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SUSITNA-WATANA HYDRO

F-S5: 2012 INSTREAM FLOW PLANNING STUDY - DRAFT

INTRODUCTION

The Alaska Energy Authority (AEA) is preparing a License Application that will be submitted to the Federal Energy Regulatory Commission (FERC) for the Susitna-Watana Hydroelectric Project (Project) using the Integrated Licensing Process (ILP). The Project is located on the Susitna River, an approximately 300 mile long river in the Southcentral region of Alaska. The Project's dam site will be located at River Mile (RM) 184. The results of this study and of other proposed studies will provide information needed to support the FERC's National Environmental Policy Act (NEPA) analysis for the Project license.

Project construction and operation, as described in the Pre-application Document (PAD, AEA 2011), will modify the flow, temperature, and sediment/turbidity regimes of the Susitna River downstream of the proposed Watana Dam. These modified regimes will affect the amount and distribution (temporal and spatial) of aquatic habitat and may affect fish access to side sloughs and tributary streams. This study plan outlines the objectives and methods for characterizing the existing information that will provide a foundation for future flow-habitat studies. This study will initiate a multi-year effort, which will include data collection activities beginning in 2012.

STUDY OBJECTIVES

A comprehensive instream flow study plan (2013-2014 Instream Flow Study Plan) will be developed during 2012 as part of the Project licensing process. The 2013-2014 Instream Flow Study will describe the response of aquatic habitats to Project-induced changes in river flow, water temperature, turbidity and other river channel/water quality parameters, as appropriate.

The objective of the 2012 Instream Flow Planning Study is to provide information that will be the foundation for the 2013-2014 Instream Flow Study and will assist in its development. The specific objectives are to:

- Synthesize the 1980s instream flow study information and evaluate the applicability of the studies to the current Project;
- Identify appropriate species/life history stages, study reaches, study sites, and instream flow modeling methods for the 2013-2014 Instream Flow Study;
- Coordinate instream flow study data needs across resource disciplines and studies; and
- Assist AEA in the development of the 2013-2014 Instream Flow Study Plan.

STUDY AREA

The study area includes all aquatic habitats and riparian areas related to river flow in the Susitna River downstream of the proposed Watana Dam (RM 184 to RM 0).

EXISTING INFORMATION

Existing information was compiled and reviewed in the Aquatic Resources Data Gap Analysis (ARDGA) (HDR 2011) and the PAD (AEA 2011). Information for the study area includes, but is

not limited to, recent and historic aerial photography; fish distribution and relative abundance from recent and early 1980s studies; and data from the 1980s instream flow studies. Some key instream flow documents include the Instream Flow Relationships Report (Trihey & Associates and Entrix 1985a and b) and its associated four volume Technical Report Series; the Aquatic Habitat and Instream Flow Reports by ADF&G in 1983 and 1984 (ADF&G 1984), Photo Documentation of the Response of Aquatic Habitat Surface Areas to Mainstem Discharge 2 volumes (Trihey & Associates 1985; R&M and Trihey & Associates 1985), and various ADF&G 1983 and 1984 Resident and Juvenile Anadromous Fish Studies. The ARDGA (HDR 2011) lists and discusses the existing information related to the following instream flow components:

- Study methods
- Baseline or reference conditions
- Geographic extent of study
- Major channel/habitat types
- Selected evaluation species/lifestages
- Species/lifestage longitudinal distribution and utilization of major channel/habitat types
- Seasonal timing of utilization of evaluation species/lifestages
- Habitat suitability criteria for evaluation species/lifestages
- Macrohabitat variables affected by flow alterations
- Hydrologic record for with-project and without-project.

METHODS AND ANALYSIS

The 2012 study components identified below will be addressed with respect to three distinct Susitna River segments: Middle River Reach from the proposed Watana Dam (RM 184) downstream through Devils Canyon (RM 150); Middle River below Devils Canyon to the three rivers confluence (RM 98 – 150); and the Lower River Reach below the three rivers confluence (RM 0 – 98). These river segments will have different types/levels of information available from the 1980s studies and potentially different physical and biological issues.

1980s Instream Flow Study Documents

1. Identify the key 1980s instream flow study documents, ensure that they are available in the ARLIS system digitally, and index the key instream flow study elements within each document.

Target Species, Lifestages and/or Guilds

1. Review and synthesize the target species/lifestages/guilds analyzed in the 1980s instream flow studies and the rationale for selecting these species/lifestages/guilds versus other species/lifestages/guilds (e.g., see HDR 2011).

2. For the purpose of facilitating discussions with licensing participants, develop a preliminary selection and rationale for target species/lifestages/guilds by river segment. Identify how species/lifestages not selected or included within guilds would be addressed.

Periodicity (seasonal timing)

1. Identify and synthesize the periodicity for target species/lifestages used in the 1980s studies.

2. Coordinate with the 2012 Synthesis of Existing Fish Population Data Study F-S1 to obtain fish timing and distribution information from the 1980s studies and from recent ADF&G studies.

3. Develop a target species/lifestage periodicity for each river segment and identify any important data gaps in the periodicity information. If a species/lifestage occurs in only a portion of the river segment, then identify the portion of the river segment. If the distribution is unknown, identify the data gap.

Observed Habitat Utilization by Target Species/lifestages/guilds

1. Review and synthesize the macro-, meso-, and micro-scale habitat utilization data collected (by species/lifestage) as part of the 1980s studies. Identify the relative proportion of species/lifestages that utilized macrohabitat types such as turbid/clear water. Identify the relative proportion of species/lifestages that utilized mesohabitat types such as riverine habitat types (main channel, side channel, sloughs, tributary mouths, tributaries) or runs, pools, riffles. Identify the microhabitat habitat utilization observed (depth, velocity, substrate, upwelling, cover) during the 1980s studies, including observed passage requirements into habitats (e.g., water depth).

2. Compare/contrast this information to the current state of knowledge regarding habitat utilization in similar river systems in Alaska. For example, review recent studies that have identified spawning habitats (turbidity, upwelling, etc.) and rearing habitats for target species/lifestages (e.g., Eiler et al. 1992; Yanusz et al. 2007; Anderson and Bromaghin 2009; Burril et al. 2010; Merizon 2010; Yanusz et al. 2010).

3. Coordinate with the 2012 Middle River Habitat Utilization Study (F-S3) to ensure that the study methods and results provide appropriate habitat utilization data for the instream flow study. At a minimum, provide up to two crew members to work with the F-S3 study to provide oversight, assist, and train the F-S3 study crews to collect the proper utilization data for use in study site selection and habitat suitability criteria. More crew members may be needed. Close coordination is needed between these two studies to develop the most efficient method of tracking fish and collecting utilization data.

Important Physical Habitat Processes

1. Identify and synthesize the important physical habitat process that were observed or anticipated to be Project and flow dependent in the 1980s studies, identify how these were addressed, and develop recommendations for addressing and integrating these processes in the 2013-2014 Instream Flow Study. For example:

    a. Upwelling and downwelling with respect to spawning and incubation and the relationship of upwelling rates to main channel discharge and/or ice cover elevation.

    b. Turbidity/suspended sediment with respect to clear water or turbid water habitats and the relationship of main channel discharge to the turbid/clear water habitats.

c. Substrate quality for primary/secondary production and spawning and the relationship of substrate composition to the Project and Project flows.

d. Ice and water temperature with respect to migration, holding, spawning incubation and rearing habitat and the relationship to reservoir operations and river discharge.

River Stratification and Study Sites

1. Identify and synthesize the stream segment or reach scale river stratification scheme used (hydrology, channel geomorphology, channel slope, water temperature, ice cover, turbidity, riparian vegetation, etc.) in the 1980s studies.

2. Identify and synthesize the sub-reach river stratification used such as riverine habitat types (main channel, side channel, sloughs, tributary mouths, and tributaries) and/or mesohabitat types (e.g., run, pool, riffle).

3. Locate and synthesize the 1980s study site locations and identify the overall approach used (or envisioned) to extrapolate the instream flow study site results to river segments and/or the entire Project area.

4. Evaluate the representativeness of the 1980s study sites within each river segment as related to both (1) pre-Project habitat that is usable by each target species/lifestage/guild; and (2) post-Project habitat that would be usable as a result of Project modifications to flow, temperature, turbidity and other parameters (substrate composition, channel structure, inundation frequency, etc.).

5. Coordinate with the 2012 Geomorphic Assessment of the Middle River Reach Using Aerial Photography Study (G-S2) regarding the mapping of geomorphic channel types (channel width, valley width, confinement, slope) and riverine habitat types (main channel, side slough, upland slough, tributary mouths, tributaries). Provide one team member to work consistently with the G-S2 contractor and provide oversight.

    a. Ensure that the geomorphic channel type mapping is at a scale that can be used to stratify the Susitna River into segments/reaches for the instream flow study. Coordinate, as appropriate, the timing of the work products with the instream flow study needs.

    b. Ensure that the digitizing of riverine habitat types is conducted over a suitable range of flows, in the proper river reaches, and at a suitable level of quality that it can be used for assisting in the development of habitat versus flow relationships in the instream flow study. If appropriate, identify study sites or areas where additional detail may be required. Coordinate, as appropriate, the timing of the work products with the instream flow study needs.

    c. Ensure that the channel change analysis (historic imagery versus current imagery) is completed at a scale applicable to the instream flow study's need to assess channel dynamic equilibrium/stability assumptions and the stability of important 1980s study sites.

6. Coordinate with the 2012 Middle River Habitat Utilization Study (F-S3) regarding the locations of habitat utilized by adult salmon. Participate with the study, as appropriate,

to ensure appropriate locations and descriptions of turbid and clear water habitats used by adult salmon are developed based on the 2012 field study and based on the data available from recent ADF&G radio telemetry studies (e.g., Yanusz et al. 2007; Merizon 2010; Yanusz et al. 2010). These data will be used to help evaluate instream flow study sites.

7. Preliminary study site selection – Based on synthesis of the 1980s studies and coordination with the 2012 Geomorphic Assessment of the Middle River Reach Using Aerial Photography (G-S2) and Middle River Habitat Utilization (F-S3) studies, initiate preliminary study site selection where appropriate data exists (e.g., Middle River below Devils Canyon). Conduct field visits, in September/October, to refine potential study sites and assess potential modeling approaches and logistics constraints.

8. For the purpose of facilitating discussions with licensing participants, develop a preliminary approach(s) to (1) segment/reach scale river stratification, (2) sub-reach habitat stratification, (3) study site selection, and (4) expansion of instream flow study site results to river segments and the Project area.

Habitat Suitability Criteria

1. Synthesize the 1980s micro habitat (depth, velocity, substrate, cover) and meso/macro habitat suitability criteria (turbidity, upwelling flow, temperature) and consider its applicability to the current Project.

2. Compare the suitability criteria to empirical habitat utilization data and suitability criteria currently being used in applicable instream flow applications in Alaska and/or the Northwest USA/Canada.

3. Identify any important habitat suitability criteria data gaps that may require habitat suitability criteria data collection.

4. For the purpose of facilitating discussions with licensing participants, develop a preliminary approach for selecting/developing habitat suitability criteria (micro, meso, and macro criteria), including coordination with other studies regarding criteria for riparian vegetation and algae/macroinvertebrates (primary/secondary production habitat).

Habitat Modeling

1. Flow range(s) modeled.

    a. Identify the range of flows that were modeled during the 1980s. Also assess the adequacy of the modeled flow range for quantifying habitat under pre-Project and post-Project conditions.

    b. Develop recommendations for the flow range to be modeled in the 2013-2014 Instream Flow Study.

2. Physical/biological habitat modeling approach that was utilized or envisioned if not completed in the 1980s studies. For example, identify and synthesize the following:

a. Empirical surface area versus flow relationships approach for riverine habitat types (main channel, side channel, sloughs, tributary mouths).

b. Usable habitat area analyses approach within the riverine habitat types (e.g., ADF&G PHABSIM studies).

c. The approach for incorporating turbidity and upwelling into the analysis.

d. The approach used for comparing pre-Project habitat with post-Project habitat.

3. Develop recommendations for the 2013-2014 Instream Flow Study regarding integration of habitat modeling including how various habitat modeling methods might be used most effectively to represent the habitat (empirical mapping of habitat over a range of flows, 1-dimensional hydraulics and habitat modeling, 2-dimensional hydrodynamics and habitat modeling) and how the various physical and biological habitat process can be integrated and used to analyze existing and post-Project habitat.

4. Develop recommendations for incorporating hydrology (period of record, water year types) and habitat time series analysis in the 2013-2014 Instream Flow Study.

5. Develop recommendations for a temporal habitat modeling approach to address load following operation in the 2013-2014 Instream Flow Study.

Water Temperature Modeling

Participate with AEA and licensing participants to develop the 2013-2014 Water Temperature Modeling Study Plan.

2013-2014 Instream Flow Study Plan Development

A formal study plan will be developed through consultation with AEA and the licensing participants that incorporate the synthesis of information described above.

NEXUS BETWEEN PROJECT AND RESOURCE TO BE STUDIED AND HOW THE RESULTS WILL BE USED

Project construction and operation will modify the flow, temperature, and sediment/turbidity regimes of the Susitna River downstream of the proposed Watana Dam. These modified regimes will affect the amount and distribution (temporal and spatial) of aquatic habitat and may affect fish access to side sloughs and tributary streams. The 2013-2014 Instream Flow Study will quantify the response of aquatic habitats to Project induced change to baseline stream flow, stream temperature, turbidity, and other parameters, as appropriate. Results of the 2013-2014 Instream Flow Study will be used to evaluate potential Project impacts and develop potential Protection, Mitigation and Enhancement measures (PM&Es).

The 2012 instream flow efforts will be coordinated with other 2012 studies to identify areas of mutual interest and shared analysis. Specifically these include: fish distribution and abundance studies; fish habitat utilization studies; water temperature studies; geomorphology studies; and riparian studies.

Existing fish and aquatic resource information appears insufficient to address the following issues that were identified in the PAD (AEA 2011):

Middle River (Watana Dam Site [RM 184] downstream to Three Rivers Confluence [RM 98]).

- F4: Effect of Project operations on flow regimes, sediment transport, temperature, water quality that results in changes to seasonal availability and quality of aquatic habitats, including primary and secondary productivity. The effect of Project-induced changes include streamflow, stream ice processes, and channel morphology (streambed coarsening) on anadromous fish spawning and incubation habitat availability and suitability in the mainstem and side channels and sloughs in the Middle River above and below Devils Canyon.

Lower River (Three Rivers Confluence (RM 98] downstream to Cook Inlet [RM 0])

- F9: The degree to which Project operations affect flow regimes, sediment transport, temperature, water quality that result in changes to seasonal availability and quality of aquatic habitats, including primary and secondary productivity.

PRODUCTS

Study products to be delivered in 2012, at a minimum will include:

Final 2012 Study Plan. The final 2012 study plan will be developed in coordination with AEA, agencies and other licensing participants. The AEA-selected environmental contractor will assist AEA, the Program Lead, and licensing participants develop the final study plans.

Draft Technical Memoranda. Draft technical memoranda will be prepared for each work group meeting. The topics for the draft memoranda will be developed in coordination with AEA and the licensing participants to meet the needs for developing the 2013-2014 Instream Flow Study Plan. Preliminary memoranda topics are indicated below. In addition, each memo will summarize progress, identify data gaps, and indicate coordination efforts with other studies.

- Key Instream Flow Documents and Contents
- Target Species/Lifestages, Periodicity, and Observed Habitat Utilization
- Important Physical Habitat Processes, River Stratification, and Study Sites
- Habitat Suitability Criteria
- Habitat Modeling
- Preliminary Study Site Selection

Relational database. A geospatially-referenced relational database of historic data used in the current analysis and data collected during 2012 field season, if applicable, will be prepared. This database will form the basis for additional data collection in 2013-2014. All new field data must

be associated with location information collected using a Global Positioning System (GPS) receiver in unprojected geographic coordinates (latitude/longitude) and the WGS84 datum. Naming conventions of files and data fields, spatial resolution, and metadata descriptions must meet the ADNR standards established for the Susitna-Watana Hydroelectric Project.

2013-2014 Instream Flow Study Plan. The 2013-2014 Instream Flow Study Plan will be developed through consultation with the Instream Flow subgroup through the formal FERC ILP study plan process. The AEA-selected environmental consultant will participate in the subgroup meetings, as appropriate, and assist AEA, the Program lead, and licensing participants develop the study plan outline, draft and final Proposed Study Plans and draft and final Revised Study Plans.

Data. All original data collected in the field in 2012 will be QC'd and delivered to AEA. The data will be entered into the relational database described above, QC'd and delivered to AEA.

Final 2012 Technical Memo. A technical memo summarizing all of the 2012 results will be presented to resource agency personnel and other licensing participants, along with spatial data products. All map and spatial data products will be delivered in the two-dimensional Alaska Albers Conical Equal Area projection, and North American Datum of 1983 (NAD 83) horizontal datum consistent with ADNR standards.

SCHEDULE

The following schedule is for milestones of the 2012 scope of work. In addition to the schedule below, draft technical memoranda and potentially other deliverables will be required between work group meetings as necessary to facilitate work group discussions and 2013-2014 Instream Flow Study Plan development. The schedule for implementation of the 2013-2014 Instream Flow Study will be developed with the AEA-selected environmental consultant during the 2013-2014 study planning process.

- Final 2012 Instream Flow Study Plan – March 20, 2012
- Final Draft 2013-2014 Study Plan Outline – March 20, 2012
- Draft 2013-2014 Instream Flow Proposed Study Plan – April 27, 2012
- Final 2013-2014 Instream Flow Proposed Study Plan – May 21, 2012
- Draft Technical Memorandum – June 29, 2012
- Draft 2013-2014 Instream Flow Revised Study Plan – August 15, 2012
- Final 2013-2014 Instream Flow Revised Study Plan – September 24, 2012
- Original QC'd Data - November 9, 2012
- QC'd Geospatially-referenced relational database – November 9, 2012
- Final Technical Memorandum on 2012 Activity – November 9, 2012.

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