Attachment E

Response to Interim Comments on Characterization and Mapping
of Aquatic Habitat Mapping Revised Study Plan (RSP 9.9)

Alaska Energy Authority Response to National Marine Fisheries Service and U.S. Fish and Wildlife Service February 5, 2013 Interim Comments on the Characterization and Mapping of Aquatic Habitats Revised Study Plan (RSP Section 9.9)

On February 5, 2013, National Marine Fisheries Service and U.S. Fish and Wildlife Service (Services) filed with the Federal Energy Regulatory Commission (FERC) interim comments on the Characterization and Mapping of Aquatic Habitats Revised Study Plan (RSP Section 9.9). Through this document, Alaska Energy Authority (AEA) responds to these interim comments.

1. **Services' Comment: AEA's proposed habitat classification system is not accurate or useful for characterizing and mapping aquatic habitats.**

AEA does not agree with the Services' general premise that the stream habitat classification system for tributaries and the mainstem, as presented in RSP 9.9, is inaccurate or not useful for characterizing or mapping aquatic habitats. The classification system proposed in RSP 9.9 is based on standard fundamentals for characterizing and mapping aquatic habitats, as described in the scientific literature. This system is based on a habitat classification system developed by the USFS for Alaska forested streams (USFS 2001) and has been applied throughout Alaska, often with site-specific modification. Furthermore, this classification system is the product of collaborative development with the Fish and Aquatic Technical Workgroup (TWG) that began in April of 2012 and continued through the November 2012 TWG meeting when mesohabitat refinements were proposed and discussed based on preliminary data from 2012 aerial mapping. The adaption of this standardized and widely accepted habitat mapping system to the unique aspects of the Susitna River is consistent with such scientific practices commonly applied in hydroelectric project licensing.

2. **Services' Comment: AEA's proposed habitat classification system is not nested and is not hierarchical.**

AEA does not agree that the classification system presented in RSP 9.9 is not nested or hierarchical. In fact, there are five levels of classification, progressing from the largest scale of river segment down to the mesohabitat level of pool, riffle, glide, etc. At the mesohabitat level, 15 different metrics of "microhabitat" are proposed for measurement. Habitat classification and measured parameters in the mainstem, tributaries, and off-channel habitats are based on the USFS (2001) tiered stream habitat survey protocol that have been refined with input from the Fish and Aquatic TWG. Habitat classifications at the mainstem habitat level were defined to be consistent with those used in the 1980s Susitna River studies. These definitions were discussed and agreed upon during agency meetings in the spring of 2012. Tables 9.9-3 and 9.9-4 depicted

the nested classifications proposed by AEA for the Upper River tributaries and mainstem habitats, respectively.

3. **Services' Comment: AEA's proposed habitat classifications are not easily identifiable and are not applicable for defining areas of species or lifestage segregation by habitat or channel type.**

AEA does not agree that the habitat classifications proposed in RSP 9.9 are not easily identifiable and are not applicable for defining areas of species or lifestage segregation by habitat or channel type. Habitat types can readily be identified using a combination of high-resolution still imagery, low elevation aerial video, and ground mapping. The hierarchical and nested levels of classification stratify the levels at which habitat selection might occur, both longitudinally and laterally. The River Segment level stratifies the river into three major units. The Geomorphic Reach level further divides each River Segment into reaches based on unique geomorphic and hydrologic factors. This geomorphic reach level addresses the longitudinal differentiation of habitat as influenced by physical processes.

The Mainstem Habitat Level categorizes types of main channel, off-channel, and tributary habitat at the "macro level" that addresses the longitudinal and lateral distribution and frequency of channel types selected by different species and lifestages. These channel types are further differentiated into sub-types of split, side channel, slough, etc. The physical processes of the Susitna River are manifested differentially in these mainstem classifications largely related to the variable morphology of the habitat types, different hydrologic influences such as surface versus groundwater flow based and subsequently the flow velocities they experience that influence the characteristics of these habitats such as depth, temperature, substrate. The historic data from the 1980s suggests that the variable characteristics of these mainstem habitats support different species and life stages of fishes throughout the year.

The Main Channel and Tributary Level differentiates habitat to mesohabitat scale. This level narrows and refines the habitat stratification to mesohabitats preferred or not preferred by different species and lifestages. Again mesohabitats are in part defined by the channel morphology of the geomorphic reach; gradient, flow, and channel shape all are defining parameters for mesohabitats. It is the variation in these parameters that affect the utility of mesohabitat for various species and life stages of fish.

With mainstem and mesohabitats, the Edge Habitat Level is proposed in order to better understand the longitudinal variation in channel complexity. A high channel complexity index indicates more edge habitat and greater channel and habitat diversity; important factors in instream flow and fisheries studies.

4. **Services' Comment: AEA has proposed new habitat classes that do not appear to be revisions based on the Services' (or other stakeholders) comments.**

AEA disagrees with this statement. At the October 25, 2012 Fish and Aquatic Resources TWG, AEA presented preliminary results of the aerial videography flown in September 2012. At that time, AEA proposed refinements to the classifications based on the habitats that were observed during video collection and from the video imagery. These refinements were presented to the TWG, discussion was had and no adverse comments were received. A few further refinements were made to the RSP classifications based on post-processing of the video, when it was made clear that specific habitat types, such as the tributary plume classification used in the 1980s, were more appropriately designated as a unique classification rather than being lumped with tributary mouths as have previously been proposed.

5. **Services' Comment: AEA's proposed habitat classification is not consistent among study plan sections**.

The RSP proposes one classification system that will be used by all of the Fish and Aquatic and Instream Flow studies for site selection, transect placement, as well as defining fish-habitat associations. Additional on the ground habitat data will be collected during fish distribution and abundance sampling that will be consistent with the classification system described in RSP Section 9.9. As a component of the instream flow modeling, AEA will also collect microhabitat data to develop species and life stage specific habitat suitability criteria (HSC) for use in instream flow modeling. As described in RSP Section 8.5.4.5.1.1, the data collected for HSC development will be at sites nested within the habitat classification system and will include microhabitat variables associated with individual fish and/or redds.

6. **Services' Comment: The additional mainstem macrohabitats result in too many habitat classes limiting adequate replication.**

AEA's proposed method maps the mainstem and, where feasible, mesohabitats that occur within the river. The number of replicates for sampling within the habitats as classified is a function of the site selection methodology. In selecting sites for fish and instream flow studies, AEA has used statistical tools to ensure that sample site selection will be spatially balanced, random, and representative of habitats that exist within each of the geomorphic reaches. Where possible we will sample multiple units of the same habitat type to evaluate variation in that habitat type within the geomorphic reach. However, the nature of the river is that some habitats are uncommon in some geomorphic reaches.. AEA's proposed site selection methods ensure that these less common habitats will be sampled where they occur.

7. **Services' Comment: Current survey methods bias toward mainstem and larger order tributaries due to the lack of visibility through riparian vegetation.**

The remote imagery is limited in its utility for characterizing channel with heavy riparian vegetation that obscures the stream channel. As described in the RSP Sections 9.9.5.3.2, 9.9.5.4.1, and 9.9.5.4.2, AEA has proposed ground-based habitat surveys to characterize

tributary habitats not visible to the camera and to delineate all mesohabitats within Focus Areas.

8. **Services' Comment: Initial classification is clearly based on water surface characteristics; therefore, classification is flow dependent and surveys or field measures need to be conducted under multiple flow conditions.**

AEA's proposed classification is not based on water surface characteristics. The purpose of habitat mapping is to map the diversity of channel types and underlying channel structure. Habitat mapping only uses the mesohabitat terms pool, riffle, glide, etc. to describe the associated underlying structure of the stream, which does not change with flow. Surface water characteristics are useful to help differentiate between fast water habitats such as glide versus riffle but they are not the only characteristic used.

Habitat mapping at low flow is the generally accepted scientific approach. First, these are the conditions when the underlying channel controls that define mesohabitat types are most evident and can be measured, e.g., the pool tail crest. Second, the low flow condition aquatic habitat is at its most limited condition for fish populations.

AEA does not agree that habitat mapping needs to be conducted at multiple flows. The Services' suggestion that habitat mapping should be repeated at multiple flows is inconsistent with standard scientifically accepted practices and procedures. The purpose of habitat mapping is not to determine the relationship between flow and habitat. Flow versus habitat relationships will be studied using instream flow methods, such as the 1-D or 2-D Physical Habitat Simulation Model (PABSIM), as is proposed in RSP Section 8.5. The Services suggest that many off-channel habitat types will be eliminated at low flows and therefore should be mapped at multiple flows. AEA does not agree. The presence and structure of off-channel habitat will be mapped and the response of off-channel habitat types to changes in flow will be studied using instream flow modeling methods, as described in RSP Section 8.5.

9. **Services' Comment: Middle and Lower River tributaries should be classified geomorphically because this level of classification distinguishes areas of salmon spawning and rearing distribution.**

Tributary mouth and habitat lying within the zone of hydrologic influence will be mapped (RSP Section 9.9) and evaluated, as described in RSP Section 9.12. AEA does not agree that there is a logical nexus between Project operations and tributary habitat above the Project's zone of hydrologic influence.

10. **Services' Comment: The Services request that AEA use their habitat classification scheme [Table 1 of Interim Comments] for project planning and assessment.**

To better understand and clarify differences between AEA's and the Services' habitat classification approaches, AEA compared, line-by-line, RSP Section 9.9 (Table 9.9-3 and 9.9-4) with the Services' Alternative Classification presented in Table 1 of the Interim Comments. The comparative analysis supports the Services' statement (Interim Comments, page 4) that "…there are minor differences between AEA's and our [Services] proposed approach to habitat classification…".

AEA agrees there are only minor differences between the two approaches. Further, AEA suggests that differences are not sufficient to justify adoption of the Services' Table 1 over the classification system described in RSP Section 9.9. Further, considerable habitat mapping analyses have already been undertaken by AEA using the RSP Section 9.9 classification system in response to FERC's January 17, 2013 letter to AEA. Further these habitat mapping results have been used for development of RSP Section 8.5 and RSP Section 9.5 implementation plans. Redoing these analyses is not warranted.

The primary differences between the approaches are listed below.

1) The Services' approach measures microhabitat parameters not included in standard habitat mapping methods, e.g. vertical hydraulic gradient, nutrients, invertebrate drift, and water chemistry. AEA will measure these parameters as part of the other aquatic studies described in the RSP.
2) The Services' approach proposes some parameters be classified at Level II whereas RSP Section 9.9 will classify at Level III.
3) The Services' approach suggests a separate category for backwaters and mouths of sloughs. AEA will identify mouths and backwaters when mesohabitat mapping sloughs. RSP Section 9.9 specifically classifies tributary mouths.
4) The Services suggest specifically classifying meander margins, eddies, and side scour alcoves. AEA suggests that these features are extremely amorphous, ubiquitous, and non-dimensional, and are therefore not appropriate for specific mapping. Their function as habitat will be captured in 2-D modeling of Focus Areas.

A detailed comparison of the two classification systems is presented in Attachment 1.

Attachment 1

A Comparison of Habitat Mapping Classifications and Measured Parameters between NMFS and USFWS (Services) 02/03/2013 Interim Comments and AEA RSP Section 9.9 Characterization and Mapping of Aquatic Habitats

Habitat Level Definitions (Annear, T., I. Chisholm, H. Beecher, A. Locke, and 12 other authors, 2004. Instream flows for riverine resource stewardship, revised edition, Instream Flow Council, Cheyenne, WY.)

Macrohabitat – Abiotic habitat conditions in a segment of river controlling longitudinal distribution of aquatic organisms, usually describing channel morphology, flow, temperature, or chemical properties or characteristics with respect to suitability for use by organisms.

Mesohabitat - A discrete area of stream exhibiting relatively similar characteristics of depth, velocity, slope, substrate, and cover, and variances thereof (e.g., pools with maximum depth <5 ft, high gradient rimes, side channel backwaters).

Microhabitat – Small localized areas within a broader habitat type used by organisms for specific purposes or events typically described by a combination of depth, velocity, substrate, cover.

Color Key – The Services' 02/03/2013 suggested classification or measurement parameters and AEA's RSP Section 9.9 proposed parameters are:

the same	similar	different	not suggested by Services but proposed in RSP Section 9.9.

Geomorphic Reach Classification (Level I)	
Services – Mainstem and Tributaries	**AEA RSP Section 9.9 - Mainstem**
Channel Width	Same
Channel Depth	Available when flow routing x-sec are analyzed
Channel Slope	Same
Sinuosity	Same
Substrate Size	Same (from 1980's data)
Channel Confinement	Same (entrenchment ratio)
	Average Number of Channels
	AEA RSP Section 9.9 - Tributaries
	Channel Slope
	Confinement
	Significant Point of Accretion
	Sediment Supply

Macrohabitat Type Classification (Level II)	
Services - Mainstem	**AEA RSP Section 9.9 - Mainstem**
Tributary Mouths	Similar (same but classified at Level III)
Main channel	Similar (same but classified at Level III)
Side Channel	Similar (same but classified at Level III)
Side Slough	Similar (same but classified at Level III)
Upland Slough	Similar (same but classified at Level III)
Services - Tributaries	**AEA RSP Section 9.9 - Tributaries**
Fast	Same
Slow	Same

Mesohabitat Type Classification (Level III)	
NMFS - Mainstem	**AEA RSP Section 9.9 - Mainstem**
Mainstem and Side Channel meander margins (eddies (side scour and alcoves))	Not specifically classified
Mainstem and Side Channel Backwater Pools	Similar[1]
Mainstem and Side Channel Point Bars	Not specifically classified
Mainstem and Side Channel Riffles	Similar[1]
Mainstem and Side Channel Runs/Glides	Similar[1]
Beaver Ponds	Similar[1]
Tributary Mouth Backwater	Similar[1]
Tributary Influenced Mainstem	Similar[1]
Side Sloughs Mouths	Similar[1]
Side Slough Scour Pools	Similar[1]
Side Slough Riffles	Similar[1]
Upland Sloughs Mouths	Similar[1]
Upland Slough Scour Pools[2]	Similar[1]
Upland Slough Riffles[2]	Similar[1]
	Split Main Channel
	Multiple Main Channel
	Split Main Channel
	Edge or Channel Complexity Index
Services - Tributaries	**AEA RSP Section 9.9 - Tributaries**
Falls	Same
Cascade	Same
Chute	Same
Rapid	Same
Boulder Riffle	Same
Riffle	Same
Run/Glide	Same
Straight Scour Pool	Same
Plunge Pool	Same
Lateral Scour Pool	Same
Backwater Pool	Same
Beaver Pond	Same
Alcove	Same

1/ Off-channel habitats, including tributary mouths, and tributaries within the zone of hydrologic influence will be 100% ground mapped and typed to mesohabitat within Focus Areas. Outside of Focus Areas, five to ten main channel mesohabitat units and five to ten off-channel habitat units of each type will be randomly selected for sub-sampling. If there are fewer than the selected number, all units of that habitat type will be sampled.

2/ Services state these habitat types may not exist due to the lack of channel forming flows.

Habitat Characteristics Microhabitat Types (Level IV)	
Services – Mainstem "Microhabitat"	**AEA RSP Section 9.9 – Mainstem "Microhabitat"**
Depth	Same[3]
Velocity	Measured as part of RSP Section 8.5
Surface Flow and Groundwater Discharge	Measured as part of RSP Section 7.5
Vertical Hydraulic Gradient	Measured as part of RSP Section 7.5
Substrate Type	Same[3]
Bank undercut/Riparian cover	Same[3]
Woody debris	Same[3]
Turbidity or Suspended Sediment	Measured as part of RSP Section 5.0 –5.5
Dissolved oxygen (intragravel and surface water)	Measured as part of RSP Section 5.0 –5.5.4.1[4]
Macronutrients (N, P)	Measured as part of RSP Section 5.0 –5.6.4.6
Temperature (intragravel and surface water)	Measured as part of RSP Section 5.0 –5.5.4.1[4]
pH, DOC, alkalinity	Measured as part of RSP Section 5.0 –5.5.4.1
Invertebrate drift density	Measured as part of RSP Section 9.8 – 9.8.4.5
Benthic Organic Matter	Measured as part of RSP Section 9.8 – 9.8.4.12
Algal Biomass and Chl-a	Measured as part of RSP Section 5.6.4.6 and Section 9.8.4.4
	Unit length
	Average wetted width
	Pool maximum depth
	Pool crest depth
	Average maximum depth
	Width of unit
	Percent erosion,
	Percent instream cover in unit
	Dominant riparian vegetation type
Services – Tributary "Microhabitat"	**AEA RSP Section 9.9 – Tributary "Microhabitat"**
Depth	Same. Also collected for HSC, RSP Section 8.5.4.5.1.1.4
Velocity	Collected for HSC, RSP Section 8.5.4.5.1.1.4
Surface Flow and Groundwater Discharge	Presence of upwelling collected for HSC, RSP Section 8.5.4.5.1.1.4
Vertical Hydraulic Gradient	Not measured
Substrate Type	Same. Also collected for HSC, RSP Section 8.5.4.5.1.1.4
Bank undercut/Riparian cover	Same. Distance to cover also collected for HSC, RSP Section 8.5.4.5.1.1.4
Woody debris	Same
Turbidity or Suspended Sediment	Collected for HSC, RSP Section 8.5.4.5.1.1.4
Dissolved oxygen (intragravel and surface water)	Not measured
Macronutrients (N, P)	Not measured. Addressed in Water Quality RSP Section 5.6.4.6
Temperature (intragravel and surface water)	Not measured
pH, DOC, alkalinity	Not measured
Invertebrate drift density	Not measured
Benthic Organic Matter	Not measured
Algal Biomass and Chl-a	Not measured
	Unit length
	Average wetted width
	Pool maximum depth
	Pool crest depth
	Average maximum depth
	Width of unit
	Percent erosion,
	Percent instream cover in unit
	Dominant riparian vegetation type

3/Parameter will be 100% mapped within Focus Areas. Outside of Focus Areas, parameter mapped in five to ten main channel mesohabitat units and five to ten off-channel habitat units of each type randomly selected for sub-sampling. If there is fewer than the selected number, all units of that habitat type all will be sub-sampled.
4/ AEA will monitor temperature at the bottom of the water column at each of the proposed transects. AEA also proposes piezometers at the end of each transect in Focus Areas. Parameter measurements here (including DO and temperature) are intended to indicate potential for detecting groundwater influence on surface water conditions.