

FEDERAL ENERGY REGULATORY COMMISSION
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February 1, 2013

OFFICE OF ENERGY PROJECTS

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

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

Reference: Study Plan Determination for the Susitna-Watana Hydroelectric Project

Dear Mr. Dyok:

Pursuant to 18 C.F.R. § 5.13(c) of the Commission's regulations, this letter contains the study plan determination for the Susitna-Watana Hydroelectric Project No. 14241 (Susitna-Watana Project or project). The determination is based on the study criteria set forth in section 5.9(b) of the Commission's regulations, applicable law, Commission policy and practice, and the record of information.

Background

On July 16, 2012, Alaska Energy Authority (AEA) filed its proposed plan for 58 studies covering geologic and soil resources, water quality, geomorphology, hydrology, instream flow, fish and aquatic resources, wildlife resources, botanical resources, recreation and aesthetic resources, cultural and paleontological resources, subsistence resources, socioeconomic and transportation resources, and project safety in support of its intent to license the project. Prior to filing its proposed study plan, AEA held resource-based technical working group (TWG) meetings and many individual and small group meetings.

On August 8, 9, 15, 16, and 17, 2012, AEA held general study plan meetings to discuss the details of the proposed study plan. Between August 17, 2012 and November 2, 2012, AEA held TWG meetings to resolve study needs. Following the conclusion of the study plan meetings, and receipt of comments on its proposed study plan, AEA filed its revised study plan on December 14, 2012.

On December 31, 2012, Commission staff notified AEA that 13 of the 58 studies proposed by AEA contained insufficient detail to complete a study plan determination. Staff's letter established a schedule for AEA to file additional information and hold meetings with licensing participants to discuss the information and for Commission staff to complete its study determination for the 13 studies by May 14, 2013.¹ On January 7, 2013, AEA requested that Commission staff revise the schedule for the 13 studies such that the study plan determination could be issued by April 1, 2013, allowing AEA sufficient time to complete the necessary prerequisites to implement all studies in the 2013 study season. On January 17, 2013, Commission staff modified the schedule for the 13 studies as requested, subject to AEA meeting its schedule for providing certain information and holding stakeholder meetings it committed to in its January 7, 2013 letter.

Comments on the revised study plan were timely filed by the Cook Inlet Region, Incorporated (CIRI); Coalition for Susitna Dam Alternatives; Center for Biological Diversity; Center for Water Advocacy; Alaska Department of Natural Resources;² National Marine Fisheries Service (NMFS); U.S. National Park Service (NPS); U.S. Fish and Wildlife Service (FWS); Resource Development Council; Northern Alaska Environmental Center; Alaska Ratepayers, Inc.; Analytica Inc.; U.S. Environmental Protection Agency (EPA); Nature Conservancy of Alaska; Cordova Electric Cooperative, Inc.; and 24 individuals. The U.S. Bureau of Land Management (BLM), the Talkeetna Community Council, and 18 individuals filed late comments.

General Comments

A number of the comments received do not address study plan issues, but rather address the need for the project and concerns about the licensing process. This determination does not address these comments, but only addresses comments on the merits of the study plans submitted pursuant to section 5.13 of the Commission's regulations and comments received thereon.

¹ The studies are: 5.5, 5.6, 5.7, 6.5, 6.6, 7.5, 7.6, 8.5, 8.6, 9.5, 9.6, and 9.

² Alaska Department of Natural Resources filed consolidated comments of the Alaska Department of Environmental Conservation and Alaska Department of Fish and Game.

Study Plan Determination Schedule

On January 18, 2013, NMFS expressed concern that the 15-day review period in Commission staff's January 17, 2013, revised schedule for the 13 studies severely limits its ability to complete a thorough review of the complex and controversial implementation plans and file comments. NMFS requests that the Commission staff revert back to the schedule contained in the December 31, 2012 letter, which provided stakeholders 30 days to review and comment on the final implementation plans.

While we understand NMFS's concern, AEA proposed in its January 7, 2013 letter, to provide draft implementation plans and all proposed focus areas by January 31, 2013, to hold meetings to discuss the draft plans and focus areas on February 14 and 15, and to file final plans and focus areas by March 1, 2013. Therefore, stakeholders now have 46 days to review the implementation plans under the January 17, 2013 schedule rather than the 30 days under the December 31, 2012 schedule. While there may be changes to the draft plans and focus areas based on the February meetings, there should be sufficient time for stakeholders to complete their review of those revisions and file comments by March 18, 2013.

In its January 18, 2013, comments, FWS correctly noted that components of the Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam (Study 11.6), are also contingent on the 2012 open-water flow routing model, habitat mapping efforts, and selection of focus areas that are to be provided in accordance with Commission staff's January 17, 2013 schedule. Consequently, this study will be considered in the study plan determination scheduled for April 1, 2013, rather than this study determination.

Study Plan Determination

Forty-four of the studies contained in AEA's revised study plan, filed December 14, 2012, are approved, some with staff-recommended modifications. As indicated in Appendix A, of the 44 proposed studies, 31 are approved as filed and 13 are approved with modifications. One requested study is not required to be conducted. The specific modifications to the study plan and the bases for modifying AEA's study plan and not requiring some requested studies are explained in Appendix B. Studies for which no issues were raised are not discussed in Appendix B. Commission staff considered all study plan criteria in section 5.9 of the Commission's regulations; however, only the specific study criteria that are particularly relevant to the determination are referenced in Appendix B.

Nothing in this study plan determination is intended, in any way, to limit any agency's proper exercise of its independent statutory authority to require additional

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studies. In addition, AEA may choose to conduct any study not specifically required herein that it feels would add pertinent information to the record.

If you have any questions, please contact David Turner at (202) 502-6091.

Sincerely,

Jeff C. Wright
Director
Office of Energy Projects

Enclosures: Appendix A-- Approved and modified studies and studies not required
Appendix B-- Staff's recommendations on proposed and requested studies

cc: Mailing List
Public Files

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APPENDIX A
Approved and Modified Studies and Studies Not Required

Study	Recommending Entity	Approved	Approved with Modification	Not Required
(1) Geology and Soils Characterization Study (study 4.5)	AEA	X		
(2) Glacier and Runoff Changes Study (study 7.7)*	AEA		X*	
(3) Salmon Escapement Study (study 9.7)	AEA		X	
(4) The Future Watana Reservoir Fish Community and Risk of Entrainment Study (study 9.10)	AEA		X	
(5) Study of Fish Passage Feasibility at Watana Dam (study 9.11)	AEA	X		
(6) Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna (study 9.12)	AEA		X	
(7) Aquatic Resources Study within Access Alignment, Transmission Alignment, and Construction Area (study 9.13)	AEA	X		
(8) Genetic Baseline Study for Selected	AEA		X	

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Fish Species (study 9.14)				
(9) Analysis of Fish Harvest in and Downstream of the Susitna-Watana Hydroelectric Project Area (study 9.15)	AEA	X		
(10) Eulachon Run Timing, Distribution, and Spawning in the Susitna River (study 9.16)	AEA	X		
(11) Cook Inlet Beluga Whale Study (study 9.17)	AEA	X		
(12) Moose Distribution, Abundance, Movements, Productivity, and Survival (study 10.5)	AEA		X	
(13) Caribou Distribution, Abundance, Movements, Productivity, and Survival (study 10.6)	AEA	X		
(14) Dall's Sheep Distribution and Abundance (study 10.7)	AEA	X		
(15) Distribution, Abundance, and Habitat Use by Large Carnivores (study 10.8)	AEA	X		
(16) Wolverine Distribution, Abundance, and	AEA	X		

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Habitat Occupancy (study 10.9)				
(17) Terrestrial Furbearer Abundance and Habitat Use (study 10.10)	AEA	X		
(18) Aquatic Furbearer Abundance and Habitat Use (study 10.11)	AEA	X		
(19) Small Mammal Species Composition and Habitat Use (study 10.12)	AEA	X		
(20) Bat Distribution and Habitat Use (study 10.13)	AEA	X		
(21) Surveys for Eagles and Other Raptors (study 10.14)	AEA	X		
(22) Waterbird Migration, Breeding, and Habitat Use Study (study 10.15)	AEA		X	
(23) Landbird and Shorebird Migration, Breeding, and Habitat Use Study (study 10.16)	AEA	X		
(24) Population Ecology of Willow Ptarmigan in Game Management Unit 13 (study 10.17)	AEA		X	
(25) Wood Frog Occupancy and Habitat Use (study 10.18)	AEA	X		
(26) Evaluation of	AEA	X		

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Wildlife Habitat Use (study 10.19)				
(27) Wildlife Harvest Analysis (study 10.20)	AEA	X		
(28) Vegetation and Wildlife Habitat Mapping Study in the Upper and Middle Susitna Basin (study 11.5)	AEA	X		
(29) Wetland Mapping Study in the Upper and Middle Susitna Basin (study 11.7)	AEA	X		
(30) Rare Plant Study (study 11.8)	AEA	X		
(31) Invasive Plant Study (study 11.9)	AEA	X		
(32) Recreation Resources Study (study 12.5)	AEA		X	
(33) Aesthetic Resources Study (study 12.6)	AEA		X	
(34) River Recreation Flow and Access Study (study 12.7)	AEA		X	
(35) Cultural Resources Study (study 13.5)	AEA		X	
(36) Paleontological Resources Study (study 13.6)	AEA	X		
(37) Subsistence Resources Study (study 14.5)	AEA		X	
(38) Regional	AEA	X		

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Economic Evaluation Study (study 15.5)				
(39) Social Conditions and Public Goods and Services Study (study 15.6)	AEA	X		
(40) Transportation Resources Study (study 15.7)	AEA	X		
(41) Health Impact Assessment Study (study 15.8)	AEA	X		
(42) Air Quality Study (study 15.9)	AEA	X		
(43) Probable Maximum Flood (PMF) Study (study 16.5)	AEA	X		
(44) Site-Specific Seismic Hazard Study (study 16.6)	AEA	X		
(45) National-level Economic Evaluation Study	Natural Heritage Institute; NMFS; American Whitewater, et al			X

*While we do not require the climate change assessment portion of this study, we have no objection to AEA conducting this portion of the study.

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APPENDIX B

Staff Recommendations on Proposed and Requested Studies

The following discusses AEA's study plan, filed on December 14, 2012, and the comments thereon, except for 14 aquatic and instream flow-related studies.³ Staff's bases for recommending or not recommending certain modifications to the study plan are discussed below. We first address a generic issue related to study duration, followed by discussion of specific comments filed on the revised study plan.

Process Plan and Schedule and Study Duration for Anadromous Fish Studies

Applicant's Proposed Study

AEA conducted several studies during 2012 to collect data on the existing environment of the study area and to provide information on appropriate study methodologies to implement during the Integrated Licensing Process (ILP) prefilming study period. The Revised Study Plan (RSP) includes a proposed schedule for all prefilming field studies and modeling efforts to be completed over a two-year period in 2013 and 2014.

Comments on the Study

The National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (FWS), and numerous individuals and non-governmental organizations (NGOs) state that AEA's proposed two-year timeframe for ILP prefilming study implementation is insufficient to collect adequate site specific data and build models that will predict how project operation would affect fish-habitat relationships. The commenters state that the lifecycle of Chinook salmon ranges from three to seven years, averaging five years, and therefore two years of study is insufficient to understand baseline population characteristics of Chinook salmon and other anadromous fish species. The agencies and commenters request a minimum of five years for all studies related to anadromous fisheries resources⁴ to coincide with the average lifespan of a Chinook salmon and to account for a substantial range of environmental variability.

³ These studies include 5.5, 5.6, 5.7, 6.5, 6.6, 7.5, 7.6, 8.5, 8.6, 9.5, 9.6, 9.8, 9.9, and 11.6.

⁴ In addition to general comments that do not reference a specific study, we received specific comments requesting that the study duration be a minimum of five years for the following studies evaluated and approved in this study plan determination:

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Discussion

AEA is proposing a habitat based approach for predicting the potential effects of the proposed project on resident and anadromous fish resources. Under this approach, the proposed study period is typically sufficient to collect the site-specific field data to develop the models, provided the target species and life stages are physically present during the study seasons to collect the field data. In this instance, there is no information to suggest that all life stages of the five species of Pacific salmon wouldn't be represented in the natural environment at the time that AEA is collecting its field data to develop the models.

We conclude that AEA's proposed two-year study schedule is consistent with generally accepted practices in the scientific community for evaluating the effects of hydropower projects on fisheries resources using a habitat-based modeling approach (section 5.9(b)(6)). Therefore, it would be premature at this time to require additional years of data collection without evaluating the data and modeling results that will be obtained from the 2013 and 2014 study seasons. The need to conduct additional years of studies will be determined on a case by case basis for each study. The type of information that we would consider in determining the need for additional years of studies would include, but not necessarily be limited to, whether: (1) the study objectives were met during the two-year study period, (2) there was substantial variability in study results between study years, (3) the study was implemented under anomalous environmental conditions, and (4) the data collected are sufficient to conduct the environmental analysis pursuant to NEPA and inform the development of license requirements. All stakeholders will have the opportunity to request additional years of data collection following the 2013 and 2014 study seasons after reviewing the initial and updated study reports, and upon a showing of good cause as specified in sections 5.15(d) and 5.15(e) of the Commission's regulation.

Recommendation

No modifications to the study plan are recommended.

Study 9.11 (Fish Passage Feasibility at Watana Dam), Study 9.14 (Genetics Baseline Study), and Study 9.7 (Salmon Escapement Study).

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Geology and Soils Characterization Study (4.5)

Applicant's Proposed Study

AEA proposes to conduct a study to define existing geological conditions at the proposed dam site, reservoir, and access and transmission-line corridors, and to develop design criteria to ensure that the proposed project facilities and structures will be safe and adequate to fulfill their stated functions. Study tasks include reviewing existing studies, and using digital imagery, field investigations, laboratory testing, and engineering analyses to characterize the conditions, limitations, and constraints in the project area. Specifically, AEA proposes to use Light Detection and Ranging (LiDAR) and Interferometric Synthetic Aperture Radar (InSAR) imagery data, field reconnaissance, geologic mapping, and, if necessary, subsurface geotechnical investigations to identify faults.

AEA also proposes to identify known mineral resources and mineral potential in the project area. Specifically, AEA would evaluate the mineral resource potential in the reservoir area up to approximately elevation 2,075 feet, and at the dam and camp facilities area because these are the sites where access to mineral deposits are most likely to be limited. In addition, AEA would evaluate the road and transmission corridors for potential quarry and aggregate sites for known mineral deposits to identify if access to mineral resources may be adversely or beneficially affected by the project. AEA's efforts would entail mapping of known mineral deposits, identification of likely areas of mineral resources, a field reconnaissance of selected areas of high mineral potential, review of area mining claims, and an analysis of mineral potential from borings and other sampling work done for the dam and other facilities ongoing geotechnical investigations.

AEA also proposes to conduct site-specific seismic hazard investigations and evaluations including trenching of lineaments and faults. Evaluation would include seismic refraction surveys, with some electrical resistivity and ground-penetrating radar surveys.

Seismic evaluations, which include reservoir-triggered seismicity, are being done under a separate study (see Study 16.6, Site Specific Seismic Hazard Evaluation Study). The Site Specific Seismic Hazard Evaluation Study plan includes assessment of faults close to the site capable of being triggered during and after the filling of the reservoir. The Geology and Soils Characterization Study would contribute information to the Site Specific Seismic Hazard Evaluation Study. AEA proposes to follow FERC engineering guidelines to evaluate seismic hazards, which includes evaluation of appropriate methods

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through a Board of Consultants (Board), established for the technical review of the dam analysis and design.

Comments on the Study

Cook Inlet Region, Inc. (CIRI) requests that AEA evaluate potential project impacts, both direct and indirect, to proven or probable mineral resources owned by CIRI within and outside the project boundary. CIRI states that the scope of the evaluation should be based on project impacts rather than location of the project elements. CIRI states that the presence of the project may impact normal extraction methods so that extraction would be impractical or require costly mitigation measures to protect project facilities.

Jeffrey Benowitz recommends that a thermochronology sampling regime approach be used to identify active and inactive faults, which may have the potential to become seismic hazards. Jeffrey Benowitz states that the weight of a large dam and reservoir can lead inactive faults to experience seismic events.

Discussion and Staff Recommendation

CIRI did not specify the extent of their recommended area of study, the level of effort to acquire the data, or how these data would be used in the environmental analysis. Nonetheless, AEA's proposed study area includes all areas likely to be affected by construction and operation of the project. If AEA's study identifies the use of mineral resources in areas affected by the project, potential project effects on those uses would be evaluated and appropriate mitigation measures identified. Thus, AEA's study is consistent with accepted methods (18 CFR 5.9(b)(6)), and would provide information necessary to support the design of the project, assess environmental effects, and evaluate proposed environmental measures. However, these investigations are not designed or intended to assess the value of mineral resources, but would provide for a qualitative assessment of mineral extraction that would be foregone with the project. Therefore, no modification to the applicant's proposed study is recommended.

The methods proposed by AEA are commonly accepted practices for identifying faults and seismic hazards. Because the size of the proposed project and its location within a seismically-active area, AEA has convened, at our request, an independent Board to oversee and assess the adequacy of investigations, designs and construction activities of the proposed project. Subject-specific experts, which includes experts on seismology and geology, would become full members of the Board or act as advisors to the Board on an as-needed basis. The seismic hazard analysis and the methodology that

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would be employed to evaluate reservoir triggered seismicity also would be recommended and reviewed by the Board and FERC as project design progresses. This process provides flexibility to consider all appropriate data collection and analytical methods, potentially including the thermochronology sampling regime. Therefore, at this time we do not recommend that a thermochronology sampling regime be used to identify geological structures including active and inactive faults. However, the Board could recommend the use a thermochronology sampling regime should it determine that this method is appropriate to obtain information concerning active and inactive faults

Glacial Runoff Changes Study (Study 7.7)

Applicant's Proposed Study

AEA proposes to analyze the potential effects of climate change on glacier wastage and retreat and the corresponding effects on streamflow entering the proposed reservoir, and evaluate the effects of glacial surges on sediment delivery to the reservoir.

Specifically, AEA proposes to:

- 1) review existing literature relevant to glacier retreat in southcentral Alaska and the upper Susitna watershed and summarize the current understanding of potential future changes in runoff associated with glacier wastage and retreat;
- 2) develop a hydrologic modeling framework that utilizes a glacier melt and runoff model (Hock, 1999) and a Water Balance Simulation Model (WaSiM) to predict changes in glacier wastage and retreat on runoff in the Susitna basin;
- 3) simulate the inflow of water to the proposed reservoir and predict changes to available inflow using downscaled climate projections up to the year 2100; and
- 4) analyze the potential changes to sediment delivery from the upper Susitna watershed into the reservoir from glacial surges.

AEA proposes to develop a hydrologic model framework over the period from 1960 to present using existing data sets, and simulate future scenarios using climate projections from the Scenarios Network for Alaska and Arctic Planning (SNAP)⁵ which are derived from a composition of the five, best-ranked general circulation models out of

⁵ SNAP is a research institute of the University of Alaska Fairbanks established to develop scenarios of climate-related future conditions for planning purposes in Alaska and the Arctic.

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the 15 general circulation models used by the Intergovernmental Panel on Climate Change models for Alaska. Assessment of changes in glacier mass and river runoff would be the primary focus, but detailed output from the WaSiM model, such as future permafrost and active layer and soil water storage, would also be analyzed. Changes in streamflow would be analyzed on annual, seasonal, and single event time-scales. Results would be used to quantify the integrated glacier-hydrology responses to climate change for the upper Susitna basin upstream of the reservoir.

To determine the potential for changes in sediment delivery rates to the reservoir as a result of periodic glacial surges, AEA proposes to review data from previous glacial surges in the upper Susitna River basin glaciers as reported by Harrison (1994) and Humphrey and Raymond (1994), and evaluate the sediment transport capacity of the reaches of the Susitna River upstream of the reservoir. If it is determined that the increased sediment load could affect project operations, a sediment loading scenario accounting for glacial surge would be added to study 6.5, Geomorphology Study. This would include an estimate of the reduction in reservoir life that could result from sediment loading associated with periodic glacial surges.

Comments on the Study

Study Need and Scope

NMFS and FWS state that recent advances in climate science and its application in hydrologic risk analyses underscore the need for FERC's licensing process to use accurate predictions of the effects of climate change on changes in glacial wasting and on the timing and availability of water in the Susitna River. NMFS and FWS contend that it is now considered routine for hydropower, dam, and water management projects in the United States and around the world to consider projections of climate variability and climate change in project planning and operations. NMFS and FWS cite FERC's Toledo Bend Project No. 2305 and Lake Powell Pipeline Project No. 12966 study plan determination letters as evidence that FERC has required climate change analysis in its ILP study plan determinations. Therefore, NMFS and FWS request that FERC require AEA to implement the study included in NMFS' May 31, 2012, study requests entitled, Comprehensive Study of Susitna River Project Effects under Changing Climate.

Specifically, in their study requests, NMFS and FWS recommended that AEA study the potential impacts of climate change on the entire Susitna watershed and ecosystems, including how anticipated seasonal, annual, and long-term changes in temperature and precipitation can be expected to affect the efficiency, longevity, and ecological impacts of the proposed project. The study recommended by NMFS would

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include developing projections for the range of hydrologic changes that are based on “state-of-the-art” global climate models and downscaled climate projections, such as the dynamical downscaling developed by the North American Regional Climate Change Assessment Program at <http://www.narccap.ucar.edu/>. NMFS and FWS assert that their recommended study would use documented and peer-reviewed methods that have been developed and applied to other hydrologic and ecological systems in Alaska and other sites (Prucha, et al., 2010; Burger, et al., 2011; Cherry, et al., 2010). NMFS recommends that the global climate models and downscaled projections be used to create a range of potential future scenarios. The climate change scenarios would then be translated into time series data on modified hydrology and temperature dynamics in the Susitna River basin using the WaSiM model. NMFS also requests that the study include a component to assess climate change vulnerabilities of the natural resources in the entire Susitna River watershed based on documented methodologies, such as the one from Bryant (2009).

In addition to NMFS and FWS, a number of individuals and NGOs also requested that the climate change study be expanded downstream of the dam site to include a comprehensive study of the effects of climate change on all reaches of the Susitna River. A number of individuals and NGOs also requested that the climate change study be used to predict downstream impacts of the project on water availability, geomorphology, and terrestrial, riparian, and aquatic resources.

In response, AEA says that the project will be able to regulate the river flow so that any impacts of climate change will be eliminated or attenuated within the zone of project effects. AEA also 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 FWS and NMFS are suggesting should be required here.⁶

Localized Climate Effects

Several individuals also requested that AEA study how reservoir creation could affect the local climate in the vicinity of the project and downstream.

⁶ See *Consideration of Climate Change in Federal EISs, 2009-2011*, Patrick Woolsey, Center For Climate Change, Columbia Law School (July 2012).

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Discussion

Study Need and Scope

Regarding previous cases, the study plan determination for the Toledo Bend Project denied a National Wildlife Federation request for the applicant to evaluate the effects of climate change on basin hydrology, on the basis that staff were unaware of any climate change assessments that were known to have the accuracy to predict the degree of specific resource impacts and serve as the basis for informing license conditions. Instead, staff concluded that the potential consequences of climate change could be evaluated using conventional hydrologic studies and monitoring techniques.⁷ Similarly, the study plan determination for the Lake Powell Pipeline Project denied Lake Powell Pipeline Coalition request for the applicant to develop a climate change hydrologic model scenario, on the basis that staff were unaware of any climate change assessments that were fine-tuned enough to make reservoir operation decisions.⁸ Instead, the study plan determination approved the applicant's proposed study to review available literature on climate change and evaluate the effects of climate change on the project and any action alternatives using historic streamflow data and an existing streamflow model.⁹

Similar to other hydroelectric licensing cases, the effects of the project on environmental resources of the project area can be effectively studied and evaluated using conventional hydrologic studies, monitoring techniques, and predictive models (section 5.9(b)(6)). The proposed climate change assessment also would be very costly¹⁰ (section 5.9(b)(7)), and the results may be too uncertain to rely upon for the development of license requirements (section 5.9(b)(5)). For these reasons, we conclude AEA's proposed climate change assessment aspects of the study are not necessary to evaluate project effects.

⁷ See *Study Plan Determination for the Toledo Bend Project*, Appendix A at 16 (August 2009).

⁸ See *Study Plan Determination for the Lake Powell Pipeline Project*, Appendix A at 16 (January 2009).

⁹ The Bureau of Reclamation's existing Colorado River Simulation (CRSS) model.

¹⁰ AEA estimates its study would cost \$1,000,000. NMFS estimates its study would cost from \$750,000 to \$1,000,000. Given that the project-specific modeling recommended by NMFS is similar to that recommended by AEA but the scope of NMFS' study is much more expansive than AEA's proposed study, we anticipate that the costs of NMFS' recommended study would be considerably greater than AEA's.

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While not identical, NMFS and AEA generally propose similar approaches in their requested and proposed climate change assessments, and in their PSP review letter, NMFS has indicated that it “supports the methods selected by AEA for streamflow on an annual and seasonal basis.” Accordingly, it is our understanding that the downscaling and hydrologic modeling approaches proposed and requested are generally similar. However, AEA has not agreed to the geographical scope of the climate change assessment or to predicting impacts on the downstream ecology as requested by NMFS, FWS, and others.

Regarding NMFS’ requested climate change assessment, we have the same concerns identified for AEA’s proposal. Regarding the recommended comprehensive assessment of the potential effects of climate change on water resources, geomorphology, and terrestrial, riparian, and aquatic resources of the entire Susitna River basin as requested by NMFS, we are requiring a comprehensive suite of environmental studies that will evaluate the effects of the project on natural resources. The geographic scope of these studies is being evaluated specific to the affected resources, and where appropriate, will be linked to the range of hydrologic effects.

Nevertheless, the Commission’s standard reopener article would be included in any license as the vehicle for making changes to the license if unforeseen and unanticipated adverse environmental effects occur in the future. In addition, flexibility can be built into operational rule curves to accommodate fluctuations in hydrology during both high and low water years.

Localized Climate Effects

The commenters do not provide any evidence that a waterbody the size of AEA’s proposed reservoir would affect local climate conditions and we are not aware of any instances where a 39-mile-long, 0.5- to 2-mile-wide reservoir has been shown to have a detectable effect on the local climate. We therefore see no nexus between the requested study and project effects (section 5.9(b)(5)).

Staff Recommendation

We find that the analysis of the potential changes to sediment delivery from the upper Susitna watershed into the reservoir from glacial surges as proposed by AEA is necessary, and therefore, are recommending approval of this portion of AEA’s proposed study (item 4 as described above in the applicant’s proposed study).

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We are not recommending approval of the remainder of AEA's proposed study (items 1-3 as described above in the applicant's proposed study). We have no objection to AEA conducting this portion of the study.

We do not recommend extending the geographic range of the climate change assessment or adding an analysis of the natural resource impacts, as recommended by the NMFS and others.

Salmon Escapement Study (9.7)

Applicant's Proposed Study

AEA proposes to conduct a study to describe the distribution and abundance of adult salmon in the lower, middle, and upper Susitna River. For the purposes of this study, the river is divided into three study segments: Lower River (river mile (RM) 30-98), Middle River (RM 98-150), and Upper River (RM 150-234). The primary goal of the study is to characterize the distribution, abundance, habitat use, and migratory behavior of all species of adult anadromous salmon within mainstem river habitats and select tributaries above the three rivers confluence area at RM 98 (i.e., confluence of the Susitna, Chulitna, and Talkeetna Rivers). A second goal of the study is to estimate the distribution, escapement, and migratory behavior of adult Chinook salmon throughout the entire Susitna River drainage, and adult coho salmon distribution and escapement in the Susitna River above the confluence of the Yentna River at RM 30. Information from the study would be used in combination with other studies to assess potential effects of the project on fisheries resources.

The study would include a variety of field methods to monitor adult upstream migration and spawning, both active and passive. Proposed methods are summarized below:

- 1) install and operate fishwheels to capture adult salmon at the following locations on the Susitna River: 2 fishwheels at RM 30, 2 fishwheels at RM 120 at Curry Station, 1 fishwheel in Devils Canyon (~RM 150) downstream of the proposed dam site (RM 184);
- 2) supplement the fishwheel effort in the lower river with gillnets or tangle nets to address potential size selectivity of capture associated with different sampling techniques and augment catch totals;
- 3) install and operate 2 fishwheels to capture adult salmon in the lower Yentna River near its confluence with the Susitna River;

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- 4) insert radio tags in a total of 700 Chinook, 600 coho, and 200 pink salmon per year in 2013 and 2014 that are captured at the Susitna River fishwheels at RM 30;
- 5) insert radio tags in a total of 700 Chinook per year in 2013 and 2014 that are captured in the lower Yentna River fishwheels;
- 6) insert radio tags in 400 Chinook, 200 chum, 200 sockeye, 200 pink, and 200 coho salmon per year in 2013 and 2014 that are captured at the Susitna River fishwheels at RM 120 at Curry;
- 7) opportunistically insert spaghetti-tags in additional adult salmon captured that exceed the radio tag goals;
- 8) implement fixed telemetry-receiver monitoring stations in the Lower, Middle, and Upper River to track fish movements (i.e., 13 stations on the Susitna River and tributaries upstream of the three rivers confluence, 6 stations on the Susitna and Yentna River and tributaries downstream of the three rivers confluence);
- 9) conduct aerial telemetry surveys (i.e., helicopter or fixed-wing aircraft) along the mainstem Susitna River at 5-day intervals from July through late October from the lower Susitna River (RM 22) to the confluence with Kosina Creek (RM 207) to track fish movements;
- 10) conduct aerial telemetry surveys along Susitna and Yentna River tributaries at 7- to 10-day intervals from late June through September;
- 11) conduct boat and foot telemetry surveys at weekly intervals from July through September at locations where concentrations of fish are identified and suspected of spawning;
- 12) use sonar to characterize any suspected salmon spawning in turbid water of the mainstem habitats of the Susitna River;
- 13) collect tissue samples from all radiotagged salmon and from all untagged spawning fish that are sampled during spawning ground surveys to use for the fish genetics study (study 9.14); and
- 14) implement capture-recapture techniques to estimate Chinook and coho salmon escapement to the Susitna River upstream of the confluence with the Yentna River, and the distribution of those fish in the Susitna River tributaries in 2013 and 2014.

Comments on the Study

Adult Salmon Escapement Estimates

FWS and NMFS state that obtaining abundance estimates for all five species of Pacific salmon within the project area of influence needs to be a basic component of the

study. The agencies contend that in the current plan the only population or escapement estimates would be for Chinook and coho salmon in the Susitna River upstream of the Yentna River confluence at RM 30 and would not adequately provide escapement estimates, abundance estimates, or abundance indices for the other three salmon species. FWS and NMFS state that total Susitna River adult escapement estimates should not be limited to Chinook and coho salmon; rather, the escapement estimates for the entire Susitna River upstream of the Yentna River should also include chum, pink, and sockeye salmon.

Radio-Tagging and Monitoring in the Lower and Middle River

FWS and NMFS state that in addition to Chinook, coho, and pink salmon, chum and sockeye salmon should also be radio-tagged at RM 30 to determine spawning escapement for all of these species (as noted above) and to determine spawning distribution throughout the Lower and Middle River. In addition, the agencies state that an unspecified amount of additional Chinook, coho, and pink salmon should be tagged at RM 30 to increase the potential sample of detections in the lower Middle River downstream of Curry Station (i.e., between RM 98 and 120).

FWS and NMFS state that estimates of the numbers of salmon spawning within the Lower River zone of project influence are required to assess project effects. The agencies request an opportunity to require additional studies to determine adult salmon spawning areas within the area of project influence after results from the flow-routing modeling are available.

FWS and NMFS state that the proposed study includes methods that would not assess fish migrating to spawning sites within the Middle River that are downstream of the Curry Station fishwheels at RM 120. FWS and NMFS provide examples of spawning sites at Whiskers Creek (RM 101) and numerous other tributaries and sloughs downstream of Curry Station that they state would not be adequately evaluated under the proposed study. Accordingly, the agencies request the following:

- 1) construct an additional fish wheel and tagging site near RM 100 (e.g., at the Chulitna River confluence or Talkeetna Station), tag all species of salmon at this site with similar tagging effort to what is proposed at Curry Station (i.e., 1,200 additional tags per year);¹¹

¹¹ The Curry Station tagging effort would include 400 Chinook, 200 chum, 200 sockeye, 200 pink, and 200 coho salmon per year in 2013 and 2014.

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- 2) use the RM 100 tagged or untagged ratio at the Curry Station recapture site to obtain Middle River escapement for Chinook, chum, and sockeye salmon; and
- 3) install and operate weirs at selected tributaries to provide a second measure of tagging ratio and counts of spawning salmon entering these streams.

FWS states that the array of fixed-station receiver sites currently proposed to identify Chinook salmon spawning sites are particularly weighted toward the upper reaches of the Middle River. FWS requests that additional fixed sites also be located in the lower Middle River to track the movement of all salmon species.

Alaska Department of Fish and Game (Alaska DFG) states that removing fishwheels at Curry Station in early September likely misses a substantial portion of the coho and chum runs; therefore, Alaska DFG recommends that AEA consider operating the fish wheels through the end of September.

Radio-Tagging and Monitoring in the Upper River

FWS and NMFS state that the proposed study includes methods that would fail to result in escapement estimates, salmon population or abundance estimates, or even indices of abundance for the Upper Susitna River or tributaries. Accordingly, FWS and NMFS request the following:

- 1) install a weir in the Susitna River mainstem at the proposed dam site (RM 184) or use DIDSON or another means to obtain an accurate estimate of all salmon (and other resident and anadromous fish species) passing upstream of this location;
- 2) use the number of Upper River tagged fish from fixed stations and aerial surveys, and tagged to untagged ratio at this requested mainstem weir at the proposed dam site to obtain Upper River escapement estimates and to obtain genetic samples;
- 3) use this requested Upper River mainstem weir at the proposed dam site as a second tagging station; and
- 4) install weirs on spawning tributaries above the proposed dam site to obtain accurate counts and ratios of tagged to untagged salmon and a second estimate of escapement past the dam site, and to obtain genetic samples.

Effects of Radio Tags

FWS states that AEA should revisit the choice of tags for this study. FWS states that the smallest, least invasive radio tag should be selected to maximize the number of

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fish that can be tagged, maximize tag recoveries, and minimize tag effects on fish behavior and mortality. FWS states the gastric radio tags proposed by AEA can reduce swimming ability and increase mortality rates (Corbett et al., 2012) which could alter evaluation of fish passage flows and the number of tagged salmon that survive and migrate through Devils Canyon. Therefore, FWS suggests that AEA consider using an alternative tag for use in Chinook salmon at the Curry Station fish wheel site (RM 120) and the site in lower Devils Canyon (RM 150–151) to assess upstream fish passage through Devils Canyon and to develop fish passage criteria.

Comparison to Historical Data

FWS and NMFS state that the proposed methods are not adequate to compare results with historical data collected during the 1980s, which is a stated objective of AEA's proposed study. The agencies state that studies in the 1980s obtained annual population estimates for all five salmon species at three locations within the project area of influence: Sunshine Station (~RM 30), Talkeetna Station (~RM 100), and Curry Station (RM 120). FWS and NMFS state that the proposed methods will only provide population estimates for Chinook and coho salmon at RM 30. The agencies request that study methods (marking and recapture, and spawning surveys) be modified to obtain comparable data. However, the agencies do not request specific modifications, other than to recommend additional and more frequent aerial, boat, and foot surveys in addition to fish counts to augment escapement data obtained at marking locations at RM 30 and RM 120.

Discussion

Adult Salmon Escapement Estimates

While this study would focus on providing absolute escapement estimates for only coho and Chinook salmon, it would also include an evaluation of chum, pink, and sockeye salmon distribution and relative abundance. The evaluation for chum and sockeye salmon would be based on existing information collected over the last seven years by Alaska DFG (Yanusz et al., 2007; Yanusz et al., 2011b; and Merizon et al., 2010). The evaluation for pink salmon would be based on a limited radio-tagging effort of 200 pink salmon in 2013 and 2014, because, unlike chum and sockeye salmon, there are no recent studies of pink salmon distribution and abundance in the lower Susitna River.

In regard to pink salmon, AEA proposes to evaluate pink salmon use of the Susitna River by capturing, radio-tagging, and tracking a subset of the adult return during

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both a peak and off-peak return year to monitor their migration characteristics and distribution by habitat type in the mainstem. FWS and NMFS request escapement estimates for pink salmon, which are not currently proposed, and have not been recently conducted by other researchers. To conduct an escapement estimate of pink salmon similar to what is proposed for coho salmon (i.e., purchasing additional radio tags, fish processing, fish tracking, and analysis) would have an additional approximate cost of \$75,000 per year. However, the abundance of this species in the Susitna River has high annual variability, including a pronounced odd-even pattern of peak run returns from year to year. For this reason, absolute escapement numbers for pink salmon in the Susitna River, as requested by FWS and NMFS, would likely be highly variable between study seasons, and is likely not necessary to evaluate project effects (section 5.9(b)(5)).

In regard to chum and sockeye salmon escapement, we reviewed recent studies completed by Alaska DF&G (Yanusz et al., 2007; Yanusz et al., 2011b; and Merizon et al., 2010) and conclude that the reports, together with AEA's proposals to document all adult salmon observed at weir locations and during aerial, boat, and ground-based surveys, should be sufficient to describe the existing environment (section 5.9(b)(4)) for these species' abundance in the Lower and Middle Susitna River.

Radio-Tagging and Monitoring in the Lower and Middle River

AEA proposes to monitor adult salmon spawning habitat use and distribution upstream of RM 22, although most information on spawning habitat use and distribution would be collected upstream of RM 30 because that is the location of the Lower River fishwheel tagging site and most salmonids do not migrate back downstream from upstream areas to access spawning sites. NMFS and FWS would have the opportunity to review the results of the open-water flow routing model in the initial study report, and if they determine that project effects extend downstream of RM 22, the agencies could request additional surveys of adult spawning distribution in areas downstream of RM 22 at that time or in subsequent study years after a showing of good cause as specified in sections 5.15(d) and 5.15(e) of the Commission's regulations.

AEA notes in its study that obtaining 200 coho salmon at the Curry Station fish wheels may be difficult due to low numbers of coho captures. Extending the operation of the Curry Station fish wheels through the entire month of September would be a relatively low-cost measure (section 5.9(b)(7)) that would assist in meeting the study objectives of capturing a representative proportion of the coho salmon run at this sampling location (section 5.9(b)(6)).

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To monitor fish migration and spawning distribution in the Lower and Middle River between RM 30 and RM 120, AEA proposes to conduct aerial, boat, and ground-based mobile telemetry surveys to track Chinook, coho, and pink salmon that are radio-tagged at RM 30, or any of the five species of salmon that are tagged at Curry Station at RM 120 and migrate downstream. In addition to aerial, boat, and ground-based mobile telemetry surveys, AEA proposes six fixed telemetry receiver sites at the following locations in the Middle River (RM 98 to 150):

- 1) Lane Creek area (~ RM 113.0),
- 2) Middle River Gateway (RM 123.7),
- 3) Slough 11 (~ RM 135.3),
- 4) Indian River confluence (RM 138.6),
- 5) Slough 21 (~ RM 141.1),
- 6) Portage Creek confluence (RM 148.8).

Of the six fixed telemetry receiver sites to be deployed in the Middle River segment, only one is located downstream of Curry Station at the Lane Creek area (RM 113), so it appears that documentation of adult salmon migration and spawning use of the lower Middle River would mostly rely on mobile telemetry surveys. If mobile telemetry surveys detect congregations of suspected spawning fish, AEA proposes to implement sonar surveys to attempt to monitor spawning use of the mainstem by these species. Additional data on fish distribution and spawning use would be collected in the Middle River focus areas downstream of RM 120 through habitat suitability criteria data collection efforts under study 8.5 (*Fish and Aquatics Instream Flow*).

Based on recent Alaska DFG studies, it appears a small (<5%) portion of the fish tagged at RM 30 would be detected in the lower Middle River. For example, two of 250 sockeye salmon radio tagged at RM 30 in 2006, six tagged in 2007, and three tagged in 2008 were tracked to Middle River spawning locations (Yanusz et al. 2007, 2011a, 2011b). Similarly, 10 of 239 radio tagged chum and 4 of 300 coho salmon were tracked to Middle River spawning locations in 2009 (Merizon et al., 2010). The implication is that of the 600 coho salmon proposed to be radio tagged at RM 30 potentially as few as 8 would be detected in the Middle River, in addition to whatever fish tagged at Curry Station migrate back downstream. The same could be true for Chinook salmon, and even fewer pink salmon would be expected to be detected. It is not clear why fish tagged in the Lower River have such a low detection rate in the Middle River, but in any event, because of the low detection rate it appears that additional tagging at the Lower River fish wheels at RM 30 may not result in substantially more detections of tagged fish using the Middle River.

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FWS and NMFS do not specify how many additional fish of each species should be tagged but assuming that they are requesting that the proposed effort include 200 each of sockeye and chum salmon, and the doubling of tagging efforts for Chinook and coho salmon, the number of fish detected in the Middle River could still be in the range of only 10 to 20 individuals per species (with possibly greater than 50 Chinook salmon) at an additional approximate cost of \$250,000 to double the tagging effort at RM 30 per year.

It is not known at this time whether AEA's proposal to capture, tag, and track Chinook, coho, and pink salmon at RM 30, and all five salmon species at RM 120, would result in sufficient detections of adult salmon in the Middle River to adequately describe the existing environment and evaluate project effects on adult salmon migration and spawning habitat in this river segment. This would especially be the case in the lower Middle River segment between RM 98 at the three rivers confluence and RM 120 at Curry Station, where there would be frequent flow fluctuations under proposed project operations, and a limited amount of information specific to adult salmon use collected under AEA's proposed study.

Constructing another fishwheel near RM 100, tagging an additional 400 Chinook, 200 chum, 200 sockeye, 200 pink, and 200 coho salmon per year in 2013 and 2014 at this location, and implementing additional fixed telemetry receiver sites in the lower Middle River segment, as recommended by FWS and NMFS, could potentially result in additional detections of mainstem and tributary spawning throughout the 22-mile lower Middle River segment between RM 98 and RM 120. However, it's also possible that few, if any, of the additional tagged fish would use mainstem or tributary habitats for spawning in this reach and instead could simply result in additional detections of these fish migrating upstream past Curry Station into the remainder of the Middle River segment. If that were the case, there would be few additional benefits to justify the additional cost of approximately \$300,000 per year to construct the additional fishwheel near RM 100, implement additional fixed telemetry receiver locations, and implement a similar tagging effort at this location to what is being proposed for all five species at Curry Station.

Instead of tagging additional fish at RM 30, implementing additional fixed telemetry receiver sites, or constructing another fishwheel and tagging additional fish at RM 100, as requested by FWS and NMFS in 2013, a reasonable initial approach that may potentially provide sufficient data at a substantially lower cost (section 5.9(b)(7)) is to evaluate the results of AEA's proposed methods in the initial and updated study reports in 2013 and 2014. If the proposed methods do not result in sufficient detections to meet the study objective of evaluating adult salmon spawning distribution, especially in the lower Middle River segment between RM 98 and RM 120, additional tagging efforts, fixed

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telemetry receiver sites, and fishwheel locations could be added in subsequent study years (sections 5.15(d) and 5.15(e)). In the event that a decision on tagging more fish, adding additional fixed telemetry receiver sites, and/or adding additional fishwheels is deferred until after a complete review of all data collected in 2013 and 2014, it is possible that additional years of study may be required after 2014 to adequately describe the existing environment (section 5.9(b)(4)) and evaluate project effects (section 5.9(b)(5)).

Radio-Tagging and Monitoring in the Upper River

AEA proposes to install and operate two fishwheels at Curry Station (RM 120) in the Middle River, and operate a fishwheel in the Upper River at Devils Canyon below the fish passage impediments located at approximately RM 150. Up to 400 Chinook salmon would be radio-tagged at these two locations combined, with as many of the 400 Chinook as possible being tagged at the fishwheel location in Devils Canyon. In addition to aerial, boat, and ground surveys to locate tagged and untagged fish, AEA proposes to implement fixed radio telemetry receiver stations in the Upper River at four locations, including:

- 1) Cheechako Creek confluence (RM 152.4),
- 2) Chinook Creek confluence (RM 157.0),
- 3) Devil Creek area (RM 164.0); and
- 4) Kosina Creek confluence (RM 206.8).

FWS' and NMFS' recommendations to install a weir or sonar counting equipment in the mainstem Susitna River at the dam site (RM 184) and in tributaries upstream of the dam, could result in more-accurate estimates of all salmon and other resident and anadromous fish species migrating upstream through the proposed dam site. The additional weirs could also be used as additional tagging and recapturing stations, and for the purpose of obtaining additional genetic samples for fish that successfully migrate upstream through Devils Canyon. However, available data indicates that few adult salmon migrate upstream past the dam location. We estimate that installation of the recommended additional weirs or sonar counting station would cost approximately \$150,000 per year and note that it is not clear at this time if any of the five adult salmon species would be observed, or whether weir construction in the mainstem would be technically feasible given the high, turbid flow conditions that persist during the summer sampling season (section 5.9(b)(6)).

Instead of constructing additional weirs or installing sonar counting equipment in 2013, as recommended by FWS and NMFS, a reasonable initial approach that may potentially provide sufficient data at a substantially lower cost (section 5.9(b)(7)) would be to evaluate the results of AEA's proposed methods in the initial study reports in 2013

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and include in the study report an evaluation, based on site-specific data obtained during the 2013 study season, of the feasibility of putting in a weir or sonar counting station at or near the dam site during the 2014 study season. If AEA's proposed methods do not result in sufficient information to meet the study objectives of evaluating adult salmon escapement, migration, and distribution into the Upper River segment, we would have the necessary information in the initial study report to determine whether a weir or sonar counting station should be required as part of the study plan for the 2014 study season. In the event that a decision on adding weirs or sonar counting equipment is deferred until after a complete review of all data collected in 2013 and 2014, it is possible that additional years of study may be required after 2014 to adequately describe the existing environment (section 5.9(b)(4)) and evaluate project effects (section 5.9(b)(5)).

Effects of Radio Tags

AEA proposes to use Advanced Telemetry Systems, Inc. (ATS), pulse-coded extended-range radio tags. Model F1835B transmitters would be used for pink salmon (16 grams, 30-centimeter-long antenna, 96-day battery life); Model F1840B tags for sockeye, coho, and chum salmon (22 grams, 30-centimeter antenna, 127-day battery life); and Model F1845B tags for Chinook salmon (26 grams, 41-centimeter antenna, 162-day battery life). These tags allow 100 unique codes on each available frequency. By using several frequencies, each fish can be individually tracked. The selection of tag type is consistent with FWS' and NMFS' requests that the smallest, least invasive radio tag should be selected; is consistent with the technology that is currently being used in the basin by Alaska DFG (Yanusz et al., 2007; Yanusz et al., 2011b; and Merizon et al., 2010); and is consistent with generally accepted practice in the scientific community (section 5.9(b)(6)).

Comparison to Historical Data

AEA proposes to compare its adult salmon data collected in 2012, 2013, and 2014 to the historical results from the 1980's data that characterized the relative abundance, locations of spawning and holding salmon, and use of mainstem, side channel, slough, and tributary habitat types. The methods proposed by AEA, including radio telemetry, sonar, aerial surveys, boat surveys, and ground surveys would support a sufficient comparison to historical results on relative abundance and habitat use (section 5.9(b)(6)), consistent with the stated objectives of the study plan. FWS and NMFS state that the proposed methods would only provide population estimates for Chinook and coho salmon at RM 30. However, escapement estimates generated for coho and Chinook salmon should be comparable for two of the three locations used in the 1980's (Sunshine Station and Curry Station). As the agencies have noted, escapement estimates for the

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other three salmon species would be not be generated at Sunshine Station, and would not be generated for Talkeetna Station (as discussed above). Many of the methods proposed can be used to compare relative abundance of all species in the basin, but not to compare escapement estimates for all species at all three of these locations. The agencies have characterized this issue as a discrepancy, and requested that study methods (i.e., marking and recapture, and spawning surveys) be modified to obtain comparable data. However, it is not clear that comparing escapement estimates for all five species at these three locations is an explicit objective of this study plan, nor that it would be needed to describe the existing environment (section 5.9(b)(4)) or evaluate project effects (section 5.9(b)(5)).

Staff Recommendation

We recommend the study be modified to require AEA to extend the operation of its Curry Station fishwheels at RM 120 through the entire month of September.

We recommend the study be modified to require AEA to include in the initial study report an evaluation, based on site-specific data obtained during the 2013 study season, of the feasibility of putting in a weir or sonar counting station at or near the dam site during the 2014 study season to provide an accurate count of any resident or anadromous fish that are successfully able to migrate upstream through Devils Canyon into the project area.

The Future Watana Reservoir Fish Community and Risk of Entrainment (9.10)

Applicant's Proposed Study

AEA proposes to predict the fish community that would develop in the proposed reservoir based on the existing fish community present upstream of the dam and the habitat that would be created by the impoundment. AEA also proposes to characterize the potential fish losses from entrainment during project operation. Specifically, AEA would (1) develop estimates of the size of each of five types of reservoir habitat under alternative project operating scenarios, (2) develop a water temperature model to predict daily and seasonal variations in reservoir temperatures and temperature profiles, (3) identify and predict exceedances of turbidity thresholds that can limit reservoir habitat utilization, (4) characterize the existing fish community in the mainstem river and any tributaries or lakes that could colonize the reservoir, (5) conduct a literature review to identify species in the existing fish community that may use lacustrine habitat for one or more life history stages, (6) identify the presence of invasive species in lakes and ponds

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that are currently disconnected from the mainstem but have the potential to be inundated, (7) assess the potential to establish viable populations of anadromous or landlocked salmon upstream of the proposed project and the potential to affect native fish, (8) characterize potential management options for a future reservoir fishery, and (9) conduct a desktop analysis of the potential for entrainment and impingement of fish species inhabiting the proposed Watana reservoir.

Comments on the Study

NMFS requests that AEA include in its study an evaluation of the potential to enhance existing fisheries for anadromous salmonids in the Susitna River upstream of the project. NMFS states that Alaska DFG (1983) studied the concept of upper Susitna River salmon enhancement and determined that construction of fish passage was possible from an engineering and construction standpoint. NMFS states that Alaska DFG (1983) found that dam construction with fish passage would enhance the production of at least four species of salmon due to reservoir and upstream habitat access.

Discussion and Staff Recommendation

AEA's proposed study includes a provision to evaluate the potential to establish viable populations of anadromous or landlocked salmon upstream of the proposed project and evaluate the potential effects of these populations on the native fish community. Although the text of AEA's proposed study does not specify which salmon species would be considered in the evaluation, the study does note that the evaluation would be based on the study approach from Alaska DFG (1983). Moreover, AEA's comment-response table included as Appendix 1 of the RSP indicates that it concurs with NMFS' request to include an assessment of the enhancement potential for Chinook, sockeye, chum, and coho salmon within its proposed study.

Therefore, we recommend modifying AEA's proposed evaluation of the potential to establish viable populations of anadromous salmonids upstream of the project, specified in task 4 of section 9.10.4.2, to include evaluation of the production potential for Chinook, sockeye, chum, and coho salmon in reservoir and riverine habitats upstream of the dam.

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Study of Fish Passage Feasibility at Watana dam (9.11)

Applicant's Proposed Study

AEA proposes to conduct a study to develop, to the feasibility level, a fish passage strategy in support of the license application for the proposed project. The study process would consider a variety of engineering, biological, sociological, and economic factors to assess three basic alternatives related to fish passage: (1) proposed project without fish passage, (2) integration of upstream and downstream passage features into the current dam design, and (3) the retrofit of upstream and downstream fish passage features to a dam designed without fish passage.

The proposed study includes six tasks that AEA contends will generally follow the process set forth in the NMFS' guidance document titled, *Anadromous Salmonid Passage Facility Design*, dated 2011. The six tasks are summarized below:

Task 1 would establish a Fish Passage Technical Work Group (Fish Passage TWG) with representatives from state and federal agencies, Commission staff, and other interested licensing participants that would convene once every other month throughout study implementation to provide input on assessing additional data needs, developing evaluation criteria, and developing conceptual-design passage strategies. Four workshops would be scheduled at study milestones addressing the following topics: (1) review of dam design and operational concepts, and biological, physical, and site-specific information, (2) conceptual alternatives brainstorming, (3) critique and refinement of concepts and packaging of conceptual components into alternatives, and (4) alternatives selection, refinement, and costs. The first Fish Passage TWG meeting would identify goals, set schedules, establish process, and refine and obtain input on the list of information needs.

Task 2 would focus on technical preparation for the concept development brainstorming session described in Task 4. AEA would compile existing and salient background information and prepare workshop materials including further development of evaluation criteria and an evaluation process. The review would allow the Fish Passage TWG to become familiar with the operational, physical, hydrologic, and biological setting of the proposed Watana dam. This information would assist the Fish Passage TWG in providing input to alternatives that are compatible with the proposed project and with hydrological and physical constraints. AEA also proposes to develop a spreadsheet-based biological performance tool and use it to qualitatively estimate potential passage success and present the positive and negative biological effects associated with the various passage concepts under consideration.

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Task 3 would include a site reconnaissance to observe conditions and collect information, as appropriate, for concept development.

Task 4 would include a facilitated two-day brainstorming workshop with the Fish Passage TWG to identify fish passage concepts. AEA would then organize the concepts and, with input from the Fish Passage TWG, perform an initial fatal-flaw analysis to eliminate any concept that cannot meet basic criteria. AEA would refine the fish passage concepts into fish passage alternatives to address site-specific applicability, hydraulic functional design, construction and operating cost estimates, and general layout, and to identify any uncertainties for further examination. Performance of the alternatives would be evaluated using the biological performance tool. Alternatives that are not technically feasible would be dropped from consideration and the reasons for them being dropped would be described. The alternatives would be combined into strategies consistent with an integrated dam design and a retrofit. An explanation of the operation and biological performance of the alternatives would be presented to the Fish Passage TWG at the third workshop. Task 4 would be completed in 2013, which should allow the conceptual alternatives to be presented in the ILP initial study report.

Task 5 would include development of an evaluation matrix to advance the existing state of each alternative's conceptual design and allow a relative comparison of the alternatives. This information would be presented at a final workshop, with the goal of selecting a final list of alternatives for refinement by AEA in Task 6.

Task 6 would include preparation of an opinion of probable construction and operating cost for each alternative, describing operational protocols and issues, addressing comments from Task 5, performing final runs of the biological performance tool, preparing a final quantitative evaluation of the alternatives using the final evaluation matrix and evaluation criteria, and addressing constructability issues and any remaining data needs or significant risks. Task 6 would be completed in 2014, which should allow the final study results to be presented in the ILP updated study report.

Comments on the Study

Consideration of Economic Costs in Fish Passage Feasibility Analysis and Development of Preliminary Fishway Prescriptions

NMFS and FWS are concerned the RSP continues to include consideration of construction and operation costs as differentials for determining the engineering feasibility of conceptual designs for fish passage measures at the project. The agencies

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are also concerned that the study does not include the agencies' goal of actually developing a preliminary fishway prescription if they conclude that a fishway prescription is warranted and feasible.

Additional Recommendations

NMFS and FWS comment that they made six recommendations in their comments on the PSP that they believe were largely unaddressed in the RSP.

Specifically, NMFS and FWS recommend the following modifications to the fish passage feasibility study as stated in their comments on the PSP:

(1) organize the study plan to address NMFS' and FWS' information needs and study requests in sufficient detail to determine what components of the agencies' study requests are adopted and what components are not adopted;

(2) conduct fisheries surveys for at least one generation of each salmon species (e.g., a range of three to seven years for Chinook salmon);

(3) acknowledge that a biological need for fish passage already exists because anadromous fish are already known to spawn and rear upstream of the proposed dam site, and remove the statements that: (a) the study will determine whether there is a biological need for fish passage, and (b) cost estimates will be developed for fish passage alternatives;

(4) develop baseline data and evaluate design alternatives that include three alternatives: (a) construct fish passage facilities at the same time as the project, (b) construct fish passage as a retrofit, and (c) no fish passage;

(5) develop hydrologic and hydraulic information along with other physical information such as expected debris loading, ice conditions, expected sediment transport, expected forebay and tailwater rating curves, project operation information, river morphology trends, predatory species expected, downstream sites for a barrier dam/trap and haul operation, size of upstream and downstream migrants, etc; and

(6) identify the relationships among the 2012 studies and the recommended ILP studies; define the timing of related studies; and explain how the studies will be completed within the ILP study planning, study dispute, and study completion schedules.

Discussion

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Consideration of Economic Costs in Fish Passage Feasibility Analysis and Development of Preliminary Fishway Prescriptions

Inclusion of costs in AEA's fish passage feasibility study would be necessary to support staff's evaluation of the benefits and costs of providing fish passage at the project. Therefore, we agree with AEA's proposal to include cost estimates.

It is not clear why the agencies are concerned that the study does not specifically include a provision for developing a preliminary fishway prescription. AEA will develop its own project proposal, and regardless of whether fish passage measures are included in AEA's proposed action, NMFS and FWS would still be able to prescribe fishways at the project pursuant to their authorities under section 18 of the FPA.

Additional Agency Recommendations

Of the 6 additional recommendations, items 4 and 5 were fully incorporated into the RSP. Items 1 and 6 were substantively addressed in either the RSP or the comment-response table (Appendix 1 to the RSP), and further discussion and refinement of this information as presented in the RSP would not improve or materially alter the study plan. Item 3 was also substantively addressed in the RSP, with the exception of the recommendation to delete the cost estimates from the study plan, which we see no reason to delete for the reasons already discussed. We address item 2, pertaining to the appropriate study duration for anadromous fish studies, in the general comments section of this study plan determination.

We conclude that the study proposes a reasonable approach to evaluate various fish passage alternatives at the project, and is consistent with the other fish passage feasibility analyses conducted within the context of hydroelectric licensing cases (section 5.9(b)(6)).

Staff Recommendation

No modifications to the study plan are recommended.

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Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries (9.12)

Applicant's Proposed Study

AEA proposes a study to describe existing fish passage barriers, identify barriers that may be eliminated or created by project operations, identify potential effects on fisheries resources associated with these anticipated changes, and determine what, if any, protection, mitigation, and enhancement measures may be appropriate.

The study area includes the Upper Susitna River within the inundation zone of the reservoir (RM 184 to ~RM 223), and the Middle Susitna River from the proposed dam site at RM 184 downstream to the three rivers confluence at RM 98. AEA does not propose any fish passage barrier study components downstream of RM 98.

General study objectives include the following:

- Locate and categorize all existing fish passage barriers (e.g., falls, cascade, beaver dam, road or railroad crossings) located in selected tributaries in the Upper Susitna River and a subsample of tributaries located in the Middle River.
- Identify and locate using GPS the type of fish passage barrier (i.e., permanent, temporary, seasonal, partial), and characterize the physical nature of any existing fish barriers located within the project's zone of hydrologic influence.
- Evaluate the potential changes to existing fish passage barriers (both natural and man-made) located within the project's zone of hydrologic influence.
- Evaluate the potential creation of fish passage barriers within existing habitats (e.g., tributaries, sloughs, side channels, off-channel habitats) related to future flow conditions, water surface elevations, and sediment transport.

AEA proposes to meet the study objectives by using existing information, consulting with the TWG and other licensing participants, and using the methods described in the study plan.

Specific study tasks include: (1) identify fish species to be included in the passage barrier study; (2) define the passage criteria for the identified fish species; (3) select specific study sites and representative study sites; (4) conduct field studies; (5) coordinate with other interdependent studies; (6) evaluate potential effects of altered fluvial processes on fish passage in sloughs, upland sloughs, side channels, and at tributary mouths; and (7) evaluate the potential for impeded movement or pooling of fish that could result in increased predation below a barrier.

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Comments on the Study

Study Plan Consultation and Process Implementation

NMFS comments that many decisions on certain aspects of study development and implementation are deferred to a later date in consultation with licensing participants or the proposed TWG. NMFS states that deferring study plan details to a later date circumvents the process for agencies and licensing participants to comment, AEA to issue revised study plans, FERC to issue a study plan determination, and agencies to have the opportunity to formally dispute the study plan determination. NMFS states that it understands the need to defer the decision making on some aspects of study implementation to a later date through consultation with agencies and licensing participants, but notes the study plan lacks information describing how the TWG would be formed, how meetings would be scheduled, who would make decisions, how consensus would be reached, or how disputes would be resolved, particularly with those agencies with mandatory conditioning authority under the FPA or Clean Water Act. NMFS states that, if decisions are to be deferred to a later date in consultation with the TWG or licensing participants, then FERC must develop, implement, and enforce a process that does not circumvent agency statutory authority.

As a specific example of these consultation concerns, NMFS states that it disagrees with the proposal to select fish species to be evaluated in the study at an unspecified later date in consultation with the TWG.

Downstream Extent of Study Area

NMFS states that it disagrees with the three rivers confluence (RM 98) as the downstream extent of the study, as well as AEA's proposal to subsample tributary mouths and off-channel habitats instead of sampling all potential barriers. NMFS states that fish movement between habitats can be influenced by project-induced changes in stage height, flow routing, geomorphology, ice processes, and fluvial geomorphology. NMFS notes the downstream extent of flow, sediment transport, and ice process effects has not been established, and states the study area should include all locations where the project could affect fish passage which would extend well downstream of the three rivers confluence, and that all potential passage barriers should be surveyed.

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Upstream Velocity Criteria for Adult Salmon in Devils Canyon

NMFS states that flow releases from the project would modify flows within the Susitna River, thereby affecting adult salmon migration through Devils Canyon. NMFS states that AEA's proposed study must determine the flow conditions that provide for adult salmon migration through Devils Canyon to protect current fish passage and for potential project enhancement of fish passage. NMFS states that neither this study, nor study 9.7 (Salmon Escapement) provide information to model fish passage through Devils Canyon.

Velocity Barriers for Juvenile Salmonids During Open-water Periods

NMFS states it is concerned the proposed study would only evaluate water depth and vertical leaping barriers as factors affecting adult salmon movement during spawning migrations. NMFS states that the study must also consider the effects of low flows and river stage height on the ability of juvenile salmon to navigate vertical barriers and move into tributaries and off-channel summer rearing and winter overwintering habitats. NMFS comments that access into these habitats may only occur when backwater from the mainstem inundates vertical drops or increases pool depths. NMFS contends that the study methods must identify not only minimum depth requirements, but also those depths under which fish would migrate into tributaries and sloughs.

NMFS states that it disagrees with AEA's conclusion that any velocity barriers to upstream adult migration that would potentially be created by the project would only occur in tributaries, and its conclusion that gradients or channel constrictions at the entrances to sloughs and side channels would likely not be sufficient to create velocity barriers to adult fish or juveniles. NMFS states that, to its knowledge, AEA has not measured channel geometry and flow conditions at side channels and sloughs to determine if project-induced changes in flows would influence juvenile salmon (especially salmon fry) movement into off-channel habitats either due to physical limitations or by affecting fish behavior. NMFS states that reduced river stage height can eliminate backwater conditions that form at tributary mouths and off-channel habitats, and therefore flowing water from side channels may create a migration barrier, particularly to newly emergent fry as they migrate from spawning to rearing locations. In addition, NMFS states that modified off-channel habitat conditions from backwater to flowing water habitats could result in behavioral migration barriers to juvenile fish.

Fish Passage into Off-channel Habitats During Ice-Cover Conditions

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NMFS states that project-induced changes in ice formation and load-following operations can modify water velocities in off-channel habitats creating physical and behavioral modifications to fish movement between habitats. Therefore, NMFS requests that the current study plan describe methods to evaluate the influence of ice and winter load-following operations on fish passage between the mainstem and off-channel habitats.

Depth Barriers in Sloughs, Side Channels, Tributaries, and Tributary Deltas

NMFS contends that the study methods do not describe how the relationship between stage height and water depth will be determined. NMFS states that breaching flows and backwater conditions will vary with channel topography. NMFS states the study methods and previous studies were directed toward adult salmon, and would only represent a small subsection of those locations important for juvenile salmon rearing that could be affected by river stage height. NMFS states that once study sites and potential barrier locations are identified, water depths need to be measured under multiple different flows during the open-water period and during winter to determine discharge-depth relationships. NMFS requests that this analysis should be conducted at all study sites, including those where depths are modeled with 2-dimensional modeling to check for model accuracy and calibrate models.

Study Site Selection for Field Studies

NMFS states that it disagrees with AEA's three proposed criteria¹² for excluding sites from the fish passage barrier evaluation. NMFS states that the project would clearly influence water depth. NMFS also states that the RSP indicates that exposed streambanks during low flow conditions may create a velocity and depth barrier to fish migration, so essentially all tributaries may be sites of potential migration barriers. NMFS contends that categorically excluding sites that do not currently support target fish species eliminates the possibility of enhancement through the removal of migration barriers and fails to consider that fish use of habitat is not static, but shifts over time as habitats naturally change or would be changed by project operations. NMFS comments

¹² The three criteria include: (1) sites where a fish barrier (depth or velocity barrier for upstream or downstream movement) does not currently exist under natural low-flow conditions within the zone of hydraulic influence; (2) sites where the instream flow study or geomorphology models do not indicate the potential for future changes to channel form, geometry, and/or water depth; and (3) the tributary does not currently support target species.

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that many small tributaries, individually or cumulatively, provide important coho and pink salmon spawning habitat, coho and Chinook rearing habitat, and resident fish spawning and rearing habitat, and these areas should be assessed. Therefore, NMFS recommends that all tributaries and potential fish passage barriers in the study area be surveyed and evaluated.

NMFS states that the RSP suggests using focus areas to evaluate fish passage into sloughs and side channels and then extrapolate from these areas to the larger river; however, the study plan does not describe the focus areas. NMFS states that, in order for it determine if the focus areas provide sites for adequate representation or are representative of a larger spatial scale, it would need to know the distribution and characteristics of all possible sites that could be migration barriers.

Additional Study Needs

NMFS states that mainstem flows, turbidity, water temperature, water depths, velocities, and vertical barriers should be monitored during adult salmon migration to determine the conditions under which adult salmon move into tributaries, off-channel habitats, and over vertical barriers. NMFS contends that these data are necessary to determine actual stream characteristics that affect fish migration, not estimates based upon measures of water depth and velocity.

Discussion

Study Plan Consultation and Process Implementation

AEA does not propose any specific dates for when its proposed consultation and decision making milestones as set forth in the study plan would occur, other than providing a schedule that indicates most of the study would be completed in 2013, and consultation would occur with an unspecified group of licensing participants it refers to as the TWG. An additional requirement could be added to the study plan requiring AEA to file a detailed plan and schedule describing which licensing participants would participate in the TWG and when specific milestones for consultation and decision making would occur throughout study plan implementation.

Downstream Extent of Study Area

To our knowledge, there is no information in the project record at this time to definitively determine whether flow fluctuations from the project, especially from proposed load-following operations during winter low-flow periods, would be attenuated

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to the extent that the project would not cause fish passage impediments in tributary and off-channel habitats downstream of the three rivers confluence. We therefore share NMFS' concerns about the appropriate downstream extent of the fish passage barrier study. However, a phased approach of first evaluating fish passage barriers in areas upstream of the three rivers confluence to determine the extent of project effects in areas with larger flow fluctuations (i.e., the Middle River) is a reasonable initial approach that is consistent with similar evaluations completed in the context of hydroelectric licensing cases (section 5.9(b)(6)). If the results of the 2013 study in the Middle River (as documented in the initial study report) indicate that the project would cause significant adverse effects on fish passage into tributaries and off-channel habitats, and/or the preliminary results from the flow-routing, instream flow, or geomorphology modeling efforts indicate that project effects would extend downstream of the three rivers confluence, additional study areas could be added downstream in 2014 or in subsequent study years (sections 5.15(d) and 5.15(e)).

Upstream Velocity Criteria for Adult Salmon in Devils Canyon

NMFS does not provide any specific information on its proposed modeling effort to predict fish passage conditions through Devils Canyon or how such conditions might change under proposed project operations, and we are not aware of any way to safely collect field data or effectively model the extremely complex hydraulic conditions that occur within this approximately 12-mile-long class VI rapid. However, one reasonable approach to document the flow conditions occurring in Devils Canyon during fish passage events would be to assess the actual discharge conditions occurring at the streamflow gages closest to Devils Canyon and near the dam site during the time periods when salmon are documented to successfully pass upstream of the passage impediment (via radio-tagging as set forth in study 9.7, Salmon Escapement). Because AEA already established multiple streamflow gages between Devils Canyon and the dam site, this would be a low cost measure that would provide information necessary to describe the existing environment for fish passage conditions within the project area (section 5.9(b)(4)), and help inform the development of license requirements to address fish passage (section 5.9(b)(5)).

Velocity Barriers for Juvenile Salmonids During Open-water Periods

There is insufficient information available at this time to validate AEA's conclusions that changes to river stage and discharge under proposed project operations would not result in velocity barriers for juvenile salmon (especially salmonid fry) at the entrances to sloughs and side channels. We therefore agree with NMFS that an evaluation of velocity barriers for juvenile salmonids and particularly salmonid fry would

be appropriate to address potential project effects (section 5.9(b)(5)). While NMFS does not specifically propose any methods to accomplish this study objective, it does recommend that AEA's proposed fish passage barriers study integrate with other studies to determine the influence of Susitna River flows on water velocities at outlets of tributary mouths and off-channel habitats. A reasonable approach to address this information gap would be to evaluate tributary mouths and off-channel habitat entrances within Middle River focus areas to determine if velocity barriers to juvenile salmonids and particularly salmonid fry would be created by modifications to the flow regime under proposed project operations. This would be a relatively low-cost measure (section 5.9(b)(7)) because AEA is already proposing to conduct extensive evaluations of channel geometry, geomorphology, and flow conditions using field data collection techniques and both 1-dimensional and 2-dimensional modeling within the Middle River focus areas. NMFS' requested evaluation could be conducted by relying on the extensive data collection and modeling that would already be conducted for other studies (e.g., fish and aquatics instream flow, geomorphology, etc.).

Fish Passage into Off-channel Habitats During Ice-Cover Conditions

It's not clear whether AEA's proposed study methods would address NMFS' request to evaluate depth and velocity passage conditions from the mainstem into off-channel habitats during the winter ice-cover period. To assess the effects of project operations on streamflow during the winter ice-cover period, AEA is proposing to develop a winter flow-routing model. However, it's not clear if the winter model can accurately predict stage-discharge relationships and streamflow velocities at a scale that is fine enough to evaluate the effects of daily flow fluctuations during proposed winter load-following operations on fish passage conditions from the mainstem into off-channel habitats. Moreover, it's not clear how AEA's proposed operations would affect ice formation and whether ice formation under proposed project operations would on its own create passage barriers (e.g., blockages created by unstable or non-uniform ice formation from frequent flow fluctuations) between mainstem and off-channel habitats. While AEA's proposed fish passage barrier study plan does not appear to specifically address this issue, we assume the intensive, multidisciplinary study elements that would be implemented within the focus areas would provide some information to evaluate fish passage conditions between the mainstem and off-channel habitats under ice cover and load-following operations.

We are not aware of any specific existing information (section 5.9(b)(4)) or proposal to evaluate the effects of winter load-following operations under ice cover on fish migration between main channel and off-channel habitats; therefore, NMFS' requested study element would be necessary to address project effects on fisheries

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resources under winter ice-cover conditions and load-following operations (section 5.9(b)(6)).

Depth Barriers in Sloughs, Side Channels, Tributaries, and Tributary Deltas

In section 9.12.4.5 of the RSP, AEA proposes to develop water depth criteria for adult and juvenile salmon passage in sloughs, side channels, and tributary deltas. The methods it proposes to use include those applied in Alaska DFG (1984), as well as 2-dimensional modeling and other unspecified survey and hydraulic modeling methods that were not available in the 1980s.

We reviewed Alaska DFG (1984) and conclude that it does provide some information on the historical methods that were used to measure water surface elevations and develop stage-discharge relationships in the sloughs, side channels, and tributary deltas that were selected for the evaluation. However, it does not appear as though these survey and modeling methods would be repeated by AEA during 2013 and 2014 because AEA proposes to use either 2-dimensional modeling or other unspecified survey and hydraulic modeling methods that it states were not available in the 1980s. Additionally, we note that neither Alaska DFG (1984)¹³ nor AEA's proposed study appear to address juvenile salmon passage in off-channel habitats and tributary deltas during the winter ice-cover period when they may be exposed to frequent daily flow fluctuations and stage changes from load-following operations.

A reasonable approach to address this potential project effect would be for AEA to specify the methods (e.g., 2-d modeling, or other modeling approach) that it would apply at each off-channel and tributary delta location for the depth barrier analysis after it selects its proposed study sites in consultation with the TWG. This would include an explanation of its proposed methods during both the open-water period for adult and juvenile fish, and ice-cover period for juvenile fish, both of which would be necessary to evaluate project effects (section 5.9(b)(5)).

Study Site Selection for Field Studies

For the reasons discussed below, we conclude that there is insufficient information at this time to verify the appropriateness of AEA's proposed criteria for excluding Middle River sites from its fish passage barrier study.

¹³ Alaska DFG (1984) was an evaluation of adult salmon passage depth criteria, and adult salmon do not occur in the Susitna River during the winter ice-cover period.

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Criterion no. 1 does not specify the flow level under which the existing barriers were surveyed nor does it provide the methods for how the barriers were surveyed. If the preliminary surveys to base the decision on excluding sites have yet to occur, it's not clear how that could be accomplished until the fall low-flow period of 2013. This is especially problematic given that, under the proposed schedule (RSP Table 9.12-5), site selection and field data collection would begin in the first and second quarters of 2013, respectively, which would be four to seven months prior to the start of the low-flow period in September or October. Further, if the assumption is that barriers can be excluded based on aerial photography, we would need substantial additional information, including site-specific photos that are verified by field surveys, to ensure that this assumption is valid.

Criterion no. 2 is based on the results of instream flow and geomorphic modeling; however, we are not aware of any instream flow or geomorphic modeling results that are currently available to make a definitive conclusion that there are sites that have no potential for future changes in channel form, channel geometry, and/or water depth. In addition, according to the schedule provided in RSP Table 9.12-5, it appears as though site selection would be completed prior to any of the 2013 and 2014 instream flow and geomorphic modeling results are available for the Middle River.

Criterion no. 3 is based on the lack of presence of target fish species. However, site selection would occur prior to any of the field studies for the 2013 and 2014 fish distribution studies so it's not clear how sites could be selected or excluded prior to understanding fish distribution within those sites. If the presence of target species is based on historic information or 2012 preliminary studies, we would need to see the additional historic information and/or 2012 fish distribution data, prior to agreeing that target species do not occur at sites that would be excluded by this criterion.

We agree with NMFS that it's not possible to determine the appropriateness of subsampling sites for the fish passage barrier analysis until the sites are selected and evaluated for their representativeness of other areas that would not be sampled. This would especially be the case for tributaries and tributary mouths, the physical characteristics of which would be based on site-specific conditions (e.g., gradient, location of boulders and other large substrate, etc.).

Additional Study Needs

AEA proposes to monitor all of the physical habitat characteristics (e.g., flow, turbidity, water temperature, water depth, etc.) requested by NMFS through its proposed fish passage barrier study, and various components of numerous other studies (e.g.,

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salmon escapement, water quality, instream flow, etc.). While AEA may not collect data on all of these parameters at all locations in the project area, its proposed intensive data collection on these physical habitat characteristics within focus areas is a reasonable approach to assess the site-specific conditions that occur when adult anadromous salmonids are migrating and should be sufficient to describe the existing environment and evaluate project effects on fish migration within the Middle River (section 5.9(b)(5)).

Staff Recommendation

We recommend that AEA assess discharge conditions at the streamflow gages established by AEA closest to Devils Canyon and near the dam site during the time periods when salmon are documented to successfully pass upstream of the Devils Canyon passage impediment in 2013 and 2014 (via radio-tagging as set forth in study 9.7, salmon escapement), and document the results in the initial and updated study reports.

We do not recommend use of any of AEA's criteria set forth in section 9.12.4.4 of the RSP for excluding study sites from the Middle River passage barrier evaluation. Instead, we recommend that AEA prepare and file a detailed plan by no later than June 15, 2013, that provides the additional information described below on implementation of the study within the Middle River study area.

- 1) A specific schedule for completing the following Middle River study components proposed for future development in consultation with the TWG as set forth in section 9.12.4 of the RSP: (a) identifying fish species to be included in the passage barrier study; (b) defining the passage criteria for the identified fish species; (c) selecting the number and location of study sites for each element of study implementation; and (d) filing the results of items (a), (b), and (c).
- 2) A description of how the effects of load-following during the winter ice-cover period on salmonid juvenile and fry passage (e.g., depth, velocity, potential ice blockages) from mainstem into off-channel habitats would be evaluated.
- 3) A description of the specific methods as set forth in section 9.12.4.5 (e.g., 2-dimensional modeling, or other unspecified modeling approach) that would be applied at the off-channel and tributary delta locations selected for the depth barrier analysis. This would include an explanation of the proposed methods and study sites for the open-water period for adult and juvenile fish, and the ice-cover period for juvenile fish.
- 4) A description of a subsample of tributary deltas and off-channel habitat entrances within Middle River focus areas where velocity measurements will

- be taken to determine if velocity barriers to juvenile salmonids (particularly salmonid fry) would be created at tributary deltas and off-channel habitat entrances by modifications to river stage and discharge through proposed project operations.
- 5) Documentation that a draft plan and schedule were provided to FWS, NMFS, and any other TWG participants at least 30 days prior to the due date of the plan and schedule (allowing at least 15 days for comment); a description of how FWS', NMFS', or other TWG participant's comments are incorporated into the final plan; and an explanation for why any of FWS', NMFS', or other TWG participant's comments are not incorporated into the final plan.

Genetic Baseline Study (9.14)

Applicant's Proposed Study

AEA proposes a study to characterize the baseline genetic structure of Pacific salmon and other selected fish species in the Lower, Middle, and Upper segments of the Susitna River. Information from the study would be used in combination with other studies to assess potential effects of the proposed project on fisheries resources.

The objectives of the study are to:

- 1) develop a repository of genetic samples for fish species captured within the entire Susitna River drainage, with an emphasis on those species found in the Middle and Upper Susitna River;
- 2) contribute to the development of genetic baselines for each of the five species of Pacific salmon spawning in the Susitna River drainage;
- 3) characterize the genetic structure of Chinook salmon in the Susitna River watershed, including determining the effective population size of fish spawning above Devils Canyon;
- 4) for 2013 and 2014, quantify the genetic variation among Upper and Middle River Chinook salmon for use in mixed-stock analyses, including analyses of Lower River samples of the entire Susitna Chinook salmon population; and
- 5) if sufficient genetic uniqueness is found based on the results of the 2012 preliminary genetics studies, estimate the annual percent of juvenile Chinook salmon in selected Lower River habitats that originated in the Middle and Upper Susitna River in 2013 and 2014.

Specific study methods include dedicated non-lethal fish tissue sampling (i.e., fin clips) by two people for two months during the summer salmon migration and spawning season in 2013 and 2014, and opportunistic fish tissue sampling during implementation of studies 9.5, 9.6, and 9.7 (i.e., fish distribution and abundance, salmon escapement) to provide additional opportunities to achieve the following sample collection targets:

- 100 tissue samples from spawning Chinook salmon from any Susitna River tributary with evidence of Chinook spawning;
- 100 tissue samples from spawning Chinook salmon from flanking region (Knik Arm and northwestern Cook Inlet) tributaries with evidence of Chinook spawning;
- 100 tissue samples from spawning pink, sockeye, chum, and coho salmon in the Susitna River upstream of the three rivers confluence at RM 98;
- 200 tissue samples each from juvenile Chinook salmon in Chinook Creek, Oshetna River, Indian River, Portage Creek, the mainstem Susitna River upstream of the three rivers confluence, as well as the Talkeetna and Chulitna Rivers;
- 100 tissue samples from juvenile Chinook salmon from 16 sites across five mainstem habitat types in the Lower Susitna River;
- 50 representative tissue samples from each of the species listed in the Table 9.14-2, with an emphasis on fish collected in the Middle and Upper Susitna River.

AEA proposes to contract with Alaska DFG's Gene Conservation Lab and consult with representatives from a Technical Work Group (TWG) over the course of study implementation to ensure that data sources and study hypotheses are rigorously examined.

General sampling locations and times are provided in the study plan; however, AEA proposes to develop and circulate detailed annual project operational plans to TWG members by April 30 of 2013 and 2014. The proposed project operational plans would establish additional details for field sampling efforts, including specific temporal and spatial sampling locations, to enhance those general locations for target sample collection presented in the RSP.

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Comments on the Study

Study Detail, Sampling Locations, and Project Operational Plans

NMFS and FWS are concerned the study plan lacks sufficient detail on study methodology to assess the scientific validity of the proposed study. The agencies are concerned that AEA proposes to defer the required detail until the annual project operational plans for the genetics study are developed and submitted to the TWG by April 30, 2013 and 2014, respectively. NMFS contends that this approach would be a violation of ILP regulations as final stakeholder comments on the RSP are due prior to submittal of the project operational plans. NMFS requests that the Commission amend the licensing schedule for this study to allow NMFS, Commission staff, and other stakeholders an adequate period to review and comment on the project operational plan, and to give the Commission time to make a study plan determination that includes a study-specific dispute process. FWS states it will defer its review of AEA's proposed project operational plans for genetics sampling until AEA provides the completed plans in April 2013 and April 2014.

As an example of the level of specificity lacking in the study plan, FWS and NMFS state the proposed study needs to have adequate sampling effort for potential populations in the most upstream reaches of the Susitna, Talkeetna, and Chulitna Rivers.

Juvenile Chinook Genetic Uniqueness

FWS is concerned that AEA disregarded its request to estimate the annual percent of juvenile Chinook salmon in Lower River habitats that originated from the Middle River and Upper River. FWS comments that AEA only proposes to estimate the annual percent of juvenile Chinook salmon in selected Lower River habitats that originated from upstream habitats in the 2013 and 2014 study seasons if the results of the 2012 preliminary genetics studies indicate that there is sufficient genetic uniqueness to differentiate among Chinook salmon originating from Upper and Middle River habitats and other areas downstream.

NMFS states that it's not clear what criteria AEA would use to determine whether Chinook salmon originating from Middle River and Upper River locations exhibit sufficient genetic uniqueness to differentiate these individuals from other juvenile Chinook sampled in Lower River habitats. NMFS therefore requests that AEA use current scientific literature to explain what is meant by the term "sufficient genetic uniqueness." NMFS and FWS both comment that AEA's proposal to wait to determine whether there is sufficient genetic uniqueness until an unspecified future date when the

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results of the 2012 preliminary genetics study would be available is not warranted given the current licensing schedule. The agencies state that the information is necessary to inform their section 18 fishway prescriptions and inform the design of any downstream fish passage facilities for Chinook salmon. Therefore, both agencies request this original component of their study request be implemented concurrently with the other adult salmon genetic studies.

Adult Coho Salmon Abundance and Genetics Sampling

FWS and NMFS state that AEA should include in its genetics study plan additional objectives to estimate the in-river abundance and mainstem spawning locations of adult coho salmon upstream of the Yentna River confluence for a minimum of three years. FWS and NMFS state that these additional study objectives address basic spatial and temporal biological information that is needed to develop genetic studies for coho salmon, particularly should they be found to pass the Devils Canyon area. As additional support for their recommendations, FWS and NMFS point to Alaska DFG's May 30, 2012 study requests that also recommended these additional study elements for coho salmon.

Study Duration

FWS and NMFS state the duration of study for both juvenile and adults should be, at a minimum, equal to one full life-cycle for the subject fish species. The agencies state that, for instance, a five-year study duration is warranted for Chinook salmon because this species has a 5 to 7 year overlapping life history and therefore changes in gene frequencies would be relatively slow. NMFS and FWS also contend that preliminary genetics sampling in 2012 was for reconnaissance purposes only and should not count as a true study year with full methodologies for the genetics baseline study.

Representative Sampling of Adult Salmon Returns

FWS and NMFS state that variations in run timing of Chinook salmon populations should be considered in the context of AEA's proposal to narrow the genetic sampling effort to two months. The agencies contend that narrowing the temporal sampling effort may result in misrepresentative sampling and lead to erroneous population structure analysis. NMFS and FWS recommend that AEA conduct temporal sampling for Chinook salmon throughout the entire run timing to capture samples that are representative of not only the peak of the run, but also the tails of the run.

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Relationship to Other Studies

NMFS and FWS state that, in addition to those studies listed on page 9-249 of the RSP, the fish genetics study plan is also tightly related to the instream flow and habitat utilization and aquatic habitat characterization studies. The agencies state that alterations to habitats and natural flows under proposed project operation would directly affect fish passage capabilities and access to habitats within the Susitna River. The agencies therefore request that the interrelatedness of the studies be reflected in figure 9.14.11 and that a schedule be developed that describes how and when the results of these and other interrelated studies will be incorporated into each other.

Discussion

Study Detail, Sampling Locations, and Project Operational Plans

In general, AEA proposes a reasonable sampling approach for meeting the study objectives of creating a genetic repository for numerous Susitna River fish species, characterizing the genetic baseline for Susitna River salmon populations, and understanding the population structure and life history characteristics of Susitna River Chinook salmon. We find that this study may provide an efficient means to collect the information for staff to use to characterize the existing fish community of the project area and assess the need for fish passage measures at the project. While the annual project operational plans would provide additional details on the field sampling efforts and specific sampling locations for fish tissue sample collection, AEA's study plan contains sufficient initial information to conclude that its proposed study approach and analytical methods are consistent with generally accepted practices in the scientific community (section 5.9(b)(6)) and, if effectively implemented, can satisfy the study objectives.

While we agree with NMFS and FWS that the specific sampling locations and details to be provided in the project operational plans are important and should be provided in advance of study implementation, the additional details in the plans would not on their own be sufficient to document that the study as proposed would meet the study objectives. Rather, the only way to conclusively determine whether the study objectives are adequately met would be to review the 2013 and 2014 study results as they are made available in the initial and updated study reports. This is because there are numerous factors that would ultimately determine whether AEA can implement its methods in a sufficient manner to meet the study objectives. Examples of these include, but are not necessarily limited to, whether AEA meets its targets for fish tissue sample collection set forth in the study plan, and whether there is a sufficient level of divergence

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in genetic profiles between fish of the same species sampled at various locations throughout the Susitna River basin.

Nevertheless, additional opportunities for agency consultation and comment should be incorporated into the schedule for project operational plan development. Additional consultation procedures would be low-cost (section 5.9(b)(7)) administrative matters that would help ensure the data collected are sufficient to describe the existing environment for fisheries resources of the project area (section 5.9(b)(4)) and provide the information necessary to evaluate project effects (section 5.9(b)(5)), including determining the potential benefits of providing fish passage.

Juvenile Chinook Genetic Uniqueness

AEA proposes to defer a decision on whether it can meet NMFS' and FWS' study objective for estimating the proportion of juvenile Chinook rearing in Lower River habitats that originated from the Middle and Upper River until after the lab analysis of the genetic uniqueness of the Upper River and Middle River Chinook (as compared to Lower River Chinook) is completed as part of the 2012 preliminary genetics study results. AEA does not specify when the 2012 study results would be available, but does commit to collecting 1,200 juvenile Chinook tissue samples in both 2013 and 2014 that would be used specifically to address this study objective. It's not clear how AEA could do the comparison without first analyzing some of the genetic material collected from the three river segments beginning in 2012. Should the preliminary results and any other preliminary information indicate that it would be possible to detect genetic differences in Chinook originating from various segments of the river, AEA would have the information necessary to do the analysis. To ensure that the results of the 2012 preliminary genetics studies are provided in a timely enough manner for FWS to evaluate whether its requested study objective is addressed, an additional provision could be included in the 2013 project operational plan for specifying when the 2012 preliminary genetics study results would be available. An additional requirement could also be added for AEA to include in its initial study report a preliminary decision on whether the 2012 study results indicate that there is sufficient genetic uniqueness for FWS' study objectives to be met.

AEA does not specify which criteria would be applied in its decision making process for whether there is sufficient genetic uniqueness between Chinook salmon sampled in the three different segments of the river to determine if it can estimate the proportion of juvenile Chinook rearing in Lower River habitats that originated from habitats upstream. Providing an explanation of the criteria that it will use to determine

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whether there is sufficient genetic uniqueness would be a low-cost administrative action that would improve the transparency of AEA's proposed study methods.

Adult Coho Salmon Abundance and Distribution and Genetics Sampling

We address FWS' and NMFS' comments on the appropriate level of study for adult coho salmon distribution and abundance in our analysis and recommendations for the Salmon Escapement Study (9.7).

In regard to the collection of additional genetic samples for adult coho salmon, we are not aware of any information in the project record suggesting that coho salmon are successfully able to migrate upstream through Devils Canyon, which appears to be the basis for FWS' and NMFS' request to collect additional genetics samples for this species. Therefore, we see no relationship between the requested study component and potential project effects (section 5.9(b)(5)). However, in the event that radio telemetry surveys, spawning ground surveys, or any other studies detect adult coho salmon upstream of Devils Canyon, additional genetics studies for coho salmon could be added in subsequent study years upon a showing of good cause (section 5.15(d)).

Study Duration

We address FWS' and NMFS' comments on the appropriate study duration for all anadromous fish studies in the general comments section of this study plan determination. We note, however, that we agree with NMFS that it would be premature to accept any of the 2012 preliminary genetics study results as useful or adequate for the purposes of meeting the study objectives for the genetics study until we review the data and any interpretation of results. Because the study plan does not clearly specify when the 2012 genetics study results would be available, an additional requirement could be included in the 2013 project operational plan to provide a schedule for presenting the 2012 genetics study results. This additional requirement would be a low-cost (section 5.9(b)(7)) administrative item that would provide documentation of when the 2012 study results would be available.

Representative Sampling of Chinook Salmon Return

The proposed sampling approach includes a commitment to dedicate a team of two people and logistics support for two months each year to collect tissue samples for genetic analysis. The sampling approach also notes that this level of effort would be in addition to the tissue samples that would be collected by other study teams associated

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with the fish distribution sampling studies and adult salmon escapement studies in 2013 and 2014.

There is insufficient information in the study plan to determine whether AEA intends to accommodate FWS' and NMFS' request to sample a representative proportion of the Chinook salmon run because specific sampling dates by location are not provided. It appears as though two months of direct sampling would be an inadequate level of effort to accommodate this request because the run timing of the five species of salmon alone would span a much greater time period than two months (i.e., late-May through October). However, the additional tissue sampling effort that would be implemented through the fish distribution studies (9.5 and 9.6) and adult salmon escapement study (9.7) would provide ample additional opportunity to enhance the temporal scope of tissue collection within the Chinook salmon run.

Similarly, FWS' comment that the proposed study needs to have adequate sampling effort for potential populations in the most upstream reaches of the Susitna, Talkeetna, and Chulitna Rivers cannot be evaluated at this time. That is because AEA does not propose the specific sampling locations for these rivers other than specifying that 100 samples for adult Chinook and 200 samples for juvenile Chinook would be collected from each of these rivers per year. AEA should be able to clarify in its project operational plans the locations within these watersheds where it intends to collect the tissue samples.

Relationship to Other Studies

The agencies' request to modify the study plan to include more information on the interrelated nature of the genetics study with other study plans, notably the fish and aquatics instream flow and habitat characterization studies, would not improve or materially alter the study plan or its implementation. Additional information on the interrelated nature of the studies would become available in the study reports, the preliminary licensing proposal, and the license application.

Staff Recommendation

We recommend the study plan be modified to include the following: AEA consult with the FWS and NMFS prior to preparing the project operational plans; distribute draft project operational plans to the agencies by March 31 of each year of study implementation; allow 15 days for the agencies to provide comments on the draft plans; file the final plans with the Commission by April 30 of each year of study implementation; and include with the final plans, documentation of agency consultation,

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a description of how agency comments are incorporated into the final plans, and an explanation for why any agency comments are not incorporated into the final plans.

To the extent feasible, we recommend that AEA collect tissue samples over a representative proportion of the entire adult Chinook salmon run.

We recommend that AEA include in the 2013 project operational plan, a schedule for when the 2012 genetics studies would be available, and include provisions for filing those results with the Commission through either the initial study report, or a supplemental report in 2013. We also recommend that the report on the 2012 preliminary genetics studies clearly describe the criteria, using current scientific literature, to determine whether there is sufficient genetic uniqueness to estimate the percentage of Chinook originating from Upper and Middle River habitats in areas sampled downstream. Finally, we recommend that the report on the 2012 preliminary genetics studies clearly describe whether the study results indicate that sufficient genetic uniqueness is found to characterize the presence and relative proportion of fish originating from the Upper and Middle River in selected Lower River habitats as described in section 9.14.4.7 of the study plan.

Cook Inlet Beluga Whale Study (9.17)

Applicant's Proposed Study

The applicant proposes to collect data on marine mammals in the project area, focusing on the distribution, movements, and behavior of Cook Inlet Beluga Whales (CIBWs) in the lower Susitna River and delta. Specifically, AEA proposes to use a combination of 15-20 aerial surveys, four live-feed video cameras, and up to four still-photo cameras to document CIBW presence in the delta and the river up to RM 50 during ice-free conditions (April through October), and to document CIBW group size, composition (e.g., juveniles, cow-calf pairs, etc), and behavior (e.g., foraging) up to RM 10 during ice-free conditions. To help understand the relationship of river hydrology and project effects on that hydrology and CIBW foraging habitats in the lower Susitna River and delta to a depth of 30 feet, AEA would develop a river discharge versus water surface elevation model. The water surface elevation modeling, in conjunction with the results from other investigations (salmon escapement, eulachon study, baseline water quality, geomorphology, fish and aquatic instream flow, and ice processes) would be used to evaluate the potential effects of the project on CIBW or habitat of their primary prey-salmon and eulachon.

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Due to logistics and safety concerns, as well as documented lower concentrations of CIBW in the Susitna River delta during winter, winter surveys would not be conducted. AEA proposes to limit its aerial surveys to no lower than 1,000 feet to prevent harassing the endangered CIBW.

AEA considered using alternative methods to gather winter use data including Passive Acoustic Monitoring (PAM) and satellite telemetry. AEA chose not to use PAM to provide year-round data because of the following factors that limit its efficacy: (1) limited range/coverage of the survey area, (2) high in-water noise masking reception of recorded sounds, and (3) high probability of false negatives. Additionally, AEA states that PAM would be difficult because arrays would have to be put in deeper water away from the mudflats to avoid ice scour, and thus would not be adequate for detecting beluga use of the river and delta area of interest. AEA states that satellite telemetry is likely the best method of collecting year-round data, even through ice, but did not propose this approach because of the unlikelihood of obtaining the necessary permits to tag CIBW given their endangered status.

To address the lack of winter use, AEA proposes to assume that beluga whales are present and foraging in the delta throughout the winter months for the purposes of evaluating potential effects of the project. Thus, AEA would be adopting the most conservative assumption possible for their impact analysis.

Comments on the Study

In its comments on the revised study plan, NMFS notes that AEA still has not proposed to gather data during the winter. In comments on the proposed study plan, both NMFS and Alaska DFG recommended the use of PAM, suggesting that the amount of effort planned by AEA for collecting behavioral and group number and age-composition information might be better spent implementing PAM. The Alaska DFG commented that the use of PAM is warranted because the proposed methodology (video and still cameras) would limit data collection to daylight hours and periods of good visibility and that PAM could be used to collect additional information on the presence of CIBW, 24 hours per day, 7 days a week, independent of weather conditions. They note that, when visual and PAM methodologies are used concurrently at the same locations, acoustic and behavioral information (e.g., foraging) from those locations can be applied to acoustic datasets from areas where no visual observations are collected.

NMFS also states that conducting aerial surveys at a flight altitude of 1,000 feet will prevent collection of reliable data on group composition and requests more detail on the use of the still cameras. NMFS states that AEA has not described the number of still

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cameras that would be deployed or the protocol that would be followed, including the frequency of photos and exact location of placement. “For example, will a camera be placed at RM 10 and, if acquired data shows the CIBW at RM 10, how will the northernmost extent be documented?”

NMFS also states that although the water surface elevation data may provide valuable information, it remains unclear how the data will be used to evaluate project impacts on beluga prey availability, foraging, and reproductive success.

The Center for Biological Diversity states that two years of study is insufficient to determine baseline conditions for belugas in the face of the population’s continued decline, which continues despite increased protections and suspension of harvest. They argue that the continued decline, and the lack of understanding of the mechanisms causing it, will make it impossible to determine how to minimize any impacts of the project on the Cook Inlet beluga whale population. The Center for Water Advocacy shares similar concerns.

Discussion and Staff Recommendation

Although PAM arrays have been used to monitor CIBW activity in Cook Inlet and could provide year-round use of Cook Inlet where the Susitna empties into the inlet, they would not be a viable option for documenting winter use within the Susitna River due to ice scour. Information from the PAM monitoring in Cook Inlet at the Beluga River and Little Susitna River, which are located about 10 miles on either side of the Susitna River, could be used to extrapolate information on winter movements and presence. The study methods AEA proposes are consistent with methods commonly followed in investigations of marine mammal distribution (Hobbs et al. 2011) and have been used successfully to document CIBWs and other marine mammal movements and behaviors in large river systems in Alaska (Easley-Appleyard et al. 2012; Hobbs et al. 2011, 2012).

While the altitude proposed for observing CIBW may not be ideal, the combination of AEA’s increased number of surveys, particularly during the calving period, and the use of video and still cameras should improve observers’ ability to determine group composition.

Up to four still cameras would be used. Site installation would be determined in the field. This is reasonable because it would provide the field crew with greatest flexibility to find a good place to install the cameras, with a maximum field of view.

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If results from aerial and camera footage show that little information is being gathered, or that CIBW are using habitats above RM 10, additional effort, including the use of PAM may be needed in subsequent years. However, this should not be decided until after the initial study reports are filed.

In sum, AEA is using techniques that are proven and would provide data on most of the year. The collective information provided by all studies would be sufficient for the Commission to analyze potential effects on CIBW.

For the above reasons, no modification to the proposed study is recommended at this time.

Moose Distribution, Abundance, Productivity, and Survival (Study 10.5)

Applicant's Proposed Study

To determine existing distribution, abundance, productivity, and survival of moose populations that may be affected by project construction and operation, AEA proposes to conduct biweekly aerial radiotracking of moose during spring calving (May 10–June 15) and fall hunting seasons (September 1-20) and conduct daily aerial radiotracking during peak calving period of May 15-31 in years 2013 and 2014.

Comments on the Study

While Alaska DFG recommends daily radiotracking during peak moose calving as AEA proposes, Alaska DFG recommends that the reference to peak calving as May 15-31 be removed because the precise dates for moose calving may vary between populations and years.

Discussion and Staff Recommendation

Alaska DFG's recommended study modification would provide greater flexibility in the event that the calving dates vary from the May 15-31 timeframe, would not increase cost or effort, and would ensure efficient use of resources. Alaska DFG's recommended methods are consistent with generally accepted practices in the scientific community (section 5.9(b)(6)) and should be adequate to collect the information necessary to address project effects (section 5.9(b)(5)). Therefore, we recommend that AEA modify the study as recommended by Alaska DFG.

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Surveys of Eagles and other Raptors (Study 10.14)

Applicant's Proposed Study

To assess the potential risk of raptors colliding with the proposed transmission lines, AEA proposes as part of its eagle and raptor survey, to conduct fixed-radius migration point counts along the transmission line corridors for each of the corridor alternatives. Survey protocols would follow FWS' Draft Eagle Conservation Plan Guidance. Plot locations would be delineated along the transmission line corridors before surveys begin, and the final selection of plots would be determined by focusing on areas judged likely to concentrate migrating raptors (on the basis of topography).

Comments of the Study

Without elaboration, FWS recommends modifying the study to specify the number of point counts, and that such point counts be maximized along the entirety of the transmission line corridor.

Discussion and Staff Recommendation

AEA's proposed study plan follows accepted protocols. AEA intends to define the number of point counts prior to field efforts. Review of the survey efforts in 2013 would allow FWS and other stakeholders to recommend additional efforts in 2014, if needed. Therefore, no modification to the applicant's proposed study is recommended.

Waterbird Migration, Breeding, and Habitat Use Study (Study 10.15)

Applicant's Proposed Study

To assess the potential risk of landbirds and waterbirds colliding with the proposed transmission lines during migration, AEA proposes to collect data on the volume and flight directions of birds (including raptors) migrating past the project dam site using a combination of visual surveys and radar monitoring. Diurnal visual observations would be conducted during daylight hours (sunrise to sundown) from late April to early June and from mid-August to mid-October. Observers would record data along four visual transect lines (oriented in the cardinal directions) during 25-minute sampling sessions. Data from a portable radar device would be collected in several 1-hour sessions throughout the night and diurnal radar sampling sessions would be conducted during the day (shifting 3-hour blocks from morning to evening). Nocturnal audiovisual surveys would be conducted during the first 2 hours of nocturnal radar sampling.

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Comments on the Study

FWS recommends that the study be modified to clarify that visual observations (both diurnal and nocturnal) to be conducted along each of the four transects would be done by a separate observer during each sampling session. In other words, four observers would be used to collect data during each sampling session. FWS also recommends that the study be modified to clarify that the maximum number of possible 1-hour radar sampling sessions would be conducted each night because the start and stop time is not currently specified in the study plan.

Discussion and Staff Recommendation

AEA states in the study plan that the migration study (which also will provide data for the Landbird and Shorebird Migration, Breeding and Habitat Use Study [study 10.16]) would require a crew of four biologists working day and night shifts over a period of 120 days in 2013. While AEA's study plan suggests that it plans to conduct the study as recommended by FWS, the plan is not explicit. Using four biologists to concurrently document birds observed in each direction would ensure better correlation and interpretation of visual observations with radar data. Although the study plan does not explicitly state the start and stop times for radar sampling sessions, the plan is clear as to the sampling framework and that efforts are intended to maximize sampling sessions.

We recommend that AEA implement the study with FWS' proposed modification for clarifying the use of four observers during visual observations. No modification of the study plan is needed regarding maximizing the number of radar sessions because AEA's study plan already provides for maximizing the number of radar sessions.

Landbird and Shorebird Migration, Breeding, and Habitat Use Study (Study 10.16)

Applicant's Proposed Study

To collect baseline data on the occurrence and habitat use of breeding landbirds and shorebirds in habitats that would be affected by project construction and operation, AEA proposes, in part, to conduct point-count surveys during the breeding season (mid-May to mid-June), which is the preferred method in Alaska for sampling large, remote, roadless areas. A pseudo-stratified random plot allocation procedure would be used to establish sampling locations based on aerial photosignatures as the sampling strata. To improve detection of several birds that are not commonly recorded in standard point-count surveys, but are commonly associated with riparian and lacustrine habitats that

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could be affected by project construction, AEA would conduct in May an additional set of point-count surveys and linear surveys between point-count plot locations in riparian and lacustrine habitats within the proposed reservoir inundation zone, in the infrastructure area surrounding the proposed dam site, and immediately below the dam site. Point-count surveys would be conducted for about 28 days each year (2013 and 2014) in late spring and early summer, with the goal of obtaining 800 point-count samples each year. AEA would also collect habitat-use data for landbirds and shorebirds during the point-count surveys to inform the Evaluation of Wildlife Habitat Use Study, which would be used in quantifying habitat change (i.e., gain, loss, alternation) from project construction.

Comments on the Study

FWS recommends that the study be modified to define what percentage of, and how many points in, the riparian and lacustrine habitat would be sampled, the days to be sampled, and the targeted observer hours. FWS states that while 800 point count samples per year may be reasonable, it is important that the distribution in space and time over the two survey types (i.e., standard and riparian/lacustrine-focused) be understood and specified ahead of time. Because habitat data collection could interfere with bird sighting consistency, FWS also recommends that detailed protocol be developed prior to commencement of the field season and practiced by all observers.

Discussion and Staff Recommendation

The proposed sampling design does not partition sampling effort between the standard and focused point-surveys in the riparian/lacustrine habitats. Because the riparian- and lacustrine-focused surveys would entail both point counts and linear walking surveys between point-count locations in riparian and lacustrine (margin) habitats, these habitats should be adequately covered. If 2013 habitat mapping efforts and survey results indicate otherwise, additional effort could be expended in 2014.

AEA would not collect detailed vegetation data at each point-count plot during the survey because a fine-scale wildlife habitat map would be prepared for the project that would encompass the entire point-count study area through other study efforts. General habitat data that are being used by the birds at the time of observation would be recorded by the observers, which should not detract from their survey efforts.

Because AEA's study design follows accepted methods that are consistent with generally accepted practices in the scientific community (section 5.9(b)(6)) and should be adequate to collect the information necessary to address project effects (section 5.9(b)(4)), no modification of the study plan is recommended.

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Population Ecology of Willow Ptarmigan in Game Management Unit 13 (Study 10.17).

Applicant's Proposed Study

To determine how willow ptarmigan move and use habitats that may be affected by project construction and operation, AEA proposes to capture and radio tag ptarmigan in three areas, including upper Fog Creek (tributary to the upper Susitna River), upper Busch Creek (tributary to Goose Creek), and the pass between upper Jay and Coal Creeks. AEA would primarily use mist netting to capture ptarmigan, but would also opportunistically use Coda net guns to capture territorial male birds on the ground, primarily as a backup to the mist net method.

Comments on the Study

Based on experience gained in capturing ptarmigan in the study area in 2012, Alaska DFG recommends that the number of capture sites be increased to between 4 and 6 and that capture of ptarmigan be conducted primarily by the use of Coda net gun and noose carpets. Alaska DFG states that the additional capture locations would provide a more comprehensive understanding on willow ptarmigan movement throughout the proposed hydroelectric site and would not increase costs. Also, based on several overflights of the study area, Alaska DFG is now confident access into areas previously thought to be inaccessible will be feasible. Testing of the Coda net gun, mist nets, and noose carpets found that both the net gun and noose carpets were very effective, efficient, and safe for the birds, more so than mist nets. Therefore, Alaska DFG does not recommend using mist nets for this study. Alaska DFG does not expect project cost will increase with the use of net guns and noose carpets.

Discussion and Staff Recommendation

Alaska DFG's recommended changes would ensure efficient use of resources, and its proposed methods are consistent with generally accepted practices in the scientific community (section 5.9(b)(6)) and should be adequate to collect the information necessary to address project effects (section 5.9(b)(4)). Therefore, we recommend that AEA modify the study plan to include Alaska DFG's recommended modification.

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Recreation Resources Study (Study 12.5)

Applicant's Proposed Study

To assess potential project effects on recreation resources and activities (by both visitors to Alaska and Alaska residents), AEA proposes to: (1) identify and document recreation resources and facilities that support commercial and non-commercial recreation in the project area; (2) identify the types and levels of current recreational use and reasonably foreseeable future uses based on mail and intercept surveys, executive interviews, consultation with licensing participants, regional and statewide plans, and other data; (3) evaluate the potential impacts of project construction and operation on recreation resources, needs, and uses in the project area; and (4) develop data to inform AEA's development of a Recreation Management Plan for the project.

The proposed study area covers an area generally bounded by the George Parks, Denali, Richardson, and Glenn Highways and includes the Susitna River from the Denali Highway bridge downstream to the George Parks Highway bridge at RM 83 near Sunshine. AEA proposes to exclude from study the portion of the Susitna River below the George Parks Highway bridge until the initial results of river flow, geomorphology, and ice studies are available, which would determine whether project effects are likely to occur along the lower river. If effects are likely, the recreation study area would be expanded and conducted in 2014.

The Recreation Resources Study would include a regional recreation analysis; a review of existing plans and data; an inventory of facilities, including trails; a description of recreation opportunity areas based on land classes; a Natural Resource Recreation Setting (NRRS) analysis;¹⁴ an assessment of recreation supply, demand, and use; an estimate of carrying capacity for planned, developed, and dispersed recreation areas; and the collection of recreation use data. In-person intercept surveys would be structured to gather data on recreation uses, frequency, quality of recreation and/or aesthetic experience, recreation spending, and other perceptions. In-person intercept surveys

¹⁴ AEA describes the NRRS analysis as an adaptation of Recreation Opportunity Spectrum (ROS) analysis, which was developed to describe the mix of possible outdoor recreation settings based on the assessment of physical, social, and operational recreation site characteristics (RSCs). Similar to the ROS, the NRRS analysis considers classes ranging from primitive to urban, while allowing the RSCs to be displayed on maps individually with current recreation settings, complexity of the recreation setting, and clear implementation direction. The NRRS analysis would be conducted for existing and post-project conditions within the Recreation Use Study Area.

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would be conducted in all months, except from late November 2013 through early February 2014. AEA does not propose to collect winter use data during this period because extended darkness, extreme cold, and poor road conditions create potentially unsafe conditions for surveyors. AEA concludes that the conditions are potentially too extreme and study area use too limited to justify risking staff safety. AEA states that survey instrument design would allow the study team to capture January/early February and late November/December recreation activities from users encountered during other sampling periods. AEA included a draft intercept survey instrument in the revised study plan that it intends to modify in collaboration with stakeholders in early 2013.

AEA indicates that the work conducted in 2012 (e.g., interviews, compilation of resource and user information, observations, mapping, field reconnaissance) was used in developing the study, that the results were generally described during work group meetings, and that the final results would be made available in early 2013.

Comments on the Study

Incomplete baseline information and duration of studies

The NPS states that a solid baseline of recreation information is needed to appropriately design resource studies, including the temporal and geographic scope of the studies. NPS argues that very little data on recreation resources were gathered in the 1980s and AEA's recreation use studies conducted in 2012 were not made available to further inform their review of the RSP. Consequently, the assumption of two years of study being adequate is questionable and the study determination should not be made before an appropriate level of collaboration is completed under the ILP. NPS asserts that the period of study should be a minimum of five years. Others also question the reliability of baseline data gathered for a proposed project on the Susitna River in the 1980s. The Coalition for Susitna Dam Alternatives comments that without the 2012 results, scientific validity of the studies is in question.

Geographic study scope

The NPS comments that the construction and operation of the proposed project is likely to affect recreation resources along the lower Susitna River, due to altered flows, geomorphology, ice cover, and recreation access. Activities along this reach of the river, such as sport fishing, hunting, boating, and winter travel, could all be affected. Therefore, NPS requests that the study area for recreation resources be extended downriver to Cook Inlet now, then excluded later only if studies indicate there will be no significant effects on the lower river. NPS asserts that delaying the decision results in the

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loss of two years of data and puts the decision on whether to conduct studies in the hands of AEA. The NPS and Talkeetna Community Council, Inc. (TCCI) also point to the absence of criteria for determining whether to broaden the study area.

The TCCI recommends that the recreation study include the north side of the Denali Highway and the headwaters of the Susitna because the Denali Highway corridor would be heavily impacted by one of the possible access corridors. In responding to a similar request made by BLM on the proposed study plan, AEA explained that it did not include the north side of the Denali Highway and the headwaters of the Susitna River because no effects on resources, facilities or uses north of the Denali Highway would occur.

Timing and locations of intercept surveys

The NPS states that, despite challenges of winter, winter use needs to be assessed and recommends that intercept surveys be conducted through the winter months, avoiding remote locations, if necessary, to address safety concerns. AEA did not specifically respond to sampling less remote areas during the winter months.

Final survey instruments

NPS comments that the intercept survey instrument contained in the RSP was significantly modified without further stakeholder review. NPS believes the survey may be emphasizing socioeconomic elements at the expense of those elements needed to assess potential project impacts and that a separate survey of recreation users for socioeconomic purposes may be needed. NPS also states that the “Don’t Know” and “Refused” fields shown in the proposed intercept survey instrument would serve no useful purpose in the self-administered mail or online surveys instruments, and therefore, these fields should be removed. NPS further comments that the proposed surveys do not ensure a comprehensive understanding of user preferences, including facility management and security preferences. In addition, NPS is concerned about the opportunity for input on the final intercept survey instrument, as well as the opportunity to observe pretesting.

In its comments on the proposed study plan, Commission staff recommended that intercept and mail survey instruments be modified to distinguish between guided and unguided recreation for various recreational activities. AEA states that draft survey design addresses guided and unguided use generally, but not for specific activities due to survey length. Instead, this information would be deduced from various survey sources, including intercept surveys.

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NPS comments that potential changes to recreation experiences and the types of activities that would be available after the project is developed are not adequately addressed in the proposed studies. For example, the study does not specifically address potential conflicts among types of users (e.g., motorized and non-motorized recreation) or the kinds of recreation experiences sought by users. Further, the NPS asserts that AEA has not explained why these elements are not included in the study.

Effects of altered flow and ice processes

A number of commenters expressed concern that the RSP does not adequately address the potential effects of the project on river hydrology for navigation and recreational access, or the stability of winter ice on the river. For many, the concern applies not just to the portion of the river within the study area, but the lower river as well.

Trail mapping accuracy

In its review of the PSP, Commission staff recommended that existing trails in the immediate project area be mapped to the 1:24,000 national map accuracy standard of +/- 40 feet. NPS agrees this would be an appropriate mapping standard for these trails. AEA does not commit to mapping at this scale, only stating that existing trails in the immediate project area would be mapped at a scale that will ensure sufficient accuracy for analysis across studies.

Discussion

Incomplete baseline information and duration of studies

Like NPS and others, Commission staff's study recommendations are based on available information (18 CFR 5.11(d)(3)). It would be premature at this time to require additional years of data collection without an evaluation of the data and modeling results that will be obtained from the 2013 study season. The type of information that we would consider in determining the need for additional years of study would include, but not necessarily be limited to whether: (1) the study objectives are met during the study period, (2) the study was implemented under anomalous environmental conditions, and (3) the data collected are sufficient to conduct the environmental analysis pursuant to NEPA and inform the development of license requirements.

Further, all stakeholders would have the opportunity to request additional years of data collection following the 2013 study season after reviewing the initial study report,

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and upon a showing of good cause as specified in sections 5.15(d) of the Commission's regulation.

Geographic study scope

Potential project effects along the lower river are unknown at this time. AEA's approach of waiting until the initial results of river flow, geomorphology, and ice cover studies are available (February 2014) to determine if a detailed inventory of recreational facilities, recreational use, carrying capacity, and other attributes are needed for the lower river would avoid unnecessary costs.¹⁵ If effects on the lower river are determined to be likely, a recreation study of the lower river would not begin until early 2014 and would need to carry over to early 2015 in order to include a full winter season of study. At least one full year of recreation data would be needed to characterize recreation use in the lower river.

The schedule concerns notwithstanding, there is insufficient information currently available on potential effects to recreation on the lower river for staff to require AEA to expand the study area to the lower river at this time.

As for expanding the study area north of Denali Highway as recommended by TCCI, we concur with AEA that there is no evidence that project construction and operation would affect an area far outside the immediate bounds of the Denali Highway. If the Denali Road and Transmission corridor option is chosen, it would enter the Denali Highway from the south and construction traffic could increase on about 20 miles of the highway. AEA proposes to include in the study area all campgrounds and infrastructure along the north side of the Denali Highway, but only defines the study area as being bounded by the highway corridor. AEA does not define what is intended by the term "corridor." Based on a review of maps and aerial photos, it appears that a majority of developed and dispersed recreation sites along the Denali Highway corridor, including access to trails, campsites, lodging, viewing areas, boating areas, and other destinations, are located within one-quarter mile of the center of the road. Similar circumstances exist along the George Parks Highway, including the segment passing through Denali State Park. Therefore, defining these two highway corridors to include recreation sites and activities within one-quarter mile of the highway centerlines (generally west of the George Parks Highway and north of the Denali Highway) would provide needed clarity on the bounds of the proposed study areas and is likely to encompass the resources and activities that are most relevant to the purposes of the studies.

¹⁵ Neither AEA nor NPS provide an estimate of the cost for expanding the efforts downstream.

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Timing and locations of winter intercept surveys

Conducting intercept surveys through all of the winter months offers an important and direct means of gathering valuable data on winter recreational use in the study area. Because such use may be more likely to occur during less severe winter weather, it would not be necessary to conduct surveys in extreme conditions as suggested by AEA. To further address safety concerns, we agree with the NPS that it is not necessary to survey in remote locations to obtain useful data on snowmachining, skiing, snowshoeing, dog-sledding, and other winter recreation activities. Instead, an abbreviated set of intercept locations could focus on parking areas and entry points, resting or warming areas, special events, likely social or gathering areas, or other sites as determined through executive interviews, agency consultation, and other stakeholder input. The information collected would help confirm the accuracy of recreational use data gathered through mail surveys, overflights, or other means, and would contribute to the analysis of potential project effects on recreation resources. This effort could be done for about \$30,000.

Final survey instruments

Several comments on the final survey instruments were identified, including user preferences, user conflicts, and guided versus unguided use.

As AEA explains, some information on user preference requested by the NPS would be extracted from the survey results and some would be obtained from other data sources. Contrary to NPS's assertions, the intercept survey does address experiential elements in questions about camping preferences, the user's sense of crowding, visual distractions, types of activities engaged in, and the relative importance of solitude, enjoying nature, getting exercise, being with friends, and the like. However, potential user conflict is not specifically addressed in the survey. If one or more questions addressing potential user conflict were added to the survey (e.g., identifying activities that diminish the quality of one's experience such as motorized versus non-motorized use of the same trail), the data generated would be valuable to both an assessment of existing recreational use and potential project effects, as well as later development of a recreation management plan for the project.

It is unclear from the draft survey instrument design that AEA would be able to distinguish and gather appropriate data on guided versus unguided use and would miss an important component of potential recreational uses in the project area. While the content of the surveys needs to be carefully balanced to achieve optimal results, the survey needs to include a specific component that evaluates whether the recreational experience is

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“Guided/Unguided” and identifies the party size. This can be done without overly burdening the survey instrument. Similar information is included in the proposed river recreation and access survey and this approach would help maintain consistency.

We agree with NPS that the “Don’t Know” and “Refused” fields shown in the proposed intercept survey instrument would serve no useful purpose in the self-administered mail or online surveys instruments, and therefore, these fields should be removed.

Notwithstanding the above issues, the draft intercept survey instrument is generally adequate to address recreation needs. Commission staff’s and NPS’ concerns can be resolved during the finalization of the survey instruments with stakeholders as proposed by AEA. Major modifications should not be needed. Respondent fatigue must be balanced with the value of the data to be gathered. AEA is conducting several types of recreation intercept surveys, subsistence surveys, and socioeconomic surveys to answer a variety of interrelated questions. Therefore a separate recreational survey instrument as suggested by NPS is not needed.

Filing all survey instruments with the Commission by April 15, including stakeholder comments, would allow AEA to finalize and implement the surveys by early spring. Providing stakeholders timely information about when pre-testing would occur would allow NPS an opportunity to observe the pretesting.

Effects of altered flow and ice processes

The Susitna River is utilized year-round for transportation and recreation. The revised study plan includes several studies that are designed to assess the potential effects of the project on river flows, geomorphology, and river ice. The results of these studies will be used to determine how altered conditions along the river that would result from construction and operation of the proposed project would affect river transportation and recreational use and access. The location and extent of potential effects on recreation cannot be evaluated until these river studies are substantially complete. Initial study results will likely provide some insight into the effects on recreation and it is possible that proposed recreation resource studies may be modified or expanded, in order to more fully evaluate potential effects.

Trail mapping accuracy

AEA proposes to map trails with “sufficient accuracy,” which is ambiguous. Formal and informal trails may be among the principal recreation facilities that presently

exist in the immediate project area and their use and condition could be directly affected by the proposed project. While it is appropriate to incorporate various sources of trail data, it is important that they be represented accurately in the areas where effects are more likely to occur. The 1:24,000 mapping scale is commonly used for this purpose by NPS, BLM, and Forest Service and readily accommodates field surveys utilizing portable GPS devices and GIS-based digital imagery. Mapping these facilities to this level of accuracy would provide sufficient detail to evaluate potential effects and identify opportunities for protection, mitigation, or enhancement measures.

Staff Recommendation

We recommend that AEA modify the Recreation Resources Study Plan as follows:

- The study area should be modified to include the area within one-quarter mile west of the George Parks Highway and one-quarter mile north of the Denali Highway.
- The intercept and mail survey instruments should include a specific component that evaluates whether the recreational experience is “Guided/Unguided and defines party size.
- One or more questions addressing potential user conflict should be added to the survey (e.g., identifying activities that diminish the quality of one’s experience).
- The “Don’t Know” and “Refused” fields should be removed from the intercept survey instrument.
- Intercept surveys should be conducted through all the fall and winter months of 2013-2014, weather permitting, and focused on an abbreviated list of survey locations identified through stakeholder input. The list should be finalized at the same time final survey instruments are reviewed by stakeholders.
- Final intercept and mail survey instruments should be filed with the Commission by April 15, 2013. The Recreation TWG should be allowed a minimum of 15 days to review the instruments before filing them with the Commission. The filing should include stakeholder comments on the instruments and how such comments were addressed.
- Trails in the immediate project area should be mapped at a scale of 1:24,000 national map accuracy standard of +/- 40 feet.
- Include in the initial study report any proposed modifications to the study plan based on the first year’s data on the lower river uses, hydrology, and ice processes.

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Aesthetic Resources Study (Study 12.6)

Applicant's Proposed Study

AEA proposes to inventory and document baseline aesthetic conditions and potential project effects on aesthetic resources within a primary study area (a 30-mile radius surrounding all project components) and a secondary study area (a desktop analysis area generally enclosed by the Parks, Denali, Glenn, and Richardson Highways). Objectives of the study are to assess the type and distribution of scenic quality attributes present within the study area, the area's visual sensitivity to change, and existing visual distance zones. The study would include viewshed modeling and photo simulations for all project features, including the reservoir, roads, and transmission lines. The study also includes a soundscape analysis to quantify the existing sound environment and anticipated changes that would result from construction and operation of the proposed project. AEA proposes to survey the sound environment over at least two, and up to four, seasons, and believes this is consistent with the NPS guidelines.

As with the recreation study above, AEA proposes to add the lower river to the study area in 2014 only if it is determined through its river flow, geomorphology, and ice studies that effects on the lower Susitna River are likely.

Comments on the Study

The NPS recommends expanding the study area to include the lower Susitna River due to the likelihood of project effects on river flows, geomorphology, and ice conditions, which in turn could affect aesthetic resources.

The NPS also requests that the proposed survey of ambient sound levels include data collection over all four seasons because activity occurs in all seasons.

Discussion

Staff's reasons for not requiring expansion of the survey area to the lower Susitna River are explained above for recreational resources.

The proposed project entails a lengthy construction phase and would operate in all seasons. Activities associated with the project would change noise levels year-round. Therefore, conducting a sound analysis over four seasons, as requested by the NPS, would provide the data necessary to evaluate seasonal effects of the project on noise levels.

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Staff Recommendation

We recommend that AEA modify the Aesthetic Resources Study Plan as follows:

- Conduct surveys of ambient sound levels in all four seasons.
- Include in the initial study report any proposed modifications to the study plan based on the first year's data on the lower river uses, hydrology, and ice processes.

Recreation River Flow and Access Study (Study 12.7)

Applicant's Proposed Study

AEA proposes to conduct a recreation flow analysis on three mainstem reaches of the Susitna River that considers the relationship between river flows and ice conditions and river recreation and transportation. Goals and objectives of the study are to document recreational use, recreation experience, and transportation opportunities along each reach; describe the potential project effects of altered river flows on existing and potential boating activity and other recreational use; determine river ice preferences for ice-dependent winter recreation and transportation on the river; and describe new boating or other flow-dependent recreational opportunities that may be created by construction and operation of the proposed project.

The three river reaches to be studied are Reach 1, from the Susitna River Bridge on the Denali Highway downriver to Fog Creek (RM 291 to RM 177); Reach 2, from Fog Creek to the confluence with Portage Creek below Devils Canyon (RM 177 to RM 149); and Reach 3, from Portage Creek to the Parks Highway Bridge below the confluence with the Talkeetna and Chulitna Rivers (RM 149 to RM 83). The lower study reach may be extended downriver in 2014 if it is determined that project effects on flows, geomorphology, and ice conditions could potentially change the way recreationists currently use the lower river.

The study would assess the range of flows associated with motorized and non-motorized watercraft use of the flowing or frozen river for recreation and transportation. This assessment would be based on field intercept surveys, online surveys, one-on-one executive interviews, and analysis of river flow and ice data generated by other studies. A proposed River Recreation and Access Survey would be posted online and survey participation would be solicited through a multitude of forums (e.g., whitewater groups, adventure racing forums, fishing and hunting groups, commercial outfitters and guides, transportation services, etc.). River users, area residents, resource agency staff, and other

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knowledgeable persons would be interviewed. Data would be summarized by primary and secondary activities, user demographics, frequency of use, access, campsites, trip length, comparisons with other Alaska rivers, and quality of experience.

The study would include an assessment of flow ranges (baseline and post-development), as well as frequency and timing of flows relative to recreational use and opportunities. Aerial observations in winter would evaluate tracks in the snow to help map areas of winter recreation and transportation.

Comments on the Study

The NPS states that one year of study is not adequate to support conclusions about flow-dependent recreation along the Susitna River, such as sport fishing and float hunting. Conditions that affect recreational use and access (e.g., weather, road closures, etc.) are highly variable, while opportunities and experiences will also vary year to year. NPS recommends at least two years of study. The Talkeetna Community Council, Inc. (TCCI) also comments that more than one year of study will be needed to document flow-dependent and ice-dependent activities. AEA explains that while the study would collect users' experience on the river in 2013, respondents also would be encouraged to provide information on their historical experiences. AEA also states that there are 56 years of flow data available to review, which would allow AEA to relate observations of flow-dependent preferences to a range of available flows.

The NPS and TCCI recommend that the study area (Reach 3) be extended to the lower Susitna River and Cook Inlet due to likely project effects on flows, geomorphology, and ice conditions. NMFS recommends that an intercept survey location be included near the river mouth, suggesting that the launch ramp at Ship Creek in Anchorage be investigated to determine whether it is a significant access point for boating and fishing on the lower river.

The NPS states that the use of focus groups would provide more useful information about the river's value to whitewater boaters than one-on-one executive interviews. NPS asserts that tools such as webinars and videoconferences make it possible to conduct focus groups with subjects who cannot be physically present in the same place. AEA asserts that the expansive study area (i.e., Denali Highway to the George Parks Highway Bridger a distance of over 200 miles) and dispersed nature of the river recreation activities, both in space and time, makes the use of focus group sessions recommended by the NPS impracticable. AEA explains that flow preference questions would be asked during executive interviews.

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Discussion and Staff Recommendation

If the study is conducted during a “typical” flow year and winter season, the study results would likely provide adequate opportunities to observe and evaluate a range of flow and ice conditions that typically support or do not support recreation and transportation on the river. While a variety of factors may affect whether the study results are representative, the ILP provides a mechanism to require additional data if the study is conducted under anomalous conditions (e.g., severe flooding, fire, road closures, etc.). Similarly, if the initial results of instream flow, sediment transport, and ice processes studies suggest that project operation may affect flows downstream of Parks Highway Bridge, additional study may be warranted in the lower river. Requiring AEA to conduct multi-year field studies and flow-related studies in the lower Susitna River now would be premature and could cause AEA to expend resources needlessly. Therefore, we do not recommend modifying the study to include the lower river at this time.

Much of the flow-dependent information to be gathered for the study would be done remotely (e.g., interviews and online surveys), although the study would also utilize data collected during the recreation intercept surveys to be conducted in the field as part of the Recreation Resources Study (study 12.6). At little additional cost (\$20,000), AEA could add focus group discussions, as suggested by the NPS, that would substantially add to the information base for, and the analysis of, flow preferences for whitewater boating and ice conditions needed for motorized and non-motorized travel.

Therefore, we recommend AEA modify the study plan to include at least one focus group discussion on whitewater boating and one on winter ice and snow travel in the river corridor for motorized and non-motorized users. Focus group participants would be identified by building on the executive interviews with commercial and non-commercial users of the river to include boating clubs, dogsled clubs, etc. Opportunities for online or teleconference participation should be provided for the focus group discussions.

Cultural Resources Study (Study 13.5)

Applicant’s Proposed Study

To assess project effects on cultural resources that are eligible for inclusion in the National Register of Historic Places (National Register), AEA proposes to identify, inventory, document, and evaluate cultural resources within a defined direct and indirect area of potential effects (APE). The direct APE encompasses the reservoir impoundment

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area, construction camp, and three potential access/transmission corridors. The indirect APE consists of those areas outside of the direct APE that may experience project induced human activity, particularly dispersed recreation. This area includes the upper Susitna River from the upper extent of the reservoir inundation zone to the Denali Highway Bridge, Fog Lakes, areas around the inundation zone within local drainages that flow into the reservoir, existing trails and camps leading to the reservoir area and the upper Susitna River, and Bureau of Indian Affairs (BIA) ANSCA 14(h)(1) sites.

Phase I (Inventory) surveys, consisting of a combination of aerial reconnaissance and pedestrian transect surveys, would be conducted in areas of the direct and indirect APEs not previously surveyed in the 1980s or in areas within the APE that have high potential for containing cultural resources. Phase II (Evaluation) studies to assess eligibility and analyze effects to eligible historic properties that may be adversely affected by the project would be conducted for sites within the direct APE only. If it is determined later that a site may be affected by changes in project design, scope, and/or location, then those sites would be recommended for evaluation in field studies beyond the 2013-2014 seasons. AEA would also conduct an ethnogeographic study to identify and assess potential project effects on traditional cultural properties. The ethnogeographic portion of the study includes consultation with Ahtna and Dena'ina elders to integrate Alaska Native perspectives on historical land use and cultural values into the cultural resource investigation.

Comments on the Study

CIRI points out that although AEA has substantially revised its cultural resources study plan to address CIRI's concerns, AEA continues to limit the ethnographic investigations primarily to the identification of Ahtna place names, ethnography, history, and culture. CIRI recommends that the Commission direct AEA to consult more closely with CIRI in order to effectively identify Dena'ina cultural resources, and that AEA interview knowledgeable Dena'ina elders at locations convenient to them. CIRI also requests that the Commission designate them as a consulting party, pursuant to Section 106.

BLM states that although AEA adequately addressed its comments involving locating cultural resources in both the direct and indirect APE, BLM remains concerned that AEA would only assess National Register eligibility status for those cultural resources located within the direct APE, and not for those in the indirect APE. The BLM asserts that for it to have enough information to assess effects to historic properties in areas concerning its jurisdiction, AEA should evaluate for National Register eligibility those cultural resource sites that are: (1) adjacent to existing campsites along the Susitna

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River downstream of Denali Highway/Susitna River bridge to the dam's proposed impoundment area; and (2) adjacent to, or directly impacted by off-highway vehicles (OHV) trails that currently access the impoundment area.

Discussion and Staff Recommendation

In its description of existing information and need for additional information, AEA commits to gathering ethnographic information from tribal communities associated with CIRI, and to engaging with knowledgeable Dena'ina tribal elders, especially from the CIRI communities of Chickaloon and Knik. However, in the methods and analysis sections (sections 13.5.4.8 and 13.5.4.9) there remains, as asserted by the CIRI, a heavy emphasis on ethnographic research with individuals associated with the Ahtna culture. In contrast to a number of Ahtna individuals to be contacted for the ethnographic investigations, there are no Dena'ina individuals designated to be interviewed by AEA. While the study area is predominately within the Ahtna culture region, there is enough ethnographic complexity with peoples associated with both the Dena'ina and Ahtna to warrant further ethnographic scrutiny of the project area with knowledgeable members of the Dena'ina community, and with the assistance of CIRI.

In response to BLM's concerns, AEA revised the indirect APE to include areas that are likely to be affected by induced dispersed recreational activity, which includes existing OHV trails and recent campsites found during the 2012 field efforts. However, without explanation, AEA limits its phase 2 eligibility evaluations to the direct APE, and only commits to evaluating eligibility for those sites outside the direct APE if it is determined later that changes in project design, scope, and/or location may affect a particular site.

We believe AEA's approach is too limited. Existing trails and camp sites leading to the reservoir are likely indicative of past uses. Project-induced recreational activity along such existing trails and campsites could exacerbate any ongoing adverse effects or create new adverse effects. Section 106 requires that the Commission consider project effects on sites eligible for the National Register. How much additional effort this may require would not be known until initial surveys are completed as proposed by AEA.

Therefore, we recommend that the study plan be modified to require AEA to consult with CIRI and interview knowledgeable Dena'ina elders, as recommended by CIRI, in order to adequately identify place names, ethnography, history, and culture associated with this culture group. We also recommend that AEA designate specific locations where they would interview knowledgeable Dena'ina elders that are convenient for both AEA and the elders.

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As far as the Commission inviting CIRI to be a consulting party to any programmatic agreement associated with this project, we have already committed to doing so through letters and consultation meetings and will do so when we prepare the programmatic agreement. Stating this in the study plan is not necessary.

We also recommend that AEA evaluate cultural resource sites in the indirect APE for eligibility for the National Register. However, when and how this may be accomplished is best left until the initial study results are available and in consultation with BLM, SHPO, and affected tribal representatives.

Subsistence Resources Study (14.5)

Applicant's Proposed Study

To determine the effects of project construction and operation on subsistence harvest and use, AEA, in conjunction with the Alaska DFG Division of Subsistence, proposes to conduct a subsistence study that includes conducting a series of household harvest surveys, mapping subsistence activities, and conducting traditional and local knowledge (TLK) interviews. The study would collect baseline data and document traditional and contemporary subsistence harvest and use of communities surrounding the project.

Comments on the Study

The Alaska DFG clarified that its request for mapping of subsistence activities has been expanded to include the communities of Cantwell, Chase, Chitna, Gakona, Kenny Lake, McCarthy, Skwentna, Susitna, Talkeetna, and Trapper Creek in 2013, and Copperville, Glennallen, Gakona, Lake Louise, Nelchina, Mendeltna, Paxson, Tazlina, Tolsona, and Tonsina in 2014. Alaska DFG notes that changes to Table 14.5.5 should be made to reflect the additional communities where subsistence mapping would occur and where appropriate harvest surveys should be labeled "one-year mapping" to differentiate those efforts from historical mapping efforts that have been completed in the listed communities.

Alaska DFG also clarified that the list of communities where TLK interviews should be conducted has been modified and expanded from eight to twenty and includes the communities of Cantwell, Chase, Chitna, Gakona, Kenny Lake, McCarthy, Skwentna, Susitna, Talkeetna, and Trapper Creek in 2013 and Copperville, Glennallen, Gakona, Lake Louise, Nelchina, Mendeltna, Paxson, Tazlina, Tolsona, and Tonsina in 2014.

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Alaska DFG suggests that RSP Table 14.5.5 *Communities Selected for Traditional Knowledge, Subsistence Mapping, and Household Survey* be revised to acknowledge TLK interview components of the baseline harvests surveys in the Alaska DFG identified study communities.

Discussion and Staff Recommendation

Alaska DFG's recommended modifications would provide the information needed to accomplish the study objectives. Therefore, we recommend AEA implement the study with Alaska DFG's recommended modifications.

Regional Economic Evaluation Study (Study 15.5)

Applicant's Proposed Study

AEA proposes to evaluate potential changes in regional economic conditions in the study area resulting from the construction and operation of the proposed project. The regional economic impacts of the new energy source provided by the project would be concentrated in the area collectively referred to as the Railbelt, which includes the Fairbanks North Star Borough, Denali Borough, Matanuska-Susitna Borough, Municipality of Anchorage, and Kenai Peninsula Borough.

Much of the analysis of regional economic conditions with and without the project would be based on economic forecasts generated by the Regional Economic Models, Inc. (REMI) model. As part of this effort, AEA would 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 gas-fired plants that are under design or construction. Other assumptions used in the REMI model would be developed from information from several different sources and engineering feasibility studies, including information on project construction and operations cost, the cost of power, amount of power available, financing options, and similar information.

The primary variables that would be modeled using REMI include: population, employment, labor income, output (sales), and housing. The REMI model being used to forecast future economic conditions has been calibrated for Alaska and recently used in work completed for the Alaska Pipeline Project. The REMI model is used by federal, state, and local governments as well as universities and consulting firms. In addition, the forecasts generated by the REMI model would be used to further evaluate effects of the project on other socioeconomic factors as discussed in the Social Conditions and Public Goods and Services Study.

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Comments on this Study

The Talkeetna Community Council asks that AEA provide the assumptions for financing the project in the revised study plan. NMFS recommends that AEA expand the economic analysis to consider the impacts of increased power rates. Specifically, NMFS asks that the REMI model be used to evaluate the regional economic impacts of increased power rates necessary to construct the project.

Discussion and Staff Recommendation

AEA's financial assumptions are required to be provided in its license application. The regional economic analysis using the REMI model will fully evaluate the impacts of constructing and operating the project on the regional economy. This includes any relative changes in electricity prices. This appears to address NMFS's request regarding the REMI model analysis. The Commission's developmental analysis compares the cost of alternative power to the proposed project cost. This comparison would show that the project's power is either less or more than the cost of alternative power in the region. In any event, AEA's proposed REMI model and our analysis is sufficient to evaluate the regional economic impacts of the project.

Therefore, no modifications to AEA's proposed Regional Economic Evaluation Study is recommended.

Air Quality (Study 15.9)

Applicant's Proposed Study

Using applicable state and national air quality standards, AEA proposes to assess air quality conditions in the project area¹⁶ and evaluate the project's effects on air quality. Study objectives include the following:

- Assess the current conditions of the area against applicable state and national air quality standards;
- Review and summarize existing air monitoring data in the area;

¹⁶ The study area would mainly comprise the immediate vicinity of the project and the greater Railbelt Region.

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- Determine attainment status of the study area (i.e., unclassifiable/attainment, nonattainment, maintenance);
- Quantify short-term (construction) and long-term (operational) emissions;
- If applicable, analyze ground level impacts using air dispersion models;
- If applicable, evaluate indirect mobile source emissions from additional project-related traffic;
- Compare project emissions to the without-project alternative;
- Evaluate potential emission reductions from Railbelt fossil-fuel utility plants if the project is operating; and
- Develop information to be used in the identification of potential mitigation measures, if necessary, to reduce emissions during construction.

To accomplish the above objectives, AEA would:

- Document existing conditions by reviewing existing air monitoring reports prepared by Alaska Department of Environmental Conservation (Alaska DEC);
- Estimate and compare emissions from construction equipment and related activities with appropriate state permitting criteria;
- Summarize baseline fossil fuel generation emissions in the area;
- Analyze and compare future estimated with-project emissions to future estimated without-project emissions; and
- Identify best management practices to reduce emissions related to construction and operation of the project including evaluating dust mitigation measures.

AEA intends to assess greenhouse gas emissions (GHG) in its license application based on unspecified guidelines for projects in boreal regions and using existing information from studies that show such emissions from reservoirs in boreal regions are low. While GHG emissions initially increased after construction, within 10 years they returned to levels similar to natural water bodies (Tremblay, 2009). AEA states it would assess GHG emissions in its license application based on unspecified guidelines for projects in boreal regions.

Comments on the Study

The Coalition for Susitna Dam Alternatives (Coalition) and the Center for Biological Diversity request that AEA include in its Air Quality Study a comprehensive evaluation of greenhouse gas emissions due to project construction and operation. They state that hydroelectric reservoirs produce significant amounts of carbon dioxide and methane from decaying, inundated organic materials. They also assert that greenhouse

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gas emissions can come from the thawing of the permafrost at the south and north abutment of the dam, and along the transmission line.

Discussion and Staff Recommendation

The Coalition and the Center for Biological Diversity do not explain how they would have AEA conduct the GHG emission evaluation. There is sufficient existing information (section 5.9(b)(4)) to assess the project's effects on GHG emissions through AEA's proposed study. Therefore, no modification of the study plan is recommended.

National-Level Economic Valuation

Agency or Other Entity's Recommended Study

The Natural Heritage Institute (NHI) requests that AEA conduct a national-level economic valuation of the project. This study request was supported by the National Marine Fisheries Service (NMFS), The Nature Conservancy (TNC), American Whitewater, Alaska Hydro Project, Alaska Survival, Coalition for Susitna Dam Alternatives (Coalition), Hydropower Reform Coalition, Chase Community Council, and various individuals. NHI argues that for the Commission's licensing decision to be in the public interest, it must consider not only the interests of the Alaska Railbelt region, or even the entire State of Alaska, but those of the nation as a whole. The NHI argues that equal consideration of developmental and non-developmental resources implies an equivalent level of information and knowledge of the non-power values as for the value of power and other economic benefits ascribed to the power production of the proposed project. NHI, the Coalition, Chickaloon Village, TNC and others also state that the NEPA process must put a value on the ecosystem services of the Susitna Basin, which it defines as the conditions and processes through which the natural ecosystems and their species sustain and fulfill human life. The proponents argue that "[t]o ensure a reliable comparison of all relevant values, the Commission should use economic valuation as a means of evaluating the trade-offs involved in the licensing action;" and an assessment of benefits and costs should be part of the information set available to FERC in deciding among alternatives.

NMFS, in its letter dated January 18, 2013, requests that AEA "fully assess the market-based and non-market/non-use socioeconomic values associated with the status quo condition of a free flowing pristine river," and that such "economic welfare assessments should be conducted at local, regional, and national levels." NMFS states that such methods are scientifically valid and that it has applied these methods to the listing of the Stellar sea lion and Cook Inlet beluga whales, and that national level

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valuations have been used to assess the non-market economic welfare associated with the dam removal and restoration of the Klamath River. In its January 18, 2012 comments, TNC restates its position that a full analysis of the economic values of the 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 (sport and commercial fisheries, tourism, recreation, subsistence, and winter transportation for local residents, climate change through carbon sequestration, fish and wildlife habitat) provided by the undammed river. TNC states that it is currently undertaking a study to value ecosystem services throughout the Mananuska-Susitna Borough with the Institute of Social and Economic Research and with Earth Economics. The effort includes surveys of how residents value natural places and the use of Benefit Transfer Method to value ecosystem services.

Comments on the Study

AEA opposes conducting a national-level economic valuation. AEA argues that its Social Conditions and Public Goods and Services Study, would adequately evaluate a number of the potential changes in the environmental goods and services derived from the river system and surrounding areas in dollar terms at the local and regional scale. In support, AEA explains that its proposed study, in coordination with other social analyses such as regional economics, recreation, subsistence, transportation, and health analysis, would provide an in-depth understanding of both the existing socioeconomic conditions and the implications that are likely to occur with the project. These analyses would include, but would not be limited to, effects on municipal and state services; fiscal changes in local government revenues and utility costs; transportation infrastructure, traffic volumes and public safety; local and regional tourism establishments (e.g., river sport fishing, whitewater boating) and the regional economy; subsistence-related expenditures; surrounding property uses and values; and the level of production of commercial farming, grazing, logging, mining, and fishing operations. The analysis would also identify and quantify (where possible) ecosystem service values with and without the project, including non-power resources such as aquatic habitat, fish and wildlife, recreation, and cultural and aesthetic resources. For example, AEA would use a random utility model to estimate changes in recreational use values associated with sport fishing, sport hunting, boating, wildlife viewing, hiking, and camping in the study area. AEA would qualitatively assess changes in quality of life, values, attitudes, and lifestyle preferences for local residents with and without the project.

AEA then states that while the analysis in its Social Conditions and Public Goods and Services Study would address both market (e.g., jobs, revenue) and nonmarket (e.g., recreation, aesthetics) values, economic (i.e., monetary) valuations of environmental

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goods and services, monetary evaluations of environmental goods and services are not required, nor may they be sufficient, in order for the positive value of the environmental assets of the Susitna River system to be given full and equal consideration in the licensing decision making process for the proposed project. Quoting *Great Northern Paper, Inc.*, and *City of Tacoma, Washington*, AEA further argues that the Commission has consistently found that the monetization of non-market goods and services is inadequate in the context of assessing non-power values under sections 4(e) and 10(a)(1) of the FPA and should continue to do so here.

AEA also argues that the study proponents failed to meet the Commission's requirements for requesting additional information gathering and study requests because (1) economic valuation of non-developmental values, while obviously having some support, is not a generally accepted practice within the scientific community; (2) the proponents have not demonstrated why a national economic valuation study is necessary to augment or supplant FERC's NEPA evaluation of the project's impacts on aesthetics, cultural, and socioeconomic resources; (3) the proponents failed to describe the methodology and level of effort or cost to implement the proposed study, and why the proposed Social Conditions and Public Goods and Services Study would not be sufficient to meet the stated information needs (18 CFR § 5.9(b) (6) and (7)). As to why economic valuations are not accepted practice, AEA cites to Shavel's (1993) findings that "contingent valuation should not now be used to attempt to measure nonuse values of natural resources, either in public decision making or in liability assessment. In these contexts, society is likely to be better off not seeking to estimate nonuse values with contingent valuation because of the serious problems that this would engender." AEA citing Diamond and Hausman (1994) and National Research Council, Committee on Assessing and Valuing Aquatic and Related Terrestrial Ecosystems (2004) concludes that "it is well settled that contingent value surveys are expensive, subject to bias and even "[s]tudies conducted in controlled experimental settings suggest that . . . contingent valuation . . . methods may overestimate values producing "implausible" results.

Discussion and Staff Recommendation

As stated in Commission staff's scoping document 2, while section 4(e) of the FPA requires the Commission to give "equal consideration" to the purposes of energy conservation, the protection, mitigation of damages to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of environmental quality," "equal consideration" is not the same as "equal treatment." Nothing in the statute requires the Commission to place a dollar value on non-power resources. Nor does the fact that because the

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Commission assigns dollar figures to the licensee's economic costs require that the Commission do the same for non-power resources.¹⁷

Further, we do not dispute that the existence of a free-flowing Susitna River that supports salmon and other resources has have intrinsic value to Alaskans and potentially others nationally and that various methods have been developed and used in an attempt to express existence values in dollars. However, we also recognize that the balancing of environmental and economic impacts cannot be done with mathematical precision. Where the dollar cost of enhancement measures, such as diminished power production, or for resource uses such as recreation, can be reasonably ascertained, we will do so using the information gathered from the various studies being conducted. However, for non-power resources such as aquatic habitat, fish and wildlife, and cultural and aesthetic values, their value will be assessed more qualitatively.¹⁸

Therefore, we do not recommend that AEA be required to conduct a national-level economic valuation study.

¹⁷ See: *CLF et al. v. FERC et al.*, 216 F.3d 41 (D. C. Cir., 2000), citing *California v. FERC*, 966 F.2d 1541, 1550 (9th Cir. 1992).

¹⁸ See *Great Northern Paper, Inc.*, 85 FERC ¶ 61,316 (1998), *reconsideration denied*, 86 FERC ¶ 61,184 (1999), *aff'd*, *CLF v. FERC*, 216 F.3d 41 (D.C. Cir. 2000); *Joseph M. Keating*, 42 FERC ¶ 61,030 (1988), *citing Namekegon Hydro Co.*, 12 FPC 203, 206 (1954), *aff'd*, *Namekegon Hydro Co. v. FPC*, 216 F.2d 509 (7th Cir. 1954) (when unique recreational or other environmental values are present such as here, the public interest cannot be evaluated adequately only by dollars and cents).

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