish passage may not be an objective of NMFS because of factors such as limited habitat or lack of naturally occurring runs of anadromous fish upstream of the site. To determine whether NMFS will use its various authorities to promote or to prescribe fish passage, NMFS will rely on a collaborative approach, considering the views of other fisheries resource agencies, Native American Tribes, nongovernment organizations, and citizen groups, and will strive to accomplish the objectives in watershed plans for fisheries restoration and enhancement."*

This guidance is intended for the *restoration* of fish passage, not for the initial blockage of fish passage through construction of a new dam. The guidance indicates that economic factors may be used to evaluate various alternatives that all achieve fish passage should the agencies determine that fish passage is necessary and thus prescribe fish passage under authority of the Federal Power Act. This guidance does not indicate in any way that cost-benefit analysis can be used to determine whether fish passage is necessary on the basis of benefits exceeding costs. The proposed study plan should be revised to clarify that the consideration of economic factors is limited to evaluating the cost effectiveness of various fish passage alternatives and will not be a factor in the Service's determination of whether fish passage will be prescribed.

PASS-05

The three-year limit of the study period is inadequate to understand adult salmon migrations especially at a time when stocks, particularly Chinook salmon, are low and their abundance above the project may be drastically reduced. We recommend that fisheries surveys be conducted for at least one average life span of each salmon species, which is an average of five years for Chinook salmon (range to seven years). This is needed to obtain the minimum amount of biological information about the population that is necessary to develop and design mitigation, and determine the need for fish passage.

7.11.2. Existing Information and Need for Additional Information

PASS-06

The PSP states that there is currently no specific engineering information and little biological information to provide a basis for determining the need for and feasibility of passage at the proposed dam. The biological need for passage is an issue independent of the engineering feasibility; these issues should be analyzed separately. While the Service agrees that there is little biological information for the upper river, it has been known since 1982 that Chinook salmon pass upstream of the Devils Canyon and spawn successfully in the upper Susitna River. It is the professional judgment of the ADF&G Susitna Hydro Aquatic Studies Team made in 1982 that juvenile Chinook salmon are produced in the upper Susitna River (ADF&G 1983). The outstanding biological questions relate to the population size, productivity, and habitat availability and use, rather than whether there is a biological need for Chinook salmon, possibly other salmon species, and other anadromous and resident species to migrate through the proposed dam site to habitat used for spawning, incubation, rearing, and migration.

7.11.4.1. Compile, Review and Summarize Information

PASS-07

The Service has not concurred with AEA's suggested use of target species for fish passage, in large part due to the paucity of information regarding the species, life stages and timing of fish passage at Watana. The following information has not been provided or reviewed:

- the 2012 Upper Susitna River Fish Distribution and Habitat Study;
- the Salmon Escapement Study;
- the Middle and Lower River Fish Production Study, and
- the Fish Passage Barriers Study; along with
- any outstanding historical data and reports that are not yet available from the 1980s historical studies; and
- a comprehensive literature review,

Once the above information is provided, it may be desirable and possible to select a smaller range of target species and life stages. The target fish species should include both anadromous and non-anadromous and resident species that require passage at the site (juvenile and adult passage both upstream and downstream passage and the timing) because fishways by definition consist of the physical structures, facilities, or devices necessary to maintain all life stages of fish by enabling fish to safely bypass the dam. In addition to the general physical information at the project site, specific hydrologic and hydraulic (including project operations) information should be provided for the fish passage season (for both upstream and downstream passage).

7.11.4.3. Define and Document a Development Process

PASS-08 The Service agrees that a process should be discussed to establish appropriate evaluation criteria for different fish passage alternatives. However, it is inappropriate to unduly limit the range of fish passage options under consideration from a biological and engineering standpoint by including estimated costs associated with facilities into a weighted comparison matrix. In determining which alternatives are considered for further analysis of fish passage, the biological goals, objectives and concerns and the technical issues such as constructability, climate and logistical considerations, operations, etc. should be assessed. This could be a valuable tool to decide between various alternatives.

At this stage, biological information and criteria should be gathered, and a full-range of engineering options should be pursued, including novel ones. No alternative should be rejected based on cost at the feasibility stage. If that process were to be followed, then the ability to develop and prescribe fish passage would be seriously limited or even excluded from the onset. The process to develop a fishway feasibility assessment should be constructed in a manner that helps federal fishery agencies make decisions regarding fishway prescription without eliminating options prematurely and diminishing the authority of federal fishery agencies to require FERC licenses to include fishway prescriptions.

Section 7.11.6. Schedule

PASS-09 There appears to be a disconnect regarding when some of the biological information from the studies will be available and the initiation of the conceptual design process. For example, a lot of the biological information on juvenile, adult or smolt passage will not be available until the 2013/2014 time frame and the conceptual alternative are supposed to be completed by 2013. This means that it may be necessary to revisit the conceptual alternative design assumptions based upon any new data and update the designs as necessary.

<u>Outstanding Information Needs and Unresolved Issues</u>

Study reports from AEA's 2012 Fisheries Studies are expected to add to the available information; this information is not yet available for agency review and is a serious constraint on the agency's ability to timely and effectively assess the proposed studies. These reports should be made available, even if in draft form, as soon as possible to facilitate a more informed and effective study plan development process.

NMFS has initiated involvement of their Fish Passage Engineers in the project, beginning with a series of meetings and a site visit to the Susitna River in late September. NMFS Senior Fish Passage Engineer from the Northwest Region, Ed Meyer, traveled to Anchorage and met with Alaska Region staff, AEA, and the Service on September 24, 2012. On September 25, NMFS convened a meeting of state and federal agency staff and the applicant to discuss Section 18 Fish Passage Authority, fish passage at other hydro facilities, and the formation of a Fish Passage Technical Working Group. On September 26 NMFS conducted a site visit to the proposed Watana dam site. NMFS developed an information-needs list working with AEA's Fish Passage Engineering contractor, Dennis Dorratcague of Montgomery Watson/Harza. The Service supports and agrees with NMFS steps to address our agencies fish passage concerns pursuant to our joint federal authorities under the FPA.

In these meetings on September 24 and 25, NMFS, AEA, the Service and ADFG agreed to hold brainstorming meetings as a first step to identify and discuss potentially viable fish passage design concepts for the Susitna-Watana Project. A group of experienced fish passage engineers will convene to develop design concepts for both upstream and downstream fish passage. Project concepts will be developed during the course of studies for two alternative approaches listed below, to compare with the current proposal, which does not include passage structures.

1. Develop concept designs for fish passage facilities integral with the design development of the dam and outlet works.
2. Develop fish passage concept designs that could be added to the preferred design for the dam and outlet works later.

It was also decided in the meetings that upstream passage may likely be trap and haul. However, design specifications have not been provided to support the feasibility of this concept relative to the topography of the Susitna River basin. Brainstorming sessions will address both downstream and upstream passage. This approach conforms to the PSP, Section 7.11.

Much of the data required for the concept designs of the passage facilities is listed in 7.11.4.1 of the PSP. Therefore, it is anticipated that the design proposals will be informed by early results of data gathering efforts, lessons learned from other streams, and results from early runs of the project operations model. Any and all assumptions will be stated and validated. Additional information and guidance will be obtained from NMFS, Northwest Region, "Anadromous Salmonid Passage Facility Design", July 2011 and other accepted fish passage design books and topical scientific literature.

<u>USFWS Recommendations</u>

PASS-10
1. The study plan should be organized to address the Service's information needs and study requests in sufficient detail to determine what parts of our study request are adopted, what parts are not; and if not, why not. AEA has not identified the differences between our study request and their study, nor explained where and why they did not address our requests.

PASS-11
2. The Service continues to recommend that fisheries surveys be conducted for at least one generation of each salmon species, which is an average of five years for Chinook salmon (range to seven years). This is needed to obtain the minimum amount of biological

information about the population that is necessary to develop and design mitigation, and determine the need for fish passage for this project.

PASS-12

3. The proposed study indicates that the biological need for fish passage will be determined, and that this is linked to the economic costs of providing passage. The biological need for passage exists: anadromous fish are known to spawn and rear upstream of the proposed dam. The biological information requested is necessary to determine the engineering feasibility of designing effective up and downstream passage of fish and to determine the ecological and socioeconomic losses that would result from not providing passage. This determination must be informed by fish surveys consisting of at least one average life-span of each salmon species.

4. The study plan should be revised to investigate the ability to design, construct and operate up- and down-stream fish passage into a new project from the ground up rather than as if fish passage facilities were being considered to retrofit an existing dam that already blocks fish. The Susitna-Watana dam would be a new project on a free-flowing glacial salmon river, with no preexisting facilities, thus the project must incorporate features into its initial design and operations that increase the likelihood of successful fish passage. The RSP should include three dam design alternatives at the site:

PASS-13

   (1) A design that incorporates fish passage facilities as an integral part of the design,
   (2) The currently proposed design with fish passage retrofitted into the project and,
   (3) The current design with no fish passage.

   With this in mind, we recommend that the list of necessary baseline data be revised to provide information necessary for the design of all three project options. To aid in this development, we recommend that the Fish Passage Workgroup be convened at the earliest opportunity to help identify the necessary baseline data. The proposed schedule (7.11.6) delays development of conceptual alternatives until August of 2013. This is too late in the engineering design process for this dam and operations to allow for a full range of options for fish passage to be considered without adding unnecessary expense and delays into the project. AEA has agreed with the Service's request that the study plan for fish passage begin with early and regular consultation with agency fish passage engineers and the TWG.

   As part of the Fish Passage Workgroup, a group of experienced fish passage experts should be convened for an initial multi-day (3 to 4 day) "brainstorming session" to help identify any additional baseline information needs, as well as ideas for fish passage alternatives for the project. We recommend scheduling this meeting as early as possible, ideally in early January 2013.

PASS-14

5. In addition to the general physical information at the project site, specific hydrologic and hydraulic (including project operations) information should be provided for the fish passage season (both upstream and downstream passage) along with other physical information such as expected debris loading, ice conditions, expected sediment transport (as it affect passage facilities), expected forebay and tailwater rating curves, project operation information (rule curve, restrictions, etc.), river morphology trends, predatory species expected, downstream sites for a barrier dam/trap and haul operation, size of upstream and downstream migrants (fry versus smolt), etc.

PASS-15

6. The Service requests that AEA provide a comparison of our study request with their draft RSP, and identify any unaddressed study request components. The Service also requests

that AEA identify the relationships among the 2012 pre-ILP studies, the suggested ILP studies, define the timing of related studies, and explain how these studies will be completed within the ILP study planning, study dispute, and study completion schedules. Completing these tasks would greatly benefit the licensing process.

Literature Cited

Barrick, L., B. Kepshire, and G. Cunningham. 1983. Upper Susitna River Salmon Enhancement Study. Alaska Department of Fish and Game, Division of Fisheries Rehabilitation Enhancement and Development. 156 pp.

NMFS (National Marine Fisheries Service). 2011. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon.

Interagency Guidance for the Prescription of Fishways Pursuant to Section 18 of the Federal Power Act,May 2002. Prepared by: The U.S. Fish and Wildlife Service and National Marine Fisheries Service. 19 pp.

7. Fish and Aquatic Resources

7.14. Genetic Baseline Study for Selected Fish Species

General Comments:

These comments address the Genetic Baseline Study for Selected Fish Species Proposed Study Plan (PSP) submitted by Alaska Energy Authority (AEA) for the Susitna Watana Hydroelectric Project (Project). The U.S. Fish and Wildlife Service (Service) and National Marine Fisheries Service (NMFS) submitted a general request for baseline fish genetics to FERC on May 31, 2012 for anadromous and resident fish. The Alaska Department of Fish and Game (ADF&G) also submitted a Fish Genetic study request relevant to their fisheries management goals. Both the Service and ADF&G have fish conservation genetics laboratories; collaboration and partnering between the two agencies and other resource organizations is critical to the success of the genetic programs. Alaska's conservation genetics laboratories emphasize characterization of population structure and mixed-stock analysis. Because ADF&G has management authority over the waters of the Susitna River basin they are the resource agency that is responsible for developing and maintaining the genetic stock analysis (GSA) for fisheries resources of the basin. The Service supports ADF&G in this effort to conserve biodiversity of Alaska's fisheries resources.

It is from this perspective that the Service comments on the PSP, with occasional reference to the ADF&G Fish Genetics study request. Our comments are based on PSP review findings, coupled with those from recent AEA's preliminary 2012 study efforts specifically related to adult Chinook salmon above Devil's Canyon near the proposed Watana dam site (River Mile (RM) 184).

Historically, it was assumed that Chinook salmon were not capable of navigating above Devil's Canyon and beyond the proposed dam site. However, ancillary reports support 2012 field effort findings that adult Chinook salmon do indeed migrate above the proposed dam site. Relative abundance of these Chinook salmon is unknown. During the 2012 field work, 84 Chinook were visually observed above the proposed dam site. In light of this recent information, and with consideration given to its potential relevance to federal agencies mandatory conditioning authority under the Federal Power Act (FPA), we emphasize the need for the baseline fish genetics study for Chinook salmon. Specifically, the Service recommends AEA focus on the detail contained within ADF&G's study request, along with additional objectives for adult Chinook salmon.

We recognize that the Devil's Canyon area likely creates a fish passage impediment during a range of flows, however, the specific range of flows that restrict fish passage are not known, nor have they been investigated. It is not known whether the adult Chinook salmon that migrate above Devil's Canyon to spawn are an established spawning population, or whether they are comprised of annual strays able to navigate the canyon during opportunistic flows. Acquiring baseline biological information to answer these questions are key to informing our decision-making process pursuant to the FPA.

GENE-01

In light of AEA's 2012 findings of numbers of Chinook salmon capable of navigating above the proposed dam site, and in order to adequately inform federal fishway prescription authorities under the Federal Power Act, we refine our genetics study request to determine:

1) whether or not Chinook salmon above Devil's Canyon are genetically distinct;

2) the effective Chinook spawning population size above Devil's Canyon; and
3) the proportional contribution of the genetically distinct Chinook salmon above Devil's Canyon to the Susitna River spawning population.

This more detailed request is in addition to our prior request for the development of a repository of genetic samples for anadromous and resident fish species within the Susitna River drainage. The impetus for this additional information comes from preliminary results of the 2012 fish sampling efforts. These results, some of which are a direct result of newer technologies, provide specific information requirements for resource agency review of the proposed project. Low returns for Susitna River salmon in recent years provide additional justification for resource concern. During the 2012 season, Northern Cook Inlet area Chinook salmon runs were well below average leading to significant restriction of the Northern District set gillnet fishery and the in-river Chinook sport fisheries. Restriction of the sport and commercial fisheries had significant economic impact on commercial fishers, processors, guides, lodges and other businesses that depend on these fisheries.

<u>Specific Comments by Subsection:</u>

AEA Objective 1. Develop a repository of genetic samples for fish species captured within the Susitna River drainage, with an emphasis on those species found in the middle and upper Susitna River.

GENE-02 The Service agrees with this objective to support the GSA database for resident and anadromous fish species of the Susitna River. AEA plans to take these samples "opportunistically" during capture events. Acquiring genetic samples opportunistically at capture sites and at sites using differing gear types is reasonable for an initial season (2012) in order to identify species and their spatial and temporal utilization of riverine habitats. However, beyond the first season (2012), a more formal sampling design should be established by resource agency fish biologists, geneticists, and AEA in order to develop a scientifically sound operational plan for continued sampling. The sampling design should state needed sample sizes by species, methodologies, along with temporal and spatial sampling considerations.

Alaska lacks baseline genetic samples for most of its fish species and consequently the Service has specific resource concerns related to several of the Susitna River fish species. In our prior study request, the Service noted our concerns for Pacific lamprey. Since that time, our Regional Director has signed the Pacific Lamprey Conservation Initiative. The recent development of the Service Region 1 Pacific lamprey Conservation Initiative, which includes Alaska, highlights conservation concerns related to Pacific lamprey across their range. The Pacific Lamprey Conservation Initiative is the Service's specific strategy to improve the status of Pacific Lamprey throughout their range by helping implement research and conservation actions. This initiative specifically states the need for genetic information and analyses related to Pacific Lamprey. Lamprey species are also state species of concern described in Alaska's Comprehensive Wildlife Conservation Strategy (ADF&G 2006).

The Susitna River Bering cisco comprises one of only three Bering cisco populations worldwide. The Susitna River Bering cisco is the most genetically distinct of the three populations (R. Brown, Service, personal communication). Consequently, they are a state species of concern (ADF&G 2006) based on significant biological data gaps related to the species. There is also an increasing commercial interest in this species nationally.

Eulachon are known to spawn in the lower river, but the upper extent of their distribution is unknown. There are two eulachon runs annually. The first initiates after ice break-up in late May, and the second migration occurs in early June. A study conducted in1983 recorded several hundred thousand eulachon during the first run, and several million returning eulachon during the second run (Barrett et al 1984). The documented upper extent of these return runs is approximately RM 50 of the Susitna River. Some of the returning eulachon enter tributaries including the Yentna River (Barrett et al 1984). In addition to supporting local fisheries, eulachon are a major prey item for the federally listed Cook Inlet beluga whale, and a significant source of marine-derived nutrients to the Susitna River. There is no genetic baseline for eulachon.

Susitna River rainbow trout support a valuable trophy sport fishery in the middle river. ADFG acquired recent telemetry data for one year of adult rainbow trout; however, the results of this information have not yet been summarized. Data gaps exist for rainbow trout related to spawning locations, overwintering areas, hatching and emergence timing, and rearing habitat (Rich Yanusz, ADF&G, personal communication). Currently, there is no genetic baseline for Susitna River rainbow trout.

Additional resource concerns for Susitna River resident and andromous species are outlined in part in the Service's adult and juvenile non-salmon anadromous, resident and invasive species study request (Service Study Request 14.1) previously submitted to FERC on May 31, 2012.

GENE-03 Finally, AEA's genetic sampling efforts should be stated to clearly include fish species found to be utilizing the *lower*, middle and upper Susitna River (RM 0-233).

AEA Objective 2. Contribute to the development of genetic baseline markers for each of the five species of Pacific salmon spawning in the Susitna River drainage.

GENE-04 The addition of genetic "markers" in this objective makes this a different study than intended; as well as a more expensive study. This objective should be rewritten to state that this study will "contribute to the development of genetic baselines for each of the five species of Pacific salmon spawning in the Susitna River drainage". Genetic markers are used to differentiate between species, or for use in differentiating a new species that does not already have markers developed.

ADF&G does have genetic markers, genetic samples, and completed analysis for Chinook salmon which should be considered as a limited baseline. Although this existing Chinook salmon genetic baseline is not complete, it does indicate that there is variation among populations of Susitna River Chinook salmon. There are eight genetic reporting groups for Upper Cook Inlet Chinook salmon. The eight reporting groups are further grouped into 2 broad-scale regions: 1) Northern (West, Susitna, Yentna, Knik and Turnagain groups, and 2) "Southern" (Kenai, Kasilof, and south Kenai Peninsula groups). Overall, within the Northern region, the Susitna group has the most divergent populations (Barclay et al 2012). And within the Susitna River genetic analysis demonstrate that Chinook salmon from Portage Creek and the Chulitna River are the most genetically unique in the basin (C. Habicht, ADF&G fisheries geneticist, personal communication).

Currently, there are no baseline genetic markers for coho salmon. ADF&G has a few Susitna River genetic coho salmon samples, but markers have not yet been developed in order to

differentiate between coho salmon populations. There are no existing genetic markers for chum or pink salmon. ADF&G has a limited genetic baseline for Susitna River sockeye salmon.
AEA Objective 3. For 2013 and 2014, quantify the genetic variation among upper and middle river Chinook salmon for use in mixed-stock analyses, including analyses of lower river samples of the entire Susitna Chinook salmon population.

GENE-05

This objective attempts to answer the question, "Are the Chinook salmon that spawn above Devil's Canyon genetically distinct?" AEA's (and ADF&G) Objective 3 cannot occur without some baseline distribution and biological information about the Chinook spawning in the extreme upstream areas of the Susitna, Talkeetna, and Chulitna River where the greatest genetic divergence is expected to occur. It is important to understand the biology of the [target] species so that potential sampling issues can be avoided as much as possible (Waples and Gaggiotti 2006). This information is a data gap for Susitna River Chinook salmon. Once the needed distribution and biological baseline is available, we recommend AEA follow a robust genetic sampling design in cooperation with the state and federal fish geneticists' recommendations.

If the Chinook salmon above Devil's Canyon are determined to be a genetically distinct spawning population, then a mark recapture study is needed to get a population estimate in order to identify the proportion Susitna basin Chinook passing/migrating above Devil's Canyon (above the dam site). A minimum of three years of mark-recapture data is necessary to determine an average number of fish migrating above the dam site. Multiple years of data are also needed in order to assess 1) temporal variation, 2) and run timing variation.

GENE-06

To assess population genetics stability, AEA should consult with Service and ADFG fisheries geneticists to establish a recommended number of genetic samples and number of years required to establish a temporal stability of allele frequencies. For smaller populations, such as the Chinook salmon above Devil's Canyon, more information is needed in order to answer that question. High statistical power is necessary when attempting to estimate the contribution of stocks which contribute, at small proportions, to a mixture in order to detect the presence of these stocks (Jasper et al 2009). Generally, statistical power is increased by increasing sampling sizes within strata. However, for small populations, sampling across one to two generations (e.g., 10 years) is more powerful in establishing generational and environmental effects and the effects of genetic drift (Waples 1990).

GENE-07

Susitna River Chinook salmon have a 5-7 year overlapping life history, so changes in gene frequency are relatively slow. This is because Chinook salmon age-at-return is widely spread out, such that spawning returns from any given year overlap with those from other year classes. Therefore, we recommend that genetic samples be collected for a minimum of five consecutive years in order to capture one generation of the Chinook salmon dominant 5-year age class (ADF&G 2012).

GENE-08

Some knowledge of effective population size (Waples 1990a; Waples 1990b) is also required to estimate proportional rates of exchange from allelic frequency data (Allendorf and Phelps 1981). Estimates of the effective spawning population of Chinook salmon above Devil's Canyon are needed to sort out the genetic differentiation. In order to best inform Federal resource agencies FPA authority, we recommend a generational timeframe for genetic sample collections in order to analyze:

1) stability of allele frequencies (Allendorf and Phelps 1981)

2) variation in effective parental numbers; as a means of estimating the number of spawners above Devil's Canyon (Waples 1990).

During the 2012 field season, genetic sampling efforts for Susitna River Chinook salmon above the proposed dam site were to occur through reconnaissance and structured collaboration between ADF&G and AEA. However, ADF&G staff was only able to collect one day (July 31, 2012) of Chinook salmon genetic samples. This one day of effort resulted in the collection of genetic samples from 10 (of 16 observed that day) Chinook salmon from Kosina Creek, located above the proposed dam site (ADF&G trip report memo, September 20, 2012). Additional collaborative opportunities exist for future genetic sample collection.

GENE-09 Genetic samples limited to 10 Chinook have heightened probability of indicating a high degree of variation from Chinook above the dam site. It is therefore, in AEA's best interest to support the request for adequate sample sizes over appropriate temporal and spatial scales. To support and ensure better collaboration toward this common goal, the Service urges AEA to meet with state and federal fisheries experts to develop robust sampling efforts that address resource agencies respective management authorities. This is also needed to appropriately inform the proposed Project of potential considerations related to facility design and construction.

AEA Objective 4. In 2013 and 2014, estimate the annual percent of juvenile Chinook salmon in selected lower river habitats that originated in the middle and upper Susitna River.

GENE-10 Similar to Objective 3, AEA's (and ADF&G) Objective 4 cannot occur without acquisition of baseline distribution and biological information about the Chinook salmon spawning in the extreme upstream areas of the Susitna, Talkeetna, and Chulitna River where the greatest genetic divergence is expected to occur. Without this baseline information, we do not know where the level of genetic distinction may exist or how to structure sampling efforts. ADF&G requested information specific to habitat utilization below Devil's Canyon by Chinook salmon progeny originating upstream of Devil's Canyon.

If the results of the Chinook salmon genetics studies conducted during the summer of 2012 indicate that the Chinook salmon spawning upstream of Devil's Canyon can be characterized as an identifiable genetic reporting group, then the Service recommends AEA conduct a study to estimate the percent of juvenile Chinook salmon downstream of Devil's Canyon that originated from upstream of Devil's Canyon by taking sufficient and representative genetic samples of these juveniles. Juvenile Chinook salmon have recently been observed above the proposed dam site (Buckwalter 2011), further substantiating study requests for juvenile Chinook salmon. The Service recommends this genetics-based approach over a traditional passive integrated transponder (PIT) tag study, where fry are marked upstream of Devil's Canyon with PIT tags, because there is no need to address mark–recapture handling and tag loss assumptions.

Additionally, we support ADF&G's request for a traditional mark-recapture study to be used to assess downstream movement of juvenile Chinook salmon from above Devil's Canyon, if the Chinook salmon upstream of Devil's Canyon are not an identifiable genetic reporting group.

Objectives not included in AEA's Fish Genetics PSP:

GENE-11 *ADF&G Objective 3: For 2 years, annually estimate the minimum adult escapement of Chinook that spawn upstream of Devil's Canyon.*

The Service recommends that this study objective be included in the project study request determination. We also request that annual spawning escapement estimates be conducted for a minimum of 3 years in order to assess: 1) temporal variation, and 2) run timing variation. Escapement numbers are so variable between years that a minimum of three years is necessary in order to provide some sense of this variation.

ADF&G Study Request # 1 Adult Chinook and coho salmon spawner distribution and abundance studies, requested specific objectives related to Susitna River coho salmon.

GENE-12

The Service supports and reiterates the request which addresses basic spatial and temporal biological information needed to begin to address genetic studies for Susitna River coho salmon. The related objectives should be included as follows:

> *Objective 5. "Estimate the in-river abundance of adult coho salmon in the Susitna River upstream of the confluence of the Yentna River for a minimum of three years."*
> *Objective 6. "Identify coho salmon spawning locations in the mainstem of the Susitna River upstream of the confluence with the Yentna River for a minimum of three years."*

The Service recommends that these objectives will be incorporated into the PSP in order to inform genetic sampling efforts should coho salmon be found to migrate above the proposed dam site. Like Chinook salmon, coho salmon are known to breach significant gradient and velocity impediments to reach spawning grounds.

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8. Wildlife Resources

8.14. Waterbird Migration, Breeding, and Habitat Study

General Comments:

The U.S. Fish and Wildlife Service (Service) stated three primary objectives within our waterbird study request. These objectives are listed here along with a brief summary of how they are addressed within Alaska Energy Authority's (AEA) proposed study plan (PSP), with further detail below:

WTRBRD-06
- Objective 1 – Breeding Bird Use: Document, measure, and analyze occurrence, distribution, abundance, productivity, habitat use, and indices of waterbird numbers breeding in the Project area, so that potential impacts of habitat loss and disturbance on breeding bird number, by species, can be quantified. Most aspects of this objective, with the exception of Harlequin Duck, appear to be on track towards being met.

WTRBRD-07
- Objective 2 – Migration Use: Document, measure, and analyze occurrence, distribution, abundance, habitat use, and seasonal timing of waterbirds migrating through the Project area so that potential impacts of habitat loss, disturbance, and collision with infrastructure on birds flying across and/or using the Project area as stopovers during migration may be estimated. Stop-over use is being addressed, but unless a radar study occurs, the objectives concerning over-flying birds will not be met.

WTRBRD-08
MERC- 01
- Objective 3 – Mercury Risk Assessment: Support other related Susitna-Watana Project studies as needed, including the Piscivorous Wildlife and Mercury Risk Assessment. This objective is not being met at this time, which is of considerable concern to the Service.

Specific Comments by Topic

BREEDING SEASON

WTRBRD-09

We believe, that as of the October 4, 2012, interagency meeting on the Waterbird PSP, we have reached general agreement on most aspects of the breeding season survey, except with regard to Harlequin Duck. For most other species, and given that much of the Project-area terrain is difficult for flying transects and that there are a relatively finite number of lakes, we are in general agreement on the adequacy of a lake-to-lake pattern of aerial surveys to be run continuously and with the same methodology as the migration surveys. Surveys are planned for a minimum of 7-day intervals once breeding season is determined to have commenced, and will continue until more frequent surveys begin for fall migration.

We have not yet seen a detailed survey plan, but have the following requests:

WTRBRD-10
- Clearly describe how actual survey area and extent will be determined (e.g., how many lakes and which lakes?)

WTRBRD-11
- All actual flight lines should be recorded. It is critical that the boundaries and sizes of all surveyed lakes and any other survey areas be clearly delineated so that survey area can be calculated.

WTRBRD-12
- Use brood surveys and other data to back-date and estimate actual timing of spring migration's end, and commencement and end of breeding season each year. Take into account inter-species differences in timing.

WTRBRD-13
- Ensure that careful analyses address the relationship between the numbers or indices obtained and the actual populations targeted. How will such issues as timing and behavioral differences among species, turn-over rates, and variable visibility conditions be addressed?

WTRBRD-14

With regard to Harlequin Duck, this species is not reliably surveyed by the aerial survey methods proposed. While it is possible that we may come to agree that some aerial survey methodology will have to be considered adequate, further discussion about this species is warranted. Some ground-based surveys may be necessary, and may potentially be combined with riparian landbird/shorebird surveys, depending on timing and other factors. Survey effort and timing has been generally discussed as including two surveys sometime in May and two later in July or August for broods, but we expect that actual timing will be determined based on observed annual environmental conditions and breeding phenology indicators.

WTRBRD-15

There is general agreement between AEA and the Service, that the waterbird study area will likely be modified for Harlequin Ducks to include portions of streams that extend outside of the 2-mile buffer of the Project area. All potential Harlequin breeding streams that cross the Project area (i.e., footprint plus 2-mile buffer) should be surveyed entirely along the lengths of suitable habitat, whether or not that habitat (i.e., particular stream reach) extends outside the project area. This is because breeding birds may travel up and down their stream, and may be located off-site during a given survey.

MIGRATION USE

WTRBRD-16

The Service believes that as of the October 4, 2012, meeting we have reached agreement on the basic aspects of the sub-study that will target waterbirds using the Project-area habitats during migration. AEA and the Service generally agree that:

- the study area (Project footprint and same 2-mile buffer as described in the landbird/waterbird PSP comments) is appropriate as described;
- the concept of a "lake-to-lake" study pattern is appropriate, but details are still pending;
- survey intensity of every 5 to 7 days beginning in approximately mid-May for spring migration and early to mid-July through October for fall migration (with initial spring survey dates based on thaw degree days or other careful analysis of current local weather data, and, for fall, the timing results of the preceding breeding season surveys) is agreeable.

WTRBRD-17

The study area will be the same as that for breeding birds, and, as noted above, details remain to be worked out regarding the precise extent of lake coverage (i.e., how many and which waterbodies, and minimum size cut-off of waterbody to be surveyed). Analysis details also need to be discussed, including derivation of detectability indices and estimates of abundance, etc.

WTRBRD-18

The Service recommends that AEA develop and expand a draft proposal for a radar study that addresses birds flying across the Project area (with coordinated visual surveys). As discussed in the comments on the landbird/shorebird PSP, one of the Service's primary objectives is to survey birds flying across the Project area during migration. Because of the risk of collisions to birds in flight, including substantial long-term cumulative impacts, we continue to recommend that surveys be conducted to identify and characterize migratory pathways in the Project area. We recognize that the geographic scale will be difficult to tackle with limited radar capabilities. At the October meeting, the use of radar at the dam site was verbally proposed by AEA contractors. This would presumably target all species, including landbirds, shorebirds, raptors and others, as well as waterfowl. With further discussion, the Service may find limiting the radar studies to the dam area as proposed sufficient, IF coupled with: a) appropriate analyses of existing information to help locate transmission lines in bird-safe areas, b) commitment to a well-researched and detailed plan to mark and micro-site all transmission lines in a bird-safe manner (i.e., avoiding cliffs or drainages, etc., that may be used by migrating birds), and c) commitment to a well-researched bird-safe lighting operations plan at all Project facilities.

PISCIVOROUS WILDLIFE AND MERCURY RISK ASSESSMENT

WTRBRD-19
MERC-02
WILD-3

The Service has requested that feathers of piscivorous birds using the Project area, including Belted Kingfisher and other species, be collected to provide the baseline information on current levels of mercury critical to a wildlife and mercury risk assessment. The Service has also requested that a study be conducted to determine enough details of these birds' diets (e.g., amount or percent fish) to sufficiently inform this risk assessment. We are not yet aware that these studies are being planned by AEA.

8. Wildlife Resources

8.15. Survey Study of Eagles and Other Raptors

RAPT-1 Alaska Energy Authority's (AEA) Proposed Study Plan (PSP) addresses the U.S. Fish and Wildlife Service's (Service) 31 May 2012 study request entitled the same. The goal of our study request was to address Bald and Golden Eagles and other tree- and cliff-nesting raptors in order to characterize population, productivity, habitat use and other important aspects of local raptor species' life histories, so as to (1) inform predictions and quantifications of potential impacts that may result directly and cumulatively from the proposed Susitna-Watana Hydroelectric Project, and to (2) provide information required for a possible application(s) for federal Eagle Take (lethal or disturbance take – see below) and/or Eagle Nest Take Permits.

General Comments:

RAPT-2 The Service is satisfied that most objectives will be adequately met by following the basic study outline proposed in AEA's PSP. Two exceptions where objectives are not adequately addressed yet are the lack of intent to survey for early nesting owls, and the lack of any study plan to collect feathers, dietary information, or other data necessary to conduct a mercury risk assessment for fish-eating birds, including Bald Eagles.

Specific Comments by Subsection:

RAPT-3
MERC-03

Mercury toxicity

The most important issue that remains to be addressed is that there has been no intent reflected in any of the Migratory Bird study plans, including the Raptor study plan, to collect feathers and dietary information about Project-area fish-eating birds, including Bald Eagles, a species that may be at risk from accumulation of mercury. See PSP Section 5.12. Mercury Assessment and Potential for Bioaccumulation Study.

RAPT-4

Owl surveys

We have also requested meeting with AEA during the winter to finalize the details of the overall raptor study plan. Details regarding owl-related issues left to consult on include:

- Further discussion of surveys for early nesting owls (and how these may be combined with the landbird surveys).
- The selection of specific study areas for migration routes that may occur along planned transmission line routes.

RAPT-5

Eagle surveys and permits

Further refinement may be required for survey and analysis details for all aspects of the study plan, including information gleaned from 2012 survey experience and results, and any new information regarding the National Eagle Take Permit program. While no substantive new information is available today on the Permit Program, it is a new and evolving Program, and additional information may come from the Service's Washington D.C. Headquarters over the coming winter.

8. Wildlife Resources

8.16. Breeding Survey Study of Landbirds and Shorebirds

General Comments:

BREED-09 The U.S. Fish and Wildlife Service's (Service) objectives, as outlined in our May 2012 study request, include conducting field surveys and in-house assessments to aid estimation of potential Project impacts on migratory shorebirds and landbirds and their habitats, including birds breeding in the Project area, migrating across it, and over-wintering there. A final important objective is to support other Susitna-Watana Project studies including a Piscivorous Wildlife and Mercury Risk Assessment. The July 2012 Alaska Energy Authority (AEA) proposed study plan (PSP) did not include objectives to study birds migrating across the study area, or over-wintering birds. The AEA PSP also does not adequately meet the shared (between the Service and the AEA) objectives for breeding bird studies or the Piscivorous Wildlife and Mercury Risk Assessment.

AEA, the Service, and other stakeholders met on September 6, 2012, to discuss differences regarding the landbird and shorebird studies. While we have not yet had an opportunity to review details of a revised written document, we currently believe that some important differences were verbally resolved as of the end of that meeting, including: the intensity of breeding season surveys; the use of distance estimation techniques in order to estimate densities; and appropriate objectives and basic survey methodologies regarding "over-wintering" birds. It appears that other important study plan components may still be missing or inadequate, including, but not limited to: a documented plan or agreement to survey birds migrating across the area in order to help assess risk of collision with Project infrastructure; an adequately detailed plan to survey riparian-associated breeders; and appropriate support for the Mercury Risk Assessment. Details of these and other remaining differences are specified below.

Specific Comments by Topic

BREEDING BIRD SURVEYS

BREED-10 *Wildlife Habitat Mapping.*
The PSP proposes to use Viereck et al. (1992) to classify vegetation, which may be insufficient to address migratory bird habitat use. We recommend that a combination of Kessel's bird habitat classification and Viereck et al.'s systems may be more appropriate, and recommend utilizing Alaska Landbird Monitoring Survey (ALMS) developer Colleen M. Handel's (USGS) experience with this.

WLDHAB-2 Also, AEA proposes to calculate average occurrence figures for each bird species in each habitat type, and to derive 4 habitat categories – low, mid, high, and negligible. It should be noted that, when deriving these habitat values, it will be important to avoid confusing "not seen" and "not surveyed" with "not present" and "not using" data results.

BREED-11 *Study Area.*
We are in agreement that the primary study area is within a modified 2-mile buffer zone around the Project footprint. Modifications include shortening the buffer width in a few areas where there are prominent barriers or boundaries on the landscape, such as not crossing the Chulitna River.

BREED-12 It would be beneficial to set up comparison plots for field surveys in off-site areas such as Denali or the Copper River Basin for purposes of examining relative abundances and even estimations of habitat availability for calculations of Project impacts on long-term productivity. We will forego a formal request for this, although AEA should recognize that this may mean that any future assertions about relative "values" of Project-area habitat to birds may not be scientifically supported.

BREED-13 *Estimations of Breeding Bird Densities.*
It is critical that an objective of this study be a quantification of breeding birds using the Project site that is more rigorously supported than merely an estimation derived from assumed habitat associations. At the end of our September discussion it appeared that AEA had agreed to the use of distance estimation methodology in order to achieve this quantification.

BREED-14 Incorporation of detection probabilities according to habitat types will be needed in order to address some of the deficiencies of distance estimation methodologies. Further discussion and work is needed in order to ensure survey and analysis details are clear and agreed to prior to the initiation of the first field season.

BREED-15 *Survey Timing and Level of Effort.*
Unfortunately, it does not appear that an analysis has been conducted to determine the ideal number of point counts per habitat type actually needed to provide necessary data per species. In the absence of that analysis, however, we believe that an agreement has been tentatively reached to conduct daily early-morning surveys for fifteen days in April and then basically continuously (with allowances for weather days) from early to mid-May through mid-June. A minimum of four two-person crews will each conduct at least eight point surveys per morning.

BREED-16 It is expected, and was generally agreed to, that exact timing of onset of surveys will be based each year on careful examination of local conditions (e.g., snowmelt, current reports of bird movement and nesting timing locally and off-site, etc.).

BREED-17 Timing and effort protocol issues that may remain as sources of difference between the Service and AEA include our recommendations for double count observer methodology to help address detectability biases, and for subsets of points to be replicated within a year and between years to help account for local inter-annual variation in timing of bird-breeding. Also because of the potential magnitude of inter-annual variation, we stress that two years of data is not likely to be sufficient to best meet study objectives.

BREED-18 *General Methodology.*
It is expected that ALMS protocol for conducting surveys be followed. For example, surveys should commence within 30 minutes of local sunrise and cease within 4-5 hours of initiation.

BREED-19 *Collection of Vegetation Data.*
Collection of vegetation data during point counts, especially for two-person crews using double observer methodology, is not appropriate. We are unclear at this time how or when AEA plans to collect per-point vegetation data or precisely what variables will be collected.

BREED-20 *"Over-Wintering" Birds.*
We have come to general agreement that collection of over-wintering use will not occur, but that resident birds (including woodpeckers, owls, chickadees, etc.) will be targeted for breeding

surveys during appropriate (i.e., for each given year, based on actual local peaks of resident bird breeding activity) spring (April and May) dates. Exact level of effort for these birds has not yet been determined, but we recommend at least two additional weeks of survey (prior to those identified above in *Survey Timing and Level of Effort*).

BREED-21

Species of Conservation Concern.
Rusty Blackbird, Olive-Sided Flycatcher, and several shorebird species are Service Species of Conservation Concern for Bird Conservation Region 4, which includes the Project site. Special attention should be paid in development of survey plan details to target these species (i.e., their preferred habitat types) as much as practical, given their relatively sparse distribution across the landscape. We appeared, based on general discussion at the September meeting, to be in agreement on this point but further detailed discussion is necessary as point count locations are being pre-mapped.

BREED-22

Swallows.
Because cliff-nesting swallow species are known to breed in the banks of the Susitna River (and potentially elsewhere in the Project footprint) where Project inundation will occur, yet the general point-count methodology to be employed for most other landbirds and shorebirds are not recommended for surveying such birds, we recommend that survey methods be employed to specifically target these colonies, including the use of boat surveys of the Susitna River banks. It is unknown whether or not AEA has agreed to this.

BREED-23

Other Riparian-Associated Birds.
We have jointly agreed that several species of locally-significant (i.e., regularly using or dependent upon habitats that will be lost or otherwise impacted by the Project) landbirds and shorebirds are not commonly recorded in the standard point-count methodology, and that it is important to conduct additional surveys to target these species. Besides swallows as discussed above, these include Belted Kingfisher, American Dipper, Semipalmated Plover, Solitary Sandpiper, Spotted Sandpiper, and Wandering Tattler.

It is therefore expected that additional surveys will be conducted to target these species. The additional surveys should include, at minimum, appropriately-timed point count *and linear* surveys along all impacted streams in appropriate habitat. Details and agreement, including precise list of species to be targeted, and any use of linear surveys, remain to be worked out.

BREED-24

Owls and Hawks.
Small owls and hawks, including Short-Eared Owl which is a *Partner- in-Flight* species of conservation concern due to apparent continental population declines, are also not adequately surveyed by the standard point-count methodology proposed. We expect that sufficient efforts will be made to survey these species so that, at minimum, an adequate measure of abundance can be obtained, but details of the AEA plan on this point are not yet clear.

BREED-25

MIGRATION SURVEYS

One of the Service's primary objectives is to survey birds flying across the Project area during migration, and using the area for stop-overs during migration. Identifying and describing flight path use is critical for determining risk of direct mortality from collisions with Project infrastructure (e.g., power transmission lines and the dam itself, which may have lights that compound random collision risks with a disorienting attractant). At this time, no agreement has been reached to conduct surveys either to identify numbers/species of landbirds or shorebirds a) flying across the proposed transmission corridors and dam site during migration or b) using the Project area as migratory stop-over(s).

Because of the risk of collisions to birds in flight, including substantial long-term cumulative impacts, we continue to recommend that surveys be conducted to identify and characterize migratory pathways in the Project area. Because most of the species in question are primarily nocturnal migrants, the use of radar is warranted. We recognize that the geographic scale will be difficult to tackle with limited radar capabilities. At the October 4, 2012, meeting to discuss the Project waterfowl surveys, the use of radar at the dam site was verbally proposed by AEA contractors. This would target all species, including landbirds and shorebirds. The Service may find limiting radar studies to the dam area sufficient, IF these studies are coupled with: a) appropriate analyses of existing information to help locate transmission lines in bird-safe areas; b) commitment to a well-researched and detailed plan to mark and micro-site all transmission lines in a bird-safe manner (i.e., avoiding cliffs or drainages, etc., that may be used by migrating birds); and, c) commitment to a well-researched bird-safe lighting operations plan at all Project facilities.

Regarding stop-over site research, undoubtedly many birds (species and individuals) use the large Project footprint and general Project area for stop-overs during migration. We are, however, unaware of any particular local site of concentration, and acknowledge the tremendous effort that would be required to identify and quantify stopover habitat use (particularly for landbirds), given the vast and previously-unstudied scale of the Project area. Therefore we will agree that surveys focused on describing landbird and shorebird stop-over habitat use may not be conducted at this time.

PISCIVOROUS WILDLIFE AND MERCURY RISK ASSESSMENT.

BREED-26
MERC-04

The Service has requested that feathers from piscivorous birds using the Project area, including Belted Kingfisher and other species, be collected to provide the baseline information on current levels of mercury critical to a wildlife and mercury risk assessment. The Service has also requested that a study be conducted to determine enough details of these birds' diets (e.g., amount or percent fish) to sufficiently inform this risk assessment. We are still in the process or working with AEA to adequately develop this study.

9. Botanical Resources (RSP 11.)

9.1 to 9.4. Introduction to Summary of Consultation (RSP 11.1 to 11.4.)

General Comments:

The U.S. Fish and Wildlife Service's (Service) did not request this introduction to the Botanical Resources, however, this introduction helps set the stage for the Botanical Resources studies and we appreciate Alaska Energy Authority (AEA) including these introductory sections. Our comments are based on the Proposed Study Plan (PSP) and, in part, on AEA's Draft Revised Study Plan (Draft RSP) dated 23 October 2012. Since we have not had sufficient time to fully evaluate these recently available Draft RSPs, we reserve the opportunity for additional comment. Section numbering follows the PSP for consistency with our other PSP comments, but includes the revised Draft RSP numbering in parentheses.

The section numbering for the Draft RSPs 11.5, 11.6, and 11.7 all start with 11.1, which is confusing and suggests the automatic numbering needs to be reset for each of these studies. Please use the correct section numbers in future drafts. Our comments will be based on the correct number, substituting 11.x with the correct section number.

Please spell-out the first reference to acronyms in major sections (e.g., "RSP" referenced in the second sentence of Draft RSP Section 11.3, and "PSP" referenced in the first sentence in the Draft RSP Section 11.1).

Some sections of text are nearly identical across Draft RSPs 11.5, 11.6, and 11.7 (the sections reviewed by the Service for PSP comments). This is necessary so the studies can stand alone. However, if we provide comments in one study that shares nearly identical text with other studies, we request these comments be addressed in the other studies also, even if we did not repeat our comments in the other studies.

Specific Comments by Subsection:

9.1. Introduction (RSP 11.1.): The introduction refers to five studies with a brief summary starting with: "Two of," "A third," "A fourth, and "a fifth" study. It would be helpful if the study sections were included in parentheses. This is especially the case for the first reference to "Two of these studies," which is followed by a description involving three study elements that could be confused with the three Draft RSPs 11.5, 11.6, and 11.7.

Much of the discussion between AEA and the stakeholders to date has focused on the mapping aspect of the Botanical Resources studies, leaving the impression the Botanical Resources is solely a mapping effort. Lost in the detailed discussions of the many AEA studies has been the modeling and predictive component of the Botanical Resources studies. For example, the Service was under the impression the Riparian Instream Flow Study (PSP 6.6 / RSP 8.6) would be predicting potential riparian community changes resulting from Project operations. However, the "third study" in the Botanical Resources section appears to involve modeling efforts to predict potential changes. Perhaps the Botanical Resources section with its substantial mapping effort would be the study best suited to predicting Project effects, but this needs to be made very clear in both studies. The Service's preference would be to retain the predictive component for the riparian resources in the Instream Flow Studies like the aquatic resources.

Similarly, this may also be the case for predicting wildlife habitat changes due to Project operations.

9.3. Resource Management Goals and Objectives (RSP 11.3): The third paragraph references the Aleutian shield fern (*Polystichum aleuticum*) as the only plant species in Alaska listed as endangered under the federal Endangered Species Act (please include underlined text).

9.4. Summary of Consultation with Agencies, Alaska Native Entities and Other Licensing Participants (RSP 11.4):

Table 9.4-1. Summary of consultation on Botanical Resources study plans (RSP Table 11.4-1): We appreciate this consultation summary, but the Draft RSP table only includes comments since the PSP. The table title should be revised to be more specific, or the table should be inclusive since consultation began. Our comments regarding the Comments/Responses in this table are included in their respective Draft RSP sections.

9. Botanical Resources (RSP 11.)

9.5. Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (RSP 11.5.)

General Comments:

The U.S. Fish and Wildlife Service's (Service) 31 May 2012 study request entitled *Vegetation and Wildlife Habitat Mapping Study* is identical to Alaska Energy Authority's (AEA) Proposed Study Plan (PSP) title, however, the Draft Revised Study Plan (RSP) title listed above more accurately describes the study scope. Our comments below are based on the PSP and, in part, on AEA's Draft RSP dated 23 October 2012. Since we have not had sufficient time to fully evaluate this recently available Draft RSP, we reserve the opportunity for additional comment. Section numbering follows the Proposed Study Plan (PSP) for consistency with our other PSP comments, but includes the revised Draft RSP numbering in parentheses.

VWHAB-01 A number of terms are used to qualify the resolution of aerial/remote-sensed imagery (high-, moderate-, fine-scale) throughout the study plan. Please provide a pixel resolution the first time each term is used. Besides image resolution, the type and wavelength bands used for photo interpretation, such as true color, false color and color infrared, should be discussed.

The section numbering for the Draft RSP 11.5 all start with 11.1, which is confusing and suggests the automatic numbering needs to be reset for this study. Please use the correct section numbers in future drafts. Our comments will be based on the correct number, substituting 11.1.x with the correct section number (11.5.x).

Specific Comments by Subsection:

The following review of AEA's proposed Vegetation and Wildlife Habitat Mapping Study plan uses the structure of the plan and compares the plan to the USFWS's study-request objectives to determine if our intent is met, where improvements can be made, and which requested objectives are not addressed.

AEA General Description of the Proposed Study (Draft RSP):

VWHAB-02 The general description of the study sets the stage for the study objectives, methods and products. The description, however, describes a mapping study and does not include the second objective to quantify potential impacts to vegetation and wildlife habitats. This information should be included in the general description to more adequately describe the full scope of the study.

AEA Study Goals and Objectives (Draft RSP): The overall goals of the vegetation and wildlife habitat mapping study are to prepare baseline maps of the existing vegetation and wildlife habitats in the upper and middle Susitna basin (upstream of Gold Creek).

The Service did not provide an overall goal, and instead merged the goals and objectives into a bulleted list similar to the AEA's objectives discussed below. The scope of AEA's PSP included mapping the entire Susitna-Watana Hydroelectric Project (Project) area, which could be interpreted as including the entire Lower, Middle and Upper Susitna River. This refinement in the Draft RSP scope to the middle and upper Susitna basin upstream of Gold Creek is appropriate, although it might also help to mention the Riparian Study (PSP 9.6 / Draft RSP 11.6) will map the floodplain below the proposed dam.

VWHAB-03 AEA's Draft RSP objectives have changed somewhat from the PSP objectives, possibly due to refinements in the scope of this and the other Botanical Resources studies. The two Draft RSP objectives (map vegetation and wildlife habitat, and quantify impacts to vegetation and wildlife habitats) are similar to three of our five study request objectives. Our fifth requested study objective (develop mitigation measures) is likely more appropriate for a later stage in the licensing process.

VWHAB-04 Not addressed in AEA's Draft RSP objectives is our 31 May 2012 study request to compare the vegetation mapping results with the 1987 vegetation mapping study conducted in the original Susitna Hydroelectric Project area. The Service is concerned that vegetation and wildlife habitat changes during Project operations may be attributed incorrectly to either Project operations or to some other less obvious influence. The Botanical Resources Draft RSPs provide numerous examples where the 1980s data will be used as a starting point, but these data will need to be updated due to landscape changes over time such as fires, insect outbreaks, and permafrost degradation. The justification for AEA not including this objective was discussed at subsequent technical work group (TWG) meetings (e.g., different methods and study areas), and the Service agreed this objective could be addressed at a later date if subsequent vegetation and wildlife habitat changes may be due to less obvious influences. However, without knowing the trajectory of gradual vegetation and wildlife habitat change before the Project, the cause for any changes during Project operation may be questioned.

VWHAB-05 *AEA Study Area (Draft RSP): The proposed study area for the mapping of vegetation and wildlife habitats consists of a 4-mile buffer zone surrounding those areas that would be directly altered or disturbed by Project construction and operations…[, and] include the proposed reservoir impoundment zone, areas for infrastructure of the dam and powerhouse and supporting facilities, the proposed access route and transmission-line corridors, and materials sites (Draft RSP 11.5.3).*

The Service concurs with reducing the buffer zone from our suggested 5 mile width in our study request to 4 miles. We also appreciate the reference to the Riparian Study (Draft RSP Section 11.6) addressing potential impacts in the floodplain downstream of the proposed reservoir. For the RSP, the word "proposed" should be used only sparingly for the few remaining technical details still under discussion in the TWGs (and the "proposed" dam). Any detail still referred to as "proposed" in the RSP suggests the study plan is still under development.

AEA Methods (Draft RSP):

VWHAB-06 AEA's methods do not clearly follow the objectives, making it difficult to evaluate the appropriateness of the methods. The methods appear adequate; however, we recommend

AEA reorganize the methods to address the objectives. Our comments below are organized by objective, with references to AEA's section numbers in the Draft RSP.

VWHAB-07 If the units of ecological importance mentioned in the introductory paragraph for the methods will be defined in another study, this study should be referenced to help set the stage for collaboration between studies. Please spell-out the first reference to acronyms in major sections (e.g., "ITU" referenced in the second paragraph of Draft RSP Section 11.5.4).

AEA Objective 1 and Methods (Draft RSP): Identify, delineate, and map vegetation and wildlife habitat types in the upper and middle Susitna basin using the vegetation map prepared in the 1980s for the Alaska Power Authority's Susitna Hydroelectric Project (APA Project) as a starting point, and updating that mapping to reflect current conditions as indicated on recent aerial imagery for the study area.

VWHAB-08 Objective 1 is addressed in the Draft RSP sections for ITU Mapping and Derivation of Wildlife (11.5.4.2), and Field Surveys (11.5.4.3). There is substantial detail in the first section discussing how the 1987 data will be updated, but the final product is unclear. We understand the final product at the end of the study will be based on a combination of ITU (citation required), a Viereck Level IV (Viereck et al. 1992) classification, and wetland delineation (Environmental Laboratory 1987, U.S. Army Corps of Engineers 2007), using 2013 high-resolution imagery for the entire study area with a minimum mapping polygon size of 1.0 acres for vegetated areas and 0.25 acres for waterbodies. For consistency with the Wetland Mapping Study (Draft RSP 11.7), the wetlands classification should also include the Cook Inlet classification (Gracz 2011) with modifications as required for the Susitna River basin. The data collected at ground-reference plots will follow the methods required to delineate wetlands (Environmental Laboratory 1987, U.S. Army Corps of Engineers 2007) for wetlands, and the methods described in this section for non-wetlands. The methods for ground-reference plots in wetlands is well documented, however, the categories used for classifying non-wetlands such as visual cover, plant community structure, physiography, surface form, microtopography, site disturbances, and plant phenology should be described so they can be evaluated.

VWHAB-09 The methods for deriving wildlife habitat types need additional detail. What wildlife species will be chosen, how will their habitat criteria be defined, and who will be involved in this process? Including elements of Kessel's bird habitat classification system for Alaska (Kessel 1979) would help, but how will other wildlife habitat needs for other species be determined? The Service has concluded a potential report by the USGS comparing Kessel's classification with Viereck's Level IV classification was never prepared, so AEA's proposal to prepare a "crosswalk" between the two classification systems will be a valuable addition to this portion of the methods.

AEA Objective 2 and Methods (Draft RSP): Quantify the potential direct, indirect, and cumulative impacts to vegetation and wildlife habitats from Project construction and operations.

VWHAB-10
WLDHAB-1 Objective 2 is addressed in the Draft RSP section for Impact Assessment (11.5.4.4). The GIS component of this analysis is straightforward. The methods for ranking habitat value for each bird and mammal species of concern are described in the Evaluation of Wildlife Habitat Use Study (Draft RSP Section 10.19), which is appropriate if one of the objectives for that RSP is to provide this ranking.
RIP-02 Addressing the downstream effects on riparian habitats in the Draft RSP Section 11.6 may also be appropriate, however the Service was under the impression the

Riparian Instream Flow Study (PSP 6.6 / RSP 8.6) would be predicting potential riparian community changes resulting from Project operations (See our comments in that section for additional details).

AEA Reporting and Data Deliverables (Draft RSP):

VWHAB-11 For the pdf vegetation and wildlife habitat map deliverables, the Service recommends providing these products in geospatial pdf, so a sophisticated GIS program would not be required to readily identify coordinates on the maps.

AEA Schedule and Study Interdependencies (Draft RSP):

VWHAB-12 Will 2014 include additional field sampling in areas without high-resolution imagery until late 2013? Perhaps including a rough estimate of the area without high-resolution imagery would suggest how much additional work would be required?

VWHAB-13 Why is 2012 included in the timeline for Draft RSP Table 11.5-1 if no activities are scheduled or performed in 2012?

VWHAB-14 The Draft RSP methods suggest the Study Interdependencies figure (Draft RSP Figure 11.5-2) should include an input from the Evaluation of Wildlife Habitat Use Study (Draft RSP Section 10.19) for the bird and mammal species of concern habitat ranking. This figure suggests the GIS data layer for wildlife habitats will be developed without interaction with the Evaluation of Wildlife Habitat Use Study.

Literature Cited

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1, U.S. Army Engineer Waterway Experiment Station, Vicksburg, MS. 90 pp + appendices.

Gracz, M. 2011. Cook Inlet Lowland Wetlands. Available from http://cookinletwetlands.info/ Accessed September 2012.

Kessel 1979. Avian Habitat Classification for Alaska. The Murrelet 60(3):86-94. *http://www.jstor.org/stable/3534270?origin=JSTOR-pdf*

U.S. Corps of Engineers (USACE). 2007. Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region Version 2.0. Wetlands Regulatory Assistance Program, U.S. Army Engineer Research and Development Center, Vicksburg, MS. 72 pp. + appendices.

Viereck, L.A., C.T. Dyrness, A.R Batten, and K.J. Wenzlick. 1992. The Alaska vegetation classification. Gen. Tech. Rep. PNW-GTR-286. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 278 pp.

9. Botanical Resources (RSP 11.)

9.6. Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam (RSP 11.6.)

General Comments:

RIP-03 The U.S. Fish and Wildlife Service's (Service) 31 May 2012 study request entitled *Riparian Habitat Mapping Study* suggests a much stronger emphasis on mapping than Alaska Energy Authority's (AEA) Draft Revised Study Plan (RSP) title listed above. Our 31 May 2012 Riparian Habitat Mapping Study request envisioned primarily a mapping effort using products from other studies to visually display, in map format, the type and aerial extent of predicted riparian habitat changes resulting from operations of the Susitna-Watana Hydroelectric Project (Project). The Proposed Study Plan (PSP) and the Draft RSP go beyond the inventory and display of riparian resources by collecting *"the necessary data to enable predictions of how development of the Project could alter downstream riparian areas."* Collecting data to enable predictions of riparian and floodplain changes is a crucial objective in our 31 May 2012 study request entitled *Riparian Instream Flow Study*, and is in line with the data collection objectives to predict Project effects in AEA's Fish and Aquatics Instream Flow Study (Draft RSP 8.5). Moreover, collecting data to enable Project-related predictions in this Botanical Resources study is not in line with AEA's other Botanical Resources studies which rely upon products from other studies to spatial map potential Project-related effects on botanical and habitat resources.

At the 24 October 2012 Technical Workgroup (TWG) meeting, AEA stated their Riparian Instream Flow Study Plan would follow the structure of the Service's study request, which included an objective to characterize the water-level regime required to maintain floodplain and riparian plant communities, and then predict potential plant community change resulting from Project operations. Although informal remarks by AEA that the Riparian Instream Flow research team was working closely with the Riparian Botanical Resources research team to address our study request objective, it was not made clear our study request objective had been moved to the Botanical Resources. Subsequently, this objective was never discussed in the Botanical Resources TWG meetings, and there was never sufficient time in the Instream Flow TWG meetings to adequately discuss this objective's methods. The USFWS recommends assigning the data collection and analysis portion of this objective to the Riparian Instream Flow study like the Fish and Aquatic Instream Flow study. The Instream Flow TWG meetings have been where these topics have been discussed in detail, not the mapping efforts in the Botanical Resources TWG meetings. Upscaling the riparian habitat predictions from the Riparian Instream Flow study to the entire riparian and floodplain downstream of the proposed dam, however, could be a legitimate element of the Riparian Botanical Resources study like the Draft RSPs for the Vegetation and Wildlife Study and for the Wetlands Study. However AEA eventually chooses to
RIP-04 assign this objective, the Service recommends that AEA conduct a TWG meeting with sufficient time allocated to discuss the proposed methods for predicting riparian habitat changes before they are finalized in the RSP.

RIP-05 Riparian areas and floodplains are often the same; however, many people visualize riparian areas as a narrow band immediately adjacent to streams and rivers. We envision this study including the entire floodplain, and not simply a narrow zone along the Susitna River. To help minimize this potential misconception, the Service recommends revising the study plan title and discussion to include the word "floodplain."

RIP-06 A number of terms are used to qualify the resolution of aerial/remote-sensed imagery (high-, moderate-, fine-scale) throughout the study plan. Please provide a pixel resolution the first time each term is used. Besides image resolution, the type and wavelength bands used for photo interpretation, such as true color, false color and color infrared, should be discussed.

Since we have not had sufficient time to fully evaluate this recently available Draft RSP, we reserve the opportunity for additional comment. Section numbering follows the Proposed Study Plan (PSP) for consistency with our other PSP comments, but includes the revised Draft RSP numbering in parentheses. The section numbering for the Draft RSP 11.6 all start with 11.2, which is confusing and suggests the automatic numbering needs to be reset for this study. Please use the correct section numbers in future drafts. Our comments will be based on the correct number, substituting 11.2.x with the correct section number (11.6.x).

Specific Comments by Subsection:

The following review of AEA's proposed Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam uses the structure of the plan and compares the plan to the Service's study-request objectives to determine if our intent is met, where improvements can be made, and which requested objectives are not addressed.

AEA General Description of the Proposed Study (Draft RSP):

The general description of the study sets the stage for the study objectives, methods and products. Our concern about which RSP will be assigned the second activity to collect data to enable Project-related riparian habitat changes is discussed above in the General Comments.

RIP-07 *AEA Study Goals and Objectives (Draft RSP): The overall goals of the riparian vegetation study are to prepare baseline maps of local-scale riparian ecosystems (riparian ecotypes), wetlands, and wildlife habitat types in areas downstream from the proposed ~~for the~~ Project dam site, and to assess the extent to which the Project will alter vegetation succession, wetlands, and wildlife habitats in riparian areas of the Susitna River.* (strikethrough for suggested deletion)

The Service did not provide an overall goal, and instead merged the goals and objectives into a bulleted list similar to AEA's objectives discussed below. To help minimize potential confusion about the scope among studies, it might be helpful to expand upon the sentence describing
RIP-08 assessment of impacts to riparian ecotypes, wetlands, and wildlife resources. The Draft Botanical RSPs make a distinction between their study area boundaries, including Gold Creek and the proposed dam site. How does this study differ from the Vegetation and Wildlife Habitat Mapping Study and the Wetland Mapping Study (Draft RSPs 11.5 and 11.7)?

RIP-09 AEA's Draft RSP first and third objectives are similar to three of the four objectives in our 31 May 2012 study request (identify and map riparian communities, quantify potential loss of riparian habitats, and assess potential changes in riparian habitats). Although our 31 May 2012 study request included elements in our objectives similar to AEA's second objective (characterize riparian physical and ecological processes), as the study plans evolved during TWG discussions, the Service now believes AEA's second objective would be more appropriate in other studies focused on characterizing physical and biological processes. The products from these studies would then be used by the Botanical Resources studies to upscale and map the predicted plant community/habitat changes potentially affected by the Project. Our fourth requested study objective (develop mitigation measures) is likely more appropriate for a later stage in the licensing process.

AEA Study Area (Draft RSP): [The] downstream location [of the study area] will be determined (in the riparian instream flow study … As a starting point for delineating the lateral extent of the riparian vegetation study area, the extent of riverine physiography along the Susitna River will be mapped. Riverine physiography includes those areas of the valley bottom directly influenced by semi-regular to irregular overbank flooding (~5–25 year intervals), and will include off-channel water bodies).

RIP-10 The Service recognizes the downstream limit of the study area is still under discussion, and we look forward to participating in this discussion. For the lateral extent of the study area we requested the 100-year floodplain plus an additional buffer in our 31 May 2012 study request. The Draft RSP lateral extent proposed above for about a 5- to 25-year floodplain study area is likely barely equal to the effective recurrence interval for riparian forest establishment, and based on the 2012 flood event shortly before our October TWG site visit, would not extend very far into or even into some floodplain forest communities. Few critical structures are engineered for these relatively frequent and less damaging (environmentally rejuvenating) events. Critical structures are often engineered for 100-year or more events, so we don't understand why the environmental health cannot also be conservatively engineered by extending the study area to at least the 100-year floodplain width. In addition to considering surface-water flooding to determine the study area width, we recommend including the area of groundwater potentially influenced by Project operations. For the riparian study, the width should be at least as wide as the expected area of groundwater within the maximum depth of all plant roots and influenced by Project operations.

AEA Methods (Draft RSP):

AEA's methods do not clearly follow the objectives, making it difficult to evaluate the appropriateness of the methods. The methods appear adequate; however, we recommend AEA reorganize the methods to address the objectives. Our comments below are organized by objective, with references to AEA's section numbers in the Draft RSP.

RIP-11 Please spell-out the first reference to acronyms in major sections (e.g., "ITU" referenced in the first paragraph of Draft RSP Section 11.6.4). We understand the wetlands in this study will be classified in the same manner as wetlands in Draft RSP Section 11.7 (Wetland Mapping Study), except without the functional analysis. If this is the case, please clarify in the RSP.

RIP-12 *AEA Objective 1 and Methods (Draft RSP): Identify, delineate, and map riparian ecotypes, wetlands, and wildlife habitats downstream from the Watana Dam site.*

Objective 1 is addressed in the Draft RSP sections for Developing Mapping Materials (11.6.4.1), Field Surveys (11.6.4.2, excluding the unnumbered Intensive Study Reaches and Sediment Aging sections), and ITU Mapping (11.6.4.3). We understand the final product at the end of the study will be based on a combination of ITU (citation required), a Viereck Level IV (Viereck et al.

1992) classification, and wetland delineation (Environmental Laboratory 1987, U.S. Army Corps of Engineers 2007), using 2013 high-resolution imagery for the entire study area with a minimum mapping polygon size of 1.0 acres for vegetated areas and 0.25 acres for waterbodies. These methods are essentially identical to the methods in the Vegetation and Wildlife Mapping Study (Draft RSP 11.5). For consistency with the Wetland Mapping Study (Draft RSP 11.7), the wetlands classification should also include the Cook Inlet classification (Gracz 2011) with modifications as required for the Susitna River basin. Although a formal wetland determination and functional analysis will not be conducted downstream of the propose dam, the wetlands methods and classification will be essentially identical to the methods in the Wetland Mapping Study (Draft RSP 11.5).

AEA Objective 2 and Methods (Draft RSP): In coordination with the instream flow, ice processes, and riverine geomorphology studies, characterize the physical and ecological processes downstream from the Watana Dam site that are likely to affect vegetation succession in riparian areas.

RIP-13 Objective 2 is addressed in the Draft RSP section for Field Surveys (11.6.4.2, unnumbered Intensive Study Reaches and Sediment Aging sections). For readers unfamiliar with the complex details of the various RSPs, the methods presented here may seem out of place. There is no justification for "Intensive Study Reaches" (now referred to as Focus Areas). For reasons like this and the ones discussed above, the Service recommends this section be moved to the Riparian Instream Flow Study (Draft RSP 8.6). Our comments here are preliminary and will likely be updated after reviewing Draft RSP 8.6, which was released too late to review. Whichever study takes the lead for this objective, the lead study should provide the detailed methods, and the supporting study/studies should not include much more than brief summary of the methods and a reference to the lead study. Repeating the methods in a study not responsible for the data collection and analyses is unnecessary and risks confusion if the methods differ or are inadequate in one of the studies.

RIP-14 Phrases like "Presently, the … methods are…" are unacceptable for what will become the RSP. At this stage the methods should be finalized, or a reasonable justification provided for why the TWGs are still working on the final details.

RIP-15 Where possible, references should be provided for methods and categories such as variably-sized circular plots. Without references with additional details, duplicating this study will likely be very difficult.

RIP-16 Line intercept is a standard method for sampling shrub cover, and not often used for shrub density. Transect lengths are also typically much longer than the sum of the two 6-meter transects. The PSP included forest canopy cover. Has forest canopy cover been dropped for the RSP?

RIP-17 Root depth studies that account for all the fine roots that might penetrate deep into the soil are notoriously difficult to conduct with confidence. Still, it might be informative to qualitatively note the root density and depth in the shallow soil pits.

RIP-18 As envisioned in the Service's 31 May 2012 Riparian Instream Flow request, the ground-surface elevation will also need to be surveyed so the depth to groundwater regime (not static water level) can be determined from the Groundwater Study (Draft RSP 7.5).

The sediment aging methods essentially duplicate what was presented at the 24 October 2012 TWG meeting for the Riparian Instream Flow study and demonstrate our concern for duplicating study methods in the lead and supporting studies. Our comments for sediment aging are provided in our Riparian Instream Flow PSP 6.6.

AEA Objective 3 and Methods (Draft RSP): Predict potential changes in riparian areas due to Project construction and operations, including changes to vegetation successional pathways, riparian ecotypes, wetlands, and wildlife habitats, which could result from alterations in instream flow, ice processes, and riverine geomorphology.

RIP-19 Objective 3 is addressed in the Draft RSP section for Impact Assessment: Predicting Changes in Riparian Areas (11.6.4.4). The methods in this section are not nearly as well developed as the methods described in the Vegetation and Wildlife Habitat Mapping Study (Draft RSP 11.5) and the Wetlands Mapping Study (Draft RSP 11.7). There is no mention of using GIS to upscale predicted habitat changes derived from this and supporting studies to the study area. How will predictions and rankings from the various supporting studies be incorporated into a GIS from the supporting studies such as riparian instream flow, ice process, and riverine geomorphology? The Service envisions this objective providing maps of the study area showing predicted changes under various Project operation scenarios.

AEA Reporting and Data Deliverables (Draft RSP):

RIP-20 For the pdf vegetation and wildlife habitat map deliverables, the Service recommends providing these products in geospatial pdf, so a sophisticated GIS program would not be required to readily identify coordinates on the maps.

AEA Schedule and Study Interdependencies (Draft RSP):

RIP-21 Will 2014 include additional field sampling in areas without high-resolution imagery until late 2013? Perhaps including a rough estimate of the area without high-resolution imagery would suggest how much additional work would be required?

RIP-22 The Study Interdependencies figure (Draft RSP Figure 11.6-2) suggests the Riparian wildlife habitat mapping component will not rely upon any insights gained from the Wildlife Resources (Draft RSP Section 10). These inputs should be included in the figure if they will be used. How is the “wildlife habitats” in the Predictions of change in riparian vegetation, wetlands, and wildlife habitats different than the element to the right in the figure for Riparian wildlife habitat mapping?

<u>Literature Cited</u>

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1, U.S. Army Engineer Waterway Experiment Station, Vicksburg, MS. 90 pp + appendices.

Gracz, M. 2011. Cook Inlet Lowland Wetlands. Available from http://cookinletwetlands.info/ Accessed September 2012.

U.S. Corps of Engineers (USACE). 2007. Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region Version 2.0. Wetlands Regulatory Assistance Program, U.S. Army Engineer Research and Development Center, Vicksburg, MS. 72 pp. + appendices.

Viereck, L.A., C.T. Dyrness, A.R Batten, and K.J. Wenzlick. 1992. The Alaska vegetation classification. Gen. Tech. Rep. PNW-GTR-286. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 278 pp.

9. Botanical Resources (RSP 11.)

9.7. Wetland Mapping Study in the Upper and Middle Susitna Basin (RSP 11.7.)

General Comments:

WETLND-03

The U.S. Fish and Wildlife Service's (Service) 31 May 2012 study request entitled *Wetland Mapping and Functional Assessment Study* differs from Alaska Energy Authority's (AEA) Proposed Study Plan (PSP) title by including the additional study component (underlined) in our title. At the time of our study request, the habitat mapping Technical Work Group (TWG) was concerned about which functional analysis to use, so emphasizing this in the study title seemed appropriate. The functional analysis question has now been resolved, and the new Draft Revised Study Plan (RSP) title (above) qualifying the study area is more appropriate. Our comments below are based the PSP and on AEA's Draft RSP dated 24 October 2012. Since we have not had sufficient time to fully evaluate this recently available Draft RSP, we reserve the opportunity for additional comment. Section numbering follows the Proposed Study Plan (PSP) for consistency with our other PSP comments, but includes the revised Draft RSP numbering in parentheses.

WETLND-04

A number of terms are used to qualify the resolution of aerial/remote-sensed imagery (high-, moderate-, fine-scale) throughout the study plan. Please provide a pixel resolution the first time each term is used. Besides image resolution, the type and wavelength bands used for photo interpretation, such as true color, false color and color infrared, should be discussed.

The section numbering for the Draft RSP 11.7 all start with 11.3, which is confusing and suggests the automatic numbering needs to be reset for this study. Please use the correct section numbers in future drafts. Our comments will be based on the correct number, substituting 11.3.x with the correct section number (11.7.x).

Specific Comments by Subsection:

The following review of AEA's proposed Wetland Mapping Study in the Upper and Middle Susitna Basin uses the structure of the plan and compares the plan to the Service's study-request objectives to determine if our intent is met, where improvements can be made, and which requested objectives are not addressed.

AEA General Description of the Proposed Study (Draft RSP):

WETLND-05

The general description of the study sets the stage for the study objectives, methods and products. The lower extent of the study area, however, is inconsistent with the descriptions that follow. The General Description (Draft RSP Section 11.7.1) defines the lower limit as the proposed dam, while the Study Goals and map (Draft RSP Section 11.7.1.1 and Figure 11.7-1) define the lower limit as Gold Creek. This is roughly a 47-river mile discrepancy, which needs to be clarified. Although a careful review of the General Description sentence: "Wetlands in riparian areas along the Susitna River below the proposed dam will be mapped in a separate study, …" may be technically correct (emphasis added), open-ended references to the lower limit of the study area elsewhere in the RSP can be confusing.

AEA Study Goals and Objectives (Draft RSP): The overall goal of the wetland mapping study is to prepare a baseline map of the existing wetland habitats in the upper and middle Susitna basin (upstream of Gold Creek).

WETLND-06 The Service did not provide an overall goal, and instead merged the goals and objectives into a bulleted list similar to the AEA's objectives discussed below. The scope of AEA's PSP included mapping the entire Susitna-Watana Hydroelectric Project (Project) area, which could be interpreted as including the entire Lower, Middle and Upper Susitna River. This refinement in scope to the middle and upper Susitna basin is appropriate, although it might also be helpful to qualify the middle Susitna basin as upstream of Gold Creek and mention the Riparian Study (PSP 9.6 / Draft RSP 11.6) will map wetlands in the floodplain below the proposed dam.

WETLND-07 AEA's three Draft RSP objectives are similar to the first three of our five objectives in our 31 May 2012 study request (map wetlands, determine functional values, and quantify impacts to wetlands). Our fifth requested study objective (develop mitigation measures) is likely more appropriate for a later stage in the licensing process.

Not addressed in AEA's Draft RSP objectives is our fourth 31 May 2012 study request objective to evaluate potential changes to wetlands and wetland functions from Project operations, maintenance and related activities. The intent of this objective was primarily to evaluate Project operation effects on wetlands downstream of the proposed dam. As the study plans evolved, we understand this objective will now be addressed in the Riparian Instream Flow and Botanical Resources Riparian studies (Draft RSPs 8.6 and11.6). If our understanding is incorrect, please address our fourth 31 May 2012 study request objective.

AEA Study Area (Draft RSP): The proposed study area for wetlands mapping consists of a 2-mile buffer surrounding those areas that would be directly altered or disturbed by development of the Project. … The alteration of wetland habitats downstream of the dam (due to changes in instream flow, ice processes, and riverine geomorphology in the Susitna River) will be addressed in the riparian study (see Section 11.6).

WETLND-08 The Draft RSP study area description is essentially the same as the PSP, with a few minor updates to reflect changes in the evolving study plans. The Service concurs with the study area, and we appreciate the detail provided making the distinction between the Wetland and Riparian Botanical studies.

AEA Methods (Draft RSP):

AEA's methods generally follow the order of the objectives, with a section added to describe field surveys. Our comments below are organized by objective, with references to AEA's section numbers in the Draft RSP.

AEA Objective 1 and Methods (Draft RSP): Identify, delineate, and map wetlands in the upper and middle Susitna basin in GIS.

WETLND-09 Objective 1 is addressed in the Draft RSP sections for Wetlands Classification (11.7.4.1) and Field Surveys (11.7.4.2). Although mentioned here, presumably the updated 1987 habitat mapping work described in the Vegetation and Wildlife Habitat Mapping Draft RSP 11.5 will also be used as a starting point for the wetlands mapping also.

The minimum mapping polygon size will be smaller than for the Vegetation and Wildlife Habitat Mapping Study (Draft RSP 11.5) and the Riparian Vegetation Study (Draft RSP 11.6): 1.0 acres for vegetated areas and 0.25 acres for waterbodies, versus 0.5 acres for most upland and wetland habitats and 0.1 acres for waterbodies and other wetlands of ecological importance. Since the 2-mile buffer Wetland Mapping study area is entirely contained within the 4-mile buffer Vegetation and Wildlife Habitat Mapping study, the Service is curious how the two different minimum mapping polygon sizes will be addressed where the studies overlap?

The field data collected for delineating wetlands is well documented (Environmental Laboratory 1987, U.S. Army Corps of Engineers 2007). What additional field data will be collected to delineate Viereck Level IV and Cook Inlet basin habitats (Viereck et al. 1992, Gracz 2011)?

AEA Objective 2 and Methods (Draft RSP): Determine functional values for the mapped wetland types.

WETLND-10

Objective 2 is addressed in the Draft RSP section for Wetland Functional Assessment (11.7.4.3). The methods adequately outline a very complex process potentially fraught with value judgments and incorporating a mix of documented functional analyses (Magee 1998) and project-specific wetland functional analyses. After AEA has had a chance to work with the data, and before progressing too far with the functional analysis, the Service recommends that AEA conduct a TWG meeting to review the details of the analysis to ensure the products will meet stakeholder needs.

AEA Objective 3 and Methods (Draft RSP): Quantify the potential direct, indirect, and cumulative impacts to wetlands and wetland functions from Project construction and operations activities, which will include any new wetlands that may be created by the proposed reservoir.

WETLND-11

Objective 3 is addressed in the Draft RSP section for Wetland Impact Assessment (11.7.4.4). The GIS component of this analysis is straightforward. Before the size and number of indirect disturbance buffer(s) are finalized based on the final specifications for Project construction, operations and maintenance activities, the Service requests a TWG meeting to ensure the products will meet stakeholder needs.

AEA Reporting and Data Deliverables (Draft RSP):

WETLND-12

For the pdf wetland map deliverables, the Service recommends providing these products in geospatial pdf, so a sophisticated GIS program would not be required to readily identify coordinates on the maps.

AEA Schedule and Study Interdependencies (Draft RSP):

WETLND-13

Why is 2012 included in the timeline for Draft RSP Table 11.7-1 if no activities are scheduled or performed in 2012?

The Service has not extensively reviewed the Draft RSPs to ensure the studies providing input to the wetland functional assessment completely overlap their study areas with the wetlands study (top row in Draft RSP Figure 11.7-2, Study Interdependencies). How will incomplete overlap be addressed if input studies do not completely overlap with the wetland study?

Literature Cited

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1, U.S. Army Engineer Waterway Experiment Station, Vicksburg, MS. 90 pp + appendices.

Gracz, M. 2011. Cook Inlet Lowland Wetlands. Available from http://cookinletwetlands.info/ Accessed September 2012.

Magee, D.W. 1998. A rapid procedure for assessing wetland functional capacity based on hydrogeomorphic (HGM) classification. Bedford, NH.

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Document Content(s)

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

November 14, 2012

Kimberly D. Bose
Federal Energy Regulatory Commission (FERC)
888 First Street, NE
Washington, DC 20426

Re: NMFS's Comments on the Proposed Study Plans for the Susitna-Watana Hydroelectric Project (FERC P-14241)

Dear Secretary Bose:

The National Marine Fisheries Service (NMFS) provides the enclosed comments on the Alaska Energy Authority's (AEA) Proposed Study Plans (PSPs) to support development of the license application for the Susitna-Watana Hydroelectric Power Project. These comments are provided in accordance with the Federal Energy Regulatory Commission's (FERC) regulations governing the Integrated Licensing Process [18 CFR Section 5.12] and the September 17, 2012 order (extending by 30 days the deadline) for reviewing AEA's PSPs by November 14, 2012. Under 18 CFR Section 5.12, NMFS's filing must include any revised information, study requests, and any accommodations reached with AEA. NMFS requests that pursuant to 18 CFR §5.9(b), FERC order the completion of the studies we requested on May 31, 2012, as part of FERC's study plan determination and provide the additional information, clarifications, and changes to those proposed study plans as requested in our enclosed comments.

NMFS has completed its internal review of AEA's PSPs that were filed with FERC on July 16, 2012. As initially filed, the PSPs contain many conceptual and methodological limitations that require remediation. These changes are needed so that NMFS has the necessary information to determine the impacts of the proposed hydroelectric power project. NMFS will use this information to develop appropriate and efficiently tailored license conditions that FERC can in turn, incorporate into any license order it issues, in accordance with the following:

- Federal Power Act (FPA) section 18 fishway prescriptions for passage of anadromous fish;
- FPA section 10(j) recommendations to protect, mitigate damage to, and enhance fish and wildlife resources; and
- FPA section 10(a) recommendations to ensure that the project is best adapted to comprehensive plans for developmental and non-developmental resources.

The organization of AEA's PSPs differs significantly in organization from NMFS's study requests, which complicated our ability to review the PSPs efficiently. NMFS requested that AEA provide a comparison of our study requests and the PSPs and identify any unaddressed study requests or study request components. This information has not been provided to NMFS.

Since filing their original PSPs, AEA has made substantial revisions to the plans. During technical work group meetings held the week of October 22, 2012, AEA initially presented preliminary information on what its revised PSPs may contain. These revisions were then made available to agencies between October 29 and October 31, 2012. AEA requested that NMFS provide comment by November 14, 2012, on those as yet uncompleted revised PSPs. FERC has asked that the agencies' comments address those undocumented changes to the plans. Many of the revisions reference results of studies conducted in 2012 that are not yet complete and have not been made available to agencies.

On October 31, 2012, NMFS submitted a letter to FERC that outlined our concerns regarding those revisions and other process-related issues affecting the Susitna-Watana licensing process. As stated in that letter, a period of only 14 days is insufficient for NMFS to review and to provide comments to FERC on the revisions to the PSPs potentially affecting over a dozen inter-related studies for this proposed large original hydropower project.

Given the number and complexity of the studies associated with a project of this magnitude and given the short time-frame NMFS has had to fulfill its duties in the licensing forum, we have not thoroughly reviewed the newly revised plans and are providing comments primarily on the PSPs originally filed by AEA. NMFS acknowledges that those revisions may resolve many of our concerns about the PSPs filed in July; however, they may also complicate or deepen our concerns.

Nevertheless, we believe that our comments, if addressed, will allow AEA to develop more robust studies and that those studies will help AEA create an adequate planning record for this project and provide NMFS with sufficient information required to meet its statutory obligations under the FPA and other authorities.

NMFS stresses the importance of collaboration and communication in developing mutually beneficial solutions for affected stakeholders and trust resources. Please contact Susan Walker (susan.walker@noaa.gov) with any questions regarding this project.

Sincerely,

James W. Balsiger, Ph.D.
Administrator, Alaska Region

Enclosures:

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Executive Summary

National Marine Fisheries Service's Comments on the Alaska Energy Authority's Proposed Study Plans for the Proposed Susitna-Watana Hydroelectric Power Project

Filed pursuant to FERC's September 17, 2012, Notice of Extension of Time to File Comments on the Proposed Study and Revised Study Plan

National Marine Fisheries Service/Alaska Region

November 14, 2012

Project Background

To meets its current goals for renewable energy, the State of Alaska has renewed its interest in the hydropower potential of the Susitna River and has begun the licensing process for the proposed hydroelectric project with the Federal Energy Regulatory Commission (FERC). The Alaska Energy Authority (AEA) has been authorized by the State of Alaska to develop the Susitna-Watana hydropower project.

The proposed dam would be located on the Susitna River in Southcentral Alaska, about 100 miles east of Denali National Park and 200 miles upriver from Cook Inlet and Anchorage. As proposed, the dam would be approximately 750 feet high, flood over 40 miles of the Susitna river valley, and create a reservoir of 43 miles long by 2 to 3 miles wide and over 500 feet deep to store about 4.3 million acre-feet of water collected from summer high flows for generating electricity. Proposed hydropower operations would regulate the river's flow, basically inverting the annual hydrograph by decreasing summer flows and increasing and fluctuating winter flows. A similar project proposed in the early 1980s was cancelled after three years of biological, ecological, and economic studies showed that energy could be supplied more economically with natural gas from Cook Inlet and that environmental effects of the proposed project were unacceptable.

The proposed Susitna-Watana hydropower project is of an unprecedented scale at this latitude, would use new construction technology that is untested in a sub-arctic environment, and would pose unique challenges due to climate, seismic potential and remote location. Licensing, construction and operation of the Susitna-Watana hydropower project would alter natural resources and natural processes affecting the valuable fish, wildlife, and habitat resources of the Susitna River over its entire length, from glacial headwaters to sub-tidal waters of Cook Inlet, for the life of the project.

AEA requested use of the Integrated Licensing Process (ILP) rather than a Traditional or Alternative Licensing Process even though the physical and temporal scale of proposed development is great. No new hydropower project of this magnitude has been licensed using the ILP.

Studies from the 1980s project form the basis for analysis of the new project. However, thirty years of scientific progress and changing climate have created significant deficiencies in the results of those earlier studies. The time frames associated with the ILP limit both the time for study and analysis of the effects of the project and for the resource agencies to develop and make recommendations for measures to minimize any adverse effects from the proposed project. That is why NMFS has argued that the ILP timeframes are a poor fit for this project.

NMFS has been an active participant in the Pre-Licensing Process. We have provided timely and substantial input to FERC. On May 31, 2012, NMFS provided FERC with Study Requests for the proposed project and comments on the Pre-Application Document and Scoping Document 1. On October 31, 2012, we provided comments on process related issues affecting our participation in the licensing process. This latest submission provides comments on the Proposed Study Plans (PSPs) developed by AEA.

Resource Issues and NMFS Involvement

The Susitna River watershed supports all five species of Pacific salmon. Under Section 18 of the Federal Power Act (FPA), NMFS shares authority with the U.S. Fish and Wildlife Service (USFWS) to issue mandatory fishway prescriptions for safe, timely, and effective fish passage. Under Section 10(j) of the FPA, NMFS is authorized to recommend license terms and conditions necessary to adequately and equitably protect, mitigate damages to, and enhance, fish (including related spawning grounds and habitat) affected by the development, operation, and management of hydropower projects. Section 10(a)(1) of the FPA requires FERC to condition hydropower licenses to best improve or develop a waterway or waterways for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat) based on the Services' recommendations and plans for affected waterways.

In addition, in 1996, the U.S. Congress added new habitat conservation provisions to the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the federal law that governs U.S. marine fisheries management. The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established a requirement to describe and identify Essential Fish Habitat (EFH) in each federal fishery management plan. The EFH provisions of the MSA [§305(b)] require federal agencies to consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH.

EFH for all five species of salmon extends throughout the entire Susitna watershed. Information exists that a small but unknown number of Chinook are able to pass upriver through a torrential canyon into the upper 100 miles of habitat. Thus, as currently proposed, Chinook salmon passage to the uppermost reaches of their habitat would likely be blocked by the dam. Also, as proposed, the dam would store water from snowmelt and glacial meltwater in summer and spill water in winter to meet demand for electricity, increasing normal winter flows by three- to five-fold and varying flow rates throughout each day. This "load following" mode of operation has the potential to adversely impact fish habitat by exacerbating processes such as riverbank erosion. The proposed project could also affect endangered Cook Inlet beluga whales and their Critical Habitat, primarily through effects to salmon and other prey species.

Study Plans

AEA filed PSPs with FERC on July 16, 2012. At this time the study plans became available for review by NMFS and the USFWS. NMFS has completed its internal review of these PSPs. AEA recently provided FERC with substantial revisions to the July 16, 2012 PSPs. Unfortunately, given the number and complexity of the studies associated with a project of this magnitude, and the short time-frame afforded by the ILP for NMFS to fulfill its duties in the licensing forum, our review is focused on the PSPs originally filed, and is commenting to the extent possible on the recent revisions provided by AEA. NMFS recognizes that the revisions may resolve many of our concerns about the PSPs filed in July; however, they may also complicate or deepen our concerns.

Summary of Comments on the Proposed Study Plans

General Comments applicable to all study plans proposed by AEA

NMFS, USFWS and other participants in the ILP process have requested a more detailed study frame work. Specifically requested was a framework that not only lists a range of methods but addresses the agencies' objectives and information needs, and explains how the proposed methods would be implemented to achieve resource agencies' objectives. The additional study plan detail requested will be used to assess the applicant's plan and to determine if it meets the intent of the NMFS study requests.

The additional detail should include a process schedule (timeline) and methods for determination of habitat utilization, abundance, and distribution information on anadromous fish species (in this study plan and in the fish study plan); including temporal and spatial distribution of spawning and rearing. Each study component should have a statement of what can be determined, how other studies are integrated, and an assessment of uncertainty in each study component. Each study component should explain how confidence intervals and calculated errors for each of the indices, data summaries, and model outputs will be calculated. If the study component is dependent on or supplies data for another study, then the primary resource relationships need to be specified in that context. For example, an assessment of project operational effects on overwintering fish will rely on an understanding of winter habitat availability, utilization and variables that influence habitat utilization and on the winter hydraulic flow routing and water quality models that rely on results from ice process and groundwater modeling. The process describing how error is associated with each of these components needs to be quantified and the level of certainty about the analysis of the resulting project effects needs to be described.

The proposed studies need to be integrated in a clear and understandable manner. For instance, the groundwater-related aquatic habitat study plan proposes to coordinate with the aquatic instream flow study for groundwater data in order to integrate into its models of surface/groundwater interaction. Yet the aquatic instream flow study plan does not explicitly call for development of methods to understand the project's effects on surface/groundwater exchange. While the importance of integrating the studies may be implied in various study plans, the project will benefit from an explicit plan that describes clear strategies for information exchange and integration between studies.

A major issue with AEA's PSPs is the apparent reliance on data collected in the 1980s and the use of 1980s study sites to address the objectives regarding fish distribution and habitat utilization without any data validation. While the 1980s' studies are a rational place to start to develop study plans, relying too heavily on the results of earlier studies has the potential for fundamental inaccuracies and cannot be justified scientifically. Given that the assumptions and limitations of the 1980s studies were not documented, the accuracy and current application of results of those studies to future or combined analysis is questionable.

From NMFS' perspective and of greatest help in developing fish prescriptions and instream flow recommendations, documenting juvenile salmon and resident fish habitat relationships could be considered the most important study for assessing this project's impacts. ,The study plans do not reflect the degree of effort which should be directed toward these studies even though an understanding how the project will alter the fish community is of paramount importance. Many of our comments on the specific study plans address a need for greater detail and specificity in descriptions of study methods, many of which have not been developed to meet the intent of agency objectives. Moreover, the plans do not establish appropriate study designs and offer incomplete and sometimes cursory reviews of related studies and life history information. Because essential descriptions of analytical methods are often missing, we cannot determine what statistical tests will be applied to data and used to evaluate potential project effects.

Finally, the two-year timeframe imposed by the ILP is too short to conduct many of the studies that would provide meaningful data. For one significant example, it will take five-to-seven years to determine the run-strength of Chinook spawned during the current year of very low Chinook abundance combined with highly unusual late-season flood events that may have scoured redds.

NMFS provides the following specific comments on select PSPs. The summary comments relate to the number in the corresponding PSP. NMFS has not reviewed all PSPs due to the sheer volume of material and inadequate time for review. NMFS would have preferred that sufficient time and adequate information was made available for us to review additional PSPs and to review the recently revised PSPs. Of note, NMFS finds that the PSP 7.14, "Genetic Baseline Study for Selected Fish Species" would benefit NMFS analysis and development of measures to protect, mitigate and possibly enhance fish populations at risk of adverse effect from project operations, and to inform our decision to prescribe fish passage, but we had insufficient resources to conduct that review.

5. Water Resources

5.5 Baseline Water Quality

In general, the PSP adequately addresses the water quality issues, but several areas require improvements. The presentation of the baseline monitoring program needs to include a more uniform level of information concerning its approaches and techniques. The baseline monitoring program should include sample collection efforts and dates to correspond with important climatological events and should consider developing an additional and detailed study of dissolved organic carbon.

Monthly sampling of constituents such as TSS, turbidity and some other chemicals, should be conducted in a synchronized manner across a range of habitat types (main-stem, side channel, slough, clear-water tributary, glacial tributary) at multiple sites.

Atmospheric deposition of mercury should be quantified as an additional source to the future reservoir and should be included in the sampling effort associated with the meteorological stations.

The plan should also should develop and present evaluation criteria for protecting aquatic life, wildlife, and human life.

5.6 Water Quality Modeling Study

The Water Quality Modeling Study proposes to use information from the Baseline Water Quality Study to develop a model to evaluate potential impacts of the proposed project on various aspects of the Susitna River watershed.

The description of the models to be used to characterize conditions under operation of the dam should include a separate and detailed description of the approach to be followed in developing the final selected model. This needs to describe how terrestrial conditions will be used to develop boundary conditions outside of the current riverine conditions.

The plans should also consider in model selection the geometric and topographic complexity of the river system for potential extension of model boundary down to the Susitna-Talkeetna - Chulitna confluence.

The plan should include an explicit hydrodynamic model calibration plan to be used for water quality modeling and include an explicit description of the modeling approach to be used for determining toxicity of future water quality to aquatic life, wildlife, and human life.

The PSP should also discuss approaches to determining and evaluating the bioavailability of metals in the future reservoir and river and consider expanding the analytes to be sampled in the baseline monitoring program.

5.7 Groundwater-related Aquatic Habitat Study

General Comments: This study does not propose collecting any groundwater-related data. Rather, it proposes to gather its data from other studies and integrate that data into models of surface/groundwater interactions. The Aquatic Instream Flow PSP did not provide methods for understanding effects on surface/groundwater exchange or assessing effects on habitat associated with surface/groundwater exchange. NMFS is concerned that inadequate responsibility is assigned to this topic and that the data collected will not meet our stated goals for this study. We request a clear description of the methods used, the expected outcome, what can be determined, and how uncertainty will be calculated for each of the study objectives.
Also, the study needs more detail about how it will assess and characterize habitat utilization for overwintering juvenile anadromous fish and the influence of groundwater exchange on the suitability of winter habitat.

Objective 1: The summary of the 1980s studies related to groundwater needs to describe the differences between the 1980s project and the current project in regards to proposed winter time operations and the different data and models. We also request a review and summary of other hydroelectric projects in cold regions and their effects on surface/groundwater interactions.

Objective 2: We request the process domain definitions be vetted with the resource agencies, and that all relevant information and knowledge gained from the other studies be used to assess and refine the process-domain mapping of the Susitna River basin. We request an assessment of the precision and accuracy of the predicted effects.

Objective 3: In addition to the flow paths and conceptual surface/groundwater model we request a description of how the downstream extent of the reservoir's influence on groundwater will be determined.

Objective 4: We have three basic concerns:

- the mainstem upwelling areas will not be accurately accounted for and no actual groundwater information focuses on the mainstem;
- the study methods are not focused on determining upwelling/downwelling areas and flow paths and may not capture the actual distribution of upwelling/downwelling areas and;
- as noted above, the Groundwater-related Aquatic Habitat study plan is not responsible for collection of any of this data.

Objective 5: AEA's methods for this groundwater objective (Section 5.7.4.5) and the Riparian Instream Flow Objective (Section 6.6) confuse responsibilities and methods between the two studies. Our comments focus on the groundwater methods from both studies.

Objective 6: The study methods here are vague and it is unclear which study is responsible for collection of the site specific groundwater data. We request that the revised study plan detail the methods for collecting the groundwater potentiometric surface through each of the aquatic study sites. We also request that the monitoring and modeling approach described for the floodplain be adapted and applied to the aquatic instream flow study sites and other sites of particular fish habitat importance (spawning, rearing, overwintering habitats).

Objective 7: At focus areas, spatial and temporal water quality data should be collected to understand processes that contribute to river productivity, habitat quality, thermal refugia, and how surface/groundwater processes are influential to those processes. Additionally we request that a relative age of water be determined.

5.8 Geomorphology Study

General Comments: This and the fluvial geomorphology study should include what objectives are being met and how the studies will influence other studies. The study plan should describe how it will determine uncertainties associated with models and analyses of project effects.

Objective 1: Clarify whether methodologies proposed by NMFS will be incorporated into the study.

Objective 2: We request that existing sediment transport data be collected near the mouths of the Chulitna and Talkeetna Rivers.

Objective 3: Explain how the geomorphology study will incorporate an understanding of geomorphic change and processes to understand large wood recruitment.

Objective 4: We request that the conceptual framework be used downstream of the proposed dam and that the study be extended if the framework calculations find influence in the lower river.

5.9 Fluvial Geomorphology Modeling

General Comments: If the system is found to be in dynamic equilibrium, the geomorphology and fluvial geomorphology studies provide the magnitude and trend of geomorphic change in response to the project.

Objective 1: Site selection for the 2D models must consider habitat utilization by anadromous fish, importance of the habitat, and dynamic flow patterns and geomorphic processes. Sites should be selected that serve biologic functions (spawning, rearing, migration, overwintering) and will potentially change with project operations.

Objective 2: Additional information that should be provided with the estimate of potential channel change including a translation to habitat change, change in large wood recruitment, change in floodplain sedimentation, and change in substrate size composition.

Objective 3: We suggest that the geomorphology modeling results for project operation scenarios, along with other information, also be presented in the instream flow study to allow for an integrated analysis of the changes to riverine and floodplain habitats under project operations.

5.10 Ice Processes

General Comments: The PSP needs a more detailed study framework, one that defines specific objectives and addresses the agency's information needs and elucidates the logic for how proposed methods achieve stated objectives. We request a detailed description of the minimum number and locations of discharge measurements to be taken during winter to be used by the winter ice processes model.

The study should review existing studies of cold region hydropower projects around the world to extrapolate potential implications for the proposed project.

A more detailed and elaborate literature review needs to be conducted on the study of river ice processes.

Objective 1: The PSP should outline how the existing regime will be characterized. What are the key drivers behind dominant river ice processes? The study should also characterize spatial and temporal variability, river ice evolution,and annual variations.

Objective 2: The study period needs to be extended to gain an adequate understanding of winter effects. Describe in detail the data collection for winter hydraulic flow routing; calibrate the iceflow model CRISSP1D in open water before introducing ice effects; outline a plan of proposed data collection.

Objective 4: The fourth objective in the PSP proposes to look at the impact of various operational scenarios on ice processes downstream of the Susitna-Watana Dam. This should also look at effects on instream flows downstream of the dam.

Objective 6: The study needs to ensure that the calibrated model be able to assess how load-following operations will influence ice processes in comparison to the typically stable ice cover during winter.

5.11 Glacial and Runoff Changes Study (Climate Change)

This PSP only partially addresses NMFS' study request entitled "Susitna River Project Effects under Changing Climate Conditions." It does not address the main objective of our request which is, in brief to assess the potential project effects combined with impacts of climate change on the Susitna watershed ecosystem, in order to develop license conditions that protect anadromous fish species and their habitat.

The proposed project is designed for long-term utility and is located in an area of continued climate change. These climate-induced and project-influenced changes in habitat would affect fish in the Susitna River. Informing the likelihood, trend and timing of these events will allow NMFS to make decisions on the effects that a dam would have if it were to block the passage of fish from the upper watershed where refugia from negative effects on habitat may persist. Thus, NMFS seeks information from our requested climate study in order to inform our decision of whether prescription of fish passage is needed.

Without such an understanding of climate change, project operations would mistakenly be considered as though future conditions were to be static. The project license would be outdated from the outset. NMFS seeks the information specified in its climate change study request in order to analyze the project effects on NMFS trust resources, in the context of variable and changing climate conditions. As explained more fully in §1.3.4 of NMFS' request, the main reason for this analysis is to incorporate the results of current climate science into comprehensive decision making, and provide information NMFS can use to develop license conditions, which FERC in turn can incorporate into any license order it issues, appropriate and efficiently tailored in accordance with the following:

- FPA section 18 fishway prescriptions for passage of anadromous fish;
- FPA section 10(j) recommendations to protect, mitigate damage to, and enhance fish and wildlife resources; and
- FPA section 10(a) recommendations to ensure that the project is best adapted to comprehensive plans for developmental and non-developmental resources.

In order to fulfill their duties under the FPA and other relevant mandates, NMFS and FERC must obtain and apply the best available science, data and techniques to assess the potential effects of the proposed project on riverine processes, fish, and fish habitat. Applying recent advances in climate science, including scenario analysis and projections, to project analysis will result in more accurate and informed decisions regarding our trust resources.

5.12 Mercury Assessment and Potential for Bioaccumulation Study

The plan exhibits some serious omissions. We request the following major improvements:

1. Adopt the concept of mercury with dynamic background;
2. Document mercury increases at other hydro projects in boreal forested landscapes;
3. Do not assume mercury to be a simple, conservative behaving metal; and
4. Provide for continuous monitoring that proactively addresses mercury toxicity in fish and biota.

6. Instream Flow Studies: Fish, Aquatic and Riparian

6.5 Fish and Aquatic Instream Flow Study

General Comments: The goal of the study request is to characterize the existing flow regime and the relationship of instream flow to riparian and aquatic habitats and organisms. In contrast, the PSP's stated goal is to "provide quantitative indices of existing aquatic habitats and the effects of alternate project operation scenarios." We are unclear about the purpose of this goal and while it may contribute to meeting our request, limiting the study to indices of existing habitats falls short of our request because it does not quantify the loss of aquatic resources and their habitats as a result of the proposed project's operations.

Site selection: Site selection needs to be representative of the physical processes related to instream flow, including habitat-flow relationships, surface/groundwater exchange, geomorphic processes, and ice processes.

Duration: As proposed, this study will not represent the range of conditions that occur naturally. We suggest using as a basis the average lifespan of a Chinook salmon, five years.

Objective 1: The macro-habitat classification method must include enough study sites to capture the variability in the macro-habitat types, in each geomorphic reach, to describe characteristics that may influence fish distribution. For example, water quality and water sources seem to be the major driver of fish distribution in glacial rivers, but the current classification does not differentiate macro-habitats of different water quality.

Objective 2: The objective's methods for study site and sampling procedures selection for the Susitna River habitat types are not well defined in the plan. Study site and procedure selection alone should not be an objective; rather, the objective should be to characterize and quantify the habitat types of the Susitna River.

Objective 3: The number and location of discharge measurements to develop and calibrate the winter hydraulic flow routing model are not well described. The natural winter flow regime is stable after ice up until break up with very little flow fluctuation relative to the ice free period. Winter hydraulic flow routing will rely on the ice processes study to incorporate changes to ice cover with project; a detailed description of how that data will be provided and incorporated into the hydraulic flow routing analysis is needed. Also needed is an analysis of the applicability of winter hydraulic flow routing to assess effects of project operations to fish and their habitat.

Objective 4: Developing seasonal, site-specific Habitat Suitability Curves (HSC) and Habitat Suitability Indices (HSI) for fish species at various lifestages should come from analysis of environmental criteria that influence the distribution, condition, and growth rates of anadromous fish in the river system for each species and lifestage. Fish behavior is not addressed in the PSPs, but study of the energetic consequences of fish behavior must be conducted to ensure that bioenergetic criteria that define fish habitat quality do not depend on arbitrary assumptions about fish activity costs.

Moreover, because spatial and temporal variability is also accompanied by variability in traditional habitat suitability criteria (e.g. water depth and velocity and substrate size), all the environments supporting each target species and life stage must be surveyed for statistical discernment of habitat criteria that influence habitat selection.

Objective 5: The fifth objective is to develop integrated aquatic habitat models. However, this in itself does not address resource management goals. Integrated aquatic habitat models can be informative and, if properly chosen, can be biologically meaningful. The proposed two-year study period seems inadequate to develop models with relevant site specific data. The purpose of this objective should be to represent the analysis of project effects on ecological relevant metrics for fish and aquatic ecosystems.

As with its chronological dimensions, the proposed study must consist of models that produce data for a variety of biological metrics under a wider range of existing conditions and operational scenarios. These metrics should include the following:

- water surface elevation at selected river locations;
- water velocity within study site subdivisions (cells or transects) over a range of flows during seasonal conditions;
- varial zone area;
- frequency and duration of exposure/inundation of the varial zone at selected river locations; and
- habitat suitability indices.

Objective 8: We requested that the proposed study identify, characterize, and integrate the timing, quantity and function of instream flow to riverine processes. AEA's PSP is unclear how processes such as surface/groundwater exchange, water quality, river productivity, and biological cues will be integrated and at what scale. It is also unclear how results from these studies will be extrapolated to gain a greater understanding of the overall project effects to the Susitna River system. We request that integration of the analysis of project effects on riverine processes be conducted in the instream flow study.

6.6 Riparian Instream Flow Study

General Comments: This proposal would benefit from a statement on the need for a characterization of current conditions, a predictive model, and a tabulation of the types and amounts of riparian habitats predicted to be lost. Many of the tasks are out of order, making it difficult to visualize how one product will lead into another. A reordering of the tasks within the objectives, including linkages between tasks is needed.. Some general terminology in the PSP should be clarified, defined, and standardized.

The objectives should clearly state the intention to expand the scope of literature surveys and syntheses to include literature that describes processes and functions of similar rivers with and without hydropower projects. Include literature that integrates surface and groundwater interactions with plant community distribution and response to different riverine functions. The PSP needs to identify methods to integrate current conditions and historic data into sub-models described in other AEA PSPs in order to predict possible effects from the proposed project, whichshould be the endpoint of this study. The PSP should also include an explanation of how the process domains and lateral extent of the study area were delineated and explain the intent behind using focus areas and how they were selected.

The PSP should develop surface and groundwater response curves for key plant species and stages and provide literature citations and explanations for the height and diameter classes that were selected. In developing its scaling model, the plan should describe assumptions for and limitations of using models to extrapolate between focus areas and process domains. In establishing reference sites, the plan should establish reference sites on the Talkeetna River with similar plant communities and hydraulic regimes, and use them for comparison with corresponding sites below the proposed dam site. Reference sites can provide real time comparisons between the unaltered and altered conditions, but assumptions need to be clearly stated when comparing reference and impacted sites between rivers.

The plan needs to develop a monitoring protocol to detect physical, spatial, and temporal changes in key plant communities and establish permanent monitoring sites including reference sites in the Talkeetna River.

7. Fish and Aquatic Resources

General Comments: The PSPs give only a cursory summary of fish collection methods with a general and minimal description of sampling locations and frequency that are not based on the life histories of the fish species known to live in the Middle Susitna River or on the variability of potential habitats. Specifically, more detail is needed about the proposed approach to assess the habitat utilization and habitat characteristics, particularly for overwintering juvenile anadromous fish.

The two-year time frame of the FERC ILP gives no time to collect adequate site specific data and build models that will reflect variations in characteristics driving fish habitat relationships. One simple example of the inadequate timeframe is for studies on Chinook salmon. The Chinook salmon stocks or populations of the Susitna River are commercially important throughout the species marine habitat, and support important subsistence and sport fisheries in both marine and fresh waters. Chinook salmon are present throughout the entire Susitna watershed, including distribution above the dam, in mainstem spawning and overwintering habitat below the dam, and in side- and off-channel rearing and overwintering habitat below the dam. Access to important tributary spawning habitats above and below the dam may be adversely affected by the project.

The lifecycle of Chinook salmon ranges from three to seven years, averaging five years. Two years of study will not yield sufficient understanding of baseline population characteristics of this important species nor be sufficient to assess likely project effects. NMFS will not be able to develop effective measure to protect, mitigate or enhance this or other anadromous species with two years of data – especially in a cycle of low Chinook stock abundance throughout the state and following a rare late-season flood event that may have potentially harmed Chinook salmon eggs incubating in redds. Similar limitations to collecting adequate site specific data apply to each salmon species in the Susitna River and other anadromous fish.

7.5 Study of Fish Distribution and Abundance in the Upper Susitna River

General Comments: We request that the Upper Susitna River study objectives be refined to reflect specific information needs for evaluating potential project-effects to the fish community.

Objective 1: We are uncertain of the purpose and need for the studies proposed in this plan. The primary objective of Upper Susitna River studies should be to determine resident and anadromous fish use of the inundation zone for key life history periods (i.e. spawning and overwintering). Of particular importance is documenting Chinook salmon spawning and rearing habitats.

Determining fish-habitat relationships will require analyses of fish community metrics (i.e. relative abundance, growth rates) as a function of physical, chemical, and biological habitat characteristics. However, methods to accomplish this objective are not provided.

The PSP provides only a brief review of previous studies of fish species observed in this river segment and its tributaries, and the study methods do not identify collection methods for specific fish species or life stages. In addition, data analytical methods and the statistical design are not provided. It is unclear how the results of these studies will be used to evaluate or mitigate potential impacts to the upper river fish community, or identify which species will be targeted for sampling.

Sample timing, frequency, and location should be developed to support the project objective. For instance, middle Susitna River juvenile Chinook salmon likely overwinter in the mainstem, so sample timing and frequency should be developed to determine if this same migration pattern is observed in the upper river.

Sampling methods too should identify measures of specific habitat variables to determine fish distribution among sites and among sampling events. A general classification of "pool, riffle, or backwater" will likely not provide enough information to characterize fish-habitat relationships or to evaluate potential project effects.

Objective 2: The methods do not describe which marine-derived elements will be tested for, or methodology for sample collection and analyses to determine whether Dolly Varden and humpback whitefish exhibit anadromous or resident life histories. Rather than testing otoliths for marine-derived elements, samples could also be collected from tissues, or fin clippings to have non-lethal effects, which would allow more samples to be collected.

Objective 5: The PSP proposes to use biotelemetry to describe seasonal movements of selected fish species but does not describe how the study will determine migration timing and locations of spawning and overwintering fish, or how the efficiency of PIT and radio tags will be evaluated, especially for fish smaller than 50 mm. It is unclear what species will be tagged, what age class, where or when fish will be captured for tagging and how selection of age class, tagging location, and timing of tagging has been selected to identify migration patterns. The PSP does not identify why more fish will be tagged in the upper, compared to the middle and lower river sites.

Objective 6: The plan to document the timing of downstream movements via outmigrant traps contains no descriptions of the effectiveness of these methods for capturing fish migrating downstream at this location. There is no description of data analyses or a discussion of how the results will be applied to project operation or mitigation.

Objective 7: The purpose of documenting northern pike at all locations is unclear, and the reason for the inclusion of this objective is not identified. To our knowledge, intensive sampling for northern pike within this segment of the Susitna River has not been conducted. We recommend working with the Alaska Department of Fish and Game (ADF&G) to develop a sampling plan that identifies upper river sampling locations, sample timing and frequency, and collection methods to determine whether northern pike are present.

7.6 Study of Fish Distribution and Abundance in the Middle and Lower Susitna

General Comments: The PSP proposes instream flow analysis of habitat suitability as the analytical method to develop species and life-stage specific habitat suitability curves, but fails to describe the methods that will be used to develop habitat suitability curves and how they will address the limitations of a methodology that is debated among scientists.

Moreover, the study area in the Middle and Lower River PSP is from river mile 28 to the Watana Dam site. The USFWS and NMFS believe that studies in the lower river are necessary to evaluate potential biotic effects of species displacement from middle river habitats, to document the relative contribution to fish production and use between these two river segments, and to provide for post-project comparisons.

Objective 1: Methods have not been developed for specific study objectives. Proposed sampling frequency and locations are not appropriate for the study objective. The study plan does not propose any evaluation of sampling efficiency, accuracy, precision, or representativeness. There is no description of how the study results will be analyzed or used to evaluate potential project effects.

NMFS recommends three study components for each fish species: first, describe the seasonal distribution of anadromous salmonids, non-salmonid anadromous fishes, and resident fish; second, describe the relative abundance of each fish species; and third, describe the fish-habitat associations—with specific, detailed quantitative information for all three of these objectives. Our full comments review characteristics of Pacific salmon and its habitats that need to be studied to evaluate the proposed project. Many of the other studies are being requested largely to determine the influence of subjects such as ground water, water quality, flow routing, and productivity on fish habitat relationships.

Objective 2: This PSP partially addresses agency study requests for resident fish species. However, study methods do not support the intent of the agency objective. The study plan has not been developed to characterize synchronization of resident fish migration and life histories to other physical, chemical, or biological environmental variables. The plan provides only cursory information on the general life-history patterns of the target fish species and does not include any site specific information.

The methods do not identify when, where, or how specific fish species will be captured. The plan would address the objective using biotelemetry to identify seasonal movements of resident fish; however, it is not clear how this will relate to the habitat characterization studies or the instream flow models.

The number of fish that this PSP proposes to track is insufficient to document the migration patterns to spawning, summer foraging, and overwintering habitats to meet the study objective. And the method of tracking, the operation of radio receivers, has not been developed to track the resident species identified.

The PSP's description of the use of PIT tags needs elaboration. For instance, the target species that will be tagged for this study need to be defined, and the criteria for site selection of antenna arrays are also unclear. Additionally, the fish collection methods do not appear to be related to the project objective, but are merely a list of sampling techniques.

In our detailed comments on this study objective, we identify information on life history and site-specific studies that are needed for developing study sampling plans that account for differences among resident fish within the proposed study area.

Objective 3: This objective of documenting the timing of downstream movement for all fish using outmigrant traps seems very broad with no specific purpose and no discussion of how the gathered data will be used. The objective should be expanded and the purpose of the study clarified.

Objective 4: Determining the age structure, growth, and condition of anadromous and resident fish for multiple seasons is an important project objective, but the Study Plan does not provide any information on why this information is being collected or calculated, or how these metrics will be used in project evaluation or mitigation. The PSP should identify the specific objectives and information needs that require juvenile anadromous and resident fish growth rates.

Objective 5: The objective seems directed toward any invasive species but refers to northern pike. Are other invasive species anticipated that should be considered under this objective? If the intent is to document the seasonal distribution, relative abundance, and habitat associations of other invasive species, if present in samples, then detailed procedures should be provided on how this would be accomplished.

7.7 Salmon Escapement Studies

General Comments: The purpose of the Salmon Escapement Study is to assess the current run timing and distribution of each of the five species of salmon among different habitat types in the lower and middle Susitna River, with emphasis on the middle reach. As previous studies have been unsuccessful in consistently measuring spawning in the mainstem, this objective should be considered a priority for these studies. This information is needed to evaluate potential effects on distribution patterns, availability of spawning habitat, and access to spawning sites.

Objective 1: Methods used to capture, radio-tag, and track adults of five species of Pacific salmon should describe how fish will be selected for tagging and how tagging effort will be stratified throughout the migration/spawning season. Additionally, it is unclear why only Chinook and coho are to be tagged in the lower Susitna River, whereas all five species are tagged at Curry Station. The PSP should justify unequal sampling and tagging effort among salmonid species. Target species have not been selected, not is the concept of target species necessarily acceptable to NMFS given that the project will likely have negative effects on four of the five species of Pacific salmon (i.e., the project will not likely affect pink salmon).

Objective 2: The proposed methods to characterize the migration behavior and spawning locations of radiotagged fish in the lower, middle, and upper Susitna River will miss fish migrating to spawning sites that are in the middle river but downstream of Curry. Also, the Plan offers no methods for testing effects of radio-tagging on survival and behavior. As in the previous objective, some justification needs to be offered for tagging coho and Chinook salmon more intensively than other salmonids.

Objective 4: The use of sonar to document salmon spawning locations in turbid water may not be as effective in the Susitna as in the Columbia River.

Objective 6: It is unclear how the aerial counts conducted for this study will be used to obtain escapement numbers. Ground surveys or fish sampling methods should be conducted to ground-truth these counts or to determine if sites were spawning or holding sites, but methods only describe aerial counts.

Objective 8: The methods described do not address the stated objective of estimating system-wide Chinook and coho salmon escapement to the Susitna River and the distribution of those fish among tributaries of the Susitna River. How many weirs will be operated for this study? How will weir locations be chosen? Observations, through weirs, foot surveys, or fish sampling methods should be conducted at more tributaries than this PSP describes. Additionally, no weirs are located within the middle river, which has the greater potential for impact by a hydroelectric project than the lower river. It is important to know the distribution and escapement of salmon into these middle river tributaries.

7.8 River Productivity Study

General Comments: Hydroelectric development can directly or indirectly modify primary productivity rates, organic matter input and storage, and macro-invertebrate production, particularly in a glacial system where suspended sediment plays such a large role in species distribution and abundance. If we are to make informed decisions regarding licensing and conditioning any license for this proposed project, understanding these relationships should be an AEA and FERC priority. This PSP, however, is inadequate to obtain information on river productivity relevant to the evaluation of the license application. This section should be rewritten following a literature review, completion of the habitat classification and mapping, site reconnaissance by the principal investigators, and coordination with the resource agencies. The title of this section might more accurately reflect study contents: Macro-invertebrate and Algal Abundance.

Objective 1: The synthesis of existing literature on the impacts of hydropower development and operations (including temperature and turbidity) on benthic macro-invertebrate and algal communities is an important step in the development of our understanding of hydropower's effects on river productivity. This objective should include a literature review and annotated bibliographies of hydropower development and operation on benthic and transported organic matter, and ecosystem productivity, not just algal biomass.

Objective 2: Sampling plans for macro-invertebrates, algal community composition, biomass, and productivity, should be developed around understanding their influence on fish distribution and production, and evaluating potential project effects. More information will need to be provided on insect emergence sampling methods, design, and data analyses.

Sampling Locations: Sampling locations should be selected to obtain replicate measures documenting the range of project effects among main channel and off-channel locations and in order to evaluate the influence of macro-invertebrate and algal abundance on fish distribution and production.

Sample Timing and Frequency: Sample collection frequency should document potential project effects, particularly changes in flow and temperature. Sampling prior to and following storm events could be used to evaluate the response of the community to the flow regime. Algal sample timing and frequency should be developed to evaluate changes relative to parameters that influence growth. Algal sampling also should be collected in the fall to document this period of potential increased production. As an alternative, AEA should consider seasonal measures of ecosystem metabolism that integrate the effects of multiple different parameters influencing algal productivity.

Sampling Methods

The AEA PSP states that benthic macro-invertebrates will be collected from riffles within each macro-habitat unit. We do not agree with sample collection of riffle habitats only. This represents only one meso-habitat and will bias characterization of invertebrate communities. In addition most of the locations referenced do not contain riffles to sample. Sampling methods should be used that are quantitative and appropriate for fine and coarse substrates.

Additionally, the plan does not provide any detail on algal sample collection methods or sample handling and processing. Simply stating that methods will follow unspecified state protocols is not sufficient for evaluating the proposed methodology. The methods should describe how samples will be collected from the multiple different available substrates– in advance of any field studies being conducted.

Objective 3: This objective to "estimate" drift of benthic macro-invertebrates does not reflect the importance of this topic in understanding project effects to the biotic community. Sampling locations, timing and frequency should be selected to quantify differences in drift among habitats and be used to evaluate seasonal and spatial fish distributions and differences in potential project effects. Our concerns about sampling in Objective 2 are similar for this objective: locations, timing, methods (and the reasons for these choices) need to be clearly delineated.

Objective 5: This objective is to conduct a review on the feasibility of a trophic analysis to describe potential changes in the primary and secondary productivity of the riverine community *following* project construction and operation. We believe that a thorough review *prior to* developing monitoring plans would be beneficial. All of the information requested under Study Objective 1 should be provided as a product of this review.

Objective 6: This PSP does not provide enough information to evaluate the study will be able to meet the stated objective to generate habitat suitability criteria to predict potential changes in these habitats downstream of the proposed dam site.

Objective 7: This study objective differs from the agency study objective which is to "Characterize trophic interactions using seasonal diets (stomach content analysis) of all age classes of non-salmon anadromous, resident and invasive fish species." Determining the food resources used by fish within the Susitna River is an important project objective. Whether the PSP will accomplish the purpose of this objective is unclear.

Objective 8: This objective would characterize organic matter resources (e.g., available for macro-invertebrate consumers) in the lower, middle, and upper Susitna River. Benthic organic matter is likely the most important source of carbon within the Susitna River, and the construction and operation of hydroelectric facilities can influence the transportation, storage, and processing of benthic organic matter in many ways. Our comments provide a partial review of the literature that raises a number of questions that should be addressed through studies being developed and implemented in support the FERC license application.

While perhaps not all of the questions raised in this review can be addressed, it is unclear how the PSP will address any of them. The purposes for sampling benthic organic matter are not clarified, nor are the reasons behind the selection of sampling locations, sample timing, or sampling frequency. Sample collection methods and analyses are not provided and there is no discussion on how the resulting data would be used to evaluate project effects.

Objective 9: The study plan currently does not provide enough information for critical review. In is unclear how proposed methods would allow for "monitoring baseline conditions" or "changes in productivity" to accomplish the objective of estimating benthic macro-invertebrate colonization rates in the middle and lower reaches "to monitor baseline conditions and evaluate future changes to productivity in the Susitna River."

7.9 Characterization of aquatic habitats in the Susitna River with potential to be affected by the Susitna-Watana Project

General Comments: The goal of this PSP is to characterize all aquatic habitats that have the potential to be altered by project effects. Due to the size of the study area, the PSP proposes to use different data collection methods at different locations, based upon the degree of potential impact and hence, differences in data quality. The geomorphic and hydrological differentiations between various locations in the river are not clearly defined, and while we are not opposed to the geomorphic and hydrologic classification of the Susitna River and its tributaries, the relationship between these classification types and the distribution or abundance of any fish species must be established first.

Also, in regards to video mapping, ground surveys will be an important supplement to aerial mapping. Not only will ground surveys provide data for habitats unidentifiable by aerial video mapping (due to vegetative cover) but will be useful in evaluating video mapping accuracy.

Objective 1: The purpose for the application of this classification method to upper river tributaries and mainstem locations within the inundation zone is unclear. We are unsure why this is being conducted, given limited resources. Furthermore, the objective addresses only the mainstem and tributaries of the upper river. It is unclear whether off-channel habitats will be further characterized by aerial methods.

Objective 2: If the objective is to apply a classification method that can be used to describe the distribution of fish, other criteria must be considered than those identified in this objective.

Objective 3: The purpose for classifying tributaries and lakes upstream from the inundation zone is unclear and should be clarified. If classification is being conducted to quantify remaining post-project habitat, then the relationships between fish species and macro- meso- and micro-habitat characteristics must also be established. Current upper river fish study plan methods have not been developed to establish these relationships.

7.10 The Future Watana Reservoir Fish Community and Risk of Entrainment Study

NMFS did not submit a study request for this topic, but we have comments and recommendations for expansion of the PSPs. AEA should develop scenarios for future fish communities based on current fish species composition upstream of the proposed dam site and anticipated reservoir habitat characteristics.

If, as proposed, project operations reduce summer high flows in the Susitna River through Devils Canyon, passage of salmon may increase. NMFS recommends studying the potential for enhancement of commercial and subsistence salmon fisheries within the future reservoir. In addition to Chinook, which are known to inhabit the upper river, NMFS recommends studying the potential for the reservoir and upper river to support sockeye, chum and possibly Coho salmon

To address entrainment, NMFS recommends consulting the Fish Screen and Bypass Guidance contained in NMFS Anadromous Salmonid Passage Facility Design document.

7.11 Fish Passage Feasibility

General Comments: The Fish Passage Feasibility PSP proposes to address information needs for NMFS to determine the feasibility of developing mandatory fishway prescriptions. This differs from NMFS objectives in the Fish Passage Study Request which also includes, if warranted, developing preliminary fishway prescriptions. For resources under its jurisdiction, NMFS may prescribe fishways as necessary to maintain all life stages impacted by the project.

The PSP is very brief, and does not address NMFS information needs and study requests in sufficient detail to determine what parts of our study request are adopted, what parts are not, and if not, why not. AEA has not identified the differences between our study request and their study nor explained where and why they did not address our requests. NMFS requests again through this filing that the study plan determination order include the elements NMFS seeks in order to inform any fish passage prescription.

NMFS disagrees with the three-year limit of the study period. This short study period is inadequate to understand adult migrations especially at a time when stocks, particularly Chinook, are low and their abundance above the project may be drastically reduced. NMFS continues to recommend that fisheries surveys be conducted for at least one average life span of each salmon species, which is an average of five years for Chinook salmon (range three to seven years).

The plan states that there is currently no specific engineering information and little biological information to provide a basis for determining the need for and feasibility of passage at the proposed dam. As early as 1983 ADF&G determined that fishway construction for a high dam on the Susitna was theoretically possible, but costly. Fish passage engineering has evolved and improved considerably since then, almost exclusively in response to the need to retrofit fish passage at dams in the lower 48 states that blocked the up- and down-stream passage of salmon with detrimental financial, ecological, and social effects. The biological need for passage is an issue independent of the engineering feasibility; these issues should be analyzed separately.

At this stage, biological information and criteria should be gathered, and a full-range of engineering options should be pursued, including novel ones. No alternative should be rejected based on cost at the feasibility stage.

Finally, we offer a set of recommendations for revising this PSP and improving the project design, organization, and results that will provide information necessary to determine the necessity of fish passage prescriptions.

7.12 Study of fish passage barriers in the Middle and Upper Susitna River and tributaries.

General Comments: This PSP fails to consider physical barriers at railroad crossings, delayed migration, increased predation, and velocity and depth barriers for juvenile salmon and resident fish. It also fails to consider depth and velocity barriers to juvenile salmon and resident fish passage and adult resident spring migrations from the mainstem into tributaries. The study needs to address the well-documented, long-term effects of sediment wedge formation on tributary mouths that form as a result of regulating flows on mainstem rivers.

Objective 1: This study objective to locate and categorize all existing fish passage barriers in selected tributaries in the middle and upper Susitna River is incomplete or needs to be clarified. As stated, it is the location of passage barriers in tributaries and refers to only physical barriers but not depth barriers. It also is restrictive to tributaries. It is not clear if this includes or excludes tributary mouths, side channels, side, sloughs, and upland sloughs.

Objective 2: This objective would identify the type and characterize the physical nature of any existing fish barriers located within the project's hydrologic zone of influence, but the PSP does not define the type or character of existing fish barriers or provide definitions or methods that can be used to identify those types.

Objectives 3 and 4 (*evaluate the potential changes to existing fish barriers located within the Project hydrologic zone of influence*; *evaluate the potential creation of fish passage barriers within existing habitats*): The PSP methods do not identify how these two objectives will be addressed.

7.17 Beluga Whales and Marine Mammals

Documentation of beluga and marine mammals presence in the Susitna River Delta. As proposed, this study cannot identify the year-round use of the area. No aspect of this study addresses over-winter (November-March) use of the area by Cook Inlet belugas or other marine mammals. Understanding the year-round use of the Susitna Delta and in-river habitats by all marine mammals is necessary to begin to evaluate impacts from the year-round operation of the proposed Susitna-Watana Hydroelectric Project.

The study also proposes to obtain data from NMFS's August calf surveys rather than conduct its own August surveys. NMFS has already cautioned that data obtained from its calf surveys may not meet the study's needs. And NMFS cannot commit the calf surveys to meeting the needs of AEA's project.

The study proposes to collect data on marine mammal location, group size, group composition (i.e., adults, juveniles, and cow-calf pairs), and behavior from aviation surveys from an altitude of 1000 feet. NMFS does not believe that all of these values can reliably be obtained at the proposed altitude.

The study proposes to document the upstream extent of belugas and other marine mammals by use of cameras, but the study does not precisely describe the protocol for the cameras: where the cameras will be placed, how often they will take pictures, etc.

Evaluate impacts of hydropower changes in the lower river on beluga movements and prey availability. The study plan does not propose any work that would specifically address NMFS's concerns about how changes to habitat and prey may affect Cook Inlet beluga whales. We find no discussion of the criteria to be used to determine the significance of impacts on prey, and the study plan fails to describe how data from proposed habitat studies will help to determine effects on belugas.

Finally, the study plan suggests that the goal of its study of marine mammals is to assess the potential effects on salmon and eulachon. NMFS disagrees. As important as the impacts on salmon are, the study of impacts on marine mammals comprises a primary objective in itself.

13.0 Socioeconomic studies

Fish Passage Study: The proposed study plan should be revised to clarify that economic factors are considered in evaluating the cost effectiveness of various fish passage alternatives and are not a factor in determining whether to prescribe fish passage.

Recreations Resources Study: The analysis should identify the impacts that declines in Susitna Chinook and other salmon will have on recreational economic welfare values; also, the study should assess the impact of substitution behavior on other areas such as the Kenai River and whether management structures at substitution sites will actually allow substitution to take place.

Recreational Boating/River Access Study: Intercept surveys should include lower Susitna intercept sites where river boats are commonly launched. The study should determine whether the Anchorage launch ramp at Ship Creek is a significant access point for the lower Susitna fishermen and hunters and consider conducting intercept surveys at substitute sites such as the Kenai River to estimate the potential impact of fishing closures of the Susitna.

Social Conditions and Public Goods Study: The reference cited here is outdated and derived from a different region of Alaska where transportation costs are considerably higher than in the study area. This study should obtain area-specific costs under current conditions.

Regional Economic Evaluation Study: FERC asserts that changes in power demand and power rates are highly speculative and outside the scope of the EIS. However, scenarios can be created to estimate project costs and project a rate structure necessary to support this project. Such scenarios can be modeled to project impacts on the regional economy. To state that these costs are highly speculative and outside the scope of the EIS is simply not acceptable.

National Marine Fisheries Service, Alaska Region

Comments on the

Alaska Energy Authority's

Proposed Study Plans

For the Susitna-Watana Hydroelectric Project

November 14, 2012

National Marine Fisheries Service, Alaska Region, Comments on the Alaska Energy Authority's Proposed Study Plans and Scoping Document 2 for the Susitna-Watana Hydroelectric Project

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5 Water Resources

5.5 Baseline Water Quality

General Comments

The intent of the Proposed Study Plan (PSP) is to address the effects of the proposed Susitna-Watana Hydroelectric Project on water quality in the Susitna River basin. The goal of the National Marine Fisheries Service's (NMFS) water quality study request is to document baseline water quality conditions, assess the effects of the proposed project on water quality in the Susitna River basin, and identify and develop protection, mitigation, and enhancement measures that can be implemented to minimize these effects on NMFS trust resources. The reason for this analysis is to incorporate current water quality science analysis into comprehensive decision making, and provide information NMFS can use to develop the following:

- proposed measures and plans to protect; mitigate, or enhance environmental resources;
- Federal Power Act (FPA) section 18 fishway prescriptions for passage of anadromous fish;
- FPA section 10(j) recommendations to protect, mitigate damages to, and enhance fish and wildlife resources; and
- FPA section 10(a) recommendations to ensure that the project is best adapted to comprehensive plans for developmental and non-developmental resources.

In order to do so, NMFS must obtain and apply the best available science, data and techniques to assess the potential effects of the proposed project on riverine processes, fish, and fish habitat.

Specific Comments by Study Subsection

5.5 Baseline Water Quality Study

The Alaska Energy Authority's (AEA) PSP proposes: to characterize baseline water quality conditions; to develop a monitoring program to characterize surface water physical, chemical, and bacteriological conditions in Susitna River downstream of the project area; and to measure baseline concentrations in sediment and fish tissues.

WQ-53 In general, the PSP adequately addresses the water quality issues, but there are several areas that require improvements, specifically:

- WQ-54 The baseline monitoring program needs to include a more uniform level of information concerning the approaches and techniques to be employed in the baseline monitoring program. A discussion and development of standard operating procedures for sampling low-level mercury concentrations ("Clean Hands/Dirty Hands") to limit sample contamination during collection, shipping, and handling should be included. Example standard operating procedures for this technique can be found in Environmental Protection Agency (EPA) 1996 and Lewis and Brigham 2009.
- WQ-55 The baseline monitoring program should, but as proposed does not, include sample collection efforts and dates to correspond with important climatological events which may or may not be captured in the once monthly program presented in the PSP. Events

such as early summer snow melt and late season glacial melt can be associated with significant inputs of constituents (e.g., solids) which need to be incorporated in the modeling exercise.

WQ-56
- For constituents that get sampled monthly, such as total suspended solids, turbidity and some other chemical constituents, the sampling should occur in a synchronized manner across a range of habitat types (main-stem, side channel, slough, clear-water tributary, glacial tributary) at multiple sites on Susitna River between river mile (RM) 0 and RM 250.

WQ-57
- The baseline monitoring program should include an additional and detailed study of dissolved organic carbon (DOC) in addition to water quality components already included in the PSP. This component of water quality has a determining role in the levels of mercury methylation and in the bioavailability and toxicity of metals. Understanding and being able to predict DOC in the future river and reservoir will be a critical element of the utility and accuracy of predicting future water quality and toxicity for aquatic life, wildlife, and humans.

WQ-58
- Atmospheric deposition of mercury should be quantified as an additional source to the future reservoir, and as such should be included in the sampling effort associated with the meteorological stations.

WQ-59
- The PSP should develop and present evaluation criteria specifically protective of aquatic life, wildlife, and human fishers (recreational, commercial and subsistence), rather than just using state water quality standards that are designed to be protective of aquatic life. For example, waters complying with the Alaska Department of Environmental Conservation's (ADEC) standard for the protection of human health (0.050 µg/L) could easily exceed the EPA (1997) criteria for the protection of various fish eating wildlife (kingfishers, loons, ospreys, and bald eagles) by a factor of 50-150 times (presuming that 10% of the mercury in the water column is methylated). Standards for each receptor class should be used in the evaluating the results of the baseline water quality sampling effort.

WQ-60 If these improvements are made to the water quality monitoring program/study, then NMFS will be able to assess the project effects compared to a baseline understanding. This will be important for NMFS to consider when developing conservation recommendations to protect fish and their habitats.

[Literature cited—see Literature section of 5.12]

5.6 Water Quality Modeling Study

General Comments

AEA's Water Quality Modeling Study PSP would utilize the information collected from the Baseline Water Quality Study to develop a model in which to evaluate potential impacts of the proposed project and operations on various parameters within the Susitna River watershed. This study component will use the baseline information and an understanding of the riverine processes and project operations to assess how the project will affect water quality in the Susitna River, and linking those changes to project operations. This information will be used by NMFS to develop conservation recommendations to minimize the impacts of the project on fish and their habitat.

In general, the PSP adequately addresses the water quality issues, but there are several areas that require improvements, specifically:

WQ-61
- The description of the models to be used in characterizing future conditions following the construction and operation of the future dam should include a separate and detailed description of the approach to be followed in parameterizing and initializing the final selected model. This should include a description of how terrestrial conditions will be used to develop boundary conditions outside of the current riverine conditions. Model initialization and calibration are important components of establishing model credibility and accuracy and as such should be described in sufficient detail to allow reviewers to evaluate the approach and water quality data needs for each model.

WQ-62
- The PSP should consider (in model selection) the geometric and topographic complexity of the river system in model selection. This is important for the potential extension of model boundary down to the three river's confluence (Susitna, Talkeetna, and Chulitna). The long downstream river has many meandering braided channels with numerous tributaries. This river system will be inundated during summer snow melting seasons. These factors will require the flexibility in model grid generation (e.g., unstructured grid model), robust wetting and drying algorithm, and computational efficiency (e.g., high resolution grid only in zone of interest, parallel computing capability, etc.) for long-term simulation of water quality. The selection of structured grid model such as EFDC or CEQUAL-W2 may be difficult to represent the complex river system accurately. This can degrade the prediction capability of model. The PSP should provide an explicit plan in the worst case scenario and consider also other unstructured type of model such as MIKE (hydrodynamic + water quality). Other possible approach may be an external coupling of an unstructured grid hydrodynamic model with a similar grid frame of water quality model such as CEQUAL-ICM.

WQ-63
- The PSP should include an explicit description of the modeling approach to be used for determining toxicity of future water quality to aquatic life, wildlife, and human fishers. This model or models should be able to address the toxicity of mixtures of metals, and include a discussion of how the potential interactions of toxins (additivity, synergism, antagonism) will be evaluated in the selected model.

WQ-64
- The PSP should also discuss approaches to determining and evaluating the bioavailability of metals in the future reservoir and river such as the Biotic Ligand Model (BLM).

WQ-65
- The PSP should consider expanding the analytes (i.e., anions and cations) to be sampled in the baseline monitoring program based on the review and utility of the BLM model in evaluating the future toxicity in reservoir and downstream rivers.

WQ-66
- Example studies that can be evaluated in the design of modeling the toxicity of metal mixtures can be found in Altenburger et al. 2003; Borgmann et al. 2008; Jho et al. 2011; Kamo et al. 2008; Khan et al. 2011; Kortenkamp et al. 2009; Mumtaz et al. 1998; Sasso et al. 2006; Schmidt et al. 2010; Stockdale et al. 2010; Van Genderen et al. 2012; Vijver et al. 2011.

NMFS believes that these modifications to the proposed models and modeling will improve the understanding of project effects to water quality downstream of the reservoir. An understanding of flow routing and water quality downstream of the project area is necessary for NMFS to make conservation recommendations.

5.7 Water Resources-Groundwater-related Aquatic Habitat Study

General Comments

The goal of the May 31, 2012 NMFS groundwater-related aquatic habitat study request is *to understand project effects on surface/groundwater interactions at multiple spatial and temporal scales as they relate to habitat for aquatic and floodplain species (e.g., fish, riparian vegetation) in the water bodies of the Susitna River watershed.* The reason for this analysis is to incorporate current surface/groundwater exchange analysis into comprehensive decision making, and provide information NMFS can use to develop:

- proposed measures and plans to protect; mitigate, or enhance environmental resources;
- FPA section 18 fishway prescriptions for passage of anadromous fish;
- FPA section 10(j) recommendations to protect, mitigate damages to, and enhance fish and wildlife resources; and
- FPA section 10(a) recommendations to ensure that the project is best adapted to comprehensive plans for developmental and non-developmental resources.

In order to do so, NMFS must obtain and apply the best available science, data and techniques to assess the potential effects of the proposed project on riverine processes, fish, and fish habitat.

NMFS submitted a request for the study of groundwater because, groundwater exchange with surface water can influence the productivity, movement, distribution, reproductive success of fish (Power et al. 1999). The goal of the applicant's Groundwater-related Aquatic Habitat Study *... is to understand the effects of the project on groundwater and surface-water (GW/SW) interactions as they relate to habitat for aquatic species (e.g., fish, riparian vegetation) in the Susitna River*. The distinction between NMFS and AEA's study plan goal may seem minor but should be resolved, including the inclusion of water bodies and the floodplain that are adjacent to the Susitna River and floodplain and gaining an understanding of surface/groundwater interaction at multiple spatial and temporal scales. The PSP is designed to be a coordinated effort with other studies to help guide their data collection activities related to surface/groundwater interaction interpretative goals, and responsibility for specific study components must be defined.

GW-037 Many of the PSPs rely upon or provide data for other studies. They are interdependent. Recognizing these interdependencies is an important part of the Integrated Licensing Process (ILP); however, the study providing the data should describe the methodology while the study requiring the data should describe what data/results are required from other PSPs. Repeating the methods in a study not responsible for the data collection and analyses is unnecessary and risks confusion if the methods differ or are in adequate in one of the studies. If the 6.5 Fish and Aquatics Instream Flow, and 6.6 Riparian Instream Flow studies PSPs will be collecting and analyzing the data for the Groundwater PSP, they should describe the methods as well as the results that will be provided. The quality and consistency between studies, especially for data that is shared for multiple purposes, is a concern to the agencies. The last sentence in the first paragraph of Section 5.7.1.1 suggests the Groundwater PSP is not much more than a passive summary of other studies, when in fact the Groundwater PSP is a critical input for other studies not unlike the U.S. Geological Services's (USGS) data that will be used by other studies.

GW-037 Clarifying the purpose and roles of the PSPs will help NMFS understand what studies are actually being proposed and how and when they will be conducted.

GW-038 This study does not propose collecting any groundwater related data, but rather proposes using other studies to collect this data and then to integrate this data into models of surface/groundwater interactions. The aquatic instream flow proposed study plan did not provide methods for understanding project effects to surface/groundwater exchange, or how project operations effects to habitat associated with surface/groundwater exchange will be assessed. NMFS is concerned that inadequate responsibility is assigned to this topic and that the data collected will not meet our stated goals for this study. We request a clear description of the methods used, the expected outcome, what can be determined, and how uncertainty will be calculated for each of the study objectives requested (NMFS 2012).

GW-039 During the August 15, 2012, Technical Work Group (TWG) meetings NMFS, the U.S. Fish and Wildlife Service (USFWS) and other attendees requested a more detailed study frame work, one that not only lists a range of methods but defines the specific objectives and addresses the agencies objectives and information needs, and logic for how the proposed methods would be implemented to achieve those objectives. A schematic was presented to explain what an intensive data site would look like for the floodplain groundwater intensive study sites; a figure and explanation for what an intensive (now called focus areas) instream flow study site would include with an description of data and deliverables could explain how the study will address NMFS requested study objectives and clarify the study plan. Additionally, study plans should explain how the study will develop confidence intervals and calculated errors for each of the indices, data summaries, and model outputs. Without a description of data, deliverables, and how uncertainty will be assessed NMFS cannot determine if the proposed studies are complete or adequate.

GW-040 The additional detail requested will be used to assess the applicant's plan and if it meets the intent of the NMFS study requests. This should include a schedule and methods for attaining the groundwater data relevant to aquatic habitats and development of operation flow sensitive surface/groundwater exchange models. Specifically, more detail is needed about the proposed approach to assess the habitat utilization and habitat characteristics for overwintering juvenile anadromous fish and how groundwater exchange influences the suitability of winter habitat.

Specific Comments by Subsection

The following review of AEA's Groundwater-related Aquatic Habitat Study Plan uses the structure of the plan's stated objectives and compares them to NMFS's study request objectives to determine if our intent is met, where improvements can be made, and which requested objectives are not addressed.

AEA Study Objective 1. Synthesize historical data available for Susitna River groundwater and groundwater related aquatic habitat, including the 1980s and other studies.

The first objective is identical to our study request objective for groundwater studies. The methods described to achieve this objective are slightly different (AEA 5.7.4.1). In the summary of the 1980's studies related to groundwater we expect a description of the proposed winter time operation of the 1980's project in contrast with the current project, and assumptions and limitation of the 1980's data and models.

GW-041 In addition to the outlined methods to evaluate existing data (section 5.7.4.1 Existing Data Synthesis), we request a review and summary of other hydroelectric projects in cold regions and their effects on surface/groundwater interactions. This review will help NMFS understand the existing understanding of likely effects to surface/groundwater exchange related to hydroelectric projects and may introduce methods of study not currently being proposed. This review will also summarize the current knowledge of cold regions hydropower projects effects on ice processes and how that has altered instream flow, surface/groundwater interaction, geomorphology, vegetation, water quality, and fish habitat.

AEA Study Objective 2. Use available information to characterize the large-scale geohydrologicprocess-domains/terrain of the Susitna River (e.g., geology, topography, geomorphology, regional aquifers, shallow ground water aquifers, GW/SW interactions).

GW-042 The PSP contains large-scale geohydrologic process domains, currently undefined, but it is not clear how they will be used outside of large scale classification. NMFS requests that definitions of process domains be provided, how they are defined, and how they will be used to understand project effects to surface/groundwater exchange at multiple scales. We request the process domain definitions be vetted with the resource agencies, and that all relevant information and knowledge gained from the other studies be used to assess and refine the process-domain mapping of the Susitna River basin. Since AEA is proposing to use process-domains as means to extrapolate and predict project effects on surface-water/groundwater beyond the intensive study focus areas, we request an assessment of the precision and accuracy of the predicted effects.

AEA Study Objective 3. Assess the effect of the Watana Dam/Reservoir on groundwater and groundwater related aquatic habitat in the vicinity of the dam.

GW-043 The methods described in section 5.7.4.3 of the applicants study plan are consistent with the intent of our request. In addition to the flow paths and conceptual surface/groundwater model, we request a description of how the downstream extent of the reservoir's influence on groundwater will be determined. This will help NMFS determine if additional study is necessary to assess the reservoir effects to fish and their habitat downstream of the inundation zone.

AEA Study Objective 4. Map groundwater influenced aquatic habitat (e.g., upwelling areas, springs).

GW-044 NMFS needs further clarification on how groundwater affects aquatic habitat. It is unclear from the PSP if the various proposed methods adequately capture the influence of groundwater on aquatic habitats throughout the study area. Because the goal of our study request is to understand project effects on surface/groundwater interactions at multiple spatial and temporal scales as they relate to habitat a thorough understanding of the distribution of groundwater influence aquatic habitat is needed.

Additional methods are described in 5.7.4.4 Upwelling/Springs Broad-scale mapping; these are a series of study components from Ice Processes, geomorphology, instream flow, water quality, and fish studies. We have three basic concerns: first the mainstem upwelling areas will not be accurately accounted for and no actual groundwater information focuses on the mainstem; second these methods are not focused on determining upwelling/downwelling areas and flow paths and may not capture the actual distribution of upwelling/downwelling areas and third the Groundwater-related Aquatic Habitat study plan is not responsible for collection of any of this data. To resolve these concerns, NMFS believes that the study plan should be refined to include additional methods (Rosenberry and LaBaugh 2008) and study areas to understand the spatial distribution of surface/groundwater exchange at a scale relevant to fish and their habitat, and a clear understanding of when and who is responsible for delivering the study results.

There is a high likelihood that the characterization study components will not capture the overall distribution of upwelling/downwelling and the importance of surface/groundwater exchange for over wintering fish and fish eggs. If the pilot thermal imaging assessment successfully captures upwelling areas (quantifying the success of the method through comparison of in situ measurements) then this method should be applied to the project area. The success or failure of the thermal imaging assessment must also be defined. If the trial thermal imaging study is successful how will it be expanded and used to map upwelling? If it is unsuccessful how does AEA plan on identifying the spatial distribution of upwelling? Use of open-leads during winter ice mapping alone will not demonstrate the full extent of upwelling areas. Beyond characterization, it is unclear how scale, source, flow paths, and timing of surface/groundwater exchange processes will be accounted for. NMFS believes that the Federal Energy Regulatory Commission (FERC) should address the issue of study period extension, if study result are incompleteness or insufficient at the end of the ILP study period how will FERC determine how long studies should be extended or adapted? Without complete studies that provide results relevant to fish and their habitat NMFS will be unable to make recommendations that allow for alteration of habitat or of the natural flow regime.

AEA Study Objective 5. Determine the GW/SW relationships of floodplain shallow alluvial aquifers at Riparian Instream Flow study sites.

GW-045 An understanding of how floodplain shallow-alluvial groundwater interacts with the surface water (including relationships with both the river and the adjacent uplands) from the Susitna River and with the adjacent upland groundwater is necessary for NMFS to make conservation recommendations to protect fish and their habitat, as floodplain, riparian and surface/groundwater interaction are all closely related to fish habitat quality. This study component (described by AEA Study Objective 5) will provide the necessary groundwater information for the riparian instream flow study to develop plant community response curves, which can be used to predict the effects of project operation on floodplain plant communities.

Clarification is needed for the groundwater objective outlined in the groundwater study (Section 5.7.4.5), and the riparian instream flow study (Section 6.6). For example, the last two bulleted paragraphs in the groundwater study (Section 5.7.4.5) describe riparian methods, while Section 6.6.4.5 in the riparian study describes groundwater methods. Our comments below focus on the groundwater methods from both studies.

The suggested four to six intensive study reaches (now called focus areas) instrumented with groundwater and surface-water recording instruments may be insufficient to address this objective if plant response will be described by process-domains. NMFS believes there should more study reaches to address the spatial distribution and variability of the surface/groundwater exchange processes.

One-and-a-half growing seasons (July 2013 to September 2014) will likely provide insufficient groundwater hydrology data to fit individual species response curves (especially for annual species), and may not be enough data to reasonably predict groundwater relationships with river stage *and* to verify the model predictions with independent data. Precipitation may also dramatically affect transient but critical groundwater levels (a few days to a week or more of elevated water levels), which would be difficult to evaluate with limited data. NMFS suggests that additional years of study will be necessary to capture the variability in water years and to sufficiently understand species response to hydrologic conditions.

NMFS needs an answer to this question: what are the "project accuracy standards used for water-level measurements" for horizontal, vertical and temporal measurements? If MODFLOW will be used, what is the expected accuracy of the predicted water table surface, and how will this be determined and reported after model development? The difference between the water table being too deep or too shallow for some herbaceous species is as little 20 cm or less, and for some sedge communities about 50 cm. Should the depth to water be estimated by subtracting the predicted water table (e.g., MODFLOW) from the ground surface (e.g., LIDAR)? In that case, the combined error of both the water table and the ground surface must be considered. In addition, the predicted surface-water stage and its accuracy must also be provided for emergent communities. For complex hydrologic and biotic sites such as Whiskers Slough, the density of recording wells and surface-water gages presented in the October 1, 2012, Riparian Instream Flow (ISF) TWG meeting may need to be increased in both density along the transects and the total number of transects to achieve the accuracy required for the Riparian ISF study.

With NMFS and USFWS recommendations this study component will provide results that will allow the agencies to determine project effects to shallow alluvial aquifers and relationships between floodplain and riparian plant communities and to make recommendations to minimize these effects.

AEA Study Objective 6. Determine GW/SW relationships of upwelling/downwelling at Instream Flow Study sites in relation to spawning, incubation, and rearing habitat (particularly in the winter).

GW-046

The study methods for the Groundwater-related Aquatic Habitat Study plan are vague and unclear and do not identify which study is responsible for collection of the site specific groundwater data. NMFS requests a description of methodologies, number of piezometers, number of study sites, and deliverables. We request that the revised study plan detail the methods for collecting the groundwater potentiometric surface through each of the aquatic study sites.

Surface/groundwater exchange at scales relevant to fish and their habitat has a direct relationship with water quality, upwelling and downwelling areas may provide thermal refugia, adequate water quality for successful spawning and redd incubation. In the NMFS groundwater study request, the sixth objective is to determine the surface/groundwater relationship of upwelling/downwelling at instream flow study sites (focus areas) in relation to spawning, incubation, and rearing habitat (particularly in winter) in collaboration with fish and instream flow studies. This fits in naturally with our next study request to characterize the water quality and probable flow paths of groundwater for habitats where groundwater is important for fish use. The source and flowpath of water is an important factors influencing its temperature and chemistry (Johnson 2003). The flow paths of water through the subsurface as groundwater and hyporheic flow may moderate stream temperatures and provide thermal heterogeneity (Johnson and Jones 2000; Mellina et al. 2002; Moore et al. 2005; Rothwell 2005). NMFS requests that the focus areas include surface/groundwater study that will provide baseline understanding of surface/groundwater exchange (temporally and spatially), how these processes influence water quality, and how these processes may change with the project.

GW-047

GW-048

Study sites used to understand surface/groundwater interaction and how the process influences use of habitat by anadromous fish should span all of the habitat types used by anadromous species, including off channel (side channels, side sloughs, upland sloughs) and mainstem features in the middle and lower river. The study plan is incomplete without a description of methods for extrapolating surface/groundwater study results from focus areas to the entire project area. NMFS requests a clear description of how the project effects to fish and their habitat through changes to surface/groundwater interaction will be quantified.

A sufficient study design will include a description of the data collected for understanding the surface/groundwater relationship at each of the instream flow study sites; this data must consider all of the key biologic functions and time periods (particularly in winter), as stated. The aquatic study site data will include empirical data related to surface/groundwater interactions (e.g., piezometers, water levels, water temperature and conductivity, tracer studies). Surface/ groundwater interaction data will be collected at the intensive study reaches utilizing multiple transects of arrays of groundwater wells, piezometers, and stage gages. The surface/groundwater data will be used to quantify and model the relationship between the shallow surface aquifers and aquatic habitat types. At each of the aquatic study sites surface/groundwater interaction models will be developed to allow for temporal analysis of project operations effects on surface/groundwater exchange that may influence habitat utilization by aquatic species. This modeling may include the use of MODFLOW (USGS 2005 and Feinstein 2012) surface/groundwater interaction models of floodplain shallow alluvial aquifer and surface-water relationships. We request that the monitoring and modeling approach be further described for the aquatic instream flow study sites and other sites of particular fish habitat importance (spawning, rearing, overwintering habitats). This description and refinement are necessary in the revised study plans for NMFS to determine if the approach is adequate to describe surface/groundwater interaction at each of the focus areas.

GW-049

AEA Study Objective 7. Characterize water quality (e.g., temperature, dissolved oxygen, conductivity, nutrients) of selected upwelling areas where groundwater is a primary determinant of fish habitat (e.g., incubation and rearing in side channels and sloughs, upland sloughs).

GW-050

Characterization of water quality must have a temporal component to assess surface water influences on groundwater water quality parameters (temperature, dissolved oxygen, conductivity, nutrients). This appears to missing from the PSP. This temporal component is especially important where anadromous fish species spawn and overwinter, because it will allow NMFS to understand the effects associated with load following operations. At focus areas, spatial and temporal water quality data should be collected. This data would help NMFS understand processes that contribute to river productivity, habitat quality, thermal refugia, and how surface/groundwater processes are influential to those processes. Additionally we request that a relative age of water be determined since this would help NMFS understand flow paths and groundwater residence times and serve as a check on whether the relevant scales of surface/groundwater interactions are being considered in the study plans. This may be achieved through several methods, but must be described in the study plan.

AEA Study Objective 8. Characterize the winter flow in the Susitna River and how it relates to GW/SW interactions.

GW-051 NMFS agrees with the applicant that surface/groundwater interactions are critical to aquatic habitat functions, and that the project operations will have an impact on the winter flow conditions, including surface/groundwater exchange which will influence the habitat used by anadromous species. The methods associated with the study plan objective eight include data collection at the stream gages and at specific study areas. It may be implied by this study objective, but we request that both baseline and with project operations winter flow characterization are necessary. This should include development of surface/groundwater exchange models that include winter operations scenario analysis, accounting for changes to ice thickness and cover and changes in water quality (temperature, dissolved oxygen, nutrients, specific conductivity) all associated with the proposed winter operations (either load following or baseload). NMFS believes that adoption of our recommendation will improve the understanding of existing processes and allow a better understanding of the project effects necessary for NMFS to make conservation recommendations.

AEA Study Objective 9. Characterize the relationship between the Susitna River flow regime and shallow groundwater users (e.g., domestic wells).

GW-052 Although this objective does not directly relate to NMFS' trust resources, we believe that information gained from study objective nine will aid in the overall understanding of the Susitna River groundwater system. Additional groundwater information should be incorporated into the groundwater models developed at focus areas and at larger (potentially regional) scales.

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5.8 Water Resources – Geomorphology Study

General Comments

In the May 31, 2012 study requests submitted by NMFS, the geomorphology and fluvial geomorphology studies were combined into one study, as the data collected and models developed in both were both directly linked to aquatic habitats in the Susitna River system (NMFS 2012). The goal of NMFS geomorphology study request is to characterize the geomorphology of the Susitna River and evaluate the effects of the project by predicting the magnitude and trend of geomorphic response relevant to NMFS trust resources. The reason for this analysis is to incorporate current geomorphology science analysis into comprehensive decision-making, and provide information NMFS can use to develop the following:

- proposed measures and plans to protect; mitigate, or enhance environmental resources;
- FPA section 18 fishway prescriptions for passage of anadromous fish;
- FPA section 10(j) recommendations to protect, mitigate damages to, and enhance fish and wildlife resources; and
- FPA section 10(a) recommendations to ensure that the project is best adapted to comprehensive plans for developmental and non-developmental resources.

In order to do so, NMFS must obtain and apply the best available science, data, and techniques to assess the potential effects of the proposed project on riverine processes, fish, and fish habitat.

During the August 15-17, 2012 TWG meetings, the applicant described fish, instream flow, and water resource study plans; in all of these study plans there were broad statements about collaboration and integration of specific studies. In the meeting and previously, NMFS had requested that the integration be described in detail; for the geomorphology and fluvial geomorphology modeling study plans, this should include what objectives are being met, how they are being met, and how they will influence other studies. For example, how will the geomorphology study utilize the fish habitat utilization data that NMFS and USFWS requested to improve the spatial habitat mapping, and how will the results from the geomorphology study be integrated into the instream flow study to achieve the objectives that NMFS requested?

GEO-21 NMFS believes the PSPs to do not sufficiently describe what they will accomplish and show. The revisions for the combined geomorphology and fluvial geomorphology modeling study plans should provide a description of what can be determined at the end of the studies, and whether the results will be sufficient to address NMFS requests related to project effects to anadromous fish habitat. Also, a description of determining the uncertainties associated with the studies, models, and analysis of project effects should be provided.

GEO-24 The additional detail requested will be used to assess the applicants plan and if it meets the intent of the NMFS study requests. The additional detail should include a schedule and methods for attaining habitat utilization, abundance, and distribution information on anadromous fish species.

In our review of the applicants study plans, we first address the geomorphology and then the fluvial geomorphology modeling study plans.

Specific Comments by Subsection

The following review of AEA's Geomorphology Study Plan (2012) uses the structure of the plan's stated objectives and compares them to NMFS's study request objectives to determine if NMFS's intent is met, where improvements can be made, and which request objectives are not addressed.

AEA Study Objective 1. Determine how the river system functions under existing conditions.

GEO-23 This is a good overarching objective, but that should include several of NMFS's more specific objectives. NMFS requested specific study components relative to the river system functions under existing conditions that were not addressed in AEA's study plans. The PSP will provide adequate geomorphic characterization by addressing NMFS's specific objectives and methods, including the following tasks:

- Characterize and map relic geomorphic forms from past glaciation, paleofloods and debris flow events;
- Characterize and map the geology of the Susitna River, identifying controlling features to channel and floodplain geomorphology;
- Characterize and map the fluvial geomorphology of the Susitna River; and
- Describe and identify the primary geomorphic processes that create and influence fluvial geomorphic features.

If the specific objectives we requested are included, including past glacial form, geology, and characterization of the fluvial forms and processes, then the study plan should provide an adequate overall understanding of the river system function. But detail should be provided in the revised study plan to show that each of the NMFS study request objectives is being achieved.

GEO-19 In NMFS's study request, we suggest specific methodologies. We request that each of our requests be examined and responded to, either by being incorporated into the study plans or providing explanations why other methods are adequate or better suited to achieve NMFS's stated study objectives. Methods for channel substrate size characterization, longitudinal and cross-sectional bed profiles are not described in this proposed study plan. In the Geomorphic Characterization of the River section of NMFS's study request (1.3.5.2), we requested bed material characterization to include spatial sediment facie mapping (Buffington and Montgomery 1999), pebble counts (Wolman 1954), and bulk samples.

By addressing our specific recommendations the study will be improved and provide an accurate understanding of the current river system geomorphic function.

AEA Study Objective 2. Determine how the current system forms and maintains a range of aquatic and channel margin habitats.

The applicant's second study objective relates to NMFS's requests for understanding the primary geomorphic processes that create and influence fluvial geomorphic features. This information, along with the delineation and characterization of riverine habitat types for the project area, will provide a good understanding of which geomorphic processes create and maintain aquatic habitats. A description of how habitat utilization will inform the habitat characterization should also be included. For example, the main channel is currently one of the meso-habitat classifications but if, through utilization and fish distribution study, it is found that there are unique main channel features that are important, then the classification should identify the processes that maintain those features. This is a good foundation for development of operation effects to habitat, specifically the flows necessary to create and maintain habitats. Additional information, such as the characterization of surface area versus flow relationships of riverine habitat types, will help characterize the timing and distribution of habitat under the natural flow regime. GEO-25 A link between geomorphic process and fish habitat is necessary to understand how the project may influence the processes that create and maintain fish habitat. NMFS requested that correlation of geomorphic forms and processes to riverine habitat types be done for the project area, and that the project construction and operation be assessed to evaluate change to the habitat types.

GEO-03 The study plan includes several locations where additional data will be collected to supplement historical data (to be performed by the USGS). These locations are on the Susitna River mainstem (near Tonsina Creek, at the Susitna River Gold Creek gage, and the Susitna River at Sunshine, the Chulitna River near the mouth). The PSP proposed to use this information with other available data to calculate the sediment input from major tributaries. The sediment transport data collected at the Chulitna and Talkeetna Rivers are necessary to reduce error and increase understanding of sediment transport associated with the large and small tributaries and dispersed sediment input associated with hillslope and mass wasting processes. In view of this, NMFS requests that the study review the available and collected sediment transport data for adequacy to geomorphology models and characterize sediment transport in the Susitna River system.

GEO-29 NMFS requested an assessment of the source, transport, and storage of large woody debris (LWD) in the Susitna River and the role of LWD in channel form and aquatic habitats to assess the magnitude of these effects. This information in conjunction with data from the studies of hydrology, geomorphology, riparian and aquatic habitat, and ice processes, would be used to determine the potential effects of project operation on large wood resources. NMFS requests a description of how LWD data will be collected and how that information is sufficient to address the role of LWD debris in geomorphic processes.

AEA Study Objective 3. Identify the magnitudes of changes in the controlling variables and how these will affect existing channel morphology in the identified reaches downstream of the dam.

AEA's study plan identified many analyses necessary to achieve study objectives including the empirical characterization of the Susitna River sediment supply and transport conditions and an assessment of channel and study site stability/change (1980s versus current conditions).

This study component is key to assessment of project operation effects on riverine habitats by assessing the potential for geomorphic change. This goal should be achieved through conceptual and numerical modeling (further described in the applicant's fluvial geomorphology modeling study plan and in our request G-7 Modeling Magnitude and Trend of Geomorphic Response). GEO-31 We request that, when examining the magnitudes of change of geomorphic features, the study incorporate LWD recruitment in the controlling variables (potential to contribute to channel avulsion) and identify recruitment processes. The revised study plan should explain how the geomorphology study will develop an understanding of large wood recruitment.

AEA Study Objective 4. Determine the likely changes to existing habitats through time and space.

This objective is similar to our request for evaluation of stability and change. All of the data collection proposed in the applicants study plan, in addition to the data we request, will be used to understand the likely changes to existing habitat. The applicant proposes to calculate effective discharge for the Susitna River, similar to the methods requested by NMFS. This is important as quantification of the range of flows that transport the most sediment provides useful information to assess the current state of adjustment of the channel and to evaluate the potential effects of altered discharge and sediment delivery to channel behavior. This is a good example of study information that must be integrated with other studies, specifically instream flow, for overall project analysis.

GEO-34 For the lower river the study plan describes a reconnaissance level assessment (by assessing geomorphology and habitat via aerial photography). The applicant proposes that a conceptual frame work be used to assess project effects to the lower river, below the Chulitna and Talkeetna confluences. The conceptual frame work described by the applicant and requested by NMFS and proposed by the applicant is defined in Grant et al. (2003). It is unclear where the framework will be applied, we request that the conceptual frame work be used downstream of the proposed dam location to the downstream extent of the modeled area (downstream of Sunshine). If the GEO-35 framework calculations find that detectable change is likely in the lower river, then the riverine models should be extended downstream. This will rely on the development of the hydraulic flow routing models (see our comments on instream flow) and will require the extension of this modeling effort. The decision to extend the mapping and more qualitative assessments in the lower river must be described, as well as the determining factor for extension of these study components. Also, because the habitat mapping is being done under the Geomorphology study GEO-36 plan, the lower extent of that component must be compared to winter operations and the potential hydraulic or water quality effects downstream. This is necessary to assess which habitats and species may be affected in the lower river.

The characterization of bed material mobilization will be necessary to populate sediment transport models and to assess the likely geomorphic changes associated with reducing the sediment supply, by trapping sediment behind the dam and by altering the natural flow regime. This information will be used by NMFS to make instream flow recommendations under our 10(j) authority. A key product listed in the applicant's study plan is the calculation of effective discharge for the pre- and post-project conditions and the likely effects on channel morphology. This is further described in section 5.8.4.4. (AEA 2012), the study component to assess geomorphic change in the middle and lower rivers.

5.9 Fluvial Geomorphology Modeling below Watana Dam Study

General Comments

The applicant's stated goal for the Fluvial Geomorphology Modeling below the Watana Dam Study is to model the effects of the proposed Susitna-Watana Hydroelectric Project on the fluvial geomorphology of the Susitna River, with the Geomorphology study, to assess the impacts of the project on the dynamic behavior of the river downstream of the proposed dam, with particular focus on potential changes in instream and riparian habitat.

The applicant proposes four questions to be answered by the fluvial geomorphology and geomorphology studies:

- Is the system currently in a state of dynamic equilibrium?
- If the system is not currently in a state of dynamic equilibrium, what is the expected evolution over the term of the license?
- Will the project affect the morphologic evolution of the Susitna River compared to pre-project conditions?
- If the project will alter the morphology of the river, what are the expected changes over the term of the license?

FGM-30 NMFS agrees that those four questions should be answered. NMFS requests that, if the system is found to be in dynamic equilibrium, the geomorphology and fluvial geomorphology studies provide the magnitude and trend of geomorphic change in response to the project and that these changes are translated to spatial and temporal riverine and floodplain habitat changes. If the system is in disequilibrium, the geomorphology studies should provide an understanding of the disequilibrium without the project and then present the project's effects to the system and summarize the effects in a spatial and temporal riverine and floodplain habitat change analysis.

Specific Comments by Subsection

Study Objective 1. Model channel formation processes in the Susitna River downstream of the proposed Watana Dam site.

The applicant describes three study components, bed evolution model development and calibration, model existing and with project conditions, and coordination of model outputs. This will provide operating flow analysis over a range of flows to assist NMFS channel maintaining flow condition recommendations. In this study request the applicant lists three factors in choosing appropriate geomorphology models: 1) the level of detail required to meet the overall study objectives; 2) the class, type, and regime of flows that are expected to be modeled; and 3) the availability of necessary data for model development and calibration. As data collection can be difficult and may require several seasons, we suggest that the model selection should be made soon to ensure collection of data populate the models. The bed evolution modeling approach will consist of a 1D movable boundary sediment transport model to address reach-scale issues and 2D models to address local scale issues. Both of these should be tied back to effects on habitat by associated changes to geomorphic form and process. The 1D model will extend from the proposed dam downstream extent of the hydraulic flow routing (RM75, downstream of the

FGM-32

FGM-33

FGM-34

USGS Susitna River gage near Sunshine) unless project effects are found to occur at the downstream boundary of the model. A clear method for determine model extension is needed in the study plan to avoid misunderstanding and responsibilities of this study.

FGM-36 One of the models proposed for 1D model selection is HEC-6T, which allows for user defined transport equations; we reiterate that this will require good sediment transport data and will require data collected on the Chulitna and Talkeetna Rivers, and may additionally need other tributary inputs in the middle reach.

FGM-38 The 2D model, used to evaluate the detailed hydraulic and sediment transport characteristics on smaller, more local scales, will likely overlap with some of the instream flow study sites. Site selection for the 2D models must consider habitat utilization by anadromous fish, importance of the habitat, and dynamic flow patterns and geomorphic processes. Sites should be selected that serve biologic functions (spawning, rearing, migration, overwintering) and will potentially change with project operations.

AEA Study Objective 2. Estimate the potential for channel change for with-project operations.

The channel change associated with project operations with the operating flow analysis will provide NMFS with data to make recommendations that will allow the project's operations to maintain geomorphic processes that are responsible for maintenance and development of riverine habitats. The applicant describes using the calibrated models to model existing and with-project conditions (5.9.4.2). The with-project scenarios will be evaluated over a 50-year continuously operating scenario. The scenarios should represent a variety of operating scenarios to provide NMFS with the full operating range from no project to the current proposal. This information must be coordinated with the other studies (see below). The geomorphology study should provide a summary of channel change and links to habitat with each of the operation scenarios.

FGM-08

FGM-16 Additional information that should be provided with the estimate of potential channel change including a translation to habitat change, change in large wood recruitment, change in floodplain sedimentation, and change in substrate size composition. All of this information will help NMFS analyze the proposed operations and to develop 10(j) recommendations for instream flow.

AEA Study Objective 3. Coordinate with other studies to provide channel output data.

The applicant will provide an assessment of where the channel geometry and substrate will likely be affected by project construction and operations to the instream flow study to assess where the instream flow analysis assumptions may not be valid. We request that the geomorphology modeling results for project operation scenarios also be presented in the instream flow study to allow for an integrated analysis of the changes to riverine and floodplain habitats under project operations. Presentation of the results in the instream flow study will help NMFS compare all of the related operation effects to riverine processes. Other information that should be provided to the instream flow analysis is a change in large wood recruitment, change in substrate size composition, discharges necessary to mobilize substrate, the frequency of bed mobilization, bedload and total sediment rating curves, geomorphic response reaches, and correlated habitat effects. Additional longitudinal information, such as bed elevation adjustment, should be

FGM-17

described and provided to the groundwater and instream flow studies to assess effects of geomorphic response on habitat availability and quality. This additional information will help the other studies provide relevant operations analysis and will help NMFS make conservation recommendations that reflect an understanding of the interrelated riverine processes.

In the NMFS study request, the goal of the model coordination is to

> *...provide necessary output to the various studies that will require determination of channel change. An iterative integrated analysis will be conducted as described in the instream flow study. Coordination with instream flow, ice processes, and fish studies will be conducted to obtain lists of information they will need to reflect the results of the bed evolution modeling and predicted changes in channel conditions for the various project scenarios.*

As previously asked in our study requests (NMFS 2012) and during TWG meetings, we would like to see how the results from the geomorphology study will be integrated into the instream flow study to achieve the objectives that NMFS requested in both the instream flow and geomorphology study requests. This is necessary for NMFS to review all of the operation effects to riverine processes (geomorphology, ice processes, surface/groundwater interactions, water quality, instream flow-aquatic habitat) and to make instream flow recommendations that will minimize the effects to fish and their habitat.

<u>Literature Cited</u>

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5.9 Water Resources – Ice Processes in the Susitna River Study

<u>General Comments</u>

May 31, 2012 NMFS (2012) filed a study request with FERC entitled "Susitna River Ice Processes," with the stated goal to characterize and document ice processes of the Susitna River and to use that information to analyze Project effects on ice formation, location, persistence, and spring breakup. The reason for this analysis is to incorporate current river ice science analysis into comprehensive decision making, and provide information NMFS can use to develop the following:

- proposed measures and plans to protect; mitigate, or enhance environmental resources;
- FPA section 18 fishway prescriptions for passage of anadromous fish;
- FPA section 10(j) recommendations to protect, mitigate damages to, and enhance fish and wildlife resources; and
- FPA section 10(a) recommendations to ensure that the project is best adapted to comprehensive plans for developmental and non-developmental resources.

In order to accomplish these measures, NMFS must obtain and apply the best available science, data and techniques to assess the potential effects of the proposed project on riverine processes, fish, and fish habitat.

Ice processes directly influence instream flows, river and floodplain morphology, vegetation, and water quality, all of which are important to fish and the quality, availability and maintenance of their habitat. This study will be used to predict the project's effects on ice processes in the entire river from the reservoir to tidewater and to determine how these effects will alter instream flow, winter time surface water/groundwater exchange, fluvial and floodplain geomorphology and vegetation, riverine habitat and quality of that habitat, and water quality in the Susitna River ecosystem. AEA provided their proposed study plan for ice processes on July 15th in their broader Water Resources study plan (AEA 2012) with the goal to understand existing ice processes in the Susitna River and to model/predict both pre-project and post-project ice processes.

The revised study plan should include a detailed study frame work; such a frame work is not apparent either in the proposed study plan document or as a result of workgroup meetings with AEA. During the August 17, 2012 TWG meetings, the applicant described two potential ice
ICE-38 processes models, but no description of the data necessary to populate, calibrate and validate the models was provided. The models and necessary data for implementation should be compared with a description of how they will achieve NMFS's study objectives. Also not discussed was the ability for the models to extrapolate to proposed winter operational flow conditions well
ICE-39 outside the natural flow regime to understand the effects of the project, necessary for accurate assessment of project operation impacts on riverine processes that are important to fish and their habitat. Regardless of the modeling method hydraulic routing and accurate determination of
ICE-40 discharge under ice cover requires direct measurement. Because ice thickness and roughness will greatly influence the stage-discharge relationships, winter discharge measurements are needed at each of the routing cross-sections. We request a detailed description of the minimum number and locations of discharge measurements to be taken during winter to populate and calibrate the winter hydraulic flow routing model and to be used by the winter ice process model.

ICE-42 NMFS requests an analysis of the hydraulic flow routing and ice process model's abilities to
assess project effects under the proposed project operations; the PSP does not provide for this
analysis. Specifically, we want to know if the model will have the ability to assess hydraulic
flow routing and ice process effects at a scale relevant to fish and their habitat. What can be
determined from the proposed study? How will uncertainty be determined from the study and
ICE-43 modeling results? If the currently proposed ice process models and the winter hydraulic flow
routing models are not sufficient to understand the project effects on anadromous fish and their
habitat, additional information must be provided. Two-dimensional ice process models at key
habitats may be necessary to understand project operation effects on overwintering fish. There is
a strong potential that the winter physical processes models (winter hydraulic flow routing, ice
processes, groundwater, and water quality models) will have large uncertainty; also it is likely
that a true understanding of fish habitat utilization will not be available with only two winters of
fish surveys and studies. The combined limitations of the physical processes and fish studies
may present a difficult situation for the agencies to make recommendations to make protection,
minimization, and enhancement recommendations. Without adequate knowledge of project
affects, NMFS will require the project to operate along the natural flow regime; this would result
in recommendations that require operations at stable winter flows.

NMFS believes the proposed study plan for ice processes is incomplete; additional detail is
necessary to understand if the study plans adequately address our study requests. This additional
ICE-44 detail should include a schedule and methods for attaining ice processes data necessary for model
calibration and instream flow data necessary for calibration of the winter hydraulic flow routing
model. If this information is provided by another study, it must be explicitly described in the
other study plan and referenced. Also, this study should explain how the models and data
collected in this study will be used to assess project effects on anadromous fish species. The
study plan must include a schedule to collect necessary data, to prepare the model, and provide
analysis; additionally, the plan should have the flexibility to extend the studies if the data and
modeling products are not sufficient for NMFS to analyze winter operation effects on
anadromous fish.

ICE-45 The modeling approach must include a discussion of the selected model limitations and the
limitations of the winter hydraulic flow routing models, necessary to put the model results into
context. Although the winter hydraulic flow routing model is discussed under the instream flow
ICE-41 study plan and the model results are needed by this and other studies, no detailed data collection
for the winter hydraulic flow routing is described. The data necessary to adequately calibrate
and test the models must be described. The calibrated ice processes model review should include
ICE-46 an assessment of the model's ability to predict changes in ice processes under the project
operations at a scale relevant to fish and their habitat. Also, if the winter hydraulic routing
model and the ice process models are not adequate to assess impacts to fish and their habitat, a
more detailed two-dimensional approach may be necessary to conduct the winter analysis in the
instream flow study.

The primary role of the ice process study is to provide ice processes information and effects analysis to other studies. Changes to ice processes, including the changes of timing and ice extent and thickness may alter many of the other riverine processes such as geomorphologic processes, groundwater exchange, water quality, and instream flow (hydraulic flow routing, passage into off channel habitats, water quality). The modeling, study, and framework results of post-Project ice processes will be limited in providing analysis to the fisheries, instream flow, geomorphology, water quality, and groundwater studies; this limitation must be described.

ICE-36 In the proposed Geomorphology (AEA 2012, 5.9.4.2.2.4) study plan, the applicant describes the interaction between the geomorphology studies and the ice processes. But in the ice processes study plan there is no description of simulating the effects of surges from ice jam breakup or simulating the effect of channel blockage (which would likely require two-dimensional ice process modeling); nor does the PSP describe the ability of the ice processes modeling and winter hydraulic flow routing to provide adequate data to populate the 2D geomorphic models during winter conditions.

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National Marine Fisheries Service (NMFS). 2012. Letter and study requests to Secretary Bose, Federal Energy Regulatory Commission. May 31, 2012.

Northwest Hydraulic Consultants Ltd (NHC). 2012. Alaska Department of Natural Resources Topic 7 Ice processes and Winter Flow Routing Study Plan Review (DRAFT October 2012).

5.11. Glacial and Runoff Changes Study

General Comments

This discussion compares NMFS's study request with AEA's PSP and recommends improvements:

This PSP only partially addresses NMFS's request entitled "Susitna River Project Effects under Changing Climate Conditions." It does not address the main objective of NMFS's climate change study request, which is expressed more fully in §1.3.1 of the request. In brief, the objective of NMFS's request is to assess the potential project effects combined with impacts of climate change on the Susitna watershed ecosystem so a project license can be properly conditioned in anticipation of these changes.

The study plan is incomplete. It addresses some elements of NMFS's study request, but other elements are not addressed in this or any of AEA's other PSPs. Because the proposed project is designed for long-term utility and is located in an area vulnerable to continued climate change, it is necessary to understand the cumulative impacts from the project and climate change in order to develop license conditions that protect anadromous fish species and their habitat. Some climate-change-induced effects of the Susitna River and Susitna watershed include continued warming of stream temperatures, reduction in permafrost affecting groundwater storage and discharge and channel incision, and glacier melting and reduction of summer flow. These climate-induced and project-influenced changes in habitat would affect fish in the Susitna River. Information on the likelihood of these events will allow NMFS to make decisions on the effects that a dam would have if it were to block the passage of fish from the upper watershed, where refugia from negative effects on habitat may persist. Thus, NMFS seeks information from our requested climate study in order to inform our decision of whether prescription of fish passage is needed. Without such an understanding of climate change, project operations mistakenly would be considered as though future conditions were to be static. The project license would be outdated from the outset.

NMFS seeks the information specified in its climate change study request in order to analyze the project effects, in the context of variable and changing climate conditions, on NMFS's trust resources. As explained more fully in §1.3.4 of NMFS's request, the main reason for this analysis is to incorporate the results of current climate science into comprehensive decision making, and provide information NMFS can use to develop license conditions that FERC in turn can incorporate into any license order it issues, appropriate and efficiently tailored:

- FPA section 18 fishway prescriptions for passage of anadromous fish;
- FPA section 10(j) recommendations to protect, mitigate damage to, and enhance fish and wildlife resources; and
- FPA section 10(a) recommendations to ensure that the project is best adapted to comprehensive plans for developmental and non-developmental resources.

In order to fulfill their duties under the FPA and other relevant mandates, NMFS and FERC must obtain and apply the best available science, data and techniques to assess the potential effects of the proposed project on riverine processes, fish, and fish habitat. Applying recent advances in climate science, including scenario analysis and projections, to project analysis will result in more accurate and informed resource decision making (Brekke, 2009; Fowler 2007; Vicuna et al., 2010; Viers, 2011).

Recent advances in climate science and its application in other hydrologic risk analyses underscore the need for FERC's licensing process to utilize accurate predictions of the effects of climate change on changes in glacial wasting and on the timing and availability of water in the Susitna River. In the past, FERC has relied on historical data to evaluate project effects, in the context of changing climate a broader approach is needed. However, the best available science now includes the presently observed and projected future impacts of climate change on water resources. Congress recently emphasized the need for a broader scope of understanding, by directing the Secretary of Interior, via the SECURE Water Act, to coordinate with NOAA and its programs to ensure access to the best available information on climate change [(§) 9503 (c)(4) of the SECURE Water Act, (Pub.L. 111-11, Title IX, § 9501 et seq., Mar. 30, 2009, 123 Stat. 1329.)] stating, in part:

> Congress finds that--
>
> (1) adequate and safe supplies of water are fundamental to the health, economy, security, and ecology of the United States;
>
> (2) systematic data-gathering with respect to, and research and development of, the water resources of the United States will help ensure the continued existence of sufficient quantities of water to support—
>
> (A) increasing populations;
>
> (B) economic growth;
>
> (C) irrigated agriculture;
>
> (D) energy production; and
>
> (E) the protection of aquatic ecosystems.
>
> (3) global climate change poses a significant challenge to the protection and use of the water resources of the United States due to an increased uncertainty with respect to the timing, form, and geographical distribution of precipitation, which may have a substantial effect on the supplies of water for agricultural, hydroelectric power, industrial, domestic supply, and environmental needs.

It is now considered routine for hydropower, dam and water management projects in the United States and around the world to consider projections of climate variability and climate change in project planning and operations (Viers, 2011), and FERC should do so here. In order that FERC may fulfill its duties, the applicant should provide the information NMFS has requested.

GLAC-

FERC has also recognized that when, as is true in for this project, reasonable projections of a range of likely temperature changes are available, projections of future climate and analyses related to future reservoir levels and river flows should include a reasonable spectrum of climate change impacts. As FERC concluded in the study determination for the Toledo Bend Hydroelectric Project (FERC P-2305-020), such analyses are needed in order to reach informed judgments about likely project impacts on aquatic resources downstream of the project and on recreational resources in and around the reservoir.

FERC likewise determined in the Lake Powell Hydropower and Pipeline Project that climate change effects on existing and future water supplies should be addressed as the availability of water for the pipeline would affect the ability of the Project to supply water and generate hydroelectric power. As with the Lake Powell project, the availability of water supply is directly related to this Project's purpose.

GLAC-

Recent advances and applications of the science are described in detail in our study request; see, for example, §1.3.2 of the climate change study request. FERC should incorporate these developments into the studies it approves, rather than dismiss them. NMFS has provided adequate supporting science; the scientific community's acceptance of continued climate change and continued warming is unequivocal. NMFS again requests that, as part of the study plan determination, FERC order completion of our Comprehensive Study of Susitna River Project Effects under Changing Climate Study Request, filed with FERC on May 31, 2012 pursuant to 18 CFR Section 5.9(b).

FERC should also consider its responsibilities under the National Environmental Policy Act (NEPA) when determining the need for information about potential climate change. In issuing any license order, FERC should be informed about climate change's effect on the project and its suitability, as well as how the project may affect trust resources already potentially compromised by climate change. NMFS seeks assessment of the effects of climate change on the project and on the resources affected by the project in order to adequately prepare and support appropriate license terms and conditions, inform the need for fishway prescription and to develop effective measures to protect, mitigate, and possibly enhance resources for which we have statutory responsibilities.

NMFS has demonstrated a reasonable nexus between project operations and effects on resources resulting in cumulative effects of the project and climate change on important habitat components such as water temperatures, groundwater patterns, timing of fish migration, spawning, hatching and food availability. But to simplify the consideration of nexus, NMFS offers this hypothetical example of a cumulative effect of the project and climate change on NMFS's trust resources. Assume that, as projected, glacial recession and wastage continues to the point where summer flows from ice melt are reduced and eventually lost. Without the information NMFS has requested, FERC cannot determine to what extent the natural partial velocity barriers to upstream passage of Chinook salmon would remain barriers to fish passage, independent of the project. In other words, as glaciers melt and contribute less water to summer high flows, lower flows in Devil Canyon might naturally allow more Chinook salmon and possibly other species of salmon to swim upstream through the canyon and access now marginal habitat. Or, as stream temperatures continue warming, current summer rearing habitat for juvenile salmon may become unsuitable causing species' range to move to higher elevations and/or further upstream. But without information about these possibilities, a license order would likely be unable to account for it. Accordingly, the project could block a natural wildlife response to climate change and create significant future effects unanticipated by a license order based on conditions as they currently appear. NMFS seeks necessary information from the requested climate study.

Water is the fuel for the proposed project, and the amount, timing and variability of flows due to changes in glacial wastage have resulted in documented climate-related changes in recent decades. Models that project future climate, and usually, change, are readily available in currently in use across Alaska and northern latitudes as described in our study request at §1.3.3 and 1.3.5.

GLAC-

Where NMFS differs from AEA is that NMFS seeks to expand the climate study beyond simply the analysis of glacial retreat and flow into the proposed reservoir, and water quality. We request expanding the analysis to incorporate reasonably foreseeable changes in climate to assess vulnerabilities of natural resources in the project watershed. FERC must understand these vulnerabilities in order to determine how anadromous fish and their habitats may be affected by the project, and ultimately determine if and how the project may proceed. We suggest use of several documented methodologies, such as Bryant, 2009, and of using one of the many available and commonly used climate change vulnerability assessment processes.

In particular, we are concerned about the failure to consider the detailed content of this study request by FERC in its Scoping Document 2, and the only partial adoption of the request by AEA. In the SD2, FERC states that its common practice is to evaluate a range of flow release alternatives that take into consideration both high and low water years and to condition any license that may be issued to adaptively manage for these variations in water years. FERC asserts that its practice sufficiently addresses NMFS concerns and study request. It does not. NMFS's study request addressed the limitations of FERC's practice to analyze historic high and low water years:

The concept of a stationary environmental baseline with fluctuations (high and low water years) around a relatively stationary mean (as previously used by FERC and other regulators) is an outdated concept given the current level of scientific certainty of climate change (Milly et al. 2008; Viers 2011). Given the current trends (described below in 1.3.4), there is need to document the environmental baseline of the project, and to develop a realistic projection of the range of potential future trends in order to effectively evaluate the impacts of the project on NMFS resources and allow NMFS to make accurate conservation recommendations, license terms and conditions, and to develop recommended protection, mitigation and enhancement measures to address likely project effects.

Both precipitation and temperatures are projected to increase significantly, resulting in an increase in evaporation and evapotranspiration. In addition, rather than snowpack accumulating over the winter, increased temperatures will result in melting the snowpack "storage." The alteration of rain and snowfall timing and intensity, evapotranspiration and groundwater and surface flows, translates into changes in the annual hydrograph and potentially less water availability. Considering a static environmental baseline in project planning will not capture these projected changes. These changes need to be considered in project planning. Alaska's freshwater resources are increasingly at risk from climate change and preparing for this future is of escalating importance. Thus, studies are needed to connect the trends and projected changes in climate to variables needed for project planning.

NMFS disagrees with FERC's suggestion that adaptive management can be used for variations in water years for the reasons described in our study request and reiterated above. Adaptive management could, more appropriately, be applied to climate change. Adaptive management is one way to address the multiple uncertainties in the future faced by the Sustina project – not only climate change. However, an adaptive management framework, including monitoring and experiments, must be built into the project in the beginning (Gregory et al., 2006) including the issues for which adaptive management is more or less likely to be a viable option.

The Susitna project has characteristics may make it a good candidate for using adaptive management (in fact, DOI uses the case of re-licensing of the Tallapoosa dam as a case study), but has other characteristics that may make it more difficult. In a recent review by Gregory et al (2006), challenges to an active, experimental, adaptive management approach include:

> (a) designing statistically powerful experiments capable of discerning external effects and effectively considering issues of duration (i.e., using titration designs),
>
> (b) articulating all the costs, benefits, and risks of alternative experimental and non-experimental management plans, and again
>
> (c) ensuring that sufficient staff capacity and institutional flexibility exist.

One of the examples presented by Gregory et al. (2006) as more complex and difficult involves climate change and a multi-objective project of land planning. Adaptive management does not relieve the need for adequate baseline information in an original licensing proceeding--and in fact requires it. Adaptive management is a decision-making process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood.

Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a "trial and error" process, but rather emphasizes learning while doing. Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social and economic goals; increases scientific knowledge; and reduces tension among stakeholders. It is vital that adaptive management is the paradigm for both pre-licensing study plans and post-licensing conditions for long-term monitoring.

To be effective, adaptive management requires a deliberate, intentional process, including set up and iterative phases, and within these, decision making, post-decision monitoring, assessment of monitoring data, learning and feedback, and institutional learning, according to Williams and Brown (2012) in a recent DOI guidebook to adaptive management. Monitoring and experiments must be built into the project in the beginning (Gregory et al., 2006), and they lay out a set of criteria that suggest problems for which adaptive management is more or less likely to be a viable option. They also point out the dilemma of "clearly documenting what we do not know as the basis for experimenting with valued and, in many cases, fragile ecosystems."

The information on climate change that NMFS has requested is necessary to prior to FERC determining whether the license order should include adaptive management measures. NMFS recommends FERC order development of an adaptive management approach for all aspects of decision making associated with the proposed Study Plan and license application decisions.

Our comments below address specific components of the PSP as indicated:

5.11.4.1. Review Existing Literature.

This literature review should be expanded to include a review of climate projections and glacial regions, permafrost changes, and other existing research relevant to the impacts of climate variability and change on the water dependent resources of the region. This is because the current literature review is limited to physical processes affected by climate change, and does not cover the reasonably foreseeable cumulative effects of those changes on the natural resources that will also be affected by project operations.

GLAC-

5.11.4. Study methods.

NMFS appreciates that AEA will consider explore future runoff projections available from climate models in a qualitative manner. However, the analysis of future runoff should also be assessed quantitatively. Because the PSP is confusing where it discusses study methods, NMFS requests clarification or perhaps clarification of the following details.

The study proposes to analyze changes in glacial systems, temperature, and precipitation, and their impacts on watershed hydrology, including future runoff projections. The changes in runoff will be translated into time series data summarizing changed hydrology and temperature dynamics in the Susitna basin.

GLAC-

The study also proposes to qualitatively assess the potential effects of "climate change models." This reference is unclear – global climate models (GCMs) are used to simulate the past and project the future climate and, with greenhouse gas forcing, "change," but climate *change* models don't exist. While the glacial study plan does include an analysis of streamflow based on climate projections, it is not clear how this is being conceptualized. The revised PSP should define what is meant by "future runoff projections" as compared to "climate change models." On page 5-153, the PSP mentions, "This will include no change from current conditions, continuation of current warming trends, and adherence to various climatological scenarios such as SNAP (2011)." The phrase "climatological scenarios such as SNAP" appears to refer to several downscaled climate projections based on the global climate models, but this needs clarification.

It is unclear what is meant in the PSP by a "qualitative analysis." At a minimum, potential effects of climate change should evaluated on a relative basis (as in the Lake Powell Pipeline study), with effects on streamflow and water supply associated with climate change being applied to all interrelated and affected Susitna studies and project alternatives. For example, changes in streamflow associated with climate change should be included for each study planned for the project that would be used by NMFS in making its fish passage determination and prescription and its conservation recommendations pursuant to §§18, 10(a) and 10(j) of the FPA and the Essential Fish Habitat provisions of the Magnuson-Stevens Act §305(b)(2), 16 U.S.C. 1855(b)(2). This is true for each project alternative that may be assessed. Including effects of climate change in all potential studied resource areas that are likely to be affected by project construction and operations studies will result in a relative comparison between alternatives where effects of climate change apply equally to each alternative.

5.11.4.2. Develop a Modeling Framework

From the PSP, it is unclear how future hydrologic simulations will be developed. The PSP mentions forcing using "Max Planck Institute for Meteorology ECHAM5 model (3 hour time steps) and SNAP (daily) models. The SNAP dataset includes the years 1980-2099, with data downscaled to 2 km grid cells. Future projections from SNAP are derived from a composition of the five best ranked General Circulation Models (out of 15 used by the Intergovernmental Panel on Climate Change [IPCC]) models for Alaska. Based on how closely the model outputs matched climate station data for temperature, precipitation, and sea level pressure for the recent past, their individual ranking order for overall accuracy in Alaska and the far north was as follows: 1) ECHAM5, 2) GFDL21, 3) MIROC, 4) HAD, and 5) CCCMA." The PSP proposed to use a five-model composite from these and three emissions scenarios.

GLAC-

Calling out the ECHAM5 model separately from SNAP is unclear – ECHAM5 is a global climate model with a large spatial scale not well suited for application at the sub-watershed level as in this project. A 3-hour time step is mentioned, but this would also be at the large spatial scale of global climate models, ~1.9°x1.9° (about 210 km) in the case of ECHAM5. Daily projections from SNAP would be at a 2 km resolution downscaled from global climate models, including ECHAM5. This would be a useful level of resolution for use in this project. It is possible that the climate scientists plan to use simulations of these models of the past (e.g., since 1960 is mentioned) but the explanation of the methods is confusing and needs to be better articulated. Further on, the PSP states that "Future simulations will be forced by a suite of downscaled IPCC AR4 projection scenarios and, if available, the newer AR5 simulations." This does not appear to be different from the 5-model SNAP composite. An accurate explanation of the methods is needed in order for NMFS to understand, and FERC to determine, whether these methods are appropriate for gathering the information necessary to develop a license application.

GLAC-

NMFS supports the methods selected for analysis of change in streamflow on an annual and seasonal basis. But NMFS recommends clarification on how analysis at "single event timescales" could be completed. Perhaps this is a sort of analysis of extremes in the downscaled data. More detail on methods is needed as NMFS climate scientists are unaware of how such an analysis could be made and the PSP does not explain the methodology.

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5.12 Mercury Assessment and Potential for Bioaccumulation Study

General Comments

The PSP Study proposes to determine if significant mercury is currently present in the river and the degree to which mercury may become more bioavailable after completion of the dam. Mercury is significant to NMFS because of the potential deterioration of ecosystem health and should be studied by the applicant due to the potential for public health issues.

The PSP is deficient. There are serious omissions in the PSP mercury plan, so the following major improvements are requested:

MERC-23
- The adoption of the concept of mercury with dynamic background. The PSP should adopt an approach of documenting and assessing the dynamic background concentrations of mercury and methylmercury, particularly in fish and biota over time (not just in the landscape prior to construction). In other words, it is stated that enhanced formation of MeHg in reservoirs has been documented (section 5.12.2). The AEA plan should assume the increase in fish Hg will happen and detail how this risk will be assessed, monitored, and managed as a public health issue. There will be significant concerns regarding human and ecological health and risk assessment and the proposed study needs to outline clearly how these risks will be documented, assessed, and managed.

MERC-24
- The PSP should document mercury increases at other hydro projects in boreal forested landscapes. Attempts at modeling mercury methylation in surface waters are constrained by numerous required assumptions (e.g. methylation and demethylation rates, carbon limitations, sulfate and sulfide limitations, microbial community dynamics, parent geology and Hg content/leachability, hydrologic controls, aerobic/anaerobic boundary layer controls, etc.). The costs associated with developing and applying a modeling framework are still met by the need to validate the model with actual site-specific field data (e.g. MeHg in fish over time). To obtain an upper-bound on what the potential increase in MeHg in fish might be as a function of reservoir formation, the resulting increases in MeHg in fish from other Hydro sites needs to be documented. This requires not only reviewing peer-reviewed literature, but contacting directly agencies such as Quebec Hydro, Manitoba Hydro, Environment Canada, and authors of noted peer-review articles on the issue of enhanced MeHg in fish from reservoir formation. These include Vince St. Louis, Mariah Mailman, Britt Hall, K. Kruzikova, Reed Harris, Carol Kelly, John Rudd, S. Castelle, Dave Krabbenhoft and Drew Bodaly among others. There have been many lessons learned on how MeHg increases in fish upon flooding and impoundment and the AEA plan needs to demonstrate that that knowledge base has been incorporated into their plan. Additional topics that would benefit from this level of communication would be documenting whether the EFDC model (or any other model) has been developed and calibrated for mercury in the context of reservoir formation. Also, Scandinavian countries may have addressed this issue in detail and contacting the list above may provide access to individuals in Sweden, Norway, and Finland who could advance the project's knowledge base.

MERC-25
- The PSP should not assume mercury to be a simple, conservative behaving metal. It is known that mercury transforms into a more bioaccumulative neurotoxin, methylmercury as waters are flooded in boreal forested landscapes (St. Louis et al., 2004; Mailman et al. 2006; Porvari and Verta, 1995). Incorporating the knowledge base on the key parameters

affecting methylation at high latitudes needs to be addressed in detail by AEA's plan well before construction. The reason for this importance is that watershed-scale amendments (e.g. tree removal, vegetation burning), may be worthwhile for mitigating the MeHg risks. Mailman et al. (2004) identify several strategies that need a thorough review by the proposed study relative to MeHg formation: "Possible strategies reviewed in this article [Mailman] include selecting a site to minimize impacts, intensive fishing, adding selenium, adding lime to acidic systems, burning before flooding, removing standing trees, adding phosphorus, demethylating MeHg by ultraviolet light, capping and dredging bottom sediment, aerating anoxic bottom sediment and waters, and water level management." It is acknowledged that excluding as many wetlands from the inundated area may be a recommendation (following findings from ELA, Ontario), but that may not be possible given the site topography. If the revised study plan assumes that mercury behavior is complex, then NMFS will have better information to make recommendations to minimize the project effects. The PSP should include continuous mercury level

MERC-26 monitoring. A one-time, late-summer fish survey is inadequate to monitor dynamic background mercury concentrations. Study methodologies for toxics modeling is cited (5.5.4.4), but more explanation is necessary to determine the adequacy of the study.

MERC-27 These need to be addressed. How will human and ecological health be considered (i.e. maintaining public health) in light of the likely increase in MeHg in fish?

MERC-28 In summary, the AEA plan needs to assume that there will be an increase in fish mercury concentrations as a result of the formation of the reservoir. Managing this risk, modeling it, and monitoring it needs to be developed in accordance with what has been found at other similar landscapes. Studies have acknowledged that MeHg toxicity may be reduced by a number of possible management strategies, which must be considered and implemented before construction. With the improvements we suggested and providing an analysis of project design management strategies will allow NMFS to make recommendations on project operations and construction to minimize effects to water quality, and to fish and their habitats.

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6 Instream Flow Studies

6.5 Fish and Aquatic Instream Flow Study

General Comments

On May 31, 2012, NMFS filed a study request with FERC titled Susitna River Instream Flow. The goal of the study request is to characterize the existing flow regime and the relationship of instream flow to riparian and aquatic habitats and organisms and to use this information to quantify the changes to aquatic and riparian ecosystems due to project operations over the expected life of the project.

The reason for this analysis is to incorporate current and relevant instream flow analysis into comprehensive decision making, and provide information NMFS can use to develop the following:

- proposed measures and plans to protect; mitigate, or enhance environmental resources;
- FPA section 18 fishway prescriptions for passage of anadromous fish;
- FPA section 10(j) recommendations to protect, mitigate damages to, and enhance fish and wildlife resources; and
- FPA section 10(a) recommendations to ensure that the project is best adapted to comprehensive plans for developmental and non-developmental resources.

In order to do so, NMFS must obtain and apply the best available science, data and techniques to assess the potential effects of the proposed project on riverine processes, fish, and fish habitat.

IFS-005 In contrast to our request the applicant's goal is to "provide quantitative indices of existing aquatic habitats and the effects of alternate project operation scenarios." What is actually proposed by this goal is not clear. Although the applicant's plan may contribute to meeting our request, and the intent may be to meet our requests, it limits the study scope to indices of existing aquatic habitat and effects of alternate project operation scenarios. This falls short of resources agencies goals and objectives because it does not allow for the quantification of the loss of aquatic resources and their habitats as a result of the proposed project operations.

IFS-004 During the August 16, 2012, TWG meetings, NMFS, USFWS and other attendees requested a more detailed study frame work for all of the riverine processes studies including the instream flow study plan. Specifically requested was a framework that not only lists a range of methods but addresses the agencies objectives and information needs, and logic for how the proposed methods would be implemented to achieve resource agencies objectives. The additional study plan detail requested will be used to assess the applicant's plan and to determine if it meets the intent of the NMFS study requests. The additional detail should include a process schedule (timeline) and methods for determination of habitat utilization, abundance, and distribution information on anadromous fish species (in this study plan and in the fish study plan); including temporal and spatial distribution of spawning and rearing. Each study component should have a statement of what can be determined, how other studies are integrated, and an assessment of uncertainty in each study component. Each study component should explain how confidence intervals and calculated errors for each of the indices, data summaries, and model outputs will be calculated. If the study component is dependent on or supplies information for another study, then the uncertainty analysis must take that into context. For example, an assessment of project operation effects on overwinter fish will rely on an understanding of winter habitat utilization and variables that influence habitat utilization (biologic understanding) and on the winter hydraulic flow routing and water quality models. The hydraulic flow routing (and other models) relies on results from ice process modeling; how is error associated with each of these components quantified and what certainty do we have about the analysis of the resulting project effects?

On September 12, 2012, NMFS staff met with the instream flow contractor for AEA to discuss instream flow site selection. In AEA's proposed study plan (PSP) for instream flow, the idea of intensive study reaches (now called focus areas) was proposed to examine processes at representative habitats. The purpose of selecting specific sites for intensive and overlapping studies is to gain an understanding of physical processes at representative locations, allowing for analysis of project effects on these processes and on fish and their habitats. These sites should be selected to be representative of the physical processes that are related to instream flow, including habitat-flow relationships, surface/groundwater exchange, geomorphic processes, and ice processes. The applicant has proposed using a hierarchical method, dividing the study area into reaches by hydrology, then geomorphology, and then macro-habitat types. Each geomorphic reach would have a site that contained at least one instream flow reach (focus area) that contained all of the representative macro-habitats available in that reach. This will require that the sites be statistically representative and have replication to allow for extrapolation of results based on metrics not yet determined or described. Methods on how to select representative reaches was not provided in the PSP or TWG meetings, what was suggested was using professional judgment. We believe that sites should be selected randomly and be reproducible, that enough sites are selected to capture the variability for each geomorphic reach, and to allow for replication. This will require, at a minimum, mapping of the macro-habitat types and delineation of each of the geomorphic reaches, both described as in progress at TWG but not described in the PSPs.

IFS-090

More detail is needed about the proposed approach to assess the habitat utilization and habitat characteristics that will be used for development of criteria to assess project effects on fish and their habitat. We discuss this topic in more detail below.

IFS-043

In addition to the proposed use of the Indicators of Hydrologic Alterations (IHA) and Range of Variability models (TNC 1997; Richter et al. 1996; Richter et al. 1997), we recommend using the concept of the relationship between the natural flow regime and variation to maintain biodiversity and ecosystems, to identify ecologically relevant hydrologic indices that characterize the natural flow regime (Henriksen et al. 2006; Olden and Poff 2003; Poff et al. 1997). Also lacking in AEA's PSP is information regarding the integration and understanding of hydrologic conditions that may influence biologic cues, such as juvenile out migration timing and success, adult access to spawning areas; and indirectly flow changes that may influence water quality and influence biologic cues. For riverine processes with insufficient information at the end of the study period, the natural flow regime should be the default recommendations for instream flow.

IFS-092

Finally, we are concerned that the duration of the proposed studies will not represent the range of conditions that occur naturally. Habitat-flow relationships should be developed over a temporal scale long enough to capture natural variability. The current time frame may not allow for capturing variability in fish-habitat relationships, or for obtaining fish distribution data under various flow and biologic conditions (low and high escapement, range in temperature and precipitation years, range in Pacific Decadal Oscillation, range in flow years).

To address variability in natural hydrologic conditions and to capture variability in biologic conditions we suggest using the average span of a typical Chinook salmon, five years for Deshka River Chinook. The Deshka River Chinook salmon stock age-composition currently represents the only one of its kind within the Susitna River basin. Salmon stock age-composition is a well-noted data gap within the ADFG Chinook stock assessment analysis for Cook Inlet. (ADFG 2012)

Specific Comments by Subsection

The following review of AEA's Fish and Aquatic Instream Flow Study Plan uses the structure of the plan's stated objectives and compares them to NMFS' study request objectives to determine if the intent is met, where improvements can be made, and which NMFS request objectives are not addressed. Where specific objectives and goal are not proposed, the NMFS requests that an explanation be provided to explain the deficiency.

IFS-013

AEA Study Objective 1. Map the current aquatic habitat in mainstem and lateral habitats of the Susitna River affected by Project operations.

The first objective of the applicant's proposed study plan is to map the aquatic habitat in the mainstem and lateral habitats in the project area. The initial subdivision of habitat mapping will occur at a macro level with six divisions, consistent with the 1980s studies. Further refinement and definition of these habitat divisions are described in this study plan and in the Fish and Aquatic Resources study plan (7.9) and in the Geomorphology study plan (5.8). NMFS requests refinement of the study plan to capture flood plain habitats, specifically examining the role of beaver ponds as a macro-habitat relevant to rearing fish. The methods include remote sensing, ground based habitat surveys, field data collection of geomorphological variables (bankfull width; bankfull depth, gradient, channel pattern, channel type, substrate composition, sinuosity, and habitat classification).

There is a range of habitats represented on the river, and a valid survey of the utilization of the habitats by fish provides the temporal and spatial basis to quantify baseline, project-effects, and cumulative effects. The macro-habitat types are a geomorphic characterization, not necessarily related to specific fish species habitat. There is both adult salmon spawning and rearing in all of the geomorphic reaches. The influence of main-stem flows on mainstem and off channel habitats influences groundwater/surface water interactions, and hence water quality, which can effect some portions of fish habitat selection, in particular spawning. However, there appears to be a large variation in biotic community composition and fish use among areas with the same macro-habitat classification. Therefore, this classification method must include enough study sites (focus areas) to capture the variability in the macro-habitat types, in each geomorphic reach, to describe characteristics that may influence fish distribution. For example, water quality and water sources seem to be the major driver of fish distribution in glacial rivers, but the current classification does not differential macro-habitats of different water quality. Another example is source water, for spawning within the flood prone area, the USGS on the Matanuska River (Curran et al. 2011) identified clear water side-channels as important for spawning, with source

IFS-029

water from the surface (tributaries) or from groundwater (local or regional was not differentiated).

NMFS expects that habitat identification and utilization efforts should result in a GIS-interface with capabilities to demonstrate the spatial arrangement and relative proximity of described fish species habitats within the Susitna River under the natural flow regime (Poff et al. 1997); and under proposed operational flows. The spatial patterning of habitats is important to NMFS because differing habitats complement and supplement each other based on relative proximity (Dunning et al. 1992; Forman and Godron 1986; Pichon et al. 2006; and Schlosser 1995). Habitat patches in close proximity of one another are critical to fish persistence, and to the resiliency of fish populations, and an understanding of the spatial patterning of habitats will inform NMFS conservation recommendations.

AEA Study Objective 2. Select study sites and sampling procedures to measure and model mainstem and lateral Susitna River habitat types.

The applicant's second objective is study site and sampling procedures selection for the Susitna River habitat types is not well defined in the plan. Study site and procedure selection alone should not be an objective, the objective should be to characterize and quantify the habitat types of the Susitna River. The general approach for habitat specific model development is to use the habitat mapping effort (during the October TWG site visit this information was described to be available December 2012) and an understanding of utilization to select transects/study segments to describe habitat conditions based on channel morphology and major habitat features. The applicant also proposed selecting additional study reaches to describe distinct habitat features such as groundwater areas, spawning and rearing habitats, overwinter habitats, distinct tributary mouths/deltas, and potential areas vulnerable to fish trapping/stranding (AEA 2012, 6.5.4.5).

IFS-020 Focus area site selection should be representative of the physical processes that are related to instream flow, including habitat-flow relationships, surface/groundwater exchange, geomorphic processes, and ice processes that are important to formation, availability, and quality of fish habitat. The applicant has proposed using a hierarchical method, dividing the study area into reaches by hydrology, then geomorphology, and then macro-habitat types. Each geomorphic reach would have a site that contained at least one instream flow reach (focus area) that contained all of the representative macro-habitats available in that reach. This will require that the sites be statistically representative to allow for extrapolation of results based on metrics not yet determined or described. We recommend that sites be selected randomly and be reproducible and that enough sites be selected to capture the variability of each macro-habitat for each geomorphic reach and to allow for replication. This will require, at a minimum, mapping of the macro-habitat types and delineation of each of the geomorphic reaches, both described as in progress at TWG meetings but not described in the PSPs. Results from the first year studies may require additional sites if representative or sufficient replication is not captured from the initial sites.

IFS-028 The studies at the focus areas should provide a greater understanding of project effects on riverine processes and to be representative, providing an understanding of the potential effects to the larger project area. Currently the discussion in the TWGs has focused on the middle river. The same methods we propose for focus area site selection should be applied for select focus areas for the lower river. The extrapolation methods should allow for extending the understanding from the selected reaches to the project area. These methods should be defined prior to selecting focus areas to ensure that focus areas are selected that will work for extrapolation, by collecting enough replicates and avoiding pseudoreplication (Hurlbert 1984).

IFS-010 Additional sites should be selected that are not necessarily representative of overall riverine processes but are significant because they support disproportionate or important biologic functions. Additional site selection should be made using information on species and life stage distribution and aquatic and riparian habitat quantification. Site selection should rely on an understanding of the characteristics that define fish habitat from several years of utilization information that is being started in 2012, this will likely require additional sites to be selected at the conclusion of the 2013 studies to be implemented in 2014. Site selection to capture important anadromous fish habitat, in addition to the sites selected for extrapolation of study results should emphasize areas that are utilized by anadromous fish and not ignoring locations or time periods that are difficult to study, i.e. mainstem utilization and over wintering habitat.

IFS-026 The 1980s flow-habitat studies focused on side slough macro-habitats where spawning salmon were observed, representing habitats with high fish use density. Current methodologies require enough sites to capture a range of fish use for each of the macro-habitats. Selected sites should include both occupied and unoccupied macro-habitats to best understand the criteria influential to fish distribution and habitat site selection.

NMFS believes that if the foregoing recommendations are adopted, then the study will have sufficient study sites that better describe habitats (and the variability of these habitats) allowing for further examination of the role of instream flow on the riverine processes that influence the use and quality of these habitats.

AEA Study Objective 3. Develop a hydraulic routing model that estimates water surface elevations and average water velocity along modeled transects on an hourly basis under alternate operational scenarios.

NMFS submitted an independent study request for hydraulic flow routing because the routing model and associated data is the basis for many of the instream flow modeling efforts. An understanding of project operation effects on instream flow from the dam downstream is necessary to understand project impacts to habitat of fish and other aquatic organisms within the river system. NMFS May 31, 2012 study request, Susitna River Flow Routing Study Request, has four objectives:

1. collect instream flow data throughout all seasons to characterize instream flow and develop a flow routing model;
2. develop and calibrate an ice free period flow routing model that is capable of modeling a range of operating conditions and scales (hourly, daily, weekly, seasonally);
3. develop and calibrate a winter flow routing model that incorporates ice effects that is capable of modeling a range of operating conditions and scales (hourly, daily, weekly, seasonally); and
4. inform and integrate with other studies the project operation effects on instream flow in the reservoir and downstream of the project.

ICE-38 The number of discharge measurements and location of discharge measurement to develop and calibrate the winter hydraulic flow routing model is not well described. The natural winter flow regime is stable after ice up until break up with very little flow fluctuation relative to the ice free period. Winter hydraulic flow routing will rely on the ice processes study to incorporate changes to ice cover with project; a detailed description of how that data will be provided and incorporated into the hydraulic flow routing analysis is needed. Also needed is an analysis of the applicability of winter hydraulic flow routing to assess effects of project operations to fish and their habitat through changes in instream flow downstream of the dam and reservoir. Because ice cover and thickness will affect the hydraulic roughness and discharge in the river it is necessary that discharge measurement be taken at enough of the cross-sections used in the hydraulic flow routing models and at different flows to allow for development of ice processes and flow routing models that will be relevant to assess project effects on overwintering fish and their habitat. Additional discharge measurements may be necessary at the USGS gage locations. Model sensitivities, assumptions and limitations should be thoroughly described so that a clear understanding of how likely the results reflect reality can be applied in developing conservation recommendations. The winter hydraulic flow routing will also incorporate a water quality component that will project downstream changes to flow (timing, quantity, and water quality).

ICE-38

ICE-38

ICE-38

There is a strong potential that the winter physical processes models (winter hydraulic flow routing, ice processes, groundwater, and water quality models) will have large uncertainty. It is a valid assumption that a true understanding of fish habitat utilization will not be available with only two winters of fish surveys and studies. The combined limitations of the physical processes and fish studies may be insufficient for the resource agencies to make recommendations to minimize project impacts to fish during winter and may require operation recommendations that simulate the natural flow regime. An understanding of uncertainty and the limitations of the hydraulic flow routing models (especially the winter model) is necessary to put the study results into context. This understanding will improve NMFS ability to develop 10(j) recommendations for winter operations that will minimize the effects to fish and their habitats.

AEA Study Objective 4. Develop seasonal, site-specific Habitat Suitability Curves (HSC) and Habitat Suitability Indices (HSI) for species and lifestages of fish selected in consultation with licensing participants. Criteria will include observed physical phenomena that may be a factor in fish preference (e.g., depth, velocity, substrate, embeddedness, proximity to cover, groundwater influence, turbidity, etc.). If study efforts are unable to develop robust site specific data, HSC/HSI will be developed using the best available information and selected in consultation with licensing participants.

IFS-059 Habitat suitability indices (HSI) and criteria (HSC) should be developed from an analysis of which environmental criteria influence fish habitat use in the Susitna River system. The criteria should explain the distribution, condition, and growth rates of anadromous fish in the river system, for each species and lifestage. Site specific habitat criteria should be evaluated in the context of the hierarchical habitat framework, such that habitat criteria are determined and evaluated in all habitats of importance to each agreed-upon target species and lifestage. NMFS recommends the determination of which criteria are important prior to model selection. Fish behavior is not addressed in the PSPs; study of the energetic consequences of these behaviors must be conducted to ensure that bioenergetic criteria used to define fish habitat quality do not depend on arbitrary assumptions about fish activity costs (Boisclair 2001).

IFS-050 With an understanding of fish habitat utilization and the environmental variables that influence the use of habitat, then tool development can occur. The understanding of the variables that influence fish habitat utilization will require several years of observation to account for natural variability associated with different environmental conditions (flow, temperature, fish population trends, etc.). Several years of data will also allow for assessment of population variability. The AEA study plan describes an order of preference for information used to develop HSI/HSC:

1. new site specific data collected for selected target species and life stages (seasonally if possible (e.g., winter));
2. existing site specific data collected from the Susitna River during the 1980s studies;
3. site specific data collected from other Alaska rivers and streams; and
4. HSC curves, data and information from other streams and systems outside of Alaska.

IFS-051 NMFS requests that only site specific HSI/HSC be used in assessing instream flow effects to fish on project operations; criteria from other sites (in Alaska or other places) presents a large risk of misrepresenting project effects to fish and their habitat. Criteria developed outside of the Susitna and other large southcentral rivers are not acceptable due to the species adaptation to specific systems and because of the lack of criteria development for glacial systems like the Susitna River. Many studies have shown that habitat suitability indices are not transferable between stream systems or between habitats or times within stream systems, and that criteria/indices used should be developed on site (Guay et al. 2003; Harris et al. 1992; Mathur et al. 1985; Moyle and Baltz 1985; Persinger 2003; Thomas and Bovee 1993). Any criteria used from 1980s literature on the Susitna River must include all likely factors that influence the utilization of the habitat characteristics the curves are used to assess. This should include at a minimum water quality (dissolved oxygen, turbidity, and temperature), habitat spatial structure (distance to cover, large wood, bank and bedform characterization), and groundwater upwelling or downwelling in addition to the typical hydraulic variables (flow, depth, substrate).

IFS-050 To demonstrate that NMFS 2012 study requests are being met, the PSP needs to detail how the applicant proposes to develop site specific habitat suitability indices/criteria for each anadromous species and lifestage (or why this necessary information cannot be provided).

In addition to collecting environmental information, it will be necessary to consider habitat use strategies that are in place to minimize risk of predation by juveniles. Behavioral studies are becoming increasingly important in assessing impacts to aquatic species as a result of proposed hydro projects in both the marine and freshwaters. Loventang (2005) found that juvenile Chinook would rarely be found in mid-channel during the day but would be found in mid-channel at higher abundance at night, independent of water temperatures, suggesting that the fish were using a strategy to minimize predation. Some fish are known to move great distances or utilize specific habitats on a seasonal basis. Juvenile salmon that seasonally inhabit shallow margin and off-channel floodplain habitats, where they find important access to terrestrial inputs (Eberle and Stanford 2010), serve as another important example of seasonal movements and habitat use patterns. It is important that surveys be conducted with sufficient replication in both space and time, such that the seasonal distributions of important species and life stages are adequately surveyed.

The tendency for salmon to return to their natal site for breeding leads to reproductive isolation, in space and time. It also leads to local adaptation to the local spawning and incubation environment (Doctor and Quinn 2009). More specifically, spawning salmon are thought to select redd sites based on physical variables important to the completion of their intra-gravel life stages (Montgomery et al. 1996; Quinn 2005). Temperature during incubation has been demonstrated as one variable that is important to the distribution of spawning salmon (Connor et al. 2003). Some fish species demonstrate significant population variability in response to environmental heterogeneity. Ruff et al (2011) showed that thermal heterogeneity in an Alaskan sockeye stream promotes spatial and temporal variability in spawning sockeye populations (potentially providing resilience to environmental disturbance). Because such spatial and temporal variability is also accompanied by variability in traditional habitat suitability criteria (e.g. water depth and velocity; substrate size), it is important that all the environments supporting each target species and life stage are surveyed. This is necessary for statistical discernment of habitat criteria that are influential to habitat selection.

IFS-060 In our study requests (NMFS 2012), NMFS asked for specific criteria for each lifestage for anadromous species; if guilds are going to be used, the habitat utilization data must be shown to support this method. A list of criteria to collect at fish sampling locations and at the focus areas should include the following:

- hydraulic information (depth and velocity);
- water quality parameters (temperature, dissolved oxygen, turbidity, possibly others);
- groundwater characterization (upwelling/downwelling, temperature and chemistry of upwelling water);
- substrate (size distribution and facie mapping);
- spatial structure of the habitat;
- cover availability; and
- indicators of productivity, etc.

The micro-habitat data must be collected at all macro-habitat habitat types, with mesohabitats represented in each macro-habitat with replication. This will result in seasonal curves for each species or subset of species and lifestages for each macro-habitat. Criteria to be used must be developed over a range of representative habitats for which they will be used. Also, criteria used in flow habitat analysis of project effects must be demonstrated to have a statistically significant relationship to habitat utilization for the time of year, life-stage, and habitat for which it will be used.

Frequent problems in developing statistically sound procedures include too small a sample size, possible bias caused by error in measuring habitat variables, using poor methods for choosing the best model, not testing models, using models based on observational data to predict standing crop, and making unrealistic assumptions about capture probabilities when estimating standing crop and not addressing assumptions such as habitat being limiting rather than competition or predation (Fausch et al. 1988).

AEA Study Objective 5. Develop integrated aquatic habitat models that produce a time series of data for a variety of biological metrics under existing conditions and alternate operational scenarios. These metrics include (but are not limited to):

- *water surface elevation at selected river locations;*
- *water velocity within study site subdivisions (cells or transects) over a range of flows during seasonal conditions;*
- *varial zone area;*
- *frequency and duration of exposure/inundation of the varial zone at selected river locations; and*
- *habitat suitability indices.*

The fifth objective outlined by AEA's Fish and Aquatic Instream Flow study plan is to develop integrated aquatic habitat models. The actual development of models does not, in itself, address resource management goals. We agree that integrated aquatic habitat models can be informative and biologically meaningful if properly chosen and if relevant site-specific data is input. However, we question whether the two-year study period is adequate to develop the models with relevant site specific data. The purpose of this objective should be to represent the analysis of project effects on ecological relevant metrics for fish and aquatic ecosystems.

We appreciate the plan to use integrated aquatic habitat models that produce a time series of data for a variety of biological metrics. The applicant lists several of these metrics; each of these should be clearly linked to ecological significance. This should include an understanding of fish habitat utilization, with an understanding of variables that influence utilization at the micro-scale for each macro-habitat. We requested biologically relevant instream habitat models and study sites; both the model and study sites should be selected with a thorough understanding of anadromous fish in the Susitna River system, including life history strategies, habitat utilization, and interannual variability. Related to this objective, AEA describes an Instream Flow Study analytical framework (AEA, 6.5.4.1). This framework will result in the development of a series of flow sensitive models that will be able to translate effects of Project operations on the riverine processes and biological resources. The following is a description of AEA's (2012) proposed framework.

The Instream Flow Study plan is focused on development of macro-habitat specific models that can reliably estimate flow-habitat response patterns for different species and life stages of fish and other aquatic biota. This will include a mainstem aquatic habitat model, side channel models, one or more side slough models (may vary by flow activation level), a tributary mouth and delta model; and a riparian model. These models represent the core tools that will be used for assessing changes in aquatic habitats under alternative project operational scenarios. The conceptual framework for these tools is depicted in Figure 6.5-3. A study focused on groundwater related aquatic habitat will be also be developed that may incorporate one or more of these models to assess linkages between surface flows and groundwater flows that comprise important fish habitats. Additionally, a fish passage model (Section 7.12) will also be used to develop the relationship between main channel flow and connectivity with side channel and off-channel areas. Data collection and modeling for the fish passage study will be coordinated with the instream flow, fisheries, and geomorphology studies (Section 5.9 and 5.10) to ensure identification of potential fish passage barriers and hydraulic control points.

While this description includes some areas we requested, it does not consider the full breadth of issues we find necessary to assess project effects on anadromous fish and their habitat in the

IFS-001 Susitna River. The study plan should describe the ability to assess the full distribution of fish and the uncertainty of their habitat utilization, the criteria that influence their selection of habitat, and then understand the relationship between flow and the specific criteria to discuss how models will be combined to predict change in habitat availability, both temporal and spatial with respects to quantity and quality. In our study request, NMFS outlined an integrated framework to be developed to include the following components (NMFS Susitna River Instream Flow Study Request, 1.3.5.7):

1. Instream Flow routing – The foundation of riverine processes studies depends on the Susitna River flow routing models (HEC-RAS, CRISSP1D) that will provide hourly flow and water surface elevation data at numerous locations longitudinally distributed throughout the length of the river extending from RM 184 downstream to RM 75 (about 23 miles downstream from the confluence with the Chulitna River) unless results determine an extension of the flow routing study is needed.
2. Water Quality – This model/study, incorporating flow routing, will provide analysis on flows necessary to maintain stream temperature, turbidity, and other water quality indices within a biologically relevant range for aquatic species, using the baseline information as targets.
3. Geomorphology – Model/study will provide analysis/constraints on flows important to geomorphic processes that form/maintain fluvial morphology and vegetation (including riparian, floodplain and woody debris recruitment functions).
4. Riparian/floodplain function – This model/study will provide an analysis of flows necessary to maintain floodplain function and riparian plant community composition. This study will be directly informed by the instream flow study and by the groundwater study.
5. Surface/groundwater interaction – This study/model will analyze the effect of project operations on the exchange timing, quantity, and quality. This will inform/analyze the instream flow needs to sustain groundwater interaction necessary to sustain habitat quality and quantity.
6. Ice processes – This model/study will provide analysis and identify constraints on flows important to ice freeze-up, ice thickness, persistence, and breakup. The results will inform other studies and winter time instream flow needs, including a description of winter time load following effects.
7. Aquatic habitat models - As described in study component Instream Flow Study-6. If specific habitat models are not successful in identifying project effects on habitat and suitability for specific species then alternative methods may need to be considered including studies of population dynamics and river productivity.
8. Passage/connectivity – This study will encompass accessibility at riverine habitat types that depend on flow throughout the project area, including tributary confluences and Devil Canyon.
9. Climate – The framework will incorporate climate variability and climate change projections to assess the cumulative effects of project operations in consideration of PDO and ENSO climate variation and longer term climate change (the anticipated life of the project – at least 100 years) that are expected to continue to change the hydrograph and water quality, among the many variables influenced by climate change.

10. Biological Cues – Behavioral, population, community, and ecosystem ecology studies relative to fish distribution, relative abundances, timing, river productivity, and the ecological interactions of the biotic and physical environment.

NMFS requests that each of these components be incorporated into the Instream Flow Study and be integrated into the analysis of project operations.

Several years of fish habitat utilization data provides the basis for understanding of anadromous fish lifestages and variables that influence habitat suitability, the integration of each of the riverine components we requested is necessary to assess project effects on anadromous fish and their habitat. For example, if a species is found to spawn and overwinter in the mainstem and utilization of this habitat is influenced by groundwater exchange, flow velocity and depth, and water quality then an integrated analysis of project effects on groundwater exchange, water quality, and flow hydraulics is necessary to understand how the utilization of this habitat will be effected. IFS-053 Additional areas that need more explanation of study methods and their ability to achieve the objectives we request include a study to evaluate project effects to salmon egg incubation, fry emergence, juvenile migration, rearing and overwintering. Studies of river productivity are described in our comment on the proposed study plan for fish. Analysis of project operations on river productivity must be included in the instream flow analysis, specifically under the aquatic habitat models. This analysis of river productivity should include operations that cause rapid changes in flow (associated with the proposed load following), these recurring flow changes may the impact the aquatic systems by reducing biotic productivity directly due to flow variation or indirectly due to changes in water depth, water quality, temperature, or sediment transport (Chusman 1985).

IFS-002 We also request a flow operations analysis that will consists of a range of conditions from baseline (no project/natural hydrograph) to various proposed scenarios (as described in the PAD), and alternatives suggested by the applicant and agencies in a working group setting. The outlined alternative operating scenarios will require consensus between the applicant and agencies.

IFS-037 The results of the operations analysis will be used in a comparative frame work to inform the effects on the natural riverine system and will allow agencies to assess operating conditions and to make recommendations and mandatory conditions on the final license application. Results should also include a sensitivity analysis (Steel et al. 2009; Turner et al. 2001) After model selection, population, calibration and scenario runs a variety of post processing comparative analyses derived from the output metrics estimated under the habitat specific aquatic habitat models will be provided to resource agencies. These include (but are not necessarily limited to) the following:

IFS-069

- comparisons of habitat quantity and quality (e.g., habitat exceedance plots)
- ramping rates (e.g., changes in flow versus time);
- juvenile fish stranding/trapping;
- habitat sustainability (effective habitat analysis); and
- distribution and abundance of benthic macro invertebrates under alternative operational scenarios.

IFS-084 NMFS expects that the applicant will develop integrated aquatic habitat models that produce a time series of data for a variety of biological metrics under existing conditions and alternate operational scenarios. These metrics include (but are not limited to) the following:

- water surface elevation at selected river locations;
- water velocity within study site subdivisions (cells or transects) over a range of flows during seasonal conditions;
- varial zone area;
- frequency and duration of exposure/inundation of the varial zone at selected river locations; and
- habitat suitability indices.

AEA Study Objective 6. Evaluate existing conditions and alternate operational scenarios using a hydrologic database that includes specific years or portions of annual hydrographs for wet, average and dry hydrologic conditions and warm and cold Pacific Decadal Oscillation (PDO) phases.

AEA study plan objective six is to evaluate existing conditions and alternate operational scenarios using a hydrologic database that includes specific years or portions of annual hydrographs for wet, average and dry hydrologic conditions and warm and cold Pacific Decadal Oscillation (PDO) phases. We appreciate the work product "tabular summaries of selected IHA-type statistics" and look forward to working with the applicant to develop this list. NMFS study request's includes objectives to characterize the natural flow regime of the Susitna River and tributaries in the project area and to identify, characterize, and integrate the timing, quantity and function of instream flow to riverine processes. To do this we specifically asked for characterization of the relationship between the Susitna River flow regime and climatic PDO.

We appreciate the description of the various IHA statistics that will be presented, but just want to emphasis the need to examine hourly rate and frequency of change for winter flow conditions, to compare to the proposed operations.

AEA Study Objective 7. Coordinate instream flow modeling and evaluation procedures with complementary study efforts including riparian (Section 6.6), geomorphology (Section 5.8 and 5.9), groundwater (Section 5.7), water quality (Section 5.5), fish passage (Section 7.12), and ice processes (Section 5.10). If channel conditions are expected to change over the license period, instream flow habitat modeling efforts will incorporate changes identified and quantified by riverine process studies.

IFS-008 We recommend that the instream flow study should integrate all of the riverine process analysis (groundwater, instream flow, geomorphology, ice processes, biological response to flow changes), not simply coordinate with the other study areas. The results of an integrated riverine processes analysis should be an understanding of instream flow changes induced by project operations and changes to fish habitat and fish behavior. The intent of our request was for the flow analysis to be used to assess project effects on anadromous fish and their habitat. This would require an integration of the flow dependent results of the geomorphology studies, groundwater study, water quality study, fish studies, and ice process study to analyze all vectors of influence as a result of changes in instream flow related to fish and their habitat. This analysis, if the studies are adequate, will be used to make conservation recommendations by NMFS under the authority provided in Section 10(j) of the FPA. To understand how this integration will occur, the agencies need some certainty that each of the riverine process components is adequately addressed. This will be evident with more detailed study plans that include overall approach, schedule, methods, and contingencies if necessary site specific information is not collected.

AEA Study Objective 8. Conduct a variety of post-processing comparative analyses derived from the output metrics estimated under aquatic habitat models. These include (but are not limited to) the following:

- *juvenile and adult rearing;*
- *adult holding;*
- *habitat connectivity;*
- *spawning and egg incubation;*
- *juvenile fish stranding and trapping;*
- *ramping rates; and*
- *distribution and abundance of benthic macro-invertebrates.*

IFS-103 This objective is similar to our requests for a modeling framework that will provide a comparative temporal and spatial analysis of riverine process studies and model results for a range of alternative operations. It is unclear which studies would develop the habitat utilization data proposed for comparative analysis, specifically for the juvenile and adult rearing and egg incubation. All of the project operation analysis for instream flow effects should include groundwater and water quality analysis, especially for juvenile overwintering and egg incubation. NMFS's study requests included an objective to identify, characterize, and integrate the timing, quantity and function of instream flow to riverine processes. Included in this request were specific processes, including geomorphology, floodplain and riparian form and vegetation, biological cues, water quality, surface/groundwater exchange, and riverine habitat availability and quality. AEA's study plan includes some of these processes in the proposed plan but it is unclear how they will integrate surface/groundwater exchange, water quality, river productivity, and biological cues and at what scale. It is also unclear how results from these studies will be extrapolated to gain a greater understanding of the overall project effects to the Susitna River system. The groundwater studies proposed by AEA (see our detailed comments on the groundwater study plan) should result in dynamic flow sensitive models for main channel and off channel habitats, allowing an analysis of how the exchange flows will be altered with project operations, although it is not clear how distribution of upwelling areas will be identified if the methods described in the groundwater study plan are not successful (which is highly likely).

IFS-054 Additionally, an understanding of the surface/groundwater exchange flows will also be needed to assess water quality in these habitats. Biological cues are not addressed in AEA's proposed Instream Flow Study. NMFS specifically requested a study component to address an investigation of flow dependent biological cues, which will rely on the detailed study of habitat utilization by anadromous species throughout their life history (NMFS, Instream Flow Study Request Section 1.3.5.3). NMFS requested an examination of instream flows that may correlate with historical escapement indices, run timing and seasonal water temperatures and associated biological responses. A summary of life stage events for each of the anadromous species should be presented in table form, including the corresponding habitat and hydrologic conditions. We acknowledge that a preliminary periodicity chart was provided to attendees of the October 4th site visit to the Susitna River, and we appreciate the initial effort of AEA's consultants to provide the requested information.

IFS-003 As instream flow and habitat structure (timing, quantity, and quality) are the controlling variables for fish and their habitat in the project area, we request that integration of the analysis of project effects on riverine processes be conducted in the Instream Flow Study. This is described in our second objective, "Identify, characterize, and quantify the seasonal and spatial distribution of all fish species and life-stages of each species within the defined habitat delineations of the Susitna River floodplain." The applicant's PSP describes, under Study Methods (6.5.4.1, AEA 2012), an analytical framework that describes a series of flow sensitive models that will translate effects of alternate project operations on the respective processes and biological resources.

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6.6 Instream Flow Studies – Riparian Instream Flow Study

General Comments

On May 31, 2012 NMFS filed a study request with FERC entitled Susitna River Instream Flow. The goal of the study request is to characterize the existing flow regime and the relationship of instream flow to riparian and aquatic habitats and organisms and to use this information to quantify the changes to aquatic and riparian ecosystems due to project operations over the expected life of the project.

The reason for this analysis is to incorporate current and relevant instream flow analysis into comprehensive decision making, and provide information NMFS can use to develop

- proposed measures and plans to protect; mitigate, or enhance environmental resources;
- FPA section 18 fishway prescriptions for passage of anadromous fish;
- FPA section 10(j) recommendations to protect, mitigate damages to, and enhance fish and wildlife resources; and
- FPA section 10(a) recommendations to ensure that the project is best adapted to comprehensive plans for developmental and non-developmental resources.

In order to accomplish the above, NMFS must obtain and apply the best available science, data and techniques to assess the potential effects of the proposed project on riverine processes, fish, and fish habitat.

The following comments largely pertain to AEA July 2012 PSP 6.6. Riparian Instream Flow Study and how well they address the goals and objective of the May 31, 2012, NMFS Instream Flow study request. On October 24 and 25, 2012, Alaska Energy Authority (AEA) held TWG meetings, during this meeting AEA described studies that are greatly reworked and revised from their July 2012 study plan. Notably, the goal statement and objectives have been restructured and clarified to reflect those requested in the May 31, 2012, U.S. Fish and Wildlife Survey Riparian Instream Flow Study request (USFWS 2012). While efforts have been made to mention some of the revisions presented during the late October TWGs, because NMFS has not received any written documentation of AEA's draft Revised Study Plans (RSPs), and because we are adhering to the FERC mandated ILP process, our review process will continue to focus on the PSPs received in July.

The NMFS Instream Flow Study Request has riparian components interwoven in the goal and objectives and was not initially intended to be a standalone riparian study request. The Instream Flow objectives 1, 3, 4, 5, and 9 are largely addressed in the NMFS fish and aquatic instream flow study plan review. This review of the riparian instream flow study plan will focus on NMFS requested objectives 2, 6, 7 and 8, and how those objectives are addressed in the July RISF PSP. References to the October 24 and 25, 2012, draft RSP presentation will be made, as appropriate.

Many of the objectives in the PSP are written as tasks. NMFS believes that objectives should not be written as tasks because the tasks may not adequately address the objective. AEA should reword the objectives to clarify the reason for a particular task. Many of the tasks are out of order, making it difficult to visualize how one product will lead into another. A possible reordering of the tasks in your objectives, including utilization of deliverables from other studies, may be helpful, e.g. conduct a literature review; delineate the study area; select statistically valid representative study sites within focus areas (using the literature review, the new physical process model, and the newly delineated process domains); sample those sites using carefully explained and referenced methods; develop seed dispersal and establishment model; construct species response curves (Henszey et al. 2004); develop seedling response and plant community establishment and succession models; and develop a super model (developed in parallel with the other studies) to predict changes to floodplain habitat due to project operation.

RIFS-30 Some general terminology in the PSP needs to be clarified. To avoid confusion, it is important that readers and study plan users be on the same page, interpreting terms the same way. Define and standardize usage of the words site, study site, intensive study site, study area, project study area, project study site, focus area, each study area, plot, and plotted. Consider changing the phrase riparian habitat to floodplain habitat or explain how the two terms are being used differently (or interchangeably). Although they refer to the same habitat the word riparian is sometimes construed to mean a narrow fringe of vegetation immediately adjacent to open water. In the Susitna River valley the floodplain (i.e. habitat influenced by ground and surface water interactions) can extend thousands of feet from the river. The ancient beaver dams at Whiskers Slough which appear to be connected to the river by ground water beneath floating *Sphagnum* bogs are one example.

RIFS-31 The proposed study plan should clarify what is meant by the term "baseline", which is an essential, critical term. PSP Section 6.6.2 states that "...of primary importance ...is the previous vegetation mapping and successional dynamics studies by McKendrick et al. (1982), Collins and Helm (1997), and Helm and Collins (1997)...previous works will be used as a baseline to develop a stratified sampling protocol for this and the botanical riparian study" (p. 6.44) and that the "riparian study modeling efforts will build upon the Collins and Helm (1997)...conceptual model" (p. 6-43). The need for new data is acknowledged "...to provide a contemporary understanding of the baseline riparian conditions *existing* (emphasis ours) in the Susitna River (p. 6-44)." Which dataset(s) does the applicant consider representative of baseline conditions? Thirty year old data, data collected during studies for this ILP (and prior to impacts from the presumed hydropower dam operations), or some combination?

<u>NMFS requested study plan Objectives and Specific Comments on the AEA PSP</u>

The following objects were requested in NMFS 2012 study request for an Instream Flow Study; they are the relevant objectives in our review of AEA's riparian instream flow study plan. NMFS requests that the revised study plan address these objectives specifically.

NMFS Objective 2. Identify, characterize, and integrate the timing, quantity and function of instream flow to riverine processes: geomorphology; floodplain and riparian form and vegetation; biological cues; water quality; surface/groundwater exchange; riverine habitat availability and quality, etc.

NMFS Objective 6. Develop a modeling framework to integrate study and model results of all of the riverine functions and to assess the temporal and spatial relationships between instream flow and riverine and biological functions. This will allow agencies to develop license terms, conditions and conservation recommendations for instream flow that would minimize effects and protect aquatic resources consistent with our conservation goals.

NMFS Objective 7. Comparative temporal and spatial analysis of riverine process studies and model results for a range of alternative operations.

NMFS Objective 8. Complete a literature review of instream flow and environmental issues of other large hydropower dams; including assessment of modeling methods and results, instream flow requirements, and post project monitoring.

RIFS-32 The July 2012 AEA PSP goal is vague and does not specifically address the need to characterize and quantify current conditions. The model as proposed would rely heavily upon historic data rather than data to be collected during the study. Historic data (1980s) are important for model development but they are not representative of current conditions. A two-year study is too short to provide meaningful data; it takes at least three years for seedlings to be recruited into a reproductive cohort (Rood et al. 2007). Models should integrate new data collected over the span of five years, at a minimum, which is the average life span of a chinook salmon. A characterization and tabulation of current conditions can be used as an index to quantify predicted and measured changes to riparian/floodplain vegetation in the Susitna River Valley.

Literature survey and synthesis (addresses NMFS objectives 2, 6, 7, and 8)

RIFS-33 Clearly state the intention to expand the scope of literature surveys and syntheses to include literature that describes processes and functions of similar rivers with and without hydropower projects. Include literature that integrates surface and groundwater interactions with plant community distribution and response to different riverine functions. Studies on the Nyack River (Montana) and lower Talkeetna River (Alaska) floodplains have demonstrated that plant species richness and productivity patterns within alluvial flood plains are strongly influenced by similar factors and processes regardless of physiographic setting (Mouw et al. 2009). The more comprehensive literature review will better reflect the current understanding of riparian function relative to instream flow and will provide better insight into the potential project effects.

Relationships between models and products from other PSPs (addresses NMFS objectives 2, 6, and 7).

RIFS-34 The detailed timeline for completion of the different studies that AEA is developing for inclusion in the RISF study should help clarify some of the confusion about which product will inform subsequent steps in the study. Please provide clear linkages between different products and studies. For example, state that plant communities will be mapped before botanical riparian site selection and study can commence. Section 6.6.4.3 implies that a mapping and measurement approach will build upon those measures developed for the Botanical Riparian

Study (which is built upon vegetation mapping results). This is probably not what AEA intended to imply, and detailed study interaction charts and timelines should help clarify this.

Historic vs Current Conditions (addresses NMFS objectives 6 and 7).

RIFS-35 The need for and methods to integrate current conditions and historic data into sub-models described in other AEA PSPs in order to predict possible effects from the proposed project should be the endpoint of this study. Although AEA states that they will develop a "…series of biological and riverine process studies ….to supplement historic 1980's and 1990s' data…" they do not say when the studies will be conducted. A description of how AEA proposes reaching that endpoint, including a timeline for the completion of different sub-models and a schematic of how the different sub-models inform subsequent models, would be helpful as a summary of the products the applicant intends to develop to address proposed objectives. Figure 6.5-3 in the PSP is a rough schematic of relationships between different studies, models, and processes, however it needs to be updated and clarified. Many linkages are missing, and studies intended to inform subsequent studies appear to be scheduled simultaneously rather than sequentially. Revised interaction charts and timelines provided in late October appear to address some of these concerns.

Study area and study site selection (addresses NMFS objectives 2, 6, and 7).

RIFS-36 The October 24 and 25, 2012, TWG presentations indicate that the process of study reach/process domain delineation and selection has been refined and made more transparent. This should be reflected in the revised study plans. The study plan should include a brief explanation of how the process domains and lateral extent of the study area were delineated, with definitions of the process domains. NMFS needs an answer to whether the lateral extent includes abandoned river channels and sloughs that could be reoccupied in the future if natural Susitna River processes were allowed to continue. The instream flow model should help clarify this; however, surface and groundwater interactions and influence need to be carefully articulated. Floodplain vegetation can be very sensitive to long term changes in surface and groundwater depth, frequency, and duration of groundwater stage (Henszey et al. 2004; Mouw et al. 2009).

RIFS-37 The study plan should briefly explain the intent behind using focus areas and how they were selected. It appears that assumptions have been made about the appropriateness of some focus areas. According to information presented October 24 and 25, 2012, nearly half of the proposed focus areas are the same areas studied in the 1980s. Sites sampled in the 1980s were subjectively selected based on their anadromous fish habitat characteristics. While these reaches do contain high value anadromous fish habitat, they may not capture the range of floodplain habitat that contributes to less obvious habitat linkages for anadromous fish (and other organisms).

RIFS-38 Explain, with references, how and why transects will be selected within each focus area. How long will transects be and how will their endpoints be determined? How will the problem of pseudoreplication be addressed? Comparing similar plant communities from multiple transects within one focus area would only help describe variability within one site (pseudoreplication), not differences among multiple sites (Hurlburt 1984). Establish transects in each focus area; within each focus area include transects that intersect plant communities similar to those encountered in other focus area. This will allow for true replicates that can provide the basis for statistically valid analyses.

RIFS-39 Subsamples (smaller replicate sample units selected randomly from within different habitat types in each transect) should be selected randomly. Provide detailed descriptions of and citations for methods to allow for repeatability. There should be at least three subsamples of each selected riparian habitat type at each focus area, when possible, to capture the range of natural variability within each selected riparian habitat type. This will result in much more meaningful and credible extrapolation to the unsampled parts of the river.

Seed dispersal, hydrology, and climate synchrony model (addresses NMFS objectives 2, 6, and 7).

RIFS-40 The progression of successful dominant riparian species (e.g. balsam poplar and willows) seedling can be broken into three general categories based on general plant biology: establishment (colonization), survival (first three years) and recruitment (assimilation into the future reproductive population (Rood et al. 2007)). A two-year study is not sufficient to characterize these processes, nor does it allow enough time to characterize responses to representative flow regimes (in concert with different climatological conditions). For example, do the floods of 2006 and 2012 potentially bias seed responses, and if so, how? How do current sediment conditions and processes compare with years where flood conditions are more moderate? How long will it take for sediment conditions conducive to poplar and *Salix* establishment to develop? Piezometers should be established at seedling study sites to aid in development of plant species and community response curves (Henszey et al. 2004). Describe assumptions about and limitations of seed response models.

Scaling model (addresses NMFS objectives 2, 6, 7, and 8).

RIFS-41 To understand the operation effects, focus study sites are used to examine process, and the results are then used to extrapolate those results. Please describe assumptions for and limitations of using models to extrapolate between focus areas and process domains. Different processes operate at different locations and scales within a river valley. Plant distribution and abundance on expansive floodplains, such as those found in parts of the Susitna River, are greatly influenced by instream flow energy (Mouw et al. 2009) (The same holds true for confined reaches). Riverine processes and functions are influenced by ground and surface water interactions, and upwelling and down-welling of groundwater (Mouw et al. 2009). Floodplain flow energy is often different as one proceeds downriver, which in turn can cause riparian habitat and species composition and seral stages to respond to surface and groundwater flows differently (Mouw et al. 2009). Include literature references for instream models of varying predictive power, if possible.

Reference sites (addresses NMFS objectives 2, 6, 7, and 8).

RIFS-42 Currently no reference sites are proposed; this will be necessary to monitor project related effects if the project is built. Establish reference sites on the Talkeetna River with similar plant communities and hydraulic regimes, and use them for comparison with corresponding sites below the proposed dam site. Evaluate sites established by Mouw et al. (2009) for possible inclusion. Reference sites can provide real time comparisons between the unaltered and altered conditions. Clearly state assumptions when comparing reference and impacted sites between rivers.

Develop a monitoring protocol to detect physical, spatial, and temporal changes in key plant communities and establish permanent monitoring sites including reference sites in the Talkeetna River. Supplement plant communities identified by McKendrick et al. (1982), Collins and Helm (1997), and Helm and Collins (1997) with those identified in other systems (e.g. Mouw et al. 2009; Mouw et al. 2012). Design monitoring protocol to avoid pseudoreplication (Hurlburt 1984).

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7 Fish and Aquatic Resources

7.0 Fish and Aquatic Resources

General Comments

Fish habitat relationships are extremely complex and can be influenced by many dynamic and interacting physical, chemical, and biological parameters. NMFS considers documentation of juvenile salmon fish habitat relationships the most important information needed to evaluate the effects of the proposed project and develop measures to protect, mitigate and possibly enhance affected fish species, populations and life stages. Many other difficult and expensive studies (ground water, water quality, flow routing, productivity etc.) are being conducted largely to determine the influence of these and other related factors on fish habitat relationships. Instream flow analyses will be based on understanding the project's effects on fish-habitat relationships. Ultimately, NMFS recommended license terms and conditions affecting operation of the proposed project may be based in large part on the findings of these important studies.

Designing ecological studies in dynamically complex systems, such as the Susitna watershed, is difficult. Through sampling, we strive to characterize the availability and distribution of aquatic habitats, as well as fish use of these habitats, across the landscape, under a variety of flow regimes. These habitat distributions are highly dynamic with intra- and inter-annual variability, and studies should be designed to capture that variation. However, the AEA PSP gives only a cursory summary of fish collection methods with a general and minimal description of sampling locations and frequency that is not based on the life histories of the fish species known to reside in the Middle Susitna River or on the variability of potential habitats.

FISH-07

The FERC ILP two-year time frame makes it difficult and probably impossible to collect adequate site specific data in order to build models that will reflect this variation in characteristics driving fish habitat relationships. NMFS requests that FERC extend this timeline to allow design, completion and analysis of studies that adequately address the potential impacts to those relationships. If this short study period persists, then having well developed study plans prior to beginning field data collection becomes paramount. Given the current deficiencies in the proposed study plans for "Fish and Aquatic Resources," it is unlikely that study plan deficiencies can be remedied so that study plans that withstand scientific scrutiny and meet NMFS' and FERC's criteria will be completed in time for field data collection to begin in 2013.

The proposed study of Fish Distribution and Abundance in the Upper Susitna River and the proposed study of Fish Distribution and Abundance in the Middle and Lower Susitna River are similar in approach and substance, but they address distinct geographic areas of the Susitna River basin divided by the dam location (upstream and downstream). The current PSPs list a variety of sampling methods, with no clear links as to how any data produced will address study objectives. During the September 15, 2012, TWG meetings, NMFS, USFWS and other attendees requested that AEA provide a comprehensive, more detailed study design, with specific objectives and links explaining how the proposed methods would be implemented to achieve those objectives. That additional detail is still requested. It will be used to assess the applicant's plan to determine if it meets the intent of the agency study requests. The additional detail should include a schedule for attaining habitat utilization, abundance, and distribution information on anadromous fish species as both adults and as juveniles. Specifically, more detail is needed about the proposed approach to assess the habitat utilization and habitat characteristics, particularly for overwintering juvenile anadromous fish (i.e. pre- and post-emergence, egg development rate, hatching and emergence times, movement of juvenile fish from hatching areas to rearing habitats, potential movement between winter habitats, fish growth, fish condition).

A major flaw in AEA's PSPs is reliance on data collected in the 1980s and the potential continued use of the 1980s study sites to address the objectives regarding fish distribution and habitat utilization, without any data validation or identification of the site-selection process that was used to select study sites. AEA has not made entirely clear how or why these sites were originally chosen, or more importantly, how collecting data at these sites will address AEA's or agency study objectives. It appears that the 1980s sites were selected at that time because they were considered to be heavily utilized by spawning adult salmon (a qualitative observation), and that the sites were amenable to hydraulic modeling (e.g. Schmidt et al. 1984). This approach is highly subjective and may not accurately represent the distribution of habitats and fish on the landscape. Anadromous and resident fish surveys should be carried out over all available habitat types and over a sufficient temporal scale in order to encompass a wide range of flows and seasons. In this manner, fish data will guide the selection of detailed study sites that represent the range of variability in processes and stream physical, chemical, and biological characteristics that influence fish habitat quality. We need quantitative information describing where adult and juvenile fish are distributed, when and why they are in those habitats (function), the physical/biological factors that characterize those habitats, as well as what habitats fish are not using, and how the distribution of these habitats and fish use changes under different flow regimes. All of this data will provide an informed environmental baseline for predicting the extent and nature of potential changes and serve as a basis for developing conservation recommendations and other measures that would protect, mitigate and possibly enhance fishery resources affected by the project.

The Fish and Aquatic Studies, Instream Flow, Productivity, Fish Passage and other related studies that are being proposed to support the FERC license application are being conducted for three primary reasons:

- to describe the community of fish and aquatic species within the affected area and the biological, chemical, and physical characteristics of habitat used by these species at all life stages;
- to determine the direct and indirect effects of project construction and operation on those species and their habitats and to estimate post-project effects under different operation scenarios; and
- to provide a baseline measure of species community composition and their habitat characteristics to conduct a post-project assessment of the accuracy of predicted project effects. Through development and application of an adaptive management approach[1], study development and implementation will adapt as new information is obtained.

Investigation Plans or Quality Assurance Project Plans (QAPPs) are basic components of all proposed studies that NMFS requests be included in all study plans. Developing Investigation Plans or QAPPs for each study will ensures confidence in the quality of information and, thus, in the study results and subsequent decisions based on those results. While there is some variation

[1] See NMFS 05/31/2012 PAD comments and 7.11 Glacial and Runoff Changes Study comments in this document re: adaptive management

in the information required for study plans, there are some basic common components that should be part of each study plan:

- clear objectives, a review of relevant data;
- study methods that address the objective;
- methods to evaluate data quality, use and quality of external data;
- a description of the statistical design; and
- a description of how the study results will be used.

Our review of AEA's study plans evaluates whether these basic components were included.

FISH-08 Study plans must have clear objectives including the purpose or information need. A clear objective is necessary in order to refine study methods. Clearly defined objectives help to avoid collecting unnecessary or irrelevant data. Objectives should be developed to provide specific information or to test a hypothesis so that the appropriate statistical design can be selected. The purpose or information need shows the relationship of the study to previous work and how the study results will be applied.

While AEA and agency objectives are often similar, the study purpose and data needs vary. Differences in the purposes for the studies and how the resulting data will be used to evaluate project effects can result in methods that range from qualitative surveys to quantitative data and statistical analyses.

FISH-09 The study plan need to show a good understanding of the topic based upon a review of other related studies. Thorough reviews of previous studies are necessary to avoid repeating previous work and to build upon the current information base. Literature reviews help to avoid previously identified sampling problems and to address conflicting results. Previous site-specific information can help to guide sample site selection, sample timing and frequency, and collection methods.

FISH-10 Study methods must be developed to address the stated objective. Methods should include:

- descriptions of sample locations;
- sampling collection timing and frequency; and
- how samples will be collected, handled, and processed.

FISH-11 Depending upon the study design, sample locations should be selected randomly or randomly among strata to reduce variability among groups, or alternately, to represent the range of independent variables. Sample timing and frequency should be developed based upon the rate of change of the parameter under investigation and to represent the temporal scale of potential impacts (treatments).

FISH-12 The study design should include measures of sample representativeness, accuracy, and precision. Representativeness is a measure of the scale of spatial and temporal inference. Representativeness is dependent upon sample replication and associated error. Measures of accuracy are a comparison of sample values to known values, while precision is a measure of the difference between two or more sample values. Population estimates can be used to test for the accuracy of catch per unit effort values as an indication of fish density. Approximately 10% of the samples should be duplicated to determine the precision of catch per unit effort values.

FISH-13 Sampling plans also must describe how sampling efficiency will be determined. Differences in sampling method efficiency among locations will need to be accounted for to validate data analyses. For example, the efficiency of electrofishing may be determined as the number of fish captured per number of fish observed (Beechie et al. 2005). The efficiency of electrofishing likely will vary between clear-water sloughs, tributary mouths, deep stained streams, and the turbid mainstem and side channels or between sites with low and high water velocity. Therefore, differences in catch per unit effort (CPUE) among habitats could be due to differences in sampling efficiency. Comparisons among locations must either correct for differences in sampling efficiency or be limited to those locations where efficiency of methods is similar.

FISH-14 The study plan should identify any data that will be used from other sources and identify that external data quality. Many AEA study plans are using data from other sources. For example, Middle and lower river Fish study plans are proposing to use information from ground-water related fish habitat studies, habitat characterization, and fish passage studies, but also will need data from the water quality and river productivity studies. They should identify exactly what information is to be obtained from these other studies and how the external data will be evaluated for data quality and application to the stated objective. For example, if water temperature or turbidity data are to be used from the water quality study, the studies need to discuss explicitly how sample values represent habitat characteristics applicable to the evaluation of the distribution, relative abundance, or growth rates of fish species.

FISH-15 The study plan should describe the statistical design for data analyses. A description of the statistical design and how the study results will be used is necessary for the evaluation of study methods. If the study is being developed to determine fish density per geomorphic classification type, which will be extrapolated to estimate density at unsampled locations, then sampling locations and timing must be selected for data analyses to meet this objective. Sampling locations, timing and frequency will differ between a study designed to test for significant differences in fish metrics among groups of different geomorphic classification, and one that will use regression to test for significant relationships between fish community metrics and habitat characteristics.

This review of AEA's proposed study plans was conducted to determine if the proposed study plans met the goals and objectives of NFMS May 31, 2012 study requests, and to clarify for each PSP that:

- that the goals and objectives and information to be obtained for each PSP align with those of NMFS requested studies [18CFR §5.9(b)(1)]; and
- assess whether the proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information and schedules including appropriate field seasons and durations of proposed study plans) is consistent with generally accepted practice in the scientific community [18 CFR 5.9(b)(6)].

NMFS review identifies any deficiencies in AEA's proposed study plans that must be remedied in order for the study results to provide the information NMFS needs to:

- develop effective and well-designed fishway prescriptions;
- develop recommendations to protect, mitigate damages to, and enhance fish resources;
- develop recommendations to ensure that the project is best adapted to comprehensive plans for developmental and non-developmental resources; and
- assist FERC in providing sufficient information on impacts to NMFS trust resources that is necessary for FERC to determine if licensing the project is in the public interest.

Our review of the current study plans evaluates whether the basic components of a good study are included relative to the intent of the study objective; we describe any additional information needed and explain why this information is important in the evaluation of potential project effects on fish and aquatic resources.

Evaluation of study methods is limited by incomplete information on the operation of the proposed project, and so is based on general scenarios. Proposed study plans may need refinement once more specific operational plans are known. Post-project monitoring plans and potential mitigation options have not been provided; therefore, current comments are limited to evaluation of potential project effects. A study design developed to test for significant post-project effects may require completely different sampling methods, locations, and frequency. Therefore, pre-project data collected under the current study plans should not be assumed as baseline data for post-project evaluations.

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7.5. Study of Fish Distribution and Abundance in the Upper Susitna River

General Comments

The overall goal of the Fish Distribution and Abundance study plan is to characterize the current distribution, relative abundance, run timing, and life history of resident and non-salmon anadromous species (e.g., Bering cisco, Dolly Varden, humpback whitefish, northern pike, and Pacific lamprey), and freshwater rearing life stages of anadromous fish (fry and juveniles) in the Middle and Lower Susitna River, as well as the upper river, above Devil Canyon.

The creation of a reservoir would inundate miles of Susitna River and tributary streams. This would directly affect the abundance of fish residing in flowing waters. The reservoir could inundate important spawning habitat for resident fish, and Chinook salmon and other anadromous fish that currently migrate through Devils Canyon and use the upper watershed. Salmon smolt and migrating resident fish would have to move through the reservoir, could pass through the penstock and turbines, and would face supersaturated gas conditions below the dam. Alternately, the reservoir could provide rearing habitat for resident grayling, which often migrate downstream from spawning areas to slow velocity habitats for rearing. However, the potential quality of this reservoir habitat is unknown, particularly during the winter. Creation of a reservoir could provide habitat for lake trout. Increasing habitat conditions favorable for this predator could affect the abundance and distribution of other resident fish.

Upper river fish studies should quantify the total amount of tributary habitat that would be converted to a reservoir. Information regarding the population or relative abundance of selected fish species within the inundation zone should be obtained to determine the significance of direct effects. Lower tributary reaches, tributary mouths, and mainstem locations within the inundation zone may provide important seasonal habitat for resident and anadromous species. For example, FDAUP-69 resident Dolly Varden, grayling and juvenile Chinook salmon likely overwinter in the mainstem Susitna River, and tributary mouths may provide important Dolly Varden summer habitat. Studies should be developed to determine how the inundation will affect the suitability of these locations for spawning and rearing. Studies should determine if the remaining stream reaches will continue to support resident fish populations and rearing juvenile Chinook salmon. We request that the upper river study objectives be refined to reflect specific information needs for evaluating potential project-effects to the fish community.

Comments on AEA Study Objectives

AEA Study Objective 1. Describe the seasonal distribution, relative abundance (as determined by CPUE, fish density, and counts), and fish-habitat associations of resident fishes, juvenile anadromous salmonids, and the freshwater life stages of non-salmon anadromous species.

This objective broadly suggests that methods will be developed to quantify the seasonal distribution, relative abundance, and fish habitat associations of all fish within the upper river study area. Seasonal distribution as stated in the objective will be determined by CPUE, density, and counts. The need for this information and the purposes of these studies needs to be provided. The primary objective of upper river studies should be to determine resident and anadromous fish use of the inundation zone for key life history periods (i.e. spawning and overwinter), because this information will help FERC assess potential project effects, and help

NMFS develop protection, mitigation, and enhancement recommendations. Of particular importance to NMFS is documenting Chinook salmon spawning and rearing habitats. We are unsure of the need to obtain measures of fish density and counts for all species within the inundation zone, and the purposes for this objective should be clarified. Density, as a total number per area, will require population estimates of all fish species within specific areas, and counts, although not defined, imply that a total number of all fish species will be obtained. The purposes and use of these data should be clarified. Perhaps the term "indices" is intended by use of the word "counts?" Determining fish-habitat relationships will require analyses of fish community metrics (i.e. relative abundance, growth rates) as a function of physical, chemical, and biological habitat characteristics. However, methods to accomplish this objective are not provided.

FDAUP-70

The AEA PSP provides only a brief review of previous studies conducted on fish species likely to be observed within this river segment and its tributaries. Study methods (including sample collection, sampling locations, sample timing and frequency) do not support the stated objective. The PSP does not identify collection methods for specific fish species or life stages. Data analytical methods and the statistical design are not provided. It is unclear how the results of these studies will be used to evaluate or mitigate potential impacts to the upper river fish community. This information would be useful to NMFS as it pertains to potential losses of fish production from the dam, which could in turn affect overall productivity and result in increases in the number or range of predatory species that could prey upon vulnerable spawning, incubating or rearing salmon in the reservoir zone or downstream of the project.

FDAUP-71

The study plan does not identify which species will be targeted for sampling. Resident and anadromous species within the upper river include: Dolly Varden, rainbow trout, Arctic grayling, Chinook salmon, humpback whitefish, burbot, longnose sucker, and lake trout. Most of these species are believed to use the mainstem Susitna and lower tributary reaches within the inundation zone for some portion of their life cycle and could be affected by project construction and operation. Life histories and habitat requirements vary among these species. Species-specific sampling methods will need to be developed. Fish collection methods vary for each species and life stage, and haphazard sampling is unlikely to provide useful information.

FDAUP-72

The PSP describes a plan for eight tributary streams to be sampled during 2013 and 2014. These will be chosen with a focus on Chinook salmon distribution, selecting all tributaries in which Chinook salmon juveniles or adults were observed previously. Studies found Chinook salmon in four tributaries: Fog Creek (RM 173.9), Kosina Creek (RM 202.4), Tsusena Creek (RM 178.9), and the Oshetna River (RM 226.9) (Buckwalter 2011). The remaining four tributaries for the current study are to be selected, as described in the PSP, at random. Within each selected tributary, up to three meso-habitat types (pool, riffle, backwater) will be selected at random for sampling, and physical habitat measurements of length, width, and habitat type will be collected.

FDAUP-73

Sample timing and frequency should be developed to support the project objective. Peak juvenile Chinook abundance in middle river tributaries has been observed to be from June through August (1981 and 1982). For example, in Portage Creek few fish were captured in June, with peak Chinook catches in August (ADFG 1981). Tributary catches decreased in August and September and mainstem Chinook salmon abundance increased. Therefore, middle river juvenile Chinook salmon likely overwinter in the mainstem and sample timing and frequency should be developed to determine if this same migration pattern is observed in the upper river.

FDAUP-74 Sampling locations should be selected to address specific questions for fish species and life stages and to evaluate potential project effects. For example, sample site selection to document the distribution of burbot likely will be different than site selection to document the distribution of Dolly Varden. Additionally, by choosing sites based on past presence of, and presumably then, suitability for Chinook salmon, the plan may bias captures for or against different species, relative to the degree of sympatry among species. The PSP does not appear to be designed to document the distribution or abundance of resident fish species. Lake trout, for example, will probably not be found near the mouths of these tributaries, but they have been found in Sally Lake and Deadman Lake (ADFG 1981a). If sites similar to these lakes are not sampled, this study could miss a species that would likely move into a reservoir (functionally a large lake) and could have a large effect on the potential reservoir fish community including substantial predatory effects on any juvenile salmon that would migrate from tributary stream habitat to either downstream rearing habitat or the ocean.

FDAUP-75 The AEA PSP for the lower and middle river (Section 7.6) describes sampling efforts in the mainstem, tributary mouths, side sloughs, upland sloughs, and side channels. Sloughs and side channels may not be as common in the upper river as they are in the middle river; however, off-channel habitat provide rearing habitat fish sampling should be conducted to evaluate the relative importance of these locations to upper river fish communities. Additionally, as tributaries in the impoundment zone have the potential to be affected miles upstream of their current mouths, tributary sampling efforts need to be conducted up to and above the predicted elevations of inundation to determine what kind of habitat would be altered, and what kind of habitats will be unaltered by reservoir-filling.

FDAUP-76 The PSP states that sampling will be based on Chinook salmon distribution, with surveys above 2,200 ft focusing on locating Chinook salmon, and studies above 3,000 ft only conducted at sites where Chinook salmon were found. It is unclear if there will be any habitat measures associated with sampling the streams to be inundated. This is necessary in order to measure fish habitat loss from reservoir-creation and to measure habitat alternatives. Schmidt and Stratton ADFG (1984) found that inundation would remove some passage barriers, such as Deadman Creek falls. Additionally, fish and habitat sampling efforts should be conducted in the many small lakes and ponds in the upper river to look for anadromous salmon and resident fish overwintering habitat.

FDAUP-77 Proposed fish collection methods are similar to the middle and lower river resident fish study (Section 7.6), with monthly sampling from May to September (with two events in August), no sampling October-November, and two sampling events between December and April. As with Section 7.6, methods will involve active and passive capture methods and biotelemetry, to identify seasonal timing, distribution, and abundance of fish. This study also proposes to determine the effect of fluctuating reservoir levels on fish movement into and out of tributaries.

FDAUP-78 A combination of gill netting, electrofishing, angling, trot lines, minnow traps, snorkeling, outmigrant trapping, beach seines, fyke nets, DIDSON, and video camera techniques will be used to sample or observe fish. Field crews will record level of effort and water temperature and DO at sampling locations. All captured fish will be identified to species, measured, weighed, and scanned for a PIT tag. Comments on general methods for each species are described below (Section 7.6, Objective 2).

Sampling methods do not identify measures of habitat variables to determine fish distribution among sites and among sampling events. A general classification of "pool, riffle, or backwater" will likely not provide enough information to characterize fish-habitat relationships or to evaluate potential project effects. Determining Dolly Varden or burbot spawning habitat characteristics and their distribution relative to the inundation zone will be important for the evaluation of potential project effects, as the creation of the reservoir may result in the loss of limited habitats or expand the habitats for species known to prey upon or outcompete juvenile salmon. This likely will require more information than differences in water velocities. Other habitat variables that may explain resident fish distribution include water velocity, discharge (of the mainstem and sampled tributaries), turbidity, availability of cover, pH, conductivity, groundwater, and invertebrate drift and productivity and should be measured concurrent with fish sampling.

FDAUP-79

This study plan also does not describe how it intends to determine effects of fluctuating reservoir levels on fish passage between tributaries and the mainstem Susitna River. It is unclear if this will be based on data collected during this study, or as part of another study, such as the Study of Fish Passage Barriers (Section 7.12). As there are no methods described for how this objective will be accomplished, we are assuming that it will be part of Study Section 7.12. However, the upper river resident fish crew will need to coordinate with the fish passage barriers crew to determine which species will likely be affected by passage barriers, and what are the physical limits to passage for each migrating life stage and species.

FDAUP-80

Sampling methods, site selection, and sampling timing and frequency should be developed based on the life history of fish species and potential project effects. The PSP provides little information on the methods that will be used to determine winter habitat selection by resident and anadromous fish in the upper river. The primary project effect will be the inundation of the mainstem and lower reaches of tributary streams. Project effects are likely to be greatest to those fish that spawn or overwinter within these reaches. Tributaries at this elevation may freeze to the stream bed requiring fish migration to overwintering locations. Many resident fish present in the upper river (i.e. Dolly Varden, grayling, whitefish), migrate to the mainstem of larger rivers to overwinter. Therefore, methods should be developed to determine if resident and anadromous fish migrate to the mainstem in late fall and the overwintering habitat provided in tributary streams. The only winter sampling methods proposed in the upper river are the use of DIDSON and video cameras. Surveys will be conducted in 10 "selected" sloughs and side channels. These proposed sampling methods and site selection are not likely to provide the information necessary to document overwintering habitats or potential project effects to overwintering fish, as these methods do not identify the portion of the total population overwintering and will not sample all available habitats.

AEA Study Objective 2. Determine whether Dolly Varden and humpback whitefish residing in the upper river exhibit anadromous or resident life histories;

The AEA PSP states that otoliths will be collected from Dolly Varden and humpback whitefish greater than 200 mm to test for marine derived elements indicative of an anadromous life history pattern (Objective 2) with a target of 30 of each species.

FDAUP-81

The methods do not describe which marine derived elements will be tested for, or methodology for sample collection and analyses. The brief description of methods likely refers to a stable isotope study, but this needs to be clarified. Analyses of stable isotopes in tissue samples and otoliths have proven to be effective methods for determining anadromy in salmonids and other fishes (Kline et al. 1998; Limburg 1998; Doucett et al 1999; Zimmerman 2005).

FDAUP-82

Zimmerman (2005) found that strontium (Sr) or strongtium-to-calcium (Sr:Ca) ratios in otoliths are linearly correlated to salinity and environmental Sr concentrations. This method is sensitive enough to discriminate between fresh water, brackish water, and seawater life stages, but Sr uptake is species-specific and possibly population-specific. Testing of otoliths can provide information on the timing of transitions between freshwater and salt water, and distinguish between sympatric populations of anadromous and nonadromous fishes (Thibault et al. 2010). If testing for Sr or ratios of Sr:Ca, ratios should be compared to known resident upper river fish and known marine species. Larger individuals of each species are the most likely to exhibit anadromous life-stages and should be selected for sampling as proposed.

FDAUP-83

In contrast to testing otoliths for marine derived elements, samples could also be collected from tissues, or fin clippings to have non-lethal effects (Kline et al. 1998; Doucett et al. 1999). These studies looked at stable carbon isotopes in tissue samples and compared them to samples collected from other fish known to be resident in freshwater or resident in the marine environment. Fish known to be resident and marine should be sampled to provide values for comparison. By using a non-lethal sampling approach, more samples could be collected, which would a more thorough test for anadromy in fish populations in the upper river. Tissues are analyzed for carbon isotope ratios (Kline et al. 1998; Doucett et al. 1999). Non-lethal sampling methods should be considered, if they can provide valuable data for assessing anadromy in these populations. If redd sites are located for Dolly Varden and humpback whitefish, newly-emerged juveniles can also be tested for marine-derived elements. The tissue of juveniles will be composed mainly of elements in their yolk sac (Doucett et al. 1999). This method requires sampling before fresh water feeding dilutes the marine-derived elements.

AEA Study Objective 3. Collect tissue samples to support the Genetic Baseline Study for Selected Fish Species (Section 7.14).

NMFS supports the USFWS and ADFG to develop a genetic database to identify unique stocks and to assist in the management of mixed stock fisheries. AEA should work with the USFWS and ADFG to develop sampling plans to meet these objectives.

AEA Study Objective 4. Determine baseline metal concentrations in fish tissues for resident fish species in the mainstem Susitna River (see Mercury Assessment and Potential for Bioaccumulation Study, Section 5.12).

See Comments on Section 5.12 Mercury Assessment and Potential for Bioaccumulation Study.

AEA Study Objective 5. Use biotelemetry (PIT and radio tags) to describe seasonal movements of selected fish species (including rainbow trout, Dolly Varden, whitefish, northern pike, burbot, and Pacific lamprey if present) with emphasis on identifying spawning and overwintering habitats within the hydrologic zone of influence upstream of the project.

This objective was developed to provide a clear understanding of the seasonal migration patterns of resident fish species found in the upper river. Specifically, studies should determine migration timing and locations of spawning and overwintering. However, the PSP does not describe how this will be accomplished. Sampling methods have not been developed based on what is currently understood about the migration patterns and life histories of the selected fish species, but appear to be a by-product of other study plans. The study plans contain no information on how the efficiency of the study methods will be evaluated. PIT tagged fish often pass antennae arrays without being detected (Bryant et al. 2009) and an array can detect a tagged fish in close proximity that may not be migrating into or out of the study location. There is no discussion of the study statistical design or how migration data will be analyzed or applied to evaluating or mitigating potential project effects. Understanding resident fish use of the impoundment zone, and affected tributaries for critical life stages including spawning and overwinter is a critical information need. The distribution of these habitats, relative to the inundations zone, is necessary to evaluate effects to the remnant fish community.

FDAUP-84

The AEA PSP states that all captured fish will be identified to species, measured, weighed, and scanned for a PIT tag, with crews installing PIT tags in all untagged fish greater than 60mm. Antenna arrays will be installed at up to six sites, shortly after ice-off in 2013, and three swim-over arrays will be installed prior to ice-over, on an experimental basis. Radio tags will be surgically installed in up to 30 individuals of each species. Locating radio tagged fish will be through fixed receiver stations and aerial surveys, with up to four fixed receivers established at tributary mouths along the mainstem of the Upper Susitna River and serviced in conjunction with the Salmon Escapement Study (July through October). The Salmon Escapement Study will provide weekly aerial surveys. At other times of the year, the frequency of aerial surveys of the study area will be at least monthly.

FDAUP-85

The upper river study proposes to radio tag up to 30 individuals of each species, whereas the middle and lower river study (Section 7.6) proposes to tag up to 10 of each species. It is unclear what species will be tagged, what age class, where or when fish will be captured for tagging and how selection of age class, tagging location, and timing of tagging has been selected to identify migration patterns. The PSP does not identify why more fish will be tagged in the upper, compared to the middle and lower river sites.

FDAUP-86

With sample timing based on anadromous salmon spawn timing, July through October; the study likely will miss movements of resident fish species. Spring migration from overwintering locations or to spawning sites have been predicted or observed for many of the Susitna River resident species, including: rainbow trout, Arctic grayling, round whitefish, and longnose suckers (ADFG 1981b, 1983). If receivers are not operational until July, resident spring migrations will be missed. Monthly measures may not be frequent enough to document migration patterns and will not assess movements during winter months. Tracking winter movement is necessary to identify burbot spawning locations and early spring migrations that often occur under the ice.

AEA Study Objective 6. Document the timing of downstream movement and catch for fish species via outmigrant traps.

FDAUP-87

This objective addresses the migration of fish past the dam site, but limits quantification of downstream movement to one method. This is a modification of the agency objective that stated, "*Document the timing of downstream movement and catch for all juvenile fish species, and outmigration timing for anadromous species.*" The PSP does not provide a purpose or information need for this objective. Methods are limited to one trap which may or may not be sufficient, depending upon the purpose of the study. The PSP contains no description of the effectiveness of the methods at capturing fish that may be migrating downstream at this location. There is no description of data analyses or a discussion of how the results will be applied to project operation or mitigation.

FDAUP-88 The construction and operation of the proposed project have the potential to create a migration barrier, modify downstream migration rates, and/or result in fish mortality. Determining species outmigration and timing is an important upper river objective. Sample methods, location, timing and frequency of sampling may be different for each fish species under investigation. Mark-recapture methods should be used to determine the total number of migrating fish or determine the accuracy of "catch" at estimating total migrating population by species. The study plan should clearly identify how the data will be analyzed and used. Migrant traps can miss some species depending on when they are deployed, their location relative to spawning sites, and proximity to the shore (Thedinga et al. 1994). Therefore, the absence of fish cannot be used to indicate that a given fish species or life stage is not migrating unless a study is designed to determine the probability of fish capture by life stage.

AEA Study Objective 7. Document the presence/absence of northern pike in all samples.

FDAUP-89 This objective is unclear, and the reason for its inclusion is not identified. The AEA PSP already states that all captured fish will be identified to species, measured, and weighed. Therefore, the inclusion of this study objective implies that independent methods will be developed to determine the presence or absence of northern pike in the upper river.

It is possible that northern pike have been introduced to shallow lakes or streams along the Denali Highway and within the Upper Susitna River drainage. Increased access following project construction along with the creation of a reservoir could result in the introduction or increased distribution of pike. If pike are not present currently, pike found in post-project monitoring could be due to project construction. The presence of pike and habitat modification that favors pike, could negatively affect rearing anadromous and resident fish both in the reservoir in in the highly productive off-channel and side-channel rearing habitat in the middle river where pike are currently not found. Therefore, determining if pike are present may be a necessary objective. If this is a necessary objective, appropriate sampling methods should be developed.

FDAUP-90 To our knowledge, intensive sampling for northern pike within this segment of the Susitna River has not been conducted. We recommend working with the ADFG to develop a sampling plan that identifies upper river sampling locations, sample timing and frequency, and collection methods to determine whether northern pike are present. Analytical methods should calculate the probability of pike presence even if not captured given the level of sampling effort.

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7.6. Study of Fish Distribution and Abundance in the Middle and Lower Susitna River.

General Comments

As stated in our general comments on AEAs Fish and Aquatic Study Plans, documenting juvenile salmon and resident fish habitat relationships is likely the most important project-related study due to the likely effects of proposed flow regulation and winter load following. The proposed project would directly and indirectly affect the fish community through multiple pathways. The number of fish species and potential project effects is likely to be great downstream of the Watana Dam site, and construction of the proposed dam likely will result in changes to the fish community. Predicting how the proposed project will alter the fish community is of paramount importance to NMFS for use in developing conservation recommendations and license terms and conditions under Sections 10(j) and 10(a) of the FPA and the EFH provisions of the MSA. The AEA PSP for the distribution and abundance of fish in the middle and lower river is incompletely developed and does not reflect the degree of effort which NMFS believes is necessary to provide the information necessary for us to fulfill our statutory obligations. More effort should be directed toward these studies. We discuss below what these imitations are and how these problems can be resolved.

In general, study methods for the fish distribution and abundance in the Middle and Lower Susitna River have not been developed to meet the intent of agency objectives and appropriate study designs have not been established. There is only minimal review of related species-specific or site-specific studies and in many cases species life history information is not included in the proposed study. General fish sampling methods are listed but specific methods that will be used to sample different species or life stages are not presented. Sampling locations refer to different geomorphic classification types. Sampling locations need to be selected proportional to the distribution of habitat classification types. Sample locations should be randomly selected from all available sites with similar classification after that habitat classification assessment is completed. NMFS should agree with the habitat classification scheme and the habitat sampling methodology in advance of studies being conducted. The study plan needs to account for the variability in sampling efficiency among habitat types and establish in advance how this variability will be accounted when evaluating differences in distribution or habitat associations.

FDAML-43

Monthly sampling is proposed; however, this adequacy of this sampling frequency to address study objectives needs to be explained. There is no indication that any habitat characteristics will be measured in order to determine causal factors influencing habitat selection and habitat quality. The analytical methods need to be determined in advance; statistical tests and acceptable power analysis to determine significant differences in fish community metrics between geomorphic classification types needs to be included in the study design. The PSP must be revised to address thse concerns and describe how the data from these studies will be used to evaluate potential project effects.

FDAML-44

Instream flow analysis of habitat suitability is proposed as the analytical method to be applied to determine the distribution and abundance of fish in the middle and lower river. Both the proposed method and the methodology described in the PSP are problematic for the following reasons. The method requires development of species and life-stage specific habitat suitability curves (HSC). The development and application of HSCs have been a subject of debate among scientists since publication of the instream flow increment methodology (Mathur et al. 1985,

FDAML-45

Kondolf et al. 2000). However, the methods that will be used to develop habitat suitability curves and how they will address the limitations of this methodology need to be provided. HSC development is partially addressed in Study 6.5, Instream Flow and Aquatic Habitat. but that study request objective needs to be addressed for the upper, middle, and lower reaches for all juvenile anadromous fish species and life stages affected, and needs to be included in the PSPs for resident fish and non-salmonid anadromous fish. The PSPs need to clarify how HSC information will be collected, particularly in winter for post-emergent fish up to 60 mm when fish will be most vulnerable to load-following operations (stranding and trapping). There are no empirical studies described to evaluate potential project effects or for inclusion in habitat modeling efforts; this study planning deficient needs to be resolved. There is generic reference to developing HSC model in Study 6.5 for these species and life stages; the source of that information needs to be identified for NMFS to adequately assess that proposed study component.

FDAML-46 NMFS believes that lower river studies are necessary to evaluate potential biotic effects due to species displacement from middle river habitats, to document the relative contribution to fish production and use between these two river segments, provide replicate measures of fish-habitat relationships, and to provide for post-project comparisons. The study area for the middle and lower river fish studies in AEA's PSP is from river mile 28 to the Watana Dam site. However, during presentations at the TWG meetings, it was suggested that the study area be limited to the downstream extent of estimated flow effects as determined through the flow-routing studies. Limiting the studies based on estimated extent of flow modification ignores potential indirect project effects and NMFS does not agree with the proposed truncation of the study site given the lack of information on the extent of likely project effects.

Project operations, including especially winter flow fluctuations, could displace middle river fish thereby increasing fish densities in the lower river. Higher fish densities could exceed available resources reducing fitness and survival of lower river fish. Similarly, concentrations of transported organic matter or macronutrients may differ between the Susitna, Talkeetna, and Chulitna Rivers, and changes in Susitna River concentrations could extend project-related effects downstream into the Susitna below the three rivers confluence, and upstream into these tributary rivers. The differences in dissolved and transported organic matter between the Susitna, Talkeetna, and Chulitna Rivers should be determined to assess whether and to what extent project effects beyond flow and sediment could alter lower river and tributary river habitat quality. This information is needed by NMFS to assess the full range of project effects.

FDAML-47 Lower river fish and aquatic studies are necessary to documents the relative importance of these two stream segments. Differences in water chemical and physical characteristics could result in differences in habitat quality. For example, greater numbers of juvenile Chinook salmon were found overwintering within the middle river compared to lower river sites even though total available habitats were much lower (ADFG 1981). The biological reasons for this apparent variability in habitat quality and/or habitat use need to be assessed for NMFS application in developing protection, mitigation, and enhancements.

FDAML-48 Lower river sampling is necessary to provide adequate replication of macro-habitats to determine fish habitat relationships. Tributary mouths have been identified as one of the geomorphic classification types that may provide important juvenile salmon overwintering habitat. However, there are considerable biological, water quality, and physical differences among tributaries. For example, Whiskers Creek is a moderate sloped stream characterized by low pH, high dissolved carbon, and relatively dense coho spawning, and coho and Chinook overwintering populations. However, it is the only middle river tributary with these characteristics. Therefore, replication of this tributary type will require selection of similar lower river sites (e.g. Trapper Creek, Cache Creek, Rabideux Creek, Moose Creek, Greys Creek, and Kroto Creek/Deshka River) to determine if the characteristics of these tributary mouths are important components of fish habitat. A similar discussion could be applied to Indian River and Portage Creek, which combined provide most of the Chinook spawning but provide only two sample replicates of this stream type. Addition replicate sites could be found in the lower river including Montana Creek, Willow Creek, Sheep Creek, and possibly the Kashwitna River.

FDAML-49

Proposed study plans for post-project monitoring are not provided and need to be developed for a wide range of study areas, including this and other lower river sites. Lower river sites may be suitable as long-term monitoring locations. Lower river sites may have many of the same biological, chemical, and physical conditions as middle river locations. Lower river sites could be used to differentiate between changes in relative abundance due to changing climate, escapement or marine survival and project-related effects. Without pre-project lower river studies, any post-project changes in Susitna River fish and aquatic resources may be assumed to be due to project construction and operation. Without pre-project lower river studies, decisions regarding project mitigation including hydropower operations may need to be made without any information on pre-project fish and aquatic resources in the lower river. NMFS requests that post-project monitoring include lower river sites with sufficient baseline information on these sites to determine if any changes in their physical, chemical and biological characteristics are due to project operations or to non-project related causes. This information is needed for Adaptive Management, as recommended in NMFS Climate Change Study Request (for additional recommendations on Adaptive Management see NMFS Section 5.11 PSP comments in this document).

<u>Comments on AEA Study Objectives</u>

AEA Study Objective 1. Describe the seasonal distribution, relative abundance (as determined by CPUE, fish density, and counts), and fish-habitat associations of juvenile anadromous salmonids, non-salmonid anadromous fishes and resident fishes.

FDAML-50

Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries: NMFS finds this to be an overly-broad study objective and being so, it will result in the following problems. It includes the spatial and temporal distribution of multiple fish species with different life histories, their relative abundance, and factors influencing habitat associations. The purpose of this study objective is only briefly defined by AEA. There is only a cursory review of existing information. Methods have not been developed for specific study objectives. Proposed sampling frequency and locations are provided but are not appropriate for the study objective. The study does not include any evaluation of sampling efficiency, accuracy, precision, or representativeness. There is no description of how the study results will be analyzed or used to evaluate potential project effects.

The study methods should be broken down into three components for each fish species:

- describe the seasonal distribution of anadromous salmonids, non-salmonid anadromous fishes, and resident fish;
- describe the relative abundance of fish species, and
- describe the fish-habitat associations.

Methods for all three of these study components will vary among species and their life stages and with environmental conditions. The purpose of this study as stated in the PSP is to support the physical modeling and provide supporting information for the instream flow modeling study. Therefore, specific detailed quantitative information is necessary for all three of these objectives. If the study methods are broken down, this will provide NMFS with the ability to more clearly assess the ability of the proposed study methods to meet the stated objectives.

Pacific Salmon Seasonal Distribution

The direct effects of the construction and operation of the proposed project will mainly affect those fish species present within the affected area. The project is will also indirectly affect fish species by altering the physical, chemical and biological habitat characteristics of the river independent of fish presence or absence. Identification of the seasonal distribution of fish species is presumed to be related to direct and indirect project effects. Direct project effects can vary over time based upon different operational scenarios, long-term effects of the project on habitat, and the response to those effects can vary among fish species and life stages. The magnitude of project effects likely will decrease with distance from the dam site, and vary among different geomorphic reaches and physical habitat types. Therefore, it is important to understand the distribution of fish species by life stage both spatially and temporally.

The change in the spatial and temporal distribution of fish is due to the migration of fish among habitats during different life stages that can be influenced by environmental variables. Resident and anadromous fish migrate to spawning areas, emergence and migrate to summer rearing areas, and from summer rearing to overwintering locations. These movement patterns often are influenced by environmental factors. Adult salmon migration can be influenced by water temperatures or flows (Macdonald et. al. 2000; Torgersen et. al. 1999). Embryo development and fry emergence is dependent on thermal energy (Murray et. al. 1988; Wangaard et al. 1983) but can be influenced by flows (Milner 1985), and juvenile migration to winter habitats and smolt outmigration can be related to changing flows or light (Bustard and Narver 1975, McDonald 1960). The temporal distribution of fish may vary from year to year due to environmental conditions which can be influenced by project operations. Therefore, we must not only understand the spatial and temporal distribution of fish species by life stages, but also those factors than can initiate migration and modify migration rates. The applicant needs to determine where fish move and when so that NMFS can develop protective measures that would be protective of fish migration to and from different habitats at different life stages.

FDAML-51

The seasonal distribution of adult anadromous salmon and salmon eggs will be determined through AEAs Adult Escapement Studies (Section 7.7). However, the temporal distribution of Pacific salmon fry will be influenced by egg development rates. The presence of chum or sockeye salmon fry within the Susitna River or off-channel habitats will depend upon egg development and emergence timing. The evaluation of spawning and egg development is not included in AEA proposed study plans but is the subject of multiple agency study plan objectives outlined below. Because this important consideration is missing from the AEA PSP, NMFS wants it placed into the study plan. Given the likelihood of winter operations to affect incubating and overwintering salmon, information of the effects of the project on habitat important for those critical life stages is necessary for NMFS to develop measures such as ecological flows to protect or mitigate against these negative impacts.

Juvenile Pacific Salmon Distribution from Spawning to Rearing Locations

FDAML-52

The timing and influence of environmental variables on juvenile salmon migration from spawning to summer rearing habitats are critical to project evaluation. Emergent salmon fry are weak swimmers, and the presence and access to slow water nearshore habitats and off-channel locations can be affected by changing flows. The distribution of resident fish species and other predators may be due to the presence of migrating salmon fry. The description of the seasonal distribution of juvenile Pacific salmon will require unique sampling methods, sampling locations, and sampling frequency for different species.

FDAML-53

Environmental conditions such as temperature, discharge, and velocity influence the timing of sockeye and chum migration downstream to sea or to lower river rearing habitats. Studies have shown a stronger positive response to current by sockeye and chum fry compared to Chinook and coho fry (Hoar 1954). Chum showed the highest correlation (r=0.89) with discharge in the 1980s studies at the mainstem inclined plane traps (Roth et al 1986). Less is known about juvenile river-rearing sockeye and their dependence on discharge but previous 1980's studies revealed that large numbers of age 0+ sockeye migrate out of the Chulitna to the Devil Canyon reach in late May and June coinciding with high spring time flows. The percentage of migrants travelling to the Cook Inlet or to lower reach rearing habitats was unknown (Schmidt et al 1985). The PSP needs to specify where fyke nets will be used in to capture migrating sockeye and chum juveniles. Migrant traps such as fyke nets and inclined plane traps must be used at appropriate sites with a level of frequency that can determine if the timing of chum and sockeye migration is strongly affected by conditions that could be modified by project operations (i.e. water temperature and flow).

FDAML-54

Migrant traps (fyke nets, screw or incline plane traps) located near adult sockeye and chum salmon spawning locations should be used to document fry migration timing relative to environmental conditions, to estimate the size distribution of migrating fry, and to develop population estimates to evaluate spawning success (fry per spawning female x fecundity). The use of migrant traps for sockeye salmon is preferable to other sampling methods as electrofishing, beach seines, and minnow trapping used to capture sockeye fry had limited and variable success. The results of adult salmon escapement and incubation and emergent studies should be used to identify proposed sampling locations and the timing of migrant trap operation.

Review of previous Susitna River studies shows that sockeye salmon spawned almost exclusively in sloughs in the middle river, although a few spawning observations were made in the middle river mainstem (Barrett et al. 1984, 1985). Sloughs 11 (~ RM 136), 8A (~ RM 125), and 21 (~ RM 140) combined contained roughly 90% of all observed sockeye salmon spawning in the middle river in the 1981-1985 escapement studies (ADFG 1981a, 1983a, Barrett et al. 1984, 1985, Thompson et al. 1986). Slough 11 alone contained ~65% of the observed middle-river spawning across all monitored years. The use of fyke nets at the confluence of spawning sloughs and the mainstem Susitna was an effective method for the capture of sockeye salmon fry (Schmidt et al 1984). Previous studies have documented age-0 sockeye salmon migration from May through August, with peak migration in early to mid-July (Schmidt et al 1984).

Chinook and coho salmon spawning occurs primarily in tributary streams and fry migration to Susitna River rearing habitats can occur throughout the summer increasing in the fall. Chinook salmon spawning occurs primarily in Portage Creek and Indian River. In 1984, 96% of documented spawning Chinook salmon were found in Indian River and Portage Creek. No spawning was observed in mainstem, side channel or slough habitats, but tributary mouths at the boundary between clear and turbid water was a selected habitat (ADFG 1983a). The most important middle river spawning streams for coho salmon, in order of abundance, were Gash Creek (RM 111.6), Whiskers Creek (RM 101.2), Chase Creek (RM 106.9), and Indian River (RM 138.6) (ADFG 1981a, 1983a, Barrett et al. 1984, 1985). Some juvenile coho were captured in Portage Creek and in migrant traps below this tributary; therefore at least some coho spawning likely occurs in this stream.

FDAML-55

Migrant traps near the confluence of tributaries and the Susitna River are preferable to document juvenile Chinook and coho salmon movement from spawning to rearing areas compared to seasonal variability in CPUE. In addition to more detailed run timing, migrant traps allow for population estimates using mark recapture methods. This provides a method to calculate spawning success in tributary streams.

FDAML-56

Results from other sampling methods can be biased due to differences in catchability. Electrofishing catchability varies with differences in water depths, cover, velocities, and visibility (Schmidt et al 1984). Similarly, minnow traps can be size selective and seasonal catch rates can be influenced by water temperature, flow, and the presence of predators (Stott 1970, Jackson and Harvey 1997).

Juvenile Pacific Salmon Distribution among Summer Rearing Habitats

FDAML-57

The seasonal distribution of juvenile Pacific salmon within the Middle and Lower Susitna River during summer rearing likely will be based on the relative abundance or CPUE among sampling locations. Our understanding of the distribution of juvenile salmon among habitats can be influenced by the locations sampled, when samples are collected, the frequency of sampling, and differences in catchability due to sampling methods. Sampling timing and frequency, locations, and sampling methods should be related to species life histories and to address specific project-related questions.

FDAML-58

Sampling locations should be stratified among physical geomorphic classification types including turbid mainstem and side channels, and off-channel sloughs and tributaries. However, sampling locations also must consider the relationship to spawning areas and micro-habitat characteristics. For example, previous Susitna River studies have documented sockeye salmon spawning in discrete locations and the migration of fry from these areas following emergence peaking in early to mid-July. Due to specific sockeye salmon spawning locations and migration timing, June sampling of mainstem habitats immediately upstream and downstream of spawning areas likely will result in large differences in sockeye fry CPUE. Similarly, if sockeye salmon spawning locations are all predominantly on the left bank (i.e. Slough 8A and Slough 11), then sockeye fry CPUE may differ considerably between samples collected on the left or right bank. If these two locations are treated as replicate mainstem habitats, then CPUE will be highly variable and we will be less likely to determine if there are significant differences among habitat types. Whereas, if these are discrete sampling areas based upon stratified sampling, we will have a much better understanding of June sockeye fry distribution among mainstem habitat locations.

FDAML-59 Specific sampling locations among macro-habitat types, must also consider micro-habitat variability within that habitat type (woody debris, substrate size, bank cover, riparian cover, temperature). For example, juvenile CPUE likely will vary considerably among mainstem sampling locations adjacent to point bars, along outside bends, or within the mid-channel (Beechie et. al. 2005). Similarly, CPUE from samples collected at or near the confluence of sloughs and the mainstem could be different from those collected greater distances up sloughs due to variable water quality or physical conditions. Micro-habitat sampling locations must be identified in order to interpret sample results designed to determine temporal distribution of juvenile salmon among macro-habitat types.

FDAML-60 A similar thought process should be applied to identifying sampling locations for juvenile coho and Chinook salmon. As mentioned previously, Chinook spawning occurs primarily in two right bank tributary streams in the Middle Susitna River: Indian River and Portage Creek (upstream of Mile 138). Whereas, coho salmon spawning occurs primarily in tributaries near below river mile 110. June sampling locations closer to tributaries used by spawning adults are likely to have higher CPUE values. Therefore, sampling locations for juvenile salmon must be stratified by proximity to spawning areas including river mile and right or left bank, geomorphic classification types, and then meso-habitat characteristics (see comments on habitat classification) in order to obtain an understanding of the seasonal distribution of juvenile Pacific salmon within the Middle and Lower Susitna River.

An alternate approach would be to develop specific hypotheses regarding distribution and develop a sampling approach to test these hypotheses. For example, studies could address whether juvenile sockeye salmon use mainstem habitats for summer rearing or primarily as a transportation corridor from spawning to rearing habitats (*sensu* Galat and Zweimuller 2001). Studies could determine if there is a significant difference in juvenile sockeye salmon residence times among macro-habitat locations, and if there is a significant difference in juvenile sockeye salmon abundance between left and right bank macro-habitats.

The timing and frequency of sample collection also can have a large influence on our understanding of juvenile salmon distribution within the Susitna River and should be specific for each species or for specific project-related questions. For example, if the question is to determine when and for how long juvenile sockeye salmon are present in mainstem habitat locations, then sampling should be initiated in early June, and weekly or biweekly sampling may be necessary to document sockeye salmon residence times within mainstem habitats. For Chinook and coho salmon, sampling of mainstem habitats could begin in June, with initial monthly sampling, but more frequent weekly or biweekly sampling may be necessary in August and September to determine if the mainstem serves as a migration corridor or as important fall and winter rearing habitat.

FDAML-61 It may also be necessary to develop a sampling frequency that is tied to changes in chemical or biological characteristics, or relevant to proposed project operations. For example, if juvenile salmon distribution is believed to be related to changes in turbidity due to seasonal increases in flow from glaciers, then sampling frequency should provide measurements over a range of mainstem conditions. Similarly, if cover provided by mainstem turbid waters (Gregory and

Levings 1998, Ginetz and Larkin 1976) influences fish distribution in sloughs as water levels rise, then sampling locations and frequency should provide measures that encompass these changes in habitat characteristics. The direct effects of the project on fish likely will vary under different operational scenarios. Sampling frequency should provide measures of fish distribution when project effects are likely to be greatest. For example, if changes in flow are expected to influence migration, then sampling frequency should document fish movement prior to, during, and following similar natural variations in flow.

Juvenile Pacific Salmon Migration to Overwintering Habitats

Juvenile Pacific salmon have been shown to emigrate from summer rearing to overwintering habitats. Juvenile sockeye, Chinook, and coho salmon overwinter in the Susitna River and associated off-channel habitats. Juvenile salmon may migrate to overwintering locations or remain in summer rearing locations if characteristics are favorable for overwintering. Migration is associated with declining water temperatures but may be linked to changes in flow, or light levels (Bjorn 1971, McMahon and Hartman 1989). Migration from summer rearing habitat may be initiated by low fall flows, winter freshets, and the loss of open water as small tributaries freeze to the bottom (Prowse 1994). Juvenile salmon generally select overwintering habitats with low water velocity, cover, and relatively warmer water due to springs or upwelling groundwater (Giannico and Hinch 2003, Hillman et al. 1987, Cunjak 1996). Winter habitat selection is based on the need to minimize energy expenditure and to avoid adverse physical or chemical conditions (anchor ice, floods, low oxygen) (Cunjak 1996).

Chinook and coho salmon have different winter habitat preferences, while little is known about overwintering habitats used by stream-type sockeye salmon. Substrate with interstitial spaces that provide cover and lower water velocities may be important for overwintering Chinook salmon (Hillman et al. 1987, Bjorn 1971). Bjorn (1971) found fewer juvenile Chinook salmon migrated out of streams with large cobble substrate than those with gravel or finer substrate. Juvenile Chinook salmon were found in association with macrophytes and undercut banks during winter and the addition of cobble substrate increased overwinter abundance (Hillman et al. 1987) in the Lemhi River (Northern Idaho). Juvenile steelhead and Chinook were found overwintering in deep pools and the interstitial spaces of riprap cover in a large river in British Columbia (Swales et al. 1986). Bustard and Narver (1975) found juvenile coho salmon and steelhead trout in waters with velocity less than 0.15 cm/s when water temperatures were below 8°C. While Hillman et al. (1987) found Chinook salmon in water velocities less than 20 cm/s during winter with larger fish using higher water velocities.

Tributary mouths, side channels and sloughs of the Middle Susitna River provide overwintering habitat for Chinook salmon. A total of 707 juvenile Chinook salmon were captured along the entire reach from Cook Inlet to Devil Canyon in the winter of 1980-1981. Although the Talkeetna to Devil Canyon reach contained only 61% of the total sites on the Susitna River it accounted for 77.4% of the total Chinook captured that winter. Whiskers creek (RM 101.2) alone accounted for 27% of the total winter catch. However, this may not be an accurate evaluation of distribution because sampling effort was not equal among sites. Other reported high capture rates occurred at Slough 8A (RM 125.3), Slough 10 (RM 133.8), Slough 20 (RM 140.1), Oxbow II (RM 119.2) and Susitna Side-Channel (RM 136.1). Slough 8A had the highest catch per trap day in March (1.7); Slough 10 in February (2.4), Slough 20 in February (5.9), Oxbow II in March (2.5) and Susitna Side-Channel in April (5.9). Slough 6A (RM 112.3) was only fished once in March with a single minnow trap but resulted in the highest catch per trap of 20 fish (ADFG 1981a). In 1982, a total of 309 juvenile Chinook were collected from February through April. Very few trends can be determined based on such low numbers. Juvenile Chinook salmon were present during all sampling events at Fourth of July Creek, Slough 10, Slough 11 and Slough 20. Whiskers Creek, Slough 10 and Slough 20 accounted for the majority of catches that season. Low numbers could reflect low abundance at the sites sampled but more likely they reflect gear inefficiency (ADFG 1983b).

Overwintering juvenile coho salmon are found consistently in slow-water off channel habitats with abundant cover. Overwintering coho habitat in British Columbia is in side channels fed by ground water (Giannico and Hinch 2003). Ground water fed side channels and ponds provide stable water flows, higher temperatures and invertebrate production allowing fish to forage and continue to grow during winter (Peterson, 1982a,b; Brown, 1985 in Giannico and Hinch 2003). In coastal streams of Vancouver, juvenile coho salmon moved into side channels and beaver ponds and were associated with cover provided by woody debris or overhanging vegetation (Bustard and Narver 1975). Juvenile coho salmon emigrated from streams as light levels decreased in the fall unless they were in locations with low water velocity and abundant cover from woody debris and overhanging vegetation. Use of cover decreased with continuous ice cover (McMahon and Hartman 1989). On the Olympic Peninsula coho salmon have been found to move large distances to off channel ponds with a large amount of cover for overwintering habitat (Petersen 1982). Similarly in British Columbia, side channel and off channel habitats with abundant cover provide overwintering habitat for juvenile coho salmon (Swales et al. 1986). In colder side channels with a surface water source, woody debris increased coho salmon carrying capacity and smolt output, but in the relatively warmer side channel with a groundwater source, woody debris had no effect or a negative effect (Giannico and Hinch 2003). The authors believed that cover was more important in the cold water side channel as fish swimming ability decreased with lower temperatures. Warmer groundwater was determined to be a key characteristic of productive overwintering habitat for coho salmon (Giannico and Hinch 2003).

Sampling between Talkeetna and Devil Canyon in 1981 produced a total of 186 juvenile coho among 12 of the 42 sampled locations sites (28.6% incidence). In general, percent incidence was higher in mainstem and slough habitat locations (62%) than in tributary mouth sites (25%). The only tributary mouth where coho were found in abundance was Whiskers Creek. Age 2+ coho were captured at three of the 12 habitat locations and one of 30 selected fish habitat sites in this reach. Age 2+ coho totaled 39 individuals. The sites containing both age classes were Whiskers Creek, Slough 10 and Slough 8A. The highest capture rates for age 1+ in the Talkeetna to Devil Canyon reach were at Slough 6A (RM 112.3) and Whiskers Creek in March, Slough 16 (RM 137.7) and Slough 21 (RM 141.8) in February and mainstem sites from RM 98.8-101.6 in March (ADFG 1981b). Similar results were obtained from 1982 sampling.

Overwinter survival of sockeye salmon can limit overall production (Steinhart and Wurtsbaugh 2003). However, juvenile sockeye salmon generally overwinter in lakes, and little is known about overwinter survival of stream-type sockeye salmon. Sockeye salmon have been found to spawn in side channels of glacial rivers including the Matanuska and Susitna Rivers (Curran et al. 2011, Barrett et al. 1985), and there is indication of overwintering in Susitna River side channels and sloughs (Schmidt et al 1984).

FDAML-62 AEAs proposed study plans to document the distribution of juvenile Pacific salmon during winter should identify whether fish maintain site fidelity from summer through winter or if they emigrate from summer rearing locations. The locations selected for overwintering should be identified as well as identifying similar but unused habitat in winter. PIT tagging of salmon juveniles in tributaries with stationary antennae arrays near the Susitna confluence could be used to determine the portion of fish migrating out of these streams as water temperatures and light levels decline or in response to fall storms or changes in flow. PIT tags also could be used to determine site fidelity within upland and side sloughs with tag detection at stationary arrays near the slough mouth. The PSP is deficient because it will not provide information necessary to determine where fish overwinter and why these particular habitats are selected. If the plan follows our recommendation below, this critical information will help NMFS recommend stream flows that allow fish to maintain access to overwintering habitat.

FDAML-63 Based upon previous Susitna River sampling, juvenile salmon have been found overwintering in tributary mouth, mainstem, and off-channel habitats. Monthly winter fish sampling at random sites stratified by geomorphic classification types should be used to identify distribution during winter. However, sampling methods are likely to be limited during winter months and the probability of fish capture, or observation, will vary between sites, so differences in CPUE cannot be used to infer differences in relative importance of overwintering habitat locations. Seines were the only method that consistently captured sockeye salmon juveniles in both mainstem and off-channel habitats; however, seines cannot be used when there is partial ice cover. Similarly, minnow traps were the primary sampling method used to capture juvenile coho and Chinook salmon. However, the use of minnow traps under the ice will be difficult, and catchability varies with temperature (Stott 1970). NMFS recommends the use of underwater video as it appears to be the only method available to document the presence or absence of juvenile salmon at multiple sampling locations. It is unknown whether video observations of fish are proportional to fish densities; this should be tested through comparison with other sampling techniques.

Seasonal Distribution of Resident Fish

See comments under AEA Objective 2 of Section 7.6.

Relative Abundance

FDAML-64 For juvenile salmon, NMFS recommends using growth rates as a primary indicator of habitat quality rather than using relative abundance based on catch per unit effort (CPUE). Differences in CPUE should not be used alone to identify important fish habitats and may not be appropriate for use in developing habitat suitability criteria for instream flow analyses due to inconsistency in sampling results using various sampling methods (seine, minnow traps, electrofishing, etc.). Particularly for juvenile salmon, relative abundance can vary with proximity to spawning areas, catchability among habitats and with differences in flow, and should not be used indiscriminately to indicate relative habitat quality.

FDAML-65 The relative abundance of juvenile salmon fry closely following emergence, and in close proximity to spawning locations likely reflects spawning incubation success rather than quality of rearing habitat and should not be interpreted as an index of abundance or quality of rearing habitat.

FDAML-66 Catchability for all standard gear types can vary greatly among different habitat types. Beach seining was found to be more effective in turbid waters in a 1983 gear efficiency study in several sloughs on the Susitna River (Schmidt et al 1984, Part 2, Appendix B). In clear waters fish can see and avoid the seine or hide under cover. Although it is more effective in turbid waters, seining is less effective in habitats that contain deep pools and abundant cover. Electrofishing performs better in clear water but is also affected by cover and results vary depending on the user. For both methods, CPUE could underestimate density for all species. In addition, results based on CPUE would not directly reflect habitat quality because of the biases of gear among habitat types. This is especially pronounced for juvenile sockeye salmon, which school in deep pools, prefer clear water, but can only be caught efficiently with seining.

FDAML-67 Baited minnow trap CPUE can vary with flow, potentially recruiting a greater number of large fish in areas of increased velocity (Culp and Glozier 1989). Smaller fish can also more easily escape from traps, therefore age 0+ Chinook and coho abundance could be underestimated in the spring and early summer (Culp and Glozier 1989, Jackson and Harvey 1997). The placement and orientation of minnow traps can also affect CPUE and are hard to replicate effectively and uniformly in order to accurately represent density. This method is also proven ineffective at capturing sockeye because they are not attracted to bait.

FDAML-68 Underwater video could potentially contain less sampling biases based on flow, cover or depth but could be effected by turbidity due to poor visibility. The sampling methods for video use are only described for winter use in the PSP (detailed in Mueller et. al. 2006). Application of video during the open water season in clear water sloughs or tributaries could also provide crucial data for evaluating fish abundance. This would provide an addition method for observing juvenile sockeye salmon that are not captured in minnow traps and avoid beach seines in clear water as mentioned above.

Juvenile Pacific Salmon Habitat Associations

Determining habitat characteristics which are important for fish species found within the Susitna River and then evaluating how construction and operation of the proposed project may alter those habitat characteristics is one of the most fundamental purposes of the proposed studies. The development and completion of extensive studies to measure and model geomorphological changes, ground water flow paths, productivity, and water quality have little utility if a relationship between these physical and biotic processes and fish habitat characteristics is not clearly understood.

AEA's PSP objective is to describe fish-habitat relationships for juvenile anadromous, non-salmonid anadromous and resident fish species. However, the PSP does not outline how these data would be used, the important habitat characteristics to be measured, how they will be measured, variability in field measurements, or statistical methods to be used to determine the relationships between fish and characteristics of their habitats. Therefore, critical evaluation of the PSP is difficult. As potential habitat suitability criteria and indices have not been identified, there is no indication of what parameters may be included to develop weighted usable area for instream flow analyses.

Numerous published studies are available to determine the characteristics that define habitat quality from egg deposition through juvenile summer and winter rearing for most fish species present in the Susitna River (See summaries in Bjorn and Reiser 1991, Quinn 2006). There are few studies that evaluate juvenile salmon and resident fish habitat characteristics in large glacial rivers (Murphy et al. 1989). Therefore, while these sources do not provide the information necessary to define fish-habitat associations, they do provide us with an understanding of those parameters that should be incorporated into AEAs proposed study plans.

The important characteristics of fish-habitat relationships can be physical, chemical, or biological. Physical, chemical and biological characteristics used to define fish-habitat relationships should be measured and not obtained from model estimates. Some of the chemical and biological characteristics may be included in other study plans. Fish habitat characteristics must define conditions when fish are sampled and at the micro-habitat scale (m2); however, sampling frequency and locations should be based upon the variability of the parameter being measured. That is, channel geometry likely will not change within a season so annual measures should be adequate; however, water velocity and water depth, and most of the water quality parameters should be measured at the same time as fish sampling. Similarly, sampling locations should be representative of the physical habitat sampled for fish; however, they may not be at the spatial scale. The number of replicate mainstem water quality sampling locations will not be the same as the number of replicate fish sampling locations.

Physical characteristics include channel geometry, bank slope and undercut, water depth and velocity, substratum size distribution, woody debris abundance and quality. Channel cross-sectional and longitudinal geometry parameters control water depths and influence water velocities. Bank slopes reflect changes in water depth, influence photic zone area, potential for aquatic plant growth and riparian vegetation cover. Bank slopes along with the calculation of tractive forces, the slope toe under fluctuating flow conditions, and changes in riparian vegetation due to a reduced water table are necessary to estimate bank sloughing (Kondolf and Larsen 1995). Undercut banks provide cover for fish and proximity to sources of terrestrial invertebrates, and use of this area may be eliminated under low flow conditions. High water velocities that exceed fish sustained swimming speeds can restrict use of some areas; however, drift-feeding fishes balance the energy needed to maintain position with the benefit of greater food availability at higher water velocities. Since sustained swimming speeds vary with species, fish length, and water temperatures (Bjornn and Reiser 1991), preferred water velocities will differ considerably throughout the year and habitat suitability curves can vary through the season. Substratum size distribution and percent embeddedness should be measured at all locations, as substrate can modify velocities and provide cover and overwintering habitat for rearing fishes. Similarly, woody debris has been found to be a critical habitat characteristic for many salmonids and is likely to be affected by project operations that influence ice development, riparian vegetation, transport velocities, and frequency of floods. The abundance of woody debris and function of woody debris as cover or as modifying flows should be determined at each sampling location, and woody debris surveys must be conducted during clear-water conditions.

Chemical and physical characteristics that could modify fish habitat quality include water temperature, pH, hardness, alkalinity, specific conductivity, dissolved oxygen, turbidity, and suspended inorganic sediment. Stream water physical and chemical conditions have significant direct and indirect effects on fish habitat and must be known in order to understand fish-habitat relationships. Water temperatures limit fish metabolic and growth rates and alter both the water density and ability of fish to swim. Habitat quality can be influenced by stream water pH and dissolved oxygen concentrations and specific conductivity and can vary with water sources. Alkalinity is a measure of buffering capacity and the abundance of macro-invertebrate in Alaska streams has been related to changes in calcium carbonate (LaPerrier 1983). Turbidity and suspended sediment concentrations influence fish distribution and growth through a number of mechanisms, but also can provide cover for rearing salmonids, (see reviews by Oregon DEQ) and may be one of the most significant characteristics of fish habitat in the highly turbid Susitna River.

Biotic characteristics of fish habitat include fish community composition (competition, aggressive displacement, predation), riparian and aquatic plant community composition, macro-invertebrate community composition, terrestrial and aquatic invertebrate drift, primary production, detrital food base and processing rates. Fish density and interaction among species can have an overriding influence on fish distribution and habitat quality. In addition, the effects of competition, competitive displacement, and predation are not evaluated through instream flow analyses (Fausch et al. 1988). Habitat suitability curves can incorrectly identify habitat preferences when fish distribution and abundance are driven by predatory avoidance or food availability and not physical habitat characteristics. Recent bioenergetics studies have shown that juvenile salmonid and resident fish distribution and growth rates are a function of not only those factors that influence energy expenditure (water velocity and water temperature) but also food availability. Therefore, the relationship between fish species and water velocity will vary with changes in water temperature and food abundance. The abundance of rainbow trout in the may be due to food available at adult salmon spawning locations, juvenile sockeye rearing areas, or locations of high invertebrate drift, and all of these locations will have large differences in water velocity and water depth. The abundance of one fish species can be influenced by the presence of predators, aggressive displacement, or competition even under optimal water velocities and high food availability. This means that fish sampling for juvenile coho, for example, must also include sampling for rainbow trout, which may require completely different sampling methods.

FDAML-69

In summary, documenting juvenile salmon fish habitat relationships could be considered the most important information needed to evaluate the proposed project. The development and implementation of many other very difficult and expensive studies (ground water, water quality, flow routing, productivity etc.) are being conducted largely to determine their influence on fish habitat relationships. Instream flow analyses will be based upon understanding project effects on characteristics that drive fish habitat relationships. Ultimately, the operation of the proposed project may be determined by these studies. In addition, fish habitat relationships are extremely complex and can be influenced by many variable and interacting physical, chemical, and biological parameters. However, the AEA PSP gives only a cursory summary of fish collection methods with a general and minimal description of sampling locations and frequency that are not based upon the life histories of the fish species know to reside within the Middle Susitna River.

AEA Study Objective 2. Describe seasonal movements of selected fish species such as rainbow trout, eulachon, Dolly Varden, whitefish, northern pike, Pacific lamprey, and burbot) using biotelemetry(PIT and radio-tags) with emphasis on identifying foraging, spawning and overwintering habitats within the mainstem of the Susitna River and its associated off-channel habitat;

FDAML-70 This AEA study request partially addresses agency study requests for resident fish species. The agency's study objectives for resident fish included the following:

1. *Characterize the seasonal (spring, summer, fall, winter) distribution, relative abundance, and habitat utilization in the Susitna River mainstem (RM 0-RM 233) for all life stages of non-salmon anadromous, resident, and invasive fish species. [Documenting both hierarchal nested habitat type and use-type as described in the resource agency Instream Flow Study and Habitat Utilization Study Request].*
2. *Characterize the seasonal (spring, summer, fall and winter) movement patterns of all subject fish species and life stages as they relate to foraging, spawning, rearing and overwintering habitats. The characterization of seasonal movements includes run timing (immigration and emigration) and extent (periodicity) of non-salmon anadromous species in the Susitna River (RM 0-RM 233) and movement into and out of tributary streams. [Interface with resource agency Instream Flow and Habitat Utilization Study Request hierarchal nested habitat types and habitat mapping].*
3. *Characterize the flow-related or synchronized life history strategies (migration, movement, spawning, rearing, hatching, emergence) of non-salmon anadromous, resident and invasive species, and their biological behavorial response (e.g., potential for false attraction, delayed migration or increased holding time, synchrony of spawning, relative hatching and emergence timing) to Project-affected flow alterations (flow, temperature, habitat, water quality).*

AEA's PSP does not include the aforementioned objectives; its proposed objective is to characterize seasonal distribution, relative abundance, and habitat associations of resident fish, and migration. However, study methods do not support the intent of the agency objective. AEA study plans have not been developed to characterize flow-related, or synchronized resident fish migration and life histories as they relate to other physical, chemical, or biological environmental variables. Specific studies will need to be designed to accomplish these objectives. Incidental reports of catches of resident fish through seasonal samples at unknown sampling locations are not sufficient to address these study objectives, nor will the resulting data be useful for evaluating project effects.

FDAML-71 The study methods do not clearly identify those species that will be evaluated. However, a list of species is provided, which, in part is covered under other study objectives (i.e. seasonal movement of northern pike). The AEA PSP provides only cursory information on the general life-history patterns of the target fish species and does not include any site specific information (See Appendix to this Study Section). Methods do not identify when, where, or how specific fish species will be captured. For many species, the location and operation of receivers has not considered life history patterns of the target species. Sampling methods do not appear to be developed to address the study objective. PIT tagging is identified in the study objective, but the limitations on installation and operation of arrays will bias results. The study does not identify any of the other biological, chemical, or physical characteristics that may explain migration patterns. There is no description of how the analyses of the data obtained from this study will be conducted to meet the study objective.

FDAML-72 The methods planned to address this objective include using biotelemetry to identify seasonal movements of resident fish; however, it is not clear how this will relate to the habitat characterization studies or the instream flow models. Methods (described below) mention ways in which biotelemetry can be used to measure growth rates and calculate population estimates, but there is no objective for why these data will be collected or used. It is assumed that growth rates and abundances will be used to characterize preferred seasonal habitats for each species, which might then be combined with instream flow analyses to determine how these habitats might change thereby quantifying effects to fish populations. However, there is no description of whether physical (depth, velocity, temperature), chemical (pH, conductivity, dissolved oxygen), or biotic variables (primary and secondary productivity) will be measured in conjunction with fish capture and tracking efforts, particularly if spawning or overwintering habitats are located outside the reaches included in habitat characterization or productivity studies. Without accompanying measures of fish habitat characteristics or parameters influencing migration, no distribution trends can be estimated or extrapolated out to similar, non-sampled areas. A basic presence/absence study is not enough to provide valuable information to make decisions on how a hydroelectric project could influence fish survival and distribution or migration among foraging, spawning or overwintering habitats.

The proposed study area is from RM 28, near the Yentna River confluence, to Devil Canyon (RM 150). The lower boundary is also the lower extent of the proposed Habitat Characterization Study. Combinations of passive and active methods are proposed to be used throughout the year at a variety of locations within the Susitna River downstream of Devil Canyon. Sampling methods include gill nets, electrofishing, angling, trot lines, minnow traps, snorkeling, fishwheels, outmigrant trapping, beach seines, fyke nets, DIDSON, and video cameras will be used to sample or observe fish in the lower and middle river and tributaries draining into the Susitna River.

Stratified sampling effort is proposed covering the five major geomorphic classification types (main channel, side channel, tributary mouth, side slough, and upland slough) in the lower and middle river, with emphasis on the middle river. The proposal calls for selection of three each of the major geomorphic types in the lower river and five of each type in the middle river, for a total of 40 sites. These sites will be sampled monthly from May through September (except in August, which will have two sampling events), twice between December and April, with no samples collected in October or November.

Remote fish telemetry (radiotelemetry and PIT tags) will be used to monitor the movements and habitat utilization of individuals. Radiotracking will provide information on fine and large spatial scales related to location, speed of movement, and habitat utilization. PIT tags can be used to document relatively localized movements of fish as well as growth information from tagged individuals across seasons and years. However, "re-sighting" of PIT-tagged fish is limited to the sites where antenna arrays are placed, which is limited to sufficiently small water bodies for tagged fish to pass within several feet (sighting limit) of an array. To characterize growth rates, fish must be recaptured, checked for a tag, and measured. All captured fish 60 mm or larger of selected species will be checked for a PIT tag and tagged if one is not present.

FDAML-74

Sampling habitats based on equally measuring the "five major habitat [geomorphic classification] types" assumes that the distribution of geomorphic habitats is equal throughout the drainage. Many factors, such as water chemistry and productivity will control the distribution of fish among these sites, likely to a greater extent than this general, physical characterization. Classifying fish as preferring side channels vs. side sloughs may entirely miss what drives fish distribution in these areas. For this reason, it is important to measure habitat variables at each sampling site and event, and try to determine if any of those variables outweigh macro-habitat types (use in excess of availability) in determining fish distribution and abundance. Additionally, adding supplemental, non-intensive sampling events at sites where radio-tagged fish are observed, but that are not part of the regularly planned sampling schedule is suggested. Single sampling events of various habitats could be helpful for capturing species that may not be abundant at the sites selected or to look for presence of invasive species in more locations.

FDAML-75 The number of fish proposed to be tracked in the AEA study plan is insufficient to document the migration patterns to spawning, summer foraging, and overwintering habitats to meet the study objective. The operation of radio receivers has not been developed to track the resident species identified. Radio transmitters are proposed to be "surgically implanted in up to 10 fish of sufficient body size of each species from five geomorphic types in the Middle and lower river." This description of methods does not provide enough detail for valuable comments. General information that needs to be provided includes: which species will be tagged; the "sufficient" sizes for radio transmitters; how movements of smaller, juvenile fish will be monitored. If fish selection is equally stratified among five different habitat types, this only provides information on movements for two fish from each habitat type below Devil Canyon. It is unclear if this level of effort will be sufficient to understand general movements and seasonal habitat utilization by each species of resident fish. The plan is to only maintain fixed receiver stations during July through October, to coincide with adult salmon migrations; however, this will miss many resident fish migrations that occur in the spring (see specific species below). If a main objective for the biotelemetry studies is to track seasonal movements of resident fish, the observation period should not only be based on adult salmon migrations. Monthly winter and spring aerial surveys have the potential to miss movements and migration timing from overwintering to spawning or summer rearing habitats.

FDAML-76 Additionally, radio-tagging studies can have high failure rates, from tagging-induced mortality, expulsion of tags, or tag malfunction (Chisholm and Hubert 1985; Ridder 1998). Tagging 10 or fewer fish does not seem to account for this problem when determining sample sizes.

FDAML-77 The PSP also states that up to ten sites will be selected for deploying PIT tag antenna arrays to detect movement into or out of the site and will be deployed shortly after ice-off in 2013. Additionally, swim-over antennas are planned to be deployed at five sites prior to ice-over, on an experimental basis. As with the radio tagging plan, the target species that will be tagged for this study need to be defined. The criteria to be used for site selection of antenna arrays are also unclear. Will the experimental winter antennas be deployed at the same sites that arrays were set up during the summer? Information on large and fine scale movements of fish will be dependent on site selection for antenna arrays and tagging sites. This is a very large area to cover with ten or fewer observation sites, especially considering that it will only register movements into and out of sufficiently small tributaries and sloughs.

FDAML-78 The fish collection methods do not appear to be related to the project objective, but are merely a list of sampling techniques. The objective states that biotelemetry and tracking of PIT tagged fish will be used to document migration patterns of resident fish. The specific methods should clearly identify how target species are to be captured for tagging or for the recapture of tagged fish (although this is not discussed). For example, trot lines result if fish mortality; therefore, this does not seem to be an appropriate method to be used to collect fish for tagging and tracking. Similarly; how will sonar or snorkeling be used to track radio or PIT tagged fish?

FDAML-79 The following information, and appended information, on life history and site-specific studies is provided to clarify the need for developing study sampling plans that account for differences among resident fish within the proposed study area.

Eulachon: In the 1980s studies conducted by Alaska Department of Fish and Game (ADFG), eulachon spawning and passage in the Susitna River occurred from the river mouth up to approximately RM 50, with spawning occurring in the mainstem and associated side channels below RM 45 (Vincent-Lang and Queral 1984). Additionally, the majority of spawning locations surveyed, which were chosen based on catch data, were below RM 28 (17 of 20 surveyed). The current plan, with a suggested three mainstem and three side channel survey areas in the lower river above RM 28, has the potential to miss eulachon spawning entirely, unless a concerted effort is made to select sites based on eulachon usage. However, sampling timing will also need to be selected based on run timing. The proposed study plan suggests one sampling event sometime in May and one event in June. The 1980s studies found that there were two consecutive runs of eulachon into the Susitna River, with the entirety of both runs occurring between mid-May and early June (Vincent-Lang and Queral 1984). Dates may have shifted since these studies were conducted, but this should be taken into account when selecting dates for sampling efforts.

The use of biotelemetry on eulachon does not support the proposed objective. Not only is a significant portion of spawning located below the proposed sampling reach of the lower river, but Section 7.16 already proposes to use DIDSON and side-scar sonar to determine eulachon densities and distributions. There is no clear purpose for why biotelemetry would also be used on this species.

Rainbow trout: Based upon previous studies, CPUE by boat electrofishing and hook and line sampling identified the abundance of cover to be the major habitat characteristic affecting distribution (Suchanek et al. 1984). Measures of substrate sizes, woody debris, and overhanging vegetation are necessary variables to classify habitats used by rainbow trout and determine what habitat variables determine distribution among habitats. This is important in order to predict project-effects on rainbow trout abundance and/or distribution. Seasonal distribution may also be driven by food sources rather than physical parameters. In areas with spawning salmon, rainbow trout were found in habitats quite different than when found in areas without spawning salmon (Suchanek et al. 1984). Similarly rainbow trout movement may be related to the movements of prey species. In southwest Alaska's Wood River lakes system, rainbow trout feed primarily on macro-invertebrates, but their diet shifts to primarily salmon eggs and salmon carcasses in conjunction with salmon spawning activity (Scheuerell et al. 2007).

Summer distribution of rainbow trout in the Middle Susitna River was primarily among clear water tributaries. The largest catches were in Fourth of July Creek (RM 131.1), with relatively large catches also in Whiskers Creek (RM 101.2), Indian River (RM 138.6), Lane Creek (RM 113.6), and Portage Creek (RM 148.8) (ADFG 1981c, 1983b). Many rainbow trout can be found near the mouths of these tributaries during the summer, but a large portion will be further upstream, near spawning grounds, particularly juveniles (ADFG 1981c, 1983b; Sundet and Wenger 1984). This mismatch between distribution and sampling sites may affect biotelemetry results. Individuals that utilize upstream habitat during the summer could differ in preferred overwintering habitat than individuals that rear at tributary mouths in the summer. Since summer distribution is age/size dependent with juveniles rearing in upstream habitats, winter distribution might also be age/size dependent, due to competition or different needs for different life stages. Understanding winter distribution of juvenile rainbow trout is important for this study, as smaller fish might be more susceptible to stranding from winter ramping rates than larger, stronger-swimming fish.

<u>Dolly Varden</u>: Similarly to rainbow trout, Dolly Varden inhabit clear water tributaries during the summer months, but have been observed in the mainstem from September through June (Sundet and Wenger 1984). Dolly Varden catches were largest at the mouths of Portage Creek (RM 148.8) and Indian River (RM 138.6), but the majority of the population was believed to reside in tributaries well above their confluences with the Susitna River (Sundet and Wenger 1984). Additional fishing efforts should be employed at upstream locations in order to capture and tag Dolly Varden that are more representative of the Susitna River populations as a whole. The small numbers that could be captured at the mouths of tributaries during the summer months might not show the same migrations, between tributaries and the mainstem, that individuals captured within tributaries are likely to make (see Dolly Varden summary in attached appendix). These movements are important to classify to determine if passage barriers could be created by project development. In addition, Dolly Varden rearing in tributaries in the summer may migrate to mainstem locations during the winter. Radiotelemetry should be used to test this hypothesis, as identifying overwintering habitats is a specific study objective, and project effects are likely to be greatest during winter months. Additionally, describing the timing of migration will help to identify possible passage barriers at tributary mouths with modified flows.

Based on data from previous studies, the middle river seems to provide preferred habitat for Dolly Varden. Dolly Varden have been captured by boat electrofishing, fishwheels and minnow traps during previous sampling events with higher catches in the middle river than the lower river. Higher catches rates were achieved from minnow trapping when fishing the traps for 24 hours in 1981, as compared to only three hours in 1982 and 1983 (ADFG 1981c, 1983b; Sundet and Wenger 1984).

<u>Round Whitefish</u>: The most effective methods for capturing adult round whitefish in the 1980s ADFG studies were electrofishing and beach seining, with fishwheels also capturing significant numbers. However, the majority of juveniles captured were in the downstream migrant traps at RM 103 (ADFG 1981c, 1983b; Sundet and Wenger 1984). Therefore, whitefish spawning likely occurs in middle river off-channel locations. Winter sampling methods were ineffective at capturing round whitefish.

<u>Humpback whitefish</u>: Humpback whitefish are found in lakes, streams, and brackish water across much of Alaska, primarily north of the Alaska Range (Alt 1979; Mecklenburg et al. 2002). In the Susitna Basin, humpback whitefish are reported in mainstem rivers and slow-flowing tributaries (ADFG 1983e; ADFG 2012). Adult humpback whitefish have been successfully captured mostly with fishwheels and boat-mounted electrofishing, with low numbers also captured with gill nets, hoop nets, and beach seines (Sundet and Wenger 1984).

Mature humpback whitefish aggregate in discrete spawning habitats, leaving them at risk to both acute events during fall spawning and chronic changes to spawning habitat (Brown 2006).

Extreme high water events shortly before fall spawning may cause adult whitefish to leave spawning areas and delay spawning to another year (Underwood et al. 1998). The spawning period seems to be the most critical life stage for humpback whitefish; therefore, identifying specific spawning habitats will be crucial for assessing project effects on this species. Locations, habitat characteristics, and flow requirements during this period are necessary measures for this study. Additionally, fertilized eggs are thermally sensitive, with optimal developmental temperature around 0.5°C, and 99% mortality rates at 10°C (Morrow 1980; Scott and Crossman 1998). As a reservoir would create warmer than average temperatures during the winter incubating period, egg survival rates may be affected by the Project. It is important for studies to address current thermal regimes at egg incubation areas and to model how temperatures could change in these areas post-project. These temperature models should then be related back to mortality rates of humpback whitefish eggs for potential population effects.

Migrant traps were the only gear found effective for capturing juvenile humpback whitefish in the Susitna River, with no other gear type revealing any large concentrations of juveniles (ADFG 1983b; Sundet and Wenger 1984). In Alaska, the habitat preferences of juvenile humpback whitefish have been particularly difficult to define (Brown 2004, 2006; Brown et al. 2002). In interior Alaska and northern Canada, immature fish, from age 0 to about age 4, appear to rear far downstream of spawning areas in off-channel sites such as deltas, lakes, and sloughs, or in mainstem eddies (Brown 2006; Reist and Bond 1988). All previous winter sampling methods in this area were ineffective at capturing humpback whitefish and identifying overwintering locations. In Canada's Mackenzie River system, overwintering locations are in deep mainstem channels or delta areas (Reist and Bond 1988).

Both fishwheels and downstream migrant traps are planned to be deployed primarily for anadromous salmon captures, but they are valuable methods for capturing resident fish, such as whitefish, that utilize the mainstem during the summer months. Crews at fishwheels and downstream migrant traps should also be equipped for PIT tagging resident fish, in order to include whitefish, particularly juveniles, in fish distribution measures. It is unclear if crews will be equipped with PIT tagging equipment, and if they are it needs to be described if resident fish at these locations will be a priority for sampling or if they will only be tagged when the workload is low, during periods of reduced anadromous salmon captures.

Additionally, humpback whitefish are vulnerable to predation by piscivorous fish, such as lake trout (Van Whye and Peck 1968) and northern pike (Russell 1980). Round whitefish and Arctic grayling feed on humpback whitefish eggs (Brown 2006; Kepler 1973), and other species likely do as well. These interactions should be studied, in order to determine how fish community changes, such as potentially increased distribution of Northern pike, could influence humpback whitefish populations.

<u>Northern pike</u>: Northern pike are an invasive species in the Susitna River drainage and have spread throughout the system from the Yenta River after being illegally introduced in the 1950s (Rutz 1999). They have been reported to be present in more than 100 lakes and ponds that drain into the Susitna River (Rutz 1999). That number is expected to grow as pike become more abundant and individuals spread to other drainages in search of food or suitable habitat.

The present study seems to be mostly a presence/absence study to determine how far upstream northern pike are currently found in the Susitna River drainage. This species should be specifically targeted for sampling efforts, rather than incidentally captured during sampling for other species because they will not likely be found in large numbers in the mainstem, but may be found nearby in small ponds or lakes. Although this species may currently not be present in habitats directly influenced by changing flows, their distribution and predation on other species may be greatly enhanced by modified flows. In some areas, Northern pike are able to prey upon up to 50% of all outmigrating salmon smolts (Larsson 1985, as cited by Rutz 1999). This kind of predation could have catastrophic impacts on the Susitna River salmon populations. Sampling efforts should be directed at identifying Northern pike distribution, with sampling events outside the Susitna River hydrologic zone of influence. If any sites are chosen specifically for sampling northern pike, other target species may not be found in these areas, or at least not in large numbers, due to the extreme predatory behavior of northern pike. Northern pike have eliminated entire populations of rainbow trout and critically decrease salmon production (Rutz 1999).

Burbot: Burbot are widely distributed throughout the mainstem Susitna River below Devil Canyon, though more abundant in the lower river than the middle river (ADFG 1981c, 1983b; Sundet and Wenger 1984). Adults also seem to prefer highly turbid areas, such as the mainstem and slough mouths (ADFG 1983b), which are difficult to sample or even make observations of fish presence.

Trot lines were an effective method for sampling adult burbot in the 1980s studies, but this species seemed to exhibit a strong trap avoidance behavior, limiting studies that relied upon recaptures (ADFG 1981c, 1983b; Sundet and Wenger 1984). Additionally, trot lines are a lethal capture method, making it a poor method for capturing fish to be radio-tagged or for studies that rely on recaptures. Burbot avoidance behavior could also potentially affect this proposed study, especially growth measurements of individual burbot. Juvenile burbot were most effectively captured by downstream migrant traps; however catches were greatest when traps were set on or within six inches of the substrate (ADFG 1981, 1983a; Sundet and Wenger 1984). If downstream migrant traps are proposed for capturing juvenile burbot, placement of downstream migrant traps should be placed with burbot behavior in mind. It needs to be clarified if burbot catches will only be incidental to outmigrating juvenile salmonids, whereas results may not be useful for relative abundance measures. Also, as stated above, it is unclear if downstream migrant trap crews be PIT tagging juvenile burbot captured with this method,

The Tanana River, a nearby silt-laden glacial river, contains widely distributed populations of burbot which have been studied more successfully than the Susitna River drainage stocks. These studies all used baited hoop traps to capture burbot, which seemed to be an effective collection method (Breeser et al. 1988; Evenson 1988, 1989). In the Tanana River system, burbot were found to migrate large distances during the fall and winter, associated with prey migrations (in the fall) and spawning migrations (in the winter) (Breeser et al. 1988; Evenson 1989). Migrations in the fall were to tributary mouths to capture prey species that outmigrate to overwintering locations in the mainstem (Evenson 1989). Burbot spawning likely occurs from mid-January through mid-February, in the main channel of glacial rivers, during the winter, clear-water period (Evenson 1993; Breeser et al. 1988). Burbot tended to prefer turbid, mainstem areas for rearing during the summer, but a few were also observed in clear water tributaries, in the fall (when mainstem discharge drops) and through spawning periods (Breeser et al. 1988).

Since spawning in the Tanana River, and likely in the Susitna River, occurs during the winter low flows, increased average flows and more variable flows have the potential for major effects on burbot spawning success and population sizes. In the Kootenai River, in southern Idaho, high winter discharges below the Libby Dam have disrupted or delayed long spawning migrations of burbot, resulting in catastrophic changes to population sizes (Paragamian 2005). Additionally, dams can disrupt migrations, due to passage issues, further inhibiting successful spawning (Hesse 1993). Direct measurements of flow need to be collected during the migration period in order to determine burbot flow requirements in the Susitna River. This is a potentially critical period for burbot and should be addressed to assess potential post-project effects on migration and spawning habitat.

Pacific lamprey: Only Arctic lampreys were captured in the Susitna River during the ADFG studies in the 1980s, and in relatively small numbers. Sampling gear was not successful for lamprey because sampling was less intensive in the lower river and relied more on electrofishing, which did not capture many lamprey (ADFG 1983b). The lower river, particularly below RM 50.5 was believed to have abundant populations of Arctic lamprey (ADFG 1983b). In 1981, Arctic lamprey were observed at most of the lower tributary sites, indicating that they are much more abundant than data suggested (ADFG 1981c). Winter sampling was also ineffective at capturing lamprey (ADFG 1983c). Documenting the presence of Pacific lamprey was identified as a data gap, and the study plan should identify methods that will be used to meet this objective.

Arctic lamprey were believed to be anadromous, with a spawning run likely occurring in the spring, and with the majority of anadromous and non-anadromous spawning probably occurring in tributary mouths downstream of RM 50.5 (ADFG 1983b). The study does not appear to consider site-specific information in order to identify lamprey spawning locations. The sampling design of only three tributary mouths sampled monthly in the lower river, all upstream of RM 28, will likely miss most, if not all of anadromous Arctic lamprey spawning in the Susitna River.

Arctic grayling: This species was not listed as a possible fish to track with biotelemetry, even though it is an abundant fish in the Susitna Basin, widely distributed from the headwaters to the lower river and is an important for sport fishing in the middle river (ADFG 2012). Arctic grayling were found to be widely distributed throughout the Susitna River, above and below Devil Canyon, more abundant upstream of the Chulitna River confluence (ADFG 1981c, 1983b; Sundet and Wenger 1984). Adult grayling in the Susitna River tended to favor clear water tributaries during the summer, with the highest catches in Lane Creek, Whiskers Creek, Fourth of July Creek, Indian River, Slough 20, and Portage Creek (ADFG 1981c, 1983b). As the summer progresses, there is a movement from tributary spawning areas into the mainstem for overwintering (ADFG 1981c, 1983b; Sundet and Wenger 1984).

Boat electrofishing in previous, site-specific studies, was the most effective method for capturing Arctic grayling, especially for juveniles (ADFG 1983b). Juveniles were often captured at tributary mouths, excluded from upper more desirable habitat by larger individuals. Young of the year were predicted to also be distributed in the upper reaches of tributaries, near where they emerged (ADFG 1983b). If the current study plans to assess grayling movements within this Susitna River drainage, sampling efforts should incorporate some upper tributary sites in order to evenly capture various age classes. With this method, the timing of fall and spring movements could be characterized, and passage criteria can be measured at the tributary mouths, coinciding with the migrational periods. These kinds of measures could be critical for determining effects of modified flow on movements and survival of this abundant species.

Although fall migrations were evident, winter captures were very low for both adult and juvenile Arctic grayling, and did not provide enough information to assess where they overwinter (ADFG 1983b). Radio tagging and tracking this species may help with identifying these areas, which ADFG (1981) predicted were near the mouths of natal streams.

Longnose suckers: Longnose suckers are widely distributed throughout the Susitna River below Devil Canyon, but with the largest numbers downstream of the Chulitna River confluence (ADFG 1981c, 1983b). However, this was not listed as a fish for potential biotelemetry studies.

Adults were often abundant at the mouths of large tributaries in the 1980s summer studies, such as Lane, Fourth of July, and Portage creeks in the middle river; and Trapper Creek and the Deshka River in the lower river (ADFG 1983b; Sundet and Wenger 1984). However, winter distribution is unknown. Schooling was observed in the mainstem and at tributary mouths in the fall, but these schools were not found during winter months. PIT tagging has the potential to track these movements, but only if longnose suckers move into the specific sloughs or tributaries chosen for antenna arrays. Radio-tagging, on the other hand, may help locate schools within the mainstem, which can then be sampled to determine if schooling behavior continues through the winter months. There should be some room in the sampling approach to sample fish, as well as habitat characteristics, in areas where radio-tagged fish are found in the winter months, outside of the habitats selected for summer sampling. Finding that fish are not where they were in the summer is not enough to estimate project effects on resident fish.

Boat electrofishing was an effective method for catching this species (Sundet and Wenger 1984). And, similar to burbot, round whitefish, and humpback whitefish, many longnose suckers were captured in downstream migrant traps, compared to other fishing techniques. Downstream migrant traps at RM 103 proved to be the most effective sampling method for longnose sucker juveniles (Sundent and Wenger 1984). This should be taken into account when planning operation guidelines for the traps and biotelemetry tagging methods. As these traps have the potential to capture a significant portion of the longnose sucker catch, this would be an ideal time to tag this species.

Bering cisco: In 1981 and 1982, Bering cisco were captured during their upstream spawning migration, which lasted from the first week of September and into October (ADFG 1983a). All observed spawning areas were in the mainstem Susitna River, between RM 75 to RM 85.2. Peak spawning occurred during the second week of October in both years. The current sampling design will not define migration timing or spawning locations of this species, due to little or no sampling effort during their run timing. Additionally, escapement estimates or counts cannot be completed without more data than this sampling design is likely to provide. Previous studies relied on fishwheels to capture Bering cisco, but fishwheels for this study will only be operated through the first week of September. Bering cisco will likely only be captured during one sampling event, during their migration, with no sampling occurring during their spawning period. Sampling effort needs to be increased during this period (September/October) to address this objective.

AEA Study Objective 3: Document the timing of downstream movement and catch for all fish species using outmigrant traps;

FDAML-80 This AEA objective lacks a supporting purpose and is unduly limited to a single method. One purpose could be to document migration timing and abundance of anadromous salmon smolt from the Susitna River. However, "all fish species" are listed as the study objective. The AEA PSP states that sites within side channels that are open continuously throughout the ice-free season will be selected for outmigrant traps. Traps will be operated for 48 hours off. Without further supporting information on the purpose of this study or species-specific methods, it appears that two traps will be deployed and all captured fish will be recorded. There is no discussion on how these data will be used.

While we agree that documenting the timing of downstream movement of fish should be a study objective, the objective should be expanded and the purpose of the study clarified. As stated under our general comments, this will ensure that appropriate methods are selected and avoid collecting biased data that can't be used in the evaluation of project effects. For example, salmon smolt migration may be earlier than downstream movement of emergent fish to rearing locations. The velocities used by migrating smolt may be species specific. Therefore the timing and location of outmigrant traps will depend upon specific study objectives and methods including statistical and power analysis.

AEA Study Objective 4: Characterize the age structure, growth, and condition of juvenile anadromous and resident fish by season;

FDAML-81 The AEA PSP should provide information on why age structure, growth rates, or condition factors are being collected or calculated, and how these metrics will be used in project evaluation or mitigation. The recapture of PIT-tagged fish is the only method that is suggested for measuring growth rates. Specific objectives will affect study design, sampling locations and frequency, the sample size and data analyses. Therefore, specific study objectives must be identified and appropriate sampling and analytical methods selected. For example, flow fluctuation and potential for stranding may vary in relation to proximity to the dam site and channel morphology. A project objective may be to determine if there are longitudinal differences in juvenile salmon growth rates. Study designs could be developed to test for differences in growth rates or condition factors among groups of different geomorphic classification (i.e. mainstem, sloughs, side channels, and tributaries). In this case, growth rates will need to be calculated for each of these replicate locations. As growth rates and condition factors are an indication of habitat quality, regressions with habitat characteristics will require measuring growth rates at locations with variable habitat characteristics. Growth during winter can be an important measure of habitat quality and differences in growth and condition among overwintering site should be determined at multiple replicate locations through the winter. In addition, growth rates should be used in addition to of juvenile salmon density or relative abundance when determining weighted usable area for instream flow analyses (Beecher et al. 2010).

The AEA PSP, in cooperation with the resource agencies, should identify the specific objectives and information needs that require juvenile anadromous and resident fish growth rates. Based upon these objectives, study designs should be developed to document the species, locations, and methods that will be used to calculate growth rates and the analyses that will be applied to the data. Haphazard site selection and the use of growth rates without considering data analyses and application likely will not result in useful data.

AEA Study Objective 5: Document the seasonal distribution, relative abundance, and habitat associations of invasive species (northern pike);

FDAML-82

This AEA objective is directed toward any invasive species but refers to northern pike; therefore, it is unclear whether other invasive species are anticipated or should be considered in the evaluation of this objective. If the intent is to document the seasonal distribution, relative abundance, and habitat associations of other invasive species, if present in samples, then detailed procedures should be provided on how this would be accomplished.

The AEA PSP does not provide a purpose for this objective or how the proposed project may influence the distribution or relative abundance of northern pike (or other invasive species). The PSP states only that northern pike have been observed in the lower river, but does not provide a synopsis of known distribution, relative abundance where present, or known habitat associations. The study plan should review the current information on northern pike and habitat associations and identify how the proposed project may affect current distribution, relative abundance, and available habitats. The proposed study plan should outline the limitations of our current understanding of northern pike distribution within the Susitna River drainage and how the proposed study will build upon this information.

FDAML-83

The AEA PSP provides no description of the sampling locations, timing, frequency, or methods (passive or active) that will be used to document northern pike (or other invasive species) distribution, relative abundance, or habitat associations. A review of methods employed previously by the ADFG should be provided and a description of how and where these methods would be used by AEA to accomplish the stated objective.

FDAML-84

The AEA PSP does not provide any information on data analyses or how information on northern pike would be incorporated into the evaluation of project related effects. Based upon the current PSP it appears that evaluation of northern pike distribution, relative abundance, and habitat associations will consist of reporting when and where there are incidental catches of northern pike through other sampling efforts. Because northern pike are significant, NMFS wishes to discuss below why studies should be more robust.

As stated previously, northern pike are an invasive species in the Susitna River drainage and have spread throughout the system from the Yenta River after being illegally introduced in the 1950s (Rutz 1999). They have been reported to be present in more than 100 lakes and ponds that drain into the Susitna River (Rutz 1999). That number is expected to grow as pike become more abundant and individuals spread to other drainages in search of food or suitable habitat. Northern pike have been observed to eliminate entire populations of rainbow trout and critically decrease salmon production (Rutz 1999).

FDAML-85

The presence of northern pike has had significant effects on salmon populations in multiple Susitna River drainages. A clear understanding of the distribution of northern pike is important for the interpretation of biotic effects to the distribution and abundance of juvenile salmon and other resident salmonid and non-salmonid species. This may be of particular importance for lower sloped streams that have similar physical characteristics to those where pike are currently present. These could include tributaries that will likely be influenced by project operations including Whiskers Creek, Birch Creek and slough, Trapper Creek, Cache Creek, and Rabideux Creek, that provide spawning and rearing habitat for Chinook and coho salmon and rearing habitat for Chinook, coho and sockeye salmon. In addition, as pike distribution increases, the importance of moderate-sloped clear water tributaries to glacial rivers may become more important for salmon as locations where pike are absent. The Middle Susitna River provides important rearing and overwintering habitat for Chinook salmon and displacement of these fish due to project operations could make them more susceptible to predation by pike. Similarly, flow fluctuations during winter could displace overwintering fish from mainstem habitats to backwater locations and increase risk of pike predation. The loss of flushing flows due to project operation, could increase physical habitat characteristics that give pike a competitive advantage.

FDAML-86 The AEA study plan correctly identifies the distribution, relative abundance, and habitat associations of northern pike (and other invasive species) as an important study objective. However, methods that describe how this objective is to be accomplished are missing from the PSP. The AEA PSP should clearly define how the seasonal abundance, distribution, and habitat associations of northern pike (and other invasive species) will be determined and how these data will be used to evaluate the effects of northern pike on the abundance of other resident and anadromous fish. In addition, the proposed study plan should outline potential effects of project operation on the distribution of northern pike. AEA should work closely or contract with the ADFG biologists who have been studying pike within the Susitna drainage to develop a study plan that clearly defines specific sampling methods, including sampling locations, collection and tagging of pike, tracking of tagged fish, and analytical methods appropriate to the stated objective. The analytical methods should calculate the probability of pike presence or absence given the sampling effort.

AEA Study Objective 6: Collect tissue samples from juvenile salmon and opportunistically from all resident and non-salmon anadromous fish to support the Genetic Baseline Study.

NMFS was unable to address this important objective and the parent PSP, 7.14 Genetic Baseline Study, due to a lack of resources given the limitations of the process-driven ILP.

<u>Related NMFS Study Objectives</u>

FDAML-87 The current PSPs should be expanded to add a sampling plan to evaluate water quality and physical habitat characteristics within spawning redds or factors that could influence egg development and fry emergence. The PSPs need to be refined to include methods to measure intragravel water temperatures in redds, measure cumulative thermal units, and determine the relationship between surface water temperature, low and intragravel temperatures. NMFS developed two study objectives to characterize spawning habitat conditions, and we request that FERC order completion of these important studies.

NMFS Study Objective 1. Evaluate salmon incubation (embryo development, hatching success, and emergence times) and monitor associated water quality conditions (e.g., temperature, DO, pH) at existing spawning habitats (slough, side channel, tributary, and mainstem) in areas with and without groundwater upwelling in the middle and lower reaches of the Susitna River.

The construction and operation of the proposed project have high potential to affect spawning habitat quality and survival of incubating salmon. Sockeye, chum and possibly pink and coho salmon spawn in mainstem or off-channel habitat that could be affected by project operations. Characteristics of suitable spawning habitat vary by species but include water depth, velocity, temperature, flow, space, upwelling and downwelling, substrate size distribution, and percent fine sediment (see review in Bjornn and Reiser 1991). Incubation and emergence habitat characteristics include dissolved oxygen, water temperature, biochemical oxygen demand, substrate size, percent fines, channel gradient, water depth, flow, velocity, stream bed porosity, and velocity of water through the redd (Bjornn and Reiser 1991). These spawning and incubation habitat characteristics have the potential to be affected by the proposed project.

FDAML-88

Information on the variability in hatching success among spawning locations and differences in water quality conditions between locations used for spawning and those that have similar characteristics but are not used for spawning will help determine those site-specific characteristics of spawning and incubation. This information will be used by NMFS for determining the project effects on these parameters and developing protection, mitigation, and enhancements for any project license proposal. Collection of this necessary information should be accomplished by comparing water physical and chemical characteristics within the four major spawning habitat types and at locations with and without upwelling in each of these locations. Hatching success and emergence times could be determined from the number of adult females, fecundity, and fry population estimates.

NMFS Study Objective 2. Measure intragravel water temperature in spawning habitats and winter juvenile fish habitats at different surface elevations and different depths to determine the potential for freezing of redds, freezing of juvenile fish, and their habitats.

The construction and operation of the proposed hydroelectric project will result in flow fluctuations to accommodate variable demands for electricity. These fluctuations will occur primarily during the winter when salmon eggs are incubating within the gravel, and juvenile Chinook and other salmonids are using interstitial spaces. Reduced water depths can result in freezing subsurface temperatures and egg mortalities (McNeil 1966) and low water temperatures can delay incubation rates and reduce survival (Murray and McPhail 1988). The formation of ice can displace or kill juvenile fish rearing within the substrate (Brown and Mackay 1995).

FDAML-89

Water temperature should be measured at a minimum of 10 spawning locations and 10 winter rearing locations that, due to channel form, vary in water depth throughout the winter, in order to determine the influence of water depth on bed and intragravel temperatures. Temperatures should be measured 10 cm above the substrate, at the stream bed, and at approximately 10 cm, 20 cm and 30 cm below the stream bed. Data analyses should be conducted to determine a relationship between air temperature and water depth, and temperatures within the substrate used for egg incubation and overwintering fish. These results would be used to determine the water depths necessary to maintain optimal temperatures within the stream bed. This information is needed for NMFS to determine the characteristics of critical overwintering incubation and rearing habitat that needs to be protected from adverse effects of project operations through development of protective measures such as ecological flows, ramping rates, allowable flow fluctuations and other mitigation measures.

Collect and provide the Instream Flow study with habitat suitability criteria (HSC) data to support analysis of potential project impacts.

FDAML-90 HSC is mentioned in Study 6.5, Instream Flow and Aquatic Habitats but the study request objective needs to be addressed also in the PSP relative to Upper, Middle, or Lower reaches for juvenile anadromous, resident fish, and non-salmonid anadromous fish studies. It needs to be clearly describ how HSC information will be collected, particularly in winter for post-emergent fish up to 60 mm when fish will be most vulnerable to load-following operations. There needs to be empirical baseline information collected to evaluate potential project effects and for inclusion in habitat modeling efforts. There is generic reference to developing HSC models in Study 6.5 Instream Flow and Aquatic Habitat, for these species and life stages, but the source of that information needs to be identified.

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7.7 Salmon Escapement Studies

General Comments

ESCAPE-14 The purpose of the Salmon Escapement Study is to assess the current run timing and distribution of each of the five species of salmon among different habitat types in the lower and middle Susitna River, with emphasis on the middle reach. As previous studies have been unsuccessful in consistently measuring spawning in the mainstem, this objective should be considered a priority for these studies. Additionally, it is important habitat characteristics, including water chemistry and physical measures, will be important for determining factors influencing current distribution patterns. This information will be necessary for evaluating the potential for post-project effects on distribution patterns, availability of spawning habitat, and access to spawning sites.

Comments on AEA Study Objectives

AEA Study Objective. 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 and coho salmon in the lower Susitna River.

ESCAPE-25 Methods should describe how fish will be selected for tagging and how tagging effort will be stratified throughout the migration/spawning season. Since fishwheel captures may not be representative of migrating populations (e.g. larger individuals may be less likely to be captured), tagging efforts should be non-random in order to selectively tag fish that are not equally represented.

ESCAPE-07 Additionally, it is unclear why only Chinook and coho are to be tagged in the lower Susitna River, whereas all five species are tagged at Curry Station (RM 103). There needs to be a justification for unequal sampling and tagging effort among species.

AEA Study Objective 2: Characterize the migration behavior and spawning locations of radiotagged fish in the lower, middle, and upper Susitna River.

ESCAPE-12 The proposed methods will miss fish migrating to spawning sites within the middle river that are downstream of Curry. Whiskers Creek (RM 101.4) is a major spawning location for coho salmon, with some spawning by Chinook salmon as well (Barrett et al. 1985), but this tributary will be missed or minimized due to the location of the tagging site 20 miles upstream. Thompson et al. (1986) found that only a portion of fish that spawned downstream of Curry reached this station during milling, and this proportion was directly related to the distance from Curry Station. The further downstream of Curry spawning areas were located, the fewer fish from these areas were captured by the fishwheels. Chinook salmon spawn in three tributaries in the middle river downstream of Curry Station (RM 120); coho salmon spawn in seven downstream tributaries; pink salmon spawn in seven downstream sloughs and 12 downstream tributaries; chum salmon spawn in five tributaries and 8 sloughs downstream; and sockeye salmon spawn in 7 sloughs downstream of Curry Station (Barrett et al. 1985). For Chinook, chum, and sockeye salmon, these sloughs and tributaries did not make up a substantial portion of their total escapement to the middle river, but roughly 78% of the middle river coho and 28.3% of pink salmon escapements to tributaries were downstream of Curry Station.

ESCAPE-35 There is no description of methods to test for effects of radio tagging on survival and behavior. Radio tags can have lethal effects or non-lethal behavior effects on tagged fish, which could lead to changes in speed or direction of movements (e.g. Yanusz et al. 2011, Keefer et al. 2010). A portion of fish above the radio-tagging goals will also be spaghetti-tagged, including all Chinook and coho captured. This less-intrusive tagging method is planned to provide additional movement data beyond the radio-tagged fish movements, but it is not clear if it can be used to test the effects and accuracy of radio tagging efforts. Fish movements observed with both methods should be compared to make an assessment of radio tag effects. However, even spaghetti tags can be stressful to the fish, causing altered migration patterns due to stress (Thompson et al. 1986).

ESCAPE-05 ESCAPE-09 It is unclear why coho and Chinook salmon will be tagged more intensively than other species. It is mentioned that additional marking of sockeye and chum with spaghetti tags could be useful for this study. If these fish will be tagged to determine if fishwheel captures are random, then this needs to be described in a revised study plan. The number of tagged fish necessary to address these concerns needs to be identified to provide a clear objective.

The 1985 salmon escapement study found that fish captured and tagged at the fishwheels were non-random, and thus non-representative of the population (Thompson et al. 1986). They were able to stratify the escapement estimates to the Flathorn Station due to recapture of numbered tags, but estimates for the other stations did not have enough data for this approach. This can greatly bias escapement estimates to the middle river. Thompson et al. (1986) suggests that length data be collected for individuals (as compared to a subsample of each days catch) in order to stratify by size groups because larger fish are less susceptible to fishwheel capture.

AEA Study Objective 4: If shown to be an effective sampling method during the 2012 study, and where feasible, use sonar to document salmon spawning locations in turbid water in 2013 and 2014.

The Columbia River mainstem and Susitna River, are very different. The turbidity of the Susitna River may reduce the effectiveness of sonar surveys for spawning locations. Even when conditions are good, this method could miss large portions of present spawning populations. Tiffan et al. (2004) described DIDSON as a useful tool for identifying fall Chinook salmon redds in the Columbia River, but stated that this method is unable to detect smaller redds and may misidentify bottom features other than redds if the river bottom is not generally smooth. In that study, they were able to verify results with video, a method not feasible in the highly turbid Susitna River mainstem. Additionally, it is not clear if this method can accurately provide results by species or simply give a count of total fish in an area. It needs to be defined how DIDSON results will be verified for accuracy, and how this method be assessed for use in 2013 and 2014. If this method is determined ineffective, an alternative method should be proposed for sampling the turbid mainstem for spawning aggregations.

ESCAPE-29

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

ESCAPE-23 It is unclear how the aerial counts conducted for this study will be used to obtain escapement numbers. Ground surveys or fish sampling methods should be conducted to ground-truth these counts or to determine if sites were spawning or holding sites, but methods only describe aerial counts. Accuracy and precision of aerial counts varies with conditions, reducing counts in areas with high turbidity or depths or overhanging riparian vegetation. Additionally, smaller individuals, such as "jacks" are more difficult to see with aerial surveys, due to their size and lighter coloration (Neilson and Geen 1981). There is no justification why this study has been developed to count Chinook salmon and not the other four species of Pacific salmon spawning throughout the Susitna River drainage.

AEA Study Objective 8: Estimate system-wide Chinook and coho salmon escapement to the Susitna River and the distribution of those fish among tributaries of the Susitna River.

ESCAPE-21 The methods described do not address this objective. There is no clear description of how many weirs will be operated for this study, or how locations for these weirs will be chosen. Looking at mark-recaptures in a few tributaries does not address distribution throughout the Susitna River and its tributaries. Observations, through weirs, foot surveys, or fish sampling methods should be conducted at more tributaries than this study describes. Additionally, no weirs are located within the middle river. As this section of the river has the greater potential for impact by a hydroelectric project than the lower river, it is important to know the distribution and escapement of salmon into these middle river tributaries.

ESCAPE-04 This study objective should be expanded to all five species. NMFS does not agree that escapement, or other studies, should be limited to Chinook and coho when the project is likely to

ESCAPE-17 aeversely affect all five species of Pacific salmon. To determine run apportionment, all macro-habitat types used for spawning (mainstem, tributaries, and sloughs) will also need to be included, not just select tributary counts.

ESCAPE-26 Capture methods for tagging, through fishwheels, may be non-random and disproportionally capture fish of certain sizes or from certain populations (Thompson et al. 1986). Disproportionate sampling would, in turn, lead to incorrect assumptions about project effects, and a poorly informed licensing order.

Related USFWS/NMFS Study Objectives

The ninth specific objective of NMFS study request "Adult Salmon Distribution, Abundance, Habitat Utilization and Escapement in the Susitna River is to

> *measure critical habitat characteristics (e.g., channel type, flow, substrate, and groundwater) at reaches used for spawning and compare these characteristics with those in adjacent reaches that do not contain spawning adults.*

ESCAPE-19 This study request objective is not addressed nor is there any objective that looks at characterizing use, availability, or quality of potential spawning habitats. There appears to be no empirical baseline information being collected; only semi-quantitative surveys to determine distribution and potential abundance of redds. Also, there is a reference to studies evaluating potential dewatering or scouring of redds in Chapter 6, Instream Flow, but no empirical baseline information to assess the potential for daily load-following operations to cause redd dewatering or freezing. This information is needed by NMFS to determine the immediate effect of proposed project load-following operations on incubating salmon in the Susitna River that we will use to develop recommendations of license requirements that would protect salmon.

The eighth specific objective is to

> *determine the availability and accessibility of spawning habitats by adult salmon to mainstem and tributary locations based upon flow regime.*

ESCAPE-15

It is unclear if this specific eighth objective of NMFS Adult Salmon Distribution, Abundance, Habitat Utilization and Escapement in the Susitna River study request is being addressed anywhere in the PSP. It will be important to identify potential barriers to spawning habitats at current flow regimes and how access might change with a modified flow regime. Successful migration into tributaries can be strongly related to water levels at the mouths of the tributaries, with high rates of stranding mortalities in years of low water (Carlson and Quinn 2007). As the proposed flow regime is for increased flows during winter months and reduced flows during summer months, when adult salmon are migrating and spawning, stranding mortality could become a significant factor in spawning success. This concern needs to be addressed in the proposed studies. Flows necessary for salmon access into tributaries, sloughs, and side channels need to be determined for each of the five species.

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7.8 River Productivity Study

General Comments

We believe that this study plan is inadequate to obtain information necessary for NMFS to evaluate an eventual license application; the level of effort expended on this topic does not reflect the importance of productivity to stream ecology and fish production. NMFS's review identifies any deficiencies in AEA's proposed study plans that must be remedied in order for the study results to provide the information NMFS needs to accomplish the following:

- develop effective and well-designed fishway prescriptions;
- develop recommendations to protect, mitigate damages to, and enhance fish resources;
- develop recommendations to ensure that the project is best adapted to comprehensive plans for developmental and non-developmental resources; and
- assist FERC in providing sufficient information on impacts to NMFS trust resources that is necessary for FERC to determine if licensing the project is in the public interest.

Section 7.8 of the PSP should be rewritten following completion of the literature review, completion of the habitat classification and mapping, site reconnaissance by the principal investigators, and in coordination with the resource agencies. The title of this section should be changed to reflect study contents: Macro-invertebrate and Algal Abundance.

Studies that document the variability in the sources of carbon and energy transfer to higher trophic levels are the most important for understanding fish distribution and production, and are most likely to be directly affected by project construction and operation. Within stream primary production, organic matter from terrestrial plants, and adult salmon carcasses provide the food base for all aquatic life within the Susitna River. Major tenets of stream ecology are based on sources and transport of organic matter (Vannote et al. 1980) and the influence of dams (Ward and Stanford 1983) on those processes. There is a large body of literature directed toward understanding factors influencing primary productivity, the delivery, storage, and processing of organic matter, and the influence of carbon sources and production on macro-invertebrate community composition, production, and density.

Over the past 30 years, there has been an increasing number of studies documenting a shift in our understanding of fish distribution from one based solely on reducing energy costs (habitat based on water temperature, and velocity) and avoiding predation (proximity of cover), and competition, toward one that maximizes food intake while minimizing energy lost and the risk of predation (Dill and Fraser 1984, Fausch 1984, Dolloff 1987, Duncan et al. 1989, Adams and Breck 1990). In some cases the abundance of macro-invertebrate drift alone has explained the distribution and growth of salmonids (Lovetang 2005, Urabe et al. 2010). Food availability can affect the depths and velocities selected by drift-feeding fish which has implications toward the validity of habitat suitability indices based on these parameters (Rosenfeld et al. 2005, Rosenfeld and Taylor 2009).

Primary productivity, benthic organic matter, and macro-invertebrate abundance can be modified by hydroelectric development and, therefore, should be addressed by AEA as part of the FERC license application. Suspended sediment can limit light available for primary production (Davis-Colley et al. 1992, Lloyd et al. 1987) particularly in turbid glacial rivers (LaPerriere et al. 1989, Davis et al. 2009). Sediment storage within a reservoir can reduce turbidity and increase primary productivity immediately downstream (Blinn et al. 1998); however, even in clear water, nutrients can be lost within the reservoir through biotic uptake or adsorbed to sediment and deposition thereby limiting downstream productivity (Snyder and Minshall 1995). Primary productivity can vary with changes in water depth (Bensen et al. 2012) or be reduced due to varial zone flow fluctuations (Binn et al. 1998). Transported organic matter is retained within reservoirs reducing downstream carbon availability (see below) and transport and storage can be further affected by flow modifications. The macro-invertebrate community can be altered due to modifications in food sources or food availability or directly through changes in flow and habitat modification.

Primary productivity and benthic organic matter provide the energy base for stream ecosystems. Macro-invertebrates transfer energy from autotrophs or heterotrophs to higher fish and other secondary consumers. Macro-invertebrate drift densities play a large role in fish habitat selection and production and can modify the use different water velocities and depths. Hydroelectric development can directly or indirectly modify productivity rates, organic matter input and storage, and macro-invertebrate production (Gislason 1985), particularly in a glacial system where suspended sediment plays such a large role in species distribution and abundance.

If we are to make informed decisions regarding this proposed project, understanding these relationships should be an AEA and FERC priority. Implementation of the current AEA PSP will not provide the information necessary to test for differences in macro-invertebrate communities or carbon sources among the different macro- and meso-habitats or if these differences affect seasonal distribution of fish species among these habitats. The current study plan will not provide the necessary information to determine the relationship between invertebrate drift abundance (food availability) relative to fish energetic costs, on fish growth rates and subsequent overwintering survival and production. The PSP has not been developed to evaluate the spatial and temporal variability in potential project impacts to the macro-invertebrate community, algal biomass, or benthic organic matter, or the ecosystem characteristics that drive production. Therefore, data from the PSP will not provide the information necessary for NMFS to evaluate the potential effects of the proposed project on the primary and secondary energy sources that support the survival and production of anadromous fish.

Comments on AEA Study Objectives

AEA Study Objective 1: Synthesize existing literature on the impacts of hydropower development and operations (including temperature and turbidity) on benthic macro-invertebrate and algal communities.

As stated in our general comments, synthesizing literature is an important step in the development of our understanding of hydropower's effects on rivers and their denizens. The synthesis of relevant literature will be used by NMFS to determine if study results have provided the information necessary to estimate potential project effects and develop recommended resource protection, mitigation and enhancement measures. The scientific evaluation of the effects of construction and operation of hydroelectric dams on benthic and algal communities, along with site-specific studies quantifying the relationship between these communities and anadromous fish production, will allow NMFS to estimate potential project impacts to trust resources. This information can be used by NMFS to evaluate alternatives that could avoid, minimize, or mitigate these impacts.

RIVPRO-47

This objective should include a literature review and annotated bibliographies of hydropower development and operation effects on benthic and transported organic matter, and ecosystem productivity, not just algal biomass. The PSP should outline the steps that will be used to accomplish this task (i.e. data base searches, key words, resulting product). The literature review should result in annotated bibliographies. All data bases searched and key words should be listed. The bibliography should contain the author's abstract as well as AEAs interpretation of the study relative to the proposed project. Electronic copies of all publications should be provided along with the annotated bibliography. The AEA synthesis should identify all potential project effects and show how AEAs PSP or revised study plans have been developed to adequately evaluate and monitor these potential project effects on the Susitna River.

AEA Study Objective 2: Characterize the pre-project benthic macro-invertebrate and algal communities with regard to species composition and abundance in the lower, middle and upper Susitna River.

As stated in the PSP and above, ecosystem productivity from autochthonous or allochthonous derived organic matter, along with import of marine nutrients, provides the energy sources for the productivity of all other upper trophic levels. Macro-invertebrates transfer energy from primary producers or heterotrophic communities to fish and other secondary consumers. Variability in macro-invertebrate abundance in the drift can be directly linked to the distribution and production of drift-feeding fishes. In addition, macro-invertebrate community composition on the benthos or in drift has been used to evaluate changes in water quality, biotic communities, and physical habitats.

Hydroelectric development and operation can directly affect rates of primary production and organic matter processing through the modification of water depths and wetted area, water quality (macronutrients, temperature, and turbidity), flushing of organic matter, and sloughing of algal communities. Hydroelectric development and operation can therefore, directly and

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indirectly, affect the abundance and productivity of the fish community. Sampling plans for macro-invertebrates, algal community composition, biomass, and productivity, should be developed around understanding their influence on fish distribution and production, and evaluating potential project effects.

Several studies have reported the reduction in benthic macro-invertebrate abundance due to artificially created flow regimes by hydroelectric dams. Rehn (2008) created a multi-metric index of biotic integrity (IBI) with data from 50 dams in California. The results of the study revealed that low IBI scores were most strongly associated with reduced flows below the dam. Blinn et al. (2002) reported findings from a controlled flood below Glen Canyon which showed that 90% of primary producers were removed during flood events along with 50% of the entire invertebrate community.

The unnatural flow regimes created by hydroelectric dams aside from decreasing abundance within the varial zone can also change community composition further downstream. Cortes et al. (2002) found that dams that create constant low flows result in communities dominated by species with short life cycles. This study also found that shredders were proportionately more affected due to the lack of litter input upstream. Dams that create extreme discharges not only scour a larger area and increase the varial zone but they also selectively scour benthic organisms and selectively benefit certain biota (Blinn et al. 1999) effectively changing community composition and altering the timing of life stages. Life-history adaptations for benthic macro-invertebrates involve careful synchronization of life-cycle events to flow regime events. A life history strategy is developed depending on the short and long-term average dynamics of a system. Species would be unequally affected by changes in flow regime based on their life-history and behavioral adaptations to flood and drought events (Lytle and Poff 2004).

Drift invertebrates are also strongly affected by short and long term changes in flow regimes. Like benthic invertebrates these affects are not proportional by species. Perry and Perry (1986) studied the effect of two different flow regimes on a drift community. A slow rate of increased discharge showed a significant difference in drift densities for Ephemeroptera, Plecoptera, Tricoptera and Diptera while a faster rate of increased discharge did not show a significant difference in density for Tricoptera and Diptera. It was also shown that a faster rate of discharge did not increase drift density overall but is selective for certain taxa (Perry and Perry 1986). Similarly, stranding is disproportional among taxa with Chironomidea larvae and *Simulium spp* being stranded in larger quantities than other taxa. This may be particularly significant in the Susitna River as the invertebrate community is dominated by these Diptera.

RIVPRO-49 Measures of macro-invertebrate emergence timing and biomass among macro-habitat locations have been suggested by AEA as an additional project objective. As invertebrate development and emergence are influenced by water temperature and emergence and survival of juvenile fry are linked to this food source, this appears to be a useful addition to this study sections. More information will need to be provided on insect emergence sampling methods, design, and data analyses.

Sampling Locations

NMFS believes the site locations are wrong and unhelpful. The AEA PSP states that benthic and algal samples will be collected at nine mainstem and eighteen off channel habitats above and below the proposed dam site, stratified by geomorphic reach and macro-habitat classification, side channel, side slough, upland slough, tributary, and tributary mouth (the study plan only identifies mainstem, side channels, and sloughs). Six replicates will be collected at each sampling location, and samples will be collected on three sampling dates from April through September. “Woody snags” would be removed from the stream and invertebrates collected from the snags and identified. Measures of depth, water velocity, turbidity, and substrate would be collected at all algal sampling locations. Samples would be collected on three sampling events for two years.

RIVPRO-50 Sampling locations should be selected to obtain replicate measures documenting the range of project effects among main channel and off-channel locations and in order to evaluate the influence of macro-invertebrate and algal abundance on fish distribution and production. The PSP has located three of the proposed nine mainstem sampling locations within and just above the inundation zone. The purpose for sampling within the inundation zone requires clarification, as conversion of mainstem and tributary river habitat into a reservoir will undoubtedly alter the invertebrate and algal community, and pre-project data are not necessary to quantify this effect. However, project effects are likely to be greatest within the tributaries above the inundation zone, where current resident fish populations will be concentrated into a smaller area potentially exceeding production capacity and increasing competition and predation on rearing juvenile Chinook salmon. In addition, these streams will be providing a large portion of the food resources to the fish community likely to develop within the reservoir. Determining the area and quality of remaining stream habitat following project construction is an important project objective. Quantifying macro-invertebrate and algal production and invertebrate drift relative to the abundance of resident fish in tributaries above the inundation zone should be an additional objective. Macro-invertebrate and algal sampling locations should be located within tributaries above the inundation zones. Sampling locations should be sufficient to replicate the different stream types based upon geomorphic habitat classification. Sampling locations should be above the inundation zone in streams that currently support juvenile Chinook salmon. With this information NMFS will be able to estimate potential food resources within these remnant streams and their potential to support fish communities.

RIVPRO-51 Three of the remaining mainstem sites are located below the dam site, but above Devil Canyon. The purpose for selecting these locations is unclear, although likely to characterize distinct geomorphic reaches. Project effects likely will be greatest within these reaches, but they do not overlap with known fish distribution. We agree that documenting changes in the biotic community immediately below the dam is an important objective; however, the PSP should expand upon the reasons sites were selected within this reach, and how these sites be used to determine mainstem and off-channel effects. The PSP should identify the number of sites and replicates that are needed for the statistical design and how the analyses will be conducted. A PSP developed to monitor post-project effects has not been provided; therefore it is difficult to evaluate site selection for this objective. However, in order to evaluate post-project effects we recommend that a minimum of five mainstem sampling locations be selected within this geomorphic reach. Sampling locations should be located near the stream margin and replicate similar meso- and micro-habitat characteristics. Off-channel habitat locations should be selected to adequately characterize these habitats based upon their distribution. If available, 5 replicates of each macro-habitat type should be selected. Similar sites should be identified within the Talkeetna River that replicates these geomorphic and macro-habitat types to allow for post-project statistical evaluation of changes to the macro-invertebrate and algal communities.

RIVPRO-52 The majority of resident and anadromous fish spawning and rearing locations and the area for greatest potential project impacts are between Portage Creek and the three-rivers confluence near Talkeetna. However, the PSP has identified one mainstem and two associated off-channel sampling locations to "characterize" the macro-invertebrate and algal communities within these ~60 miles of river. As a comparison, consider the level of effort directed to measuring these major drivers of stream ecology and fish productivity with the level of effort directed toward monitoring ground water/surface water interactions that influence, to some degree, salmon spawning locations. Sample results from one mainstem and two associated off-channel sampling locations will not provide data that can be used to evaluate the influence of macro-invertebrates or algae abundance on fish distribution among or within macro-habitats or to evaluate potential project effects.

RIVPRO-53 NMFS requests that sampling locations be selected in proportion to the distribution of main channel and off-channel habitats and micro-habitats within these areas. Sampling locations should be selected so that they can be used to evaluate project effects and fish distribution and abundance, and growth rates. Sampling locations should be located above and below major tributaries to evaluate their influence on local invertebrate communities and their contribution to total invertebrate drift. We recommend a minimum of ten mainstem sampling sites between the Indian River and Talkeetna. Additional mainstem sampling sites should be selected to replicate the meso- and micro-habitat within the main channel. These meso- and micro-habitats should represent differences in substrate (woody debris, boulder/cobble, cobble/gravel, sand/silt), proximity to vegetated banks, point bars, and velocities. Extrapolation of habitat values to upper classification levels will require sampling relative to, or quantification of, the abundance of these habitat characteristics within each macro-habitat.

RIVPRO-54 A similar thought process should be applied to the selection of sites to adequately characterize off-channel habitats. The PSP is currently classifying four different off-channel habitats: tributaries, tributary mouths, side sloughs, and upland sloughs. However, there is considerable difference in the productivity among sites of the same classification (i.e. the relative contribution of invertebrate drift to the main channel from the Indian River compared to Whiskers Creek likely is large). Obtaining three replicates of these off-channel sites would result in twelve off-channel sampling locations and a minimum of five replicates is recommended. Replicate sampling within these locations to document differences in invertebrate abundance among different meso-habitats including variations in flow, substrate, depth, and velocity, and macrophytes beds, all of which can be modified by project operation (e.g. flushing flows), would require additional sampling effort.

RIVPRO-55 Algal sampling locations in the middle river, including meso- and micro-habitats should be selected independent of macro-invertebrates, as algae respond to different environmental variables and project effects will vary. However, results should be able to provide information RIVPRO-56 that can be used to evaluate macro-invertebrate and fish distribution as a function of algal abundance, and sampling locations may overlap. Algal growth will vary with differences in light availability (turbidity), water velocity, and nutrient concentrations. Algal biomass likely will vary considerable between tributaries, the main channel, and clear off-channel habitats. Nutrient concentrations could be very different below sloughs and tributaries compared to upstream locations, and nutrients and light can vary within a slough as turbid mainstem water levels increase and decrease with stage height. Haphazard sample location selection without considering and accounting for natural and potential-project related variability in factors influencing algal growth will result in data with little value.

RIVPRO-57 In order to calculate the production potential within sampling locations, samples also must be stratified by meso- and micro-habitats. For example, collection of algal samples only on cobbles within Slough 8A would overestimate the productivity of that location. Samples will need to be collected on different substrate types and then the relative abundance of those habitat types determined in order to estimate production potential for that location. This goes beyond measuring water depth, velocity, and substrate at sampling locations, but requires selecting sampling locations based upon the distribution of water velocities, depths, and substrates. Similarly, Slough 6A (below the beaver dam) more closely resembles a small lake, and phytoplankton (and zooplankton) may explain the apparent high productivity and quality of fish habitat at that location. Measures of ecosystem metabolism may be a simpler and more direct approach (Young et al. 2008) NMFS requests this as a method to measure differences in productivity.

RIVPRO-58 Many of the concerns addressed previously apply to site selection in the lower river below the three-rivers confluence. Sampling to explain fish habitat distribution should consider previous comments. However, an important lower river objective is to determine the current and post-project contribution of BOM and invertebrate drift to lower river sites. Current and post-project productivity could be much different in the Susitna River than in the Chulitna River due to differences in channel form, substrate, nutrient concentrations, temperature, and turbidity. Therefore, current and post-project changes in organic matter and invertebrate drift to the lower river could extend project effects downstream. A sampling plan should be developed around this objective, which will require sampling locations in the Chulitna and Talkeetna Rivers as well as Susitna River sites below the confluence.

Sample Timing and Frequency

Benthic macro-invertebrate sampling for monitoring purposes is generally conducted in early spring prior to emergence and in late fall to allow for summer growth. Summer sampling will be used to estimate differences in food availability among locations, which is important for understanding the distribution of juvenile bottom-feeding resident fish (e.g. burbot and suckers). Additional sampling would be necessary to measure secondary production or to determine if there are multiple cohorts in a season. Sample collection frequency should document potential project effects, particularly changes in flow and temperature. Sampling prior to and following storm events could be used to evaluate the response of the community to the flow regime. Therefore, we are not opposed to the current sample timing, but request that the PSP identify sampling locations that can be used to evaluate changes in the invertebrate and algal community following high flow events. To accomplish this objective a subset of the mainstem, side-channel, and side-slough habitats should be identified and samples collected following a storm with flows of sufficient magnitude to breach the upstream end of the selected side sloughs.

RIVPRO-59 Algal sample timing in the current AEA PSP is proposed to be concurrent with benthic macro-invertebrate sampling. Algal sample collection; however, must be conducted to characterize the variability in algal abundance relative to changes in nutrient concentrations and turbidity. Sample timing based changes on nutrients availability and turbidity may not overlap with proposed macro-invertebrate sampling. Algal sample timing and frequency should be developed to evaluate changes relative to parameters that influence growth. The availability of solar energy and nutrients is greater in early spring. Turbidity is lower during the early spring, increasing with the contribution of glacial flow. Solar input is greater prior to leaf-out and nutrient concentrations often are higher due to reduced uptake by terrestrial vegetation. Algal sample timing should begin in early spring with frequent sample collection in order to measure the change in biomass relative to changing solar radiation, turbidity, and nutrient concentrations. This information must be used to evaluate post-project effects as project construction likely will alter all three of these variables. Water depth and storm flows are the other two variables that can influence algal sloughing and production, and should be accounted for when selecting sample timing and frequency. Sample locations at multiple depths across the channel could be used to estimate changes in algal biomass due to seasonal or project-related changes in water depth. Algal biomass will vary considerable before and after flushing flows, so samples must be collected prior to and following storm events. Reduced turbidity in the late fall also may provide a brief period of algal production. Algal sampling also should be collected in the fall to document this period of potential increased production. As an alternative, AEA should consider seasonal measures of ecosystem metabolism that integrate the effects of multiple different parameters influencing algal productivity.

Sampling Methods

The AEA PSP states that benthic macro-invertebrates will be collected from riffles within each macro-habitat unit. Samples will be collected with a Hess, Surber, or Slack sampler. Six replicates will be collected at each sampling location.

We do not agree with sample collection of riffle habitats only. NMFS believes that sampling should occur at locations relative to the distribution of meso-habitats (substrate, depth, velocity, water quality, macrophytes, etc.) and request the study be expanded accordingly. As stated previously, this represents only one meso-habitat and will bias characterization of invertebrate communities. In addition most of the locations referenced do not contain riffles to sample. If meso-habitats heterogeneous within each macro-habitat, then sample locations should be stratified based on their relative abundance and processed individually or composited.

Sampling methods should be used that are quantitative and appropriate for fine and coarse substrates. ASCI methods (Major and Barour 2001) are based upon a composite of 20 samples collected proportionally to habitat availability (including woody debris, roots, and macrophytes beds) using a "D" frame kick net. Mesh size is important as the community is made up of many small organisms (~300 µm mesh is standard). This methodology; however, does not allow for determining invertebrate density which is an important metric. One possibility would be supplementing benthic samples using a Hess sampler with qualitative samples of unique habitats. Multiple samples at one sampling site should not be considered replicates of that habitat type, but metric means calculated (or samples composited) to obtain one value for that site, unless they are replicating meso-habitats within a site. Field sorting of macro-invertebrates should not be conducted. Any proposed sub-sampling method should be included in the PSP.

The PSP does not provide any detail on algal sample collection methods or sample handling and processing. Stating that methods will follow unspecified state protocols and a list of citations is not sufficient for evaluating the proposed PSP methodology. The methods should describe how samples will be collected from the multiple different available substrates. NMFS believes these questions should be answered: Will samplers look for stones of a given size and flat surface, thereby, biasing results, or will sample substrate be based upon predetermined criteria? Will entire substrate be cleared of algae or a portion of the substrate delineated for sampling? How will the area sampled be measured? Will duplicate samples from the same substrate be collected to allow for species identification, AFDM, and chlorophyll-*a* analyses? How will samples be preserved in the field without degrading chlorophyll-*a*? How many replicates will be collected to represent each site and each meso-habitat within each site? How will sampling deal with the patchy distribution of algae within a macro-habitat? Will laboratory sub-sampling occur prior to algal species identification?

Data Analyses and Reporting

The PSP provides no information on how results will be analyzed or incorporated into the project evaluation (however see comments on HSC below). For example, given the level of effort presented in the PSP, we will have one macro-invertebrate metric value (based on 6 replicates at one location) for the mainstem Susitna River from Devil Canyon to the confluence. So we will know that, for example, the dominant taxa is *Chironomidae* at 80%, or percent EPT is 12%. It is unclear how these values could be used to evaluate project effects or be representative of food resources for upper trophic levels. In view of this, NMFS asks that the sampling plan be developed so that statistical analyses can be conducted to test for differences in macro-invertebrates and algae among the identified macro and meso-habitats within each geomorphic reach. This will allow NMFS to evaluate if differences in fish distribution are related to the differences in these indicators of productivity. Combined with the evaluation of project effects to the macro-invertebrate and algal community we can estimate indirect project effects to anadromous fish either directly or through instream flow analyses.

In summary, NMFS believes that objective 2 can be enhanced by identifying sampling locations that can be used to evaluate post-project effects and test for differences among macro and meso-habitat types. Within the upper river, this will include sites in tributary streams above the inundation zone. Sites below the dam but above Portage Creek will be used primarily to evaluate post-project effects and should provide enough replicates for post-project evaluations, the details of which should be provided in a separate post-project monitoring plan. Sampling locations within the middle river from Portage to Talkeetna should be increased substantially to adequately replicate the macro-habitat types and meso-habitat characteristics. Project effects and anadromous fish abundance is greatest within this reach which should be reflected in the level of effort to document macro-invertebrate and algal communities. Sampling timing and frequency should be based on the life history of the target species (macro-invertebrates) and the parameters influencing algal productivity. The statistical design should allow for testing for differences among habitats and by season and to identify the relationships between water quality (i.e. nutrients and turbidity), algal abundance, macro-invertebrate communities, and fish distribution and production.

AEA Study Objective 3. Estimate drift of benthic macro-invertebrates in habitats within the lower, middle and upper Susitna River to assess food availability to juvenile and resident fishes.

A large number of studies have shown importance of macro-invertebrate drift in explaining the distribution, abundance, and growth of drift-feeding fishes including most salmonids. Project operations including direct effects of variable flows and indirect effects on primary production and organic matter storage can influence invertebrate drift density. Therefore, understanding the relationship between project operations and drifting invertebrates, and fish distribution is an important project objective.

RIVPRO-63 The AEA study objective, to "estimate" drift of benthic macro-invertebrates, does not reflect the importance of this topic in understanding project effects to the biotic community. Sampling locations, timing and frequency should be selected to quantify differences in drift among habitats and be used to evaluate seasonal and spatial fish distributions and differences in potential project effects.

The AEA PSP methods suggest sampling macro-invertebrates in the drift at nine of the benthic collection sites. Duplicate samples will be collected. Water velocity will be measured when nets deployed and just before removal.

As discussed for benthic invertebrate sampling location selection, the purpose for upper river sampling site selection is unclear and these reasons should be explained within the PSP. We believe that documenting invertebrate drift in tributaries above the inundation zone may be important to evaluate food available to the resident and anadromous fish remaining in these reaches and as a contribution to the reservoir.

Sampling Locations

RIVPRO-64 One sampling location for invertebrate drift between Devil Canyon and Talkeetna will be inadequate for accomplishing project objectives. Invertebrate drift sampling locations should be adjusted to coincide with juvenile and resident fish sampling. Mainstem sampling locations should be located above, within, and below major tributaries. These sampling locations will be used to document the contribution of tributaries to mainstem drift and to determine if food availability is related to rearing fish abundance at these locations. Macro-invertebrate drift (or plankton tows) should be replicated at all macro-habitat locations concurrent with fish sampling. Replicate samples should be collected within each macro-habitat; however, drift abundance does not likely vary with the same meso-habitat characteristics that influence benthic macro-invertebrate distribution. Terrestrial invertebrates in the drift likely vary with proximity to riparian vegetation and must be considered when sampling locations are selected (Johansen et al. 2005). Macro-invertebrate drift should be measured in the Chulitna and Talkeetna Rivers near the confluence to determine the relative contribution of the Susitna River to downstream food resources.

Sample Timing and Frequency

RIVPRO-65 Drift sample timing and frequency should be based upon life history and habitat use of drift-feeding fish and to evaluate potential project effects and not concurrent with benthic invertebrate sampling as proposed in the AEA PSP, otherwise the PSP is deficient. For example, what is drift density during sockeye fry migration from spawning locations to summer rearing habitat? Tributary drift should be measured to account for relative productivity among sites during summer and to determine if changes coincide with late summer Chinook and coho migrations. Invertebrate drift should be used to document summer rearing and overwintering habitat quality for juvenile salmonids. Sample collection should occur in the early morning and evening to document densities during peak fish feeding activity.

RIVPRO-66 Drift sampling should be conducted to documents potential project effects. Variations in flows and flows that breach the upper end of side sloughs alter macro-invertebrate drift densities. Flood flows may capture many terrestrial insects and result in increases in invertebrate drift. The PSP should reflect a review of relevant literature to determine other potential project effects on invertebrate drift and incorporate this information into the study design.

Sampling Methods

RIVPRO-67 Macro-invertebrate drift sample collection, preservation, and processing should be clearly explained. The PSP fails to provide for that. Mesh sizes, area of sampler, and sample depth (surface and depth) can influence the composition of drift. Mesh size should be fine enough to capture Chironomids and early instars of other taxa. Mesh size of approximately 300 μm is suggested. Due to the high concentration of fines within the mainstem, drift nets could clog within minutes resulting in the loss of samples. Therefore, samplers should be monitored during sample collection. Multiple samples may need to be collected in order to get an accurate measure of drift abundance (portion of day sample represents). Measures of water velocity when installing and removing the nets (along with the area of the net opening) will not provide an accurate measure of the volume of water flowing through the net as changes in velocity during this time will not be linear. The use of flow meters (e.g. General Oceanics) within the net opening that document total flow would be more accurate.

RIVPRO-68 Stream water turbidity and inorganic suspended sediment should be measured concurrent with fish and drift sampling. Changes in visibility caused by sediment can reduce fish capture efficiency and should be accounted for in analyses relating fish distribution with invertebrate drift abundance among macro-habitat types.

RIVPRO-69 The methods for sample storage, preservation, sorting, and identification should be provided. Drift samples should not be subsampled for identification. Weight and length/weight relationships should be obtained for all taxa and instars so that the biomass of drift can be calculated. Invertebrate biomass data will be necessary for analyses of fish feeding studies and trophic analyses if mass-balance methods are used.

Data Analyses

RIVPRO-70 No information is provided on how drift data will be analyzed, what statistical methods will be used or how the data will analyzed and used to explain differences in fish distribution and production or to evaluate potential project effects. The selection of appropriate sampling locations, sampling timing and frequency, and number of replicates depends upon clear project objectives and the statistical design. All of these components are lacking. As written, completion of this study will not produce any useful data. The PSP needs to be revised to include an a priori description of the data analysis methods and a power analysis needs to be conducted to determine needed sample size. *A priori* power analysis needs to be conducted prior to the research study to estimate sufficient sample sizes to achieve adequate power. *Post-hoc* power analysis, conducted after the study has been completed using the obtained sample size and effect size to determine what the power was in the study, is unacceptable to NMFS.

AEA Study Objective 4: Conduct a literature/data search to identify existing river systems that could act as surrogates in evaluating future changes to productivity in the Susitna River.

RIVPRO-71 The agencies request that sampling locations including replicate macro and micro-habitat types be identified on the Talkeetna River and be used to provide reference data for post-project evaluation. A PSP for post-project monitoring has not been provided; therefore, we will reserve comment until that time.

AEA Study Objective 5: Conduct a review on the feasibility of a trophic analysis to describe potential changes in the primary and secondary productivity of the riverine community following Project construction and operation.

Hydroelectric facilities clearly have the potential to reduce the carbon food base which effect fish production. Dam effects to the organic matter base have been found responsible for the decline in Kootenai River sturgeon (Perry and Perry 1991, Snyder and Minshall 2005) and in the Colorado River (Minkley 1991, Blinn et al. 1999). Pre- and post-project trophic analyses would

RIVPRO-72 provide a method to evaluate and mitigate potential project effects to the Susitna River. We believe that a thorough review prior to developing PSPs that create monitoring plans would be beneficial. All of the information requested under Study Objective 1, should be provided as a product of this review.

AEA Study Objective 6: Generate habitat suitability criteria (HSC) for Susitna River benthic macro-invertebrate and algal habitats to predict potential changes in these habitats downstream of the proposed dam site.

RIVPRO-73 This study plan does not provide enough information to evaluate whether the stated objective will be met. The AEA PSP states that habitat suitability criteria would be determined concurrent with macro-invertebrate and algal sampling at the 27 sampling locations above and below the dam stratified by macro-habitat type and collected three times from April to September. HSC would be determined from measures of water velocity, substrate, and depth concurrent with macro-invertebrate and algal sampling.

As stated previously, the level of effort (sampling locations, replication among macro and meso-habitats, and sampling frequency) is totally inadequate given the importance of this topic. The sampling plan had not been developed to evaluate the response of the macro-invertebrate community to changes in these three parameters nor does it include, or control for, the numerous other parameters that influence invertebrate community composition, richness, or diversity.

Macro-invertebrate communities are composed of multiple different species that occupy areas of variable velocity and depth. Within the Susitna River, tolerance for highly turbid waters or differences in dissolved oxygen could result in shifts in macro-invertebrate habitat preferences. Diet preferences of target fish in the Susitna River should be used to determine macro-invertebrate species for HSC if determining changes to food availability for fish is the purpose of this study. Macro-invertebrates in the diet of burbot and suckers and juvenile whitefish are likely much different than those selected by drift-feeding fishes. The portion of terrestrial invertebrates also will vary among drift-feeding fishes (e.g. juvenile sockeye versus Dolly Varden).

HSC for fish are generally not transferable among stream locations (Persinger 2003, Guay et al. 2001) and this generalization is likely true for macro-invertebrates as well, particularly when there are large differences in stream physical and chemical characteristics. The PSP should be modified to define the purpose for HSC development for macro-invertebrates and algae, and provide methods on field site selection, sampling timing and frequency that will be used to meet this objective. Water velocity at 0.6 x d is unrelated to the velocity, sheer stress, and boundary conditions experienced by macro-invertebrates. Therefore, methods to measure velocity at scales applicable to organisms under investigation should be established. Alternately, Froude number or sheer stress could be used to represent stream bed flow conditions.

AEA Study Objective 7: Characterize the benthic macro-invertebrate compositions in the diets of representative fish species in relationship to their source (benthic or drift component).

RIVPRO-74 This study objective differs from the agency study objective which is to "characterize trophic interactions using seasonal diets (stomach content analysis) of all age classes of non-salmon anadromous, resident and invasive fish species."

Determining the food resources used by fish within the Susitna River is an important project objective. Whether the PSP will accomplish the purpose of this objective is unclear. The purpose of the AEA study appears to be determining the dominant organisms in the diet of different fish species and if fish species are selective in their diets or if consumption is proportional to availability.

The proposed methodology should select sampling locations based upon the objective rather than in association with sampling conducted to meet other objectives. Target fish species and life stages should be identified. These should include all age-classes of non-salmon anadromous, resident, and invasive fish species as proposed by the USFWS. Fish sampling locations should represent the macro-habitats used by the target fish species and life stage. An appropriate sampling size should be determined *a priori*. Sampling methods for each species and life stage should be identified, along with sample handling, preservation, and analyses. Invertebrate weight data should be used to determine biomass in addition to numbers of each species consumed. The analytical methods should be described as well as how the results will be applied to evaluating potential project effects.

AEA Study Objective 8: Characterize organic matter resources (e.g., available for macro-invertebrate consumers) including course particulate organic matter, fine particulate organic matter, and suspended organic matter in the lower, middle, and upper Susitna River.

The AEA PSP is insufficient for characterization of the evaluation of the role of benthic and transported organic matter as the primary food base for productivity with the Susitna River or to evaluate potential project effects and needs to be revised as requested based on the following discussion:

Benthic organic matter is likely the most important source of carbon within the Susitna River. Bacterial colonization increases the nutrient content and quality of BOM and initiates decomposition, facilitating macro-invertebrate ingestion and metabolism. Construction and operation of hydroelectric facilities can influence the transportation, storage, and processing of BOM through multiple different pathways.

Several studies on the Colorado River have shown that the greatest proportion of organic matter transported below hydropower dams is in a smaller size fraction, and that coarse particulate organic matter and large debris accounts for a very small percentage of total organic matter transport (Angradi and Kubly 1994, Lieberman and Burke 1993, Lieberman and Burke 1991, Shannon et al. 1996). The presence of a dam reduces the ratio of CPOM:FPOM because the dam blocks the downstream transport of coarse stream detritus (Ward and Stanford 1983, Perry and Perry 1991). However, contributions from the reservoir depend on the type of release from the dam (Perry and Perry 1991). Seston from the reservoir was not abundant in the reach below the Hungry Horse Dam (Kootenai River), which has a hypolimnal release, but reflected the composition of particulate organic matter in water discharged selectively from Libby Dam (Perry and Perry 1991).

The dominance of FPOM below dams alters the benthic macro-invertebrate community favoring organisms in the grazer and filter feeder feeding groups (Angradi and Kulby 1994, Blinn et al. 1999, Lieberman and Burke 1993, Lieberman and Burke 1991). In fact, shredders are absent below the Glen Canyon Dam (Angradi and Kulby 1994). The altered food base in conjunction with modified physical and chemical conditions below can support a benthic macro-invertebrate community, although less diverse and productive than natural systems (Matter et al. 1983).

A large proportion of organic matter transported in reaches below hydropower dams consists of periphyton, macrophytes, and algae scoured from substrate below the dam (Angradi and Kulby 1994, Matter et al. 1983, Perry and Perry 1991). A study below the Glen Canyon Dam on the Colorado River found that the largest proportion of coarse particulate organic matter (CPOM, particles >1mm) transported consisted of the algae that originated below the dam (Angradi and Kubly 1994). Another study below the Hartwell Dam, GA, found that particulate organic matter collected in drift nets was primarily algal strands and mats scoured from the stream bed during flood releases (Matter et al. 1983). Jakob et al (2003) also found that seston chlorophyll values decreased significantly the day after flooding due to the major scouring of macrophytes. However, these carbon sources may be lacking in the Susitna River.

Backwater areas can be an important source of particulate organic matter to the mainstem during flood flows (Angradi and Kubly 1994, Lieberman and Burke 1993, Lieberman and Burke 1991, Perry and Perry 1991). Only sustained high flows are capable of flushing particulate organic matter from backwaters on the lower Colorado River (Angradi and Kubly 1994, Lieberman and Burke 1993, Lieberman and Burke 1991, Behn et al. 2010). At high river stage, water runs freely through the backwaters, whereas at low water levels backwaters become isolated pools or drain back into the main channel—backwaters may be lentic or lotic depending on river stage (Lieberman and Burke 1993). Backwaters on the lower Colorado River that are close to the Davis and Parker Dams are flushed almost on a daily basis, whereas others have little direct exchange with the main channel (McKinley 1979). Contributions from backwaters also depend on the vegetation within them and how frequently they are flushed (Lieberman and Burke 1993).

Behn et al. (2010) found that the standing stock of benthic organic matter in backwaters was seven times higher relative to main channel depositional areas across all flow regimes. Calculated residence time during fluctuating discharge ranged from less than five minutes in small, shallow backwaters to 28 hours in a large, deep backwater. The study indicates an estimated 2.3 and 6.5 turnovers of water per day for fluctuating flows and steady flows, respectively. Benthic resources are less susceptible to export from the backwater than water-column resources; however, because turnover rates for virtually all backwaters exceeded once per day, the rate of exchange may influence the accumulation of benthic organic matter and invertebrates (Behn et al. 2010).

Streambed and bank erosion contribute to increased particulate organic matter during flood flows (Lieberman and Burke 1993, Lieberman and Burke 1991). Maximum particulate organic matter concentrations are often associated with flash floods when shifting streambeds and increased bank erosion contribute sediment (Lieberman and Burke 1993, Lieberman and Burke 1991). In a study below the Punt dal Gall Dam, transported seston consisted mainly of coarse particulate organic matter derived from the river channel and the streambanks as water levels increased due to experimental floods (Jakob et al. 2003). High flows flush this varial zone and remove duff accumulated from riparian vegetation (Shannon et al. 1996, Blinn et al. 1999). Below the Hungry Horse dam on the South Fork Flathead River, Montana, the two largest size fractions (165-1000 μm) increased by 15 to 20 times and the two smallest fractions (0.45-165 μm) by 3 times with the increase in flow (Perry and Perry 1991).

The magnitude and frequency of floods play a role in the transport and availability of organic matter. At the Punt dal Gall Dam, an experimental discharge of a 30 m^3/s resulted in greater scouring and 4-5 times higher seston load compared to 10 m3/s experimental flood (Jakob et al 2003). Another study below the Punt dal Gall Dam showed similar results (Robinson et al. 2004). The first flood was a relatively low magnitude event (peak flow of 16 m^3/s and discharge of 10 m^3/s) and had patchy effects—there was differential loss of macrophyte coverage. The second flood (peak flow of 43 m^3/s and discharge of 25 m^3/s) mobilized most areas of the streambed and changed channel morphology, causing major reductions in macrophyte biomass. The amount of benthic organic matter present was also lower following this flood, a result not observed after the first flood (Robinson et al. 2004).

The serial discontinuity concept postulates that the position of a dam on the longitudinal river profile determines its impact on the ecology of downstream waters (Ward and Stanford 1983). Generally, this concept suggests that the ecological effects of dams on rivers decreases with increasing distance from the dam, depending on streambed and bank sediment availability and the influence of tributaries (Ward and Stanford 1983).

Both field studies and modeling support this concept and show that particulate organic matter concentration increases with distance downstream from a dam site due to tributary sources, as well as allochthonous and autochthonous sources (Angradi and Kubly 1994, Webster et al 1979, Matter et al 1983). Particulate organic matter concentrations increased by 25% at Lee's Ferry, 25 km downstream of the Glen Canyon Dam, due to tributary inputs and to a lesser extent to lotic autochthonous production (Angradi and Kubly 1994).

RIVPRO-75

This partial review of the literature raises a number of questions that should be addressed through studies being developed and implemented in support the FERC license application:

1. What is the current change in concentrations of BOM in the mainstem from the dam site to the confluence?
2. Are there significant differences in BOM among and within macro-habitat sites and is this related to the adjacent plant community?
3. How does the magnitude of overtopping flows affect BOM storage within side channels and side sloughs or the flushing of organic matter?
4. How important are beaver and woody debris dams on the retention of organic matter in side channels, side sloughs, and upland sloughs?
5. How will variable ramping rates influence the transport (flushing) of organic matter from upland and side-sloughs?
6. Is there a relationship between BOM, macro-invertebrates density, and rearing juvenile fish abundance or distribution?
7. How does the variation in water temperatures and water chemistry among macro-habitats influence BOM decomposition rates? Will these rates change with different plant species?
8. Could high concentrations of BOM result in anaerobic conditions in sloughs during winter?
9. How important are flood flows for the accrual of BOM relative to other lateral inputs and the total carbon budget?
10. What role do tributaries play in the delivery of organic matter to the Susitna River?

AEA's PSP states that in order to quantify the amounts of organic matter available in the Susitna River for river productivity, CPOM and FPOM (specifically FBOM) will be collected concurrently with all benthic macro-invertebrate sampling (Objective 2, Section 7.8.4.2.1). Suspended FPOM (seston) [27 locations three times from April through September] will be collected at same time and alongside invertebrate drift sampling (Objective 3, Section 7.8.4.3). Organic matter collection will be conducted using methods compatible with other Alaska studies, to allow for comparable results. State and federal protocols will be considered as study plans are developed, in consultation with resource agencies.

While perhaps not all of the list of questions raised in regard to BOM can be addressed, it is unclear how the PSP will address *any* of them. The purposes for BOM sampling need to be clarified, as well as the reasons behind the selection of sampling locations, sample timing, or sampling frequency. Sample collection methods and analyses are not provided, and there is no discussion on how the resulting data would be used to evaluate project effects.

RIVPRO-76

Many of these questions regarding project effects could be addressed through careful site selection, sample timing and frequency. Sample sites located in the mainstem above and below major tributaries and within those tributaries could evaluate mainstem longitudinal changes and, along with measures of TOM and tributary discharge, the role of tributaries in the organic matter budget. Replicate seasonal samples within each macro-habitat and at replicate macro-habitat locations could be used to test for significant differences among sites and between seasons. BOM and TOM sample collection at select sites prior to and following storm events along with data from flow routing studies (over topping flows) and geomorphology studies (bed sheer stress) could be used to test for flow-effects on organic matter retention in sloughs. Sites with and without beaver dams and quantification of debris dams could help identify the influence of these structures on organic matter retention. TOM sampling at the mouth of upland sloughs following storms could be used to estimate the effects of ramping rates on BOM flushing.

The use of leaf packs to measure organic matter processing at sloughs is a standard method (Young et al. 2008) that could be used to evaluate influences of temperature and nutrient concentrations on food processing. Alternately, measures of ecosystem respiration relative to BOM standing stocks and TOM could be used to assess organic matter processing and carbon spiraling lengths (Thomas et al. 2005).

BOM and TOM collection methods need to be described. The methods should identify the number of replicate samples at each site. Mesh sizes (UPOM, FPOM, CPOM) and whether nets will be nested should be clarified. The methods should state whether benthic samples will be open to transported material during sample collection. Methods should describe the depth the substrate will be disturbed and how sample loss will be avoided in cobble and boulder substrate. Methods for collecting samples in fine substrate without measureable velocity should be provided. Organic matter deposition can be patchy, so the process for selecting a site to place the sampler or to deal with unequal distribution of organic matter within a habitat should be explained. How samples will be preserved, stored, processed, and analyzed should be described.

In summary, organic matter is one of the primary carbon sources for production within the Susitna River. Previous studies have shown that hydroelectric development can significantly alter the distribution and abundance of this food resource resulting in changes in to the macro-invertebrate and fish community. In order for NMFS to adequately evaluate the proposed project, we must understand the distribution and processing rate of organic matter among the macro-habitats used by anadromous fish. Sampling methods must be refined so that differences among macro-habitats can be distinguished from differences due to variable from sample collection methods and processing. Where possible, sampling locations, timing, and frequency should be selected to evaluate changes in BOM as a function changes in natural stream conditions that may mimic proposed operational scenarios.

AEA Study Objective 9: Estimate benthic macro-invertebrate colonization rates in the middle and lower reaches to monitor baseline conditions and evaluate future changes to productivity in the Susitna River.

Using a stratified sampling approach, a field study proposed to be conducted by AEA will estimate potential benthic macro-invertebrate colonization rates for different seasons in the Susitna River. Sets of three to five preconditioned artificial substrates will be deployed incrementally for set periods of colonization time (e.g., 12, 8, 6, 4, 2, and 1 weeks) and then pulled simultaneously at the conclusion of the colonization period. Artificial substrates will be deployed at three depths at fixed sites along the channel bed. Benthic macro-invertebrate colonization rates may be conducted in a variety of habitats (e.g., turbid vs. non-turbid areas, groundwater upwelling areas vs. areas without groundwater upwelling). Benthic macro-invertebrate processing protocols would be identical to those used in sampling.

RIVPRO-77

The study plan currently does not provide enough information for critical review. In is unclear how proposed methods would allow for "monitoring baseline conditions" or "changes in productivity." While the overall approach appears sound, site selection and the disturbance regime should more closely resemble potential project effects. The effects of dewatering and recolonization will be much greater during the winter when load following is proposed. Only short term exposure to temperatures well below freezing may result in macro-invertebrate mortality. Effects will vary by species and frequency and duration of exposure. Exposure duration may not mimic currently operational flows that may dewater a site twice a day throughout the winter. Project effects and varial zone area will change with distance from the dam and channel geomorphology. Therefore, sampling locations should be selected to evaluate different levels of proposed project effects.

Operation of the proposed project will modify the daily and seasonal hydrograph. Flow fluctuations will be greatest during winter periods of load-following. Dewatering of substrates can result in the loss or reduction of macro-invertebrate density (Perry and Perry 1986, Hunter et al. 1992). The effects of flow fluctuations will vary with differences in channel morphology. Determining colonization rates is an important objective and colonization time lags have been incorporated into instream flow analyses (Hardy and Addley 2003).

NMFS recommends that the PSP be revised to identify sampling locations that reflect the distribution of macro-habitats important for anadromous fish within the Susitna River. Methods to document the colonization rates among these habitats should reflect the expected disturbance regime imposed by the project operation. This includes both the season and daily variability in flows.

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7. 9. Characterization of Aquatic Habitats in the Susitna River with Potential to be affected by the Susitna-Watana Project

General Comments

The classification of habitats based upon characteristics that influence fish distribution is of primary importance for the development of study plans directed toward the evaluation of project effects to fish and other aquatic organisms. In general we believe that there are only moderate differences between the AEA proposed upper level classification and our approach. Some of these differences likely can be addressed through clear descriptions and definitions. However, these differences must be addressed prior to sampling site selection and data collection. Specifically, habitat classification must be hierarchical (upper levels set bound on lower levels) and be based on factors influencing fish distribution. That is, turbid side channels and turbid mainstem channels are likely to provide the same fish habitat. In addition, the methods proposed for habitat classification are reasonable, with some modification to address the influence of differences in discharge on the assignment and quantification of habitats.

The goal of this proposed study is to characterize all aquatic habitats that have the potential to be altered by project effects. Due to the size of the study area, the AEA PSP proposes to use different data collection methods at different locations, based upon the degree of potential impact and hence, differences in data quality. The goal of the study is to "characterize all aquatic habitats with the potential to be altered and/or lost as the result of reservoir filling, hydropower operations, and associated changes in flow, water surface elevation, sediment regime, and temperature." Study objectives subdivide the study area into mainstem and tributary habitat in the inundation zone, the middle and lower river (RM 28), and upper river tributary and lakes upstream from the dam site to the Oshetna currently accessible to fish or that will be accessible from the reservoir. Initial classification would be based upon descriptions developed previously by the ADFG which includes main channel, side channel, off-channel, tributary mouth, and tributary (in AEA Table 7.9.1, but not in Figure 7.9.10). Off-channels would be further classified as side sloughs, upland sloughs, and other off-channel types in Figure 7.9.10, but subdivided differently in the Table, with three types of "other off-channel types" listed.

The difference and significance of differentiating between main channel and side channel are not defined, but is presumed to be due to the portion of flow in each. Similarly, the differences between side sloughs, upland sloughs, and other off-channel habitat are not defined, but may be retaining the initial ADFG system and be based upon a connection to the main channel at a defined flow or stage. To this point, the classification is based upon differences in geomorphic and hydrologic process and to some extent water quality (portion of main channel turbid flow). All of these locations provide habitat for different fish species and life stages, and can't be used as a "habitat" classification for any given species. Fish distribution is likely related more to different levels of tolerance to turbid water and water sources characterized by the agency-identified macro-habitats, which varies among these locations but also seasonally within the main channel. Upper and lower river tributaries also should be classified geomorphically based on slopes, confinement, width/depth, or substrate (*sensu* Rosgen 1994). Tributaries may not be directly affected by the project; their characteristics provide habitat preferences for different fish species, which can have important implications for understanding migration and seasonal distribution patterns.

AQHAB-15 NMFS requests the following changes to the habitat classification system that is to be used for developing study plans needed to determine the effects of this project.

Level 1 classification should be based upon geomorphology and applied to mainstem and tributary river segments. For example, if the methodology proposed by Rosgen were applied, the mainstem Susitna River including side channels could be considered as "D" channel type and tributaries primarily "A" and "B" channel types. The exact methodology is less important that the geomorphological characteristics that drive classification at this level.

AQHAB-16 The next level of classification should describe the variation in habitat characteristics restrained by the upper level. AEAs PSP is confusing because they attempt to force categories developed for type "A" or "B" streams (using the Rosgen classification methods again as an example). Classification based upon variability in flow types, riffles, runs, pools, cascades, etc., are applicable subdivision of type "A" or "B" streams but not the mainstem Susitna. The USFWS classifies habitats within the mainstem floodplain as primary channels, flood channels, tributary mouths, spring channels or floodplain ponds. This classification is similar to the classification developed by the Alaska Department of Fish and Game in the 1980s and adopted by AEA which includes main channels, side channels, side sloughs, upland sloughs, and tributary mouths. We believe that differences between these two habitat classification methods can be reconciled by defining these classifications.

AQHAB-17 The next level of classification within these "macro-habitats" should be developed based upon characteristics that influence fish distribution. These meso-habitats should be selected that describe the variability in fish among macro-habitat types. Current AEA proposed classification methods do not capture classification at this level. NMFS recommends continued discussions to develop appropriate classification at this level.

AQHAB-18 The limitations of aerial video and remote imagery should be established through ground surveys. This was not shown in the PSP. Although aerial video may be useful for habitat mapping the scale of delineation must be described in order to determine its usefulness in conjunction with ground surveys. The frequency and number of sites ground surveyed will also be determined by the objective's definition of scale. The remote imagery will only be used to cover the mainstem channel and larger tributaries. It is unclear whether an attempt will be made to cover sloughs and side-channels off the mainstem even if there is sufficient open canopy. In addition ground surveys in the upper reach will only be conducted on the mainstem and tributaries. The accuracy and statistical significance of the data collected for habitat mapping would be compromised if some habitats are missed due to the inability of aerial imaging to capture them. Ground surveys should be used to classify habitats that cannot be visualized with remote imagery or videos.

AQHAB-19 Ground surveys will be an important supplement to aerial video mapping, but their application toward determining the accuracy of aerial videos is needs to be adequately described. Not only will ground surveys provide data for habitats unidentifiable by aerial video mapping (due to vegetative cover) but will be useful in evaluating video mapping accuracy. Although it is mentioned in the methodology that a subset of sites will be used to refine video mapping and verify its accuracy a standard of accuracy is not specified. A standard of accuracy must be set before initiation of sampling that determines the amount of ground-truthing data that must be collected. Ground-truthing must also be conducted during a similar flow as when the video was obtained or else it may show more inaccuracies than actually exist. Therefore, methods must be developed to evaluate the accuracy of habitat mapping based upon aerial videos.

AQHAB-20

Video was conducted in early September, 2012, when flows were low (10,000 cfs) and the water was relatively clear. Habitat mapping using video imaging from fall after leaf-off can result in inaccurate classification of habitats due to low flow conditions. This may result in erroneous meso-habitat classification due to differences in backwater at different stage heights. Although these conditions may be the best for image quality (lack of vegetative cover), sampling only during low-flow conditions is inadequate. Habitats that are only present during high flow would not be properly classified. A classification scheme should be designed that is independent of and sampling needs to be done during both high and low flows. This is especially important if these data are to be combined with data from other studies to assess project effects on aquatic habitat.

Comments on AEA Study Objectives

AEA Study Objective 1: Characterize the existing upper mainstem Susitna River and tributary habitat within the proposed inundation zone.

AQHAB-21

The purpose for the application of this classification method to upper river tributaries and mainstem locations within the inundation zone is unclear. The PSP does not describe this objective's purpose. We ask that AEA write a clear, direct objective purpose with the following considerations. We are unsure, given AEA's limited resources, why this is being conducted.

The upper river mainstem within the impoundment zone should be classified to the macro-habitat level (i.e. off-channel habitats) to determine the overall distribution of fish habitat. It is unclear within the PSP whether off-channel habitats are to be further characterized by aerial methods as side sloughs, upland sloughs, backwaters, ponds, or relic channels (as listed in table 7.9-1 of AEA's PSP) or if they will be further classified into meso-habitats. If off-channel habitats are not being further delineated and mapped then the reasons for this limitation within the objective must be detailed. Although there may be a limited number of off-channel habitats compared to the Middle reach they may contain unique and abundant suitable habitat for a variety of species and should be addressed.

Previous impoundment studies in the upper river have caught burbot, longnose suckers and round white fish in backwaters and sloughs off the main channel so we know that some species reside in these areas (ADFG 1983). The distribution of off-channel areas above the inundation zone may be important for determining remaining habitats important to many resident and anadromous fish species. For example, if radio-tagging and tracking resident fish to overwintering locations in the mainstem, and since the mainstem in this zone will be inundated, it does not seem that mapping mainstem or tributary meso- and micro-habitats will be of much value. However, the proportional distribution of fish habitat for different life stages within or out of the inundation zone would be more important, as this is the scale of impact, as opposed to impacts that may modify macro- or micro-habitat characteristic (i.e. pools/riffles, undercut banks, w:d ratios, LWD, etc.)

AEA Study Objective 2: Characterize the middle (RM 98 to RM 184) and the lower (RM 28 to RM 98) mainstem Susitna River channel margin and off-channel habitats using the Susitna-Watana Project habitat classification system and standard U.S. Forest Service (USFS) protocols, with modifications to accommodate site-specific habitats.

AQHAB-22

NMFS supports the classification of the Susitna River into macro-habitats based upon channel morphology and water quality as proposed once differences with USFWS classification methods have been worked out, but believes that the PSP fails to adequately classify habitat. As stated in our general comments, additional discussions among agencies and AEA will need to establish applicable meso- and micro-habitat classification methods. The current AEA PSP classification of meso- and micro-habitats is unclear and needs to be refined. The Fish and Aquatics TWG are developing a Susitna River classification system based off of the USFS Aquatic Habitat Surveys Protocol (USFS 2001). It is stated in the PSP that the TWG will make adjustments and modification to the protocol where necessary; however, in TWG meetings it has been detailed that these procedures will be modified in the field (TWG meeting Oct 25, 2012). While it is expected that methods may have to vary depending on what challenges arise in the field, more detail needs to be provided within the study plan describing initial methods for review. The USFWS previously recommended the use of micro-habitat classifications for large rivers, such as Beechie (2005). Although this habitat classification scheme will be useful for a possible framework, the uniqueness of the Susitna River system must be kept in mind. The USFS habitat classification is based on data collected from southeastern Alaskan streams (USFS 2001) and will likely require many modifications to be suitable for the Susitna River and associated tributaries and off-channel habitats.

AQHAB-23

The variability in habitat characteristics within each macro-habitat will be important for our understanding of factors influencing fish distribution and production and are likely to be characteristics influenced by project operations. Therefore, clear definitions of classification at this level will need to be established. Lateral main channel habitat classification may be most important for the distribution of fish. Juvenile salmonid abundance is likely to be greater along the stream margins than in mid-channel, and greater along vegetated banks with a complex distribution of velocities and depths than adjacent to unvegetated point bars (micro-habitat classification outlined below). Fish use of off-channel habitats appears to vary with water source. Ground-water dominated side sloughs support sockeye and chum salmon spawning, side sloughs and upland sloughs with a surface water connection appear to provide important rearing habitat, while upland slough habitat quality may vary with concentration of dissolved oxygen.

AQHAB-24

NMFS believes that the study area must extend below RM 28 because the project effects may reach further than areas the PSP projects. Lastly, state and federal agencies have resource responsibilities and authorities that extend below RM 28. These include, but are not limited to the aquatic resources within the Susitna Flats State Game Refuge, beluga whales and their habitats, and anadromous and resident fish and their habitats. We remained concerned with the stunting of the proposed project-effects boundary at RM 28, and the fact that project impacts are not proposed to be assessed within the full extent of natural resource agencies management authority. The applicant refers to RM 28 as the "potential zone of project hydrologic influence" without any documentation or validation of this claim. Resource agencies have repeatedly expressed concern with this designation.

AEA Study Objective 3: Characterize the tributary and lake habitat upstream from the proposed Watana Dam site to the Oshetna River (RM 184 to RM 233.4) that is currently accessible to fish from the Susitna River or that would be accessible due to inundation of existing fish passage barriers after the reservoir is filled.

AQHAB-25 The purpose for classifying tributaries and lakes upsteam from the inundation zone, is unclear and should be clarified. Clear objectives and the purpose for the study are necessary for evaluation of the proposed methods. If classification is being conducted to quantify remaining post-project habitat, then the relationships between fish species and macro- meso- and micro-habitat characteristics must also be established. Current upper river fish study plan methods have not been developed to establish these relationships.

AQHAB-26 We recommend initial classification of tributaries using the Rosgen geomorphic classification method (Rosgen 1994), similar to the USFS Tier II habitat classification described. This level of classification could be followed by the classification of flow types. More specific habitat classification should be based upon characteristics of fish-habitat relationships important for fish within these tributaries (similar to micro-habitats listed below for the mainstem Susitna). Further classification of lakes is not provided but should include lake surface area, perimeter, bathymetry and whether or not there is a surface water connection to Susitna River tributaries. The purpose and applicability for Tier III classification for Susitna River tributaries should be clarified as they were likely developed to evaluate potential effects from timber harvesting that can result in changes in peak flows, fine sediments, and LWD input. The influence of woody debris on channel morphology and the creation of slow-water habitats, for example, is likely much different in the Tongass Forest than in the high elevations of upper river tributaries.

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7.10 The Future Watana Reservoir Fish Community and Risk of Entrainment Study

General Comments

NMFS did not submit a study request for this topic; however, after reviewing AEA's PSP and recently reviewed historic reference documents we have comments and recommendations for expansion of the PSP developed by AEA.

The overarching goal of this study is to evaluate the direct effects of the Project on the fish community in the zone of the future reservoir, their habitat within the inundation zone, and potential loss of fisheries resources from entrainment. One of the specific objectives is to develop scenarios for future fish communities based on current fish species composition upstream of the proposed dam site and anticipated reservoir habitat characteristics.

RESFSH-1 NMFS requests that future fish population development scenarios include alternatives that consider development of resources that would benefit commercial and subsistence fisheries in addition to the PSPs goals of creating sportfishing and recreational opportunities.

These alternatives falls within the range of resource enhancement goals that may be developed by the stakeholders. Assessing the potential for enhancing fish species that would support commercial and subsistence fisheries would help NMFS develop recommendations that would adequately and equitably protect, mitigate damages to, and enhance, fish and wildlife (including related spawning grounds and habitat) affected by the development, operation, and management of the project per §10(j) of the FPA.

The reason for this analysis is to incorporate current fisheries passage and enhancement analysis into comprehensive decision making, and provide information NMFS can use to develop:

- proposed measures and plans to protect; mitigate, or enhance environmental resources;
- FPA section 18 fishway prescriptions for passage of anadromous fish;
- FPA section 10(j) recommendations to protect, mitigate damages to, and enhance fish and wildlife resources; and
- FPA section 10(a) recommendations to ensure that the project is best adapted to comprehensive plans for developmental and non-developmental resources.

The PSP describes the nexus between project operations and direct, indirect, and/or cumulative effects as understanding the relationship between project design, operations, lacustrine habitat, and the potential project impact, and development of protection, mitigation and enhancement measures. The proposed Watana reservoir has the potential to provide public benefits in the form of recreational fishing opportunities. Identifying the potential fish community and species valued as sportfish is also important for identifying alternative fishery management strategies in advance of project construction.

The concept of upper Susitna River salmon enhancement was studied by ADFG in 1985 (ADFG 1983). That study was significant because it determined that only the cost of volitional fish passage (e.g., a fish ladder for upstream passage) eliminated enhancement from further consideration. It determined that construction of fish passage was theoretically possible from an engineering and construction standpoint, and that the upper watershed had significant potential for enhancement of production of at least four species of salmon from the Susitna River.

RESFSH-2 NMFS recommends that the upper river enhancement potential for salmon be reconsidered today as an alternative for the future reservoir fish community. In addition to providing recreational benefits, the proposed Watana reservoir has the potential to provide for enhanced commercial and subsistence fisheries and ecological values in the entire watershed and beyond: to the species marine habitats of the Gulf of Alaska. The 1983 ADFG FRED division study (ADFG 1983) of the potential for enhancement of salmon populations into the Upper Susitna River, its tributaries and interconnected lakes, estimated the production capability of the upper watershed for all species of Pacific salmon, except pink salmon. The conclusion was that the costs of passage over the two-dam conceptual project at that time outweighed the benefits from a salmon enhancement project, but that the salmon enhancement program was feasible if the Susitna River dams were not constructed. Given smaller project of today and the improvements in fish passage engineering made in the last decades, salmon enhancement in the upper river is worth reconsidering. The changing climate and increasing stream temperatures in the lower watershed also make enhancement of the upper watershed a viable mitigation option in consideration of future climate conditions and warming.

If, as proposed, project operations reduce summer high flows in the Susitna River through Devil Canyon, passage of salmon may increase. This is especially likely if the theory that summer high flows create passage barriers at the three rapids within the canyons proves true. If fish passage facilities are prescribed for the project, then the enhancement of the upper river would become a potentially viable option. Instead of or in addition to sport fisheries and recreational opportunities, NMFS recommends studying the potential for enhancement of commercial and subsistence fisheries within the future reservoir. In addition to Chinook, which are known to inhabit the upper river, NMFS recommends studying the potential for the reservoir and upper river to support sockeye, chum and possibly Coho salmon.

To address entrainment, NMFS recommends consulting the Fish Screen and Bypass Guidance contained in NMFS Anadromous Salmonid Passage Facility Design document.

http://www.nwr.noaa.gov/Salmon-Hydropower/FERC/upload/Fish-Passage-Design.pdf

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7.11 Study of Fish Passage Feasibility at Watana Dam

General Comments

NMFS's comments are based on the operative Proposed Study Plan of record in this matter, filed on the FERC docket in July 2012. On September 24 and 25, 2012, NMFS convened Fish Passage meetings and began to informally resolve study issues with AEA and other state and federal agencies and stakeholders per Section 5.11 of the ILP. This process is ongoing, and NMFS is hopeful it will result in agreement to pursue the necessary information for the licensing process, but NMFS supplies these comments on the July 2012 Proposed Study Plan in order to ensure a complete record. Some portions of AEA's July 2012 Proposed Study Plan may have been superseded in principle by intervening developments, but remain as the FERC record.

On its website on October 31, 2012, AEA posted a document it termed a draft Revised Study Plan (RSP). In the draft RSP, AEA proposed revisions to its July 2012 Fish Passage Feasibility PSP. Notably, the draft RSP now includes development of three conceptual alternatives for fish passage and the process would begin nearly a year earlier than AEA had initially proposed. NMFS has not had sufficient time to review this draft RSP, because we received it less than two weeks before our comments on over a dozen filed PSPs were due to FERC (as noted in our letter to FERC of October 31). Thus our comments are based upon the July plan and its failures to address the goals and objectives of the May 31, 2012, NMFS Fish Passage study request. As a result, portions of these comments may not match provisions of the newly released draft RSP.

NMFS does address herein some accommodations reached in person with AEA regarding its concerns with the July PSP. Revisions to the PSP as reflected in the new draft RSP may solve, or conversely may complicate, NMFS's original concerns. While NMFS mentions some of the revisions developed at and since our September meetings, we are adhering to the FERC mandated ILP process. In its new draft RSP AEA appears to be referring to results from some of the 2012 fisheries studies, reports of which have not yet been provided to NMFS. Lacking these reports limits our ability to begin review of the revised version of the July PSPs.

The July 2012 Fish Passage Feasibility PSP states that AEA will address information needs for NMFS to determine the feasibility of developing mandatory fishway prescriptions. However, NMFS objectives in the Fish Passage Study Request also include, if warranted, developing preliminary fishway prescriptions.

Section 18 of the FPA states that FERC "shall require the construction, maintenance, and operation by a licensee at its own expenses of such...fishways as may be prescribed by the Secretary of the Interior or the Secretary of Commerce, as appropriate." 16 U.S.C. § 811. Section 18 authority is delegated to the NMFS within the Department of Commerce and to the USFWS within the Department of Interior. For resources under its jurisdiction, NMFS may prescribe fishways as necessary to maintain all life stages impacted by the project. Congress has provided guidance that fishway prescriptions are limited to physical structures, facilities, or devices necessary for such protection; and project operations and measures related to structures, facilities, or devices necessary to ensure effectiveness. Pub. L. 102-486, title XVII, § 1701(b), Oct. 24, 1992, 106 Stat. 3008. FERC shall incorporate these mandatory conditions in a hydropower project license, or the Services may reserve their authority to include a fishway prescription in the future.

NMFS requested that FERC order completion of our Fish Passage Study Request as part of the study plan determination in our comments on the Preliminary Application Document and pursuant to 18 CFR Section 5.9(b), which comments NMFS filed with FERC on May 31, 2012.

Discussion

The central features of the proposed project are the 750 foot high dam at river mile 184 and the reservoir extending about 43 miles upriver of the dam. The dam as proposed would block the upstream and downstream passage of Chinook salmon (*Oncorhynchus tshawytscha)*, and possibly other salmon species and resident fish that migrate through and use the proposed Susitna-Watana dam site and upstream habitat in the river and its tributaries. The reservoir would inundate some tributary spawning habitat, alter or remove rearing habitat, affect migration both up- and down-stream for juveniles and adults, isolate tributaries from the mainstem as water levels rise and fall, and change the bioenergetics, temperatures, turbidity and physical and biological characteristics of the river below the dam as the natural river flows are altered by project operations.

Chinook salmon are known to migrate to the Upper Susitna River as far above the proposed dam site as the Oshetna River and to successfully spawn and presumably rear there. The first report of "any numbers" of anadromous fish above Devil Canyon was on August 5, 1982, when the Susitna Hydro Aquatic Studies Group made their first sighting of adult Chinook salmon upstream of Devil Canyon (ADFG 1983). A report from Milo C. Bell, P.E. to Lowell S. Barrick, P.E. ADFG in 1983 documents the flow conditions measured in Devil Canyon at the time those fish were presumed to have migrated upstream through the canyon. Chinook salmon adults and eggs were found in the upper Susitna River between the Devil Canyon rapids and the Devil Creek rapids for the first time ever in 1982 by ADFG staff. It is the professional judgment of the ADFG that juvenile Chinook salmon are produced in the upper Susitna River. (ADFG 1983). Devil Canyon is the presumed partial velocity barrier to upstream salmon migration at high flows; this remains unknown however.

Chinook salmon were documented in two tributaries to the proposed reservoir during ADFG sampling efforts in 2003 and 2011. Juvenile Chinook were found in Kosina Creek in 2003, one adult was observed in 2011 at an approximate elevation of 2,800 feet; juveniles were also found in the Oshetna River near its confluence with the Susitna River (ADFG 2003a, ADFG 2011b). Additional studies were conducted by AEAs contractors and ADFG in 2012, preliminary reports indicate that numbers of adult Chinook salmon were located above the proposed dam site; NMFS has not yet been provided with these reports. The 2012 studies were qualitative.

Neither the upstream extent of Chinook migration nor Chinook use of tributary or mainstem habitats is known definitively. It suspected that some Chinook that are spawned in the upper river migrate downstream to rear in the middle river as rearing habitat is limited in the upper river. All salmon that are spawned above the dam site do of course migrate downstream to Cook Inlet and the Gulf of Alaska. Little else is known about anadromous species use above the dam site in either the Susitna River or its tributary streams, as Susitna studies ceased in 1985 when planning for the previously proposed hydropower project was shelved and there was little need for expensive and logistically challenging fisheries research to be conducted in this remote and undisturbed location.

Essential Fish Habitat for salmon in Alaska includes all habitats used for spawning and incubation, rearing, and migration, including the upper Susitna River.

In NMFS's study request for fish passage, NMFS adopted the AEA's 2012 baseline data collection study objectives for the distribution of Chinook salmon and other fish species above Devil Canyon, with some requests for expansion and modification. This baseline data collection effort is planned as a multi-year fish study that includes data collection beginning in 2012 as pre-ILP studies, with two additional years proposed by AEA under the ILP study process.

NMFS requested the following modifications to the 2012 and ILP baseline data collection study objectives:

- NMFS disagrees with the three-year limit of the study period. This short study period is inadequate to understand adult migrations especially at a time when stocks, particularly Chinook, are low and their abundance above the project may be drastically reduced. NMFS continues to recommend that fisheries surveys be conducted for at least one average life span of each salmon species, which is an average of five years for Chinook salmon (range of three to seven years). This is needed to obtain the *minimum* amount of biological information about the population that is necessary to develop and design mitigation measures, and to determine the need for fish passage for this large original project located in a near-pristine environment.

- Fish surveys should be designed and conducted to determine the occurrence and timing of all species and life stages of anadromous and resident fish that migrate both upstream and downstream of the proposed dam site. Data without all species and life-stages is insufficient to inform passage due the variability in year-class strength as evidenced by the recent Alaska-wide downturns in productivity and abundance of Chinook salmon stocks.

- Genetic samples collected from Chinook salmon should be analyzed to assess the genetic makeup and viability of this population to determining the viability of this population and thus inform the need for fish passage of Chinook salmon for this project.

It is necessary to collect and analyze sufficient numbers of genetic samples from Chinook salmon adults and juveniles at collected from tagging sites, spawning sites and rearing sites to determine if they are distinguishable from other Susitna Chinook populations. It is unknown whether fish migrating into the upper river are genetically distinguishable from fish spawning elsewhere in the Susitna watershed, but given the amount of genetic variability known to occur in the species in the Susitna drainage, it is likely that any significant genetic differentiation would be detected. It is also uncertain if fish spawned in the upper river rear in that habitat, or migrate downstream to rear in the middle or lower river, or both. Collection and analysis of genetic material from these fish is needed for NMFS to try to determine the role of upper river Chinook to the Susitna River stock.

NMFS provided generic guidance on methodology and information needs for determining fish passage feasibility and design from NMFS's Anadromous Salmonid Passage Facility Design document (NMFS 2011). Given the height of the proposed dam however, NMFS advised it would be prudent to involve NMFS fish passage engineers directly in determining the feasibility of fish passage at the Susitna-Watana dam. NMFS offered to be available to discuss the criteria in general and in the context of the specific site. The applicant was encouraged to initiate coordination with NMFS fish passage specialists early in the development of the preliminary design to facilitate an iterative, interactive, and cooperative process.

NMFS requested that feasibility planning for fish passage facility design begin with early coordination with NMFS Fish Passage Engineers, starting with site reconnaissance and review of preliminary engineering designs. Collection of baseline biological information, site information, and project operations information essential to determine the need to prescribe fish passage for the proposed project was described and requested as follows:

Design Development Phases:

1) Conduct a reconnaissance study - An early investigation of one or more options for project design, siting and suitability of the proposed project design and construction of some type of fish passage facility.

2) Conceptual alternatives study - List the types of facilities that may be appropriate for accomplishing objectives at the proposed project site. It should result in a narrowed list of alternatives that merit additional assessment or explain the need for development of a novel alternative.

3) Feasibility study - An incrementally greater amount of development of each design concept (including a rough cost estimate), which enables selection of a most-preferred alternative.

4) Preliminary design - Additional and more comprehensive investigations and design development of the preferred alternative, and results in a facilities layout (including some section drawings), with identification of size and flow rate for primary project features. Cost estimates are also considered to be more accurate. Completion of the preliminary design commonly results in a preliminary design document that may be used for budgetary and planning purposes, and as a basis for soliciting (and subsequent collating) design review comments by other reviewing entities. The preliminary design is commonly considered to be at the 20% to 30% completion stage of the design process.

5) Detailed design phase - Use the preliminary design as a springboard for preparation of the final design and specifications, in preparation for the bid solicitation (or negotiation) process. Once the detailed design process commences, NMFS must have the opportunity to review and provide comments at least at the preliminary design, 30%, 60% and 90% design completion stages. If substantial changes are still needed beyond the 90% stage, NMFS will review and comment on these as well. These comments usually entail refinements in the detailed design that will lead to operations, maintenance, and fish safety benefits. Electronic drawings accompanied by 11 x 17 inch paper drawings are the preferred review medium.

Preliminary Design Development – Required Site Information:

1) Functional requirements of the proposed fish passage facilities as related to all anticipated operations and river flows. Describe median, maximum, and minimum monthly flow rates through the planned hydro facility, plus any special operations (e.g., use of flash boards, seasonal storage or drawdown etc.) that modify forebay or tailrace water surface elevations or river flows. Identify proposed project operational information that may affect fish migration (e.g., powerhouse flow capacity, period of operation, etc.).

2) Site plan drawing showing potential location and layout of the proposed downstream and upstream passage facilities relative to planned project features facilities.

3) Topographic and bathymetric surveys, particularly where they might influence locating fishway entrances and exits, and personnel access to the site.

4) Drawings showing elevations and a plan view of planned flow diversion structures, including details showing the intake configuration, location, and capacity of project hydraulic features.

5) Basin hydrology information, including daily and monthly streamflow data and flow duration exceedance curves at the proposed fish passage facility site based on the entire period of available record. Where stream gage data is unavailable, or if a short period of record exists, appropriate synthetic methods of generating flow records may be used.

6) Project forebay and tailwater rating curves encompassing the entire operational range.

7) Predict river morphology trends. Because the fish passage facility is proposed at a new diversion, determine the potential for channel degradation or channel migration that may alter stream channel geometry and compromise fishway performance. Use results from the instream flow and geomorphology studies to describe whether the stream channel is stable, conditionally stable, or unstable. Estimate the rate of lateral channel migration and change in stream gradient that has occurred over the last several decades. Also, describe what effect the proposed fish passage facility may have on existing stream alignment and gradient and the potential for future channel modification due to either construction of the facility or continuing natural channel instability.

8) Special sediment and/or debris problems. Describe conditions that may influence design of the fish passage facility, or present potential for significant problems, such as glacial silt loads.

9) Provide other site-specific or species-specific information that will inform the fishway designs and operations.

10) Derive hydrographs showing daily average river flow over the entire period of record for the proposed project area extrapolated for future projected change in hydrology.

11) Measure and report the stream bed profile (feet per mile) and composition, including the river from its mouth to the proposed project site for each species listed above. In the vicinity of the proposed project impoundment, provide three-dimensional

topography/bathymetry including proposed location of the dam (spillway, power intakes, non-flow areas) and reservoir up to the maximum inundation expected.

Preliminary Design Development – Required Biological Information:

1) Identify each species and life stages to be passed downstream.

2) For each downstream migrating species and life stage, estimate the start and end date of the downstream migration. Identify how future project operations (reservoir storage, powerhouse flow and spillway flow) may alter migration timing. Identify effects of future project features such as altered prey or predator concentrations, temperature changes, lighting changes, flow alteration and others.

3) For each downstream migrating species and life stage, determine the range of fish size, swimming ability (darting, sustained and cruising speeds) over the range of environmental conditions, run size, operational conditions and behavioral constraints to downstream fish passage.

4) Derive the standard downstream fish passage design flows for the passage season by calculation of the 5% (high design flow for fish passage) and 95% (low design flow for fish passage) exceedance flows (based on daily average flow) for the downstream passage season for each species and life stage.

5) Identify each species and life stages to be passed upstream.

6) For each annual upstream migrating species/life stage, determine the start and end date of the upstream migration.

7) For each upstream migrating species and life stage, determine the range of fish size, swimming ability (darting, sustained and cruising speeds) over the range of environmental conditions, run size, operational conditions and behavioral constraints to upstream fish passage. Identify spawning location for each salmonid species present at the site.

8) Identify other anadromous species and their life stages that are present at the proposed project site that also require intermittent passage.

9) Identify predatory species (avian, terrestrial, and aquatic) that may be present and prey on juvenile or adult anadromous species, and describe how the proposed project could affect populations or concentrations of these predators.

10) High and low design passage flow for periods of upstream fish passage. Derive the upstream fish passage design flows for the passage season by calculation of the 5% and 95% exceedence flows (based on daily average flow) for the passage season for each species and life stage to be passed upstream.

11) Identify any known behavioral factors that might affect salmonid passage. For example, most salmonid species pass upstream through properly designed orifices, but other species that are unable to pass through orifices may impede salmonid passage. In addition, some salmonid species may not pass through orifices. Other examples of

behavioral factors that should be considered include schooling behavior, migration depth, preferred water temperatures, potential reaction to natural and artificial vertical structure and cover, reaction to lighting, diel passage patterns, reaction to flow velocity gradients and others.

12) Identify what is known and what needs to be researched about upstream and downstream fish migration routes approaching the proposed project.

13) Compile available information on the minimum and maximum streamflow that will allow upstream migration up to the proposed project.

14) Describe the degree of activity (fishing/bears/otters) in the area of the proposed project and the need for measures to reduce or eliminate fishing activity.

15) Identify water quality factors that may affect fish passage at the site. For each species/life stage migration, estimate the start and end date of the migration and assess the potential variation in migration season based on environmental factors (e.g., Changes in water temperature, impoundment effects, forebay delay, water temperature (average and reservoir profile), egg hatch timing, dissolved oxygen, low river flow, high river flow etc.). Fish may not migrate if water temperature and quality are marginal, and may instead seek holding zones until water quality conditions improve.

Assessment of Operational Impacts on Fish Passage for the proposed project will require the following project-specific information:

1) Forebay rating curve - Provide the expected operation of the forebay for the migration season for each species and life stage to be passed downstream. Include expected operations for future years given the climate forecasting hydrology study results (snow pack, stream gaging, glacial meltwater). The rating curve should display day of year as the independent variable and forebay elevation as the dependent variable, and should also include appropriate bands identifying each migration season.

2) Tailwater rating curve - Provide the expected tailwater operation for the extent of the upstream migration season. The rating curve should display day of year as the independent variable and tailwater elevation as the dependent variable, and should also include appropriate bands identifying each upstream migration season.

3) Turbines - Turbine design should maximize fish survival through the turbine, and minimize turbulence and total dissolved gas uptake in the tailrace. Derive the expected effects of passage through turbines for the range of sizes of fish expected in the project forebay. Include blade strike, scraping of fish (between the blades and hub and between the blade tips and turbine housing), the pressure change within the turbine, and the pressure profile from fish migration depth through the turbine intake, through the turbine, through the draft tubes and into the tailrace.

4) Draft tube velocity - Calculate draft tube velocity range for all standard operations, including turbine up ramp rates and turbine shut down rates. Identify turbine intake locations, in elevation relative to the range of forebay elevation. Identify draft tube discharge depth and locations in relation to tailrace.

5) Sediment capacity - By collection of stream samples over the entire range of expected stream flows, model the change in reservoir bathymetry over a 50-year period in annual increments.

6) Reservoir hydraulics - By computational fluid dynamic model, demonstrate the reservoir velocity contours in increments of 0.01 ft/s (or as appropriate) for each forebay level expected over the downstream migration season, in five foot increments. Include powerhouse flows, spillway flows and seasonal flow storage volumes. Include the entire reservoir, but data is most important and therefore should be the most detailed around the dam structure.

7) Flow continuation - Identify means of providing continuous instream flow if turbine and/or spillway becomes inoperable.

8) Upstream passage flows downstream of the project – Identify minimum instream flow that will provide optimal upstream passage up to the proposed project, including habitat impacts from proposed project revising the flow regime downstream of the project.

9) Describe range of forebay fluctuation, relative to preliminary plans for power operations.

10) Describe range daily tailrace fluctuation, relative to preliminary plans for power operations.

11) Describe river ramping rates, relative to preliminary plans for power operations.

12) General layout of planned hydro project. Include dam layout (in plan, elevation and typical cross sections), flow direction (for the entire operational scenario), powerhouse location, spillway location, top, submerged spill routes (include longitudinal profile and cross sections of conveyance structures) and any appurtenant structures.

13) General operating plan. Identify expected power production on an annual basis, based on the expected water use for power production and spill. For the spillway, derive from flow records the expected frequency, duration and seasonal occurrence of spill. For the powerhouse, derive the hourly and seasonal operation schedule, in terms of flow used for power production. For the reservoir, based on the expected operation schedule, identify daily and seasonal changes in storage.

14) Describe design capacities for hydraulic conveyance structures.

PASS-16 The PSP is very brief and does not address NMFS information needs and study requests in sufficient detail to determine what parts of our study request are adopted, what parts are not, and if not, why not. AEA has not identified the differences between our study request and their study or explained where and why they did not address our requests. NMFS requests again through this filing that the study plan determination include the elements NMFS seeks in order to inform any fish passage prescription under Section 18 of the FPA.

Comments on Specific Sections

7.11.1.1 Study Goals and Objectives

The study plan articulates fish passage study goals and states that "[a] variety of engineering, biological, sociological, and *economic factors* (emphasis added) may need to be considered." The study plan further indicates that feasibility analysis of fish passage alternatives (last bullet under first paragraph in 7.11.4 page 7-92) will be conducted. This section also states that the applicant will "generally follow" NMFS's 2011 guidance in the Anadromous Salmonid Passage Facility Design document. NMFS agrees that its passage design documents should be helpful to AEA's effort, but there is an important distinction to be made between NMFS's study request and the cited document. AEA quotes a portion of design guide text referring to passage facility development for restoration purposes, a situation distinct from this hydropower licensing proceeding. In this licensing proceeding, instead of restoring passage, a federal agency contemplates authorizing a project which would block current fish passage, and the FPA provides NMFS with mandatory passage prescription authority.

With regard to "economic factors," the referenced NMFS guidance document states

> *Instances will occur where a fish passage facility may not be a viable solution for correcting a passage impediment, due to biological, sociological, or economic constraints. In these situations, removal of the impediment or altering operations may be a suitable surrogate for a constructed fish passage facility. In other situations, accomplishing fish passage may not be an objective of NMFS because of factors such as limited habitat or lack of naturally occurring runs of anadromous fish upstream of the site. To determine whether NMFS will use its various authorities to promote or to prescribe fish passage, NMFS will rely on a collaborative approach, considering the views of other fisheries resource agencies, Native American Tribes, nongovernment organizations, and citizen groups, and will strive to accomplish the objectives in watershed plans for fisheries restoration and enhancement.*

This guidance is intended for the *restoration* of fish passage, not for developing mitigation for an constructed dam's future blockage of fish passage. The guidance indicates that economic factors may be used to evaluate various alternatives that all achieve fish passage at a facility, should the agency determine that fish passage is necessary and thus prescribe fish passage under NMFS's
PASS-03 FPA authority. NMFS stresses that this guidance does not indicate in any way that cost-benefit analysis can be used to determine whether fish passage is necessary on the basis of benefits exceeding costs. In other words, while achieving economic efficiency in passage measures themselves is important, the decision as to *whether* to prescribe passage is not one NMFS is authorized under the FPA to base on economic balancing. Instead, FERC makes its own decision on whether to issue a license at all on a variety of factors, which may include economic considerations. The economic considerations in issuing a license may, in turn, include the cost of passage balanced against the benefits of a project, but they cannot dictate whether NMFS prescribes passage in the first place.

Existing Information and Need for Additional Information

PASS-17 The PSP states that there is currently no specific engineering information and little biological information to provide a basis for determining the need for and feasibility of passage at the proposed dam. The biological need for passage is an issue independent of the engineering feasibility; these issues should be analyzed separately. While NMFS agrees that there is little biological information for the upper river, it has been known since 1982 that Chinook salmon pass upstream of the Devil Canyon and spawn successfully in the upper Susitna River. It is the professional judgment of the ADFG Susitna Hydro Aquatic Studies Team made in 1982 that juvenile Chinook salmon are produced in the upper Susitna River (ADFG 1983). The outstanding biological questions relate to the population size, productivity, and habitat availability and use rather than whether there is a biological need for Chinook salmon, possibly other salmon species, and other anadromous and resident species to migrate through the proposed dam site to habitat used for spawning, incubation, rearing, and migration.

7.11.4.1. Compile, Review and Summarize Information

PASS-18 NMFS has not concurred with AEA's suggested use of target species for fish passage, in large part due to the paucity of information regarding the species, life stages and timing of fish passage at Watana. It may be both desirable and possible to select a smaller range of target species and life stages, once the information from the following studies is available:

- the 2012 Upper Susitna River Fish Distribution and Habitat Study;
- the Salmon Escapement Study;
- the Middle and lower river Fish Production Study; and
- the Fish Passage Barriers Study.

This information should be coupled with any outstanding historical data and reports that are not yet available from the 1980s historical studies and a comprehensive literature review (both of which should have been included in the Pre-Application Document). At that point, the target fish species should include both anadromous and nonanadromous and resident species that require passage at the site (juvenile and adult passage both upstream and downstream passage and the timing) because fishways by definition consist of the physical structures, facilities, or devices necessary to maintain all life stages of fish by enabling fish to safely bypass the dam. In addition to the general physical information at the project site, specific hydrologic and hydraulic (including project operations) information should be provided for the fish passage season (both upstream and downstream passage).

7.11.4.3. Define and Document a Development Process

PASS-19 NMFS agrees that a process should be discussed to establish appropriate evaluation criteria for different fish passage alternatives. However, it is inappropriate to unduly limit the range of fish passage options under consideration from a biological and engineering standpoint by the including estimated costs associated with facilities into a weighted comparison matrix. In determining which alternatives are considered for further analysis of fish passage, the biological goals, objectives and concerns and the technical issues such as constructability, climate and logistical considerations, operations, etc. should be assessed.

PASS-20 At this stage, biological information and criteria should be gathered, and a full range of engineering options should be pursued, including novel ones. No alternative should be rejected based on currently operative assumptions about cost at the feasibility stage. If AEA's suggested process were to be followed, then the development of suitable fish passage could be seriously limited or even excluded from the onset, and FERC's ability to produce a license order in compliance with federal environmental laws could be unnecessarily hampered. NMFS believes in the innovative ability of the parties in collaborative effort to create appropriate and economically efficient passage mechanisms, where passage measures appear warranted. The process to develop a fishway feasibility assessment should be constructed in a manner that helps federal fishery agencies make decisions regarding fishway prescription without eliminating potential options prematurely.

7.11.6. Schedule

PASS-21 There appears to be a disconnect regarding when some of the biological information from the studies will be available and the conceptual design process. For example, a lot of the biological information on juvenile, adult or smolt passage will not be available until the 2013/2014 time frame, but the conceptual alternatives are supposed to be completed by 2013. This means that it may be necessary to revisit the conceptual alternative design assumptions based upon any new data and update the designs as necessary, which may be wasteful of applicant and agency resources and result in avoidable delays.

Outstanding Information Needs and Unresolved Issues

Study reports from AEA's 2012 Fisheries Studies are expected to add to the available information; this information is not yet available for agency review and is a serious constraint on the agency's ability to timely and effectively assess proposed studies. These reports should be made available, even if in draft form, as soon as possible to facilitate a more informed and effective study plan development process.

NMFS has initiated involvement of our Fish Passage Engineers in the project, beginning with a series of meetings and a site visit in late September. NMFS Senior Fish Passage Engineer from our Northwest Region, Ed Meyer, traveled to Anchorage and met with Alaska Region staff, AEA, and the USFWS on September 24. On September 25, NMFS convened a meeting of state and federal agency staff and the applicant to discuss Section 18 fish passage authority, fish passage at other hydro facilities, and the formation of a Fish Passage TWG. On September 26, NMFS conducted a site visit to Watana. NMFS developed an information needs list working with AEA's Fish Passage Engineering contractor, Dennis Dorratcague of Montgomery Watson/Harza.

In these meetings on September 24 and 25, NMFS, AEA and other fisheries agencies agreed to hold expert conferences as a first step to identify and discuss potentially viable fish passage design concepts for the Susitna-Watana project. A group of experienced fish passage engineers will convene to develop design concepts for both upstream and downstream fish passage. Project concepts will be developed during the course of studies for two alternative approaches listed below, to compare with the current proposal, which does not include passage structures:

1. develop concept designs for fish passage facilities integral with the design development of the dam and outlet works; and

2. develop fish passage concept designs that could be added to the preferred design for the dam and outlet works later.

It was also considered in the meetings that upstream passage would most likely be trap and haul. Therefore the main focus of the expert conferences will be downstream passage, although upstream passage will also be addressed. This approach conforms to the Proposed Study Plan, Section 7.11.

Much of the data required for the concept designs of the passage facilities is listed in 7.11.4.1 of the Proposed Study Plan. Therefore, it is anticipated that the data will be taken from early results of data gathering efforts, data from other streams, and results from early runs of the project operations model. Other data and information will be assumed, and all assumptions will be stated. Additional information and guidance will be obtained from NMFS, Northwest Region, "Anadromous Salmonid Passage Facility Design", July 2011 and other accepted fish passage design books and papers. NMFS recognizes that the recently presented draft RSP has yet to be finalized, and urges AEA to include the following revisions when it issues the RSP by the ILP due date:

NMFS Recommendations

PASS-22
1. The RSP should be organized to address NMFS's information needs and study requests in sufficient detail to determine what parts of our study request are adopted, what parts are not, and if not, why not AEA has not identified the differences between our study request and their study nor explained where and why they did not address our requests.

PASS-23
2. NMFS continues to recommend that fisheries surveys be conducted for at least one average life span of each salmon species, which is an average of five years for Chinook salmon (range from three to seven years). This is needed to obtain the minimum amount of biological information about the population that is necessary to develop and design mitigation, and determine the need for fish passage for this project.

PASS-24
3. The proposed study indicates that the biological need for fish passage will be determined, and that this is linked to the economic costs of providing passage. The RSP should reflect that the biological need for passage exists: anadromous fish are known to spawn and rear upstream of the proposed dam. The biological information requested is necessary to determine the engineering feasibility of designing effective up and downstream passage of fish and to determine the ecological and socioeconomic losses that would result from not providing passage, including conducting fisheries surveys for at least one average life-span of each salmon species.

PASS-25
4. The RSP should be revised as a plan to investigate the ability to design, construct and operate up- and down-stream fish passage into a new project from the ground up rather than as if fish passage facilities were being considered to retrofit an existing dam that already blocks fish.

The Susitna dam would be a new project on a free-flowing salmon river, with no preexisting facilities, thus the project can and should incorporate features into its initial design and operations that increase the likelihood of successful fish passage. The RSP should include the following dam design alternatives at the site:

(1) A design that incorporates fish passage facilities as an integral part of the design,

(2) The currently proposed design with fish passage retrofitted into the project.

With this in mind, we recommend that list of necessary baseline data be revised to provide information necessary for the design of all three project options. To aid in this development, we recommend that the Fish Passage Workgroup be convened at the earliest opportunity to help identify the necessary baseline data. The proposed schedule PASS-26 (7.11.6) delays development of conceptual alternatives until August of 2013. This is too late in the engineering design process for this dam and operations to allow for a full range of options for fish passage to be considered without adding unnecessary expense and delays into the project. NMFS continues to request that the study plan for fish passage begin with early and regular consultation with NMFS fish passage engineers and the Fish Passage TWG. We are pleased that the applicant has agreed to do this, and expect this commitment will be reflected it the RSP.

As part of the Fish Passage Workgroup, a group of experienced fish passage experts should be convened for an initial multi-day (three to four days) conference to help identify any additional baseline information needs as well as ideas for fish passage alternatives for the project. We recommend scheduling this experts' meeting as early as possible, ideally in early January, 2013, with sufficient advance planning to account for travel and availability of agency personnel.

PASS-27

5. In addition to the general physical information at the project, specific hydrologic and hydraulic (including project operations) information should be provided for the fish passage season (both upstream and downstream passage). Other physical information is needed including expected debris loading, ice conditions, expected sediment transport (as it affect passage facilities), expected forebay and tailwater rating curves, project operation information (rule curve, restrictions, etc.), river morphology trends, predatory species expected above and below the dam, downstream sites for a barrier dam/trap and haul operation, and size of upstream and downstream migrants (fry versus smolts). Determining the specific information needs for fish passage should be the first task of the Fish Passage TWG.

PASS-28

6. NMFS also requests that AEA identify the relationships among the 2012 pre-ILP studies, the suggested ILP studies, define the timing of related studies, and explain how these studies will be completed within the ILP study planning, study dispute, and study completion schedules.

Completing these tasks would greatly benefit the licensing process and is essential to its success in determining if any license application provides the sound evidentiary basis necessary for FERC, NMFS and other participants to make recommendations including whether it is in the public interest to prescribe fishways and issue a license.

Literature Cited

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NMFS (National Marine Fisheries Service). 2011. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon.

Interagency Guidance for the Prescription of Fishways Pursuant to Section 18 of the Federal Power Act, May 2002. Prepared by: The U.S. Fish and Wildlife Service and National Marine Fisheries Service. 19 pp.

7.12. Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries

General Comments

The AEA PSP provides methods for determining creation for migration barriers for adult resident and anadromous fish due to project operations. Within the upper river, surveys will be conducted to determine the location of currently present physical barriers to fish passage. Physical barriers within this reach are cascades or falls; beaver dams are not excluded. Within the lower river, surveys (aerial and foot) will identify existing physical barriers within the zone of project influence (primarily beaver dams). Middle river studies also will evaluate the potential for shallow depth barriers. Data from the geomorphology mapping, flow routing, and instream flow studies will be used to locate potential future, project operations caused migration barriers into sloughs, side channels, and tributaries. Field surveys will be conducted to survey suspected physical barriers and shallow depth barriers. The determination of a fish passage barrier will be based upon fish species capabilities, migration timing, passage criteria, and channel and flow characteristics.

BARR-2 The AEA PSP needs to consider existing and likely future physical barriers at railroad crossings, delayed migration, increased predation, and velocity and depth barriers for juvenile salmon and resident fish that could result from project operations, particularly over time due to channel aggradation and the formation of sediment wedges. The Alaska Railroad parallels the east side of the Susitna River from Talkeetna to Gold Creek. The railroad crosses multiple streams on bridges and over culverts. Access to culvert outlets and water depth and velocity at bridges and within crossings could be influenced by future Susitna River water elevations due to channelization, formation of sediment wedges and channel incision. Surveys must include all railroad stream crossings. These potential barriers to fish access should also be studied downstream where the railroad alignment is adjacent to the Susitna River, specifically at Wiggle Creek.

Future project induced changes in water surface elevations could result in delayed migration of adult and juvenile salmon. Low water depths can cause physical and behavior barriers to important habitat including that used by salmon and other fishes for spawning, rearing and migration. Adult salmon may hold within the mainstem or in tributary mouths due to water depths at crossing locations. This behavior may be to avoid predation (Thorstad et al. 2008, Quinn 2006 or Bjorn and Reiser 1991). Delayed spawning can also affect egg viability. Therefore, this study must also evaluate factors (water surface, depth, velocity, temperature, cover) that could delay spawning and affect egg viability. Reductions in water depths at the confluence of spawning side channels or tributaries and the mainstem could increase the risk of predation. Adult salmon can select spawning locations near cover to avoid predation (Quinn BARR-3 2006). The risk of predation due to reduced water depths at fish passage locations, even when not a physical barrier to passage, must be evaluated.

The PSP fails to consider depth and velocity barriers to juvenile salmon and migrating resident fish, and adult resident spring migrations from the mainstem into tributaries. Juvenile salmon and resident fish species migrate to and from spawning locations, summer rearing, and overwintering habitats. Water depths and velocities can physically restrict juvenile fish movement into tributaries and off-channel habitats (Davis and Davis 2011) and flow conditions during migration may influence habitat selection. For example, the upland slough at Whiskers Creek provides juvenile salmon rearing and overwintering habitat but is only accessible under breaching flows based on 1980s Susitna studies. Similarly, side sloughs with beaver dams may only be accessible under breaching flows allowing access at the upper end. As mentioned in AEAs PSP high flows may be necessary for juvenile salmon to migrate upstream or downstream around beaver dams. Differences in water surface elevation could inhibit juvenile salmon access into or out of critical summer rearing and overwintering habitats.

Velocity barriers to juvenile fish could be created at many of the tributaries under certain project altered flow conditions. Juvenile fish species distribute among tributary streams for rearing. For example, juvenile coho salmon likely migrate into the wetland habitat in lower McKenzie Creek, Chase Creek and Lane Creek. During low Susitna River water elevations tributaries discharge across the exposed bank of the Susitna River. The bank of the Susitna River is steep in some locations and when exposed, tributary flow over this bank has higher water velocities than just upstream within the tributary proper. These water velocities easily could exceed the sustained or even burst swimming speed of juvenile fish. During low flow conditions, juvenile fish must migrate across this high velocity area, whereas during higher flows access could be directly into the tributary. Juvenile fish passage across ARRC culverts may require high Susitna River water elevations to eliminate or reduce perch heights or to create backwater conditions reducing water velocities within the culvert, under a bridge, or in a natural stream channel.

Migrating juvenile salmon and resident fish distributing from spawning areas are seeking preferable habitats that may be characterized by water velocity. For example, juvenile coho and sockeye salmon are found in low velocity areas of side and upland sloughs. During high stage height, fry migrating downstream likely encounter low or zero velocity zones near the mouth of sloughs due to backwater from the mainstem; this could result in selection of that area for summer rearing. Alternately, under low flow conditions, water may be flowing out of the sloughs into the Susitna River mainstem. In this case, water velocity (or differences in water quality) could result in a behavioral barrier to juvenile migration. This is not unlike coho and Chinook avoidance of high water velocity at a culvert inlet or behavioral avoidance of entering a culvert (Kemp et al. 2005). Velocity barriers also could be formed at the mouth of sloughs during winter. Flow fluctuations due to project operation coupled with reduced cross-sectional area at the mouths of sloughs due to ice could result in high water velocities that exceed the sustained or burst swimming speed of juvenile fish, thereby creating a velocity barrier to fish passage.

BARR-4 The AEA PSP should be revised to include objectives, field methods, including possible empirical studies, and data analyses that will evaluate the effects of the proposed project to fish passage. These studies must include surveys of ARRC stream crossings, the influence of water surface elevation at passage locations on migration rates and predation, and the physical and behavioral effects of flow modification on juvenile salmon and juvenile resident fish migration into off-channel and tributary rearing and overwintering habitats.

Comments on AEA Study Objectives

AEA Study Objective 1. Locate and categorize all existing fish passage barriers (e.g., cascade, beaver dam) located in selected tributaries in the middle and upper Susitna River (middle river tributaries to be determined during study refinement).

BARR-5 This study objective is incomplete and needs to be clarified. As stated, it is the location of passage barriers in tributaries and refers to only physical barriers but not depth barriers. It also is restrictive to tributaries. It is not clear if this includes or excludes tributary mouths, side channels, side, sloughs, and upland sloughs—all critically important habitats for salmon production in the Susitna River and likely to be negatively affected by project operations. The location of physical or depth barriers in these off-channel locations is not included in any of the objectives. Objective 2 is the identification of the type of barrier, which may include depth barriers as those characterized as "seasonal", or "partial," but does not include determining the location of these barriers. As this is the only study objective that includes locating barriers, it should include locating all physical, temporary, seasonal, and partial, physical, depth, velocity, and behavior barriers located within the project's hydrologic zone of influence, and within selected tributaries outside of the hydrologic zone of influence.

AEA PSP methods to locate barriers are based primarily on data from other studies: Habitat Mapping, Upper River Fish, Geomorphology, Flow Routing, and Instream Flow. However, the PSP does not specify exact information that these studies will provide or if data quality will meet project objectives. Upper river fish studies are identified as providing the location of fish passage barriers in upper river tributaries; however, the PSP does not identify this as an objective or provide methods on how this will be accomplished. As other studies are still in development it is unclear whether they will be able to provide the information necessary to locate, classify, evaluate changes, or evaluate potential creation of fish-passage barriers. Geomorphology transects likely will not be located at potential barrier locations. Flow-routing models may not evaluate the influence of beaver dams on water surface elevations, and instream flow analyses
BARR-6 may not be able to provide velocities at a cross-section at the mouth of a side slough. The PSP should clearly identify the criteria that will be used to determine potential fish barriers, and identify the methods or study that will be used to determine or define the passage barrier criteria and locations of those barriers. If methods specific to this objective are not provided in any interrelated study, they should be described in this PSP.

AEA Study Objective 2. Identify the type (permanent, temporary, seasonal, partial) and characterize the physical nature of any existing fish barriers located within the Project hydrologic zone of influence.

The proposed study plan did not provide definitions or methods that will be used to identify the type or characterization of existing fish barriers. Even bedrock falls, while permanent structures could be partial barriers, or barriers to certain species, life stages, or fork lengths. Falls or leap type barriers also may be flow-dependent, and therefore seasonal. We assume that beaver dams are considered temporary as well as any man-made barrier (e.g. railroad crossings), but this should be clarified, and either of these could be seasonal or partial barriers. A diagram explaining the classification method and criteria would be helpful.

BARR-7 Potential barrier characterization will require more than measurements of leap heights, pool depths, water depth, and passage length. Site-specific adult salmon and resident fish data should be obtained to determine under what flow conditions (tributary, side channel, and mainstem) passage across a barrier occurs. Studies should evaluate holding times under variable flow conditions and relate these data to egg viability. Additional information necessary to evaluate juvenile fish migration must be provided in the Revised Study Plans.

AEA Study Objective 3. Evaluate the potential changes to existing fish barriers located within the Project hydrologic zone of influence.

AEA Study Objective 4. Evaluate the potential creation of fish passage barriers within existing habitats (tributaries, sloughs, side channels, off-channel habitats) related to future flow conditions, water surface elevations, and sediment transport.

BARR-8 The PSP methods need to identify how these two objectives will be addressed; currently they do not. Objective 3 refers to changes to existing fish barriers. This objective should be clarified. Changes include evaluating whether flowing ice is the predominant mechanism for removing beaver dams. This objective should also evaluate how fish passage across barriers will be influenced by changes in water depth, velocity, stage height, ratios of pool depth to leap height due to different project operational scenarios in low to high water years and as flows are projected to change over time as informed by the study of the effects of changing climate conditions on flows.

While methods for these two objectives are not provided, it appears that analyses will be dependent upon data from the instream flow, flow routing, geomorphology, ice process, water quality, and fish studies. If so, this could change other study objectives and influence site selection and methods for those study plans. For example, modeling flow revisions to the Fish
BARR-9 Passage study plan must clearly define the proposed methods. NMFS request that the PSP be expanded so that it may determine what data are necessary for analyses, how will they be obtained, what are the data quality expectations, when will sampling be conducted, the analytical and modeling that will be applied, and the interpretation and application of results.

<u>Literature Cited</u>

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Thorstad, E.B., F. Økland, K. Aarestrup, and T.G. Heggberget. 2008. Factors affecting the within-river spawning migration of Atlantic salmon, with emphasis on human impacts. Reviews in Fish Biology and Fisheries 18: 4, 345-371.

7.17 Cook Inlet Beluga Whale Study Plan

General Comments

AEA Study Objective 1. Document Cook Inlet beluga whale and other marine mammal presence within the Susitna River Delta.

This PSP proposes to address our request for several systematic surveys each month to document the use of the Susitna Delta by marine mammals. In order to understand the impacts from the year-round operation of the proposed Susitnta-Watana Hydroelectric Project, there must first be an understanding of the year-round temporal and spatial use of the Susitna Delta and in-river habitats by all marine mammals. This includes identifying which marine mammals species are present in the area, when they are present, how many are present, and what they are doing.

CIBW-17 As designed, this PSP is likely to meet our request for documenting the spatio-temporal use of the Susitna Delta and River for the months April through October. However, this study will not identify the year-round use of the area since no aspect of this study addresses over-winter (November-March) use of the area by Cook Inlet belugas, or other marine mammals. Given the limitations of conducting visual surveys during the winter, NMFS recommends AEA consider alternative methods for detecting beluga presence/absence of the Susitna River and Delta for the over-winter period. One possible method AEA could consider is the use of passive acoustic monitoring devices. While this method does have some limitations, such as the potential for false negatives (i.e., assuming no detection means no animals present), the benefits may outweigh the limitations.

AEA is proposing not to conduct a survey in August, and instead, at a meeting held August 15, 2012, indicated they may try to obtain data collected from NMFS's August calf surveys. NMFS cautioned at that meeting that the data obtained from NMFS's calf surveys may not meet the needs of AEA in regards to the type or availability of data within AEA's time frames. In other words, NMFS cannot commit to completing the data analysis from our calf survey in time to serve AEA's purposes, nor can we assure that our analysis, once completed, will fulfill AEA's needs in this regard. More discussions are necessary prior to AEA making any assumptions regarding using NMFS's data.

As part of these aerial surveys, AEA proposes to collect data regarding marine mammal location, group size, group composition (i.e., adults, juveniles, and cow-calf pairs), and behavior. NMFS questions whether all of these values will reliably be obtained given the proposed altitude of the survey (at or above 1000 feet). At the proposed altitude, it will be very difficult to obtain reliable information regarding group composition; NMFS surveys are conducted at 800 feet and involve high definition video cameras to aid in identifying beluga calves. Additionally, given very little of a beluga's body is exposed when surfacing, NMFS questions whether AEA will have the ability to distinguish juveniles from adults from a plane at the proposed altitude. As such, this PSP is not likely to address NMFS's request to document the timing and extent of use of the area by reproductive Cook Inlet beluga females and calves. NMFS recommends AEA consider alternative methods for documenting the timing and extent of use by reproductive beluga females and calves. One possible method AEA could consider is the use of data collected during long-term photo-identification studies of Cook Inlet beluga whales in the Susitna River Delta, which have confirmed females based upon the proximity of neonates (newborn calves).

AEA Study Objective 2. Determine the upstream extent of Cook Inlet beluga whales and other marine mammals in the Susitna River.

CIBW-18 This PSP proposes to address our request to document the northernmost extent of belugas and other marine mammals within the Susitna River. In order to understand the spatial extent of the impacts of the proposed project to marine mammals, there must be an understanding as to the extent of up-river habitats that are used by marine mammals. NMFS requested surveys of the Susitna River to establish a baseline data set documenting the presence/absence and abundance of marine mammals in the Susitna River throughout the year.

AEA proposes to document the northern most extent of marine mammals in the Susitna River with a combination of live-feed remote video camera systems and still cameras. Up to four live-feed cameras will be placed at the mouth of the river and up to four still cameras being placed up to RM 10 to document up-river presence of marine mammals. AEA will also examine photographic data from cameras installed to monitor ice processes and in-stream flow for the presence of marine mammals.

Data proposed to be collected via the live-feed cameras at the river mouth include group location, size, composition, and behaviors. Given the proximity of the cameras to the water, and the ability to maneuver and zoom the cameras, this may be an appropriate method for collection of this type of data, although not without limitations (see below). The method described for collecting group counts which includes the independent operation of each camera ("Scenario Two") appears to be the most thorough and accurate technique of the options provided in the proposed study plan.

However, given the location of the live-feed cameras at the river mouth, it is unlikely these cameras will be beneficial in clearly identifying the northernmost extent of marine mammals within the river. The live-feed cameras will be beneficial, however, in further refining the information requested in the previous PSP (documenting the use of the Susitna River Delta), and may be informative (depending upon the resolution of the video feed and survey design) for answering the NMFS request to document the timing and extent of use of the Susitna River Delta by reproductive beluga females and calves.

Little information is provided in the PSP regarding the placement or use of still cameras. As such, with the exception of knowing *up to* four still cameras may be placed *up to* RM 10, NMFS has no understanding of precisely where the cameras will be placed (will there be coverage at RM 10?), how often the cameras will be taking pictures (are they on timers or motion sensors?), or any protocol related to the use of the still cameras. Until such information is provided, NMFS cannot provide meaningful comments beyond the fact that the *idea* is sound for documenting the upriver extent of marine mammals. Furthermore, if acquired data shows belugas at RM 10, how will AEA document the northernmost extent of the whales?

Also, an important question that is not addressed in the PSP concerns the timing of the use of the cameras. The NMFS study request stated "throughout the year," but there are no dates provided in the PSP. NMFS suspects this PSP is also limited in time to April-October given reference in the PSP to "seasonal movement" of Cook Inlet belugas. More information is requested before NMFS can provide comments regarding this aspect of the study.

AEA Study Objective 3. Evaluate the relationship among potential hydropower-related changes in the lower river, Cook Inlet beluga whale in-river movements, and prey availability.

This final PSP presumably proposes to address our requests to 1) collect and compare data regarding current environmental conditions and prey species in the Susitna River and Delta; 2) develop a model, using data collected about prey and habitat, to predict how changes in environmental conditions as a result of the proposed project could alter existing beluga prey characteristics; and 3) determine possible impacts to belugas' foraging and reproductive success, using the current data about Cook Inlet beluga whales' use of the Susitna River Delta and the results about potential effects to beluga prey.

Changes in either habitat characteristics or prey dynamics have the potential to adversely affect Cook Inlet beluga whales. The identification of impacts from the proposed project to Cook Inlet beluga whales requires an interdisciplinary understanding of how changes to habitat and prey, independently and synergistically, may affect Cook Inlet beluga whales. The three study requests identified above were developed by NMFS to assist in the assessment of impacts to belugas from the proposed project.

CIBW-19 AEA has not proposed to conduct any work to specifically address these study requests. Instead, AEA has stated that "if significant project-related impacts to prey are identified" from the other fish studies, they will collaborate with NMFS to determine the best model to use to estimate effects to Cook Inlet beluga whales. There is no discussion regarding what criteria will be used to determine if impacts to prey are significant. NMFS contends that any adverse impacts to beluga prey species (as identified in the critical habitat designation) should lead to an assessment of impacts to beluga whales.

CIBW-22 In this PSP, AEA recognizes that belugas may also be impacted by potential changes to sediment transport and delivery, stream temperature, water quality, stream flow, and ice processes. There is no mention how data from the proposed habitat studies will be used in determining effects to belugas, or if habitat studies are even planned for the mouth of the Susitna River. Further, AEA states that project-induced changes in these factors may prevent, impair, or delay beluga whale access to delta or river habitats that support known prey species. While changing belugas' access to the habitats is one potential effect, changes to the hydrologic and bathymetric characteristics of the Susitna River Delta may be sufficient to restrict or prohibit necessary biological activities of Cook Inlet belugas, including foraging and reproductive success. The potential for impacts other than changes in access needs to be addressed.

CIBW-21 AEA proposes to combine the data from the proposed beluga distribution study with the data from other proposed habitat studies to "assess the potential effects on salmon and eulachon habitat, productivity, abundance, and run timing." While NMFS recognizes and agrees with the importance of assessing effects to salmon and eulachon, NMFS disagrees that this should be the sole goal of this proposed study. NMFS has stated that the PSP must address how the proposed project may alter the habitat used by Cook Inlet beluga whales in the Susitna River Delta, how beluga prey species in the area may be affected, and how changes to habitat or prey may affect belugas' foraging and reproductive success. NMFS is not confident that the proposed PSP will adequately address these concerns.

13. Socioeconomics

13.0 Socioeconomics

Fish Passage

This PSP proposes to address our concerns about fish passage for Chinook salmon as detailed in our Fish and Aquatic resources study request.

Section 7.11.1.1 the AEA PSP articulates fish passage study goals and states "A variety of engineering, biological, sociological, and *economic factors* [emphasis added] may need to be considered." The study plan further indicates that feasibility analysis of fish passage alternatives (last bullet under first paragraph in 7.11.4 page 7-92) will be conducted. This section also states that the applicant will "generally follow" NMFS 2011 guidance in the Anadromous Salmonid Passage Facility Design document.

With regard to "economic factors," the referenced NMFS guidance document states

> *Instances will occur where a fish passage facility may not be a viable solution for correcting a passage impediment, due to biological, sociological, or economic constraints. In these situations, removal of the impediment or altering operations may be a suitable surrogate for a constructed fish passage facility. In other situations, accomplishing fish passage may not be an objective of NMFS because of factors such as limited habitat or lack of naturally occurring runs of anadromous fish upstream of the site. To determine whether NMFS will use its various authorities to promote or to prescribe fish passage, NMFS will rely on a collaborative approach, considering the views of other fisheries resource agencies, Native American Tribes, nongovernment organizations, and citizen groups, and will strive to accomplish the objectives in watershed plans for fisheries restoration and enhancement.*

NMFS would like to clarify that this guidance indicates that economic factors may be used to evaluate various fish passage alternatives should the agency determine that fish passage is necessary and therefore prescribe fish passage under NMFS's authority in the Federal Power Act. NMFS would like to stress that this guidance does not indicate in any way that cost-benefit analysis can be used to determine whether fish passage is necessary on the basis of benefits exceeding costs. The proposed study plan should be revised to clarify that the consideration of economic factors is limited to evaluating the cost effectiveness of various fish passage alternatives and will not be a factor in NMFS's determination of whether fish passage will be prescribed.

Recreation Resources Study: Recreation Demand Modeling

SOC-20 This PSP proposes to address our concerns about baseline recreational resources valuation as commented on in our scoping comments. The PSP provides limited information on the planned methodology for estimation of recreational demand and potential changes in economic welfare measures that may occur with impacts from the proposed project. However, it is our understanding that the contractors are planning to develop a Recreational Utility Model (RUM) to assess economic welfare values associated with the study area. NMFS supports this approach because recreational use could be significantly affected by the project. NMFS expects that the revised study plan will contain significantly more information on development of the RUM, the contractors that will be doing the work, and the planned linkages between results of other study plans (e.g. fisheries resources, aesthetics etc.) and the site selection and value parameters to be modeled for each site. Of critical importance to the development of the RUM will be ensuring that the model addresses the importance of Susitna drainage Chinook salmon as a relatively unique recreational opportunity. The methodology needs to capture the reality that the Susitna River Chinook run and the Kenai River Chinook run are really the two in-river recreational Chinook harvest opportunities in the Cook Inlet area. The analysis should identify what impact declines in Susitna River Chinook, and other salmon, will have on recreationally derived economic welfare values but also what substitution behavior may mean for other areas such as the Kenai River and whether management structures at substitution sites will actually allow substitution to take place.

<u>Recreational Boating /River Access Study: Intercept Surveys</u>

RECFLW-7 This PSP proposes to address NMFS's concerns about baseline recreational resources valuation as commented on in our scoping comments. It is our understanding that intercepts surveys and plans for their deployment are presently being developed for inclusion in the revised study plans. NMFS would like the intercept surveys to include lower Susitna (below confluence of Talkeetna River) intercept sites where river boats are commonly launched. It may also be advantageous to reconnoiter the Anchorage launch ramp at Ship Creek to determine whether it is a significant access point for the lower Susitna fishermen and hunters. If so, it should be included as an intercept site. Further, the study should consider conducting intercept surveys at substitute sites such as the Kenai River in order to estimate the potential impact on substitute sites of closure of the Susitna to retention of, for example, Chinook salmon.

<u>Social Conditions and Public Goods and Services Study: Subsistence food harvesting expenses</u>

SOC-16 This PSP proposes to address our concerns regarding subsistence resources as commented on in our scoping comments. The PSP states that "Approximate cash expenses to generate each pound of subsistence harvest will be based on published information (Goldsmith 1998)." The reference cited here is outdated and is derived in a different region of Alaska where transportation costs are considerably higher than in the study area. This study should obtain study area specific cost parameters for current conditions. This data could be collected as part of the survey plan and/or via consultation with the ADFG, Division of Subsistence.

<u>Regional Economic Evaluation Study: REMI Economic Impact Modeling</u>

ECON-1 This PSP proposes to address NMFS's concerns regarding socioeconomic impacts of the project as expressed in our scoping comments.

The Scoping Document version 2 states the following:

> We [NMFS] cannot factor into our public interest determination effects on retail rates when financing for the project has not been obtained. Moreover, it is the responsibility of the Regulatory Commission of Alaska (RCA) to ensure that the retail rates are just and reasonable and we have no reason to think the RCA will not fulfill its responsibilities in this regard.

Further, in Scoping Document version 2 FERC has, in several comment responses, asserted that changes in power demand and power rates are highly speculative and outside the scope of the Environmental Impact Statement. However, scenarios can be created showing the rate structure would be necessary to support this project once project cost is estimated. These scenarios can be run through REMI to show what will happen in the regional economy.

RCA will simply pass on the charges the applicant asks for even if the cost of the project is not known in advance. "Just and reasonable" to RCA simply means what is just and reasonable to the applicant to cover their costs regardless of impact to consumers (e.g. Alaska Electric Light and Power, Lake Dorothy project). What is needed is to identify, up front with full disclosure and full transparency, the estimated cost of the project and the rates that would be necessary for the project to stand on its own. Those rates must then be used to estimate economic effects.

The intended source of funding (e.g. legislative appropriation) should be identified so that the public can be informed of the tradeoffs that will occur. For example, the billions of dollar spent on this project, if taken from State revenues, will not be spent on other rural energy projects. This must be reflected in the REMI model of regional economic impacts as a taxation or rate recovery. The analysis must show the economic impact of the project in the case that it is not directly subsidized and must stand on its own revenue generating ability (e.g. to pay off revenue bonds). The consequences for power rates, regional economic effects, and economic effects in the other parts of the State of Alaska that will not receive this funding are all key outcomes of the socioeconomic analysis.

Whether the project will be subsidized or not is a legislative appropriation issue that is outside the authorities of AEA, FERC, and the NEPA process and it is not clear that such an appropriation will be made. In the absence of a legislative commitment to fund this project the applicant must proceed with the assumption that the project will be funded with revenue bonds that are paid down via rate payer revenue. The estimated rate change must then be used in the REMI model of potential economic effects. To do otherwise will significantly bias the results of the REMI model and will create artificially large economic benefits of the project without properly assessing the economic costs of the project. To state these costs are highly speculative and outside the scope of the PSPs simply begs the question that the study should endeavor to analyze.

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Kimberly D. Bose
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Subject: Comments on the Proposed Study Plan, Susitna-Watana Hydroelectric Project

Dear Ms. Bose:

The Glennallen Field Office (GFO) of the Bureau of Land Management (BLM) offers the following comments on the proposed Study Plan, Susitna-Watana Hydroelectric Project FERC Project No. 14241 on the State of Alaska's Susitna-Watana Hydroelectric Project website (http://susitna-watanahydro.org/Studies.html) as of November 14, 2012. The comments are organized by resource area of concern.

Cultural and Paleontological Comments to the Susitna Watana Proposed Study Plan, November 2012

Section 11.5 Cultural Resources Study

11.5.1, Second Paragraph.

CUL-01

The BLM would like to ensure that Off Highway Vehicle trails, which currently access or could potentially access the initial APE study area, will be included in the expanded APE for areas of potential direct or indirect effects.

11.5.1.1., Study Goals and Objectives.

CUL-04

This section does not treat whether AEA and its contractors will investigate local paleo-environment and sediment data, which can provide a contextual framework for understanding the area's archaeological record in terms of past environmental changes and associated shifts in subsistence or other land use strategies.

11.5.1.1., Major Objectives, First Bulleted Item, "*consult with the SHPO and Alaska Native entities throughout implementation of the 2013-14 cultural resources survey*;"

CUL-05

Additionally, AEA and its contractors should similarly consult with the BLM during implementation of the 2013-2014 cultural resources survey.

11.5.2.1., Archaeological Resources, Paragraph 2, *"Only a sample of sites will be prioritized for radiometric dating." "Those sites that do contain well-preserved materials, such as animal bone or charcoal, and especially sites that have multiple occupations would be given a higher priority for dating analyses."*

CUL-06

What is intention of these statements regarding prioritization of radiometric dating? Are there limitations on the number of radiometric tests that will be conducted? If so, how many will be allocated through-out the project? Is it possible that sites that meet the above criteria will not be chronometrically dated? The BLM expects that sites with well-preserved organics or multiple components will be radiometrically dated as part of the process for determining their eligibility for the National Register of Historic Places, regardless of any other prioritization.

11.5.4.2., Ethnogeography-Related Activities, First Bulleted Item, "Hold regional Elders conference..."

CUL-08

Has there been any consideration of participating in the Alaska Federation of Natives (AFN) annual meetings to ensure that a broad range of interested Alaska Natives can attend? Most tribes and villages have a number of members attending AFN and the BLM has been asked several times to schedule consultation meetings complementary with those meetings.

Section 11.6 Paleontological Resources Study

PALEO-01

11.6.1.1., First Paragraph, "...Paleontological Resources Protection Act of 2009..."

Should be changed to "...Paleontological Resources Preservation Act of 2009..."

11.6.2, First Paragraph, "The potential for Pleistocene faunal remains needs to be reviewed..."

PALEO-02

How will this be accomplished? It does not seem that a literature review alone will be effective in this regard. Will exposed bluff faces similar in context to this find be examined in the field?

Subsistence

In order to adequately address federal subsistence resources and issues involved in issuing Right-of-Way permits to AEA (namely ANILCA sec. 810 analysis), GFO needs accurate and up-to-date information involving significantly affected subsistence resources and the short-term and long-term impacts/effects to BLM managed lands. BLM's management goals as stated in R-1 of the East Alaska Resource Management Plan are to;

1. Conserve healthy populations through management and protection of habitat and Federal subsistence harvest permitting and regulations.
2. Provide reasonable access to subsistence resources.
3. Maintain a viable and accessible Federal subsistence unit in Unit 13 in order to provide a rural preference to the residents of the Copper Basin.

SUB-04

12.5. Subsistence Baseline Documentation Study:
BLM requests more clarity on the "Impact Analysis" to analyze the effects of more access to BLM managed lands to subsistence users, particularly possible conflicts between subsistence users and major increases in non-rural resident/non-resident users

SUB-05 The BLM also requests more clarity on the effects of how lands lost to reservoir inundation and transportation/transmission corridors will affect subsistence users by the redistribution of fish, wildlife, and plant resources within and around BLM managed lands. (i.e.: what analysis tool(s) will you use?)

SUB-06 The BLM requests an analysis of the potential short and long term increased user base of federally qualified subsistence users as a result in population growth in the Cantwell area.

Wildlife Resources

In order to adequately address wildlife resources and issues involved in issuing Right-of-Way permits to AEA, GFO needs accurate and up-to-date information involving adversely affected wildlife habitat and the short-term and long-term impacts/effects to affected BLM lands. BLM's management goals as stated in Y-1 of the EARMP are to;

1. In cooperation with the Alaska Division of Fish and Game (ADF&G), ensure optimum populations and a natural abundance and diversity of wildlife resources, including those species that are considered BLM sensitive status species.

2. Perpetuate a diverse and abundance of waterfowl and wetland habitat.

8.5. Study of Distribution, Abundance, Productivity, and Survival of Moose:

MOOSE-3
- BLM acknowledges that most previous comments have been adequately addressed and believes that the combined results from the four study methods, namely the Moose Browse Survey and Habitat Survey (8.5.4.3), will help sufficiently calculate mitigation measures for the proposed inundation zone that will be assessed, if the dam project proceeds. Future issues may be added as new data becomes available.

MOOSE-4
- The BLM notes that the study plan puts less emphasis on transportation corridors in the Moose Browse and Habitat Survey, by stating that the "seasonal habitat use and importance of the…transportation corridors will be quantified by analysis of radio and satellite tracking data to determine…habitat preferences". Therefore, BLM believes the current study plan does not adequately address moose habitat that may be lost and/or altered along the transportation corridors to assist in mitigation measurement, since a significant portion of the habitat is located on uplands away from the forested inundation zone. Future issues may be added as new data becomes available.

8.6. Study of Distribution, Abundance, Movements, and Productivity of Caribou:

CBOU-1
- At this time, the BLM acknowledges that most previous comments have been adequately addressed and current study plan has generally addressed the needs of the BLM to assess right-of-ways; however, no current study addresses the cumulative effects on Nelchina caribou herd (NCH)by the proposed hydro project, the associated transmission and road corridors, reasonably foreseeable mineral developments in surrounding areas within the NCH range, and the proposed expansion of FOX-3 military operations area. BLM recommends that these likely foreseeable actions should be included a cumulative effects analysis. Future issues may be added as new data becomes available.

The following comments are specific to the Summary of Recreation Resource Survey Methodology (dated 9.19.2012)

REC-24 *Recommended Definition of the Study area, page 1.*
This section specifically excludes the North side of the Denali Highway and the headwaters of the Susitna River. The BLM recommends that these areas be included. Inclusion of the headwaters of the Susitna is needed on order to provide information for WSR suitability study.

REC-25 *Campgrounds and Trailheads, page 4.*
BLM requests prior notification to Glennallen Field Office prior to conducting campground surveys.

REC-26 *Denali Highway Intercept Locations, page 7.*
Correction to text; "Only 21 miles of road on the eastern end and three miles on the western end are paved"

REC-27 BLM suggests adding the Susitna River Bridge as an intercept location.

REC-28 Delta Wayside is located at mile 21 (not MP 16). (adjust maps accordingly)

REC-29 *2013 Executive Interview Protocol*
Page 3 – Correction: Tangle River Inn owners are Jack and Nadine Johnson.

BLM also suggests that these additional candidates be considered for interviews based on their past history of dispersed recreational use in the area: Ray Adkins, Bailey – Stephan Lake Lodge, National Outdoor Leadership School (NOLS), Talkeetna Air, Denali Air, Jake Jefferson, and Braun Kopsak.

REC-30 Page 4 – BLM GFO recreation contacts are: Field Manager -Beth Maclean, Assistant Field Manager-Elijah Waters, and Outdoor Recreation Planners- Cory Larson, Denton Hamby, Heath Emmons, and Marcia Butorac.

Document Content(s)

GFO consolidated comments Susitna Hydro Nov 14.DOCX....................1-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
ALASKA OPERATIONS OFFICE
222 West 7th Avenue, #19
Anchorage, AK 99513-7588

November 14, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

RE: EPA comments on proposed PSP/RSP for the Susitna-Watana Hydroelectric Project No. 14241, EPA Project #12-4162-FERC

Dear Ms. Bose:

The U.S. Environmental Protection Agency (EPA) has reviewed the Proposed Study Plan (PSP) and Revised Study Plan (RSP) filed by the Alaska Energy Authority (AEA) for the Susitna-Watana Hydroelectric Project in the Matanuska-Susitna Borough, Alaska (FERC Project #14241-00). The current proposal is for construction of a single, 750' dam, as well as a transmission line and access road to the Watana site along the Susitna River. We began our review of the PSP as filed with the Federal Energy Regulatory Commission (FERC) on July 16, 2012. Once revisions to the PSP were posted by AEA on their project website, we evaluated the most recent information.

The EPA reviewed only a few individual studies in detail. Resource limitations precluded reviewing the majority of the proposed studies. A letter recently filed by the National Marine Fisheries Service (October 31, 2012) articulates some of the challenges faced by agencies trying to review project documents and participate effectively in Technical Work Group meetings.

Our review focused on the '*Geomorphology*' and '*Fluvial Geomorphology Modeling below Watana Dam'* sections of the PSP and RSP as well as the '*Instream Flow'* study Section 8.5. Sections 5.8 and 5.9 of the PSP were renumbered and became 6.5 and 6.6 of the RSP. Section references will be to 6.5 and 6.6 hereafter. We selected these sections to review because flow pattern and sediment supply are significant drivers of river form and therefore the physical, chemical, and biological characteristics of a river. Changes to these variables give rise to a cascade of ecological changes via alterations of the channel and habitat properties and ultimately the biotic response of the plant and animal assemblages. As ranked by Fischenich (2006), the 'General Hydrodynamic Balance' function, defined as the provision of proper flow conditions at the appropriate seasons for support of the biotic community, is the single function that directly or indirectly supports all other functions critical to stream and riparian ecosystem health. This is why the outputs of studies 6.5 and 6.6 become the inputs for a series of related studies and analyses, including for the Instream Flow study.

To support our review of these sections of the PSP/RSP, we consulted with Dr. David P. Braun of Sound Science LLC, and Ms. Marit Larson. Dr. Braun is one of the original authors of the Indicators of Hydrologic Alteration (IHA; TNC 2009) methodology. The Instream Flow PSP/RSP (see Section 8.5.4.4.1.3) states that the IHA program will be used to compare the potential regulated flow to the current flow patterns, so Dr. Braun's insights are of particular relevance.

The proposed studies are generally intended to: 1) establish the baseline, pre-project environmental conditions; and 2) allow for modeling of how the Susitna River (and associated riparian and upland habitats) may be affected by the project. The study outputs should be adequate to describe the affected environment and the environmental consequences of the project in the Environmental Impact Statement (EIS). We previously filed detailed scoping comments relative to the required National Environmental Policy Act (NEPA) document ((May 22, 2012).

As we stated in our scoping comments, the ability to evaluate and compare alternatives is critical to ensuring that the EIS provides the public and the decision-maker with information that sharply defines the issues and identifies a clear basis for choice among alternatives as required by NEPA. Quantification of the change to habitat variables and the resultant effects on resources of concern associated with each alternative is the best way to provide meaningful disclosure and discussion of potential environmental impacts.

Our scoping comments contained a list of suggested topics for inclusion in the alternative analysis. Some of these are repeated below. Inclusion of these topics would facilitate the direct comparison between alternatives that is fundamental to the NEPA process.

- Definitions used;
- Desired goals and conditions;
- Process to ensure that ecosystem health is sustained; and rationale of why the selected process is expected to maintain ecosystem health (include "indicators" or "criteria" used to judge the health of the ecosystem and rationale of why they are considered to be representative of the health of the ecosystems);
- Identification of characteristics and species which need to be separately tracked to ensure protection (e.g., listed species and their habitat);
- Identification and protection of the unique, small but ecologically important sites that function as key elements of the ecosystem (i.e., springs, wetlands);
- A monitoring program and its objectives (what, how much, how often, data and analysis needs, level of data and analysis required/analyzed, including how is monitoring improved compared to current plans); and
- Adaptive management (process to measuring effects and detect problems and feedback monitoring results to make changes/corrections to protect, restore and sustain resources);

In addition to supporting FERC's licensing decision, study outputs ideally will be adequate to support decision-making by other agencies. For example, construction of the project will require a Clean Water Act (CWA) Section 404 permit from the U.S. Army Corps of Engineers (Corps). The Section 404 permit review includes a series of factual determinations (e.g., physical substrate determinations, water circulation, fluctuation, and salinity determinations) relative to whether the project may *"cause or contribute to significant degradation"* of a water of the U.S.

Our previous comments noted that the scale of the proposed project in terms of its physical size and degree of alteration of the natural hydrograph of the Susitna River raises the distinct possibility that it would cause significant degradation and not be permittable under Section 404. For this reason, the EPA strongly recommend that the EIS evaluate and disclose the impacts to the specific aquatic resources and functions listed in the Guidelines at 40 CFR 230.10(c).

'*The Notice of Extension of Time to File Comments on the Proposed Study and Revised PSP/RSP*,' dated September 17, 2012, cited the complexity of the issues and large number of proposed studies as two reasons why extending the review period was appropriate. We concur with FERC's assessment that the issues associated with licensing this large, original project are complex. Furthermore, we found assessing the adequacy of the PSP/RSP to generate outputs that will meet the NEPA, licensing and permitting needs of the project difficult without an assessment framework. To facilitate our review, we couched the study objectives in the context of the regulatory needs and asked a series of questions that are listed below.

The specific PSP/RSPs 6.5 and 6.6 are intended to: 1) describe how aquatic habitats are created and maintained under the pre-project conditions (in part, through geomorphic classification of aquatic habitats); and 2) allow modeling of geomorphic changes due to project-induced changes to the drivers of channel form, discharge and sediment supply. If the PSP/RSP achieves these objectives, they can support the NEPA alternatives analysis and analyses contained within the other regulatory processes.

As mentioned above, the geomorphic classification of habitats and the model outputs of post-project channel form will be used to analyze project impacts to a variety of resources, including fisheries. Model results could potentially be used as inputs to analyses that would examine specific resource questions such as the percentage of main channel chum salmon spawning redds that will experience bed mobilization during the months of egg incubation or which tributary mouths will aggrade during adult migration. The adequacy of the specific PSP/RSPs 6.5 and 6.6 will affect the accuracy of numerous integrated project-affect analyses.

Available fish habitat-use data for the Susitna River indicates that the use of macro- (e.g., main channel, side slough) and meso-habitats (e.g., riffle, pool) by fish is not consistent. The disproportionate use by fish of a limited number of discreet habitats indicates that habitat suitability, quality, accessibility and actual use by aquatic organisms are determined at the microhabitat scale (e.g., water depth, velocity, and substrate). The initial question we posed for our PSP/RSP review was whether the proposed studies are intended to or capable of capturing and describing these fine-scale, seasonal channel dynamics.

The four questions we posed for our review of the specific studies are as follows:

1. *Are PSP/RSPs 6.5 and 6.6 intended to or capable of capturing and describing the fine-scale, seasonal channel dynamics that affect habitat suitability, quality, accessibility and actual use by aquatic organisms?*

2. *Are PSP/RSPs 6.5 and 6.6 adequate (in terms of level of detail and ecological process mechanisms) to describe how aquatic habitats are created and maintained under the pre-project conditions (in part, through the geomorphic classification of aquatic habitats)?*

3. *Are PSP/RSPs 6.5 and 6.6 adequate to allow modeling of project induced geomorphic changes to the Susitna River at ecologically-meaningful scales?*

4. *Will PSP/RSPs 6.5 and 6.6 generate outputs that may be used for factual determinations pursuant to the Section 404(b)(1) Guidelines (e.g., physical substrate determinations, water circulation, fluctuation, and salinity determinations)?*

The answers to these four questions are best summarized in a single answer, because all four point to a single set of underlying limitations in the PSP/RSP with respect to aquatic biological and ecological resources. We provide a summary answer here. More detailed review comments of Sections 6.5 and 6.6, as well as aspects of Section 8.5, are found in Enclosure I.

Posing the four questions was helpful, but we soon realized that we needed to take an even broader view in order to capture the 'big-picture' purposes of the PSP/RSPs. We needed to go beyond the suggestions we had previously made regarding the alternatives analysis (see above). Specifically, we needed to ask what information was proposed to be collected, why it was being collected, and how it would be used to assess the proposed project.

For help in articulating these needs, we turned to an EPA document entitled *A Framework for Assessing and Reporting on Ecological Condition* (Framework; USEPA Science Advisory Board 2002).

We found in reviewing the PSP/RSP that it does not explicitly discuss or include any organized process for assessing how the hydrologic and geomorphic variables proposed for measurement are causally related to (or predictive of) the conditions that support species assemblages in the Susitna River. More broadly, the PSP/RSP does not discuss or include conceptual ecological models for the key aquatic resources (e.g., species, assemblages, ecological characteristics or processes) of the Susitna River. Nor does it identify any process or timeline for developing conceptual models.

As described in *A Framework for Assessing and Reporting on Ecological Condition* (Framework), conceptual ecological models are needed to:

1. Identify the biological and ecological resources of concern;
2. Identify key attributes of each resource that characterize or shape its integrity, including natural driving processes and natural environmental constraints, i.e., the attributes that *"affect habitat suitability, quality, and accessibility;"*
3. Identify indicators with which to measure the status (integrity) of each resource and its key attributes, and potentially also to model the likely impacts of the proposed project;
4. Identify the natural or acceptable (*aka* reference) range of variation for each indicator; and
5. Establish a scale for rating the implications for resource integrity associated with departures from these reference ranges.

The conceptual model for each resource then provides the scientific basis for the following five additional, equally crucial steps in any impact assessment:

6. Identifying gaps in our understanding of the natural conditions and dynamics of each resource, and our understanding of the best indicators of these conditions and dynamics;
7. Identifying potential stresses to the resource, consisting of potential alterations to key attributes or introductions of foreign ingredients that could result in conditions outside the natural range of variation for individual key attributes;
8. Identifying likely sources of such stress (aka stressors) and causal mechanism (e.g., geomorphic processes) by which they act or could act;
9. Guiding field-based and data-mining studies to assess the existing condition and dynamics of their key attributes, and the status of individual stressors; and
10. Establishing clear criteria (hypotheses and information needs) for assessing how the proposed project could affect the key attributes and associated indicators for each resource.

The lack of conceptual ecological models is the primary, systemic flaw we identified in the PSP/RSP. Without articulation of the ecological context within which to assess the collected data and modeling results, we cannot tell whether the plans will achieve their stated objectives or be adequate to meet the regulatory needs of the project.

Developing explicit, measurement-oriented conceptual models is the responsibility of the project proponent. This deficiency is addressed in the first of twelve specific comments contained in our Enclosure I. Some of the twelve comments are in response to specific information contained in sections

6.5, 6.6, and 8.5. Other comments contain recommendations that stem from the ten steps identified in the *Framework* document. The comment topics are listed below.

1. Lack of conceptual ecological models with linked indicators for important resources
2. Key variables affecting fish utilization of the Susitna River and tributaries
3. Indicators for key fish habitat variables
4. Acceptable ranges of variation in indicator condition
5. Environmental flow assessment methodology
6. Selection of environmental flow components, including “effective discharge”
7. Quantifying habitat turnover rates versus qualitative assessment of channel “stability”
8. Other surrogate measures of habitat condition and area
9. Incorporating large woody debris into geomorphic modeling
10. Incorporating ice movement as erosive force in geomorphic modeling
11. Incorporating stochasticity in geomorphic modeling
12. Downstream extent of hydraulic and geomorphic modeling below RM 75

The PSP/RSP (e.g., Section 8) provides some of the information required for Steps 1 and 2 (see above). Specifically, it indicates that the most important key attributes of habitat for the aquatic ecosystem – here using the salmonid assemblage as the template – consist of both specific microhabitat conditions affected by flow and the abundance and quality of macrohabitats that are used differentially by different aquatic species and their individual life stages. Presumably, individual species differentially use specific macrohabitats based on their provision of suitable microhabitat conditions for different life stages and activities. The PSP/RSP (Section 8) provides some information on the relationship of suitable microhabitat conditions with macrohabitat type. However, the PSP/RSP does not formally organize or integrate information on the associations between micro- and macrohabitats to specifically articulate these relationships. Finally, connectivity between the main channel and sloughs, and between the main channel and tributaries, constitute additional key variables related to the spatial relationships and connectivity among macrohabitat types.

The PSP/RSP indicates that these two scales (i.e., micro and macro) of habitat variables constitute key ecological attributes for fishes and other aquatic species. However, the PSP/RSP does not propose quantitative studies focused on any of the key variables of microhabitat; and mostly does not define how microhabitat conditions vary among macrohabitats. Instead, the *Geomorphology* study (Section 6.5), *Fluvial Geomorphology Modeling below Watana Dam* study (Section 6.6) and *Instream Flow* study (Section 8.5) focus on measures of possible drivers or surrogate variables that are (a) potentially related to key microhabitat or macrohabitat attributes and (b) potentially amenable to quantification and modeling. These measures of possible drivers or surrogate variables include measures related to river discharge, ice cover, sediment supply and size class distribution, substrate particle size class distribution, channel planform (including braiding and wetted area), channel stability, and bed aggradation-degradation.

Some of the proposed measurements might provide (or could be designed to provide) unambiguous information concerning the status and distribution of the microhabitat and macrohabitat conditions of greatest relevance to aquatic ecosystem integrity. In addition, the usefulness of the information obtained during the field studies also could be amplified through literature reviews of comparable studies, although the PSP/RSP does not contain plans for such comparative studies.

It is a common practice in aquatic ecosystem assessments to focus measurements on key drivers of habitat dynamics, because of the difficulties of measuring finer-scale conditions. Geomorphic analyses, in particular, can provide key information of long term ecological significance more effectively than shore term biotic studies (Ligon 1995). However, neither Section 6.5 nor Section 6.6 explicitly states how the variables they propose to measure will provide surrogate information about the key microhabitat and macrohabitat variables of interest. Without such an explicit "map" of causal or predictive relationships, stakeholders must independently determine whether the proposed surrogates are the right ones to study. In many instances – as discussed in our extended comments below – the PSP/RSP does not provide enough information to make this determination. In other instances, we present information suggesting that a specific proposed surrogate is not the right one to study, because it does not have a clear connection to key ecological variables for the aquatic system or would not have as clear a connection as some other measure.

Critically, the PSP/RSP does not explicitly discuss, and presents no process for estimating, the ecologically acceptable range of variation for any of the variables it proposes to measure. As a result, even for the variables it proposes to measure, the PSP/RSP provides no information concerning how much change in a given variable might affect the ecological integrity of the aquatic system. Such estimates are crucial for assessing the potential impacts of specific project actions. (Here, again, there is a need to bring to bear comparative information). Without such estimates, stakeholders must independently determine whether the proposed studies will provide information on the potential impacts of the Project. And here, too, the PSP/RSP does not provide enough information to allow stakeholders to make this determination.

It is never possible to create a 'perfect' study design, or to collect 'all' the necessary data to completely remove uncertainty. Nonetheless, without a guiding framework based on conceptual ecological models and associated hypotheses, an extremely detailed program of field sampling, remote sensing, data mining, and computer modeling will always run a much greater risk of collecting more information than is needed about some features/environmental characteristics, and less information than needed about others. This will be true even with a high level of coordination among studies. A guiding framework based on conceptual ecological models and hypotheses is all the more critical given the short time frame of the proposed studies, including the short field seasons, and the high degree of variability of the measured parameters. Without this framework, we will never know if the shotgun approach will produce the information necessary to understand the risks posed by the project for specific resources of concern.

The PSP/RSP does a good job of 'connecting the dots' among the numerous technical studies it proposes. Integrated Resource Analysis diagrams, for example, display the close relationships and flow of information among studies of hydrology, geomorphology, and fish habitat use. We suspect this is at least partly in response to repeated agency requests for this information. What the PSP/RSP does not do, however, is 'connect the dots' from this information back to conceptual models of the ecological requirements and sensitivities of biological and ecological resources. There is no connection to the indicators for key microhabitat and macrohabitat variables for these resources, and the acceptable ranges of variation in these indicators. As a result, the studies 6.5 and 6.6 may intend to address *"the fine-scale, seasonal channel dynamics that affect habitat suitability, quality, accessibility and actual use by aquatic organisms"* but they do not provide sufficient information to determine if they are capable of achieving this objective.

Thank you for the opportunity to provide comments on the PSP/RSP. Please feel free to contact me at (907) 271-1480 or lacroix.matthew@epa.gov if you have questions or would like additional information regarding our comments. I will be your primary contact for Clean Water Act Section 404-related issues; Jennifer Curtis also here in the EPA Alaska Operations Office will be your primary NEPA contact.

Sincerely,

Matthew LaCroix

Matthew LaCroix, Biologist
Aquatic Resources Unit, Alaska Operations Office
Office of Ecosystems, Tribal and Public Affairs

Cc: Wayne Dyok, AEA
David Turner, FERC

Enclosure I

ENCLOSURE 1

EPA DETAILED COMMENTS FOR THE FERC SUSITNA-WATANA HYDROELECTRIC PROJECT, REVISED PSP/RSP SECTIONS 6.5, 6.6, AND 8.5

GEN-31

Comment 1: Lack of conceptual ecological models with linked indicators for important resources
It is standard practice in natural resource impact assessments to begin with five crucial steps (e.g., USEPA Science Advisory Board 2002; Parrish et al. 2003; Unnasch et al. 2008) (see also http://www.nature.nps.gov/water/nrca/frameworks.cfm), which are lacking in the Proposed PSP/RSP. These five Steps are as follows:

(1) Identify the biological and ecological resources of concern;
(2) Identify key attributes of each resource that characterize or shape its integrity, including natural driving processes and natural environmental constraints;
(3) Identify indicators with which to measure the status (integrity) of each resource and its key attributes, and potentially also to model the likely impacts of the proposed project;
(4) Identify the natural or acceptable (*aka* reference) range of variation for each indicator; and
(5) Establish a scale for rating the implications for resource integrity associated with departures from these reference ranges.

The identification of the resources of concern, their key attributes, their indicators, and their reference ranges of variation requires development of a conceptual ecological model of the project area overall and, more importantly, a conceptual model for each individual focal resource (e.g., USEPA Science Advisory Board 2002). The biological or ecological resources may be individual species or stocks, habitat types (e.g., waterfowl overwintering areas) or species assemblages, natural communities, or ecological processes. Key attributes for a freshwater ecosystem, for example, typically address hydrology, vertical hydraulic exchange, physical habitat and connectivity, water temperature and chemistry, forms and magnitudes of primary productivity, uniquely adapted species, and characteristic and dominant species at different levels in the food web. The conceptual model for each resource then provides the scientific basis for the following five additional, equally crucial Steps in any impact assessment:

(6) Identifying gaps in our understanding of the natural conditions and dynamics of each resource, and our understanding of the best indicators of these conditions and dynamics;
(7) Identifying potential stresses to the resource, consisting of potential alterations to key attributes or introductions of foreign ingredients that could result in conditions outside the natural range of variation for individual key attributes;
(8) Identifying likely sources of such stress (*aka* stressors) and causal mechanism by which they act or could act;
(9) Guiding field-based and data-mining studies to assess the existing condition and dynamics of their key attributes, and the status of individual stressors; and
(10) Establishing clear criteria (hypotheses and information needs) for assessing how the proposed project could affect the key attributes and associated indicators for each resource.

The PSP/RSP lacks any such conceptual models or integrating framework. Instead, it focuses exclusively on the technical studies needed to fill in gaps in knowledge, without providing any explicit framework for assessing how filling those particular gaps will affect understanding of the resources and the potential effects of the Project on them. In effect, the PSP/RSP jumps to “Step 6” in the above sequence of 10 assessment steps, without any of the guidance that would be provided by having first gone through the preceding five crucial steps.

The PSP/RSP includes Integrated Resource Analyses (IRAs), to show how the technical Study components relate *to each other*. However, the IRAs do not show how these Study components relate to core questions about how the project will affect specific biological or ecological (or social-cultural or economic) resources. Each IRA is specifically intended to show how various Study components will be brought together to assess the current (baseline) condition and likely impacts of the proposed Project to all potentially important resources. However, without any explicit conceptual model of what resources matter – nor any explicit conceptual model for each such resource, its key ecological attributes, the indicators for these key attributes, and estimated reference ranges for these indicators – the IRAs provide no structure for this integrated assessment of baseline *resource* condition and potential impacts for each resource. The IRAs thus provide no structure for assessing whether the Project has the potential to affect the *integrity* of any particular resource, let alone reduce that integrity beyond some acceptable level.

Without such an explicit framework, each stakeholder must independently review the entire PSP/RSP and its individual Study components, in order to assess how the knowledge produced by the proposed studies might affect understanding of the resources of concern to the stakeholder and the potential effects of the Project on these resources. For example, each stakeholder must independently seek information regarding the potential significance of various indicators, such as changes in the flood frequency distribution overtime. Ordinarily, explicitly developing and presenting foundational conceptual models for key resources – including documenting the rationale for all elements of each conceptual model based on literature reviews, comparative studies, and expert judgment – is the responsibility of the scientific teams assembled by the project proponent. Here the burden is shifted and scattered among stakeholders, and left for the external comment process rather than incorporated directly 'up front' in the planning process.

The Corps and EPA both share responsibility under the CWA for safeguarding the *"physical, chemical, and biological integrity"* of U.S. waters, but there is no conceptual model anywhere in the PSP/RSP that explicitly describes, let alone explains, how the proposed studies will lead to critical information on the present and possible future condition of the integrity of the aquatic ecosystem or any of its individual species. This is the case even though the PSP/RSP recognizes the aquatic/riparian ecosystem and several of its individual fish species as important resources that the project could affect. The PSP/RSP also contains no discussion of tools available to help link information on hydrology and geomorphology back to information on habitat condition, even though it explicitly mentions the existence of such tools in its discussion of modeling software (see below, Point 4).

Information with which to begin building conceptual models for key resources (see the list of five initial planning Steps 1-5, above) is present throughout the Plan. However, this information is scattered, not integrated. The Proposed PSP/RSP nowhere uses this information to link the proposed Studies back to a framework for asking pivotal questions about the potential impacts of the Project, based on the key attributes of key resources and their acceptable ranges of variation. Such questions might include, How will the project affect the abundance or spatial distribution of spawning gravel for adult Chinook salmon and rearing habitat (in backwaters and sloughs) for juvenile Chinook salmon along the river; affect periphyton or benthic invertebrate productivity in different macrohabitat settings; or affect riparian community vegetative composition and use of the riparian zone by different animal species?

Thus, the PSP/RSP puts the burden of such integration on the shoulders of the stakeholders rather than on the scientific and engineering teams preparing the Plan. This is contrary to current best practices for environmental impact assessments and planning. This does not mean that the specific proposed technical studies will not interact extensively, in the coordination of data collection and computer modeling, etc. (e.g., see Section 6.6.4.2.2.4). However, this extensive interaction is not a substitute for a guiding framework for all the studies that focuses on explicit questions about what biological and ecological resources are potentially at stake, how they function under natural conditions, and how the project could affect them. Nor does this extensive interaction eliminate the need to also review the literature and findings of hydrogeologically and ecologically comparable studies to supplement and amplify the findings of the proposed field studies. Each section of the PSP/RSP (e.g., Geomorphology, Section 6) should not simply lead to products that are left to be interpreted as best as possible in light of the others. Rather, the key ecological attributes, indicators, acceptable ranges of variation, and controlling factors should be identified at the outset, so that each study is specifically and explicitly aimed at answering key questions concerning potential impacts to those key ecological attributes, indicators, ranges of variation, or controlling factors.

GEN-32

Comment 2: Key variables affecting fish utilization of the river system

The PSP/RSP, Section 8 (file version of 2012.10.26) provides guidance on existing knowledge concerning fish habitat along the Middle and Lower Susitna River (Watana Canyon downward). There is legitimate debate about the accuracy of this existing knowledge, but this information can be integrated to identify some of the key ecological attributes for the Middle/Lower Susitna River fish assemblage as a whole, at both the micro- and macro-habitat scales. As described in the PSP/RSP, key variables include:

- Microhabitat needs for different species depend on "…a suite of different parameters influenced by flow. These include specific conditions of water depth, water velocity, substrate, upwelling occurrence, and turbidity." Winter microhabitat conditions are particularly important, with depth, temperature, and velocity strongly shaping egg incubation and juvenile survival and development. Inter-gravel flow and vertical hydraulic exchange are also important for egg and emergent fry survival, in part by sustaining water temperatures above freezing. Egg and fry viability are also sensitive to gravel instability, bed exposure, and extreme winter flow velocities. The exact microhabitat preferences and sensitivities of individual species may not be known, but we do know that the natural range of variability in conditions along the Susitna historically provided a suitable distribution of microhabitat settings with the right ranges of conditions for several species.
- Different fish species and their individual life stages show different patterns of use of six macrohabitat classes – main channel, side channel, side slough, upland slough, tributary mouth, and tributary. Main channel habitat is further divided into four sub-types (mesohabitats): riffle, pool, run, and glide. Presumably, individual species differentially use these macrohabitats based on their provision of suitable microhabitat conditions for different life stages and activities. The PSP/RSP (Section 8) provides some information on the relationship of suitable microhabitat conditions with macrohabitat type. For example, side sloughs provide lower flow velocities and shallower depths than the main channel. However, the PSP/RSP does not formally organize or integrate information on microhabitat-macrohabitat associations to specifically articulate these relationships. Finally, connectivity between the main channel and sloughs, and between the main channel and tributaries, constitute additional key variables related to the spatial relationships and connectivity among macrohabitat types.

This discussion addresses fish (particularly salmonid) assemblage integrity, for convenience. It is not intended to suggest that flow depth and velocities are the most important variables in determining microhabitat use by fish. A review of the PSP/RSP information on other aspects of the aquatic ecosystem – e.g., primary production; benthic macroinvertebrates; non-economic fishes; use of the river and its floodplain by insects, birds, and mammals; etc. – would result in the identification of other key ecological attributes for the aquatic (or aquatic + riparian) ecosystem as a whole.

GEN-33

Comment 3: Indicators for key fish habitat variables

Ideally, indicators for the key fish microhabitat and macrohabitat variables would provide quantitative information about the availability of suitable habitat – on average and over space and time – and its condition for different species and life stages, particularly the most abundant, better known species. However, the available scientific knowledge may not be sufficient to support defining a range of values for each variable that characterize "good" habitat condition for each species – even after completion of the PSP/RSP components for aquatic resources. This shortfall would occur because of the inherent difficulties in acquiring such knowledge, particularly over a short research period, particularly for less abundant species or species whose life history and habitat requirements are not as fully understood. (Nevertheless, the PSP/RSP should call for a thorough integration of the literature, findings of comparable studies, and expert judgment to assemble the available knowledge).

Further and perhaps more importantly, the available scientific knowledge and tools (e.g., modeling methods) may not be sufficient to support modeling the future condition of fish microhabitat and macrohabitat indicators under the Project (see Point 2, above, for discussion of key microhabitat and macrohabitat variables). Consequently, the PSP/RSP would be expected to identify other indicators that provide at least surrogate information on the actual key habitat variables of interest. Such surrogate indicators must meet two criteria: (1) they must be amenable to measurement and modeling; and equally importantly, (2) they must provide unambiguous information concerning the likely availability and abundance of microhabitat and/or macrohabitat conditions suitable to the fish species of concern.

Typically in such circumstances (common in ecological impact assessments), *surrogate indicators consist of measures of the key environmental drivers that create and maintain the microhabitat and macrohabitat conditions of interest*. And, indeed, the *Geomorphology* study and *Fluvial Geomorphology Modeling below Watana Dam* study (Sections 6.5 and 6.6, respectively) address such potential surrogate indicators (even if they do not explicitly identify them as surrogates for the key ecological attributes of actual interest). These potential surrogate indicators include measures related to river discharge, ice cover, sediment supply and size class distribution, substrate particle size class distribution, channel planform (including braiding and wetted area), channel stability, and bed aggradation-degradation. In some river systems, for example, the ratio of spawning female salmon to the number of redds indicate that the availability of suitable spawning gravels could be limiting for the population (Ligon et al. 1995).

Based on this critical link between the physical habitat and the biota, a fluvial geomorphic study analysis would then focus on how spawning gravel area would be impacted due to reduced upstream sediment load, and less frequent channel avulsion, and thus less gravel recruitment from the banks, due to reduced peak flows. However, neither Section 6.5 nor Section 6.6 provides a "map" of how the variables they propose to measure provide information on the actual key microhabitat and macrohabitat variables of interest, let support this map with a review of the literature on how these relationships operate. Without such a map, stakeholders cannot reliably assess whether the proposed surrogate indicators are the right ones to study.

This review of the PSP/RSP is not the appropriate place to develop an alternative "map" or conceptual model of potential surrogate indicators for the key microhabitat and macrohabitat variables of interest. Developing such conceptual models should be the responsibility of the teams developing the PSP/RSPs and their partner Technical Working Groups. These experts need to identify potential surrogate indicators based on how the habitat dynamics work, and on the causal or predictive relationships that may exist between the proposed surrogate indicators and the actual microhabitat and macrohabitat variables of interest. And they need to support the resulting conceptual models with reviews of current knowledge, not only about the Susitna-Watana system but about comparable systems in general. This will provide the information needed to assess the suitability of the proposed surrogate indicators for assessment under the plans for the Geomorphology Study and Fluvial Geomorphology Modeling below Watana Dam Study (Sections 6.5 and 6.6) or the Instream Flow Study (Section 8.5). "Suitability" in this context refers to the correspondence (causal and/or predictive relationship) between the actually proposed hydrogeomorphology indicators (i.e., measures related to river discharge, ice cover, sediment supply and size class distribution, substrate particle size class distribution, channel planform – including braided and wetted area, channel stability, and bed aggradation-degradation – and the key microhabitat and macrohabitat variables noted above.

Our preliminary review suggests there is not a close correspondence between the proposed measures and the actual microhabitat and macrohabitat variables of interest. The Geomorphology PSP/RSP (Section 6.5) has ten Study Components:

(1) Delineate Geomorphically Similar (Homogeneous) Reaches;
(2) Bedload and Suspended Load Data Collection at Tsusena Creek, Gold Creek, and Sunshine Gage Stations on the Susitna River and Chulitna River near Talkeetna;
(3) Sediment Supply and Transport Middle and Lower River;
(4) Assess Geomorphic Change Middle and Lower Rivers;
(5) Riverine Habitat versus Flow Relationship Middle River;
(6) Reconnaissance-Level Assessment of Project Effects on Lower River Channel;
(7) Riverine Habitat Area versus Flow Lower River;
(8) Reservoir Geomorphology;
(9) Large Woody Debris; and
(10) Geomorphology of Stream Crossings along Transmission Lines and Access Alignments.

These ten components focus on the need to assess the natural flow and ice cover regimes; quantify natural sediment supply and transport, including substrate particle size class distributions; classify reach types and assess riverine habitat types in relation to flow; assess channel planform variation, channel and habitat stability, and bed aggradation-degradation over the last decades; assess large woody debris (LWD) recruitment and distribution; and assess potential geomorphic impacts of the reservoir and stream crossings.

Nowhere does the PSP/RSP for these ten *Geomorphology* study components explicitly state how indicators for these particular conditions or dynamics are causally related to predictive of the key microhabitat and macrohabitat variables that actually affect the suitability of the river for its native fishes. Similarly, the PSP/RSP for these ten *Geomorphology* study components does not explicitly discuss whether or how the studies will estimate the acceptable range of variation in any metrics, in order to provide a basis for assessing whether project impacts will exceed such ranges of variation. For example, the plans do not explicitly provide information organized so that stakeholders can tell how a change in the sediment budget or channel braiding in a given reach might affect fish habitat availability along that reach, and whether such changes would warrant concern for the integrity of any specific fish species or the fish assemblage overall. Such relationships potentially could be estimating using computer modeling or other methods, but only if based on sound conceptual models in the first place, which in turn should rest on reviews of current knowledge about the Susitna River system and comparable systems in general.

The content of the proposed *Geomorphology* study (Section 6) and the *Instream Flow* study-Fish, Aquatics and Riparian (Section 8) suggest that the scientific teams responsible for these plans had implicit conceptual models in mind when they prepared these PSP/RSPs. Without making these conceptual models explicit, however, the PSP/RSPs provide insufficient information with which to assess their adequacy.

Of course, decades of scientific and engineering studies worldwide of rivers with and without dams demonstrate that the independent variables (drivers) such as flow regime, ice cover regime, sediment supply; and the response variables of bed grain, channel pattern, and the channel conditions of lateral stability and bed aggradation/degradation all do affect the availability of microhabitat conditions and macrohabitat types in rivers in general. These variable and their relationships to habitat conditions and availability are implied in the proposed assessments of macrohabitat distributions described in Sections 6.5, Study Components 1-7, and in Section 6.6 (see also Section 8.5).

However, the PSP/RSP does not explicitly address how these variables, and the ways in which they will change with the Project, specifically and quantitatively will affect macrohabitat type abundance and distribution (let alone suitable microhabitat conditions) in this river, the Susitna system. For example, the PSP/RSP does not explain how it will connect (a) predictions of expected lower peak annual floods, the load-response discharge regime in the winter, and reduced sediment and LWD supply from the mainstem to (b) estimates of the likely distribution of macrohabitats with suitable inter-gravel flow/upwelling, substrate stability, water depth (especially related to even brief exposure or excessive inundation), and flow velocity for fish egg and juvenile viability during the critical winter season. The PSP/RSP may embody implicit assumptions about such causal relationships but the absence of explicit models forces stakeholders to surmise these assumptions in order to evaluate the plans.

Comment 4: Acceptable ranges of variation in indicator condition.

For the sake of argument, Point 4 here assumes that the indicators proposed for actual measurement – e.g., indicators of the flow regime, ice cover regime, sediment supply and transport, substrate particle size class distribution, channel planform, channel stability, and bed aggradation-degradation – are the right indicators to measure. That is, simply for the sake of argument, it assumes that the implicit strong causal and predictive relationships discussed under Point 3 (between surrogate indicators and the microhabitat and macrohabitat variables of actual interest) exist, and that measuring these indicators will provide appropriate data, with which to assess project impacts on the ability of the Susitna River to provide sufficient habitat for all key fish species within their natural ranges of abundance. Making this assumption, we then must ask: What is the *acceptable range of variation* in these variables?

GEN-34

The PSP/RSP does not ask nor attempt to answer any questions concerning the acceptable range of variation with respect to any of the hydrologic and geomorphologic variables that are proposed for study. Consequently, the PSP/RSP says nothing about how the proposed studies will provide information on the likely distribution and severity of *ecological* impacts from the Project. Thus, the PSP/RSP does not ask and provides no pathway to answering questions such as: Is there a threshold duration of above-water exposure of redds due to winter flow variation, beyond which the eggs would experience some specific percent (e.g., 50%) mortality; and what would be the frequency and spatial distribution of such conditions under the different flow release alternatives, as assessed by the hydraulic modeling for specific reaches? Or, Are there minimum and maximum inter-gravel flow rates that define suitable habitat for Chinook salmon, and what is the relationship between the overall substrate particle size class distribution and the likely availability of habitat with suitable ranges of inter-gravel flow rates? Or, Is there a hydrogeomorphic threshold, or combination of thresholds, where channel incision resulting in the disconnection of the river from its flood-channel network is likely to occur?

Admittedly, questions of this sort may test the limits of present knowledge. However, without asking such questions, the proposed investigations will have no chance of developing even preliminary estimates that could be used to assess project impacts. The PSP/RSP does not raise such questions, and presents no process for studying or answering them using some combination of field studies and reviews of past studies and expert judgment. As a result, it is not possible to assess whether the proposed PSP/RSP components will produce information truly useful for assessing potential Project impacts on the aquatic biological or ecological resources of concern.

Tools may be available to assist in asking such questions. For example, the discussion in Section 6.6 of the PSP/RSP, concerning 2D fluvial geomorphology modeling software, points in this direction. The discussion there indicates that at least two of the programs under consideration include modules for assessing fish habitat availability based on the hydraulic-geomorphic output of the main program. Specifically, the MD_SWMS Modeling Suite includes "…a Habitat Calculator for assessing fish habitat under 2D conditions," and the River2D program "… also has the capability to assess fish habitat using the PHABSIM weighted-usable area approach." The PSP/RSP does not mention a third option: the U.S. Army Corps of Engineers HEC-EFM (Ecosystem Functions Model) program (http://www.hec.usace.army.mil/software/hec-efm/index.html).

This program provides a range of tools for assessing the potential ecological impacts of flow and habitat changes based on the hydrologic and geomorphic output of other HEC modeling tools, such as the HEC-RAS program already recommended for use in the Study. The PSP/RSP should include: (a) an evaluation of the potential to use such tools to assess the crucial causal connections noted above; and (b), if any of these tools are found suitable, a plan for their use in the quantitative assessment of potential Project impacts to the aquatic biological and ecological resources of concern. Incorporating computer modeling of physical habitat into the PSP/RSP would require careful planning at a very early stage in the Study process, because such computer models require very specific inputs and data for calibration and validation. Further, computer modeling of physical habitat typically is carried out at a relatively fine scale, such as at individual reaches or cross-sections. Consequently, the PSP/RSP would need to establish criteria for selecting the habitat modeling sites, perhaps based on the priority habitat requirements identified for specific species (e.g., key ecological attributes). The results from such local-scale modeling would yield products (such as weighted usable areas or hydraulic habitat suitability) that can be used to extrapolate impacts quantitatively to larger scales

An alternative investigative strategy might also be feasible, for assessing the suitability of expected variations in variables, such as flow regime and LWD dynamics. This alternative strategy would focus on the relationships between field-measured variables and integrated indices of biological condition at a range of sites in the region encompassing the Project, from relatively pristine reference conditions to more impacted conditions. Hydrologic indicators have also been established that are linked to geomorphic characteristics and ecological functions based on investigation of pre-and post project conditions (Graf 2004). Although these examples are of indices that are not necessarily easily linked to specific species, they can be used to assess the likely deviation of these indicators from target ranges as a result of the project. Information on index values from reference rivers can also be used to set target ranges for management and operations (or mitigation), if they can be statistically associated with gradients of alteration of habitat.

Comment 5: Environmental flow assessment methodology

Reviewing the proposed Geomorphology Study or Fluvial Geomorphology Modeling below Watana Dam Study (Sections 6.5 and 6.6) also requires reviewing the proposed Instream Flow Study (Section 8.5), because the three are closely related. Specifically, the Mainstem Flow Routing study (e.g., Section 8.5.4) and its associated hydraulic model (HEC-RAS) are key ingredients in the two geomorphology studies. For example, the hydraulic modeling is a necessary foundation for the fluvial geomorphology modeling. Further, water depth and velocity are crucial microhabitat variables shaping the availability of suitable macrohabitat for fish assemblage integrity (see above); and there not be a 1:1 correspondence between macrohabitat type and water depth/velocity conditions. Consequently, the PSP/RSP should not

FGM-13

assume that reaches with nominally acceptable distributions of macrohabitat types will also experience acceptable variation in water depths and flow velocities, which are determined by river discharge. Rather, the PSP/RSP needs to handle this as a hypothesis for testing, which requires integrating the results of the flow modeling with the results of the geomorphic studies.

The HEC-RAS flow routing model below the proposed Watana Dam site will incorporate a series of cross-sections, at which the program calculates daily (and perhaps hourly or finer) stage, velocity, energy gradient and other hydraulic variables (and calculates output values for discharge based on these variables), between River Miles (RM) 75 and 184. [The question of whether the hydrologic and geomorphic modeling should stop at RM 75, or continue to the Bay has been debated among the PSP/RSP team, TWGs, and stakeholders; we return to this question separately, below.] The modeling for each of these cross-sections will produce output not only for each alternative model of flow regulation but also for existing conditions (historic period of record). The modeling process will necessarily involve calibration and validation of the model based on flow data at the existing gage points. However, the model will include many cross-sections *other than at the existing gage locations*, and the choice of these non-gaged cross-sections will be important: the USGS places its gage at locations with specific geomorphic characteristics (e.g., stable planform, straight run, etc.), and these

FGM-27

locations therefore do not constitute a representative sample of all channel and habitat conditions. The selection of additional cross-sections for the HEC-RAS modeling needs to produce a geomorphically representative sample of locations.

FGM-15

In turn, the analysis of the potential hydrologic impacts of alternative patterns of flow regulation must involve a comparison of existing to alternative flows at a geomorphically and geographically representative sample of the modeled cross-sections. Assuming that the HEC-RAS (flow routing) model is well-calibrated and well-validated, such comparisons will provide crucial information on how each flow-regulation alternative will alter the natural flow regime at locations representing the full spectrum of hydro-geomorphic conditions along the river. The PSP/RSP may explicitly state that this is how it will assess flow alteration, but we did not find this information. It needs to be stated.

Assuming that the assessment of potential flow alteration will proceed as just described, we must also ask, *How will the comparisons be carried out between the unregulated and potential regulated flow records*? The Instream Flow PSP/RSP (see Section 8.5.4.4.1.3) states that it will use the Indicators of Hydrologic Alteration (IHA; TNC 2009) program to carry out the necessary comparisons. This specific proposal should be reviewed, for several reasons (the present reviewer is one of the original authors of the IHA methodology):

IFS -049

- The present suite of 33 IHA parameters represents a “kitchen sink” of variables that can be compared between records. Some or many of these variables may not be ecologically relevant to the Susitna-Watana project. Comparing all 33 variables may produce results for some variables indicating a lack of impact (small or no difference between the records being compared). However, if these latter variables are not ecologically relevant to the project, including them in the assessment will give an inaccurate picture of the project impacts. *The analysis must focus only on Environmental Flow Components (EFCs) that are ecologically relevant to the project, and relevant to each season of the annual cycle*. Selection of the right EFCs is in fact one of the most important steps in any environmental flow assessment (e.g., Olden and Poff 2003; Poff et al. 2010) – a step seemingly missing from the PSP/RSP (see also Point 6, below).

IFS-038
- The IHA output measures the difference between pairs of records based on the percent difference in value for each parameter. *However, percent difference values per se provide no information on the ecological significance of difference between flow records*. For example, a 10% change in the frequency of extreme Summer high flows may or may not be ecologically significant, depending on the natural range of variability of the system. Further, a 10% change might be ecologically significant for one parameter, but not for another, depending on the ecosystem. Percent difference values thus are unhelpful, unless accompanied by an evaluation of how much alteration would be ecologically significant for each parameter, for each season of the year. The PSP/RSP does not include any process for estimating what magnitude of change (from existing to regulated flows) would be ecologically harmful for any IHA parameter.

IFS-036
- Percent difference values are particularly unhelpful for assessing change in the average timing of specific event types between two flow records. The average timing of a flow event cannot be changed by more than ± 365 days (or ± 183 days, depending on the choice of method). Thus, for example, a seemingly small ± 10% shift in the average timing of a flow event type actually corresponds to a potentially ecologically significant shift of ± 36.5 days. *Changes in the timing of specific flow conditions must be assessed based on absolute differences, not percentages.*

IFS-048
- The present version of the IHA program does not include some parameters that could be useful for assessing change in flow regimes along the Susitna, such as the annual center-point of discharge and some of the indexes suggested by Graf (2006). Alternative programs (e.g., the USGS HIT program; Henriksen et al. 2006; Kennen et al. 2009) may include some of these potential additional parameters (see also Olden and Poff 2003; Poff et al. 2010). However, other programs may not incorporate features found in the IHA, such as the ability to analyze flows by season. As a result, it may be better to program all or at least supplemental Environmental Flow analyses in a stand-alone environment, such as a statistical package or spreadsheet program, to create a suite of analyses tailored to the specific needs of a project. And the PSP/RSP needs to include a rigorous assessment of the right parameters to apply to the Susitna-Watana system, rather take a "kitchen sink" approach (see above).

IFS-040
- The present version of the IHA program has known bugs. The PSP/RSP team should consult with the support team for the software.

<u>Comment 6: Selection of environmental flow components, including "effective discharge"</u>

IFS-039 The *Instream Flow* study (Section 8.5) plan is silent on what Environmental Flow Components (EFCs) it will select for assessment (see discussion of the IHA program, above). In turn, the Geomorphology PSP/RSP (Section 6.5) discusses at length the importance of assessing at least one EFC: "Effective Discharge." The rationale for assessing Effective Discharge needs to be integrated into a discussion of the entire suite of EFCs relevant to the Project, a necessary step seemingly missing from the PSP/RSP, as noted under Point 5, above. In turn, this overarching discussion of the EFCs for the Project should include recommendations for the seasons of the annual cycle that need to be assessed separately during the flow analysis. For example, it is clear that Winter EFCs should be different from all others, and that other ecologically meaningful divisions of the annual hydrologic cycle are necessary.

IFS-104 Winter high and low flows define the range of water depths and velocities available for fish egg development and juvenile maturation, mostly under the ice (see Points about ice dynamics, below). Winter high flows also may be closely tied to ice dynamics, such as the formation and breakup of ice dams, which may affect channel geomorphology (see above, and Point 10, below). The Instream Flow Study needs to assess how much impact dam operations will have on river stage during the Winter and, crucially, how far downstream these impacts will be evident. (And, again, as noted above, the impacts need to be addressed in terms of absolute alteration relative to the natural range of variation, not in terms of "percent difference"). The effects of Winter dam releases (e.g., hourly variation; increased daily discharge) on river stage may persist further downstream than the effects on river geomorphology. Thus, as noted above, the PSP/RSP should actively assess rather than assume that reaches with nominally acceptable distributions of macrohabitat types will also experience acceptable patterns of variation in river discharge, stage, and flow velocities – and do so separately by season.

The PSP/RSP presents an extended argument for assessing the impacts of the Project on Effective Discharge. While we agree that annual Effective Discharge should be one of the EFCs, we think the argument for a dominant role for Effective Discharge in shaping habitat along the Susitna is overstated. Effective Discharge is the discharge rate that, over the course of years and decades, cumulatively transports the largest mass of sediment along a river. However, Effective Discharge does not accomplish this feat by being able to mobilize and transport more sediment *per instant* than flows at other magnitudes of discharge. It does its work by mobilizing and transporting a moderate amount of sediment, but doing so often enough that it has a large cumulative effect. In contrast, extreme flow events (e.g., 50-, 100-, or >100-year high-flow events) cause channel avulsion, change meander lengths, change channels from singular to braided planforms, create sloughs and natural levees, rework channel bed aggradation and degradation at large scales, shift tributary deltas, and so forth. In the Susitna-Watana system, ice jams and the flow pulses that result when the river escapes these jams, conceivably could be counted among such high-flow events with significant geomorphic consequences (e.g., see papers by Beebee, Davis and Davis, and Mouw presented at the 2011 Mat-Su Salmon Science & Conservation Symposium, http://conserveonline.org/workspaces/matsusalmonsymposium/documents/withkeyword-documents.html?keyword=00002011%20symposium; and see also Shields 2000; Clipperton et al. 2003). And the geomorphic disturbance caused by such extreme events may well play an important role in shaping the biodiversity of the river. Thus, Effective Discharge may well be only one potentially important EFC with respect to average annual cumulative sediment transport in the Susitna-Watana system that provides information on year-to-year changes in channel form that may affect, for example, the narrowing of the main active channel following extreme flow events, with consequent encroachment by vegetation. As Doyle et al. describe (2005), the application of an effective discharge analysis in ecology is more complex than in geomorphology; effectiveness curves will vary across ecological variable and ecosystems. But understanding fluvial geomorphologic dynamics – and the potential impacts of the Project on these dynamics – requires assessing larger flows as well. The PSP/RSP should identify specific high- and extreme high-flow event types (EFCs) for inclusion in the study (by season, if appropriate); and should include some approach for assessing flow pulses associated with ice jams, as well.

IFS-041

Comment 7: Quantifying habitat turnover rates versus qualitative assessment of channel "stability"

FGM-18

The *Geomorphology* study (Section 6.5) includes a discussion of a proposed qualitative assessment of channel *"stability."* This assessment will involve a visual comparison of overlaid digitized maps of the channel zone from the 1980s versus the present. Two questions arise for this particular study component: (1) Why is "channel stability" a variable of interest at all; and (2) Why not directly measure overall aquatic habitat turnover rates with the same map data, thereby providing a more useful ecological and also quantitative analysis?

Our assumption is that the project team is asking about "channel stability" because of the need to distinguish project-induced geomorphic change from pre-project conditions of instability or directional trends. Key to addressing this need is a quantification of the rate of geomorphic change.

As noted earlier, channel stability represents one of a suite of variables that the PSP/RSP proposes for the *Geomorphology* study. However, the PSP/RSP does not identify how information on channel stability reveals the ways in which the project could affect the abundance and distribution of suitable microhabitat conditions and macrohabitat types for different fish species. At best, information on channel stability provides only surrogate information on the actual key habitat variables of interest; and at worst, provides no information on these key habitat variables at all. The PSP/RSP needs to make clear why the assessment of channel stability is important to understanding Project impacts on key resource attributes; and doing so will require building the conceptual models described earlier.

The *Fluvial Geomorphology Modeling below Watana Dam* study (Section 6.6) also raises the topic of channel stability, and poses the question, *"[Will] the existing channel morphology …remain the same or at least be in "dynamic equilibrium" under post-project conditions…?"* This question is unnecessary. There is no question about whether the project will influence channel morphology. It is not possible to completely alter the controlling variables (hydrology and sediment load) on a fluvial system and not change the channel morphology. Decades of investigations of the impacts of dams on river hydrology, sediment transport, and geomorphology make this abundantly clear (e.g., Williams and Wolman 1984; Kellerhalls and Church 1989; Ligon et al. 1995; Friedman et al. 1998; Collier et al. 2000; Shields et al. 2000; Graf 2005, 2006). This modeling study component needs to be directed at much more specific questions concerning the magnitude and scale of impacts to key attributes in the system.

FGM-22

The study authors state that it is important to understand whether the river is currently in dynamic equilibrium, to get at the question of channel stability. But a snapshot comparison of habitat distribution between 1980 and 2011 is not useful by itself for understanding the dynamic equilibrium of a system. Instead, the investigations must also assess whether any changes took place in the factors that control channel morphology over that timespan. Only an analysis of the hydrologic and sediment regimes preceding those two periods of observation, or of other disturbance regimes and biotic controls (fire, temperature, predation, herbivory, species competition, exotic species etc.), can inform the question of dynamic equilibrium. Potential indirect influences on these controls, such as changes in land use, development, land management, hunting, beaver trapping, etc. must also be assessed.

Given the hydrology and substrate material of the Susitna River, a certain degree of channel planform instability is natural to the system. The Susitna's channel morphology is naturally dynamic, wherever permitted by an absence of valley confinement and bedrock grade control (i.e., outside of Devils Canyon). And, because of the way that river ecosystems work, this dynamism may well be important to sustaining the biological richness of the system. Therefore, the ecologically more relevant question may not be, Is the channel stable, but rather, *How much "instability" is natural to the system*? And this can be quantified. The same digitized maps of the river valley can be used to measure, for individual reaches, how much of the area covered by water in the 1980s is now (2012) land versus still covered by water, taking into account river stage; and how much of the area covered by water today was land versus covered by water in the 1980s.

The resulting transition matrixes can be used to calculate a "turnover rate" (water to land and land to water, in hectares per year) for each reach, for the period between the 1980s and 2012 aerial imagery. The resulting reach-scale data can then be used to define the frequency distribution of reach-scale turnover rate values, and associated measures of central value. And, for those reaches with aerial imagery from the 1950s, similar data can be compiled for the period between the 1950s and 1980s. The resulting quantitative data on turnover can be compared statistically to hydrologic metrics, such as the frequency of extreme high-flow events, to assess how the rate of turnover may have varied in relation to potential hydrologic drivers, and in relation to the effects of the three large tributaries to the lower river (Talkeetna, Chulitna, Yentna Rivers).

FGM-19

The resulting quantitative data on turnover can also be compared statistically to data on other potential determinants of channel planform, such as gradient, bedrock confinement, and magnitudes of sediment inputs from tributaries. This will result in a more robust, quantitative model of the factors that affect turnover rate, for incorporation into the understanding of the geomorphic modeling results. Such a suite of quantitative analyses would be directly relevant to the ultimate purposes of the Study and both methodologically more sound and ecologically more relevant than a qualitative assessment of channel planform stability.

Comment 8: Other surrogate measures of habitat condition and area

The PSP/RSP proposes measurements of channel braiding, bar area, and wetted area, as additional tools for assessing habitat abundance and distribution. The PSP/RSP does not, however, explain how or why these measurements will provide information on the ways in which the project could affect the abundance and distribution of suitable microhabitat conditions and macrohabitat types for different fish species. For example, will these measurements be used to construct indices of habitat condition relevant to microhabitat conditions and macrohabitat types, or to calibrate a 2D model of physical habitat changes with changes in flow regime? Because the PSP/RSP does not address such questions, it is not clear whether these measurements are proposed simply because they can be measured, or because they actually provide unambiguous information concerning the likely availability and abundance of microhabitat and/or macrohabitat conditions suitable to the fish species of concern (see Point 3, above). The PSP/RSP needs to make clear why these are potentially useful measurement approaches; and doing so requires building the conceptual models described earlier.

FGM-21

It does seem that some measures of at least macrohabitat areas by type will be used to inform the fluvial geomorphic modeling effort and, presumably, used to predict Project impacts on aquatic habitat based on the modeling output. However, in the reviewers' experience, the deterministic approaches proposed for these modeling efforts (discussed more below) are best suited for application to environments where natural geomorphic controls simplify the system. Examples of such simpler systems include bedrock dominated systems, where vegetation plays little or no role in controlling riparian geomorphology; and arid systems, where vegetative extent is more predictable.

Where systems are very complex and dynamic, however, modeling ideally should be augmented with other study approaches to help predict impacts. For example, a "space for time" (or "space for modeling") approach also should be considered for the Susitna study. Such an approach would assess habitat conditions downstream from dams on similar sized rivers in similar biogeographic environments, and compare these habitat conditions to those found either along unaffected reaches elsewhere on those rivers or to similar reaches along the Susitna. The data on different rivers could be compared based on the assumption that regional river reaches will demonstrate ecological similarities because they share hydrologic and geomorphic contexts, climatic regimes, and, prior to damming, at least some natural communities and species assemblages (e.g., Graf 2005). The project scientists should look for any such data that might be available regionally.

More generally, the PSP/RSP lacks discussions of opportunities to pursue comparative approaches in lieu of or to complement and extend the usefulness of field studies along the Susitna itself. As noted earlier (see Point 7, and citations therein), investigations worldwide and especially in North America over the past few decades have produced a wealth of knowledge of the downstream hydrologic and fluvial geomorphic effects of dams. Some of these investigations address systems comparable in one or more factors to the Susitna – for example, systems with highly braided natural channels and significant involvement of ice (e.g., Shields et al. 2000; Clipperton et al. 2003). Shields et al. (2000) also specifically note that *"Since channel migration is episodic, migration rates measured over shorter time periods (20–30 yr) exhibit greater scatter than those over 100–200 yr …, particularly for streams with banks that experience mass wasting …"*

Given the very brief window of time proposed for the new field studies of the Susitna – and the brief window of time studied during the 1980s – it could be crucial to extend the knowledge acquired on the Susitna itself with knowledge acquired from other river systems affected by dams in comparable hydro-geologic settings, including studies of long-term dynamics (see also Wellmeyer et al. 2005). The experiences of analogous river systems can provide insight into the river variables that might be affected and can help AEA to develop specific studies to assess potential impacts. The experiences of analogous rivers can also serve as independent validation of AEA's assumptions and modeling results.

Comment 9: Incorporating Large Woody Debris into geomorphic modeling

FGM-22 The *Geomorphology* study (Section 6.5) proposes a study component addressing Large Woody Debris ("LWD," Study Component 9). The Plan states that *"Large wood and wood jams can create pool habitat, affect mid-channel island and bar development, and create and maintain anastomosing channel patterns and side channels … [and] can provide cover and holding habitat for fish and help create habitat and hydraulic diversity."* Given the contribution of LWD to channel geomorphic dynamics, it should be incorporated into the *Fluvial Geomorphology Modeling below Watana Dam* study (Section 6.6). Doing so would not substitute for the analysis of the larger-scale geomorphic processes of channel widening and lateral channel migration that supply LWD to the system. It would, however, support a quantitative assessment of the potential geomorphic consequences of a loss of LWD due to reservoir entrapment; or an increase in LWD recruitment due to riparian erosion or mass wasting below the Dam.

FGM-23 In addition to identifying LWD functional roles, the proposed studies could estimate/quantify the volume of sediment (and approximate associated particle sizes) retained by LWD within the active river area; and the surface area of the geomorphic features (e.g., pools, point bars, etc.) formed by the wood. The proposed map of LWD should have an attribute table that includes the volume/area of habitat and geomorphic features associated with individual LWD occurrences. This would permit development of more quantitative products from the LWD Study, such as estimates of the anticipated reduction in areas of specific habitat types and in the volume of sediment retained, as a result of changes in the volume or number or LWD supplied downstream of the dam.

Comment 10: Incorporating ice movement as erosive force in geomorphic modeling

FGM-24 The ice cover regime clearly is an important variable shaping the aquatic ecosystem of the river. The ice cover regime potentially influences fish egg and juvenile maturation and the distribution of suitable microhabitat conditions and macrohabitat settings for this maturation. However, neither the *Geomorphology* nor the *Fluvial Geomorphology Modeling below Watana Dam* studies (Sections 6.5 and 6.6, respectively) explicitly addresses the potential contribution of ice to the geomorphic dynamics of the system. For example, ice fragments can be potent scouring elements affecting not just channel banks but the bed as well, when mobilized during ice breakup. The fluctuations in dam releases proposed for the project during the winter (load-following operations) could result in repeated daily cycles of ice formation and disruption, resulting in a high rate of mobilization of ice fragments. It is plausible that this frequent mobilization of ice fragments could cause unnatural scouring of the active river area. Given the potential contribution of ice scour to channel geomorphic dynamics, consideration should be given to whether ice cover, fragmentation, and mobilization could be incorporated into the *Fluvial Geomorphology Modeling below Watana Dam* study (Section 6.6). Doing so would support a quantitative assessment of the potential geomorphic consequences of ice formation and disruption due to reservoir operations.

Comment 11: Incorporating stochasticity in geomorphic modeling

The 1D and 2D modeling proposed for the *Fluvial Geomorphology Modeling below Watana Dam* study (Section 6.6) appear to involve deterministic modeling. That is, a given set of input and boundary conditions will produce a single solution. The inputs and parameter values can be varied to produce a range of results, but there is no actual stochastic, or random, parameter included that makes it possible for the modeling to produce varying outputs for a given set of inputs. Statistical likelihood enters into most of the proposed models through manipulation of the input parameters (e.g., by running the models for storms with selected recurrence intervals). The boundary conditions are fixed, or change based on outputs from other models (e.g., coarser-scale sediment transport models) that are also deterministic. Other input parameters are determined based on an understanding of field conditions, such as bed particle size, or roughness coefficients.

FGM-25

River system dynamics, however, are naturally somewhat stochastic, in that chance conditions – e.g., the arrival of a piece of LWD or the timing of a tributary inflow pulse – can change local and reach-scale conditions in ways that may persist for many years. This is particularly true in the case of braided-channel systems such as the Susitna River. Ideally, simulation of such systems would include some stochasticity, in that each simulation run would describe a particular possible but not absolutely deterministic outcome. The output of multiple runs would then describe the range of possible outcomes. A statistical analysis of the resulting range of variation would then provide a more robust representation of the way the system might work under a given future scenario. This type of analysis should consider where in the river network stochastic disturbances may play the greatest role in creating geomorphic and habitat heterogeneity, such as at tributary confluences (Benda et al. 2004).

Alternatively, the modeling could incorporate one or more sensitivity analyses, exploring the consequences of varying particular input parameters or boundary conditions, for which natural variation (or uncertainty) would be expected. For example, bedload and suspended sediment load are highly variable parameters (DeVries 1970). Even the additional sampling proposed in Section 6.5.4.2 is likely to produce an average with a wide standard deviation. The field sampling protocols for recording the size of bed material are not well described in the PSP/RSP. It is likely, however, that sampling results will reflect the wide range of variability in such parameters. This should be particularly true for sub-surface particle size distributions.

The 1D and 2D computer modeling efforts therefore need to conduct sensitivity analyses, to assess how variability in inputs for such parameters affects the model results. Any discussion of model uncertainty also needs to be tied back to the question of how the representation of geomorphic uncertainty affects predictions for key indicators (Wilcock et al. 2003). For example, given the uncertainties in our understanding of ice formation and its role in scour and bed and bank particle mobilization and in the entrainment of LWD, the study designers should explain how this uncertainty could affect model results. We therefore would ask, Are sensitivity analyses or the incorporation of variability into model inputs feasible for the proposed Study? (The description of software options indicates that simulation run times are a matter of concern.)

Comment 12: Downstream extent of hydraulic and geomorphic modeling below RM 75

The hydrologic and geomorphic modeling is currently proposed to stop at RM 75. As noted earlier, the question exists as to whether the modeling should continue to the river's mouth at Cook Inlet. The PSP/RSP, including the Summary of Consultation with Agencies, Alaska Native Entities, and Other Licensing Participants (Section 6.4) indicates that this has been a subject of debate among the project team, TWGs, and stakeholders. The PSP/RSP repeatedly states that the results of the 1D and 2D geomorphic modeling to RM 75 will be evaluated to determine if the detailed study area needs to extend further downstream. Section 6.6.3.2 presents the proposed process for making this important determination.

It has been well-documented that the effects of dams on sediment size distribution and other channel characteristics have the potential to extend hundreds of km downstream (Williams and Wolman 1984; Shields et al. 2000; Schmidt and Wilcock 2008). These effects may emerge over time spans of decades to centuries, depending on basin geology and geomorphic and runoff processes from the hillslopes, valleys and channels throughout the basin network (Grant et al. 2003; Benda et al. 2004). Given the complex linkages and the natural variability in the system and in bedload sampling, an estimate of bedload sediment balance for the river from a single comparison (1980s versus 2012) is not sufficient for deciding whether or not to extend the modeling downstream (DeVries 1970). The PSP/RSP proposes developing an analytical framework that takes into account the dynamics of sediment and water fluxes throughout the river network (Section 6.5.4.6.). However, this analysis must be conducted and the results reviewed in time to allow implementation of any recommended additional studies in the Lower River in 2013.

FGM-26

We recommend that the output of the initial 50-year modeling to RM 75 should be formally, quantitatively evaluated to ask the specific question: Are *potentially ecologically significant* effects of dam operations detectable in the 1D or 2D or hydrologic modeling results at RM 75? Answering this question requires not just the modeling output, and the consideration of the length of time over which impacts may occur, but the conceptual ecological (and physical) models described above. These conceptual models would summarize present understanding of what constitutes the acceptable range of variation in indicator condition, for those indicators measurable with the modeling output. The persistent uncertainty over whether to extend the modeling downstream from RM 75 appears to be a consequence of the failure of the PSP/RSP to include development of such conceptual models.

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ENCLOSURE 2

Document Content(s)

12-4162-FERC StudyPlanComments1.DOCX..................................1-25

CIRI

November 12, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Re: Cook Inlet Region, Inc. Comments on Alaska Energy Authority Proposed Study Plans and Revised Draft Interim Study Plans, Scoping Document 2, Board of Consultants Approval, Requests for Designation of CIRI as a Consulting Party, and Requests for Meeting with FERC Staff for the Susitna-Watana Hydroelectric Project (FERC P-14241-000)

Dear Secretary Bose:

Cook Inlet Region, Inc. (CIRI) appreciates the opportunity to provide these comments on Alaska Energy Authority's (AEA) Proposed Study Plans (PSPs) and Revised Interim PSPs, the Federal Energy Regulatory Commission's (FERC or the Commission) Scoping Document 2 (SD2), and the Commission's October 23, 2012 approval of a Board of Consultants for the Susitna Hydroelectric Project (Project) (FERC P-14241-000). In addition, CIRI requests designation as a consulting party with respect to effects of the Project on historic properties and a meeting with Commission staff.

CIRI is an Alaska Native regional corporation owned by more than 7,300 Alaska Native shareholders. CIRI was established as an Alaska law corporation pursuant to the Alaska Native Claims Settlement Act of 1971 (ANCSA), 43 U.S.C. § 1601 *et seq*. As the Commission is aware, CIRI owns or controls, on behalf of itself and various Alaska Native village corporations pursuant to Public Laws No. 94-204 and No. 94-456 (see especially §12(e) and § 4 thereof, respectively), over 200,000 acres in the vicinity of the Project, including approximately 25,000 acres that would be directly affected by the Project's dam and reservoir. A map depicting CIRI land ownership in the Project vicinity is found at Figure 13.1-1, AEA Revised Interim Draft Cultural Resources Study Plan at 13-13 (10/25/2012), copy enclosed with this letter, as Attachment A.

As CIRI has stated in prior comments, CIRI is conditionally supportive of the Project. One key condition involves ensuring that the Project, if licensed, is designed, constructed, operated and maintained in a manner protective of CIRI lands and resources. The Commission's licensing process should ensure that CIRI and all involved ANCSA village corporations and their respective shareholders are routinely informed about the full range of the proposed Project's potential and anticipated environmental and resource impacts, with an explanation of how unavoidable adverse impacts of the Project are both minimized and adequately mitigated. To these ends, CIRI's comments are primarily focused on ensuring that Project impacts are fully and adequately studied, described and evaluated in the Commission's National Environmental Policy Act (NEPA) review process and are fully and adequately evaluated and protected in accordance with the Federal Power Act, ANSCA, the federal government's unique obligations to Alaska Natives, and other applicable laws and policies in the Commission's license and permit, terms, conditions, approvals and authorizations other agencies may issue for the Project.

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I. PROPOSED AND REVISED INTERIM DRAFT STUDY PLANS AND COMMENTS ON SD 2

A. Draft PSPs and Revised Interim Draft PSPs

AEA issued its Draft PSPs in July 2012 and the document is available at FERC's website docket for the Project and AEA's website. Sometime in October 2012, AEA began loading a partial set of Revised Interim Draft PSPs. AEA is to be commended for its efforts to respond to some of the comments it has received on the Draft PSPs.

AEA's October 31, 2012 letter to Commission Secretary Bose "encourages" comments on the Revised Draft PSPs. In footnote 3 to that letter, AEA indicated that it "publicly released comments/response tables, to allow all resource agencies and stakeholders to track how AEA addressed their prior comments on the PSP in the interim draft RSP." The Revised Draft Cultural Resources Study Plan does not include a responsiveness document or track changes that make it readily apparent as to what changes have been made to the Draft PSPs. Accordingly, a reader trying to determine changes set forth in the Revised Interim Draft Cultural Resources Study Plan has to conduct a side-by-side comparison of the Draft PSPs and Revised Draft PSPs. It is a difficult and time consuming effort. We recommend that future changes to the study plans include or be accompanied by a document clearly describing changes, as well as the reasons for and effect of the changes. This is needed to ensure clarity, transparency, responsiveness and consultation by AEA on behalf of the Commission with CIRI and others.

B. Geology and Soils (Minerals Resources Assessment Study Plan)

1. AEA's Draft Geology and Soils Study Plan

GS-4

CIRI's May 30, 2012 comments on Scoping Document 1 (SD1) requested that AEA conduct a Minerals Resource Assessment Study. AEA's July 2012 Draft Geology and Soils study plan acknowledges CIRI's request as well as comments submitted by FERC staff on May 31, 2012 requesting that AEA prepare a geology and soils report. AEA's Draft Geology and Soils study plan states that "the FERC and CIRI study requests correspond to AEA's proposed geology and soils characterization study, and through this study plan AEA is attempting to meet the expectations and objectives of those study requests." Draft Geology and Soils study plan at 4-2. AEA has not posted a Revised Draft Geology and Soils study plan at its web site as of November 6, 2012. AEA's Draft Geology and Soils study plan is a good start. However, ambiguities in AEA's proposed study could fall short of what CIRI requested and FERC's regulations governing geology and soil studies at 18 C.F.R. § 4.41(f), as well as what FERC needs to complete its NEPA assessment.

As context, FERC regulations require a license application's Exhibit A Environmental Report to contain a report on geological and soils resources: "The applicant must provide a report on geological and soil resources *in the proposed project area and other lands that would be directly or indirectly affected by the proposed action* and the impacts of the proposed project on those resources." 18 C.F.R. § 4.41(f) (emphasis added). Among other things, the report must contain "A detailed description of geological features, including bedrock lithology, stratigraphy, structural features, unconsolidated deposits and mineral resources; [and]... A description of any proposed measures or facilities for mitigation of impacts on soils."

The basis for CIRI's Minerals Resource Assessment Study Plan request is CIRI's concern about potential Project impacts on exploitability of mineral resources owned by CIRI both within and outside the proposed Project boundary. The ability of CIRI to explore for and develop these mineral resources could be significantly impaired during the term of the original license, terms of any subsequent FERC licenses, and thereafter so long as the Project dam and reservoir remain, following license surrender or decommissioning. *See* 60 Federal Register 339, 340 (January 4, 1995) (Commission's policy on decommissioning recognizes a range of possible decommissioning alternatives "from simply shutting down power operations to tearing out all parts of the project, including the dam, and restoring the site to its pre-project condition.").

As recommended by CIRI, AEA states that AEA will consult the Bureau of Land Management (BLM) and United States Geological Survey (USGS) "in review of this study plan to determine the most appropriate methods and evaluation techniques are used for the mineral resources investigation." Proposed Study Plan, Section 4.5.4 at 4-5. However, the text preceding this statement states that "A survey of the mineral resources will be performed to assess mineral potential and mining activity *in the impoundment area*." *Id.* (emphasis added). Other statements suggesting that AEA is proposing too narrow a scope include Section 4.5.2 (study will examine "specific information on the properties of Project-site-specific rock and soil units that would be affected by the newly proposed Project") and Section 4.5.3 (noting that FERC regulations require a report to demonstrate that proposed structures are safe and adequate, but no mentioning impacts to mineral resources on adjacent lands).

CIRI requested a Minerals Resource Assessment of: "known or exploitable mineral resources . . . in the vicinity of the proposed Project," CIRI Study Request Section 5.9(b)(1); "in the Project area," Section 5.9(b)(4); whether the "Project . . . may make mineral exploration and development beneath or near the Project technically or economically infeasible," Section 5.9(b)(5); seeking BLM and USGS assistance for a mineral resource assessment of "CIRI subsurface interests in the Project area," Section 5.9(b)(6); of "CIRI subsurface interests . . . in the Project area." Section 5.9(b)(7). As noted above, FERC's regulation requires an Exhibit E report on geology and soils "in the project area *and other lands that would be directly or indirectly affected by the proposed action and the impacts of the proposed project on those resources*." AEA's Section 4.5.1 General Description of the Proposed Study acknowledges that FERC requires Exhibit E to provide such a report and that AEA's geology and soils report "will provide the basis for the information needed for the Exhibit E." Further, Section 4.2.1 of SD 2 includes the following new environmental issue to be addressed in the Commission's NEPA environmental impact statement: "Effects of project construction and operation on access to proven or probable mineral deposits." To the extent AEA's study proposal would not meet CIRI's objectives or FERC's requirements, the study would be deficient.

2. Recommendation

AEA's Geology and Soils minerals assessment study plan component is a good start but is ambiguous in part. It includes statements that would lead to a study "consistent" with CIRI's Minerals Resource Assessment Study request and FERC's regulation. It also includes language that could lead to a narrow study scope that would be inconsistent with CIRI's recommended study and FERC's regulation. We recommend that AEA consult with CIRI toward the goal of seeking clarification or agreement that the scope of the minerals resource assessment component of the Geology and Soils study plan will be as broad as requested by CIRI, as required by FERC's regulations, and as proposed by FERC in section 4.2.1 of SD 2.

C. Cultural Resources

1. AEA's Draft and Revised Cultural Resource Study Plans

AEA's web site includes AEA's July 30 Draft Cultural Resources Study Plan and a Revised Draft Cultural Resources Plan, dated "10/25/2012." In response to comments on the Draft Cultural Resource study plan, AEA included a map showing Alaska Native corporation land ownership interests in the proposed Project area. CIRI land ownership in the dam, reservoir, Gold Creek/ Southern access and Chulitna / Hurricane access alternatives, and other areas within the proposed Project boundary are depicted on the map. Figure 13.1-1, AEA Revised Draft Cultural Resources Study Plan at 13-13, copy enclosed as Attachment A.

CIRI is a steward of all cultural resources on land owned or controlled by CIRI as well as those cultural resources located outside CIRI land that are of traditional importance to the Dena'ina Athabascan Indians represented among CIRI's Native Alaskan shareholders. In the area of the proposed Project dam and reservoir alone, approximately 25,000 acres are owned or controlled by CIRI. Some cultural resources of concern to CIRI and its shareholders have been identified in prior studies. Many others remain unidentified as well as unevaluated for the historic value or significance to CIRI and its shareholders, independent of whether they are eligible for listing on state or federal registers of historic places. Among cultural resources of concern to CIRI but not identified in many prior studies are traditional cultural properties (TCPs, first acknowledged in National Register Bulletin 38, Guidelines for Evaluating and Documenting Traditional Cultural Properties, first issued in 1990, cited in Revised Draft Cultural Resources at 13-8), Native Alaskan human remains, and sacred sites and objects that have only recently been recognized as eligible for protection under federal and state laws, regulations, executive orders, and guidance documents.

CUL-09

AEA's Revised Interim Draft Cultural Resources study plan is an improvement over the Draft Cultural Resource study plan but leaves room for meaningful improvement relevant to FERC's responsibilities. In several places, the Revised Interim Draft Cultural Resources study plan recognizes the need to take into account Dena'ian place names, ethnography, history and culture. In other places, the Revised Draft Cultural Resources study plan takes a narrow approach to the history, anthropology, archaeology and ethnography of the Project area, studying some ethnographic groups or languages, but not Dena'ina, calling for interviews of some Native Alaska elders, but not Dena'ina elders, calling for supplemental study of Dena'ina tribal practices "as appropriate," and suggesting less intensive study of Dena'ian tribal practices. It is common for an area to have been used by more than one Native group either over different time periods or more or less at the same time and for different purposes. *E.g., Navajo Nation v. Forest Service*, 535 F.3d 1038, 1063 n.2 (9th Cir. 2008) (San Francisco Peaks in Northern Arizona has importance to 6 Indian tribes). It is not necessary or appropriate, therefore, to treat the significance of an area to one indigenous, ethnographic community as excluding or precluding its historic significance to other indigenous communities. CIRI's comments should not be understood as suggesting that the study of other ethnographic or tribal groups should not go forward as proposed. AEA's Revised Interim Draft Cultural Resources study plan fails to adequately take into account that history and culture often are complicated by significance of a place to more than one community at the same or different times and for different purposes. This failing results in part from AEA's inadequate consultation with CIRI regarding cultural resources of concern to CIRI and its shareholders.

CIRI is no ordinary stakeholder in the FERC licensing process. As noted above, CIRI owns approximately 25,000 acres in the area of the proposed dam and reservoir, and other land where access and transmission line corridors may be located. CIRI owns and manages these lands in accordance with the intent of ANCSA, a unique federal law. CIRI has a unique legal and economic relationship to FERC's undertaking and the property to be affected by the Project and thus should be engaged as a consulting party with respect to Project impacts on cultural and historic properties under the National Historic Preservation Act (NHPA) section 106, 16 U.S.C. § 470f, Advisory Council on Historic Preservation implementing regulations, 36 C.F.R. § 800.2(c)(5), NEPA, 42 U.S.C. § 4331(a) (federal government cooperation with concerned public and private organizations) and (b)(2) (federal government responsibility to improve and coordinate functions to assure culturally pleasing surroundings) and (4) (federal government responsibility to improve and coordinate functions to preserve important historic, cultural and natural aspects of our national heritage), and NEPA implementing regulations, 40 C.F.R. § 1502.1(d)(2) (federal agency consultation under NEPA with appropriate "interested private persons and organizations"), incorporated by the Commission, 18 C.F.R. § 380.1. Meaningful and good faith consultation with a consulting party uniquely situated in respect to this Project requires more than sending out letters or documents, posting documents at a web site, inviting comments, and invitations to meetings along with the general public.

2. Recommendation

AEA should consult with CIRI directly and meaningfully regarding reasonable and good faith efforts on behalf of FERC to identify and evaluate impacts upon cultural resources of concern to CIRI that may be affected by the Project that should be studied by AEA and taken into account by FERC in its NHPA section 106 and NEPA compliance efforts for the Project licensing process.

D. Transportation Resources - Draft Watana Transportation Access Corridor Report

1. Draft Watana Transportation Access Corridor Report

AEA posted to its web site a June 2012 Draft Watana Transportation Access Analysis prepared by the Alaska Department of Transportation and Public Facilities (ADOT&PF). Four transportation access corridors with variants were included in that report. The Draft Watana Transportation Access Analysis available at AEA's web site did not include the Appendices referenced therein. AEA requested comments on the Draft Watana Transportation Access Analysis by August 31, 2012. CIRI submitted comments on that draft report, copy attached as Appendix B.

AEA subsequently made available a CD copy of Appendices to the Draft Watana Transportation Access Analysis. CIRI also provided comments on the Appendices, copy attached at Appendix B.

CIRI's comment letters strongly opposed both northern corridors (Seattle Creek and Butte Creek) described in the Draft Watana Transportation Access Analysis and Appendices. CIRI also commented on the need for more detailed analysis before any access or transmission line corridor route selection decisions were made.

TRANS-11 Section 15.7.1.1 of AEA's Revised Draft Transportation Resources Study would assess the construction and operational direct and indirect impacts of the Project, including demands for road, railroad, aviation, port and river traffic. Text following Table 15.7-5 notes that additional information needed to complete the Transportation Resources Study includes Project information on proposed access corridor alternatives. Table 15.7-2 references a report "Access Corridor Evaluation," describing its year published as 2012 and "in progress," and the publishing agency as ADOT&PF. It is unclear from the Draft Transportation Resources Study whether the Draft Watana Transportation Access Analysis is the report described in Table 15.7-2. Out of an abundance of caution, CIRI has included its comments on the Draft Watana Transportation Access Analysis in Appendix B.

TRANS-12 An October 15, 2012 letter from the U.S. Fish and Wildlife Service (USFWS) to AEA reviewing AEA's Draft Watana Transportation Access Analysis at FERC's docket states that USFWS learned during a "26 July 2012 AEA-sponsored agency site reconnaissance that the Butte Creek (East) alternative has been dismissed." The Butte Creek corridor described in the Draft Watana Transportation Access Analysis is not a reasonable transportation access alternative. CIRI supports dropping it from further study, if USFWS correctly characterizes AEA's position.

2. Recommendation

TRANS-13 CIRI spent considerable time analyzing the Draft Watana Transportation Access Report. AEA should clarify whether it has dropped the Butte Creek transportation access alternative.

AEA should consider CIRI's comments on the Draft Watana Transportation Access Report in its Transportation Resources Study, including CIRI's very strong and unwavering opposition to both northern access alternatives and recommendation for more substantial study of the western access alternatives. CIRI recommends dropping the Butte Creek transportation access alternative, if not already done, from further study as it is not a reasonable access alternative.

E. Geomorphology (Glacial and Runoff Changes Study Plan)

1. Glacial Melt and Runoff Changes Study

AEA's Preliminary Application Document (PAD) states that climate change may accelerate melting of glaciers (net rate of glacier loss, PAD at 4-39) and may significantly modify the expected energy from hydroelectric projects like the Project due to altered seasonal and annual reservoir inflow regimes. PAD at 3-35. AEA's PAD reports that the Susitna River basin watershed "is in a region that is projected to have among the highest average annual increases in runoff worldwide," about a 10 percent increase by 2050. PAD at 3-48. Section I.D of CIRI's May 30, 2012 SD 1 comment letter noted that AEA had not discussed or indicated "plans to evaluate how *accelerated* glacial input and associated sediment deposition behind the dam may affect the Project's storage capacity and load following operations." CIRI recommended that the Commission evaluate the proposed action in the context of anticipated changes in the hydrologic system in its NEPA analysis.

The Commission's July 16, 2012 SD 2 responded to SD 1 comments from CIRI and others which suggested the need for glacial wasting and climate change analysis as part of the Commission's environmental review of the Project. SD 2 opined that the Commission was unaware of ways to accurately predict the effects of changes in climate on glacial wasting and on the timing and availability of water in the Susitna River based on the current state of science. SD 2 at 18 and 35.

The Commission added that it would request AEA to reexamine the effects of surging glaciers on sediment accumulation rates based on historical data and AEA proposed monitoring.

The goal of AEA's Glacial and Runoff Changes Study is to analyze the potential impacts of glacial retreat on the Project. Specifically, "how glacial retreat, along with associated changes to the climate, impact the flow of water into the proposed reservoir and water quality." Glacial and Runoff Changes Study, Section 5.11.1.1 at 5-147. Acknowledging that the glacial retreat trend is well documented, "and may impact the Project," *id.*, AEA's Glacial and Runoff Changes Study states that "understanding how changes to the upper basin hydrology due to glacial retreat and climate change can affect Project operations is necessary to inform the evaluation of potential protection, mitigation and enhancement (PM&E) measures."

2. Support for Glacial Melt and Runoff Study and NEPA Analysis

GLAC-15

CIRI supports AEA's proposed Glacial and Runoff Changes Study as an appropriate response to the climate change phenomenon and as a means of securing information the Commission may be able to use in its NEPA analysis.

II. FERC AND DOI CONSULTATION REQUIREMENTS UNDER US TRUST RESPONSIBILITY

A. FERC Consulting Authority and Requirements

Every agency of the United States is subject to the federal government's trust responsibility, as FERC[1] and courts have recognized.[2] To better inform these trust obligations, federal agencies began consulting with Indian tribes on a "government-to-government" basis. The federal-tribal government-to-government consultation concept is now recognized in statutes,[3] regulations,[4] executive orders,[5] Presidential memoranda,[6] and agency policies.[7]

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[1] FERC Policy Statement, 104 FERC ¶ 61,018, Order 635 (2003), and corresponding rule, 18 C.F.R. § 2,1c.

[2] Parravano v. Babbitt, 70 F.3d 539, 546 (9th Cir. 1995) ("the trust responsibility attaches to the federal government as a whole").

[3] National Historic Preservation Act, § 479a(d)(6)(B) ("a Federal agency shall consult with any Indian tribe . . . that attaches religious and cultural significance to properties" eligible for listing on the National Register of Historic Places).

[4] Advisory Council on Historic Preservation Act regulations, 36 C.F.R. § 800.2(c)(2)(ii)(C) (federal agencies are to consult with Indian tribes for projects regardless of location; "Consultation with an Indian tribe must recognize the government-to-government relationship between the Federal Government and Indian tribes.").

[5] Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, 65 Federal Register 67249 (Nov. 6, 2000) (Section 2(b), "The United States continues to work with Indian tribes on a government-to-government basis . . . ."); Executive Order 1307, Indian Sacred Sites, 61 Federal Register 26771 (May 29, 1996).

[6] President Obama, Memorandum For the Heads of Executive Departments, Subject, Tribal Consultation, November 5, 2009, 74 Federal Register 57881 ("My Administration is committed to regular and meaningful consultation with tribal officials in policy decisions that have tribal implications, . . .through complete and effective implementation of Executive Order 13175."); President Clinton, Memorandum, for the Heads of Executive

(continued . . .)

Shortly before leaving office in 2000, President Clinton issued Executive Order (EO 13175), Consultation and Coordination with Indian Tribal Governments. Section 5 of EO 13175 directs federal executive agencies to have accountable processes to ensure meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications. President Obama's November 5, 2009 memorandum to all federal executive agencies directed those agencies to develop plans to implement the policies of EO 13175. While EO 13175 does not apply explicitly to independent agencies such as FERC, Sec. 8. states, "independent regulatory agencies are encouraged to comply with the provisions of this order."

In 2004, Congress enacted appropriation acts requiring federal agencies to "consult with Alaska Native Corporations on the same basis as Indian tribes under Executive Order 13175."[8] DOI and the Corps therefore must consult with CIRI when they consult with Indian tribes under EO 13175, and so should FERC. This should be read in concert with FERC's 2003 tribal policy rule at which acknowledges FERC's trust responsibility and (b) states that FERC will "endeavor to work with Indian tribes on a government-to-government basis, and will address the effects of proposed projects on tribal rights and resources through consultation pursuant to the Commission's trust responsibility." 18 C.F.R. § 2,1c(a) - (c).

FERC properly wants to hear from all parties who may have significant interests in the licensing process. CIRI therefore would like to meet with FERC staff to discuss the licensing process, how CIRI can participate in the licensing process to the fullest extent possible, CIRI's substantial interests and concerns in the Project area, and how to establish procedures to ensure appropriate communications between CIRI and FERC.

B. DOI's ANC Consultation Policy

The constitutional, statutory and other bases cited in DOI's Tribal Consultation Policy go beyond EO 13175. This is important in evaluating DOI's Policy on Consultation with Alaska Native Claims Settlement Act (ANCSA) Corporations issued on August 12, 2012 (ANC Consultation Policy). The Preamble to DOI's ANC Consultation Policy states that it establishes a framework for consulting ANCs in "compliance with Congressional direction," citing the 2004 congressional acts requiring all federal agencies to consult with ANCs "on the same basis as Indian tribes under Executive Order No. 13175." The narrower basis for conducting ANC consultations—"on the

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(. . . continued)
Departments and Agencies, Government-to-Government Relations with Native American Tribal Governments, 59 Federal Register 22591 (May 29, 1994).

[7] Department of the Interior Policy on Consultation with Indian Tribes, and Secretarial Order No. 3317 ("The purpose of this Order is to update, expand, and clarify the Department's policy on consultation with American Indian and Alaska Native tribes; and to acknowledge that the provisions for conducting consultations in compliance with Executive Order (E.O.) 13175 [ ] and applicable statutes are expressed in the Department of the Interior Policy on Consultation with Indian Tribes." (December 11, 2011).

[8] Pub. L. 108-199, Div. H, § 161, Jan. 23, 2004, 118 Stat. 452, as amended by Pub. L. 108-447, Div. H, Title V, § 518, Dec. 8, 1997, 118 Stat. 3267.

same basis as Indian tribes under Executive Order No. 13175"—is made explicit in the Preamble to DOI's ANC Consultation Policy:

> The select provisions of the Tribal Consultation Policy are modified below for the purpose of consultation with ANCSA Corporations. The Department of the Interior distinguishes the Federal relationship with ANCSA Corporations from the government-to-government relationship between the Federal Government and federally recognized Indian Tribes in Alaska and elsewhere, and this Policy does not diminish in any way that relationship and consultation obligations toward federally recognized Indian tribes.

The Guiding Principles of DOI's ANC Consultation Policy add: "To the extent that concerns expressed by Indian Tribes and ANCSA Corporations substantially differ, Departmental officials shall give due consideration to the right of sovereignty and self-governance of federally recognized Indian tribes."

As DOI's Tribal Consultation Policy does not rely solely on EO 13175, it is possible that DOI or Alaska Indian tribes could invoke DOI consultation with Alaska Indian tribes on a government-to-government, "trust responsibility" or other basis, not EO 13175. In short, they may assert that the 2004 congressional acts mandate DOI consultation with ANCs when DOI invokes consultations with Indian tribes under EO 13175.

CIRI could consult with BLM to advise that it strongly opposes transportation and transmission line corridors over the Seattle and Butte Creek alternatives on BLM land, urge BLM to advocate for corridors favored by CIRI, and develop FPA section 4(e) conditions FERC must include in a license for the Project for the use of BLM land, if authorized by FERC, that might cause FERC and AEA to choose transportation access and transmission line corridors favored by CIRI. For the reasons described above, if Indian tribes consulting with BLM advocate corridors opposed by CIRI, DOI consultations with CIRI and Indian tribes may not be on a level basis.

III. BOARD OF CONSULTANTS

A. Support for Board of Consultants

On October 23, 2012, the Commission's Director, Division of Dam Safety and Inspections (Director), approved a Board of Consultants (BOC) recommended by AEA for the Project. AEA requested approval of the BOC to oversee and assess the adequacy of AEA's study plans, investigations, designs and construction for the Project. The Director's approval identified minimum responsibilities of the BOC.

In accordance with the BOC's responsibilities, AEA will provide "data packages" to each BOC member, the Director, and Division of Dam Safety and Inspections (D2SI) Portland Regional Engineer (Regional Engineer) two weeks before BOC meetings. Within 15 days of BOC meetings, AEA will provide the Director and Regional Engineer copies of a plan and schedule to comply with the BOC's recommendations or a statement identifying a plan to resolve any issues, together with detailed reasons for not doing as BOC recommended.

CIRI recognizes that some of the information included in "data packages" provided by AEA to BOC members and documents prepared by AEA following BOC meetings that must be provided to the Director and Regional Director may include documents or information exempt from disclosure to the general public under the Freedom of Information Act, 5 U.S.C. § 552, or because it is Critical Energy Infrastructure Information (CEII), 18 C.F.R. § 388.113.

As noted previously, CIRI owns approximately 25,000 acres in the Project dam and reservoir area and other land that may be affected by the Project, including unanticipated floods caused or contributed to by the Project, and floods that could be exacerbated by seismic hazards in the Project area. *See* CIRI lands in relation to the Project depicted on Figure 13.1-1, AEA Revised Interim Draft Cultural Resources Study Plan at 13-13 (10/25/2012), Appendix A. The Commission's rules provide that a landowner whose property is crossed by or in the vicinity of a project may receive detailed alignment sheets containing CEII directly from the Commission, 18 C.F.R. § 388.113(d)(3), without submitting a non-disclosure agreement under 18 C.F.R. § 388.113(d)(3).

CIRI's interests in site geology include but are not limited to mineral resources, the exploitation of which may be adversely affected by the Project design and construction alternatives evaluated by the BOC and AEA. CIRI's ability to manage lands and resources it owns or controls down-river from the proposed dam, together with human safety of those entering and using CIRI land will be affected by Project design, construction and operation considered by the BOC.

B. Recommendation

CIRI recommends that the Commission direct AEA to negotiate with CIRI toward the goal of reaching an agreement regarding CIRI access to BOC "data packages" and AEA reports of BOC recommendations that takes into account CIRI's unique interests as a major Alaska Native Corporation ANCSA landowner in the area that will be affected by the Project, and AEA's interests in protection of CEII information. This recommendation is not itself a request for CEII information. Neither AEA nor CIRI should be deemed to waive any position it has or could assert regarding disclosure or nondisclosure to CIRI of BOC "data packages" or reports of BOC recommendation by reason engaging in the negotiations hereby recommended.

IV. NHPA CONSULTING PARTY DESIGNATION AND MEETING WITH FERC STAFF

A. Request for Designation as NHPA Section 106 Consulting Party

NHPA Section 106, 16 U.S.C. § 470f, requires federal agencies, including FERC, DOI and the Corps, to take into account the effects of their actions on properties listed on or eligible for listing on the National Register of Historic Places (National Register). Properties "of traditional and cultural importance to Indian tribes may be eligible for inclusion in the National Register." 16 U.S.C. § 470a(d)(6)(A). The NHPA directs federal agencies to "consult with any Indian tribe . . . that attaches religious and cultural significance to properties" eligible for listing on the National Register. 16 U.S.C. § 470a(d)(6)(B).

The NHPA also requires agency Section 106 procedures to be consistent with regulations adopted by the Advisory Council on Historic Preservation (Advisory Council). 16 U.S.C. § 470h-2(a)(2)(E)(i). Advisory Council regulations establish elaborate, multi-step procedures for extensive government-to-government consultation with Indian tribes. Among other things, Advisory Council regulations state that "agency official shall recognize that Indian tribes . . . possess special expertise in assessing the eligibility of historic properties that may possess religious and cultural significance to them." 36 C.F.R. § 800.4(c)(1).

With respect to CIRI's interests, the Advisory Council regulations provide that "organizations with a demonstrated interest in the undertaking may participate as consulting parties due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties." 36 C.F.R. § 800.2(c)(5). The action agency must identify any parties entitled to be consulting parties and invite them to participate in the section 106 process. 36 C.F.R. § 800.3(f). Consulting parties have procedural rights under the Advisory Council's regulations comparable in some but not all respects to those of Indian tribes. See, e.g., 36 C.F.R. § 800.6(c)(3) (consulting parties may be invited to be concurring parties to a document resolving adverse effects).

The Advisory Council's regulations also provide that the views of the "public are essential to informed Federal decisionmaking in the Section 106 process. The agency official shall seek and consider the views of the public in a manner that reflects the nature and complexity of the undertaking and its effects on historic properties. . . . confidentiality concerns of private individuals and businesses, and the relationship of the Federal involvement in the undertaking." 36 C.F.R. § 800.2(d).

Because the Project dam, reservoir, borrow sites for construction materials, airport, likely recreation facilities on or around the reservoir, and other Project works will be on CIRI land and certain alternatives for transportation access and transmission line(s) are on CIRI land, CIRI has interests as a business-landowner in historic properties on its land that may be affected by the Project, including business confidentiality concerns, and may have organizational interests on behalf of its shareholders in historic properties on CIRI land. FERC's January 19, 2012 letter inviting CIRI to consult with FERC staff regarding the Project is broad enough to include, but is not limited to, NHPA Section 106 historic property matters.

CIRI has significant interests in the Project area and by actively engaging as a consulting party with FERC, AEA, and the Alaska State Historic Preservation Officer in FERC's Section 106 process. Thus, pursuant to 36 C.F.R. § 800.3(f)(3), CIRI requests that the Commission designate CIRI as a consulting party to participate in consultations with the Alaska State Historic Preservation Office and the Commission in the NHPA section 106 process for the Project. This request is based on (a) the location of the proposed Project on CIRI land, (b) CIRI's stewardship interest in identification, documentation, evaluation of effects, and resolution of adverse effects of the Project on historic properties listed on or eligible for listing on the National Register of Historic Places on CIRI land as well as those historic properties located outside CIRI land of concern to CIRI and its Dena'ina shareholders, and (c) long-term economic impacts on CIRI of managing its lands taking into account historic properties affected by or potentially affected by Project development, including but not limited to regulation of recreation trespass on historic trails on CIRI land attributable to Project development.

B. <u>Meeting with FERC Staff</u>

On January 19, 2012, the Commission invited CIRI to meet with Commission staff to discuss the Commission's licensing process, how CIRI can participate to the fullest extent possible, CIRI's interests and concerns in the affected area, and how to establish procedures to ensure appropriate communication between FERC and CIRI staffs. We realize our response is well beyond the Commission's requested response date of February 3, 2012; however, the licensing process for this Project will proceed over a lengthy period and such a meeting remains relevant. Engagement in the process thus far has stretched CIRI's staff and financial resources and CIRI staff does not have extensive experience with FERC licensing procedures for a Project of this magnitude. Thus, we wish to accept the Commission's invitation at this time. Please contact me or Dara Glass, CIRI Land Manager, at 907.263.5140, or dglass@ciri.com, to schedule a meeting among Commission and CIRI staffs.

V. CONCLUSION

CIRI looks forward to working with the Commission and AEA to ensure that the Project is designed, constructed, operated and maintained in a manner that addresses CIRI's unique land, resources and other interests.

Thank you in advance for considering these comments. Please direct any questions to Dara Glass, CIRI Land Manager, at 907.263.5140, or dglass@ciri.com or myself.

Sincerely,

COOK INLET REGION, INC.

By: Ethan G. Shutt
Sr. Vice-President, Land and Energy Development

Attachments

ATTACHMENT A

FIGURE 13.1-1, AEA REVISED INTERIM DRAFT CULTURAL RESOURCES STUDY PLAN AT 13-13 (10/25/2012)

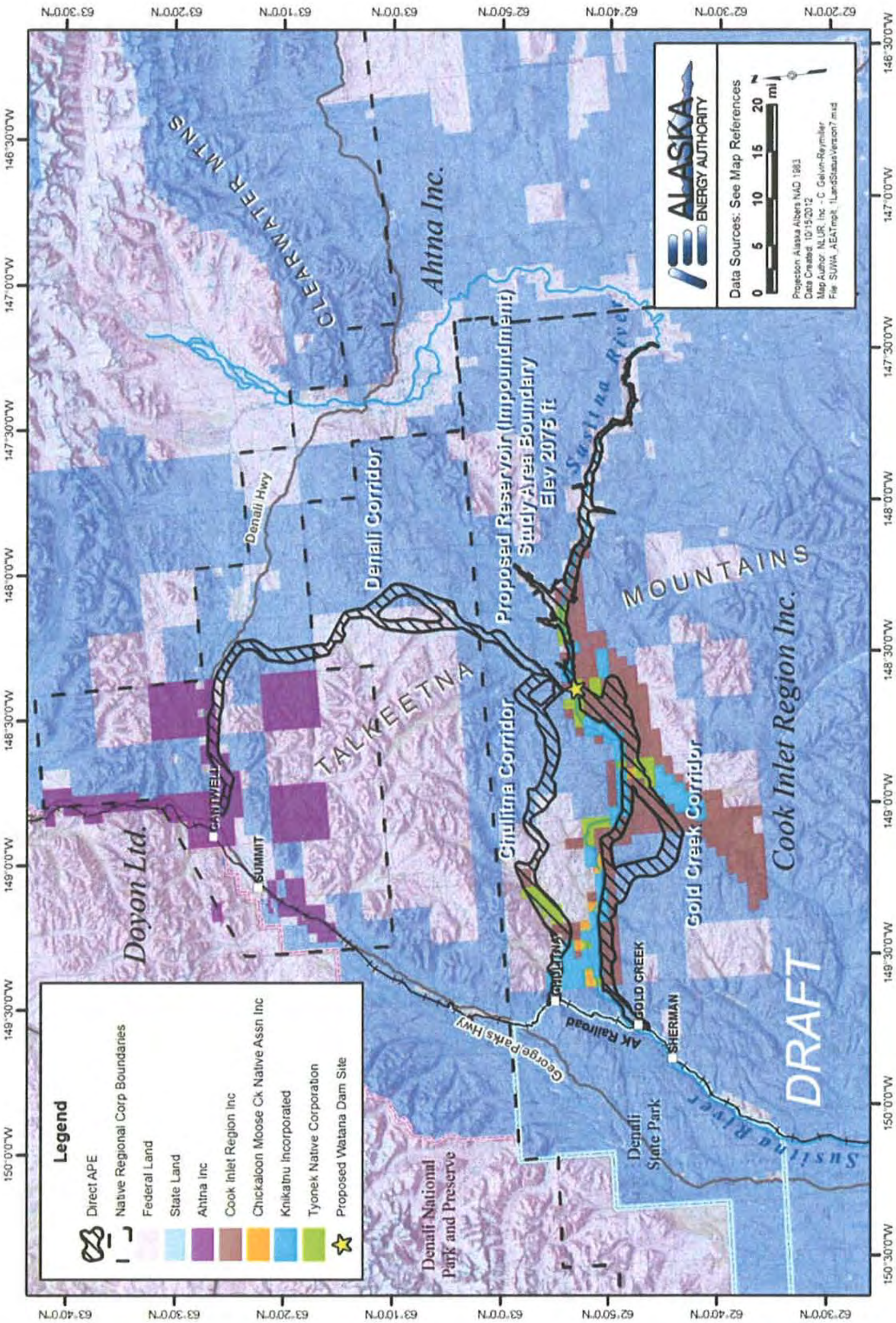

Figure 13.1-1. Property ownership in the vicinity of the study area.

APPENDIX B

CIRI COMMENTS ON DRAFT TRANSPORTATION ACCESS ANALYSIS AND APPENDICES

CIRI

October 15, 2012

Alaska Energy Authority
Susitna-Watana Hydroelectric Project
c/o Wayne Dyok, Project Manager
813 W. Northern Lights Blvd.
Anchorage, AK 99053

SENT VIA EMAIL
susitnawatana@aidea.org

Re: Supplemental Comments on Appendices, Draft Transportation Access Analysis, Susitna-Watana Hydroelectric Project (FERC Project No. 14241)

Dear Mr. Dyok:

Cook Inlet Region, Inc. ("CIRI") appreciates the opportunity to provide these supplemental comments regarding the Appendices ("Appendices") to the Draft Transportation Access Analysis, Susitna-Watana Hydroelectric Project ("Draft Access Analysis") recently provided to CIRI by the Alaska Energy Authority ("AEA") with respect to the proposed Susitna-Watana Hydroelectric Project (the "Project"). This letter supplement CIRI's comments on the Draft Access Analysis, provided to you in our August 31, 2012 letter.

As the AEA is aware, CIRI owns or controls, on behalf of itself and various Alaska Native village corporations, over 200,000 acres in the vicinity of the Project, including approximately 25,000 acres that would be directly affected by the Project's dam and reservoir. Thus, CIRI has a vested interest in how the access route to the Project site is selected and which route is ultimately chosen.

CIRI's August 31 comments on the Draft Access Analysis and comments on the Pre-Application Document and the Scoping Document 1 for the Project, filed with the Federal Energy Regulatory Commission ("FERC") on May 30, 2012, emphasized CIRI's strong opposition to any transmission or access corridor that would run north from the Project site to the Denali Highway. After reviewing the Appendices, CIRI remains strongly opposed to such routes and therefore objects to the Seattle Creek (North) and Butte Creek (East) access routes identified in the Draft Access Analysis and Appendices, including the variants on each of them. Our comments on the Appendices are outlined below.

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I. Comments on Appendices

A. Overview

The Appendices confirm concerns expressed by CIRI in its August 31, 2012 comment letter. These concerns include but are not limited to: AEA's evaluation of rail, road, and bridge alternatives without field-level reconnaissance for the Southern route, reflecting in part AEA's lack of consultation with CIRI; analyses of road alternatives without adequate contemporary engineering, geotechnical, or other appropriate field investigations; AEA's failure to take into account transmission line siting cost and other considerations that could significantly impact Project construction costs and schedule, energy security considerations, and environmental impacts; use of subjective evaluation criteria; failure to evaluate climate change data and trends on road and transmission line construction and maintenance costs for all alternatives in Appendix D; and appearance of prejudgment favoring the Seattle Creek and Butte Creek alignment alternatives.

B. Appendix H, Geotechnical Report

Appendix H confirms that the investigators conducted very limited if any on-the-ground geotechnical investigation of the South [Road] Alignment or rail alternative on CIRI land as part of the work for that Appendices. Appendix H states, at 4, that the South Alignment "was not given the same attention given other alignments during the field reconnaissance effort," and that "Subsequently, it has been requested that we provide evaluation of the South Alignment." The report does not disclose what that further evaluation involved or how it would compare in scope and detail to investigations conducted of other access alternatives. Confirmation of the limited investigation of the South Alignment and rail alternative is found in the eighty (80) geotechnical photographs in Attachment H, including photographs incorporated into the Hurricane West, Seattle Creek and Butte Creek site plans. Not one of these 80 photographs depicts South Alignment road or rail geotechnical features. Appendix H concedes, at 4, that "the geotechnical evaluation and conclusions regarding the South Alignment are based on literature review and limited observations in the field," a qualification not repeated for any other Alignment.

Appendix H concludes, at 25, that each Alignment "provides a viable option for accessing the Watana Hydroelectric Project site," but that "the corridors are not equal in their favorability based on several factors." Appendix H gives an "opinion" ranking alignments in the following order from most to least favorable: Butte, Seattle, Hurricane and South Alignments. Id. According to Appendix H, that "opinion" is "corroborated through the subjective ranking system presented in Section 7.0 and discussed in further detail below." Id. (emphasis added). That "opinion" is based on criteria outlined in Section 6, including permafrost conditions. The Conclusion's unfavorable "opinion" regarding the South Alignment is based in part on "poor subgrade support conditions [that] may exist in the form of thaw unstable permafrost." Appendix H at 28. That conclusion and opinion appear to have been formed in the absence of any field-level geotechnical reconnaissance and core sampling on CIRI land.

Appendix H states, at 1, that the "results of our evaluation will be used to supplement other criteria, such as construction costs and environmental impacts, in an attempt to select the optimum alignment corridor to be submitted in the Federal Energy Regulatory Commission (FERC) application for the Watana Hydroelectric Project." Whatever else may be said of Appendix H, it does not provide at this point an adequate technical or scientific basis for a recommendation to make a selection decision against the South Alignment.

C. Appendix B, Structures Report (Bridges), Appendix D, Cost Estimate, Appendix J, Wetlands

Appendix B focuses on bridges for several South Alignment road alternatives. Like Appendix H, this Appendix does not appear to be based on any on-the-ground field-level investigations on CIRI land or consultations with CIRI. Some of the pictures in Appendix B appear to be based on aerial over-flights.

The Introduction to Appendix B includes a generalized observation that "Even under ideal circumstances, . . . large bridges can add years to the duration of a project." This is followed in Section 3, captioned South Road Alignment Concerns, by a statement: "In the case of the South Road alignment, the challenges could prove to be nearly insurmountable." Section 3 adds that "the presence of the major structures [for the South Alignment road bridges] will inflate the schedule of the South Road alignment relative to other alignments studies." Section 3 adds that "without a feasible concept in mind the difficulties of construction could render this alignment financially reckless to achieve." In the absence of on-the-ground investigations and consultations with CIRI, these statements reinforce the appearance that the Draft Access Analysis and Appendices are the product of pre-judgment by AEA favoring the Seattle Creek and Butte Creek alignment alternatives.

Appendix B notes that design and construction techniques, costs and schedules for long-span bridges, those over 300 feet, are significantly different than those under 300 feet. The cost of constructing "conventional" bridges under 300 feet is calculated based on a 35 foot wide bridge and a cost per square foot of $350. Bridges over 300 feet are assumed to have the same width but cost $1,000 per square foot, due to different design, construction and access requirements. Whether long-span bridges could be constructed to a width narrower than 35 feet consistent with the Project purpose and need and cost impacts of a narrower bridge design are not evaluated in Appendices B or D.

The South Alignment, climbing to a higher elevation than the South B Variant, would bridge Gold Creek (conventional: 200 feet), Cheechako Creek (long-span: assumed to be 400 feet for Appendix D cost estimate, but could be 500 feet), Fog Creek Tributary (conventional: 250 feet) and Fog Creek (conventional: 150 feet). The South B Variant would run closer to the Susitna River, making the same crossing as the South Alignment but adding 800 feet of conventional bridge tributary crossings. The Fog Creek Variant would cross Gold Creek (conventional), Cheechako Creek (long-span), and Fog Creek Gorge (long-span: 700 feet). The South Alignment would be least-cost among the three Southern variants.

Appendix D adopts the South Alignment for its cost estimate comparisons. Direct and indirect cost estimates in millions for the road and rail alternatives are as follows: South $251.2; Hurricane (Western) – $211.5; Seattle Creek - $164.2: Butte Creek - $175.7; rail $400.3 million. These cost estimates do not include life-of-the Project license maintenance, permitting and mitigation costs of any access alternative or associated transmission line(s).

For example, there are significant differences in wetlands impacted among the various alternatives for which no cost is estimated for design, permitting and mitigation that may be required to comply with Clean Water Act section 404, 33 U.S.C. § 1344, and Corps of Engineers mitigation regulations, 33 C.F.R. Part 332, Compensatory Mitigation for Losses of Aquatic Resources. See Draft Access Analysis Section 4.2.6.2 ("Seattle Creek (North) alternative impacts the greatest total of acres of wetlands . . . . Consultation with the Corps will be necessary to further evaluate permit stipulations and conditions, including potential mitigation options."); Appendix J, Wetlands (same). Table 2, Appendix J, tabulates Category 3 and 4 wetlands likely requiring greatest scrutiny for design to avoid and minimize wetland impacts and further evaluation for permitting and mitigation within the 150 foot right of way buffer most likely to be impacted by Project construction and operation. Of these, 36.3 acres are within the Southern alternative, compared to 147.3 acres for the Seattle Creek alternative, a four-fold difference. Even assuming that some of the 316.5 acres of unmapped Southern alternative lands qualify as Category 3 and 4 wetlands, the Seattle Creek alignment is still likely to be burdened by more wetlands imposing greater costs for design to avoid and minimize wetland impacts and permitting and mitigation than the Southern Alignment. With 135 acres of Category 3 and 4 wetlands falling within the 150 foot right of way buffer for that half of the Butte Creek alternative for which wetland maps area available, the Butte Creek alternative also is likely to be burdened by more costs for design to avoid wetland impacts and wetland permitting and mitigation than the Southern alignment. On a subjective professional judgment basis, using a scale from 1 to 5 with 1 being "no impact" and 5 being "significant impact," Appendix J characterizes the Seattle Creek and Butte Creek alternatives as having a value of 3 for wetlands impacts compared to a value of 2 for the Southern and Hurricane (West) alternatives. Whether Appendix J subjectively understates the significance of wetland impacts for the Seattle Creek and Butte Creek could be debated. Regardless, wetland design, permitting and mitigation costs for the Seattle Creek and Butte Creek alternatives are likely to be greater than for the Southern alternative. Appendices B and D also do not evaluate transmission line alternatives construction, maintenance, mitigation and permitting costs, wetlands or otherwise.

Appendix D does not estimate impacts of permafrost on road, rail or transmission line construction and maintenance costs for any access or transmission line alignment or reasonable alternatives in light of current climate change information, data and trends. It may be inappropriate to make transportation access and transmission line alignment cost estimate and selection decisions without consideration of relevant climate change data and trends information that may be relevant to consideration of those alternatives.

For each access and associated transmission line(s) alternative, "all-in" cost estimates should include direct and indirect construction, life-of-the Project license maintenance, permitting and mitigation costs. Before AEA and FERC make an irreversible and irretrievable commitment of resources to a preferred access and transmission line alignment, CIRI recommends that AEA and FERC consult with CIRI regarding (a) appropriate on-the-ground investigation of access road or rail and transmission line alternatives on or affecting CIRI land, (b) appropriate criteria for "all-in" cost estimates for each road, rail and transmission line alternative and (c) consideration of direct, indirect and cumulative environmental impacts, permitting, mitigation, and energy security considerations which should be factored into any decision on Project access and transmission line route alternatives.

D. Appendix A, Design Criteria

CIRI anticipates that AEA will request FERC to issue a license with a 50 year term. Is it appropriate, therefore, to propose a "20-year design" for the Project's access road? What are the life-of-the Project maintenance and replacement cost estimates that flow from a "20-year design" for the Project's access road? Are the 22-foot wide lane and shoulder road width description on page 4 of Appendix A consistent with the 35-foot wide bridge design described in Appendix B used to estimate costs in Appendix D?

Appendix A acknowledges, at 3 and 4, that the access road will open potential recreation opportunities for the public after construction of the dam is completed. While certain limited recreation opportunities may be made available to the public within the Project boundary under the Project license, the Seattle Creek and Butte Creek alignments and related transmission line will afford the public unregulated and uncontrolled access to CIRI land. Predictably, this will result in unregulated and uncontrolled trespass, hunting, fishing and travel on CIRI land, theft of or other harm to cultural resources, timber and other natural resources on CIRI land, demand for medical and rescue emergency services on CIRI land, management of unauthorized waste disposal on CIRI land, and increased risk of human-causes fires endangering lives and damaging natural resources on CIRI land. These are among the bases of CIRI's opposition to those routes articulated in our August 31, 2012 and May 30, 2012 comment letters.

II. Conclusion

As stated in CIRI's May 30, 2012 comment letter to FERC, CIRI is supportive of the Project in principle. But, CIRI is interested in ensuring that the Project is investigated, constructed, operated, maintained and mitigated in a manner that is sensitive to CIRI lands and resources, involved Alaska Native village corporations and that their respective Alaska Native shareholders. CIRI owns and manages land and resources for Alaska Native shareholders in accordance with federal law, including the Alaska Native Claims Settlement Act, 43 U.S.C. § 1603 *et seq*.

Thus, CIRI is no ordinary, private landowner or stakeholder. FERC and AEA should ensure that CIRI, involved Alaska Native village corporations and their respective Alaska Native shareholders are informed of the full range of potential environmental, natural resource, energy, and economic impacts of the Project, and are compensated appropriately for the Project's use and inundation of and impacts on CIRI lands and resources. Throughout the Project licensing process, FERC and AEA should consult with CIRI in meaningful ways and at meaningful times consistent with these goals and the special role that CIRI plays in ownership and management of land and resources affected by the Project.

Our comments on the Appendices are offered to these ends.

Sincerely,

COOK INLET REGION, INC.

By: ______________________
Ethan G. Schutt
Senior Vice-President, Land and Energy Development

CIRI

VIA EMAIL
susitnawatana@aidea.org

August 31, 2012

Alaska Energy Authority
Susitna-Watana Hydroelectric Project
c/o Mr. Wayne Dyok, Project Manager
813 W. Northern Lights Blvd.
Anchorage, AK 99053

Re: Comments on Draft *Watana Transportation Access Analysis*; Susitna-Watana Hydroelectric Project (FERC Project No. 14241)

Mr. Dyok:

Cook Inlet Region, Inc. ("CIRI") appreciates the opportunity to provide these comments on the Draft *Watana Transportation Access Analysis* (the "Draft Access Analysis") prepared for the Alaska Energy Authority ("AEA") by the Alaska Department of Transportation and Public Facilities ("ADOTPF") and published on June 26, 2012, with respect to the proposed Susitna-Watana Hydroelectric Project (the "Project"). CIRI's comments consist of both (1) the comments presented in the body of this letter and (2) the comments from Richard Weldin, President of CIRI Services Corp., to Dara Glass, Land Manager of CIRI, in the letter dated August 29, 2012 and attached as Appendix A. Mr. Weldin has 35 years of experience in the construction industry in Alaska, having supervised over $100 million in projects including excavation and road work. CIRI Services Corp. is a wholly-owned subsidiary of CIRI.

As the AEA is aware, CIRI owns or controls, on behalf of itself and various Alaska Native village corporations, over 200,000 acres in the vicinity of the Project, including approximately 25,000 acres that would be directly affected by the Project's dam and reservoir. Thus, CIRI has a vested interest in which route to the Project site is chosen.

In CIRI's comments on the Pre-Application Document and the Scoping Document 1 for the Project, filed with the Federal Energy Regulatory Commission ("FERC") on May 31, 2012, CIRI strongly opposed any transmission or access corridor that would run north from the Project site to the Denali Highway. CIRI continues its staunch opposition to the Seattle Creek (North) and Butte Creek (East) roads identified in the Draft Access Analysis, including the variants on each of them.[1]

[1] Variants on the Seattle Creek (North) route identified in the Draft Access Analysis include the Kettle Lake Variant (North B) and the Deadman East Variant. The Butte Lake (East) variants include the Raptor Trail Variant and the Butte Lake (A and B) Variants.

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As the following comments will show, the conclusion drawn in the Draft Access Analysis "that the South Road and Hurricane (West) corridors would be less desirable as the access road corridor than the other two corridors" is based on (a) no contemporary engineering, geotechnical or other on-the-ground field investigations of CIRI land of which we are aware, (b) no consultation with CIRI, possibly in violation of Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, (c) no other public consultation of which we are aware, (d) erroneous statements (some attributable to a lack of consultation), (e) data gaps, (f) sweeping, subjective, qualitative assumptions in lieu of quantitative data, (g) no current climate change data and trends which need to be considered in evaluating access corridors on permafrost and other lands, and (h) a general absence of field verifications at a level sufficient to support access and transmission corridor planning-level decisions for a project of this character. The Draft Access Analysis glosses over the importance of co-locating the transmission corridor and access road, and fails to consider important practical construction concerns affecting the cost and feasibility of each proposed access route and transmission corridor.

In short, the Draft Access Analysis supports the need for much more information, not a fact-based decision on an access corridor for the Project. Therefore, CIRI recommends that the AEA consult with CIRI, and other public agencies and interested parties, including CIRI, to (1) conduct studies sufficient to support a fact-based, technically-sound decision on an access corridor, including undertaking a core sampling operation by helicopter along each of the proposed routes with the consent of the appropriate landowners, (2) develop a model for accurately projecting the cost of each option, including the cost impact of co-locating (or not) the transmission line(s), and (3) select preferred access and transmission routes.

Detailed Comments

A. Appendices to the Draft Access Analysis Were Not Published; Request to Extend the Comment Period

The AEA did not publish the appendices to the Draft Access Analysis. So that interested parties may provide comprehensive feedback on the report, including any analysis of cost estimates, CIRI requests that the AEA make the appendices available and extend the public comment period on the Draft Access Analysis to September 30 to permit supplemental comments based on information in the appendices.

B. Conclusions in the Access Analysis are Not Based on Current Quantitative Data

CIRI has serious concerns that the Draft Access Analysis came to its conclusions in the absence of current quantitative data.

On page 1, the Draft Access Analysis states that "[t]he information contained in this report is based largely on existing information that was supplemented by limited field investigations performed in October 2011. No public or agency consultation was conducted in the development of this report." Presumably, the "existing information" referenced by the ADOTPF is the 1982 *Access Planning Study Supplement* and other studies used in the 1980s licensing effort. However, that data is 30 years old. The AEA should not base any access corridor siting decision on a report that uses 30-year old data and where "[n]o public or agency consultation was conducted" that might have led to relevant site-specific information, and bases its conclusions, even in part, on subjective, unverified qualitative generalities labeled "criteria."

For example, the geologic and geotechnical analysis in Section 4.2.2 is, by its own terms, based on a "lack of quantifiable data." As Mr. Weldin describes in his letter, the rock borrow quality and availability is crucial to keeping construction costs low; therefore, accurate data on geologic and geotechnical conditions is very important to the route-selection process. However, the Draft Access Analysis relies solely on work done in the 1980s combined with aerial reconnaissance and hand-sampling of selected locations, and bases its conclusions with respect to rock quality on a geotechnical engineer's qualitative evaluation of that information. Moreover, Table 4-12 states that rock borrow availability, soil borrow availability, drainage, rock slope stability, and foundation support are "not used as evaluation criteria." These characteristics of each route must be included as evaluation criteria in the route-selection process.

Conclusions in the Draft Access Analysis cannot be relied upon without recent, quantitative data, especially with respect to critical cost-controlling components, like borrow rock quality and availability and natural conditions that are likely to have changed over the last 30 years, like permafrost conditions.

C. Certain Conclusions are Based on Unfounded Assumptions

In several places, the Draft Access Analysis states unfounded assumptions that are then relied upon in making its conclusions. First, Section 4.2.7 states that "[l]ands owned by Native corporations typically take between 18 and 24 months to negotiate acquisition." *Id.* at 67. This rings untrue to CIRI with respect to its lands. As you know, CIRI is a major landowner along the South Road corridor alternative as well as in the dam and reservoir area. However, the Draft Access Analysis runs with the assumption, characterizing the South Road and Hurricane (West) corridors as "not preferable." CIRI recommends that AEA and ADOTPF consult with CIRI about access over CIRI land for the Project corridor before preparing a final Access Analysis report.

Second, in Section 4.2.1.4, the Draft Access Analysis assumes that construction on the access corridors will not take place during the winter months "because of the need to achieve compaction with moisture and density controls." *Id.* n.13. Such an assumption, if proven invalid, would have a substantial impact on the construction schedule for each route. In fact, based on his 35 years of construction experience, it is Mr. Weldin's professional opinion that "dealing with permafrost, high ground water, creek crossings, and excavating waste and overburden is <u>best</u> accomplished in the winter months under most circumstances" (emphasis added).

D. Climate Change and Permafrost

Section 2.2.2.6 discusses permafrost conditions. No consideration of permafrost as a construction factor is adequate without an evaluation of current data and projections relating to climate change. The access road needs to support access to the Project site for heavy equipment during construction, operation and maintenance for the initial license period, which could be up to 50 years. Regardless of cause, reasonably foreseeable warming climate conditions over the next 50-60 years will likely affect permafrost, making an area that might be suitable for access in the near term unsuitable or unreasonably more expensive to operate and maintain during later stages of the

Project license. The final Access Analysis report needs to analyze this issue based on best available science. That analysis may affect the access corridor selection.

E. The Access Analysis Glosses Over the Importance of Co-Locating the Access Road and Transmission Corridor

Co-location of the access road and the transmission corridor will be very important to minimizing the overall cost of the Project. Section 4.2.1.7 states that the advantages of co-location include "lower transmission line construction and maintenance costs and reduced project footprint." Draft Access Analysis at 33. CIRI agrees and believes the Draft Access Analysis did not properly consider the cost and logistical impacts of (1) constructing the Butte Creek (East) corridor when the AEA has stated that it is not considering locating a transmission line there or (2) the total number of linear miles of transmission line that would be required above 3,000 feet in each corridor.[2]

The Draft Access Analysis indicates that the Butte Creek (East) corridor is not being considered as a location for a potential transmission line. *Id.* at 93. Based on this information and pending confirmation that separately locating the access road and transmission corridor would result in a substantial increase in total Project costs, the Butte Creek (East) corridor should be rejected.

The Draft Access Analysis also indicates that the elevation of the transmission line should be less than 3,000 feet, likely because of potential snow loading and icing on the lines. *See id.* at 13. Although the Draft Access Analysis indicates that *short segments* above 3,000 feet *may be* acceptable, *id.*at 33, it presents no justification for recommending the Seattle Creek (North) corridor, which would locate 32 of its 43.3-mile length above the 3,000-foot level. Similarly, the Draft Access Analysis does not take into account the potential additional cost of locating only a portion of the transmission line within the Seattle Creek (North) corridor. *See id.* at 93 ("In a meeting on October 25, 2011, AEA and their consultants indicated . . . that the transmission line could share a corridor with the access road within *most* of the Seattle Creek (North) corridor."). Approximately 9.5 miles of the transmission line[3] would have to be routed on the east side of Deadman Mountain, while the access road would remain on the west side. The additional costs of constructing a transmission line (1) 74% of which is located above 3,000 feet and (2) only a portion of which would be co-located with the Seattle Creek (North) access road, must be calculated and considered in the Draft Access Analysis.

Conclusion

Even a cursory review of the red ("not preferable") and green ("favorable") designations in Table 5-1 of the Draft Access Analysis reveals that the analysis improperly weighted its chosen criteria. For

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[2] In an October 25, 2011 meeting with the ADOTPF project team, the AEA indicated it would prefer to locate the transmission line in the same corridor as the road but would prefer to remain under an elevation of 3,000 feet. Draft Access Analysis at 13 n.7.

[3] Calculated based on the route description on pp.13-14 of the Draft Access Analysis, which states that the Seattle Creek (North) corridor would split near MP 18.5 and, presumably, reconnect as the corridor drops down into the Deadman Creek drainage at MP 28.

example, both the South Road and Hurricane (West) corridors are given "not preferable" ratings because the Draft Access Analysis relies on the unproven assumption, based in part on failure to consult with CIRI, that access rights to Native corporation lands cannot be negotiated in less than 18-24 months. No other reason for this designation is given or can be inferred from the report. In addition, the table omits rock borrow availability, soil borrow availability, drainage, rock slope stability, and foundation support- all of which are important engineering and cost considerations, but none of which is used as an evaluation criteria.

Finally, transmission line impacts are not properly considered. Not only is the cost impact of not co-locating a transmission line with the Butte Creek (East) or all of the Seattle Creek (North) corridors not weighted at all in Table 5-1, but the Seattle Creek (North) corridor is given a "favorable" designation for having a transmission line in close proximity, even though 74% of the line would be located above the Draft Access Analysis report's preferred elevation threshold of 3,000 feet.

Thank you again for the opportunity to comment on the Draft Access Analysis. Please direct any questions you have regarding CIRI's comments to Dara Glass, CIRI Land Manager, at 907.263.5140 or dglass@ciri.com.

Sincerely,

COOK INLET REGION, INC.

By: Ethan G. Schutt
Its: Sr. Vice President, Land and Energy Development

APPENDIX A

Letter from Richard Weldin

[Follows this page.]

CIRI Services Corporation
2525 C Street, Suite 500 • PO Box 93330
Anchorage, AK 99509-3330 • 907.274.8638

August 29, 2012

Dara Glass
Land Manager
COOK INLET REGION, INC.
2525 C Street
Anchorage, Alaska 99503

Re: Comments on Draft Watana Transportation Access Analysis

Dear Ms. Glass:

I have had an opportunity to review the Draft *Watana Transportation Access Analysis* document as you requested. At this time, I do not believe it is possible to make an accurate determination as to the proposed access routes. At page 34, paragraph 4.2.2, the report states:

> Due to the lack of quantifiable data to evaluate the geologic and geotechnical conditions, the project team decided to develop a set of specific development criteria assign each criterion a value between 1 and 5, with 1 being most favorable. These values, assigned by a geotechnical engineer, represent the overall suitability of the criteria for a road corridor and are shown in Table 4-12 (located at the end of this section). The remainder of this section describes each criterion considered. (Emphasis added.)

From my perspective, building a good road largely depends on the availability of suitable material in the quantities necessary and within a reasonable hauling distance to the construction site. This factor is not quantified in the report. Another factor is the disposal of waste material, which would be of considerable volume on this project. Simply "assuming" this material can be deposited in an alluvial borrow pit or a rock quarry is not a good basis for a determination.

I disagree with the assumption that construction on the access corridors will not take place during the winter months. In my 35 years of construction experience, dealing with permafrost, high ground water, creek crossings, and excavating waste and overburden is best accomplished in the winter months under most circumstances.

The routes with the shortest overall distance to Anchorage should be given initial priority consideration because Anchorage is the largest city with the biggest port and would, therefore, result in a better value for initial construction costs, as well as use and maintenance over time.

The report is misleading and is formatted in a way that makes it difficult to interpret. The comparison factors, *see* attached Table 5-1, appear to be based in a manner consistent to support a pre-determined selection.

- In the Travel Time section, if the basis is moved to Anchorage, the favorable rating moves over to the South Road and Hurricane (West) routes. I do not understand why Cantwell was used as a point of basis for the other two routes.
- Combining the road work (new and upgrade) on the Seattle Creek (North) and Butte Creek (East) options completely changes the view and moves the favorable colors on the sheet over to the South Road and Hurricane (West) routes.
- Using linear feet of bridge to give the Seattle Creek (North) and Butte Creek (East) routes a favorable rating is a poor basis. The height and complexity is a more accurate measurement, and could easily change the ratings.
- Under the Geologic and Geotechnical section, the Seattle Creek (North) and Butte Creek (East) options are given a favorable rating despite the fact there is simply no quantifiable data to back this rating up.
- Transporting equipment to the dam site will involve extremely heavy loads, and I see no comments regarding the possibility of upgrading the bridges on the Denali Highway route.
- I believe that the travel time from the railroad to the dam should have given the Hurricane (West) route a favorable rating, yet the report gave no rating.

Clearly a few factors in the basis and the way the routes were rated could be changed, and the most favorable route would be different.

This report is subjective in my opinion because no quantitative data was provided, and numerous qualifying statements were made. It appears to me the authors of this report were allowed to select their own criteria, and this was accomplished in a manner that allowed a specific route to be chosen.

Please feel free to contact me if you have questions or wish to discuss the report further.

Very truly yours,

Richard Weldin

Richard Weldin
President
CIRI Services Corporation

Attachment: Table 5-1

Table 5-1. Summary of alternatives analysis

Category	Criteria	South Road	Hurricane (West)	Seattle Creek (North)	Butte Creek (East)
Engineering	New road (miles)	54.8	51.7	43.3	42.5
	Upgrades to Denali Highway (miles)	0.0	0.0	20.0	53.0
	Total length (including Denali Highway; miles)	54.8	51.7	63.3	95.5
	Highest elevation (feet)	3,450	3,250	4,100	3,200
	New road above 3000 feet (miles)	5.0	12.5	32.0	6.4
	Travel time from Hurricane to Watana Dam (hours)	N/A	1.5	2.4	3.1
	Distance from Hurricane to Watana Dam (miles)	N/A	51.7	102.6	134.7
	Travel time from Cantwell to Watana Dam (hours)	N/A	2.1	1.8	2.7
	Distance from Cantwell to Watana Dam (miles)	N/A	91.0	63.4	95.5
	Travel time from railroad siding to Watana Dam (hours)	1.6	1.5	1.9	2.8

Category	Criteria	South Road	Hurricane (West)	Seattle Creek (North)	Butte Creek (East)
Engineering (cont.)	Distance from railroad siding to Watana Dam (miles)	54.8	52.3	65.3	97.4
	Potential transmission line in close proximity	Yes	Yes	Yes	NO
Geologic and Geotechnical Conditions	Borrow soil quality[a]	4	4	3	1
	Borrow rock quality[a]	2	4	3	2
	Subgrade support[a]	2	2.5	2	1.5
	Soil slope stability[a]	3	3	2	1
	Permafrost conditions[a]	2	2	3	1
Hydrology and Hydraulics	Number of bridges on new roadway	4	6	4	4
	Linear feet of bridge on new roadway	1,000	800	200	300
	Drainage culverts on new Hydraulics roadway	0	2	4	0
	Small fish culverts on new roadway	15	25	3	23
	Large fish culverts on new roadway	4	2	4	2

Category	Criteria	South Road	Hurricane (West)	Seattle Creek (North)	Butte Creek (East)
Hydrology and Hydraulics (cont.)	New/ replacement bidges on Denali Highway	0	0	1	2
	Replacement of small culverts along the Denali Highway	0	0	6	13
	Replacement of large fish culverts along the Denali Highway	0	0	0	1
Fisheries and StreamAquatics	Salmon streamcrossings	8	4	0	0
	Stream crossings requiring fish passage	23	32	15	29
Terrestrial	Caribou habitat[a]	2	2	3	3
	Moose Habitat[a]	2.5	2	3	3
	Migratory duck habitat (acres)	763.5	965.3	322.1	744.7
	Swan habitat (acres)	166.4	163.6	0.0	71.3
	Bear habitat (acres)[a]	3.5	3	2.5	2
Wetlands	Category 2, 3 and 4 wetlands (acres)	226.8[b]	553.9	699.2	544.1[b]
Fish and Wildlife Use	Sport fishing[a]	2	3	2	2.5
	Sport and Use subsistence hunting[a]	2	2	3	3
Land Status	Corridor (acres)				
	Federal lands	0	14,817	6,613	10,238
	State lands	13,719	19,443	36,042	50,634
	Native	40,828	9,521	896	896

Category	Criteria	South Road	Hurricane (West)	Seattle Creek (North)	Butte Creek (East)
Land Status (cont.)	Private or Borough	1,692	5,160	0	818
	ROW (acres)				
	Federal lands	0	771	357	255
	State lands	417	749	1,174	1,230
	Native	1,466	300	45	45
	Private or Borough	112	66	0	0
Socioeconomics	Distance between Parks Highway junction and Cantwell (miles)	N/A	39	0	0
Costs	New road construction ($ millions)	251.2	211.5	149.1	144.0
	Denali Costs Highway upgrades ($ millions)	0	0	14.6	31.7
	Total roadway ($ millions)	251.2	211.5	163.7	175.7

Red: Not preferable **Green: Favorable**

[a] Criteria evaluated on a qualitative basis

[b] Wetland information was only available for a portion of the corridor. However, based on existing aerial photography and other information, it is believed that the unmapped portion of the corridor also contains a photography and other information, it is believed that the unmapped portion of the corridor also contains a substantial amount of wetland.

Document Content(s)

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November 14, 2012

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To: Kimberly D. Bose, Secretary, Federal Energy Regulatory Commission

Fr: Jan Konigsberg, Alaska Hydro Project; Becky Long, Alaska Survival; Rick Leo, Coalition for Susitna Dam Alternatives.[1]

Ref: Comments on Alaska Energy Authority Proposed Study Plan for Susitna Dam FERC project #14241.

SOC-01

1. National-Level Economic Valuation Study Request

In July, both FERC and Alaska Energy Authority rejected the rationale for the national-level economic valuation study.[2]

Essentially, FERC, while acknowledging that economic valuation of natural resources and non-power values is an imperfect exercise, suggests, moreover, there is no acceptable methodology for assigning value to many non-power values, which means that FERC will ultimately decide what value will be assigned to the natural and other non-power values without having articulated the process by which they derived the value(s). In doing so, FERC seems to be opting for an even more imperfect approach to valuation than the various methodologies that many economists would employ in ascertaining value of non-market goods and services.

Below we address the FERC's and AEA's arguments rejecting the study request.

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[1] The study request was submitted under the auspices of Natural Heritage Institute (NHI). Jan Konigsberg is no longer affiliated with NHI, and now directs Alaska Hydro Project with support from Hydropower Reform Coalition.

[2] See Federal Energy Regulatory Commission, "Scoping Document 2, Susitna-Watana Hydroelectric Project, FERC Project #14241-000," July 2012, Washington D.C. pp. 8-9. "Proposed National-Level Valuation," pp. 3-1 – 3-8 of AEA's "Proposed Study Plan," July 2012 in which Alaska Energy Authority mistakenly refers to American Whitewater as the study's instigator; American Whitewater specifically states it is supporting NHI et al. study request.

A. "Equal Consideration" by the Commission is Procedural and Substantive

Congress amended the Federal Power Act in 1986 requiring the Commission give equal consideration to non-power values when deciding to license a hydropower project. Historically, the Commission's licensing decisions and licensing conditions took little or no account of the jeopardy the project posed to the extant environmental, social, and cultural values. Consequently, the 1986 amendment imposed equal consideration not only as a procedural requirement, but also a substantive one: In its decision on appeal by the Platte River Whooping Crane Critical Habitat Trust, the US Court of Appeals reasoned that

> . . . equal consideration must be viewed as a standard, both procedural and substantive, that cannot be satisfied by mere consultation or by deferring consideration and imposition of environmental conditions until after licensing. Protection, mitigation and enhancement of fish and wildlife, energy conservation, and the protection of recreational opportunities are a potential cost of doing business for hydropower projects.[3]

In other words, we understand the Court of Appeals to say that the Commission must not only have considered the non-power values, but also be able to demonstrate its licensing decision has been substantially informed by its consideration of non-power values.

Further, the Court of Appeals, when explaining that a key objective of the ECPA was to give environmental factors *equal weight* as power production in licensing deliberations, refers to the Conference Committee report to elucidate the historic import of the equal-consideration amendment:

> The conferees believe that as a Nation we have come a considerable distance in recognizing the importance of our heritage. This legislation extends that "distance" a bit more. The amendments expressly identify fish and wildlife protection, mitigation and enhancement, recreational opportunities and energy conservation as nondevelopmental values that must be adequately considered by FERC when it decides whether and under what condition to issue a hydroelectric license for a project. We agree that there are instances in which careful and thoughtful consideration of the impact of a proposed project would and *should lead to the conclusion that an original license ought not to be issue*d [emphasis added].

Thus, one possible outcome of equal consideration of non-power values is the Commission's denial of a license, ostensibly because the public would be worse off with

[3] *Platte River Whooping Crane Critical Habitat Maintenance Trust v. Federal Energy Regulatory Commission,* 876 F.2d 109, (D.C. Cir.1989).

the project than without it.[4] This outcome would seem to be more likely in original-license proceedings than relicensing, where the baseline condition is the post-project environment and where environmental improvement is change to project operation (e.g. increased minimum flow) and/or project infrastructure (e.g. fish passage).

Denying an original license would be a weighty decision for the Commission, presumably due to the Commission having determined that the nation would be worse off if the project were built. In other words, the Commission would find that no amount of compensation for and/or mitigation of the impacts to non-power values from developing the river for power, irrigation, flood control, water supply results in a net improvement to society.[5]

B. Equal Consideration in FERC Practice

Equal consideration of non-power values relies principally upon the information and analysis provided to the Commission in the license application. In general, FERC's practice is to rely upon the information and analyses provided in the license application to prepare the NEPA document as well as to fulfill the equal-consideration mandate of the FPA. The Commission's default licensing process –the Integrated Licensing Process (ILP) – integrates FERC hydropower licensing with the NEPA process. In an ILP proceeding, as Susitna dam is, FERC approves the suite of studies it deems necessary to fulfill its NEPA responsibility on the assumption that this information is necessary and usually sufficient for the Commission's equal-consideration "exercise."

If it is acknowledged that the public-interest calculus is the determination of whether the nation is better off with the project than without it, then it would follow the public-interest calculus involves comparing the value to the nation of the undeveloped watershed to the value of the watershed if developed as proposed. If so then, a crucial

[4] A plausible standard for deciding a project is in the public interest is the gainers must gain more than the losers lose and further that the gainers must be able to compensate and/or mitigate the losses and still go along with the change; society must be better off after the change than before.

See *Udall v. Federal Power Commission*, 387 U.S. 428 (1967): "The grant of authority to the Commission to alienate federal water resources does not, of course, turn simply on whether the project will be beneficial to the licensee. Nor is the test solely whether the region will be able to use the additional power. The test is whether the project will be in the public interest. And that determination can be made only after an exploration of all issues relevant to the public interest."

[5] With respect to a federal hydroelectric license, the "public " whose interest the Commission is authorized to ascertain is that of the entire country, not that subset of the public that resides in Alaska or even more narrowly, that population of Americans residing in the Railbelt, which is region to be supplied by the electricity from the proposed Susitna dam.

question is how the watershed is to be valued at the national level and whether the information garnered pursuant to FERC's ILP study plan, while necessary, is sufficient for such a valuation calculation.

The geographic bounds for the environmental data required by the FERC study plan is the area that the proposed project is likely to affect, which in the case of the proposed Susitna dam is 40 miles upstream of the dam site and up to 184 miles downstream of the dam site as well as the road and transmission corridors. The geographic bounds for the socio-economic data required by the FERC study plan is the area that will experience the economic and social impacts of the project. This area is usually greater than that of the potential environmental impact of the project. In the case of the proposed Susitna dam, the region that will be affected stretches from Homer on the southern end of the Kenai Peninsula, north to Fairbanks, a straight-line distance of around 400 miles.

The major premise of our "National-Level Economic Valuation Study" request is that the project's potential costs and benefits to the nation are likely to be significantly different from the proposed project's potential costs and benefits to the directly affected (Railbelt) region. Therefore, we argue that the information FERC typically collects at the watershed-level and at the regional-level may be necessary but is not sufficient for the Commission's equal consideration exercise, especially if the Susitna River in its currently undeveloped state is assumed to be a river of national, if not global importance, particularly given its recreational opportunities, 5 species of Pacific salmon and critical habitat for the endangered Cook Inlet Beluga whale. [6]

In determining that a project is best adapted to a comprehensive plan for the affected waters, FERC considers national as well as regional interests.

> Works designed to control our waterways have thus far usually been undertaken for a single purpose, such as the improvement of navigation, the development of power, the irrigation of arid lands, the protection of lowlands from floods, or to supply water for domestic and manufacturing purposes. While the rights of the people to these and similar uses of water must be respected, the time has come for merging local projects and uses of the inland waters in a comprehensive plan designed for the benefit of the entire country. Such a plan should consider and include all the uses to which streams may be put, and should bring together and coordinate the points of view of all users of waters. '(The plans of the Commission

[6] AEA rejects the national-level economic valuation on the grounds that the information to be gathered for the social economic analysis pursuant to NEPA is sufficient for the Commission's determination of the public interest, claiming that "there is simply no evidence that public-interest balancing of environmental and economic impacts requires a national perspective to weigh and balance all public interest considerations consistent with FERC's statutory obligations under FPA."

> should be formulated) in the light of the widest knowledge of the country and the people, and from the most diverse points of view.[7]

FERC (SD2) does "not dispute that the existence of a free-flowing, wild Susitna River that supports salmon and other resources would have intrinsic value to Alaskans and others nationally." This begs the question of how, then, is FERC to adjudge the intrinsic value of the free-flowing, wild Susitna River in relation to a dammed, regulated river.

We do not deny the Commission has discretion in determining the public interest and its public-interest calculus is necessarily subject to professional judgment. Yet, if the Commission is, in the Court of Appeals words, to "give these nondevelopmental values the same level of reflection as it does to power and other developmental objectives," such reflection is unlikely to be productive if the information about the non-power values is of poor quality. In other words, if equal consideration is to be meaningful, the information about non-power values provided to the Commission must be as complete, accurate, and precise as the information for development objectives, which we argue includes information about the value the nation places on an undeveloped Sustina watershed.[8]

FERC (SD2) asserts:

> . . . for non-power resources such as aquatic habitat, fish and wildlife, recreation, and cultural and aesthetic values, to name just a few, the public interest cannot be evaluated adequately only by dollars and cents . . . Moreover, the public interest balancing of environmental and economic impacts cannot be done with mathematical precision, nor do we think our statutory obligation to weigh and balance all public interest considerations is served by trying to reduce it to a mere mathematical exercise.

We agree that the public-interest calculus is not supposed to be a "mere mathematical

[7] *Scenic Hudson Preservation Conference v. Federal Power Commission,* 354 F.2d 608 (2d Cir., 1965)

[8] *See Scenic Hudson Preservation Conference v. Federal Power Commission*: "The Commission must see to it that the record is complete. The Commission has an affirmative duty to inquire into and consider all relevant facts."

exercise."[9] Our study request acknowledges that total economic value an individual derives from a natural resource, such as a river basin, can be conceptually divided into use and nonuse values. The point is to measure the overall value the public places on the benefits from the undeveloped watershed. We also fully understand that the value of public goods cannot be fully evaluated using market-based methods, and nonuse values cannot be captured by analyzing data on observed choices. We also understand a methodologically sound approach exists to measure values that include individuals' nonuse values for public goods, such as a free-flowing, salmon-bearing river.[10]

We contend, therefore, that to the extent that an economic valuation of non-market goods and services is methodologically viable and valid, the less likely it is that the Commission may either undervalue or overvalue those non-market goods and services, particularly *undervalue*, as it compares the value(s) of "non-market" goods and services to the ostensibly objective market-value of the goods and services from the hydropower-developed watershed.[11] Further, to the extent that monetization of non-power values can be justified methodologically, such quantification serves to minimize the subjectivity of the Commission public-interest determination, thereby reducing the potential of arbitrary judgment.

FERC (SD2), however, questions the efficacy of economic valuation of non-power resources in the Commission's public-interest calculus:

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[9] This assertion, at least in the context of FERC's rejection of NHI et al.'s study request, is a red herring: our study request does not suggest nor does it imply that the public-interest determination is or should be a *mere* mathematical exercise. We are well aware of the fact that valuation of non-market goods and services cannot be as precise as the market pricing of goods and services, and when this acknowledgment is coupled with the fact that some non-market goods and services have intrinsic value (non-use) that cannot be monetized – but may nevertheless be assessed (valued) in terms of preferences — there can be no question that the public-interest calculus cannot be reduced merely to a computational matter. But to conclude, however, that the public-interest calculus ought to therefore eschew any computational analysis is simply fallacious.

[10] See *Namekagon Hydro Co. v. Federal Power Commission,* 216 F.2d 509, 511-512 (7th Cir. 1954). The Commission realizes that in many cases where unique and most special types of recreation are encountered a dollar evaluation is inadequate as the public interest must be considered and it cannot be evaluated adequately only in dollars and cents'). In affirming Namekagon the Seventh Circuit upheld the Commission's denial of a license, to an otherwise economically feasible project, because fishing, canoeing and the scenic attraction of a 'beautiful stretch of water' were threatened.

[11] Non-market goods and services can be valued/monetized, such as wetlands filtering surface water (a service) and wetlands providing clean water (a good), at the same time the wetlands, in toto, also have intrinsic value.

> In the context of public interest balancing for long-term authorizations, it is not appropriate to rely too heavily on the accuracy of current dollar estimates of non-power resource values, calculated using any number of reasonably disputable assumptions and methods. This is particularly true if we were to try to determine and weigh national values against the energy needs of Alaskans, as the Natural Heritage Institute would have us do.

The Commission's public-interest calculus boils down to Railbelt region's need for power and the value the nation ascribes and derives from the undeveloped watershed. We are admonished by FERC that the public-interest calculation should not rely "too heavily" on estimates that are based on reasonably disputable assumptions and methods. but without FERC explaining to what extent these estimates should be relied upon and without acknowledging that economic valuation of hydropower also relies on assumptions, if not methods, that may be reasonably disputed (as do the models for environmental-impact analysis).

We would argue that FERC has a duty to understand the value of the free-flowing Susitna River to the extent that reasonable methodologies are available to do so.

Still, FERC (SD2) does not agree it has such a duty:

> Equal consideration is not the same as *equal treatment* [emphasis added]. Nothing in the statute requires the Commission to place a dollar value on non-power benefits, even if the Commission assigns a dollar value to the licensee's economic costs.[12] . . . Where the dollar cost of measures can be reasonably ascertained, we will do so.

Here, FERC is simply reiterating its traditional cost-benefit analysis for valuing hydropower projects, where project financing, construction, operations and maintenance costs, along with the costs of preventive, mitigation and enhancement measures are compared to the expected benefits from power sales over the life of the project. In other words, FERC does not agree it is required to value the loss of non-power resources that would result from construction of the project, albeit some portion of the loss of value is ostensibly reflected in the cost of mitigation and enhancement measures required by the license.

While equal consideration might not require equal treatment of non-power resource values, it does not preclude it and, nonetheless, the statute presumably requires non-power resource values be treated *fairly*. Further, FERC is wrong to assume that

[12] See Scoping Document 2. In its rebuttal of the NHI et al. study request, AEA is also eager to point out that not all values can be monetized, implying that we propose monetizing all values, when, in fact, our study request acknowledged and stipulated not all values can be monetized.

economic valuation of non-power goods and services implies equal treatment: The valuation of non-power goods and services, which flow from so-called "natural capital" comprised of the various biological and physical elements and processes of the watershed, is not the same as the valuation of goods and services that are generated by hydropower. The latter's value is set by sellers and buyers in the marketplace, whereas no market of willing buyers and sellers exists to establish the market price of many non-power goods and services.[13] Nonetheless, methodologies are available to estimate a reasonable price/cost for some non-market goods and services. Fundamental to our study request is that economics *treats* valuation of market and non-market goods and services *differently,* not necessarily equally, to enable a valid and informed comparison of the non-power values to power values to the extent that is methodologically valid.

C. Conclusion

If the licensing process is supposed to ascertain whether the change to the Susitna watershed from developing hydropower makes Americans as a whole better off, but neither FERC nor AEA support our request for a national-level economic valuation of the watershed is justified, we are left to conclude that the Commission will continue to rely on its traditional approach to cost-benefit analysis, supplemented by its judgment about the value of those non-power resources to the nation that is not captured by the cost-benefit analysis. Without incorporating information that would be provided by our proposed national-level valuation, we believe FERC's licensing decision will be inherently more subjective. Admittedly, information provided by the proposed national-level economic valuation will be based upon disputable assumptions and methods, but is, we believe, superior to the Commission's traditional approach to adjudging the value Americans would place on the free-flowing, salmon-bearing Susitna River.[14]

[13] From the perspective of the market, many non-power resources are perceived to have no value. In other words when the non-power resources are treated in the same manner as the goods and services from hydropower, then their value is zero. Economic theory suggests that valuation of non-market goods and services is not derived by the same (equal) treatment as accorded to goods and services bought and sold in a market; hence, when non-market goods and services are valued in the market context, the valuation is invalid and not accurate.

[14] See *Scenic Hudson Preservation Conference v. Federal Power Commission*: "The Commission must see to it that the record is complete. The Commission has an affirmative duty to inquire into and consider all relevant facts."

2. Instream Flow Study

IFS-070 Project construction and operation would have an effect on the flows downstream of the dam. As the project is intended to operate in a load-following mode, the project would cause seasonal, daily, and hourly changes in Susitna River flows compared to existing conditions. The proposed flows would influence downstream resources and processes, including fish and aquatic biota and their habitats, channel form and function including sediment transport, water quality, groundwater/surface water interactions, ice dynamics and riparian and wildlife communities. The Instream Flow Study (IFS) will characterize and evaluate these effects.

Of particular concern is the effect of fluctuating flows on juvenile salmon, especially during the winter. An objective of the revised proposed instream flow study is to ascertain the potential of fluctuating flows to strand or trap juvenile fish, where a stranded fish is almost always a dead fish and a trapped fish, if trapped long enough, is also a dead fish.

The potential of fluctuating flows to displace fish laterally as well as downstream should also be ascertained, because displacement may increase the overall mortality rate of the juvenile salmon populations.

The juvenile salmon that overwinter in the mainstem would likely be affected by flow fluctuation when occupying habitat near or at the river's edge. Flow fluctuation affects the river stage and river velocity. When the stage changes, so does the river edge. Presumably, as the river's edge moves laterally back and forth in response to flow fluctuations, so do juvenile salmon – moving back and forth in response to flow fluctuations takes energy, which will likely result in loss of body weight. If fry are continually moving to and fro in response to changes in stage, then they must increase food intake to maintain body mass. If body mass cannot be maintain, then the juvenile mortality rate mortality increases.

Also, if juvenile salmon were to respond to stage fluctuation by moving to habitats that are not as subject to flow fluctuation, the risk is that the habitat may be marginally suitable and/or increase in occupation of the habitat leads to density-dependent mortality.

Presumably, too, the more juveniles are forced to move in response to fluctuations in stage, whether laterally or downstream, the more subject they are to predation, due to increased movement which increases the chance of detection by predators.

Further, while reduced body mass is likely to increase the mortality rate of over-wintering juveniles in the mainstem, reduced body size may also increase mortality of smolts entering marine waters. Pacific salmon experience relatively high mortality rates during the first few months at sea and it are believed that the high mortality rates may be partly related to size. Size dependent marine mortality of juvenile salmon may be concentrated during two specific early marine life-history stages: The first stage may occur just after juvenile salmon enter the marine environment, where smaller individuals are believed to experience higher size-selective predation. The second stage is thought to occur following the first summer at sea, when smaller individuals may not have sufficient energy reserves to survive late fall and winter. Thus, larger individuals within a cohort likely have higher probability of survival, emphasizing the importance of size during the first summer at sea.

Literature Cited

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Document Content(s)

JK Nov 14 PSP comments..DOC...1-10

NRDC
THE EARTH'S BEST DEFENSE

NATURAL RESOURCES DEFENSE COUNCIL

November 14, 2012

Hon. Kimberly C. Bose, Secretary
Federal Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Via online submission to: http://www.ferc.gov

NRDC COMMENTS ON PROPOSED STUDY PLAN AND REQUESTED MODIFICATIONS TO THE PROPOSED STUDY PLAN OF THE ALASKA ENERGY AUTHORITY FOR THE SUSITNA-WATANA HYDROELECTRIC PROJECT (FERC PROJECT P-14241)

Dear Secretary Bose:

On behalf of the Natural Resources Defense Council ("NRDC") and our more than 1.3 million members and online activists, we submit to the Federal Energy Regulatory Commission ("FERC" or "Commission") the following comments and requested modifications to the Proposed Study Plan ("PSP") published on July 16, 2012, by the Alaska Energy Authority ("AEA"). The PSP consists of over 1,200 pages summarizing 58 proposed studies of potential impacts on a pristine environment of the construction of a hydroelectric generating facility, dam, reservoir, access roads and transmission corridor, proposed to be constructed on a remote stretch of the Susitna River in Alaska ("Project"). The Commission has established November 14, 2012 as the deadline for comments and requested modifications to proposed studies pursuant to its regulations for the Integrated License Process ("ILP") under which the license application is being reviewed. (18 C.F.R. 512.) On November 1, 2012 AEA published a revised "Interim Draft Revised Study Plan" ("Interim Draft RSP"), and has requested that stakeholders and resource agencies base their study plan comments on the Interim Draft RSP rather than the "now largely outdated PSP."[1] The following comments and requested study plan modifications apply equally to both the PSP, dated July 16, 2012, as well as the AEA's Interim Draft RSP, published November 1, 2012.

Neither stakeholders nor resource agencies have had sufficient time to adequately analyze, assess, and provide comments on the recent revisions to the PSP, considering that publication of the most revision occurred November 1 and the deadline for comments is November 14. As the National Marine Fisheries Service ("NMFS") points out: "A period of only 14 days is insufficient for NMFS to review and to provide comments to FERC on the revisions to the PSP potentially affecting over a dozen studies for this proposed large original hydropower project."[2]

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[1] Letter from AEA to Hon. Kimberly D. Bose, FERC, October 31, 2012.
[2] Letter from NMFS to Kimberly D. Bose, October 31, 2012, p.2.

As noted above, AEA has requested stakeholders and agencies to respond to the Interim Draft RSP, rather than the version of the PSP published July 16, 2012. This shifting goal line for comment only two weeks before the deadline precludes meaningful public and agency comment on the proposed studies.

NRDC has a vital interest in this Project. NRDC is a non-profit organization that has as its established purpose to safeguard the Earth, its people, its plants and animals, and the natural systems on which all life depends. Among NRDC's priorities are to curb global warming and create a clean energy future; revive the world's oceans; defend endangered wildlife and wild places; protect our health by preventing pollution; ensure safe and sufficient water for people and the environment; and to foster sustainable communities. NRDC is concerned that the Susitna hydroelectric project will likely have serious and significant adverse impacts on the surrounding complex, pristine environment due to the project's magnitude and location. We appreciate the opportunity to provide comments on the PSP and Interim Draft RSP, and to provide suggested modifications to the studies proposed in the plan and the Interim Draft RSP. These comments and requested study proposal modifications should be read in conjunction with NRDC's comments and study requests pertaining to the Project submitted to FERC on May 30, 2012.

1. The ILP is an Inappropriate Process for an Application for a New Hydroelectric License, and the Issue is not Addressed in the PSP or the Interim Draft RSP.

As noted in our May 30th, 2012 letter, the two-year study time-frame built into the ILP process does not provide sufficient time to study the baseline conditions in the Susitna River basin. Due to the time constraints built into the ILP, AEA is now asking stakeholders and resource agencies to respond to hundreds of pages of technical study plan revisions in a matter of weeks, something that would take months for meaningful review. This has been a consistent problem since the outset of the Project. In reviewing the comments and study requests submitted in May by the federal agencies in response to the AEA's Pre-Application ("PAD") and Scoping Document 1 ("SD1"), the most consistent comment provided by the resource agencies was that the ILP does not allow adequate time to design and execute studies necessary to establish baseline environmental conditions. However, despite the agencies' attention to this critical issue, neither the July 16 PSP nor the November 1 Interim Draft RSP include a response by AEA to the assertion by agencies and stakeholders that the ILP, with its two-year study time frame, is inappropriate for licensing of a new, large scale, hydroelectric generating facility in an isolated, undeveloped area.

The United States Fish and Wildlife Service ("USFWS") stated in its May 31st comments on the PAD and SD1 that, "the time limits imposed by the ILP have prevented a fully integrated discussion and review of the study requests by federal resources agencies"; and further noted that the agency was "unable to create Study Requests for all fish, wildlife and habitat under our purview, within the time constraints imposed by the ILP process."[3]

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[3] USFWS "Scoping Comments, Recommendations, and Study Requests," May 31, 2012, FERC Project No. 14241, p. 11

The National Marine Fisheries Service ("NMFS") echoed the comments of USFWS regarding the inadequacy of the ILP process to accommodate a project of this scale within the time constraints of the ILP. In its May 30th Comments on the PAD and SD1, NMFS states, "the ILP timeframes are a poor fit for this project. An adequate amount of time must be allowed for necessary rigorous impact assessments in support of FERC's ultimate licensing decision."[4] The ILP abbreviated study time-frame has prevented NMFS from performing its statutory duty to provide comments and study requests, as it states, "NMFS lacked time and staff resources to create Study Requests for all fish species and issues related to their habitat, within the time constraints imposed by the ILP process."[5] The agency points out that the staff at FERC acknowledged during planning meetings that the ILP was designed more appropriately for relicensing existing facilities where the baseline conditions are known, rather than for a new license application.[6] In fact, as pointed out by NMFS, a new hydroelectric generating facility license application is unprecedented at this scale and latitude, and is the first of its kind generally to be proposed in the past 40 years, largely due to scientific evidence of the hugely adverse ecological impacts of large hydroelectric projects on previously undammed rivers.[7]

NMFS' October 31st letter to FERC reinforces its prior contention that the ILP is unworkable for the agency, and that such an abbreviated time frame for study of a project of this size, located within an ecosystem the complexity of the Susitna River basin, is inadequate. The agency states, "NMFS must alert FERC to the problems posed by the short two-week turnaround expected for NMFS' comments on redrafts of plans which were originally filed and distributed for review on July 16, 2012."[8] NMFS notifies FERC in its October 31 letter that it "will likely not be able to review [the] revised plans" because of the applicant's rush to complete the study proposals to meet the ILP's strict deadlines.[9]

Given the inability of federal agencies charged with developing, responding to, and commenting on study requests to actually prepare these study requests within the ILP timeframe, the ILP is a demonstrably inappropriate process for licensing of the Susitna project. FERC should either substantially extend the too-short deadlines of the ILP, or, on its own motion, select an alternative licensing process for the Susitna project pursuant to FERC's regulations under the Federal Power Act. (18 C.F.R. Subchapter B.)

To this end, the PSP and the Interim Draft RSP prepared by AEA are intended to respond to the comments and study requests on the PAD and SD1 filed by the agencies and stakeholders in May, and refined during the Technical Work Group meetings conducted in Alaska since August. (18 C.F.R. 5.12, 5.13) However, neither the PSP nor the Interim Draft RSP include a response to

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[4] Letter from NMFS to FERC, May 31, 2012, p. 5
[5] Id.; NMFS Study Requests, May 31, 2012, p. 2
[6] Id.
[7] Letter from NMFS to FERC, May 31, 2012, p. 3 (citing, Graf, William L., (2006) Downstream hydrologic and geomorphic effects of large dams on American rivers. Geomorphology 79 336-360.)
[8] Letter from NMFS to Kimberly D. Bose, October 31, 2012, p. 2.
[9] Id., at 2.

the comment, consistently raised by the agencies, NRDC and other stakeholders, that the ILP is inappropriate for analysis of the Susitna project. A response to these comments and their related study requests should be included in the PSP and RSP. (18 C.F.R. 5.11.) AEA should explain why it has not requested authorization to use the traditional licensing process, which would better suit its pre-license application. An applicant has the discretion under FERC's regulations to select a process other than the ILP such as "traditional license" or "alternative license" where there are factors present in the application such as the "complexity of the resource issues," and "potential for significant disputes over studies." (18 C.F.R. 5.2 (c).) The Susitna dam application invokes a tremendously complex and diverse ecosystem and has already demonstrated potential for disputes over studies to be implemented, hence the time-frames built into the ILP are inappropriate for such an application.

2. The Amount of Time Proposed for Study is Insufficient to Provide a Baseline for Conditions of the Susitna River Fisheries.

GEN-04

The inadequacy of the ILP two-year study time frame is especially apparent with respect to studying the baseline conditions of the Susitna River fisheries and the anticipated Project-induced impacts on fish populations, including accurate adult escapement estimates, juvenile densities, macro invertebrate communities, spawning rates and other critical habitat factors. NRDC reasserts its study request that FERC require AEA to increase the period of study from the current two year study to a minimum five year study (preferably 6 to 7) in order to adequately assess the habitat needs and life spans of affected fish species. This request is consistent with similar requests made by both USFWS and NMFS during the recent comment period for the PAD and SD1 for the Project. Specifically, NRDC objects to the study time frame for studies proposed and described in both the PSP and Interim Draft RSP contained in Section 6 "Instream Flow Studies: Fish, Aquatics and Riparian," and Section 7 "Fish and Aquatic Resources," including all studies and analysis found in those sections. The length or term of study for these proposed studies should be altered accordingly.

NMFS and USFWS submitted comments on the PAD and SD1 in May which also objected to such a short time frame for the studies of the Susitna River fisheries. NMFS stated, "It is important that field studies take place over a temporal scale that includes a range of hydrological and environmental conditions. For example, Chinook salmon completes their life cycle over a five-to seven-year range; therefore, a two year study period is inadequate to document biological baseline conditions and evaluate habitats and biological responses of this population under a variety of hydrologic conditions."[10]

Similarly, USFWS commented that at least 5 years of study of salmon abundance and habitat must be undertaken to gain sufficient data to provide information to decision makers about fish resources and develop the scientific basis for fishway prescriptions and mitigation recommendations. USFWS points out those Chinook salmon populations are "currently depressed statewide, for unknown reasons. If all baseline studies are conducted under this temporary period of low Chinook abundance, a significant bias may be introduced into the data

[10] Letter from NMFS to FERC, May 31, p. 5.

which will hamper accuracy of future modeling outputs and determinations of appropriate compensatory mitigation."[11]

NRDC objects to the two-year study of fisheries because it will not accurately assess baseline environmental conditions, necessary under NEPA in order to provide an accurate analysis of the impacts of the project on the environment. Many factors can make the two-year time frame for studying the impacts unreliable. For example, two years of data collection are insufficient to characterize Chinook salmon (*Oncorhynchus tshawytscha*) populations in the Susitna River for reasons including:

- Chinook salmon occur upstream of the proposed dam site[12], but are poorly characterized due to the inaccurate assumption that Devil's Canyon served as a migration barrier during previous studies in the 1980s.

- The life cycle of Chinook salmon up to 7 years[13], with 0-2 years in freshwater and 0-5 years at sea. Studies should last for the duration of the dominant life cycle in the Susitna River in order to characterize productivity (recruits per spawner), a basic and important fisheries statistic.[14] Ideally, studies should characterize productivity long enough to assess inter-annual variation and thus general trends in productivity.

- Alaska's Chinook salmon populations—including Cook Inlet populations—are currently in a period of particularly low returns, prompting a declaration by the state government of a Fisheries Disaster.[15] Because run numbers have fallen dramatically, characterizing spawning populations in 2012-2013 is vulnerable to underestimation of average baseline conditions.

- The Susitna valley witnessed exceptionally high flows in September 2012,[16] after the period of Chinook salmon spawning. Floods can scour eggs from salmon redds, increase juvenile mortality, and increase mortality of aquatic invertebrates which are important diet items.[17] Consequently, juvenile population estimates are vulnerable to

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[11] Letter from USFWS to FERC, May 30, 2012.
[12] Alaska Department of Fish & Game, Anadromous Waters Catalog. http://www.adfg.alaska.gov/sf/SARR/AWC/index.cfm?adfg=maps.interactive. Accessed 8 November 2012.
[13] Groot, C. and L. Margolis. 1991. Pacific salmon life histories. UBC Press, Vancouver.
[14] Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bulletin of the Fisheries Research Board of Canada 191: 1-382.
[15] United States Department of Commerce, Secretary of Commerce. 2012. http://www.nmfs.noaa.gov/stories/2012/09/docs/blank_parnell_9_13_12.pdf. Accessed 8 November 2012.
[16] NASA Earth Observatory. 2012. http://earthobservatory.nasa.gov/IOTD/view.php?id=79321. Accessed 8 November 2012.
[17] Thorne, R.E. and J.J. Ames. 1987. A note on variability of marine survival of sockeye salmon (*Oncorhynchus nerka*) and effects of flooding on spawning success. Canadian Journal of

underestimation; resulting skewed baseline data could be useless for the purpose of detecting future impacts to salmon populations from dam development.

- More generally, studies without multi-year data fail to estimate inter-annual population variability, making them worthless for the purpose of detecting trends.[18] Salmonid fishes exhibit high levels of inter-annual variability, such that even five years of abundance estimates or indices may be insufficient for detecting population trends.[19]

A short duration of study fails to capture the life history of a species, especially one at risk, and may overlook cyclic or temporary changes to habitat, weather, or other factors. It is crucial to assess conditions over time to take into consideration the annual variability of hydrological and environmental conditions. As a result, NRDC restates its request that the time frame be extended for a minimum period of 5 years for any proposed study analyzing fisheries population, population health, presence-absence information, spawning, rearing, or incubation patterns, habitat requirements, or other measure of species health or viability.

3. The PSP and the Interim Draft RSP do not Include an Explanation as to why the Proposed Study Request for a longer time frame for study of Aquatic Habitat and Abundance was not Adopted.

Pursuant to ILP regulations, if the AEA decides not to adopt a study request made during the comment period on its Pre-Application and Scoping process, the PSP should include an explanation of why it does not adopt the study request. (18 C.F.R. 5.11(b)(4), providing "If the potential applicant does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in 5.9(b)" must be included in the PSP.) USFWS, NMFS, NRDC, and other stakeholders have requested that AEA amend the time-frame for all aquatic habitat and abundance studies from its proposed two years of study to a period of at least 5 years in order to include one full life-cycle for salmon. However, neither the PSP nor the Interim Draft RSP address this issue; nor do the proposed study plans offer explanation for AEA's decision not to adopt this study request for a longer term of study, as FERC's regulations require. NRDC requests that AEA include in its Revised Study Plan a response detailing its reasons for failing to pursue a minimum 5-year study of aquatic habitat and abundance.

Fisheries and Aquatic Sciences 44: 1791-1795. Elwood, J.W. and T.F. Waters. 1969. Effects of floods on food consumption and production rates of a stream brook trout population. Transactions of the American Fisheries Society 98: 253-262.

[18] Gibbs, J.P., S. Droege, and P. Eagle. 1998. Monitoring populations of plants and animals. BioScience 48: 935-940. Shea, K. and M. Mangel. 2001. Detection of population trends in threatened coho salmon (*Oncorhynchus kisutch*). Canadian Journal of Fisheries and Aquatic Sciences 58(2): 375-385.

[19] Ham, K. and T.N. Pearsons. 2000. Can reduced salmonid population abundance be detected in time to limit management impacts? Canadian Journal of Fisheries and Aquatic Sciences 57: 17-24.

4. The PSP does not Explain Why the Proposed Study Request for a 2-year time frame for study of Aquatic Habitat and Abundance is Consistent with Generally Accepted Practice in the Scientific Community.

The ILP regulations require the PSP to "explain how any proposed study methodology (including . . . a schedule including appropriate field seasons and the duration) is consistent with generally accepted practice in the scientific community. . . ." (18 C.F.R. 5.11(d)(5).) As noted above both USFWS and NMFS have stated that a minimum 5-year study of the aquatic habitat and abundance of the Susitna River fisheries is appropriate given the need for data spanning several seasons over the life-cycle of anadromous fish in order to accurately assess the existing conditions and predict post project construction conditions. Further, we have presented evidence in the sections above that two years of data collection are insufficient for study of at least one, and likely many, fish populations that will be affected by the Project. It is therefore incumbent on AEA to explain how the proposed two-year timeframe for study would meet the "generally accepted practice in the scientific community," the standard called for under the regulations.

5. Data Collected from the 1980's is insufficient for establishing today's Baseline Environmental Conditions.

GEN-05

The AEA is planning to rely on resource data collected in the 1980's for a previous Susitna dam project which was abandoned in 1985. As NRDC stated in its May 30 Comments and Study Requests on the PSP and SD1, such outdated data cannot be relied upon as the basis for substantial evidence of existing environmental conditions in the Susitna watershed today. Protocols for how data is collected have evolved since the 80's; equipment that collects data has improved, and modeling which was one-dimensional in the 80's is multi-dimensional today. As noted by USFWS in its comments on the PAD and SD1, since the 1980's: "there have been significant changes in . . . field study technology and methodology (e.g., Geographic Information System mapping, Light Detection and Ranging remote sensing, GPS, and in stream flow and habitat modeling techniques); recreational activities and users (including equipment, demographics, and economics); and our understanding of short and long-term climate variability (e.g., El Nino/La Nina, the North Pacific Decadal Oscillation and global climate change)."[20]

This objection is again echoed by NMFS, which characterizes the 1980's data as "inadequate for the current proposal" for reasons that include: 1) The 1980's project encompassed two dams, with the second dam to regulate downstream flow, while the current project is for one dam operating in a load following capacity with greater downstream impacts; 2) the studies of fish species and habitats were focused on only a few species in the 1980's, while the current project requires evaluation of impacts on a significantly greater number of species and their life stages and downstream habitats; 3) the scientific work performed in the 1980's no longer "represents the best scientific information necessary for planning such a massive project with potential for significant impacts to fish, wildlife, and their habitats"; 4) significant amendments made since the early 1980's to the Federal Power Act, and the adoption of the Magnuson-Stevens Fishery Conservation and Management Act (which together require consultation with NMFS), require

[20] Letter from USFWS to FERC, May 31, 2012, p. 3

FERC to give equal consideration in making license decisions to environmental quality, protection of fish habitat and spawning grounds as to the need for the project; and 5) climate change knowledge was “in its infancy in the 1980’s”, and “climate change has altered many of the ‘baseline’ measures estimated estimated through the 1980’s studies”.[21] The 1980’s data must be viewed as unreliable for analysis of the existing environmental conditions on the Susitna River.

CONCLUSION

For the foregoing reasons, NRDC objects to the AEA’s use of the ILP, and to its failure to properly respond to agency and stakeholder comment or requests for study. NRDC requests that FERC and the AEA establish a minimum 5-year period for study of fish species and habitat in the Susitna River, and of the impacts of Project operation on aquatic life and the environment both upstream and downstream of the Project site. Please do not hesitate to contact us if you have any questions.

Sincerely,

Noah Garrison
Project Attorney
Natural Resources Defense Council

[21] Letter from NMFS to FERC, dated May 31, 2012, pp. 3-4.

Document Content(s)

NRDC Comments on PSP (Final 11-14-12) P-14241.PDF......................1-8

November 14, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

via Electronic Filing

Re: Comments on Alaska Energy Authority's Proposed Study Plan and Draft Revised Study Plans for the Proposed Susitna-Watana Hydroelectric Project. P-14241-000

These comments are submitted on behalf of Trout Unlimited (TU), whose mission is to conserve, protect and restore North America's coldwater fisheries and their watersheds. TU is a national organization comprised of over 400 chapters and more than 140,000 members. TU has more than 800 members in Alaska, many of whom rely on the important fish, wildlife and water resources of the Susitna River watershed for fishing, hunting and recreation, and employment in related industries. TU and its members have serious concerns about potential impacts from the proposed Susitna-Watana Dam and stand to suffer significant personal, cultural and economic impacts if the dam is permitted and developed.

In addition to TU's concerns regarding the dam itself, TU has significant concerns about the quality and adequacy of the Alaska Energy Authority's (AEA) Proposed Study Plan. The most significant of these concerns are as follows:

I. The Proposed Study Plan and Integrated Licensing Process must Accurately Evaluate Potential Impacts to Important Fish, Wildlife and Water Resources.

Large dams, such as the proposed Susitna-Watana Dam, have extremely complex, unpredictable and long-lasting impacts. Despite this, the AEA and FERC only contemplate two years of studies in an effort to fast track the permitting process that shortchanges our scientific understanding of the potential impacts and makes it impossible for the public or regulating agencies to make informed decisions regarding the project.

GEN-02

This abbreviated Proposed Study Plan is insufficient to provide an adequate baseline or to evaluate potential impacts to specific species or their ecosystem. For example, the Susitna River watershed is an important fishery that produces all five of Alaska's Pacific salmon. Chinook salmon, which are one of the most important fishes produced in the Susitna River watershed, have a life history that spans five to seven years and can exhibit significant differences in abundance from one year to the next. By only conducting two years of studies, the AEA virtually guarantees that it will be unable to collect sufficient information to form an accurate baseline or to accurately anticipate potential impacts to Chinook salmon. The Proposed Study Plan has similar shortcomings with regard to other important fish and wildlife species, and these shortcoming compound when tying to evaluate complex ecosystem-scale impacts or cumulative impacts.

Stream flow, water level and winter ice conditions can vary significantly from one year to the next and will not be adequately studied in the Proposed Study Plan. Just this past fall, for example, much of Southcentral Alaska, including the Susitna River watershed, experienced unusually high flows and flooding above what has typified recent years or historical averages.

By only conducting two years of studies, the Proposed Study Plan is unlikely to collect sufficient data to account for unusual seasonal or annual events such as the floods of 2012. Additionally, if such an unusual event happens to occur during the two year study period, the data will suffer the opposite fault and not be representative of normal, baseline conditions.

In addition to our concerns regarding the short, two-year study period, the Proposed Study Plan is insufficient for evaluating the full geographic scope of potential impacts. The proposed project will require significant road, transmission and other infrastructure development that will extend well beyond the footprint of the dam and reservoir. Impacts from development and operation of the dam will extend upstream of the project site and well downstream clear to Cook Inlet. The project development and how it is operated will affect water quality and quantity below the dam site, it will have significant sediment and water flow impacts, and it will affect the connectivity of the watershed and the movement of anadromous and other migratory fishes. The Proposed Study Plan neglects many of these impacts and, as such, is inadequate.

GEN-03

Another concern with the Proposed Study Plan is that it fails to adequately evaluate and synthesize the existing data and information already available about the affected area. Much of the data AEA relies on is from the 1980s and may be either outdated, incomplete, or inaccurate. AEA should conduct a biometric review study as was requested by the U.S. Fish and Wildlife Service and National Marine Fisheries Service to ensure that all of the available data is considered and that that data is reliable.

II. The Proposed Study Plan and Integrated Licensing Process must Accurately Evaluate Potential Impacts to other Affected Industries and Economic Sectors.

Fishing, recreation and tourism are some of the most important and valuable industries in the region and to the state generally. People travel from all over the country to visit Alaska and the proposed project area. Despite this, there is nothing in the current permitting process to evaluate the socioeconomic impacts of the project to the region, state and country as a whole. The proposed Susitna-Watana Dam is of a scale and size that is unprecedented in Alaska. A comprehensive economic valuation study should be required in order for regulating agencies and the public to adequately evaluate the project's potential impacts and to come to an informed opinion on the matter.

SOC-04

III. The Proposed Study Plan and Integrated Licensing Process must Address Geologic and Hydrologic Concerns.

The project site is near multiple active faults and the Proposed Study Plan is inadequate for evaluating the potential seismic risk and project stability. TU supports the U.S. Geological Survey's comment that nearby seismic features have not been sufficiently studied to determine the credible risk of earthquake. The Proposed Study Plan fails to adequately evaluate these risks.

SEIS-1

Another significant concern that the Proposed Study Plan overlooks is the potential changes to local and regional hydrology that are likely to occur from climate change. Climate change is likely to have significant impacts to local hydrology that could affect the project productivity. The Proposed Study Plan needs to evaluate the changes to water availability, both in quantity and timing, that is likely to occur from climate change, and evaluate how operation of the dam under those new future conditions are likely to impact fish, wildlife and water resources.

GLAC-01
IFS-046

IV. The Integrated Licensing Process makes it Impossible for the Public to Fully Participate in the Regulatory and Decisionmaking Process.

The Integrated Licensing Process requires multiple processes and studies to occur simultaneously with overlapping and occasionally conflicting public participation deadlines. This process does not provide sufficient time to allow studies to be completed to inform environmental analysis and consideration of potential mitigation or project alternatives. Specifically, meaningful collection and evaluation of baseline date for fish populations—including estimates of juvenile density, adult escapement, spawning rates and condition—will require significantly more time than allowed in a two-year period.

V. Conclusion.

Thank you for the opportunity to review and provide comments on the Proposed Study Plan and the related documents. I hope that these comments are helpful in developing a strong and complete record upon with to evaluate this proposed project. Please do not hesitate to contact me by email at awilliams@tu.org or by phone at 907.227.1590 if you have any questions.

Respectfully,

Austin Williams
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Document Content(s)

Trout Unlimited Proposed Study Plan Comments - 20121114.PDF...........1-5

Chase Community Council

P.O. Box 205

Talkeetna AK 99676

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November 14, 2012

Kimberly D. Bose
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Via FERC eFile P-14241-000

Subject: Comments on Alaska Energy Authority Proposed Study Plan (PSP) & Draft Revised Study Plans for the Proposed Susitna-Watana Hydroelectric Project P-14241-000

Dear Secretary Bose:

The Chase Community Council is the elected local advisory body that represents public interests for the Community Area of Chase, Alaska, and the first incorporated Community Council downstream of the proposed Susitna-Watana Dam. Our boundaries are consistent with the Chase Community Planning Area boundaries represented by the Chase Comprehensive Plan as adopted by Matanuska-Susitna Borough Ordinance No. 93-071AM. We are bounded to the north by Gold Creek, to the East by the Susitna River, to the south by the Talkeetna River and to the West by Disappointment Creek and the Talkeetna River. Our northernmost point is the confluence of the Susitna River and Gold Creek. Our Southern-most point is the confluence of the Talkeetna River and Susitna River.

On behalf of the residents of the Chase area, we respectfully offer the following comments on the Alaska Energy Authority's Study Plan and Revised Study Plan for the Proposed Susitna-Watana Hydroelectric Project P-14241-000.

Inadequate Information and Time Due to The ILP Process
the Integrated License Process selected for review continues to offer inadequate timeframes for a project of this scope and complexity. As a result of the compressed timeline, FERC and AEA are putting residents, Agencies and many stakeholders in the position of commenting without adequate information or review and analysis time. Publication of the most recent revisions occurred November 1 and the deadline for comment is November 14. A period of only 14 days is grossly insufficient for meaningful review of dozens of study plans and leaves members of the public and residents downstream of the dam greatly concerned about the potential for critical information to be missed. Agencies have commented repeatedly about inadequate review time. Without the comprehensive assessments and insights from public agents the public is at a significant disadvantage and left without adequate information and representation. Agencies are not able to coordinate among studies to

provide an integrated and holistic approach to assessment, interpretation and data sharing - resulting in a silo'd approach to the baseline assessments which significantly limits the ability to assess the value and functions of a healthy ecosystem. Further, it wastes time by forcing reviews to be conducted without adequate information.

GEN-18

Lack of Integration and Coordination among Study Plans
Overall the study plans present a silo'd approach to the assessment of baseline conditions and do not allow adequate time, incentive or planning for coordination among major studies. A key example is the lack of explicit links between the wildlife biology studies and the hydrology studies. How will the wildlife component be tied to the hydrology studies to show how nesting habits will be impacted by shifting hydrologic regimes? How will Caribou migration be impacted by the shifting hydrologic conditions not just above the dam but below also? How will nesting birds be impacted by changing water levels. Will predation increase as flows decrease during the summer months leaving nesting water fowl more susceptible to predators? How will the shifting ice conditions impact wildlife migration and movements? What are the natural hydrologic conditions that are necessary to support wildlife habitat and behavior? These cross-cutting lines of inquiry seem to be absent.

Inadequate Winter Studies
There continues to be inadequate emphasis on the impacts of the Dam during the winter - the time during which the most significant impact will be seen on natural conditions. The impacts of a changing winter flows are not well understood from previous studies and two years does not allow adequate time to access and characterize the range of conditions that exist throughout the river system in the winter, which in turn support human and wildlife populations. Specific examples of the questions that need to be addressed include:

- RIFS-02 How will the natural floodplain system be impacted if there is no longer a spring flush of ice and water?
- ICE-05 Will the winter ice making and jamming change and if so, how will that impact the system downstream
- TRANS-2 What are the potential detrimental impacts of varying flows on safety and transportation?
- WILD-2 How will wildlife and fish be impacted by the change in ice conditions and loss of stable transportation routes?
- FISH-05 How will fish studies be conducted in the winter without impacting the behavior of the fish?
- What effect will the winter water levels have on ice formation? How will these changes impact transportation corridors, access to homes private property, local wildlife who tend to congregate on the river in winter, access to hunting and fishing, recreational activities, including skiing, snow-mobiling, dog mushing, and camping.
- Will ice be unsafe to travel on with the lower water levels and predicted warmer water?
- MOOSE-2 How will moose populations that congregate along the river in winter be impacted by poor ice conditions?

GEN-19

Inadequate timeframe for the proposed studies
The two-year study period proposed for studies is inadequate, particularly for fisheries and ice processes. Two years does not allow adequate time to characterize baseline conditions required by NEPA to assess impacts of the project on the environment and to assess the natural conditions that would need to be met if the dam were operational. In particular, two years of data collection are insufficient to characterize Chinook salmon - one of the dominant species in the Susitna watershed and a critical source of income and food for residents throughout the region. The life cycle of Chinook

salmon is up to 7 years. As documented by many of the agencies, 2 years of study does not allow the necessary time to characterize and understand the potential impacts on the full life cycle in the Susitna River. Given the inaccurate assumption from the studies in the 1980s that Chinook could not migrate above Devils Canyon, adequate data from the upper river does not exist from previous efforts and therefore cannot be used to supplement the studies being done today. Furthermore, the 2012 summer returns were the lowest on record and therefore this year does not accurately characterize typical baseline conditions. Furthermore, the 2012 flood prematurely halted studies, resulting in an incomplete season of study.

Assessment of Emergency Actions

GEN-20 There is no discussion of the potential impact from emergency actions that could be necessary in the operation of the dam. What are the possible scenarios and how would they impact residents and wildlife downstream. For example, if there were a need for an emergency release during the winter or summer, how would human and wildlife safety be impacted downstream. What are the relative impacts and how would they be different depending upon the season?

Chulitna River Studies

GEO-05 There does not appear to be any significant study of the Chulitna to help understand how the changes in the Susitna flow regime might impact the conditions of the Chulitna. For example, if the Susitna flow is reduced, how will it impact the directional flow of the Chulitna, which is currently pushed westward by the Susitna river. With a decrease in flow, will the Chulitna move eastward and if so how might that impact the Alaska Railroad and the town of Talkeetna?

Assumptions about Costs and Rates

GEN-21 It appears that assumptions regarding costs and rates are based only on power optimization scenarios. Given the potential need to operate the dam to also meet ecosystem functions, there should be adequate study of alternative scenarios for operation such that a range of costs and rates can used to reflect reasonable assumptions.

Groundwater Studies

GW-002 There does not appear to be a clear link between the groundwater and surface water studies and the engineering studies. How will the ground to surface water interaction at the dam site impact the stability of the dam? Particularly the groundwater piping and infiltration? Additionally, there does not seem to be any link between the groundwater studies and the potential impact on surrounding forests, including both the forests above the dam and also the major forested regions downstream of the dam. How will changing groundwater conditions impact the health of the forests downstream given the potential for dropping groundwater levels - particularly given the observed destruction of forest ecosystems under similar conditions in other parts of the country. How will the riparian zone above the dam be impacted as water pressure increases with the reservoir?

Narrow Scope of the Subsistence Studies

SUB-03
WHARV-1
The subsistence studies are focusing exclusively on a narrow set of target communities (Talkeetna, Trapper Creek, Chase, etc.) However the lower Mat Su Valley and Anchorage heavily use game unit 13 in the region of the Dam. The study needs to be expanded to better understand the impact on these user groups and the cumulative impact of the dam, access roads, and other impacts on sustainability of the wildlife populations.

Water Quality Studies

WQ-01 The water quality studies seem to focus exclusively on tributaries and slough that work well. There should be equal emphasis put on learning from the drainages, sloughs and tributaries that are not supporting fish so that we can better understand the conditions that don't work. This will help to better understand what kind of conditions need to be avoided.

Inadequate Long-term Economic Valuation

SOC-07 Despite AEA's rejection of this study request, the Chase Community Council continues to believe that one of the most important studies missing from the Study Plan is an assessment of the cost/benefit, loss/reward of the value of a free flowing river versus a dammed Susitna River. We believe this study is necessary to give equal consideration to the non-power values of this river system and the scope of the proposed net benefit calculations of the non power uses does not allow for adequate characterization of a diverse, healthy and fully functioning ecosystem.

We believe that the revised study plans do not adequately evaluate the public's best interest. The studies should include an assessment of the full, long-term costs of the project to the State of Alaska and local residents in the form of lost benefits such as:

- Subsistence and commercial fishing impacts (set-net permits and cook inlet commercial fishing)
- Recreational fishing economic impacts, including the impact to the local small businesses that support tourism
- Personal fishing rights (for subsistence)
- Personal subsistence harvest
- Access to residences and personal property - including winter access that specifically relies on river travel and summer travel by boat.

In closing, the Chase Community Council appreciates the opportunity to provide comments on the Interim Draft RSP, and to provide suggested modifications to the studies proposed in the plan. These comments compliment and build off of comments and study requests submitted by the Chase Community Council to FERC on May 31, 2012 and therefore should be read in conjunction with them.

Chase Community Council

Peg Foster, Secretary

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Respectfully submitted on May 31, 2012

Document Content(s)

Chase Community Council Comments on Susitna Study Plans.DOCX..........1-4

Ruth McHenry, Copper Center, AK.
November 8, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E., Room 1A
Washington, DC 20426

Re: Susitna-Watana Hydroelectric Project No. P-14241-000
Study Plan

Dear Kimberly Bose:

Copper Country Alliance, a conservation group based in the Copper River Basin, feels that the Alaska Energy Authority (AEA) has omitted two crucial points of concern in its study plan. They are as follows:

- The national importance of natural free flowing rivers: Throughout the Lower 48 dams are being torn down. The people of our nation now see the long term negative impact of dams and want natural free-flowing rivers, valuing the resources they provide.
- Climate change in the dam area from the creation of a massive man-made lake: Certainly a relatively still, large body of water will change local climate. Will this change adversely affect wildlife, fish, and flora? Also, would the regulated water flow downriver influence local climate?

GLAC-06

Residents of the Copper River Basin, Cantwell, and Talkeetna have a long history of hunting, fishing, and berry picking between the Denali Highway and the proposed Watana dam site. Consequently, Copper Country Alliance strongly feels that AEA needs to contain the above essential components in its study plan.

Respectfully,

COPPER COUNTRY ALLIANCE

Linda Rutledge, Secretary

Document Content(s)

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THE CENTER FOR WATER ADVOCACY

November 14, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First St., N.E.
Washington D.C. 20426

RE: Susitna-Watana Project (P-14241-000).

Dear Secretary Bose:

Thank you for the opportunity to submit the comments below on the Proposed Study Plan (PSP) for the above Project. The Center for Water Advocacy (CWA) is a party to the Federal Energy Regulatory Commission (FERC) licensing process for the Alaska Energy Authorities (AEA's) Susitna-Watana Hydropower Project Docket #14241 (Project). In general, we are concerned that the PSP: 1) development process is procedurally flawed; 2) does not adequately identify, discuss, and summarize all the readily available information relevant to the existing environment for fish and wildlife or subsistence uses including all proposed ILP studies that were submitted to AEA; 3) does not provide a thorough discussion of the environmental baseline and effects of the Project on aquatic and subsistence resources downstream of the proposed Project; 4) does not provide recommendations on measures that must be taken to eliminate or mitigate impacts of the Project; 5) fails to comprehend the scope and dynamics of the Susitna River watershed ; 6) fails to properly consult with affected Native Alaskan Tribal Governments and to apply Traditional Environmental Knowledge; and 7) fails to even mention the impacts of the Project on Instream Flows for Fish, Aquatic, Riparian and Subsistence resources in association with climate change.

Our specific concerns include the following:

I. The PSP Development Process is Procedurally Flawed

a. <u>Failure to Include Licensing Participant Proposed Study Plans</u>

As part of its comments on the original scoping document and ILP studies, CWA submitted a proposed study regarding the impacts of the Project on instream flows (attached) which was not mentioned in the PSP. CWA believes that the elements of <u>all</u> ILP study requests, including those submitted by CWA and groups other than governmental agencies must be considered as part of the study plan process.

That AEA's failure to consider CWA's ILP study request is a violation of ILP regulations, is illustrated by the fact that during some of the August Technical Working Group (TWG) meetings, FERC staff comments during the meetings were indicative of the agency's overall concern about the limited quality of many of the proposed studies. In fact, FERC asked AEA why it failed to adhere to ILP regulations by failing to explain why it rejected an agency-proposed study element and FERC, itself, admonished AEA for not adhering to ILP regulations by failing to explain in its proposed studies why it rejected an agency-proposed study element.

In addition, other federal agencies, including the U.S. Fish and Wildlife Service (WSFS), the National Marine Fisheries Service (NMFS) and the Alaska Department of Fish and Game (ADF&G), have expressed concern, during TWG meetings, about the lack of specificity in the study plans and the lack of coordination in the Study Plan process, as illustrated, in part, by AEA's failure to produce a "Critical Path" document showing how the data collection and analysis components of the various studies are intended to interrelate.

GEN-06

b. **Failure to Adhere to ILP Standards**

AEA's recent changes to the Integrated License Process (ILP) for the Project and process-related issues substantially affect CWA's participation in the Susitna-Watana licensing process. Although, for example, comments are due on the PSP by November 14, 2012 just a few weeks before this deadline, AEA drafted substantial revisions to the PSP, based on input from federal and state agency stakeholders. This has, not only resulted in a short two-week turnaround expected for CWA's comments on redrafts of plans which were originally filed and distributed for review on July 16, 2012, but because AEA requested informal concessions on these revision prior to the deadline for the submission of PSP comments, AEA is in violation of the Study Plan notice and comment standards. The lack of coordination in the Study Plan process has caused state and federal agencies to complain repeatedly during TWG meetings and in writing. According to as recent letter to FERC regarding these problems the National Marine Fisheries Service (NMFS), for example, provides:

> A period of only 14 days is insufficient for NMFS to review and to provide comments to FERC on the revisions to the PSP potentially affecting over a dozen studies for this proposed large original hydropower project. NMFS is currently completing its internal review of AEA's PSP filed with FERC on July 16, 2012.[1]

In accordance with FERC regulations governing the ILP [18 CFR Section 5.12] and the September 17, 2012, order extending by thirty days the deadline for reviewing

[1] James W. Balsiger, Administrator Alaska Region NMFS re: FERC Order for Extension of Time to File Comments on the Proposed Study and Revised Study Plans for the Susitna-Watana Hydroelectric Project (FERC P-14241), p. 2 (October 31, 2012) (NMFS Letter).

both FERC's Scoping Document 2 and AEA's PSP for the proposed project, CWEA and other Licensing Participants are required to submit comments on the PSP by November 14, 2012. In addition, although FERC guidelines require that a Revised Study Plan will be submitted after the comments on the PSP are submitted and reviewed, during the last week in October and before the PSP comments were even submitted, AEA issued several RSPs on instream flows, riparian and subsistence resources just a couple of weeks prior to the November 14 comment deadline.

The submission of RSPs just a before the PSP comment deadline, however, not only results in much confusion as to whether Licensing Participants should be commenting on the RSP or the PSP, but turns commenting on the PSP into an excercise in futility because AEA has asked licensing participants to include any revised information or study requests concerns and any accommodations reached with AEA regarding those concerns prior to submitting the comments on the PSP. According to a resent letter submitted by NMFS to FERC on this issue:

> During Technical Work Group meetings held the week of October 22, 2012, AEA presented preliminary information on what its revised PSPs may contain. Some of these revisions were made available to agencies on October 29, 2012. AEA has requested that NMFS provide comment by November 14, 2012 on those as yet uncompleted revised PSPs, and FERC staff have stated publically during last week's meetings that FERC prefers that agency comments address those undocumented changes to the PSPs.[2]

This requirement, however, makes the comments on the PSP obsolete in violation of FERC regulations because AEA is setting up an informal Study Plan review and commenting process with the agencies that will result in decision making on the Study Plan even before the comments are filed on the PSP. This "informal review and resolution process", therefore, is contrary to the study plan notice and comment process and FERC regulations because, if the state and federal agencies and AEA have worked out most of the study plan issues prior to the comment deadline on the PSP, licensing participants comments who are not involved in the informal decision making process are excluded from the Study Plan process.

Nor is it possible for CWA or other Non-Governmental Organizations (NGOs) to participate in the informal decision making process because such organizations do not have the resources or time it takes to participate in the multiple TWG meetings, field trips, conference calls that have and will take place on the multiple study plan topics and in which AEA representatives are asking for our in-put "now, not down the road," when formal commenting is supposed to takes place.

According to NMFS, for example, the PSP comment:

[2] *Id.*

> …deadline presents a problem where the accommodations may or may not have (as NMFS does not yet know) been reached only days before the comments are due. The period between October 31 and November 14 leaves NMFS with less than 14 days to prepare and submit comments on the proposed and revised study plans.
>
> NMFS will address, to the extent possible, any accommodations reached with AEA regarding its concerns with those study plans to date, but likely will not be able to review revised plans. Unfortunately NMFS has had to prepare comments on plans which may be outdated and substantially revised in order to fulfill its duties in the licensing forum. Conversely, NMFS will not have the benefit of revisions to the PSP which may solve, or complicate, NMFS' original concerns.[3]

AEA's failure to comply with ILP regulations as part of the Study Plan calls, not only harms the licensing process as a whole, but calls into question it's ability to manage the process at all. This concern is best illustrated by NMFS which states:

> AEA's repeated failures to follow its own ILP meeting guidance compromises NMFS full participation in the ILP and harms the process as a whole. NMFS respectfully requests that FERC ensure AEA comply with its own meeting guidance; including scheduling, adequate notice, provision of materials in addition to presentations, agendas, and meeting notes and minutes. If AEA is unable to do so, NMFS is willing to work with AEA to find a structure which would be efficient and fair to all the participants in the process, with FERC's oversight.[4]

Chapter 2 of AEA's Pre-application Document (PAD) lays out a process plan, schedule, and communications protocol. This plan and schedule extends from the filing of the Notice of Intent through filing of the application for license, and prescribes specific timeframes, deadlines, and responsibilities of FERC, AEA, and other stakeholders involved in the ILP. Adherence to this plan is essential for guiding the application development process in a collaborative, structured, complete, and timely manner. CWA shares this goal and requests that FERC and AEA comply with this plan and schedule. To this end, we, hereby incorporate by reference into these comments the comments and recommendations relate to the specific section in Chapter 2 of the PAD listed in the NMFS Study Plan Letter.[5]

Based on the fact that CWA is unable to determine whether it should be commenting on the PSP, RSP or informal revisions worked out between AEA and agency stakeholders, we will focus these comments on the PSP only. The PSP, therefore, fails to ensure the effective participation of CWA and other stakeholders in order to develop an adequate study planning record for this large and controversial project. Without

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[3] NMFS Study Plan Letter p. 2.
[4] *Id.* at 3.
[5] *Id.* at 2-3.

procedural safeguards in place, all the parties to this proceeding risk compromise of their goals and duties.

II. Failure to Address Endangered Species

Although, FERC's initial Scoping document for the Project provides that the "Cook Inlet beluga whale is an endangered species with designated critical habitat in Upper Cook Inlet, which is located 184 river miles downstream of the proposed dam sit"[6] neither the proposed Instream Flow Studies for Fish, Aquatics and Riparian nor the Subsistence Studies contain any reference to analyzing project impacts on the beluga. This ignores the fact that the Cook Inlet beluga whale is a genetically distinct and geographically isolated population that lives only in Cook Inlet.[7] It is the smallest population of beluga whales in Alaska.[8] In recent years, the population has plummeted from approximately 1,300 to 284 whales.[9] NMFS has taken various actions over the past decade in an attempt to halt the decline, but the effort has been unsuccessful.

Similarly, On May 31, 2000, NMFS listed the Cook Inlet beluga whale population as "depleted" under the Marine Mammal Protection Act ("MMPA").[10] NMFS believed that the population decline was due to subsistence harvest, and that by restricting harvest, it could restore the population to healthy numbers.[11] However, NMFS restricted subsistence harvest and the population continued to decline by an average of 1.45% per year from 1999 to 2008.[12]

In response to a 2006 petition by conservationists, NMFS evaluated whether the whale should be listed under the Endangered Species Act. After conducting an expert status review, NMFS concluded that the whale had a 26% probability of extinction in 100 years and a 70% probability of extinction in 300 years.[13] Based on that finding and evidence that human development, including hydropower facilities, poses a serious threat to the whale's survival, NMFS listed the Cook Inlet beluga whale as endangered.[14]

NMFS also designated critical habitat for the whale. The designation includes 3,013 square miles of marine habitat in Cook Inlet that NMFS determined is biologically important to the conservation of this small, range-limited population.[15] Despite MMPA and ESA protections, however, the belugas' numbers have continued to decline.

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[6] Scoping Document 1 for Susitna-Watana Hydroelectric Project (No. 14241-0000), p. 10 (February 23, 2012).
[7] 76 Fed. Reg. at 20181 (Apr. 11, 2011).
[8] *Id.*
[9] *See*, The National Marine Fisheries Service (NMFS) 2011 Stock Assessment.
[10] 64 Fed. Reg. 56298 (Oct. 19, 1999).
[11] 69 Fed. Reg. 62920 (Oct. 22, 2008).
[12] *Id.*
[13] 73 Fed. Reg. 62927 (Oct. 22, 2008).
[14] 73 Fed. Reg. at 62919.
[15] 76 Fed. Reg. 20180 (Apr. 11, 2011).

CIBW-01

In relation to the Cook Inlet beluga whales, therefore, pursuant to Section 7(a)(2) of the ESA, the PSP must discuss the potential impacts to the beluga and provide recommendations how to ensure that any action authorized, funded, or carried out by FERC in relation to the Project is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat.

III. Instream Flows

a. Expansion of Study Plan Time Period

The PSP fails to provide a sufficient study plan period for instream flow and aquatic habitat studies to be consistent with state instream flow data collection requirements. During TWG meetings as part of the Study Plan process, federal and state agencies expressed concern regarding the ILP-prescribed, two-year study period. According to the PSP, for example:

> The Instream Flow Riparian Study is planned as a 2 year effort, with field sampling conducted spring through summers and fall of 2013-2014. Delivery of Initial Study Report in late 2013 and Updated Study Report in late 2014. Figure 6.5-7 depicts general work flow and key deliverable dates for the ISF and Riparian ISF Studies.[16]

ESCAPE-36

As part of the TWG meetings, however, the federal and state agency stakeholders have asserted that because of the economic and recreational importance of salmon in the Susitna River, it is critical to adequately characterize their life history needs in the watershed. The PSP, however, does not indicate the need to study the distribution and abundance of salmon and other species that are potentially impacted by the Project through their entire lifecycle. This is regardless of the fact that both NMFS and USFW filed study requests for anadromous fish for a minimum of the life cycle of each species.

IFS-095

In addition, that the PSP's maximum 2 year study period for analyzing impacts on instream flows is insufficient in this case, is illustrated by the fact that the Alaska Department of Natural Resources (DNR), typically, requires a minimum of 5 years of discharge data prior to issuing an instream flow water right permit under the state water code because.[17] Such 5 year minimum is necessary to determine the average amount of instream flow necessary for habitat needs for which the water right is requested. Although, a limited amount of hydrological data exists for some of the river reached affected by the project,[18] this data does not fully address the impacts to instream flows

[16] Instream Flows Studies: Fish, Aquatics and Riparin, p. 6-29 (Instream Flows-FA&R).

[17] *See,* 11 AAC 05.010(a)(8).

[18] This data includes a 57-year hydrologic record for the Susitna River at Gold Creek (RM 136.5), which continues to be gaged, and a 17-year hydrologic record for the river at Cantwell (RM 223.7) covering 1961-1972 and 1980-1986 and in 2011 a new gage was established at Tsuena Creek ~RM 182, about two miles downriver from the dam site, RM 184.

that will be affected by the scope of the Project, and therefore, that the need for additional stream gaging illustrates the need for FERC to require AEA to extend the study period.

Further, due to the practical problems that arise in the field as a result of weather, equipment failure and other unforeseen factors that might well prevent or curtail some studies during one or even two of the data collection seasons proposed by AEA, the supposed two years of study may in fact only be one year for some studies. Even in the event there are no weather related delays, equipment failures, etc., the critical-path issue means that some studies presumably cannot begin until the second and last study year.

Moreover, the Study Plan calls for the development of:

> …integrated aquatic habitat models that produce a time series of data for a variety of biological metrics under existing conditions and alternate operational scenarios. These metrics include (but are not limited to):
>
> • water surface elevation at selected river locations;
>
> • water velocity within study site subdivisions (cells or transects) over a range of flows during seasonal conditions;
>
> • varial zone area;
>
> • frequency and duration of exposure/inundation of the varial zone at selected river locations; and
>
> • habitat suitability indices.[19]

Such models cannot adequately predict a time series of project impacts if such time series will only address a two year period. Similarly, without extending the study period beyond, the current, two years, it is not possible to carry out AEA's planned "[e]valuation of existing conditions and alternate operational scenarios using a hydrologic database that includes specific years or portions of annual hydrographs for wet, average and dry hydrologic conditions and warm and cold Pacific Decadal Oscillation (PDO) phases…"[20]

GEO-02
FGM-01
ICE-01
GW-001
IFS-033
RIFS-01
FDAUML-01
AQHAB-01
BARR-1
EUL-1
RIP-01S

b. <u>Insufficient Scope of the Instream Flow for Fish, Aquatics and Riparin Study</u>

The PSP fails to study of the change to the hydrogaph for Lower River even though the Project will sufficiently affect river morphology in such reach. AEA's contention, during the TWG meetings, that the project's change to the hydrograph will not be significant enough to affect the various physical process that affect river morphology in the Lower River is questionable because changes in the timing of high

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[19] PSP Instream Flows-FA&R at 6-9.
[20] *Id.* at 6-10.

flows affect anadromous species and habitats by altering timing of immigration and emigration, ability to ascend natural and artificial barriers and overbank habitats that provide cover and nutrients in juvenile life-stages.

In addition, changes in the stage of the reach below the powerhouse due to project operations can have numerous effects on anadromous species and their physical habitats. Down ramping events, for example, can rapidly change the water surface elevation and wetted perimeter of a reach, stranding juvenile fish or dewatering redds and up ramping can scour redds and create increased velocities which can be barriers to upstream migration. Floodplain functions and ecological processes depend on seasonal and periodic inundation of the floodplain. Finally, alteration of streamflow rates are the primary predictor of biological integrity for fish and macroinvertebrate communities. Water uses such as hydroelectric power, therefore, have the potential to change both the riparian and aquatic habitat conditions needed to by fish.

c. **Failure to Include TEK**

SUB-01
FHARV-1

The PSP's Instream flow for Fish, Aquatic and Riparian Studies section is completely devoid of the collection of TEK for determining impacts on instream flows. TEK will not be applied in any of the listed Study Goals and Objectives for these studies.[21] The PSD, therefore, fails to appreciate a significant tool for addressing potential project impacts to instream flow, aquatic and riparian resoruces.

In fact, although "[c]riteria will include observed physical phenomena that may be a factor in fish preference (e.g., depth, velocity, substrate, embeddedness, proximity to cover, groundwater influence, turbidity, etc.) [and i]f study efforts are unable to develop robust sitespecific data, HSC/HSI will be developed using the best available information and selected in consultation with licensing participants,"[22] there is no mention of taking advantage of TEK to fill data gaps or when observed physical information is needed.

IV. Subsistence Resources

a. Failure to Consult With Native Alaskan Tribal Governments

The PSP fails to include the need to consult with Native Alaskan Tribal Governments as a measure to protect and enhance environmental resources of the project area. The sole reference to consultation appears in the RSP which provides that "[c]onsultation efforts to date include discussions with agency representatives, Alaska Native entities, and other licensing participants at the Project Technical Workgroup Meetings and other meetings with the Alaska Department of Fish and Game (ADF&G) held between December 2011 and June 2012."[23]

[21] PSP Instream Flows FA&R, p. 6-9-10.
[22] Instream Flow Studies: Fish, Aquatics and Riparian, p. 6-9.
[23] Draft Revised Study Plan Subsistence Resources at 14-3.

The need to consult with the Tribes, however, illustrated by the fact that there are a number of regional and village Native corporation lands in the dam project area including the area slated for submersion by the reservoir. First, a number of the land holdings of village corporations are not near the villages themselves. This is because Southcentral Alaska was already very populated by the time the Alaska Native Claims Settlement Act was passed, so there was little land left to select that was not already privately owned or otherwise unavailable. That ultimately, put back the schedule of selections, and also put many land selections at a geographical remove from the villages. CIRI owns land in the project area that's essentially held in trust. The land will ultimately go to village corporations. The fact that future ownership of those lands, some of which area involved in court proceeding, is unknown, complicates negotiations with AEA and project development regarding land access and use of the dam project.

In addition, CWA is concerned regarding AEA's funding of federal and state agencies so that such agencies can hire contractors to assist them with their Project related work. Specifically, we understand that AEA recently provided funding to the federal agencies so that they can secure additional expertise for their Susitna project work. As we understand the process, AEA is providing the funds to the Alaska Department of Natural Resources; the federal agencies prepare and announce the Requests for Proposals and will choose the contractors, but DNR will execute the contracts and presumably pay the contractors.

While state and federal agencies have been funded by AEA for project related work, however, it appears that Native Alaskan Tribal Governments have not received any such funding even though there are several such entities that will be affected by the project. This is contrary to FERC regulations and policy regarding tribal consultations which provide that:

> Before it files any application for a new license, a nonpower license, an exemption from licensing, or, pursuant to § 16.25 or § 16.26 of this part, a surrender of a project, a potential applicant must consult with the relevant Federal, State, and interstate resource agencies, including … *any Indian tribe that may be affected by the project*.[24]

Similarly, FERC has issued a:

> …policy statement to articulate its *commitment to promote a government-to-government relationship between itself and federally-recognized Indian tribes*. The policy statement recognizes the sovereignty of tribal nations and the Commission's trust responsibility to Indian tribes…. Finally, the policy statement establishes certain actions specific to the hydroelectric program.[25]

[24] 18 C.F.R. §16.8 & §4.38. (emphasis added).
[25] UNITED STATES OF AMERICA FEDERAL ENERGY REGULATORY COMMISSION
18 CFR Part 2, (Docket No. PL03-4-000; Order No. 635), Policy Statement on Consultation with Indian Tribes in Commission Proceedings, (Issued July 23, 2003). (emphasis added).

That the provision of funding to Native Alaskan Tribal governments so that they can hire consultants and technical staff and obtain other resources to meaningfully sit at the table with both AEA and federal state agency technical staff and consultants regarding hydro-power projects such as the one in question is illustrated by the fact that:

> The policy statement recognizes the unique relationship between the Federal government and Indian tribes as defined by treaties, statutes, and judicial decisions. It acknowledges the Commission's trust responsibilities. It states that the Commission will endeavor to work with the tribes on a government-to-government basis and *will seek to address the effects of proposed projects on tribal rights and resources* through consultation pursuant to trust responsibilities, the statutes governing the Commission's authority…and in the Commission's environmental and decisional documents…. It states that the *Commission will assure tribal issues and interests are considered in making decisions*.[26]

Finally, many of the Technical Working Group meetings, to date, have not involved tribal technical staff either during the meetings or comments provided by such staff. We believe this is contrary to the fact that the "Commission will seek to engage tribes in high-level meetings to discuss general matters of importance, such as those that uniquely affect the tribes."[27]

SUB-02

IV. The Subsistence Section Does Not Consider Mitigation or Prevention of Project Impacts

The PSP fails to even mention Traditional Ecological knowledge (TEK) and it does not request information regarding how to mitigate or prevent project impacts. AEA's failure to incorporate TEK into potential solutions to the substantial impacts the Project could have on subsistence resources, however, ignores the primary purpose of the ILP study requirement and shows a lack of understanding of the definition of TEK.

While, TEK has many definitions, it is generally referred to as a "body of information about the connected elements of the natural environment which traditional indigenous people have been taught, from generation to generation"[28] In addition, TEk has been described as "a cumulative body of knowledge and beliefs, handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment. Further, TEK is an attribute of societies with historical continuity in resource use practices; by and large,

[26] FERC Policy Statement at 8-9. (emphasis added).
[27] Policy Statement at 16.
[28] Bombay, H. 1996. Aboriginal forest-based ecological knowledge in Canada. National Aboriginal Forestry Association, Ottawa, ON.

these are non-industrial or less technologically advanced societies, many of them indigenous or tribal"[29]

That TEK can, therefore, be a valuable tool for preventing or mitigating potential Project impacts on instream, aquatic and subsistence resources is illustrated by the fact that it is practical, common sensical,based on teachings and experiences passed on from generation to generation, and dynamic and changing. Similarly, TEK covers knowledge of the environment, climate and the relationships between things and unlike conventional data collection, TEK is holistic. It cannot be compartmentalized and cannot be separated from the people who hold it.[30]

At the same time, TEK is qualitative knowledge which is gained through intimate contact with the local environment, while noting patterns or trends in its flora, fauna, and natural phenomena. It is based on data collected by resource users through observation and hands-on experience. Further that the failure to ask native communities about how to mitigate or prevent impacts to subsistence resources from Project operations, is that TEK is an authority system. It sets out the rules governing the use of resources such as respect, an obligation to share.[31]

IFS-107

IV. The PSP's Work Products are Incomplete.

The PSP's Work Products for the PSP Do not Contain Recommendations on how to Prevent Impacts to Instream, Riparian or Subsistence Resources. The Instream Flow Studies: Fish, Aquatics And Riparian Study's Hydraulic Routing and Hydrologic Data Analysis Work Product section, merely, includes:

• Executable model of the Susitna River to route unsteady flows from the Watana Dam site downstream to the river reach where the influence of Project operations is dampened to within the range of natural stage fluctuations;
• Tabular summaries of selected IHA-type statistics;
• Summary charts to provide visual comparisons of selected hydrologic statistics to

[29] Berkes, F. 1993. Traditional ecological knowledge in perspective. In Traditional Ecological Knowledge: Concepts and Cases, J. T. Inglis (ed). Ottawa: International Program on Traditional Ecological Knowledge and International Development Research Centre. Pp 1- 9.
[30] *See,* Abele, F. 1997. Traditional knowledge in practice. Arctic 50(4):iii-iv.
Berkes, F. 1999. Sacred Ecology. Second Edition. New York: Routledge.
Huntington, H. 1998. Observations on the Utility of the Semi-directive Interview for Documenting Traditional Ecological Knowledge. Arctic (51)3:237-242. Mayor 1994 (Quoted on ANSC website). The Alaska Native Science Commission (ANSC)
http://www.nativescience.org/html/traditional_knowledge.html as retrieved on 6 April 2012.
[31] See, Menzies, C. (ed.) 2006. Traditional ecological knowledge and natural resource management. Lincoln: University of Nebraska Press. Stevenson, M. 1996. Indigenous knowledge in environmental assessments. Arctic 49(3): 278-291. United Nations Environment Programme.
http://www.unep.org/ik/Pages.asp?id=About%20IK as retrieved on 6 April 2012.

facilitate discussion of the effect of modeled future operational scenarios on the without-Project hydrologic regime.[32]

Further, the extent of AEA's use of such graphs, models and charts and other results of the hydraulic routing and hydrologic data analyses will be to compile and present then in a study report.[33] The PSP, therefore, leaves out the critical component of providing recommendations how the instream flow studies: fish, aquatics and riparian IFS objectives will prevent or mitigation impacts on water, aquatic and subsistence resources.

V. Failure to Address Climate Change

GLAC-02

Regardless of overwhelming evidence of the existence of climate change and that such change will, almost certainly exacerbate the impacts of the Project on stream flows, aquatic habitat and riparian and subsistence resources, these sections of the PSP are completely devoid of any information regarding climate change nor what measures AEA will take to mitigation such impacts when combined with the effects of the Project.

A recent joint publication of the US Geological Survey (USGS) states that:

> Potential climate change impacts affecting water availability include changes in precipitation amount, intensity, timing and form (rain or snow); changes in snowmelt timing and changes to evapo-transpiration…The prudent use of reservoir storage, as well as conjunctive surface water and ground water management are strategies that water managers employ to optimize water availability." Therefore: Because climate change is traditionally detected over a period that spans multiple decades (Intergovernmental Panel on Climate Change, 2007), decisions with application horizon greater than 20 years might reasonably be informed by climate change information. Examples of such decisions include general planning studies exploring feasibility, economic benefits and costs, and estimation of risks to decide alternative actions, infrastructure or long-term operations criterion; expected benefits and impacts of proposed actions; environmental conditions and aquatic species likely to be affected by proposed actions; etc.[34]

In addition, hydropower facilities are generally licensed for 10 years before they are eligible for renewal for another 10 year period, therefore, according o the above statement by the USGS, planning for stream flows and aquatic habitat which are altered

[32] Instream Flow FA& R, p. 6-20.
[33] *Id.*
[34] K.D. Sharma & A.K. Gosain, Intergovernmental Panel on Climate Change, Application of Climate
Information and Predictions in Water Sectors; Capabilities, p. 5-6 (2009). (Draft White Paper). (Attachment 5).

by hydroppower plant water use can, therefore, reasonably be informed by looking at climate change information.

In addition, in an article published in the journal, Nature, USGS scientists examined water-availability projections of climate models. Water availability is directly related to climate. However, there is no simple relationship between future temperatures and future water resources that would cover all regions of the world. Some regions may experience increases in precipitation and run-off while other regions may experience decreases.

In the USGS study, the scientists compared simulations from an ensemble of 12 global climate models with a century of streamflow measurements from 165 locations around the world. They determined that the model ensemble is useful for simulating regional historical longterm trends in streamflow around the world. The model ensemble was then used to predict the complex pattern of streamflow change that can be anticipated in the twenty-first century. Results from the models predict 10 to 40 percent increases in runoff in eastern equatorial Africa, the La Plata basin and high latitude North America and Eurasia by the year 2050. They also predict 10 to 30 percent decreases in runoff in southern Africa, southern Europe, the Middle East and mid-latitude western North America by the year 2050.[35]

Finally, Dr. Robert Lackey a Certified Fisheries Scientist and a Fellow in the American Institute of Fishery Research Biologists says:

> Changing climate offers another challenge. Some species of current policy interest (i.e., salmon, bull trout, marbled murlets, northern spotted owl, etc) are likely doomed to serious threat of extinction in the Pacific Northwest given the warming climate and decreased snow pack. Other species will fare much better in the altered environment and exert competitive on these species.[36]

VI. Failure to Comprehend the Magnitude of Project Impacts.

By failing to extend the study period, properly apply TEK and to adequately address the scope of the Project, the impacts of Climate Change when combined with project impacts, and to study changes in the lower river reach due to Project impacts, the Study Plan fails to Comprehend the magnitude and implication of the Project on instream, fish and wildlife, riparian and subsistence resources. The scope and dynamics of the river watershed is illustrated by the fact that:

> the Susitna River [is] divided into six macro-habitat categories consisting of mainstem, side channel, side slough, upland slough, tributaries, and tributary mouths…The distribution and frequency of these habitats varies

[35] Milly, P.C.D., Dunne, K.A., and Vecchia, A.V., 2005, Global pattern of trends in streamflow and water availability in a changing climate: Nature, v. 438, no. 7066, p. 347-350.
[36] http://oregonstate.edu/dept/fw/lackey/CurrentResearch.htm.

longitudinally within the river depending in large part on its confinement by adjoining floodplain areas, size, and gradient.[37]

In addition, the complexity of the Susitna River Watershed is illustrated by the fact that these habitat feature types include:

• Mainstem Habitat consists of those portions of the Susitna River that normally convey streamflow throughout the year…;
Side Channel Habitat consists of those portions of the Susitna River that normally convey streamflow during the open water season but become appreciably dewatered during periods of low flow…;
• Side Slough Habitat is located in spring fed overflow channels between the edge of the floodplain and the mainstem and side channels of the Susitna River and is usually separated from the mainstem and side channels by well vegetated bars…;
• Upland Slough Habitat differs from the side slough habitat in that the upstream end of the slough is not interconnected with the surface waters of the mainstem Susitna River or its side channels…;
• Tributary Habitat consists of the full complement of hydraulic and morphologic conditions that occur in the tributaries…;
• Tributary Mouth Habitat extends from the uppermost point in the tributary influenced by mainstem Susitna River or slough backwater effects to the downstream extent of the tributary plume which extends into the mainstem Susitna River or slough.[38]

Further:

…these habitat types are utilized to varying degrees and at different times by different species and life stages, with some species seeming to prefer certain habitat types over others…Importantly, there will likely be both inter- and intra-habitat: flow response differences between and among these habitat types, and each will require separate investigation.[39]

Finally, the enormity of the task in analyzing Project impacts on the highly complex and dynamic Susitna River Watershed is illustrated by the fact that:

The distribution and proportion of major habitat types in the Susitna River will be identified using analyses of bathymetric data, aerial photography, site-specific habitat and biological surveys (e.g., 1980s studies), and licensing participant knowledge of the Project area This effort will be coordinated with other riverine process and fish studies (See Sections 5.8-Geomorphology Study, 5.9 - Fluvial Geomorphology Study, and various fish studies designed to characterize the distribution, abundance and

[37] PSP Instream Flows-FA&R at 6-14.
[38] *Id.* at 6-7-14.
[39] *Id.*

> habitat characteristics of fish populations in the lower, middle and upper Susitna River…. The location and distribution of distinct habitat types, areas of intense fish spawning activity/rearing will also be identified using available information and the results of site-specific surveys….[40]

Indeed, for the anticipated 2 year study period alone, the Riparian ISF Study Plan's total approximate effort/cost: $1.2-1.5 million (not including costs for riparian groundwater/surface water study instrumentation, field installation and monitoring, and MODFLOW modeling).

Finally, the need to properly address the scope and impacts of the Project and making realistic recommendations for mitigating Project impacts on the Susitna River watershed is illustrated by the need to focus on hydrologically based stream flows in order to assure that the Project does not harm instream flows needed for the Susitna River watershed fishery. As we mentioned in our study request, the focus of the instream flow studies, should be to maintain the natural water quantity and quality at streamflows and water levels that will provide suitable habitat for fish, migratory waterbirds, and other wildlife and to protect fish and wildlife aquatic habitat and to protect the natural biological diversity of the river system and its floodplain by mimicking the natural hydrological system. A large body of evidence shows that the natural flow regime of all rivers is inherently variable, and that this variabilitiy is critical to ecosystem function and native biodiversity"[41]

Stream characteristics and ecological processes affected by hydrologic regimes, therefore, include stream channel width and depth, floodplain inundation, transport, storage, deposition, and recruitment of substrates and organic matter, and development, recruitment, and persistence of riparian vegetation. In addition, hydrological based natural (as opposed to minimum) stream flows are now recognized as central to sustaining and conserving native species diversity and ecological integrity in river and watershed ecosystems.

CONCLUSION

In addition to failing to comprehend the magnitude of impacts that the Proposed Susitna-Watana Hydropower project will have on fish, aquatic, riparian and subsistence resources, by failing to follow ILP regulations, extend the study period, properly apply Traditional Environmental Knowledge, consult with Native Alaskan tribal governments, discuss impacts to the endangered beluga whale, adequately address the scope of the Project, the impacts of Climate Change when combined with project impacts, and to study changes in the lower river reach due to Project impacts, the Study Plan fails to adequately analyze how hydrologic regimes substantially influence aquatic habitat and ecology. Because salmon species native to the Susitna Watershed have evolved in and adapted to the unique hydrologic regime of the Susitna and Cook Inlet Watersheds. Changes in the timing of instream flows, therefore, affect anadromous species and

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[40] PSP at 6-14.
[41] Poff et al. 1997.

habitats by altering timing of immigration and emigration, ability to ascend natural and artificial barriers, and ability to utilize overbank habitats that provide cover and nutrients in juvenile life-stages. Also, the timing, or predictability, of flow events, is ecologically critical because the life cycles of many aquatic and riparian species depend on environmental cues provided by flow events and are timed to avoid or exploit flows of variable magnitude. Alteration of streamflow magnitudes is the primary predictor of biological integrity for fish and macroinvertebrate communities.

Similarly, the Susitna River Watershed is a significant contributor of streamflow to the larger Cook Inlet watershed. Altered flow from the Hydro-Power Project (Project) has the ability to affect water quantity and quality downstream to the Inlet. Further, the Inlet is an important ecosystem from which consumptive water exports are made.

The Project's potential impacts to instream flows, riparian areas, water quality and amount and quality of aquatic habitat including data development; alterations of peak flows; dam spills including the timing, magnitude, duration, and volume of spill events below the dam; ramping on change in flow and stage and effects of the powerhouse discharge of affected reaches; floodplains comparing the unimpaired and current frequency, magnitude and duration of floodplain inundation and how much floodplain area is currently accessible; natural gradient barriers to adult salmonid migration, therefore, remain largely unaddressed by the PSP.

Please contact me, if you have any questions regarding these comments.

Respectfully,

s/*Harold Shepherd*
Harold Shepherd, Director
Center for Water Advocacy

Cc; Licensing Participants

Document Content(s)

CWA_Comments_PSP.PDF..1-16

Talkeetna Community Council, Inc.
PO Box 608
Talkeetna, Alaska 99676

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC, 20426

Subject: Comments Re. AEA's Proposed Study Plan
Susitna-Watana Hydroelectric Project No. 14241-000

These comments are submitted by the Talkeetna Community Council, Inc. (TCCI), the elected local advisory body that represents public interests for the Community of Talkeetna, Alaska, an unincorporated National Historic Townsite located within the Matanuska-Susitna Borough 90 river miles south of the proposed Susitna-Watana Dam.

The Talkeetna Community Council has many concerns about the proposed Susitna-Watana Dam; with this statement TCCI presents the most critical concerns regarding AEA's Proposed Study Plan. The proposed studies will attempt to represent base line data for existing Susitna watershed conditions as well as attempt to identify potential impacts from operations of the proposed project. The Talkeetna Community Council, Inc. recognizes the gravity of these studies in their responsibility of encompassing the vast and complex Susitna ecosystem. These studies require absolute and thorough diligence if the state and the public are to rely on them to make scientifically based resource decisions. TCCI maintains the importance of thoroughly examining the natural conditions and resources present in the current Susitna River watershed and how they determine the ecological and economic future of the region.

TCCI concerns include, but are not limited to, the following key issues:

Licensing Process Plan - TCCI continues to express disappointment in the FERC, ILP timeline and AEA's handling of the public process. Following the May 31st submission of Scoping comments, stakeholders and agencies have once again been forced to run the marathon of developing overlapping comments and data in a compressed time frame. TCCI has reviewed AEA's initial PSP submitted July 16, 2012 and has attended the AEA Technical Workgroup Meetings. We have attempted to track the evolution of the PSP over the summer and fall as it has morphed through modified study area boundaries, methodological discrepancies and various comment tables. AEA did attempt to update some of the changes through the aforementioned tables - but not until October and yet another extension of the comments period. (At this point in the FERC ILP timeframe, every comment period to date has been delayed by a month - Scoping, Transportation, PSP etc. proving the skeletal ILP timeline impractical for a proposed project of Susitna's scope)

AEA has a responsibility to present timely meeting notes and keep stakeholders and agencies informed throughout the licensing process. A simple "red line" or "tracked text changes" format for the Revised PSP would have benefitted all participants. Mandatory conditioning agencies such as NYMS have requested that AEA develop a system to facilitate the required transparency required in the ILP:

" AEA's repeated failures to follow it's own ILP meeting guidance, compromises NMFS full participation in the ILP and harms the the process as a whole"
(James W. Balsinger, Ph. D., Admin., Alaska Div., NMFS)

2012 Study Results

TCCI has requested results of the 2012 studies from AEA to better inform comments on PSP studies with interdependencies to results gathered this year and which also dictate the scope and adequacy of 2013-14 studies. AEA's inability to present 2012 data in a transparent manner prior to the PSP Nov. 14 deadline is unacceptable. Although these studies are not officially part of the FERC process, their results will be incorporated into the 2013-2014 study scope.

Fish Distribution and Abundance Studies / Habitat Suitability

ISF-098
FISH-04

TCCI is concerned that aquatic resource studies are limited by the ILP two year time frame. Mandatory conditioning agencies USFWS and NMFS both have requested study periods in accordance with the life cycle of study species. TCCI directly represents the interest of commercial and sport fisherman in the region. The annual Susitna Chinook run ushers in the Susitna Valley's tourist season and provides a sport/subsistence resource for residents. The regional economy depends on the health of the stock and it's habitat - from fishing tours to lodging, restaurants, and shops. In a Sept. 5, 2013 letter to AKF&G Commissioner Campbell, TCCI expressed it's concern:

We, the TCCI, are concerned that the Department's request did not indicate the need to study the distribution and abundance of these species through their entire life cycle. Both the National Marine Fisheries Service and the U.S. Fish and Wildlife Service filed study requests for anadromous fish for a minimum of the life cycle of each species. According to the federal fisheries agencies, To characterize the life history needs of a fish community would require at a minimum looking collectively at each species through at least one life cycle. Chinook salmon, which are the longest lived salmon, typically live 5-7 years (for non-jacks) in the Susitna River drainage. Five years of study would only provide information for one Chinook salmon return. Aside from being the second least studied salmon in the Susitna River basin, Chinook salmon are also in a period of low abundance in the Susitna River basin and statewide. (USFWS, Enclosure #13, p. 3; NMFS, pp. 50-51.)

Further, according to NMFS,

> In periods of low abundance, fish may not occupy or use all suitable habitats, and in periods of high abundance fish may be forced to occupy marginal habitats if habitat is limiting. Therefore, it is important to understand the factors limiting their distribution and abundance by habitat, particularly when developing habitat suitability models to evaluate potential project effects. (NMFS, p. 51.)
>
> TCCI asserts that recent events including the 2012 low Susitna Chinook salmon returns and a series of flooding events in 2006 and 2012, present inaccurate conditions for modeling accurate base line data in the abbreviated study time frame. TCCI continues to support the federal agencies in their request for more robust study periods for both anadromous and Susitna resident fish species.
>
> According to the recent Alaska Chinook Salmon Conference / Knowledge Gaps and Needs:
>
> "Chinook salmon are critically important to subsistence, commercial, and sport users across many diverse fisheries in Alaska. Recent Alaska-wide downturns in productivity and abundance of Chinook salmon stocks have created social and economic hardships across many communities in rural and urban areas of Alaska. "
>
> Further...." There is a significant need to AKF&G to.......identify actions that could be taken to lessen the social and economic hardships being experienced by Alaskans that utilize and depend upon this important natural resource".
>
> Abbreviated studies of the Susitna's most important renewable resource thwarts this goal. Both Goose Creek and Willow Creek have been identified by the State as Chinook stocks with "yields of concern". TCCI notes the proximity of both tributaries to the "middle river" Susitna-Watana study area.
>
> The Susitna River has been selected as one of the 12 Chinook indicator stocks to be examined. Recommended research durations ranged from 3 year trawl cruises (to study near shore abundance and distribution of juvenile Chinook) to 4-5 year tracking of freshwater and marine survival rates. Deshka River assessments identify Susitna Chinook ranging in age from 3-7 years but dominated by

5 year old fish ("although 4-6 year olds can predominate in some years") This data supports a study duration which more accurately reflects the Chinook life cycle.

Another goal for filling Susitna "knowledge gaps" in the data gap survey was to " estimate the number of smolt produced by each brood year. There is currently no program to estimate smolt abundance". This highlights how much is still unknown regarding such a critical resource. The impacts of the proposed project operations will undoubtedly effect juveniles during various life stages - some, like overwintering, can be difficult to model. These juveniles will be most vulnerable to load-following operations. It is critical that the "Early Life History and Juvenile Fish Distribution and Abundance in the Susitna River Study" meet all of the goals stated - most notably stranding, freezing of redds, and scouring of redds.

It is concerning that many of the studies connected to the larger Distribution and Abundance Studies, will only be run as "pilot" studies in 2013 and refined in the final 2014 period.

National and Regional Resource Valuation -

SOC-02

TCCI supports the study requests from agencies recommending valuation of resources - on both regional and national levels.

AEA has responded that it " is not providing a resource valuation because FERC does not require monetary value be placed on fish and wildlife resources potentially affected by a proposed project".

We urge AEA and FERC to reconsider resource valuation and the study requests of those agencies who have stressed the relevance of methodology available. Public trust resources are at stake and require valuation - if not monetary, than some form which represents resource importance to the ecosystem at large. TCCI questions how correct PM&E can be assessed without valuating the losses of specific resources such as fish or game.

(USFWS has requested resource valuation of non-salmon anadromous and resident fish resources)

Socio - Economic Studies -

SOC-22

TCCI requests broader socio-economic studies based on valuation of resource based local economies. Although FERC does not require monetary valuation of resources under project effects, it must at least identify those livelihoods which could potentially be affected by limited fish and wildlife.

Ice Process Studies

TCCI supports agencies need for longer study periods for ice studies.

(NMFS - Eric Rothwell 9/12/12) "The ice process modeling will need several years of data....I see lack of time to collect data for models, calibrate the models, and the selections sites and methods to conduct ISF studies to assess project effects on fish during winter operations under the currently proposed study period".

As noted in TCCI's Scoping comments, the winter conditions of the Susitna River are of paramount importance to the region's fish and wildlife habitat as well as the safety and recreation of it's residents.

Riparian Studies

TCCI supports USFWS in it's efforts to conduct thorough studies with the specific goals and objectives to "characterize the water level regime required to maintain floodplain riparian plant communities."

There is grave concern in the Northern Susitna region that changes in seasonal flows, daily flow regimes, and groundwater effects could diminish riparian habitat. This vegetation is crucial for controlling erosion to property owners and communities in the floodplain, as well as habitat for fish and wildlife. The operations of the proposed project could have a devastating long range effect on Cottonwood populations etc. which control riverbank structures.

Recreational Studies - i.e. "Flow Dependent Recreation"

REC-12 TCCI is concerned that AEA has not involved the local Community Council's in any of it's efforts to collect recreational use data. Again, we are also concerned that recreational data will only be collected for 2013 and in 2014 only " as a provision to capture data in the event of unusual circumstances". This study duration allows for only one December study period.

RECFLW-4 TCCI supports NPS in expanding the recreational study area to the Lower River.
REC-13 NOAA also supports the expansion of the study area below Talkeetna.

"Limiting downstream scope of the recreational and other studies to Talkeetna is unfounded" (NPS - Recreational study comments 8/12)

To date, TCCI has not been given an opportunity to preview any of the SCORP, recreational "intercept surveys", or executive interview content. It is customary for local council's to be points of contact for statewide or regional surveys.

TCCI is disappointed to learn that AEA continues to "sell" their project under the guise of what should be an unbiased survey by including project benefits that have yet to be determined (i.e. suggesting 50% of rail belt electricity will be generated before engineering and operations have been confirmed)

REC-14 (NPS-PSP comments) "Goal of executive interviews is to gather more info about baseline conditions and potential project effects - not 'sell" the project to recreationists"

REC-15 TCCI also concurs with NPS that voter registration is not an accurate survey sampling database. Many Susitna recreationists may come to the area seasonally form other areas of the state or the Lower 48.

Ice Related Recreation -

TCCI supports the inclusion of ice related recreation effects.

REC-16 (NPS re. sec. 12 / Rec.) - " There is no mention of impacts on recreation access and experiences due to changed ice/ snow cover resulting from changed flow regimes"

More specifically, the current studies lack methodology for user experience other than a "preference curve" for ice conditions. AS NPS notes in their comments -

"Unlikely that a preference curve can be developed for winter activities that require stable river ice...It will either be present or not".

TCCI strongly agrees that 1 year of study is not enough to get an adequate sample size "to support conclusions about important flow-dependent activities like sport-fishing, float hunting- NOTE emergency Chinook closure" (NPS)

Northern Susitna recreation is subject to highly variable conditions which will not be accurately represented with "historic" 80's data. The Susitna hosts the Iditarod Sled Dog Race as well as the Oosik Classic ski race and stable ice is required for both popular events.

Climate Change-

GLAC-05

TCCI requests that AEA and FERC reconsider the study requests for climate change studies. Ambient temperature changes affect glacial wasting, sediment transportation, water quality and water temperature. Data being used from the 80's does not reflect the current rising temperatures in the Susitna watershed. Agencies who requested climate change studies noted relevant methodology and the use of such studies currently used by Lower 48 utilities.
FERC has a responsibility to require analysis of cumulative conditions - science done by ignoring relevant changes in baseline temperatures leads to an inaccurate record.

Document Content(s)

PSP word.DOC..1-6

The Nature Conservancy
SAVING THE LAST GREAT PLACES ON EARTH

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14 November 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington DC 20426

RE: Susitna-Watana Hydroelectric Project NO. P-14241

I‟m writing on behalf of The Nature Conservancy in Alaska to comment on the Alaska Energy Authority‟s (AEA) Proposed Study Plans (PSPs) and draft Revised Study Plans (RSPs) for the Susitna-Watana Hydroelectric Project.

The mission of The Nature Conservancy is to conserve the lands and waters on which all life depends. For over 50 years, we have pursued this mission by using best available science and a pragmatic, non-confrontational approach to achieve conservation results. In Alaska, as elsewhere, we have conducted rigorous biodiversity assessments to identify and prioritize areas that – if managed to conserve key species – will ensure that Alaska‟s healthy ecosystems will be passed on to future generations. In south-central Alaska, we work to conserve habitat for five species of Pacific salmon in the Susitna and Matanuska Basins.

While the proposed hydroelectric project will be built 184 miles from the Susitna River mouth, what occurs on the upper river has ramifications for the salmon systems downstream and the salmon themselves as they migrate throughout the basin. We hope to see that the project will develop in a way that maintains the natural variability of the hydrological processes of the Susitna River that form spawning, rearing, and overwintering habitat for five species of Pacific salmon; maintains adequate hydrological flows for adult salmon to migrate to spawning habitat and for juvenile salmon to access rearing and overwintering habitat in the Susitna River and its tributaries; and ensures the return of wild Pacific salmon to the Susitna River to continue their keystone contribution to the aquatic, riparian, and terrestrial habitats that all species in the Susitna River drainage, including humans, depend upon.

Given our programmatic emphasis on salmon conservation, we have focused our comments on the study plans that relate to the river and its fisheries. Where available, our comments refer to the draft RSPs that AEA has posted on its website; where RSPs were not provided, our comments refer to the PSPs submitted in July. We highlight the following areas for improvements to the study plans to adequately understand the impacts of this project on the Susitna River and the habitat that it provides for five species of Pacific salmon.

Integration of Studies to Understand Project Impacts
AEA has proposed a large number of studies of varying complexity and interrelationship. While interdependency flow charts in many study plans show how multiple studies are related, these

charts do not clarify how or when data and information will be shared. It is unclear that information can be integrated into related and subsequent studies within the short time frame of the study period. The use of 2012 studies in the RSPs is also not clear. In addition, it is not clear how the studies will be synthesized collectively to answer questions about project impacts to salmon and salmon habitat and to inform AEA on project design and operation. We suggest that the Revised Study Plan include a comprehensive process description and timeline for sharing information between studies, integrating studies, and synthesizing overall results.

Climate Change

GLAC-14

Climate change effects will change the Susitna Basin in the next 50 years and could have dramatic effects over the full life of the proposed project. The draft RSP on Glacier and Runoff Changes (7.7) is limited to the upper Susitna Basin. AEA must study the entire basin to understand anticipated changes to water flow (including quantity and timing from precipitation and glaciers) throughout the basin. AEA claims that the upper river only contributes 17% of total flow at the mouth, but without understanding how flows will change across the basin, we cannot understand how the proposed project will affect the Middle and Lower river over the life of the project. This study should provide information to the instream flow and geomorphology studies on expected changes overall to hydrological flows and sediment input to all reaches of the Susitna River. The effects of climate change on glacial melt, snow pack, precipitation, and sediment load should be studied. These effects throughout the basin, not just the upper Susitna watershed, must be included to understand how the cumulative impacts of the dam and climate change will affect flows and sediment transport throughout the Susitna River.

Focus Area Selection

GEO-13, 14, 15
FGM-09, 10, 11
ICE-08
GW-010
IFS-019
RIFS-11
FDAML-17

The study plans are inconsistent on the use of the terms „focus areas" and „study sites." In these comments, we assume that these are intended to be the same places so will use the term „focus area." The method for selection of focus areas is also inconsistent between and within study plans. Table 8.5-13 of the Fish and Aquatics Instream Flow Study (8.5) indicates that Focus Area selection is happening currently (Q3-4 2012) even before studies are approved or officially begin. If selection is to be based on the criteria presented in 8.5.4.2, habitat mapping results from 2013 studies would seem to be required to select focus areas.

Focus areas should be selected based on biological functions and habitat utilization by salmon as well as physical processes related to instream flow, including habitat-flow relationships, surface-groundwater interactions, geomorphic processes, and ice processes. Biological functions for salmon (i.e. spawning, rearing, migration, overwintering) could potentially change with project operations, and appropriate focus area selection can help to characterize and quantify that anticipated change.

Focus areas should be selected in the Middle and Lower Rivers. The river from the three river confluence and below is especially dynamic. Focus areas in the Lower River are required to understand changes to salmon habitat due to project operations. As noted in our comments on

Climate Change impacts above, the cumulative impacts of this project with other anticipated changes to the basin could affect salmon and salmon habitat in the Lower River.

GEO-16
FGM-12
ICE-02
GW-011
IFS-024
RIFS-12
FDMAL-18
WQ-24
WQMOD-01

Lower River Studies

Many of the study plans assume no effects from the project and its operation below Talkeetna (Mile 97) and do not include the Lower River in their scope. As noted in our comments on Climate Change impacts above, the cumulative impacts of this project with other anticipated changes to the basin could affect salmon and salmon habitat in the Lower River. Load-following operation, which will essentially flip the hydrological pattern between winter and summer, must be modeled for effects on the Lower River. The hydrological model has been extended to Mile 84 in the upper Lower River, and the study plan notes that the model will be extended further into the Lower River if project effects are seen at Mile 84. It is not clear what the trigger will be to extend the model and how or when that will be decided. The Revised Study Plans, including those for geomorphology, instream flow, and ice processes, should include the Lower River. If they do not but leave the possibility open depending upon early results, the plans should be explicit about why they assume no effect on the Lower River and what criteria will be used to revisit the need to extend models when early results are available.

ICE-09
FGM-07
GW-012
IFS-102
RIFS-13
WQMOD-02
CIBW-16

Operation Scenarios

The various models that are developed for the study plan should look at three scenarios: existing (non-project), proposed load-following operation, and base load operation. Early introductions of this current project proposed base load operations. With current power generation dependent upon natural gas supplies, it is foreseeable that in the future this project could be operated to supply base loads. In case of that operational change in future, the base load case should be included in the models. This would also provide the opportunity to gage the impacts of a wider range of operation regimes.

ESCAPE-03

Study Period and Horizon

The licensing process must allow sufficient time for field studies to document how salmon use the entire Susitna River, from Cook Inlet to above the proposed reservoir. This timeline should be driven by natural cycles, such as salmon lifecycles, and not hurried for human convenience. AEA‟s proposal to study salmon for only three years is inadequate. Susitna River salmon, including sockeye, coho, and Chinook, are experiencing declines in returns and this project has the potential to add to the negative conditions for salmon. A minimum of five years of data is required to understand fish distribution and utilization by life stage.

Late fall flooding this year also brings into question AEA‟s ability to complete complex studies of a complex system under conditions that make field studies difficult in years with typical weather conditions. Such extreme events as seen this last year with high snow pack, high spring runoff, and fall flooding may have effects that skew results from most studies about salmon and their habitat when only two or three field seasons are employed.

The horizon of these study plans must look beyond the 50-year licensing period of FERC. The impacts of the dam can be expected to accumulate over multiple generations of salmon, decades of changes to human use of the landscape, and the continued alterations from climate change. The full impact of this project is likely to be seen after 50 years and it is highly unlikely that the dam will not exist in 50 years.

Socioeconomic Analysis

ECON-6
SOC-08

A full analysis of the economic values of this proposed project should include the costs of constructing the dam and related infrastructure, the expected price of the power generated, and the change in economic value of the current goods and services provided by an undammed river; the no-action alternative should also be analyzed. The goods and services of the Susitna River that are important to Alaskans include sport and commercial fisheries, tourism, recreation, subsistence, and winter transportation for local residents. The river and upper watershed also supply a host of nationally and globally important ecosystem services (e.g. climate regulation through carbon sequestration, fish and wildlife habitat). A full socioeconomic analysis should quantify all of the existing economic values of the Susitna River and predict how they will change with construction of the proposed project. The local and national interests should be addressed.

We are currently undertaking a project to value ecosystem services throughout the Matanuska-Susitna Borough with the Institute of Social and Economic Research (ISER) at the University of Alaska Anchorage and with Earth Economics, a consultant in Tacoma, Washington. Our project has two components which relate directly to the Social Conditions and Public Goods and Services Study (15.6). First, ISER is developing primary data for the Mat-Su based on household surveys to find out how residents value the natural places around them. Second, Earth Economics is using Benefit Transfer Method to value ecosystem services based on studies in similar geographies. These two components are grounded in well-established methods of ecosystem services valuation. While valuation does not result in precise figures of economic value, it does provide an opportunity to compare economic costs and benefits for the project, including power generations, infrastructure costs, and impacts to local economies and communities. Ecosystem service valuation provides FERC with information for fulfilling the requirement under the amended Federal Power Act of 1986 to give equal consideration to non-power values when deciding to license a hydropower project. We are available to talk with AEA about our study and how it might better inform the economic studies of this project.

We have a few specific comments about the Regional Economic Evaluation Study (15.5) and the Social Conditions and Public Goods and Services Study (15.6):

ECON-2

- Objectives for 15.5 Regional Economic Evaluation Study seem to presuppose only benefits from power generation and ignore the possibility of economic loss from the project. An analysis by ISER (Colt 2012) predicted higher electrical rates with the project.

SOC-09

- Objectives for 15.6 Social conditions and Public Goods and Services Study do not seem to include quantification of economic value of non-power effects of the project, which puts an analysis of costs and benefits on unequal footing. Again, there seems to be a bias toward primarily the potential positive and not the negative impacts to the existing economy.

SOC-12
- Informal interviews are not appropriate for conducting a comprehensive and unbiased analysis of impacts to local residents and communities. If "little published information on non-economic, socio-cultural values, quality of life, and needs of study area residents"(p 14) exists for the area, a formal survey of random-selected individuals is required to produce an unbiased analysis of impacts to communities. A survey can be designed to produce descriptive and quantifiable results using methods such as willingness-to-pay and contingent valuation.

SOC-17
- AEA"s economic studies should use the same population estimates that the Mat-Su Borough and Alaska Department of Transportation are using for various planning projects in the area. The borough has developed build-out scenarios with these population estimates that would be useful to AEA"s analyses.

SOC-18
- How will AEA"s economic studies include the potential loss of salmon due to habitat loss due to the project and the resulting reduction in commercial, sport, and subsistence fishing economic value in its market-based natural resources analysis?

SOC-19
- The Social Conditions and Public Goods and Services Study (15.6) does not reference Benefit Transfer Method yet it is mentioned in the consultation table (15.6.4.1). The use of this methodology should be clarified in the study plan.

Thank you for the opportunity to comment on the proposed and revised study plans for the Susitna-Watana Hydroelectric Project. Please contact me if you have any questions.

Sincerely,

Corinne L. Smith

Corinne Smith
Mat-Su Basin Program Director

ecc: Wayne Dyok, AEA
Joe Klein, ADF&G
Monte Miller, ADF&G
Eric Rothwell, NMFS
Sue Walker, NMFS
Ann Rappoport, USFWS
Mike Buntjer, USFWS
Bill Rice, USFWS

Cassie Thomas, NPS
Matthew LaCroix, EPA
Jeff Davis, ARRI
Jan Konigsberg, Hydropower Reform Coalition
Richard Leo, Coalition for Susitna Dam Alternatives
Randy Hagenstein, The Nature Conservancy
Dave Albert, The Nature Conservancy

Document Content(s)

TNC Comment on SuHydro PSP 12Nov14.PDF................................1-6

Talkeetna Defense Fund, Talkeetna, AK.
PO Box 292
Talkeetna, AK 99676
November 13, 2012

Honorable Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Comments for the proposed Susitna-Watana Hydroelectric Project No.14241-000
Proposed Study Plans and Draft Revised Study Plans

Dear Secretary Bose:

We are submitting these comments on behalf of the Talkeetna Defense Fund; a group established in the spring of 2009, whose purpose is:

To provide financial assistance that may be needed to maintain and sustain the quality of life of Talkeetna as outlined in the Talkeetna Comprehensive Land Plan (1999 edition), or any other similar documented management guidelines of protective criteria deemed important by the…board of five. The areas of focus include Talkeetna, the greater Talkeetna area, or those areas in the Susitna River Valley or the State of Alaska where issues arise that may pose a threat to the quality of life, character, or environment of Talkeetna.

Here are our major concerns about AEA’s Proposed Study Plans:

The allotted time for most studies of two years of study time is not adequate for many reasons, perhaps the most important being that salmon life cycles are three times longer than this. Related to this, we see the Integrated Licensing Process as the wrong choice for licensing a new dam that would be the largest built in the nation in decades and the only dam sited in this far north where impacts will be different than for dams in the contiguous United States.

AEA’s inability to present data from the studies already undertaken (2012) is unacceptable and throws doubt on how transparent the agency will be with further study results. It is imperative that data be readily available to the public, and for peer review.

The question of how winter ice conditions would be impacted by the proposed dam requires serious consideration and study. Again, this dam would be unique in its location in a subarctic climate, so there is little or no data from other dams to pull from. Potential impacts are not trivial for this area. People depend on Susitna River ice for winter transportation by dogsled, snowmachine and ski; animals also depend on safe river ice for winter migrations. The dam’s winter impacts could seriously damage our seasonal commercial, sport fishing, and subsistence fisheries, with concomitant economic loss.

Finally, National and Regional Resource Valuation should be conducted! The Susitna watershed is a national treasure. This study to define the value of a free flowing vs. dammed Susitna has been rejected by AEA; we are adding our voice to the many who see this as a critical study. The Federal Power Act requires that equal consideration be given to non-power values of the river system. Because this river is important locally but is also at the heart of one of Alaska's most-visited tourist areas, valuation studies should be done for both a local and national constituency.

Thank you for your consideration of our comments.

Sincerely,

Ellen Wolf
Board Secretary
Talkeetna Defense Fund

Document Content(s)

16059.TXT...1-2

Jennifer Barnett, Talkeetna, AK.
I oppose the Susitna dam and I think AEA's Proposed Study Plans are not adequate for understanding the impacts the dam would have on a river system as biologically rich and complex as the Susitna.

Two years of study is not enough. There has never been a dam so massive, built so far north, on a river so large. Even the agencies studying the extent of the dam's impacts and risks say that only two study years cannot return a full understanding of what would happen if the dam is built. For instance, with the Susitna running at much reduced summer flows, the Chulitna could push the main stem of the Susitna toward Talkeetna. What is the likelihood of this, and what would the impacts of increased erosion be on the town of Talkeetna? Also, what impacts would the changes in Susitna River water flows have on the five species of salmon? The life cycle of a Chinook salmon is five to seven years. A comprehensive, meaningful study that confidently predicts the potential effects of a dam of this nature on Susitna River salmon simply cannot be conducted in two years.

ICE-51

Winter water flows are planned to fluctuate across the day, at times reaching four times average flows. This would make river ice unstable, making travel dangerous, or even impossible, for both humans (snowmachine, dogsled or ski) and animals (moose and caribou). It would disrupt winter habitat of juvenile salmon in the main river, for example by removing still pools where they would normally rest, making their survival difficult at best and impossible at worst.

Studies from the early 80's are being used to speed the process, but the climate of the Susitna Valley has changed dramatically in 30 years, averaging 4 to 5 degrees warmer. Many of the old studies are no longer accurate for today's conditions. In addition, there are much more sophisticated data collection and computer modeling techniques that were not available 30 years ago. But still AEA is insisting that they can use those old studies to... speed the process.

A National Valuation Study has been dismissed by AEA, but the impacts of the dam should be considered from a national level, not just Alaskan. A free-flowing Susitna River has value to Alaskans and all Americans. Formally called a National-Level Economic Valuation Study, this study would fully explore and define the cost/benefit, loss/reward of the national value of a free flowing river versus a dammed river, including costs to such factors as recreation, aesthetics, and culture. FERC is a national agency. The value of an intact Susitna watershed should be considered on a national scale.

All data should be transparent and available to the public, and it must be peer reviewed. AEA has not made any of this summer's study data available.

Document Content(s)

15985.TXT...1-1

Donnie Billington, Talkeetna, AK.
I was unable to access your website in order to send copies of my comments to AEA concerning transportation access. Below is a copy of that comment.

P.O. Box 56
Talkeetna, AK 99676
10-11-12

AEA
susitnawatana@aidea.org

To Whom It May Concern:

RE: Draft Watana Transportation Access Analysis

I would like for it to become a part of public record that I am opposed to all of your proposed routes for road construction and transmission lines. I am also opposed to all of your proposed runway/airport possibilities. All of the options would impact the entire area in a negative way.

I have hunted in that area since 1970. Construction in that area would impact caribou migration/calving, moose habitat and calving, fishing, berry picking and all of the traditional/subsistence activities that take place. Traditional Native land use would be impacted. Subsistence is a big part of Alaskan life and this proposed project would adversely affect the residents’ abilities to feed their families.

The state of Alaska would be better off with a number smaller, less destructive projects, instead of a mega project that would destroy the entire ecosystem of South Central Alaska.

Sincerely,

Don Billington
907-733-2578
in care of: cathyt@mtaonline.net
(I do not do email...I live off the grid)

Document Content(s)

16047.TXT...1-1

Donnie Billington, Talkeetna, AK.
P.O. Box 56
Talkeetna, AK 99676
November 9, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N. E., Room 1A
Washington, DC 20426

RE: Susitna-Watana Hydroelectric Project No. 14241-000

Thank you for the opportunity to comment on AEA's study plan for the proposed Susitna-Watana Hydroelectric Project No. 14241-000.

1. It is ridiculous to only have studies for a two year period involving a dam of this magnitude. This dam would impact 5 species of salmon and other species, such as burbot, grayling, rainbows, dollies, etc. Two years of study is inadequate to study the life cycles of Chinook salmon, which is 5 to 7 years. Not enough information could be obtained in a two year period to determine how Chinooks would be affected.

2. There would be impacts on the Susitna River as a travel corridor for people and wildlife due to unstable ice resulting from fluctuating flow.

ICE-51

3. There would be impacts on traditional recreational activities such as snowshoeing, skiing, snowmachining, and dog sledding due to unstable ice resulting from fluctuating flow.

4. The studies from the '80's are no longer appropriate, as the climate of the upper Susitna Valley has changed since then, warming 4 or 5 degrees. What impacts would a huge reservoir of water have on the climate of the region and how would that impact the entire ecosystem? Using the old studies to speed up the process is inappropriate and would not produce reliable answers to important questions. It is painfully obvious that AEA wants to fast track this process and not even begin to do adequate studies. They are not looking at any other viable options. More smaller projects would be much more sensible than one mega project where all your money is put into one project. This is insane. Mother nature could throw us another 9.7 quake like we had in '64. Who is to say whether or not that was the big one. Events like hurricane Sandy come along and humble us. No engineer can make any project bullet proof. It is not worth the risk.

5. AEA hasn't agreed to a National Valuation Study. I want to know why. This region is a national treasure, visited by countless people from all over the United States and all over the world. The reason they come here is that the Susitna is a wild river. This would forever be changed if the project goes forward. You can't take it back. Everyone benefits from the jobs produced by the Susitna, the recreation it provides, and the food it provides. The economics of tourism must be considered. Dams across the lower 48 are being dismantled at huge costs. There are less expensive ways to generate power, financially and environmentally. This is the most financially and environmentally irresponsible proposal that I have ever seen. The cost of

building the dam and the small amount power it would provide would be prohibitive. The Susitna is worth much more to our nation as is.

6. This project would completely disrupt the subsistence lifestyles of the indigenous people and others who live in the region. This is traditional use and it should be honored.

7. AEA has not made any of the data they obtained from studies this summer available to the public. Why not?

Thank you for allowing us more time to comment.

Sincerely,

Donnie Billington
in care of: cathyt@mtaonline.net
907-733-2578

Document Content(s)

16022.TXT...1-2

will boardman, Talkeetna, AK.
As a resident of the upper Susitna Valley I am opposed to the building of the Susitna-Watana Hydroelectric project due to its large cost, and unforeseen ecological impacts. Electricity is currently the most inexpensive utility bill I pay each month and when the costs of building the dam are considered the newly generated electricity is to costly.

The ecological impacts on the area are to great. While great care may be taken to mitigate these concerns there is no substitute for a natural free flowing river. Areas like the Upper Susitna are what make Alaska unique and draw people to this great state.

I believe the Susitna-Watana Dam to be the wrong direction for Alaska's future energy needs. Please leave the Susitna River free of dams for future generations.

Thank you,

Will Boardman

Document Content(s)

16029.TXT...1-1

Greg Campbell, Talkeetna, AK.
First of all, I strongly oppose the dam on the Susitna River here in Alaska.

GEN-13

Secondly, I believe AEA’s study plan is not sufficient to understand the impacts of this huge dam. The Susitna is a complex ecosystem and river, and there needs to be more rigorous studies to determine the true impact. More time needs to be spent, 5 years at a minimum.

I am very concerned that the timeline for these studies has been sped up to force the project through, and that accurate results cannot be obtained in this short timeline. 5 years would be the minimum time period to understand complex issues such as Salmon life cycles and impacts.

GEN-14

I would like to see the results of impacts of dams on other rivers in this study. This is not the first dam to be constructed on a river with Salmon. I think it is important to see what has happened to Salmon populations on these other rivers, as well as impacts to recreation, loss of free flowing rivers, etc. AEA has used known positive outcomes of dams in other places, such as electricity generation, in their FERC filings to justify the construction of this dam. Since they have used this evidence to justify their project it is only fair to include negative impacts of dams from other dams, such as loss of Salmon populations.

GEN-15

I am very concerned that results of studies done in the 1980’s are being used in order to speed up the process. Much has changed since the 1980’s in science as well as the climate of the area. Science has made great leaps and bounds in the last 30 years, and we cannot use old data to make accurate conclusions. We now have powerful computer modeling techniques that were not available 30 years ago, data collection has become more sophisticated, and new study techniques have been invented. In addition, the climate of the Susitna Valley has changed in the past 30 years, making the results of studies done 30 years ago somewhat irrelevant to our current situation.

GEN-16

A National Valuation Study has been dismissed by AEA, but the impacts of the dam should be considered from a national level, not just Alaskan. FERC is a national agency, and should be evaluating this project in national terms. This dam will be built in America, and will impact all Americans, so it should be looked at with an eye towards national values. Some of these values are the value of a free flowing river of this size versus a damned river, and include values such as recreation, scenery, and culture.

ICE-51

Winter impacts of this dam need to be studied better. Fluctuations in winter river levels will impact ice formation, and these impacts will be felt by wildlife trying to use the river ice for transportation as well as recreational users such as snow machiners and skiers. This needs further rigorous study.

I firmly insist that all data be made available to the public in a timely manner, and that this data and all conclusions go through a peer review process. In order to have accurate scientific results we need to follow scientific methods The cornerstone of science is peer review and transparency.

In conclusion, I strongly oppose the dam. I also believe that the study plan proposed by AEA for this project is not sufficient to understand this complex river, and that 5 years should be the minimum study period.

Document Content(s)

16034.TXT...1-2

Shelly Campbell, Talkeenta, AK.
I strongly oppose the dam on the Susitna River here in Alaska.

AEA's study plan is not sufficient to understand the impacts of this huge dam. The Susitna is a complex ecosystem and river, and there needs to be more rigorous studies to determine the true impact. More time needs to be spent, 5 years at a minimum.

I am very concerned that the timeline for these studies has been sped up to force the project through, and that accurate results cannot be obtained in this short timeline. 5 years would be the minimum time period to understand complex issues such as Salmon life cycles and impacts.

I would like to see the results of impacts of dams on other rivers in this study. This is not the first dam to be constructed on a river with Salmon. I think it is important to see what has happened to Salmon populations on these other rivers, as well as impacts to recreation, loss of free flowing rivers, etc. AEA has used known positive outcomes of dams in other places, such as electricity generation, in their FERC filings to justify the construction of this dam. Since they have used this evidence to justify their project it is only fair to include negative impacts of dams from other dams, such as loss of Salmon populations.

I am very concerned that results of studies done in the 1980's are being used in order to speed up the process. Much has changed since the 1980's in science as well as the climate of the area. Science has made great leaps and bounds in the last 30 years, and we cannot use old data to make accurate conclusions. We now have powerful computer modeling techniques that were not available 30 years ago, data collection has become more sophisticated, and new study techniques have been invented. In addition, the climate of the Susitna Valley has changed in the past 30 years, making the results of studies done 30 years ago somewhat irrelevant to our current situation.

A National Valuation Study has been dismissed by AEA, but the impacts of the dam should be considered from a national level, not just Alaskan. FERC is a national agency, and should be evaluating this project in national terms. This dam will be built in America, and will impact all Americans, so it should be looked at with an eye towards national values. Some of these values are the value of a free flowing river of this size versus a damned river, and include values such as recreation, scenery, and culture.

ICE-51 Winter impacts of this dam need to be studied better. Fluctuations in winter river levels will impact ice formation, and these impacts will be felt by wildlife trying to use the river ice for transportation as well as recreational users such as snow machiners and skiers. This needs further rigorous study.

I firmly insist that all data be made available to the public in a timely manner, and that this data and all conclusions go through a peer review process. In order to have accurate scientific results we need to follow scientific methods The cornerstone of science is peer review and transparency.

In conclusion, I strongly oppose the dam. I also believe that the study plan proposed by AEA for this project is not sufficient to understand this complex river, and that 5 years should be the minimum study period.

Document Content(s)

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COALITION FOR SUSITNA DAM ALTERNATIVES
PO BOX 32O, TALKEETNA AK 99676
SUSITNADAMALTERNATIVES@GMAIL.COM

November 5, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington DC 20426

Subject: Comments on Alaska Energy Authority Proposed Study Plan (PSP) & Draft Revised Study Plans for the Proposed Susitna-Watana Hydroelectric Project P-14241-000

Dear Ms. Bose:

The Coalition for Susitna Dam Alternatives (CSDA) is a non-profit corporation whose mission is to facilitate awareness of alternatives to the Proposal through stakeholder processes, education, and advocacy. CSDA is dedicated to research and communication of the state and federal public processes that involve the licensing and construction of this Proposal.

These studies are being done by the applicant, the Alaska Energy Authority (AEA) in order for the Federal Energy Regulatory Commission (FERC) to develop the Environmental Impact Statement and to evaluate license approval and conditions. The goals of the studies are to develop adequate information about the existing environment in order to analyze project impacts.

Two Years of Study are Not Enough

The impacts of large dams are extremely complex and difficult to predict. But AEA and FERC say they will complete all analyses in two years of studies. This is in spite of official agency and numerous stakeholder objections that the two year Integrated Licensing Process (ILP) time frame is not appropriate for an important world class salmon producing river that communities depend upon for their livelihoods and food.

CSDA surmises that the ILP licensing process was picked due to the short study plan time frame which fits in with the current state administration's political goal to fast track the project. The ILP was created by FERC for the purposes of relicensing dam projects and is inadequate for an original project on a free flowing river with such diverse, complex and interrelated resources.

The ILP is forcing many processes to occur at one time. This has resulted in limited and less than thorough public comments. For instance, May 31, 2012 was the comment deadline for the Preliminary Application Document (PAD), the Scoping Document 1(SD1) and Study Requests. The National Marine Fisheries Service (NMFS) and the US Fish and Wildlife Service (USFWS) both commented that since the time frame was so limited, the agencies had to concentrate on the development of the study requests so that comments on the PAD and the SD1 were cursory. Furthermore, the agencies and stakeholders did not have adequate time to thoroughly review to develop the 2012 pre-licensing studies. The 2012 pre-licensing study results are to inform the development, modification, and expansion of the official 2013/2014 ILP studies. However, due to the ILP schedule, the 2012 published results and analysis will not happen before the ILP study plan process is finalized. Some of the 2013 ILP studies will have started.

The PSP is a massive scientific endeavor of 58 studies. The data from certain studies provides the framework for other studies. This means that coordination is essential—and lacking. For instance, the Integrated Resource Analysis which is a schematic document of “Study Interdependencies for Fish and Aquatic Instream Flow” show spaghetti-like line flow charts virtually impossible to read. In essence, this is a very complicated “scientific” process.

This further points to the fast pace of the study plan process. It is antithetical to good science. Full information disclosure to all stakeholders including state and federal agencies to make responsible comment and fulfilling state and federal laws is thus limited.

Besides the fact that the 2012 published reports will not be done before the ILP Study Plan comment periods occur and the 2013 ILP studies begin, the agencies do not have the time to comment on the draft Revised Study Plans dated October 31, 2012 for the November 14 comment period. These draft plans are a result of Technical Work Group meetings. This is poor planning. Once again the agencies and the public are being driven by an ILP time frame that makes adequate, responsible scientific evaluation difficult.

It is highly questionable whether the two year ILP studies will legally fulfill state policy under AS 46.03.010(a) “to conserve, improve, and protect its natural resources and environment and control water, land, and air pollution, in order to enhance the health, safety and welfare of the people of the state and their overall economic and social well being." These studies determine how our public trust resources will be impacted by a massive development project.

Some Specifics

The first year of a study is at a feasibility and reconnaissance level to determine and refine sampling methodologies. This limits the availability and interpretation of study results if there are only two years. For instance, if there are no low water years or no average water years, there would be no baseline information or inter-annual variability.
The majority of the Susitna River Watershed is remote which makes access difficult. Severe weather and wildlife issues during all the seasons can hamper or delay field activities.

ESCAPE-01
PASS-01

- Fish Passage Study: This is a necessary study in order for NMFS to determine the need and feasibility of fishway prescriptions which they have to do under federal law. This study should span at least 5 years and preferably 7 years. It is directly tied into the investigation into the salmon species that are migrating above Devil's Canyon.

FISH-02

- The studies of the various life stages, distribution, abundance, escapement and habitat utilization of fish should be through a life cycle of a Chinook salmon which is 5 to 7 years. This is necessary considering the lack of knowledge about the affected fish and marine mammal species and their habitat needs. Two years is inadequate to document baseline biological conditions. Susitna River Chinook populations are currently depressed. If baseline studies are done under a period of low abundance, a bias will be introduced that will hamper accuracy of future modeling outputs. This can be applied to all the 13 studies of Fish and Aquatic Resources.

IFS-094

- Instream Flow Studies should be developed over a temporal scale of five years. This is in order to encompass a representative time frame.

WTRBRD-01
BREED-01

- Two years of bird studies are inadequate to understand bird migration routes in order to determine new transmission line locations and their impacts on migratory birds.

ICE-03

- Two years are not enough for the Ice Processes Study.

BREED-02

- Two years of data will be insufficient to calculate the densities of land birds and shorebirds due to the short time period during each season. This refers to the draft RSP study Breeding Survey Study of Landbirds and Shorebirds.

IFS-091

- A minimum of 2 years is needed to establish the site-specific Habitat Suitability Index (HIS) curves needed for all target fish species.

FDAML-02
- A minimum of 2 years is needed to evaluate the potential project impacts on incubation and fry emergence in off channel habitats in the middle Susitna River.

AQTRANS-1
- Regarding the proposed access routes' stream crossings, USFWS recommends a minimum of 3 years of onsite stream gage data.[1]

Biometric Review of the 1980's Susitna Hydroelectric Project Studies

A biometric review study is a statistical analysis of biological observations and phenomena. The USFWS first asked for this analysis in a 12/20/11 letter to AEA and in their 5/31/12 PAD, SD1, and Study Request comments. The National Marine Fisheries Service (NMFS) concurred with this request in their own 5/31/12 comments.

Historic and contemporary studies of the Susitna River watershed have not been comprehensively synthesized. This should have been done in the PAD. Many of the 1980's studies have not been made available electronically to the resource agencies or the public.

GEN-07

A biometric review should have been conducted prior to basing any current study plans on the 1980's studies and the results. The review would estimate the precision and accuracy of the study results and is necessary to determine the scientific validity. The statistical validity of the results is unknown now. This is considered a minimum recommendation in order to satisfy concerns about the assumptions, relevance and applicability of 30 year old studies conducted for a very different proposal in such a dynamic watershed. An important concern is that climate change has altered many of the baseline measures from those studies. The older studies did not consider climate change. Alaska is in the front line of climate change impacts.

But a biometric study has not been supported by AEA. This is in spite of the fact that many of the draft RSPs are using data from the 1980's studies. For instance, in the Ice Processes Study, AEA consultants are counting on the 1979-1985 data from the 1980's studies to complement the 2 year proposed study.

The National-Level Economic Valuation Study Request

[1] October 15, 2012 USFWS letter to AEA re: Susitna-Watana Hydroelectric Project Draft Watana Transportation Access Analysis, "For larger projects such as the Susitna-Watana Dam, the Service recommends estimating peak discharge for each stream to be crossed by correlating a minimum of three years of onsite stream gage data with the installation of nearby long-term stream gages."

AEA has rejected this study request. Eleven Non-Governmental Organizations[2] and several individuals requested this. This study would fully explore and define the cost/benefit, loss/reward of the value of a free flowing river versus a dammed Susitna River. It would establish a framework by which this megaproject's value to the nation can be weighed.

We request that FERC accept this study in order to carry out their mandate under the Federal Power Act as amended in 1986 to give equal consideration to non-power values of a river system. The FERC licensing action is a federal action, and the relevant population for this action is the national population. This is a more rigorous implementation of non-power values into the net benefit calculations.

The scale of the project proposal is unprecedented at this latitude with the many unique challenges due to climate change, seismic potential and lack of access due to the remote nature of the watershed.

SOC-5 The Susitna River watershed economies go beyond the constituencies of Alaskan regional populations. People from all over the US and the world visit, recreate, hunt, and fish in the watershed. The Susitna River is a national treasure. The value of the Susitna River wild salmon populations and their unique genetic diversity is enormous and of national importance.

This study is an important tool for establishing credible information and analysis into the national public interest in conserving an important free flowing river and for equal consideration to the non-power uses. This river is a national public trust resource.

The NMFS supports this study.

> NMFS recommends FERC expand socioeconomic analysis for this project and design and conduct an economic valuation study…the socioeconomic values, market based and non-market/non-use, associated with the status quo condition must be fully assessed, at local, regional, and national levels, so that impacts of the alternatives on the status quo condition can be properly assessed. What this means is that the analysis must create a comprehensive socioeconomic baseline of pre-impact values and compare them with projected post-impact values to determine the "cost" of the action in terms of socioeconomics effects.

[2] These were National Heritage Institute, American Whitewater, Alaska Center for the Environment, Alaska Survival, Coalition for Susitna Dam Alternatives, Center for Water Advocacy, Cook Inletkeeper, National Wildlife Federation, Alaska Chapter Sierra Club, Talkeetna Community Council, Inc., Talkeetna Defense Fund.

> NMFS recognizes that the proposed action does not promulgate a federal regulation and, thus, is not subject to the guidance of Executive Order (EO) 12866 regarding analysis of socioeconomic impacts of regulatory actions. However, the new license will have a 50-year life and the project will have impacts on public welfare at a national level of significance as well as local level. Thus, NMFS recommends that the analysis of socioeconomic impacts conform to the requirements of EO 12866. Specifically, the cost benefit framework is the appropriate methodology for evaluating the proposed action; however, disparate valuation methods, some qualitative, will prevent complete monetization of all the costs and benefits. A well informed qualitative assessment of impacts that cannot be monetized is also critical to the assessment of potential socioeconomic impacts. Further, this analysis should consider "all costs and benefits" of the proposed project, which means consideration of regional economic impacts, including economic multiplier effects, as well as national level impacts on economic welfare.[3]

AEA's reasons for rejecting a National-Level Economic Valuation study are without merit. Their proposed socioeconomic study proposals are narrowly confined to regional populations only.

<u>Ecosystem Functioning Changes from Project Impacts</u>

The May 31, 2012 FERC Office of Energy Projects letter to AEA regarding the PSP discusses the concerns regarding the relationship between the Wildlife Resources Investigations and the application to project impacts on the ecosystem. CSDA also has this concern.

GEN-08

AEA's fish and wildlife studies are designed to get information about species' habitats, their distribution and their population numbers. Such data would also establish baseline environmental conditions for the species. But we are concerned that there are not adequate impact assessment analyses to understand the ecological role that species have in the ecosystem. At this point, it appears that species' ecological role will be based on literature searches and not on field work. This is not sufficient.

For instance, it is important to understand how dependent the riparian vegetation in various drainages is on the marine-derived nutrients from the carcasses of salmon and non-salmon anadromous species. Another example is

[3] Pages 6-7, Enclosure 1 of May 31, 2012 Comments of the National Marine Fisheries Service on the Pre-Application Document, Scoping Document 1, Study Requests for the Susitna-Watana Hydropower Project P-14241-000.

that there are significant predator/prey dynamics when fish move out of the mainstem river into the tributaries and sloughs. It is important to understand this in order to understand project impacts.

There needs to be knowledge of complex ecological relationships between fish, wildlife, and vegetation from field studies. Without this knowledge, project impacts will likely be underestimated especially over a long period of time. This means the project benefits could be overestimated. FERC should NOT be satisfied with literature searches only for ecosystem functioning changes. Beyond project impacts, this information is necessary for the establishment of FERC licensing conditions that guarantee the existence of the natural conditions of the Susitna River watershed in order to have healthy fish, wildlife, and hydrologic resources.

ILP Study Data

GEN-09

The ILP study plan process must be transparent. The data at every stage must be available to the public. We request that the studies be peer reviewed. The global, national, and regional environmental consulting firms AEA is now using are big for-profit businesses. Peer reviews of the completed studies will give the public confidence in the study data and results.

The Glacial and Runoff Changes Study

The study goals are to analyze and predict the effects of glacier wastage and retreat and non-glacier hydrological processes on the hydrology and the sediment delivery to the proposed reservoir upstream of the dam site as a result of climate change. In other words, this would be to predict the amount of water and sediment that will be in the reservoir up until the year 2100. This is the only study that deals with climate change impacts on the project area.

GLAC-03

This study does NOT fulfill the study requests of NMFS and USFWS "Project Effects under Changing Climate Conditions." We support the agencies' climate change study requests and urge FERC to consider this. FERC has not accepted climate change studies in their relicensing activities due to concerns about the utility, accuracy, and uncertainty of climate projections. However, the recent advances in climate science should answer FERC's concerns. Indeed, the advances in climate change modeling will be used in this study by AEA, but it is only to be applied to the upper basin above River Mile 184. The study goals need to be expanded to impacts on the total Susitna River ecosystem. It is imperative to have temperature and hydrological data due to climate change in order to have responsible comprehensive decision making regarding project impacts on fish, wildlife and their habitats.

The Susitna River watershed is an area vulnerable to climate change. In fact, the average temperature of the Susitna Valley has increased 4.5 degrees F since the early 1980's when prior studies were done. There has to be climate change data beyond the current study parameters.

Socioeconomic Resources Studies

SOC-06

The Social Conditions and Public Goods and Services Study needs to evaluate and monetize the Ecosystem Services that the Susitna River watershed provides to communities in and visitors to the Railbelt. This study does not mention this as a goal. Ecosystem Services are benefits to society, public goods that include wildlife habitat and biodiversity, watershed services, carbon storage, scenic landscape and other natural assets.

Federal agencies such as the US Forest Service and the US Environmental Protection Agency have accepted the reality of Ecosystem Services and have promoted such in their programs. EPA's Healthy Watershed Initiative recognizes that maintaining the integrity of natural biological systems provides economic benefits. Degradation of riparian ecosystems can cause negative economic impacts far from the altered site. For instance, society has found that major forests are dying off downriver of dams due to low groundwater. Project impacts on Susitna River forests need to be evaluated because those forests perform important functions in the ecosystem.

Yes, assigning a monetary value can be a challenge and can be complicated, but there are methods.

- Payment for Ecosystem Services (PES) program that compensate landowners for conserving land
- Citizens Willingness to Pay (WTP) to use or protect land area or ecosystem services.
- Cost Avoidance Scenarios which estimates the avoided costs to society due to protection of resources.[4]

Ecosystem Service baseline data is needed to quantify the changes in these ecological functions due to the changes in the Susitna River ecosystem from project effects. Will this project compromise the ability of future generations to meet their needs in light of project effects on river hydrology, plant biodiversity, aquatic and terrestrial resources?

[4] EPA 841-N-12-004

Also missing from both this study and the Regional Economic Evaluation Study are the socioeconomic impacts to the area by the very implementation of these ILP studies. The study emphasizes the goal of assessing community impacts from workers in the construction phase only. The implementation of these studies means increase in population, increase in river and air transportation and effects on lodging. Last summer, the impacts from the 2012 pre-licensing studies had an estimated ten-fold increase in noise and emissions from increased boat, fixed wing, and helicopter traffic. It will increase even more in the next two years.

Comprehensive Evaluation of Green House Gas (GHG) Emissions as a project effect

There is no indication that this is being considered in any of the studies. Certainly it is not being addressed in the Air Quality Study.

Hydroelectric dams produce significant amounts of the GHG carbon dioxide and methane. Dams are not carbon neutral. In some cases, the dams produce more GHG than power plants running on fossil fuels. Within the last decade, the GHG dynamics in hydroelectric reservoirs have become the topic of increased awareness and interest with a need for more complete studies.

AIR-01

GHG's are produced from the decaying, inundated organic materials in the reservoir. To be specific, they are produced by direct flux across air-water interfaces at surface water level, turbulent exchange with the atmosphere immediately downstream of the hydroelectric turbines, and flux across the air-water interface in the river outflow downstream of the reservoir. Methane can be transported by either diffusion or ebullition to the atmosphere. Methane can also be oxidized in the water column and emitted as carbon dioxide.[5]

Another source of GHG emissions is thawing permafrost. According to the AEA's PAD, permafrost conditions exist to a depth of 120 feet on the south abutment of the dam and up to 60 feet on the north abutment.

Also the draft Watana Transportation Access Analysis assumes the majority of the ground in each of the proposed access and transmission line alignments is permafrost. As permafrost thaws, the bacterial breakdown of the organic material will either be carbon dioxide under aerated conditions or methane

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[5] Barros_et_al_NatGeo.pdf, *Nature Geoscience* 7/31/11

when oxygen is limited. Well-known scientific data is emerging presently about this climate change factor in Alaska and the Arctic in general.

This project is being touted as a renewable resource with no GHG emissions. This needs to be proved.

General Geology Studies Comments

Many of these proposals lack specifics. Most of the geology and soil studies proposed are dam-site specific, rather than addressing the whole reservoir area. There is an over-reliance on the geologic data that were gathered prior to 1985. Without ability to review that data, it is difficult to address what needs to be further studied.

The studies that were done in the summer of 2012 and those proposed in the next two field seasons are not detailed.

GEO-40 The stability of the reservoir rim, especially in the drawdown area, is critical. It is difficult to tell what studies, if any, are proposed to investigate soil liquefaction, solifluction, or gelifluction effects on the reservoir rim.

GEO-39 Silt accumulation in the reservoir is also critical. It is not clear in any way what is proposed for investigating sediment load due to glacial melt, if anything.

4. GEOLOGY AND SOILS

GS-1 This study plan will review the existing information on the Susitna-Watana Project (Project) area regarding geology and soils and gather additional information in order to define the geologic, geotechnical, seismic, and foundation conditions at the sites of Project works (e.g., dam, reservoir, access road, construction camps, and materials borrow sites). The study appears to be confined to the immediate area of dam construction and access road only. This information will be used to support development of the Project design, with an emphasis on minimizing risks to dam safety. In general, the study tasks will include field investigations, laboratory testing, review of existing studies, and engineering analyses to characterize site conditions, limitations, and constraints. The study will also identify impacts of Project construction and operation, such as soil erosion along the reservoir rim, slope stability, excavation, and spoil disposal, on environmental resources (e.g., oil, gas, and minerals). This sentence doesn't make sense with parenthetical phrase.

4.2. Nexus Between Project Construction / Existence / Operations and Effects on Resources to be Studied

GEO-38 · Sediment load contributions due to glacial melt and possible surging glacier event The impact of silt input into the reservoir and its effect on operation of the dam is critical. This is the only place it is mentioned as being considered in planning for the dam, but there is nothing indicating what kind and the extent of studies planned if any.

4.5. Geology and Soils Characterization Study

4.5.1. General Description of the Proposed Study

The general objectives of the study plan are to:

· identify the existing soil and geologic features at the proposed construction site; Identifying soil conditions and geologic features should not be confined to only the dam site, but to the whole reservoir especially in a periglacial area. Solifluction and gelifluction, the downslope movement of waterlogged sediments over impermeable rock or permafrost, respectively, are important considerations for assessing the potential for sloughing of sediment into the reservoir, especially during any seismic activity.

GS-2 The field investigation activities for each season will be coordinated with resource agencies, ANCSA Corporation landowners. A Geotechnical Exploration Program Work Plan (Work Plan) will be developed which outlines the field program information that will be needed for submitting applications and obtaining land access permits from applicable agencies and ANCSA Corporation landowners. The Work Plan will identify known impacts to geology and soil resources. FERC regulations require "evaluation of unconsolidated deposits, and mineral resources at the project site" 18 CFR 5.(d)(3)(ii)(A). For the Exhibit E, AEA must provide a report on the geological and soil resources in the proposed project area and other lands that would be directly or indirectly affected by the proposed action and the impacts of the proposed project on those resources. This "and other lands" implies that there was a FERC directive to investigate the whole area of the potential reservoir, rather than limiting the study to the site area, as this chapter does. The whole reservoir region should be studied. This study report will provide the basis of the information needed for the Exhibit E.

4.5.2. Existing Information and Need for Additional Information

· evaluation of reservoir induced seismicity (RIS) (Harza-Ebasco 2005) There is no reference to this study in Literature Cited;

In summary, the following geotechnical investigations were performed prior to 2012 (No geotechnical investigations were preformed after 1985, except whatever might have been done in the summer field season of 2012.):
· geologic mapping
· drilling at the dam site, construction materials source areas, and in other geologic features (i.e., relict channel near dam site)
· instrumentation monitoring (groundwater and temperature)
· seismic refraction
· test trenches and pits (Borrow Areas E)
· trenching of lineaments and faults

4.5.4. Study Methods

The study of geology and soils resources for supporting licensing and detailed design will include a number of components:
· Develop understanding of geologic and foundation conditions for the dam site area and specifically for each of the project surface and underground components of the project; This should be for the "reservoir area" rather than "dam site."
· Evaluate the mineral resource potential in the reservoir, dam and upland facilities areas;
· Evaluate major geologic features, rock structure, weathering/alteration zones, etc.; Where, how?? It should be the whole reservoir area.
· Delineate and characterize construction material sources for the dam and appurtenant structures, access road, transmission line, and construction camp;
· Evaluate the surficial geology and potential thawing of localized permafrost on reservoir slope stability. This should be done on the whole reservoir area.

Geologic and Geotechnical Investigation and Testing Program Development

The development of a geological and geotechnical exploration and testing program work plan for completion of geologic field studies for final design and ultimately for construction will be undertaken. Based on review of the existing data including previous geologic mapping, subsurface investigations and laboratory testing from the 1970s and 1980s, additional investigations and testing will be to:
o Evaluate major geologic features, rock structure, weathering/alteration zones, etc.; How? Where?
o Evaluate the effect of project features on permafrost and periglacial features (thawing of permafrost), as well as the impact of these features on permanent structures, work camps, temporary construction areas, road corridors, transmission lines, etc.; (this should include the whole reservoir area)

Field Geologic and Geotechnical Investigations

Geologic and geotechnical field investigations will be carried out in phases with portions of that work contributing to the report on geology and soils in 2013 and updates in 2014. It is real important to know WHAT was done and WHAT is proposed. What are the specifics? The geotechnical (This should read "geologic" rather than "geotechnical") investigations and testing being undertaken as part of the Project feasibility and design effort will include geologic mapping, drilling, sampling and in situ testing, test trenches, pump tests, test adit, laboratory testing, instrumentation monitoring, etc. Where, how many? A geotechnical exploration and testing program is planned for the 2012 season to investigate the dam foundation and a new quarry site for concrete aggregate material, installation and monitoring of geotechnical instrumentation, and reconnaissance geologic mapping. Specifics?

Reservoir Slope Stability Study

An assessment will be made of reservoir rim stability based on the geologic conditions in the reservoir area, particularly in the reservoir drawdown zone. Geologic information from the previous study on reservoir slope stability (1982) as well as mapping, geotechnical investigations and instrumentation monitoring will be used to assess the stability concerns of the reservoir rim. Key factors in this study are the planned reservoir level and anticipated range of drawdown, soil conditions, presence of permafrost, topography and slope conditions. Specifics?

4.5.6. Schedule

The proposed study includes a limited field investigation program in 2012 for aerial photographic interpretation, reconnaissance geologic mapping, drilling, lineament analysis, installation of a long-term earthquake monitoring system, assessment of slope stability for the reservoir rim, and reservoir triggered seismicity study. For 2013-14, comprehensive investigations (What are they?) will focus on the dam site, reservoir area, and access road and transmission line corridors. Initial and Updated Study Reports explaining actions taken and information collected to date will be issued in December 2013 and 2014. Again, generally lacking in specifics.

Conclusion to Proposed Study Plans

We do not believe that the ILP study plan time frame is conducive to good science. The fast pace and the two year timeframe produces an overreliance on the 1980's studies. There is no adequate analysis that this is scientifically defensible. Our comments describe some of the goals in the studies that are not being considered. We believe these goals protect the public's best interests.

Respectfully submitted,

Becky Long, Richard Leo, Ellen Wolf, Whitney Wolff
Board of Directors
Coalition for Susitna Dam Alternatives

Document Content(s)

CSDA ILP Study Plan Comments.DOC......................................1-14

Tony Crocetto, Talkeetna, AK.
This is the second time I am trying to submit these comments. The first time i tried, I received a message that there was a server error. So, if you have already received this, please disregard this one.

The Coalition For Susitna Dam Alternatives has submitted very detailed commentary to you about why the studies being undertaken now are inadequate to insure that there will be no adverse effects to the ecosystem and the socio-economic systems that are in place now in the area that the dam will affect. I will not attempt to voice these concerns in my own words. Instead, I simply declare that I am opposed to the construction of this dam. I am not a tree-hugger or a radical left-winger. I believe that the concerns of the people who will be impacted by projects like these should be given paramount importance. To ruin forever the place that one calls home, for which one has worked part of or all of a lifetime in order to make the cost of electricity cheaper by a few cents or more abundant for consumers of power from outside of this area is immoral. Put yourself in the shoes of someone in this predicament. Would you be willing to have the place that you fell in love with and worked hard to establish as your homeland drastically altered so that it was no longer attractive to you, maybe even dangerous to continue living there? Where the activities that you worked hard to be able to enjoy were no longer available to you? And how could you, in good conscience, not explore every avenue to insure that there would be no negative impacts? The people being impacted are your fellow citizens of Alaska. Many of them very well educated in the possible impacts that a huge project like this will have, and who are open to proposing alternative energy producing projects, which is what our government should be investigating if they wish to move ahead into the 21st century, and not be left in the dust like an obsolete dinosaur. Please think of your fellow citizens first when considering huge projects like these. Compromise is the way to the future.
Thank you for taking my comments.
Tony Crocetto

Document Content(s)

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David B Downey, Palmer, AK.
Build it!
Seems to be common sense to me. There is limited private lands there, a vast area, with only fly in access or ATV. Build it while you can. Also, a lake of that size in that area, will create a lot of recreational activity and commerce in the future.

Document Content(s)

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Lara Gentzel, Talkeetna, AK.
Lara Gentzel
P.O. Box 951
Talkeetna, AK 99676

November 11, 2012

Federal Energy Regulatory Commission
888 First Street, N.E.
Wahington, DC 20426

Dear FERC,

I am writing this letter to express my exceedingly strong opposition to the proposed Susitna River Dam (Susitna-Watana Project). While I am excited about the idea of increasing our state's use of alternative energy, I feel this specific project will have far more negative impacts than positive.

I was born and raised in Talkeetna, AK, a beautiful and lively town built near the convergence of the Susitna, Talkeetna and Chulitna rivers. I lived in Washington State for roughly ten years, where I attended college and married an avid fisherman and outdoor enthusiast. We moved back to Talkeetna to begin our careers and purchase a home, knowing that it is a wonderful place to someday start a family. We have seen the immense damage done throughout the Lower 48 due to damming of rivers. Now we are seeing a huge movement to remove these outdated energy sources and attempts to repair the severe damage done to the ecosystems and communities. By installing a large hydroelectric dam on the Susitna River, there would be severe and immediate damage to the local wildlife, habitat, economy and community.

I am asking FERC to deny Alaska Energy Authority's (AEA) application to license the Susitna River Dam for the following reasons:

First of all, and most important for Alaska as a whole, the proposed dam does not make long-term sense in terms of energy production or energy cost. We know that Alaska is rushing to produce "sustainable" energy, but in this rush AEA has developed a plan that is far too expensive and will actually increase the cost of local energy, and consume most if not all of our state's precious financial surplus. It will not produce enough of Alaska's energy to justify the huge price tag. This dam would do nothing to improve the heating expenses for homes in Alaska, almost all of which are from fuel/oil heat sources. Research in the field of energy shows that the most efficient and cost affective way to produce alternative "sustainable" energy, is through smaller, diverse projects. With a combination of wind, solar, tide, geothermal and other renewable projects, Alaska could develop a comprehensive energy program that could produce energy for many generations to come. It is known that a dam built on a glacial river such as the Susuitna, has a very short life due to the build up of silt in the reservoir. With such exceedingly high construction costs, and such a limited productive time for the dam to produce energy, this dam is not a long-term solution for our energy needs.

If built, the dam will not only block the path of a run of large King Salmon returning upstream to spawn, it will also dramatically alter the water levels and flow throughout the year, damaging the habitat and conditions for salmon eggs and fry. In addition to altering the Susitna River, all the rivers downstream will also be negatively affected. Alaska is a state that depends on salmon for both subsistence and economical reasons. My husband and I both fish for salmon, which is a substantial food source for us throughout the year. My husband is also a fishing guide part-time in our small community. With already declining salmon populations, we cannot afford to drive the salmon numbers any lower.

The dam would also create an enormous reservoir that would flood migratory lands and habitat for caribou, moose, bears, and other wildlife. The increased flow and water temperatures from the reservoir in the would postpone or prevent the ice from freezing across the Susitna River in the winter, making the typical travel in these areas dangerous/deadly for snowmachiners, dog mushers and wildlife who use this river for transportation. Lower water levels in the summer will again endanger salmon, but also limit the use of boats on the river for commercial, recreational, and travel purposes. This could have a very negative impact on our local economy which is largely dependant on tourist activities such as fishing, sightseeing, rafting, and jet boat tours.

I also have concerns that the proposed location of the dam is too close to a known geological fault in an area that recently suffered an earthquake that destroyed mountainsides with a magnitude of 7. A 750-850 foot tall dam with a 42 mile reservoir behind it is asking for disaster in this area. If built, I would fear for my family and my community if this dam were to break. We all know that building so close to a fault line would greatly increase the possibility of dam failure.

We live in Alaska because we love this state. I want to see Alaska and my local community of Talkeetna thrive. I want to see us make positive steps forward to developing less expensive renewable energy. The proposed Susitna Dam will not help us meet any of these goals.

Please deny Alaska Energy Authority’s application to license the Susitna-Watana Project. Thank you for your time and effort.

Sincerely,
Lara Gentzel

Document Content(s)

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Sarah Kehoe, Talkeetna, AK.
I oppose the Susitna dam and I think AEA's Proposed Study Plans are not adequate for understanding the impacts the dam would have on a river system as biologically rich and complex as the Susitna River.

There has never been a dam so massive, built so far north, on a river so large. Two years of study is simply not enough.

In addition, AEA has dismissed a National Valuation Study. I believe the value of an intact Susitna watershed should be considered on a national scale.

AEA insists on using studies that are 30 years old. We need to allow for climate change (the climate of the Susitna Valley has changed dramatically in 30 years, averaging 4 to 5 degrees warmer) and also make decisions after much more sophisticated data collection and computer modeling techniques have been used.

AEA has not made any of this summer's study data available. All data must be available to the public and be peer-reviewed.

Document Content(s)

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Jen Latham, Talkeetna, AK.
I oppose the Susitna dam and I think AEA's Proposed Study Plans are not adequate for understanding the impacts the dam would have on a river system as biologically rich and complex as the Susitna.

Two years of study is not enough. There has never been a dam so massive, built so far north, on a river so large. Even the agencies studying the extent of the dam's impacts and risks say that only two study years cannot return a full understanding of what would happen if the dam is built. For instance, with the Susitna running at much reduced summer flows, the Chulitna could push the main stem of the Susitna toward Talkeetna. What is the likelihood of this, and what would the impacts of increased erosion be on the town of Talkeetna? Also, what impacts would the changes in Susitna River water flows have on the five species of salmon? The life cycle of a Chinook salmon is five to seven years. A comprehensive, meaningful study that confidently predicts the potential effects of a dam of this nature on Susitna River salmon simply cannot be conducted in two years.

ICE-51 Winter water flows are planned to fluctuate across the day, at times reaching four times average flows. This would make river ice unstable, making travel dangerous, or even impossible, for both humans (snowmachine, dogsled or ski) and animals (moose and caribou). It would disrupt winter habitat of juvenile salmon in the main river, for example by removing still pools where they would normally rest, making their survival difficult at best and impossible at worst.

The fish and wildlife resources of Game Management Unit 13 will be negatively impacted by this developed access. This means trespassing issues, increased harvest pressure, user conflicts, increased use of Off Road Vehicles on the tundra, and disturbance to caribou calving areas. The preferred access route bisects the range of the Delta Subherd of the Nelchina Caribou Herd.

The establishment of access routes is an extensive carbon footprint. The majority of the ground in each access alignment is permafrost. Development will cause the thermal regime to warm and thaw creating an increase of greenhouse gas emissions to the environment.

The Seattle Creek route joins the Susitna River Watershed to the Tanana/Nenana River Watershed with the increased potential for invasive species penetration. This is worrisome because government agencies usually want to spray herbicides when invasive plants are discovered.

Studies from the early 80's are being used to speed the process, but the climate of the Susitna Valley has changed dramatically in 30 years, averaging 4 to 5 degrees warmer. Many of the old studies are no longer accurate for today's conditions. In addition, there are much more sophisticated data collection and computer modeling techniques that were not available 30 years ago. But still AEA is insisting that they can use those old studies to... speed the process.

A National Valuation Study has been dismissed by AEA, but the impacts of the dam should be considered from a national level, not just Alaskan. A free-flowing Susitna River has value to Alaskans and all Americans. Formally called a National-Level Economic Valuation Study, this study would fully explore and define the cost/benefit, loss/reward of the national value of a free flowing river versus a dammed river, including costs to such factors as recreation, aesthetics, and culture. FERC is a national agency. The value of an intact Susitna watershed should be considered on a national scale.

All data must be available to the public, and it must be peer reviewed. AEA has not made any of this summer's study data available.
-

Document Content(s)

16037.TXT...1-2

November 10, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
666 First St., NE, Washington DC 20426

RE: Proposed Study Plan (PSP) for proposed Susitna Dam P-14241-000, Applicant Alaska Energy Authority (AEA)

Ecosystems have Intrinsic Rights

Ecosystems have intrinsic rights. Residents of communities in ecosystems have the right to act as legal guardians of a threatened ecosystem. The Susitna Valley communities take the protection of the natural environment seriously. Proper functioning of the ecosystem is essential to human life. Aldo Leopold in A Sand Country Almanac states:

> An action is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.

Accurate, peer reviewed scientific data is necessary to decide if this project will negatively impact the natural environmental ecosystem.

Inadequate Study Time

GEN-11

The two-year Integrated Licensing Process (ILP) timeframe is not legally defensible. A major dam on a major complex river system in an area which is vulnerable to climate change means major impacts. Two years of studies are not enough. Looking at these studies, many of them are in reality only one year of actual field study. Many of the studies that are connected to the larger distribution and abundance studies will be run as "pilot studies in 2013 and then refined in the final 2014 year.

This scarcity of data will in no way characterize the full knowledge of the 19 resident fish species. The October 8, 2012 Alaska Chinook Salmon Knowledge Gaps and Needs report from the Alaska Department of Fish and Game Office of the Commissioner shows the large amount of unknown data regarding the Susitna River Chinook stocks. Annual run size and freshwater and marine survival rates of all the stocks are unknown.

With an inadequate time frame, there is a scarcity of information which may result in underestimating the negative project impacts and overestimating the benefits.

FISH-03
IFS-099
WTBRD-02
BREED-03
ICE- 04

The following studies should be 5-7 years long: all fish and aquatic Resources, Instream Flow studies, Breeding Survey of Landbirds and Shorebirds, Ice Processes. This is to just name a few.

<u>Over-reliance on the 1980's Alaska Power Authority Su Hydro Studies</u>

GEN-12

The proposed Study plans include data from the 1980's as points of reference and also as actual data upon which to base project impacts. For instance, the Ice Processes Study consultants will be using data from the studies for the years 1979-1985. The relevance of using this data is questionable. We do not know the scientific validity of these studies. This is because many of them were not completed, were for a different project of a 2 dam configuration, and did not take into consideration any sort of climate change projections into their calculations. A Biometric Study of these older studies has been requested by the federal agencies. This needs to happen.

<u>Comments on Socioeconomic Resources Studies</u>

SOC-10

An important component of these studies should be the National-Level Economic Valuation. The Susitna Valley economy of tourism, hunting, fishing, subsistence, and recreation is dependent on the natural resources and is enjoyed by national and international consumers. It is an economy based on a wild river, an undammed river. Thus, there needs to be a national valuation of this aspect as part of the non-power uses of the river figured into cost/benefit figures. Calculations for this kind of study are perfectly acceptable among government agencies and NGOs. Without this, the socioeconomic studies are narrowly defined, unrealistic and hopelessly out of date.

Also, the social Conditions and Public Goods and Services Study needs to include an ecosystem service component. According to the Environmental Protection Agency, these include water filtration and storage, air filtration, carbon storage, nutrient cycling, soil formation, recreation, food and timber. These considerations are directly connected to economic benefits and economic costs. Healthy watersheds reduce capital costs to supply clean drinking water and to treat wastewater.

ECON-1

In the Socioeconomic Resource Studies, the following information from the study 7/26/12 <u>Susitna-Watana Cost of Power Analysis Discussion Paper</u> written by the Institute of Social and Economic Research, University of Alaska Anchorage needs to be presented in order to give a realistic picture to future electrical costs to retail customers.

The reference case assumptions include a capital cost of 5.0 billion year 2008 dollars, 100% debt financing at 6%, and an on-line date of

2024…the retail rate for Susitna power in 2024 at a Railbelt customer's meter would be about 40 cents a kilowatt-hour (kWh). By comparison, if natural gas is available to electric utilities in year 2024 at a price of about $13 per million btu, and neglecting potential carbon taxes, then the retail rate for power from a new conventional combined cycle gas turbine going online in 2024 would be about 21 cents per kWh. If the State of Alaska were to contribute cash to cover part of the cost of the Watana project, required rates would be lower. For example, if the state paid 50% of the reference case cost of $ 5billion, then a retail rate of about 23 cents per kWh would be required to cover the remaining 50%. The required outlay by the state would be the equivalent of about $15,000 per family of three Railbelt residents.

Climate Change

Thankfully, AEA proposes to establish by study some climate change projections. The Glacial and Runoff Changes Study will consider the future water quantity and sediment quantity in the proposed reservoir from future glacier melt and wasting. But this is not enough.

I fully support the study request of the federal agencies "Project Effects under Changing Climate Condition." The impacts from a changing

GLAC-04

climate will continue to become more evident as more extreme storms such as the September storms in Alaska and the recent storm from Hurricane Sandy. These will happen more often. Studies such as the agency study request will become status quo when impacts from large development projects such as the proposed Susitna Dam are considered. FERC needs to recognize this and accept climate change studies. Another aspect of climate change that must be considered is how the project itself will change the climate of the project area. How will the creation of a large artificial lake and the changed downstream flows affect local climate?

Short Comments

- Engineering and design studies are being conducted now. This seems inappropriate until applicant sees the study results of ground and surface water movement studies at the dam site. Groundwater piping and infiltration are causes of dam failure.
- With increased Susitna River mainstem flows from the project, how will this impact the Chulitna River? Will the Chulitna River encroach more on Talkeetna and cause erosion?

- With so much of the sediment removed from the Susitna River by the project, will the Susitna River become a “hungry” river and pick up more sediment and cause significant erosion?
- Currently, the Susitna River clears up around September when the glaciers shut down. Photosynthesis occurs in the river ecosystem. Project impacts will create a year round turbid river. These impacts need to be studied.
- If there are emergency situations in winter after the dam is completed and water must be let out of the reservoir, will there be mid-season break up in winter time? How will this affect public health?
- There needs to be seismic studies to determine if there is a Deadman Earthquake Fault near the dam site.
- There needs to be a study that determines the carbon footprint of the construction of the project and the greenhouse gas emissions of methane and carbon dioxide from the reservoir and melting permafrost.
- There needs to be total transparency on all the study data that is available to the public.
- The studies need to be peer reviewed. This is a must.

Becky Long

Document Content(s)

Becky Long Study plan doc.DOC......................................1-4

BrianOkonek, Talkeetna, AK.

Nov. 13, 2012

To: FERC

Ref: P-14241-000, Proposed Susitna River Dam

Dear FERC representatives,

All around the world people are finding out the detrimental affects that dams have on rivers ecosystems. Dams are being removed (at considerable expense) to bring life back to rivers. The Susitna River supports runs of all five species of salmon. This fishery is important to the economy of Talkeetna and other communities in the Susitna valley and to the commercial fisheries in Cook Inlet. Although few salmon make it up Devil's Canyon (where the dam is proposed) the change in river flow and water temperature below the dam could have detrimental affects to salmon eggs and fry down river and the adult salmon's spawning habitat.

The 39 mile reservoir the dam will create could disrupt the migratory route of the Nelchina caribou herd, an important source of meat for many Alaska hunters. Alaska is renown for its scenery, wilderness and wildlife. These resources attract thousands of tourist to the Susitna valley and Alaska every year. I do not believe that two years is long enough to study the many impacts that a dam will have on life in and along the length of the Susitna River both summer and winter.

There needs to be long term, comprehensive studies done to determine exactly how a dam will impact the Susitna River ecosystem, communities along or near the river and the economy of the region. How will the change in river flow rates effect salmon and other fish species both summer and winter? How will ICE-52 flow rates effect the winter ice conditions on the river? Will traditional winter travel on the ice of the river still be possible? How will the sediment load the river carries in the summer be changed? What will change at the confluence of the Chulitna River with the change of flow rates in the Susitna River? What impacts will there be from roads, construction camps, power lines, the dam, the reservoir and increased recreation and hunting access into the wilderness where the dam is proposed? How has climate change effected the river? How will escalating glacier melt effect the proposed reservoir? If an earthquake damages the dam causing a flood how will this effect the river ecosystem, the railroad and highway bridges and Talkeetna and its' residences? What would be the economic consequences of a failure of the dam? These are all broad concept questions that each can be broken down into dozens of others for information that needs to be gathered to have a clear understanding of how a dam will effect the Susitna River and the life along it. It will take longer than two years to gather this information. Do not hurry the process.

The tourism and fisheries of the Susitna River drainage is of international interest. The Susitna River should be considered a resource worthy of a National-Level Economic Valuation Study.

As studies proceed all reports need to be made available to the public and must be peer reviewed. It is important that the data collected is reviewed and evaluated on a timely and regular basis.

Please ensure that the study and planning process for the proposed Susitna River dam is accomplished with the highest degree of integrity, that all questions are answered, that the science is sound and the process is transparent.

Sincerely,

Brian Okonek and
Diane Calamar Okonek

Document Content(s)

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Sandra, Trapper Creek, AK.
Comments on FERC's Proposed Study Times

We have lived near the Susitna River since 1973. We do not feel that a true picture of the nature of the Susitna River can be gained in only a two-year study. There are far too many variables. Before building a massive dam of such magnitude as the one proposed, a longer, comprehensive study needs to take place. Therefore, we support extending the study period.

We understand that studies from the 1980's may be used in the decision process. We understand these might be used for some comparisons; however, given 30 years of change in climate, population, data gathering techniques, and the river itself, these studies are of questionable validity for basing decisions on current proposals. They should not be used to speed up the studies that are being done now.

We have learned that a National Valuation Study has been ignored by AEC. We feel this is a narrow view of the importance of the river to everyone in our country, not only Alaskans. The Susitna River is a free-flowing river that is visited by people from all over the United States and the world each year. Impacts of the dam should be viewed in the most global manner possible.

Thank you for the opportunity to comment. We implore you to keep us all informed by making the research data public and peer reviewed.

David and Sandra Porter
PO Box 13152
5494 S. Sawmill Lane
Trapper Creek, AK 99683

Document Content(s)

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Denis Ransy, Talkeetna, AK.
11/12/12

Kimberly D. Bose, Secretary, Federal Energy Regulatory Commission
888 First St. NE, Washington DC 20426

Comments on the Proposed Study Plan for the Proposed Susitna Dam P-14241-000

First and foremost, the two-year time period for studies is completely inadequate for any real understanding of the Susitna River. The Integrated Licensing Process (ILP) was chosen for the project. The ILP process was originally for the relicensing of existing dams, not new ones. AEA's desire to fast track the project is the rationale.

So far comments from federal agencies have already been adversely affected by the timeframe. NMFS and USFWS both have stated that their PAD and SD 1 comments were not adequate due to the short time constraints. This tells me that AEA is not interested in complete scientific studies. It just wants to get all that tiresome science stuff out of the way and start pouring concrete. And as far as considering the old studies from the 1980's, please spare me…that is a pathetic joke. Present day water, air, fish, wildlife and socioeconomic factors have all changed since then. If you want to use those outdated studies, please proceed to your nearest time machine, and head on back there. We are living in the present and these issues are critical to us now.

The average life span of a Chinook salmon is six years. Two years of study is ridiculous to even consider.

What are the life spans of moose and caribou? What are the life span of glaciers, upon which the dam would so heavily rely upon? Two years barely gets things off the ground.

PASS-02

Serious studies must be done on fish passage above the dam because we are going to preserve the salmon that do migrate above the dam site. We need to know exactly how many and what species they are. The sacrifice of this important part of the run is unacceptable.

Susitna salmon are under stress now, due to increase climactic changes, other environmental factors, and increasing fishing pressure. The great environmental changes caused by the dam would increase the stresses many times over.

Speaking of climate change, comprehensive long-term studies must be done on this all-important subject. AEA acts as if it is not really happening, when 85% of the world's scientists say that it is, and it is at least in part human-caused. And the entire Susitna River must be included, not just from the dam site up.

SEIS-2

Seismic studies must be intensive and complete. There are several earthquake faults near the dam-site. Their proximity creates a very high-risk environment for dam construction. The 2002 Denali Fault Quake created lateral earth movements of 16-30 feet according to the US Geological Survey finding reported 11/8/12 on Alaska News Nightly. This quake caused damage throughout Interior Alaska. Recent findings point to the possibility of a Deadman Fault, which may be virtually at the dam-site. This must be determined with absolute certainty; a fault at the dam itself would create unacceptable dangers to population and property downstream. The presence of a Deadman Fault would point to increased danger from reservoir-induced seismicity. The weight of millions of gallons of water directly on or very near a fault could spell disaster. This factor must be included in any seismic study.

CIBW-02

Beluga Whale Studies must be complete and long term. The Cook Inlet Beluga is an endangered Species, and must be considered accordingly. Cook Inlet Beluga populations have been declining for many years, and their continued existence is not assured. They are known to live in the Susitna River delta area, and actually go upriver occasionally to catch fish. They eat salmon and eulachon (hooligan). If either of these fish species decrease in abundance, it will adversely affect the beluga population. This could place the state in direct violation of Federal Law.

The socioeconomic study Social Conditions and Public Goods and Services Study must have a much wider scope. Alaskans benefit from clean water, abundant fish and wildlife, thriving commercial and sport fishing, and tourism industries. Tourists come to the Susitna Valley to see a natural landscape not an industrial city and river. These values will be lost due to the project.

AIR-02

A Greenhouse Gas Emissions Study must also be done. There is significant documentation of GHG production in hydroelectric reservoirs, caused by rotting of the drowned vegetation. The resulting methane and carbon dioxide emissions have been found to be comparable to fossil fuel power plants.

A study is clearly required on National-Level Economic Valuation. This River is visited by thousands of people per year from the US and foreign countries. Its national importance is obvious and is a valuable asset to all Americans in its natural state. It has long been discussed as a possible National Wild and Scenic river, and is in fact on the Bureau of Land Management's list of potential candidates. Many national and local NGOs endorse the need for this study. The Federal Power Act requires FERC to give equal weight to river values other than damming. NMFS also strongly supports this study. These factors cannot be ignored.

Submitted by
Denis Ransy

Document Content(s)

16043.TXT...1-2

Mary L. Raychel, Willow, AK.
Nov. 13, 2012

I am opposed to the Susitna-Watana Hydroelectric Project.
I feel like this is being pushed ahead without enough comprehensive studies and too many unresolved issues.
This project will impact 3 rivers. How will it change salmon runs and fishing? How will it effect the rivers in regard to boating and fishing and sightseeing? Will the rivers be safe for snowmachines, trappers, etc. during the winter months?
This will be in an earthquake prone area. Will the Town of Talkeetna and other places along the river be more vulnerable to floods?

I feel that Alaska should invest more in gas reserves in Cook Inlet and not waste money on this project.

Document Content(s)

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Cari Sayre, Talkeetna, AK.

Thank you for the opportunity to comment on the study plans submitted to FERC by the Alaska Energy Authority regarding the Susitna Hydro Project. This proposed project is a massive one, and one that would have massive impacts. Two years of study is simply not sufficient to fully understand what could and would happen if the dam were built.

We who live in the Upper Susitna Valley value our resources. We value the fish in the river, as well as the other wildlife that depend on the river for sustenance, as a travel corridor, as a part of their habitat. Any study of salmon must take into account at least one full life cycle, which is five to seven years. A comprehensive, meaningful study which accurately predicts the potential effects of a mega-dam on the Susitna River salmon simply cannot be conducted in two years.

We also value our winters for the ease with which we can travel to far-flung places. The Susitna River is a highway, not only for humans on snowmachines, dogsleds or skis, but also for animals (moose and caribou). The dam would impact winter water flows, making travel dangerous or even impossible. It would also disrupt the winter habitat of juvenile salmon. Again, with winters being variable, a study of only two years seems insufficient.

I lived in Talkeetna in the 1980s when studies were being done for this dam project. Those studies are no longer valid. The climate has changed. It is much warmer than it was then (4-5 degrees warmer, on average). The predictions made then are no longer accurate. In addition, there are much more sophisticated data collection and computer modeling techniques that were not available 30 years ago. AEA should not be allowed to use short-cuts to speed this process along. The river deserves better.

This Susitna River is not just important to folks who live in Talkeetna. Granted, we would suffer most if the dam were to be built (especially in the event of catastrophic dam failure). In speaking with thousands of visitors last summer, I heard again and again how much they value a free-flowing Susitna River. This river has innate value. It has value as a source of recreation, of aesthetic beauty, of cultural resources. It has economic value to our community and also to the many tourism businesses that bring visitors to the Susitna Valley. AEA has refused to consider a National Valuation Study, but the impacts of the dam really would be felt on a national, if not international, level. This issue must be explored.

AEA has been far from transparent with their study data. It is critical that the data be held open to the public, and that it be peer-reviewed.

Thanks for listening,

Cari Sayre

Document Content(s)

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Douglas Smith, Talkeetna, AK.
Nov. 13, 2012

Kimberly Bose, Secretary
FERC
888 First St. NE
Washington DC 20426

Dear Ms. Bose,

I am writing to comment on the Alaska Energy Authority's Proposed Study Plan (PSP) for the Susitna-Watana Hydroelectric Project. This is a project that I oppose for a variety of reasons – it's exorbitant cost, impacts, and the inappropriate use of the Integrated Licensing Process for a project of this scale, something that has never been done before. As a retired science teacher with degrees in biology and toxicology, I am now vacillating between despair and disgust at the short study period that fulfills the requirements for the PSP under this licensing approach.

In short, this PSP sacrifices quality and validity for expediency. The AEA proposes to finish all its scientific studies in two years – in Alaska that translates into two short summers of field work – which is not enough time to even get a snapshot of what possible effects this dam could have on the northern Susitna Valley. In less than half the life cycle of many of the salmon this project is sure to impact, the AEA contends that it can reliably predict the impacts of reduced summer river flows, widely-fluctuating and higher winter river flows, siltation changes, temperature changes, migration pattern alterations, and a host of other impacts on a rich and diverse biological community covering hundreds of square miles. It's not possible. For example, researchers that I have talked to from one participating state agency don't think they can even accurately count the impacted moose population in the given time frame, and moose are relatively easy to count. Like all organisms up here, their populations move and vary considerably over time, as forest succession, predation, and a host of other factors affect their populations. What will we know bout moose from AEA's two-year snapshot? Are we looking at a high in the moose population cycle? A low? Who knows? This pinhole view of what's going on with moose populations (or waterfowl, caribou, trout, or five salmon species) cannot give us reliable information on what a huge dam's impacts will be. Everyone knows it (and knew it when the ILP was approved). The goal is to get a license, not understand an ecosystem. So the studies, and the charade, go on for one more short summer of field work. In the end, we'll end up with the minimum quantity (and quality) of studies necessary to fulfill the meager requirements of the all-in-one dam-promoting and dam-regulating agency.

That sound rather cynical, but actually, I'm not. I'm hopeful. Because YOU CAN DECIDE THAT THESE STUDIES ARE IMPORTANT, AND NECESSARY, AND NOT JUST LICENSING WINDOW-DRESSING.

Please restore our faith in the licensing process. Tell AEA that they are required to expand the timeframe, and the scope of their studies. These studies must be peer-reviewed, and the data should be available to the public. Please make this study process more rigorous, valid, and transparent.

Thank you for the opportunity to comment.

Doug Smith
P.O. Box 371
Talkeetna, AK 99676
dougseabird@yahoo.com

Document Content(s)

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PO Box 766
Talkeetna, AK 99676
November 12, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington DC 20426

Subject: **Comments on Alaska Energy Authority Proposed Study Plan (PSP) and Draft Revised Study Plans for the Proposed Susitna-Watana Hydroelectric Project Number P-14241-000**

To Whom It May Concern:

I am submitting these comments as a long term resident of Talkeetna and user of the backcountry and wilderness areas of the northern Susitna Valley. I own properties and two recreational cabins at various locations in the northern Susitna Valley, where I have recreated extensively for over 40 years. I have used and continue to use the Susitna River, as well as some of its tributaries for both summer and winter travel. In the winter, I travel primarily by dogteam; in the summer by river boat or raft. I use the river for recreation and also for access to my remote cabin. I have fished and hunted along the Susitna River Corridor.

I gain a great deal of enjoyment from, and have an abiding appreciation for, the natural and in-tact environment. I live in a community that relies heavily on tourism, guiding and other outdoor based businesses, which in turn rely on the natural, unaltered wildlife habitat, waters, and landscapes, in order to maintain its economic health.

1. The two year time frame allotted to the study plan is utterly inadequate.

The Susitna River watershed is a biologically rich and productive river system. The Susitna River is located in a sub-arctic region. The proposed Susitna-Watana dam would be one of the largest dams in the United States and the only one in a sub-arctic environment. The scale of the proposed project and the environment in which it would be located present unique and extraordinary challenges.

The proposed dam, if built, would dramatically and permanently alter the natural Susitna watershed on which so much depends.

Winter temperatures in the Susitna Valley are very cold, with daytime <u>high</u> temperatures sometimes at 30 degrees <u>below</u> zero Fahrenheit, with nighttime temperatures much colder. Ice formation and condition is a significant issue. In trying to study the dynamics of the river, resident and anadromous fish, other organisms, nutrients, vegetation, the side streams, sloughs, water chemistry, sediment, and so on, ice complicates everything.

MOOSE-1

Ice and snow conditions also affect wildlife movements and winter refuges important to wildlife survival. For example, the current (no dam) conditions allow moose to find refuge (e.g., in sheltered areas near the river or on islands) from the heavy snows and where they can feed on willow. High volume winter flows, ranging from 2 to 7 times the average winter flow (at Gold Creek), would potentially eliminate these wintering areas. This just one of the countless variables and effects that must be studied. I doubt that AEA is even close to knowing all of what it must study.

Another major complicating factor is the dramatic fluctuation in flow volumes (i.e., the load following regimen) that would occur on a daily basis. This adds a whole new layer of variables that need to be studied.

Study of the environmental impacts that the proposed dam would have is so enormously complex that I can see taking two years to gather the information to design comprehensive, scientifically sound studies. But it is simply not possible to design and conduct such studies in a two year period. A two year time frame is not just "inadequate," it is ***absurd***. It is absurd to suggest that comprehensive, legitimate studies can be conducted in two years.

Here is just one example. The ongoing health and abundance of Susitna's wild salmon are critically important in so many ways: subsistence, commercial and recreational fishing, guiding businesses, and most important is salmon's critical role in maintaining the structure of the ecological community of the watershed. Salmon support wildlife such as bears, birds, otters, and the decaying bodies of spawned-out salmon supply nutrients that the salmon acquire from the ocean (e.g. nitrogen, carbon, phosphorus) to the lands and forest. It takes 1-3 years for the salmon fry to grow into smolt and go to the ocean; the adults stay in the ocean for another 4 years. It is clear that a two year study is not sufficient.

Even agency folks object to the compressed time frame. I attended the Susitna-Watana Hydroelectric Project FERC Public Outreach meeting in Talkeetna last August 29, 2011 and heard an agency person object, complaining that the ILP didn't provide sufficient time to do the necessary studies.

There were studies conducted on the 1980s with respect to another project on the Susitna River, but these studies provide only historical data, which is of very limited usefulness today. The modeling then was relatively unsophisticated and the data is both limited and dated. The previous studies were conducted nearly 30 years ago for a different project under different circumstances and different assumptions. Those studies are not sufficient to justify the decision to go with the fast track ILP process that allows only two years for the studies for the current project proposal.

There are so many unknowns and variables, so many widespread and far-reaching effects, and so many hydrological complexities and interrelationships that must be studied. This proposed project is an extremely risky proposition with a huge downside. It is astonishing to me that AEA, by insisting on a ILP process and only two years of study, is willing to plunge ahead with this project lacking complete, comprehensive information on its effects.

In summary, two years is much too short a time frame to properly study a project of such massive scale and consequence. FERC should require a sufficient time frame be allotted for the design and conduct of the studies. If the ILP process doesn't allow for this, then I recommend that FERC disallow the use of the ILP and require a full blown licensing and application process that is customary for new dams.

2. In 1986, Congress amended the Federal Power Act to require FERC to give equal consideration to non-power values when deciding whether or not to license a hydropower project.

In order to comply with this 1986 provision, non-power values, such as the value of an intact natural watershed, must be considered using methods that enable comparison with power related values. Non-power values must be identified and fairly valued and otherwise treated in a manner that allows comparison to power related values.

The methods used to determine power and non-power values likely will not be the same. It is straightforward to quantify the value of a mega watt of electricity. It is not so easy to attach a value to an intact ecosystem or watershed. Nonetheless, there are methods by which power and non-power values can be fairly derived and compared.

It makes no sense for Congress to have stipulated that non-power values be "considered" if it did not intend that "consideration" would result in meaningful, substantive research and evaluation that would inform the decision to approve or deny the license. There would be no reason for this stipulation to "consider" non-power values if Congress intended that the non-power values be simply looked at and effectively ignored. To give meaning to the stipulation to consider non-power values, "consideration" must include adding the appropriate studies, so that these non-power values are fairly assessed such that they can be compared to power-related values.

Thank you for this opportunity to comment.

Sincerely,

John Strasenburgh

Document Content(s)

Comments FERC study plans project no 14241 FINAL 111212.PDF...........1-3

Cathy Teich, Talkeetna, AK.
P.O. Box 155
Talkeetna, AK 99676
November 9, 2012

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N. E., Room 1A
Washington, DC 20426

RE: Susitna-Watana Hydroelectric Project No. 14241-000

I would like to comment on AEA's study plan for the proposed Susitna-Watana Hydroelectric Project No. 14241-000.

1. Two years of study is not even close to enough time to evaluate the impacts of a dam of this size, built further north than any other dam, on such a large, silty river, with five fault lines in the region. There are so many things to be considered, such as:

-Impacts on 5 species of salmon and other fish due to changes in river flow and temperature and changes in food supply due to changes in flow and temperature.

ESCAPE-02

-A 2 year study is inadequate because the life span of Chinook salmon is 5 to 7 years. Not enough information could be obtained in a 2 year period to determine how Chinooks would be affected.

TRANS-01
WILD-1

-Impacts on the Susitna River as a travel corridor for people and wildlife due to dangers of unstable ice resulting from fluctuating flow.

REC-17

-Impacts on traditional recreational activities such as snowshoeing, skiing, snowmachining, and dog sledding due to dangers of unstable ice resulting from fluctuating flow.

-The studies from the '80's are no longer appropriate, as the climate of the upper Susitna Valley has changed since then. Using the old studies to speed up the process is inappropriate and would not produce reliable answers to important questions. It is painfully obvious that AEA doesn't want to find anything to slow down the process. It appears that they may have been mandated to force this particular project rather than look at any other alternative.

SOC-03

2. AEA dismissed a National Valuation Study. This is EXTREMELY inappropriate, as Alaska is a NATIONAL treasure, visited by countless people from all over the United States and all over the world. This area should receive study at the national level (FERC is a national agency) because everyone benefits from the jobs produced by the Susitna, recreation it provides, and food it provides. The economics of tourism must be considered. Dams across the lower 48 are being dismantled at huge costs. They are old technology and very expensive. There are less expensive ways to generate power, financially and environmentally. Putting all of your eggs in one basket is short sighted...and not very smart.

3. AEA has not made any of the data they obtained this summer available to the public, which is inappropriate. The public needs to see what is going on and the data must be peer reviewed to ensure that unethical practices aren't going on.

GEO-04

4. Talkeetna had quite a flood this past August. We need to have studies done to determine whether or not the changes in the flow of the Susitna would affect the flow of the Chulitna and Talkeetna Rivers. Could this cause more erosion and put the town of Talkeetna at risk? What other settlements would be at risk?

Thank you for allowing us the time to comment. I would appreciate your taking our comments seriously and looking at these studies carefully while they are being peer reviewed in order to determine honestly how the eco system of the Susitna River drainage, our traditional uses, and our current economy would be impacted.

Sincerely,

Cathy Teich
cathyt@mtaonline.net
907-733-2155

Document Content(s)

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Cathy Teich, Talkeetna, AK.
I was unable to access your website earlier to send copies of transportation corridor comments that I sent to AEA. Here is a copy of that comment:

P.O. Box 155
Talkeetna, AK 99676
10-11-12

AEA
susitnawatana@aidea.org

To Whom It May Concern:

RE: Draft Watana Transportation Access Analysis

I would like for it to become a part of public record that I am opposed to all of your proposed routes for road construction and transmission lines. I am also opposed to all of your proposed runway/airport possibilities. There is no “lesser of all evils” route. They are all extremely damaging.

We hunt/berry pick in that area and any of the proposed construction would impact hunting, caribou migration, moose habitat, bear habitat, small mammal habitat, bird habitat and nesting, migratory bird habitat and nesting, berry picking, camping, hiking, subsistence use, the Native peoples traditional use of the area, fishing, and tourism in a negative way.

GEN-17

Viable energy alternatives have not been considered in your studies and should be. Dams are archaic and many of them are being torn down in the lower 48. You need to offer a no-action alternative.

This dam threatens not only Alaskan jobs, it threatens Alaskan, U. S., and World food supplies. There has already been disaster funding for fishermen in Cook Inlet. The proposed dam would only make that situation worse.

This proposed dam would bankrupt Alaska. There are better ways. You should be doing research on better ways instead of having the governor tell you what he wants. You are SUPPOSED to be an agency that finds out the best ways for us to go instead of rubber stamping what someone with a hidden agenda has in mind.

Please do not hesitate to call me if you have questions.

Sincerely,

Cathy Teich
907-733-2155
cathyt@mtaonline.net

Document Content(s)

16045.TXT...1-1

Ellen Wolf, Talkeetna, AK.
PO Box 371
Talkeetna, AK 99676
November 13, 2012

Honorable Kimberly D. Bose, Secretary, FERC
888 First Street, N.E.
Washington, D.C. 20426

Comments for proposed Susitna-Watana Hydroelectric Project No.14241-000 Proposed Study Plans and Draft Revised Study Plans

Dear Secretary Bose:

Please add my voice to the many voices expressing serious concerns about AEA's Proposed Study Plans and Draft Revised Study Plans.

First and foremost, that the proposed dam would forever change the Susitna River in a way that will cost us a wild and vital river ecosystem is certain. So here, then, is the question that we must address: Do we have the right to dam the Susitna River in order to generate what boils down to 300 megawatts of electricity? In the year 2012, with a century's worth of evidence about the impacts of large dams on river systems, and with a generation's worth of perceptions of how vulnerable and precious what remains of our natural treasures are, the answer is clear: THIS DAM SHOULD NOT BE BUILT.

The rest of my comments speak to the process that has been set into motion. However, I remain confident that intelligent minds at FERC and in the state of Alaska will recognize that the project should not be licensed or constructed.

- Two years is not enough time for many of the planned studies to be thorough and conclusive.

- The ILP process continues to prove to be the wrong choice for considering a newly licensed large dam on a subarctic river. The process is for relicensing dams where impacts are already understood. This dam's location far north of other similar-sized U.S. dams should be reason enough choose a licensing process that guarantees thorough study. No dams of this size have been built in the U.S. in decades; indeed, dams such as this are being torn down in order to reverse devastating impacts, especially to salmon. The Susitna River is home to salmon of all five species – where is the sense in endangering these populations when we can look to what happened in rivers like the Elwha in Washington?

- The Susitna is an important transportation corridor for humans and wildlife in both summer and winter. The impacts of the dam on both seasons are of serious concern. The impacts in winter are of particular concern because of the potential dangers posed by unstable ice. Will the proposed studies be able to confidently predict the effect of fluctuation river levels on winter ice?

ICE-54

- Resource Valuation is increasingly undertaken for many federal projects because we are recognizing that the values of our natural resources go beyond the economic. It is imperative that both state and national valuation assessments be conducted.

Thank you for your consideration.

Ellen Wolf

ellenmwolf@yahoo.com

Document Content(s)

16066.TXT...1-2

Ruth Wood, Talkeetna, AK.

RUTH D. WOOD
P. O. BOX 766
TALKEETNA, AK 99676

TO: Secretary Kimberly Boss, Federal Energy Regulatory Commission

RE: Comments on Alaska Energy Authority Proposed Study Plan for Susitna Dam
FERC Project #14241

Dear Ms. Boss:

These are my comments on AEA's Proposed Study Plan for the Susitna Dam, FERC Project #14241.

I oppose the Susitna dam because I think it is an unnecessary boondoggle project that will will permanently and irreparably damage this magnificent and vital river - the Susitna. My opposition does not mean that I don't understand that others have a different view, but it does make me realize that those who propose this have to bear the burden of proof that it is a necessary project, that there are not suitable alternatives, that natural resources will not be harmed, that alternative uses and users will not be displaced. Because the consequences of mistakes or misjudgements are so he standard of proof must be higher than high.

Unfortunately, I do not think AEA's approach meets those high standards, and the Proposed Study Plans are not adequate to measure and analyze the impacts.

1. There should be no reliance on studies done in the 1980's. Temperatures in the Susitna Valley are averaging 4 to 4 degrees warmer than they were in the 1980s. Data collection, research, and analysis (including modeling) are much more sophisticated now. AEA wants to use the old studies in the interest of speeding of the process. Making the

2. Two years of study is not sufficient. The Susitna is different. It is a glacial river, in the sub-Arctic. Every summer here is different from previous summers. Every winter here is different from previous winters. Two years is not enough time to conduct studies and draw meaningful conclusions.

ICE-53

3. Winter impacts need to be measured from the source to the mouth, and that includes the tributaries that flow into the Susitna. The Yentna River is a massive winter-recreation river that joins with the Susitna. Will the river freeze or run free in the winter? Will the ice be solid or unsafe shelf ice? What are the impacts on various load-following scenarios? We know the river will freeze differently. What effect will that have on moose and caribou and other animals? The research and analysis needed to answer these (and other) questions cannot possibly be completed in two years.

4. Summer impacts need to be measured from the source to the mouth, and that includes the tributaries that flow into the Susitna. What will be the impact where the Chulitna joins the Susitna? Will the Chulitna impact Talkeetna in new ways. What happens at the confluence of the Susitna and the Yentna in summer? How does this impact the lower reaches, all the way to Cook Inlet. As with winter impacts, the research and analysis needed to answer these (and other) questions cannot possibly be completed in two years.

5. A National Valuation Study, or National-Level Economic Valuation Study, should be undertaken. The value of the other non-power uses, such as scenic, recreation, or life style needs to be measured and quantified in order to do a true cost/benefit analysis. There are methodologies to assign economic value to these factors. Without such a study the value assigned to these other uses is just speculation.

6. 2012 summer data would be invaluable when developing comments on additional studies, but AEA has not made any of this summer's study data available. This should be a public process, and AEA should be required to make data available in an easily accessible manner. AEA's Revised PSP, for example, should have been issued earlier than October for a November comment, and it should have been presented in a "red line" format.

7. Socio-Economic Studies need to be broader than proposed. Impacts to fish and wildlife will impact local economies, and the impacts to local people's livelihoods and life styles need to be studied.

8. Every few months, the world gets another notice that Climate Change is real. It makes no sense for AEA and FERC to take a position that climate change studies are not needed. The increase in average temperatures that we've already experienced in conjunction with further increases will effect glacial melt, sediment transportation, water quality, and water temperature. Cumulative conditions are relevant and they must be studied and taken into account in the licensing process.

Thank you for considering my comments.

Sincerely,

Ruth D. Wood

Document Content(s)

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Katie Writer, Talkeetna, AK.
Katie Writer PO Box 440 Talkeetna, AK 99676 907/863-7669 November 10, 2012

I strongly oppose the Susitna Dam. My passion for the beauty and power of the Susitna River Valley is shared by a majority of the people that live in Talkeetna, Alaska and nearby communities. It is home of salmon, bear, moose, caribou and pristine wilderness that should never be destroyed by the construction of a Dam that Makes No Sense!

As an 8+ year Talkeetna River Sub-Division resident, I have lived thru 2 major floods….August 18th, 2006 and more recently, September 21, 2012. During both events, I witnessed the powerful force of water come whipping through our neighborhood. We do not live on the bank of the Talkeetna River, yet the water levels reached 6-8 feet of fast flowing water thru our property that engulfed our house. We evacuated our small children in a raft on Friday morning, the day the water's peaked. I witnessed the town of Talkeetna get evacuated as well as the water's rise and flood the town. I am a pilot and had the ability to go flying and witness the Susitna River, the Chultina River and The Talkeetna River in their peak flood stage. It was a very frightening sight to behold and I did not stay in the air long. Talk about scary! The destructive power of water in the Susitna River Valley environment is enormous. If the Susitna Dam were ever built, and there was an earthquake or rain event that the dam could not handle…Talkeetna would be wiped off the map and human and animal life would be sacrificed for a project that should have been never begun.

There are so many reasons to oppose the Susitna Dam. Dollars are of importance to the state of Alaska. From the recent Presidential Election, one cannot miss the bottom line of politics…money. $4.5 Billion to create a Dam in a subarctic environment means two things to me. The hidden escalating costs of the future problems of creating this Dam in an un-trodden landscape would far exceed $4.5 Billion. This Dam is a financial nightmare. If money matters and we know it does...then let's go with the available natural gas in the Cook Inlet. As scientist have already explored, "the Cook Inlet gas resource could be as little as 50% of the required investment in the hydropower dam, but will provide four times the energy demand as Watana, enough to meet the current Railbelt energy demand for electric power and space heating for the next 100 years." Now that makes Sense to me….Natural Gas is our solution, not a Dam.

This 700' foot high dam would flood an area 39 miles long, 2 miles wide and 500' deep in a subarctic environment where freezing temperatures begin in October and lasts thru April(7 months of the year). Managing water flow would be a nightmare. There are hundreds of residents and thousands of recreationalists that utilize the Susitna River for travel, mushing, and snowmobiling. The uneven water release proposed for the dam would make river ice unsafe for travel for man and beast! Please, don't jeopardize this fragile ecosystem and human life. If you don't issue a permit, you can rest your head at night knowing that you made the best decision.

Just like the recent Election Day, the American people were relieved to have the Elections over in order for President Obama to get busy with the things that need attention, like running the country! Let's be Smart for the planet! NO PERMIT, NO DAM, NO more wasting money on a problematic Dam. Let's get on with the natural gas. It's that simple. Sincerely, Katie Writer

Document Content(s)

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Diane Ziegner, Talkeetna, AK.
I am opposed to this project. I feel that there has not been adequate study. Additionally I feel that the project is too far away from the population that will benefit the most from it. After the flooding of the Susitna River this fall I also feel it is an unreasonable risk to the communities that are down stream from the proposed dam. I urge you to find an alternate solution to our energy concerns and be more forward thinking rather than resorting to this rather "primitive" technology of damming a river. Thank you for the opportunity to make a comment.

Document Content(s)

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