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SUSITNA-WATANA HYDRO

Revised Study Plan

Susitna-Watana Hydroelectric Project

FERC No. 14241

Appendix 1

Comment Response Table of FERC-filed Comments

ALASKA ENERGY AUTHORITY

December 2012

Appendix Arrangement: The comments and responses in this appendix are arranged by resource area, following the order of the RSP sections.

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

Comment Code[1]	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

Comment Code[1]	RSP Study Title (Resource Area)	RSP Section Number
DALL	Dall's Sheep Distribution and Abundance	10.7
LGCAR	Distribution, Abundance, and Habitat Use by Large Carnivores	10.8
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

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

Commenter Acronym Key

Commenter Acronym	Commenter
ADEC	Alaska Department of Environmental Conservation
ADNR-ADF&G	Alaska Department of Natural Resources - Department of Fish and Game
ADNR-DF	Alaska Department of Natural Resources - Division of Forestry
ADNR-DGGS	Alaska Department of Natural Resources - Division of Geological and Geophysical Surveys
ADNR-DMLW	Alaska Department of Natural Resources - Division of Mining, Land and Water
ADNR-DPOR	Alaska Department of Natural Resources - Division of Parks and Outdoor Recreation
ADNR-OHA	Alaska Department of Natural Resources - Office of History and Archaeology
AHP	Alaska Hydro Project
AHTNA	Ahtna, Inc.
AS	Alaska Survival
BLM	United States Department of the Interior – Bureau of Land Management
CCA	Copper County Alliance
CCC	Chase Community Council
CIRI	Cook Inlet Region, Inc.
CSDA	Coalition for Susitna Dam Alternatives
CWA	The Center for Water Advocacy
EPA	United States Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
HRC	Hydropower Reform Coalition
NHI	Natural Heritage Institute
NMFS	United States Department of Commerce – National Oceanic and Atmospheric Administration
NPS	United States Department of the Interior – National Park Service
NRDC	Natural Resource Defense Council
TCCI	Talkeetna Community Council, Inc.
TNC	The Nature Conservancy
TU	Trout Unlimited
USFWS	United States Department of the Interior – Fish and Wildlife Service

Appendix 1

Alaska Energy Authority's (AEA) Response to Comments on the Proposed Study Plan (PSP) and Interim Draft Revised Study Plan (RSP) (Letters filed with FERC November 1 through 14, 2012)

General / Global				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
GEN-01	NPS	11/14/2012	"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." – pdf page 2	As explained in Section 1.2 and in each individual study plan in the RSP, AEA will be meeting requirements of 18 CFR 5.11(b)(3) through periodic TWG meetings scheduled quarterly through 2013 and 2014. The purpose of these meetings will be to update licensing participants with information on study progress and initial results, as available. In accordance with the Communication Protocol, AEA will strive to make meeting summaries available on its website within 15 days of these quarterly meetings, with comments provided within 15 days of posting.
GEN-02	TU	11/14/2012	A two year study is inadequate to understand the potential impacts and make informed decisions regarding the project. – pdf page 2	AEA believes that the study plans set forth in the RSP will provide sufficient information to make informed decisions regarding the proposed Project. Depending on information needs, each study plan in the RSP proposes one or two years of study. These study plans have been developed to supplement the existing information summarized in the PAD and baseline data collected during the 2012 field season. The proposed Project has been the focus of many years of study dating back to the 1950s, and a wealth of information already exists related to the Project and its environs. Historic information is being used, where appropriate, to help assess the issues raised during scoping. Specific resource information will be collected in 2013 and 2014. In so doing, these study plans adequately address issues associated with construction and operation of the proposed Project. By properly utilizing existing data, 2012 baseline information, and results of the 2013-2014 licensing studies, AEA's License Application and state and federal regulatory agencies' environmental analyses will make well-supported, informed impact assessments and decisions related to the proposed Project. AEA understands, however, that assessments related to data adequacy must be addressed on an individualized, study-specific issue. For this reason, where licensing participants' comments raised questions related to length of

General / Global				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
				the proposed studies for specific resource areas, this comment response table provides a resource-specific response to this issue in the applicable sections of this table.
GEN-03	TU	11/14/2012	The PSP fails to "adequately evaluate and synthesize the existing data and information already available about the affected area." – pdf page 3	A goal of the RSP is to provide a summary of the existing information to assist the reader in understanding the study plan itself. Each section of the RSP includes a detailed summary and evaluation of existing data and information, as required by FERC's ILP regulations. 18 CFR 5.11(d)(3). In addition, the Pre-Application Document (PAD) provides a synthesis of the existing information for each resource. In light of the wealth of information collected in the 1980s, as the studies move forward in 2013 and 2014, AEA will continue to integrate historic information into each study, as appropriate, as the data is analyzed.
GEN-04	NRDC	11/14/2012	Request that AEA is required to conduct over two years of study. A minimum of five years is suggested. –pdf pages 4-7	See AEA's response to comment GEN-02.
GEN-05	NRDC	11/14/2012	Data collected in the 1980s is outdated and inadequate when using to describe existing environmental conditions. –pdf pages 7-8	FERC's ILP regulations specifically recognize the value of existing environmental information regarding a proposed project. At the very beginning of the licensing process, a prospective applicant such as AEA is required to prepare a PAD that assembles "existing, relevant, and reasonably available information," and to provide the PAD to resource agencies and other licensing participants for purposes of identifying issues and developing study needs. 18 CFR 5.6(b(1). When preparing its study plan, moreover, the prospective applicant is required not only to describe existing information, but to explain "the need for additional information." 18 CFR 5.11(d)(3). Indeed, there is no scientific justification for disqualifying information as "outdated" and "inadequate" simply because it exists—particularly where baseline conditions have not changed since the collection of the data. FERC's ILP regulations recognize this by requiring prospective applicants to devote considerable resources in identifying existing, relevant information instead of completing an entirely new, comprehensive suite of studies in every licensing proceeding. With regard to this proposed Project, AEA believes as a general matter that use of the 1980s data provides context for data collected in 2012, 2013 and 2014. Further, historic data is useful to ascertaining environmental baseline

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				and assessing longer-term trends. This does not mean, however, that AEA plans simply to revive and re-package the 1980s-era data. As explained in each of AEA's proposed 58 individual study plans, AEA proposes not only to use the 1980s-era studies, but to build upon this wealth of existing data with additional studies and analyses. See also AEA's response to comment GEN-39.
GEN-06	CWA	11/14/2012	There is a "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." – pdf page 2	A detailed overview of the study plan process appears in Section 2 and includes a detailed study plan schedule at Attachment 2-1, which has been prepared at FERC's request. See AEA's response to comment GEN-41. In addition, for each of the 58 studies proposed in the RSP, AEA has included a section entitled "Relationship with Other Studies." This section provides a detailed narrative on how the study uses outputs from other studies and/or provides inputs to other studies. These interdependencies also are illustrated graphically in each study plan. Although this level of detail is not required by FERC's ILP regulations, AEA believes it important for all licensing participants to understand the relationships within the RSP and stay coordinated on these matters.
GEN-07	CSDA	11/14/2012	Request for a biometric review of the 1980's Susitna Hydroelectric Project. – pdf page 4	AEA is not conducting a biometric review of the data collected in the 1980s for the Project. Instead, each study plan in the RSP describes the extent to which—if any—AEA is relying upon the1980s-era data and how that data will be used to meet the goals and objectives of the study plan. See also AEA's response to comment GEN-39.
GEN-08	CSDA	11/14/2012	CSDA expresses concerns about the relationship between the wildlife resources investigations and the application to project impacts on the ecosystem, asserting that "there are not adequate impact assessment analyses to understand the ecological role that species have in the ecosystem." CSDA asserts that "[t]here needs to be knowledge of complex ecological relationships between fish, wildlife, and	AEA's RSP has been prepared in accordance with FERC's ILP regulations, following consultation with CSDA and other licensing participants. While the 58 individual study plans are drafted separately to facilitate fieldwork across several disciplines, AEA recognizes that the impacts analysis related to the Project must be multi-disciplinary. AEA's Environmental Exhibit component of its License Application, upon which will be supported by the studies prepared during the licensing process, will conform with FERC's "Preparing Environmental Assessments: Guidelines for Applicants, Contractors, and

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			vegetation from field studies."– pdf pages 6-7	Staff." 18 CFR 5.18(b). While many of the ecological relationships of fish, wildlife and vegetation will be explored in AEA's License Application, several of the study plans in the RSP contemplate ecological-based investigations that cut across multiple disciplines. For example, the IFS Analytical Framework integrates the analysis of Project effects on riverine processes. Project effects on geomorphology, ice processes, water quality and groundwater/surface water interactions will be used to quantify changes in fish and aquatic habitat and riparian indicators (Section 8.5.4.1). The Evaluation of Wildlife Habitat Use will use information from the botanical and terrestrial studies to provide Project-specific habitat evaluation information for birds, mammals, and amphibians (Section 10.19.4). The River Productivity Study will investigate the contribution of marine-derived nutrients from spawning salmon to freshwater ecosystems (Section 9.8.4.5.2).
GEN-09	CSDA	11/14/2012	"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." – pdf page 7	As explained in Section 1.1 and demonstrated by Appendices 1 through 4 of this RSP, the ILP study process has been open and collaborative. During the study implementation phase, AEA is required under FERC's ILP regulations to provide periodic progress reports during the study phase, and as explained in Section 1.2 and each of the individual study plans, AEA plans to convene quarterly TWG meetings in 2013 and 2014. See also AEA response to comment GEN-01. AEA has not adopted the request to obtain formal peer review of licensing studies. FERC's ILP regulations do not require study reports to be peer reviewed, and the study reports in this in this process will be subject to expert review and scrutiny by all licensing participants, including AEA, AEA's technical consultants, FERC, FERC's third-party contractor, federal and state resource agencies, agencies' technical consultants, Alaska Native entities, and the environmental community.
GEN-10	Various Individuals	11/07/2012 – 11/14/2012	Request for all data and conclusions to go through a peer review process.	See AEA's response to comment GEN-09.
GEN-11	Long, Becky	11/13/2012	Two years of study is inadequate. –pdf page 1	See AEA's response to comment GEN-02.
GEN-12	Long, Becky	11/13/2012	A Biometric Study of the historic studies has been	See AEA's response to comment GEN-07.

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			requested by the federal agencies. This needs to happen." –pdf page 2	
GEN-13	Various Individuals	11/07/2012 – 11/14/2012	Two year study is inadequate; studies should be completed over request 5 to 7-year timeframe.	See AEA's response to comment GEN-02.
GEN-14	Various Individuals	11/07/2012 – 11/14/2012	Consider impacts and merits of dams on other rivers.	Where relevant, the study plans in the RSP have considered the effects and merits of dams on other river systems. For example, the river ice model was developed in part on other river systems that have load-following (Section 7.7). At the same time, the study plans in the RSP—as required by the Federal Power Act (FPA) and National Environmental Policy Act (NEPA)—are designed to identify and analyze effects of the proposed Project.
GEN-15	Various Individuals	11/07/2012 – 11/14/2012	Given thirty years in climate, population, data gathering techniques and the river, use of the 1980s data is inadequate in decision making.	See AEA's response to comment GEN-05.
GEN-16	Various Individuals	11/07/2012 – 11/14/2012	Consider impacts and merits at a national and global level.	AEA does not believe it appropriate to establish a national or global scope for the study plans in the RSP. As detailed in Section 3.1.5, the FPA requires FERC to ensure that a proposed project "is best adapted to a comprehensive plan for improving or developing a waterway," and does not require a broader public interest evaluation. 16 U.S.C. 803(a)(1). The study plans in the RSP are appropriately scoped to allow FERC to fulfill its FPA and NEPA responsibilities.
GEN-17	Teich, Cathy	11/14/2012	"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." –third paragraph for Teich, Cathy (2) file –pdf page 1	AEA will include an alternatives analysis in its License Application, and FERC's NEPA document will include Project alternatives, including a no-action alternative. However, specific studies are not needed for these alternatives analyses, as AEA believes that existing information and the studies in the RSP will support alternative analyses.
GEN-18	CCC	11/15/2012	"Lack of Integration and Coordination among Study Plans" –pdf page 2	See AEA's response to comment GEN-06.
GEN-19	CCC	11/15/2012	"The two-year study period proposed for studies is inadequate" –pdf pages 2-3	See AEA's response to comment GEN-02.
GEN-20	CCC	11/15/2012	"There is no discussion of the potential impact from emergency actions." –pdf page 3	Should FERC issue a license for the proposed Project, FERC will require AEA to develop an emergency action plan (EAP). This is standard practice at large FERC-licensed hydropower projects. AEA will be required to conduct annual functional exercises with local authorities. As required by

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				FERC's project safety regulations, specifics of the EAP would be developed with FERC and the local and State authorities. In addition, as detailed in Sections 16.5 and 16.6, AEA will be conducting Site-Specific Seismic Hazard Study and Probable Maximum Flood Study to ensure that the dam is designed and operated in a safe manner.
GEN-21	CCC	11/15/2012	"It appears that assumptions regarding costs and rates are based only on power optimization scenarios." –pdf page 3	As detailed in Section 8.5, AEA will be conducting studies to assess various operational modes. AEA is using the environmental flows proposed in the 1980s as a starting point for assessing project operation scenarios. AEA plans to investigate full load-following, partial load-following based on primary use of load-following from other existing hydro power projects like Bradley Lake, Eklutna and Cooper Lake. AEA recognizes that maintenance of ecosystem functions may require an assessment of other operational scenarios. These will be developed as resource needs are identified through the environmental resource assessments.
GEN-22	FERC	11/14/2012	"We recommend that [AEA's] RSP clearly track all differences between [its] study proposal and the requested studies, as well as any future comments [AEA] receive[s] on the draft RSP. [AEA's] filing must include an explanation of why any components of the study requests are not adopted."— pdf page 22.	As detailed in Section 1.1, AEA has been working closely with federal and state resource agencies and other licensing participants over the last year to develop this study plan. Following AEA's development of the PSP, AEA continued to consult with licensing participants on the PSP, which led to AEA's release of an interim draft RSP at the end of October 2012. AEA's response to comments received during the numerous TWG and other meetings held during this phase appear in Appendix 3, and documentation supporting these comments (e.g., meeting summaries, e-mail messages) appear in Appendix 4. With regard to the RSP, this Appendix 1 sets forth AEA's response to licensing participants' written comments filed with FERC after November 1, and participants' written comments appear in Appendix 2. Finally, at the request of USFWS and NMFS, AEA has prepared a written "crosswalk" table that compares these agencies' original study requests and the RSP. AEA is providing this "crosswalk" table to these agencies and FERC concurrently with its filing of the RSP.
GEN-23	FERC	11/14/2012	"Adaptive Study Implementation. In multiple study plans, you propose to modify the methods or	The individual study plans in the RSP have been modified and expanded considerably to clearly describe any future decision making. In each

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			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." –pdf page 4	instance in which a future decision is necessary, the study plan includes a process, schedule and criteria that will govern the decision.
GEN-24	FERC	11/14/2012	"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. Provide a clear description of the relationship between 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."–pdf page 5	When preparing the RSP, AEA has taken great care to use consistent language and terminology across all 58 individual study plans. A List of Acronyms and Scientific Labels appears after the table of contents to the RSP. While AEA has made a good faith effort to be consistent with language and terminology, it notes that this RSP spans over 2,000 pages and represents the work of dozens of professionals. Given the scope of this undertaking, some minor inconsistencies are inevitable. With regard to independencies between study plans, please see AEA's response to comment GEN-06.
GEN-25	FERC	11/14/2012	"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." -pdf pages 5-6	Section 1.4 and Attachment 1-1 detail AEA's 2012 study efforts. Where AEA proposes to use the results of the 2012 studies to inform the 2013-2014 studies in the RSP, the individual study plan explains how the 2012 studies will inform or be incorporated into the 2013-2014 study effort.
GEN-26	ADNR-DF	11/14/2012	"The DF 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	AEA has not adopted this information request in any study plan in the RSP, as this requested information is not needed for purposes of FERC's licensing of the Project. AEA anticipates working with ADNR-DF and BLM on this

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			ensure salvage is undertaken. The DF is available to offer assistance with this assessment of the impoundment area." –pdf page 4	issue separately, outside the FERC process, prior to the clearing of the reservoir.
GEN-27	ADNR-ADF&G	11/14/2012	"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." –pdf page 18-19	AEA has decided to organize study plans by resource area, to take advantage of common background issues related to all studies in each resource area. When preparing the RSP, AEA took great care to explain the interdependencies of all proposed studies. See AEA's response to comment GEN-06.
GEN-28	ADNR-ADF&G	11/14/2012	"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." – pdf page 19	When preparing the RSP, AEA significantly expanded discussions on proposed methodologies, federal and state protocols, sampling and quality control procedures, schedules, and decision-making criteria. Many of these changes are based upon consultation among AEA, ADF&G, and other licensing participants.
GEN-29	ADNR-ADF&G	11/14/2012	"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." –pdf page 19	A List of Acronyms and Scientific Labels appears after the table of contents to the RSP. In addition, each resource area has an individual glossary, where necessary. For example, Hydrology-Related Resources (Section 7), Instream Flow (Section 8), and Fish and Aquatics (Section 9), all have an attached glossary.
GEN-30	ADNR-ADF&G	11/14/2012	"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." –pdf page 19	See AEA's response to comment GEN-28.
GEN-31	EPA	11/14/2012	EPA comments that the PSP/RSPs lack the five crucial steps for developing a conceptual ecological models with linked indicators for important resources: 1. Identify the biological and ecological resources of concern; 2. Identify key attributes of each resource that characterize or shape its integrity, including natural	AEA believes that the FERC licensing process, prescribed by regulation, adequately satisfies the steps identified in EPA's comments related to the development of ecological models. Early in the process, during the preparation of the PAD, the prospective applicant must reach out to federal and state resources and gather existing relevant information of the project and its environs. 18 CFR 5.6(b). Using this existing information, the PAD describes the existing environment and resource impacts, including geology

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			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. -pdf pages 8-9.	and soils; water resources; fish and aquatic resources; wetland, riparian, and littoral habitat; rare, threatened and endangered species; recreation and land use; aesthetic resources; cultural resources; socioeconomic resources; tribal resources; and a description of the river basin. 18 CFR 5.6(d)(3). The PAD also includes a preliminary issues list, and federal and state resource agencies and other licensing participants have an opportunity to comment on the PAD. 18 CFR 5.6(d)(4), 5.8(b). FERC then issues a scoping document, convenes an environmental scoping meeting and site visit, and solicits comments on the scoping document. 18 CFR 5.6. Following the scoping process, the prospective applicant develops a proposed study plan—a process that, as described in Section 1.1, has taken AEA nearly a year to complete, in close consultation and collaboration with licensing participants. As a result of this iterative, consultative process, AEA believes that the FERC ILP process unquestionably develops ecological models and an integrated framework for evaluating resources, as illustrated throughout the RSP. For example, the Fish and Aquatics Instream Flow Study—one of the few studies EPA reviewed in detail—clearly shows and describes the development of a number of flow sensitive models that are linked to important ecological processes related to fish and aquatic biota (Section 8.5.4.1; Figure 8.5-10). The framework represents a measurement-oriented approach to assessing the relationship of hydrologic and geomorphic variables to the biological and ecological resources of concern. Stressors associated with Project effects include changes in the volume, timing and quality of instream flow, and changes in ice processes and sediment and large woody debris transport. The effects of these stressors on resources of concern will be evaluated using indicators that measure changes in habitat suitability, quality and accessibility. Reference conditions establish the range of variation for each indicator and will be defined by analysis of unregulated flows under average, wet, dry, hydrologic conditions and warm and cold Pacific decadal oscillation phases. Project effects under alternative operational scenarios are defined as departures from the reference conditions. This framework—and the numerous others throughout the RSP—provides the tools to identify operational scenarios that balance resource interests and quantify any loss of aquatic resources and their habitats that result from Project operations.

General / Global				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
				See also AEA's response to comment GEN-08.
GEN-32	EPA	11/14/2012	EPA comments that in addition to the two key variables affecting fish utilization of the river system identified in AEA's PSP (microhabitat and macrohabitat), "[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 insets, birds, and mammals; etc. – would result in the identification of other key ecological attributes for the aquatic (or aquatic + riparian) ecosystem as a whole." – pdf page 10	The RSP proposes to study key variables identified in EPA's comment, as well as others, that affect fish utilization of the river system, including the following: Baseline Water Quality Study (Section 5.5); Water Quality Modeling Study (Section 5.6); Mercury Assessment and Potential for Bioaccumulation Study (Section 5.7); Riparian Instream Flow Study (Section 8.6); Study of Fish Distribution and Abundance in the Upper Susitna River (Section 9.5); Study of Fish Distribution and Abundance in the Middle and Lower Susitna River (Section 9.6); River Productivity Study (Section 9.8); Aquatic Resources Study within the Access Alignment, Transmission Alignment, and Construction Area (Section 9.13); Genetic Baseline Study for Selected Fish Species (Section 9.14); Distribution and Abundance, and Habitat Use by Large Carnivores (Section 10.8); Aquatic Furbearer Abundance and Habitat Use (Section 10.10); Riparian Vegetation Study Downstream of the Proposed Watana Dam (Section 11.6); and Wetland Mapping Study (Section 11.7).
GEN-33	EPA	11/14/2012	EPA comments that neither the Geomorphology Study and Fluvial Geomorphology Modeling below Watana Dam Study "provides a 'map' of how the variables they propose to measure provide information on the actual key microhabitat and macrohabitat variables of interest, let [alone] 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." EPA expresses the view that "developing such conceptual models should be the responsibility of the teams developing the PSP/RSPs and their partner Technical Working Groups." -pdf page 11	A conceptual model 'map' of how geomorphic variables are used to develop key microhabitat and macrohabitat indicators is now provided as Figure 6.1-1. As described in RSP Section 6.6.4.3.2.2, the Fluvial Geomorphology Modeling below Watana Dam Study includes both reach-scale and focus area scale analyses to provide input to Fish and Aquatic and Riparian Instream Flow Study indicators. The process includes the evaluation of unregulated flows and alternative operational scenarios under existing channel conditions and analyses at future time steps to reflect potential future changes in channel morphology.
GEN-34	EPA	11/14/2012	EPA comments that the PSP "does not ask nor attempt to answer any questions concerning the acceptable range of variation with respect to any of the hydrologic and geomorphic variables that are proposed for study." EPA requests AEA to consider using Amy Corps of	As described in Section 8.5.4.4, an acceptable range of variation in indicator condition will be identified by evaluating existing, unregulated flows over individual water years selected to represent average, wet and dry hydrologic conditions and warm and cold Pacific decadal oscillation phases. In addition, a multi-year, continuous flow record will be evaluated to identify year-to-year

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			Engineer HEC EFM (Ecosystem Functions Model) program. - pdf pages 13-14	variations independent of average, wet or dry conditions. The selection of representative hydrologic conditions and the duration of the continuous flow record will be developed in consultation with the TWG in Q4 2013. The IHA/EFC type statistics described in Section 8.5.4.4.1.3 represent one approach to developing comparative evaluations between existing conditions and alternative operational scenarios. The USACE HEC-EFM is another planning tool that aids in analyzing ecosystem responses to changes in flow. The merits of these planning tools will be discussed with the TWG in Q3 2013, and if HEC-EFM is deemed preferable by the TWG it will be used to support the evaluation of potential Project effects on resources of concern.
GEN-35	USFWS	11/14/2012	"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." –pdf page 2	As noted in Section 1.1.4, AEA has prepared the requested crosswalk table and is providing it to USFWS, NMFS, and other licensing participants under separate cover, concurrent with the filing of the RSP. See also AEA's response to comment GEN-22.
GEN-36	USFWS	11/14/2012	"[T]he 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	See AEA's response to comment GEN-06.

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			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." "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."-pdf page 3	
GEN-37	USFWS	11/14/2012	"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." –pdf pages 3-4	See AEA's response to comment GEN-28.
GEN-38	USFWS	11/14/2012	"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	The two riparian studies (Riparian Vegetation Study Downstream of the Propoased Watana Dam (Section 11.6) and Riparian Instream Flow Study (Section 8.6)) have been revised significantly since the PSP to, among other things, improve the coordination between the individual study plans. In the Riparian Vegetation Study Downstream of the Propoased Watana Dam (Section 11.6), detailed data will be collected on existing vegetation and soils, existing riparian vegetation in the Susitna River floodplain will be

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			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." –pdf page 4	mapped, and vegetation succession will be modeled. The data collected in Focus Areas (previously Intensive Study Reaches) and the successional modeling results from the Riparian Study will then be used by researchers in the Riparian Instream Flow Study (RSP Section 8.6) to prepare a spatially explicit model to predict Project-influenced changes in riparian vegetation across the floodplain study area. Researchers in the Instream Flow Study also will be responsible for incorporating information from the Groundwater Study (Section 7.5), Fluvial Geomorphology Modeling below Watana Dam Study (Section 6.6), and Ice Processes in the Susitna River Study (Section 7.6) in their modeling to predict Project-influenced changes in riparian vegetation. More details on the collaboration between the various studies are provided in Sections 11.6.4.2, 11.6.4.4, 11.6.7, and 8.6.
GEN-39	USFWS	11/14/2012	"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	As contemplated by FERC's ILP regulations, AEA has expended a significant effort to synthesize the 1980s data. The results of the initial synthesis were presented in the Pre-Application Document (PAD). See AEA's response to comment GEN-05. AEA notes that over 3,000 documents were produced during the intensive studies of the 1980s. AEA will continue to review this information and include relevant information in the currently proposed studies. This effort will continue through 2013 and 2014. Although the proposed APA project in the 1980s was different than the anticipated RCC proposed Project today, the historic environmental information remains relevant, including from an historic and trends perspective. Further, the impacts assessment should not be discounted. Much of the assessment contained in the 1983 application, FERC's draft EIS, and the 1985 amended License Application may be useful for comparison of the impact assessment to be completed for the 2015 License Application.

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			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 propose Project. Past studies only concentrated on a few fish species and potential effects to their macrohabitats; 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." –pdf page 4	AEA concurs that supplemental information should be collected and has included objectives and methodologies for collecting additional habitat and fisheries data in the RSP. AEA also agrees that technological advancements have been made since the 1980s and the RSP has been developed to capitalize on those advancements. The 2015 License Application will utilize the current studies and the historic information to develop protection, mitigation and enhancement measures, as appropriate.
GEN-40	USFWS	11/14/2012	"Adherence to the [process plan, schedule and communications protocol] 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." –pdf pages 4-5	AEA agrees with this comment. As explained in detail in Section 1, AEA has exceeded the requirements in FERC's ILP regulations in its efforts to collaborate and consult with licensing participants. AEA recognizes the importance of working closely with licensing participants in the development of licensing studies that will support AEA's License Application, inform protection, mitigation and enhancement measures, serve as a foundation to environmental review under NEPA, and support all needed state and federal permits including FERC's licensing determination under the FPA. While AEA endorses the Communication Protocol and will continually assess and improve its efforts to the ideals expressed therein, it does not intend to allow strict adherence to the Communication Protocol unintentionally to stifle the frequent dialogue, informal communications, and exchange of ideas that AEA believes are essential to resolving disputes and achieving consensus on the many complex issues related to this licensing effort.
GEN-41	FERC	11/14/2012	"To avoid future coordination and reporting concerns expressed by the National Marine Fisheries Service in	A detailed overview of the study plan process appears in Section 2, and a comprehensive master schedule appears at Attachment 2-1. In addition,

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			their October 31 filing, 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." –pdf page 1	each of the 58 individual study plans contains a "Schedule" section, which discusses (and charts) the estimated start and completion date for field studies, provides the date for filing the Initial Study Report and Updated Study Report, and a discussion of regular progress reporting. Each study plan also includes a section entitled "Relationship with Other Studies," which provides a detailed narrative on how the study uses outputs from other studies and/or provides inputs to other studies. These interdependencies are illustrated graphically in each study plan. With regard to regular progress reporting, please see AEA's response to comment GEN-01.

Geology and Soils Characterization Study				
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GS-01	CSDA	11/14/2012	"The study appears to be confined to the immediate area of dam construction and access road only." –pdf page 10	As explained in RSP Section 4.5.3, the Geology and Soils Characterization Study will include extensive investigations to characterize the geologic, geomorphic, and seismic conditions in the Project area, including the dam site, reservoir, and proposed access and T-line corridor areas. Although there is a focus of the investigations is on the dam site, a comprehensive regional investigation is also planned for the Project "region or area" to better understand and characterize the geology and soil resources of this remote region as well as to identify potential impacts and the development of appropriate mitigation measures for the project These studies include review and evaluation of previous geologic, geomorphic and seismic reports for the area and region; plan and implement comprehensive field investigations and testing in the project area to characterize the surficial and bedrock geology and soils materials, groundwater, slope stability and permafrost conditions, make assessments of the dam site foundation area, mineral resources including construction material and minerals, seismic hazards, slope stability and erosion potential including along the proposed reservoir rim; reservoir triggered seismicity; and establish a network of seismic monitoring stations to augment those of the Alaska Earthquake Information Center reservoir triggered seismicity.
GS-02	CSDA	11/14/2012	"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 the sediment into the reservoir, especially during any seismic activity. . . 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."–pdf page 11-13	As explained in RSP Section 4.5.3, the Geology and Soils Characterization Study includes extensive investigations to characterize the geologic, geomorphic, and seismic conditions in the project area including the dam site, reservoir, and proposed access and T-line corridor areas. The use of the term "geologic features" refers to structural geologic features here. Mass wasting features are being studied and an assessment will be made in the Project area – dam site, reservoir, and corridor areas. Details of the investigations and studies of the geologic, geomorphic, and seismic conditions are in development as AEA employs ongoing and thorough evaluations of project data based on the findings and assessments made while building on the 1975-1986 and 2011-12 data and studies. AEA employs a phased, flexible approach to planning and implementation of field investigations, testing, and instrumentation and to thorough evaluations of geologic, geomorphic and seismic conditions hazards for the Project. See also AEA response to comment GS-1.
GS-03	ADNR-DGGS	11/14/2012	Page 4-4 of PSP section 4.5 "Necessary laboratory tests of physical and strength properties of rock and	Section 4.5.4 provides that both physical and chemical testing as well as petrographic analysis will be undertaken in order to characterize the geology and

Geology and Soils Characterization Study				
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			soil should include solubility testing of component minerals." –pdf page 12	soils materials.
GS-04	CIRI	11/14/2012	Conduct a Mineral Resource Assessment Study including a detailed description of known or exploitable mineral resources within and outside of the Project boundaries. The proposed study appears to be limited to the project footprint. FERC regulations require geology and soils evaluation to include impacts to non-project lands that would be directly or indirectly impacted by the project (citing 18 CFR 4.41(f)) and FERC SD2 requires study to include assessment of access to proven or probable mineral deposits. –pdf page 2	CIRI's reliance on 18 CFR 4.41(f) is misplaced, as this regulation expressly does not apply for applications prepared pursuant to FERC's ILP regulations. 18 CFR 5.18(b). Instead, AEA's Exhibit E (Environmental Exhibit) will follow FERC's "Preparing Environmental Assessments: Guidelines for Applicants, Contractors, and Staff." *Id.* FERC's ILP regulations, moreover, require the application to analyze any effects identified in FERC's environmental scoping documents. 18 CFR 5.18(b)(5)(ii)(A). Here, FERC's Scoping Document 2 (SD2) states that its EIS will include evaluation of the "effects of project construction and operation on access to proven or probable mineral deposits." SD2, Section 4.2.1. Consistent with these requirements, AEA's Geology and Soils Study plan will identify impacts "in the Project area, including the dam, reservoir, and access and T-line corridors." Section 4.5.1. The Regional Geologic Analysis and Mineral Resources Assessment will include a survey to identify proven and probable mineral resources using existing data to assess mineral potential and mining activity in the impoundment area (Section 4.5.4). Moreover, the study area is not limited to the footprint of the impoundment, but includes the area in the general vicinity of the impoundment, as this is the area where access to mineral resources is most likely to be affected (Section 4.5.3). The survey will include mapping of known deposits, identification of likely areas of mineral resources, plus field reconnaissance of selected areas of high mineral potential, and analysis of mineral potential from borings and other sampling work undertaken in connection with geotechnical investigations. The purposes of these investigations are to support development of Project design, as well as to assess impacts of Project construction and operation on geologic, soil and other environmental resources. These investigations, however, are not intended to assess the value or exploitability of mineral resources, as these issues are beyond the scope of the FERC licensing process.

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WQ-01	CCC	11/15/2012	"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." – pdf page 5	Extensive water quality data will be collected at non-productive areas of the river, including sloughs. This will be performed primarily during the focus study area sampling. A description for the Focus Areas (Section 8.5) can be found in Table 8.5-7 including a site description and rationale for selection.
WQ-02	FERC	11/14/2012	"Clearly describe the exact number, location, and spatial extent of your proposed focus areas for each proposed study. Provide justification for the number of proposed sites selected for detailed 2-D hydraulic modeling and other intensive study elements. Include criteria to be used for selecting focus areas and study-specific rationale for co-locating sites." –pdf page 5	The sites selected for detailed 2-D hydraulic modeling are fully described in Section 6.6.3.1 of the RSP including rationale for selection. Please also see response GEO-06 for more detailed information. Focus Area selection is based on representative mainstem Susitna River reaches, side channels, and sloughs where important fisheries habitat has been identified (Seciton 8.5.4.2 of the RSP). The results for this study will be used in Study 8.5 (IFIM) and monitoring of the water quality parameters listed in Section 5.5.4.5 in the Baseline Water Quality Study. Other considerations for representative Focus Area reach selection have been the influence on groundwater on surface water quality conditions. Resolution for modeling select water quality parameters in Focus Areas will be finer (100 m) than for the mainstem Susitna (250 m to 1 km) modeling effort. The Focus Area model will be nested within the mainstem model framework coupled with the same hydraulic routing model. The objective is to determine how water quality conditions may change with surface elevation changes due to alternative Project operational scenarios. A description for the Focus Areas (Section 8.5 of the Revised Study Plan) can be found in Table 8.5-7 inlcuding a site description and rationale for selection.
WQ-03	FERC	11/14/2012	"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." –pdf page 6	Inconsistencies between the text and Table 5.5-2 regarding river miles associated with meteorological stations have been addressed in Section 5.5.4.3. River miles reported in Table 5.5-2 reflect actual locations where MET Stations have been

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				established in 2012 and are currently collecting continuous data at 15-minute intervals. Currently, 3 new MET Stations have been established below the proposed dam site (riverine), at the dam site (forebay of the proposed dam), and above the upstream end of the proposed reservoir. Additional potential locations for updating existing MET Station sites have been examined, but not yet established. The 3 new MET Stations are necessary for providing input in constructing the virtual reservoir model and for use in constructing the riverine model.
WQ-04	FERC	11/14/2012	"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." –pdf page 6	The reference to monthly site visits at Focus Areas (Section 5.5.4.8) has been revised to reflect the same sampling frequency stated in Section 5.5.4.5 of the Revised Study Plan. Sampling for water quality conditions at Focus Area reaches will be conducted every two weeks. Continuous monitoring of water temperature and dissolved oxygen will be conducted continuously using datalogging probes (Section 5.5.4.8 of the RSP).
WQ-05	FERC	11/14/2012	"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." –pdf page 6	Thermal imagery will be calibrated with select temperature probes currently located on the mainstem Susitna River and have been logging temperature data at 15 minute intervals in the middle river (the extent of the thermal imagery data). The *in situ* probe data will be matched by time and location on the river with thermal imagery recorded at the same time and location. The coupling of these data using actual temperature data with spectral patterns in the digital imagery will be analyzed for consistency of the relationship and spatial extrapolation to other areas of the river will be made (Section 5.5.4.9). If the thermal imaging is not successful, the study component will be reevaluated (RSP Section 5.5.4.9). Future actions will depend on the causes of the failure. Potential solutions would include: • Hand held FLIR meters that could be used during stream side studies, and a more focused thermal mapping task within Focus Areas using hand-held

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				temperature meters and probes may prove useful. • Use of documentation of open water leads as a substitute. • Outfit the R44 helicopter to take advantage of regular field presence. Thermal imagery could be shot all summer long and brief intervals of ideal conditions could be used. • The Focus Area results represent habitat identified as representative of the most important for fisheries use as described by the rational for site selection in Section 8.5.4.2 of the RSP. These results can be extrapolated to similar reaches, side channels, and sloughs in other areas of the Susitna drainage not directly monitored in this study to determine thermal refugia for fish. Thermal imagery data is currently being calibrated with continuous temperature monitoring collected during the same time frame during 2012 from the Middle River sites beginning RM 98.5 through RM 165 (below the beginning of Devils Canyon).
WQ-06	FERC	11/14/2012	"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." –pdf page 6	Temperature probes were calibrated in the office by first identifying 4 units that would serve as controls and not be deployed in the field. These probes and the field deployed probes were submersed in room temperature water bath and then an ice bath in the laboratory and the times and temperature for each bath recorded using a NIST calibrated thermometer. Once probes are retrieved from the field and re-submersed into similar bath tests, battery power and temperature measurements are compared for measurement drift and battery power. A correction factor for field probes will be developed based on this relationship so that all field data can be corrected, if necessary. Interim temperature measurements are made using a NIST calibrated thermometer during each download interval at the field sites. Surface water temperature is measured prior to removing the temperature probe from the water and time of measurement is made. A comparison between the instantaneous site temperature

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				and the probe temperature determines interim correction factors. Calibration procedures as outlined above are included in the 2012 Water Temperature Monitoring QAPP (Section 5.8, Attachment 5-1, B8.0 of the RSP).
WQ-07	FERC	11/14/2012	"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." –pdf page 6	Additional detail describing content of the Interdependency Chart is provided in Section 5.5.7 of the Revised Study Plan.
WQ-08	FERC	11/14/2012	"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." –pdf page 6	Agree. AEA has revised RSP Section 5.6.4.8 in response to this comment.
WQ-09	FERC	11/14/2012	"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." –pdf page 7	AEA has revised the plan to address inconsistencies in referencing of river miles. The updated river mile list reflects shifts of some monitoring sites upstream/ or downstream in order to have access to current temperature monitoring sites and future water quality sampling sites.
WQ-10	FERC	11/14/2012	"In section 5.6.4.8, please clarify what is meant by the statement: measuring additively 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." –pdf page 7	AEA has revised the plan in response to this comment. The revised statement reads as follows: "Measuring additively or synergism of toxics effects is possible using laboratory bioassays, but may not be adequately predicted by a model. The level of uncertainty in extrapolating results from laboratory to field conditions is large and potentially unreliable." Mumtaz et al. (1998) describes a weight of evidence (WOE) approach that estimates potential toxicity of mixtures using a weighting factor to modify chronic or acute toxicities. This is a qualitative approach that address additive or synergistic effects of metals mixtures. Additional explanation for how a mixture of metals and resulting toxicities to aquatic life will be addressed is found in AEA's response to comment WQMOD 06.
WQ-11	FERC	11/14/2012	"Section 5.6.6, Schedule, contains two different versions of the schematic titled Interdependencies for Water Resource Studies. Please	Outdated version of the Interdependency Table removed. See Figures 5.5-3, 5.6-2 and 5.7-3. A single updated Interdependency

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			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." –pdf page 7	Chart is used for all three studies.
WQ-12	FERC	11/14/2012	"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…" –pdf page 7	Relevant literature citations have been added to Section 5.7.2 to accompany the statement made in Section 5.7.1 ("Based on several studies…") in the RSP following the sentence beginning with "Many studies…"
WQ-13	FERC	11/14/2012	"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." –pdf page 7	The list of mechanisms associated with the production of methylmercury in freshwater has been revised in Section 5.7.2 to reflect the toxics Pathway Diagram for mercury. Relevant environmental condition factors and transfer mechanisms will be visually described with companion explanation for how the production and transfer mechanisms are activated. The focus for methylmercury will be on production in the sediments and mobilization in the water column. The bioaccumulation of methylmercury in aquatic life will be examined using two transfer mechanisms: 1) direct contact and absorption, and 2) consumption of food with adsorbed toxics. Detail has been included in the study plan as part of the description for how methylmercury is cycled in the aquatic ecosystem. The focus for methylmercury production is on sediments and sediment boundary layer conditions that would promote methylization of mercury. Once methylmercury is produced and released from sediments, contact with aquatic organisms' tissues in the water column will be the primary pathway for bioaccumulation. Anoxic conditions in the water column occur as a result of two activities: 1) cellular respiration by bacteria and dark cycle phytoplankton metabolism, and 2) bacterial demand of oxygen in

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				the water column as suspended organics are used for growth and division into multiple cells. Inorganic mercury is used as a carrier in cellular metabolism and is associated with organic by-products before depuration, or release, as a metabolic by-product. Bacteria are consumed by lower trophic levels like benthic macroinvertebrates that scrape foodstuffs from hard substrate. The biofilm that forms on hard substrates are comprised by bacteria that create a microenvironment promoting proliferation of the bacterial community and use organics that settle out of suspension from the overlying water column. The benthic macroinvertebrates (BMI) are consumed by predatory BMI and grazing fish. The biofilm on hard substrates have methylmercury and other toxics in it and has been demonstrated as the way in which toxics re transferred up the food chain. Larger predators accumulate mercury by indirect means and biomagnify the toxics. Methylmercury will strongly associate with organic particles suspended in the water column. The consumption of these particles may be consumed by zooplankton, free-swimming or adsorbed to respiratory tissue from any aquatic organisms.
WQ-14	FERC	11/14/2012	"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." –pdf page 7	The proposed study will describe impacts from road crossings on mercury concentrations. Several access road corridors are currently under consideration. One road will be constructed in order to access the proposed dam site. Road crossings constructed are expected to impact streams at each of the crossings and these locations will be surveyed for toxics concentrations above background in sediment and surface water. This information has been added to section 5.7.3. of the RSP. Additional details regarding proposed mercury sampling sites is described in section 5.7.4 and Table 5.7-5 in the Revised Study Plan.
WQ-15	FERC	11/14/2012	"Section 5.7.4.2, Collection and Analyses of Soil, Vegetation, Water, Sediment, Sediment Pore Water, Avian, Terrestrial Furbearer, and Fish	Section 5.7.4.2 of the Revised Study Plan provides greater detail for sampling bioaccumulated mercury in tissue media (e.g., birds,

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			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." –pdf page 8	mammals, and fish) and environmental media (e.g., terrestrial soil, water sediment, and pore water).
WQ-16	FERC	11/14/2012	"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." –pdf page 8	Study Plan has been revised in the appropriate section.
WQ-17	FERC	11/14/2012	"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." –pdf page 8	Please see AEA's response to comment MERC 07.
WQ-18	ADEC-Division of Water	11/14/2012	Page 5-14 in PSP section 5.5.4.3.1 "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.'" –pdf page 15	AEA has revised language in the RSP Section 5.5.4.4.1 in response to this comment.
WQ-19	ADNR-ADF&G	11/14/2012	"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." –pdf page 19	Calibration of thermal imagery and products completed in winter 2012 are addressed in AEA response to WQ-05.
WQ-20	ADNR-ADF&G	11/14/2012	"Information is needed on the availability of the "Sampling and Analysis Plan" and the 'Quality Assurance Project Plan'." –pdf page 19	SAP/QAPPs have been prepared and are included in the RSP as Section 5.8: Attachments 5-1, 5-2 and 5-3.

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WQ-21	ADNR-ADF&G	11/14/2012	"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." –pdf page 19	SAP/QAPPs (Section 5.8: Attachment 5-1) include language on calibration of field sensors and equipment as suggested.
WQ-22	ADNR-ADF&G	11/14/2012	"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." –pdf page 19	At least three monitoring strategies are currently implemented or proposed: 1) continuous temperature monitoring (currently implemented in 2012), 2) monthly site visits for water quality (2013 through 2014), and 3) Focus Areas (intensively sampled water quality with continuous temperature and dissolved oxygen monitoring probes installed 2013/2014 and sampling every two weeks for all other parameters). To adequately characterize basic water quality parameters within the Susitna River frequent (continuous) measurements of temperature and DO will be collected at 15-minute intervals within the Focus Areas (Section 8.5; Table 8.5-7). Continuous monitoring has already been implemented for surface water temperature at mainstem sites from RM 15.1 through RM 233.4. Continuous measurements of conductivity, pH, and turbidity require use of multi-parameter probes that are easily damaged and lost under conditions in the Susitna River. Because of the unfavorable conditions within the Susitna River, continuous measurements of conductivity, turbidity, and pH will not be collected. However, measurements of these parameters will be collected every 2-weeks within the Focus Areas and will be at a frequency adequate for description of dynamic water quality conditions in each area. Monthly site visits are adequate at all other sites in terms of characterizing general water quality conditions (nutrients, metal concentrations, etc).
WQ-23	ADNR-ADF&G	11/14/2012	"Baseline metals and mercury assessment are not the same. What is being sampled and to what standards? What metals are being studied?" –pdf page 22	Metals and mercury assessment are being studied on a broader scale as input to the water quality model. The separate mercury assessment study (Section 5.7 of the RSP) is focused on tributaries and mainstem of the Susitna below and above the proposed dam location. Multiple media like surface water,

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				sediment, and fish tissue analysis will be used to determine potential for bioaccumulation in fish from this area. The metals being sampled in these media can be found in Table 5.5-3 of the RSP. Fish tissue sampling is described in Section 5.7.4.2.6 of the RSP including species, age, and field procedures suggested for describing potential for bioaccumulation of methylmercury. This information coupled with results generated from Section 8.5.2.1.2 in the RSP (Fish Distribution and Abundance in the Upper Susitna River) will be used to determine the risk of potential for bioaccumulation of methylmercury to existing fisheries. Metals to be analyzed in fish tissue are listed in Table 5.5-3. of the RSP.
WQ-24	TNC	11/14/2012	"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." –pdf page 3	Currently, water quality sampling and temperature monitoring is proposed to extend down to RM 10.1. We are collecting temperature data as low as RM 15.1 for the 2012 Temperature and MET Station Study.
WQ-25	USFWS	11/14/2012	"In general, the PSP adequately addresses the water quality issues. The Service recommends specific improvements, as follows:"	AEA appreciates USFWS concurrence with the RSP and appreciates USFWS participation in study plan development.
WQ-26	USFWS	11/14/2012	"Standard Operating Procedures:	The RSP has been revised to address this comment in Section

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			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." –pdf page 6	5.5.4.4.2 and Section 5.7.4.2. SAP/QAPPs have been prepared and are included in the RSP as Section 5.8: Attachments. SAP/QAPP documents describe appropriate techniques and SOPs to be implemented during water quality sampling.
WQ-27	USFWS	11/14/2012	"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." –pdf page 6	The RSP has been revised to address this comment in Section 5.5.4.4.2 of the RSP. Months when sampling will occur are stated in this section of the RSP and samples will likely be collected in the middle of each month. The initial sample event will be launched to reflect conditions during early summer snowmelt and late season glacial melt. The intervals when these events occur are at least two weeks in length and will be captured by the monthly water sampling effort.
WQ-28	USFWS	11/14/2012	"Sampling timing and location. 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." –pdf page 6	The RSP has been revised to address this comment in Section 5.5.4.4.2.
WQ-29	USFWS	11/14/2012	"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." –pdf page 6	DOC is included in the RSP as a parameter to be analyzed for the baseline WQ-monitoring program. See Table 5.5-3. This table has been revised to reflect monthly collection of DOC whenever surface water samples are collected for metals analysis. This revision is also reflected in the SAP/QAPP (Section 5.8; Attachments).
WQ-30	USFWS	11/14/2012	"Water Quality Standards The PSP should develop and present evaluation criteria specifically	Human health will be protected using existing EPA and state guidelines for fish consumption and water quality. We will also be

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			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." –pdf page 7	looking at NOAA SQuirT tables (RSP Section 5.7.4.5) for guidance. Ecological receptors will have individual calculations of risk using an exposure and toxicity assessments to link a chemical of potential concern with adverse ecological effects (known as the toxicity reference value or TRV). The hazard quotient (HQ) is the ratio of average anticipated concentration of being ingested to the known concentration where adverse effects may occur. It will be calculated for all species for which significant samples are available (RSP Section 5.7.4.2.5.4).
WQ-31	USFWS	11/14/2012	"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" –pdf page 7 – pdf page 7	Included in the SAP/QAPP for Study 5.5; Section 5.8, Attachment 5-1; B1.0 and B2.0. Table B1-1 in the SAP/QAPP for Study 5.5 lists all parameters to be analyzed as part of the baseline WQ-monitoring program by sample type (media type) and the frequency of collection. The SAP/QAPP for Study 5.5 can be found in Section 5.8 of the RSP. For the Baseline WQ-monitoring study sediment samples for mercury/metals analysis will be collected just below and above the proposed dam site. Additional samples will be collected near the mouths of tributaries near the proposed dam site, including Fog, Deadman, Watana, Tsusena, Kosina, Jay, and Goose creeks, and the Oshetna River. Sediment samples will be collected during one sampling event during the summer. For the Baseline WQ-monitoring study fish tissue samples for mercury/metals analysis will be collected near the vicinity of the Susitna-Watana Reservoir in late August or early September. A table will be developed for the Technical Report that will summarize comparative standards for each analyte and matrix analyzed.
WQ-32	USFWS	11/14/2012	"Our study request indicated that "Additional temperature monitoring locations will be identified in cooperation with Fish Studies, the	AEA has added to the RSP continuous temperature monitoring to be conducted within the Focus Areas (Section 8.5 of the RSP;

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			Groundwater Study, and the Instream Flow study to identify areas of thermal refugia for fish". This does not appear in the study plan." –pdf page 7 –pdf page 7	Table 8.5-7). Temperature probes placed within the Focus Areas will generate temperature data at 15-minute logging intervals. The Focus Area monitoring locations were identified in cooperation with Fish studies, the Groundwater study and the instream flow study (see Section 8.5.4.2 in the RSP). The continuous temperature data collected in the Focus Areas help will to determine areas of thermal refugia.
WQ-33	USFWS	11/14/2012	"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." –pdf page 7	Continuous temperature data is currently being collected at 33 Susitna River and tributary sites. Recovery of data from winter months may be compromised by loss of equipment due to physical conditions at each site (see Section 5.5.4.1 of the RSP).
WQ-34	USFWS	11/14/2012	"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." –pdf page 7	Upgrading existing MET Stations is currently being explored and permission from station owners is being sought. If permission to add monitoring equipment is granted by the owner of an existing MET Station then the location and types of monitoring data will be included for use in calibrating the reservoir and riverine water quality models (see Section 5.6.4.8 of the RSP).
WQ-35	USFWS	11/14/2012	"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." –pdf page 7	Federal hydrologists requested a minimum of 12 MET Station placements. AEA responded, with consultation from Tetra Tech modelers that fewer were adequate in calibrating both the riverine and reservoir models. New MET Stations installed in 2012 collect data from the uppermost extent of the reservoir, the conditions at the site of the proposed dam, and a riverine location typical of the Susitna River mainstem corridor. These representative locations for collection of meteorological data will be adequate for determining influence of localized climate conditions for the EFDC model. One strategy for adding to the pool of MET Stations is to attempt to upgrade existing MET Stations operated by other agencies with equipment that would generate any missing measurements not currently installed at individual stations.
WQ-36	USFWS	11/14/2012	"The Service's study request included three MET station parameters	The following are in the RSP: Solar radiation and

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			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." –pdf page 7	evapotranspiration. Snow depth and precipitation are currently not included. Snow depth and precipitation are measured using the same apparatus, however, MET Stations must be visited routinely in order to make measurements and service the tipping bucket to ensure accurate readings. Some of the MET Station sites are inaccessible during the winter months. The current data generated at 3 new MET Stations installed by AEA contractors are adequate for use in calibrating and running the riverine and reservoir models (see Section 5.5.4.2. of the RSP).
WQ-37	USFWS	11/14/2012	"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." –pdf page 8	SAP/QAPPs for each study have been prepared and included in the RSP as Section 5.8: Attachments. Language requiring a SAP/QAPP has been added to the RSP (Section 5.5, Section 5.6, and Section 5.7). Sampling details associated with each proposed study are included in the appropriate SAP/QAPP. The SAP/QAPPs were prepared according to Alaska state guidelines.
WQ-38	USFWS	11/14/2012	"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." –pdf page 8	The thresholds and criteria are currently incorporated by reference into the document (RSP Section 5.5.4.8 and 5.7.4.5 for NOAA SquiRT; ADEC, 2003) These thresholds will be defined based upon input from USFWS and other state and federal agencies.
WQ-39	USFWS	11/14/2012	"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." –pdf page 8	Parameters listed in comment have been added to Table 5.5-3 in the RSP and samples will be analyzed for those parameters according to methods listed in Table 5.5-3 of the RSP.
WQ-40	USFWS	11/14/2012	"Page 5-13, paragraph 3, the PSP states: "Metals monitoring for total and dissolved fractions in surface water include the full set of	The requested information has been added to Section 5.5.4.7 of the RSP (Baseline Metals Levels in Fish Tissue). The elements

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			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." –pdf page 8	analyzed are measured in fish filets by ADECs Fish Monitoring Program. The information may be shared by ADEC with the State Health Department to develop fish consumption advice, if necessary. Some of the toxics proposed for monitoring in surface water may be bioaccumulated in fish in two ways: 1) through respiratory tissue like gill filaments, and 2) by consumption of food that has adsorbed toxics associated with particles. The sampling data will consider the type of toxic and the pathway for bioaccumulation by aquatic organisms.
WQ-41	USFWS	11/14/2012	"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." –pdf page 8	Besides comparison of water quality results with drinking water primary maximum contaminant levels, NOAA SQuiRT tables have been included in Section 5.5.4.8 of the RSP for use in determining protection of ecological receptors and whether chronic or acute toxicity to aquatic organisms is present.
WQ-42	USFWS	11/14/2012	"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." –pdf page 8	Current language in RSP states that sampling will be conducted once a month from June through September and twice in the winter (once in December and March). The limited winter sampling was proposed due to a review of existing data that shows few criteria exceedences occur during winter months. Section 5.5.4.4.2 of the RSP states "If the 2013 data sets suggest that metals and other general water quality parameters exceed criteria or thresholds, then an expanded 2014 water quality monitoring program will be conducted to characterize conditions on a monthly basis throughout the winter months."
WQ-43	USFWS	11/14/2012	"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	In response to this comment, the following language has been added in Section 5.5.4.4.2 of the RSP: "Water quality indicators like conductivity (specific conductance) have been suggested as a surrogate measure for transfer of metals from groundwater to

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			completely ineffective for toxic inorganic elements present in relatively "trace" concentrations." –pdf page 8-9	surface water or in mobilization of metals within the river channel. Should the one-time survey for metals at each of the sampling sites show elevated concentrations of select parameters, then a full list of metals sampling will be conducted one time that analyzes groundwater concentrations in order to adequately characterize current conditions. Available USGS data from select continuous gaging stations will be reviewed for increases in specific conductance during monthly and seasonal intervals, and these results will be used to determine if further metals sampling is warranted during additional winter months."
WQ-44	USFWS	11/14/2012	"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." –pdf page 9	A flow-integrated sampling technique will not be used as data generated using this technique will not answer how representative the single location grab sample at a site is of the Susitna River cross-section. Section 5.5 of the RSP includes language describing the sampling approach proposed for the 2013 sampling period. Water samples will be collected at each monitoring location along a transect. Samples will be collected at 3 equidistant locations along each transect and at 2 discrete depths for a total of 6 samples per site. Section 5.5.4.4.2 in the RSP has been revised to include this transect sampling approach. Specific sampling details are included in the SAP/QAPP which is in Section 5.8: Attachments.
WQ-45	USFWS	11/14/2012	"As a general note, reference to USGS guidance for conducting water quality sampling has been deleted throughout the AEA PSP." –pdf page 9	Protocols for collection of water, sediment, and fish tissue samples will be following ADEC and U.S. EPA Guidance included in Section 5.5.4.4.2 of the RSP. The USGS flow-integrated sampling technique was removed from the RSP because it would be extremely difficult to use under the conditions and setting of the Susitna River. In addition, the objective for collecting data from several locations along a transect is to characterize how variable water quality is along a cross-section of the river versus a single grab sample at one location on the transect.
WQ-46	USFWS	11/14/2012	"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	Section 5.5 of the RSP includes a description for how tocis pathways analysis and toxics modeling analysis will be completed (see Section 5.5.4.6 of the RSP. In addition, strategy for how modeling of toxics using EFDC and secondary modeling tools

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			aquatic life, and for mixture toxicity (the elements are not present in isolation). Metals do not have to bioaccumulate to have a toxic effect." – pdf page 9	(e.g., limited use of the Biotic Ligand Model) is described in WQMOD 06 in the Section 5.6 Comment/Response Table.
WQ-47	USFWS	11/14/2012	"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." –pdf page 9	Section 5.5.4.6 of the RSP fully describes a strategy using pathways analysis that identifies transfer gradient of toxics by means of direct contact with of respiratory tissue or by consumption of food with adsorbed toxics.
WQ-48	USFWS	11/14/2012	"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." –pdf page 9	Please see AEA's response to comment WQ-41. Language addressing comment included in RSP Section 5.5.4.4.8.
WQ-49	USFWS	11/14/2012	"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." –pdf page 9	Please see AEA's response to comment MERC 20.
WQ-50	USFWS	11/14/2012	"Page 5-17, paragraph 4, the PSP states: "Results will be reported with respect to applicable Alaska State and federal standards".	AEA has revised Section 5.5.4.7 and other portions of the RSP that reference protective criteria for beneficial uses. The primary

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			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." –pdf page 9-10	approach for evaluating acceptable concentrations of pollutants in surface water will be comparison against Alaska Water Quality Standards (18 ACC 70.020(b)). Other thresholds will be used as guidance for interpreting condition of water quality and other media (please see AEA's response to comment WQ-41).
WQ-51	USFWS	11/14/2012	"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." –pdf page 10	Please see AEA's response to comment MERC 08. The potential for biomagnification of mercury in fish tissue will be determined prior to Project development. Current conditions for mercury transfer to fish tissue will be compared with post-dam construction conditions to determine the likelihood for mercury bioaccumulation.
WQ-52	USFWS	11/14/2012	"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." –pdf page 10	Please see AEA's response to comment MERC 06. Several media will be sampled based on the potential of transfer of mercury during and after flooding of the reservoir.
WQ-53	NMFS	11/14/2012	"In general, the PSP adequately addresses the water quality issues, but there are several areas that require improvements, specifically:" -pdf page 28	Thank you. Please see AEA's response to comment WQ-53.
WQ-54	NMFS	11/14/2012	"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 HandslDirty Hands") to limit sample	The RSP has been revised to address this comment in Section 5.5.4.4.2 and Section 5.7.4.2. SAP/QAPPs have been prepared and are included in the RSP Section 5.8: Attachments. SAP/QAPP documents describe appropriate techniques and SOPs to be implemented during water quality sampling.

Baseline Water Quality Study				
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			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." -pdf page 28	
WQ-55	NMFS	11/14/2012	"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." –pdf page 28-29	Please see AEA's response to comment WQ-27.
WQ-56	NMFS	11/14/2012	"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." –pdf page 29	The RSP has been revised to address this comment in Section 5.5.4.4.2.
WQ-57	NMFS	11/14/2012	"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." –pdf page 29	Please see AEA's response to comment WQ-29.
WQ-58	NMFS	11/14/2012	"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." –pdf page 29	Please see AEA's response to comment MERC 05.
WQ-59	NMFS	11/14/2012	"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	Please see AEA's response to comment WQ-30.

Baseline Water Quality Study				
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			human health (0.050 ~g/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." –pdf page 29	
WQ-60	NMFS	11/14/2012	"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." –pdf page 29	AEA believe that results from the implementation of the RSP will enable NMFS to assess the project effects.
WQ-61	NMFS	11/14/2012	"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." -pdf page 30	Please see AEA's response to comment WQMOD-04. A QAPP has been prepared for the WQ-modeling Study and is included in Section 5.8: Attachments. The QAPP describes model initialization and calibration procedures that will be implemented.
WQ-62	NMFS	11/14/2012	"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	Please see AEA's response to comment WQMOD 03.

Baseline Water Quality Study				
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			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." -pdf page 30	
WQ-63	NMFS	11/14/2012	"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." -pdf page 30	Please see AEA's response to comment WQMOD 06.
WQ-64	NMFS	11/14/2012	"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)." -pdf page 30	Please see AEA's response to comment WQMOD 06.
WQ-65	NMFS	11/14/2012	"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." -pdf page 30	Please see AEA's response to comment WQMOD 06.
WQ-66	NMFS	11/14/2012	"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." -pdf page 31	Please see AEA's response to comment WQMOD 06.

Water Quality Modeling Study				
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WQMOD-01	TNC	11/14/2012	"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." – pdf page 3	Water Quality Baseline monitoring extends to River Mile 15.1 (above the Beluga Line) in order to avoid any contact with critical stages of the Beluga's life cycle that occurs in the Lower River. The Middle River and Upper River water quality monitoring sites will be monitored at the same time as the Lower River so the synchrony between these sections can be further examined for changes in water quality between these sections and the influence of major tributaries in the Lower River. The water quality modeling will be limited to the furthest downstream the hydraulic routing model extends. The complexity of the Susitna River channel below confluence of the major tributaries may preclude construction of a reliable hydraulic model which will limit the use and future development of a water quality model for the Lower River. The prediction of water quality impacts from dam operations at the lowermost section of the Middle River will be compared with conditions absent the dam at this point. The difference between the pre-dam and post-dam scenarios at the lowermost point of the Middle River will be compared with pre-dam water quality conditions in the Lower River and a determination made to extend water quality modeling if there is a difference in conditions that represents significant change.
WQMOD-02	TNC	11/14/2012	"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." –pdf page 3	Load-following operations reflect predictable power demands throughout the year and are accompanied by pool elevation fluctuations as well as riverine fluctuations based on routine releases from the project. Influence on water quality conditions in both the reservoir and riverine models during power demand scenarios will be modeled on an hourly time-step and so will reflect influence of power demand releases. Section 6.6.4.2.2.1 and Section 6.6.4.2.2.2 describe four operations scenarios that will be used for modeling. The initial operations scenario will reflect "Existing Conditions-Base Case Modeling (see Section 6.6.4.2.2.1 of the RSP for a more detailed description of this scenario). The remaining scenarios are "Future Conditions-with Project Scenarios" and represent maximum load-

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				following, intermediate load-following, and base-load scenarios (see Section 6.6.4.2.2.2 of the RSP for additional details).
WQMOD-03	USFWS	11/14/2012	"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." –pdf page 12	The selection of EFDC for use in predicting water quality conditions under various operational scenarios for both riverine and reservoir environments was finalized in the Technical Workgroup (TWG) Meeting on August 17, 2012. The TWG agreed that EFDC would be selected for the Water Quality Modeling Study (Section 5.6 of the Revised Study Plan). Rationale for choosing the EFDC model is included in the RSP in Section 5.6.4.6. Table 5.6-2 in the RSP provides a direct comparison between EFDC, H2OBAL/SNTEMP/DYRESM, and CE QUAL W2. Table 5.6-2 evaluates all 3 model options based on technical, regulatory, and management criteria. EFDC is capable of evaluating the impact of dam/reservoir operations/climate change on reservoir stratification as well as simulating dynamic interactions between nutrients and algae in reservoirs and interactions between nutrients and periphyton in riverine sections. EFDC is fully capable of predicting sediment erosion, transport, and settling/deposition processes, as well as, simulating fate and transport of metals in association with sediments in both riverine and reservoir environment. EFDC will be coupled with an external ice model with a properly designed interface to communicate temperature results during seasonal boundary conditions (e.g., winter to spring and fall to winter). EFDC is also a three-dimensional model that can be configured at nearly any spatial resolution to represent local effects. The grid will be auto-generated by one of the EFDC modules to capture complexity of local terrain and complexity in channel geometry. These conditions have been successfully modeled in similar riverine environments; most recently in the Athabasca River. The successful use of EFDC in a similar riverine system as the Susitna River provides verification that the model will meet the challenges of a worst case scenario. The model evaluation described in Section 5.6.4.5 of the RSP and criteria for model

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				selection outlined in Table 5.6-2 account for the worst case scenarios. EFDC meets all the technical, regulatory, and management criteria as outlined in Table 5.6-2 including a worst case scenario.
WQMOD-04	USFWS	11/14/2012	"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." –pdf page 12	The EFDC model is described in the RSP Section 5.6.4.4. Technical considerations for the EFDC model are summarized briefly in the RSP in Section 5.6.4.6. Input variables are fully described in the EFDC Guidance (Tetra Tech 2002) and listed as "Card Images" where there are 90 such examples. The reservoir representation will be developed based on the local bathymetry and dimensions of the proposed dam. A three-dimensional model will be developed for the proposed reservoir to represent the spatial variability in hydrodynamics and water quality in longitudinal, vertical, and lateral directions. The model will be able to simulate flow circulation in the reservoir, turbulence mixing, temperature dynamics, nutrient fate and transport, interaction between nutrients and algae, sediment transport, and metals transport. The key feature that needs to be captured is water column stratification during the warm season and the de-stratification when air temperatures cool down. The capability of predictively representing the stratification/de-stratification period is of critical importance for evaluating the impact of the dam because this is the critical water quality process in the reservoir. Downstream of the proposed dam location, a river model will also be developed to evaluate the effects of the proposed Project. It is anticipated that the same model platform used for the reservoir model will be implemented for the river model (at a minimum, the two models will be tightly coupled). The river model will be capable of representing conditions in both the absence and presence of the dam. Flow, temperature, TSS, DO, nutrients, turbidity (continuous at USGS sites and bi-weekly at additional locations required for calibrating the model), and chlorophyll-a output from the reservoir

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				model will be directly input into the downstream river model. This will enable downstream evaluation of potential impacts of the proposed Project on hydrodynamic, temperature, and water quality conditions.
WQMOD-05	USFWS	11/14/2012	"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." –pdf page 12	Because the dam is not in place when the reservoir model is constructed, proper calibration of the model using actual reservoir data is not possible. To achieve reasonable predictions of water quality conditions in the proposed reservoir, a literature survey will be conducted to acquire parameterization schemes of the model. An uncertainty analysis approach will also be developed to account for the lack of data for calibration, therefore enhancing the reliability of reservoir model predictions. The river model will be calibrated and validated using available data concurrently with the initial reservoir condition model (representing absence of the dam). Output from the models will be used directly in other studies (e.g., Ice Processes, Productivity, and Instream Flow studies). The development of a baseline hydrodynamic routing model is discussed in Section 8.5.4.3 of the Revised Study Plan. The EFDC model will be calibrated in order to simulate water quality conditions for load-following analysis. Organic carbon content from inflow sources will be correlated with mercury concentrations determined from the Baseline Water Quality Study discussed in Section 5.5. Predicted water quality conditions established by Project operations and that promote methylation of mercury in the bioaccumulative form will be identified by location and intensity in both riverine and reservoir habitats.
WQMOD-06	USFWS	11/14/2012	"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	The Biotic Ligand Model (BLM) is focused on determining toxicity of individual metals to binding sites on tissue like gill filaments of freshwater fish while considering other factors that compete for the same binding sites. The BLM is restricted to predicting potential toxicity of copper, silver, cadmium, zinc, nickel, and lead to aquatic life.

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			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. –pdf page 12	The other (water quality) factors used in the biotic ligand model to predict potential toxicity to aquatic life will be generated by the EFDC water quality model and so can input information in order to use the BLM. However, the BLM will be restricted from use if the combination of water quality monitoring results for metals concentrations in sediments and surface water show little or no detectable concentrations and the water quality model shows that changes, if any, to water quality conditions that mobilize metals does not occur. This is part of the pathways analysis for individual metals toxics and is where decisions for use of secondary models (like BLM) in addition to the EFDC primary model will be made. Please see Section 5.6.4.6.5 in the RSP. Borgmann et al. 2008 outline several assumptions under which toxicity of metals concentrations at sites of bioaccumulation interactions are additive. The use of the BLM to estimate a toxic effect from mixtures of metals must satisfy several unknowns and, as stated by the authors, should be used with caution and other strategies for these toxicity estimates considered. This comment response has been included in Section 5.6.4.6.5.

Mercury Assessment and Potential for Bioaccumulation Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
MERC-01	USFWS	11/14/2012	"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." –pdf page 146	The RSP includes additional detail toward addressing Objective 3. The RSP includes sampling for piscivorous birds and aquatic mammals (Section 5.7.4.2.5), a predictive risk analysis of possible impacts (Section 5.7.4.2.5.4), fish tissue sampling (Section 5.7.4.2.6), and three modeling methods (Section 5.7.4.3).
MERC-02	USFWS	11/14/2012	"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." –pdf page 148	The RSP includes feather sampling from piscivorous birds, including the belted kingfisher, in the proposed inundation zone (see Section 5.7.4.2.5). Please refer to AEA's response to comment RAPT-03 in the Comment/Response Table for collection of feathers for mercury analysis. AEA will be conducting a literature review on the diet of the birds in question (Sections 10.15.4.3 and 10.14.4.1). Information on species diet is well developed in the literature.
MERC-03	USFWS	11/14/2012	"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." –pdf page 149	The RSP addresses this issue in Section 5.7.4.2.5.1. Feathers will be collected and analyzed from several species of birds including eagles. Please see AEA's response to comment RAPT-03 in the Comment/Response Table for collection of feathers for mercury analysis.
MERC-04	USFWS	11/14/2012	Piscivorous Wildlife and Mercury Risk Assessment. 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	Please see AEA's response to comment MERC-04.

Mercury Assessment and Potential for Bioaccumulation Study				
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			process or working with AEA to adequately develop this study. –pdf page 153	
MERC-05	USFWS	11/14/2012	"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." –pdf page 7	AEA has not included quantification of mercury atmospheric deposition within the RSP because, as illustrated in RSP Figure 5.7-1, mercury cycles between the water soil, and atmosphere, net accumulation rates are very low. Also, the rate and amount of atmospheric deposition doesn't depend on whether the water body is a natural lake or reservoir. As explained in RSP Section 5.7.2, previous studies have found that increases in methylmercury concentrations in a reservoir after filling are not related to atmospheric deposition. While inorganic mercury deposition from the atmosphere is not a significant source of mercury concentrations that are elevated above background, it can be a source of background mercury concentrations (see Section 5.7.2). As explained in Section 5.7.1, the goal of the Mercury Assessment and Potential for Bioaccumulation Study in relation to the inundation zone is to quantify mercury resulting from filling the reservoir, not necessarily background mercury. Background mercury concentrations are better predicted from studying mercury levels in nearby natural lakes, not quantifying atmospheric deposition. Background lake studies are included as part of the fish tissue sampling (see Section 5.7.4.2.6). As explained in Section 5.7.2, mercury in reservoirs typically isn't source limited, but is related to methylation rates in the reservoir. The water quality model will predict methylation rates in the reservoir (Section 5.6.4.8).
MERC-06	USFWS	11/14/2012	"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	This work is planned to be done regardless of whether methylmercury is detected in the sediment or water (see Section 5.7.4.2). It should be noted, however, that mercury concentrations in soil and vegetation are poor predictors of methylmercury concentrations in a reservoir after impoundment, given that methylmercury production is rarely source constrained.

Mercury Assessment and Potential for Bioaccumulation Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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. –pdf page 10	
MERC-07	USFWS	11/14/2012	Likewise, macroinvertebrates need to be added to the current study plan." –pdf page 10	There are no plans for macroinvertebrates sampling at this time (Section 5.7.4.2). As with soil and vegetation, current mercury concentrations in macroinvertebrates are poor indicators of the potential methylmercury concentrations in fish and wildlife, and most methylmercury models do not utilize this data for that reason. Fortunately models for predicting methylmercury concentrations in fish are well advanced and fairly accurate (Harris and Hutchison, 2008, Hydro Quebec, 2003, etc). Methylmercury in fish tissues is generally higher by an order of magnitude than that of their food (Rennie et al, 2011). Therefore predictive models for fish can be generally applied to macroinvertebrates. In addition, impacts on other species are going to be evaluated (see Section 5.7.4.2.5.3).
MERC-08	USFWS	11/14/2012	"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	The Mercury Assessment and Potential for Bioaccumulation Study scope does not include detail regarding the management of a problem that has not yet been measured or predicted. Implementing the RSP will generate information that AEA will rely upon in its environmental analysis supporting its FERC License application. There are many ways to manage methylmercury, and how the issue is managed, or whether it needs to be managed, is something that will need to be assessed based upon the outcome of that environmental analysis.

Mercury Assessment and Potential for Bioaccumulation Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			method used for predicting potential impacts to water quality conditions in both the proposed reservoir and the riverine portion of the Susitna basin."). –pdf page 46	
MERC-09	USFWS	11/14/2012	The AEA plan should 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." –pdf page 46	Predictive risk analyses (Section 5.7.4.2.5.3) will be used to estimate risks to wildlife. Human health will be protected utilizing ADEC and EPA standards for fish consumption. The Mercury Assessment and Potential for Bioaccumulation Study scope does not include detail regarding the management of a problem that has not yet been measured or predicted. See AEA's response to comment MERC-08.
MERC-10	USFWS	11/14/2012	"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." –pdf page 46	Mercury modeling is addressed throughout the Mercury Assessment and Potential for Bioaccumulation Study Section 5.7.4.3. The source of the mercury above background in reservoirs is not typically the geology, atmosphere, or woody plant debris. Otherwise, mercury concentrations would not decrease to background after only 20-30 years. Green vegetation (leaves of trees and shrubs) and the top centimeters of humus are the primary source of mercury in newly filled reservoirs. This is well researched and generally accepted science (Meister et al. 1979; Hydro Quebec, 2003, etc.). As explained in Section 5.7.2, methylmercury is significantly more toxic than inorganic mercury, and unlike inorganic mercury, bioaccumulates in the ecosystem. The water quality model (see Section 5.6.4.8) will focus on modeling methylization in the reservoir.
MERC-11	USFWS	11/14/2012	"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	a) The primary source of mercury to reservoirs is inundated fine organic material. This material is being sampled and analyzed (Sections 5.7.4.2.1 and 5.7.4.2.2). However, the concentration and type of mercury inputs are not good indicators of whether a methylmercury problem will occur in a reservoir, because the amount of inorganic mercury available does not control methylmercury production. Some mercury reservoir models (Harris and Hutchison, 2008, Hydro-Quebec 2003) do not incorporate mercury sources into methylmercury predictive equations for this

Mercury Assessment and Potential for Bioaccumulation Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 46	reason. b) Mercury methylation rates will be determined using the EFDC modeling (see RSP Section 5.6.4.8). c) Uptake and biomagnification will be addressed by fish, bird, and mammal sampling, and application of a predictive risk analyses for all species which significant samples are available, as well as mercury modeling in fish (see RSP Section 5.7.4.3). d) The proposed study quantifies methylmercury impacts at the chemistry/bacterial level, with fish, and terrestrial wildlife that may be susceptible to exposure (birds and aquatic mammals). We believe that the RSP satisfies these concerns.
MERC-12	USFWS	11/14/2012	"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	Documentation of mercury methylation at other hydro projects in boreal forested landscapes is presented in RSP Section 5.7.2. It has been documented in studies of other reservoirs (Hydro Quebec, 2003, Harris and Hutchison, 2008, Schetagne et al., 2003, etc.) that most of the "required assumptions" listed are not necessary to predicting methylmercury concentrations in fish and wildlife as a result of inundating of the land with a reservoir. Publications of most of the authors listed to be reviewed are included as the references in the RSP. EFDC will incorporate known dynamics of methylmercury generation from terrestrial sources that would be inundated to form the reservoir as part of the model (see RSP Section 5.6.4.8).

Mercury Assessment and Potential for Bioaccumulation Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 47	
MERC-13	USFWS	11/14/2012	"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,	No assumption was made regarding the simplicity of mercury in the ecosystem, and the references in the comments are largely incorporated into the text of the RSP (Section 5.7.2). Consideration of potential mitigation, such as those strategies identified by Mailman et al. (2004), is outside the scope of the RSP, and is premature prior to data collection and analysis. However, as explained in RSP Section 5.7.4, data collected will be used to provide background concentrations for mercury, and will also help evaluate potential mitigation methods (e.g., soil and vegetation removal) should that become necessary.

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			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." –pdf page 47	
MERC-14	USFWS	11/14/2012	Baseline mercury levels should be determined in fish-eating birds from the study area, by measuring mercury in feathers. 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). Bird feathers are an excellent tissue for determining mercury body burden in birds, and feathers can be collected non-invasively. 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. –pdf page 48	Agreed. Section 5.7.4.2.5 discusses the collection and use of feathers from fish-eating birds, including eagles, osprey, loons, and kingfishers to determine baseline mercury levels. Non-invasive feather sampling will be conducted for as many specimens of piscivorous species as possible in the area. Aquatic furbearers (mink and river otter) that eat fish are included in the sampling program as well (Section 5.7.4.2.5).
MERC-15	USFWS	11/14/2012	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	Samples from piscivorous fish, birds and aquatic mammals will be collected and tested for mercury as part of the study (Section 5.7.4.2). Predictive risk analyses (Section 5.7.4.2.5.3) will be performed for

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Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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. –pdf page 48	sensitive piscivorous birds and mammals (Section 5.7.4.2.5.3). This EPA approved method determines the ratio of the potential exposure to the substance and the level at which no adverse effects are expected. Species selected are those most likely to be impacted by methylmercury in the Project area. EPA suggests that a predictive risk analysis is a better indicator than a risk assessment for potential impacts on the terrestrial wildlife, since the number of samples that may be collected will be low due to low wildlife density (US EPA, 1997). The predictive risk analysis includes dietary estimates. Human exposure to methylmercury is predominately via consumption of impacted fish. EPA and ADEC have extensive guidelines to protect human health from this source of methylmercury, and no risk assessment for human health is necessary. Screening level models have been reasonably accurate in predicting future methylmercury concentrations in fish based on current methylmercury concentrations in fish. These models are based on 35+ year studies in dozens of reservoirs in northern climates (Harris and Hutchison, 2008). There is significant value in establishing background methylmercury concentrations in the study area prior to reservoir development, given that naturally occurring elevated methylmercury have been previously reported in the area (ADEC 2012).
MERC-16	USFWS	11/14/2012	A one-time, late-summer fish survey is inadequate to monitor dynamic background mercury concentrations. –pdf page 49	Fish were captured in 2012 as part of this study and will be used in addition to the samples collected in 2013 The "one-time" survey of 2013 involves collection of dozens of samples from multiple species over a period of two months in 2013. AEA anticipates collecting and analyzing as many as 100 individual samples. In addition, ADEC has been collecting background data on methylmercury in fish on the Susitna River, and that data will be incorporated into this study as well (see Table 5-7.4 of the RSP). For comparison purposes, Hydro-Quebec, in their extensive study of methylmercury impacts from existing reservoirs, collected 131 lake trout from 7 lakes over a period of 22 years (Hydro Quebec, 2003). This

Mercury Assessment and Potential for Bioaccumulation Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
				comes to less than 1 fish per water body per year. AEA is proposing collecting many more fish over a shorter period of time. Methylmercury concentrations in fish vary far more by species, age, reservoir size, and location, than they do "dynamically" (Section 5.7.4.2.6). The proposed collection time (mid to late summer) corresponds to the time when most fish in the reservoir may be harvested by humans and wildlife, and is therefore representative of exposure conditions to other trophic levels. Studies have shown that methylmercury in fish peaks with shallow water temperature in northern climates (Section 5.7.4.2.6), therefore the timing should correspond to maximum methylmercury concentrations and exposure.
MERC-17	USFWS	11/14/2012	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?) 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 –pdf page 49	a) The proposed modeling will estimate increases in methylmercury production in the reservoir as a whole, fish, and piscivorous wildlife. See Section 5.7.4.3 b) The Mercury Assessment and Potential for Bioaccumulation Study scope does not include development of any detail regarding management of a problem that has not yet been measured or predicted, see AEA's response to comment MERC-08. c) .For a response on how human and ecological health will be considered, see AEA's response to comment MERC-27. For a response to USFWS's summary comment, see AEA's response to comment MERC-28.

Mercury Assessment and Potential for Bioaccumulation Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
MERC-18	USFWS	11/14/2012	PSP "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)." –pdf page 49	In response to this comment, the Mercury Assessment and Potential for Bioaccumulation Study does not include the reference paragraph.
MERC-19	USFWS	11/14/2012	PSP "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)." –pdf page 49	Mercury concentrations in fish are typically nearly 100% methylmercury, however, the Susitna River system is very large, and there are notable variations in methylmercury concentrations between species in different parts of the drainage. Mercury methylation in natural systems is dependent on the amount of wetlands connected to those drainages, and the migration patterns of fish. Previous studies (St. Louis et al. 1994) have shown that methylmercury occurrence is positively correlated with wetland density. The Deshka River has significantly more wetlands in the drainage than other tributaries to the Susitna River, thus resident fish may display higher methylmercury concentrations (Frenzel, 2000). See Section 5.7.2.
MERC-20	USFWS	11/14/2012	PSP "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,	Section 5.7.4.2.6 identifies the collection of adult specimens, which should represent the highest mercury concentration for each species.

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Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 49	
MERC-21	USFWS	11/14/2012	PSP "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." –pdf page 50	Section 5.7.4.4 contains a discussion of methylmercury sources and migration pathways. Mercury modeling is discussed in detail throughout Section 5.7.4.3.
MERC-22	USFWS	11/14/2012	PSP "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" –pdf page 50	Quantitative modeling of mercury inputs is not included in the Mercury Assessment and Potential for Bioaccumulation Study RSP. Mercury inputs are acknowledged to exist. Mercury is not necessarily the problem, methylation of mercury is the principal concern. Methylation will be modeled as part of the EFDC modeling (see Section 5.6.4.4). A predictive risk analyses will be performed for sensitive piscivorous birds and mammals (Section 5.7.4.2.5.3). This EPA approved method determines the ratio of the potential exposure to the substance and the level at which no adverse effects are expected. The standard exposure level is calculated over a similar exposure period and is estimated to pose no appreciable likelihood of adverse health effects to potential receptors. Species selected are those likely to be impacted by methylmercury in the Project area. EPA suggests that a predictive risk analysis is a better indicator than a risk assessment for potential impacts on the terrestrial wildlife, since the number of samples that may be collected will be low due to low wildlife density (US EPA, 1997). The predictive risk analysis includes dietary estimates.

Mercury Assessment and Potential for Bioaccumulation Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
MERC-23	NMFS	11/14/2012	"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 ABA 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." –pdf page 58	The Mercury Assessment and Potential for Bioaccumulation Study scope does not include development of detail regarding management of a problem that has not yet been measured or predicted. The RSP will provide information that AEA will rely upon in its environmental analysis supporting its FERC License Application. There are many ways to manage methylmercury, and how the issue is managed, or whether it needs to be managed, is something that will need to be assessed based upon the outcome of that environmental analysis. Predictive risk analyses (Section 5.7.4.2.5.3) will be used to estimate risks to wildlife. Human health will be protected utilizing ADEC and EPA standards for fish consumption.
MERC-24	NMFS	11/14/2012	"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	See AEA's response to comment MERC-12.

Mercury Assessment and Potential for Bioaccumulation Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			Krabbenhoft and Drew Bodaly among others. There have been many lessons learned on how MeHg increases in fish upon flooding and impoundment and the ABA 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." –pdf page 58	
MERC-25	NMFS	11/14/2012	The PSP should not assume mercury to be a simple, conservative behaving metal. 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 monitoring. 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. –pdf page 58	See AEA's response to comment MERC-13.

Mercury Assessment and Potential for Bioaccumulation Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
MERC-26	NMFS	11/14/2012	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. –pdf page 59	See AEA's response to comment MERC-16.
MERC-27	NMFS	11/14/2012	How will human and ecological health be considered (i.e. maintaining public health) in light of the likely increase in MeHg in fish? –pdf page 59	Human and ecological health will be protected using the following: 1) Establishing baseline conditions for methylmercury in the environment and sensitive eco receptors (Section 5.7.4.2). 2) Predicting methylmercury formation in the reservoir using EDHC (Section 5.6). 3) Predicting methylmercury concentrations in sensitive fish, birds, and aquatic mammals using two models (Section 5.7.4.3). 4) Predictive risk analyses (Section 5.7.4.2.5.3) will be used to estimate risks to wildlife. Human health will be protected utilizing ADEC and EPA standards for fish consumption. 5) Monitoring the reservoir post-impoundment to make sure resulting methylmercury concentration are consistent with model predictions and managing the resources going forward based on the risks identified in steps 1 to 3.

Mercury Assessment and Potential for Bioaccumulation Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
MERC-28	NMFS	11/14/2012	"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." –pdf page 59	Section 5.7.4.3 outlines three methods for modeling methylmercury production and impact from the reservoir. Two models predict fish tissue concentrations of methylmercury for piscivorous and non-piscivorous fish species; one predicts methylmercury formation in the reservoir. The Harris and Hutchison model used over 35 years of fisheries studies in reservoirs and a regression equation to develop a model to predict peak mercury concentrations in fish in reservoirs, based only on the flooded area, total reservoir area and mean annual flow (Harris et al., 2008). The phosphorus release model is being used by both Hydro Quebec and Manitoba Hydro, and this model was calibrated against data from whole-ecosystem reservoir experiments at the Experimental Lakes Area (ELA) in Ontario, Canada (Bodaly at al, 2005). It predicts peak fish mercury levels and the timing of the response to flooding. The Mercury Assessment and Potential for Bioaccumulation Study scope does not include the development of detail regarding the management of a problem that has not yet been measured or predicted. The RSP will provide information that AEA will rely upon in its environmental analysis supporting its FERC License Application. There are many ways to manage methylmercury, and how the issue is managed, or whether it needs to be managed, is something that will need to be assessed based upon the outcome of that environmental analysis.

Geomorphology Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
GEO-01	ADNR-DGGS	11/14/2012	Page 5-69 in PSP section 5.8.4.3.3 "Will there be an opportunity to comment on the Geomorphology report?" –pdf page 13	Yes. There will be opportunities to comment on the Initial Study Report (ISR) and the Updated Study Report (USR). There will also be opportunities to provide input on technical memorandums within the context of the Technical Workgroup meetings. See the Geomorphology Study and the Fluvial Geomorphology Modeling below Watana Dam Study (Table 6.5-5 and 6.5-6) indicate numerous intermediate Technical Memorandums as well as the ISR and USR.
GEO-02	CWA	11/14/2012	Scope is insufficient in studying the Lower River based on AEA's apparent assumption that Project effects will not significantly affect the Lower River geomorphology. –pdf page 7	AEA is not assuming there are no Project effects on instream flow or channel morphology in the Lower River Segment. The downstream study limit for the Fluvial Geomorphology modeling effort has been identified as RM 75, which includes 23.5 miles of the Lower Susitna River Segment including all 14.5 miles of Geomorphic Reach LR-1 (RM 98.5 to RM 84) and the upper 9 miles of Geomorphic Reach LR-2. The downstream limit for the Fluvial Geomorphology Modeling below Watana Dam Study will be confirmed or adjusted based on review of study results at several stages. This process and criteria for modifying the lower extent of the study area are presented in Section 6.6.3.2 of the Fluvial Geomorphology Modeling below Watana Dam Study Plan and Section 8.5.3 of the Instream Flow Study. The first review will be conducted in Q1 2013 as initial results of study component 6.5.4.6. Reconnaissance-Level Assessment of Project Effects on the Lower and Middle Susitna River Segments and Open-Water Flow Routing Model are available (Section 8.5.4.3) and the Operations Model (Section 8.5.4.3.2). A second check-in will occur after the results of the initial runs of the 1-D bed evolution model become available. Several of the efforts in the Geomorphology Study extend to either RM 28 or RM 00 such as the mapping of geomorphic features and comparison of current and historical channel locations (Section 6.5.4.4). Also see AEA's response to comment FGM-26.
GEO-03	NMFS	11/14/2012	"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	Section 6.5.4.2.2 describes review and assessment of the adequacy and applicability of the historical sediment transport data for the Susitna River at Gold Creek, the Susitna River at Sunshine and the Chulitna River near Talkeetna. Based on review of the historical data collected by the USGS (USGS 1987), AEA has decided to include collection of sediment transport data at the Talkeetna River near Talkeetna gage in 2013.

Geomorphology Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 42	
GEO-04	Teich, Cathy	11/13/2012	Request for studies to determine if changes in the flow of the Susitna would affect the flow of the Chulitna and Talkeetna rivers, given the floods of 2012, would the project increase erosion and put the town of Talkeetna or other settlements at risk. –pdf page 1	To address this potential Project effect a concurrent flow/stage analysis for the Susitna, Chulitna and Talkeetna rivers using the existing hydrology and with-Project hydrology to ascertain the influence the Project may have on the flow characteristics of the Susitna in the Talkeetna area has been added to Section 6.5.4.6.2.1 of the RSP. If this analysis shows a significant change in the relationship during peak flows, then a hydraulic model would be developed for several miles of the Talkeetna River and possibly the Chulitna, so that Project effects on the hydraulics of the Talkeetna River (and possibly the Chulitna) near its confluence with the Susitna River can be quantified. This would include evaluation of hydraulic parameters that influence erosion including stage, depth, velocity and shear stress.
GEO-05	CCC	11/15/2012	"There does not appear to be any significant study of the Chulitna."	The Chulitna River is studied in terms of its contribution of sediment and water (flow) to the Susitna. This includes the development of a 61 year extended record of daily flows on the Chulitna River, collection of sediment transport data in 2012 and 2013, and the determination of the various components of the sediment supply from the Chulitna River (fines, sand and gravel) (See Sections 6.5.4.2 and 6.5.4.3). In response to other comments received on the PSP, a concurrent stage and flow analysis has been added to the Streamflow Assessment (Section 6.5.4.6.2.1) to identify the potential for the Project to affect flow patterns during periods of high flow on the Chulitna and Talkeetna Rivers.
GEO-06	FERC	11/14/2012	"Clearly describe the exact number, location, and spatial	Section 6.6.3.1 of the Fluvial Geomorphology Modeling below Watana

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			extent of your proposed focus areas for each proposed study. Provide justification for the number of proposed sites selected for detailed 2-D hydraulic modeling and other intensive study elements. Include criteria to be used for selecting focus areas and study-specific rationale for co-locating sites." –pdf page 5	Dam Study introduces the concept of the Focus Areas including the need to apply a 2-D bed evolution model at most Focus Areas rather than the 1-D bed evolution model. Section 6.6.4.1.2.4 provides the details on the involvement of the Geomorphology Studies in the Focus Area site selection. This includes the exact location (RM), number of sites (10) and geomorphic criteria (one site in each geomorphic reach and representative of the range of geomorphic features found in the reach) and modeling criteria (extent of site for proper boundary conditions use modeling approach). Table 6.6-5 identifies the Focus Areas and their extent in RMs. Additional detail on the overall Focus Area selection process is provided in the Fish and Aquatics Instream Flow Study (Section 8.5.4.2). This includes maps of the individual Focus Area showing upstream and downstream limits and discussion of fish use and habitat information applied in the Focus Area selection process. Additional text was added to Section 6.6.4.1.2.4 to further respond to this comment.
GEO-07	FERC	11/14/2012	"Geomorphology (Section 6.5) and Fluvial Geomorphology Modeling (Section 6.6); 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." –pdf page 8	Sediment storage zones, including mid-channel (braid bars, vegetated islands) and bank-attached (floodplain) are directly incorporated into the preliminary classification system addressed in Section 6.5.4.1.2.2.1. A discussion of the temporal and spatial elements of sediment storage is provided in Section 6.5.4.1.
GEO-08	FERC	11/14/12	"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	The macrohabitat types (main channel, side channel, side slough, upland slough, tributary mouth and tributary) delineation of the Middle Susitna River Segment is being performed in 2012 for ~ 50% of the Middle Susitna

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			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." –pdf page 10	River Segment in the Geomorphology Study per the 1980s definitions. The further subdivision of the main channel macrohabitat type identified in Table 9.9-4 (Multiple split main [changed from "braided-main channel" to avoid confusion with the reach types] and split main) is being performed by the Fish and Aquatic Resources over the 1980 macrohabitat type delineation being supplied by the Geomorphology Study. Similarly, the identification of backwater areas and beaver complexes will be performed in the FAR (Section 9.9) study after the Geomorphology Study provides the results of the habitat delineation per the 1980s definitions. Table 9.9-4, detailing the habitat classification system reflects this coordination.
GEO-09	ADNR-DGGS	11/14/2012	Page 5-58 of PSP section 5.8.1 "It is unclear whether due consideration is being given to the Upper River and the dam's potential impact on geomorphologic conditions there." –pdf page 12	The potential project impacts to the geomorphology of the Upper River are limited to the reservoir shoreline, the tributary confluences with the reservoir and the main channel delta at the upstream end of the reservoir. These are all addressed in Section 6.6.5.8 Reservoir Geomorphology.
GEO-10	ADNR-DGGS	11/14/2012	Page 5-77 of PSP section 5.8.4.6.1 "Will the potential impact of wildfires on sediment load be factored into this study?" –pdf page 13	No. Additional sediment loading scenarios other than the possible increase in sediment supply to the reservoir from glacial surge are not proposed in the RSP.
GEO-11	ADNR-DGGS	11/14/2012	Page 5-88 of PSP section 5.8.4.8.3.2 "Proper terminology would be 'thawing of permafrost', not 'melting of permafrost.'" –pdf page 13	Agreed. The two uses of the term "melting of permafrost" was changed to "thawing of permafrost" in Section 6.5.4.8.2.3.
GEO-12	ADNR-DGGS	11/14/2012	Pages 5-93 to 5-94 of PSP section 5.8.4.10.2 "Suggest including an evaluation of potential icings (aufeis) at stream crossing locations." –pdf page 13	This is a detail design issue that will not likely be initiated until 2015 as part of the AEA FERC License Application. The potential for aufeis will be evaluated during the road engineering phase and measures to address aufeis formation will be developed. Part of the design criteria would be to address aufeis icing issues.
GEO-13	TNC	11/14/2012	Focus Area Selection 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	The terminology in the Geomorphology Study has been edited to refer to "Focus Areas" rather than "intensive" or "detailed" study sites. The Characterization of Aquatic Habitats Study (Section 9.9) is preparing "line" based habitat mapping per the 5-level mapping scheme identified in Table 9.9-4 to be available the end of Q1 2013. The Geomorphology Study is also preparing polygon based mapping of ~50% of the Middle Susitna River Segment (Section 6.5.4.5) based on the 1980s definitions of the

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			(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. – pdf page 2	macrohabitat types (main channel, side channel, side slough, upland slough, tributary mouth and tributary). This will also be available end of Q4 2012.
GEO-14	TNC	11/14/2012	Focus Area Selection 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. –pdf page 2	The overall selection process, schedule and criteria for the Focus Areas is provided in the Fish and Aquatics Instream Flow Study (Section 8.5.4.2). Section 6.6.4.1.2.4 of the Fluvial Geomorphology Modeling below Watana Dam Study provides the details on the involvement of the Geomorphology Studies in the Focus Area site selection. This includes the exact location (RM), number of sites (10) and geomorphic (one site in each geomorphic reach and representative of the range of geomorphic features found in the reach) and modeling criteria (extent of site for proper boundary conditions use modeling approach).
GEO-15	TNC	11/14/2012	Focus Area Selection 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". –pdf page 2	Although both Middle and Lower River segments are under consideration as part of the IFS, the majority of detailed study elements described in the RSP are concentrated within the Middle River Segment. This is because project operations related to load-following and variable flow regulation will likely have the greatest potential effects on this segment of the river. These effects tend to attenuate in a downstream direction as channel morphologies change, and flows change due to tributary inflow and flow accretion. (Please see AEA's response to comments IFS-016 and IFS-019 for additional detail). AEA intends to seek TWG input and finalize the initial set of study areas by February/March of 2013 to enable detailed field studies to occur. The need to add or redistribute Focus Areas and study sites into the Lower River Segment will be determined based upon the results of the open-water flow routing model (see Section 8.5.3). The downstream study limit for the Fluvial Geomorphology modeling effort has been identified as RM 75, which includes 23.5 miles of the Lower Susitna River Segment including all 14.5 miles of Geomorphic Reach LR-1 (RM 98.5 to RM 84) and the upper 9 miles of Geomorphic Reach LR-2. The downstream limit for the Fluvial Geomorphology Modeling below Watana

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				Dam Study will be confirmed or adjusted based on review of study results at several stages. This process is presented in section 6.6.3.2 of the Fluvial Geomorphology Modeling below Watana Dam Study Plan and Section 8.5.3 of the Instream Flow Study. The first review will be conducted in Q1 2013 as initial results of study component 6.5.4.6 Reconnaissance-Level Assessment of Project Effects on the Lower and Middle Susitna River Segments and Open-Water Flow Routing Model are available (Section 8.5.4.3). A second check-in will occur after the results of the initial runs of the 1-D bed evolution model become available. Several of the efforts in the Geomorphology Study extend to either RM 28 or RM 00 such as the mapping of geomorphic features and comparison of current and historical channel locations (Section 6.5.4.4).
GEO-16	TNC	11/14/2012	"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." –pdf page 3	Please see AEA's response to comments GEO-02 and GEO-15.

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GEO-17	USFWS	11/14/2012	"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." –pdf page 24	AEA has revised the RSP to address this and similar comments. This includes: text added to Section 6.1 to better explain the relationship between the Geomorphology Study, Fluvial Geomorphology Modeling below Watana Dam Study and the various aquatic resource studies including the Fish and Aquatics Instream Flow Study and Riparian Instream Flow Study, identification of key indicators that the Geomorphology studies will provide to the aquatic resource studies, the wording of the objectives of several study components was modified to be more in line with the NMFS and USFWS Study requests as well as convey the actual intended objectives better (these are detailed in subsequent comment responses made on specific objectives by NMFS, USFWS and EPA), the study interdependency charts were added to Sections 6.5.6 and 6.6.6 along with tables providing inputs form other studies and products provided by the Geomorphology studies to other studies. Tables 6.6-5 and 6.6-7 identify specific information that the 1-D and 2-D modeling effort and the Geomorphology Study will provide other studies. A study component was added to the Geomorphology Study (Section 6.5.4.11) that describes the integration of the Geomorphology Study with the Fluvial Geomorphology Modeling below Watana Dam Study to provide the support to interpret modeling results and develop the habitat indicators for the aquatic resource studies. Sections 6.6.4.3 has been modified to more clearly identify products that the Fluvial Geomorphology Modeling below Watana Dam Study, in concert with the Geomorphology Study will provide to the Fish and Aquatics Instream Flow Study (Section 8.5), Riparian Instream Flow Study (Section 8.6), Ice Processes in the Susitna River Study (Section 7.6) and Groundwater Study (Section 7.5) Section. Note: The Geomorphology Study is performing the habitat mapping to the 3rd level, macrohabitat. Subsequent levels of habitat mapping will be performed in the Fish and Aquatic Resources (Section 9.9). The mapping performed by the FAR will consider fish habitat utilization data.
GEO-18	USFWS	11/14/2012	"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	Field Data Collection Efforts of the Fluvial Geomorphology Study further describes the substrate size characterization, and cross-section and longitudinal profile surveys (Section 6.6.4.1.2.9). AEA proposes that mapping of the substrate facies within the Focus Area be based on mapping of the mesoscale habitat unit. This mapping will identify features

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			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." –pdf page 24	at the scale of the individual habitat units that include riffles, pools, runs, meso-scale bars (i.e., dimensions on the order of the channel width in side channels and sloughs), banklines, large LWD clusters and similar features. Characteristics of the substrate making up these features will be measured using techniques appropriate to the size range of the material in each unit. In coarse-grained areas (i.e., gravel and cobbles), surface samples will be taken using the pebble count method (Wolman, 1954). In areas where the material is sufficiently fine (i.e., sand and fine- to medium-gravel), bulk samples will be collected for laboratory grain size analysis.
GEO-19	NMFS	11/14/2012	"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." –pdf page 41	See AEA's response to comment GEO-18.
GEO-20	USFWS	11/14/2012	"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." –pdf page 24	Identification of the information to be supplied from the Geomorphology Study to support the Fluvial Geomorphology Modeling below Watana Dam Study is identified in Section 6.5.4.11. The study interdependencies charts and associated discussions in Section 6.5.6 and 6.6.6 also identify products and associate schedule for delivery to various studies that will require the results of the Geomorphology Study to evaluate project effects on aquatic resources. Section 6.6.4.3 identifies the end-products that will be delivered through the combination of the Fluvial Geomorphology Modeling and Geomorphology studies to facilitate evaluation of Project effects on anadromous fish and other aquatic resources can be evaluated by the Fish and Aquatics Instream Flow Study (Section 8.5). To assist in identifying and understanding uncertainties, sensitivity

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				analysis will be performed for the 1-D and 2-D modeling efforts by varying key input parameters within the range of physically reasonable values (Section 6.6.4.2.2.3). Additionally, a range of hydrologic conditions will be evaluated in the 50 year simulation period to be used for the 1-D model bed evolution model encompasses a broad range of hydrologic conditions and will be used to assess the sensitivity of the study areas to hydrologic variability. The influence of extreme events will be addressed by modeling the 100-year flood with both 1-D and 2-D models. Variation in response to the six representative years (wet, average, and dry for wet and cold PDO) based on both the 1-D and 2-D model results will also provide an understanding of the uncertainty associated with hydrologic conditions.
GEO-21	NMFS	11/14/2012	"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." –pdf page 40	Please see AEA's response to comment GEO-20.
GEO-22	USFWS	11/14/2012	"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	Subsection 6.5.4.1.2.3 was added to the RSP to clearly indicate that the effort requested by USFWS and NMFS will be conducted and that a thorough geomorphic characterization of the existing Susitna River system will be developed. The understanding of how the system functions including the formation and maintenance of the geomorphic features that comprise the important aquatic habitats in the Middle and Lower Susitna River Segments is necessary to quantify potential Project effects on the aquatic habitat. Field verification of the mapping effort will be conducted as part of the field data collection effort described in the Fluvial Geomorphology Modeling below Watana Dam Study Section 6.6.4.1.2.9.

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			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." –pdf page 24	
GEO-23	NMFS	11/14/2012	"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 ABA'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	Please see AEA's response to comment GEO-22.

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			being achieved." –pdf page 41	
GEO-24	NMFS	11/14/2012	"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." –pdf page 40	The Geomorphology Study is performing the habitat mapping to the 3rd level, macrohabitat. Subsequent levels of habitat mapping will be performed in the Fish and Aquatic Resources (Section 9.9.5.4.2 Middle River and 9.9.5.4.3 Lower River). The mapping performed by the Fish and Aquatics Resources studies in the Middle and Lower Rivers will "aid in understanding the behavior, movements, and spatial use of fish in the Fish Distribution and Abundance in the Upper (Section 9.5) and Middle and Lower Susitna River (Section 9.6). Habitat characterization will help in understanding the potential Project effects of the flow regime in the Instream Flow Study (Section 8)." (Quoted from Section 9.9.8). The schedule (Section 9.6.6) and methods (Section 9.6.4) for obtaining habitat distribution and abundance information on anadromous fish in the Middle and Lower Rivers is presented in Section 9.6.
GEO-25	NMFS	11/14/2012	"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." –pdf page 42	The linkage between geomorphic process and fish habitat is first established in the Subsection 6.5.4.1.2.3 Geomorphic Characterization of the Susitna River. In-channel (e.g. side channels, bars, islands) and channel margin (e.g. floodplain, side sloughs) geomorphic subunits are the foundations for the range of available habitats in the Susitna River, and thus, an analysis of river and floodplain morphology and morphologic change over time and space also provides a measure of the distribution and changes of habitats. Characterization and understanding of the processes that create influence and maintain the geomorphic subunits (and therefore, the habitat units) will be updated throughout the study as further knowledge is acquired through the field data collection and analysis efforts, and coordination with the other resource teams. The results of modeling and analysis of the effects of the altered hydrology and sediment supply under Project conditions on the geomorphic features and corresponding riverine habitat types will be used to either directly quantify key habitat indicators or will provide information to the Fish and Aquatics Instream Flow Study to facilitate quantification of key habitat indicators that involve both geomorphic and non-geomorphic factors.
GEO-26	USFWS	11/14/2012	"The Service requested that correlation of geomorphic forms and processes to riverine habitat types be done for the	Please see AEA's response to comment GEO-25.

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			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." –pdf page 25	
GEO-27	USFWS	11/14/2012	"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."	See AEA's response to comment GEO-03.
GEO-28	USFWS	11/14/2012	"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	An assessment of LWD is included in Section 6.5.4.9 of the study plan and includes an evaluation of LWD recruitment, loading, function, and potential project effects. The LWD study will evaluate the interaction of LWD with hydrology, riparian, aquatic, ice processes, and river geomorphology. Data will be collected from aerial photographs throughout the entire study area and field studies in Focus Areas.

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			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." –pdf page 25	
GEO-29	NMFS	11/14/2012	"NMFS requested an assessment of the source, transport, and storage of large woody debris (LWD) in the Susitna River and the role of L WD 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." –pdf page 42	Please see AEA's response to comment GEO-28.
GEO-30	USFWS	11/14/2012	"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." –pdf page 26	An evaluation of the interaction of LWD with hydrology, riparian, aquatic, ice processes, and river geomorphology will be completed through discussions among the appropriate resource specialists during the study process (Sections 6.5.4.9.2 and 6.6.4.1.2.7). Geomorphic modeling of potential changes in LWD loading will take place at selected Focus Areas utilizing the 2-D model. Additional text is included in Section 6.6.4.1.2.7 of the Fluvial Geomorphology Modeling below Watana Dam Study to describe the integration of LWD into the overall assessment of potential changes in geomorphic features. Additional text is included in Section 6.5.4.9.2 to identify support from the Large Woody Debris study component for the modeling effort.
GEO-31	NMFS	11/14/2012	"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	Please see AEA's response to comment GEO-30.

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			recruitment." –pdf page 42	
GEO-32	USFWS	11/14/2012	"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." –pdf page 27	Section 6.5.4.6 describes use of the framework as part of the evaluation to confirm or alter the downstream study limit in early Q1 2013. The section has been revised to include application of the framework, the sediment transport assessment and the streamflow assessment to include both the Lower and Middle Susitna River Segments and for these tools to be used throughout the study to help integrate with and interpret results of the Fluvial Geomorphology Modeling below Watana Dam Study (Section 6.6). AEA emphasizes that the framework entails more than calculation of the dimensionless parameters as implied by the comment. As Grant et al. 2003 indicates, other factors influence the sensitivity of the system to experience channel adjustment as a result of changes in the dimensionless parameters. The framework will be used in evaluating the downstream study limit in Q1 2013.
GEO-33	FERC	11/14/2012	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."	The Geomorphology Study in 2012 is preparing polygon based mapping of ~50% of the Middle Susitna River Segment based on the 1980s definitions of the macrohabitat types (main channel, side channel, side slough, upland slough, tributary mouth and tributary). Portions or all of the remaining Middle River may be mapped in 2013 depending on the specific data needs of the Fish and Aquatics Instream Flow Study. The mapping is being performed for three discharges in order to establish surface area vs. flow relationships for the macrohabitat units defined in the 1980s (main channel, side channel, side slough, upland slough, tributary mouth and tributary). This will provide one means by which the Fish and Aquatics Instream Flow Study determine change in habitat related to alteration of flows. The habitat mapping can also be used to extrapolate Fish and Aquatics Instream Flow Study results from Focus Areas to similarly mapped but not modeled areas. Additional detail on modeling of habitat versus flow relationships and extrapolation of Focus Area results can be found in the Fish and Aquatics Instream Flow Study (Sections 8.5.4.6 and 8.5.4.7).
GEO-34	NMFS	11/14/2012	"For the lower river the study plan describes a reconnaissance level assessment (by assessing geomorphology and habitat via aerial photography). The	Section 6.5.4.6 describes use of the framework as part of the evaluation to confirm or alter the downstream study limit in early Q1 2013. The section includes application of the framework, the sediment transport assessment

Geomorphology Study				
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			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)." –pdf page 43	and the streamflow assessment to include both the Lower and Middle Susitna River Segments and for these tools to be used throughout the study to help integrate with and interpret results of the Fluvial Geomorphology Modeling below Watana Dam Study (Section 6.6). AEA emphasizes that the framework entails more than calculation of the dimensionless parameters as suggested by the comment. As Grant et al. 2003 indicates, other factors influence the sensitivity of the system to experience channel adjustment as a result of changes in the dimensionless parameters. The framework will be used in evaluating the downstream study limit in Q1 2013.
GEO-35	NMFS	11/14/2012	If the 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. –pdf page 43	See AEA's response to comment GEO-02.
GEO-36	NMFS	11/14/2012	"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." –pdf page 43	Extension of habitat mapping and flow routing model will be conducted if the criteria indicate the need to continue the Fish and Aquatics Instream Flow Study further downstream into the Lower River. Although both Middle and Lower River segments are under consideration as part of the IFS, the majority of detailed study elements described in the RSP are concentrated within the Middle River Segment. This is because project operations related to load-following and variable flow regulation will likely have the greatest potential effects on this segment of the river. These effects tend to attenuate in a downstream direction as channel morphologies change, and flows change due to tributary inflow and flow accretion (Please see AEA's response to comments IFS-016 and -019 for additional detail). AEA intends to seek TWG input and finalize the initial set of study areas by February/March of 2013 to enable detailed field studies to occur. The need for additional Focus Areas and study sites in the Lower River Segment will be determined based on results of the Open-water flow

Geomorphology Study				
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				routing model (see Section 8.5.3) Geomorphology Study identified below. Note: Mapping of geomorphic features for both the 1980s and current aerial photography is being performed for the entire Lower Susitna River Segment.
GEO-37	USFWS	11/14/2012	"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)." –pdf page 26	The computational procedure that will be used to characterize bed material mobilization is the same as those suggested in the NMFS and USFWS comment. The relationships from Parker, et al (1982) will be used for bed material gradations that contain less than about 20 percent sand because sand in this relatively small fraction does not affect the critical shear stress for mobilization. For locations in which the bed material contains more than about 20 percent sand, the relation from Wilcock and Crowe (2003) will be used because it accounts for the effect of reduced critical shear stress when substantial sand is present. Both these relationships recognize the importance of the hiding factor when considering mobilization thresholds for individual sizes in the overall gradation. It is common practice to assume a Shields critical value of 0.03 for bed material mobilization of the median D_{50} particle size in gravel bed streams, but there is considerable uncertainty in the precise value, and from a practical perspective, it is very difficult to define true incipient motion, even in a laboratory setting. For this reason, both Parker, et al (1982) and Wilcock and Crowe (2003) define incipient motion based on a small but non-zero dimensionless transport rate that is a function of the Shields stress for the D_{50}, and as described in the study plan, this definition will be adopted for this study. The measured bedload data will be used to validate (or adjust, if necessary) estimates of bed material mobilization thresholds. We do not believe that particle tracking through the use of painted rocks or similar techniques can be used to define general bed mobilization in the Susitna River because there is no practical way to place the painted rocks in the key areas in a manner that would be representative of the bed material structure, and particularly in areas with flowing water. Painted rocks could be used to help define mobilization thresholds in the shallow side channels and chutes.
GEO-38	CSDA	11/14/2012	PSP – "Sediment load contributions due to glacial melt and possible surging glacier event." CSDA Comment – "The	The analysis of reservoir trap efficiency in Section 6.5.4.8.2.1 includes analysis of a sediment loading scenario that considers glacial surge if the

Geomorphology Study				
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			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." –pdf page 11	Glacier and Runoff Changes Study (Section 7.7.4.4) indicates the potential for increased sediment delivery to the reservoir. This includes an estimate of the reduction in reservoir life.
GEO-39	CSDA	11/14/2012	"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." –pdf page 10	The trapping of sediments in the reservoir will be studied under Section 6.5.4.8.2.1 of the Geomorphology Study. This includes an initial estimate of sediment trap efficiency based on available equations and relationships and a more refined estimate based on results of the EFDC modeling of the reservoir conducted in the Water Quality Modeling Study (Section 5.6). The analysis of reservoir trap efficiency in 6.5.4.8.2.1 includes analysis of a sediment loading scenario that considers glacial surge if the Glacier and Runoff Changes Study (Section 7.7.4.4) indicates the potential for increased sediment delivery to the reservoir.
GEO-40	CSDA	11/14/2012	"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." –pdf page 10	A description of reservoir erosion studies is included in section 6.5.4.8.2.3 and includes: • Mass wasting. • Surface erosion from sheetwash. • Wave erosion (wind and boat wakes if motorized boat recreation is permitted). • Solifluction, freeze-thaw, and thawing of permafrost. • Beach/bank development at full pool. • Erosion by ice movement on the reservoir surface.

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FGM-01	CWA	11/14/2012	Scope is insufficient in studying the Lower River based on AEA's apparent assumption that Project effects will not significantly affect the Lower River geomorphology, which should be modeled. –pdf page 7	Please see AEA's response to comment GEO-02
FGM-02	USFWS	11/14/2012	"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." –pdf page 24	Please see AEA's response to comment GEO-17
FGM-03	ADNR-DMLW	11/14/2012	"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?" –pdf page 9	It has always been the intent of the study to apply a holistic, integrated multi-disciplinary approach to the Geomorphology studies. A study component was added to the Geomorphology Study (Section 6.5.4.11) that describes the integration of the Geomorphology Study with the Fluvial Geomorphology Modeling below Watana Dam Study to provide the support to interpret modeling results and develop the habitat indicators for the aquatic resource studies. Section 6.6.4.3 has been modified to more clearly identify products that the Fluvial Geomorphology Modeling below Watana Dam Study, in concert with the Geomorphology Study will provide to the Fish and Aquatics Instream Flow Study, Riparian Instream Flow Study, Ice Processes and Groundwater Studies.
FGM-04	FERC	11/14/2012	"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." –pdf page 5	A model "Precedence Table" (Table 6.6-4) has been added to Section 6.6.4.1.2.2 of the Fluvial Geomorphology Modeling below Watana Dam Study (FGMS) to identify which models will take precedence in providing flow and hydraulic information. Additional detail has been added to Section 6.6.4.3 as to specific parameters the FGMS will be providing

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				other studies (see Table 6.6-6 & 6.6-7).
FGM-05	ADNR-DMLW	11/14/2012	"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)?" –pdf page 9	Yes, there will be cross-checking between models. Significant differences will either be explained based on differences in model formulation and resolution or inconsistencies in input parameters. In cases where the difference may be due to use of different input parameter values, for example Manning's n-values, the values will be adjusted appropriately. This discussion is in Section 6.6.4.1.2.2. There is also a hierarchy or precedence as to which models results will take precedence for specific types of information. This "Precedence Table" (Table 6.6-4) is included in Section 6.6.4.2.
FGM-06	ADNR-DMLW	11/14/2012	"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." –pdf page 9	The mesh size of the 2-D model will be determined based on the physical conditions and modeling needs within each area of the model domain, the spatial scale of the geomorphic and habitat features that are being modeled, and the resolution necessary to correctly represent their hydraulic effects and behavior in the model. Computer run time, while a potential issue in meeting schedules, will not be a factor in establishing the grid size. This issue was discussed in the draft RSPs simply to make readers aware that it is an issue that must be considered in planning the work. Models that allow a variable mesh size, with high resolution in areas of key interest and coarser resolution in other areas, can help overcome part of the runtime problem without degrading the quality of the information produced from the 2-D model. As a result, capability for using variable mesh size is a factor in model selection. The discussion on grid size in Section 6.6.4.1.2.3 has been edited to clarify the priorities in mesh size considerations.
FGM-07	TNC	11/14/2012	"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	AEA has included four operational scenarios in the RSP. The four scenarios represent the existing condition, a maximum load-following, an intermediate load-following, and a base-load scenario. The three with-Project scenarios will provide bookends and an intermediate assessment of potential Project effects. The text in Section 6.6.4.2.2.2 has been edited to reflect this commitment.

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			opportunity to gage the impacts of a wider range of operation regimes." –pdf page 3	
FGM-08	NMFS	11/14/2012	"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." –pdf page 45	See AEA's response to comment FGM-07. The Geomorphology Studies will provide a summary of channel change identified for each scenario. Section 6.6.4.3 identifies habitat indicators that the Geomorphology Studies will evaluate directly and information the Geomorphology Study will pass to other Studies, such as the Fish and Aquatics Instream Flow Study to evaluate other habitat indicators.
FGM-09	TNC	11/14/2012	"Focus Area Selection 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. –pdf page 2	See AEA's response to comment GEO-13.
FGM-10	TNC	11/14/2012	"Focus Area Selection 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. –pdf page 2	See AEA's response to comment GEO-14.
FGM-11	TNC	11/14/2012	"Focus Area Selection Focus areas should be selected in the Middle and Lower	See AEA's response to comment GEO-15.

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			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." –pdf page 2	
FGM-12	TNC	11/14/2012	"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." –pdf page 3	See AEA's response to comment GEO-02 and GEO-15.
FGM-13	EPA	11/14/2012	"The PSP/RSP should not 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	The approach does not make the assumption identified in the comment. The overall framework for the geomorphology studies and the relationship to the studies for the other resource areas is provided in Section 6.1. Integration between the Geomorphology Study and the Fluvial Geomorphology Modeling below Watana Dam Study is provided in Section 6.5.11. A more detailed discussion of the overall integration of the

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			modeling with the results of the geomorphic studies." –pdf page 15	studies to develop the Integrated Resource Analysis is provided in Instream Flow Study Section 8.5.4.1Instream Flow Study. The changes in habitat indicators based on future geomorphic conditions and flow conditions will be evaluated.
FGM-14	USFWS	11/14/2012	"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." –pdf page 29	AEA agrees that the geomorphology studies will provide the information identified in the Service's comment or provide the information necessary for studies such as the Fish and Aquatics Instream Flow Study and Riparian Instream Flow Study to determine the influences for their resource areas. The Geomorphology Studies will provide a summary of channel change identified for each scenario. This summary will be included in the Instream Flow Study Section 6.6.4.3 of the Fluvial Geomorphology Modeling below Watana Dam Study identifies habitat indicators that the Geomorphology Studies will evaluate directly and information the Geomorphology Studies will provide other studies, such as the Fish and Aquatics Instream Flow Study, Riparian Instream Flow Study and Groundwater Study, to evaluate Project effects in their resource areas. Tables 6.6-6 and 6.6-7 list the 1-D and 2-D model parameters and other information that will be provided by the Geomorphology and Fluvial Geomorphology Modeling studies.
FGM-15	EPA	11/14/2012	"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." –pdf page 15	The development of the flow routing model is presented in the Instream Flow Study (Section 8.5.4.3) including cross-section selection. An IHA analysis is also being conducted in the Instream Flow Study (Section 8.5.4.4.1.1.3). In the case of Focus Areas where the 2-D bed evolution model is applied, the routing model will provide the boundary conditions for the 2-D model to determine the hydraulic conditions for both existing and with-Project hydrologic conditions. Details on the overall Focus Area selection process are provided in the Fish and Aquatics Instream Flow Study (Section 8.5.4.2). Section 6.6.4.1.2.4 provides the details on the involvement of the Geomorphology studies in the Focus Area site selection.

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FGM-16	NMFS	11/14/2012	"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." –pdf page 45	The Geomorphology Study will provide the requested information. Section 6.6.4.3 of the Fluvial Geomorphology Modeling below Watana Dam Study identifies habitat indicators that the Geomorphology Studies will evaluate directly and information the Geomorphology Studies will provide other studies, such as the Fish and Aquatics Instream Flow Study, Riparian Instream Flow Study and Groundwater Study, to evaluate Project effects in their resource areas. Tables 6.6-6 and 6.6-7 list the 1-D and 2-D model parameters and other information that will be provided by the Geomorphology and Fluvial Geomorphology Modeling studies.
FGM-17	NMFS	11/14/2012	"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 described and provided to the groundwater and instream flow studies to assess effects of geomorphic response on habitat availability and quality…" –pdf page 45-46	Section 6.1 explains the relationship between the Geomorphology Study, Fluvial Geomorphology Modeling below Watana Dam Study and the various aquatic resource studies including the Instream Flow Study (Section 8.5) and Riparian Instream Flow Study (Section 8.6) and identifies the key indicators that the Geomorphology studies will provide to the aquatic resource studies. Additionally, AEA has modified the wording of the objectives of several study components to be more in line with the NMFS and USFWS Study requests as well as to convey the actual intended objectives better. AEA has also added the study interdependency charts to Sections 6.5.6 and 6.6.6 along with tables providing inputs form other studies and products provided by the Geomorphology studies to other studies. AEA also added a study component to the Geomorphology Study (Section 6.5.411) that describes the integration of the Geomorphology Study with the Fluvial Geomorphology Modeling below Watana Dam Study to provide the support to interpret modeling results and develop the habitat indicators for the aquatic resource studies. AEA has also modified Section 6.6.4.3 to more clearly identify products that the Fluvial Geomorphology Modeling below Watana Dam Study, in concert with the Geomorphology Study will provide to the Instream Flow Study (Section 8.5), Riparian Instream Flow Study (Section 8.6), Ice Processes in the Susitna River Study (Section 7.6), Water Quality (Section 5) and Groundwater Study (Section 7.5). Tables 6.6-6 and 6.6-7 in the Fluvial Geomorphology Modeling below Watana Dam Study RSP list 1-D and 2-D model results and other Geomorphology Study results that will be supplied to these studies to support the determination of Project effects.
FGM-18	EPA	11/14/2012	Comment 7 Part 1 – The RSP needs to make clear why the	The RSP clarifies that the assessment of channel stability / dynamics is

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			assessment of channel stability is important to understanding Project impacts on key resources attributes. The Susitna's channel morphology is naturally dynamic. Therefore, the ecologically more relevant question may not be, *is the channel stable?*, but, *How much "instability" is natural in the system?* This can be quantified using digital maps of the river valley, for individual reaches, by determining 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 area covered by water today was land versus covered by water in the 1980s. The resulting transition matrix can be used to calculate a "turnover rate", for each reach, for the period between the 1980s and 2012. For those reaches with aerial imagery available from the 1950s, similar data can be compiled for the period between the 1950s and 1980s. –pdf page 17	important to understanding Projects effects. The need for this understanding is first brought up in the Introduction (Section 6.1) to the Geomorphology Studies. It is further discussed in the objectives of the Geomorphology Study (Section 6.5.1.1). It is again discussed in subsection 6.5.4.14.1 of the study components: Assess Geomorphic Change Middle and Lower Susitna River Segments. It is central to establishing a baseline for comparison of with Project conditions and in understanding the geomorphic processes governing the creation and maintenance of the geomorphic features that provide the important aquatic and riparian habitats. The introduction to the overall Geomorphology Study effort, Section 6.1 was edited to include this discussion upfront. The turnover analysis and expansion of the analysis of channel change to include aerial imagery from ~1950s, contingent on images of sufficient quality being available, were added to the Geomorphology Study in Section 6.5.4.4. The turnover analysis and inclusion of the 1950s aerials will apply to both the Middle and Lower Susitna River Segments.
FGM-19	EPA	11/14/2012	Comment 7 Part 2 – The quantitative data on turnover rate can be compared statistically to data on other potential determinants of channel change, such as gradient, bed rock confinement, and magnitude of sediment impacts from tributaries. This will result in a more robust, quantitative model of factors that affect turnover rate, for incorporation into the understanding of geomorphic modeling results. –pdf page 19	The turnover rate analysis (Section 6.5.4.4) will be viewed and interpreted in respect to potential determinants of channel change such as gradient, confinement and channel type. It is unlikely that there will be sufficient information to perform a meaningful statistical analysis.
FGM-20	EPA	11/14/2012	Comment 7 Part 3 – An analysis of the hydrologic and sediment, or of other disturbance regimes and biotic controls (fire, temperature, predation, herbivory, species competition, exotic species etc.), preceding the periods of observation for the aerial imagery comparison can inform the question of channel dynamics. Potential indirect influences on these controls such as changes in land use, development, land management, hunting, beaver trapping, etc. must also be assessed. –pdf page 19	The Geomorphology Study will consider hydrology and sediment transport (including glacial related events) in the analysis of channel change and turnover rate. This and other details of the turnover analysis are presented in Section 6.5.4.2.2.

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FGM-21	EPA	11/14/2012	Comment 8– 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 hydrogeologic settings, including studies of long-term dynamics (see also Wellmeyer et al. 2005). 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. –pdf page 19	AEA has added Section 6.5.4.6.2.4 to the Geomorphology Study that involves performing a literature search and review for downstream effects of dams, focused on projects in similar cold region environments.
FGM-22	EPA	11/14/2012	Comment 9 Part 1 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). This would 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. –pdf page 20	An assessment of LWD is included in Section 6.5.4.9 of the study plan and includes an evaluation of LWD recruitment, loading, function, and potential project effects. The LWD study will evaluate the interaction of LWD with hydrology, riparian, aquatic, ice processes, and river geomorphology. Data will be collected from aerial photographs throughout the entire study area and field studies in Focus Areas. Geomorphic modeling of potential changes in LWD loading will take place at selected Focus Areas utilizing the 2-D model. Additional text has been added to Section 6.6.4.1.2.7 of the Fluvial Geomorphology Modeling below Watana Dam Study to describe the integration of LWD into the overall assessment of potential changes in geomorphic features. Additional text has also been added to section 6.5.4.9.2 to identify support from the Large Woody Debris study component for the modeling effort.
FGM-23	EPA	11/14/2012	Comment 9 Part 2 – In addition to identifying LWD functional roles, the proposed studies could estimate/quantify the volume of sediment (and	Mapping of LWD on aerial photographs upstream of Three Rivers will include information on associated geomorphic features as possible from the photographs. Detailed mapping of LWD and associated

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			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. –pdf page 20	channel/substrate/habitat features in the Focus Areas was added to the Study Plan to permit more quantitative analysis of LWD with hydraulics, bedload transport, channel geomorphology, aquatic and riparian habitat in these Focus Areas (Section 6.5.4.9).
FGM-24	EPA	11/14/2012	Comment 10 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. –pdf page 20	The Ice Processes in the Susitna River Study (Section 7.6) in the Susitna River will provide the Geomorphology study with the information on the potential Project effects on ice break-up and the formation of fragments. The River 1-D model will predict whether the ice cover will be broken up by the load-following fluctuations. The model will address hourly and daily cycles of flow fluctuation. Quantitative tools to estimate bed scour from ice fragments are not currently available. If this remains the case, we propose that if Project scenarios result in increased frequency of break-up, that the potential for bed scour be identified as a relative ranking among scenarios based on the frequency of break-up.
FGM-25	EPA	11/14/2012	Comment 11 The modeling effort described is deterministic; however, river system dynamics are naturally somewhat stochastic. If a	To assist in identifying and understanding uncertainties, sensitivity analysis will be performed for the 1-D and 2-D modeling efforts by varying key input parameters within the range of physically reasonable values

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			stochastic approach to the modeling is not performed, 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). The 1-D and 2-D 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.) –pdf page 21	(Section 6.6.4.2.2.3). Additionally, a range of hydrologic conditions will be evaluated in the 50 year simulation period to be used for the 1-D model bed evolution model encompasses a broad range of hydrologic conditions and will be used to assess the sensitivity of the study areas to hydrologic variability. The influence of extreme events will be addressed by modeling the 100-year flood with both 1-D and 2-D models. Variation in response to the six representative years (wet, average and dry for wet and cold PDO) based on both the 1-D and 2-D model results will also provide an understanding of the uncertainty associated with hydrologic conditions.
FGM-26	EPA	11/14/2012	Comment 12 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 1-D or 2-D 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. –pdf page 22	The process, criteria and schedule for determining the need to extend the downstream limits into or further into the Lower River are presented in the Instream Flow Study (Section 8.5.3) and the Geomorphology Study (Section 6.5.3). The assessment and the following six criteria will be used to evaluate the need to extend studies into the Lower River Segment and if studies are needed, will identify which geomorphic reaches require instream flow analysis in 2013. The criteria include: 1) Magnitude of daily stage change due to load-following operations relative to the range of variability for a given location and time under existing conditions (i.e., unregulated flows); 2) Magnitude of monthly and seasonal stage change under Project operations relative to the range of variability under unregulated flow conditions; 3) Changes in surface area (as estimated from relationships derived from LiDAR and comparative evaluations of habitat unit area depicted in aerial digital imagery under different flow

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				conditions) due to Project operations; 4) Anticipated changes in flow and stage to Lower River off-channel habitats; 5) Anticipated Project effects resulting from changes in flow, stage and surface area on habitat use and function, and fish distribution (based on historical and current information concerning fish distribution and use) by geomorphic reaches in the Lower River Segment; and 6) Initial assessment of potential changes in channel morphology of the Lower River (Section 6.5.4.6) based on Project related changes to hydrology and sediment supply in the Lower River. Results of the 2013 studies would then be used to determine the extent to which Lower River Segment studies should be adjusted in 2014.
FGM-27	EPA	11/14/2012	"The selection of additional cross-sections for the HEC-RAS modeling needs to produce a geomorphically representative sample of locations." –pdf page 15	The development of the flow routing model is presented in the Instream Flow Study (Section 8.5.4.3) including cross-section selection. In the case of Focus Areas where the 2-D bed evolution model is applied, the routing model will provide the boundary conditions for the 2-D model to determine the hydraulic conditions for both existing and with-Project hydrologic conditions. Additional cross-sections are to be surveyed in 2013 to provide the appropriate resolution for the 1-D sediment transport model. Section 6.6.4.1.2.9 identifies which indicates on the order of 80 to 100 additional cross-sections will be surveyed in 2013. These cross-sections will also be used in the routing model.
FGM-28	USFWS	11/14/2012	"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." –pdf page 24	Identification of the information to be supplied from the Geomorphology Study to support the Fluvial Geomorphology Modeling below Watana Dam Study is identified in Section 6.5.4.11. The study interdependencies charts and associated discussions in Section 6.5.6 and 6.6.6 also identify products and associated schedule for delivery to various studies that will require the results of the Geomorphology Study to evaluate Project effects on aquatic resources. Section 6.6.4.3 identifies the end-products that will be delivered through the combination of the Fluvial Geomorphology Modeling and Geomorphology studies to facilitate evaluation of Project effects on anadromous fish and other aquatic resources can be evaluated by the Fish and Aquatics Instream Flow Study (Section 8.5). Tables 6.6-6 and 6.6-7 list the 1-D and 2-D model parameters and other information that will be provided by the Geomorphology and Fluvial Geomorphology Modeling studies. To assist in identifying and understanding uncertainties, sensitivity

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				analysis will be performed for the 1-D and 2-D modeling efforts by varying key input parameters within the range of physically reasonable values (Section 6.6.4.2.2.3). Additionally, a range of hydrologic conditions will be evaluated in the 50 year simulation period to be used for the 1-D model bed evolution model encompasses a broad range of hydrologic conditions and will be used to assess the sensitivity of the study areas to hydrologic variability. The influence of extreme events will be addressed by modeling the 100-year flood with both 1-D and 2-D models. Variation in response to the six representative years (wet, average and dry for wet and cold PDO) based on both the 1-D and 2-D model results will also provide an understanding of the uncertainty associated with hydrologic conditions.
FGM-29	USFWS	11/14/2012	"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." –pdf page 28	AEA agrees with the comment and the point it makes is consistent with our approach. This is why the without-Project condition, including the operations scenarios, is assessed for 50 years into the future. This, along with the analysis of historical information such as comparison of the 1980s cross-sections with current cross-sections and comparison of aerial photographs from the 1950s and 1980s with current photos, will help identify current trends. The existing condition, projected 50 years into the future, provides a basis for comparison with alternative scenarios representing potential Project conditions over the same period to identify change (Project effects) both spatially and temporally. The wording has been revised in the introductory description of the study to acknowledge the possibility that the system is not in a state of dynamic equilibrium (Section 6.1).
FGM-30	NMFS	11/14/2012	"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	See AEA's response to comment FGM-30.

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			spatial and temporal riverine and floodplain habitat change analysis." –pdf page 44	
FGM-31	USFWS	11/14/2012	"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 1-D movable boundary sediment transport model to address reach-scale issues and 2-D models to address local scale issues." –pdf page 28	As indicated in the schedule for Model Selection (Section 6.6.6), a model will be selected in early Q2 2013 (April). This will provide ample time for development of the 2013 field data collection. In general, the data needs for the candidate 1-D models are basically the same. This is also true for the 2-D models.
FGM-32	NMFS	11/14/2012	"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.–pdf page 44	See AEA's response to comment FGM-31.
FGM-33	NMFS	11/14/2012	"The bed evolution modeling approach will consist of a 1-D movable boundary sediment transport model to address reach-scale issues and 2-D 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. –pdf page 44	AEA agrees with the comment. The effort described in 6.5.4.1.2.3 Geomorphic Characterization of the Susitna River provides the initial understanding of the processes that create and maintain the geomorphic features that represent important aquatic habitat. The effort in section 6.5.4.11 provides for integration with knowledge gained from the geomorphology study to interpret results of the Fluvial Geomorphology Modeling. This, combined with the results of the Fluvial Geomorphology Modeling below Watana Dam Study developed in Section 6.6.4.3, will provide the linkage to changes in geomorphic form and process. Additional interpretation of changes in habitat will be developed by the Instream Flow Study (Section 8) from information developed by the Geomorphology studies. Tables 6.6-6 and 6.6-7 list the 1-D and 2-D model parameters and other information that will be provided by the Geomorphology and Fluvial Geomorphology Modeling studies.
FGM-34	NMFS	11/14/2012	The 1-D 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. A clear method for determine model extension is needed in the study plan to avoid misunderstanding and responsibilities of this study." –pdf page 44	See AEA's response to comment GEO-02.

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FGM-35	USFWS	11/14/2012	"One of the models proposed for 1-D 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." –pdf page 29	See AEA's response to comment GEO-03.
FGM-36	NMFS	11/14/2012	"One of the models proposed for ID 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." –pdf page 45	See AEA's response to comment GEO-03.
FGM-37	USFWS	11/14/2012	"The 2-D 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 2-D 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." –pdf page 29	All the Focus Areas with 2-D modeling are expected to be Focus Areas for the Fish and Aquatics Instream Flow Study. The Fish and Aquatics Instream Flow Study is considering the habitat and biologic functions identified in the comment in selection of the sites. In turn the Fluvial Geomorphology Modeling below Watana Dam Study is reviewing the sites to ensure that the sites include the range of geomorphic features and flow conditions that help define the habitat that may potentially be changed by Project operations. The overall selection process, schedule and criteria for the Focus Areas are provided in the Fish and Aquatics Instream Flow Study (Section 8.5.4.2). Section 6.6.4.1.2.4 of the Fluvial Geomorphology Modeling below Watana Dam Study provides the details on the involvement of the Geomorphology Studies in the Focus Area site selection. This include the exactly location (RM), number of sites (10) and geomorphic (one site in each geomorphic reach and representative of the range of geomorphic features found in the reach) and modeling criteria (extent of site for proper boundary conditions use modeling approach).
FGM-38	NMFS	11/14/2012	"The 2-D 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 2-D models must consider habitat utilization by anadromous fish, importance of the	See AEA's response to comment FGM-37.

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			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." –pdf page 45	

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GW-01	CWA	11/14/2012	Scope is insufficient in studying the Lower River based on AEA's apparent assumption that Project effects will not significantly affect the Lower River groundwater processes. –page 7-8	AEA is not assuming insignificant Project-related effects on the Lower River groundwater processes. Although both Middle and Lower River segments are under consideration as part of the Instream Flow Study (Section 8.5), the majority of detailed study elements described in the RSP are concentrated within the Middle River Segment. This is because Project operations related to load-following and variable flow regulation will likely have the greatest potential effects on this segment of the river. These effects tend to attenuate in a downstream direction as channel morphologies change, and flows change due to tributary inflow and flow accretion. The downstream boundary of the Study Area is currently RM 75 because existing information indicates that the hydraulic effects of the Project below the Three Rivers Confluence are attenuated. See Section 8.5.3. However, AEA will reevaluate how far downstream Project operational significant effects extend based in part upon the results of the Open-water Flow Routing Model (see Section 8.5.4.3). The results of the Open-water Flow Routing Model, to be completed in Q1 2013, will be used to determine whether, and the extent to which, Project operations related to load-following, as well as seasonal flow changes, occur within the Lower River Segment. Thus, an assessment of the downstream extent of Project effects will be developed in Q1 2013 with review and input of the TWG. This assessment will include a review of information developed during the 1980s studies and study efforts initiated in 2012, such as sediment transport (see Section 6.5), habitat mapping (see Sections 6.5 and 9.9), operations modeling (see Section 8.5.4.3.2), and the Mainstem Open-water Flow Routing Model (see Section 8.5.4.3). The assessment will guide the need to extend studies into the Lower River Segment and if needed, will identify which geomorphic reaches will be subject to detailed instream flow analysis in 2013. Results of the 2013 studies would then be used to determine the extent to which Lower River Segment studies should be adjusted in 2014. In addition, the results of the 1-D sediment transport modeling (see Section 6.6) from RM 184 to RM 75 will be available in Q1 2014 and will further inform the need for these adjustments. Pilot HSC/HSI studies were initiated in 2012, and will be continued in 2013, and include data collection within Lower River Segment habitats (see Section 8.5.4.5). See also Section 8.5.3 for more discussion regarding the Lower River Segment. The Groundwater Study also includes an analysis of shallow residential wells (see Section 7.5.4.9), many of which may be in the more populated upper portion of the Lower River. Following an inventory of existing shallow wells, those wells that have the highest likelihood of being affected by changes in the mainstem Susitna River flow regime will be

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				monitored and potential Project effects evaluated to assess groundwater vulnerability.
GW-02	CCC	11/15/2012	a) There does not appear to be a clear link between the groundwater and surface water studies and the engineering studies. b) How will the ground to surface water interaction at the dam site impact the stability of the dam? c) How will changing groundwater conditions impact the health of the forests downstream? d) How will the riparian zone above the dam be impacted as water pressure increases with the reservoir?	Regarding comments a and b, as described in Section 7.5.4.3, the Groundwater Study will be responsible for analyzing potential changes in groundwater flow at the proposed dam site associated with Project operations. Input to the Groundwater Study will be provided by Engineering Feasibility studies and the Geology and Soil Characterization Study (Section 4.5). One of the objectives of the engineering design studies will be to seal potential groundwater flow paths to reduce potential impacts to the dam structure and operations. Regarding comment c, potential effects of Project operations on riparian forests downstream of the dam site will be analyzed by the Riparian IFS (Section 8.6). As described in Section 7.5.4.5, the Groundwater Study will provide data related to groundwater/surface water interactions and coordinate the analysis of groundwater processes with the Riparian IFS. The Riparian IFS (Section 8.6) will also be responsible for analyzing Project effects on the riparian zone above the dam, with the Groundwater Study providing input on groundwater-surface water interactions,
GW-03	FERC	11/14/2012	"Clearly describe the exact number, location, and spatial extent of your proposed Focus Areas for each proposed study. Provide justification for the number of proposed sites selected for detailed 2-D hydraulic modeling and other intensive study elements. Include criteria to be used for selecting Focus Areas and study-specific rationale for co-locating sites." –pdf page 5	The location, number, and spatial extent of the proposed Focus Areas are discussed in Sections 7.5.4.5 and 7.5.4.6. For purposes of the RSP, a total of ten FAs in the Middle River Segment were identified. These ten areas were selected for planning purposes and will be evaluated for their depiction of non-modeled areas based on mapping results to be completed in Q1 2013 (see Section 9.9). The results of this evaluation will be discussed with the TWG and refinements in Focus Area selection made prior to commencement of the 2013 studies. In addition, the Groundwater Study includes specific objectives at the proposed dam site (Section 7.5.4.3), which are in addition to the proposed Focus Areas.
GW-04	ADNR-DMLW	11/14/2012	"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." –page 10	Coordination with Engineering Feasibility studies and the Geology and Soil Characterization Study (Section 4.5) will include the evaluation of observation wells in select geotechnical borings (see Sections 7.5.4.3 and 7.5.4.9). A review of available groundwater well data bases (e.g. USGS) will be used to identify existing deep wells that can provide information on groundwater conditions in deeper portions of the watershed aquifers. The drilling of deep wells is not planned as part of the Groundwater studies and is not necessary to evaluate Project effects on groundwater levels.
GW-05	ADNR-DMLW	11/14/2012	"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, wetlands (surface-water) and wetland vegetation are covered in the Riparian Vegetation Dependency on Groundwater/Surface-Water Interactions (Section 8.5.4.5). Results of the 1980s studies and other available

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			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." –page 10	groundwater data will be used to extend the record of observations to supplement information to be collected in 2013-2014. The groundwater models, using input from the surface-water flow routing models, will use the data sets to build simulation modeling tools. Those tools will be used to define groundwater conditions under the range of hydrologic years analyzed using the operations model (Section 8.5.4.3.2) and meet the goals and objectives of the study.
GW-06	ADNR-DMLW	11/14/2012	"The following comments are submitted regarding Prior Appropriator Water Rights: 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." –page 10	Potential Project effects on groundwater wells will be addressed as described in Section 7.5.4.9. The ADNR and USGS databases will be used to identify wells in the study area, and a subset of the wells will be monitored to help study and characterize the groundwater and surface-water interactions and processes taking place in the shallow water table aquifers along the river corridor.
GW-07	ADNR-ADF&G	11/14/2012	"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	The relationship between the Groundwater Study and the thermal imaging study is described in Section 7.5.7. The thermal imaging assessment performed in 2012 is described in Baseline Water Quality Study Section 5.5.4.9. The thermal imagery data was gathered in fall 2012 and is being calibrated with concurrent continuous temperature data from the Middle River sites RM 98 through RM 165. Calibration of thermal imagery and products to be completed in winter 2012 is also discussed Section 5.5.4.9. Additional thermal imaging of the Upper River and Lower River may be completed once the thermal imaging assessment of the Middle River is complete.

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			project lead." –page 19	
GW-08	ADNR-ADF&G	11/14/2012	"Dissolved oxygen should also be measured as a parameter for HSC and HSI development." –page 20	Dissolved oxygen measurements in groundwater and surface water will be measured in association with HSC/HSI sampling efforts using hand-held probes and continuous monitoring loggers (see Section 7.5.4.6 and Section 8.5.4.5.1).
GW-09	ADNR-ADF&G	11/14/2012	"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." –page 20	This comment is addressed in Riparian Vegetation Dependency on Groundwater/Surface-Water Interactions (Section 7.5.4.5) and a figure has been added to help show how wells may be located in a typical study area (Figure 7.5-8).
GW-10	TNC	11/14/2012	"Focus Area Selection 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,	The Groundwater Study (Section 7.5) is a key supporting study needed to improve the understanding of groundwater and surface-water interactions as they relate to riverine processes and the response of aquatic and riparian habitats to changes in flow and stage. The Groundwater Study will also evaluate the effects of changes in mainstem flow and stage on water rights and use of groundwater by the public. The Focus Areas are locations where the cumulative understanding is increased by the concentration of multidisciplinary studies in a series of unique locations that represent the variability in hydrologic, geomorphologic, aquatic and riparian habitat and other factors. The concentration and coordination of studies in these areas will lead to a better understanding of riverine processes at the reach-scale and Focus Area-scale and the use of predictive simulation tools to evaluate potential Project effects. See AEA's response to comment IFS-14. As described in Section 8.5.4.2.1.1, ten proposed Focus Areas were identified in the Middle River Segment , and are illustrated in Figures 8.5-13 to 8.5-22. These ten areas were selected for planning purposes and will be evaluated further for their representativeness of non-modeled areas based on results of habitat mapping that will be completed in Q1 2013 as part of Section 9.9. The results of this mapping effort will be discussed with the TWG and refinements in Focus Area selection made prior to commencement of the 2013 studies. Criteria used in selecting the proposed Focus Areas include: 1) All major habitat types (main channel, side channel, side slough, upland slough, tributary delta) will be sampled within each geomorphic reach.

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			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." –pdf page 2-3	2) At least one (and up to three) Focus Area(s) per geomorphic reach (except geomorphic reaches associated with Devils Canyon – MR-3 and MR-4) will be studied that is/are representative of other areas. 3) A replicate sampling strategy will be used for measuring habitat types within each Focus Area, which may include a random selection process of mesohabitat types. 4) Areas that are known (based on existing and contemporary data) to be biologically important for salmon spawning/rearing in mainstem and lateral habitats will be sampled (i.e., critical areas). 5) Areas for which little or no fish use has been documented or for which information on fish use is lacking will also be sampled to help identify factors affecting the distribution, timing and abundance of fish.
GW-11	TNC	11/14/2012	"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	See AEA's response to comment GW-01.

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			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." –pdf page 3	
GW-12	TNC	11/14/2012	"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." –pdf page 3	The Groundwater Study will use the various simulations provided by the Operations Model (Section 8.5.4.3.2), as routed downstream by the hydraulic routing models (Section 8.5.4.3.1 and Section 7.6), to provide hydrologic input conditions for groundwater model simulations. Modeled scenarios will include existing conditions, maximum load-following, intermediate load-following and a base-load scenario. The three with-Project scenarios will provide bookends and an intermediate assessment of potential Project effects.
GW-13	USFWS	11/14/2012	"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." –pdf page 15	Although AEA has not changed the title of the Groundwater Study, the scope of the study includes the floodplain (Section 7.5.1).
GW-14	USFWS	11/14/2012	"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	Please see Sections 7.5.4.5 Riparian Vegetation Dependency on Groundwater / Surface Water Interactions and 7.5.4.6 Aquatic Habitat Groundwater / Surface- Water Interactions.

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			Instream Flow studies)." –pdf page 15	
GW-15	USFWS	11/14/2012	"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." –pdf page 15	The study has been revised to include an interdependency figure with timeline information (Figure 7.5-3) for each of the Section 7.5.4 study elements. The interdependency figure and associated timelines are discussed in Sections 7.5.4.1 to 7.5.4.9.
GW-16	USFWS	11/14/2012	"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." –pdf page 15	The study has been revised to include an interdependency figure with timeline information in each of the Section 7.5.4 study elements. The interdependency figure and associated timelines are discussed in Sections 7.5.4.1 to 7.5.4.9. The riparian groundwater study objective (Section 7.5.4.5) and the aquatic habitat study objective (Section 7.5.4.6) are examples of studies that work collaboratively in terms of data collection, use and reporting.
GW-17	USFWS	11/14/2012	"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." –pdf page 15	AEA has deleted the referenced sentence. Consistent with the comment, AEA has provided additional detail clarifying the timing and relationship of the Groundwater Study to other studies. The relationship between studies is described in the study methods sections (7.5.4.1 through 7.5.4.9), and interdependencies are described in Section 7.5.7-Relationship with Other Studies and Figure 7.5-3. In the riparian (7.5.4.5) and aquatic (7.5.4.6) study elements, the installation of wells, groundwater modeling, data reduction and analysis are the responsibility of the Groundwater Study. Groundwater Study objectives pertaining to the Watana Dam site will use data collected by the Geology and Soils Characterization Study (Section 4.5) and Engineering Feasibility studies.
GW-18	USFWS	11/14/2012	"The methods should be described in sufficient	Additional details are provided in Sections 7.5.4.1 through 7.5.4.9. Where specific ASTM

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			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." – pdf page 15-16	or other standards are referenced, additional details have been added to help evaluate the application of the standard. The proposed groundwater studies could be duplicated by other parties using the study implementation descriptions provided in the Groundwater Study and cited references regarding standard methods and practices.
GW-19	USFWS	11/14/2012	"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." –pdf page 16	The current Riparian Instream Flow Study is not designed as an "impact study" as specified by Green (1979). The goal of this study is to provide a physical and vegetation process modeling approach to predicting potential impacts to downstream riparian floodplain vegetation from Project operational flow modification of natural Susitna River flow, sediment, and ice processes regimes (see Section 8.6.1.1). The environmental analysis within AEA's FERC License Application will inform the need for ongoing monitoring.
GW-20	USFWS	11/14/2012	"AEA's overall study goal is similar to the Service	The overall goal of the study plan has been revised to be consistent with the language

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			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." –pdf page 16	requested by the USFWS. With respect to the Lower River Segment, see AEA's response to comment GW-11.
GW-21	USFWS	11/14/2012	"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." –pdf page 16	The lateral extent of the Focus Areas will be determined by assessing the extent of surface water / groundwater interaction through multiple lines of evidence. Mapping of the geologic floodplain will be conducted first using an uncorrected LiDAR shaded relief map. Alluvial terrain will be mapped relative to adjacent hill slopes. HEC-RAS (1-D) modeling of discharge and stage will be used to delineate valley bottom floodplain flooding discharge magnitudes by the fluvial geomorphology modeling (Section 6.6). The width of the floodplain where groundwater is influenced by surface water, and Project operations, will be determined by a combination of: (1) land surface mapping, using LiDAR or surface mapping information, (2) geologic information, (3) observations of springs and groundwater recharge to sloughs and ponds, (4) well observations, and (5) floodplain plant community distribution. Further details are provided in Section 8.6.3.6 as well as Section 7.5 (Groundwater Study).
GW-22	USFWS	11/14/2012	"Service Objective1 (meaningful differences underlined): "Synthesize historical data for Susitna River groundwater and groundwater-dependent aquatic and floodplain habitat, including the 1980s studies". "Floodplain" should be included in the objective to broaden the objective scope." –pdf page 17	Objective 1 of the study plan has been revised to be consistent with the language proposed by the USFWS (Section 7.5.1).
GW-23	USFWS	11/14/2012	"Not included in AEA's methods is a review and	As described in Section 7.5.4.1, Existing Data Synthesis, the groundwater literature review

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			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." –pdf page 17	will include studies conducted at other cold region hydropower and water control projects. The groundwater literature review will be coordinated with the Ice Processes in the Susitna River Study (Section 7.6.4.11) and the Geomorphology Study (Section 6.5).
GW-24	USFWS	11/14/2012	"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." –pdf page 17	This comment is addressed in Section 7.5.4.2, Geohydrologic Process-Domains. Riparian study area selection is based upon riparian process domain characterization described in Section 8.6.3.2. Riparian Instream Flow Study areas will be selected through a spatially constrained cluster analysis process and expert-opinion in coordination with the TWG. Constrained cluster analysis is designed to statistically group river segments, and reaches, such that classification of similar river elements, including floodplain types (full range of plant communities) is made through an objective quantitative process (see Section 8.6.3.2 for further details and references). Ten proposed Focus Areas in the Middle River Segment have been identified (see AEA's response to comment GW-10). In Q1 2013 the quantitative GIS-based cluster analysis will be conducted in support of finalizing Focus Area selection for 2013, in consultation with the TWG. See Section 8.6.3.2 for detailed methods. Riparian process domain delineation will be an iterative process where Focus Areas will be first selected for 2013 fieldwork and if needed, additional Focus Areas will be selected for study in 2014.
GW-25	USFWS	11/14/2012	"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	The downstream extent of changes in groundwater associated with construction and operation of the reservoir is described in Section 7.5.4.3, Watana Dam/Reservoir.

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			groundwater." –pdf page 18	
GW-26	USFWS	11/14/2012	"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." –pdf page 18	The requested edits have been incorporated into the Groundwater Study objectives. This comment is addressed in Sections 7.5.4.4 and 7.5.4.5. The mapping of floodplain habitat and groundwater- dependant wetlands and other riparian habitat will use a combination of LiDAR data, vegetative mapping (Section 11.5), and hydrologic and riparian analysis from the Riparian Instream Flow Study (Section 8.6).
GW-27	USFWS	11/14/2012	"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." –pdf page 18	See Section 7.5.4.5, Riparian Vegetation Dependency on Groundwater / Surface Water Interactions.
GW-28	USFWS	11/14/2012	"Aquatic groundwater-influenced habitat on the	This comment is addressed in the Fish and Aquatics Instream Flow Study (Section

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			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." –pdf page 18	8.5.4.6.1.5). Additional details on mainstem winter discharge measurements are covered in the Instream Flow Study Section 8.5.4.4. Winter discharge measurements, in coordination with USGS data collection program, will occur at 11 of the 13 AEA gaging stations. The lower two stations are operated for understanding potential tidal effects. Winter gaging will occur in January and March of 2013 and 2014, or at time frames in coordination with USGS measurements. Coordination with the Ice Processes in the Susitna River Study (Section 7.6) on the identification of open leads and the influences that lead to the open leads will also help identify primary areas of upwelling on the main channel. Groundwater analyses in main channel areas are described in Sections 7.5.4.1, 7.5.4.2, and 7.5.4.4, and in main channel areas within Focus Areas as described in Sections 7.5.4.5 and 7.5.4.6. The Groundwater Study is responsible for the collection of groundwater data and will coordinate with other studies on collecting data that are ancillary, but pertinent, to groundwater investigations. No single method is expected to capture the complete distribution of upwelling areas; however, in combination, the proposed methods should be sufficient to evaluate effects of the Project on aquatic groundwater influenced habitats.
GW-29	USFWS	11/14/2012	"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 groundtruthing 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	This comment is addressed in Section 7.5.4.4. Also, see AEA's response to comments GW-07 and GW-28.

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			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." –pdf page 19	
GW-30	USFWS	11/14/2012	"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." –pdf page 19	In response to this request, groundwater methods are described in the Groundwater Study (see Section 7.5.4.5). .
GW-31	USFWS	11/14/2012	"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	This comment is addressed in Section 7.5.4.5. The Groundwater Study is not a stand-alone study; it is designed to be a coordinated effort with other studies to help guide data collection activities related to GW/SW interactions. See AEA's response to comment GW-24 regarding selection of Focus Areas.

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			Areas. A master matrix of studies, data needs and data products would greatly facilitate this process and stakeholder acceptance." –pdf page 19	
GW-32	USFWS	11/14/2012	"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." –pdf page 19-20	These comments are addressed in Sections 7.5.4.5 and 7.5.4.6, as well as the Riparian Instream Flow Study (Section 8.6). The proposed study methods address the potential influence of local precipitation on groundwater processes. This study will utilize hydrologic data from the 1980s studies, as well as data collected 2012 through 2014, and will include development of analysis tools to improve the understanding of hydrologic processes outside that gained by data collection programs alone. The surface-water records extend the range of hydrologic information beyond a ten year period of record. The record of surface-water data collection is being further developed by a thorough data collection program developed in conjunction with Fish and Aquatics Instream Flow Study (Section 8.5.4.4.1.1) and USGS data collection programs. These data collection and analysis approaches will provide sufficient data to evaluate potential Project effects.
GW-33	USFWS	11/14/2012	"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	See Section 7.5.4.5. The accuracy of MODFLOW is not a function of the model code, but of the information being applied to any one specific modeling project. The combination of the proposed well networks and development of groundwater modeling simulation tools provides a thorough approach to understand the relationships between groundwater, riparian vegetation, and resulting variations created by surface-water interactions. The model simulations, along with independent analysis of field data, inform the complex processes and their interactions.

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			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 surfacewater 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 surfacewater 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." –pdf page 20	
GW-34	USFWS	11/14/2012	"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." –pdf page 21	The methods section of the Groundwater Study (Section 7.5.4) has been revised and expanded to identify parties responsible for collecting and analyzing site-specific groundwater data. The data collection program for proposed Focus Areas sites related to aquatic resources is described in Section 7.5.4.6. The potentiometric surface (water table surface) will be developed by incorporating a series of groundwater and surface measurements at each Focus Area. The continuous data collection stations will provide an understanding of rising and falling water stages for groundwater and surface-water systems. This in combination with the understanding gained from groundwater model, aerial maps and observations will all be used to help develop potentiometric maps.
GW-35	USFWS	11/14/2012	"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 number, extent, and location of proposed Focus Areas is intended to span all of the geomorphic classification types used by anadromous fish species (see AEA's response to comment GW-10). Additional detail can be found in section 7.5.4.6. The extrapolation of results of modeled areas to non-modeled areas is described in Section 8.5.4.7 Temporal and Spatial Habitat Analyses and will be adjusted as needed to address groundwater-related processes.

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			The methods for extrapolating surface-water/ groundwater study results from the Focus Areas to the river segments are unclear." –pdf page 21	
GW-36	USFWS	11/14/2012	"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)." –pdf page 21	The Groundwater Study addresses these comments. Further details can be found in sections 7.5.4.5 Riparian Vegetation Dependency on Groundwater/Surface-Water Interactions, and 7.5.4.6 Aquatic Habitat Groundwater/Surface-Water Interactions.
GW-37	NMFS	11/14/2012	"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 Service's (USGS) data that will be used by other studies. Clarifying the purpose and roles of the PSPs will help NMFS understand what studies are actually be proposed and how and when they will be conducted. the pdf page 33.	See AEA's response to comment GW-17.
GW-38	NMFS	11/14/2012	"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	The Groundwater Study has been revised and expanded to address these comments. Section 7.5.4.6 Aquatic Habitat Groundwater/Surface-Water Interactions has additional details on the collection and analysis of data related to aquatic habitat. The collection of groundwater data will be the responsibility of the Groundwater Study.

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			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)." –pdf page 33	
GW-39	NMFS	11/14/2012	"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	The Groundwater Study has been revised and expanded to address these comments. Figures 7.5-8, 7.5-9 and 7.5-10 illustrate groundwater data collection networks for riparian and fish and aquatic habitats within a Focus Area. The study method sections also include information on data collection, model simulations, and sensitivity and accuracy analyses. Data deliverables are described for each of the study elements in Sections 7.5.4.1 through 7.5.4.9.

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			description of data, deliverables, and how uncertainty will be assessed NMFS cannot determine if the proposed studies are complete or adequate." –pdf page 33	
GW-40	NMFS	11/14/2012	"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." –pdf page 33	As described in Section 7.5.4.6, groundwater data collection, modeling and analyses are the responsibility of the Groundwater Study, but analyses of the interaction of groundwater/surface-water with fish and aquatic habitats requires close coordination with the Fish and Aquatics Instream Flow Study (Section 8.5). The instream study programs (Sections 8.5 and 8.6) will address habitat utilization and characteristics, while the Groundwater Study will focus on the physical and hydraulic aspects of groundwater/surface-water interactions. Based on the results of the 1980s studies, the influence of groundwater/surface-water interactions on salmonid spawning and incubation and juvenile salmonid overwintering habitats are key concerns of proposed Project operations. The Groundwater Study (Section 7.5) has been designed to analyze such groundwater exchanges associated with existing conditions and alternative operational scenarios under winter conditions.
GW-41	NMFS	11/14/2012	"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."	See AEA's response to comment GW-23.
GW-42	NMFS	11/14/2012	"The PSP contains large-scale geohydrologic	This comment is addressed in Section 7.5.4.2 Geohydrologic Process-Domains. See

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			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's response to RIFS-21, which covers the evaluation of the process domains, selection, and scaling of Focus Areas for habitat resources. The continued interaction with the TWG at regularly scheduled meetings will allow the process to be reviewed at the different stages of development and implementation. The proposed Focus Areas in the Middle River Segment are intended to reflect the full range of riparian and floodplain plant communities within the segment. Focus Area selection was based upon riparian process domain characterization described in Section 8.6.3.2. Potential refinement of proposed Focus Areas will be conducted using 2012 field data collected under the Riparian Vegetation Study Downstream of the Proposed Watana Dam (Section 11.6), and a spatially-constrained cluster analysis process in coordination with the TWG. Constrained cluster analysis is designed to statistically group river segments, and reaches, such that classification of similar river elements, including floodplain types (full range of plant communities) is made through an objective quantitative process (see Section 8.6.3.2 for further details and references). Riparian process domain delineation will be an iterative process where Focus Areas will be confirmed for 2013 fieldwork. As additional field data are collected, specifically ice process evidence (tree scars), additional Focus Area sites may be selected for study in 2014.
GW-43	NMFS	11/14/2012	"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."	See AEA's response to comment GW-02.
GW-44	NMFS	11/14/2012	[below is paraphrased section from relevant NMFS letter] a) 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	a) The Groundwater Study RSP (Section 7.5) addresses this comment. Additional information is available in AEA's responses to comments GW-07 and GW-28, as well as WQ-05. b) The methods are defined in the Groundwater Study (Section 7.5.4.4), in Fish and Aquatics Instream Flow Study hydrology (Section 8.5.4.4.1.1), Baseline Water Quality Study (Section 5.5.4.9), and Ice Processes in the Susitna River Study (Section 7.6.4.1). The cumulative methods that will be used to define groundwater discharge (upwelling) areas to mainstem areas (main channel, side

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			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. b) 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. c) 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.	channel, side sloughs, upland sloughs, ponds and wetland) include the following: - Winter discharge measurements conducted in January and March of 2013 and 2014 at AEA gaging stations, in coordination with USGS measuring discharge at USGS stations. These data sets will be used to measure the variation and potential increases in discharge along the Middle River Segment to characterize potential zones of ground discharge to the Susitna River (Section 8.5.4.4.1.1). - Winter open leads characterization to identify open leads that may be thermal systems (discharge of warmer groundwater), velocity systems, or combinations of both (Section 7.6.4.1). - Open leads identified by ice studies will be surveyed during winter months to help verify if leads are primarily thermal or velocity driven (Section 7.5.4.4). c) Focus Areas included in Groundwater Study Section 7.5.4.6 will have additional temperature measurements made in selected side channel, side slough, and upland slough habitats to help further characterize groundwater discharge and upwelling processes. d) Pilot thermal imaging with Forward Looking Infra-Red (FLIR) technology was flown in October 2012. If this technology proves useful, it may be expanded for other segments in the Middle and Lower River areas. e) Clarification has been added to Sections 7.5.4.1 through 7.5.4.9 to indicate in which study data will be collected and analyzed.

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			d) 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. e) 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.	
GW-45	NMFS	11/14/2012	[Below is paraphrased section from relevant NMFS letter, bottom of PDF page 35 through the top half of PDF page 36.]	a) The Groundwater Study RSP (Section 7.5) addresses this comment. See AEA's response to comment GW-32. This response addresses the comments regarding growing seasons, precipitation and study period duration. Clarifications on

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			a) 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). b) 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. c) 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. d) Precipitation may also dramatically affect transient but critical groundwater levels (a	groundwater study methods have been added to Sections 7.5.4.1 through 7.5.4.9. b) The Groundwater Study has been designed to support the Riparian Instream Flow Study (Section 8.6) and the Fish and Aquatics Instream Flow Study (Section 8.5). These studies, in conjunction with agency review and input, will determine the final number of Focus Areas for each study. The Groundwater Study will implement the supporting study elements (Sections 7.5.4.5 and 7.5.4.6, respectively) at each of the Focus Areas. c) This comment is addressed in Section 7.5.4.5. See AEA's response to comment GW-33. d) The accuracy of manual groundwater and surface-water level measurements is 0.02 feet. The accuracy of continuous water level measurements by pressure transducers is generally within 0.02 feet. The accuracy to Project sea level datum is related to the survey control network. Relative accuracy between measurements within a Focus Area will typically be within 0.02 feet, but between Focus Areas may be within 0.2 feet vertical accuracy. e) The accuracy of MODFLOW water table elevations will be determined by comparison of measured water levels from wells and simulated water levels from modeling runs. f) The measurement of the error in the LiDAR surface is described in the Fish and Aquatic Instream Flow Study Section 8.5.4.4.1.1. Where the LiDAR data is determined to not meet study objectives, then the ground-based mapping of Focus Areas will be conducted to provide ground surface elevation maps meeting study requirements. g) The number of wells for each study area will be determined in Q1 2013 in coordination with other studies and will be presented for input at TWG quarterly meetings.

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			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. e) NMFS needs an answer to this question: what are the "project accuracy standards used for waterlevel 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? 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. f) 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	

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			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.	
GW-46	NMFS	11/14/2012	"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." –pdf page 36	This comment is addressed in Sections 7.5.4.1 through 7.5.4.9. Groundwater and surface-water levels will be measured manually and at a subset of data stations continuously with pressure transducers. These data, in conjunction with the understanding gained through the groundwater models will help calculate and define the potentiometric water surfaces, also called water table maps. .
GW-47	NMFS	11/14/2012	"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." –pdf page 37	This comment is addressed in Section 7.5.4.6 Aquatic Habitat Groundwater/Surface-Water Interactions. The data collection programs and development of groundwater simulation models, with surface-water and water quality components, will be used to develop the understanding of how groundwater and surface water (main channel, side channel, side sloughs, upload sloughs, wetlands) interact and how this interaction may change with potential Project operations.
GW-48	NMFS	11/14/2012	"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.	See AEA's response to comment GW-35.

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			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." –pdf page 37	
GW-49	NMFS	11/14/2012	"Modeling may include the use of MOD FLOW (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." –pdf page 37	This comment is addressed in Section 7.5.4.6.
GW-50	NMFS	11/14/2012	"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." –pdf page 37	This comment is addressed in Section 7.5.4.6. The study incorporates continuous groundwater and surface-water monitoring of water temperature, dissolved oxygen, and spot measurements of conductivity. These parameters are the most useful groundwater tracers to understand groundwater and surface-water interactions and resulting water quality changes. AEA is not measuring groundwater age in this study. The data collection related to water quality will provide useful data informing local scale groundwater flow systems, without the use of the water age data.
GW-51	NMFS	11/14/2012	"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	A range of alternative operational scenarios will be evaluated as described in the Fish and Aquatics Instream Flow Study (Section 8.5.4.3.2). The four modeling scenarios include existing conditions, maximum load-following, intermediate load-following and a base-load scenario. The three with-Project scenarios will provide bookends and an intermediate assessment of potential Project effects. The range of operational scenarios will account for

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			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." –pdf page 38	changes to ice cover and thickness in the Ice Processes in the Susitna River Study model (Section 7.6) which will be used to provide input boundary conditions for the main channel in each of the groundwater modeling domains. As described in Section 7.5.4.6, groundwater data collection, modeling and analyses are the responsibility of the Groundwater Study, but analyses of the interaction of groundwater/surface-water with fish and aquatic habitats requires close coordination with the Fish and Aquatics Instream Flow Study (Section 8.5). The instream study program (Section 8.5 and 8.6) will address habitat utilization and characteristics, while the Groundwater Study will focus on the physical and hydraulic aspects of groundwater/surface-water interactions. Based on the results of the 1980s studies, the influence of groundwater/surface-water interactions on salmonid spawning and incubation and juvenile salmonid overwintering habitats are key concerns of proposed Project operations. The Groundwater Study (Section 7.5) has been designed to analyze such groundwater exchanges associated with existing conditions and alternative operational scenarios under winter conditions.
GW-52	NMFS	11/14/2012	"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." –pdf page 38	This comment is addressed in Section 7.5.4.9. The groundwater data collected in shallow groundwater wells will help improve the understanding of groundwater and surface-water interactions along the river segments where homeowner and businesses have existing wells. This information will help in some areas to scale the results and processes understanding from Focus Areas to geomorphic reaches and segments.

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ICE-01	CWA	11/14/2012	Scope is insufficient in studying the Lower River based on AEA's apparent assumption that Project effects will not significantly affect the Lower River ice processes. –pdf pages 7-8	AEA is not assuming an insignificant Project-related effect on Lower River ice processes. AEA is investigating potential Project-induced effects on ice processes on the Lower River (Section 7.6.3.4). The Ice Processes in the Susitna River Study includes a section describing the scope of ice processes observations and modeling on the Lower River (Section 7.6.3.10).
ICE-02	TNC	11/14/2012	"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." –pdf page 3	See AEA's response to comment ICE-01. See also AEA's response to comment IFS-33.
ICE-03	Coalition for Susitna Dam Alternatives	11/14/2012	"Two years are not enough for the Ice Processes Study." –pdf page 3	The number of years of winter observation which will be relied upon for this study is sufficient to meet the goals and objectives of the study plan. The study plan will rely upon at least seven years and likely eight winters/years of observations (including 5 years in 1980's, 2012-2013, 2013-2014, possibly 2014-2015 (7-8 years)). As described in Section 7.6.2, these observations span a range of meteorological conditions. This will allow AEA to meet study plan goals and objectives.

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ICE-04	Long, Becky	11/13/2012	Two years are inadequate, request for 5 to 7 year study –pdf page 2	See AEA's response to comment ICE-03.
ICE-05	Chase Community Council	11/15/2012	"Will the winter ice making and jamming change and if so, how will that impact the system Downstream. What effect will the winter water levels have on ice formation?" –pdf page 2	AEA will be using the ice processes model to predict potential changes in ice cover formation and break-up, including ice production, water levels, and jamming (Section 7.6.4.8.)
ICE-06	FERC	11/14/2012	"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." –pdf page 5	The Ice Processes River1D Model will provide flow routing and temperature results for the Middle River for the ice-affected period. The ice-affected period begins when a portion of the river cools to 32 degrees and ice begins to form in the fall until ice has flushed out of the river in the spring and is no longer affecting temperature or hydraulics (Section 7.6.4.6 and 7.6.4.7). The Water Quality Temperature Model and the Open-Water Hydraulic Routing Model will provide flow routing and temperature results for the Middle River for the ice-free period. The detailed River2D and River1D models developed for Instream Flow Study Focus Areas will provide hydraulic data for the ice-affected period for these Focus Areas. (Section 7.6.6).
ICE-07	FERC	11/14/2012	"Clearly describe the exact number, location, and spatial extent of your proposed Focus Areas for each proposed study. Provide justification for the number of proposed sites selected for detailed 2-D hydraulic modeling and other intensive study elements. Include criteria to be used for selecting Focus Areas and study-specific rationale for co-locating sites." –pdf page 5	The Ice Processes in the Susitna River Study will provide physical hydraulic data and modeling results for winter conditions at Focus Areas. The determination of whether a1-D or 2-D model will be needed will be made after the Focus Areas are selected. See Section 8.5.4.2.1.1 (Table 8.5-6 and Figures 8.5-13 to 8.5-22) for a discussion of how the Instream Flow Study Focus Areas will be selected. As indicated in IFS-014 response, a total of ten Focus Areas were identified. These 10 areas were selected for planning purposes and will be evaluated further for their representativeness of other areas based on results of habitat mapping that will be completed in Q1 2013. The results of this evaluation will be discussed with the TWG and refinements in Focus Area selection made prior to commencement of the 2013 studies. Table 8.5-6 provides the rationale for Focus Area selection. The specific criteria that were used in selecting the proposed Focus Areas include: 1) All major habitat types (main channel, side channel, side slough,

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				upland slough, tributary delta) will be sampled within each geomorphic reach. 2) At least one (and up to three) Focus Area(s) per geomorphic reach (excepting geomorphic reaches associated with Devils Canyon – MR-3 and MR-4) will be studied that is/are representative of other areas. 3) A replicate sampling strategy will be used for measuring habitat types within each Focus Area, which may include a random selection process of mesohabitat types. 4) Areas that are known (based on existing and contemporary data) to be biologically important for salmon spawning/rearing in mainstem and lateral habitats will be sampled (i.e., critical habitats). 5) Areas for which little or no fish use has been documented or for which information on fish use is lacking will also be sampled.
ICE-08	TNC	11/14/2012	"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." –pdf page 3	AEA has revised the study plan to clarify that it intends to include a base load scenario included in the Ice Processes Proposed Conditions model (Section 7.6.4.7).
ICE-09	USFWS	11/14/2012	"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	The Ice Processes River1D Model will handle winter flow routing, as described in Section 7.6.6. The River1D model selected was designed to simulate hydropower operations on ice-covered rivers, among other scenarios. The model will route flows at the same scale as the open-water flow routing model. Where this scale is insufficient to determine effects to fish habitat, the River1D model will provide boundary conditions for more detailed Focus Area

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			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." –pdf page 31	models, which will be River1D or River2D models as appropriate for the local conditions (Section 7.6.4.8).
ICE-10	USFWS	11/14/2012	"Winter discharge measurements are 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)." –pdf page 31	The Instream Flow Study (Section 8.5.4.3.1) describes how winter discharges will be measured: "Winter mainstem flows will be measured using a combination of current meter and ADCP methods. The winter gaging program will be coordinated with USGS so that the measurements from both programs occur at the same general time period. The current schedule is to conduct winter measurements in January and March of 2013 and 2014. The winter discharge measurement will occur at the AEA gaging stations from ESS80 downstream to ESS20 (Table 8.5-8). Winter discharge measurement will not be collected at ESS10 and ESS15. These discharge measurements will help assess gaining and losing river reaches during winter conditions. This effort will be coordinated with Ice Processes in the Susitna River Study (Section 7.6) so that measurements also have direct applications to the ice processes analysis and model development efforts".
ICE-11	USFWS	11/14/2012	Paraphrased regarding the literature review: • Should present a general overview of river ice processes relevant to the Susitna River with reference to the study reach. • The literature review should be expanded beyond the 5 listed papers to include international project sites and non-hydropower infrastructure projects • The review should provide greater insight into processes in the study reach, impacts of the project, and methods of analysis used to assess impacts on river ice processes and winter fish habitat. • A glossary of river-ice related terms should be provided. –pdf page 31	AEA has revised the study to expand the scope of the white paper to include an overview of ice processes and methods of analysis of river ice problems relevant to the Susitna River (Section 7.6.4.11). The review will also cover relevant ice-affected large rivers with hydropower development where applicable beyond the five listed publications, including international projects. Hydropower development has very specific impacts on river ice that other development (bridges, levees, diversions) does not. Thus, hydropower will be the focus of the white paper. A glossary of river ice terms will be provided.

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ICE-12	USFWS	11/14/2012	"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." – pdf page 32	The study schedule is presented in Section 7.6.7. The ILP process provides sufficient flexibility and includes opportunities for agency review and comment.
ICE-13	USFWS	11/14/2012	"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." –pdf page 33	The RSP describes the methods of characterizing the existing ice regime by various methods of observation (aerial reconnaissance, time-lapse cameras, measurement, continuous pressure transducers, meteorological data) (Sections 7.6.4.2 to 7.6.4.4). These methods, combined with the detailed characterizations from the 1980s, will provide fisheries and geomorphology studies with the necessary information they need to assess how their resources are affected by ice. This is described in the Relationship with Other Studies Section 7.6.7.
ICE-14	USFWS	11/14/2012	"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." –pdf page 33	The Ice Processes Model will route winter flows. The data described in Section 7.6.4 is needed to populate and calibrate the Ice Processes Model. Winter Flow Routing specifically will be calibrated using the winter discharge measurements and associated ice thickness measurements at transects as described in ISF Section 8.5.4.3.1. Description of limitations and sources of error in modeling is included in Section 7.6.4.8..
ICE-15	USFWS	11/14/2012	"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	Added detail on key findings of the modeling to the study plan (Section 7.6.2.1), and expanded on the limitations of the model.

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			they similar or very different than current needs?); and, their limitations (what limitations are we overcoming with the proposed model(s)?)." –pdf page 33	
ICE-16	USFWS	11/14/2012	"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"." –pdf pages 33-34	The RSP includes additional detail on how the 1980's project configuration was different and had some different issues (i.e., the reregulation dam and non-fluctuating flow releases made it less important to have winter flow routing and unsteady ice modeling). Additional detail about 1980s data that is relevant to this study has been added to Section 7.6.2.1. The last factor was revised to provide more detail (section 7.6.2.2)
ICE-17	USFWS	11/14/2012	"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." –pdf page 34	Relevance of the 1980s data is detailed in Section 7.6.2.2. AEA does not intend to dismiss the 1980s data; the 1980s data will be appropriately incorporated into the analysis.
ICE-18	USFWS	11/14/2012	"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." –pdf page 34	The relationship between ice processes and other resource areas is detailed in Section 7.6.7.
ICE-19	USFWS	11/14/2012	The use of one model to carry out both flow routing and ice	The RSP has been updated to specify that River1D will be used to

Ice Processes in the Susitna River Study				
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			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. –pdf page 34	model ice processes as well as winter temperature and winter flow routing. River 1D will be calibrated to open-water conditions prior to applying an ice cover. See section 7.6.4.6
ICE-20	USFWS	11/14/2012	Hourly time-steps are feasible with CRISSP1D and even desirable from the ice process modeling perspective die to the diurnal fluctuations in air temperature. –pdf page 34	River 1D can be run using an hourly time step or smaller, if necessary for model stability (Section 7.6.4.6).
ICE-21	USFWS	11/14/2012	A1-D model will not be able to simulate the effects of open leads if they occupy only part of a channel width. –pdf page 34	The mainstem River 1-D model will not simulate open leads within the ice cover. These may be simulated using River2D at Focus Areas if that detail is determined to be needed at the particular Focus Area.
ICE-22	USFWS	11/14/2012	In some instances, it may be appropriate to extend the1-Dmodel results with very judicious application to address 2-D problems. –pdf page 34	AEA agrees with this comment. The extension of 1D mainstem flow routing model results, such as ice thickness or water surface elevations, to 2-D areas such as sloughs may be warranted, but the application of the model in these areas will be determined on a case-by-case basis by the modeling experts when the input data is available and the open-water model has been calibrated (7.6.4.8).
ICE-23	USFWS	11/14/2012	No mention is made of modeling the reservoir and upstream tributaries. –pdf page 34	The Water Quality Modeling Study (Section 5.6) includes the reservoir ice model.
ICE-24	USFWS	11/14/2012	It is important to model the thermal regime of the reservoir area. –pdf page 34	The Water Quality Modeling Study (Section 5.6) includes the reservoir thermal and ice model.
ICE-25	USFWS	11/14/2012	"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.	Suggested measurements, including total and submerged ice thickness and frazil slush thickness, have been added to Section 7.6.4.3. In places, the velocity profile may be more easily measured with current meter methods rather than an ADCP, but the decision will be made in the field based upon site-specific conditions.

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			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 2-D model calibrations." –pdf pages 34-35	
ICE-26	USFWS	11/14/2012	"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." –pdf page 35	The RSP acknowledges that conditions may be challenging and leaves flexibility to use alternative methods where needed (Section 7.6.4.4). Focus Area selection will be based on an understanding of the ice regime utilizing five years of detailed 1980s data as well as that collected in 2012.
ICE-27	USFWS	11/14/2012	"The PSP would benefit from a plan outline of the proposed data collection program. The above considerations do not represent a	The RSP includes more detail on data collection, and more detail on the Lower River study (section 7.6.4.10).

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			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." –pdf page 35	The modeled study area for the River1D model is bounded by the dam site upstream and the Chulitna confluence downstream. To extend the model further downstream would require greatly simplifying the channel geometry. The detailed models, however, will extend upstream and downstream from the Focus Areas as necessary to reduce the influence of boundary condition assumptions (Section 7.6.4.8).
ICE-28	USFWS	11/14/2012	"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." –pdf page 36	A model can only be calibrated to observed conditions, by definition. The process of model verification and error analysis is presented in Section 7.6.4.9. The model must be applied outside of the range of observed conditions in order to evaluate effects of the Project, since the Project currently does not exist. The model will be developed under the guidance of people who have several decades of specialized experience developing the model and applying it to regulated ice-covered rivers.
ICE-29	USFWS	11/14/2012	"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". –pdf page 36	The study results regarding the winter hydraulic conditions specified in the comment will be used by other studies as outlined in Section 7.6.7, Relationship with Other Studies.

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ICE-30	USFWS	11/14/2012	"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." –pdf page 36	The ice processes model (River1D) will provide winter flow routing data and winter water temperatures downstream of the dam (Section 7.6.4.6). The error analysis to be performed is described in Section 7.6.4.9.
ICE-31	USFWS	11/14/2012	"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." –pdf page 36	An error analysis to be completed along with the ice processes modeling has been added to the Section 7.6.4.9.
ICE-32	USFWS	11/14/2012	"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	See AEA's response to comment ICE-28.

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			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." –pdf page 37	
ICE-33	USFWS	11/14/2012	"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." –pdf page 37	The limitations of the ice model are described in Section 7.6.4.8. The combined field, modeling, and research study is designed to provide adequate data to meet the requirements of the listed studies for winter hydraulic information. Each of these studies will be undertaking additional fieldwork and analysis in order to determine project effects to their resources during the winter period.
ICE-34	USFWS	11/14/2012	"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." –pdf page 37	The Relationship with Other Studies Section 7.6.7 describes how information will be transferred to other studies, and what information will be used by the Ice Processes in the Susitna River Study from other studies.
ICE-35	USFWS	11/14/2012	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. 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	River1D and River2D can assess channel blockages and simulate surges from ice jam flood releases (7.6.4.8). The potential for applying these capabilities in support of other studies has been added to Section 7.6.7 on Relationships with Other Studies. These are the key processes that the Geomorphology Study requires from the winter conditions hydraulic models as these processes may play an important role in the creation and/or maintenance of the off-

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			the 2-D geomorphic models during winter conditions. –pdf page 37	channel habitats.
ICE-36	NMFS	11/14/2012	"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 the2-D geomorphic models during winter conditions." –pdf page 49	See AEA's response to comment ICE-35.
ICE-37	NMFS	11/14/2012	"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. –pdf page 47	The methodologies described in the RSP meet the goals and objectives of the study, and will provide physical process data to other studies, as described in Section 7.6.7, Relationship with Other Studies.
ICE-38	NMFS	11/14/2012	During the August 17,2012 TWG meetings, the applicant described two potential ice 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. –pdf page 47	The RSP includes a description of the chosen model, River1D (see Section 7.6.4.6), and the necessary input and calibration data (Sections 7.6.4.1 and 7.6.4.3).
ICE-39	NMFS	11/14/2012	Also not discussed was the ability for the models to extrapolate to proposed winter operational flow conditions well 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. –pdf page 47	See AEA's response to comment ICE-28.

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ICE-40	NMFS	11/14/2012	Regardless of the modeling method hydraulic routing and accurate determination of 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." –pdf page 47	See AEA's response to comment ICE-11.
ICE-41	NMFS	11/14/2012	Although the winter hydraulic flow routing model is discussed under the instream flow 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. –pdf page 48	See AEA's responses to comments ICE-09 and ICE-14.
ICE-42	NMFS	11/14/2012	"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? –pdf page 48	See AEA's responses to comments ICE-09 and ICE-14.
ICE-43	NMFS	11/14/2012	How will uncertainty be determined from the study and 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	See Section 7.6.4.9 on determination of model uncertainty for the Ice Processes Model. The selection of modeling methods and determination of detailed data input needs at Focus Areas will be done with the goal of minimizing error so that the modeling effort will provide the most relevant information possible to determining effects to fish habitat. The error analysis will be incorporated into the Instream Flow Study (Section 8.5) along with initial model results. Where the scale of the mainstem River1D model is insufficient to determine effects to fish habitat, the River1D model will provide boundary conditions for more detailed Focus Area models, which will be River1D or River2D models as appropriate for the local conditions. These models will be based on more detailed geometry

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			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." –pdf page 48	and more intensive measurements, thus model error will be reduced. The Instream Flow Study (Section 8.5) discusses how model results will be used in conjunction with observations to assess impacts to fish habitat.
ICE-44	NMFS	11/14/2012	"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 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." –pdf page 48	The RSP has been updated with methods for collecting calibration data (Section 7.6.4.1 - 7.6.4.4) and a schedule (Section 7.6.7). The data necessary for calibrating the winter flow routing model includes the winter discharge measurements and ice thickness data. This study will provide observations and hydraulic data to the Instream Flow Study and fisheries studies. Details on how these data will be used to determine effects on anadromous fish can be found in the Instream Flow Study, Section 8.5.
ICE-45	NMFS	11/14/2012	"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. –pdf page 48	See AEA's response to comment ICE-31.
ICE-46	NMFS	11/14/2012	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. 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	As discussed in Section 7.6.4.8, more detailed modeling will be performed at Focus Areas using either a detailed River 1D model or a River 2D model, depending on the local hydraulics. This is to ensure that hydraulic results are at a scale applicable to fish habitat studies. The spatial detail will be the same as that used in the open-water models for these areas.

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			study." –pdf page 48	
ICE-47	NMFS	11/14/2012	"The number of discharge measurements and location of discharge measurement to develop and calibrate the winter hydraulic flow routing model is not well described."-pdf page 66	See AEA's response to comment ICE-10.
ICE-48	NMFS	11/14/2012	"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." -pdf page 66	The ice processes model will handle winter hydraulic flow routing. The model input and calibration data are described in Section 7.6.4.6 and 7.6.4.7 and in the Instream Flow Study Section 8.5.4.3.1.
ICE-49	NMFS	11/14/2012	"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." -pdf page 66	See AEA's response to comment ICE-28.
ICE-50	NMFS	11/14/2012	"The winter hydraulic flow routing will also incorporate a water quality component that will project downstream changes to flow (timing, quantity, and water quality)." -pdf page 66	See AEA's response to comment ICE-30.
ICE-51	Various Individuals	11/09/2012	(paraphrased): Fluctuating flows would make river ice unstable, making travel dangerous, or even impossible, for both humans (snowmachine, dogsled or ski) and animals (moose and caribou).	One of the primary objectives of the Ice Processes in the Susitna River Study is to predict whether proposed project operations would destabilize the winter ice cover, and where the winter ice cover would be affected. The results of this study will be used by the transportation and recreation studies to determine the effects of the project on winter travel on the Susitna River.
ICE-52	Okenok, Brian	11/13/2012	How will flow rates effect the winter ice conditions on the river? Will traditional winter travel on the ice of the river still be possible? –pdf page 1	See AEA's response to comment ICE-51.
ICE-53	Wood, Ruth	11/15/2012	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? –pdf page 1	The Ice Processes in the Susitna River Study area includes the Lower and Middle Rivers and the Upper River to the Oshetna confluence. The impacts of the project to ice cover on the major tributaries (Yentna, Chulitna, and Talkeetna Rivers) will be considered in the analysis. The objectives of the Ice Processes in the Susitna River Study is to determine changes in river ice extent

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				and stability under project scenarios, including load-following.
ICE-54	Wolf, Ellen	11/15/2012	Will the proposed studies be able to confidently predict the effect of fluctuation river levels on winter ice? –pdf page 1	One of the primary objectives of the Ice Processes in the Susitna River Study is to predict whether proposed project operations would destabilize the winter ice cover. This will be accomplished by developing a River1D model of the Middle River. This method of modeling ice-covered rivers was developed in part to determine the effects of load-following on ice cover, and the model of the Susitna River will be developed under the guidance of leading experts in the field. The error in the model will be determined using the error analysis methods outlined in Section 7.6.4.8.

Glacier and Runoff Changes Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
GLAC-01	TU	11/14/2012	"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." –page 4	See AEA's response to comments GLAC-4, GLAC-16, and GLAC-17.
GLAC-02	CWA	11/14/2012	Failure to address the potential additive effects of climate change on the inherent impacts of the Project on streamflows, aquatic habitat and riparian and subsistence resources. -pdf page 7	See AEA's response to comment GLAC-4, GLAC-16, and, GLAC-17.
GLAC-03	CSDA	11/14/2012	The Glacial and Runoff study does not fulfill the need for climate change studies to determine a responsible comprehensive decision regarding project impacts. –page 7-8	See AEA's response to comment GLAC-4, GLAC-16, and, GLAC-17.
GLAC-04	Various Individuals	11/13/2012	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. 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?	AEA is not proposing this scope of study. While the proposed reservoir may have minor influences on air temperatures and humidity in its immediate vicinity until ice over, any Project-related adverse effects are expected to be insignificant. Moreover, the requesters have made no effort to comply with the study request content requirements of 18 CFR 5.9(b) and provide no support for their speculation that the extremely localized microclimatic influences have any potential to be significant or adverse.
GLAC-05	TCCI	11/07/2012	TCCI requests that AEA and FERC reconsider the study requests for climate change studies. -pdf page 6	See AEA's response to comment GLAC-4, GLAC-16, and, GLAC-17.
GLAC-06	CCA	11/14/2012	"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?" -pdf page 1 third paragraph	See AEA's response to comment GLAC-4, GLAC-16, and, GLAC-17.
GLAC-07	ADNR-DGGS	11/14/2012	Page 5-147 P3 in PSP section 5.11.1.1 "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." –pdf page 13	AEA agrees with this comment. Section 7.7.1 was not intended to imply that high flows could only occur during years that there is negative mass balance for the glacier; it only states that glaciers tend to buffer annual variations in precipitation.

Glacier and Runoff Changes Study				
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GLAC-08	ADNR-DGGS	11/14/2012	Page 5-148 P2 in PSP section 5.11.2.1 "Definition 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'). " –pdf page 13	Section 7.7.2.1 has been changed to refer to "recent decades."
GLAC-09	ADNR-DGGS	11/14/2012	Page 5-148 P2 in PSP section 5.11.2.1 "Reference needed for statement 'Alaska glaciers with the most rapid loss are those terminating in sea water or lakes.' " –pdf page 13	Section 7.7.2.1 cites to Markon et al, 2012 as support for this statement.
GLAC-10	ADNR-DGGS	11/14/2012	Page 5-149 P1 in PSP section 5.11.2.3 "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. " –pdf page 13	This sentence is not included in the Glacier and Runoff Changes Study Plan.
GLAC-11	ADNR-DGGS	11/14/2012	Page 5-159 13 Fig. 5.11-1 in PSP section 5.11.9 "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." –pdf page 13	A direction (northeast) is included in the caption of RSP Figure 7.7-1.
GLAC-12	ADNR-DGGS	11/14/2012	Page 5-160 14 Fig. 5.11-3 in PSP section 5.11.9 "Suggest labeling Susitna Glacier " –pdf page 13	RSP Figure 7.7-3 includes labels for Susitna Glacier, West Fork Glacier, and East Fork Glacier.
GLAC-13	ADNR-DGGS	11/14/2012	Page 5-161 15 Fig. 5.11-5 in PSP section 5.11.9 "Caption should read 'Mean annual temperature and total annual precipitation at Talkeetna…'" –pdf page 13	The caption for RSP Figure 7.7-5 reads "Mean annual temperature and total annual precipitation at Talkeetna…"
GLAC-14	TNC	11/14/2012	"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	See AEA's response to Comment GLAC-1, GLAC-16, and GLAC-17.

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			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." –pdf page 2	
GLAC-15	CIRI	11/14/2012	"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." –pdf page 7	AEA appreciates CIRI's comment related to this proposed study.
GLAC-16	USFWS NMFS	11/14/2012 11/14/2012	"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." –pdf pages 40-41 (USFWS)	AEA does not believe that FERC's study plan determinations for the relicensing of the Toledo Bend Project or the initial licensing of the Lake Powell Pipeline Project support USFWS's and NMFS's request for a comprehensive study of Susitna River Project effects under changing climate. To the contrary, FERC's study plan determinations for these projects support AEA's view that the comprehensive climate study proposed by USFWS and NMFS does not meet study criterion 5.9(b)(5) of FERC's ILP regulations, 18 C.F.R 5.9(b)(5), which requires a nexus between project operation and effects on the resource to be studied, and an explanation on how study results will inform license requirements. In the relicensing of the Toledo Bend Project, FERC rejected a proposed study on the effects of climate change on basin hydrology. FERC stated: "We are not aware of any climate change models that are known to have the accuracy that would be needed to predict the degree of specific resource impacts and serve as the basis for informing license conditions. The potential consequences of climate change can be effectively monitored using conventional hydrologic

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				studies and monitoring techniques. For these reasons and those expressed by the [license applicant], we do not adopt this requested study." Study Plan Determination for the Toledo Bend Project, P-2305-020 (issued Aug. 6, 2009). Similarly, in its study plan determination for the Lake Powell Pipeline Project, FERC stated that it "was unaware of any climate change models that are fine-tuned enough to make reservoir operation decisions." Study Plan Determination for the Lake Powell Pipeline Project, P-12966-001 (issued Jan. 21, 2009). In the Lake Powell Pipeline Project licensing, FERC did approve the applicant's proposed study plan to assess potential effects of water supply on the proposed project, including estimates of how climate change and climate variability would affect project operations and water deliveries. This is essentially the same approach AEA proposes in this proceeding, i.e., assessing the impact of climate change on glacier runoff into the reservoir. For these reasons, AEA is not proposing to adopt the request of USFWS and NMFS to conduct a more comprehensive study of climate change that would assess potential Project effects combined with impacts of climate change on the Susitna watershed ecosystem. The results of any such study would be highly speculative and would not inform license requirements, and AEA's proposed study would adequately assess effects of climate change on glacier runoff into the reservoir.
GLAC-17	USFWS NMFS	11/14/2012 11/14/2012	"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	The nexus between climate change and the proposed Project is that climate change may affect the amount and timing of runoff from glaciers into the reservoir.

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			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)." – pdf pages 40-41 (USFWS)	The Project will reregulate the river flow so that any impacts of climate change will be eliminated or attenuated within the zone of Project effects. The combined effects of climate change and Project operations will be incorporated into the reservoir sedimentation, downstream instream flow, geomorphology, and other studies that address stream flow related impacts below the dam. As explained in AEA's response to comment GLAC-16, this approach is consistent with the approach being taken in other FERC proceedings. Moreover, AEA notes that a recent study of consideration of climate change in over 200 federal EIS' shows that the approach to climate change analysis AEA is proposing for the Susitna-Watana Project is consistent with the practices of other federal agencies, and AEA is aware of no other federal agency conducting the kind of detailed, ecosystem level study that NMFS and USFWS are suggesting should be required here. See Woolsey, Consideration of Climate Change in Federal EISs, 2009-2011, Ctr. For Climate Change, Columbia Law School (July 2012). Finally, a review of recent NMFS Biological Opinions and other documents shows that AEA's study proposal is consistent with the approach NMFS is taking to address potential impacts of climate change on resources potentially affected by a proposed action. AEA has not found any instance in which NMFS has conducted a comprehensive assessment of climate change impacts on the entire ecosystem of an affected river basin. Rather, in some instances it has included general climate change background information from existing studies and, to extent it is available, information on climate change impacts on the river or

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				other water bodies that host the listed species; e.g., timing of flows, precipitation, water temperatures. See, e.g., (1) Draft Environmental Assessment: Authorization for Incidental Take and Implementation of the PacifiCorp Klamath Hydroelectric Project Interim Operations Habitat Conservation Plan for Coho Salmon. NOAA/NMFS, April 2011, at pp. 3-29, 5-6, 5-9, 5-10); (2) Biological Opinion on Incidental Take Permit to implement Klamath Hydro Project Interim Operations HCP for Coho Salmon: NMFS, SW Region (Feb. 22, 2012) at pp. 83-85; 129. 189-190; (3) Biological Opinion and Essential Fish Habitat Recommendations for U.S. Bureau of Reclamation San Joaquin River Restoration Program: NMFS, Southwest Region (Sept. 18, 2012) at pp. 53, 108-109; (4) Biological Opinion and EFH Response for the Reedsport Ocean Power Technologies 10-PoweBuoy Wave Park; NMFS Pacific Northwest Region (June 7, 2012) at pp. 38, 54-55; (5) Impacts to Essential Fish Habitat from Non-Fishing Activities in Alaska: NMFS Alaska Region (Nov. 2011) *passim*.; (6) Biological Opinion and Essential Fish Habitat Recommendations for Enloe Dam Project: NMFS, Pacific Northwest Region (Sept. 27, 2012) at p. 26.
GLAC-18	USFWS NMFS	11/14/2012 11/14/2012	"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 analyses 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." –pdf page 42	See AEA's responses to comments GLAC-4, GLAC-16 and GLAC-17.
GLAC-19	USFWS	11/14/2012	"5.11.4 Study methods. NMFS and the Service appreciate that AEA	The models are calibrated with in situ data and are

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	NMFS	11/14/2012	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. pdf page 44 (USFWS)	validated against glacier mass balance and river discharge records. Section 7.7.4.4 clarifies that future runoff is calculated in the model and will be assessed quantitatively in this study. The use of the word "qualitative" was meant to recognize the uncertainty inherent to long-range climate model projections.
GLAC-20	USFWS NMFS	11/14/2012 11/14/2012	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 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." pdf page 44	See AEA's response to Comment GLAC-19.
GLAC-21	USFWS NMFS	11/14/2012 11/14/2012	"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	As explained in Section 7.7.4.2, AEA is planning to use the five-model SNAP composite projection scenarios to force future hydrologic simulations. AEA plans to update these simulations with improved downscaled climate model projections if available (e.g., from IPCC AR5).

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			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." –pdf page 45	
GLAC-22	USFWS NMFS	11/14/2012 11/14/2012	"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." –pdf page 45	Analysis at "single event timescales" was in reference to model runs over the period from 1960 to present. This is clarified in the text in Section 7.7.4.2.

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IFS-001	NMFS	11/14/2012	"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." Each component of the 10-component framework (outlined in the NMFS Study Request) needs to be incorporated into the study plan and integrated into analyses of project operations: flow routing, water quality, geomorphology, riparian function, surface-groundwater interactions, ice processes, habitat modeling, habitat connectivity, climate and biological cues.-pdf pages 71-72	Studies of the distribution of habitat types are described in the Aquatic Habitat Characterization Study (Section 9.9), while studies to determine the spatial and temporal distribution of fish are described in the Fish Distribution and Abundance in the Middle and Lower River Study (Section 9.6). The IFS Analytical Framework (see Section 8.5.4.1) is designed to integrate study and model results of riverine processes such as water quality, geomorphology, riparian functions, groundwater, and ice processes to assess the temporal and spatial relationships between riverine and biological functions. Components of the IFS framework include flow routing (Section 8.5.4.3), operations modeling (Section 8.5.4.3.2), habitat modeling (Section 8.5.4.6), habitat connectivity (Section 8.5.4.6.1.2.3) and climate and biological cues (Section 8.5.4.5.1.3).
IFS-002	NMFS	11/14/2012	"We 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." -pdf pages 72-73.	The flow operations modeling (see Section 8.5.4.3.2) is designed to evaluate a range of conditions including baseline (no project/natural hydrograph), a maximum load-following, an intermediate load-following, and a base-load scenario. The three with-Project scenarios will provide bookends and an intermediate assessment of potential Project effects.
IFS-003	NMFS	11/14/2012	"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. 1bis 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."" –pdf page 75	As described in Section 8.5.4.1, the IFS Analytical Framework integrates the analysis of Project effects on riverine processes. Project effects on geomorphology, ice processes, water quality and groundwater/surface water interactions will be used to quantify changes in fish and aquatic habitat and riparian indicators (see Figure 8.5-10). The results developed from studies conducted in modeled Focus Areas will be extrapolated to non-modeled areas through temporal and spatial habitat analyses described in Section 8.5.4.7 and integrated with the results of studies conducted in other resource areas to gain a greater understanding of overall Project effects to the Susitna River system (see Section 8.5.4.8).
IFS-004	NMFS	11/14/2012	"During the August 16,2012, TWG meetings, NMFS, USFWS and other attendees requested a more	Additional detail is in the RSP. The study framework is described in Section 8.5.4.1, the process schedule is provided in Table 8.5-14, and a description

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			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." –pdf pages 62-63	of the temporal and spatial analyses of Project effects on aquatic habitats is provided in 8.5.4.7. Details pertaining to fish distribution are provided in Section 8.5.2.1.2. Integration with other studies is explained throughout the Fish and Aquatics Instream Flow RSP and illustrated in Figures 8.5-1 and 8.5-10,
IFS-005	NMFS	11/14/2012	"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	As explained in Section 8.5.4.1, the IFS Analytical Framework is designed to integrate study and model results of riverine processes and to assess the temporal and spatial relationships between riverine and biological functions. By quantifying indicators of aquatic habitats under unregulated and alternative operational scenarios, information will be developed as part of the environmental analysis that will support AEA's FERC License Application.

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			proposed project operations." –pdf page 62	
IFS-006	FERC	11/14/2012	"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." -pdf page 10	Pertinent RSP section numbers are included in the IFS analytical framework figure (see Figure 8.5-10); the reservoir operations model is described in Section 8.5.4.3.2, and hydrologic elements are described in Section 8.5.4.4.
IFS-007	USFWS	11/14/2012	"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	As described in Section 8.5.4.1, the IFS Analytical Framework integrates the analysis of Project effects on riverine processes. Project effects on geomorphology, ice processes, water quality and groundwater/surface water interactions will be used to quantify changes in fish and aquatic habitat and riparian indicators (see Figure 8.5-10).

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			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." –pdf pages 62-63	
IFS-008	NMFS	11/14/2012	"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." –pdf pages 73-74	See AEA's response to comment IFS-007.
IFS-009	USFWS	11/14/2012	To understand Project effects, it will be necessary to integrate the 10 riverine study components outlined in the May 2012 study request (flow routing, water quality, geomorphology, riparian function, surface-groundwater interactions, ice processes, habitat modeling, habitat connectivity, climate and biological cues). –pdf page 61	The riverine study components are integrated in the proposed Instream Flow Study as described in the IFS analytical framework (see Section 8.5.4.1).
IFS-010	NMFS	11/14/2012	"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.	Please see AEA's response to comment IFS-011. Also please note that winter investigations are part of the IFS (see Section 8.5.4.5.1.2.1).

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			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." –pdf page 66	
IFS-011	USFWS	11/14/2012	"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." –pdf page 56	As described in Section 8.5.4.2.1.2, the study area/study site selection approach is adaptive, and will allow for the shifts in study focus to other areas, should results of 2013 studies reveal their biological importance and sensitivity to flow modifications. Thus, additional sites or Focus Areas may be added based on results of, for example the fish distribution studies (see Section 9.5) or habitat characterization studies (see Section 9.9). AEA notes that this comment essentially refers to what are termed critical study areas, which are defined in Section 8.5.4.2.1.2 and which factored directly into the selection of the Focus Areas.
IFS-012	USFWS	11/14/2012	"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	AEA has further refined the hierarchical classification system. These refinements are provided in Section 8.5.4.2.1.1 and described in more detail in Section 9.9. Habitat mapping of mesohabitats is in the Middle River Segment is underway and due to be completed in Q1 2013. More detail regarding the geomorphic reach delineation process is provided in Section 6.5.

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			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." –pdf page 55	
IFS-013	NMFS	11/14/2012	"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)." –pdf page 64	Beaver ponds have been included in the classification system under off-channel habitats. This classification system is presented in Table 8.5-5 and described further in Section 9.9. More details concerning the characterization of riparian habitats as they pertain to floodplains are found in Section 8.6.
IFS-014	FERC	11/14/2012	"Clearly describe the exact number, location, and spatial extent of your proposed focus areas for each proposed study. Provide justification for the number of proposed sites selected for detailed 2-D hydraulic modeling and other intensive study elements. Include criteria to be used for selecting focus areas and study-specific rationale for co-locating sites." –pdf page 5	The number of proposed Focus Area sites for the IFS is described in Section 8.5.4.2.1.1, listed and described in Table 8.5-6 and illustrated in Figures 8.5-13 to 8.5-22 of the RSP. For purposes of the RSP, a total of ten potential Focus Areas were identified. These 10 areas were selected for planning purposes and will be evaluated further for their representativeness of other areas based on results of habitat mapping that will be completed in Q1 2013. The results of this evaluation will be shared with the TWG and refinements in Focus Area selection made prior to commencement of the 2013 studies. Table 8.5-6 provides the rationale for

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				Focus Area selection. The specific criteria that were used in selecting the proposed Focus Areas include: 1) All major habitat types (main channel, side channel, side slough, upland slough, tributary delta) will be sampled within each geomorphic reach. 2) At least one (and up to three) Focus Area(s) per geomorphic reach (excepting geomorphic reaches associated with Devils Canyon – MR-3 and MR-4) will be studied that is/are representative of other areas. 3) A replicate sampling strategy will be used for measuring habitat types within each Focus Area, which may include a random selection process of mesohabitat types. 4) Areas that are known (based on existing and contemporary data) to be biologically important for salmon spawning/rearing in mainstem and lateral habitats will be sampled (i.e., critical habitats). 5) Areas for which little or no fish use has been documented or for which information on fish use is lacking will also be sampled.
IFS-015	USFWS	11/14/2012	"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." – pdf page 55	Please see Section 8.5.4.5.1.1 for a listing and description of microhabitat variables that will be collected as part of Habitat Suitability information. In addition to microhabitat variables that are commonly collected, (e.g. depth, velocity, substrate), data concerning cover/habitat structure, upwelling presence/absence, and turbidity will be collected. Upwelling presence/absence was likewise noted during the 1980s studies and a binary relationship developed that factored into habitat area computation as part of the Direct Habitat (DIHAB) model development.
IFS-016	FERC	11/14/2012	"Fish and Aquatics Instream Flow (Section 8.5) 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	Although both Middle and Lower River segments are under consideration as part of this IFS, the majority of detailed study elements described in the RSP are concentrated within the Middle River Segment. This is because project operations related to load-following and variable flow regulation will likely have the greatest potential effects on this segment of the river. These effects tend to attenuate in a downstream direction as channel morphologies change, and flows change due to tributary inflow and flow accretion.

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			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." -pdf page 9	The downstream boundary of the Study Area is currently RM 75 because existing information indicates that the hydraulic effects of the Project below the Three Rivers Confluence are attenuated. See Section 8.5.3. However, AEA will reevaluate how far downstream Project operational significant effects extend based in part upon the results of the Open-water Flow Routing Model (see Section 8.5.4.3),which is scheduled to be completed in Q1 2013. Thus, an initial assessment of the downstream extent of Project effects will be developed in Q1 2013 with review and input of the TWG. This assessment will include a review of information developed during the 1980s studies and study efforts initiated in 2012, such as sediment transport (see Section 6.5), habitat mapping (see Sections 6.5 and 9.9), operations modeling (see Section 8.5.4.3.2), and the Mainstem Open-water Flow Routing Model (see Section 8.5.4.3). The assessment will guide the need to extend studies into the Lower River Segment and if needed, will identify which geomorphic reaches will be subject to detailed instream flow analysis in 2013. Results of the 2013 studies would then be used to determine the extent to which Lower River Segment studies should be adjusted in 2014. In addition, the results of the 1-D sediment transport modeling (see Section 6.6) from RM 184 to RM 75 will be available in Q1 2014 and will further inform the need for these adjustments. Given the importance of multiple-year studies to evaluate the behavioral response of fish to flow conditions, pilot HSC/HSI studies were initiated in 2012, and will be continued in 2013, and include data collection within Lower River Segment habitats (see Section 8.5.4.5). See also Section 8.5.3 for more discussion regarding the Lower River Segment.
IFS-017	FERC	11/14/2012	"Fish and Aquatics Instream Flow (Section 8.5): 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	MR-3 is a relatively short reach (3.5 mile) located just upstream from the Devils Canyon reach, MR-4. MR-3 is steep (slope is second highest (17 feet/mile) next to Devils Canyon (30 feet/mile) and is confined within a relatively narrow canyon. Although flow routing transects were initially considered for this reach, any attempt to sample this reach was abandoned once field teams were on the ground and realized it could not be safely measured. Of particular concern were the swift currents within the reach and the lack of any margin of safety for recovering someone before they would be swept into Devils Canyon. MR-3 consists primarily of single-thread main channel habitat with two areas with split-main channel islands. No major tributaries enter the reach and it is likely that any anadromous salmonids (Chinook salmon) that make it through Devils Canyon simply

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			fish habitat" in the reach." -pdf page 9	pass through MR-3. Since there are no Focus Areas or cross-sectional transects proposed within MR-3 or MR-4, the assessment of project operational impacts within these reaches will rely largely on the results of habitat mapping completed in these reaches and the development and weighting of habitat-flow response relationships (by mesohabitat type) from the two upper geomorphic reaches, MR-2 and MR-1 (there are 15 existing cross-sectional transects within these two reaches and three Focus Areas.) and the next lower reach MR-5, which contains 4 transects. These relationships, will then be applied to respective mesohabitat types in MR-3 and MR-4 and reach specific habitat-flow response relationships. These relationships will be adjusted based on flow accretion.
IFS-018	FERC	11/14/2012	"Fish and Aquatics Instream Flow (Section 8.5): 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 flowrouting 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	As noted in Section 8.5.4.2.1.2, a total of 80 cross-sectional transects in the Middle River Segment and 8 transects in the Lower River Segment have been established and flow data collected to support development of the flow routing model (see Section 8.5.4.3 and Table 8.5-7). As the comment indicates, these transects were primarily located across single thread sections of the river and most are outside of the Focus Areas. However, some of the transects do extend across more complex sections. In most cases, two to three sets of flow measurements have been made at each transect. The resulting data sets can be used, at a minimum, for evaluating velocity-depth distributions across the channel that can be related to biologically relevant criteria associated with various life stage requirements (e.g., spawning, adult holding, juvenile rearing). In many cases (pending review of the cross-sectional data) it should be possible to develop actual habitat-flow relationships following a 1-D PHABSIM type analysis (see Section 8.5.4.6). The cross-sectional transects represent an important data set that can be used to characterize habitat-flow response characteristics of the main channel of the Susitna River. These types of data were never collected during the 1980s studies and no main channel habitat - flow relationships were developed. Importantly, once the main channel habitat mapping is completed (see Section 9.9), the transect locations will be assigned to specific mesohabitat types (e.g., riffle, run, glide, pool) that could be randomly selected for analysis. These additional transects may also be useful for extrapolating results/relationships from measured to unmeasured sites. Supplemental main channel transects will be established as needed to more fully characterize main channel habitats, either as part of the Focus Area analysis or at separate locations

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			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." -pdf pages 9-10	associated with specific mesohabitat types. The need for and exact number of the supplemental transects will be determined based on results of the habitat mapping.
IFS-019	TNC	11/14/2012	"Focus Area Selection 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	In response to this comment and others, AEA has revised the RSPs to reflect the common use of terms. However, one point to note is that while many of the resource studies will be evaluating the Focus Areas in coordination with other disciplines, there will be "study sites" located outside of the Focus Areas and these will be specified separately. The comment concerning Focus Area selection process is addressed in Section 8.5.4.2.1.2. This section provides greater details on the sampling strategies considered and the rationale for the proposed approach. It also provides details on the criteria applied for selecting the Focus Areas. It is important to note that the 10 potential Focus Areas that were identified were selected for planning purposes and will be evaluated further for their representativeness based on the results of the habitat mapping that will be complete in Q1 2013. The results of this evaluation will be discussed with the TWG and refinements in Focus Area selection made prior to commencement of the 2013 studies. AEA intends to seek TWG input and finalize the initial set of study areas by February/March of 2013 to enable detailed field studies to occur. The need for redistribution or additional Focus Areas and study sites in the Lower River Segment will be determined based on results of the Open-water flow routing model (see Section 8.5.4.3).

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			cumulative impacts of this project with other anticipated changes to the basin could affect salmon and salmon habitat in the Lower River." –pdf pages 2-3	
IFS-020	NMFS	11/14/2012	"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." –pdf page 65	This comment is similar to IFS-021 but appears to be more directed toward the actual selection of study sites, rather than HSC sampling sites which presumably was at the center of the IFS-021 comment. AEA has given careful consideration to the study site/area selection process as outlined in Section 8.5.4.2. This included consideration of the different sampling strategies including representative, critical, and random selection, as well as the pros and cons of each of these approaches and their applicability to the Project. In the end, it was determined that all three sampling strategies had applicability to the Project but at different levels of the analysis. Specific to the recommendation regarding random sampling, please see the specific discussion on that strategy in Section 8.5.4.2.1.2. That discussion notes that although random sampling is the least subject to bias, it becomes increasingly difficult to apply in site selection when the sites become more complex, such as is the case on the Susitna River. Strict random sampling is therefore not likely applicable for evaluating off-channel habitats and sloughs where the morphology of multiple channels varies substantially and in complex ways within and across sites. However, random sampling is still applicable and will be applied on the Project for sampling mesohabitat types and selection of HSC study sites, which was discussed in the response to IFS-021.
IFS-021	USFWS	11/14/2012	"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	Section 8.5.4.5.1.1.3 contains a detailed description of the site selection process that will be used for conducting HSC data collection. The process includes a stratified random sampling scheme that will include river segment, geomorphic reach and habitat types as listed in Table 8.5-5. For the Middle Segment, three sites of each habitat type will be randomly selected from within each of the seven geomorphic reaches (excludes Geomorphic Reach MR-4 due to safety issues) for a maximum of 168

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			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." –pdf page 56	potential sampling locations. This total will include the Focus Areas. For each of the Middle River Segment sampling sites, a special effort will be made to ensure that HSC sampling occurs within each of the main channel mesohabitat types present. Sampling is also proposed in the upper portions of the Lower River Segment extending from RM 77 to RM 97 where three replicates of each mainstem habitat type will be randomly selected for a maximum of 24 sample sites. The proposed number and distribution of 2013 HSC sampling sites will be presented to the TWG during the Q2 2013 meeting.
IFS-022	FERC	11/14/2012	"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." -pdf page 10	A more complete description of the hierarchical system is provided in Section 8.5.4.2.2.1. This now includes split and multiple split main channels as described in Table 8.5-5. The system was developed input from the TWG. AEA has revised the RSP to provide for consistent use of terminology across studies. The description provided in the HSC Study Area Selection (see Section 8.5.4.1.1.3) is now consistent with that described in 8.5.4.2.1.1.
IFS-023	USFWS	11/14/2012	"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,	AEA is not limiting its IFS evaluation to only sites sampled in the 1980s. Indeed, three of the ten Focus Areas identified in the RSP are located above Devils Canyon and were never studied during the 1980s (see Table

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			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." –pdf page 54	8.5-6). Moreover, the Focus Areas are all relatively long (ranging from 0.5 to 1.9 miles) and therefore include habitat types and features that were never studied in the 1980s. The 80 main channel transects that were established for the flow routing model and any supplemental main channel transects that will be considered as part of the IFS were likewise not utilized in the 1980s studies. The fact that a number of sites surveyed in the 1980s are included within the Focus Areas is not surprising given the spatial extent of surveys completed then. AEA has used the information provided in the 1980s studies to help guide but not dictate the selection of study areas. AEA also notes that the Focus Areas and cross-sectional transects contain a variety of habitat types (e.g. side channel, side slough, upland slough, main channel, tributary mouth) and are not focused exclusively on side sloughs, as the comment suggests.
IFS-024	TNC	11/14/2012	"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	See AEA's response to comment IFS-033.

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			are available." –pdf page 3	
IFS-025	ADNR-ADF&G	11/14/2012	"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?" –pdf page 21	Additional details describing the study site selection process including the criteria for selecting the Focus Areas is provided in Section 8.5.4.2.1.2. Those criteria included the following: ● All major habitat types (main channel, side channel, side slough, upland slough, tributary delta) will be sampled within each geomorphic reach. ● At least one (and up to three) Focus Area(s) per geomorphic reach (excepting geomorphic reaches associated with Devils Canyon – MR-3 and MR-4) will be studied that is/are representative of other areas. ● A replicate sampling strategy will be used for measuring habitat types within each Focus Area, which may include a random selection process of mesohabitat types. ● Areas that are known (based on existing and contemporary data) to be biologically important for salmon spawning/rearing in mainstem and lateral habitats will be sampled (i.e., critical habitats). ● Areas for which little or no fish use has been documented or for which information on fish use is lacking will also be sampled.
IFS-026	NMFS	11/14/2012	"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." –pdf page 66	Please see AEA's response to comment IFS-030.
IFS-027	USFWS	11/14/2012	"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." –pdf page 55	Consistent with this comment, AEA has revised objective 2 as follows: 2) Select study sites and sampling procedures to collect data and information that can be used to characterize, quantify, and model mainstem and lateral Susitna River habitat types at different scales.
IFS-028	NMFS	11/14/2012	"The studies at the focus areas should provide a greater understanding of project effects on riverine	Please see AEA's response to comment IFS-033 regarding lower extent of studies.

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			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." –pdf page 65	
IFS-029	NMFS	11/14/2012	"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 water from the surface (tributaries) or from groundwater (local or regional was not differentiated)." –pdf page 65	Please see AEA's response to comment IFS-030.
IFS-030	USFWS	11/14/2012	"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	The 1980s studies focused on a variety of habitat types, not just side sloughs where salmon were observed spawning. Detailed flow related studies were conducted in side channels, side sloughs, tributary mouths, upland sloughs and on a limited basis the main channel. These focused on both spawning and juvenile rearing habitats. See Table 8.5-3 for a listing of instream flow related sites sampled in the 1980s, along with the types of habitats they contained. The Focus Areas selected in the RSP were those deemed representative of the major features in the geomorphic reach and included mainstem habitat types of known biological significance (i.e., where fish have been observed based on previous and/or contemporary studies), as well as some locations (e.g., Slough 17) where previous sampling revealed few/no fish (see Section 8.5.4.2.1.2). The Focus Area approach described in Section 8.5.4.2.1.2 was designed to not only capture the variability of

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			habitats, studied at multiple scales, including macro-, meso- and micro-habitat scale." –pdf page 55	different habitat types, including those with and without clear water, but also to allow for an integrated assessment of habitats and how they function, across multiple disciplines including water quality (Section 5.5), groundwater (Section 7.5), riparian instream flow (Section 8.6), ice processes (Section 7.6), and geomorphology (Section 6.5). However, the Focus Areas were selected for planning purposes and will be reevaluated for their representativeness of other areas based on results of habitat mapping that will be completed in Q1 2013.
IFS-031	ADNR-ADF&G	11/14/2012	"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." –pdf pages 20-21	Additional information and descriptions of the hierarchical classification are provided in Section 8.5.4.2.1 and contained in Table 8.5-5. The habitat mapping analysis of the Middle River Segment will be completed in Q1 2013.
IFS-032	ADNR-ADF&G	11/14/2012	"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.)?" –pdf page 20	The fish passage/off-channel connectivity element of the IFS will be coordinated closely with the Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries (see Section 9.12). As noted in Section 8.5.4.6.1.2.3, there are 12 major tributaries with names, approximately 50 unnamed tributaries, and approximately 50 sloughs located within the Middle River Segment. Passage evaluation studies in the Middle River Segment will therefore begin in 2013 within each of the Focus Areas with the selection criteria being that they support spawning habitats that would be influenced by Project operations. Thus, the studies will center on the associated tributary mouths, side channels, and side sloughs within the Focus Areas. Focus Areas within the Middle River Segment that contain those habitat types include Focus Area-170, Focus Area-168, Focus Area-148, Focus Area-141, Focus Area-138, Focus Area-135, Focus Area-124, and Focus Area-101 (See Table 8.5-6). In 2014, barrier surveys may be expanded to include both additional locations within the Middle River Segment that, based on results from fish distribution (see Section 9.5) and escapement studies (see Section 9.7) indicate are used for spawning and that based on geomorphic analysis (see Section 6.5) would be susceptible to flow changes resulting from Project operations, as well as locations in the Lower River Segment. The decision to conduct

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				studies in the Lower River Segment will be made based in part on results of the open-water flow routing model as discussed in Section 8.5.4.3.
IFS-033	CWA	11/14/2012	Scope is insufficient in studying the Lower River based on AEA's apparent assumption that Project effects will not significantly affect the Lower River instream flow. – pdf pages 7-8	AEA is not assuming an insignificant Project-related effect on instream flow in the Lower River Segment. As noted in Section 8.5.3, both Middle and Lower River segments are under consideration as part of this IFS. However, the majority of detailed study elements described in the RSP are concentrated within the Middle River Segment. This is because Project operations related to load-following and variable flow regulation will likely have the greatest potential effects on this segment of the river. These effects tend to attenuate in a downstream direction as channel morphologies change, and flows change due to tributary inflow and flow accretion. The diversity of habitat types and the information from previous and current studies that indicate substantial fish use of a number of slough and side channel complexes within this segment, also support the need to develop a strong understanding of habitat–flow response relationships in this segment. The downstream boundary of the study area is currently RM 75 because existing information indicates that the hydraulic effects of the project below the Three Rivers Confluence are attenuated. See Section 8.5.3. However, AEA will reevaluate how far downstream Project operational significant effects extend based in part upon the results of the Open-water Flow Routing Model (see Section 8.5.4.3), which is scheduled to be completed in Q1 2013 as well as results of the operations model. The results of the Open-water flow routing model completed in Q1 2013 will be used to determine whether and the extent to which Project operations related to load-following as well as seasonal flow changes occur within a section of the Lower River Segment that includes all of Geomorphic Reach LR-1 and a portion of LR-2 (down to RM 75). Thus, an assessment of the downstream extent of Project effects will be developed in Q1 2013 with review and input of the TWG. This assessment will include a review of information developed during the 1980s studies and study efforts initiated in 2012, such as sediment transport (see Section 6.5), habitat mapping (see Sections 6.5 and 9.9), operations modeling (see Section 8.5.4.2.2), and the Mainstem Open-water Flow Routing Model (see Section 8.5.4.3).

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				The assessment and the following five criteria will be used to evaluate the need to extend studies into the Lower River Segment and if studies are needed, will identify which geomorphic reaches require instream flow analysis in 2013. The criteria include: • Magnitude of daily stage change due to load-following operations relative to the range of variability for a given location and time under existing conditions (i.e., unregulated flows); •Magnitude of monthly and seasonal stage change under Project operations relative to the range of variability under unregulated flow conditions; • Changes in surface area (as estimated from relationships derived from LiDAR and comparative evaluations of habitat unit area depicted in aerial digital imagery under different flow conditions) due to Project operations; • Anticipated changes in flow and stage to Lower River off-channel habitats; and • Anticipated Project effects resulting from changes in flow, stage and surface area on habitat use and function, and fish distribution (based on historical and current information concerning fish distribution and use) by geomorphic reaches in the Lower River Segment. Results of the 2013 studies would then be used to determine the extent to which Lower River Segment studies should be adjusted in 2014.
IFS-034	FERC	11/14/2012	"Fish and Aquatics Instream Flow (Section 8.5): 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." -pdf page 9	Hydraulic flow routing (see Section 8.5.4.3.1) is used to provide flow and stage data at various locations downstream of the proposed dam site under existing conditions and alternative operational scenarios. The results of the flow routing will be used by all riverine process and aquatic resources to support Q1 2013 decisions regarding the need to extend resource studies into the Lower River. See AEA's response to comment IFS-033. Decision criteria to guide extension of studies into the Lower River are specific to each riverine process and aquatic resource. For instance, the process to determine the downstream limit for the Fluvial Geomorphology Modeling below Watana Dam Study will follow the process described in Section 6.6.3.2. The process to determine the downstream limit for fish and aquatic habitats will follow the river stratification and study area selection process

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				described in Section 8.5.4.2. The flow routing description in Section 8.5.4.3.1 has also been modified.
IFS-035	FERC	11/14/2012	"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." –pdf page 4	Results of the draft open-water flow routing model (see Section 8.5.4.3.1) will be available in Q1 2013. The initial model will be used to assess the magnitude, timing and frequency of hourly flow and stage changes associated with proposed load-following operations during ice-free periods. The results will be used by all riverine process and aquatic resource groups to evaluate downstream extent of Project effects. Project operations will likely include storing water during the snowmelt season (May through August) and releasing it during the winter (October through April) (AEA 2011). This would reduce flows downstream of the dam site from May through August and increase flows October through April. During Q1 2013, results of the draft open-water flow routing model will be used to evaluate downstream flow and stage changes associated with reduced Project flow releases during the open-water portions of the reservoir refill period. Since the results of the Ice Processes in the Susitna River Study model (see Section 7.6) will not be available prior to the start of the 2013 summer field season; the downstream extent of Project effects on flow and stage during the winter will be assessed by routing winter flow releases identified by the operations model (see Section 8.5.4.3.2) downstream using the open-water flow routing model. Although winter stage and flow projections will not be robust, they will provide sufficient information on downstream flow and stage effects to support early 2013 decisions regarding the need to extend resource studies into the Lower River. As discussed in AEA's response to comment IFS-034, decision criteria to guide extension of studies into the Lower River are specific to each riverine process and aquatic resource. The flow routing description in Section 8.5.4.3.1 has been modified. Should extension of an open-water flow routing model downstream of RM 75 be needed to address data needs of riverine process and habitat modeling studies, the additional channel and hydraulic data can be collected in Q3 2013. The additional data will be incorporated into a revised open-water flow routing model which will be shared with the TWG in Q4 2013 and the results provided in the ISR. A final open-water flow routing model will be developed in Q4 2014 and reported in the USR.
IFS-036	EPA	11/14/2012	"Percent difference values are particularly unhelpful for assessing change in the average timing of specific	As described in Section 8.5.4.4.1.3, the suite of hydrologic statistics to be used to evaluate existing conditions and alternative operational scenarios,

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			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." –pdf pages 15-16	including modifications to select parameters to increase ecological relevance to the Susitna River resources, will be developed with input from the TWG.
IFS-037	NMFS	11/14/2012	"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)" -pdf page 72	As described in Section 8.5.4.3.2, operations modeling will provide downstream flow releases that will be input to habitat modeling of existing and alternative operational scenarios over a range of hydrologic conditions. Sensitivity analysis will be conducted of individual habitat modeling components (see 8.5.4.5.1.1.8) and sensitivity analyses of overall results will be conducted as described in Section 8.5.4.7: Temporal and Spatial Habitat Analyses.
IFS-038	EPA	11/14/2012	"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. 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." –pdf pages 15-16	The results of statistical analyses of IHA/EFC-type parameters will be reviewed with the TWG to identify ecologically meaningful differences between existing conditions and alternative operational scenarios. The results of the hydrologic analyses, combined with the results of the habitat modeling efforts, will inform the development of AEA's environmental analysis in its License Application and provide guidance when developing operational rules.
IFS-039	EPA	11/14/2012	"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	As described in Section 8.5.4.4.1.3, the suite of hydrologic statistics to be used to evaluate existing conditions and alternative operational scenarios, including modifications to select parameters to increase ecological

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			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." –pdf page 16	relevance to the Susitna River resources, will be developed in consultation with the TWG in Q1 2014 (see Table 8.5-14).
IFS-040	EPA	11/14/2012	"The present version of the IHA program has known bugs. The PSP/RSP team should consult with the support team for the software." –pdf pages 15-16	AEA will consult with the IHA program support team to identify known bugs. Modifications to the standard IHA/EFC statistical packages are envisioned to correct bugs and to increase ecological relevance of select parameters to Susitna River resources.
IFS-041	EPA	11/14/2012	"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. . . . 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	See AEA's response to comment IFS-039.

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			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." –pdf page 17	
IFS-042	USFWS	11/14/2012	"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)." –pdf page 53	See AEA's response to comment IFS-042.
IFS-043	NMFS	11/14/2012	"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." – pdf page 63	The suite of hydrologic statistics (see Section 8.5.4.4.1.3), including modifications to select parameters to increase ecological relevance to the Susitna River resources, will be developed with input from the TWG by Q1 2014 (see Table 8.5-14). This may include the timing, magnitude and frequency of spring and early summer freshets that provide biological cues that influence juvenile salmon out-migration, and summer and fall freshets that provide biological cues that may influence adult access to spawning areas. The results of the hydrologic analyses, combined with the results of the habitat modeling efforts, will inform the development of AEA's environmental analysis in its License Application and provide guidance when developing operational rules. As described in Section 8.5.4.5.1, HSC/HSI will be developed that describe fish utilization as parameters of depth, velocity, substrate, cover, turbidity, and upwelling. Fish utilization of parameters, such as cover, depth, and substrate, may be in response to the risk of predation, but may be a function of other interrelated factors such as water temperature and food availability. Development of HSC/HSI will document target species and life stages utilization of microhabitat habitat types. In coordination with fish distribution studies (see RSP Section 9.6), habitat use strategies will be considered when developing HSC/HSI to evaluate the effects of Project operations on the temporal and

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				spatial distribution of fish.
IFS-044	USFWS	11/14/2012	"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." –pdf page 54	The distribution of instrumentation to assess hydrographic relationships between main channel and off-channel habitats is described in Section 8.5.4.4.1.1: Hydrologic Data Collection and Section 7.5: Groundwater Study.
IFS-045	USFWS	11/14/2012	"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." –pdf page 53	As described in Section 8.5.4.4.1.3, the suite of hydrologic statistics to be used to evaluate existing conditions and alternative operational scenarios, including modifications to select parameters to increase ecological relevance to Susitna River resources, will be developed with input from the TWG in Q1 2014. Mapping of aquatic habitats and information on the seasonal distribution of fish within the habitats will be conducted and are described in Section 9.9 and Section 9.6, respectively.
IFS-046	TU	11/14/2012	"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	The effects of glacier wastage and retreat on runoff in the Susitna basin and changes in climate over the license term will be analyzed to estimate annual runoff, seasonality and peak flows to simulate the inflow of water to the proposed Susitna-Watana reservoir (see Section 7.7). Operation of the Project under existing conditions and alternative operational scenarios will

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			water resources." –pdf page 4	be analyzed as described in Section 8.5.4.3.2.
IFS-047	USFWS	11/14/2012	"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." –pdf page 61	As described in Section 8.5.4.3.2, the operations model will be used to evaluate a range of alternative operational scenarios.
IFS-048	EPA	11/14/2012	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). –pdf pages 15-16	As described in Section 8.5.4.4.1.3, the suite of hydrologic statistics to be used to evaluate existing conditions and alternative operational scenarios, including modifications to select parameters to increase ecological relevance to the Susitna River resources, will be developed with input from the TWG. For instance, a stand-alone statistical package will be developed to analyze effects of hourly flow changes associated with proposed Project load-following operations.
IFS-049	EPA	11/14/2012	Use of IHA to compare differences between unregulated and regulated flow conditions should be reviewed because the 33 IHA parameters represent a 'kitchen sink' of variables, some of which may not be ecologically relevant to the Susitna-Watana Project. Inclusion of variables that are not ecologically relevant to the Project will give an inaccurate picture of the Project impacts. The analysis must focus only on	The hydrologic statistics described in Tables 8.5-12 and 8.5-13 will be reviewed with input from the TWG in Q1 2014 to identify those parameters that are ecologically relevant to Susitna River resources (see 8.5.4.4.1.3).

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			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 –pdf pages 15-16	
IFS-050	NMFS	11/14/2012	"Any (HSC) 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)." -pdf page 68	We agree. Data collected at sampling locations include primary factors considered to influence fish habitat use and will consist of the following: biological information (fish species, life stage, length, location of juvenile fish within the water column, redd dimensions, fish position relative to cover features and relevant comments regarding fish behavior), hydraulic data (water depth, velocity, presence of upwelling), habitat type and structure (macro- and mesohabitat type, substrate size and percent composition, and cover feature type), and water quality metrics (temperature, dissolved oxygen, turbidity, upwelling presence and temperature) (see Section 8.5.4.5.1.1).
IFS-051	NMFS	11/14/2012	"NMFS requests that only site specific HSIIHSC 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." -pdf page 68	Habitat suitability criteria (HSC) will be developed for target species based on data specific to the Susitna River. If site-specific data cannot be obtained for a target species/life stage, HSC curves will be developed from the following secondary sources, in order of preference: existing site-specific data collected from the Susitna River during the 1980s studies; site-specific data collected from other similar Alaska river systems; or professional opinion (roundtable or Delphi) of local resource specialists that are familiar with habitat use by the species and life stages of interest for this study (see Section 8.5.4.5).
IFS-052	NMFS	11/14/2012	"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 life stage (or why this necessary information cannot be provided)." - pdf page 68	The site specific habitat criteria/indices will be produced for all target species and life stages and is detailed in Section 8.5.4.5 ('Habitat Suitability Criteria Development'). Proposed target species identified in this section are: Chinook, coho, chum, and sockeye salmon; rainbow trout; arctic grayling; Dolly Varden trout; burbot; longnose sucker; humpback whitefish; and round whitefish. Determination of target species and life stages will be with input from the TWG group during Q1 2013 (see Section 8.5.4.5.1).
IFS-053	NMFS	11/14/2012	"Additional areas that need more explanation of study methods and their ability to achieve the objectives we	Potential effects of Project operation on salmon egg incubation and fry emergence will be evaluated as part of 'Effective Spawning-Incubation

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			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)." –pdf page 72	Habitat Analyses' (see Section 8.5.4.6.1.5). Project effects on salmon rearing, including winter rearing, will be addressed as part of habitat-specific modeling (see Section 8.5.4.6) and 'Winter Habitat Use Sampling' (see Section 8.5.4.5.1.2.1). Evaluation of effects on juvenile migration will be completed in association with habitat-specific modeling (see Section 8.5.4.6) and Fish and Aquatic Resources (see Section 9). Effects of Project operation on river productivity are described in Section 9.8 ('River Productivity Study) and Section 8.5.4.5.1.2.3.
IFS-054	NMFS	11/14/2012	"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 ABA's consultants to provide the requested information." –pdf pages 74-75	As described in the IFS analytical framework (see Section 8.5.4.1), riverine process studies will be integrated rather than independent in order to evaluate Project effects on aquatic habitats. In response to the NMFS study request, an evaluation of flow dependent biological cues has been included in the RSP (see Section 8.5.4.5.1.3). Long-term adult salmon escapement data will be examined to identify relationships between temporal patterns in environmental conditions and salmon distribution, abundance and migration. Analyses of possible relationships between climatic, hydrologic, and fish habitat indices and salmon abundance and migration timing will be based on available long-term data sets for Deshka River Chinook salmon and Yentna River sockeye salmon, though other long-term data sets pertaining to salmon migration timing and abundance will be included if available. Implementation details will be discussed with the TWG in Q2 2013 and study results presented in the ISR in Q1 2014. For each target species, including all salmon species, a table will be prepared that summarizes the periodicity of fish use, by life stage and macrohabitat type within each Susitna River Segment (see Section 8.5.4.5.1). A draft version of the periodicity table for salmon species (without macrohabitat types) is presented in Table 8.5-2. Periodicity tables that depict timing of use among macrohabitat types in each Susitna River Segment will be produced for all target species and life stages as part of the Periodicity TM in Q1 2013. Hydrologic conditions are not included in

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				species periodicity tables, however, further development of fish periodicity and habitat utilization data and identification of data needs will occur with input from the TWG during 2013 and 2014 (see Table 8.5-14).
IFS-055	USFWS	11/14/2012	"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)." –pdf pages 58-59	As described in Section 8.5.4.5.1, HSC/HSI will be developed for each target species and life stage based on site specific data in the Susitna River. If site-specific data cannot be obtained for a target species/life stage, HSC curves will be developed from the following secondary sources, in order of preference: existing site-specific data collected from the Susitna River during the 1980s studies; site-specific data collected from other similar Alaska river systems; or professional opinion (roundtable or Delphi) of local resource specialists that are familiar with habitat use by the species and life stages of interest for this study (see Section 8.5.4.5). HSC curves were developed during the 1980s for depth, velocity, substrate, cover, turbidity and upwelling, though the extent of parameters measured and analyzed varied by species (see Table 8.5-1). The development of HSC/HSI data and determinations of the need for and applicability of 1980s data to supplement site specific data collected during 2012-2014 will occur with input from the TWG (see Section 8.5.4.5.1).
IFS-056	ADNR-ADF&G	11/14/2012	"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	Section 8.5.4.5.1.2.2, Section 8.5.4.6.1.1.4, and Section 8.5.4.6.1.6.1 provide a detailed description of the theory, sampling methods, and analysis of the potential impacts of alternative Project operational scenarios on stranding and trapping of juvenile fish. Stranding and trapping analysis will be completed in conjunction with and rely on and incorporate data developed as part of the flow routing model, varial zone modeling, bathymetric and digital terrain modeling, and juvenile fish surveys.

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			scenarios under normal, dry and wet hydrologic conditions. Factors that may contribute to stranding and/or trapping should be considered including: aquatic species/life stage, cover, duration of a stranding/trapping event, and time of year." – pdf pages 21-22	
IFS-057	USFWS	11/14/2012	"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." –pdf page 63	In response to the USFWS study request, an evaluation of flow dependent biological cues has been included in the RSP (see Section 8.5.4.5.1.3). Long-term adult salmon escapement data will be examined to identify relationships between temporal patterns in environmental conditions and salmon distribution, abundance and migration. Analyses of possible relationships between climatic, hydrologic, and fish habitat indices and salmon abundance and migration timing will be based on available long-term data sets for Deshka River Chinook salmon and Yentna River sockeye salmon, though other long-term data sets pertaining to salmon migration timing and abundance will be included if available. Implementation details will be discussed with the TWG in Q2 2013 and study results presented in the ISR in Q1 2014. For each target species, including all salmon species, a table will be prepared that summarizes the periodicity of fish use, by life stage and macrohabitat type within each Susitna River Segment. A draft version of the periodicity table for salmon species (without macrohabitat types) is presented in RSP Table 8.5-2. Periodicity tables that depict timing of use among macrohabitat types in each Sustina River Segment will be produced for all target species and life stages as part of the Periodicity TM in Q1 2013. Hydrologic conditions are not included in species periodicity tables, however, further development of fish periodicity and habitat utilization data and identification of data needs will occur with input from the TWG (see Section 8.5.4.5.1).
IFS-058	ADNR-ADF&G	11/14/2012	"Dissolved oxygen should also be measured as a parameter for HSC and HSI development." –pdf page 20	Dissolved oxygen will be measured in association with HSC/HSI sampling efforts using hand-held probes and continuous monitoring loggers (see Section 8.5.4.5.1).
IFS-059	NMFS	11/14/2012	"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	Habitat suitability indices (HSI) and criteria (HSC) will be based upon data specific to the Susitna River and will be developed for target species, life stages and macrohabitats (e.g., main channel/side channel/side slough, clear/turbid water, upwelling presence/absence) such that multiple curves

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			distribution, condition, and growth rates of anadromous fish in the river system, for each species and life stage. 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 life stage. 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)." –pdf page 67	will be generated for certain species and life stages (see Section 8.5.4.5.1). Data collected at HSC sampling locations will include primary factors considered to influence fish habitat use and sites will be randomly selected among available aquatic habitats. A stratified random site selection approach will be used to ensure that data collection sites cover the range of conditions within all habitat types in the Susitna River (see Section 8.5.4.5.1.1.3). Habitat suitability data for agreed upon target species and life stages will be developed with input from the TWG (see Section 8.5.4.5.1). While we agree that HSC/HSI should explain fish distribution, it is not clear that these metrics determine fish condition and growth; there are environmental (e.g., air temperature, precipitation), biological (e.g., genetic composition) and behavioral factors (e.g., intra- and inter-specific competition) irrespective of the proposed criteria that have been shown to affect fish condition and growth. Observations of fish behavior will be recorded during winter to identify potential diurnal patterns in habitat use, which will inform HSC/HSI development. HSC/HSI are approximations of the biological response of fish to physical habitat conditions (i.e., depth, velocity, substrate, water quality, upwelling). Relationships between fish behavior, growth and aquatic habitat will be evaluated in association with bioenergetic modeling described in Section 9.8.4.5.
IFS-060	NMFS	11/14/2012	"In our study requests (NMFS 2012), NMFS asked for specific criteria for each life stage 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;	We agree; the use of guilds will only be used if supported by site-specific utilization data. Data collected at sampling locations include primary factors considered to influence fish habitat use and will consist of the following: biological information (fish species, life stage, length, location of juvenile fish within the water column, redd dimensions, fish position relative to cover features and relevant comments regarding fish behavior), hydraulic data (water depth, velocity, presence of upwelling), habitat type and structure (macro- and mesohabitat type, substrate size and percent composition, and cover feature type), and water quality metrics (temperature, dissolved oxygen, turbidity, upwelling presence and temperature) (see Section 8.5.4.5.1.1). HSC curves will be developed by species and life stage based on stream-specific data (e.g., macrohabitat type, clear vs turbid water, upwelling sites) such that multiple curves will be generated for certain species and life stages (see Section 8.5.4.5.1.1.7). A stratified random site selection approach will be used to ensure that data collection sites cover the range of conditions within all habitat types in the Susitna River (see Section 8.5.4.5.1.1.3). Variance and confidence intervals associated with

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			• 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 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." -pdf page 69	each HSC data set will be determined during bootstrap analyses (see Section 8.5.4.5.1.1.8).
IFS-061	ADNR-ADF&G	11/14/2012	"information is needed on criteria that will be used to identify cover types and substrate sizes." –pdf page 20	Cover types to be used in association with HSC/HSI data collection are: boulder (> 10 inch diameter), large wood debris (> 4 inch diameter, > 10 feet long), aquatic vegetation, undercut bank, overhanging vegetation (< 3.3 feet of water surface), and water depth (> 3.3 feet depth) (see Section 8.5.4.5.1). Substrates will be classified using a Wentworth grain scale modified to reflect English units of measurement (see RSP Table 8.5-17).
IFS-062	ADNR-ADF&G	11/14/2012	"Information is needed on equipment that will be used and calibration protocols." –pdf page 21	Equipment to be used in association with habitat specific HSC/HSI data collection will include: Price AA current meters for water velocity measurement, portable hand-held temperature probes for instantaneous measurement of surface streamflow and groundwater upwelling temperatures, portable hand-held dissolved oxygen probes, portable turbidity meters (see Section 8.5.4.5.1). In addition to the above listed materials, equipment to be used during studies of winter fish behavior, habitat utilization, and water quality sampling will include: continuously monitoring temperature loggers to measure surface and intergravel water temperature, continuously monitoring dissolved oxygen loggers to record intergravel dissolved oxygen levels and continuously monitoring surface water and groundwater stage recorders (see Section 8.5.4.5.1.2.1). Procedures for accuracy testing and/or calibration of this equipment are described in the identified Sections associated with each effort.

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IFS-063	USFWS	11/14/2012	"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." –pdf page 59	See AEA's response to comment IFS-60.
IFS-064	USFWS	11/14/2012	"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." –pdf page 57	We agree that a statistically valid sampling approach is necessary. In regards to HSC/HSI data collection, a stratified random site selection approach will be used across geomorphic reaches, macro- and mesohabitats in each Susitna River Segment to ensure that sampling sites cover the range of conditions within all habitat types (see Section 8.5.4.5). Data collected at sampling locations will include primary factors that are considered to influence fish habitat use and will consist of the following: biological information (fish species, life stage, length, location of juvenile fish within the water column, redd dimensions, fish position relative to cover features and relevant comments regarding fish behavior), hydraulic data (water depth, velocity, presence of upwelling), habitat type and structure (macro- and mesohabitat type, substrate size and percent composition, and cover feature type), and water quality metrics (temperature, dissolved oxygen, turbidity, upwelling presence and temperature) (see Section 8.5.4.5.1.1). Determination of necessary fish habitat utilization criteria and development of HSC/HSI data will occur with input from the TWG (see

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				Section 8.5.4.5.1).
IFS-065	ADNR-ADF&G	11/14/2012	"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." –pdf page 20	The extent and distribution of lateral habitats (off-channel areas) will be determined as part of the Characterization and Mapping of Aquatic Habitats (see Section 9.9.5) using IFSAR 20-foot contour topographic data, low altitude aerial video, LiDAR imagery, cross-sectional profiles, and the 2012 geomorphic mapping of channel types as applicable (see Section 6.5.4.5). Analysis of off-channel habitat surface area versus mainstem flow relationships will be completed over a range of flows (e.g., 5,100 to 23,000 cubic feet per second [cfs] measured at Gold Creek gage (~RM 134) in the Middle River (see Section 6.5.4.5). Predicting and defining the connectivity of off-channel habitats with mainstem river flow will be completed as part of the breaching flow analysis (see Section 9.12).
IFS-066	ADNR-ADF&G	11/14/2012	"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." –pdf page 20	As described in Section 8.5.4.5, HSI data will be collected in defined habitat types over 2 years. HSC/HSI data collection efforts were initiated as a pilot program in 2012 and will continue in 2013 and 2014. HSC/HSI data collected during 2012-2014 will be specific to the Susitna River and will be supplemented, if necessary, by site-specific HSC/HSI data collected in the early 1980s. Selection of target fish species and life stages and development of HSC/HSI data will occur with input from the TWG (see Section 8.5.4.5.1).
IFS-067	FERC	11/14/2012	"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." –pdf page 14	The pilot 2012-2013 winter study is described in Section 8.5.4.5.1.2.1. Results from 2012-2013 pilot studies will be finalized and distributed to the TWG by Q3 2013 and will be included in the ISR in Q1 2014 (see Table 8.5-15). Study methods for the 2013-2014 winter fish distribution study, which will incorporate 2012-2013 pilot study results, will be completed by Q3 2013.
IFS-068	ADNR-ADF&G	11/14/2012	"Intergravel, over-winter temperature monitoring of redds should be expanded to include measurements of	We agree. As described in Section 8.5.4.5.1.2.1, intergravel dissolved oxygen levels in spawning sites will be monitored during 2012-2013 winter studies using a continuously recording DO logger that will be deployed

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			dissolved oxygen." –pdf page 21	approximately 20 centimeters (7.9 inches) below the substrate surface. Instantaneous measurements of surface water DO will also be measured using hand-held probes during 2012-2013 Winter Studies.
IFS-069	NMFS	11/14/2012	"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: comparisons of habitat quantity and quality, ramping rates, juvenile fish stranding/trapping, habitat sustainability and distribution and abundance of benthic macro invertebrates under alternative operational scenarios." -pdf page 73	See AEA's response to comment IFS-084.
IFS-070	AHP, AS, CSDA, NHI, HRC	11/14/12	"The potential of fluctuating flow 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." Stage fluctuations will cause increased fish movement, which may indirectly cause increased juvenile fish mortality rates due to increased predation, movement to unsuitable habitats, and reduced body condition. -pdf pages 9-10	The IFS study will measure the potential for direct effects of fluctuation flow on fish habitat and in particular baseline conditions regarding stranding and trapping of juvenile fishes (see Sections 8.5.4.5.1.2.2 and 8.5.4.5.1.2.3). In addition, there are specific objectives in the Fish Distribution and Abundance Middle and Lower Susitna River Study plan that will document baseline conditions for movement patterns of juvenile salmon from spawning to rearing habitats (see Section 9.6.4.3.3) and will describe diel behaviors of fish (see Section 9.6.4.3.3). These baseline data will provide information relevant for addressing potential effects of fluctuating flows. To the best of AEA's knowledge there is no model or accepted scientific approach that would allow for predictions as to how potential flow fluctuations would directly affect fish movements and subsequent indirect consequences of those movements as the result of fish moving into future habitats with uncertain ecological conditions.
IFS-071	ADNR-ADF&G	11/14/2012	"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." –pdf page 21	Varial zone modeling (see Section 8.5.4.6.1.6) and time series analysis (see Section 8.5.4.7.1) will be used to assess the rate and magnitude of stage change under both natural and with Project operational flow scenarios. The result of these analyses will be presented as a tabular list of rate of stage change (inches per hour) and habitat quantities (time series) under different flow levels for each of the target species and life stages.
IFS-072	ADNR-	11/14/2012	"For PHABSIM and similar transect-based methods,	Habitat modeling is expected to represent a combination of dependent and

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	ADF&G		will transects be hydraulically independent, dependent or a combination and accordingly, what water surface elevation models and composite suitability index will be used?" –pdf page 20	independent techniques. The selection of PHABSIM modeling techniques will be determined in 2nd Quarter 2013, with input from the TWG (see Section 8.5.4.6). Model selection will be based on the hydraulic characteristics of each site and the information needed to address Project effects. For instance, the use of 2-D modeling techniques will involve dependent water surface modeling techniques. The mainstem flow routing model, used to calculate site boundary conditions, will represent a combination of dependent and independent transect calculations.
IFS-073	FERC	11/14/2012	"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)." -pdf page 10	Assessment of potential stranding and trapping of juvenile fish related to Project operations will utilize results of flow routing modeling, bathymetric mapping, 1-D and 2-D hydraulic modeling, and HSC/HSI curve development. Sections 8.5.4.5.1.2.2 and 8.5.4.6.1.6 provide a detailed description of how information and data from each of these data sources will be used to evaluated stranding and trapping as part of the varial zone modeling (see Section 8.5.4.6.1.6) that is proposed for at each of the Focus Areas.
IFS-074	FERC	11/14/2012	"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	Potential habitat shifts in response to Project operations will be addressed through an evaluation of flow effects on the range of habitats available under existing, unregulated flows and habitats that become available under alternative operational scenarios. As described in Section 8.5.4.2.1.2-Selection of Study Areas/Study Sites, habitat modeling will be conducted in areas selected to be representative of the range of physical conditions in each geomorphic reach. Operations modeling (Section 8.5.4.3.2) will quantify flow releases under existing and alternative operational scenarios and Section 6.6-Fluvial Geomorphology Modeling will quantify changes in the distribution of mesohabitat units. Habitat modeling results will be compiled by mesohabitat unit (Section 8.5.4.7) and will quantify potential habitat shifts. Load-following operations increase the magnitude, frequency, duration, and timing of stage changes. Fish inhabiting areas of repeated inundation and dewatering, termed the varial zone, are exposed to potential stranding, trapping, reduced food supply and energy

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			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." –pdf page 11	expenditure. Varial zone modeling (Section 8.5.4.6.1.6) is designed to quantify the extent of the varial zone and stability of available habitats for three time scales under existing conditions and alternative operational scenarios.
IFS-075	FERC	11/14/2012	"In section 8.5.4.6.1.5, [AEA describes] 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 [AEA's] 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." –pdf page 12	Significant detail has been added to Section 8.5.4.6.1.5, Effective Spawning/Incubation Habitat Analyses. The model framework is shown in Figure 8.5-32. Analyses of potential salmonid spawning areas within Focus Areas will include input from Section 7.5-Groundwater Study, Section 6.6 Fluvial Geomorphology Modeling below Watana Dam Study, and Section 5.6-Water Quality Modeling Study. As described in Section 8.5.4.6.1.5, model assumptions include duration of spawning, egg incubation and alevin life stages, minimum water depth for spawning, and mortality rates of eggs exposed to dewatering, scour, low oxygen and reductions in groundwater upwelling. The results of the analyses will provide quantitative habitat indicators under existing and alternative operational scenarios.
IFS-076	ADNR-ADF&G	11/14/2012	"Information is needed on flow ranges that will be collected to evaluate flow-habitat relationships for each modeling approach." –pdf page 20	Three stage-discharge data sets, collected at flow levels of approximately 8,000 cfs, 16,000 cfs and 28,000 cfs at the USGS gage at Gold Creek (No. 15292000), will be used to establish Focus Area boundary conditions. As described in Section 8.5.4.6-Habitat Specific Model Development, various models may need additional stage and flow data to develop habitat-specific analyses; data requirements for each model are described in the specific section. For example, stage recorder data at select off-channel habitats and adjacent main channel areas will be needed to establish the

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				relationship between mainstem and off-channel flow and stage for habitat connectivity and breaching flows (see Section 8.5.4.6.1.2.3).
IFS-077	FERC	11/14/2012	"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 Interactions, 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." –pdf page 12	Several studies are being proposed to assess the effects of load-following operations on upwelling and groundwater dynamics related to egg incubation and emergence survival including effective spawning/incubation analysis (see Section 8.5.4.6.1.5), varial zone modeling (see Section 8.5.4.6.1.6), winter habitat use (see Section 8.5.4.5.1.2.1), and Groundwater Study (see Section 7.5). Specific details on study area, data needs, model parameters, and assumptions are presented for each of the proposed studies. Analysis of the temporal and spatial effects of load-following on the habitat-flow relationships in the Susitna River will be completed using several different tools including habitat-time series analysis, habitat duration curves, and extrapolation methods presented in Section 8.5.4.7.
IFS-078	USFWS	11/14/2012	"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	Identifying and quantifying the predicted changes in aquatic habitat in the Middle and Lower Segments of the Susitna River under the proposed Project operational scenarios will require the use of several different hydraulic and biological models. The mainstem aquatic habitat model integrates hydraulic modeling, channel bathymetry, and biological information on the distribution, timing, abundance, and suitability of habitat to estimate metrics (such as varial zone area and frequency of inundation and dewatering) that will be used to compare the effects of the proposed operational scenarios. Section 8.5.4.6.1.1 provides an overview of the habitat and hydraulic models proposed for as part of the evaluation of Project related effects including boundary conditions transects, 2-Dimensional (2-D) modeling, single transect PHABSIM, stranding and

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			for use in forecasting the environmental impact of the proposed Project." -pdf pages 59-60	trapping, and fish passage/connectivity. The selection of specific habitat models will be made following a careful review of the approaches used during the 1980s studies, and a review of contemporary methods available for addressing the objectives of the instream flow study. AEA will seek TWG input on habitat model selection during Q2 2013 (see Section 8.5.4).
IFS-079	USFWS	11/14/2012	"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." –pdf page 54	Lateral connectivity will be identified through a combination of remote sensing and on-site data collection. The extent and distribution of lateral habitats (off-channel areas) will be determined as part of the Fisheries and Aquatic Resources Study (see Section 9.9.5) using IFSAR 20-foot contour topographic data, low altitude aerial video, LiDAR imagery, cross-sectional profiles, and the 2012 geomorphic mapping of channel types (see Section 6.5.4.5). Defining the connectivity of off-channel habitats with main channel flow will be completed as part of the breaching flow analysis (see Section 8.5.4.6.1.2.3, and Section 9.12.
IFS-080	FERC	11/14/2012	"Understanding the effects of load following on fish egg incubation, egg and alevin 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	Section 8.5.4.6 provides a detailed description of the specific models, proposed sampling area, data collection needs and methods, analyses, calibration, and metrics for evaluation of potential Project impacts to spawning/incubation habitat and stranding and trapping of juvenile fish.

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			evaluated." –pdf pages 10-11	
IFS-081	ADNR-ADF&G	11/14/2012	"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." –pdf page 21	To assist with the assessment of potential Project effects, 2-D hydraulic modeling will be used to evaluate the detailed hydraulic characteristics of the Susitna River on smaller, more local scales where it is necessary to consider the more complex flow patterns to understand and quantify project affects under various Project operation scenarios. The 2-D model will be applied to specific Focus Areas that are representative of important habitat conditions and the various channel classification types. These sites will be chosen with input from the TWG and the Fish and Aquatics Instream Flow Study, Riparian Instream Flow Study, Ice Processes in the Susitna River Study, and Fish and Aquatics studies to facilitate integration of available information between the studies (see Section 8.5.4.2). A detailed discussion of the 2-D modeling is presented in Section 6.6.
IFS-082	ADNR-ADF&G	11/14/2012	"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." –pdf page 21	Time-step increments, used to calculate stage changes, will be identified during calibration of the Mainstem (Open-water) Flow Routing Model in 4th Quarter 2012 (see Section 8.5.4.3). Depending on the initial calibration results, time steps as short as 3-minutes may be needed to match predicted to measured stage changes. In 2014, the calibrated flow routing model will be used to evaluate the effects of Project operations using 1-hour time-steps unless the Technical Workgroup (TWG) determines that shorter time steps are needed to evaluate specific fisheries resources.
IFS-083	ADNR-ADF&G	11/14/2012	"What criteria will be used to select and weight transects used to provide information for habitat-flow models?" –pdf page 20	With input from the TWG and riverine process study leads, transect selection within each Focus Area will be based on known fish use (see Section 9), habitat composition (see Section 9.9), groundwater– aquatic habitats (see Section 7.5), river access, and sampling safety will all be considered. Additional habitat transects/segments will be selected to describe distinct habitat features such as groundwater areas, spawning and rearing habitats, overwintering habitats, distinct tributary mouths/deltas, and potential areas vulnerable to fish trapping/stranding. The transects used for defining the flow routing model will also be integrated into this analysis. Results of sites that are modeled using either 1-D (i.e., transect) or 2-D techniques will be extrapolated to non-modeled sites based on the proportion of habitat area they represent within the geomorphic reach. If biological studies indicate that specific habitat types are highly important to a species, the weighting of modeling results from

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				those habitat types will be given priority as determined with input from the TWG Q3 2014.
IFS-084	NMFS	11/14/2012	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." -pdf page 73	The IFS will result in the collection of data and development of different types of habitat-flow relationships including but not limited to those founded on PHABSIM that depict WUA or habitat versus flow by species and life stage; effective habitat versus discharge relationships that define how spawning and incubation areas respond to flow changes; and varial zone analysis that quantifies areas of stranding and trapping relative to flow change. Additional components that will factor into the habitat – flow relationships will include those associated with water temperature, turbidity, and groundwater. These relationships will be part of the analytical framework that will be used in evaluating the operational effects of the Project (see Section 8.5.4.8). This will require both a temporal analysis that focuses on how the various habitat response variables change with flow over biologically important time periods (i.e., periodicity), and a spatial analysis that can be used for expanding or extrapolating results from measured to unmeasured habitats within the river. Section 8.5.4.7 provides a detailed description of how each of the aquatic habitat models will be will be used in evaluating operational effect of the Project on different habitats.
IFS-085	USFWS	11/14/2012	"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." –pdf page 60	See AEA's response to comment IFS-080.
IFS-086	ADNR-ADF&G	11/14/2012	"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." –pdf page 22	This comment relates to stranding and trapping which is described in detail in Sections 8.5.4.6.1.1.4 and Section 8.5.4.6.1.6.1. The results from the varial zone modeling and the stranding and trapping studies will be included in the Integrated analysis described in Section 8.5.4.8.
IFS-087	ADNR-	11/14/2012	"How will the data be aggregated from the different	Results from the different habitat models, as well as models from other

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	ADF&G		models to evaluate single flow recommendations?" – pdf page 21	resource disciplines will be used to select a suite of indicator variables that will be applied in evaluating overall project effects. This process is described further in Section 8.5.4.8. Methods for completing temporal and spatial analysis of the models are described in Section 8.5.4.7.
IFS-088	USFWS	11/14/2012	"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." –pdf page 56	The methods for spatial analysis and the extrapolation of results from modeled to un-modeled areas are generally described in Section 8.5.4.7.1.2. As noted in that section, this analyses will be challenging for the Susitna River given its length, widely variable size (width), diverse geomorphologies, and complex habitat types. The approach considers the distinctiveness of the different habitat types within a given area and at the same time the similarity of these habitat types to other areas. Development of habitat – flow relationships for specific habitat types (e.g. side channel, side slough) and mesohabitat types (riffle, run, pool, etc.) from one area should then, with appropriate adjustment for dimensional differences and other distinguishing factors, be expandable to unmeasured areas containing similar characteristics. The Focus Areas identified in the RSP were selected in part due to their representativeness of other habitat types in the river (see Section 8.5.4.2.1.2) and therefore should be appropriate for scaling up to other areas. However, as noted in that discussion, these areas are subject to review and may be modified based on results of habitat mapping completed in Q1 2013.
IFS-089	USFWS	11/14/2012	"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)." –pdf page 60	The selection of habitat models is described in Section 8.5.4.6. How model results would be spatially evaluated is described in Section 8.5.4.7. See also AEA's response to comment IFS-088.
IFS-090	NMFS	11/14/2012	"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	Please see AEA's Response to comment IFS-020.

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			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 macrohabitat types and delineation of each of the geomorphic reaches, both described as in progress at TWG but not described in the PSPs." –pdf page 63	
IFS-091	CSDA	11/14/2012	"A minimum of 2 years is needed to establish the site-specific Habitat Suitability Index (HIS) curves needed for all target fish species." –page 3	See AEA's response to comment IFS-095.
IFS-092	NMFS	11/14/2012	"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)." –pdf pages 63-64	See AEA's response to comment IFS-095. In addition, the commenter has not provided a rationale for the number of years of study other than suggesting the life cycle of a salmon. AEA believes that it is not the years of data collection that are important, but rather, an understanding of the affected environment and how the Project would impact it. AEA believes the hydrologic and climactic variability of the historic record is sufficient to understand how the Project would affect the resources. With the IFS modeling efforts combined with the physical and biological information collected informally in 2012 and through formal study efforts in 2013 and 2014, AEA will have sufficient information to understand the physical processes, and the effects the proposed Project will have on instream flow resources. This will permit AEA to propose appropriate protection, mitigation and enhancement measures in its License Application to FERC.
IFS-093	USFWS	11/14/2012	"Habitat-flow relationships should also be developed over a minimum temporal scale to address the	See AEA's response to comment IFS-095.

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			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." –pdf page 52	
IFS-094	CSDA	11/14/2012	"Instream Flow Studies should be developed over a temporal scale of five years. This is in order to encompass a representative time frame." –pdf page 3 third bullet	See response to IFS-095 comment.
IFS-095	CWA	11/14/2012	"The PSP's maximum 2 year study period for analyzing impacts on instream flows is insufficient."–pdf page 6 with more detail on page 7	In addition to the 57-year hydrologic record for the Susitna River at Gold Creek, AEA is expanding the number of flow gaging sites in the Susitna River watershed as described in Section 8.5.4.4. This hydrologic record will capture the annual and seasonal variability of flows and exceed the state ADNR instream flow data collection requirements. However, the hydrologic record should be considered an input to the IFS modeling effort. The IFS

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				Analytical Framework is designed to integrate study and model results of riverine processes and to assess relationships between riverine and biological functions. Indicators of aquatic habitats under unregulated and alternative operational scenarios will be calculated under average, wet, and dry hydrologic conditions, and warm and cold Pacific decadal oscillation phases. One objective of the IFS modeling efforts is to extrapolate measured conditions to non-modeled conditions both spatially and temporally. This allows data collected over the study period to be used to evaluate Project effects over the range of environmental conditions that occur naturally. Several years of HSC/HSI and other habitat utilization data are available from the 1980s studies and contribute to site-specific knowledge of the potential local adaptations of the species. Additional biological information was developed in 2012 and formal studies will be conducted in 2103 and 2014 as part of the current licensing efforts. These multiple years of site specific studies from the 1980s, and 2012 through 2014, will capture variability in flow-habitat and fish-habitat relationships and support the IFS as a licensing decision tool.
IFS-096	USFWS	11/14/2012	"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)." –pdf pages 51-52	See response to IFS-095 comment.
IFS-097	USFWS	11/14/2012	"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	See response to IFS-095 comment.

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			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." –pdf page 58	
IFS-098	TCCI	11/07/2012	The study should be conducted for a longer duration to encompass natural variation in fish abundance and distribution and environmental conditions. The council agrees with recommendations by NMFS and USFWS to conduct studies for a minimum of one salmon life cycle (5 - 7 years) -pdf pages 2-4	See AEA's response to comment IFS-092.
IFS-099	Long, Becky	11/13/2012	Two years are inadequate, request for 5 to 7 year study –pdf page 2	See AEA's response to comment IFS-092.
IFS-100	ADNR-ADF&G	11/14/2012	"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." –pdf page 21	A description of the decision support system-type process is described in Section 8.5.4.8.
IFS-101	FERC	11/14/2012	"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." –pdf page 5	A decision support system-type process will be used to integrate the range of habitat modeling results and inform the evaluation of alternative operational scenarios (see Section 8.5.4.8).
IFS-102	TNC	11/14/2012	"Operation Scenarios	A range of alternative operational scenarios will be evaluated as described

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			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." –pdf page 3	in Section 8.5.4.3.2. See AEA's response to comment IFS-002.
IFS-103	NMFS	11/14/2012	"Ibis 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	As described in Section 8.5.4.1, the IFS Analytical Framework provides a comparative temporal and spatial analysis that integrates Project effects on geomorphology, ice processes, water quality and groundwater to quantify changes in fish and aquatic habitat and riparian indicators under existing conditions and alternative operational scenarios (see Figure 8.5-10). The framework of the effective spawning/incubation analyses is described in Section 8.5.4.6.1.5 and Figure 8.5-32. The results developed from studies conducted in modeled Focus Areas will be extrapolated to non-modeled areas through temporal and spatial habitat analyses described in Section 8.5.4.7 and integrated with the results of studies conducted in other resource areas to gain a greater understanding of overall Project effects to the Susitna River system (see Section 8.5.4.8).

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			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)." –pdf page 74	
IFS-104	EPA	11/14/2012	"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." –pdf pages 16-17	Winter flow and stage conditions downstream of the proposed dam site will be predicted under existing conditions and alternative operational scenarios as part of the Ice Processes in the Susitna River Study modeling efforts (see Section 7.6). The results of the Ice Processes model, in terms of stage and velocity data relative to bed elevations, will be used as input to the hydraulic and habitat modeling of Focus Areas as described in Section 8.4.5.6.
IFS-105	ADNR-ADF&G	11/14/2012	"For the eulachon (Section 7.16) and boating (Section10.7) studies, similar information is needed on	Information concerning eulachon spawning habitat will be collected as part of the Eulachon Run, Timing, Distribution, and Spawning in the Susitna

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			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?" –pdf page 21	River study (see Section 9.16.4.3). This information will be useful for evaluating how these habitats may be altered under different flow conditions.
IFS-106	USFWS	11/14/2012	"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." –pdf page 52	The analytical framework for the IFS has been revised and is described in Section 8.5.4.1. Integration of studies is discussed in Section 8.5.4.8 and study interdependencies depicted in Figure 8.5-1. A detailed process schedule is presented in Table 8.5-14.
IFS-107	CWA	11/14/2012	The PSP's work products are incomplete and exclude prevention and/or mitigation efforts. -Pages 11-12 – (Section IV)	The studies described in the RSPs are focused on the collection of data and information that will be used in part for defining baseline conditions (i.e. pre-project conditions) and for developing a set of analytical tools that can be used to evaluate Project effects on different resources. These studies will inform the environmental analysis that will be used to support AEA's FERC License Application.
IFS-108	FERC	11/14/2012	"In attachment 8-1, List of Terms and Definitions, you identify the size classes for nine sediment types to be	The method for determining sediment sizes will be visually estimating the percentages of the dominant and subdominant substrate surface layers at

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			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." -pdf page 13	each HSC/HSI measurement location using a modified Wentworth (1922) substrate size classification system as presented in Table 8.5-17. Characterization of bed material during the Fluvial Geomorphology Modeling (see Sections 6.6 and 6.6.4.1.2.8) will be conducted utilizing surface pebble counts (Wolman count) or photo grid. Completion of the pebble counts yields the diameter of the intermediate axis of a randomly selected sample (generally n=100) of surface substrate. The pebble count data can then be combined according to the modified Wentworth size classes (see Table 8.5-17) and converted into percentages by size class. The data can then be graphed to illustrate percentage of total for each size class, dominant size class, and cumulative distribution.

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RIFS-01	CWA	11/14/2012	Scope is insufficient in studying the Lower River based on AEA's apparent assumption that Project effects will not significantly affect the Lower River riparian habitat. – pdf pages 7-8	AEA is not assuming insignificant Project-related effects on the Lower River groundwater processes. Although both Middle and Lower River segments are under consideration as part of the Instream Flow Study (Section 8.5), the majority of detailed study elements described in the RSP are concentrated within the Middle River Segment. This is because Project operations related to load-following and variable flow regulation will likely have the greatest potential effects on this segment of the river. These effects tend to attenuate in a downstream direction as channel morphologies change, and flows change due to tributary inflow and flow accretion. The downstream boundary of the study area is currently RM 75 because existing information indicates that the hydraulic effects of the Project below the Three Rivers Confluence are attenuated. See Section 8.5.3. However, AEA will reevaluate how far downstream Project operational significant effects extend based in part upon the results of the Open-water Flow Routing Model (see Section 8.5.4.3),which is scheduled to be completed in Q1 2013. Thus, an initial assessment of the downstream extent of Project effects will be developed in Q1 2013 with review and input of the TWG. This assessment will include a review of information developed during the 1980s studies and study efforts initiated in 2012, such as sediment transport (see Section 6.5), habitat mapping (see RSP Sections 6.5 and 9.9), operations modeling (see Section 8.5.4.3.2), and the Mainstem Open-water Flow Routing Model (see Section 8.5.4.3). The assessment will guide the need to extend studies into the Lower River Segment and if needed, will identify which geomorphic reaches will be subject to detailed instream flow analysis in 2013. Results of the 2013 studies would then be used to determine the extent to which Lower River Segment studies should be adjusted in 2014. In addition, the results of the 1-D sediment transport modeling (see Section 6.6) from RM 184 to RM 75 will be available in Q1 2014 and will further inform the need for these adjustments. Pilot HSC/HSI studies were initiated in 2012, and will be continued in 2013, and include data collection within Lower River Segment habitats (see Section

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				8.5.4.5). See also Section 8.5.3 for more discussion regarding the Lower River Segment.
RIFS-02	CCC	11/14/2012	"How will the natural floodplain system be impacted if there is no longer a spring flush of ice and water?" –pdf page 2	The goal of the Riparian Instream Flow Study is to provide a physical and vegetation process modeling approach to predicting impacts to downstream riparian vegetation from Project operational flow modification of natural Susitna River Flow, sediment and ice processes regimes (Section 8.6.1.1). See the method description in Section 8.6.3.
RIFS-03	FERC	11/14/2012	"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." –pdf page 5	Modeling results, flow charts depicting parameters, and multiple model interdependencies are included in each of the Riparian Instream Flow Study components (see Sections 8.6.3.2 through 8.6.3.7). AEA has provided a description in each of these studies regarding how the modeling results will be used. Measurement and modeling values will be used in various modeling studies to answer different questions. For example, groundwater levels will be measured at Focus Areas at individual well point locations. These values will be used to construct floodplain vegetation (individual species and plant community types) groundwater response curves (Section 8.6.3.6.2). MODFLOW will be used to model groundwater response to various Project operational scenarios (see Groundwater Study Section 7.5 for methods) based upon measured groundwater depths and surface water levels (Groundwater Study Section 7.5). Surface water and sediment transport will be both measured and modeled at each Focus Area by the Fluvial Geomorphology Modeling below Watana Dam Study (Section 6.6). The measured values, river stage and sediment transport, will be used in the 2-D modeling that will assess potential changes to sediment deposition throughout each Focus Area for various Project operational scenarios. Ice Processes effects, areas of ice dams and vertical zones of ice floodplain interactions, will be modeled (Section 7.6). Ice process floodplain vegetation interaction zones will be measured by mapping tree ice-scars throughout the Study Area (Section 8.6.3.4).
RIFS-04	FERC	11/14/2012	"Clearly describe the exact number, location, and spatial extent of your proposed focus areas for each proposed study. Provide justification for the number of proposed sites selected for detailed 2-D hydraulic modeling and other intensive study elements. Include criteria to be used for	Additional detail regarding the Focus Area selection process, criteria and rationale is included in the Fish and Aquatic Instream Flow Study (Section 8.5.4.2.1.2) and Riparian Instream Flow Study (Section 8.6.3.2). The RSP includes 10 proposed Focus Areas which are located in the Middle River and a process for which

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			selecting focus areas and study-specific rationale for co-locating sites." -pdf page 5	Focus Areas may be redistributed or added in the Lower River (see Section 8.5.4.2.1.2 and Figure 8.5-11). Section 8.6.3.2 describes a quatitative analytical approach for selecting the number and locations of Focus Areas, with riparian components, as an iterative process using additional data as it becomes available. Section 8.5.6.1.1.2 describes the rationale for use of 2-D hydraulic modeling. The number of sites for which the 2-D model, and other intensive study elements, will be applied will be determined when details are finalized (see Focus Area Selection−Riparian Process Domain, Section 8.6.3.2 for details of Focus Area selection).
RIFS-05	FERC	11/14/2012	"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." -pdf page 12	Study objectives, methods and expected results are detailed in Tables 8.6.-2 through 8.6-9. Flow charts depicting parameters and multiple model interdependencies are included in each of the Riparian Instream Flow Study components in Figure 8.6-1, Figure 8.6-3, Figure 8.6-4, Figure 8.6-7, Figure 8.6-9, Figure 8.6-13, Figure 8.6-14, Figure 8.6-19, and Figure 8.6-20.
RIFS-06	FERC	11/14/2012	"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." -pdf page 12	Focus Areas with riparian components will be selected through a spatially constrained cluster analysis process and expert-opinion. Additional detail regarding the Focus Area selection process, criteria and rationale is detailed in the Fish and Aquatic Instream Flow Study (Section 8.5.4.2.1.2) and Riparian Instream Flow Study (Section 8.6.3.2). The RSP includes 10 proposed Focus Areas which are located in the Middle River and a process for which sites will be redistributed or added to the Lower River (Section 8.5.4.2.1.2 and Figure 8.5-11). The process for revising number and locations of Focus Areas as data becomes available is described in Section 8.6.3.2. In Q1 2013 a quantitative GIS-based cluster analysis will be conducted for the study area in support of making Focus Area selections for 2013, with input from the TWG. Field data from 2012 Riparian Vegetation Study Downstream of the Proposed Watana Dam (Section 11.6) and additional river reconnaissance efforts conducted in October 2012, will be used in support of the Focus Area selection process. The 2012 field data includes: mapping and characterization of floodplain plant community types; soils type characterization; and fluvial terrain mapping and characterization; and preliminary mapping of tree ice-

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				scars. The 2012 riparian vegetation mapping effort was conducted to both support 2013/2014 riparian vegetation mapping and characterization and to support development of the Riparian Instream Flow Study final study design, including Focus Area selection process. The Focus Area sampling protocol and methods concerning the number of transects, plot types and configurations can be found in Riparian Vegetation Study Downstream of the Propoased Watana Dam plan (Section 11.6).
RIFS-07	FERC	11/14/2012	"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." -pdf pages 12-13	Section 8.6.3.2 Focus Area Selection−Riparian Process Domain Delineation describes the rationale for the study area stratified sampling approach. Focus Area and Riparian Process Domain modeling linkages are described in detail in Section 8.6.3.2.
RIFS-08	FERC	11/14/2012	"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." -pdf page 13	Development of HSC/HSI is an element of the Fish and Aquatic Instream Flow Study not the Riparian Instream Flow Study. See AEA's response to comment IFS-108.
RIFS-09	ADNR-DMLW	11/14/2012	"There are no large lakes in the Study 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	Although the Riparian Instream Flow Study addresses physical, chemical and biologic functions of floodplain wetlands from the perspective of floodplain vegetation, wetland functional analysis is

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			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." –pdf page 9	not a goal or objective of this study. Wetland functional assessments in the Susitna River riparian area below the dam site will be performed as part of the Riparian Vegetation Study Downstream of the Proposed Watana Dam (Section 11.6) and for areas within the vicinity of the corridors and above the dam are site will be performed as part of the Wetland Mapping Study (Section 11.7). The methods are fully described in Section 11.6.4 and 11.7.4.3, respectively.
RIFS-10	ADNR-DMLW	11/14/2012	"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." –pdf page 9	See AEA's response to comment RIFS-09.The Riparian Instream Flow Study will measure and model groundwater and surface water interactions, including "groundwater recharge, " however the focus is not wetlands, but floodplain vegetation. Groundwater and surface water interactions will be modeled in floodplains affected by ice (see Section 8.6.3.4) and groundwater (see Section 8.6.3.6).
RIFS-11	TNC	11/14/2012	"Focus Area Selection 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.	See AEA's response to comment IFS-019.

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			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." –pdf pages 2-3	
RIFS-12	TNC	11/14/2012	"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." –pdf page 3	See AEA's response for comment IFS-024.
RIFS-13	TNC	11/14/2012	"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	See AEA's response for comment IFS-102.

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			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." –pdf page 3	
RIFS-14	USFWS	11/14/2012	"The U.S. Fish and Wildlife Service's (Service) 31 May 2012 study request entitled Instream Flows for Floodplain and 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."" –pdf page 67	Although AEA is not revising the study title, the scope of the study includes an evaluation of the floodplain as described in the study.
RIFS-15	USFWS	11/14/2012	Interdependency figure – "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 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." –pdf page 67	See AEA's response to comment RIFS-05.
RIFS-16	USFWS	11/14/2012	"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." –pdf page 67	See Schedule (Section 8.6.5) and Relationship with Other Studies (Section 8.6.6).
RIFS-17	USFWS	11/14/2012	"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	The current Riparian Instream Flow Study is not designed as an "impact study" as specified in Green (1979). The goal of this study is to provide a physical and vegetation process modeling approach to predicting potential impacts to downstream riparian floodplain vegetation from Project operational flow modification of natural

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			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." –pdf page 68	Susitna River flow, sediment, and ice processes regimes (see Section 8.6.1.1). The environmental analysis within AEA's FERC License Application will inform the need for ongoing monitoring.
RIFS-18	USFWS	11/14/2012	"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." –pdf page 68	AEA's Riparian Instream Flow Study goals and objectives are consistent with the USFWS Study Plan Request's goals and objectives. Susitna River flow, groundwater, sediment and ice process regimes (magnitude, duration, frequency and timing) will be measured and modeled in the Riparian Instream Flow Study (Section 8.6.1.1). Section 8.6.3.6 explains that the floodplain vegetation groundwater and surface water interaction study will measure and model (1) groundwater depth seasonally, and (2) surface water hydroregime, including water surface elevation, frequency, duration, timing throughout the Focus Areas. Sediment transport and deposition will be 2-D modeled at each Focus Area by Fluvial Geomorphology Modeling below Watana Dam Study (Section 6.6). The rate of historic sediment deposition will be sampled by direct isotopic and dendrochronologic measurement (Section 8.6.3.5). Soil development will be described in detailed soil sampling conducted in the Riparian Vegetation Study Downstream of the Proposed Watana Dam (Section 11.6). An individual study of ice effects on floodplain vegetation will be conducted comparing ice effected floodplain vegetation establishment and development with unaffected floodplains (Section 8.6.3.4).
RIFS-19	USFWS	11/14/2012	"In addition to the longitudinal dimensions of the study area	The lateral extent of the Focus Areas will be determined by

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			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." –pdf page 69	assessing the extent of surface water / groundwater interaction through multiple lines of evidence. Mapping of the geologic floodplain will be conducted first using an uncorrected LiDAR shaded relief map. Alluvial terrain will be mapped relative to adjacent hillslopes. HEC-RAS (1-D) modeling of discharge and stage will be used to delineate valley bottom floodplain flooding discharge magnitudes by the fluvial geomorphology modeling (Section 6.6). The width of the floodplain where groundwater is influenced by surface water, and Project operations, will be determined by a combination of: (1) land surface mapping, using LiDAR or surface mapping information, (2) geologic information, (3) observations of springs and groundwater recharge to slough and ponds, (4) well observations, and (5) floodplain plant community distribution. Further details are provided in Section 8.6.3.6 as well as Section 7.5 (Groundwater Study).
RIFS-20	USFWS	11/14/2012	"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." –pdf page 69	Riparian Instream Flow Study sites will be selected independently through the process described in Section 8.6.3.2 *Focus Area Selection−Riparian Process Domain Delineation.* Criteria for selection include: geomorphic type classification, riparian vegetation types, and ice process domain delineation (Section 8.6.3.2). Riparian study sites, including the riparian components of the Focus Areas, will be selected through a process of cluster and power analyses and expert-opinion as described in Section 8.6.3.2. There will be significant overlap between Riparian Instream Flow Study sites and Aquatic Instream Flow Study sites because geomorphic processes, valley planform configuration, and resulting channel types result in a limited number of "geomorphic channel types." Therefore both studies will have overlapping study site needs and can use the same sites, Focus Areas. See Fluvial Geomorphology Modeling below Watana Dam Study Section 6.6 for details concerning geomorphic classification. Riparian sites within Focus Areas are selected based upon riparian process domain characterization described in Section 8.6.3.2. Focus Areas will be selected through a spatially constrained cluster analysis process and expert-opinion. Proposed Focus Areas have been previously identified through the expert-opinion process for both Fish and Aquatic Instream Flow Study and Riparian Instream

Riparian Instream Flow Study				
				Flow Study. In Q1 2013 a quantitative GIS-based cluster analysis will be conducted of the Study Area in support of making Focus Area selections for 2013, in consultation with the TWG. See Section 8.6.3.2 for detailed methods. Field data from the 2012 Riparian Vegetation Study Downstream of the Proposed Watana Dam (Section 11.6), and additional river reconnaissance efforts, will be used in support of the Riparian study site selection within Focus Area process. Individual study Focus Areas will be presented to TWG in Q1 2013 with the results of the Riparian GIS cluster analysis. Focus Area selection process is described in detail in Fish and Aquatic Instream Flow Study Section 8.5.4.2 and Riparian Instream Flow Study Section 8.6.3.2. A 'master matrix' of studies, data needs and data products will be presented at the Q1 2013 TWG Focus Area selection meetings.
RIFS-21	USFWS	11/14/2012	"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." –pdf page 69	Riparian Instream Flow Study sites reflect the full range of riparian and floodplain plant communities along the Susitna River. See AEA's response to comment RIFS-20.
RIFS-22	USFWS	11/14/2012	"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." –pdf page 69	Focus Areas likely to experience channel bed aggradation will be determined in 2013 (Q4 2013, Q1 2014) through initial sediment transport modeling and geomorphic reach analyses conducted by theFluvial Geomorphology Modeling below Watana Dam Study (Section 6.6). Additional Focus Areas will be selected in Q1 2014, if necessary, to capture these geomorphic processes and floodplain vegetation response analysis.
RIFS-23	USFWS	11/14/2012	"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	Focus Area for the riparian study will be selected based upon riparian process domain characterization described in Section 8.6.3.2. Focus Areas will be selected through a spatially

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			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, 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." –pdf pages 69-70	constrained cluster analysis process, and expert-opinion, with input from the TWG. Constrained cluster analysis is designed to statistically group river segments, and reaches, such that classification of similar river elements, including floodplain types (full range of plant communities) is made through an objective quantitative process (see Section 8.6.3.2 for further details and references). The cluster analysis will form the basis for stratifying the river into similar process domains. The number of Focus Areas necessary to capture riparian process domain floodplain vegetation variability will be determined through a power analysis. Focus Areas, by design, will be representatively composed of the range of plant community types found throughout each riparian process domain. The number of replicate plant community samples, within all domain specific Focus Areas, necessary to capture the variability found in floodplain vegetation, and floodplain geomorphic land form types, will be assessed through a power analysis in Q1-2 2013. Further sample survey details are included in both Riparian Instream Flow Study Section 8.6.3.2 and Riparian Vegetation Study Downstream of the Propoased Watana Dam Section 11.6.
RIFS-24	USFWS	11/14/2012	"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"	It is AEA's view that a two year Seedling Establishment and Recruitment Study (Section 8.6.3.3.2) using woody seedling dendrochronology to date the year of seedling year of establishment is adequate to characterize seedling establishment hydrologic conditions. Seedling year of establishment will be used, with the historic discharge record, to model the flood regime at the sample site 1-D or 2-D hydraulic models (see Section 8.6.3.3.2 for further details). While not included within the AEA study plan, to address USFWS request, AEA will conduct a longitudinal three year second-peak seedling cohort establishment and survival analysis to inform the adaptive management components of future Project instream flow

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			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." –pdf page 70	regimes. This analysis is described in Section 8.6, Attachment 8-2. Specifically, the objective of the analysis is to identify, and measure, seedling and flow regime characteristics in a longitudinal cohort analysis as compared to the two-year Seedling Establishment and Recruitment Study (Section 8.6.3.3.2) The seedling establishment analysis will be initiated in summer 2013 and carried through for three years 2014 to 2016; final results will be presented in a technical memorandum to be prepared Q4 2016. The technical memorandum is not necessary for the environmental analysis supporting AEA's License Application because the anticipated results are not necessary to assess overall Project effects. Instead, AEA anticipates relying upon the technical memorandum for adaptive management of future Project operations.
RIFS-25	USFWS	11/14/2012	"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	MODFLOW will be used to model groundwater regime throughout the Focus Areas to quantitatively describe groundwater and plant community type relationships. Groundwater well points will be installed, with recording pressure transducers, in all plant community types, including seedling establishment areas, within each Focus Area. Plant community data will be collected at each well point (see Riparian Botanical Study 11.6). Meteorological stations will collect precipitation and temperature data. The seedling plot data, and plant community type sample data, will be used to develop both select individual plant species and plant community type response curves. Therefore the sensitivity necessary to capture seedling establishment groundwater relationship will be measured at individual well points with pressure transducers collecting data in 15 minute increments (see Groundwater Study 7.5 for detailed methods). MODFLOW modeling is designed is to quantify the range of floodplain terrain surfaces and plant community types groundwater relationship that would not be possible with well points alone. Therefore, the

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			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." - pdf page 71.	combined well point and MODFLOW design will capture both seedling plot and floodplain plant community groundwater spatial variability.
RIFS-26	USFWS	11/14/2012	"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." –pdf page 71	Plant abundance is defined by a number of measures including Point intercept transects, ocular estimates of cover, tree basal area as defined in Riparian Vegetation Study Downstream of the Proposed Watana Dam Section 11.6. Elevation reference throughout the Riparian Instream Flow Study is NAVD88. Vertical datum. Plant sampling methods, including plot size and shape, are detailed in the Riparian Vegetation Study Downstream of the Proposed Watana Dam Section 11.6.4.2. Two meter square plots are no longer in the sampling design; one-meter square plots will be used for seedling sampling (Mueller-Dombois, D. and H. Ellenberg. 1974. *Aims and Methods of Vegetation Ecology*. Wiley, New York.; Elzinga, C.L., D.W. Salzer, and J.W. Willoughby. 1998. *Measuring and Monitoring Plant Populations.* UDI, Bureau of Land Management). See Section 8.6.3.3.2 for sample plot dimensions.
RIFS-27	USFWS	11/14/2012	"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,	The method in modeling the ice processes-floodplain vegetation interaction presented by AEA at the October 24, 2012 TWG meeting is explained in detail in the Riparian Instream Flow Study Section 8.6.3.4.2

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			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 i 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." –pdf page 72	
RIFS-28	USFWS	11/14/2012	"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." –pdf page 72	Analysis of floodplain soil and plant community development is presented in Section 8.6.3.5. The stated goal of the study is to characterize the role of erosion and sediment deposition in: evolution of floodplain plan form, soil development and trajectory of plant community succession. This study will investigate the geomorphic evolution of Susitna River study area floodplain stratigraphy, and soils, and associated plant community succession. Complete study approach and methods are presented in Section 8.6.3.5.
RIFS-29	USFWS	11/14/2012	"The Service also asked how the results from this objective will be used to predict potential Project-related changes in	Natural seed dispersal hydro and sediment regime relationships will be measured in the field (individual studies). Project operational

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			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 Study 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." -pdf page 71.	changes to the natural hydrograph 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 study area to model potential Project-related changes in the recruitment "safe site" conditions (Harper, J. 1977. Population Biology of Plants), as described in Section 8.6.3.5 and Section 8.6.3.7. Seedling establishment and recruitment study detailed approach and methods are presented in Section 8.6.3.3.2.
RIFS-30	NMFS	11/14/2012	"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 (Le. 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." –pdf page 79	In the Riparian Instream Flow Study the term Focus Area supplants: study site and intensive study site. Study area is defined as the extent of the Susitna River anticipated to be affected by Project operations. The term riparian habitat has been revised to read "floodplain habitat" in the Riparian Instream Flow Study.
RIFS-31	NMFS	11/14/2012	"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	Baseline conditions are the current conditions of the Susitna River and floodplains under the natural flow, sediment and ice processes regimes. Baseline condition documentation and analysis is a goal of the Riparian Instream Flow Study. The 1980s study data is an invaluable description of riparian conditions in 1980s and is therefore one of the multiple sources of data used in the Riparian

Riparian Instream Flow Study				
			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?" –pdf page 79	Instream Flow Study. The study builds upon and updates these studies. See Section 8.6.1.1.
RIFS-32	NMFS	11/14/2012	"The July 2012 ABA 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." –pdf page 80	See AEA's response to comment RIFS-31 for discussion of approach to characterizing current conditions. For the remainder of AEA's response to this comment, see RIFS 24
RIFS-33	NMFS	11/14/2012	"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	The review will include studies of surface and groundwater interactions. See Section 8.6.3.1 for full details.

Riparian Instream Flow Study				
			reflect the current understanding of riparian function relative to instream flow and will provide better insight into the potential project effects." –pdf page 80	
RIFS-34	NMFS	11/14/2012	"The detailed timeline for completion of the different studies that ABA 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." –pdf pages 80-81	See AEA's response to comment RIFS-05.
RIFS-35	NMFS	11/14/2012	"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." –pdf page 81	See AEA's response to comment RIFS-05.

Fish and Aquatic Resources				
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FISH-01	TU	11/14/2012	"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." – pdf page 5	The Fish and Aquatic Resources studies will begin with a review of biological data available from the 5 years of study in the 1980s and additional studies conducted in various locations throughout the River between 2000 and 2011. AEA also initiate fish studies in 2012 that will be expanded upon in 2013, and 2014. All of these data, a total eight years of study on Fish and aquatic populations in the Susitna River will support AEA's License Application. The 13 proposed studies describe in Section 9 of the study plan have been designed to provide meaningful data to describe the fish populations and the aquatic habitats that they rely upon and include estimates of fish density, distribution and apportionment of spawning salmon, among a myriad of other relevant study objectives. AEA licensing study program has been designed to provide a comprehensive and rigorous data set over three sampling season that can be combined with existing data to describe baseline conditions and provide the basis for assessments of potential project impacts and development of appropriate Protection, Enhancement, and Mitigation plans. Additional years of data collection are not needed to improve the quality of the data necessary to support a FERC License Application.
FISH-02	CSDA	11/14/2012	"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 AquaticResources." –pdf page 3 second bullet	See AEA's response to comment – FISH-01. Anadromous salmon populations are variable and are subject to long term cycles in abundance that are driven by circulation patterns acting on a global scale and subsequently affect ocean conditions. AEA concurs that Chinook salmon populations statewide presently appear to be in a low abundance phase of the cycle. AEA is also aware that this low abundance phase is expected to continue for the next several years, so adding more years of Chinook salmon data after 2014 is not likely to address a different phase of the cycle and would not likely improve the quality of the data collected regarding Chinook salmon populations. Understanding the interannual variability in fish abundance has been an important influential factor in AEA's approach to characterizing the Fish and Aquatic Resources and assessing potential project impacts. For example, AEA has proposed a habitat-based characterization of the Fish and Aquatic Resource and will be collecting information on relative fish abundance, distribution and apportionment of fish by

Fish and Aquatic Resources				
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				representative habitats not on counts or estimates of fish populations. The fish data collected by habitat type will help us understand the fish-habitat relationships that are currently occuring. The models that AEA will use to predict potential Project impacts are also habitat based and will make predictions of changes to aquatic habitat not absolute fish numbers to demonstrate an effect. These models have the advantage of incorporating both site specific data on fish habitat as well as data from numerous studies in other systems where fish habitat has been characterized. Thus, if the current data set for Chinook salmon habitat appears more restrictive, perhaps as a function of fewer fish occupying only the best habitats, the model can be adjusted to broaden the range of habitat suitability criteria applied to the model. The AEA program has been designed to collect detailed and appropriate data that will be effective in addressing potential impacts associated with the proposed Wantana Dam, will help to develop protection, mitigation and enhancement measures, as appropriate.
FISH-03	Long, Becky	11/13/2012	Two years are inadequate, request for 5 to 7 year study – top of pdf page 2	See AEA's response to comment FISH–01.
FISH-04	TCCI	11/07/2012	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:..	See AEA's response to comment FISH–01.
FISH-05	CCC	11/15/2012	"How will fish studies be conducted in the winter without impacting the behavior of the fish?" -pdf page 2 – Bullet five	Active fish sampling methods are used to capture fish and, as such, are intended to alter fish behavior. In addition, several passive methods for monitoring fish movements and diel behavior are proposed in Fish Distribution and Abundance in the Middle and Lower Susitna River Study plan and described in Section 9.6.4.5. These

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				include use of a multibeam sonar technology (DIDSON), underwater video, and by tagging fish with PIT and radio tags and remotely tracking them over time.
FISH-06	FERC	11/14/2012	"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." –pdf page 14-15	In response to the FWS and NMFS study requests, an evaluation of biological flow cues has been included in the Fish and Aquatics Instream Flow Study (see Section 8.5.4.5.1.3). Long-term adult salmon escapement data will be examined to identify relationships between temporal patterns in environmental conditions and salmon distribution, abundance and migration. Analyses of possible relationships between climatic, hydrologic, and fish habitat indices and salmon abundance and migration timing will be based on available long-term data sets for Deshka River Chinook salmon and Yentna River sockeye salmon, though other long-term data sets pertaining to salmon migration timing and abundance will be included if available.
FISH-07	NMFS	11/14/2012	"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." -pdf page 85	For the reasons described in AEA's response to comment FISH–01, the FERC ILP two-year study process is adequate to meet the goals and objectives of the study program.
FISH-08	NMFS	11/14/2012	"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	AEA concurs, as was evidenced by the planning process that has occurred in 2012. Initial study objectives were developed with input from the TWG in March of 2012. Since that time AEA has conducted numerous TWG meetings and subgroup meetings to identify new objectives, and modify and refine existing study objectives. Preliminary study objectives were prepared by AEA in draft study

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			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." -pdf page 87	requests, the objectives were then modified and refined based on agency comments received first for the PSP and then subsequently for the Interim-RSP prepared and distributed by AEA in October 2012. AEA believes that this iterative 9-month process has resulted in specific and clear objectives that will adequately describe baseline conditions and support environmental analysis that will accompany the AEA FERC License Application.
FISH-09	NMFS	11/14/2012	"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." –pdf page 87	AEA agrees. AEA's science team has been reviewing and summarizing the existing literature on the Susitna River throughout 2012. Our understanding of the extensive historic data has grown through 2012 and is reflected in the changes and additional detail added to the RSP. Continued synthesis of the existing information is an important component of several Fish and Aquatic study plans, including Sections 9.5, 9.6, 9.8, and 9.11.
FISH-10	NMFS	11/14/2012	"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." –pdf page 87	Study method details are described throughout the RSP. It is the very nature of sampling in a dynamic natural environment that some details, size of nets to be used and specific sampling locations, need to be determined at the time of field data collection as they are dependent upon flow and access and other physical conditions of that location at the time of sampling. In order to ensure consistency and reliability among samples we will be developing Fish Distribution and Abundance and River Productivity Implementation Plans. The implementation plans, described within specific study plans, will include the level of detail sufficient to instruct field crews in data collection efforts. In addition, each plan will include protocols and a guide to the decision making process in the form of a chart or decision tree that will be used in the field, specific of sampling locations, details about the choice and use of sampling techniques and apparatuses, and a list of field equipment needed.
FISH-11	NMFS	11/14/2012	"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	AEA has proposed a habitat-based approach to the characterization of the Fish and Aquatic Resources that incorporates both systematic sampling across reaches and habitat types with random selection within habitats. Sampling timing varies from bi-weekly for emergent

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			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)." –pdf page 87	fish to seasonally for algae and macroinvertebrates and was based on anticipated changes in habitat use that are related to life history dependent and seasonal behavior exhibited by aquatic organisms.
FISH-12	NMFS	11/14/2012	"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." –pdf page 87-88	There are more than 13 distinct study designs included in the Fish and Aquatic Resources studies and although there is much variability of experimental design from study to study, there are consistencies in sampling approaches that address representativeness, accuracy and precision. Overall, AEA has taken a habitat-based study design that stratifies sampling by geomorphic reach and physical aquatic habitats that occur within those reaches. The basis for the delineation of the reaches and habitat types within the sampling strata are consistent across all resources and include remote reach delineation in the Geomorphology Study (Section 6.5), and habitat delineation in Characterization and Mapping of Aquatic Habitats, Section 9.9. Replicate sampling within these predefined reaches and habitats will allow for synthesis of data at the same representative spatial scale across studies and resource areas. Temporal representativeness is more study specific as it pertains specifically to the time step required to address specific objectives and this will vary from diel sampling to evaluate day and night movement patterns to seasonal sampling to evaluate changes in patterns of river productivity. In all studies replicates are being collected within the study-specific time step. During the September 13th Fish Distribution and Abundance Subgroup meeting and at the October 25th TWG meeting, the USFWS noted that collection of population estimate data was not necessary to characterize baseline conditions, nor to evaluate potential Project impacts and recommended eliminating this scale of data collection from the studies. On both occasions some discussion ensued but no one present dissented with this opinion. As a result, the studies were revised to eliminate data collection designed to estimate fish populations. It was stated that relative abundance and presence/absence data was adequate to describe fish populations and habitat use and infer potential impacts to fish. Thus, AEA does not propose to evaluate accuracy of fish counts but will use relative

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				abundance estimates to compare across strata as appropriate based on sampling method used. AEA has agreed to evaluate precision of fish collection methods and will address how sampling events will be randomized to determine sampling precision by habitat type and method in the Fish Distribution Implementation Plan.
FISH-13	NMFS	11/14/2012	"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 electro fishing 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." –pdf page 88	Although AEA agrees that understanding the efficiency of sampling methods is important when generating populations estimates based on fish counts, AEA disagrees that determine a level of sampling efficiency is necessary for determination of relative abundance. As stated in comment response FISH – 13, population level estimates are not included in the RSP at the request of USFWS. AEA proposed fish sampling focuses on fish distribution (presence/absence) and relative abundance. As described in RSPs 9.5 and 9.6.4.3.1 all methods will be conducted consistent with generating estimates of CPUE that are meaningful and facilitate comparison of counts or densities of fish over space and time. This includes calibration and quality control of methods and documentation of conditions that affect sampling efficiency—such as visibility, water temperature, and conductivity—to ensure that a consistent level of effort is applied over the sampling unit. In addition, in the event that these data will be used for statistical comparison during future effects analysis. Section 9.6.4 indicates that AEA will determine how to incorporate additional samples to evaluate precision of count data within habitats and by method and will include this design detail in the Fish Distribution and Abundance Implementation Plan that will be filed with FERC on March 15, 2013.
FISH-14	NMFS	11/14/2012	"The study plan should identify any data that will be used from other sources and identify that external data quality. Many ABA 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	Data interdependencies between and among studies are identified in each study plan. For example, Sections 9.5.7 and 9.6.7 describe the exchange and flow of data. Regarding data quality, in 2012 AEA established data standards and QAQC procedures that have been and will continue to be implemented across all water-related resources and include standards for location data. The intent of establishing these data standards was to ensure that all data are collected in appropriate fashion for exchange across various study plans an resources.

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			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." –pdf page 88	
FISH-15	NMFS	11/14/2012	"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." –pdf page 88	As described in the Fish and Aquatic Resources study plans, data will be collected to characterize existing conditions as well as to inform future effects analysis. AEA agrees that it is important to design studies to facilitate analysis and to a large extent has done that by incorporating specific objectives such as, the early life history of juvenile salmon and winter spawning species, and through development of predictive models such as fish bioenergetics model, the water surface elevation model for Cook Inlet beluga whales, and the instream flow model. In other cases it is premature to understand exactly what comparisons or analysis will best to facilitate an understanding of potential Project impacts. In these cases, more specific information about the type, magnitude, timing, and location of potential impacts is needed prior to determining what are the correct analyses or even appropriate data comparisons. To facilitate these future data analyses, AEA has proposed broad and intensive sampling of fish and aquatic habitats that will occur on a monthly time step from June 2013 through October 2014. These data are being collected in a manner to facilitate statistically valid comparisons (e.g. standard protocols, derivation of CPUE) to address potential Project impacts during final analysis of the Project.

Study of Fish Distribution and Abundance in the Upper Susitna River				
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FDAUP-01	FERC	11/14/2012	"In sections 9.5.4.1 (Upper River) and 9.6.4.1 (Middle and Lower River), [AEA describes] methods for selecting study sites for [the] 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)." –pdf page 13	Level two stratification (geomorphic reaches) is discussed in Section 9.5.4.1 but is not included in Figure 9.5-2. because not all habitat types will be found within each geomorphic reach and inclusion would make the figure confusing. Site section for fish sampling in the Upper River will necessarily vary with habitat and will not be stratified equally among geomorphic reaches. Stratification of site will occur as much across geomorphic reaches but is limited due to habitat availability, access and safety. Site selection methods describe a nested hierarchical approach; mesohabitat units will be selected using a random approach. See Section 9.5.4.1.
FDAUP-02	FERC	11/14/2012	"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 [AEA's] RSP, please describe how these habitat units will be selected within the ten focus areas." –pdf page 14	AEA has not proposed any IFS Focus Areas in the Upper River Segment since the effects of flow regulation from Project operations will not occur above the dam. Please see AEA's responses to comments FDAML-04 and IFS-004 regarding extending studies into the Lower River Segment.
FDAUP-03	FERC	11/14/2012	"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	Selection of main channel habitats is described in the same level of detail as in the Middle and Lower River (Sections 9.5.4.2 and 9.6.4.2). However, the manner in which tributary habitats will be sampled varies greatly between the two study plans. Because of access issues (steep canyon walls and swift, non-wadeable streams), less habitat mapping detail is available from the Upper River tributaries. These tributaries will be selected based on accessibility, among other criteria. For

Study of Fish Distribution and Abundance in the Upper Susitna River				
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			Fish Distribution and Abundance in the Upper Susitna River (9.5) that includes the sampling frequency for each method." –pdf page 14	this reason, AEA proposes to sample 25% of the mapped habitats which will encompass replicates of all habitat types. See Section 9.5.4.2 and Section 9.9.
FDAUP-04	FERC	11/14/2012	"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." –pdf page 14	Additional information on PIT-tagging can be found in Section 9.5.4.4.12. The PIT tag work is predominantly focused on juvenile Chinook salmon. All juvenile Chinook salmon of taggable size will be tagged. Up to 1000 fish per species per array will be tagged based on proximity to PIT arrays. Target species include Arctic grayling, burbot, humpback white fish, round white fish, Dolly Varden, and northern pike if present. Protocols for pit tagging will be described in further detail in the Fish Distribution and Abundance Implementation Plan. As specified in Section Section 9.5.4, AEA will file the study implementation plan with FERC by March 15, 2013.
FDAUP-05	ADNR - ADF&G		"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." –pdf page 22	Because of winter access issues and accompanying safety concerns, no winter sampling is planned for the Upper River. Details on the winter approach in the Middle and Lower River have been included in Section 9.6.4.5.
FDAUP-06	ADNR - ADF&G	11/14/2012	"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" –pdf page 22	Because of this general inaccessibility, very rugged terrain, and mostly non-wadeable stream channels, near census mapping (100 percent coverage) is challenging and in some cases unsafe or impossible. For these reasons, only tributaries mapped by the Characterization and Mapping of Aquatic Habitats (See Section 9.9; Table 9.9-2) will be eligible for fish distribution and abundance sampling. Up to 18 tributary streams will be targeted for sampling during 2013 and 2014. Of the 18 tributaries selected for sampling, all tributaries in which Chinook salmon juveniles or adults were observed within or at the mouth of a tributary during 2012, or during previous surveys by Buckwalter (2011) will be sampled. AEA agrees to the request made by ADF&G and of the remaining tributaries that are suitable for sampling listed in Section 9.9, Table 9.9-2, efforts will be focused on streams that are not already identified as supporting anadromous fishes in the ADF&G AWC (see

Study of Fish Distribution and Abundance in the Upper Susitna River				
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				updated Section (9.5.4.1).
FDAUP-07	ADNR - ADF&G	11/14/2012	"Baseline metals and mercury assessment are not the same. What is being sampled and to what standards? What metals are being studied?" –pdf page 22	Object 5 has been amended to differentiate between metals and mercury (Section 9.5.4.3.5). As described in Baseline Water Quality Study (Sections 5.5.4.5, 5.5.4.6, and 5.5.4.7), sediment, fish tissue and water will be sampled for metals. EPA methods will be used for analysis. Table 5.5.-3 contains a list of all the metals that are being sampled. As described in Mercury Assessment and Potential for Bioaccumulation Study Section 5.7.4.2, vegetation, soil, water, sediment, sediment pore water, piscivorous birds and mammals, and fish tissue (see Section 5.7.4.2.6) samples will be evaluated for mercury. Modeling will be used to estimate methylmercury concentrations in fish (5.7.4.3). Target fish species for baseline metals testing include: Dolly Varden, Arctic grayling, whitefish species, long nose sucker, lake trout, burbot, and resident rainbow trout. Target fish species for mercury sampling include: Dolly Varden, arctic grayling, stickleback, long nose sucker, whitefish species, lake trout, burbot, and resident rainbow trout.
FDAUP-08	ADNR - ADF&G	11/14/2012	"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." –pdf page 23	Radio tags will be implanted in up to 30 fish of selected species (Arctic grayling, burbot, humpback white fish, round white fish, Dolly Varden, and northern pike if present). These tags will be tracked via aircraft and/or boat on a monthly basis to describe seasonal movements with emphasis on identifying spawning and overwintering habitats within the hydrologic zone of influence upstream of the project. See Section 9.5.4.4.12. Chinook salmon spawning locations will be documented in a similar manner in the Salmon Escapement Study. See Section 9.7.4.2.
FDAUP-09	ADNR - ADF&G	11/14/2012	"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."–pdf page 23	AEA has added Arctic grayling to objective 2, which identifies all of the target species (Section 9.5.1).

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FDAUP-10	ADNR - ADF&G	11/14/2012	Documentation of all fish collected during sampling shall include species and length." –pdf page 23	Consistent with this comment, Section 9.5.4.4.11 indicates that all fish captured will be identified to species and up to 30 fish per species per day will be measured for length as per ADF&G protocol.
FDAUP-11	ADNR - ADF&G	11/14/2012	"Species listing in this section does not match species list on Table 7.5.9. Update table with current information." –pdf page 23	The species list in Sections 9.5.1, 9.5.2, and 9.5.4 match the list in Table 9.5-1. These lists have been updated by cross-referencing information from 2012 studies.
FDAUP-12	ADNR - ADF&G	11/14/2012	"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." –pdf page 23	Agreed. However, there is currently no documentation that Dolly Varden, humpback whitefish and long nose suckers above Devils Canyon are anadromous.
FDAUP-13	ADNR - ADF&G	11/14/2012	"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." –pdf page 23	Agreed. AEA has revised Section 9.5.4.3 to include language that reflects sampling during twilight hours.
FDAUP-14	ADNR - ADF&G	11/14/2012	"7.5.4.1 Passive and Active Sampling (Page 7-13) "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." –pdf page 23	Agreed. AEA has revised the language as follows "The decisions about what methods to apply will be made… in accordance with state and federal fish sampling permit requirements." And "All fish sampling and handling techniques described within this study will be conducted under state and federal biological collection permits. Limitations on the use of some methods during particular time periods or locations may affect the ability to make statistical comparisons among spatial and temporal strata." See Section 9.5.4.3 and 9.5.4.4.
FDAUP-15	ADNR - ADF&G	11/14/2012	"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	Net specifications will be described in further detail in the Fish Distribution and Abundance Implementation Plan. As specified in Section 9.5.4, AEA will file the study implementation plan with FERC by March 15, 2013.

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			nets be deployed? What is the targeted time duration for each set." – pdf page 23	
FDAUP-16	ADNR - ADF&G	11/14/2012	Electrofishing (Page 7-13) – "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." –pdf page 24	Protocols for electrofishing will be described in further detail in the Fish Distribution and Abundance Implementation Plan. As specified in Section 9.5.4, AEA will file the study implementation plan with FERC by March 15, 2013.
FDAUP-17	ADNR - ADF&G	11/14/2012	Electrofishing (Page 7-13) - "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." –pdf page 24	AEA will endeavor to sample on a biweekly basis during critical transition periods (i.e., migration from natal to rearing habitats) in May and June. Owing to the size of the area, it will be challenging to survey each site in July-October more than on a monthly basis. See Section 9.5.4.2.
FDAUP-18	ADNR - ADF&G	11/14/2012	Electrofishing (Page 7-13)- " 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." –pdf page 24	Agreed. AEA will cease electrofishing activities if large fish are encountered (Section 9.5.4.4.2). Protocols for electrofishing will be described in detail in the Fish Distribution and Abundance Implementation Plan. As specified in Section 9.5.4, these protocols will be consistent with NMFS (2000). AEA will file the study implementation plan with FERC by March 15, 2013.
FDAUP-19	ADNR - ADF&G	11/14/2012	Electrofishing (Page 7-13) "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." – pdf page 24	Agreed. AEA has revised Section 9.5.4.4.2 to address this comment.
FDAUP-20	ADNR - ADF&G	11/14/2012	Electrofishing (Page 7-13) "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." –page 24	Agreed. AEA has revised Section 9.5.4.4.2 to address this comment.
FDAUP-21	ADNR - ADF&G	11/14/2012	Electrofishing (Page 7-13) "Field protocols and site selection/justification is needed. Length of transects, type of	Protocols for electrofishing will be described in detail in the Fish Distribution and Abundance Implementation Plan. As specified

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			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." –pdf page 24	in Section 9.5.4, these protocols will be consistent with NMFS 2000. AEA will file the study implementation plan with FERC by March 15, 2013.
FDAUP-22	ADNR - ADF&G	11/14/2012	Trot Lines (Page 7-14) "Trot line sampling is terminal, recommend use of alternative, non-lethal methods of burbot sampling whenever possible." –pdf page 24	Agreed. Hoop traps will be the preferred non-lethal method for capturing burbot; trot lines will be used secondarily to provide additional data. See Section 9.5.4.4.8.
FDAUP-23	ADNR - ADF&G	11/14/2012	Trot Lines (Page 7-14) "More information needed on site selection and rationale." –pdf page 24	AEA has revised Section 9.5.4.1 to add additional information on the site selection criteria. After review of the preliminary results from the habitat characterization and mapping efforts (9.9) selected sites will be described in detail in the Fish Distribution and Abundance Implementation Plan. As specified in RSP Section 9.5.4, AEA will file the study implementation plan with FERC by March 15, 2013.
FDAUP-24	ADNR - ADF&G	11/14/2012	Trot Lines (Page 7-14) "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." –pdf page 24	No winter sampling is planned for the Upper River owing to access and safety considerations. However, evaluation of the effectiveness of both trot lines and under ice video is proposed in the Middle and Lower River 2012-13 winter sampling approach. See section 9.6.4.3.4.
FDAUP-25	ADNR - ADF&G	11/14/2012	Trot Lines (Page 7-14) "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." –pdf page 25	AEA appreciates the suggested reference material. AEA will review this material prior to 2012-13 winter sampling in the Middle/Lower River and while developing the implementation plan (Section 9.5.4).
FDAUP-26	ADNR - ADF&G	11/14/2012	Minnow Traps (Page 7-14) "Salmon eggs are required to be sterilized or disinfected in iodine solution under conditions of ADF&G sampling permits." –pdf page 25	The following language has been added: "As per ADF&G Fish resource Permit stipulations, all salmon eggs used as bait will be commercially sterilized or disinfected with a ten minute soak in a 1/100 Betadyne solution prior to use." See Sections 9.5.4.4.4 and 9.5.4.4.5
FDAUP-27	ADNR - ADF&G	11/14/2012	Minnow Traps (Page 7-14) "When and where will minnow traps be deployed and how will areas for deployment be selected?" –pdf page 25	Minnow traps will be selected as an alternative gear type for sampling reaches where other methods would be ineffective (Section 9.5.4.4.6). This determination will be made on-site based on site characteristics. Detailed protocols for gear type section and deployment including minnow traps will be developed in the Fish Distribution and Abundance Implementation Plan. As specified in Section 9.5.4, AEA will file

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				the study implementation plan with FERC by March 15, 2013.
FDAUP-28	ADNR - ADF&G	11/14/2012	Minnow Traps (Page 7-14) "Winter deployment of minnow traps should be considered." –pdf page 25	Because of winter access issues and accompanying safety concerns, no winter sampling is planned for the Upper River. Details on the winter approach in the Middle and Lower River including the use of minnow traps can be found in Section 9.6.4.5.
FDAUP-29	ADNR - ADF&G	11/14/2012	Snorkeling (Page 7-14) "Will two or one biologist snorkel during each snorkeling survey event?" –pdf page 25	AEA has added additional detail to Section 9.5.4.4.6 in response to this comment. In stream channels with a width of less than 4 meters (1.2 feet), the survey will be conducted by a single snorkeler viewing and counting fish on both side of the channel, alternating from left to right counts. In stream channels with a width greater than 4 meters (1.2 feet), the surveys will be conducted by two snorkelers.
FDAUP-30	ADNR - ADF&G	11/14/2012	Snorkeling (Page 7-14) "What is the sampling schedule? When? Seasons? Site selection criteria/rational needed." –pdf page 25	AEA has added additional detail to Section 9.5.4.4.6 in response to this comment. In the Upper River, sampling will occur on a monthly basis from ice-out to freeze-up. Sampling will be more frequent (biweekly) early in the season (May-June) to encompass critical transitions from spawning to rearing areas. The decisions about what methods to apply will be made by field crews after initial site selection in coordination with Fish Distribution and Abundance Study Lead and the Fish Program Lead. Snorkeling will be the preferred method when adult fish are present, and where water is not swift, deep or turbid.
FDAUP-31	ADNR - ADF&G	11/14/2012	Snorkeling (Page 7-14) "Will block nets be used?" –pdf page 25	Block nets will be used for estimates of relative abundance; they will not be used for fish presence/absence surveys. See Section 9.5.4.4.6.
FDAUP-32	ADNR - ADF&G	11/14/2012	Fyke/Hoop Nets (Page 7-15) "What is the mesh size, hoop size, number of hoops, length of nets, etc.?" –pdf page 25	AEA has included specifications for fyke nets and hoop traps in Sections 9.5.4.4.7 and 9.5.4.4.8. Fyke nets and hoop traps have 1/8-inch mesh size diameter, hoop size is 1 foot in diameter, and up to 4 hoops. Length is anticipated to be up to12 feet; net specifications will be described in further detail in the Fish Distribution and Abundance Implementation Plan. As specified in Section 9.5.4, AEA will file the study implementation plan with FERC by March 15, 2013.

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				Hoop traps of two lengths may be used, 3.05 and 3.66 m (10 and 12 ft). The small hoop trap has seven, 6.35-mm (0.25 in) steel hoops with diameters tapered from 0.61 m (2 ft) at the entrance to 0.46 m (1.5 ft) at the cod end. The large trap has inside diameters tapering from 91 to 69 cm (36 to 27 in) with throat diameters of 36 cm (14 in). Each trap has a double throat that narrows to an opening 10 cm (4 in) in diameter. All netting is knotted nylon woven into 25-mm (1-in) bar mesh.
FDAUP-33	ADNR - ADF&G	11/14/2012	Fyke/Hoop Nets (Page 7-15) "Is this continued sampling or a single event? What time of year? How many sampling events? List protocols." –pdf page 25	Fyke nets will be used to capture small fish in sloughs and side channels with moderate velocity throughout the ice free season. Fyke nets will be deployed for a maximum of 2 days. Hoop traps will be deployed in main channel habitats of low to moderate velocity late August through early October to catch burbot for tagging studies. Hoop traps will be deployed overnight, but less than 24 hours. See Section 9.5.4.4.7 and 9.5.4.4.8. Sampling methods will be described in further detail in the Fish Distribution and Abundance Implementation Plan. As specified in Section 9.5.4, AEA will file the study implementation plan with FERC by March 15, 2013.
FDAUP-34	ADNR - ADF&G	11/14/2012	Beach Seine (Page 7-15) "Identification of beach seines should not limit the equipment choices as to length and depth. What is the mesh size?" –pdf page 25	Agreed. Seines will be 15 and 25 feet wide by 5 feet depth with ¼ inch mesh. See Section 9.5.4.4.9.
FDAUP-35	ADNR - ADF&G	11/14/2012	Beach Seine (Page 7-15) "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." –pdf page 25	Agreed. AEA has revised the RSP to reflect this comment. See Section 9.5.4.4.9
FDAUP-36	ADNR - ADF&G	11/14/2012	Beach Seine (Page 7-15) "Will different substrate types be sampled? Identify geomorphic areas to be sampled." –pdf page 25	Yes. Beach seines will be used in shallow water areas that are free of debris and snags predominantly in side channels and sloughs. See Section 9.5.4.4.9.
FDAUP-37	ADNR - ADF&G	11/14/2012	Beach Seine (Page 7-15) "Will sampling include all time periods including daylight, twilight and periods of darkness?" –pdf page 25	Yes. See Section 9.5.4.3.1.
FDAUP-38	ADNR - ADF&G	11/14/2012	Beach Seine (Page 7-15) "Identify protocols." –pdf page 25	AEA has revised Section 9.5.4.3.1 to add protocols; net sizes and soak times will be standardized.
FDAUP-39	ADNR -	11/14/2012	Outmigrant Trap (Page 7-15) "Identify if traps will be manned during	Traps will be checked twice daily while operational. See

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	ADF&G		deployment." – pdf page 25	Section 9.5.4.4.10.
FDAUP-40	ADNR - ADF&G	11/14/2012	DIDSON and Video Cameras (Page 7-15) "Recommend that these cameras be used to identify burbot spawning in these areas." –pdf page 26	As described in AEA's response to comment FDAUP-24, no winter sampling is planned for the Upper River owing to safety and access concerns. Burbot are winter spawners. Use of under ice video to identify burbot spawning has been added to Section 9.6.4.3.4 of the Fish Distribution and Abundance in the Middle and Lower Susitna River.
FDAUP-41	ADNR - ADF&G	11/14/2012	DIDSON and Video Cameras (Page 7-15) "Identify camera locations." –pdf page 26	DIDSON and video cameras will be deployed in selected sloughs and side channels (Section 9.5.4.4.13.). A detailed description of site selection and sampling methods will be in the Fish Distribution and Abundance Implementation Plan. As specified in Section 9.5.4, AEA will file the study implementation plan with FERC by March 15, 2013.
FDAUP-42	ADNR - ADF&G	11/14/2012	DIDSON and Video Cameras (Page 7-15) "Location of all video and DIDSON surveys should be located by GPS and identified on aerial photos and project maps." –pdf page 26	Agreed. AEA has revised Section 9.5.4.4.13 to address this comment.
FDAUP-43	ADNR - ADF&G	11/14/2012	Fish Handling (Page 7-16) "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 FLOYTM tags be used for recapture studies?" –pdf page 26	Sampling protocols for PIT-tagging will be described in further detail in the Fish Distribution and Abundance Implementation Plan. As specified in Section 9.5.4, AEA will file the study implementation plan with FERC by March 15, 2013.
FDAUP-44	ADNR - ADF&G	11/14/2012	Fish Handling (Page 7-16) "Goals for assessment of baseline metal studies and mercury studies may be vastly different and require different age classes." –pdf page 26	As described in Section 5.5.1, the fish-specific objective of the metals study is to: Measure baseline metals concentrations in sediment and fish tissue for comparison to state criteria. As described in Sections 5.7.1 the fish specific objectives of the mercury study are to: (1) Characterize the baseline mercury concentrations of the Susitna River and tributaries. This will include collection and analyses of vegetation, soil, water, sediment pore water, sediment, piscivorous birds and mammals, and fish tissue samples for mercury. (2) Use modeling to estimate methylmercury concentrations in fish. Assess potential pathways for methylmercury to migrate to the surrounding environment. There is a well-known positive correlation between fish size (length and weight) and metal concentrations in muscle tissue. Larger, older fish tend to have

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				higher concentrations and will be the targeted for sampling (see Sections 5.5.4.7 and 5.7.4.2.6).
FDAUP-45	ADNR - ADF&G	11/14/2012	Fish Handling (Page 7-16) "Due to subsistence uses of whole fish, whole fish samples should be processed." –pdf page 26	Unlike some contaminants, methylmercury concentrates in the muscle tissue of fish (RSP Section 5.5.4.7). Because of this whole fish samples can underestimate the amount of methylmercury present, and can be less protective to human health (Section 5.7.2). For this reason AEA proposes to collect and analyze samples of muscle tissue for most fish, and muscle and liver tissue for burbots. This is consistent with ADEC methylmercury sampling program (ADEC 2012), as well as USGS and EPA protocols (Frenzel; 2000; USEPA 2000; USEPA 1997a), and should be protective of all consumers.
FDAUP-46	ADNR - ADF&G	11/14/2012	Fish Handling (Page 7-16) "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." –pdf page 26	Agreed. Tissue or whole adult fish samples will also be collected in the mainstem Susitna River for assessment of metals (see Section 5.5.4.7, Baseline Metal Levels in Fish Tissue) and mercury (see Section 5.7.4.2.6, Mercury Assessment and Potential for Bioaccumulation Study) concentrations. Target adult fish species for baseline metals testing include: Dolly Varden, Arctic grayling, whitefish species, long nose sucker, lake trout, burbot, and resident rainbow trout. Target adult fish species for mercury sampling include: Dolly Varden, arctic grayling, stickleback, long nose sucker, whitefish species, lake trout, burbot, and resident rainbow trout.
FDAUP-47	ADNR - ADF&G	11/14/2012	7.5.4.2. Remote Fish Telemetry (Pages 7-16 to 7-18) "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." –pdf page 26	Agreed. The use of PIT tag arrays is limited to smaller waterbodies and habitat features. Arrays in the Upper River will be primarily focused on areas identified as important juvenile Chinook salmon habitats. See Section 9.5.4.4.12. Limitations of various sampling techniques is the rationale behind the suite of techniques that are proposed to understand fish distribution and abundance (9.5.4.4). Sampling protocols for PIT-tagging and other remote telemetry methods will be described in further detail in the Fish Distribution and Abundance Implementation Plan. As specified in Section 9.5.4, AEA will file the study implementation plan with FERC by March 15, 2013.
FDAUP-48	ADNR -	11/14/2012	7.5.4.2. Remote Fish Telemetry (Pages 7-16 to 7-18) "The likelihood	Agreed. The likelihood of intentional human consumption will

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	ADF&G		of unintentional human consumption of PIT tags needs to be addressed." –pdf page 26	be described in further detail in the Fish Distribution and Abundance Implementation Plan. As specified in Section 9.5.4, AEA will file the study implementation plan with FERC by March 15, 2013.
FDAUP-49	USFWS	11/14/2012	"Studies should determine if the remaining stream reaches will continue to support resident fish populations." –pdf page 76	There is no nexus with Project affects and stream reaches above the reservoir inundation zone. There will be no Project-induced changes to the habitat, flow regime, or water quality upstream of the reservoir inundation zone that would impact the ability of these streams reaches to support resident fish communities. Existing information and data collected in 2012 indicate that all fish species within the reservoir zone are native. Anticipated Project impacts upstream of the dam site are limited to the inundation zone where AEA is collecting baseline data and addressing the potential for changes related to fish and aquatic habitats (Section 9.9.2), fish distribution and abundance (Section 9.5.1), adult salmon use (Sections 9.7.4.2 and 9.7.4.3), fish community (Section 9.10.1.1), reservoir water quality (Section 5.6.4.8), and fish barriers (Section 9.12.1).
FDAUP-50	USFWS	11/14/2012	"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." –pdf page 76	The proportion of adult Chinook salmon spawning above the proposed dam site falls under the Salmon Escapement Study (Section 9.7). Juvenile salmon in the Upper River will be surveyed in this study (Sections 9.5.4.3.1, 9.5.4.3.2, and 9.5.4.3.3). The timing of juvenile salmon and resident fish migration is addressed in Section 9.5.4.3.2. There is an objective that specifically addresses the timing of migration. Fish distribution and relative abundance information will be collected for Dolly Varden and Arctic grayling over all three segments of the river (Section 9.5.4.3.1). Data collection will allow for comparison over river segments, geomorphic reaches, and habitat types. Location, life cycle, and species information will be collected (See objective 1; Sections 9.5.1 and 9.5.4.3.1). Information on the distribution and availability of habitats will be collected under the Characterization and Mapping of Aquatic

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				Habitats (see Sections 9.9.5.3, 9.9.5.4.1, and 9.9.5.5).
FDAUP-51	USFWS	11/14/2012	"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." –pdf page 77	The RSP contains a list of species to be sampled. See Section 9.5.1 and Table 9.5-1. Agreed. Sampling methods will be species specific and site specific (see Sections 9.5.4.3 and 9.5.4.4). Sampling methodology and site selection will be described in further detail in the Fish Distribution and Abundance Implementation Plan. As specified in Section 9.5.4, AEA will file the study implementation plan with FERC by March 15, 2013.
FDAUP-52	USFWS	11/14/2012	"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." –pdf page 77	Section 9.5.4.1 describes the sampling strata. Because of the general inaccessibility, very rugged terrain, and mostly non-wadeable stream channels, near census mapping (100 percent coverage) is challenging and in some cases unsafe or impossible. For these reasons, only tributaries mapped by the Characterization and Mapping of Aquatic Habitats (See Section 9.9; Table 9.9-2) will be selected for fish distribution and abundance sampling. Up to 18 tributary streams will be targeted for sampling during 2013 and 2014. Of the 18 tributaries selected for sampling, all tributaries in which Chinook salmon juveniles or adults were documented within or at the mouth of a tributary during previous surveys will be sampled. Per ADF&G request, of the remaining tributaries that are suitable for sampling, tributaries where no data exists in the AWC catalog will be prioritized. See Section 9.5.4.1.
FDAUP-53	USFWS	11/14/2012	"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	Sampling will occur on a monthly basis for each site except during critical periods (i.e., migration from natal to rearing habitats) where it will occur biweekly. See Section 9.5.4.2. This sampling frequency in conjunction with continuous PIT tag monitoring (9.5.4.4.12) and out-migrant trap (9.5.4.4.10) sampling at more frequent intervals will capture juvenile salmon movements. Sampling frequency will be described in further

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			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." –pdf pages 77-78	detail in the Fish Distribution and Abundance Implementation Plan. As specified in Section 9.5.4, AEA will file the study implementation plan with FERC by March 15, 2013.
FDAUP-54	USFWS	11/14/2012	"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." –pdf page 78	Sampling methods will be species specific and site specific and will depend on site conditions encountered in the field. Additional detail will be provided in the Fish Distribution and Abundance Implementation Plan. See Sections 9.5.4.3 and 9.5.4.4. The study is directed at documenting baseline conditions of fish distribution and relative abundance within the reservoir inundation zone. There is no nexus with Project affects and stream reaches or lakes above the reservoir inundation zone. There will be no Project induced changes to the habitat, flow regime, or water quality upstream of the reservoir inundation zone that would impact the ability of these streams reaches or lakes to support resident fish communities. Existing information and data collected in 2012 indicate that all fish species within the reservoir zone are native. Anticipated Project impacts upstream of the dam site are limited to the inundation zone where AEA is collecting baseline data and addressing the potential for changes related to fish and aquatic habitats (Section 9.9.2), fish distribution and abundance (Section 9.5.1), adult salmon use (Sections 9.7.4.2 and 9.7.4.3), fish community (Section 9.10.1.1), reservoir water quality (Section 5.6.4.8), and fish barriers (Section 9.12.1).
FDAUP-55	USFWS	11/14/2012	"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. Offchannel 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	Sample strata have been revised. Off-channel habitats will be sampled. See Section 9.5.4.1. All known Chinook salmon-bearing tributaries will be sampled up to the 3,000-foot elevation, which is based on the known extent of Chinook salmon distribution. Other tributaries will be sampled up to the 2,200-foot contour which defines the zone of hydrologic influence. See Section 9.5.4.1.

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			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." –pdf page 78	
FDAUP-56	USFWS	11/14/2012	"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." –pdf page 78	Habitats will be characterized and measured under the Characterization and Mapping of Aquatic Habitats study (Section 9.9). Fish passage barriers will be surveyed and measured under the Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries (Section 9.12).
FDAUP-57	USFWS	11/14/2012	"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." –pdf page 78	Sampling frequency and timing has been revised. Sampling will occur on a monthly basis for each site except during critical periods (i.e., migration from natal to rearing habitats) where it will occur biweekly. See Section 9.5.4.2. The schedule for fixed radio telemetry receivers has been revised to begin shortly after ice out on June 1. Monthly aerial surveys will occur throughout the year with biweekly surveys occurring from July through September. See Section 9.5.4.4.12.
FDAUP-58	USFWS	11/14/2012	"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	Agreed. The evaluation of fish passage barriers falls under the Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries (Section 9.12). Fish Distribution and Abundance studies will coordinate closely with Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries (see Section and 9.5.7 and Figure 9.5-4).

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			are to passage for each migrating life stage and species." –pdf page 79	
FDAUP-59	USFWS	11/14/2012	"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." –pdf page 79	Selected sampling methods will be species-specific and site-specific. See Sections 9.5.4.3 and 9.5.4.4. Because of safety and access concerns, no winter sampling is proposed for the Upper River; however remote fish telemetry techniques are proposed to document the seasonal movements of resident fishes (Table 9.5-2). For radio telemetry, the Salmon Escapement Study (9.7) will provide approximately weekly aerial survey coverage of the study area (approximately July through October). At other times of the year, the frequency of aerial surveys may be monthly and during critical species-specific time periods (e.g., burbot spawning), may be biweekly. More detail on sampling frequency will be provided in the Fish Distribution and Abundance Implementation Plan. As specified in Section 9.5.4, AEA will file the study implementation plan with FERC by March 15, 2013.
FDAUP-60	USFWS	11/14/2012	"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). 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.	Marine-derived nutrient analyses falls under the purview of the River Productivity Study (Section 9.8). One objective of that study is to "Conduct a trophic analysis, using trophic modeling and stable isotope analysis, to describe the food web relationships in the current riverine community within the Middle and Upper Susitna River" (see Section 9.8.4.5.2). Typically, Carbon (δ13C) and nitrogen (δ15N) isotope ratios are used for these analyses. More detail will on stable isotope analysis will be included in the River Productivity Implementation Plan. As specified in Section 9.8.4, AEA will file the study implementation plan with FERC by March 15, 2013.

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			1998; Limburg 1998; Doucett et al 1999; Zimmerman 2005)." –pdf page 79-80	
FDAUP-61	USFWS	11/14/2012	"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." –pdf page 80	Marine-derived nutrient analyses falls under the purview of the River Productivity Study. One objective of that study is to "Conduct a trophic analysis, using trophic modeling and stable isotope analysis, to describe the food web relationships in the current riverine community within the Middle and Upper Susitna River" (See Section 9.8.4.5.2). The non-lethal collection of fish tissue samples are proposed to accomplish this objective (9.8.4.5.2). More detail will on stable isotope analysis will be included in the River Productivity Implementation Plan. As specified in Section 9.8.4, AEA will file the study implementation plan with FERC by March 15, 2013. As per objective 4, otoliths will be collected from Dolly Varden and humpback whitefish in the Upper River to determine whether these fish are anadromous. Otoliths are also necessary to support an on-going study being conducted by the USFWS.
FDAUP-62	USFWS	11/14/2012	"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." –pdf page 81	Agreed. Data on fish distribution, relative abundance, and habitat associations will be collected under objective 1. See Sections 9.5.1 and 9.5.4.3.1. Because of safety and access considerations, no winter sampling is planned for the Upper River; however remote fish telemetry techniques are proposed to document the seasonal movements of resident fishes (Table 9.5-2). For radio telemetry, the Salmon Escapement Study (Section 9.7) will provide approximately weekly aerial survey coverage of the study area (approximately July through October). At other times of the year, the frequency of aerial surveys may be monthly and during critical species-specific time periods (e.g., burbot spawning), may be biweekly. More detail will on sampling frequency will be provided in the Fish Distribution and Abundance Implementation Plan. As specified in Section 9.5.4,

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				AEA will file the study implementation plan with FERC by March 15, 2013.
FDAUP-63	USFWS	11/14/2012	"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." –pdf page 81	AEA has added additional information to the RSP on target fish species, sample, size, location, and fish size. See Section 9.5.4.4.12.
FDAUP-64	USFWS	11/14/2012	"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." –pdf page 81	The schedule for fixed radio telemetry receivers has been revised to begin shortly after ice out on June 1. Monthly aerial surveys will occur throughout the year with biweekly surveys occurring from July through September. See Section 9.5.4.4.12.
FDAUP-65	USFWS	11/14/2012	"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 Service 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	AEA has modified the Study Plan to include a multitude of techniques. In addition to sampling efforts in the Middle and Lower River (Section 9.6), up to six PIT tag arrays (Section 9.5.4.4.12) and two out-migrant traps (Section 9.5.4.4.10.) will be deployed in the Upper River to gather data on downstream movement timing. Other methods (i.e., seining, electrofishing, minnow trapping) will be conducted on a monthly basis can be used to infer migratory movements and timing (monthly). See Section 9.5.4.4.

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			location. There is no description of data analyses or a discussion of how the results will be applied to Project operation." –pdf page 81	Catch-Per-Unit-Effort will be provided along with the time, location, species, and size of fish observed. See Section 9.5.4.4.
FDAUP-66	USFWS	11/14/2012	"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." –pdf page 81-82	In addition to sampling efforts in the Middle and Lower River (Section 9.6), up to six PIT tag arrays (Section 9.5.4.4.12) and two out-migrant traps (Section 9.5.4.4.10.) will be deployed in the Upper River to gather data on downstream movement timing. Other methods (i.e., seining, electrofishing, minnow trapping) will be conducted on a monthly basis can be used to infer migratory movements and timing (monthly). See Section 9.5.4.4. All juvenile salmon captured will be PIT-tagged in an effort to document downstream migration and movement patterns. Migration patterns of adult fish in the Upper River will be monitored with remote telemetry techniques. However, because of the size of the river and the potentially large number of fish, determining the total number of migrating fish is not a study objective. It would be challenging, if not impossible, to produce reliable estimates of the total number of fish migrating past the proposed dam site. AEA agrees that the absence of fish cannot be used to indicate that a given fish species or life stage is not migrating.
FDAUP-67	USFWS	11/14/2012	AEA Study *Objective 7. Document the presence/absence of northern pike in all samples*: "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." –pdf page 82	Northern pike is an invasive non-native species present in the Susitna basin; its presence and distribution is a management concern to ADF&G. AEA included this objective in the study based upon a specific request by ADF&G. While angling will be the primary method of targeting northern pike, the presence of pike will be documented in all surveys. See Section 9.5.4.3.6.
FDAUP-68	USFWS	11/14/2012	"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	See AEA's response to comment FDAUP-67.

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			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." –pdf page 82	
FDAUP-69	NMFS	11/14/2012	"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." –pdf page 90	See AEA's response to comment FDAUP-49.
FDAUP-70	NMFS	11/14/2012	"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." –pdf page 91	AEA has added additional detail to Section 9.5.4 describing the sample site selection, sampling frequency and methods. As described in Section 9.4.5.3.1, Objective 1 will characterize the baseline condition of fish distribution and relative abundance. The proposed sampling approach is a stratified random design (Section 9.5.4.1) that proposes collecting data monthly during the open water period at 45 sites using a variety of methods (Section 9.5.4.4) to facilitate capture of all species and life stages present.] Given that this task is descriptive in nature it does not require statistical tests or analysis. The data are being collected in a fashion that standardizes them across place and time, for example the derivation of density and CPUE (Section 9.5.4.3.1). These data will allow for comparative analysis and application of statistical tests that would be developed, as necessary, during final analysis in support of the License Application.
FDAUP-71	NMFS	11/14/2012	"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, an~ 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.	See AEA's response to comment FDAUP-51

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			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." –pdf page 91	
FDAUP-72	NMFS	11/14/2012	"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." –pdf page 91	See AEA's response to comment FDAUP-52.
FDAUP-73	NMFS	11/14/2012	"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 (ADF&G 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." –pdf page 91	See AEA's response to comment FDAUP-53.
FDAUP-74	NMFS	11/14/2012	"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 bur bot 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	See AEA's response to comment FDAUP-52.

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			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 (ADF&G 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." –pdf page 92	
FDAUP-75	NMFS	11/14/2012	"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, offchannel 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." –pdf page 92	See AEA's response to comment FDAUP-55.
FDAUP-76	NMFS	11/14/2012	"The PSP states that sampling will be based on Chinook salmon distribution, with surveys above 2,200 ft focusing Oli 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 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 to look for anadromous salmon and resident fish overwintering habitat." –pdf page 92	See AEA's response to comment FDAUP-56.
FDAUP-77	NMFS	11/14/2012	"Proposed fish collection methods are similar to the middle and lower river resident fish study (Section 7.6), with monthly sampling from	See AEA's response to comment FDAUP-57.

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			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." –pdf page 92	
FDAUP-78	NMFS	11/14/2012	Sampling methods do not identify measures of habitat variables to determine fish distribution among sites and among sampling events. –pdf page 67-68	See AEA's response to comments FDAUP 53-57.
FDAUP-79	NMFS	11/14/2012	"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." –pdf page 93	See AEA's response to comment FDAUP-58.
FDAUP-80	NMFS	11/14/2012	"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	See AEA's response to comment FDAUP-59.

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			tributary streams. The only winter sampling methods proposed in the upper river are the use of DID SON 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." –pdf page 93	
FDAUP-81	NMFS	11/14/2012	"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)." –pdf page 93-94	See AEA's response to comment FDAUP-60.
FDAUP-82	NMFS	11/14/2012	"Zimmerman (2005) found that strontium (Sr) or strontium-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." –pdf page 94	See AEA's response to comment FDAUP-61.
FDAUP-83	NMFS	11/14/2012	"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	See AEA's response to comment FDAUP-61.

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			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." –pdf page 94	
FDAUP-84	NMFS	11/14/2012	"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." –pdf page 95	Several methods will be used to assess resident fish use of the impoundment zones and its tributaries. Two out migrant traps will be deployed to gather data on downstream movement timing (Section 9.5.4.4.10). Other methods (i.e., seining, electrofishing, minnow trapping) will be conducted on a monthly basis during the open water period and can be used to infer migratory movements and timing (monthly) (See Section 9.5.4.4). Because of safety and access concerns, no winter sampling is proposed for the Upper River; it will, however, be included in the Lower and Middle River (See Section 9.6.1). Also see AEA's response to comment FDAUP-63.
FDAUP-85	NMFS	11/14/2012	"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." –pdf page 95	See AEA's response to comment FDAUP-63.
FDAUP-86	NMFS	11/14/2012	"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	See AEA's response to comment FDAUP-64.

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			spawning sites have been predicted or observed for many of the Susitna River resident species, including: rainbow trout, Arctic grayling, round white fish, and longnose suckers (ADF&G 1981 b, 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." –pdf page 95	
FDAUP-87	NMFS	11/14/2012	"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." –pdf page 95-96	See AEA's response to comment FDAUP-65.
FDAUP-88	NMFS	11/14/2012	"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." –pdf page 96	See AEA's response to comment FDAUP-66.

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FDAUP-89	NMFS	11/14/2012	"AEA Study Objective 7. Document the presence/absence of northern pike in all samples. This objective is unclear, and the reason for its inclusion is not identified. The ABA 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." –pdf page 96	See AEA's response to comment FDAUP-67.
FDAUP-90	NMFS	11/14/2012	"To our knowledge, intensive sampling for northern pike within this segment of the Susitna River has not been conducted. We recommend working with the 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. Analytical methods should calculate the probability of pike presence even if not captured given the level of sampling effort." –pdf page 96	See AEA's response to comment FDAUP-67. See Section 9.5.4.3.6.

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FDAML-01	CWA	11/14/2012	Scope is insufficient in studying the Lower River based on AEA's apparent assumption that Project effects will not significantly affect the Lower fish community. –pdf page 7-8	AEA is not assuming insignificant Project-related effects on the Lower River processes. As noted in Section 9.6.3, both Middle and Lower River segments are under consideration as part of the Fish Distribution and Abundance Study. The proposed study area for Fish Distribution and Abundance encompasses the Susitna River from RM 61 upstream to the proposed Watana Dam site (RM 184). Section 9.6.4.1 indicates that there will be 27 sampling sites for fish distribution within the Lower River. However, the majority of detailed study elements described in the RSP are concentrated within the Middle River Segment. This is because project operations related to load-following and variable flow regulation will likely have the greatest potential effects on this segment of the river.
FDAML-02	CSDA	11/14/2012	"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." –pdf page 4 first bullet	Section 9.6.4.3.3 describes a baseline study objective focused on the early life history of juvenile salmon that includes tasks focused on emergence time and fry movement. This specific study will be conducted over 2013 and 2014. Potential for the Project to impact salmon incubation habitat will be address within the Instream Flow Study Program as described in Section 8.5.4.6.1.5. In addition, a pilot study is planned to investigate off-channel intergravel temperature and DO at two locations during the 2012/2013 winter season (see Section 9.6.4.5). That study will serve to inform methods for the 2013/2014 winter study.
FDAML-03	FERC	11/14/2012	"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	Level two stratification (geomorphic reaches) is discussed in Section 9.6.4.1 but is not included in Figure 9.6-2 because not all habitat types will be found within each geomorphic reach and inclusion would make the figure confusing. Site section for fish sampling in the Upper River will necessarily vary with habitat and will not be stratified equally among geomorphic reaches. Stratification of site will occur as much across geomorphic reaches but is limited due to habitat availability, access and safety. Site selection methods describe a nested hierarchical approach; mesohabitat units will be selected using a random approach. See Section 9.6.4.1.

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			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)." –pdf page 13	
FDAML-04	FERC	11/14/2012	"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." –pdf page 14	The Fish Distribution and Abundance Middle and Lower Susitna River Study will include sampling for relative abundance of fishes and fish habitat association in Focus Areas. Final site selection for Focus Area-sampling is dependent upon results of the geomorphic reach delineation and habitat mapping tasks. These results are anticipated in spring of 2013 and the process for finalizing the locations is explained in Section 8.5.4.2.1.2 of the Instream Flow Study. Within each Focus Area, one sampling site representative of each mesohabitat type (side slough, upland slough, side channel, beaver pond, and tributary mouth) present will then be selected for sampling using techniques to determine relative abundance (9.6.4.1). The site selection process and specific locations of proposed Focus Areas for fish sampling is described in the Fish and Aquatics Instream Flow Study Section 8.5.4.2.1. No Instream Flow Study Focus Areas are proposed for the Upper River Segment since the effects of flow regulation from Project operations will not occur above the dam. Please see response to comment IFS-004 regarding extending studies into the Lower River Segment.
FDAML-05	FERC	11/14/2012	"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." –pdf page 14	Details on the Winter Pilot Study Approach are described in Section 9.6.4.5. As described in the Interdependencies Section of the RSP (Section 9.6.7). An iterative process will take place during the first and second quarters for 2013 where the winter study helps to inform other studies including the Fish Distribution and Abundance in the Middle and Lower Susitna River Implementation Plan. The results of the 2012-2013 winter pilot study will be filed with the FERC in the Initial Study Report.

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FDAML-06	FERC	11/14/2012	"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." –pdf page 14	See AEA's Response to FDAUP-04.
FDAML-07	ADF&G	11/14/2012	"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." –pdf page 26	Agreed. Section 9.6.4.5, incorporates minnow trapping, videography and use of DIDSON for winter sampling.
FDAML-08	ADF&G	11/14/2012	Section 7.6.1.1. Study Goals and Objectives (Page 7-23) "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" –pdf page 27	Due to the number and varied nature of tributaries, sampling in 18 of the 62 middle river tributaries is proposed. Tributaries will be selected in a stratified random design across the eight geomorphic reaches that represent multiple stream orders. AEA is amenable to prioritizing tributaries that have not previously been sampled as long as they are representative. Sampling within the lower reaches of tributaries in the lower river is not proposed. See Section 9.6.4.1.
FDAML-09	ADF&G	11/14/2012	Section 7.6.1.1. Study Goals and Objectives (Page 7-23) "Identify target species"" –pdf page 27	Target species are juvenile salmonids and selected fish species such as rainbow trout, Dolly Varden, humpback whitefish, round whitefish, northern pike, arctic lamprey, Arctic grayling, and burbot. See Section 9.6.1.
FDAML-10	ADF&G	11/14/2012	Section 7.6.1.1. Study Goals and Objectives (Page 7-23) "Is goal #1 for juveniles only?" –pdf page 27	Objective 1 refers to juvenile salmonids and all juvenile non salmonid anadromous fish and resident fish. See Section 9.6.1.
FDAML-11	ADF&G	11/14/2012	Section 7.6.4.1.2. Outmigrant Traps (Page 7-27) "Identify locations of out-migrant traps and if traps will be manned during deployment." –pdf page 27	A maximum of 6 out-migrant traps will be deployed. Between two and three will be deployed in the main channel to indicate broad timing of out-migrants from all upstream sources. Between three and four will be deployed in tributary mouths and sloughs, such as Fog Creek, Kosina Creek, Portage Creek, Indian Creek and possibly Gold Creek and Whiskers Slough. Specific locations will be described in detail in Fish Distribution and Abundance in the Implementation Plan. AEA will file the implementation plan with FERC no later than March 15, 2013. Traps will be checked twice

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				daily while operational. See Section 9.6.4.4.10.
FDAML-12	ADF&G	11/14/2012	Section 7.6.4.1.2. Outmigrant Traps (Page 7-27) "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?"" –pdf page 27	Depending on flow and site access, traps will be fished on a cycle of 48 hours on and 72 hours off throughout the ice-free period. See Section 9.6.4.4.10.
FDAML-13	ADF&G	11/14/2012	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." 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." –pdf page 27	Agreed, all juvenile salmon, rainbow trout, Arctic grayling, Dolly Varden, burbot, longnose sucker, and whitefish greater than 60 mm in length that are handled will be scanned for PIT tags using a portable tag reader. See Section 9.6.4.4.14.
FDAML-14	ADF&G	11/14/2012	Section 7.6.4.2.1. Radiotelemetry (Page 7-27) "Identify species to be tagged." –pdf page 27	Up to 30 radio transmitters will be implanted in selected species including Arctic grayling, Dolly Varden, rainbow trout, burbot, round whitefish, humpback whitefish, Arctic lamprey, and northern pike. See Sections 9.6.4.3.2 and 9.6.4.4.12.
FDAML-15	ADF&G	11/14/2012	Section 7.6.4.2.1. Radiotelemetry (Page 7-27) "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?" –pdf page 27	See radio telemetry details in Section 9.6.4.4.12 and 9.6.4.4.14. Further information on protocols to be described in detail in Fish Distribution and Abundance in the Implementation Plan. AEA will file the implementation plan with FERC no later than March 15, 2013. Run timing from five seasons of intensive effort in the 1980s and from 2012 was used to judge the duration of field operations for the Curry fishwheels. These data suggest the vast majority of chum and coho salmon have moved past Curry by late August. Catches in early September (and electrofishing in the 1980s) suggest the runs of new fish are complete by early September. In the event that fishwheel catches are still significant and/or the runs are late (and water and ice conditions permit), AEA will continue to run the fishwheels into as late into the fall as

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				catches of migrating fish are sustained.
FDAML-17	TNC	11/14/2012	"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." –pdf pages 2-3	Study sites are specific locations where data is being collected. Focus Areas are stretches of river in which a full complement of cross-disciplinary intensive studies will occur to enhance the richness of the data. These multidisciplinary studies include geomorphology, water quality, instream flow, aquatic habitat, and fish sampling. Focus Area sites are being selected based on a combination of recent and historic data along with the professional judgment of the various technical teams (see Section 8.5.4.2.1.2). The first selection criterion is to select one or more sites that are considered representative of the stratum or larger river and that contain all habitat types of importance. A suite of criteria includes, but is not limited to geomorphological, riparian/floodplain, fish presence, and habitat characteristics; groundwater, ice, and water quality. Constraints such as safety considerations, raptor nests, land ownership and access will also be considered. Geospatial data for these individual attributes will be overlain in the Geographic Information System (GIS) to assist in site selection.
FDAML-18	TNC	11/14/2012	"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	See AEA's response to comment FDAML-01. In addition, flow effects tend to attenuate in a downstream direction as channel morphologies change, and flows change due to tributary inflow and flow accretion.

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			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." –pdf page 3	AEA will reevaluate how far downstream Project operational significant effects extend based in part upon the results of the Mainstem Flow Routing Models (see Section 8.5.4.3), which is scheduled to be completed in Q1 2013. Thus, an initial assessment of the downstream extent of Project effects will be developed in Q2 2013 with review and input of the TWG. This assessment will include a review of information developed during the 1980s studies and study efforts initiated in 2012, such as sediment transport (Section 6.5), habitat mapping (Sections 6.5 and 9.9), operations modeling (Section 8.5.4.3), and the Mainstem Flow Routing Models (Section 8.5.4.3). The assessment will guide the need to extend studies into the Lower River Segment and if needed, will identify which geomorphic reaches will be subject to detailed instream flow analysis in 2013. Results of the 2013 studies would then be used to determine the extent to which Lower River Segment studies should be adjusted in 2014.
FDAML-19	USFWS	11/14/2012	Re: AEA Study Objective 1 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, nonsalmonid 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. Specific detailed quantitative information is necessary for all three study components. 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. 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. –pdf page 86	AEA disagrees that this study should characterize all factors or variables that may influence the distribution and abundance of juvenile anadromous and resident fish. First, AEA does not think that to "characterize all factors and variables" is a clear and achievable objective. We know from past study some of the variables that may influence fish distirbutions such as cover, presences/absence of predators, presence/absence of prey, presence/absence of competitors, temperature, flow, three dimensional structure, upwelling. However, scientists do not know all of the possible factors that may influence distribution and they do not know the intracacies of how these factors interact to influence distribution and/or how a fish may prioritize factors in choosing habitats. Furthermore, we do not think this level of detail is necessary to characterize fish distributions and/or fish habitat associations. Objective 1, as written in Section 9.6.1, is to "describe the seasonal distribution, relative abundance and fish habitat associations of juvenile anadromous salmonids, non-salmonid anadromous fishes and resident fishes." AEAs approach to sampling for fish under this objective has been to use a stratified random design. Sampling will be random for habitat units within the coarse strata of mainstem and mesohabitats as Methods presented in Section 9.6.4.3.

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				Proposed sampling techniques include the collection of qualitative (presence-absence) as well as quantitative (including CPUE, fish density, and counts) data. The sampling approach is based on stratified-random sampling of all habitats not sampling where environmental factors suggest fish may or may not be present. As described in Section 9.6.4.2, sampling frequency will vary among seasons and sites based on specific objectives. Generally, sampling will occur monthly at all sites for fish distribution and relative abundance surveys during the ice-free season. At Focus Areas, sampling will occur monthly year-round. As per USFWS, sampling will occur bi-weekly to characterize the movements of juvenile salmonids during critical transition periods from natal to rearing habitats. Established protocols will be followed to ensure consistent application of methods; however, since sampling efficiency, accuracy and precision are influenced by site conditions we are not going to be able to predict these estimators. This RSP describes baseline characterization of data that will be used to evaluate potential Project effects. Dam design and project operations would need to be advanced prior to determine the appropriate effects analysis.
FDAML-20	USFWS	11/14/2012	Embryo development, fry emergence and the spatiotemporal distribution of juvenile fish during the summer, fall, and winter rearing periods may vary from year to year due to environmental conditions (temperature, flow, ect) which can be influenced by Project Operations. The seasonal distribution of eggs will be determined through the Adult Escapement Study; however, the temporal distribution of fry will be influenced by egg development rates. The Service's request for the evaluation of egg development is not addressed in the PSP. –pdf page 87	See AEA's response to comment FDAML-02.
FDAML-21	USFWS	11/14/2012	Understanding of the timing and influence of environmental variables on juvenile salmon migration from spawning to rearing habitats is critical for Project evaluation and will likely	AEA agrees that understanding the seasonal distribution and migration timing of juvenile salmon is important for Project evaluation. As described in Sections 9.6.4.3.1 and 9.6.4.3.3, Bi-weekly sampling of fish distribution

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			require multiple sampling methods, locations and frequencies. Migrant traps should be used with a sufficient level of effort to determine the timing and environmental conditions for chum and sockeye. The service recommends that placement of migrant traps occur near spawning locations 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. Trap locations should be identified during the adult spawning study. –pdf pages 87-88	(Objective 1, Task A) from ice-out through July 1 will occur in Focus Areas to identify changes in fish distribution by habitat type. Sampling methods will include snorkeling, seining, electrofishing, minnow traps, fyke nets, and out-migrant traps. In addition, we propose to sample with up to six out-migrant traps on a schedule of 48 hours on, 72 hours off throughout the ice-free period (Section 9.6.4.4.10). The selection of sampling sites will be based on data from the adult spawning study and will be described in detail in the Fish Distribution and Abundance Implementation Plan.
FDAML-22	USFWS	11/14/2012	Understanding of the seasonal distribution of juvenile salmon among habitats can be influenced by sampling methods. The Service recommends sampling locations be stratified among geomorphic classification types but also consider the relationship to spawning areas and microhabitat characteristics as well. A description of the methods, the link from methods to objectives and the analytical approach, and the metrics used for analysis are still unknown and should be described in the RSP. –pdf page 88	Agreed. A combination of methods will be used to reduce the influence of gear bias from any single method on fish distribution and abundance data. As with any sampling effort, results should be interpreted judiciously in light of potential biases. Potential biases are outlined in gear descriptions in Sections 9.6.4.3 and 9.6.4.4. AEA agrees to stratify by habitat type across geomorphic reaches where possible; however, it is anticipated that not all habitat types will be present within each reach. Further detail on sampling protocols and site selection will be provided in the Fish Distribution and Abundance Implementation Plan, which will be filed with FERC no later than March 15, 2013.
FDAML-23	USFWS	11/14/2012	"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." –pdf page 88-89	Fish sampling in microhabitats will be conducted under the HSC/HSI task (Section 8.5.4.5.1.1.4) of the Fish and Aquatics Instream Flow Study, As described therein, the specific location of sampling will be recorded with a GPS, photographed, and microhabitat features will characterized for many fish sampling sites during HSC data collection. In addition, a general description of microhabitat characteristics will be described for all HSC sampling sites on data collection forms to help explain variability; however, sampling at the microhabitat level of stratification would result in very small sample sizes of these features that would preclude useful analytical comparisons. For fish sampling in mainstem and mesohabitats, the proposed nested stratification scheme (Section 9.6.4.1) was designed so as to capture variability in relative abundance between and seasonal use of habitat types on a spatial scale that is useful for evaluating project effects. A mesohabitat level assessment based on river morphology and ecologically

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				significant habitat attributes provides documentation that is consistent and reproducible.
FDAML-24	USFWS	11/14/2012	"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." –pdf page 89	AEA agrees to stratify by habitat type across geomorphic reaches where possible; however, it is anticipated that not all habitat types will be present within each reach. The tributary streams mentioned may be good locations for the placement of out-migrant traps. The locations of out-migrant traps will be determined with input from the Fish and Aquatic TWG (Section 9.6.4.3.2). Further detail on sampling protocols and site selection will be given in the Fish Distribution and Abundance Implementation Plan, which will be filed with FERC no later than March 15, 2013 (see Section 9.6.4) .
FDAML-25	USFWS	11/14/2012	"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,	As described in Section 9.6.4, AEA proposes to conduct fish distribution and relative abundance sampling at a total of 262 sites that represent all habitat types present in the Upper, Middle and reach 1 of the Lower River (LR-1) at a monthly sampling frequency during the ice free period. A reduced number of sites also will be sampled during the ice in period. In addition, movements of multiple fish species will be monitored through the use of pit tags, radio tags, and fish traps (Section 9.6.4.3.2). These methods will be implemented throughout the year. AEA is confident that this frequency will cover a full range of environmental conditions including chemical, biological and hydrologic conditions that change over the course of the year.

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			and following similar natural variations in flow." –pdf page 89	
FDAML-26	USFWS	11/14/2012	As an objective to determine if juvenile salmon maintain site fidelity from if summer through winter or emigrate to new locations, PIT tag arrays could be used at Susitna confluence and at upland and side sloughs. To infer the relative importance of overwintering habitat locations a variety of methods is likely needed including PIT tagging and video. Monthly winter fish sampling using these methods could be done at sites randomly stratified by geomorphic class types. – pdf page 90	Locations for PIT tag arrays and fish traps will be determined in Q1 2013 with input from the TWG. The specific locations and rationale used to select them will be documented in the Fish Distribution and Abundance Implementation Plan, which will be filed with FERC no later than March 15, 2013 (Section 9.6.4).
FDAML-27	USFWS	11/14/2012	"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." – pdf page 91	AEA agrees the winter pilot study in 2012 will provide an assessment of the value of DIDSON and underwater video in this system. As described in Section 9.6.4.3.3, if these tools prove effective they will be used seasonally to evaluate diurnal behaviors of fish in Focus Areas.
FDAML-28	USFWS	11/14/2012	The PSP does not outline how fish-habitat relationships for juvenile salmon will be used, how habitat characteristics will be measured, or how statistical methods will be used to determine these relationships. The Service recommends that AEA review literature on the characteristics that define habitat	The Fish Distribution and Abundance Middle and Lower Susitna River RSP describes collection of data for baseline characterization on fish distribution, relative abundance, and fish-habitat associations, as well as six other specific study objectives that help to describe fish use of habitats. These data are, by nature, descriptive and do not require specific

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			quality from egg through summer and winter rearing to better understand parameters that should be incorporated into the RSP. –pdf page 91	statistical approaches or analysis to determine relationship between fish abundance and habitat type. During future analysis of Project effects, statistical analysis may be appropriate to compare across samples or over time. Habitat characterization is described in Section 9.9. On-the-ground habitat surveys will be conducted using a standardized, and widely accepted habitat protocol developed by USFWS. This protocol, including habitat parameters that will be documented is described in Section 9.9.5.3.
FDAML-29	USFWS	11/14/2012	The methods outlined in PSP to describe the seasonal movements and migratory patterns of juvenile anadromous and resident juvenile fish have not been developed to meet the Service's study request. The PSP lacks methods to characterize flow related, or synchronization of resident fish migration and life histories to other physical, chemical, or biological environmental variables. Methods should clearly identify target species and when, where, and how each species is to be captured and identify important physical, chemical, or biological variables that may explain movement patterns. Pit tag receiver operations and installation could limit results; locations should further consider the life history patterns of target species. Pit tagging is also limited by fish size and will not provide information on the early life stages most vulnerable to Project operations. –pdf page 92	An early life history of salmon objective is described in Section 9.6.4.3.3. This objective specifically addresses movements of juvenile salmonids from incubation to rearing habitats. In addition, radio telemetry is being used with multiple species to document seasonal and/or life history based movements into and out of habitats. These data will allow for future evaluations of movement patterns such as effects of storm events and rapidly changing flows on fish movement. Target species for radio telemetry are listed in Section 9.6.4.4.12. As explained in Section 9.6.4.4.12, selection of locations for telemetry and PIT tag arrays will include current knowledge of the distribution, habitat use, and life histories of all target species. Locations will be selected in Q1 of 2013 with input from the TWG. Multiple environmental factors affect fish movements including flow, storm events, presence of predators and conspecifics, food availability, temperature, light, celestial cues, individual motivational state, among likely many other variables yet to be shown to result in fish movement. AEA anticipates that the Project will likely affect the seasonal flow regime in the river and, as described above, is undertaking studies to provide baseline data relevant to seasonal movements and flows. AEA believes that understanding the intricate synchronization of fish migration and life histories to a variety of other physical, chemical, and biological environmental variables is outside of the nexus of the Project.
FDAML-30	USFWS	11/14/2012	"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	Telemetry studies are intended to describe the baseline condition of seasonal and life history based movements of target fish species throughout the year. The study may or may not relate directly to habitat

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			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." –pdf page 93	characterization or instream flow modeling efforts. It is only after the results are available that an understanding can be achieved of where tagged fish move and the data collected can be used in other studies to help interpret those movements. For instance, it is feasible that a group of rainbow trout tagged while in a tributary mouth habitat move well upstream in the tributary and remain there for the duration of the study period. In this case there would be no relationship to habitat or instream flow studies. However, much more likely is the scenario that tagged fish move throughout habitats that have been mapped and characterized by the Characterization and Mapping of Aquatic Habitat study (Section 9.9). Then, the results of the habitat mapping and characterization and/or instream flow studies (Section 8.5) can be synthesized with telemetry results to describe seasonal fish-habitat relationships and to predict potential project related effects. Because, PIT tags are individually coded the recapture of tagged fish can provide data regarding fish growth. This is not an objective of the study but opportunity to collect ancillary data to help characterize existing fish populations. The approach to Fish and Aquatic Resources that AEA proposes is a habitat-based approach. The Project has the potential to alter aquatic habitat and thereby potentially affect fish and other aquatic resources using those habitats. All of the baseline data collected that describes the aquatic environment including habitat mapping and characterization, flow-habitat relationships, water quality, geomorphology, algal and macroinvertebrate communities, fish presence, fish relative abundance, fish-habitat associations, and fish movement patterns will be available for integration and synthesis as a part of the environmental analysis that will support AEA's FERC License Application.
FDAML-31	USFWS	11/14/2012	"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	Stratification will occur across geomorphic reaches as much as possible but will be dictated by the distribution of habitat types present within each reach. AEA is confident that the stratified random sampling design at the mesohabitat scale (see Section 9.6.4.1) will document baseline conditions of fish distribution and abundance at a level that is consistent and reproducible. A macrohabitat level stratification approach is beyond the scope of this study. Because site characteristics change temporally (i.e., with flow), habitat measurements will be collected at each site using the

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			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." –pdf page 93	characterization methods identified in Section 9.9. Some additional variables specific to each gear type will be collected, for example, conductivities will be taken at all sites where electrofishing will occur (Section 9.6.4.4.2). To help elucidate what physical and chemical variables may be influencing fish-habitat use and fish movements at specific sites or for specific species, additional information will be collected at sites identified as Focus Areas (Section 8.5.4.2.1.2), HSC sampling sites (Section 8.5.4.5.1.1.4), or Winter Sampling (Section 9.6.4.5) by multiple resources such as instream flow, water quality, riparian, groundwater, ice, and geomorphology.
FDAML-32	USFWS	11/14/2012	The number of fish to be tagged may not be sufficient to meet study objective. If fish selected for tagged are stratified by habitat type, this only allows for two fish per strata which may not provide an understanding of movements habitat utilization by species. Monthly winter and spring aerial surveys have the potential to miss movements and migration timing, more frequent surveys are needed. More information is need regarding which species will be tagged, the minimum size for radio transmitters, and how the movement of fish <60mm will be monitored. –pdf page 93	AEA agrees that the proposed radio tag sample size of 10 fish for each target species, as indicated in the PSP, is insufficient and has modified the RSP to reflect that up to 30 fish per species will be tagged. As described in Sections 9.6.4.3.2 and 9.6.4.4.12,up to 30 radio transmitters will be implanted in each target species including Dolly Varden, humpback whitefish, round whitefish, northern pike, Arctic grayling, burbot, and rainbow trout. In addition to PIT tagging (Section 9.6.4.4.12), the proposed approach to radio tag up to 30 individuals of each resident or non-anadromous target species will help achieve the stated objectives (Sections 9.6.4.3.2 and 9.6.4.3.4) and allow for a level of understanding of seasonal movement patterns necessary to establish a baseline. As described in Sections 9.6.4.4.12 and 9.6.4.4.14, the radio telemetry study will rely upon both mobile tracking and fixed antenna arrays. The location of the fixed antenna arrays can be used to help focus in on important migratory components that may be missed with monthly mobile surveys. The location of fixed arrays installed in 2013 will be determined with input from the TWG in Q1 2013. Section 9.6.4.4.12 reads "Tags will be surgically implanted in up to 30 fish of sufficient body size of each species distributed temporally and longitudinally throughout the middle and lower river". Because some fish species will be difficult to capture in sufficient numbers, and some habitat associations are dubious (i.e., fishwheel capture does not mean fish are associated with that habitat), tagging efforts will be stratified temporally and longitudinally to provide a greater opportunity to achieve sample size

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				targets. Detailed information on the size of tags and the size of fish to be tagged are provided in Section 9.6.4.4.12, Table 9.6-3, and Figure 9.6-6.
FDAML-33	USFWS	11/14/2012	"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." –pdf page 94	AEA disagrees that more than 10 PIT tag antenna arrays are necessary to achieve the level of detail necessary to achieve study Objective 2, seasonal movements (Section 9.6.4.3.2). In addition to PIT tagging, other techniques including radio telemetry and out-migrant traps will be used to address seasonal fish movements (Section 9.6.4.3.2). Additional information has been provided in Section 9.6.4.4.12 with respect to PIT tagging. Up to 1000 tags per species per PIT tag array will be tagged based on proximity to PIT arrays. Target species include juvenile salmonids and selected fish species such as rainbow trout, Dolly Varden, humpback whitefish, round whitefish, northern pike, Arctic lamprey, Arctic grayling, and burbot. Site selection of PIT tag antenna arrays will be determined with input from the Fish and Aquatic Resources TWG and may include selected side channel, side slough, tributary mouth, and upland slough sites to detect movement of tagged fish into or out of the site. Further detail on PIT tag protocols and site selection will be given in the Fish Distribution and Abundance Implementation Plan, which will be filed with FERC no later than March 15, 2013 (Section 9.6.4).
FDAML-34	USFWS	11/14/2012	The stated study objective to "Document the timing of downstream movement and catch for all fish species using outmigrant traps" is too broad; the objective should be expanded and state a purpose to ensure that appropriate methods and sites are selected. The study should also discuss how the data collected will be used. –pdf page 94	The stated objective serves it purpose and the methodology is designed to provide necessary information to meet this study objective. Out-migrant traps are passive sampling tools and, as such, they collect all fish that swim into them. As implied by the objective, catch data will be used to help describe the timing of downstream movements of all species collected. However, as described in Section 9.6.4.3.2, the out-migrant objective will be focused on movements of fish species out of select tributaries and out of select Middle River habitats such as Focus Areas with documented high fish use. The location of traps will be determined with input from the TWG.
FDAML-35	USFWS	11/14/2012	Under the PSP objective "Characterize the age structure, growth, and condition of juvenile anadromous and resident fish by season" no information is provided on why metrics are being collected and how they will be used in Project evaluation. AEA should identify the specific study objectives and information needs that require juvenile anadromous and	The study objective in the Section 9.6.4.3.5 is *Document the Seasonal Age Class Structure, Growth, and Condition of Juvenile Anadromous and Resident Fish by Habitat Type.* These baseline data will be used to support the stranding and trapping portion of the Fish and Aquatics Instream Flow Study (Section 8.5.4.5.1.2.2). Detailed information on sampling locations and methods will be provided in the Fish Distribution

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			resident fish growth rates. Then appropriate sampling location and methods and analytical methods should be developed. – pdf page 95	and Abundance Implementation Plan, which will be filed with FERC no later than March 15, 2013 (Section 9.6.4). The intent of this study objective is to document baseline conditions for age, growth and condition by habitat type that is consistent and reproducible. AEA is confident that the level of effort proposed (27 sites in Lower River for relative abundance, 96 sites in Middle River for fish distribution, 54 sites in the Middle River for relative abundance, 18 tributaries in the Middle River, and up to 40 sampling locations within Focus Areas) is rigorous and sufficient for effects analysis.
FDAML-36	USFWS	11/14/2012	It is not clear whether invasive fish species other than northern pike will be considered or evaluated under study objective 5. The PSP did not provide the purpose of this study objective or identify how northern pike distribution, relative abundance or habitat associations may be affected by the proposed Project. –pdf page 95	The purpose of this study is to document baseline conditions on the seasonal distribution, relative abundance, and habitat associations of all invasive fish species encountered. Northern pike is identified because it is presently the only known invasive fish species in the Middle/Lower River, is a known predator of juvenile salmon, and will be the focus of Objective 6 (see Section 9.6.4.3.6). The presence/absence and habitat associations of northern pike and other invasive fish species will be documented in all sampling events involving fish capture or observation associated with Objectives 1 and 2. Directed efforts with angling will also be used to capture northern pike. Radio-tagging 30 northern pike will provide additional information on distribution and movements.
FDAML-37	USFWS	11/14/2012	"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." Pdf page 96	As described in Section 9.6.4.3, the initial task of this study will consist of a focused literature review to guide selection of appropriate methods by species and habitat type, sampling event timing, and sampling event frequency. This includes a synthesis of existing information on life history, spatial and temporal distribution, and relative abundance by species and life stage and a review of sampling strategies, methods, and procedures used in the 1980s fish studies. In addition to the suite of fish sampling methods designed to capture a multitude of species, there will be directed efforts to capture northern pike with angling. Radio-tagging of up to 30 northern pike will provide additional information on distribution and movements. See Section 9.6.4.3.6. Further detail will be given in the Fish Distribution and Abundance Implementation Plan, which will be filed with FERC no later than March 15, 2013 (see Section 9.6.4).

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FDAML-38	USFWS	11/14/2012	"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." –pdf page 96	Northern pike is an invasive non-native species present in the Susitna basin; its presence and distribution is a management concern to ADF&G. AEA included this objective in the study based upon a specific request by ADF&G. While angling will be the primary method of targeting northern pike, the presence of pike will be documented in all surveys.
FDAML-39	USFWS	11/14/2012	"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." –pdf page 96	See AEA's response to comment FDAML-338.
FDAML-40	USFWS	11/14/2012	"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,	An objective has been added in the Instream Flow Study that specifically addresses Intergravel monitoring. See AEA's response to comment FDAML–02.

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			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." –pdf page 97	For the 2012-2013 study component focused on intergravel temperature, dissolved oxygen and water surface levels, monitoring sites will be selected using a stratified random sampling approach. The Whiskers Slough and Slough 8A study areas will be stratified by habitat type (main channel, side channel, tributary mouth, side slough, and tributary), with special emphasis given to areas at which salmon spawning was observed in 2012. A total of 10-12 monitoring sites will be randomly selected among strata. Depending on individual site characteristics, temperature monitoring devices will be installed at locations of 1) groundwater upwelling, 2) bank seepage and lateral flow from mainstem, 3) mixing between upwelling and bank seepage, 4) no apparent intergravel discharge, 5) fish spawning, and 6) main channel Susitna River flow. See Section 9.6.4.3.3 for a description of the early life history of salmon study the address emergence and fry movements.
FDAML-41	USFWS	11/14/2012	"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." –pdf page 97	A specific objective has been added to the study at the request of USFWS to focus on early life history. Specific tasks under this objective include: describe emergence timing, determine movement patterns and timing of juvenile salmonids from spawning to rearing habitats. See Section 9.6.4.3.3.
FDAML-42	USFWS	11/14/2012	*"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,*	See AEA's response to comments FDAML-02 and FDAML-40.

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			freezing of juvenile fish, and their habitats. This Study Request Objective (Agency Study Objective 9) 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." –pdf page 97	
FDAML-43	NMFS	11/14/2012	"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." –pdf page 99	As described in Section 9.6.4.3, the initial task of the study will consist of a focused literature review to guide selection of appropriate methods by species and habitat type, sampling event timing, and sampling event frequency. Sampling efficiency among gear types is discussed in Section 9.6.4.4. AEA does not propose to sample study sites based on a geomorphic reach classification scale but on a mesohabitat scale (Section 9.6.4.1) that is consistent with licensing studies completed in the 1980s. AEA has proposed a habitat-based characterization of the Fish and Aquatic Resources and will be collecting information on fish relative abundance, distribution and apportionment of fish by representative habitats (Section 9.6.4.1). This will help us understand the current fish-habitat relationships. The models that AEA will use to predict potential Project impacts are also habitat based and will use predictions of changes to aquatic habitat to demonstrate an affect instead of absolute fish numbers. These models have the advantage of incorporating both site specific data on fish habitat as well as data from numerous studies in other systems where fish habitat has been characterized. AEA is confident that it has developed rigorous fish and instream flow programs that will be effective in understanding the potential impacts of the proposed Project on fisheries resources. Detailed information on gear types, sampling protocols, and site selections will be provided in the Fish Distribution and Abundance Implementation Plan, which will be filed with FERC no later than March 15, 2013 (see Section 9.6.4).
FDAML-44	NMFS	11/14/2012	"Monthly sampling is proposed; however, this adequacy of this	Sampling frequency and timing has been revised. Sampling will occur on

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			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 these concerns and describe how the data from these studies will be used to evaluate potential project effects." –pdf page 99	a monthly basis for each site except during critical periods (i.e., migration from natal to rearing habitats) where it will occur biweekly. See Section 9.6.4.2. Since site characteristics change temporally (i.e., with flow), habitat measurements will be collected at each site using the characterization methods identified in Section 9.9. Additional information may be collected specific to each gear type; for example, conductivities will be taken in all sites where electrofishing will occur. See Section 9.6.4.4.2. Multiple environmental factors affect fish movements including flow, storm events, presence of predators and conspecifics, food availability, temperature, light, celestial cues, individual motivational state, among likely many other variables yet to be shown to result in fish movement. AEA anticipates that the Project will likely affect the seasonal flow regime in the river and, as described above, is undertaking studies to provide baseline data relevant to seasonal movements and flows. AEA believes that understanding the intricate synchronization of fish migration and life histories to a variety of other physical, chemical, and biological environmental variables is outside of the nexus of the Project. This study is focused on baseline characterization of the current fish assemblage and their distribution, relative abundance, and species habitat associations. Comparison of fish community metrics between habitat types is not a study objective. AEA is confident that the approach proposed in the RSP will allow for the level of detail necessary to address potential Project effects.
FDAML-45	NMFS	11/14/2012	"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, Kondolf et al. 2000). However, the	Fish sampling in microhabitats will be conducted under the HSC/HSI task (Section 8.5.4.5.1.1.4) of the Fish and Aquatics Instream Flow Study. As described therein, the specific location of sampling will be recorded with a GPS, photographed, and microhabitat features will characterized for many fish sampling sites during HSC data collection. In addition, a general description of micro habitat characteristics will be described for all HSC sampling sites on data collection forms to help explain variability; however, sampling at the microhabitat level of stratification would result in very small sample sizes of these features that would that preclude useful analytical comparisons.

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			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." -pdf pages 99-100	
FDAML-46	NMFS	11/14/2012	"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." –pdf page 100	See AEA's response to comments FDAML-01 and FDAML-18. AEA agrees that sampling in the Lower River is necessary and the RSP includes sampling locations in the upper reaches of the Lower River Segment (RM 61-98). AEA disagrees with the comment that potential project effects on organic matter and macronutrients will extend downstream of the Three Rivers Confluence into the Lower River. A review of USGS average monthly flow data indicates that the Chulitna and Talkeetna rivers combine and contribute annually more than 50% of the flow in the Lower River, where as the Middle Susitna River contributes more on the order of 40%. This pattern is reflected in winter monthly flow contributions as well. Based on the documented flow differences between the Sustina River and the Chulitna and Talkeetna rivers and well as varying temperature regimes and turbidity regimes, AEA anticipates that substantial differences in organic matter and nutrients occur within these river systems. We also anticipate that the larger combined flow related influences of the Chulitna

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				and Talkeetna rivers in combination will attenuate potential Project operation effects on the mainstem Susitna River downstream from the Three Rivers Confluence. As described in Section 9.8.3, AEA will reevaluate how far downstream potential project operational effects may extend based in part upon the results of the Open-water Flow Routing Model (see Section 8.5.4.3), which is scheduled to be completed in Q1 2013. AEA does not agree that the potential Project changes in concentrations of organic matter and nutrients could extend upstream into the Chulitna and Talkeetna River. The concentrations of these parameters and subsequently the habitat quality in these tributary rivers will be determined primarily by the flow, sediment and temperature conditions that occur within these basins. These environmental conditions will not be affected by the construction or operation of the proposed Watana Dam.
FDAML-47	NMFS	11/14/2012	"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." –pdf page 100	Agreed. The focus of Lower River sampling will be to select sites in lateral habitats where the Project may affect changes and to supplement habitat types with limited or no replication in the Middle River. See AEA's response to comment FDAML-46.
FDAML-48	NMFS	11/14/2012	"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.	The Lower River sampling described in the RSP includes selection of sites in lateral habitats which may be susceptible to potential project effects. See Section 9.6.4.3.

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			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 CreeklDeshka 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." –pdf pages 100-101	
FDAML-49	NMFS	11/14/2012	"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)." –pdf page	The objectives of this study plan do not include development of post-Project monitoring plan. Based upon the results of its environmental analysis supporting AEA's FERC License Application, AEA will determine the nature, scope, and location of post-Project monitoring.

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FDAML-50	NMFS	11/14/2012	"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." –pdf page 101	The potential exists for the Project to alter flow and flow-related physical habitat features in such a way as to create impediments to fish passage into and out of Middle River habitat. Thus, four objectives are proposed for study in Section 9.12.1.1. These study objectives are specific and relate directly to the potential Project nexus. Detailed methods to accomplish these objectives are presented in Section 9.12.4. Section 9.12.4.13 provides a summary description of data necessary to support analyses and a summary of how it will be analyzed.
FDAML-51	NMFS	11/14/2012	"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 ABA 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, infonnation of the effects of the proj ect 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." –pdf pages 102-103	See AEA's response to comment FDAML-02.
FDAML-52	NMFS	11/14/2012	"The timing and influence of environmental variables on juvenile salmon migration from spawning to summer rearing	The proposed monthly sampling frequency with additional biweekly sampling in incubation and early life history rearing habitats, as described

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			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." –pdf page 103	in Section 9.6.4, is adequate to capture variability in relative abundance of fishes between habitats and across time. A mesohabitat level assessment based on river morphology and ecologically significant habitat attributes provides documentation that is consistent and reproducible and at a spatial scale that is useful for future evaluations of Project effects.
FDAML-53	NMFS	11/14/2012	"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)." –pdf page 103	As described in Section 9.6.4.3.3, methods to capture emergent juvenile salmon, including fyke net traps, will be deployed bi-weekly starting in mid-April or when ice clears. The decision to collect bi-weekly data on emergent fish was made with input from USFWS and NMFS representatives at the September 13, 2012 subgroup meeting. Additional details on this strategy will be provided in the Fish Distribution and Abundance Implementation Plan that will be filed with FERC no later than March 15, 2013.
FDAML-54	NMFS	11/14/2012	"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 electro fishing, 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." –pdf page 103	See AEA's response to comment FDAML-53 regarding identification of the location of out-migrant traps. See also Section 9.6.4.3.3 for a description of the early life history of salmon study component that addresses emergence and fry movements. In additional to other gear types, out-migrant traps will be deployed to determine out-migration timing and relative abundance of juvenile salmon including sockeye; see Section 9.6.4.10. Regarding population estimates of fry, AEA disagrees. Fish population estimate are highly variable over time and space, have large amount of uncertainity associated with them even under the best conditions, and require sufficient effort so as to compromise AEA's ability to obtain comprehensive coverage for fish. As discussed both in the September 13, 2012 subgroup meeting and October 25, 2012 TWG meeting, USFWS requested that AEA not collect data in order to derive population estimates, but rather increase sampling associated with relative fish abundance and presence/absence. For additional reference ADF&G outlined the biases associated with estimates of productivity (smolts per spawner) in their review of 1980s studies and future recommendations report., Susitna Aquatics Study Report #3501.

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				In addition, AEA eliminated sampling to generate population estimates at the request of USFWS. This request was made during the October 25, 2012 TWG meeting; and no opposition was noted to this request.
FDAML-55	NMFS	11/14/2012	"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." – pdf page 104	Agreed. A maximum of six out-migrant traps will be deployed. Up to three traps will be stationed in the mainstem Susitna River to characterize downstream migratory timing. Because Chinook salmon are predominantly tributary spawners, out-migrant traps will also be deployed in mouths of tributaries such as Portage Creek, Indian River, and Whiskers Creek. Specific locations will be provided in the Fish Distribution and Abundance Implementation Plan, which will be filed with FERC no later than March 15, 2013. See Sections 9.6.4.3.2 and 9.6.4.4.10.
FDAML-56	NMFS	11/14/2012	"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. I984). 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)." –pdf page 104	Agreed. A combination of methods will be used to reduce the influence of gear bias from any single method on fish distribution and abundance data. As with any sampling effort, results should be interpreted judiciously in light of potential biases. Potential biases are outlined in gear description Sections 9.6.4.3 and 9.6.4.4.
FDAML-57	NMFS	11/14/2012	"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." –pdf page 104	Agreed. See Section 9.6.4.3.
FDAML-58	NMFS	11/14/2012	"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	See AEA's response to comment FDAML-31.

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			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 main stem habitat locations." –pdf page 104-105	
FDAML-59	NMFS	11/14/2012	"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." –pdf page 105	Agreed, where sub-sampling of habitat types is required the specific length of habitat sampled will need to be randomly and or systematically determined. The protocols that will be used to determine specific lengths of aquatic habitat sampled will be determined once mainstem and mesohabitats are selected for sampling and will be provided in the Fish Distribution and Abundance Implementation Plan which will be filed with FERC no later than March 15, 2013 (see Section 9.6.4).
FDAML-60	NMFS	11/14/2012	"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:	See AEA's response to comment FDAML- 59. AEA does not agree that it would be useful to stratify sampling locations by proximity to spawning areas, river mile, or mirco-habitat features for the purposes of this study.

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			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." –pdf page 105	For fish sampling in mainstem and mesohabitats, the proposed nested stratification scheme (Section 9.6.4.1) was designed so as to capture variability in relative abundance between and seasonal use of habitat types on a spatial scale that is useful for evaluating project effects. A mesohabitat level assessment based on river morphology and ecologically significant habitat attributes provides documentation that is consistent and reproducible. Fish sampling in microhabitats will be conducted under the HSC/HSI task (Section 8.5.4.5.1.1.4) of the Fish and Aquatics Instream Flow Study, As described therein, the specific location of sampling will be recorded with a GPS, photographed, and microhabitat features will characterized for many fish sampling sites during HSC data collection. In addition, a general description of microhabitat characteristics will be described for all HSC sampling sites on data collection forms to help explain variability; however, sampling at the microhabitat level of stratification would result in very small sample sizes of these features that would preclude useful analytical comparisons.
FDAML-61	NMFS	11/14/2012	"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." –pdf page 105-106	See AEA's response to comment FDAML-25. Sampling frequency and timing has been revised since the submission of the Proposed Study Plan. Sampling will occur on a monthly basis for each site except during critical periods (i.e., migration from natal to rearing habitats) where it will occur biweekly. See Section 9.6.4.2. To help elucidate what physical and chemical variables may be influencing juvenile fish-habitat use and fish movements at specific sites or for specific species, additional information will be collected at sites identified as Focus Areas (Section 8.5.4.2.1.2), HSC sampling sites (Section 8.5.4.5.1.1.4), or Winter Sampling sites(Section 9.6.4.5) by multiple resources such as instream flow, water quality, riparian, groundwater, ice, and geomorphology. In addition, since site characteristics change temporally (i.e., with flow), habitat measurements will be collected at each site using the characterization methods identified in the Characterization and Mapping of Aquatic Habitat, Section 9.9. Additional information may be collected specific to each gear type. For example, conductivities will be taken in all sites where electrofishing will occur. See Section 9.6.4.4.2.

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FDAML-62	NMFS	11/14/2012	"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." –pdf page 108	See AEA's response to comment FDAML-26. In addition to PIT tagging, other techniques including out-migrant traps and regular sampling at more than 250 sites over 158 river miles will be used to address seasonal fish movements (Section 9.6.4.3.2). Further data collected on juvenile fish-habitat use and fish movements at specific sites or for specific species, will be collected at sites identified as Focus Areas (Section 8.5.4.2.1.2), HSC sampling sites (Section 8.5.4.5.1.1.4), or Winter Sampling (Section 9.6.4.5) by multiple resources such as instream flow, water quality, riparian, groundwater, ice, and geomorphology. AEA expects that this amount of effort will provide the level of detail necessary on seasonal movements of juvenile salmonids to address potential project effects.
FDAML-63	NMFS	11/14/2012	"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	Agreed. As described in Section 9.6.4.5, winter fish sampling will employ multiple methods to determine which are most effective for each fish species, life stage, and habitat type. Based on results of Winter 2012-2013 Pilot Studies, under-ice fish observations will be made using DIDSON sonar and underwater video cameras. Because sampling efforts will occur in both open water and ice covered sites, methods will vary depending on conditions. In ice-covered sites the primary sampling methods will be trotlines and minnow traps. In open water sites, the fish capture methods will be baited minnow traps, electrofishing, and beach seines. Radio telemetry and half duplex PIT technologies will be used at ice covered sites to test tag detection range and efficiency during winter conditions.

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			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." –pdf page 108	
FDAML-64	NMFS	11/14/2012	"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." –pdf page 108	AEA concurs that indiscriminate use of fish abundance data would be inappropriate and that fish abundance is not likely to be the only predictor of habitat quality. When evaluating habitat quality AEA will consider a number of factors including but not limited total fish abundance, species richness, fish growth, number of life stages present, water quality parameters, algal and macroinvertebrate communities. AEA disagees that growth rates should be the primary indicator of habitat quality simply because fish move and may move between habitats at a daily, weekly, monthly or seasonal time step depending on life stage, size, and a variety of other environmental factors. As fish move among habitats daily growth rates will vary overtime with the dynamic environmental conditions they encounter. Given the size and dynamic nature of the Sustina river and the number of species and life stages that AEA proposed to describe fish-habitat associations for we cannot expect to understand movements at a level of detail necessary to assign growth rate to a specific habita. Thus, AEA does not consider defining the growth-habitat relationships, that would be necessary to use growth as an indicator of habitat quality, as a realistic or achievable objective.
FDAML-65	NMFS	11/14/2012	"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." –pdf page 108	AEA agrees, in the early life history component of the RSP (Section 9.6.4.3.3.) it states that the sampling objective for fry stage is to describe emergence timing not relative abundance as a measure of rearing habitat. Since relative abundance data will be collected year-round, it will be important that this data is reviewed before it is analyzed. As an example, during QAQC procedures, salmonids of a certain size class may be selected or excluded if data are to be used for abundance or habitat quality. As with any sampling effort, results should be interpreted judiciously in light of potential temporal, spatial or gear biases (see Section 9.6.4.3.1).
FDAML-66	NMFS	11/14/2012	"Catchability for all standard gear types can vary greatly	See AEA's response to comment FDAML-56

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			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." –pdf page 109	
FDAML-67	NMFS	11/14/2012	"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." –pdf page 109	Agreed. The efficacy of minnow traps varies with species, life stage, and habitat characteristics. A combination of methods will be used to reduce the influence of gear bias on fish distribution and abundance. During the 1980s, minnow traps were effective and the primary method used for capturing sculpin, lamprey, and threespine stickleback. See Section 9.6.4.4.5.
FDAML-68	NMFS	11/14/2012	"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." –pdf page 109	Agreed. Details on underwater video sampling are described in Section 9.6.4.4.13.

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FDAML-69	NMFS	11/14/2012	"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 offish 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." –pdf page 111	Baseline fish-habitat association data associated with this study will be collected as part of Objective 1, described in Section 9.6.4.3.1. Additional information on fish-habitat use and fish movements at specific sites or for specific species, will be collected at sites identified as Focus Areas (Section 8.5.4.2.1.2), HSC/HSI sampling sites (Section 8.5.4.5.1.1.4), and during Winter Sampling (Section 9.6.4.5) by multiple resources such as instream flow, water quality, riparian, groundwater, ice, and geomorphology. Additional detail on sampling protocols sufficient for implementation by field crews, sampling site selection protocols, and specific locations of sampling sites will be presented in the Fish Distribution and Abundance Implementation Plan, which will be filed with FERC prior to March 15, 2013 (Section 9.6.4).
FDAML-70	NMFS	11/14/2012	NMFS study objectives for resident fish have not been addressed in the PSP. The characterization of seasonal distribution, relative abundance ad habitat associations of resident fish and migration will not result in data useful for evaluating project effects. Study plans need to be developed to characterize flow-related, or synchronized resident fish migration and life histories as the related to other physical, chemical, or biological environmental variables. –pdf page 112	.AEA disagrees that the study plan will not result in useful data to evaluate potential project effects on resident fishes. Resident fish seasonal distribution, abundance, habitat use and movements are address under three separate objectives in the Section 9.6. Objective 1 of the characterizes the distribution, relative of abundance of resident and anadromous species using the same approach. This includes sampling at 217 different sites once a month during the open water period, with multiple methods to target all life stages and species present (Section 9.6.4.3.1). In addition, as described under Obejctive 2, seasonal movements of resident fish species will be addressed by operating fish traps and following target resident fish species using biotelemetry, specifically PIT and radio tags (Section 9.6.4.4.12). As explained in Section 9.6.4.4.12, selection of locations for telemetry and PIT tag arrays will include current knowledge of the distribution, habitat use, and life histories of all target species. Locations will be selected in Q1 of 2013 with input from the TWG.

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				Furthermore, Objective 4 (Section 9.6.4.3.4) focuses in of resident species that spawn in winter and therefore require additional sampling to understand spawning habitat associations. Multiple environmental factors affect fish movements including flow, storm events, presence of predators and conspecifics, food availability, temperature, light, celestial cues, individual motivational state, among likely many other variables yet to be shown to result in fish movement. AEA anticipates that the Project will likely affect the seasonal flow regime in the river and, as described above, is undertaking studies to provide baseline data relevant to seasonal movements and flows. AEA thinks that understanding the intricate synchronization of fish migration and life histories to a variety of other physical, chemical, and biological environmental variables is outside of the nexus of the Project.
FDAML-71	NMFS	11/14/2012	"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." –pdf page 112	Section 9.6.4 and 9.6.6.6.12 describe target species and specifics regarding the use of radio-telemetry and PIT tagging to document fish movements in the Middle and Lower River. In addition the initial study task, Section 9.6.4.3, is to compile relevant life history information to support sampling of all species thought to be present in the study area See AEA's response to comment FDAML–29 regarding the determination of biological, chemical and or other physical characteristics that may explain fish movement patterns.
FDAML-72	NMFS	11/14/2012	"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	See AEA's response to comment FDAML – 30.

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			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." –pdf pages 112-113	
FDAML-74	NMFS	11/14/2012	"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	See AEA's response to comment FDAML-31.

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			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." –pdf page 113-114	
FDAML-75	NMFS	11/14/2012	"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." –pdf page 114	AEA agrees, the number of fish to be radio tagged has been revised. Instead of 10, a goal of 30 fish of selected species will be tagged. Target species include Dolly Varden, humpback whitefish, round whitefish, northern pike, Arctic grayling, burbot, and rainbow trout. See Section 9.6.4.3.2. In addition to radio tagging, PIT tagging and monthly/bimonthly sampling techniques at more than 250 sites over 158 river miles will be used to address seasonal fish movements (Section 9.6.4.3.2). AEA expects that the level effort and combination of techniques will be sufficient for baseline data collections to meet the stated objectives (Sections 9.6.4.3.2 and 9.6.4.3.4). The Salmon Escapement Study (See Section 9.7) will provide approximately weekly aerial survey coverage of the study area (approximately July through October). At other times of the year, the frequency and location of aerial surveys will be at least monthly and bi-weekly during critical species-specific time periods (e.g., burbot spawning). Telemetry surveys will also be conducted by boat, snow machine, and on foot to obtain the most accurate and highest resolution positions of spawning fish. Fixed Station receivers operated July through October by the Salmon Escapement Study (Section 9.7) will be extended to include the month of June. Using the guidance of fixed-station and aerial survey data on the known positions of tagged fish, specific locations of any concentrations of tagged fish that are suspected to be spawning will be visited to obtain individual fish positions. See Section 9.6.4.4.12.

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FDAML-76	NMFS	11/14/2012	"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." –pdf page 114	AEA agrees, the number of fish to be radio tagged has been revised. Instead of 10, a goal of 30 fish of selected species will be tagged. Target species include Dolly Varden, humpback whitefish, round whitefish, northern pike, Arctic grayling, burbot, and rainbow trout. See Section 9.6.4.3.2.
FDAML-77	NMFS	11/14/2012	"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 fme 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." –pdf page 114	See AEA's response to comment FDAML- 6.
FDAML-78	NMFS	11/14/2012	"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?" –pdf page 114-115	Because of the wide diversity of habitat types, species, and life stages under investigation, a variety of methods must be deployed (Section 9.6.4). Detailed information on sampling locations and methods will be provided in the Fish Distribution and Abundance Implementation Plan, which will be filed with FERC no later than March 15, 2013 (Section 9.6.4). Methods by objective are given in Section 9.6.4.3. Methods will be site-specific and species specific. For radio tagging efforts, capture of target fish species will occur opportunistically with regular distribution and abundance sampling and as directed efforts if necessary and as using a variety of gear types along a temporal and longitudinal gradient (9.6.4.4.12). Preference will be given fish caught with more benign techniques that cause minimal harm/stress to fish. AEA agrees that trot lines are generally lethal and therefore not an effective capture method for tagging studies and this is clearly stated in Section 9.6.4.4.4. Alternate

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				methods will be pursued, for example using hoop traps for burbot following protocols outlined by ADF&G (e.g., Evenson 1993). See Section 9.6.4.4.8.
FDAML-79	NMFS	11/14/2012	"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." –pdf page 115	Thank you for the comment and additional information. AEA will consider this information when implementing the study plan. The initial task of this study will consist of a focused literature review to guide selection of appropriate methods by species and habitat type, sampling event timing, and sampling event frequency. Anticipated products from the literature review include the following: • A synthesis of existing information on life history, spatial and temporal distribution, and relative abundance by species and life stage. • A review of sampling strategies, methods, and procedures used in the 1980s fish studies. • Preparation of periodicity charts for each species within the study area (timing of adult migration, holding, and spawning; timing of incubation, rearing, and out-migration). • A summary of mainstem Susitna River habitat utilization for each species, by riverine habitat type (main channel, side channel, side slough, upland slough, tributary mouth, tributary). • A summary of existing age,size, and genetics information. • A summary of distribution of invasive species, such as northern pike. See Section 9.6.4.3.
FDAML-80	NMFS	11/14/2012	The stated study objective to "Document the timing of downstream movement and catch for all fish species using out-migrant traps" is too broad; the objective should be expanded and state a purpose to ensure that appropriate methods and sites are selected. The study should also discuss how the data collected will be used. –pdf page 121	See AEA's response to comment FDAML-34.
FDAML-81	NMFS	11/14/2012	Under the PSP objective "Characterize the age structure, growth, and condition of juvenile anadromous and resident fish by season" no information is provided on why metrics are being collected and how they will be used in Project evaluation. AEA should indent specific study objectives and information needs in collaboration with the Services. Then	The study objective in the RSP has been modified to *Document the Seasonal Age Class Structure, Growth, and Condition of Juvenile Anadromous and Resident Fish by Habitat Type (Section 9.6.4.3.5).* These baseline data will be used to support the Fish Stranding and Trapping Study. Detailed information on sampling locations and methods will be provided in the Fish Distribution and Abundance in the Middle and Lower

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			appropriate sampling location and methods and analytical methods should be developed. –pdf page 121	Susitna River Implementation Plan, which will be submitted to FERC on March 15, 2013 (Section 9.6.4).
FDAML-82	NMFS	11/14/2012	"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." –pdf page 122	See AEA responses to FDAML-36 to FDAML 39. The purpose is to document the seasonal distribution, relative abundance, and habitat associations of all invasive fish species encountered. Northern pike is identified because it is presently the only known invasive fish species in the Middle/Lower River, is a known predator of juvenile salmon, and will be the focus of this objective. The presence/absence and habitat associations of northern pike and other invasive fish species will be documented in all fish capture and observation sampling events associated with Objectives 1 and 2. Additional directed efforts with angling will be used to capture northern pike. Radio-tagging of up to 30 northern pike will provide additional information on distribution and movements. See Section 9.6.4.3.6 In addition the initial task for this RSP is the compilation of all relevant life history information for all target species. This will include information available on northern pike in the Lower Sustina River.
FDAML-83	NMFS	11/14/2012	"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." –pdf page 122	See AEA responses to FDAML-36 to FDAML 39. The initial task of this study will consist of a focused literature review to guide selection of appropriate methods by species and habitat type, sampling event timing, and sampling event frequency. This includes a synthesis of existing information on life history, spatial and temporal distribution, and relative abundance by species and life stage and a review of sampling strategies, methods, and procedures used in the 1980s fish studies See Section 9.6.4.3 In addition to the suite of fish sampling methods designed to capture a multitude of species at more than 250 sites over 158 river miles in the Lower, Middle and Upper Susitna River, there will be directed efforts to capture pike with angling. Radio-tagging of up to 30 northern pike will

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				provide additional information on distribution and movements. See Section 9.6.4.3.6. Further detail will be provided in the Fish Distribution and Abundance Implementation Plan, which will be filed with FERC no later than March 15, 2013 (Section 9.6.4).
FDAML-84	NMFS	11/14/2012	"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." –pdf page 122	See AEA responses to FDAML-36 to FDAML 39. AEA expects that the level of effort proposed is rigorous and will provide the baseline data that is necessary for effects analysis. Evaluation of project related effects will occur as a part of the environmental analysis supporting AEA's FERC License Application. In addition to radio and PIT tagging, a suite of fish sampling methods are proposed to capture a multitude of species at more than 250 sites over 158 river miles in the Lower, Middle and Upper Susitna River, including directed efforts to capture pike with angling. See Section 9.6.4.3.6.
FDAML-85	NMFS	11/14/2012	Understanding northern pike distribution is important for the interpretation of biotic effects to the distribution and abundance of juvenile salmon and other resident species. This may be particularly important in lower sloped tributaries where pike may be present, and moderate sloped tributaries that may become more important as pike become more abundant. Displacement of juvenile salmon from overwintering habitat could make them more susceptible to predation. –pdf page 123	See AEA's response to comment FDAML -38.
FDAML-86	NMFS	11/14/2012	"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	See AEA's response to comment FDAML- 85 The presence/absence and habitat associations of northern pike and other invasive fish species will be documented in all fish capture and observation sampling events associated with Objectives 1 and 2. Additional directed efforts with angling will be used to capture northern pike. Radio-tagging of up to 30 northern pike will provide additional information on distribution and movements. (see Section 9.6.4.3.6)

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			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." –pdf page 123	
FDAML-87	NMFS	11/14/2012	"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, flow and intragravel temperatures. NMFS developed two study objectives to characterize spawning habitat conditions, and we request that FERC order completion of these important studies." –pdf page 123 The NMFS Study objectives (1) to evaluate embryo development, hatching success and emergence times at areas with and without groundwater upwelling and (2) measure intergravel temperature at different surface elevations and depths in spawning and overwinter habitats to determine potential for freezing.	Potential effects of Project operation on salmon egg incubation and fry emergence will be evaluated as part of 'Effective Spawning-Incubation Habitat Analyses' (see Section 8.5.4.6.1.5). Project effects on salmon rearing, including winter rearing, will be addressed as part of habitat-specific modeling (see Section 8.5.4.6) and 'Winter Habitat Use Sampling' (see Section 8.5.4.5.1.2.1). AEA disagrees with the need to collect information on hatching success. Recent data indicate most of the variability in hatching success is confounded by parentage, and therefore it would not be realistic to expect to tease out lesser affects on variability that might be associated with Project-induced flow or temperature changes. Consistent with their overall approach AEA is taking a habitat-based approach to the evaluation of incubation habitat quality. Emergence timing is to be addressed by this study. Section 9.6.4.3.3 describes a baseline study objective focused on the early life history of juvenile salmon that includes tasks focused on emergence time and fry movement. This specific study will be conducted over 2013 and 2014. Several studies are being proposed to assess potential project effects of on upwelling and groundwater dynamics related to egg incubation and emergence survival including effective spawning/incubation analysis (see Section 8.5.4.6.1.5), varial zone modeling (see Section 8.5.4.6.1.6), winter

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				habitat use (see Section 8.5.4.5.1.2.1), and Groundwater Study (see Section 7.5). Specific details on study area, data needs, model parameters, and assumptions are presented for each of the proposed studies.
FDAML-88	NMFS	11/14/2012	"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." –pdf page 124	Water quality information on spawning grounds is being collected as part of the Intergravel Monitoring component of the Instream Flow Study. See Section 8.5.4.5.1.2.1. AEA disagrees with the need to collect information on hatching success. Recent data indicate most of the variability in hatching success is confounded by parentage, and therefore it would not be realistic to expect to tease out lesser affects on variability that might be associated with Project-induced flow or temperature changes. Consistent with their overall approach AEA is taking a habitat-based approach to the evaluation of incubation habitat quality. For the 2012-2013 pilot study component focused on intergravel temperature, dissolved oxygen and water surface levels, monitoring sites will be selected using a stratified random sampling approach (See Section 8.5.4.5.1.2.1). The Whiskers Slough and Slough 8A study areas will be stratified by habitat type (main channel, side channel, tributary mouth, side slough, and tributary), with special emphasis given to areas at which salmon spawning was observed in 2012. A total of 10-12 monitoring sites will be randomly selected among strata. Depending on individual site characteristics, temperature monitoring devices will be installed at locations of 1) groundwater upwelling, 2) bank seepage and lateral flow from mainstem, 3) mixing between upwelling and bank seepage, 4) no apparent intergravel discharge, 5) fish spawning, and 6) main channel Susitna River flow. In addition, data on emergence timing will be collected as described in Section 9.6.4.3.3.
FDAML-89	NMFS	11/14/2012	"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	To help elucidate what physical and chemical variables may be influencing fish-habitat use and fish movements at specific sites or for specific species, additional information will be collected at sites identified as Focus

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			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." – pdf page 124	Areas (Section 8.5.4.2.1.2), HSC/HSI sampling sites (Section 8.5.4.5.1.1.4), and during Winter Sampling (Section 9.6.4.5) by multiple resources such as instream flow, water quality, riparian, groundwater, ice, and geomorphology. A 2012-2013 winter pilot study will monitor intergravel temperature at 10-12 monitoring sites at two Focus Area locations. The Whiskers Slough and Slough 8A study areas will be stratified by habitat type (main channel, side channel, tributary mouth, side slough, and tributary), with special emphasis given to areas at which salmon spawning was observed in 2012. Based on this pilot study, recommendations will be developed for 2013-14 winter sampling. For intergravel temperature measurement, Hobo Tidbit temperature probes will be deployed at three separate gravel depths (5 cm, 20 cm, and 35 cm) corresponding to observed burial depth ranges of chum and sockeye eggs (Bigler and Levesque 1985, DeVries 1997). For more details specific to intergravel temperature monitoring at spawning locations see the proposed methods for the winter pilot study in Section 8.5.4.5.1.2.1 and 9.6.4.5.
FDAML-90	NMFS	11/14/2012	"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 describe 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." –pdf page 125	While this study may be used to validate HSC associations, HSC development is under the purview of the Instream Flow Study, a detailed description of data collection is provided in Section 8.5.4.5.1.1. For 2013–2014 studies, site-specific habitat suitability information will be collected for target species using HSC-focused field surveys to locate and measure microhabitat use by spawning and rearing (adult and juvenile) life stages. Proposed sampling methods include biotelemetry, pedestrian, snorkel, and seining. Two other possible methods, DIDSON sonar and electrofishing, are being explored for use in detecting habitat use in turbid water conditions. Selected methods will vary based on habitat characteristics, season, and species/life history of interest. Selected methods are subject to ADF&G Fishery Resource Collection Permit requirements. Additionally, winter surveys will utilize underwater video during clear water periods to identify under-ice and open-water habitat use by rearing life stages. Depending on safety concerns, it has been proposed to conduct both daytime and nighttime surveys during winter sampling to determine any

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				differences in habitat use. See Section 8.5.4.5.1.1.6 for a description of data collection methods for each HSC sampling technique for juvenile fishes. The 2012-13 Winter Pilot Study methodology for HSC is detailed in Section 8.5.4.5.1.2.1 and 9.6.4.5 and includes the use of underwater video cameras and DIDSON sonar obtain measurements of site-specific habitat utilization data for juvenile and adult fish species in support of habitat suitability criteria development.

Salmon Escapement Study				
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ESCAPE-01	CSDA	11/14/2012	"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."	See AEA's response to comment FISH-02.
ESCAPE-02	Various Individuals	11/07/2012-11/14/2012	Two year study is inadequate for Chinook salmon, recommends 5-7 years.	See AEA's response to comment FISH-02. Chinook salmon will be studied in the Lower, Middle, and Upper Susitna River for three years (2012-14). The substantial study effort across three years along with extensive work by ADF&G since 2007, including about 5,400 radio-tagged Chinook salmon in the Lower and Middle River, and multiple other approaches (visual aerial and ground surveys, acoustics, etc.) will be sufficient to characterize the spawning distribution of Chinook salmon to adequately characterize potential Project impacts. Given the range of ages at maturity, these three years will represent fish from parts of all Chinook salmon brood years on the Susitna River.
ESCAPE-03	TNC	11/14/2012	"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."	See AEA's response to comment ESCAPE-02. Note that with multiple ages at maturity, these study years will sample at least parts of all brood years that return to the Susitna River. The extent of adult Salmon Escapement Study components in the study plan is not limited to three years across all areas and species. The studies will be based on multiple research projects at multiple study sites across the last five years (Yanusz et al 2007; Merizon et al. 2010; Yanusz et al. 2011; Cleary et al. (multiple documents in prep.; AEA in prep): • Chinook salmon tagging in Lower River, 2012-2014; • Chinook salmon tagging in Middle River, 2012-2014; • Coho salmon tagging in Lower River, 2009-2014; • Coho salmon tagging in Middle River: 2012-2014; • Chum salmon tagging in Lower River, 2009-2012; • Chum salmon tagging in the Middle River, 2012-2014;

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				• Sockeye salmon tagging in the Lower River, 2006-08; • Sockeye salmon tagging in the Middle River, 2012-2014; • Pink salmon tagging in the Lower River, 2012-2014; • Pink salmon tagging in the Middle River, 2012-2014.
ESCAPE-04	NMFS	11/14/2012	"Objective 8…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 adversely affect all five species of Pacific salmon."	See AEA's response to comment ESCAPE-03. As described in Section 9.7.4.8, coho and Chinook salmon will be more intensively studied in 2013-14 in order to develop system- or Susitna-River-wide escapement estimates. Susitna River chum (2009-2012) and sockeye salmon (2006-2008) have been the focus of escapement estimation studies by ADF&G in recent years. Distribution and habitat use by pink salmon (apportionment by habitat type, but not absolute escapement estimates) will be studied in the Lower and Middle River in 2012-2014. Pink salmon abundance in the Susitna River alternates annually between even-year peak and odd-year off peak returns; as well it is highly variable across years of each brood line. Absolute system-wide escapement estimates from pink salmon over 3 or 5 years will not materially alter an assessment of the Project impacts. Collectively, all species will have received multiple years of research effort in the Lower, Middle, and Upper River during the period 2007-2014; results across all species will be based on over 12,000 radio-tagged salmon.
ESCAPE-05	NMFS	11/14/2012	"It is unclear why coho and Chinook salmon will be tagged more intensively than other species...'	See AEA's response to comment ESCAPE-03 and ESCAPE-04.
ESCAPE-06	USFWS	11/14/2012	"It is unclear why coho and Chinook salmon will be tagged more intensively than other species.	See AEA's response to comment ESCAPE-03 and ESCAPE-04.
ESCAPE-07	NMFS	11/14/2012	"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."	See AEA's response to comment ESCAPE-03 and ESCAPE-04.
ESCAPE-08	USFWS	11/14/2012	"Additionally, it is unclear why only Chinook and coho salmon will be tagged in the lower Susitna River, whereas all five salmon	See AEA's response to comment ESCAPE-03 and ESCAPE-04. In addition, AEA has added pink salmon tagging in the Lower

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			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.'	River (see Section 9.7.12, Objective 1).
ESCAPE-09	NMFS	11/14/2012	'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.'	AEA proposes to capture and tag the greatest number of sockeye and chum salmon at Curry as permitted. Recoveries of these additional tagged fish will be analyzed together with radio-tagged fish recoveries, and if sufficient numbers are tagged, will be analyzed separately, to test the study's assumptions. *A priori* spaghetti-tagging goals are not meaningful as all fish that can be captured and tagged in excess of the radio-tagging goals (without severely limiting radio tagging effort) will maximize the power of such tests. The additional statistical power from spaghetti tagging will be strongly a function of the numbers of recoveries. Additional text has been added to Section 9.7.4.1.3 to further elaborate on the approach and provide more definitive commitment to the spaghetti-tagging effort.
ESCAPE-10	USFWS	11/14/2012	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."	See AEA's response to comment ESCAPE-09.
ESCAPE-11	USFWS	11/14/2012	"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	As found in the 1980s and in 2012, Curry provides an excellent location to capture and tag large numbers of salmon for intensively studying adult salmon in the mid and upper Middle River. While some of these Curry fish redistribute themselves to the lower Middle River (1980s and 2012), this will aid in the identification of spawning sites in that area. In addition, AEA will address adult salmon use of the lower Middle River areas with a multi-faceted approach. First, several years of chum, sockeye, and coho salmon radio tagging in the lower Susitna have been conducted recently by ADF&G (see AEA's response to comment ESCAPE-03). Second, Chinook, coho, and pink salmon will be radio-tagged in the Lower River at

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			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."	~RM 30 in 2013 and 2014. Radio-tagging in the Lower River will provide information about the use of the lower Middle River area by adult salmon. Third and more importantly, fish distribution and abundance surveys will address Focus Areas (Section 9.6.4.1) in the lower Middle River and establish presence of adult salmon during the spawning periods and characterize habitat features and suitability criteria. Between radio-tagged fish from the Lower River and fish distribution surveys in this area, AEA will not miss fish spawning below Curry.
ESCAPE-12	NMFS	11/14/2012	"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. …. 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."	See AEA's response to comment ESCAPE-11.
ESCAPE-13	USFWS	11/14/2012	"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	AEA agrees and these study objectives are addressed by several studies in the RSP. The Instream Flow Study (Section 8.5) will develop habitat suitability criteria (Section 8.5.4.5), entailing measurements of physical habitat and water quality at spawning sites in mainstem habitat (Section 8.5.4.5.1.1.5). The study will also develop models to evaluate connectivity with off-

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			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."	channel habitats (Section 8.5.4.6.1.7). The potential for Project effects on fish passage barriers will be further assessed by Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries (see Section 9.12.1).
ESCAPE-14	NMFS	11/14/2012	"The purpose of the Salmon Escapement Study is to assess the current rum 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."	See AEA's response to comment ESCAPE-13.
ESCAPE-14	USFWS	11/14/2012	"Determine the availability and accessibility of spawning habitats by adult salmon to mainstem and tributary locations based upon flow regime. 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."	Barriers at current conditions and post-Project are addressed in the Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries (see Section 9.12.1). Access into off-channel habitats at various flows will be addressed in the Instream Flow Study (see Section 8.5.4.6.7).

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ESCAPE-15	NMFS	11/14/2012	"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."	See AEA's response to comment ESCAPE-14.
ESCAPE-16	USFWS	11/14/2012	"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."	AEA agrees. The objectives of this study include identification of the spawning locations of radio-tagged salmon (see Section 9.7.4.2, Objective 2) and the methods include identification of these locations at sufficient spatial resolution to assign a macrohabitat type to the fate of tagged fish (mainstem, tributary, slough, and side channel)
ESCAPE-17	NMFS	11/14/2012	"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."	See AEA's response to comment ESCAPE-16.
ESCAPE-18	USFWS	11/14/2012	Related USFWS/NMFS study objective not addressed: I 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. 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	The USFWS/NMFS study objective is being addressed in several studies. The Instream Flow Study (Section 8.5) will assess the potential for redd effects from load-following operations (Section 8.5.4.6.1.5); the availability and quality of spawning habitat (Section 8.5.4.5); and the characteristics of spawning sites (Section 8.5.4.1.1.5). Habitat will be characterized at various levels, including at spawning sites as described in Section 8.5.4.5 and at random sites as described in Section 9.9.5.4.. Based upon data collected in these studies, AEA anticipates that it will conduct this type of comparison as part of its environmental analysis supporting its FERC License

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			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."	Application.
ESCAPE-19	NMFS	11/14/2012	"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; ….. 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."	See AEA's response to comment ESCAPE-18.
ESCAPE-20	USFWS	11/14/2012	"Objective 8… 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."	AEA has revised the study plan to clarify how the methods will address Objective 8. Radio tags establish the distribution and weirs and spawning ground surveys establish the mark rate on the fish, which is used to convert distribution into relative and/or absolute abundance, depending on the precision and variability of mark rate estimates from the different recapture sites (see Sections 9.7.4.1.3, 9.7.4.6, and 9.7.4.8). ADF&G has considerable weir experience in the Susitna (and elsewhere) and combined that experience with historical aerial survey data to develop the four proposed weir sites. These four weir sites will likely provide ample numbers of fish to examine for developing system-wide mark-recapture estimates and allow for testing of key assumptions. The distribution and relative escapement of salmon in the Susitna River and Middle River Segment tributaries will be established using the 1,400 radio tags on Chinook and 600 tags on coho salmon that will be deployed in the Lower River Segment in each of 2013 and 2014.
ESCAPE-21	NMFS	11/14/2012	Objective 8: "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.	See AEA's response to comment ESCAPE-20.

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			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-22	USFWS	11/14/2012	"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."	Aerial counts will be used to establish minimum tributary-specific mark rates in Portage Creek and Indian River, and combined with ground surveys/sampling, will provide the likely ranges of possible mark rates. The justification for this methodology is that mark rates can be combined with the numbers of radio tags present in these tributaries and in other locations to get the approximate numbers of all fish by habitat or tributary. Experience from 2012 confirmed that aerial surveys will not provide a useful means of estimating mark rates on other species (too few fish observable from the air). AEA has revised Section 9.7.4.2.2 to more clearly establish the purpose (and limits) of the aerial survey effort.
ESCAPE-23	NMFS	11/14/2012	"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."	See AEA's response to comment ESCAPE-22.
ESCAPE-24	USFWS	11/14/2012	"The Service recommends that AEA provide additional detail in describing methods for selecting fish for tagging and how the	Based on the 2012 study and anticipated catch rates at Curry, nearly all captured Chinook, coho, and sockeye salmon will be

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			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 nonrandom in order to selectively tag fish that are not equally represented.'	tagged. For chum and pink salmon, a fraction of fish will be randomly selected from the daily catch for tagging. Tag goals by date (daily and cumulative year-to-date) will be established, as was done in 2012, using historical run timing curves from 1981-85, and 2012. Once underway each season, the tagging rate will be updated and will be a function of the current catches compared to the historical run timing curves. This approach could possibly result in tagging something like 1 out of 2, or 2 out of 3 Chinook salmon if much higher catches are encountered in 2013 and 2014 compared to 2012. A similar situation could occur for the other salmon species, as well. A description of the methods for assessing size or stock-specific selectivity has been added to Section 9.7.4.1.7. The standard (and preferred) approach is to tag all the catch or randomly select fish from the catch for tagging and then assess the degree of selective capture and tagging post-season. This can provide a complete picture of the ultimate selectivity, which also captures any post-release differences in behavior as a function of fish size or the stock of origin. There is no empirical estimate of the degree of size selectivity to apply using the method proposed in the comment, and if after years it were possible, the standard approach is much preferred as it allows a direct calculation of any such effect.
ESCAPE-25	NMFS	11/14/2012	"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."	See AEA's response to comment ESCAPE-24.
ESCAPE-26	NMFS	11/14/2012	"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	See AEA's response to comment ESCAPE-24. Also, if disproportionate sampling can be quantified, stratification can address the issue and not result in incorrect assumptions/conclusions. The study plan sets out methods to

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			project effects, and a poorly informed licensing order."	test assumptions about capture probabilities by stock and body size.
ESCAPE-27	USFWS	11/14/2012	"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)."	See AEA's responses to comments ESCAPE-24 and ESCAPE-26.
ESCAPE-28	USFWS	11/14/2012	"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."	A more complete description of how this will be assessed, including alternative sampling methods, has been added to Section 9.7.4.4.
ESCAPE-29	NMFS	11/14/2012	"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."	See AEA's response to comment ESCAPE-28.
ESCAPE-30	FERC	11/14/2012	"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: a description of what is meant by a commonly applied two-event, capture recapture experiment"	Additional detail has been added to Section 9.7.4.8 to provide generic and Susitna-specific application of the two-event, capture-recapture experiment. A commonly applied two-event, capture-recapture experiment will be used to estimate the annual abundance of Chinook salmon in the entire Susitna River drainage and the coho salmon abundance in the Susitna River above the Yentna River confluence. Such methods to estimate salmon escapement are ubiquitous in Alaska and along the West Coast of North America. In the Susitna River, the capture event will be provided by fishwheels operating throughout the seasonal salmon migration. Radio tags will be applied to fish as close to proportional of the migrating salmon as possible. Later in the salmon migration, a series of recapture sites at tributaries and mainstem locations will establish the proportion of each species' that has a tag (also known as the species-specific and stock-specific mark rate). Using relatively simple algebra and making some testable assumptions, an estimate of the total species-specific abundance that passed the tagging site can be estimated, in this case, the abundance and in-river escapement

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				at the fishwheels sites on the Susitna (Chinook and coho salmon) and the Yentna (Chinook salmon) rivers. Length, sex, and genetics information from the tagged and untagged fish will be used to assess the validity of most assumptions. Behavior of radio-tagged fish following tagging also provides information for evaluating two critical assumptions – the number of tagged fish that have "entered" the experiment, and whether their behavior compromises the experiment.
ESCAPE-31	FERC	11/14/2012	"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: 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)."	Section 9.7.4.1 (Objective 1) provides the goals for the numbers of fish to be tagged by species, year, and location. Section 9.7.4.1.3 has been clarified to emphasize that fish captured in addition to radio-tagging goals will be spaghetti tagged; the exact numbers for which will depend on fishwheel catches obtained (e.g., some species will be too small a catch to exceed radio-tagging goal).
ESCAPE-32	FERC	11/14/2012	"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: 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."	AEA has removed the reference to a possible genetics-based method to estimate escapement. Prior to the 2012 field season, ADF&G requested and proposed that two options remain open for estimating the system-wide escapement of Chinook salmon. These options included two types of mark-recapture studies: one study using radio tags as a mark (the preferred method) and one study using genetic information as a mark. ADF&G proposed two options because it was not known if sufficient numbers of fish for a traditional radio-tagging study could be captured in the Lower River. Based on the capture success experienced during the 2012 radio telemetry study, AEA and ADF&G decided that the system-wide escapement estimate be developed using the radio tag approach.
ESCAPE-33	FERC	11/14/2012	"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 [Yentna] River and the Susitna River, with two fish wheels deployed at each capture site. You also propose to	See AEA's response to comment ESCAPE-32. Tagging is the preferred method and appears feasible based on the 2012 radio telemetry studies. Some tissue samples were collected in 2012, as well as in earlier years, from stocks in the Susitna drainage; more intensive samples will be collected in 2013-14 as described in the Genetic Baseline Study for Selected Fish

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			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."	Species (Section 9.14).
ESCAPE-34	USFWS	11/14/2012	"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)."	Section 9.7.4.1.6 has been revised to address handling-induced effects on fish behavior. Fish will be spaghetti tagged to provide additional data to test assumptions (i.e., assess the representativeness of the fish that are captured in the fishwheels) and to augment the development of a mark rate in the population (Section 9.7.4.1.3). Although spaghetti tagging can provide some additional insight into post-tagging behavior (e.g., differing mark rates between tag type), the sample sizes for both spaghetti tags released and subsequently observed at spawning sites are not likely to be sufficient to assess this issue with adequate statistical power (see Section 9.7.4.1.3).
ESCAPE-35	NMFS	11/14/2012	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)."	See AEA's response to comment ESCAPE-34.

Salmon Escapement Study				
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ESCAPE-36	CWA	11/14/2012	"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."	See AEA's responses to comments FISH-02 and ESCAPE-03.

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RIVPRO-01	FERC	11/14/2012	"In section 9.8.4.1 of the River Productivity Study, you propose to review, 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.)." –pdf page 14	The literature review will be presented as a written report (see Section 9.8.4.1).
RIVPRO-02	FERC	11/14/2012	"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 longterm 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." –pdf page 15	As described in Section 9.8.4.4, statistical analyses will test for similarities and significant differences between Talkeetna sites and Middle Susitna site by comparing community compositions and a collection of calculated metrics. Specific details on statstical methods will be provided in the River Productivity Implementation Plan (Section 9.8.4.), but may include ANOVA, MANOVA, Cluster Analyses using NonMetric MultiDimensional Scaling (NMDS) ordination with the Bray-Curtis Dissimilarity Coefficient, and/or other multivariate ordination techniques (Principal Components Analysis, Canonical Correspondence Analysis). Results indicating close similarities, or no significant differences between the two rivers would indicate suitability as a reference.
RIVPRO-03	FERC	11/14/2012	"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. However, during the October 25, 2012, fish and aquatics study meeting,	Because northern pike are limited to the tributaries in lower reaches of the Sustina River, AEA does not believe they are appropriate for evaluation of Project effects in the Middle River Segment. The upstream-most population has been documented in the Casewell Creek, a tributary to the Susitna that enter at approximately RM 63. At this time AEA thinks it is more prudent to use species

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			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 replacement or a surrogate for northern pike). –pdf page 15	distributed in the Middle River where the greater potential for Project impact occurs. In lieu of northern pike, AEA has selected Chinook salmon for the trophic model, due to its high ecological and economic value in the Susitna Basin, and its wide distribution throughout the Susitna River, and that sufficient data exists on Chinook for the bioenergetics model. Thus, Section 9.9.8.4.5.1 describes the selection of coho salmon, Chinook salmon, and rainbow trout for bioenergetics modeling.
RIVPRO-04	FERC	11/14/2012	Regarding Section 9.8.4.5 please address whether sufficient information is available on the alternative species' foraging and bioenergetics parameters or if model parameters would need to be developed. –pdf page 15	As described in Section 9.8.4.5.1, sufficient information on foraging and bioenergetics parameters are available for coho salmon and rainbow trout. Mechanistic drift foraging models for Chinook salmon are not yet available to allow the estimation of growth rate potential under changing conditions. However, field data and bioenergetics analysis will allow useful comparisons of growth rates, consumption rates, and growth efficiency (the growth achieved per gram of food consumed) among different habitats under current conditions. To make these comparisons, a Wisconsin bioenergetics model parameterized for Chinook salmon (Stewart and Ibarra 1991; Madenjian et al. 2004) will take field inputs of body size, growth rate, water temperature, diet composition, and the energy density of prey. The model will estimate the consumption rate and growth efficiency. These metrics will be compared among habitats to determine whether growth is currently limited primarily by water temperature, food consumption, or food quality in the study area, and whether these limiting factors differ among habitats (McCarthy et al. 2009).
RIVPRO-05	FERC	11/14/2012	In Section 9.8.4.5, please describe the methods you propose for capturing each fish species, the number of individuals required, sampling site locations, and a sampling schedule." –pdf page 15	Methods for collecting fish specimens are included in Sections 9.5.4.3 and 9.6.4.3, as fish collected in those study efforts will be sampled for fish diet analysis, scales, and stable isotope analyses. Detail of the number of specimens per species/life stage

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				(8 for diet and scales, 5 for stable isotopes) has been described in the methods (Section 9.8.4.5). Site locations will be finalized in the first quarter of 2013, with review and input from the TWG, a review of 2012 results, and a site reconnaissance visit to assess final candidate sites. Reaches where stations are to be located are indicated in RSP 9.8.4.2.1 and figures 9.8-1 and 9.8-2. Sampling sites will be located within Focus Areas established by the Instream Flow Study plan (Section 8.5.4.2.1.1). Specific details on site locations will be provided in the River Productivity Implementation Plan (Section 9.8.4.). Because river conditions can be unpredictable, timing of seasonal sampling events can only be tentatively set for April – early June for spring, late June – August for summer, and September/October for fall, subject to weather and river conditions (flow, stage).
RIVPRO-06	FERC	11/14/2012	"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." –pdf page 16	Marine derived nutrients (MDN) cannot be traced back to their source species. Stable isotope analysis can only detect the ^{15}N isotope levels that are indicative of having come from a marine source. Target fish species to be sampled for stable isotope analysis are those that are abundant in the middle river and will be coho and Chinook salmon juveniles, and rainbow trout adults and juveniles, as well as salmon carcasses, drifting invertebrates, benthic macroinvertebrates, organic matter, and algae. No other anadromous fishes spawn in sufficient abundance above RM 98 to allow for their inclusion as a component of marine derived nutrients.
RIVPRO-07	FERC	11/14/2012	"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.	Site locations will be finalized in the first quarter of 2013, after review and input from the TWG, a review of 2012 results, and a site reconnaissance visit to assess final candidate sites. Locations and the protocol used to select them will be described in the River Productivity

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			Please include in your RSP the frequency and timing of fish and macroinvertebrate sampling for this analysis." –pdf page 16	Implementation Plan that will be filed with FERC no later than March 15, 2013 (Section 9.8.4.) River conditions are unpredictable; therefore timing of seasonal sampling events can only be tentatively set. The study establishes sampling periods for April – early June for spring, late June – August for summer, and September/October for fall. Specific sampling dates within those periods will be determined by reviewing the hydrograph and weather patterns.for targeted seasonal flows. Development of thee targeted seasonal flows will be addressed in the River Productivity Implementation Plan.
RIVPRO-08	FERC	11/14/2012	"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." –pdf page 16	As described in Section 9.8.4.9, collection of baseline colonization rate data will occur in multiple habitat types to address two likely Project effects: changes in turbidity and temperature. The influences of turbidity and temperature on the benthic community colonization rates will be investigated for four habitat types, which would reflect varying conditions of these two factors. Due to the difficulty of isolating each of conditions under natural conditions, colonization will be examined under turbid/warm, clear/warm, turbid/cold, clear/cold conditions. AEA's proposed design does not include colonization rates in upwelling vs. non-upwelling areas because upwelling areas have multiple interrelated environmental factors that would effect colonization (e.g., nutrients, conductivity, flow, temperature, dissolved oxygen) which would prevent isolating individual Project effects. Sampling would be conducted for both study years. Sampling locations and scheduling will be deterimined after a review of 2012 results, from both AEA studies as well as data collected outside of AEA, and site reconnaissance visits to assess final candidate sites. Specific details on site locations will be provided in the

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				River Productivity Implementation Plan. Another potential Project effect is fluctuating water levels, resulting in a varial zone downstream of the dam. Colonization data collected from this study will be used as part of the varial zone model (Section 8.5.4.6), in order to address potential impacts of fluctuating flow releases on the benthic macroinvertebrate community.
RIVPRO-09	FERC	11/14/2012	"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." –pdf page 16	Section 9.8.4.2.1 indicates that shoreline bathymetry will be evaluated such that changes in water level must remain constant enough that accessible substrates remain continually inundated for a period of at least one month, to facilitate colonization of those substrates.
RIVPRO-10	ADF&G	11/14/2012	Section 7.8.4.2.1.Benthic Macroinvertebrate sampling." Should consider drill holes for winter macroinvertebrate sampling; probably safer than sampling winter open water sites." –pdf page 28	The additional resources required to conduct winter sampling is not warranted for this study. Aquatic insects in the Susitna River are largely univoltine (one generation); therefore, the generation sampled in the late fall before ice up would be representative of the overwintering population. The sample collections in the early spring before or during the initial ice out event would be the resulting population that had successfully overwintered (Section 9.8.4.2.1).
RIVPRO-11	ADF&G	11/14/2012	Section 7.8.4.2.1.Benthic Macroinvertebrate sampling. "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." –pdf page 28	See AEA's response to comment RIVPRO-09
RIVPRO-12	ADF&G	11/14/2012	Section 7.8.4.2.1.Benthic Macroinvertebrate sampling. "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." –pdf page 28	Sampling method is based on those detailed in Moulton et al. 2002, which states that each sample will be taken from separate snag pieces, but that snags may be at the same location, depending on abundance of woody debris at a site. Sampling details will be provided in the River

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				Productivity Implementation Plan filed with FERC no later than March 15, 2013 (Section 9.8.4.).
RIVPRO-13	ADF&G	11/14/2012	"Section 7.8.4.2.2 Benthic Algae Sampling Describe the methods that will be used for sampling and analysis." –pdf page 28	Algal sampling methods will follow the EPA's field operations procedures for periphyton single or targeted habitat sampling (Peck et al 2006; Barbour et al. 1999). Further details will be provided in the River Productivity Implementation Plan (Section 9.8.4.).
RIVPRO-14	ADF&G	11/14/2012	"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.)." –pdf page 28	Section 9.8.4.4 describes the proposed reference site feasibility study. One station will be established on the Talkeetna River, with a mainstem site and two off-channel habitat sites associated with the mainstem site. Benthic macroinvertebrate, algae, and drift sampling will occur during approximately the same periods as sampling in the Middle Susitna River Segment (Sections 9.8.4.2 and 9.8.4.3), with seasonal sampling during 2013 only. In the first quarter of 2014, sampling results from Talkeetna sites will be compared to results from similar sites in the Middle Susitna River Segment to determine whether the Talkeetna River would serve as a suitable reference site. See also RIVPRO-02 for response on analysis.
RIVPRO-15	ADF&G	11/14/2012	Section 7.8.4.7 Fish Diet "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?" –pdf page 28	As described in Section 9.8.4.7, species/life stages for diet analysis will be coho and Chinook salmon juveniles, and rainbow trout adults and juveniles. Stomach lavage with syringes will be used. This method has been shown to be effective at flushing stomach contents from juvenile salmonids with low mortalities. (personal comm. M. Wipfli, UAF). Further details regarding sample collection will be provided in the River Productivity Implementation Plan (Section 9.8.4.).
RIVPRO-16	ADF&G	11/14/2012	Section 7.8.4.7 Fish Diet "What sample preservation will be used? Need to consider prey condition after flushing. To what level of taxonomic resolution will samples be identified?" –pdf page 28	Section 9.8.4.7 indicates that stomach contents will be preserved with ethyl alcohol (not denatured) immediately. Further details regarding sample processing and levels of taxonomic resolution will be provided in the River Productivity Implementation Plan (Section 9.8.4.).

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RIVPRO-17	ADF&G	11/14/2012	"Section 7.8.4.9 Macroinvertebrate Colonization What is the artificial substrate material and likelihood it will influence colonization results?" –pdf page 28	Before any final decision on what artificial substrate design can be made, additional information is needed on flows, stream bed movement, public accessibility and the risk of vandalism, as well as natural substrates in the selected study sites, and considerations of logistics (transportation limitations). All artificial substrates display a bias towards colonization, but such bias can be corrected for with proper design (Rosenberg and Resh 1982). This information will be collected and synthesized Q1 2013, and the decision process used and the artificial substrate design selected will be described in the River Productivity Implementation Plan (Section 9.8.4.).
RIVPRO-18	USFWS	11/14/2012	"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. 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." –pdf page 108	AEA considers an annotated bibliography as beyond the scope and need of the study. A literature review that summarizes existing relevant literature will be sufficient to describe what is known about the effects of hydrodevelopment. The topic of effects on organic matter will be addressed in the literature review, in the context of how it is related to benthic communities as a food source. To the extent consistent with copyright laws, AEA will provide electronic copies of all publications cited in the review through the ARLIS library. The objective of the literature review is to review the current state of knowledge of the effects of hydropower operations on benthic macroinvertebrate and algal communities. The review, by its very nature, will identify effects upon the benthic communities as recorded in the literature. The literature review is a starting point in the assessment of potential effects, not the assessment itself. Identifying all potential Project effects would require having actual Project operation scenarios, which will not be available until late 2013.

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RIVPRO-19	USFWS	11/14/2012	"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." –pdf page 109	As described in Section 9.8.4.2.1, AEA's sampling design includes replicate measures to document the range of Project effects in the mainstem channel and off-channel locations within the Upper River Segment. Figure 9.8-2 includes two sampling stations (6 sites) in the Upper River Segment upstream of the inundation zone. The study no longer includes stations within the inundation zone. AEA does not agree that Project effects are likely to be greatest within the tributaries above the inundation zone, for the following reasons: 1) Changes to temperature, turbidity, and flow in the mainstem below the dam will be the greatest Project effects; 2) There is no information that fish populations will be concentrated within smaller areas within the tributaries. In fact, some fish populations may expand into the reservoir, and may benefit from the larger food base available there. The potential for fish population expansion into the reservoir will be addressed in Section 9.10. Production from the tributaries above the inundation zone will not be altered due to Project effects, and do not have a Project nexus. Therefore, quantification of benthic macroinvertebrates, algae, and drift is unnecessary
RIVPRO-20	USFWS	11/14/2012	"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." –pdf page 109	As described in Section 9.8.4.2.1, AEA's sampling design includes replicate measures to document the range of Project effects in the mainstem channel and off-channel locations in the Middle River Segment immediately below the proposed dam site. This study includes two sampling stations (6 sites) in the MR-1 and MR-2 reaches which will be located within Focus Areas established by the Instream Flow Study plan (Section 8.5.4.2.1.1). (See Figure 9.8-1). Selection of these locations for sampling was based on their proximity to the dam, where the largest Project effects are anticipated. Sampling within the Middle River Segment will occur within these multi-disciplinary Focus Areas, in an attempt

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				to correlate benthic community data with additional environmental data collected by other studies (water quality [Section 5.5], geomorphology [Section 6.5], and instream flow [Section 8.5]) also sampling in Focus areas. These sites are intended to provide a representation of benthic macroinvertebrates, algae, and their relationships in the food web of the Susitna River at the reach scale. Sites are designed as monitoring sites, to collect pre-Project baseline data at these locations for later comparisons to post-Project sampling, as well as to provide that data to various models that can be used to predict potential Project effects (IFIM and Varial Zone Modeling, Section 8.5.4.6.; Trophic Modeling, Section 9.8.4.5..) Specific details on site locations and sample sizes will be provided in the River Productivity Implementation Plan.
RIVPRO-21	USFWS	11/14/2012	"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	Section 9.8.4.2.1 includes the establishment of two sampling locations within this Middle River Segment, which will be located within Focus Areas established by the Instream Flow Study plan (Section 8.5.4.2.1.1). Specific details on site locations will be provided in the River Productivity Implementation Plan. The proposed two stations (6 sites) are intended to provide a representation of benthic macroinvertebrates, algae, and their relationships in the food web of the Susitna River at the reach scale. Sites are designed as monitoring sites, to collect pre-Project baseline data at these locations for later comparisons to post-Project sampling, as well as to provide that data to various models that can be used to predict potential Project effects (IFIM and Varial Zone Modeling, Section 8.5.4.6; Trophic Modeling, Section 9.8.4.5.) AEA does not agree that 10 sites are necessary or that

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			habitat values to upper classification levels will require sampling relative to, or quantification of, the abundance of these habitat characteristics within each macro-habitat." –pdf page 109	sampling needs to be replicated at the meso- and microhabitat levels. That level of detail is unnessary to address potential Project effects. Furthermore, river productivity at a meso- or finer habitat scale would be highly variable over time fluctuating with localized changes perhaps related to seasonal runoff, nutrient input, and turbidity fluctuations. AEA's proposed design assesses river productivity at a reach scale where localized effects will be diminished and the ability to detect potential effects from the Project will be enhanced. AEA's proposed approach achieves study objectives in a more cost-effective manner, with less risk of complications due to uncontrollable natural variation. AEA does not agree the extrapolation to the reach level requires sampling at the macro- and microhabitat levels. AEA is proposing a parsimonious design that will efficiently evaluate Project effects on algae and macroinvertebrate communities. AEA is confident that the River Productivity Study as designed with six sampling stations and seasonal sampling frequency will provide sufficient data to describe existing conditions, support rigorous modeling efforts that can be used to evaluate potential Project effects and will facilitate future monitoring needs.
RIVPRO-22	USFWS	11/14/2012	"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	AEA does not agree that 5 replicates per off-channel habitat location are necessary or that sampling needs to be replicated at the meso- and microhabitat levels. That level of detail is unnessary to address potential Project effects. Furthermore, river productivity at a meso- or finer habitat scale would be highly variable over time fluctuating with localized changes perhaps related to seasonal runoff, nutrient input, and turbidity fluctuations. AEA's proposed design assesses river productivity at a reach scale where localized effects will be diminished and the ability to detect

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			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." –pdf page 109	potential effects from the Project will be enhanced. This requested level of effort unnecessarily refocuses the study to the mesohabitat and microhabitat scale, which is in excess of that required to address the potential Project effects. Focused efforts at the reach scale at established representative locations using standardized sampling methods are sufficient in order to collect meaningful data to establish a pre-Project baseline, as well as to provide that data to various models that can be used to predict potential Project effects (IFIM and Varial Zone Modeling, Section 8.5.4.6.; Trophic Modeling, Section 9.8.4.5.). AEA's proposed approach achieves study objectives in a more cost-effective manner, with less risk of complications due to uncontrollable natural variation. See AEA's response to comment RIVPRO-21.
RIVPRO-23	USFWS	11/14/2012	"Algal sampling locations within the Middle River, including meso- and microhabitats should be elected independent of macroinvertebrates, as algae respond to different environmental variables and project effects will vary." –pdf page 110	As proposed in Section 9.8.4.2.2, algal sampling is conducted in conjunction with benthic macroinvertebrate sampling in order to correlate the two communities. Algae serves as a food resource to benthic macroinvertebrates, and can influence the distribution, abundance, and composition of the macroinvertebrate community. These sites are intended to provide a representation of benthic macroinvertebrates, algae, and their relationships in the food web of the Susitna River at the reach scale. Sites are designed as monitoring sites, to collect pre-Project baseline data at these locations for later comparisons to post-Project sampling, as well as to provide that data to various models that can be used to predict potential Project effects (IFIM and Varial Zone Modeling, Section 8.5.4.6.; Trophic Modeling, Section 9.8.4.5.).
RIVPRO-24	USFWS	11/14/2012	"Results should be able to provide information that can be used to	AEA concurs with the potential for high variability in these

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			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." –pdf page 110	results across habitats. Furthermore, AEA understands the need to determine the primary driver(s) of productivity in the Susitna River, be it algae, drift, organic matter. It is for these reasons AEA is proposing to evaluate river productivity at the reach level by determining not only the abundance of these nutrient and food resources but also how they are utilized by fish. As described in Sections 9.8.4.5, the River Productivity Study includes a robust trophic analysis, using bioenergetics modeling and stable isoptope analysis to assist in defining trophic relationships and explaining energy source pathways in the Susitna River food web (Section 9.8.5). Stable isotope analysis has the potential to trace the sources of productivity, stream-based vs. terrestrial vs. marine-derived, within the food web.
RIVPRO-25	USFWS	11/14/2012	"In order to calculate the production potential within sampling locations, samples also must be stratified by meso- and microhabitats." –pdf page 110	See AEA's response to comment RIVPRO-21 and RIVPRO-22.
RIVPRO-26	USFWS	11/14/2012	"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." –pdf page 110	The Lower Susitna River Segment, defined as the approximate 98-mile section of river between the Chulitna and Talkeetna rivers confluence and Cook Inlet, will not be sampled in this study, as it is anticipated that the larger influences of the Chulitna and Talkeetna rivers will attenuate Project operation effects, if any, that would affect benthic communities on the mainstem Susitna River below the confluence of the three rivers AEA will reevaluate how far downstream Project operational significant effects extend based in part upon the results of the Open-water Flow Routing Model (see Section 8.5.4.3), which is scheduled to be completed in Q1 2013. Thus, an initial assessment of the downstream extent of Project effects will be developed in Q2 2013 with input from the TWG. This assessment will include a review of information developed during the 1980s studies and study efforts initiated in 2012, such as sediment

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				transport (Section 6.5), habitat mapping (Sections 6.5 and 9.9), operations modeling (Section 8.5.4.2.2), and the Mainstem Open-water Flow Routing Model (Section 8.5.4.3). The assessment will guide the need to extend studies into the Lower River Segment and if needed, will identify which geomorphic reaches will be subject to detailed instream flow analysis in 2013. Results of this 2013 assessment will then be used to determine the extent to which the study should be modified to include sampling in the Lower River Segment in 2014.

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RIVPRO-27	USFWS	11/14/2012	"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." –pdf page 111	AEA concurs with the need to capture seasonal variability including potential peaks in algal growth when turbidity is lower. However, because river conditions can be unpredictable, timing of seasonal sampling events can only be tentatively set for April – early June for spring, late June – August for summer, and September/October for fall, subject to weather and river conditions (flow, stage). These collection periods would conincide with the Service's request. In order to address the effects of changing flow patterns on algae, baseline data will be collected to assess benthic community responses to storm events within side slough habitats. Sampling will be conducted both before and after storm events that meet or exceed a 1.5-yr flood event at two side sloughs sites located in two separate Focus Areas in the Middle River Segment between Portage Creek and Talkeetna (Section 8.5.4.2.1.1.). Samples will be collected at both the upstream and downstream ends of each slough, and will include benthic macro-invertebrates, algae, and organic matter. Sampling will be conducted for two storm events per year. Specific details on site locations and targeted flows will be will be based on information from the instream flow (Section 8.5). and geomorphology (Section 6.5) studies available in early 2013, and will be provided in the River Productivity Implementation Plan (Section 9.8.4.).

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RIVPRO-28	USFWS	11/14/2012	"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 Therefore, adopting a stratified random sampling and standardizing the mesohabitat conditions reduces contain riffles to sample. –pdf page 111	Sampling habitats which have coarser substrates and faster velocities, i.e., riffle/run habitats, focuses sampling efforts on those areas that are higher in macroinvertebrate diversity and abundances (Barbour et al 1999; Carter and Resh 2001; Moulton et al. 2002; Resh and Jackson 1993). Flow and substrate are considered among the most important controlling factors of benthic communities (Ward and Stanford 1979; Armitage 1984; Minshall 1984). As riffles and runs feature swift and turbulent flows, those habitats feature high dissolved oxygen, currents for both the transport of drifting insects and detritus, and an influence on substrate composition available (Hart and Finelli 1999). Coarser substrates generally provide more interstitial spaces for macroinvertebrates to use as refugia, as well as for the trapping of detritus for food (Hershey and Lamberti 2001; Rabeni and Minshall 1970). As a result, diversity and abundance generally increases with substrate stability and detritus (Minshall 1984). Riflle/run areas also offer a level of standardization in terms of habitat stratification, which reduces sample variability and facilitates comparisons among sites (Carter and Resh 2001; Resh and Jackson 1993; Klemm et al. 1990; Hilsenhoff 1988). The proposed sampling sites are intended to provide a representation of benthic macroinvertebrates, algae, and their relationships in the food web of the Susitna River at the reach scale (Section 9.8.4.2.1.) See also Table 9.8-1, and Figures 9.8-1 and 9.8-2. Sites are designed as monitoring sites, to collect pre-Project baseline data at these locations for later comparisons to post-Project sampling, as well as to provide that data to various models that can be used to predict potential Project effects (IFIM and Varial Zone Modeling, Section 8.5.4.6.; Trophic Modeling, Section 9.8.4.5.).

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RIVPRO-29	USFWS	11/14/2012	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 subsampling method should be included in the study plan." –pdf page 111	AEA does not agree that sampling needs to occur in both fine and coarse substrates because sampling across substrate types introduces site variablility, specifically regarding species compositions and abundances that would complicate evaluation of Project effects. AEA proposes a more robust sampling design which focuses sampling coarser substrates and faster velocities, i.e., riffle/run habitats, because: 1) those areas that are higher in macroinvertebrate diversity and abundances (Barbour et al 1999; Carter and Resh 2001; Moulton et al. 2002; Resh and Jackson 1993); 2) offer a level of standardization in terms of habitat stratification, which reduces sample variability and facilitates comparisons among sites (Carter and Resh 2001;Resh and Jackson 1993; Klemm et al. 1990; Hilsenhoff 1988). See also RIVPRO-28. AEA disagrees that rapid bioassessment protocol such as ASCI is appropriate to meet multiple study objectives. ASCI method is a rapid bioassessment method, intended to collect general information about an entire site or location, and all the various habitats within it. It combines all materials from all 20 samples collected from a variety of habitats into one sample, from which metrics are calculated that represent the site as a whole. While this is preferable to agencies that need to assess the health and conditions of mutliple streams region-wide, it is not an appropriate sampling method when setting up a study design that will require statistical comparisons among reaches, seasons, and years. This lack of replication, by reducing the sample size to one, will prevent any statistical analysis with other sites, time periods, and any pre- versus. post-Project comparisons. AEA agrees that a further disadvantage of the ASCI method is that it does not allow for determining macroinvertebrate density estimates.

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				AEA does not agree with averaging and compositing samples at a site. AEA believes replicate samples can be obtained within one habitat type. By employing a controlled sampling order, downstream to upstream, we can obtain truly independent replicate samples to faciliate statistical analyses. AEA concurs that field sorting of macroinvertebrates is not recommended. Full samples will be preserved in the field, and sorting and subsampling procedures will be conducting in a laboratory. Details on sorting and subsampling methods will be provided in the River Productivity Implementation Plan (Section 9.8.4.).
RIVPRO-30	USFWS	11/14/2012	"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 shouldm 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;	Algal sampling methods will be based upon the EPA's field operations procedures for periphyton single or targeted habitat sampling (Peck et al 2006; Barbour et al. 1999). As specified in these procedures, the recommended substrate/habitat combination is cobble obtained from riffles and runs with current velocities of 10-50 centimeters per second. Further details specific to algae sample collections, sample handling, and processing will be summarized from the EPA field

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			• 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." –pdf page 111	operations procedures in the River Productivity Implementation Plan (Section 9.8.4.).
RIVPRO-31	USFWS	11/14/2012	"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." –pdf page 112	AEA disagrees that the study objective does not reflect the importance of this topic of drift. Our objective of sampling invertebrate drift addresses what species, quantities, and sources of invertebrates are entering the water column as drift, and their availability to fish as food resources. This information is a critical component in the bioenergetics model, and is significant in evaluating Profect effects on the trophic transfer of energy in the Sustina aquatic community. As proposed in Section 9.8.4.3, drift sampling will be conducted at all six sampling stations, which include mainstem and off-channel habitat types.Site locations will be finalized in the first quarter of 2013, with input from the TWG, a review of 2012 results, and a site reconnaissance visit to assess final candidate sites. Specific details on sampling timing and frequency will be provided in the River Productivity Implementation Plan (Section 9.8.4.). Regarding sites in the inundation zone, drift above the inundation zone would not be expected to change due Project operation effects. See AEA's response to comment RIVPRO-19

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RIVPRO-32	USFWS	11/14/2012	"Sampling Locations 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." –pdf page 112	AEA disagrees that its drift sampling design will be inadequate for accomplishing study objectives. AEA's sampling design, which includes the establishment of two sampling locations (6 sites in total) within this Middle River Segment, is adequate to describe Project effects at the reach level. Project construction and operations are not expected to affect drift or fish populations within major tributaries (including the Chulitna and Talkeetna rivers) except within the zone of hydrologic influence (tributary mouths). Therefore, it is not necessary to document the contribution of tributaries to mainstem drift. Specific details on site locations will be provided in the River Productivity Implementation Plan (Section 9.8.4.). AEA does not agree that sampling at the macro- and microhabitat is necessary to evaluate Project effects. These sites are intended to provide a representation of benthic macroinvertebrates, algae, and their relationships in the food web of the Susitna River at the reach scale. Sites are designed as monitoring sites, to collect pre-Project baseline data at these locations for later comparisons to post-Project sampling, as well as to provide that data to various models that can be used to predict potential Project effects (IFIM and Varial Zone Modeling, Section 8.5.4.6.; Trophic Modeling, Section 9.8.4.5.).
RIVPRO-33	USFWS	11/14/2012	"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	Timing of life history events for coho and Chinook salmon, and rainbow trout (target species for trophic analysis) will be consulted when scheduling sampling efforts (Section 9.8.4.2.1.). As proposed, invertebrate drift sampling is conducted in support of the trophic analysis, specifically the bioenergetics model (Section 9.8.4.5.1.). AEA disagrees

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			quality for juvenile salmonids. Sample collection should occur in the early morning and evening to document densities during peak fish feeding activity." –pdf page 113	with the value to evaluate drift in relation to sockeye fry migration, Chinook and coho salmon migrations, as this sampling would not support sampling objectives, and would not feed into the bioenergetics model and trophic analysis. In the selection process for determining study sites, we will incorporate available information on distributions and habitat use of target species/life stages. Specific details on sampling locations, timing and frequency will be provided in the River Productivity Implementation Plan (Section 9.8.4.).
RIVPRO-34	USFWS	11/14/2012	"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." –pdf page 113	As proposed, invertebrate drift sampling is conducted in support of the trophic analysis, specifically the bioenergetics model (Section 9.8.4.5.1). AEA has added additional sampling specific to macroinvertebrate sampling in relation to storm events (Section 9.8.4.2.1). However, drift sampling is not included, as sampling would need to occur immediately during and after the flood event, to capture drift responses effectively. AEA believes the level of sampling described in the study plan (benthic macroinvertebrates, algae, and OM) is sufficient to address potential Project impacts. See AEA's response to comment RIVPRO-44. Literature review of hydropower effects on invertebrate drift is included as part of Objective 1 (Section 9.8.4.1.).
RIVPRO-35	USFWS	11/14/2012	"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	Information on drift sampling methods, including sample collection, preservation and processing will be fully described in the River Productivity Implementation Plan (Section 9.8.4.), to be filed with FERC no later than March 15, 2013. In Section 9.8.4.3., AEA included the use of an in-net flow meter.

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			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." –pdf page 113	
RIVPRO-36	USFWS	11/14/2012	"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." –pdf page 113	Since drift sampling is to be conducted in conjunction with benthic macroinvertebrates and algae samples, turbidity and photosynthethically active radiation (as an estimator of visibility/light penetration) will be collected during sampling (Section 9.8.2.2).
RIVPRO-37	USFWS	11/14/2012	"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." –pdf page 113	Section 9.8.4.3 provides additional information on measuring weights from the drift samples. Information on biomass and energy density of drifting prey items for use in the bioenergetics model (Section 9.8.4.5.1). Drifting terrestrial invertebrates from two stations will be utilized for stable isotope analysis. Additional information requested on sample processing will be described in the River Productivity Implementation Plan (Section 9.8.4.), to be filed with FERC no later than March 15, 2013.
RIVPRO-38	USFWS	11/14/2012	"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." –pdf page 113	Section 9.8.4.3 provides additional information on the use of results from drift sampling. Drift results will be compared to fish diet analyses, and the benthic macroinvertebrate data, to discern source of drift items and preference of drift items in fish diets. Drift results will also be utilized by the trophic analysis (Section 9.8.4.5). Enviromental data collected in conjunction with samples during the collection period (e.g., turbidity, flow, temperature, and possibly others) would serve as covariates in any statistical comparisions to other sites, seasons, years. Specific information requested on statistical design and

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				analysis will be described in the River Productivity Implementation Plan (Section 9.8.4.), to be filed with FERC no later than March 15, 2013.
RIVPRO-39	USFWS	11/14/2012	"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." –pdf page 113	See AEA's response to comment RIVPRO-14.
RIVPRO-40	USFWS	11/14/2012	"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." –pdf page 114	AEA is confident that the proposed approach for River Productivity will adequately document existing conditions and provide a rigorious data set that will support both modeling efforts that can be used in effect analysis as well as future monitoring needs. A literature review addressing documented impacts at existing hydroelectric facilities is included as an objective of this study (Section 9.8.4.1) and will be conducted early in 2013.
RIVPRO-41	USFWS	11/14/2012	AEA Study Objective 6 Comments on Objective 6 of the PSP: Level of effort (sampling locations, replication among macro- and mesohabitats, and sampling frequency) is insufficient to provide an adequate HSC. Diet preferences of target fish in the Susitna should be used to determine macroinvertebrate species HSC. 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, timing, and frequency. Methods to measure velocity at scales applicable to benthic organisms should be established. Alternatively, Froude number or sheer stress could be used. –pdf page 114	Section 9.8.4.6 details the process of developing HSC for benthic macroinvertebrates and algae communities and defines the purpose for HSC development in relation to macroinvertebrates and algae. Data for use in HSC development will be collected from Objectives 2, (Section 9.8.4.2), and Objective 9, (Section 9.8.4.9), and information in the literature. This approach is the most efficient to achieve study objectives and consistent with a reach level analysis of Project effects. HSC data collection will be replicated within habitat types. HSC species selection will consider diet preferences of target fish (See Section 9.8.4.6.) Additionally, HSC may be developed for guilds, by grouping taxa into guilds based on life histories, behavior, and functional feeding groups. Velocities will be measured at the stream bed level (Section 9.8.4.2.1.). This will be added to the RSP.

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				Additional information requested on field site selection, timing and frequency will be described in the River Productivity Implementation Plan (Section 9.8.4.), to be filed with FERC no later than March 15, 2013.
RIVPRO-42	USFWS	11/14/2012	"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." –pdf page 115	AEA's study objective, Section 9.8.4.7, does differ from the Service's study request objective. AEA agrees that while the importance of this objective is to determine the food resources used by fish within the Susitna River, the study does not need to address all age classes of non-salmon anadromous, resident and invasive fish species. The data collected by this objective is a critical component of the trophic analysis, and is therefore focused to provide fish dietary data to the bioenergetics model and stable isotope analysis for the targeted fish species and life stages chosen for that analysis (Section 9.8.4.5.1). These targeted fish species are coho and Chinook salmon juveniles, and rainbow adults and juveniles; fish stomach content samples will be collected from those species only. AEA has selected sampling locations in the Middle River Segment that are located among Focus Areas established by the Instream Flow Study, as described in Section 8.5.4.2.1.1. The Focus Areas to be sampled will be selected, in part, because of their importance in spawning and rearing habitat for the target species. Therefore, AEA has selected the sampling locations based upon the study objective. Methods for collecting fish specimens are included in Sections 9.5.4.3 and 9.6.4.3, as fish collected in those study efforts will be sampled for fish diet analysis, scales, and stable isotope analyses. Specific information on sampling design and methodology, and analysis will be described in the River Productivity

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				Implementation Plan (Section 9.8.4.), to be filed with FERC no later than March 15, 2013. See also AEA's response to comment RIVPRO-05

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RIVPRO-43	USFWS	11/14/2012	"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 macrohabitats 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?" –pdf page 115	AEA is not proposing investigations to such questions regarding organic matter system dynamics because such investigations would be focused on river processes, and less on the trophic community analysis that is the focus of this study. Results of such investigations would not be easily related/ correlated to the organisms of interest, i.e. macroinvertebrates and fish, and, therefore, would be difficult to use those results to predict project effects on those communities. In addition, each of these would require a specialized and extensive study involving development with or by other study plans. AEA believes that Section 9.8.4.8 sufficiently addresses the role of organic matter resources as it relates to the trophic analysis. Organic matter collection is included in the study plan in order to relate it as a food source available to the benthic community. Collecting and measuring BOM in conjunction with benthic macroinvertebrates reveals the amount of OM immediately available to those organisms, and as such, can indicate the influence such OM content can have on the distribution, abundance, and community structure of benthic macroinvertebrates (Rabeni and Minshall 1977; Minshall 1984). The sampling collections proposed, with additional information supplied by the stable isotope analysis proposed in Section 9.8.4.5.2, will provide information relating to Questions 1, 2, 6, and 10. In addition, the RSP proposes sampling pre-and post-storm (increased flow) events (Section 9.8.4.2.1). In order to address the effects of changing flow patterns on benthic macroinvertebrates, algae, and associated organic matter resources, baseline data will be collected to assess benthic community responses to storm events within side slough habitats. Sampling will be conducted both before and after storm events that meet or exceed a 1.5-yr flood event at two side sloughs sites located in two separate Focus Areas in the Middle River Segment between Portage Creek and Talkeetna (Section 8.5.4.2.1.1). Samples will be collected at both the upstream and downstream ends of each slough, and will include benthic macroinvertebrates, algae, and BOM. Sampling will be conducted for two storm events per year, and will provide

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RIVPRO-44	USFWS	11/14/2012	Comments on Objective 8 of the PSP: requests sample site in the mainstem above, below, and within major tributaries, as well as within each macrohabitat (multiple sites) and Seasons, and before and after storm events. recommends leaf packs to measure organic matter processing, or measures of ecosystem respiration. requests more detail on collection methods. –pdf page 116	AEA does not agree in the establishment of sampling sites focused on major tributaries nor at macrohabitat scales (See AEA's response to comment RIVPRO-19). Project construction and operations are not expected to affect organic matter within major tributaries except within the zone of hydrologic influence (tributary mouths). Therefore, it is not necessary to document the contribution of tributaries to mainstem organic matter. AEA agrees that sampling should occur in mainstem and lateral habitats, and across seasons. Section 9.8.4.8 provides information on the collection of organic matter in the study. In order to address the effects of changing flow patterns on BOM, baseline data will be collected to assess benthic community responses to storm events within side slough habitats (Section 9.8.4.2.1.). Sampling will be conducted both before and after storm events that meet or exceed a 1.5-yr flood event at two side sloughs sites located in two separate Focus Areas (Section 8.5.4.2.1.1.) in the Middle River Segment between Portage Creek and Talkeetna. Samples will be collected at both the upstream and downstream ends of each slough, and will include benthic macroinvertebrates, algae, and BOM. Sampling will be conducted for two storm events per year. AEA has not included leaf packs to measure organic matter processing, or measures of ecosystem respiration. The use of leaf packs to measure OM processing, while useful in detailed studies of organic matter dynamics, do not add relevant data to the trophic analysis that is the focus of the study plan. Stable isotope analysis is the tool that will be used to assess energy pathways of organic matter to benthic macroinvertebrates to fish (Section 9.8.4.5.2). See also AEA;s response to comment

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				RIVPRO-43. Specific details on collection methods, site locations, and targeted flows will be provided in the River Productivity Implementation Plan (Section 9.8.4.), to be filed with FERC no later than March 15, 2013.
RIVPRO-45	USFWS	11/14/2012	"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." –pdf page 117	Section 9.8.4.9 includes the objective to "Estimate benthic macroinvertebrate colonization rates in the Middle Susitna River Segment under pre-Project baseline conditions to assist in evaluating future post-Project changes to productivity in the Middle Susitna." As described in Section 9.8.4.9, the collection of baseline colonization rate data will occur in multiple habitat types to address two likely Project effects: changes in turbidity and temperature. The influences of turbidity and temperature on the benthic community colonization rates will be investigated for four habitat types, which would reflect varying conditions of these two factors. Due to the difficulty of isolating each of conditions under natural conditions, colonization will be examined under turbid/warm, clear/warm, turbid/cold, clear/cold conditions. Sampling locations and scheduling will be deterimined after a review of 2012 results, from both AEA studies as well as data collected outside of AEA, and site reconnaissance visits to assess final candidate sites. Another potential Project effect is fluctuating water levels, resulting in a varial zone downstream of the dam. Colonization data collected from this study will be used as part of the varial zone model (Section 8.5.4.6), in order to address potential impacts of fluctuating flow releases on the benthic macroinvertebrate community. Specific details on site locations will be provided in the

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				River Productivity Implementation Plan (Section 9.8.4.), to be filed with FERC no later than March 15, 2013.
RIVPRO-46	USFWS	11/14/2012	Unaddressed Service objective: recommends that AEA develop a study plan to survey *Macoma balthica* in the Susitna River Flats; to determine the factors influencing their abundance, distribution, and availability to overwintering shorebirds; and determine how Project operations may affect their abundance and distribution. –pdf page 117	The population of bivalve species *Macoma balthica* is the food supply of overwintering Bering race of Rock Sandpipers in the Susitna River flats. This intertidal habitat is located in the lower few miles of the Susitna River. The Lower Susitna River Segment will not be sampled in this study, as the larger influences of the Chulitna and Talkeetna rivers will attenuate Project operation effects, if any, that would affect benthic macroinvertebrate communities on the mainstem Susitna River below the Three Rivers Confluence. AEA will reevaluate how far downstream Project operational significant effects extend based in part upon the results of the Open-water Flow Routing Model (see Section 8.5.4.3), which is scheduled to be completed in Q1 2013. Thus, an initial assessment of the downstream extent of Project effects will be developed in Q2 2013 with review and input of the TWG. This assessment will include a review of information developed during the 1980s studies and study efforts initiated in 2012, such as sediment transport (Section 6.5), habitat mapping (Sections 6.5 and 9.9), operations modeling (Section 8.5.4.2.2), and the Mainstem Open-water Flow Routing Model (Section 8.5.4.3). The assessment will guide the need to extend studies into the Lower River Segment and if needed, will identify which geomorphic reaches will be subject to detailed instream flow analysis in 2013. Results of the 2013 studies would then be used to determine the extent to which Lower River Segment studies should be adjusted in 2014.
RIVPRO-47	NMFS	11/14/2012	"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	See AEA's response to comment RIVPRO-18.

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			accomplish this task (Le. 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." –pdf page 137	
RIVPRO-48	NMFS	11/14/2012	"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." –pdf page 137	AEA does not agree that sampling macroinvertebrates should be developed around fish distribution and production. AEA's sampling design is reach based in order to evaluate potential Project effects by study reach. This study plan is designed to collect pre-Project baseline data at a number of locations that are representative of habitats important to fish populations in the Susitna River. Sampling at these locations is intended to provide a representation of benthic macroinvertebrates, algae, and their relationships in the food web of the Susitna River at the reach scale. Pre-Project baseline data is collected for later comparisons to post-Project sampling, as well as to provide that data to various models that can be used to predict potential Project effects (IFIM and Varial Zone Modeling, Section 8.5.4.6.; Trophic Modeling, Section 9.8.4.5.) In addition, AEA will consider existing information fish distribution and habitat use when determining specific sites for sampling to support the trophic analysis.
RIVPRO-49	NMFS	11/14/2012	"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." –pdf page	The study plan includes information on insect emergence sampling methods, design, and data analyses. Section 9.8.4.2.1 describes the use and deployment of floating emergence traps at each site to determine both the timing and the amount of adult insect emergence from the Susitna River. Adult aquatic insect emergence mass is a product of aquatic insect production from the stream and

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			138	is therefore a good surrogate for actual production (minus predation). Trapped adults will be identified, enumerated, and weighed. Staple isotope analysis wil be conducted on specimens from 2 sampling stations (6 sites). Exact trap design, processing methods, and analyses will be detailed in the River Productivity Implementation Plan (Section 9.8.4.), to be filed with FERC no later than March 15, 2013.
RIVPRO-50	NMFS	11/14/2012	"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." –pdf page 138	See AEA's response to comment RIVPRO-19.

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RIVPRO-51	NMFS	11/14/2012	"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 postproject statistical evaluation of changes to the macro-invertebrate and algal communities." –pdf page 139	As described in Section 9.8.4.2.1, AEA's sampling design includes replicate measures to document the range of Project effects in the mainstem channel and off-channel locations in the Middle River Segment immediately below the proposed dam site. Two sampling stations (6 sites) in the MR-1 and MR-2 reaches which will be located within Focus Areas established by the Instream Flow Study plan (Section 8.5.4.2.1.1); see Figure 9.8-1. Selection of these locations for sampling was based on their proximity to the dam, where the largest Project effects are anticipated. AEA does not agree that 5 sites are necessary or that sampling needs to be replicated at the meso- and microhabitat levels. That level of detail is unnessary to address potential Project effects. Furthermore, river productivity at a meso- or finer habitat scale would be highly variable over time fluctuating with localized changes perhaps related to seasonal runoff, nutrient input, and turbidity fluctuations. AEA's proposed design assesses river productivity at a reach scale where localized effects will be diminished and the ability to detect potential effects from the Project will be enhanced. AEA's proposed approach achieves study objectives in a more cost-effective manner, with less risk of complications due to uncontrollable natural variation. AEA has proposed a reference site feasibility study on the Talkeetna River, as described in Section 9.8.4.4. One station will be established on the Talkeetna River, with a mainstem site and two off-channel habitat sites associated with the mainstem site. Benthic macroinvertebrate, algae, and drift sampling will occur during approximately the same periods as sampling in the Middle Susitna River Segment (Sections 9.8.4.2 and 9.8.4.3), with seasonal sampling during 2013 only. See AEA's response to comment RIVPRO-14.

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RIVPRO-52	NMFS	11/14/2012	"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." –pdf page 139	See AEA's response to comment RIVPRO-21.
RIVPRO-53	NMFS	11/14/2012	"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." –pdf page 139	See AEA's response to comment RIVPRO-21.
RIVPRO-54	NMFS	11/14/2012	"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	See AEA's response to comment RIVPRO-22.

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			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 offchannel 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." –pdf page 140	
RIVPRO-55	NMFS	11/14/2012	"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." –pdf page 140	See AEA's response to comment RIVPRO-23.
RIVPRO-56	NMFS	11/14/2012	"Results should be able to provide information 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." –pdf page 140	See AEA's response to comment RIVPRO-24. AEA's approach to sampling will not be haphazard. AEA's approach stratifies sampling by reach upstream and downstream of the Watana Dam site, factoring in Project effects of flow, temperature, and turbidity on benthic macroinvertebrates, algae, and organic matter. AEA expects Project effects to be greatest in the Middle River Segment and has focused the bulk of sampling therein, with additional sampling upstream of the inundation zone above potential Project effects. In anticipation that Project effects will vary between mainstem and lateral habitats, we have included three sampling sites per station to address potential Project effects across the channel.
RIVPRO-57	NMFS	11/14/2012	"In order to calculate the production potential within sampling locations, samples also must be stratified by meso- and micro-habitats." –pdf page 140	See AEA's response to comment RIVPRO-25.
RIVPRO-58	NMFS	11/14/2012	"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 ofBOM and invertebrate drift to lower river sites.	See AEA's response to comment RIVPRO-26. As described in Section 9.8.4.2.1, AEA proposed baseline data collection to assess the benthic community responses to storm events within side slough habitats. Sampling will be conducted both before and

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			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." –pdf page 141	after storm events that meet or exceed a 1.5-year flood event at two side slough sites, located in two separate Focus Areas in the Middle River Segment between Portage Creek and Talkeetna (Section 8.5.4.2.1.2). Additional sampling detail is provided in Section 9.8.4.2.1. Study site selection will be provided in the River Productivity Implementation Plan that will be filed with FERC on March 15, 2013.
RIVPRO-59	NMFS	11/14/2012	"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	See AEA's response to comment RIVPRO-27.

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			influencing algal productivity." –pdf page 141	
RIVPRO-60	NMFS	11/14/2012	"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 Therefore, adopting a stratified random sampling and standardizing the mesohabitat conditions reduces contain riffles to sample. –pdf page 111	See AEA's response to comment RIVPRO-28.
RIVPRO-61	NMFS	11/14/2012	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 subsampling method should be included in the study plan." –pdf page 111	See AEA's response to comment RIVPRO-29.
RIVPRO-62	NMFS	11/14/2012	"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 shouldm 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;	See AEA's response to comment RIVPRO-30.

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			• 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." –pdf page 111	
RIVPRO-63	NMFS	11/14/2012	"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." –pdf page 111	See AEA's response to comment RIVPRO-31.
RIVPRO-64	NMFS	11/14/2012	"Sampling Locations 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 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). 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." –pdf page 144	See AEA's response to comment RIVPRO-32.

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RIVPRO-65	NMFS	11/14/2012	"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." –pdf page 144	See AEA's response to comment RIVPRO-33.
RIVPRO-66	NMFS	11/14/2012	"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." –pdf page 144	See AEA's response to comment RIVPRO-34.
RIVPRO-67	NMFS	11/14/2012	"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 Ilm 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." –pdf page 144	See AEA's response to comment RIVPRO-35.

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RIVPRO-68	NMFS	11/14/2012	"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." –pdf page 145	See AEA's response to comment RIVPRO-36.
RIVPRO-69	NMFS	11/14/2012	"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." –pdf page 145	See AEA's response to comment RIVPRO-37.
RIVPRO-70	NMFS	11/14/2012	"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. Posthoc 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." –pdf page 145	AEA is collecting data suited for a before-after-control-impact sampling design, in order to evaluate future post-Project effects. AEA is not convinced that an *a priori* power analysis is possible due to a lack of data on the variation between pre- and post-Project communities; in lieu of conducting a power analysis, AEA has utilized recommendations from the literature that specify at sample size of 3-5 replicates is standard among macroinvertebrate sampling studies (Resh and McElravy 1993; Klemm et al 1990). AEA also considered sampling methods used in the 1980s Susitna studies (Hansen and Richards 1985; Trihey and Associates 1986) Specific information on statistical design and analysis will be described in the River Productivity Implementation Plan (Section 9.8.4.), to be filed with FERC no later than March 15, 2013.
RIVPRO-71	NMFS	11/14/2012	"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	See AEA's response to comment RIVPRO-14.

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			comment until that time." –pdf page 145	
RIVPRO-72	NMFS	11/14/2012	"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." –pdf page 146	See AEA's response to comment RIVPRO-40.
RIVPRO-73	NMFS	11/14/2012	Comments on Objective 6 of the PSP: Level of effort (sampling locations, replication among macro- and mesohabitats, and sampling frequency) is insufficient to provide an adequate HSC. Diet preferences of target fish in the Susitna should be used to determine macroinvertebrate species HSC. 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, timing, and frequency. Methods to measure velocity at scales applicable to benthic organisms should be established. Alternatively, Froude number or sheer stress could be used. –pdf page 146	See AEA's response to comment RIVPRO-41.
RIVPRO-74	NMFS	11/14/2012	"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.	See AEA's response to comment RIVPRO-42.

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			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." –pdf page 146	
RIVPRO-75	NMFS	11/14/2012	"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 ofBOM result in anaerobic conditions in sloughs during winter? 9. How important are flood flows for the accrual ofBOM 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?" –pdf page 149	See AEA's response to comment RIVPRO-43.
RIVPRO-76	NMFS	11/14/2012	"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	See AEA's response to comment RIVPRO-44.

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			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." –pdf page 150	
RIVPRO-77	NMFS	11/14/2012	"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	See AEA's response to comment RIVPRO-45.

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			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." 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." –pdf page 151	

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AQHAB-01	CWA	11/14/2012	Scope is insufficient in studying the Lower River based on AEA's apparent assumption that Project effects will not significantly affect the Lower River aquatic habitats. –pdf page 7	AEA is not assuming an insignificant Project-related effect on instream flow in the Lower River Segment. However, due to the direct relationship between flow and physical habitat changes that may result in barriers, the study elements described in the study are concentrated within the Upper and Middle River Segments. Project operations related to reservoir creation, load-following, and variable flow regulation will have the greatest potential effects on these segments of the river. In addition, flow effects will attenuate in a downstream direction as channel morphologies change, tributary inflows are added and flow accretion occurs. The downstream boundary of the Study Area is currently RM 98 because existing information indicates that the hydraulic effects of the project below the three river confluence is significantly attenuated. See Section 9.9.3. However, AEA will reevaluate how far downstream Project operational significant effects extend based in part upon the results of the Open-water Flow Routing Model (see Section 08.5.4.3), which is scheduled to be completed in Q1 2013. Thus, an initial assessment of the downstream extent of Project effects will be developed in Q2 2013 with review and input of the TWG. This initial assessment includes a review of information developed during the 1980s studies and study efforts initiated in 2012, such as sediment transport (Section 6.5), habitat mapping (Sections 6.5 and 09.9), operations modeling (Section 8.5.4.2.2), and the Mainstem Open-water Flow Routing Model (Section 8.5.4.3). The assessment will guide the need to extend studies into the Lower River Segment.
AQHAB-02	FERC	11/14/12	"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	AEA has revised the terminologies for channel and habitat category descriptions and definitions i to be consistent with terminologies used in the Geomorphology Study, Characterization, Mapping of Aquatic Habitats Study, and any other related studies.

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			HSC Study Site Selection, you refer to a percolation channel, a term that is not used elsewhere." –pdf page 10	
AQHAB-03	FERC	11/14/2012	"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." –pdf page 10	Section 9.09 is revised to clarify locations for line-mapping versus polygon mapping and to clarify how on-the-ground mapping will be used. Referring to Table 9.9-4, of Study 9.9, main channel habitat will be typed to Level 4 (Mesohabitat) throughout the entire Middle River hydrologic segment using the line segment method. Mesohabitat for Level 4 includes pool, glide, run, riffle, and rapid. Cascade type is eliminated in the study, as there are no cascades in the main channel of the Middle or Upper rivers. Off-channel habitats will be typed to Level 3. Level 3 off-channel habitat types include side slough, upland slough, backwater, and beaver complex (these off-channel types are also referred to as macrohabitat in the study. Level 3 Slough and Upland Slough habitat types will be delineated by polygons as opposed to the mainstem, which will be delineated by line segments. Section 9.9.5.4 is revised to clarify. As stated in the Section 9.9.5.4, a sub-set of off-channel and main channel habitat units will be ground mapped and will include metrics described for tributaries, e.g. depth, width, wood, cover, etc., as appropriate for off-channel and main channel habitats. In addition, all off-channel and main channel types in the Instream Flow Study Focus Areas will be surveyed. 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. Whether Focus Areas are representative of the range of off-channel types in the Middle river can then be determined.
AQHAB-04	USFWS	11/14/2012	"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	AEA disagrees with the USFWS statement that "the relationship between these classification types [sloughs, side channels, percolation channels, etc] and the distribution or abundance of any fish species has not been established." It is AEA's opinion that the

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			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".' –pdf page 122	selectivity of these channel types by different species and life stages in the Susitna and other rivers is well established. Differential utilization by fish is due to differences in unique microhabitats offered by the different types of channels. The selection of the various channel types is based less on the degree of connection to the main channel, as suggested by the USFWS, than by the preference by different species and life stages of the microhabitats contained in these different channel types. Section 9.9.5.4 includes classification to mesohabitat type for the main channel of the entire Middle and Upper rivers and to tributaries within the zone of hydrologic influence in the Middle River and the length of the study area for Upper River tributaries. Regarding the use of the term "habitat", unless AEA uses the terms macro, meso, or micro, the term "habitat" is used in the general context or meaning of the word.
AQHAB-05	USFWS	11/14/2012	"The next level of classification is defined as "meso-habitat" and the PSP argues that mesohabitat 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." –pdf page 123	The study includes a separate classification system for the mainstem versus tributaries. The nested and hierarchical classification system for both tributaries and mainstem address most of the USFWS comment. AEA does not agree with the USFWS statement that "There is no indication that this classification [fast versus slow water] based on water velocity is related to fish habitat selection." On the contrary, inherent in any fish habitat classification system is the microhabitat variable of water velocity. Velocity is a fundamental habitat-use-criteria for differential utilization of habitat at both the species and life stage levels. The use of fast and slow water at the higher hierarchical level is standard and completely appropriate. AEA agrees with the USFWS that the "fast and slow water" hierarchical level is less applicable in the mainstem and more applicable in the tributaries. This difference is reflected in the study plan.

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AQHAB-06	USFWS	11/14/2012	"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." –pdf page 123	Habitat definitions and classifications in the study were revised from the PSP to be more clear and consistent within and across all studies, particularly the instream flow study and the geomorphology studies. Regarding USFWS's microhabitat comment, microhabitat is typically not mapped in habitat mapping. Habitat mapping stops at the mesohabitat level. Microhabitat is generally "mapped and measured" using an instream flow model as is proposed in Study 8.5. A fundamental assumption of PHABSIM or similar instream flow method is that if mesohabitats are adequately represented in the instream flow model then associated microhabitats will be adequately represented in the instream flow model. The nested and hierarchical channel and habitat classification system as described in Section 9.09 is not designed or intended to be representative of fish distribution or habitat site selection. Its purpose is to determine the variability, distribution, frequency, and structure of the range of habitat types in the study area available for fish use.
AQHAB-07	USFWS	11/14/2012	"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." –pdf page 123	The scale of delineation, application, and use of aerial video for channel and habitat mapping and how it will be complemented with ground surveys are described in detail in Sections 9.9.5.2 and 9.9.5.3..
AQHAB-08	USFWS	11/14/2012	"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	Off-channel habitats in both the Middle and Upper rivers will be delineated and channel typed using a combination of still aerial imagery, LiDAR, and, where visible using aerial video. A sub-set of representative off-channel types will be ground mapped to the mesohabitat level. This approach is clearly described in the Section 9.9.5.4. Mainstem is defined as all channel types within the zone of hydrologic influence of the Susitna River. This includes tributaries

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			would be compromised if some habitats are missed due to the inability of aerial imaging to capture them." –pdf page 123	up to the upper limit of hydrologic influence. The mainstem does not include tributaries or ponds above the limit of hydrologic influence. As stated in the Sections 9.9.5.4.1 and 9.9.5.4.1, a sub-set of off-channel and main channel habitat units will be ground mapped and will include metrics described for tributaries, e.g. depth, width, wood, cover, etc., as appropriate for off-channel and main channel habitats. In addition, all off-channel and main channel types in the Instream Flow Study Focus Areas will be surveyed. 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. Section 9.9.5.4.2.
AQHAB-09	USFWS	11/14/2012	"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." –pdf page 123	Aerial video will only be used where the stream is clearly visible and mesohabitat types are clearly discernible. Aerial video will only be used for determining reach type, channel type, and mesohabitat type. Ground truthing will be used to both sub-sample the video mapping and help "calibrate" the video mapper's eye. Sections 9.9.5.3.2 and 9.9.5.4.2describes the details for the ground mapping component. Regarding reliability or "accuracy" of aerial video for habitat typing,Section 9.9.5.3.1 describes testing of its reliability. The test demonstrated the reliability of the method. The method has been successfully applied on several FERC relicensings. Mesohabitat typing is best done at a low to moderate flow. This is the flow that visually best represents the habitat type that is created by the underlying bed structure. Bed structure does not change from flow to flow. Pools, riffles, runs, glides, etc are created by the underlying channel, bed structure, and substrate.
AQHAB-10	USFWS	11/14/2012	"It is most concerning that the video mapping data will only be collected in mid to late September when flows are expected to	Video mapping at a high flow would not be effective for delineating habitat types. As described above in AEA's response to comment

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			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." –pdf page 123	AQHAB-09, habitat mapping is best done at a low to moderate flow. Video taping at a high flow would only show the spatial extent of channel and floodplain inundation. Visibility into the water column would be almost zero and habitat types, such as pools, riffles, and runs would be indistinguishable. GIS maps showing water depth and the water's edge overlays using flow routing results would be a much better tool for understanding the spatial extent and inundation at high flow. Also, the objectives of other study plans include consideration of high flows. the Instream Flow Study, Section 8.5, includes modeling microhabitat at multiple flows, including high flows. The Geomorphology Study, Section 6.5, includes obtaining aerial still imagery of the river at multiple flows.
AQHAB-11	USFWS	11/14/2012	"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." "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.)" "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." –pdf page 124	Section 9.9 is revised to more clearly describe the methods to determine the distribution and frequency of main channel and tributary mesohabitats that may be lost due to impoundment in the Upper River. Section 9.9.5. AEA agrees with the USFWS statement that "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.)" Section 9.9.5 provides that the emphasis of habitat mapping in the Upper River is the distribution and frequency of mesohabitat types. These data will then be used in combination with fish habitat associations (Fish Distribution and Abundance Study in the Upper Susitna River, Section -9.05) to determine fish distribution and relative abundance. All Upper River off-channel habitat types in the main channel will be typed and mapped to Level 3 as described in the Section 9.9.5.4.1. A representative sub-set will be mapped to Level 4

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				(mesohabitat) as described in the RSP.
AQHAB-12	USFWS	11/14/2012	"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". "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." "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 un-vegetated 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." –pdf page 124	AEA has not adopted USFWS' recommended approach because . . . . As described in Section [insert], the study applies the hierarchical and nested channel and habitat classification system. The study's classification system embodies all of the habitat constituents and levels (down to the mesohabitat level) that are included in the recommended USFWS classification table presented on page 126 of the USFWS Comment letter. AEA does not agree that its classification system ignores the fundamental influences of ground and surface water exchanges in its classification system. Classification by slough, side channel, upland slough, etc. inherently classifies channels and habitats of different hydrology or connectivity to the main channel. The habitat mapping method proposed in the study does not extend to the microhabitat level, which is the typical limit of habitat mapping. Microhabitat constituents of hydraulics, water quality, substrate, and cover are "micro" mapped and analyzed by application of an instream flow model such as PHABSIM. The "lateral main channel" mapping method proposed in Section 09.9 maps and quantifies edge habitat separately from mesohabitat typing (Section 9.9.5.5). Also, as stated above, classification by slough, side channel, upland slough, etc. inherently classifies channels and habitats of different hydrology or connectivity to the main channel, thereby differentiating between channel types and habitat types preferentially selected by different species and life-stages.
AQHAB-13	USFWS	11/14/2012	"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.	AEA has clarified the study objectives described in Section 9.9.2 regarding the Upper River.. Section 9.9.5.5 addresses lakes to be mapped that are potentially inundated by the reservoir. The study includes a nested hierarchical classification system that

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			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." –pdf page 125	incorporates the FWS recommendations. Sections 9.9.5.3.2.1 and 9.9.5.3.2.2 described the habitat classification system for tributaries. Study methods described in Section 9.9 will provide necessary data to quantify the spatial extent and types of habitat lost due to inundation of the lower sections of Upper River tributaries. Sections 9.9.5. and 9.9.5.3.
AQHAB-14	USFWS	11/14/2012	Though AEA agrees 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. –pdf page 126	Regarding USFWS's microhabitat comment, microhabitat is typically not mapped in habitat mapping. Habitat mapping stops at the mesohabitat level. Microhabitat is generally "mapped and measured" using an instream flow model as is proposed in Study 8.5. A fundamental assumption of PHABSIM or similar instream flow method is that if mesohabitats are adequately represented in the instream flow model then associated microhabitats will be adequately represented in the instream flow model. AEA does not agree that the classification system described in Sections 9.9.5.3 and 9.9.5.5 ignores the fundamental influences of ground and surface water exchanges in its classification system. Classification by slough, side channel, upland slough, etc. inherently classifies channels and habitats of different hydrology or connectivity to the main channel. Regarding a nested hierarchical classification system See AEA's response to comment AQHAB--13.
AQHAB-15	NMFS	11/14/2012	"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 main	NMFS suggests that the habitat classification system be in line with geomophological characteristics that drive habitat classification at the reach level. NMFS also suggests using the Rosgen typing methodology. Section 9.9 presents a nested hierarchical classification system

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			stem 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." –pdf page 157	that AEA believes incorporates NMFS' comments and recommendations. Moreover, the classification system used in Section 9.9 (and other dependent studies) must integrate with the channel classification system used in the Geomorphology Study Section 6.5. AEA's habitat classification system described in the Section incorporates concepts of the Rosgen classification system. A habitat classification system for tributaries is clearly described in the Sections 9.9.5.3.2.1 and 9.9.5.3.2.2.
AQHAB-16	NMFS	11/14/2012	"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." –pdf page 157	Regarding a nested hierarchical classification system, see AEA's response to comment AQHAB-15.
AQHAB-17	NMFS	11/14/2012	"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." –pdf page 157	The study presents a nested hierarchical classification system that incorporates NMFS' comments and recommendations. Moreover, the classification system used in study (and other dependent studies) must integrate with the channel classification system used in the Section 6.5. AEA's habitat classification system described in the RSP incorporates concepts of the Rosgen classification system. The study presents a nested hierarchical classification system that

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				incorporates the NMFS recommendation to apply a different classification system for Upper River high gradient tributaries than for the large low-gradient floodplain rivers of the mainstem Susitna River. The two classification systems are clearly described in Sections 9.9.5.3 and 9.9.5.5.
AQHAB-18	NMFS	11/14/2012	"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. –pdf page 157"	See AEA's response to comment AQHAB-9.
AQHAB-19	NMFS	11/14/2012	"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	.See AEA's response to comment AQHAB-9.

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			show more inaccuracies than actually exist. Therefore, methods must be developed to evaluate the accuracy of habitat mapping based upon aerial videos." –pdf page 157	
AQHAB-20	NMFS	11/14/2012	"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." –pdf page 158	See AEA's response to comment AQHAB-9.
AQHAB-21	NMFS	11/14/2012	"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 macrohabitat level (i.e. off-channel habitats) to determine the overall distribution offish 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	AEA has clarified the Study Objective 3 regarding study objectives in the Upper River. Section 9.9.2. Study methods described in the study will provide necessary data to quantify the spatial extent and types of habitat lost due to inundation of sections of the Upper River tributaries. Section 9.9.5. and 9.9.5.3.. Sections 9.9.5.4.1 and 9.9.5.4.1 describes the methods for mapping off-channel habitat types.

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			abundant suitable habitat for a variety of species and should be addressed." –pdf page 158	
AQHAB-22	NMFS	11/14/2012	"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." –pdf page 159	The study includes a nested hierarchical classification system, which incorporates the NMFS recommendations. Sections 9.9.5.3.2.1 and 9.9.5.3.2.2 includes a habitat classification system for tributaries.
AQHAB-23	NMFS	11/14/2012	"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	Section 9.9.5.3.2.1 includes a clear definition of the Tier Levels and macrohabitat and mesohabitat types in both tributaries and the mainstem. Categorization by slough, side channel, and upland slough inherently classifies channels and habitats into different degrees of hydrology or connectivity to the main channel.

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			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." –pdf page 159	AEA will map and analyze microhabitat constituents of hydraulics, water quality, substrate, and cover through applying an instream flow model such as PHABSIM.
AQHAB-24	NMFS	11/14/2012	"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." –pdf page 159	See AEA's response to comment AQHAB-01.
AQHAB-25	NMFS	11/14/2012	"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 microhabitat characteristics must also be established. Current upper river fish study plan methods have not been developed to establish these relationships." –pdf page 160	Regarding "Study Objective 3" See AEA's response to comment AQHAB-13. AEA agrees that the emphasis of habitat mapping in the Upper River (Section 9.9.5) is the distribution and frequency of mesohabitat types. These data will then be used in combination with fish habitat associations (Fish Distribution and Abundance Study in the Upper Susitna River – Section 9.5) to determine relative use of habitat types relative abundance.

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AQHAB-26	NMFS	11/14/2012	"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 L WD 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." –pdf page 160	Regarding a nested hierarchical classification system See AEA's response to comment AQHAB-15. Section9.9.5.5 includes mapping of lakes that are potentially inundated by the reservoir.

The Future Watana Reservoir Fish Community and Risk of Entrainment Study				
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RESFSH-01	NMFS	11/14/2012	"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." – pdf page 162	AEA concurs with the request to include evaluation of the potential development of a future reservoir that may support commercial and subsistence fisheries as a management alternative for the future reservoir fish community. The Study includes this evaluation as an objective (see Section 9.10.1.1) and task (see task 4 in Section 9.10.4.2).
RESFSH-02	NMFS	11/14/2012	"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. 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." – pdf page 163	Although currently available information suggests that under the current flow regime only Chinook are able to navigate the rapids at Devils Canyon, AEA concurs with the request to include an assessment of the enhancement potential for Chinook, sockeye, chum, and Coho salmon within the future reservoir fish community and entrainment analysis (see Section 9.10.2). The evaluation of the potential establishment of new fisheries is beyond the scope of this study as it would require Alaska State regulatory change and state commission actions.

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PASS-01	CSDA	11/14/2012	"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." – pdf page 3	As explained in Section 9.11.2, both adult and juvenile Chinook salmon have been documented upstream of the proposed Watana Dam site. In addition there are other migratory species for which distribution has been documented both upstream and downstream of the proposed dam. Thus, this study address the engineering feasibility of designing fish passage facilities to provide an effective means of passing these fish species around the proposed dam. As described in Section 9.11.4 Task 2, the study will begin with a review of biological data available from the 5 years of study in the 1980s as well as additional studies recently conducted in the upper river. The study will incorporate new information collected by AEA in 2012, 2013, and 2014. These data will provide the basis of the feasibility assessment. Furthermore, critical information needs will be evaluated by the Fish Passage Technical Workgroup (TWG) at the beginning of the study with the intent of incorporating those data needs into 2013 and 2014 data collection efforts (see Section 9.11.4 Task 1). Additional years of data collection are not needed to improve the quality of the data necessary to determine passage feasibility. See also AEA's response to comment FISH-01 and FISH-02.
PASS-02	Ransy, Denis	11/14/2012	"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." – pdf page 1	AEA has planned for multiple studies to address distributions and movements of fish above and below Devils Canyon. Objectives of these studies are described in Section 9.5.1 and 9.6.1 and methods to accomplish these include: 1) radio-tagging adult Pacific salmon and resident migratory fishes, 2) fish tagging and trapping, and 3) year round fish sampling at more than 200 different sites within the Middle and Upper River. The Study of Fish Passage Feasibility at Watna Dam will be initiated using existing data and will incorporate data from the new studies as it becomes available. See Section 9.11.7 and Figure 9.11-1 for details regarding interdependencies between these studies and the Fish Passage Study.
PASS-03	NMFS	11/14/2012	NMFS would like to stress that this guidance does not indicate that 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	As described in the AEA's response to comment PASS-08, the study has included economic factors in the feasibility study solely for evaluating the cost effectiveness of various fish passage alternatives. This study is limited to analyzing the feasibility of fish

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			revised to clarify that 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. – pdf page 172	passage and does not analyze the benefits of fish passage at the proposed Project. Whether AEA includes fish passage as part of its proposed Project, however, will depend on a more comprehensive analysis that examines the benefits of fish passage to the species compared with the costs of fish passage and with the benefits and costs of alternative mitigation measures. Further, AEA does not agree that economic factors are irrelevant to NMFS' determination of whether fish passage will be prescribed. See Section 33 of the Federal Power Act (as added by section 241 of EPAct 2005).
PASS-04	USFWS	11/14/2012	"The Services provided generic guidance on methodology and information needs for determining fish passage feasibility..." and requesting planning begin with early coordination with Resource Agency Engineers starting with site reconnaissance and review of preliminary engineering design. – pdf page 129	AEA's study plan follows the generic guidance provided by the Services. Because these guidelines were developed primarily to address fish passage at existing hydro-electric developments (pers comm Ed Meyer NMFS Fish Engineer, October 18, 2012), AEA has tailored them to specifically address the feasibility of fish passage at a new hydro-electric development. As such, the Service's Design Development Phases 1 -3 were directly incorporated in Tasks 2-5 (Section 9.11.4). Design Development Phases 4 and 5 were not included as Preliminary and Final Design are steps that follow after a feasibility study is completed and alternatives are selected. Section 9.11.4 lists biological, physical, and Project operations data that will be compiled for this feasibility study. As described in AEA's response to comment PASS-02, AEA engaged NMFS Fisheries Engineer, Ed Meyer on two occasions in Fall 2012 to discuss feasibility study planning. AEA participated in a two-day meeting on September 24th and 25th and AEA Consultants had a teleconference with Ed on October 18, 2012. AEA's proposed schedule (Section 9.11.6 and Table 9.11-1) acknowledges that a site reconnaissance is scheduled for Q2 2013, which will allow viewing of proposed dam and facility sites without snow/ice. In addition, a workshop for the Fish Passage Technical Workgroup will be convened at the end of the first quarter 2013. This will allow time for assembly and synthesis of existing relevant biological and engineering data to present to the Fish Passage Technical Workgroup.

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PASS-05	USFWS	11/14/2012	"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." – pdf page 134	Section 9.11 does not address the need for passage. As described in Section 9.11.1, the study presumes a need for passage exists and addresses whether and what engineering options are feasible to provide passage. As described in Section 9.11.4 Task 2, the study will begin with a review of biological data available from several years of study in the 1980s as well as additional studies recently conducted in the Upper River. The study will incorporate new information collected by AEA in 2012, 2013, and 2014. These data will provide the basis of the feasibility assessment. Furthermore, as described in Section 9.11.4 Task 1, critical information needs will be evaluated by the Fish Passage Technical Workgroup at the beginning of the study with the intent of incorporating those data needs into 2013 and 2014 data collection efforts. AEA expect that the existing and proposed (2012-2014) data collection efforts will be sufficient to determine passage feasibility.
PASS-06	USFWS	11/14/2012	7.11.2. Existing Information and Need for Additional Information 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." – pdf page 134	AEA concurs that biological need should not be an objective of the Study of Fish Passage Feasibility at Watana Dam. As described in Section 9.11.1, AEA will assess whether to propose fish passage based on the results of other studies and other available information along with input from federal and state agencies and other licensing participants.
PASS-07	USFWS	11/14/2012	The Service has not concurred with AEA's use of target species	The Study of Fish Passage Feasibility at Watana Dam proposes

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			due to the paucity of information regarding fish passage at Watana. – pdf page 134	identification of all potential target species to help make informed decisions about passage facilities (i.e., consideration of location downstream collection options, and/or effectiveness of a surface or at depth collector). It is not the intent to limit passage alternatives to a reduced number of species. In fact it is the opposite. Target species are noted during the passage feasibility study to make sure that the conceptual design of passage brackets the full range of fish that may benefit from passage including for example, weak swimmers, anguilliform versus fusiform swimmers, bottom versus surface swimmers. Specifics about the biology of target species are used to address selection between options. All available information will be included to ensure that the passage feasibility study considers all migratory species/life stages, anadromous and resident, with the potential to pass upstream or downstream of the proposed dam site. The target species will be identified as part of Task 2 in Section 9.11.4.
PASS-08	USFWS	11/14/2012	The Service does not support limiting a range of options by including costs in the comparison matrix. – pdf page 135	AEA concurs that all passage option should be considered during feasibility and none should be eliminated on the basis of cost at this feasibility phase. AEA proposes to keep cost as one of the criteria for the Pugh Matrix. As described in the Section 9.11.4 Task 5, the matrix is not used to choose an alternative but is used to compare components across conceptual alternatives. It will influence but not dictate decisions. With use of the matrix, the effectiveness of passage facilities will be evaluated and the results used to refine and optimize each alternative. Cost is one of many criteria that may be helpful to compare across two components, such as trap and haul by truck versus trap and haul by helicopter, that have been previously determined to be equally effective at accomplishing the stated objective. It is important as part of the feasibility study to rank or compare between alternatives and that is where the multiple criteria will be relevant and will be used.
PASS-09	USFWS	11/14/2012	"Section 7.11.6. Schedule There appears to be a disconnect regarding when some of the biological information from the studies will be available and the	AEA agrees that the Study of Fish Passage Feasibility at Watana Dam will need to incorporate new information as it is obtained and selecting and refining alternatives will likely be an iterative

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			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." – pdf page 135	process. To allow for this iteration, the study include regularly scheduled meetings and workshops that will be conducted (Section 9.11.6) with the Fish Passage Technical Workgroup throughout the duration of the study.
PASS-10	USFWS	11/14/2012	"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." – pdf page 136	The study plan has been organized to address the generic guidance provided by the Service and to accommodate steps and information needs identified in the Design Development Phases. See AEA's response to comment Pass-04. Steps 1-3 from the Service's study request are directly incorporated into Tasks 2-5 (see Section 9.11.4). Task 1 of Section 9.11.4 incorporates the collection of the necessary information to inform a feasibility study.(see comment-response PASS-04), AEA will compile and synthesize all of the information as detailed in The Service's Study Request. More specifically biological, site specific and operational information that is available and deemed relevant to fish passage will be compiled and synthesized starting in January 2013. It is important to note that the NMFS guidelines list data that are needed to inform Preliminary Design Development and that this step is one beyond feasibility. However, AEA understands the need for much of this data to address feasibility and will provide information on all topics listed in the study requests at a sufficient level of detail to understand intended project details and operation. A synthesis of this information will be presented to the Fish Passage Technical Workgroup at the Q1 2013 meeting to evaluate additional data needs. AEA does not propose collecting operational information detailed by the Service's items 3-7 as these items are generally accepted as needs for preliminary design in order to determine compatibility between facility design specifications and operations, which will occur after the feasibility analysis. These items fall outside the level of detail necessary for feasibility assessment.
PASS-11	USFWS	11/14/2012	"The Service continues to recommend that fisheries surveys be	See AEA's response to comment FDAUP-01.

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			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." – pdf page 136	
PASS-12	USFWS	11/14/2012	"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." – pdf page 137	See AEA's response to comment PASS-06.
PASS-13	USFWS	11/14/2012	The RSP should include three dam design alternatives: 1) a dam design that integrates fish passage, 2) the current dam designed without passage and with retrofitted passage facilities, and 3) the current dam with no passage facilities. The schedule as proposed include conceptual alternative development in August 2013 and this is too late to all for a full range of options for fish passage to be considered without adding unnecessary expense and delays into the project. – pdf page 137	Section 9.11.1 describes that the alternatives developed under this feasibility study will address the three dam design alternatives proposed by the Service. The proposed schedule, Table 9.11-1, in the RSP has conceptual alternative development occurring from July 1 through December 30, 2013 and then the Feasibility of Alternative and Alternative Refinement occurring in 2014. This schedule was designed to integrate passage concepts into the overall dam design schedule, fits well within two year ILP timeframe and is design to allow for iteration and a full consideration of all passage options considering the influx of biological data from 2012 -2014 studies.
PASS-14	USFWS	11/14/2012	"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	Task 1 of theStudy of Fish Passage Feasibility at Watana Dam (Section 9.11.4) incorporates the collection of the necessary information to inform a feasibility study. AEA will compile and synthesize all of the information as detailed in the Service's Study Request. More specifically biological (Service's items 1-15), site specific (Service's items 1-11) and operational (Service's items 1, 2, 8-14) information that is available and deemed relevant to fish

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			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." – pdf page 137	passage will be compiled and synthesized starting in January 2013. This information will be presented to the Fish Passage Technical Workgroup at the first workshop in March to assess additional data needs.
PASS-15	USFWS	11/14/2012	"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." – pdf page 137	See AEA's response to comment PASS-10 for comparison between the USFWS study request and this study plan. Section 9.11.7 and Figure 9.11-1 address interdependencies across the pre-ILP and ILP studies and defines the timing of the information flow. The schedule that outlines completion of studies and study deliverables is presented in Section 9.11.6 and Table 9.11-1.
PASS-16	NMFS	11/14/2012	The comment includes the follow component: a- The PSP is very brief and does not address NMFS information needs [listed in the comments as Design Development Phases (NMFS comment at page 142), b- Preliminary Design Development – Required Site Information (NMFS comment at page 143), c- Preliminary Design Development – Required Biological Information (NMFS comment at page 144), and Assessment of Operation Impacts on Fish Passage for the Proposed Project information (NMFS comment at page 145-146))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. – pdf page 171	As part of the AEA collaborative process to resolve outstanding issues related to the development of study plans (as described in Section 1), on September 24 and 25, 2012, AEA, NMFS, and other state and federal agencies and licensing participants had meetings on the Study of Fish Passage Feasibility at Watana Dam. Based upon feedback from NMFS and others during the meetings, AEA made substantial revisions to the Study of Fish Passage Feasibility at Watana Dam. RSP 9.11 includes these revisions. AEA believes that this study plan is now responsive to the NMFS information needs regarding fish passage feasibility. As explained in Section 9.11.4, the feasibility evaluation includes six tasks needed to determine fish passage technical feasibility for the Project. This study generally follows the guidance provided in the NMFS Anadromous Salmonid Passage Facility Design document (NMFS 2011). These tasks are summarized below: 1. Establish a Fish Passage Technical Workgroup to provide input on the feasibility assessment. 2. Prepare for feasibility study. 3. Conduct site reconnaissance. 4. Develop concepts. 5. Evaluate feasibility of conceptual alternatives. 6. Develop refined passage strategy(ies). This study follows the generic guidance provided by the Services.

Study of Fish Passage Feasibility at Watana Dam				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
				Because these guidelines were developed primarily to address fish passage at existing hydro-electric developments (pers comm Ed Meyer NMFS Fish Engineer, October 18, 2012), AEA has tailored them to specifically address the feasibility of fish passage at a new hydro-electric development. Regarding component a, the identified information needs related to Design Development Phases (NMFS comment at page 142), the study includes all of the numbered items except for 4 and 5. The RSP has not included these items because they comprise Preliminary and Final Design phases that by necessity follow the completion of a feasibility study. As indicated within the description of these phases within the guidelines document and comment text (NMFS 2011 at [Insert]), preliminary design occurs after a preferred alternative has been selected. Regarding components b, c, and d, Preliminary Design Development – Required Site Information (NMFS comment at page 143), Preliminary Design Development – Required Biological Information (NMFS comment at page 144), and Assessment of Operation Impacts on Fish Passage for the Proposed Project information (NMFS comment at pages 145-146), the RSP includes compilation and synthesis of information under all of the numbered items. As the heading in the NMFS guideline document and comments suggest, much of the information listed in the numbered items is required for the Preliminary Design Development Phase. However, AEA understands the need for some of this data to address feasibility and will provide information on all numbered items at a sufficient level of detail to understand intended project details and operation. A synthesis of this information will be presented to the Fish Passage Technical Workgroup at the first quarter of 2013 and will assist with evaluating additional data needs.
PASS-17	NMFS	11/14/2012	"Existing Information and Need for Additional Information 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	See AEA's response to comment PASS-06

Study of Fish Passage Feasibility at Watana Dam				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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)." – pdf page 173	
PASS-18	NMFS	11/14/2012	"7.11.4.1. Compile, Review and Summarize Information NMFS has not concurred with ABA'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: – pdf page 173	See AEA's response to comment PASS-07.
PASS-19	NMFS	11/14/2012	"7.11.4.3. Define and Document a Development Process 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." – pdf page 173	See AEA's response to comment PASS-08.
PASS-20	NMFS	11/14/2012	"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	AEA concurs that all available information should be gathered, all relevant criteria consider and a full range of engineering options considered. This is the intent of Task 4 (see Section 9.11.4). See also AEA's response to comment PASS-14. To specifically address including cost as a criteria for the Pugh Matrix, please See AEA's response to comment PASS-08.

Study of Fish Passage Feasibility at Watana Dam				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			produce a license order in compliance with federal environmental laws could be unnecessarily hampered." – pdf page 174	
PASS-21	NMFS	11/14/2012	"7.11.6. Schedule 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." – pdf page 174	Section 9.11.7 and Figure 9.11-1 describe the interdependencies among the Study of Fish Passage Feasibility at Watana Damand other ILP studies and specifically address the timing and the flow of information into the Feasibility Study. Furthermore the schedule (Section 9.11.6 and Table 9.11-1) is designed to allow for the iterative exchange of information and refinements to conceptual designs and passage alternatives. For details on correspondence throughout the study, See AEA's response to comment PASS-09.
PASS-22	NMFS	11/14/2012	"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." – pdf page 175	See AEA's response to comment PASS-10.
PASS-23	NMFS	11/14/2012	"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." – pdf page 175	See AEA's response to comment FDAUP-01.
PASS-24	NMFS	11/14/2012	"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	See AEA's response to comment PASS-06.

Study of Fish Passage Feasibility at Watana Dam				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			passage, including conducting fisheries surveys for at least one average life-span of each salmon species." – pdf page 175	
PASS-25	NMFS	11/14/2012	"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." – pdf page 175	The Study of FIsh Passage Feasibility at Watana Dam will assess feasibility of both a dam design with integrated fish passage facilities as well as the current design with retrofit passage facilities per NMFS and USFWS comments and communications with NMFS Fish Passage Engineer, Ed Meyer (Sept 24th and 25th meeting, teleconference on October 18,2012).
PASS-26	NMFS	11/14/2012	The proposed schedule 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. – pdf page 176	See AEA's response to comment PASS-13.
PASS-27	NMFS	11/14/2012	"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 TWO.' – pdf page 176	See AEA's response to comment PASS-14.
PASS-28	NMFS	11/14/2012	"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	The Section 9.11.7 and Figure 9.11-1 address interdependencies across the pre-ILP and ILP studies and defines the timing of the information flow. The schedule that outlines completion of the studies and study deliverables in presented in Section 9.11.6 and

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			completion schedules.' – pdf page 176	Table 9.11-1.

Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
BARR-01	CWA	11/14/2012	Scope is insufficient in studying the Lower River based on AEA's apparent assumption that Project effects will not significantly affect the Lower River fish passage. – pdf page 7	AEA is not assuming no Project effects on Fish and Aquatic Resources in the Lower River Segment. However, due to the direct relationship between flow and physical habitat changes that may result in barriers, the study elements described in the Section 9.12 are concentrated within the Upper and Middle River Segments. Project operations related to reservoir creation, load-following, and variable flow regulation will have the greatest potential effects on these segments of the river. In addition, flow effects will attenuate in a downstream direction as channel morphologies change, tributary inflows are added and flow accretion occurs. The downstream boundary of the Study Area is currently RM 98 because existing information indicates that the hydraulic effects of the project below the three river confluence is significantly attenuated. See Section 09.12.3. However, AEA will reevaluate how far downstream Project operational significant effects extend based in part upon the results of the Open-water Flow Routing Model (see Section 8.5.4.3), which is scheduled to be completed in Q1 2013. Thus, an initial assessment of the downstream extent of Project effects will be developed in Q2 2013 with review and input of the TWG. This initial assessment includes a review of information developed during the 1980s studies and study efforts initiated in 2012, such as sediment transport (Section 6.5), habitat mapping (Sections 6.5 and 9.9), operations modeling (Section 8.5.4.2.2), and the Mainstem Open-water Flow Routing Model (Section 8.5.4.3). The assessment will guide the need to extend studies into the Lower River Segment and, if needed, will identify which geomorphic reaches will be subject to barrier analysis. Results of the 2013 studies would then be used to determine the extent to which Lower River Segment studies should be adjusted in 2014.
BARR-02	NMFS	11/14/2012	"The ABA PSP needs to consider existing and likely future physical	Regarding potential juvenile depth barriers across tributary

Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." – pdf page 178	deltas, refer to Section 9.12.4.2.3. All barriers within the ZHI will be investigated whether natural or manmade. Sections 9.12.1, Objective 3, and 9.12.4 clarify that "barriers" includes both natural and manmade features. Regarding velocity barriers to juvenile salmonids, AEA agrees that tributary entrances across steep deltas need to be assessed. See Section 9.12.4.6. Regarding delayed migration that may result in increased predation, see AEA's response to comment BARR-3.
BARR-03	NMFS	11/14/2012	"The risk of predation due to reduced water depths at fish passage locations, even when not a physical barrier to passage, must be evaluated." – pdf page 178	AEA agrees there is a potential for increased predation on fish below a barrier that may be created by Project operation. The primary reason for the increase would be the impedance of movement or a "pooling" of fish below the barrier. This impedance to movement or pooling effect could make the fish more vulnerable to predation. However, if the depth or velocity at the passage section are within the fish's capabilities to pass, impedance to movement and increased predation cannot be assumed, and therefore, the potential for increased predation will not be evaluated at that location. Studies to evaluate the potential for increased predation at specific passage barriers due to impeded movement assumes the feature has been identified as a physical, depth, or velocity barrier connected with the proposed Project. If such a barrier is created by the Project, the potential for impeded movement or pooling of fish below the barrier will be evaluated. These types of studies are not specified in the RSP as such studies are very specific to the type of barrier, its location, the species/life stage of concern, and the type of predation, i.e. mammalian, avian, piscivorous, or all three. These and other specifics will be determined with input from the license participants on a

Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
				barrier-by-barrier basis. Section 9.12.4.2 of the RSP has been revised to include the the option of an evaluation of delayed movement at barriers as determined necessary with input from license participants.
BARR-04	NMFS	11/14/2012	"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." – pdf page 179	Regarding passage at ARRC stream crossing, see AEA's response to comment BARR-2. Regarding predation, see AEA's response to comment BARR-3.
BARR-05	NMFS	11/14/2012	"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." – pdf page 180	The four study goals and objectives stated in Section 9.12.1 of the RSP must be considered as a whole. When considered together the goals and objectives include all tributaries and mainstem habitats "within the zone of hydrologic influence." Text has been added in the RSP to clearly identify mainstem sloughs and side channel type habitat as areas of study (Section 9.12.4). The term "barrier", as used in the four objectives includes all the types of potential barriers including structural (physical), depth, and velocity barriers in tributaries and the mainstem and both upstream and downstream migration barriers (Section 9.12.1). The term "Identification", as used in the 4 objectives, includes GPS location of any and all potential barriers investigated. Section 9.12.1 is revised to clarify that GPS location will be obtained for all barriers. The identification and location of potential barriers "outside of the hydrologic zone of influence" will only occur in the Upper River tributaries. AEA does not propose to

Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
				investigate barriers above the zone of hydrologic influence in the Middle River.
BARR-06	NMFS	11/14/2012	"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." – pdf page 180	RSP Section 9.9 references existing criteria that are available with a detailed description of how they will be used. Where they are not available the RSP states that they will be determined in consultation with Licensing Participants (Section 9.12.4).
BARR-07	NMFS	11/14/2012	"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." – pdf page 180	AEA proposes to use existing passage criteria or existing criteria modified with input from the TWG. Studies to evaluate holding times would assume that an upstream or downstream migration passage barrier due to the Project has been identified. If such a depth, velocity, or physical barrier is created as a result of the Project, potential delay or holding times will be evaluated. These types of studies are not specified in the RSP but will be determined once a barrier is identified in consultation with Licensing Participants on a barrier-by-barrier basis. Such questions as species and life stage, seasonal timing of the barrier, type of barrier would be considered.
BARR-08	NMFS	11/14/2012	"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." – pdf page 181	The Sections 9.12.4.2.3, 9.12.4.2.4, and 9.12.4.5 are specific on how changes to depth and velocity will be evaluated in side channels and sloughs under different Project flows and seasons. Physical barriers (other than beaver dams) that require leaping behavior to pass are not expected to be present within the ZHI in the Middle River. Regarding ice and beaver dams, beaver dams are transient and dynamic in the Susitna River, as they are in most large rivers. They are removed by high river flows, by ice, or are abandoned and deteriorate over time. The beaver dam may be partially removed by flow or ice and rebuilt within a matter of days or the dam may be completely removed and rebuilt some time in the future or

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Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
				never rebuilt. Beaver are opportunistic dam builders. Section 9.9 will identify the location of beaver dams in the Susitna River within the ZHI that may be barriers and RSP Section 7.6 will provide information regarding potential changes in ice processes in the Susitna River, including side channel and sloughs in general where beaver dams are most prevalent. Whether this information will determine the relative importance of ice versus other causal factors of beaver dam removal is unknown at this time. AEA questions whether a study, as suggested by NMFS, could conclusively determine the contribution of the Project to the net rate of beaver dam removal and whether the change in removal is caused by ice, river flows, or a shift in the beaver dam population or dam building activity from year to year. NMFS has not sufficiently explained the type of study envisioned for AEA to include such a study component in Section 9.9.
BARR-09	NMFS	11/14/2012	"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." – pdf page 181	Section 9.12.4.provides a summary description of the data necessary to conduct any analyses and provides a summary of how the data will be analyzed. Section 9.12.4 describes how the data will be obtained. Section 9.12.6 provides a study schedule.

Aquatic Resources Study within the Access Alignment, Transmission Alignment, and Construction Area				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
AQTRANS-01	CSDA	11/14/2012	"Regarding the proposed access routes' stream crossings, USFWS recommends a minimum of 3 years of onsite stream gage data." – pdf page 4	Two years of data will be sufficient to meet the study objectives of 1) characterizing the aquatic habitats and fish assemblages at potential stream crossings within a 200-meter (650-foot) buffer zone along proposed access road and transmission line alignments; and 2) describing aquatic habitats and species present within the construction area for the dam and related hydropower facilities. See also AEA's response to comment FISH-01 and FISH-02.
AQTRANS-02	FERC	11/14/2012	"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." –pdf page 18	The Section 9.13.4.2.2 specifies a minimum electrofishing survey length of 50 meters.
AQTRANS-03	FERC	11/14/2012	"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	Section 9.13.2.1 includes text as follows: "From 2006 to 2007 ADF&G conducted a Level 1 assessment of stream crossings for central and Interior Alaska road systems including the Denali Highway (O'Doherty, 2009). The ADF&G methodology followed a standardized protocol focusing on juvenile salmonid fish passage. Culverts were surveyed for type, size, slope, outfall height and other physical parameters. Of the 1,591 culverted stream crossings evaluated throughout the state, the Denali Highway crossings were classified among those "having the greatest potential to pass juvenile fish" (O'Doherty, 2010). If the Denali Corridor is chosen, all crossings will be re-inventoried and surveyed to the ADF&G Level 1 standard. This survey work will be

Aquatic Resources Study within the Access Alignment, Transmission Alignment, and Construction Area				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 18	completed in 2014."

Genetic Baseline Study for Selected Fish Species				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
GENE-01	USFWS	11/14/2012	"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." - pdf pages 139-140	The proposed Objectives 1 and 2 have been added to the RSP (Objective 3; Section 9.14.1.1). The proposed third objective will be addressed in the Salmon Escapement Study (Section 9.7) using the numbers of radio-tagged Chinook salmon above Devils Canyon and estimates of the mark rate on fish in the Middle River (tagged at Curry). In addition, independent or separately-derived estimates can be made (although less precise) by examining the mark rate from fish radio-tagged in the Lower River and the numbers of those tags located above Devils Canyon. Each dataset will have the estimate of the mark rate numbers of fish above Devils Canyon. The mark rate from the lower river fish will likely be more precisely estimated but there will be fewer of these tagged fish located above Devils Canyon. Fish tagged at Curry will be more numerous above Devils Canyon but it is likely that a less precise estimate of the mark rate will be available compared to fish tagged in the Lower River.
GENE-02	USFWS	11/14/2012	"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." – pdf page 140	The scope of the Genetics Study has been revised to include a dedicated sampling crew to encompass the spawning period. In addition, a detailed project operation plan will be provide to the TWG by April 30 of 2013 and 2014. The text in the RSP has been revised to reflect this additional scope (Section 9.14.2.2).
GENE-03	USFWS	11/14/2012	"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)." – pdf page 141	Text has been added to RSP Sections 9.14.1.1 and 9.14.4.1 stating sampling will occur in the entire Susitna River. In addition, the extent of current and desired sample coverage of Chinook salmon stocks is provided in RSP Table 9.14-1.

Genetic Baseline Study for Selected Fish Species				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
GENE-04	USFWS	11/14/2012	"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." – pdf page 141	The word "markers" has been removed from the objective so it now reads: "Contribute to the development of genetic baselines for each of the five species of Pacific salmon spawning in the Susitna River drainage."
GENE-05	USFWS	11/14/2012	"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." – pdf page 142	Baseline data on the distribution of Chinook salmon will be obtained through fish distribution studies (RSP Sections 9.5 and 9.6) and the escapement study (RSP Section 9.7) and this includes the application of 1,800 radio transmitters into Chinook salmon in each of 2013 and 2014. (Objectives 1 and 8 in RSP Section 9.7, Salmon Escapement Study). Combined with approximately 800 radio-tagged Chinook salmon in 2012, the baseline distribution of spawning Chinook salmon will be based on approximately 2,600 tagged fish. These tagging programs and tag recovery efforts will be used to estimate the abundance of Chinook salmon above Devils Canyon. Added to the results from 2012, there will be three years of escapement estimates that can provide insight into the variation in behavior, including run timing, of fish that migrate above Devils Canyon.
GENE-06	USFWS	11/14/2012	"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	Agreed, more information is needed and the types of information needed will be a function of what is learned each year. Two sections (RSP Sections 9.14.2.1 and 9.14.2.2) have been added to the RSP to outline how new information will influence sampling needs. AEA proposes an approach of collecting sufficient samples to address as many inevitabilities and hypotheses as may emerge. In

Genetic Baseline Study for Selected Fish Species				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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)." – pdf page 142	this way, the samples will be in hand and will be analyzed as needed to address the questions for an impact assessment of the Project. AEA has consulted extensively with ADF&G's gene lab, including Habicht, Templin, and Jasper, to develop the approach outlined in the RSP. In addition, a detailed operational plan will be available for review annually by the TWG (RSP Section 9.14.2.2).
GENE-07	USFWS	11/14/2012	"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)." – pdf page 142	Also, samples collected from 2012-14 will represent three calendar years and fish from at least 4 brood years, and possibly 5 brood years. There may be a need for five consecutive years of sampling to ensure sufficient sample sizes, but this will depend on at least the five factors outlined in the RSP Sections 9.14.2.1 and 9.14.2.2.
GENE-08	USFWS	11/14/2012	"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; 3) as a means of estimating the number ofspawners above Devil's Canyon (Waples 1990)." - pdf pages 142-143	The RSP has been revised to include estimating the effective population size (Section 9.14.4.2.1).
GENE-09	USFWS	11/14/2012	"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	The commitment to estimate EPS has been made more explicit in the RSP (New Objective 3 and in Section 9.14.4.6.4). The commitment to meet with state and federal experts has been made in Section 9.14.2.1.

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Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			respective management authorities. This is also needed to appropriately inform the proposed Project of potential considerations related to facility design and construction." – pdf page 143	
GENE-10	USFWS	11/14/2012	"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." – pdf page 143	See AEA's response to comment GENE-06 on the extent of baseline data collection from adult Chinook salmon distribution. Table 9.14-1 documents the extent of the existing baseline sample sizes and the goals of the proposed sampling efforts. Regarding the juvenile fish redistribution from the Upper to the Lower Susitna, the suggested work is part of Objective 5.
GENE-11	USFWS	11/14/2012	"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." – pdf page 143	See AEA's response to comment GENE-06.

Genetic Baseline Study for Selected Fish Species				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
GENE-12	USFWS	11/14/2012	"ADF&G Study Request # 1 Adult Chinook and coho salmon spawner distribution and abundance studies, requested specific objectives related to Susitna River coho salmon. 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." – pdf page 143	Baseline studies done in 2012 and studies proposed to continue through 2013-14 will obtain spatial and temporal biological information on coho salmon. Among this work, the Salmon Escapement Study (RSP Section 9.7) will place radio transmitters in up to 600 adult coho salmon (as part of objectives 1, 2, 3, 6 and 8 in RSP Section 9.7). These studies will provide three years of data to inform genetic sampling efforts of coho salmon.

Analysis of Fish Harvest in and Downstream of the Susitna-Watana Hydroelectric Project Area				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
FHARV-01	CWA	11/14/2012	Include TK into RSP. –pdf page 8	As explained in the Subsistence Resources Study RSP (see Section 14.5.4.5, Traditional Knowledge regarding the physical, biological and social environment, including fish specifically, is being documented. Each program lead for the project has the opportunity to provide questions for the TK workshops. Task 1-4 of the Subsistence Resources Study RSP address fish harvest and use areas. Task 5 of the Subsistence Resources Study RSP incorporates TK questions related to fish and other wildlife resources.
FHARV-02	FERC	11/14/2012	"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." –pdf page 19	ADF&G fish harvest data are of an appropriate geographic scale to permit an analysis that meets the study objectives. The geographic harvest reporting areas that will be selected from the Statewide Harvest Survey (SWHS) data as described in RSP Section 9.15.4.2 will conform with the area of potential Project effects. If the fishery size or level of participation is too small to be adequately assessed by the SWHS, RSP 9.15.4.2 provides that qualitative information on angler success and participation will be obtained by interviewing guides, outfitters, fishery participants, and lodge owners operating in the Upper Susitna. RSP Section 9.15.4.2 was revised to clarify the compilation of harvest and effort data from sport fisheries.
FHARV-03	FERC	11/14/2012	"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	As described in Section 9.15.4 of the RSP AEA's approach minimizes the affect of emergency closures by averaging data over a time period. As stated in the RSP, "ADF&G opens and closes fishing areas each year by

Analysis of Fish Harvest in and Downstream of the Susitna-Watana Hydroelectric Project Area				
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			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." –pdf page 19	issuing emergency orders. These orders are necessary to achieve escapement goals for the various salmon returns to the Cook Inlet area as well as adhering to regulatory directives for allocation of harvest between user groups. To minimize the affect that emergency order closures may have on a given year, harvest data will be averaged over a 20 year time period."

Eulachon Run Timing, Distribution, and Spawning in the Susitna River				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
EUL-01	CWA	11/14/2012	Scope is insufficient in studying the Lower River based on AEA's apparent assumption that Project effects will not significantly affect the Lower River eulachon community. –page 7-8	This study area is sufficient to meet the objectives of the study. As stated the Section 9.16.1, the objectives of the Eulachon Run, Timing, Distribution, and Spawning in the Susitna River study are to collect information that will facilitate evaluation of the overall potential Project effects to eulachon run timing and duration (Section 9.16.4.1), spawning sites (Section 9.16.4.2), and spawning habitat (Section 9.16.4.3). The study area extends from the mouth of the Susitna River to the uppermost extent of spawning, which will be determined by a combination of telemetry and acoustics. A split beam sonar device will be positioned at a fixed site near RM 10 to collect information on run timing and duration. This is within the area sampled daily in 1983 (RM 4.5 to RM 60; ADF&G 1984). Few spawning locations were detected below RM 10 (Section 9.16.3 and Figure 9.16-1).
EUL-02	ADNR-ADF&G	11/14/2012	"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?" –page 21	AEA is not developing an HSC as part of theEulachon Run, Timing, Distribution, and Spawning in the Susitna River study. Physical habitat data associated with spawning locations will be collected over a wide range of flows and stages. This will enable (1) characterization of habitat associated with eulachon spawning, and (2) evaluation of the availability of spawning habitat during expected post-Project flows and stages. Details are included in theEulachon Run, Timing, Distribution, and Spawning in the Susitna River study Section 9.16.4.3.3

Cook Inlet Beluga Whale Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
CIBW-01	CWA	11/14/2012	"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." –pdf page 6	It is premature for the study plan to include this type of discussion. Instead, AEA will use the information collected from this study and other studies in the environmental analysis that will support AEA's FERC License Application for the Project. This analysis will include an assessment of whether the project affects CIBW. The goals of the CIBW study are to document the seasonal and temporal use of the Susitna River delta by CIBWs, determine the upstream extent and study possible Project effects on the mudflats where CIBWs forage. SectionOther studies will analyze the effects on CIBW prey species (Fish Distribution in the Middle and Lower River Study (Section 9.6), Salmon Escapement Study (Section 9.7) and theEulachon Run, Timing, Distribution, and Spawning in the Susitna River study (Section 9.16). Several studies will also analyze the potential impacts to beluga critical habitat (Baseline Water Quality Study (Section 5.5), Water Quality Modeling Study (Section 5.6), Geomorphology studies (Sections 6.5 and 6.6), Ice Processes in the Susitna River Study (Section 7.6), and Fish and Aquatics Instream Flow Study (Section 8.5).
CIBW-02	Ransy, Denis	11/14/2012	"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." –pdf page 1	See AEA's response to comment CIBW-01.
CIBW-03	FERC	11/14/2012	"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	AEA has clarified the camera terminology in Section 9.17.4.2.

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Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			the description of study methods. –pdf page 19	
CIBW-04	FERC	11/14/2012	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. 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. 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." –pdf page 20	Two video cameras will be located at each station (See Section 9.17.4.2). One video camera at each station will present a wide-angle overview of the study site and will conduct broad sweeps over the area to look for other groups while still maintaining the first group in view. The second camera will focus on each group for counts and observations. Camera locations will be determined based on field of view, permits and co-location with instruments from other studies (i.e. Ice Processes in the Susitna River Study Section 7.6 and Instream Flow Section 8.5). In 2012, cameras were established as far downstream as RM 15. The existing cameras will be used for incidental observations of CIBWs and new camera locations further downstream will be established for the CIBW study. The exact locations will depend on site-specific information which will be determined in early 2013.
CIBW-05	FERC	11/14/2012	"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)." –pdf page 20	Methodology clarified in Section 9.17.4.2, live feed video cameras will be monitored May through September. Monitoring will average eight hours per day five days a week. The 8 hours will cover a range of daylight hours with focus on high tides. The five days a week will be rotating to cover both weekend and week days.
CIBW 06	FERC	11/14/2012	"Please clarify whether video footage of beluga observations will be digitally archived." –pdf page 20	Clarified in Section 9.17.4.2 video footage will be digitally archived.
CIBW 07	FERC	11/14/2012	Where you mention the potential for identifying individual animals, please describe the previously collected photo-identification information available for the beluga population." –pdf page 20	As explained in Section 9.17.4 a photo identification catalog is maintained by LGL. This catalog will be referenced to identify animals with markings. Photo identification is possible but photo quality and the fact that not a large fraction of the CIBW has large and obvious marks will limit the number of individuals identified.
CIBW-08	FERC	11/14/2012	"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	There is limited data on CIBW winter movements. Hansen and Hubbard (1999) stated that CIBWs can be found in waters that are up to 60% ice covered. However, whales are more dispersed in

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Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 20	winter and are found in offshore waters, further south than the Susitna River (Rugh 2000). Hobbs et al. (2005) also stated that CIBWs dive deeper in winter than in summer, suggesting that the shallow, ice-covered Susitna mudflats are not primary winter foraging grounds. Further details are included in the Section 9.17.2. The best methodology for winter movements would involve the use of satellite telemetry. However, obtaining appropriate permits would be highly unlikely given their ESA status and proven difficulties attaching satellite tags to CIBWs.
CIBW-09	FERC	11/14/2012	"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. –pdf page 20	Project operations may potentially have an influence over the physical structure of the mudflats, a PCE for CIBWs. The modeling effort has been revised to include a water surface elevation (WSE) model (see Section 9.17.4.3). The WSE model will evaluate the influence of river discharge on water surface elevation under four operational scenarios. The four scenarios represent the existing condition, a maximum load-following, an intermediate load-following, and a base-load scenario. The three with-Project scenarios will provide bookends and an intermediate assessment of potential Project effects.
CIBW-10	FERC	11/14/2012	Describe any and all ongoing survey efforts by other researchers and agencies and how your efforts will compare or build upon others, where you will collaborate with other agencies in sharing data, etc." –pdf page 20	AEA will collaborate with other CIBW studies when possible. Ongoing CIBW studies in the Susitna River delta include NMFS aerial surveys which are conducted in June and August. The aerial survey protocol has been revised in Section 9.17.4.1 such that there is no longer a need to rely on NMFS aerial data; AEA will collect sufficient data to analyze spatial and temporal variation in CIBW presence in the Susitna River delta. The other ongoing CIBW study is a photo-identification study conducted by boat by LGL Alaska from May through October. The AEA team will coordinate with the boat-based work of LGL's to avoid overlapping surveys on the days that LGL is on the water (as NMFS aerial team does).
CIBW-11	FERC	11/14/2012	"Acoustic monitoring was brought up as a potential monitoring method for beluga (Bob Small, ADF&G, August 19, 2012,	At the August 15, 2012 TWG meeting, ADF&G requested consideration of acoustic monitoring. AEA has considered this

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Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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" –pdf page 21	request, but has determined it will not conduct acoustic monitoring because several factors would limit the efficacy of an acoustic array. These include sufficient range/coverage of the survey area, high in-water noise, and, most importantly, a high probability of false negatives regarding presence of whales. AEA believes that the data collected through aerial surveys and video studies are sufficient to document the distribution, movement patterns and behavior of CIBWs in the delta to effectively assess potential project impacts. See also AEA's response to comment CIBW-14.
CIBW-12	ADF&G	11/14/2012	"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." –pdf page 29	AEA has revised Section 9.17.4.3 to provide more detail for Objective 3. See AEA's response to comment CIBW-09.
CIBW-13	ADF&G	11/14/2012	"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." –pdf page 29	AEA has revised the aerial survey methodology Section 9.17.4.1. Data will be collected on relative group sizes. There will be no attempt to perform abundance estimation.
CIBW-14	ADF&G	11/14/2012	"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. Information on when and where belugas are foraging, which can be obtained through	Passive acoustic monitoring (PAM) has been considered as a method to document CIBWs. However, several factors would limit the efficacy of an acoustic array, including sufficient range/coverage of the survey area, high in-water noise, and, most

Cook Inlet Beluga Whale Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			PAM, will increase the ability to determine project-induced changes." –pdf page 29	importantly, a high probability of false negatives regarding presence of whales. Additionally, winter PAM monitoring would be difficult because arrays would need to be placed in deeper, offshore waters due to ice scour in the river and intertidal areas. Therefore, data collected offshore of the delta would not be helpful in evaluating potential impacts from the Project. While satellite telemetry would be a useful tool to document movements of CIBWs in the Susitna River delta and throughout Cook Inlet year-round, obtaining appropriate permits would be highly unlikely given their ESA status and proven difficulties attaching satellite tags to CIBWs. AEA believes that the data collected through aerial surveys and video studies are sufficient to document the distribution, movement patterns and behavior of CIBWs in the delta to effectively assess potential Project impacts.
CIBW-15	ADF&G	11/14/2012	"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." –pdf page 30	See AEA's response to comment CIBW-14.
CIBW-16	TNC	11/14/2012	"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." –pdf page 3	See AEA's response to comment CIBW-09.
CIBW-17	NMFS	11/14/2012	"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	See AEA's response to comment CIBW-14.

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Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			could consider is the use of passive acoustic monitoring devices." –pdf page 182	
CIBW-18	NFMS	11/14/2012	NMFS questions how the live-feed and still cameras will document the northern extent of CIBWs in the Susitna River. NMFS also requests more information on the camera protocol. –pdf page 183	Methods have been revised to clarify that more frequent aerial surveys will also be used to determine the upstream extent of CIBWs in the Susitna River. See Section 9.17.4.1. Live-feed video cameras will be used to document group composition and behavior which may document the presence of young animals and foraging behavior. Camera locations will be determined based on field of view, permits and co-location with instruments from other studies (i.e. Ice Processes in the Susitna River Study [Section 7.6] and Instream Flow [Section 8.5]). See AEA's response to comment CIBW-05.
CIBW-19	NMFS	11/14/2012	"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." –pdf page 184	Section 9.17.4.3 describes the data that will be collected to evaluate the relationship among potential hydropower related changes in the Lower River, CIBW In-River Movements, and Prey availability. If there are any adverse impacts to whales, AEA will assess those impacts in the environmental analysis supporting AEA's FERC License Application.
CIBW-20	NMFS	11/14/2012	"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	See AEA's response to comments CIBW-01 and CIBW-05.

Cook Inlet Beluga Whale Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 184	
CIBW-21	NMFS	11/14/2012	"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." –pdf page 184	See AEA's response to comment CIBW-01.

Wildlife Resources				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
WILD-01	Various Individuals	11/07/2012-11/14/2012	Two year study is inadequate to determine potential project impacts on ice stability from fluctuating flows and rivers use as a corridor by people and wildlife.	The Ice Processes in the Susitna River Study (Section 7.6.2.1) addresses the adequacy of the study of ice stability. The number of years of winter observation which will be relied upon for this study is sufficient to meet the goals and objectives of the study plan. The study plan will rely upon at least seven years and likely eight years of winters of observations (including 5 years in 1980's, 2012-2013, 2013-2014, possibly 2014-2015 (7-8 years)). As described in Section 7.6.2, these observations span a range of meteorological conditions. This will allow AEA to meet study plan goals and objectives.
WILD-02	CCC	11/15/2012	"How will wildlife and fish be impacted by the change in ice conditions and loss of stable transportation routes?" –pdf page 2	At this time, AEA believes it premature to assume any impacts due to possible changes in ice conditions. Potential impacts on terrestrial wildlife due to changes in ice conditions and stability will be analyzed in the impact assessment to be conducted in 2015 for the FERC License Application, drawing on information produced by the Geomorphology Study (Section 6.5), the Ice Processes in the Susitna River Study (Section 7.6), the Fish and Aquatics Instream Flow Study (Section 8.5), and the Riparian Instream Flow Study (Section 8.6).
WILD-03	USFWS	11/14/2012	PISCIVOROUS WILDLIFE AND MERCURY RISK ASSESSMENT. "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." –pdf page 148	Proposed methods for obtaining feather samples are described in the RSP under Surveys of Eagles and Other Raptors (Section 10.14.4), Waterbird Migration, Breeding, and Habitat Use (Section 10.15.4), and Landbird and Shorebird Migration, Breeding, and Habitat Use Study (Section 10.16.4), depending on the bird species of interest. Hair sampling of river otter and mink is described under the Aquatic Furbearer Abundance and Habitat Use (Section 10.11.4). The review of food habits and diets for piscivorous species of wildlife also are described in these sections of the RSP.

Moose Distribution, Abundance, Movements, Productivity, and Survival				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
MOOSE-01	Strasenburgh, John	11/14/2012	"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." –pdf page 2	The RSP includes components of several studies that will examine ice and snow conditions, flow regimes, and moose habitat in riparian areas downstream from the proposed dam. The Riparian Instream Flow Study (Sections 8.5 and 8.6) and the Riparian Vegetation Study Downstream of the Proposed Watana Dam (Section 11.6) will document current conditions and will model future changes based on LIDAR, ADCP, and flow-stage data collected during 2012–2014, which then can be used in the impact assessment that will be conducted in 2015 for the FERC License Application.
MOOSE-02	CCC	11/15/2012	"How will moose populations that congregate along the river in winter be impacted by poor ice conditions?" –pdf page 2	The effects of changes in ice conditions and stability on moose using riparian habitats downstream from the proposed dam will be assessed in 2015 in the FERC License Application after analyzing information produced by the Ice Processes in the Susitna River Study (Section 7.6) and the Instream Flow Studies (Sections 8.5 and 8.6).
MOOSE-03	BLM	11/14/2012	"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." –pdf page 3	AEA acknowledges and appreciates that BLM considers the previous comments to have been addressed adequately. In accordance with FERC's ILP regulations, AEA will propose any needed modifications to the study plan in the Initial Study Report, if necessary, in response to any new data that becomes available.
MOOSE-04	BLM	11/14/2012	"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." –pdf page 3	As is described in Sections 10.5.4.3 and 10.5.7 of the RSP, two study elements will address the quality of moose habitats in the road and transmission corridors. First, radio telemetry for a large number of collared moose will provide empirical data for the analysis of habitat preferences. The browse survey will be conducted in a large area encompassing habitats located both above and below the proposed dam and reservoir within the extent of the GSPE survey grid, and will include large areas of the proposed access corridors. The browse data will be applied to the wildlife habitat map produced by the Vegetation and

Moose Distribution, Abundance, Movements, Productivity, and Survival				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
				Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (Section 11.5) and the Riparian Vegetation Study Downstream of the Proposed Watana Dam (Section 11.6) to inform the habitat quality rankings that will be produced by the Evaluation of Wildlife Habitat Use (Section 10.19) for eventual use in the impact assessment that will be conducted in 2015 for the FERC License Application. Hence, the browse study information will be applied to the entire Project area plus the 4-mile buffer surrounding the corridor alignments. AEA is confident that the intensive study methods proposed for the Moose Distribution, Abundance, Movements, Productivity, and Survival study will provide solid information for future use in mitigation planning. In the event new, relevant data becomes available during the study process, AEA will propose any needed modifications to the study plan in the Initial Study Report, if necessary, in accordance with FERC's ILP regulations.
MOOSE-05	ADF&G	11/14/2012	"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." –pdf page 30	Unsuitable weather conditions and snow cover in November 2012 precluded the GSPE effort, so Sections 10.5.4.2 and 10.5.6 of the RSP state that the GSPE survey will be attempted again in November 2013 or, if conditions are unsuitable, in March 2014. The late winter (March) population survey in the reservoir inundation zone in 2012 provided useful data on use of that area during a year of record high snowfall, which will provide a good comparison for the same type of survey planned in March 2013. Deployment of all 40 GPS collars in October 2012 will provide two full years of fine-scale movement data for the Updated Study Report.

Caribou Distribution, Abundance, Movements, Productivity, and Survival				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
CBOU-01	BLM	11/14/2012	"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." –pdf page 3	AEA agrees that the RSP addresses the needs of the BLM to assess rights-of-way. Although cumulative effects will not specifically be analyzed as part of this study plan, AEA plans to analyze cumulative effects in the environmental analysis that will be prepared to support its License Application. In accordance with FERC's ILP regulations, AEA will propose any needed modifications to the study plan in the Initial Study Report, if necessary, in response to new information.
CBOU-02	ADF&G	11/14/2012	"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." –pdf page 30	AEA believes that two years of data will provide sufficient information to characterize variation in movement patterns. As explained in Sections 10.6.4 and 10.6.6, refurbished GPS collars will be redeployed late in 2014, but no additional animals will be collared after 2014. Although ADF&G will extend the study throughout the battery life of the collars into 2016, AEA expects that the combination of telemetry data from historical APA studies, ADF&G studies conducted since the 1980s, and the Caribou Distribution, Abundance, Movements, Productivity, and Survival study described in the revised study plan will provide adequate data on the movements of the Nelchina and Delta caribou herds to support the Project impact assessment. However, when evaluating data collected during two years of study (collected through the 4th quarter of 2014) during preparation of the Updated Study Report, AEA will evaluate whether any additional information is needed to assess Project-related effects on caribou movement patterns. At that time, in accordance with FERC's regulations, AEA will propose in the Updated Study Report any needed modifications to the study plan, if necessary, to sufficiently evaluate this issue.

Dall's Sheep Distribution and Abundance				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
DALL-01	ADF&G	11/14/2012	"DWC agreed to conduct Dall's sheep surveys of suitable sheep habitat within GMU 13E south of the Denali Highway and east of the Parks Highway. ADF&G submitted a revised draft study plan that describes this work." – PDF page 31	AEA appreciates ADF&G's input on study design and has incorporated the material from ADF&G's revised draft study plan into AEA's revised study plan. As described in Section 10.7.3, the study area for Dall's sheep consists of the portion of GMU Subunit 13E south of the Denali Highway and east of the Parks Highway.
DALL-02	ADF&G	11/14/2012	"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." – PDF page 31	The study area map (Figure 10.7-1) has been revised to reflect the changes discussed with ADF&G in TWG and small-group meetings in August, September, and October 2012.
DALL-03	ADF&G	11/14/2012	"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." – PDF page 31	The revised study plan incorporates ADF&G's suggested changes in Section 10.7.4. No radio collars will be deployed and the mineral licks will not be monitored intensively.

Distribution, Abundance, and Habitat Use by Large Carnivores				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
LGCAR-01	ADF&G	11/14/2012	"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."	This proposed modeling effort was discussed in meetings on September 13 and October 16, 2012 (see Appendices 3 and 4), was accepted by AEA, and has been included in the RSP (Sections 10.8.3 and 10.8.4.1.1).
LGCAR-02	ADF&G	11/14/2012	"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 10.8.4.1.2 of the RSP describes consultation with ADF&G concerning the sampling design and analyses of hair samples for DNA and stable isotopes; for example, ADF&G DWC recommended at the small-group meeting on September 13, 2012 (see Appendices 3 and 4) that the single-sample hair-snag trap developed by Lavern Beier of DWC (Juneau) be used in field sampling. This trap design has been added to Section 10.8.4 of the RSP.

Wolverine Distribution, Abundance, and Habitat Occupancy				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
WOLV-01	FERC	11/14/2012	"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, ADF&G stated that a single aerial survey would not be sufficient to develop habitat associations for wolverines and the objective should be eliminated. ADF&G 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." –pdf page 21	The comment by ADF&G on the PSP was acknowledged and that specific objective was removed from Section 10.9.1 in an earlier draft of the revised study plan. However, as is documented in Appendix 3 and under the WOLV-3 comment below, continued consultation with ADF&G included the addition of occupancy surveys and modeling to the study methods (Section 10.9.4), which will adequately address the objective of evaluating habitat associations.
WOLV-02	ADF&G	11/14/2012	"DWC agreed to conduct a Sample-Unit Probability Estimator (SUPE) survey for wolverine." –pdf page 31	AEA agrees with this method, which has been adopted and is described throughout the RSP (Section 10.9.4).
WOLV-03	ADF&G	11/14/2012	"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." –pdf page 31	AEA agreed to incorporate this method and the objective of habitat associations and population trend analysis at the October 16 TWG meeting. The method is described in the RSP (Section 10.9.4).

Terrestrial Furbearer Abundance and Habitat Use				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
TERFUR-01	ADF&G	11/14/2012	"DWC supports this project intended to assess abundance of coyote, red fox, lynx, and marten with modifications to address concerns expressed here." –pdf page 31	AEA is pleased that ADF&G supports the proposed study and appreciates the opportunity to work with ADF&G in its development. AEA has addressed ADF&G's specific comments separately in the responses to the next three comments (TERFUR-2, TERFUR-3, and TERFUR-4) below.
TERFUR-02	ADF&G	11/14/2012	"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." –pdf page 32	After further consultation with ADF&G during the follow-up meeting on September 13, 2012 (see Appendices 3 and 4), the wording of Objectives 1 through 4 was clarified to reflect these changes (see Section 10.10.1, Study Goal and Objectives).
TERFUR-03	ADF&G	11/14/2012	"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." –pdf page 32	After further consultation with ADF&G during the follow-up meeting on September 13, 2012 (see Appendices 3 and 4), more details regarding capture heterogeneity and population closure for the mark–recapture analyses were added to Section 10.10.4.4. Although sample sizes cannot be predicted in advance, sample sizes have been estimated and the relative effects of sample size and recapture rate on the precision of mark–recapture estimates are discussed in the third paragraph of Section 10.4.4. The study will be conducted over two years (2013–2014) to provide the information needed for the FERC license application.
TERFUR-04	ADF&G	11/14/2012	"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." –pdf page 32	As is described in the 3rd and 4th paragraphs of Section 10.10.4.4, AEA understands that the study will occur during a low phase of the snowshoe hare population cycle and discusses the implications of that factor on the study results and conclusions. Care will be exercised and uncertainty will be acknowledged appropriately in drawing conclusions and making comparisons with other areas.

Aquatic Furbearer Abundance and Habitat Use				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
AQFUR-01	ADF&G	11/14/2012	"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." – pdf page 32	After further discussion with H. Golden of DWC (see Appendix 4), the survey method for river otters (described in Section 10.11.4.2) has been modified to include transect sampling (but not occupancy modeling). Mr. Golden suggested that helicopter transects be oriented perpendicularly to the mainstem Susitna River to sample otters using areas away from streams, such as lakes and ridges or passes between adjacent watercourses, rather than following watercourses, as proposed in the interim draft RSP. AEA considers the watercourse surveys to have value for detecting and delineating areas likely to be used most consistently by river otters, but also recognizes the need to sample areas away from watercourses. Hence, Section 10.11.4.2 of the RSP has been revised to state that, in early 2013, both types of surveys will be flown and the results will be compared, so that further changes in the survey approach can be made later in 2013 and 2014, if warranted. In addition, it is expected that the helicopter transect surveys proposed for the study of Terrestrial Furbearer Abundance and Habitat Use (see Section 10.10.4.3) will provide additional information on the occurrence of river otters.
AQFUR-02	USFWS	11/14/2012	"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)." – pdf page 48	The RSP (Section 10.11.1, Study Goal and Objectives) includes acquisition of hair samples for river otter and mink as the fifth objective of the Aquatic Furbearer Abundance and Habitat Use study (see Sections 10.14–Surveys of Eagles and Other Raptors; 10.15–Waterbird Migration, Breeding, and Habitat Use; and 10.16–Landbird and Shorebird Migration, Breeding, and Habitat Use Study, for details regarding collection of feather samples). River otter and mink hair samples will be sought from trapper-harvested animals. If trapper harvests are insufficient, then hair-snags will be deployed in the reservoir inundation zone and its tributary streams, as is described in Section 10.11.4.3. Some samples of mink hair may be obtained incidentally in hair-snag tubes intended for marten hair sampling as part of the study of Terrestrial Furbearer Abundance and Habitat Use (Section 10.10).

Small Mammal Species Composition and Habitat Use				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
SMAM-01	ADF&G	11/14/2012	"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." –pdf page 32	At the TWG meeting on October 16, 2012, AEA proposed to convert the small mammal study to an office-based effort only, drawing on the intensive fieldwork conducted for the original APA project in the early 1980s, which was a more comprehensive and intensive effort than was envisioned in the PSP. Based on the consistency of relative abundance of most species of small mammals across large portions of Interior and Southcentral Alaska, the results of more trapping in 2013 likely would have produced very similar results to the trapping conducted in the 1980s. AEA concurs with ADF&G that a short-term field trapping effort would not be likely to produce significant new information beyond what has already been well-documented in the Project area. In a telephone conversation on November 25, 2012, BLM concurred with the conversion of this study to an office-based effort (see RSP Appendices 3 and 4).

Bat Distribution and Habitat Use				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
BAT-01	FERC	11/14/2012	"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 ADF&G 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. [AEA does] not propose to conduct these efforts unless seasonal concentration areas such as roosting sites, maternity colonies, or hibernacula are located in 2013 because [AEA agrees] with ADF&G that anticipated effects on these species are not expected to be great. [AEA goes] 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. [AEA's] statement of little adverse effects would suggest that this study is not needed. Nonetheless, it is unclear how [AEA's] efforts would identify important seasonal concentration areas for further study in 2014 and why ADF&G's recommendations should not be incorporated into the study plan now. Further, [the] revised study plan should explain what would dictate "to the extent possible." –pdf page 21	ADF&G's recommendations have been incorporated in the Revised Study Plan (Section 10.13.4.1) to document seasonal variations and habitat-specific levels of activity in the study area and to conduct a search for roost sites, maternity colonies, and hibernacula in 2013. The proposed study methods (Section 10.13.4.1) include documenting areas of seasonal concentration such as maternity colonies and hibernacula, and the study will continue in 2014 if such sites are discovered. The phrase "to the extent possible" has been deleted.
BAT-02	ADF&G	11/14/2012	"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." –pdf page 33	This request has been addressed in Sections 10.13.1 and 10.13.4.1.
BAT-03	ADF&G	11/14/2012	"Locate any potential human-made structures within the inundation zone that could serve as maternity colonies or hibernacula." –pdf page 33	This request has been addressed in Section 10.13.4.1 and includes coordination with the Cultural Resources Study (Section 13.5) to locate suitable human-made structures (see Section 10.13.7).
BAT-04	ADF&G	11/14/2012	"Document level of use for any maternity colonies or hibernacula identified." –pdf page 33	This request has been addressed in Section 10.13.4.1.

Surveys of Eagles and Other Raptors				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
RAPT-01	USFWS	11/14/2012	"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." –pdf page 149	AEA appreciates USFWS's involvement in the development of this study plan and is pleased that USFWS is satisfied that the study plan for Surveys of Eagles and Other Raptors (Section 10.14.1, Study Goal and Objectives) addresses the goal of USFWS's study request.
RAPT-02	USFWS	11/14/2012	"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." –pdf page 149	AEA is pleased that USFWS is satisfied that the Proposed Study Plan for Surveys of Eagles and Other Raptors (Section 10.14.1, Study Goal and Objectives) is adequate to meet most of their objectives. Based on further meetings held since the filing of the PSP in July 2012 (see Appendices 3 and 4 for details), further changes have been made to the Revised Study Plan to address the two exceptions identified by USFWS, as is explained below in the responses to comments RAPT-3 and RAPT-4.
RAPT-03	USFWS	11/14/2012	"*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." –pdf page 149	Sections 10.14.1 (Objective 6), 10.14.4.1, and 10.14.7 of the Revised Study Plan now include nonlethal collection of feathers from the nests of piscivorous raptors (Bald Eagle and, if available, Osprey) for analysis of mercury levels (also see Section 5.7), as well as review and synthesis of information on food habits, diets, and effects of mercury on these birds. Similar methods are specified in the Revised Study Plan sections for waterbirds (10.15), landbirds and shorebirds (10.16), and aquatic furbearers (10.11).
RAPT-04	USFWS	11/14/2012	"*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:	Surveys of early nesting owls were discussed at the TWG meeting on August 9, 2012, and at the follow-up meeting on landbirds and shorebirds (and wildlife habitat

Surveys of Eagles and Other Raptors				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 149	evaluation) on September 6, 2012 (see Appendices 3 and 4 for details). AEA explained that it had concerns about personnel safety because the surveys for certain species (most notably Boreal Owl) would require intensive nocturnal sampling during winter to detect a species that occurs in low density over broad areas. At the September 6 meeting, USFWS agreed that specific surveys of small cavity–nesting owls would not be needed, provided that AEA acknowledges their occurrence in the study area and includes them in the Evaluation of Wildlife Habitat Use (Section 10.19), which AEA agreed to do. The other early nesting species using tree cavities (Northern Hawk Owl), as well as several species of small- to medium-sized hawks, should be detected incidentally during point counts for landbirds and shorebirds conducted during the month of May. Short-eared Owls should be detected incidentally on aerial surveys for other raptors and waterbirds, on point counts for landbirds/shorebirds, and on migration visual watches. Large species of early nesting owls that use stick nests (Great Horned Owl, Great Gray Owl) will be detected on aerial surveys for eagles and other tree-nesting raptors. All of these details are described in Section 10.14.4 of the RSP, and the coverage of small- to medium-sized raptors on the landbird and shorebird point counts is also described in Section 10.16.4. As is described in RSP Section 10.14.4.1, circular plots for migration point counts (with a fixed radius of 800 meters) will be delineated along the length of the transmission line corridors before the field surveys begin. Specific plots to be sampled then will be determined by examining topographical characteristics likely to concentrate flight activity by migrating raptors. of the terrain.
RAPT-05	USFWS	11/14/2012	"*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.	AEA recognizes the evolving nature of the National Eagle Take Permit Program and anticipates working with USFWS in the coming months and years to ensure that adequate data are collected on both species of eagles to

Surveys of Eagles and Other Raptors				
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			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." –pdf page 149	comply with federal laws, regulations, and policies. The results of the 2012 surveys confirmed the utility of the survey methods used to locate territories and nest of both species (see RSP Section 10.14.2). The 2012 results also underscored the need to allocate more survey time in 2013 and 2014 to assessment of sightability.
RAPT-06	FERC	11/14/2012	"In some cases, [AEA has] 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." –pdf page 5	The results of the 2012 surveys confirmed the utility of the survey methods used to locate territories and nests of eagles and other raptor species (see RSP Section 10.14.2). These aerial survey methods are the same ones described in Section 10.14.4.1 of the Revised Study Plan: two nest occupancy surveys (late April to late May), two nest productivity surveys (mid-June to late July), and four surveys of potential foraging, staging, and communal roosting areas (primarily for Bald Eagles, from mid-October to early December). Survey numbers and timing may be adjusted in 2013 and 2014, based on the results of the surveys conducted in 2012 (Section 10.14.4.1) and the phenology of the nesting season each year. The 2012 results also underscored the need to allocate more survey time in 2013 and 2014 to assessment of sightability.

Waterbird Migration, Breeding, and Habitat Use Study				
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WTRBRD-01	CSDA	11/14/2012	"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." –pdf page 3	Implementing the study plan will yield information sufficient to understand Project-related effects, if any, on migrating birds. Moreover, more than two years of study will be available to understand bird migration in the Project area. The two-year bird study conducted for the original APA Susitna Hydroelectric Project studies concluded that the Project area was not a major corridor for migrating birds. Nevertheless, AEA intends to conduct intensive monitoring of spring and fall migration in the area of the proposed dam in 2013 (using visual and radar detection methods), as described in Section 10.15.4.1.2, and will use the findings of that study as the basis for a decision on whether to continue the radar monitoring study in 2014. Aerial surveys of waterbirds will be conducted during spring and fall in 2013 and 2014, as described in Section 10.15.4.1.1.
WTRBRD-02	Long, Becky	11/13/2012	Two years are inadequate, request for 5 to 7 year study –pdf page 2	See AEA's response to comment WTRBRD-1.
WTRBRD-03	ADF&G	11/14/2012	"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)." –pdf page 33	The comment correctly characterizes AEA's intent in conducting helicopter surveys for Harlequin Ducks (described in Sections 10.15.3 and 10.15.4.2.2), which were discussed with ADF&G and USFWS at the small-group meeting on waterbirds on October 4, 2012 (see Appendices 3 and 4). Whereas ADF&G did not think it is necessary to extend the Harlequin Duck surveys outside of the 3-mile study area buffer, USFWS requested that it be done, so AEA has accommodated the USFWS request (also see AEA's response to comment WTRBRD-15 below). AEA agrees with ADF&G that the extent of suitable habitat will be defined better during the first survey.
WTRBRD-04	ADF&G	11/14/2012	"DWC consulted with AEA and the USFWS and the interim draft RSP appears to adequately address concerns discussed during consultation." –pdf page 33	AEA is encouraged to see that DWC considers the concerns discussed during consultation after the release of the PSP (documented in Appendices 3 and 4) to have

Waterbird Migration, Breeding, and Habitat Use Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
				been addressed adequately in the interim draft RSP.
WTRBRD-05	ADF&G	11/14/2012	"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." –pdf page 33	Rather than specifying a minimum water body size to define the sampling universe for the waterbird surveys, AEA proposes a lake-to-lake survey approach targeting water body complexes, as discussed at the small-group meeting on waterbirds on October 4, 2012 (see Appendices 3 and 4). Further description has been added to Section 10.15.3. The same section of the RSP states that surveys will included nearly all lakes surveyed by Kessel et al. (1982) with the exception of six large lakes between the Tyone and Maclaren river mouths, which are well upstream from the area that may be affected by the Project.
WTRBRD-06	USFWS	11/14/2012	"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." –pdf page 146	AEA is encouraged to see that USFWS considers most of their stated objectives to be met by the RSP. Section 10.15.1, Study Goal and Objectives, directly addresses these objectives. With regard to Harlequin Ducks, AEA plans to employ the survey methods discussed and agreed to in the small-group meeting on waterbirds on October 4, 2012 (see Appendices 3 and 4), which are discussed in more detail below in AEA's comment to response WTRBRD-14 and WTRBRD-15.
WTRBRD-07	USFWS	11/14/2012	"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." –pdf page 146	The study plan addresses all aspects of the USFWS objective concerning migration use, as is described in several sections of the RSP. The aerial surveys planned during spring and fall migration will address migratory stopover use of waterbodies in the study area, as is described in detail in Sections 10.15.3 and 10.15.4.1.1. Visual and radar survey methods to investigate migratory flights across the study area have been added to the RSP, as proposed at the small-group meeting on waterbirds on October 4, 2012, and as described in detail in Section 10.15.4.1.2. The radar study component was added by AEA specifically to address USFWS's request for more

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				information on bird migration through the study area.
WTRBRD-08	USFWS	11/14/2012	"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." –pdf page 146	Section 10.15.4.3 of the RSP describes the planned literature review and synthesis of information on food habits, diets, and effects of mercury on waterbirds, which was included as an objective of this study in the PSP. Section 10.15.4.3 has been updated to include nonlethal collection of feathers after the nesting season from the nests of piscivorous waterbirds, as available, and from prey remains collected at Peregrine Falcon nest sites. Those samples will be provided to the investigators conducting the mercury risk assessment for analysis of mercury levels (described in Section 5.7.4.2.5). Collection methods for feathers and hair also are described in the respective study plans for fish-eating species of eagles and other raptors (Section 10.14.4.1), landbirds and shorebirds (Section 10.16.4.6), and aquatic furbearers (10.11.4.3). The RSP includes sampling of feathers and hair of piscivorous birds and aquatic mammals (Section 5.7.4.2.5), a predictive risk analysis of possible impacts (Section 5.7.4.2.5.4), fish tissue sampling (Section 5.7.4.2.6), and three modeling methods (Section 5.7.4.3).
WTRBRD-09	USFWS	11/14/2012	Breeding Season: "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." –pdf page 146	AEA is encouraged that USFWS thinks that general agreement has been reached on most aspects of the breeding-season surveys. With regard to Harlequin Ducks, AEA plans to employ the survey methods discussed and agreed to in the small-group meeting on waterbirds on October 4, 2012 (see Appendices 3 and 4), which are discussed in more detail below under Comments WTRBRD-14 and WTRBRD-15. The lake-to-lake survey pattern is described in Sections 10.15.3 and 10.15.4.1.1 and the transition from migration to breeding surveys is described in Sections 10.15.4.1.1 and 10.15.4.2.1. The aerial surveys conducted during spring migration will occur at intervals of 5 days (weather permitting), as was agreed to at the October 4, 2012 small-group meeting, and the

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				decision to transition to breeding surveys will be made based on the chronology of the season each year and the species composition and behavior of the waterbirds. AEA does not propose to conduct weekly surveys throughout the entire breeding season until fall migration, as suggested in the comment. Rather, as was discussed in the October 4 meeting and is described in Section 10.15.4.2.1, two breeding-pair surveys will be flown in June, with an interval of approximately 10 days between surveys, to target the expected peaks of breeding by dabbling ducks and diving ducks, respectively. The next breeding-season surveys flown after that will be brood surveys, beginning about mid-July, as is described in Section 10.15.4.2.3.
WTRBRD-10	USFWS	11/14/2012	Breeding Season: "Clearly describe how actual survey area and extent will be determined (e.g., how many lakes and which lakes?)" –pdf page 146	As is described in Section 10.15.3, the study area will encompass all waterbodies located within the 3-mile buffer portrayed in Figure 10.15-1, plus several other waterbodies that were sampled by Kessel et al. (1982) outside of that buffer and the newly delineated transect-survey block located east of the upper end of the reservoir inundation zone. Section 10.15.3 describes the process for selecting the sample of waterbodies to be surveyed during the migration, breeding-pair, and brood surveys. The survey will attempt to cover as many of the water body complexes in the study area as possible (with the exception of the breeding-pair transect sampling that will be done in the transect-survey block). All waterbodies known to have been sampled by Kessel et al. (1982) will be included, except for six lakes between the Tyone and Maclaren river mouths, which are located far upstream from the area of probable impact. Brood surveys will concentrate on waterbodies within 1 mile of the reservoir inundation zone and access and transmission corridor alignments (see Section 10.15.4.2.3).
WTRBRD-11	USFWS	11/14/2012	Breeding Season: "All actual flight lines should be recorded. It is critical	Sections 10.15.3 and 10.15.4.1.1 describe the use of GIS

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			that the boundaries and sizes of all surveyed lakes and any other survey areas be clearly delineated so that survey area can be calculated." –pdf page 146	and GPS to plan and record survey flight lines. The same flight path will be followed on each migration and breeding-pair survey to accomplish consistent survey coverage and to allow for delineation and calculation of water body areas for use in density calculations. Brood surveys will target waterbodies within 1 mile of Project infrastructure (see Section 10.15.4.2.3).
WTRBRD-12	USFWS	11/14/2012	Breeding Season: "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." –pdf page 147	As is described in Section 10.15.4.2.3, the age classes of young waterbirds found on the brood surveys in July will be used to estimate the probable dates of hatching and laying by back-dating using standard reference materials describing developmental stages.
WTRBRD-13	USFWS	11/14/2012	Breeding Season: "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?" –pdf page 147	As is described in Section 10.15.4.2.1, standard USFWS protocols will be followed to convert raw survey counts to indicated total population indices and species-specific correction factors will be applied to the indices to derive population estimates of each species detected in the transect strips for which correction factors are available. Breeding-pair surveys will be timed to coincide with the peak presence of pairs and males of dabbling ducks and diving ducks to account for the differences in migration timing and turnover of those two general categories of ducks. Weather and visibility conditions will be recorded during surveys to assess the quality of the information recorded, and surveys will not proceed unless conditions are suitable.
WTRBRD-14	USFWS	11/14/2012	Breeding Season: "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	Sections 10.15.3 and 10.15.4.2.2 describe the aerial survey methods planned for use in Harlequin Duck surveys to detect pre-nesting pairs and brood groups, as was discussed and agreed to in the interagency small-group meeting on waterbirds on October 4, 2012 (see Appendices 3 and 4). The planned helicopter survey technique is a standard, efficient method that has been used successfully by USFWS and others to survey for this

Waterbird Migration, Breeding, and Habitat Use Study				
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			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." – pdf page 147	species in Alaska and Canada, as is documented in Section 10.15.5 with relevant citations listed in Section 10.15.9. Hence, no ground-based surveys are planned for this species, although observers conducting riparian point-count surveys for the landbird/shorebird study (Section 10.16) may record Harlequin Ducks, because they will record all bird species detected on those surveys. The exact timing of the helicopter surveys will be based on the specific environmental conditions and breeding chronology observed each year.
WTRBRD-15	USFWS	11/14/2012	Breeding Season: "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." –pdf page 147	Sections 10.15.3 and 10.15.4.2.2 describe the survey area for Harlequin Ducks as extending outside of the waterbird study area (which is based on a 3-mile buffer around Project alignments and the reservoir zone, not a 2-mile buffer) wherever necessary to cover suitable stream habitats located upstream from the study area boundary. AEA notes that ADF&G and USFWS differ in their recommendations regarding the upstream extent of survey coverage (see Comment WTRBRD-03 above), but AEA's approach will be to cover all suitable habitat along these streams, which will be better defined on the first pre-nesting survey in late May 2013.
WTRBRD-16	USFWS	11/14/2012	Migration Use: "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	AEA is encouraged that USFWS thinks basic agreement has been reached on the migration surveys. The waterbird study area is based on a 3-mile buffer around the reservoir inundation zone and the alignments for the access and transmission corridors, not a 2-mile buffer (see Section 10.15.3). Selection of the waterbodies to be surveyed on the lake-to-lake surveys during migration and the breeding season is described in Section 10.15.3 and 10.15.4.1.1, 10.15.4.2.1, and 10.15.4.2.3 (also see entries for Comments WTRBRD-10 and WTRBRD-11, above).

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			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." –pdf page 147	As is described in Sections 10.15.4.2.1.1 and 10.15.6, spring migration surveys will begin in late April, with the exact start date being determined by field observations of the timing and progress of break-up, rather than on thawing degree-days. Fall migration surveys will begin in mid-August rather than early to mid-July (brood surveys will be conducted in July and possibly early August, however). The survey interval between successive migration surveys will be 5 days.
WTRBRD-17	USFWS	11/14/2012	Migration Use: "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." –pdf page 147	The selection process for waterbodies to be covered by the lake-to-lake surveys is described in Sections 10.15.4.1.1, 10.15.4.2.1, and 10.15.4.2.3 (also see entries for Comments WTRBRD-10, WTRBRD-11, WTRBRD-16, above). The migration surveys will produce counts of the number of birds of each species on the survey waterbodies. Detectability estimation will not be conducted for the migration surveys (but species-specific population indices and correction factors will be used for the breeding-season surveys).
WTRBRD-18	USFWS	11/14/2012	Migration Use: "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	The methods proposed for radar and visual surveys of migratory movements by all species of birds around the dam site in 2013 is described in detail in Sections 10.15.4.1.2 (and is referenced in Section 10.16.4.4). The decision to conduct a second year of study in 2014 will be based on the results obtained during the spring and fall migration monitoring in 2013. Regardless of whether one or two years of radar/visual monitoring surveys are conducted, however, AEA intends to follow industry standards and best practices (examples cited in Section 10.15.7) in designing transmission towers and siting transmission lines to reduce risk to birds, in marking transmission lines for maximum visibility, and using bird-safe lighting at all Project facilities to minimize

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			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." – pdf pages 147-148	the attraction of birds, consistent with human safety considerations dictated by other federal and state agencies.
WTRBRD-19	USFWS	11/14/2012	Piscivorous Wildlife and Mercury Risk Assessment: "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." –pdf page 148	The RSP (Section 10.15.4.3) has been updated to describe the nonlethal method proposed to collect feathers of piscivorous waterbirds after the nesting season from nests of loons, grebes, and Arctic Terns, as well as from prey remains at nest sites of Peregrine Falcons, which prey on a variety of waterbirds. Feather collections of other species of piscivorous birds are described elsewhere in Sections 10.14.4.1 and10.16.4.6. Feather samples will be provided to the researchers working on the Mercury Assessment and Potential for Bioaccumulation Study (Section 5.7) for laboratory analysis of mercury levels. In addition, a literature review and synthesis of information on food habits, diets, and effects of mercury on piscivorous waterbird species will be conducted and that information will be provided to the researchers working on the mercury assessment study.

Landbird and Shorebird Migration, Breeding, and Habitat Use Study				
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BREED-01	CSDA	11/14/2012	"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." –pdf page 3	AEA believes that two years of data will be sufficient to understand bird migration movements in the Project area. A detailed study of bird migration in the area of the proposed dam (using visual and radar detection methods) is noted in Section 10.16.4.4 and described in detail in Section 10.15.4.1.2.
BREED-02	CSDA	11/14/2012	"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." –pdf page 3	AEA believes that two years of data will be sufficient to calculate densities. Point-count surveys will be conducted for approximately 30 days each season, and with 4 field teams it is likely that upwards of 800 point-count sites will be sampled each year. With 1,600 point-count sites, sufficient data should be available to calculate densities, at least for the more common species. For uncommon species for which there will be fewer observations, removal analyses (as recommended by the USFWS) will be conducted to improve detectability estimates. Additionally, detection functions will be "borrowed" from other studies in the region, as needed, to increase precision in the density calculations for uncommon species (see Section 10.16.4.1.3).
BREED-03	Long, Becky	11/13/2012	Two years are inadequate, request for 5 to 7 year study. –pdf page 3	With an intensive point-count study effort in 2013 and 2014, AEA will have sufficient data to calculate densities for breeding landbirds and shorebirds for the two years of the study (see AEA's response to comment BREED-02 above). This information will be used to provide an estimate of the numbers of birds that could be affected by Project development, and this estimate will be interpreted with an understanding of both (1) the variability inherent in density estimates derived in point-count survey data, and (2) the known variability in breeding bird numbers in Alaska among years. Additionally, AEA will have sufficient information on habitat-use from these same point-count surveys to quantitatively estimate habitat loss, habitat alteration, and disturbance effects for breeding landbirds

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				and shorebirds.
BREED-04	ADF&G	11/14/2012	"Establishing 3 – 4 or more distance bands instead of requiring observers to estimate actual distances." –pdf page 34	All data will be recorded in distance classes in the field as described in Section 10.16.4.1.2.
BREED-05	ADF&G	11/14/2012	"Observers must be trained, tested and prequalified for species identification and distance before going afield." –pdf page 34	All observers will be trained, tested, and prequalified for bird identification (visual and auditory) and distance estimation, as described in Section 10.16.4.1.2.
BREED-06	ADF&G	11/14/2012	"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." –pdf page 34	AEA concurs with the USFWS perspective (as stated by the USFWS landbird coordinator for Alaska at the landbird-shorebird meeting on September 6, 2012 [DWC's landbird specialist was not in attendance; see RSP Appendices 3 and 4]), that a combination of removal and distance analyses would be adequate to calculate detection probabilities, and that using double-observer methods is not likely to result in substantially more reliable estimates of detectability. Adding double-observer methods would result in three analyses used to calculate detection probabilities, which is unnecessarily duplicative. Moreover, it is well known that the density estimates from point-count data are highly variable (due largely to variation in distance estimates, which is independent of detectability), and AEA believes that adding another analysis to inherently variable data is unlikely to substantially increase confidence in the resulting density estimates. For these reasons, AEA is not planning to incorporate double-observer methods in the point-count surveys.
BREED-07	ADF&G	11/14/2012	"DWC supports 2 sampling periods and 2 years of sampling as called for in plan." –pdf page 34	AEA is pleased that DWC supports the two sampling periods in each of two years protocol, as outlined in RSP Section 10.16.
BREED-08	ADF&G	11/14/2012	"Need specific surveys to inventory shorebirds and cavity nesters in addition to raptors and water birds as proposed." –pdf page 34	Point counts have recently been adopted for inventories of shorebirds by the USGS and others, and have been recognized by the Alaska Shorebird Group as an

Landbird and Shorebird Migration, Breeding, and Habitat Use Study				
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				appropriate method to survey for shorebirds, especially in forested areas in which shorebird habitat is patchy in occurrence. Aerial surveys for shorebirds are not suitable (low identification potential) and plot-based methods for shorebird surveys (in forested habitats as opposed to tundra habitats on the North Slope) are likely to result in few observations of low-density nesting shorebirds. AEA believes point-count surveys will be adequate to inventory shorebirds in the largely forested Project area. Specific surveys for cavity nesters are likely to involve a large effort for little data in return (for these relatively uncommon species). The same survey concerns for cavity nesters also apply to the requested surveys of owls and small raptors (see AEA's response to comment BREED-24 below). Cavity nesters are likely to be detected, at least when in-transit between point-count locations and during other wildlife survey efforts in the Project area. Cavity nesters will not be ignored. Project effects on cavity nesters will be assessed through evaluations of habitat use and impact assessments of habitat loss/alteration/disturbance for those species, to be conducted in the FERC License Application (see Section 10.19).
BREED-09	USFWS	11/14/2012	"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 overwintering 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	A specific migration study is now proposed, which would include landbirds and shorebirds (see Section 10.16.4.3). This study would involve radar and visual surveys of all migrant birds near the proposed dam site. The USFWS is aware of this study proposal and appears to approve of it (see AEA's response to comment BREED-25 below). At the September 6, 2012 landbird-shorebird meeting (see Appendices 3 and 4), the USFWS stated that they did not believe that surveys for overwintering birds were needed, and that the data from the 1980s for overwintering birds in the Project area could be used to determine the occurrence and abundance of overwintering bird species. The USFWS also notes (in the comment BREED-20

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			Mercury Risk Assessment." –pdf page 150	below) that they believe surveys for overwintering birds are not necessary. A specific survey effort for piscivorous and partly piscivorous landbirds and shorebirds is now proposed (see Section 10.16.4.2), as well as a literature review study for those species (see Section 10.16.4.6), and the data from those two study efforts will be used to support the Mercury Assessment and Potential for Bioaccumulation Study.
BREED-10	USFWS	11/14/2012	"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." –pdf page 150	The proposed methodology (Viereck et al. 1992, Level IV vegetation types, plus ABR's landscape feature additions), will address habitat parameters beyond plant species composition and vegetation types (e.g., vegetation structure, landscape position, disturbance level). The habitat mapping approach is further described in Section 11.5.4.2. The USFWS has not located the USGS report that compares the Viereck and Kessel classifications, but in the absence of that material, AEA has prepared a "crosswalk" between the two classification systems and has the following comments. First, some aspects of the Kessel classification system will be integrated into the mapping of habitats for the Project (e.g., cliff and bluff faces for nesting birds will be extracted from barren vegetation types using DEM data). Second, the low, moderate, and tall shrub classes used in the Kessel system cannot be consistently delineated from aerial imagery. Those fine-scale shrub classes can be used for on-the-ground vegetation classifications, but those three shrub classes cannot be reliably identified from aerial imagery (the Project will use a habitat map derived from aerial imagery to quantitatively estimate habitat loss and alteration effects). Lastly, AEA notes that recent Alaskan landbird data indicate that the clean separations in habitat use by landbird species in low, moderate, and tall shrub types, which Kessel refers to in her 1979 paper, are not common. Rather, many species often show a wide range in use of shrub types with an emphasis, in some cases, in

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				tall or low shrub habitats depending on the species. AEA will use the complete range in habitat use for each species (e.g., from low to tall shrub types) in the estimates of Project-induced habitat effects noted above.
BREED-11	USFWS	11/14/2012	"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." –pdf page 150	AEA is pleased that the USFWS agrees on the study area to be used for the point-count surveys. The 2-mile buffer has been truncated at the western ends so as to not cross the Parks Highway, Chulitna River, or the Alaska Railroad corridor (see Section 10.16.3).
BREED-12	USFWS	11/14/2012	"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." –pdf page 151	Comparative reference plots in an undisturbed region might be informative in evaluating the Project's long-term impacts, but this is a broad, landscape-scale monitoring question that will have to be addressed later in the licensing process. Additionally, there may be more focused methods to evaluate the primary impacts of the proposed Project on breeding landbirds and shorebirds, which would be the displacement of birds from their natal habitats.
BREED-13	USFWS	11/14/2012	"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." –pdf page 151	AEA agreed, at the September 6, 2012 landbird-shorebird meeting (see Appendices 3 and 4), to use removal and distance analyses to calculate densities for breeding landbirds and shorebirds and has included text to this effect in the RSP (see Section 10.16.4).
BREED-14	USFWS	11/14/2012	"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." –pdf page 151	More clarification on the field methods and data analysis proposed is provided in the revised PSP (see Section 10.16.4). AEA is following the recommendations for field methods (ALMS protocols) and data analysis for point counts as provided by the USFWS at the September 6, 2012 landbird-shorebird meeting (see RSP Appendices 3 and 4). Detection probabilities will be calculated using the two methods (removal analyses and distance analyses)

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				recommened by the USFWS landbird coordinator for Alaska at that same September 6, 2012 landbird-shorebird meeting.
BREED-15	USFWS	11/14/2012	"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." –pdf page 151	AEA is not aware of a request for a formal analysis to determine the optimal number of point counts per habitat. An optimal number of point counts per species, of course, depends on their local abundance, which will be determined in this study. Briefly, given that surveys are planned over a roughly 30-day period (see below), and that 4 teams can conduct at least 8 counts per day and probably more: 32/day x (30 - 5 weather days) = ~800 point counts per year. Assuming 25 habitat types will be mapped, there could be: 1,600 counts/25 = ~64 point counts per habitat over two years. At the September 6, 2012 landbird-shorebird meeting (see Appendices 3 and 4), the USFWS landbird coordinator for Alaska indicated that he did not believe point-count surveys in April were necessary, and that removal analyses would help correct the abundance data for resident species, which are recorded less commonly in point-count surveys than migrant species. Resident species are typically recorded (albeit in low numbers) during point counts in May and June, but they may be more prevalent during May at the higher elevations typical of the Project area. AEA has agreed to double the originally proposed survey effort, so that surveys would be conducted over an approximately 30-day period from mid-May to mid-June. As indicated in Section 10.16.4, the May surveys would target shorebirds and early nesting landbirds and the June surveys would target later nesting landbirds, mostly neotropical migrants.
BREED-16	USFWS	11/14/2012	"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.)." –pdf page 151	This is correct. Survey timing will be flexible in each year to accommodate any variability in the onset of breeding activities of landbirds and shorebirds because of variability in environmental conditions. This is described in the RSP

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				in Section 10.16.4.1.2.
BREED-17	USFWS	11/14/2012	"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." –pdf page 151	See AEA's response to BREED-06, which was prepared in response to ADF&G's comment on this same topic. AEA believes that replicate point-count plots within a year or between years will be counterproductive to one of the primary goals of this study, which is to provide abundance data on the less common species of conservation concern. To collect adequate data on uncommon species, which typically are patchy in occurrence, it is important to conduct point counts in many different locations. Given that survey timing will be adjusted each year to account for any variability in the timing of breeding (because of environmental factors; see AEA's response to comment BREED-16 above), AEA believes it is not necessary and counterproductive, as noted above, to replicate point-count plots within a year or between years in an attempt to account for inter-annual variation in the timing of breeding.
BREED-18	USFWS	11/14/2012	"General Methodology. It is expected that ALMS protocol for conducting surveys be followed." –pdf page 151	As noted in RSP Section 10.16.4, ALMS protocols for point-count surveys will indeed be followed, except that the collection of vegetation data at each point-count location will not be necessary (see AEA's response to comment BREED-19 below).
BREED-19	USFWS	11/14/2012	"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." –pdf page 151	AEA will not be collecting detailed vegetation data at each point-count plot because a fine-scale wildlife habitat map will be prepared for the Project and the map will encompass the entire point-count study area. The point-count study will be conducted in close coordination with the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (Section 11.5). The habitat surveyed at each point-count plot will be determined by the habitat that is mapped at each point-count site in the wildlife habitat mapping process. Point-count observers, however, will be asked to record the habitat that birds are actually using at the time of

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				observation, and the habitat records from the point-count surveys also will be used as additional ground-reference data for the habitat mapping effort (see Section 10.16.4.1.2).
BREED-20	USFWS	11/14/2012	""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)." –pdf pages 151-152	AEA is pleased that USFWS agrees that surveys for overwintering birds are not needed. As noted above, AEA concurs with the perspective of the USFWS landbird coordinator for Alaska that surveys targeted for resident species in April are not needed. Surveys in May, however, will be conducted, as indicated in Section 10.16.4. At the September 6, 2012 landbird-shorebird meeting, AEA understood that agreement was reached on the resident bird issue and that targeted surveys for resident species in April were not needed, although surveys in May would be conducted (see Appendices 3 and 4).
BREED-21	USFWS	11/14/2012	"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." –pdf page 152	As indicated in AEA's response to comment BREED-17 above, the point-count study has been designed specifically with species of conservation concern in mind, because AEA is aware that these species are of prime concern to management agencies. For example, the study protocol calls for surveys to be conducted in as many occurrences of each habitat type as possible (spread throughout the study area) to maximize the detection of uncommon species, which are often patchy in occurrence across the landscape (see Section 10.16.4.1.1).
BREED-22	USFWS	11/14/2012	"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." –pdf	The landbird-shorebird study plan now includes a targeted boat-based survey of swallow colonies along the Susitna River and tributary streams in the reservoir inundation zone as recommended by the USFWS (see Section 10.16.4.3).

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			page 152	
BREED-23	USFWS	11/14/2012	"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." –pdf page 152	As agreed to previously, AEA is proposing to conduct additional riparian- and lacustrine-focused surveys within the inundation zone and infrastructure area surrounding the proposed dam site (see Section 10.16.4.2). Both riparian and lacustrine habitats will be targeted because some of the riparian-associated species noted by the USFWS, especially the shorebirds, also are known to use lacustrine habitats. A precise list of species to be targeted could be prepared for these surveys, but the surveys will, by necessity, have to target habitats (i.e., riparian and lacustrine habitats will be the focus). All species observed in these surveys will be recorded. The riparian- and lacustrine-focused surveys will entail both point counts and linear walking surveys conducted between point-count locations in riparian and lacustrine (margin) habitats. For the linear surveys, a measure of relative abundance (birds/unit time) will be calculated.
BREED-24	USFWS	11/14/2012	"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." –pdf page 152	Surveys of small owls and hawks were discussed at the TWG meeting on August 9, 2012, and at the follow-up meeting on landbirds and shorebirds on September 6, 2012 (see Appendices 3 and 4). AEA explained that it had concerns about personnel safety because the surveys for certain owl species (most notably Boreal Owl) would require intensive nocturnal sampling during late winter/early spring to detect a species that occurs in low density over broad areas. USFWS agreed that specific surveys of small cavity-nesting owls would not be needed, provided that AEA acknowledges their occurrence in the study area and includes them in the Evaluation of Wildlife Habitat Use (Section 10.19), which AEA agreed to do. As with small owls, AEA is concerned that ground-based surveys for small hawks also would involve a large amount of effort (given the large Project area size and the late winter/early spring snow cover present during the breeding

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				period) in return for what is likely to be few observations of uncommon species. Hence, AEA is not proposing ground-based surveys focused on these species. All these species will be assessed for impacts, however, as described in RSP Section 10.19. Additionally, a large number of aerial surveys will be conducted for wildlife, raptors in particular (see Section 10.14), and all small hawks and owls will be recorded when seen during those surveys (Short-eared Owls, which are medium sized and prefer open habitats, are readily observed during aerial surveys). These species also are likely to be observed, as incidental observations, during the point-count surveys to be conducted during spring and summer 2013 and 2014. (It is common to observe a number of additional species, not recorded during the point counts themselves, when in transit between point-counts sites.) AEA's wildlife contractors regularly record all observations of uncommon bird species during field survey efforts (whether those species are the focus of the survey or not) and that protocol will be followed on this Project as well.
BREED-25	USFWS	11/14/2012	"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	AEA is pleased that USFWS is considering that the proposed radar and visual studies of bird movements at the dam site (see Sections 10.16.4.4 and 10.15.4 .1.2) may be sufficient to address concerns over impacts to migrant birds in flight (when coupled with additional work to site transmission lines in bird-safe areas, mark transmission lines for maximum visibility to birds, and to use lighting protocols at all Project facilities to minimize the attraction of birds). AEA also is pleased that USFWS recognizes the difficulty in acquiring data on stop-over and/or staging use of the Project area during migration, and that they are not recommending such studies at this time.

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			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." –pdf pages 152-153	
BREED-26	USFWS	11/14/2012	PISCIVOROUS WILDLIFE AND MERCURY RISK ASSESSMENT. "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." –pdf page 153	The landbird-shorebird study plan now notes that nonlethal collections of feathers from the nests of piscivorous species (Belted Kingfisher) for analysis of mercury levels will be made if kingfisher nests are found during the swallow survey (see Section 10.16.4.6). Additionally, a review and synthesis of information on food habits and diets of Belted Kingfishers and partly piscivorous species (e.g., American Dipper and Spotted Sandpiper) will be conducted, with an emphasis on Alaska studies, and the information will be provided to the researchers working on the Mercury Assessment and Potential for Bioaccumulation Study.

Population Ecology of Willow Ptarmigan in Game Management Unit 13				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			No Comments Received	

Wood Frog Occupancy and Habitat Use				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
FROG-01	ADF&G	11/14/2012	"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." –pdf page 34	As explained in Section 8.4 of the PSP and 10.4 of the RSP, AEA has consulted extensively with ADF&G in the development of the proposed wildlife study plans over the past six months, including the proposed study of wood frogs. As a result of the Technical Working Group meetings, focused meetings on individual wildlife study plans, and development of the interim draft RSP (which included alterations in the wood frog study design recommended by ADF&G), AEA believes that the Wood Frog Occupancy and Habitat Use study plan has been developed to be responsive to all comments received. AEA proposes a design that is consistent with generally accepted scientific practice and can be used to assess potential Project effects on wood frogs. As noted in Sections 10.18.4.2 and 10.18.6 of the RSP, in early 2013 AEA will develop the sampling protocol for Batrachochytrium dendrobatidis in consultation with ADF&G and USFWS. Should ADF&G have any comments or concerns on the proposed study design in the RSP, it should be sure to submit comments to FERC by January 18, 2013, as provided by FERC's regulations, 18 CFR 5.13(b), and FERC's September 17, 2012 notice extending the comment deadline.
FROG-02	ADF&G	11/19/2012	"The document says 'The second survey at each site will be conducted by a different observer with no knowledge of the survey results from the first survey.' This makes sense, but it goes on to say, 'However, if detected on the first survey, a second survey will not be needed.' The two statements don't really jive. The second statement apparently assumes a detectability of '1'. All sites should be surveyed twice to assess detectability. The draft goes on to explain that a small number of acoustic monitoring devices will be deployed to increase accuracy. That is a good approach in addition to making at least two site visits. The document lists a number of covariates such as habitat and environmental characteristics that will be noted. Recording these parameters will be very useful." –email from Mark Burch	The Wood Frog Occupancy and Habitat Use study is based on a removal design (once detected at a site, that site is removed from further surveys). This is as opposed to a standard occupancy study design in which each site is surveyed multiple times. We looked in to this more and based on Mackenzie and Royle (2005 [Designing occupancy studies: general advice and allocating survey effort. J. of Appl. Ecol. 42:1105-1114]), it appears that removal designs are more efficient statistically than standard designs when occupancy rates and detectability are high. Given an estimated occupancy rate of ~45–50% (from studies at Denali NP and Pebble) and detectability of ~27% (Pebble), a removal design is slightly more efficient than a standard design. The most efficient design, however, would entail 8 visits to each site for a removal design (6 for a standard design), but that level of repeat sampling would be counterproductive for a broad, landscape-scale study such as the

Wood Frog Occupancy and Habitat Use				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
				one proposed for the Project. If the Project area were very small, that level of repeat sampling might be feasible, but in this case, the goal is not so much to get a highly accurate occupancy estimate as to sample broadly within the Project area to determine how widespread frogs are. With a limited number of repeat visits, we can determine an occupancy rate and also spend more time surveying additional sites for frogs, which we believe will be more beneficial.

Evaluation of Wildlife Habitat Use Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
WLDHAB-01	USFWS	11/14/2012	"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." –pdf page 158	Section 11.5.7 clarifies that impact assessments will be conducted during the FERC license application process. Also, AEA further clarified, in Section 11.5, the relationship between the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (Section 11.5) and the Evaluation of Wildlife Habitat Use study (Section 10.19).
WLDHAB-02	USFWS	11/14/2012	"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." –pdf page 150	As discussed with USFWS at the September 6, 2012 landbird-shorebird meeting (see Appendices 3 and 4), AEA is aware of the dangers in determining that a species is not present when it is simply not observed, and similarly determining that a species does not use a particular habitat, for example, when those habitats were not sampled or undersampled. AEA will correct for these potential problems when ranking habitat values. In short, habitat values are ranked for wildlife species independent of their abundance, primarily because of the problems inherent in determining habitat use for species that are only rarely observed. For cases such as these in which Project-specific data are limiting, as is described in Section 10.19.4.1, habitat values will be derived by reference to habitat use information from other studies in Alaska and/or from field experience with the species in Alaska.

Wildlife Harvest Analysis				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
WHARV-01	CCC	11/15/2012	"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." –pdf page 3	As is described in Section 10.20.3 of the RSP, the Wildlife Harvest Analysis will summarize all harvest data reported to ADF&G and USFWS for a large area, including GMU Subunits 13A, 13B, 13E, 14B, 16A, and part of 20A. The Subsistence Resources Study Plan (Section 14) addresses 37 study communities, 25 of which have planned subsistence fieldwork. Section 14 does address communities in the lower Mat Su Valley, including Wasilla and outlying CDPs. Section 14.5.4.1 includes a subtask to access ADF&G's "winfonet" database to identify "subsistence users and communities in Alaska who travel to the proposed Project area to participate in land mammal harvest activities and additional information about study communities' (including those located in nonsubsistence area) subsistence activities in the Project area." Results from the Wildlife Harvest Analysis (Section 10.20), as well as results from the variety of physical, biological, and cultural resource studies, will be compared with subsistence harvest data to assess impacts on subsistence uses.

Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
VWHAB-01	USFWS	11/14/2012	"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." –pdf page 156	The image resolution terminology has been standardized now throughout Section 11.5. Detailed information on the image quality and image types to be used for mapping is presented now in Section 11.5.2.
VWHAB-02	USFWS	11/14/2012	"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." –pdf page 156	Section 11.5.1 clarifies that the goals and objectives. Impacts will not be assessed in the Project environmental studies, but instead will be assessed in the FERC License Application in 2015. The specific products of the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin are the maps themselves, which will be used, in the License Application, to inform impact assessments.
VWHAB-03	USFWS	11/14/2012	"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." –pdf page 157	AEA agrees with this comment, and because the study does not include development of PM&E measures as a study objective, no changes to the RSP are needed to address this comment. While the vegetation and wildlife habitat maps will be used to inform both the impact assessments and the preparation of mitigation measures, those activities will be conducted in the FERC License Application (in 2015) when Project design details are more refined.
VWHAB-04	USFWS	11/14/2012	"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	AEA agrees with these points, which do not require changes to the RSP. The objective for use of the 1987 vegetation map within the structure of the RSP is to refine it based on currently available imagery, and then use it as a planning tool for field-plot selection and to assist, if needed, with the boundary delineation for currently existing vegetation types. Currently, it is unclear whether the 1987 vegetation map is accurate enough at a fine scale to use to address gradual, natural vegetation and wildlife habitat changes; to assess its accuracy would involve detailed comparisons of the line-work with the

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			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." –pdf page 157	original 1980s aerial photography used in the 1987 mapping, which is an activity outside the scope of the RSP. AEA believes the potential impacts to vegetation from the proposed Project would be localized and not easily confused broader, landscape-scale changes in vegetation due to natural causes.
VWHAB-05	USFWS	11/14/2012	"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." –pdf page 157	AEA is pleased that USFWS agrees with the modified study area boundaries, which is incorporated throughout RSP Section 11.5. In addition, the RSP does not include the word "proposed" when referencing technical details of the study plan that have been finalized through months of consultation between AEA, USFWS, and other licensing participants.
VWHAB-06	USFWS	11/14/2012	"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." –pdf page 157	As noted above in AEA's response to VWHAB-02, the objective for conducting impact assessments has been removed from section 11.5 because that work will occur in the FERC License Application. The single objective of this study is to develop vegetation and wildlife habitat maps that describe baseline conditions in the study area, and the methods describe how those maps will be prepared.
VWHAB-07	USFWS	11/14/2012	"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	Clarification to the first paragraph of text in Section 11.5.4 was made to define the first use of "ITU." The units of ecological importance sentence was rewritten to indicate that wildlife habitats will be defined in this study (now

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			sections (e.g., "ITU" referenced in the second paragraph of Draft RSP Section 11.5.4)." –pdf page 158	cross-referenced to the appropriate methods subsection). Further noted (in Section 11.5.6) that the habitats will be defined in coordination with wildlife researchers for the Project and the riparian vegetation study team.
VWHAB-08	USFWS	11/14/2012	"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." –pdf page 158	The description of field data collection methods were clarified and expanded in Section 11.5.4.3 to indicate the full suite of data collected for this study (Section 11.5) and the Wetland Mapping Study (Section 11.7), because the field surveys for both studies will be conducted concurrently to maximize efficiency. In this study, however, only maps of vegetation and wildlife habitats will be prepared, so there is no need to cite the Cook Inlet wetland classification system, which is discussed in the RSP for the Wetland Mapping Study (Section 11.7). Wetlands will not be mapped in this study; they will be mapped in the Wetland Mapping Study only.
VWHAB-09	USFWS	11/14/2012	"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	The set of wildlife habitats will be developed using an iterative process taking into account wildlife species/habitat associations for all birds, mammals, and amphibians to be assessed for impacts (see Section 10.19). Elements of Kessel's (1979) habitat classification will be used in developing the wildlife habitats to be mapped (see Section 11.5 in the PSP-to-Draft RSP comment/response table; Appendix 3). Habitats will be developed in coordination with the wildlife researchers on

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			addition to this portion of the methods." –pdf page 158	the Project (i.e., Project-specific observations of habitat use and, when needed, available literature on habitat use for the birds, mammals, and amphibians known to occur in the Project area will be used to ensure that the habitats mapped will be representative of those known to be used by wildlife in the Project area). Sections 11.5.4.2 and 11.5.6 were modified to clarify this iterative process of developing the wildlife habitats to be mapped.
VWHAB-10	USFWS	11/14/2012	"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." –pdf page 158	RSP Section 11.5 indicates that impact assessments will be conducted during the FERC License Application process, and are not a part of the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin. The approach for conducting those impact assessments is detailed in Section 11.5.7. As a point of further clarification, Section 11.5 describes the relationship between the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin and the Evaluation of Wildlife Habitat Use study (Section 10.19).
VWHAB-11	USFWS	11/14/2012	"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." –pdf page 158	ADNR has developed an interactive online webmap application specific to this Project: http://www.dmlwmaps.dnr.alaska.gov/Watana_App/. The site will have available map layers including current imagery, archival data layers, draft and final GIS layers related to the individual Project studies. AEA recommends that all licensing participants make use of this resource when reviewing the vegetation and wildlife habitat map products.
VWHAB-12	USFWS	11/14/2012	"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?"	AEA expects fieldwork to occur in 2013 and 2014 to cover the substantial Project areas not currently covered by the existing high-resolution imagery. The 2013 field program will be conducted primarily using the moderate-resolution RapidEye imagery (Section 11.5.4.3). Follow-up fieldwork is expected in 2014 to cover any areas that were not adequately surveyed in 2013, and AEA's Initial Study

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				Report will include recommendations for 2014 fieldwork (Section 11.5.4.4).
VWHAB-13	USFWS	11/14/2012	"Why is 2012 included in the timeline for Draft RSP Table 11.5-1 if no activities are scheduled or performed in 2012?"	The 2012 columns were removed from the timeline in the schedule (Table 11.5-1) because those columns do not apply to a study plan describing work to be conducted in 2013 and 2014.
VWHAB-14	USFWS	11/14/2012	"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."	Based on this comment and further review AEA has modified the interdependency flow chart and text (Section 11.5.7) to indicate that input on habitat use from the wildlife researchers conducting each of the wildlife studies for the Project, as noted above in AEA's response to comment VWHAB-09, will be used in developing the wildlife habitats to be mapped.

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RIP-01	CWA	11/14/2012	Scope is insufficient in studying the Lower River based on AEA's apparent assumption that Project effects will not significantly affect the Lower River riparian plant community. –pdf pages 7-8	AEA is not assuming there are no Project effects on the Lower River riparian plant community. Both Middle and Lower River segments are under consideration as part of this RSP. Although the majority of study elements described in this RSP are concentrated within the Middle River Segment, this is because Project operational effects on hydraulic variables (stage and flow primarily) will likely be greatest in this segment of the river. These effects tend to attenuate in a downstream direction as channel morphologies change, and flows change due to tributary inflow and flow accretion. That said, the downstream extent of the study area for the Riparian Vegetation Study Downstream of the Proposed Watana Dam may be expanded further into the Lower River, pending the results of additional modeling of operational effects on hydrology in the Lower River in Q1 and Q2 2013 (see Section 11.6.3).
RIP-02	USFWS	11/14/2012	"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)." –pdf pages 159-160	As described in Section 11.6.7, these two riparian studies are interdependent and will be coordinated closely. The mapping of existing riparian vegetation will be conducted in the Riparian Vegetation Study Downstream of the Proposed Watana Dam (see Section 11.6), and the collection of vegetation data used to predict riparian community changes will be done jointly by the Riparian Vegetation Study Downstream of the Proposed Watana Dam and the Riparian Instream Flow Study (see Section 8.6). USFWS is correct that the predictions of change in riparian communities will be done in the Riparian Instream Flow Study (see Section 11.6.7 for an explanation of the roles of these two studies).
RIP-03	USFWS	11/14/2012	In the USFWS study request (May 31, 2012), the Service had envisioned that the riparian vegetation study was primarily a mapping effort that would use products from other studies to map the type and extent of predicted changes in riparian habitat. However, the riparian vegetation PSP and RSP include field data collection as an objective, a	The two riparian studies (riparian vegetation and riparian instream flow) have been revised. In the Riparian Vegetation Study Downstream of the Proposed Watana Dam (see Section 11.6), detailed data will be collected on existing vegetation and soils, existing riparian vegetation

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			role that USFWS had envisioned would be entirely within the scope of the riparian instream flow study. In the Technical Work Group meeting on October 24, 2012, AEA informally remarked that the riparian instream flow study team was working closely with the riparian vegetation study team to address the USFWS study-request objective, however it was not made clear to the Service that the USFWS objective was being addressed also by the riparian vegetation study. The USFWS recommends assigning the data collection and analysis portion of this objective (i.e., predicting changes in riparian habitats downstream of the proposed dam) to the riparian instream flow study since 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. The USFWS suggests that the objective of up-scaling the riparian habitat predictions from the Focus Areas to the entire study area may be an appropriate study element for the riparian vegetation study. Lastly, the USFWS 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. –pdf page 160	in the Susitna River floodplain will be mapped, and vegetation succession will be modeled. The data collected in Focus Areas (previously Intensive Study Reaches) and the successional modeling results from the Riparian Vegetation Study Downstream of the Proposed Watana Dam will then be used by researchers in the Riparian Instream Flow Study (see Section 8.6) to prepare a spatially explicit model to predict Project-influenced changes in riparian vegetation across the floodplain study area. More details on this collaboration between the two studies are provided in Sections 11.6.4.2, 11.6.4.4, and 11.6.7. These two riparian studies will continue to be closely coordinated with the overarching goal of determining how riparian areas may change because of construction and use of the proposed dam.
RIP-04	USFWS	11/14/2012	"However AEA eventually chooses to 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." –pdf page 160	The RSP has been revised to add additional detail on the methodology for addressing this objective (see Sections 8.6 and 11.6). Through quarterly TWG meetings in 2013, AEA and licensing participants will have the opportunities to discuss methods to be used to predict changes in riparian habitats (see Section 11.6.6).
RIP-05	USFWS	11/14/2012	"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."" –pdf page 160	In Section 11.6.3, the RSP defines "riparian areas" to include all vegetation and soils that are directly (via flooding and overland flow) or indirectly (via ground water) influenced by river waters. This definition is inclusive of floodplains.
RIP-06	USFWS	11/14/2012	"A number of terms are used to qualify the resolution of aerial/remote-sensed imagery (high-, moderate-, fine-scale) throughout the study	In Section 11.6.2, the pixel resolution for the high- and moderate-resolution imagery is defined and the formats

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			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." –pdf page 161	(true color, false natural color, and CIR) for that imagery, which will be used for photo interpretation, also are noted.
RIP-07	USFWS	11/14/2012	"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 assessment of impacts to riparian ecotypes, wetlands, and wildlife resources." –pdf page 161	In Section 11.6.1, the overall goals of the Riparian Vegetation Study Downstream of the Proposed Watana Dam are clarified. In Section 11.6.4.4, the approach to predicting changes in riparian areas is described. In Section 11.6.7, the interdependencies among the riparian studies for the Project are described and a discussion of the approach to assessing the impacts to riparian ecotypes, wetlands, and wildlife habitats has been provided.
RIP-08	USFWS	11/14/2012	"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)?" –pdf page 161	As noted in Section 11.6.3, "The Riparian Vegetation Study Downstream of the Proposed Watana Dam will be focused on riparian areas along the Susitna River and its tributaries below the proposed dam site." The study areas for the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (Section 11.5) and the Wetland Mapping Study (Section 11.7) have been clarified; those studies only involve riparian areas along the Susitna River upstream of the dam site and do not include any riparian areas below the dam. There is no overlap in those two studies with the Riparian Vegetation Study Downstream of the Proposed Watana Dam (Section 11.6).
RIP-09	USFWS	11/14/2012	"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	Regarding the second objective, as noted in Section 11.6.1, the Riparian Vegetation Study Downstream of the Proposed Watana Dam involves (1) collecting vegetation and soils data to map existing vegetation on the Susitna

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			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." –pdf pages 161-162	River floodplain, and (2) characterizing sedimentation and erosion, modeling vegetation succession, and describing vegetation-soil-landscape relationships, all of which will feed into the riparian instream flow and Geomorphology Study objectives of characterizing physical and ecological processes downstream of the proposed dam. There is an ongoing collaborative effort between the Riparian Instream Flow Study, Riparian Vegetation Study Downstream of the Proposed Watana Dam, and Geomorphology Study leads to coordinate their respective studies and fieldwork for maximize efficiency. Regarding the fourth requested objective, AEA agrees that this objective need not be included in this study; the development of any mitigation measures needed, will occur during the preparation of the FERC License Application (see Section 11.6.7).
RIP-10	USFWS	11/14/2012	"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	The 100-year floodplain, the original conception for the width of the Riparian Vegetation Study Downstream of the Proposed Watana Dam area, will be used as the lateral extent of riverine physiography, and will serve as the initial lateral boundary of the riparian study area. The RSP provides further details as to the selection of the lateral extent of the riparian study area (see Section 11.6.3). The draft riverine physiography layer is expected to be available for agency review by Q1 2013. Once the agencies have reviewed the study area, their comments will be incorporated into the final 2013 study area in late Q1/early Q2 2013. That study area version may be subject to change in Q4 2013 based on additional field data and modeling. Using the 100-year floodplain limit for the lateral boundary of the study area should result in the study area width being at least as wide as the area in which groundwater could be affected by project operations. As noted in RSP

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			roots and influenced by Project operations." –pdf page 162	Section 11.6.3, the lateral boundary proposed for the Riparian Vegetation Study Downstream of the Proposed Watana Dam will be reviewed by the other study leads for riparian-focused studies and the agencies before a final lateral boundary is determined.
RIP-11	USFWS	11/14/2012	"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." –pdf page 162	In the RSP, AEA has spelled-out the first reference to acronyms in major sections (i.e., in each individual study plan section). Yes, wetlands in this study will be classified in the same manner as wetlands in the Wetland Mapping Study (see Section 11.7), but without a functional assessment. This has been clarified in the RSP (see Section 11.6.1).
RIP-12	USFWS	11/14/2012	"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	Wetlands mapped as part of the Riparian Vegetation Study Downstream of the Proposed Watana Dam will be classified using the same methods as in the Wetland Mapping Study (see Section 11.7), and will include a crosswalk of wetland types mapped similarly to those in the Cook Inlet classification (with modifications for the higher elevation wetlands in the Project area). In the Riparian Vegetation Study Downstream of the Proposed Watana Dam and the Wetland Mapping Study, wetlands will be mapped consistently for areas upstream and downstream of the proposed dam so as to provide a comprehensive wetland map for the Project. As stated in Section 11.6.4.3, the minimum mapping polygon size of 1 acre for vegetated areas and 0.25 acres for waterbodies will be maintained.

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			Mapping Study (Draft RSP 11.5)." –pdf pages 162-163	
RIP-13	USFWS	11/14/2012	"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." –pdf page 163	AEA agrees and this duplication of methods material has been corrected in the RSP. In the Riparian Vegetation Study Downstream of the Proposed Watana Dam, AEA will collect vegetation and soils data to map existing vegetation on the Susitna River floodplain; AEA also will collect vegetation and soils data in focus areas, which will be used to model successional vegetation changes. Those data and the successional model results will then be used in the Riparian Instream Flow Study and geomorphology studies to predict (in a spatially explicit manner) how the riparian landscape and vegetation is expected to change across the floodplain because of operational flows, and to characterize physical and ecological processes in riparian areas. There is an ongoing effort between the Riparian Instream Flow Study, Riparian VegetationStudy Downstream of Watana Dam, and Geomorphology Study leads to coordinate their respective studies and fieldwork for maximize efficiency and avoid duplication of effort (see Section 11.6.4.2).
RIP-14	USFWS	11/14/2012	"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" –pdf page 163	In the RSP, the final methods are noted and, when necessary, reasonable justification is provided for why the TWGs are still working on the final details (e.g., study area boundaries; see Section 11.6.3).
RIP-15	USFWS	11/14/2012	"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." –pdf page 163	References and detailed methods are included in the RSP, making duplication of this study possible (see Section 11.6.4). Note also that a detailed methods section will be prepared in the Initial Study Report and the Updated Study Report. Any duplication of this study would best be done by referencing those study reports, as opposed to a study plan.
RIP-16	USFWS	11/14/2012	"Line intercept is a standard method for sampling shrub cover, and not often used for shrub density. Transect lengths are also typically much	Transect lengths for the point-intercept sampling are now the sum of four 16.25-meter transects on the ELS plots

Riparian Vegetation Study Downstream of the Proposed Watana Dam				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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?" –pdf page 163	(see Section 11.6.4.2.4). Vegetation sampling methods in the RSP include measuring forest canopy cover using densiometers (see RSP Section 11.6.4.2.4).
RIP-17	USFWS	11/14/2012	"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." –pdf page 163	In the Riparian Instream Flow Study (see Section 8.6.3.7.2.2), the characteristics of roots in soil pits, including root depth and width, will be documented.
RIP-18	USFWS	11/14/2012	"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)." –pdf page 163	Riparian vegetation elevation surveying will be conducted in the following manner: All botanical plots and soil pits will be surveyed in using a transit (elevation) and Trimble geoXT (GPS location). Transit surveys will be tied into an intermediate benchmark established at each Focus Area and all transects outside Focus Areas. The flow-routing teams will survey in the intermediate benchmark using an RTK instrument, thus tying the riparian transit survey plot elevations into the project-wide elevation datum. This is explained in detail in Sections 8.6.3.7.2 and 11.6.4.2.
RIP-19	USFWS	11/14/2012	"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." –pdf page 164	Predicting changes in riparian areas due to Project effects is now a primary objective of the Riparian Instream Flow Study (see RSP Section 8.6). As explained in Section 11.6.4.4, the Riparian Vegetation Study Downstream of the Proposed Watana Dam will be providing existing vegetation mapping, field data, and vegetation successional model results to the instream flow riparian study researchers, who will complete the objective of spatially modeling and illustrating on maps the predicted changes in riparian areas.
RIP-20	USFWS	11/14/2012	"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	Geospatial pdf files are handy but are very large in size and will greatly inflate the size of Project reports. AEA will provide access to interactive GIS products for the Project

Riparian Vegetation Study Downstream of the Proposed Watana Dam				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			coordinates on the maps." –pdf page 164	via ADNR's webmap so that license participants can view maps of riparian vegetation, wetlands, and wildlife habitats, zoom in and out, turn layers on and off etc., without the need for an expensive GIS program (see Section 11.6.4.5).
RIP-21	USFWS	11/14/2012	"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?" –pdf page 164	2014 field studies likely will include additional field sampling in areas where high-resolution imagery will not be available until late 2013. Fieldwork for 2014 will be assessed once the 2013 field season is completed, at which time more information will be available regarding the availability of high-resolution imagery (some mapping can be completed on new high-resolution imagery when received in late 2013) (see Section 11.6.2).
RIP-22	USFWS	11/14/2012	"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?" –pdf page 164	In the revised RSP Section 11.6.7 (including Figure 11.6-4), the interdependencies of the habitat mapping component of Riparian Vegetation Study Downstream of the Proposed Watana Dam and the Project Wildlife Resource studies are described. The wildlife habitat mapping in the Riparian Vegetation Study Downstream of the Proposed Watana Dam will be completed in full coordination with the researchers conducting the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (see Section 11.5), and will also rely on inputs from the wildlife researchers for the Project (see Sections 10.5–10.18) and the scientific literature indicating habitat relationships for wildlife in Alaskan riparian areas. Figure 11.6-4 is split now into three charts. The "Riparian vegetation, wildlife habitat, and wetlands mapping" chart illustrates the study interdependencies involved in mapping the current conditions for these resources. "Prediction of change in riparian vegetation, wetlands, and wildlife habitats" illustrates the study interdependencies involved in predicting future conditions due to projected

Riparian Vegetation Study Downstream of the Proposed Watana Dam				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
				Project effects, and "Field study coordination" illustrates the study interdependencies pertaining to the collection of field data. These interdependencies are further explained in RSP Section 11.6.7.
RIP-23	FERC	11/14/2012	"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." -pdf pages 5-6	The use of the 2012 data and mapping efforts for the Riparian Vegetation Study Downstream of the Proposed Watana Dam has helped to better define the study goals and objectives (see Section 11.6.1), the study area to be used to assess potential changes in riparian habitats (see Section 11.6.3), and to refine the field survey and mapping methods (see Section 11.6.4).

Wetland Mapping Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
WETLND-01	ADNR-DMLW	11/14/2012	"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." – pdf page 9	Recharge that is related to riverine processes is discussed in the Riparian Instream Flow Study (Section 8.6) and the Riparian Vegetation Study Downstream of the Proposed Watana Dam (Section 11.6).
WETLND-02	ADNR-DMLW	11/14/2012	"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." – pdf page 9	Downstream of the proposed dam site, groundwater movements will be evaluated in the Groundwater Study (Section 7.5) and the Riparian Instream Flow Study (Section 8.6). Detailed data on groundwater and surface water movements will be correlated to existing riparian vegetation downstream of the proposed dam, and wetlands will be mapped in the same area, in the Riparian Vegetation Study Downstream of the Proposed Watana Dam (Section 11.6). Upstream of the proposed dam site, wetland functions will be evaluated in the Wetland Mapping Study RSP (Section 11.7). Wetland water movement patterns for the mapped wetland types are first addressed through the classification of wetlands into wetland functional groupings. The functional groupings are then used in the wetland functional assessment as described in Section 11.7.4.3. Water storage capacity, including groundwater recharge and discharge, is one of the primary functions to be addressed in the functional assessment. The functioning of wetlands in the Upper and Middle Susitna Basin will be specifically evaluated within the broader landscape in the study area.
WETLND-03	USFWS	11/14/2012	"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	AEA agrees that, through consultation with USFWS and other licensing participants over the months since the May 31, 2012 study requests, the functional analysis question

Wetland Mapping Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			(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." –pdf page 166	has been resolved. The RSP title has been revised to better differentiate the study area boundaries of the Wetland Mapping Study (Section 11.7) from the Riparian Vegetation Study Downstream of the Proposed Watana Dam (Section 11.6).
WETLND-04	USFWS	11/14/2012	"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." –pdf page 166	The RSP has been revised to note the resolution, type, and wavelength bands that are currently being used to support the preliminary mapping effort (Section 11.7.4.1). Not all of the imagery that will be used to classify and map wetland and upland boundaries has been acquired, but AEA has requested 1 ft. resolution, and it is AEA's understanding that both true-color and color-infrared will be available.
WETLND-05	USFWS	11/14/2012	"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." –pdf page 166	Section 11.7.3 has been revised to clarify the study area boundaries. Wetlands within the 2-mile buffer of the proposed transmission line routes will be included in the Wetland Mapping Study (Section 11.7), but wetlands in the riparian areas along the Susitna River between the dam site and Gold Creek will not be mapped in that study. Wetland mapping in the Susitna River floodplain downstream of the proposed dam site will be mapped in the Riparian Vegetation Study Downstream of the Proposed Watana Dam (Section 11.6).

Wetland Mapping Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
WETLND-06	USFWS	11/14/2012	"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."	See AEA's response to comment WETLND-05. The study area in the Wetland Mapping Study (Section 11.7.3) has been revised to clarify the study area boundaries and the relationship between the riparian mapping and wetland mapping studies as it relates to wetland impacts downstream of the dam.
WETLND-07	USFWS	11/14/2012	"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." –pdf page 167	The assessment of impacts to wetlands affected by project operations, maintenance, and related activities upstream of the dam (e.g., road dust, spills, impoundments) will be performed in 2015, as part of the FERC licensing process and Section 404 wetlands permit application processes (see Section 11.7.6). Impacts to wetlands downstream of the dam that relate to changes in flow will be evaluated in the Riparian Vegetation Study Downstream of the Propoased Watana Dam (see Section 11.6.6).
WETLND-08	USFWS	11/14/2012	"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." –pdf page 167	AEA appreciates the opportunity to work closely with USFWS and other licensing participants in the development of this study plan and agrees that the study area issue has been resolved in this RSP.
WETLND-09	USFWS	11/14/2012	"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	The Wetlands Mapping Study is using a smaller minimum mapping size because wetland impacts due to fill placement will need to be as accurate as possible. The areas will be tied to mitigation planning and fees. For the

Wetland Mapping Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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)?" –pdf page 167	Riparian Mapping Study, the slightly larger minimum mapping boundaries are appropriate because changes to vegetation are likely to be on more of a landscape scale, rather than by individual mapped polygon. The fact that the wetlands study area boundary is within the Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin area boundary is not a concern because "scaling up" with respect to mapping is relatively easy to do. For example, habitat maps are often derived from wetlands maps, and are developed using landscape position, wildlife use, and vegetation structure as the primary criteria. The field data collection protocol detailed in the USACE 1987 and 2007 documents provides sufficient information to produce a Viereck Level IV map as long as field plot site selection is focused on upland habitats as well as wetland habitats. To create a Cook Inlet Basin wetlands crosswalk and Viereck level IV classes, wildlife habitat types, and to assist the functional assessment, a variety of parameters will be assessed at each field plot (Section 11.7.4.1).
WETLND-10	USFWS	11/14/2012	"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." –pdf page 168	Opportunities for review on the progress of the functional assessment will be available during the scheduled, quarterly Technical Workgroup Meetings as results become available in 2013 and 2014.
WETLND-11	USFWS	11/14/2012	"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	The wetland impact analysis will be conducted during the preparation of the FERC License Application in 2015 based on final proposed Project plans.

Wetland Mapping Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			requests a TWG meeting to ensure the products will meet stakeholder needs." –pdf page 168	
WETLND-12	USFWS	11/14/2012	"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."	Licensing participants will be able to access Project GIS data layers via ADNR's webmap application, which will provide interactive digital wetland maps without the need for additional software (Section 11.7.4.4).
WETLND-13	USFWS	11/14/2012	"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?" –pdf page 168	Since the focus of the RSP is for 2013-2014, the blank 2012 columns have been dropped from Table 11-7.1 to eliminate confusion. The RSP acknowledges, however (Sections 11.7.4 and 11.7.4.1), that 2012 data are being used to guide 2013-2014 planning efforts.

Rare Plant Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			No Comments Received	

Invasive Plant Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			No Comments Received	

Recreation Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
REC-01	NPS	11/14/2012	The baseline data collected in the 2012 recreation and aesthetic studies are required for the stakeholders to determine the adequacy of 2013-2014 ILP studies. –pdf page 3	The 2012 scope of work concentrated on the collection of existing data, and an evaluation of the comprehensiveness and applicability of existing data to understand the baseline conditions. In addition, field reconnaissance conducted in 2012 informed the study plan process, adjusting methods, sampling approaches and survey design, and the assessment of demand approach. Many of the outcomes of this research (and the impact on study plan design) have been presented and discussed during Technical Working Group meetings (such as potential intercept sites, intercept survey design, executive interview protocol and candidates, etc.) The 2012 Study Report will summarize the evaluation of existing data and will be available 1Q 2013.
REC-02	NPS	11/14/2012	Include the Lower Susitna River Reach in the recreation study area. – page 5-6 and page 13 ("Ice Processes")	The study area in the RSP extends to river mile 83 where the George Parks Highway Bridge crosses the Susitna River. (RSP Section 12.5.3, Figure 12.5-1) This termination point was selected based on the influence of the Chulitna and Talkeetna rivers on the channel shape and structure of the Susitna downstream of their confluence. As explained in RSP Section 12.5.3, if studies conducted in 2013 indicate that there may be Project-related changes to river flow, sediment transport, and ice formation, extent, and seasonal availability (i.e, freeze/thaw cycles) on the portion of the river located downriver of the Parks Highway Bridge downstream on the Susitna River that could impact recreation, an expansion of the Recreation Use Study Area/Recreation Supply and Demand Analysis Area and associated level of analysis of recreation resources uses to include the effected portion will be triggered in time for the 2014 study season. Any recommended changes to any study areas will be included in AEA's Initial Study Report, which will be prepared and distributed in early February 2014.
REC-03	NPS	11/14/2012	"Recreation Management Plan- We reiterate that a Recreation Management Plan (RMP) for both land and water-based use of the	AEA agrees with NPS's comment, and RSP Sections 12.2 and 12.5.7 confirm that the recreational resources studies

Recreation Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			project area will need to be developed, as required by FERC (18 CFR 4.51(t)(5)).” –pdf page 3	in the RSP will form the basis for a RMP.
REC-04	NPS	11/14/2012	“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.” –pdf page 8	Existing survey research, such as AVSP VI and RSVP, are statistically rigorous research methods that measure all types of Alaska visitors and are not biased toward large-scale packaged tourism. The intercept sample plan as designed captures significant samples of Alaska visitors, independent visitors, and Alaska residents, in the study area. Key intercept locations for independent visitors and residents will be along the Denali Highway, Parks Highway, at local air carriers and in Talkeetna. The Regional Resident Household mail survey will capture additional information about resident use of the area (Section 12.5.4).
REC-05	NPS	11/14/2012	“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.” –pdf page 9	Understanding potential changes in experiential and activity-specific recreation opportunities is central to the recreation impact analysis. To complete this assessment, inputs from all components of the Recreation and Aesthetics Program (i.e., Use & Demand [including socioeconomics analysis], Trails & Facilities, River-based Recreation, Aesthetics, and Soundscape) will be synthesized to understand changes in (bio)physical, social, and operational aspects of recreation experience and potential change to existing opportunities. This analysis will be spatially explicit, and completed at the scale of the Study Area. This objective and anticipated outcome is clarified in the RSP (Section 12.5.4).
REC-06	NPS	11/14/2012	Recreation User Intercept Survey- Eliminate “Don’t Know” and “Refused” from the mail/online (self-administered) survey instrument. –pdf page 9	RSP Section 15.5.4 explains that the differences in some questions (and response code block) are based on the mode of delivery.
REC-07	NPS	11/14/2012	“Recreation User Intercept Survey- Question 20(t) & (g)- Table should ask about need for Information and Education resources: kiosks, signage, trail information, points of interest, geologic, historic and I or cultural information.” –pdf page 9	The intercept survey draft (Attachment 12-2) includes a question (Q. 15 m.) that specifically asks if respondents would like to see more “signage with cultural, historic, geologic, and points of interests.”
REC-08	NPS	11/14/2012	“Recreation User Intercept Survey- Question 20(t) & (g)- We believe	Questions regarding facility management were

Recreation Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			that user preference for greater management attention (level of maintenance, staff presence, security, etc.) should be added to this question." –pdf page 9	considered, but due to concerns for survey length they were not included in the current draft. This line of questioning, however, will remain in consideration until the intercept and mail surveys are pre-tested and finalized. As noted in Section 12.5.4, AEA will seek agency input on the final survey instruments in early 2013.
REC-09	NPS	11/14/2012	"Recreation User Intercept Survey- Question 21(a)- Wording is awkward. Perhaps the words 'would not' could be deleted…" –pdf page 9	Revision of the survey question will be considered to remove awkwardness. As noted in Section 12.5.4, AEA will seek agency input on the final survey instruments in early 2013.
REC-10	NPS	11/14/2012	"Recreation User Intercept Survey- Question 24.- We believe that the determination of party size should appear earlier in survey." –pdf page 9	Based on experience, group size questions are best situated close to questions regarding spending. Final placement of all questions will be determined during pre-testing of the survey instruments. As noted in Section 12.5.4, AEA will seek agency input on the final survey instruments in early 2013.
REC-11	NPS	11/14/2012	"Mail/Online User Survey- NPS would like to see the actual survey instrument." –pdf page 9	As noted in Section 12.5.4, AEA will seek agency input on the final survey instruments in early 2013.
REC-12	TCCI	11/07/2012	"TCCI is concerned that AEA has not involved the local Community Council's in any of its 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." –pdf page 5	The study plan includes executive interviews with key organizations, associations, etc., including the Talkeetna Community Council. The purpose of these interviews is to gather baseline information on historical and current recreation use and attributes within the Study Area. These interviews are expected to take place in the 1st and 2nd quarter of 2013 (Section 12.5.4). The studies are designed to understand recreation trends in addition to a 2013 snapshot. The studies in 2013 and 2014 are also intended to collect data from recent years, in addition to identifying recreation trends and uses, and quality of experience in past seasons. AEA will also use 2014 to perform further investigations related to recreation if determined necessary based on 2013 study results. For example, the Recreation and Aesthetics Studies will evaluate the extent to which any anticipated changes in

Recreation Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
				river flow, sediment transport, and ice processes would affect these resources (4Q 2013/1Q 2014). If such an effect may exist, the Recreation Resources Study and Aesthetics Resources Study areas (including recreation use and demand, trails and facilities, recreation experience, river ice-dependent recreation, soundscape and aesthetics) and associated analyses will be expanded.to include affected areas.
REC-13	TCCI	11/07/2012	"TCCI supports NPS in expanding the recreational study area to the Lower River." –pdf page 5	See AEA's response to comment REC-02.
REC-14	TCCI	11/07/2012	(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" –pdf page 5	The interview protocol provides an unbiased, factual introduction to the project. The purpose of the interviews is to collect baseline recreation conditions/use/attributes and not influence opinions, see Attachment 12-3.
REC-15	TCCI	11/07/2012	"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." –pdf page 5	As explained in Section 12.5.4, AEA believes that use of the voter registration database is a valid sample universe for the Regional Resident Household Mail Survey. The voter registration database is readily available, screens for those over age 18, and also contains a mailing address in addition to a physical address of those registered to vote. While it is understood that not all regional residents are registered to vote, this database represents a wider diversity of names and addresses than commercially purchased mailing lists (such as utility customers). Information about non-Regional residents or non-residents recreation use will be captured through the intercept survey method.
REC-16	TCCI	11/07/2012	TCCI supports the inclusion of ice related recreation effects. The current studies lack methodology for user experience other than a "preference curve" for ice conditions. 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	An investigation of river ice dependent winter recreation is included in Section 12.7 of the RSP. The Study will investigate winter recreation activities occurring within the bounds of the Susitna River channel that are dependent on river ice formation. The purpose of the 2013 ice-dependent recreation portion of the winter recreation program is to determine existing ice-dependent recreation, the purpose (i.e., transportation or recreation) and the

Recreation Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			Classic ski race and stable ice is required for both popular events. –pdf page 5	conditions under which these activities occur. The ice dependent recreation activities are likely to include snowshoeing, skiing, dog sledding, trapping and snowmobiling as well as use of river ice for winter transportation corridor. Additional activities observed during the field investigations will be documented as well. A list of winter recreation and competitive events dependent on river ice formation will also be compiled and analyzed. The river ice dependent winter recreation study will document winter recreation activity on the Susitna River ice using a combination of field observations, executive interviews and analysis of recreation and competitive events. The executive interviews and analysis of events will include data beyond the current 2-year field data collection period. Use patterns will be analyzed to determine spatial and temporal use preferences as well as frequency of use by month.
REC-17	Various Individuals	11/07/2012-11/14/2012	Two year study is inadequate to determine potential project impacts on ice stability from fluctuating flows and recreational use for activities, such as, snowshoeing and dogsledding skiing.	AEA believes that two years is sufficient time to assess potential Project-related effects on recreational resources. The purpose of the 2013 ice-dependent recreation portion of the winter recreation program is to determine existing ice-dependent recreation, the purpose (i.e., transportation or recreation), the demand, and the conditions under which these activities occur. The winter recreation study, including the river ice dependent winter recreation study, will document winter recreation activity on the Susitna River ice using a combination of field observations, executive interviews and analysis of recreation and competitive events. The executive interviews and analysis of events will provide data that extends beyond the 2-year field data collection period. This work will be completed through coordination with the Ice Processes in the Susitna River Study (Section 7.6).

Recreation Resources Study				
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				The extent to which impacts to ice-dependent recreation is expected as a result of the proposed Project will be dependent on the outcome of modeling completed by the ice-processes work. Preliminary results from the Ice Processes in the Susitna River Study will be reviewed early in the 4th quarter of 2013 to determine the downstream effects of the Project on river ice formation.
REC-18	FERC	11/14/2012	"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." –pdf page 19	The ADF&G data is collected at the tributary level. Because the majority of this sport harvest occurs at the confluences of these tributaries with the Susitna, the data is relatively site specific, meaningful, detailed, and adequate for analysis. Review of baseline data conducted and field reconnaissance research in 2012 suggests sport fishing use in the Upper Susitna and lakes within the watershed is very light and dispersed. Sections 12.5.4 (Recreation Supply, Demand and Use) and 12.5.7 explain the adequacy of ADF&G fish harvest data in context to its geographic extent and its ability to meet the needs of the Project.
REC-19	FERC	11/14/2012	"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." –pdf page 22	The recreation study area figure (12.5-1) has been revised to more clearly indicate study areas and to include place names used in the text.
REC-20	FERC	11/14/2012	"You propose to identify and map trails based on aerial imagery, existing GIS datasets, field identification, agency interviews, and	Existing trails in the immediate project area will be mapped at a scale that will ensure sufficient accuracy for

Recreation Resources Study				
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			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." –pdf page 22	analysis across studies. See Section 12.5.4.
REC-21	FERC	11/14/2012	"The Study Interdependencies chart on page 12-51 illustrates this integration; please describe how and when this integration will occur in the study methods." –pdf page 22	Section 12.5.7 has been added to the RSP and provides a detailed description of study interdependencies.
REC-22	FERC	11/14/2012	"The recreation demand analysis should also consider latent demand for new facilities or opportunities that could result from development of the project." –pdf page 22	Section 12.2. has been clarified to state that the Recreation Resources Study will identify existing and foreseeable future recreation opportunities, including latent demand. Although there are no specified developments associated with this Project to consider latent demand, AEA recognizes that it will be important to consider latent demand for new facilities or opportunities that might result, and the draft intercept survey has a question regarding a development scenario (Attachment 12-2). Additionally, the interdependency between Social Conditions and Public Goods and Services Study (Section 15.6.4) and the Recreational Resource studies will address latent demand. See Section 12.5.7.
REC-23	FERC	11/14/2012	"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." –pdf page 22	Preliminary draft survey design ascertains whether respondent used a guide or not. It does not capture what activity or activities were guided. Survey length is of great concern and compromises need to be made. Baseline data revised in 2012 suggest that the level of guided fishing in the area is low. Likely, there is more guided hunting and perhaps some small amount of hiking/backpacking and other activities. The random intercept surveys will capture a proportionate share of these guided users while they are in the field, at air carriers, or in Talkeetna. Executive interview research and ADF&G data will also supplement data on guided vs. unguided use.
REC-24	BLM	11/14/2012	"This section specifically excludes the North side of the Denali	AEA has not adopted BLM's recommendation that the

Recreation Resources Study				
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			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." –pdf page 4	North side of the Denali Highway and the headwaters of the Susitna River be included in the study area for the Recreation Resources Study. The operation of the Project is not anticipated to affect recreation resources, facilities, and uses north of the Denali Highway; therefore, there is no nexus between Project operations and effects on recreation resources, facilities, and uses on the Susitna River north of the Denali Highway and on or along the headwaters of the Susitna River. However, the licensing studies may provide useful information for BLM's WSR suitability study. The Aesthetic Resources Study area includes all lands located within a 30 miles radius of the viewshed of Project components, and therefore will extend north of the Denali Highway (Section 12.6.3). The impact analysis will include the potential change to aesthetic attributes within the WSR study area should visibility of Project components be determined to extend to this area, or changes in soundscape anticipated. In addition, the Recreation Resources Study will include al campgrounds and infrastructure located on the north side of the Denali Highway; however recreation demand will not be assessed beyond these locations (Section 12.5.3).
REC-25	BLM	11/14/2012	"BLM requests prior notification to Glennallen Field Office prior to conducting campground surveys." –pdf page 4	The Recreation Resources Study plan (Section 12.5.4) has been updated to accommodate BLM's request.
REC-26	BLM	11/14/2012	"Correction to text; 'Only 21 miles of road on the eastern end and three miles on the western end are Paved'" –pdf page 4	This reference is no longer included in the RSP.
REC-27	BLM	11/14/2012	"BLM suggests adding the Susitna River Bridge as an intercept location." –pdf page 4	Figure 12.5-2 includes this intercept point.
REC-28	BLM	11/14/2012	"Delta Wayside is located at mile 21 (not MP 16). (adjust maps accordingly)" –pdf page 4	Delta Wayside is located at mile 21.5 in the RSP (Section 12.5.4).
REC-29	BLM	11/14/2012	"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	AEA appreciates receiving this information. Current owners will be identified and considered for interviews.

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			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." –pdf page 4	
REC-30	BLM	11/14/2012	On PSP 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." –pdf page 4	See AEA's response to comment REC-29.
REC-31	ADNR-DPOR	11/14/2012	"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 DPOR. 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." –pdf page 3	AEA agrees with the four points highlighted within the comment and they are addressed within the study plan. The Recreation Use Study Area includes the Denali State Park (RSP Section 12.5.3) and the study plan is designed to assess the potential impacts to recreational and aesthetic resources as a result of the Project (RSP Section 12.5.4), including potential conflict among recreational users and increased access and visual impacts to the Denali State Park east of the Parks Highway.
REC-32	ADNR-DMLW	11/14/2012	In PSP section 13.7.2 "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. "–pdf page 11	The Recreation Resources Study and River Recreation Flow and Access Study (RSP Section 12.7) will analyze all guide and tour activities within the study area, including all river based operators. However, the study area does not include portions of the river downstream from the Park Highway Bridge, as explained in AEA's response to REC-02. Also, please see Ice Processes in the Susitna River Study Plan (Section 7.6) for further details.
REC-33	ADNR-DMLW	11/14/2012	In PSP section 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 Susitna-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.	RSP Section 12.5.4 (Trails) outlines the study methods that will be used to assess and analyze impacts to all RS2477 and 17(b) easement within the Recreation Use Study Area. This analysis will focus on trails and access routes that may be affected by development of the Project. This includes RST-199, RST-200, RST-1509, all of which fall within the Recreation Use Study Area. However, the study area does not include portions of the river downstream from the Park Highway Bridge, as

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Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 11	explained in AEA's response to comment REC-02.
REC-34	ADF&G	11/14/2012	"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." –pdf page 35	The RSP contains considerably more detail that the PSP and no longer includes mail and internet survey instead of the telephone survey presented in the PSP (Section 12.5.4). As noted in Section 12.5.4, moreover, AEA will seek agency input on the final survey instruments in early 2013.
REC-35	ADF&G	11/14/2012	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." –pdf page 35	Section 12.5.4 includes ATV, ORV, hiking and wildlife viewing recreation activities.

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REC-36	ADF&G	11/14/2012	Section 10.5.4 Recreation Use and Demand (pg.10-6) "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." –pdf page 35	Section 12.5.4 includes fishing and berry picking as "consumptive" recreation activities and bird watching is included as "wildlife viewing" under non-consumptive uses.
REC-37	ADF&G	11/14/2012	Section 10.5.4 Recreation Use and Demand (pg.10-6) "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." –pdf page 35	This sentence no longer appears in the RSP.
REC-38	ADF&G	11/14/2012	Section 10.5.4 Recreation Use and Demand (pg.10-6) "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. ADF&G, 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." –pdf page 35	These studies were reviewed in 2012 and will be considered in the recreation demand assessment analysis.
REC-39	ADF&G	11/14/2012	"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	These studies were reviewed in 2012 and will be considered in the recreation demand assessment analysis.

Recreation Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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. ADF&G, 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." –pdf page 36	
REC-40	ADF&G	11/14/2012	"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." –pdf page 36	The purpose of the IOS is to capture information from field researchers about dispersed recreational use within the Recreation Use Study Area. The survey helps to identify types and patterns of recreation use and is considered qualitative. AEA will review the IOS results prior to and throughout survey fielding to identify any potential gaps in survey sampling. There are no plans to map reference points; however, data results of the IOS will be included in the ISR and/or USR, as appropriate.
REC-41	ADF&G	11/14/2012	"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	After initial consultation, the telephone sampling methodology was reviewed and subsequently changed to a mail survey. Rationale for this approach is included in the Recreation Resources Study RSP (Section 12.5.4). Subgroup analyses will include residence, day/overnight users, transportation mode, party size, length of stay, and recreation activity.

Recreation Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 36	
REC-42	ADF&G	11/14/2012	"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." –pdf page 37	ATV/ORV trailheads and access points are considered in the survey intercept plan (see RSP Section 12.5.4). ATV/ORV users will be randomly surveyed at both developed and undeveloped trail heads. As described in Section 12.5.4., stratified random sampling will be used to collect a statistical sample of recreation users. The sample plan will first be stratified by month, day, and to some degree day parts. This will be overlaid with selected survey locations throughout the study area.

Aesthetic Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
AES-01	NPS	11/14/2012	Include the Lower Susitna River Reach in the aesthetics study area. –pdf page 5	The study area in the RSP extends to river mile 83 where the George Parks Highway Bridge crosses the Susitna River. (RSP Section 12.6.3, Figure 12.6-1) This termination point was selected based on the influence of the Chulitna and Talkeetna rivers on the channel shape and structure of the Susitna downstream of their confluence. As explained in RSP Section 12.6.3, if studies conducted in 2013 indicate that there may be Project-related changes to river flow, sediment transport, and ice formation, extent, and seasonal availability (i.e, freeze/thaw cycles) on the portion of the river located downriver of the Parks Highway Bridge downstream on the Susitna River that could impact aesthetic resources, an expansion of the Aesthetic Resources Study Area and associated analyses will be triggered in time for the 2014 study season. Any recommended changes to any study areas will be included in AEA's Initial Study Report, which will be prepared and distributed in early February 2014.
AES-02	NPS	11/14/2012	"Unresolved issues: 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." –pdf page 10	The baseline noise/soundscape analysis (RSP Section 12.6.4) takes into account existing trails and areas of dispersed used. As explained in Section 12.6.7, coordination with Recreation, Subsistence, and Wildlife Resources is planned for first quarter 2013 to ensure all baseline data pertaining to soundscapes (i.e, location of receptors) is accounted for. In addition, areas that could be affected by increase in Project-related and non-Project-related traffic will be assessed for baseline measurements.
AES-03	FERC	11/14/2012	"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." –pdf page 23	The following Statement has been added to Section 12.6.4: Soundscape Analysis: "The analysis will include an assessment of Project-induced effects based on the assessment of future recreation use and demand and Project-related opportunities (Section 12.5.4)." The Interdependencies figure has been updated to indicate this objective, including coordination with Wildlife Resources. See Figure 12.6-2.

Aesthetic Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
AES-04	NPS	11/14/2012	NPS would like to verify that the sound analysis is consistent with NPS guidelines. –pdf page 10	AEA looks forward to receiving any comments NPS may have on the study methods proposed in Section 12.6 in RSP comments filed with FERC by January 18, 2013. See Section 1.2.

River Recreation Flow and Access Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
RECFLW-01	NPS	11/14/2012	"NPS suggested that focus groups be used to assess optimum and acceptable flow alternatives for the project." – pdf page 11	As part of the Recreation Resources Study (RSP Section 12.5) AEA has elected to conduct executive interviews with commercial and non-commercial users familiar with river recreation flows in the three river recreation reaches extending from the Denali Highway Bridge to the George Parks Highway Bridge at Sunshine. The large study area and dispersed nature of the river recreation activities, both in space and time, are not practical for focus group sessions. Flow preference questions will be asked during executive interview sessions.
RECFLW-02	NPS	11/14/2012	10.7 .3. Study Area (and following bullet) - Clarify the study area determination process/rational. Expand the Recreation Study area to include all river miles of the Lower Susitna River Reach (to Cook Inlet). –pdf page 11	As explained in Section 12.7.3 of the RSP, AEA has proposed to study river recreation downstream to river mile 83 where the George Parks Highway Bridge crosses the Susitna River. This termination point was selected based on the influence of the Chulitna and Talkeetna rivers on the channel shape and structure of the Susitna downstream of their confluence coupled with proximity of egress for non-motorized watercraft on the Susitna River. Also as explained in Section 12.7.3 of the RSP, if studies conducted in 2013 indicate that there may be Project-related changes to river flow, sediment transport, and ice formation, extent, and seasonal availability (i.e, freeze/thaw cycles) on the portion of the river located downriver of the Parks Highway Bridge downstream on the Susitna River that could impact recreational uses in the lower reach of the river, an expansion of the River Recreation Flow and Access Study and associated analyses will be triggered in time for the 2014 study season. Any recommended changes to any study areas will be included in AEA's Initial Study Report, which will be prepared and distributed in early February 2014.
RECFLW-03	NPS	11/14/2012	"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." –pdf page 12	AEA believes that implementation of the study plan, as proposed in the RSP, will support conclusions about flow-dependent activities. Flow records on the Susitna extend 56 years. While the study plan contemplates the collection of users' experience on the Susitna River beginning in 2013, respondents will be encouraged to provide information on current trips in 2013 as well as trips made in previous years (Section 12.5.4).

River Recreation Flow and Access Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
RECFLW-04	TCCI	11/07/2012	"TCCI supports NPS in expanding the recreational study area to the Lower River." –pdf page 5	Please see AEA's response to comment RECFLW-2.
RECFLW-05	FERC	11/14/2012	"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." –pdf page 23	Section 12.7.3 clarifies that Devils Canyon is in Reach 2. See also Figure 12.7-1.
RECFLW-06	ADNR - ADF&G	11/14/2012	"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?" –pdf page 21	The study will examine the stage-flow relationships developed by the fisheries group, in particular, the results of the HEC-RAS model (RSP Section 8.5.4.3). This information will help determine the downstream influence of the project on recreation. Channel cross-sections measuring water depth and velocity will not be used for the recreation flow study. Numerous recreation instream flow studies have documented the deficiencies associated with this approach and the associated assumptions. Whittaker et al. (1993) reported that depth and velocity have proven to be unreliable for predicting recreation instream flow needs. This method assumes that (i) all critical transects (shallow areas) have been identified for all watercraft; (ii) the channel bed shape will remain static maintaining a consistent path for boat passage through time; and (iii) boat passage is the definitive attribute for river recreation quality. The Susitna River channel is dynamic typically changing course on an annual basis. Because of this dynamic nature, channel cross-section analysis for navigation purposes is not applicable. Furthermore, suitability curves are not available for all the watercraft utilizing the Susitna.
RECFLW-07	NMFS	11/14/2012	"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	The boat launch at Ship Creek is primarily used to access the Lower Susitna River at the mouth, not the reaches of the Susitna River currently included in the Study Use area. If, as explained in AEA's response to RECFLW-2, results of the other resource disciplines studies (e.g., ice processes, etc.) indicate possible Project-related effects on recreation in the lower Susitna River, AEA will recommend expansion of the study area in the ISR. As part of any such recommendation, AEA will consider conducting intercept

River Recreation Flow and Access Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 186	surveys at the Ship Creek boat launch. AEA has not adopted NMFS's request to add intercept sites at substitute sites, such as the Kenai River. AEA believes that the proposed surveys are comprehensive in breadth to obtain reliable information within the vicinity of the Project area, without relying on surrogate sites that are unlikely to produce applicable information related to the Project area.
RECFLW-08	NPS	11/14/2012	Study title and initial statements about its scope appear contradictory, study goal should look at all forms of recreation that could be affected by flow changes. –pdf page 11	AEA agrees with this comment, and the objectives of this study encompass forms of recreation other than boating and access, providing that "recreation use and experience for the respective river recreation and transportation opportunities on three mainstem Susitna River reaches" (Section 12.7.1). Section 12.7.4 provides: "Survey participation will be solicited by advertising the river recreation survey electronically through a multitude of forums including but not limited to national and regional whitewater groups, forums for outdoor recreation including adventure races, fishing, hunting, motorized and non-motorized user groups, message boards, commercial outfitters and guides, adventure schools and transportation services to the study area."
RECFLW-09	NPS	11/14/2012	"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 <u>may</u> alter the timing and longitudinal extent of ice formation, and impact such uses. Under any of the currently proposed project operations scenarios, the Project <u>will</u> have that effect." –pdf page 12	Before completing the Ice Processes in the Susitna River Study (Section 7.6), AEA believes it is premature to conclude whether and to what extent flow changes in the Lower River attributable to Project-related operations will affect recreational use.

Cultural Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
CUL-01	BLM	11/14/2012	"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." –pdf page 1	The RSP (Section 13.5.3) defines the indirect APE to include: 1) areas likely to be affected by induced dispersed recreational activity extending from existing trails, including all-terrain (ATV, or OHV – Off Highway Vehicle) trails, and recent campsites observed during the 2012 field investigations; 2) areas near or related to known sites including APE-mapped trails and recreation use areas; and 3) areas of high cultural resource potential adjacent to APE-mapped trails and recreation areas.
CUL-02	ADNR-OHA	11/14/2012	"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." –pdf page 6	AEA concurs that the Section 106 process does not require a 100 percent pedestrian inventory across the entire APE and did not intend to imply such a level of effort. The RSP (Sections 13.5.4.2, 13.5.4.5, and 13.5.4.6) explicitly defines the intensity of pedestrian survey methods according to environmental variables within the study area and their probability for revealing cultural resources.
CUL-03	ADNR-OHA	11/14/2012	"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. –pdf page 4 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." –pdf page 5	The RSP (Section 13.5.4;4) includes a lake-coring component in the field investigations, to produce information on pollen frequencies and other paleoenvironmental data through time and thus help establish the context in which to evaluate and interpret the archaeological inventory.

Cultural Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
CUL-04	BLM	11/14/2012	"This section [PSP 11.5.1.1., Study Goals and Objectives] 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." –pdf page 1	Please see AEA's response to CUL-03.
CUL-05	BLM	11/14/2012	PSP 11.5.1.1: "Additionally, AEA and its contractors should similarly consult with the BLM during implementation of the 2013-2014 cultural resources survey." –pdf page 1	The RSP (Section 13.5.1.1) includes consultation with BLM as a specific objective.
CUL-06	BLM	11/14/2012	PSP 11.5.2.1: ""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." –pdf page 1	The RSP (Section 13.5.2.1) clarifies that sites which will be evaluated for National Register eligibility, and which have well-preserved organics or multiple components, will be radiometrically dated to assist in the eligibility evaluation.
CUL-07	ADNR-OHA	11/14/2012	In PSP section 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. –pdf page 7	Please see AEA's response to CUL-06.
CUL-08	BLM	11/14/2012	PSP 11.5.4.2: "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." –pdf page 2	AEA desires that a broad range of interested Alaska Native parties have the opportunity to participate in the ethnogeography investigations, and that the effort be efficient and sensitive to participants' scheduling constraints. To that end, the regional elders' conference (RSP Section 13.5.4.8) is planned to be held in the Ahtna region (since most Native contributors are from that region) with invitations to others, and scheduled so as not to interfere with the AFN annual meeting. A conference date in early March of 2013 will avoid traditional Ahtna and Dena'ina subsistence activity windows and will be scheduled concurrent with other community meetings or gatherings for maximum efficiency and courtesy.

Cultural Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
CUL-09	CIRI	11/14/2012	"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'ina 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' ina 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. 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." –pdf page 4	The Cultural Resources Study plan is intended to document Historic Properties and Traditional Cultural Properties that may be affected by the Project, whether resulting from prehistoric or contemporary practices of Ahtna or Dena'ina. AEA concurs with the principle suggested by CIRI that all such resources should be considered. In Section 13.5.1, the RSP states: "For the Dena'ina communities of Chickaloon and Knik, AEA will build on the existing Upper Cook Inlet Dena'ina place names work (Kari and Fall 2003), supplemented by additional interviews with knowledgeable Dena'ina elders." The RSP notes that the ethnogeographic study addresses many topics, "with emphasis on Ahtna tribal practices, supplemented by information on Dena'ina and Lower Tanana tribal practices as appropriate." As a practical matter, Ahtna tribal practices are less represented in the published scientific literature, and so the RSP addresses this shortfall while including both Dena'ina and Lower Tanana tribal practices. AEA welcomes the collaboration of CIRI in identifying source materials and Dena'ina elders to be interviewed for the Cultural Resources Study.

Cultural Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
CUL-10	ADNR-OHA	11/14/2012	"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" –pdf page 4	The RSP (Section 13.5.4.5) states that pedestrian surveys are conducted in areas that have a high potential for cultural resources and high potential for deep aeolian sediments, especially during the 2013 field season.
CUL-11	ADNR-OHA	11/14/2012	"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." – pdf page4	As explained in Section 13.5.5, all survey crews will meet the personnel standards of the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation. Also as noted in Section 13.5.5, survey crews will receive classroom/laboratory instruction on tephra identification and its importance, as well instruction on soil stratigraphy.
CUL-12	ADNR-OHA	11/14/2012	"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…in order to better plan survey of that area." –pdf page 5	The RSP (Section 13.5.4.2) states that prior to fieldwork, field crews will be briefed on the criteria for defining high and low probability areas in order to better execute the survey.
CUL-13	ADNR-OHA	11/14/2012	"…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." –pdf page 5	As explained in the RSP, a variety of multivariate location types are created by the locational model using a variety of environmental data sets (RSP Section 13.5.4.2 and Tables 13.5-1 and 13.5-2), leading to probabilistic definitions of high and low potential for cultural resources, with the realization that such statistical models have limitations in application. Consequently, survey will not be exclusively devoted to high potential zones but will also be conducted in a smaller sample of areas deemed low potential.

Cultural Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
CUL-14	ADNR-OHA	11/14/2012	"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'." –pdf page 5	Because FERC's standard practice in hydropower licensing processes is to enter into a Programmatic Agreement (PA) with the State Historic Preservation Officer (SHPO), AEA agrees with ADNR-OHA that a PA is appropriate for this undertaking. AEA expects FERC to circulate a draft PA following the completion of the Cultural Resources Study, and likely shortly after its issuance of the draft environmental impact statement. For these reasons, Sections 13.2.1 and 13.5.6 reference the development of a PA between FERC and ADNR-OHA.
CUL-15	ADNR-OHA	11/14/2012	PSP section 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…" –pdf page 6	The RSP (Section 13.1) includes this language, although the "protection, mitigation and enhancement" language is standardized throughout the RSP and the other types of measures listed in ADNR-OHA's comment are subsumed within this standardized language.
CUL-16	ADNR-OHA	11/14/2012	PSP section 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. –pdf page 6	The RSP (Section 13.1) incorporates ADNR-OHA's comment, as suggested.
CUL-17	ADNR-OHA	11/14/2012	PSP section 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. –pdf page 6	FERC regulations use this term, 18 CFR 5.9(b), which has been standardized for consistency in all the study plans in the RSP.
CUL-18	ADNR-OHA	11/14/2012	PSP section 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	As a general matter, AEA agrees that cultural resources that are expected to be affected by the construction and operation of the project will require evaluation for National Register (NR) eligibility. As recognized in ADNR-OHA's comment, however, in this early phase of the licensing process it is not clear whether the direct APE proposed in the RSP precisely delineates every location of expected Project-

Cultural Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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. –pdf page 6	related direct effects. By necessity, as AEA's licensing study program progresses, the direct APE may need to be refined to ensure that it is limited to those areas of actual project-related effects. If licensing studies conducted in 2013 indicate that there may be Project-related effects to cultural resources in areas currently outside the APE, the APE may be further adapted to encompass these areas. Any recommended changes to the APE will be included in AEA's Initial Study Report, which will be prepared and distributed in February 2014 (Section 13.5.3). In addition, the "Guidelines for Development of Historic Properties Management Plans for FERC Hydroelectric Projects," issued jointly by FERC and the Advisory Council on Historic Preservation (ACHP), recognize that it is not always possible for FERC to determine all of the effects of various activities that could affect cultural resources over the course of a long license term. As such, these Guidelines provide for the development of a project-specific Historic Properties Management Plan (HPMP) that will specify procedures for the continued identification and evaluation of cultural resources, as well as for the management and protection of historic properties, for the term of the license. As noted in Section 13.5.6 of the RSP, AEA will develop the HPMP in consultation with ADNR-OHA during the licensing process. The Programmatic Agreement (PA) between FERC and ADNR-OHA is expected to require AEA to implement the HPMP upon FERC's issuance of the license. For these reasons, AEA does not believe it appropriate to presume at this early juncture that Project-related effects will occur at every location within the proposed direct APE. Where necessary, the direct APE will be refined to encompass only areas that are expected to be directly affected by the Project. Moreover, as authorized by ACHP regulations, 36 CFR 800.14, FERC's use of a PA in this case allows some flexibility in the sequencing of the steps typically employed to inventory, evaluate, and assess effects to

Cultural Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
				historic properties. In the HPMP, AEA anticipates the development of procedures and options—such as avoidance and management measures—that would allow AEA, in consultation with ADNR-OHA, to adequately protect cultural resources in areas affected by the Project without having to undertake a formal National Register evaluation in every instance.
CUL-19	ADNR-OHA	11/14/2012	In PSP section 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. –pdf page 7	The sentence is complete in the RSP (Section 13.5.1.1).
CUL-20	ADNR-OHA	11/14/2012	In PSP section 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. –pdf page 7	The RSP (Section 13.5.4.9) includes additional detail about the Cultural Resources Study reports. The reports will go beyond updating cultural chronology to develop the Project's archeological data within a synthetic regional framework for the comprehensive, but restricted, volume on the cultural resources investigation.
CUL-21	FERC	11/14/2012	"In some cases, [AEA has] developed plans for and are carrying out studies in consultation with stakeholders to voluntarily collect information in 2012 that will help [AEA] prepare or refine a study plan. Please describe how these 2012 efforts were or are being incorporated into the RSP." – pdf page 5	Sections 13.5.1 and 13.5.4.2 explain AEA's 2012 efforts and how the results of these efforts have been incorporated into the RSP.

Cultural Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
CUL-22	Ahtna	05/02/2012	Ahtna requested that a non-technical volume summarizing the cultural resource investigation results be produced for public distribution. –pdf page 5	To meet regulatory requirements, AEA is required to produce a technical report on cultural resources. For this reason, the requested non-technical volume is beyond the scope of this RSP. AEA recognizes, however, that the Native communities are sharing their knowledge and expertise with the goal that the resulting documentation of their heritage, showing how they lived and thrived in this landscape through time, would be available as a teaching tool for their communities. AEA looks forward to further consultation with Ahtna on these matters.

Paleontological Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
PALEO-01	BLM	11/14/2012	PSP Section "11.6.1.1., First Paragraph, "…Paleontological Resources Protection Act of 2009…" Should be changed to "…Paleontological Resources Preservation Act of 2009." –pdf page 2	The RSP refers to the Paleontological Resources Preservation Act in Section 13.3.
PALEO-02	BLM	11/14/2012	Regarding PSP Section "11.6.2, First Paragraph, "The potential for Pleistocene faunal remains needs to be reviewed…" 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?" –pdf page 2	The potential for Pleistocene faunal remains will be determined not through literature review alone but in conjunction with paleontological field survey, augmented by the results of the geology and geomorphological studies. The RSP (Section 13.6.4) elaborates upon field methods and sampling approaches informed by the literature review.
PALEO-03	ADNR-OHA	11/14/2012	In PSP Section 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. –pdf page 7	The RSP (Section 13.6.3; Figure 13.6-1) defines the study area for paleontological investigations to be the same as that for the direct and indirect APE of the cultural resource investigations, including the confluence of the Susitna and Tyone rivers.
PALEO-04	ADNR-DGGS	11/14/2012	Page 11-17 in the PSP Section 11.6.2 "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." –pdf page 14	The language in the RSP (Section 13.6.2) better describes the temporal range of specimens.

Subsistence Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
SUB-01	CWA	11/14/2012	Include TK into RSP. –pdf page 8	Traditional Knowledge regarding the physical, biological and social environment, including fish specifically, is being documented as part of the Subsistence Resources Study, see RSP Section 14.5.4.5.
SUB-02	CWA	11/14/2012	"The Subsistence Section Does Not Consider Mitigation or Prevention of Project Impacts" –pdf page 10	Section 14.5.4.7 notes that the impact analysis will identify potential protection, mitigation, and enhancement measures, as necessary.
SUB-03	CCC	11/15/2012	"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." –pdf page 3	The Subsistence RSP addresses 37 study communities, 25 of which have planned subsistence fieldwork. The RSP does address communities in the lower Mat Su Valley, including Wasilla and outlying CDPs. In addition, RSP Section 14.5.4.1 includes a subtask to access to ADF&G's Winfonet database to identify "subsistence users and communities in Alaska who travel to the proposed Project area to participate in land mammal harvest activities and additional information about study communities' (including those located in nonsubsistence areas) subsistence activities in the Project area." Harvest by residents of the lower Mat-Su Valley and Anchorage areas will be analyzed as part of the Wildlife Harvest Analysis study (RSP Section 10.20). Results from the Wildlife Harvest Analysis study, as well as results from the variety of physical, biological and cultural resource studies will be compared with subsistence harvest data and for impacts to subsistence uses.
SUB-04	BLM	11/14/2012	"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" –pdf page 2	The Subsistence Study will collect baseline subsistence data and document traditional and contemporary subsistence harvest, which—in combination with other study results—to evaluate Project-related impacts on BLM and other lands (Section 14.5.7).
SUB-05	BLM	11/14/2012	"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?)." –pdf page 3	See AEA's response to comment SUB-4.
SUB-06	BLM	11/14/2012	"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." –pdf page 23	See AEA's response to comment SUB-4.

Regional Economic Evaluation Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
ECON-01	Long, Becky	11/13/2012	The RSP should reference the work prepared by ISER regarding the Susitna-Watana Cost of Power Analysis Discussion Paper which indicated that power from natural gas-fired generation could be lower than power from the Project –pdf page 2	AEA does not believe it appropriate to reference the ISER Discussion Paper, as some of the assumptions used in the model for the Discussion Paper were incorrect. For example, the Susitna-Watana Hydroelectric Project is not subject to RCA regulatory authority; the Project will not charge depreciation to power purchasers; the capital costs used in the Discussion Paper are too high; and interest rates may be too high.
ECON-02	TNC	11/14/2012	"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." –pdf page 4	See AEA's response to comment ECON-1.
ECON-03	FERC	11/14/2012	"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." –pdf page 23	Interview questions are included in RSP Section 15, Attachment 15-1.
ECON-04	FERC	11/14/2012	"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	The tables in RSP Section 15, Attachment 15-1 have been combined as Table 15.A-1 to show the type of information that is anticipated from each individual/organization; proposed questions are included. A line item in RSP Table 15.5.1 shows when the interviews will be conducted and completed.

Regional Economic Evaluation Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 23	Documentation of the interviews will be provided in the Regional Economic Evaluation Study (Section 15.5.6).
ECON-05	FERC	11/14/2012	"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" –pdf page 24	As explained in Section 15.5.4.1, as part of its ongoing responsibilities separate and apart from licensing and developing the Project, AEA will provide information on power generation, transmission, and demand in the Railbelt, which will be used in the REMI model. As part of this effort, AEA will collect or develop information on the historic electricity rates and system average interruption duration index reliability minutes for Railbelt utilities, as well as power generation costs for the gas-fired plants that are presently under design or construction. Other assumptions used in the REMI model will come from several different sources and engineering feasibility studies that will provide information on Project construction and operations cost and the amount spent locally, the cost of power, amount of power available and similar information. In addition, the interviews described in Section 15.5.4.1 will provide information for developing assumptions regarding the future for both the With Project and Without Project alternatives. Information collected for the Social Conditions and Public Goods and Services Study (RSP Section 15.6.4.1) will also provide information to be used in the regional economic modeling. As provided in Section 15.5.6 of the RSP, the assumptions will be provided during quarterly TWG meetings in 2013 and 2014 and the Regional Economic Evaluation Study.
ECON-06	TNC	11/14/2012	"Socioeconomic Analysis 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	The RSP made no changes to the RSP based on this comment. The Regional Economic Evaluation Study will address the cost of constructing the dam and related infrastructure and the expected price of power generated.

Regional Economic Evaluation Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 4	In addition, nothing in the Federal Power Act requires FERC to place a dollar value on non-power benefits, even if FERC assigns a dollar value to the licensee's economic costs. Moreover, the public interest balancing of environmental and economic impacts cannot be done with mathematical precision, and FERC's statutory obligation to weigh and balance all public interest considerations would not be served by trying to reduce it to a mere mathematical exercise. Where the dollar cost of measures can be reasonably ascertained, AEA will do so. However, 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 accurately or adequately only by dollars and cents.
ECON-07	NMFS	11/14/2012	AEA should model the Project once the cost and funding are known to ascertain the change in power rates, the subsequent effect on the regional economy, and the effect on other areas of the state in the event that state funding is used for the Project. In the latter event, spending on the Project would mean fewer funds available for other projects or programs throughout the state. –pdf page 186	The REMI model will include information on the capital and operating cost of the Project and this model will be used to determine the regional economic effect from changed power rates in the Railbelt region as described in Section 15.5.3. With regard to NMFS's comment related to alternative uses of state funding, such speculative investigations would not lead to any quantifiable, reliable information that could inform measures to address Project effects.

Social Conditions and Public Goods and Services Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
SOC-01	AHP, AS, CSDA, NHI, HRC	11/14/2012	"National-level Economic Valuation Study Request"	AEA does not propose a National-Level Economic Valuation Study as explained in Section 3.1 of the RSP.
SOC-02	TCCI	11/07/2012	A National Valuation Study, or National-Level Economic Valuation Study, should be undertaken. "–pdf page 4	See AEA's response to comment SOC-01.
SOC-03	Various Individuals	11/14/2012	Support for a national valuation study.	See AEA's response to comment SOC-01.
SOC-04	TU	11/14/2012	"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." "–pdf page 4	See AEA's response to comment SOC-01.
SOC-05	CSDA	11/14/2012	Request for a National-level Economic Valuation Study. "–pdf page 5	See AEA's response to comment SOC-01.
SOC-06	CSDA	11/14/2012	"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. "–pdf page 8	The RSP made no changes to the RSP based on this comment. Nothing in the Federal Power Act requires FERC to place a dollar value on non-power benefits, even if FERC assigns a dollar value to the licensee's economic costs. Moreover, the public interest balancing of environmental and economic impacts cannot be done with mathematical precision, and FERC's statutory obligation to weigh and balance all public interest considerations would not be served by trying to reduce it to a mere mathematical exercise. Where the dollar cost of measures can be reasonably ascertained, AEA will do so. However, 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 accurately or adequately only by dollars and cents.
SOC-07	CCC	11/15/12	"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	See AEA's response to comment SOC-6.

Social Conditions and Public Goods and Services Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			diverse, healthy and fully functioning ecosystem." "–pdf page 4	
SOC-08	TNC	11/14/2012	"Socioeconomic Analysis 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." "–pdf page 4	See AEA's response to comment SOC-06.
SOC-09	TNC	11/14/2012	"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." "–pdf page 4	See AEA's response to comment SOC-06.
SOC-10	Long, Becky	11/13/2012	An important component of these studies should be the National-Level Economic Valuation. …Also, the Social Conditions and Public Goods and Services Study needs to include an ecosystem service component. …These considerations are directly connected to economic benefits and economic costs. "–pdf page 2	See AEA's response to comments SOC-01 and SOC-06
SOC-11	FERC	11/14/2012	"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	Section 15.6.4.1 clarifies that the methodology is consistent with that used in the analysis by Braund and Lonner (1982), which successfully collected information on the values, attitudes, and lifestyle preferences of residents in the Talkeetna, Trapper Creek, Cantwell, and "railroad community" areas as far north as Hurricane through informal interviews with community residents, MSB

Social Conditions and Public Goods and Services Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." "–pdf page 24	officials, and other knowledgeable people. The interviews will be conducted using the Recreation Study Plan interview protocol (Attachment 12-4) as a template. Section 15.6.4.1 also includes more detail on the number of interviews planned, how individuals will be identified and selected for interview, and the topic focus of the questions that will be asked.
SOC-12	TNC	11/14/2012	"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." "–pdf page 5	AEA's proposed methodology has been expanded and clarified in Section 15.6.4.1. See also AEA's response to comment SOC-11.
SOC-13	FERC	11/14/2012	"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." "–pdf page 24	Table 15.6.1 in the RSP includes a line item for the informal interviews showing when they will be conducted and completed. The RSP text (Section 15.6.4) has been changed to provide more discussion regarding documentation of the results and the integration of the results into other studies. The text has also been changed to indicate that the results of the informal interviews will be contained in the Social Conditions and Public Goods and Services Initial Study Report.
SOC-14	FERC	11/14/2012	"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?" –pdf page 24	Section 15.6.8 (Level of Effort and Cost) does not propose any additional data collection than specified in the earlier sections of the study plan. Rather, it is a general statement to inform the estimate of effort and cost.
SOC-15	FERC	11/14/2012	"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	As described in the Social Conditions and Public Goods and Services Study plan (Section 15.6.4.1) the team will use RUM methodologies to estimate changes in welfare and recreator behavior. The RUM will use pre-existing

Social Conditions and Public Goods and Services Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 24	preferences functions for the appropriate recreation activities from peer reviewed literature combined with locally available estimates of recreator trip numbers from secondary sources. The RUM efforts will be further informed by the work conducted in the Recreation Study plan (Section 12) and by estimates in changes in biological processes by other study groups.
SOC-16	NMFS	11/14/2012	"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." "–pdf page 186	See AEA's response to comment SOC-15.
SOC-17	TNC	11/14/2012	"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." "–pdf page 5	The RSP text (Section 15.6.4) indicates that the Without Project alternative will have population estimates similar to those prepared by the Mat-Su Borough and the Alaska Department of Transportation.
SOC-18	TNC	11/14/2012	"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?" "–pdf page 4	As described in the Social Conditions and Public Goods and Services Study plan (Section 15.6.4), the team will use RUM methodologies to estimate changes in welfare and recreator behavior. The RUM will use pre-existing preferences functions for the appropriate recreation activities from peer reviewed literature combined with locally available estimates of recreator trip numbers from secondary sources. The RUM efforts will be further informed by the work conducted in the Recreation Study plan and by estimates in changes in biological processes by other study groups. This work will include changes in angler behavior. Changes in commercial fisheries will depend on combining recent historical ex-vessel values

Social Conditions and Public Goods and Services Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
				with estimates of changes in fish populations from biology studies.
SOC-19	TNC	11/14/2012	"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." "–pdf page 5	As described in the Social Conditions and Public Goods and Services Study plan (Section 15.6.4.1), benefits transfer involves the application of unit value estimates, functions, data, and/or models from one or more previously conducted valuation studies to estimate benefits associated with the resource under consideration (Black et al. 1998). The benefits transfer approach will be used to apply recreation preference functions from the published literature to the random utility model and to estimate changes in non-use values (existence value, bequest value, option value) and values associated with ecological functions in the study area.
SOC-20	NMFS	11/14/2012	"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	As described in Section 15.6.4, AEA will use RUM methodologies to estimate changes in welfare and recreator behavior. Please see AEA's response to SOC-15. In addition, Section 15.6.7 denotes that study plans that are interrelated and the interdependencies are noted therein. The RUM model will evaluate changes in fisheries in different areas, including Chinook Fisheries. This will include not only the Susitna River Chinook run and the Kenai River Chinook run referenced in NMFS's comment, but also runs in the Little Susitna River, Ship Creek, the Kasilof River, the Anchor River, the Eklutna Tailrace, and the Westside Cook Inlet streams and rivers. Anglers frequently substitute trips between rivers near their preferred location when closures affect their preferred location. It is unclear how much the Kenai Rivers and Mat-Su valley rivers act as substitutes for each other given the complexity of management regimes on the Kenai.

Social Conditions and Public Goods and Services Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." "–pdf page 185	
SOC-21	NPS	11/14/12	"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." Do not make the assumption that visitation will increase due to the Project, and be specific of activity when discussing increase/decrease. "–pdf page 9	Understanding potential changes in experiential and activity-specific recreation opportunities is central to the recreation impact analysis. To complete this assessment, inputs from all components of the Recreation and Aesthetics Studies (Section 12) (i.e., Use & Demand [including socioeconomics analysis], Trails & Facilities, River-based Recreation, Aesthetics, and Soundscape) will be synthesized to understand changes in physical, social, and operational aspects of recreation experience and potential change to existing opportunities. This analysis will be spatially explicit, and completed at the scale of the Study Area. This objective and anticipated outcome is clarified in the Social Conditions and Public Goods and Services Study plan RSP (Section 15.6.4). The Social Conditions and Public Goods and Services Study RSP (Section 15.6.4) indicates that visitation will change by activity and that these changes will be identified by specific activity.
SOC-22	TCCI	11/07/2012	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. "–pdf page 4	As described in the Social Conditions and Public Goods and Services Study Plan (Sections 15.6.1 and 15.6.3), the analysis will describe effects of Project operations and features (i.e., reservoir and access roads) on the local or regional economy, including changes in commercial opportunities related to fishing, hunting, boating, wildlife viewing, mountaineering, and other recreation. In addition, the study plan states that the results of the analyses of Project effects on population, local economies, subsistence, recreation, and transportation will be used to evaluate the overall effects on the quality of life of residents of the region (Section 15.6.4)

Social Conditions and Public Goods and Services Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
SOC-23	ADNR-DMLW	11/14/12	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. "–pdf page 11	As described in Section 15.6.4.1 of the Social Conditions and Public Goods and Services Study plan, the economic impact of the Project on local tourism establishments (e.g., river sport fishing, whitewater boating) and the regional economy will be estimated.
SOC-24	ADNR-ADF&G	11/14/12	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. "–pdf page 35	As described in the Social Conditions and Public Goods and Services Study plan, the analysis will review an extensive number of previously conducted studies, including the referenced study that estimated the value of sport fishing in Alaska and elsewhere (Section 15.6.4.1).

Transportation Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
TRAN-01	Various Individuals	11/07/2012-11/14/2012	Two year study is inadequate to determine potential project impacts on ice stability from fluctuating flows and rivers use as a corridor by people and wildlife.	The Ice Processes in the Susitna River Study (Section 7.6.2.1) addresses the adequacy of the study of ice stability. The number of years of winter observation which will be relied upon for this study is sufficient to meet the goals and objectives of the study plan. The study plan will rely upon at least seven years and likely eight years of winters of observations (including 5 years in 1980's, 2012-2013, 2013-2014, possibly 2014-2015 (7-8 years)). As described in Section 7.6.2, these observations span a range of meteorological conditions. This will allow AEA to meet study plan goals and objectives.
TRAN-02	CCC	11/15/2012	"What are the potential detrimental impacts of varying flows on safety and transportation? Will ice be unsafe to travel on with the lower water levels and predicted warmer water?" –pdf page 2	Changes in ice formation will be evaluated as part of the Ice Processes in the Susitna River Study (Section 7.6.4). Evaluation of the effects of changes in ice formation on river transportation uses is included in the Transportation Resources Study (Section 15.7.4.5).
TRAN-03	FERC	11/14/2012	"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." –pdf page 25	The schedule (Section 15.7.6) includes a line item for interviews. Interviews will be conducted during data collection. Interview summaries will be included in an appendix of the Initial Study Report and will be used to support the existing conditions discussion in the report.
TRAN-04	ADNR-DMLW	11/14/2012	"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." –pdf page 8	Information from the Recreation Boating Access Study (Section 12.7) and Instream Flow Study (Section 8.5) will be used to evaluate the effects of transportation from relevant launch sites as noted in Section 15.7.4.5.
TRAN-05	ADNR-DMLW	11/14/2012	"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	The stability of ice will be evaluated in the Ice Processes in the Susitna River Study (Section 7.6.4). The potential for effects on ice road formation will be evaluated as noted in Section 15.7.4.5 of the Transportation Resources Study.

Transportation Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 9	
TRAN-06	ADNR-DMLW	11/14/2012	In PSP section 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." –pdf page 10	The stability of ice will be evaluated in the Ice Processes in the Susitna River Study (Section 7.6.4). The Transportation Resources Study will evaluate potential effects of changes in ice formation on transportation uses by the oil industry, lodges and homesteads (Section 15.7.4.5).
TRAN-07	ADNR-DMLW	11/14/2012	In PSP section 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. "–pdf page 11	The stability of ice will be evaluated in the Ice Processes in the Susitna River Study (Section 7.6.4). The Transportation Resources Study will evaluate potential effects of changes in ice formation on transportation uses by commercial lodges (Section 15.7.4.5) The Transportation Resources Study will also use information from the Instream Flow Study (Section 8.5) and the Recreation Boating Access Study (Section 12.7) to evaluate potential effects on transportation use of the river during the summer (Section 15.7.4.5).
TRAN-08	ADNR-DMLW	11/14/2012	In PSP section 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." "–pdf page 11	This Plan has been added to the list of documents to be reviewed in Section 15.7.2 Table 15.7-1.
TRAN-09	ADNR-DMLW	11/14/2012	In PSP section 13.7.2 "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 15.7.4.2 discusses the information that will be used for the Recreation Boating/Access Study (Section 12.7. Section 15.7.4.3 describes how interviews with knowledgeable individuals, including individuals

Transportation Resources Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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. ""–pdf page 11	representing guides and/or lodges to evaluate recreational transportation use.
TRAN-10	ADNR-DMLW	11/14/2012	In PSP section 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." "–pdf page 11	Documentation of RS2477 easements and other recorded easements will be incorporated into the data collection and documentation of existing conditions as documented in Section 15.7.4.2. Representatives of the Western Cook Inlet oil and gas industry are considered knowledgeable individuals for documenting existing uses of the river for transportation (Section 15.7.4.3) and for evaluating potential impacts based on results from the Ice Processes in the Susitna River Study.
TRAN-11	CIRI	11/14/2012	"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	AEA acknowledges CIRI's comments on the Draft Watana Transportation Access Analysis, which is listed in Section 15.7.2, Table 15.7-2.

Transportation Resources Study				
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			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. "–pdf page 5	
TRAN-12	CIRI	11/14/2012	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. "–pdf page 6	Except with regard to the Butte Creek corridor, which is no longer being considered. AEA has not made any final decision on transportation access corridors. All three remaining corridors are under consideration as shown in Figure 1.2-1 of the RSP. These three corridors will be evaluated in the Transportation Resources Study.
TRAN-13	CIRI	11/14/2012	Recommendation. 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." "–pdf page 6	As noted in its response to comment TRAN-12, AEA is no longer considering the Butte Creek corridor. With regard to the northern access alternatives, AEA understands and appreciates CIRI's concerns. At this early phase of the Project licensing, however, it is premature to deem any as unreasonable and eliminate it from further evaluation. To fulfill responsibilities under the National Environmental Policy Act, FERC and other federal action agencies must consider alternatives. While CIRI's concerns with the northern access alternatives certainly will be analyzed as part of this process, until AEA completes a more exhaustive analysis of potential Project-related effects within each of these corridors, as proposed in the suite of studies proposed in the RSP, all three corridors will remain under consideration.

Health Impact Assessment Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			No comments received	

Air Quality Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
AIR-01	CSDA	11/14/2012	A comprehensive evaluation of greenhouse gas (GHG) emissions was not addressed in the project, specifically the Air Quality Study. – pdf page 9	AEA has not adopted CSDA's request to conduct a comprehensive evaluation of greenhouse gas (GHG) emissions that possibly could be associated with the proposed project reservoir. Quebec Hydro and more recently Manitoba Hydro (July 2012) have conducted significant studies on GHG emissions and concluded that GHG emissions from boreal hydroelectric reservoirs appear to be low. GHG emissions increase rapidly after flooding and then return towards levels similar to natural water bodies within 10 years (Tremblay et. al. 2009). AEA will estimate GHG emissions in its License Application based on guidelines for boreal reservoirs. Tremblay, A., Demers, C & J. Bastien. 2009. GHG fluxes (CO2, CH4) of the first three years flooding on the Eastmain reservoir (Quebec, Canada). Proceeding of the Annual Conference on Hydraulic Engineering, Waterpower & Climate Change, Necessary Strategies – new technologies. March 12-13, 2009. Dresden Germany. P.179-187.
AIR-02	Ransy, Denis	11/14/2012	"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." –pdf page 2	See response to comment AIR-01.
AIR-03	ADEC	11/14/2012	Page 13-27 in PSP section 13.9.1.1 "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."	Baseline emissions will be estimated for fossil fuel sources per Section 15.9.4.3.
AIR-04	ADEC	11/14/2012	Pages 13-27 to 13-28 in PSP section number 13.9.2 "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." –pdf page 16	Wood-heating and wood-burning devices are included in the discussion of particulate matter emissions in Section 15.9.2.
AIR-05	ADEC	11/14/2012	Page 13-28 in the PSP section 13.9.2 "There are some limited data	The NPS currently operates two monitoring sites, one near

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Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			available from a site in Denali National Park. There are two Denali monitoring sites. To which site is this statement referring?" –pdf page 16	the park headquarters and one located at Trapper Creek. Data from these sites will be used when preparing the baseline air quality assessment as discussed in Section 15.9.2
AIR-06	ADEC	11/14/2012	In PSP section 13.9.2 "13-28A table comparing the Project emission with Without-Project alternative emissions will be generated. Also include in table current emissions." –pdf page 16	The table includes baseline emissions from fossil fuels sources per Section 15.9.4.3.
AIR-07	ADEC	11/14/2012	Page 13-28 in PSP section 13.9.2 "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?" –pdf page 16	AEA does not believe there is a need to conduct background air quality monitoring as there are no major emission sources in the area (Section 15.9.2).
AIR-08	ADEC	11/14/2012	Page 13-28 in PSP section 13.9.2 "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)." –pdf page 16	Section 15.9.2 includes this citation.
AIR-09	ADEC	11/14/2012	Page 13-28 in PSP section 13.9.2 "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." –pdf page 16	Section 15.9.2 states that the area has not been identified as a nonattainment area. The lack of existing data results in classification as an unclassifiable/ attainment based on 18 AAC 50.015.
AIR-10	ADEC	11/14/2012	Page 13-28 in PSP section 13.9.2 "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." –pdf page 16	Section 15.9.2 includes this information.
AIR-11	ADEC	11/14/2012	Page 13-28 in PSP section 13.9.4 "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 http://www.susitna-watanahydro.org/project/project-	It has not been determined if a Portland cement facility will be required. Section 15.9.4.2 addresses how the potential emissions from a Portland cement facility would be evaluated against Federal and State permitting thresholds. Emissions from the plant would be estimated and air quality dispersion modeling would be conducted to ensure

Air Quality Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			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." –pdf page 16	the emissions comply with the NAAQS.
AIR-12	ADEC	11/14/2012	Page 13-29 in PSP section 13.9.4 "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?" –pdf page 17	An extensive air quality study is not being proposed. The existing conditions will be assessed per Section 15.9.4.1. Short-term and long term impacts will be evaluated as described in Section 15.9.4.2 to 15.9.5.4.
AIR-13	ADEC	11/14/2012	Page 13-29 13.9.4 "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." –pdf page 17	Baseline emissions will be estimated for fossil fuel sources per Section 15.9.4.3.
AIR-14	ADEC	11/14/2012	Page 13-29 in PSP section 13.9.4.1 "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	The text in Section 15.9.4.1 is designed to simply summarize the types of attainment designation and not detail the processes for developing each type of designation or redesignation. The summary presented in Section 15.9.4.1 is similar to the ADEC definition under 18

Air Quality Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
			nonattainment region and the process should be outlined to avoid misunderstanding." –pdf page 17	AAC 50.990(51).
AIR-15	ADEC	11/14/2012	Page 13-29 in PS section 13.9.4.2 "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." –pdf page 17	Section 15.9.4.2 reads "fugitive particulate matter".
AIR-16	ADEC	11/14/2012	Page 13-29 in PSP section 13.9.4.2 "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 modeling guidelines. License should be permit." –pdf page 18	Section 15.9.4.2 reads "state permit".
AIR-17	ADEC	11/14/2012	Page 13-29 in PSP section 13.9.4.2 "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)." –pdf page 18	Although secondary emissions may not count toward potential to emit for permitting, these emissions will be addressed as part of the overall study of project effects. Emissions from construction equipment will be estimated per Section 15.9.4.2.
AIR-18	ADEC	11/14/2012	Page 13-30 in PSP section 13.9.4.2 "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." –pdf page 18	Although secondary emissions may not count toward potential to emit for permitting, these emissions will be addressed as part of the overall study of project effects (Section 15.9.4.2)
AIR-19	ADEC	11/14/2012	Page 13-31 in PSP section 13.9.7 "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?" –pdf page 18	AEA does not believe there is a need to conduct background air quality monitoring at the site as there are no major emission sources in the area (Section 15.9.2).
AIR-20	ADEC	11/14/2012	Pages 13-27 to 13-28 in PSP sections 13.9.1.1, 13.9.2, and 13.9.4 "contain 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." –pdf page 18	The appropriate Alaska Statutes are cited in Section 15.9.1.1 and listed in the references for the study plan.

Probable Maximum Flood Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
FLOOD-01	ADNR-DGGS	11/14/2012	Page 14-2, 14-3 in PSP section numbers 14.5.1.1 and 14.5.4.1 "Who comprises the Board of Consultants and how are members selected?" –pdf page 14	Members of the Board of Consultants are selected pursuant to Part 12, Subpart D of FERC's regulations, 18 CFR 12.30 *et seq*. For the Susitna-Watana Hydroelctric Project, FERC approved the following individuals as the Board of Consultants: Dr. Alfred J Hendron, Jr., P.E. (Geotechnical); Mr. Brian Alistair Forbes (Concrete); Ms. Ellen Faulkner, P.E. (Hydrology); Mr. George Taylor (Meteorologist); Mr. Joseph L. Ehasz, P.E. (General Hydroelectric); and Dr. Yusof Ghanaat, P.E. (Structural).
FLOOD-02	ADNR-DGGS	11/14/2012	Page 14-4 in PSP section 14.5.4.1 "Will the results of the glacier runoff study be included in determining the 100 year snowpack and snow water equivalent?" –pdf page 14	The PMF study has very specific requirements that include snow water equivalent by 1000-ft elevation band, by sub-basin and by month. The PMF study also has its own schedule needs. If timely and detailed snowpack results are made available to us, they will be reviewed and considered.
FLOOD-03	ADNR-DGGS	11/14/2012	Page 4-7 in PSP section 14.5.4.13 "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?" –pdf page 14	Reservoir sedimentation will be analyzed as part of the Geomorphology Study (Section 6.5.4.8). AEA will consider the sedimentation profile generated after 50 years of operation. However, based on sedimentation patterns at other reservoirs, sedimentation is expected to largely occur in the dead storage area of the reservoir, with little effect on the freeboard volume.
FLOOD-04	ADNR-DGGS	11/14/2012	Page 14-7 in PSP section 14.5.4.13 "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."–pdf page 14	Unusual circumstances could involve equipment failure scenarios or unusual combined events such as wind from an unusual but critical direction. These scenarios are yet to be determined, but will be detailed in the PMF report.
FLOOD-05	ADNR-DGGS	11/14/2012	Page 14-8 in the PSP section 14.5.6 "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). –pdf page 14	It is not anticipated that later completion of other portions of the Study Plan will result in an update to the PMF study in 2014. Analytically determined parameters are subject to calibration in the PMF study. If critical information, such as a rare flood, becomes available during 2013-2014, the need to incorporate it into the PMF study will be revisited.

Site-Specific Seismic Hazard Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
SEIS-01	TU	11/14/2012	"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." –page 4	A thorough and complete Site-Specific Seismic Hazard Study for the Susitna-Watana Project is underway and will be used as input to develop seismic design criteria for the site that are only just beginning (Section 16.6). These studies will include seismic source characterization, including paleoseismic studies of lineaments and faults, improved seismic monitoring networks in the project area, site-specific PSHA and ground motion evaluations, and an assessment of reservoir triggered seismicity, and a Probabilistic Site Hazard Analysis (PSHA) for the Susitna-Watana site. Additional seismic monitoring stations are being installed in the project area in conjunction with the Alaska Earthquake Information Center to provide increased monitoring and detection capabilities of any local earthquakes and provide additional information for use in understanding the seismic hazards in the project area. The geologic, geophysical, and seismic network data will all be used to provide thorough and complete evaluations of seismic hazards for the project including evaluation of the potential for reservoir triggered seismicity.
SEIS-02	Ransy, Denis	11/14/2012	"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." –paragraph 8	See AEA's response to comment SEIS-1.

Site-Specific Seismic Hazard Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
SEIS-03	ADNR-DGGS	11/14/2012	"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." – PDF page 12	The Pass Creek crustal fault is within the 125-mile buffer of the dam site, and therefore will be considered in the preliminary and on-going seismic source characterization and for site-specific ground motion evaluations of the Watana Dam site (Section 16.6.3).
SEIS-04	ADNR-DGGS	11/14/2012	Page 14-9 in PSP section 14.6.1.1 "The components outlined are adequate and represent state of the practice for assessing seismic safety of dams. " – PDF page 14	AEA appreciates ADNR-DGGS's review and comment of this study plan and agrees that it will appropriately assess the seismic safety of the proposed Project.
SEIS-05	ADNR-DGGS	11/14/2012	Page 14-10 in PSP section 14.6.2 "The section clearly outlines the previous studies conducted at the site except for the seismic hazards study conducted by Fugro in Dec. 2011." – PDF page 14	AEA appreciates the comment, and notes that Site-Specific Seismic Hazard Study is on-going. AEA will continue to collect and develop a more complete geologic and seismic-tectonic information.
SEIS-06	ADNR-DGGS	11/14/2012	Page 14-10 in PSP section 14.6.2 "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. " – PDF page 14	See AEA's response to comment SEIS-3. AEA is proposing a deterministic and probabilistic seismic hazard evaluation to update the seismic hazard studies from the 1980s in order characterize the seismic sources, to define site-specific earthquake ground motion parameters, and to develop seismic design criteria for the Project structures (Section 16.6.4.4).
SEIS-07	ADNR-DGGS	11/14/2012	Page 14-10 in PSP section 14.6.3 "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." – PDF page 14-15	See AEA's response to comment SEIS-3. In addition, all of these faults are being considered in the evaluations of potential seismic sources in the site region. The relative level of activity and significance to site-specific ground motion evaluations at the Susitna-Watana site is a factor in determining the level of study accorded different features within the region.

Site-Specific Seismic Hazard Study				
Reference Number	Commenter	Date Filed	Comment or Study Request	AEA's Response
SEIS-08	ADNR-DGGS	11/14/2012	Page 14-11, 14-12 in PSP section 14.6.4.4 "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." – PDF page 15	The recently-acquired LiDAR and INSAR data in the region is currently in review and initial desktop mapping will be followed by field based recon, geologic mapping, and subsurface investigations as dictated by the initial studies (Section 16.6.4.4). Future studies will also include an update to the seismic source characterization, site-specific ground motion evaluations and PSHA.
SEIS-09	ADNR-DGGS	11/14/2012	Page 14-11 "Who comprises the Board of Consultants and how are members selected? We recommend that a ADNR-DGGS geologist be part of the Board of Consultants review panel for seismic hazard studies." –pdf page 14	Members of the Board of Consultants are selected pursuant to Part 12, Subpart D of FERC's regulations, 18 CFR 12.30 et seq. For the Susitna-Watana Hydroelctric Project, FERC approved the following individuals as the Board of Consultants: Dr. Alfred J Hendron, Jr., P.E. (Geotechnical); Mr. Brian Alistair Forbes (Concrete); Ms. Ellen Faulkner, P.E. (Hydrology); Mr. George Taylor (Meteorologist); Mr. Joseph L. Ehasz, P.E. (General Hydroelectric); and Dr. Yusof Ghanaat, P.E. (Structural). While a ADNR-DGGS geologist was not included on the Board of Consultants, AEA welcomes the participation of ADNR-DGGS to participate in the implementation of the studies for the licensing of the Project.