SUSITNA-WATANA
HYDROELECTRIC PROJECT

Draft 2013-2014 Instream Flow Riparian Study Plan

Susitna-Watana Hydroelectric Project

Alaska Energy Authority

Draft Version – March 20, 2012

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1. 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 proposed Project would be located on the Susitna River at RM 184, which is roughly 90 river miles northeast of the community of Talkeetna. As currently envisioned, the Project would include a large dam with a 20,000-acre (ac), 39-mi long reservoir. The type and height of dam construction are still being evaluated as part of on-going engineering feasibility studies, but early comparisons have demonstrated that it will most likely be a roller-compacted concrete structure. The dam has a nominal crest elevation at elevation (El.) 2,025 ft mean sea level (msl) corresponding with a maximum height of approximately 700 ft above the foundation and a crest length of approximately 2,700 ft. Following completion of the studies mentioned above, a nominal crest elevation up to El. 2,125 ft msl may be proposed in the license application, corresponding to a maximum dam height of up to 800 ft above the foundation. Preliminary studies have indicated the surface powerhouse should have three generating units and have a nominal installed capacity of 600 megawatts (MW). However, optimization studies are ongoing and the capacity of the Project eventually proposed for licensing could extend up to 800 MW.

Project construction and operation, as described in the Pre-application Document (PAD, AEA 2011), would have a substantial regulatory effect on the flows downstream of the dam, the degree of which will ultimately depend on its final design and operating characteristics. The project will change the timing, magnitude and duration of flows in the river below the powerhouse. Currently, the project is proposed to be operated in a load following mode to meet power demands during November through April. Thus, flows during this period would be higher than what would occur naturally during the winter low flow period. Conversely, flows will be much lower during the spring and summer months (May-July) than natural conditions. This alteration in the timing and magnitude of flows in a river can influence many downstream resources/processes, including fish and aquatic biota and their habitats, channel form and function including sediment transport, water quality, ice dynamics and riparian and wildlife communities, all of which have been alluded to in the PAD (AEA 2011).

Alterations of natural flow regime timing, magnitude and duration will have effects upon riparian vegetation recruitment, establishment, and maintenance processes. In particular, dominant riparian plant species such as Balsam cottonwood (*Populus balsamifera*) and willow (*Salix* spp.) have very specific flow requirements (seasonal timing of peak flows, flow magnitude, and flow

duration) for recruitment and establishment. These potential operational flow induced effects will need to be carefully evaluated as part of the licensing process.

This study plan describes the instream flow riparian related work that will be completed during 2012. This work was identified during agency Work Group meetings and was described in the recent AEA solicitation (RFP #12-013) for completing the Instream Flow Planning Study (F-S5). This work is preparatory to implementing formal studies that are described more fully in the draft 2013-2014 plan that was submitted as a companion document to this study plan. Although containing some of the same section headings presented in the draft 2013-2014 Riparian Study Plan, this plan is focused on the following tasks: review of 1980s reports and data; coordination of riparian modeling efforts with Botanical Riparian, Geomorphology, Ice Processes and Wildlife study teams; development of physical processes and vegetation succession modeling approach; and development of 2013/2014 studies and field implementation.

2. STUDY OBJECTIVES

A comprehensive instream flow riparian study plan (2013-2014 Riparian Plan) will be developed during 2012 as part of the Project licensing process. The 2013-2014 Riparian Plan studies will describe the response of riparian vegetation to Project-induced changes in river hydroregime, ice process regime and sediment transport regime, as appropriate.

The specific objectives of the 2013-2014 Riparian Study are to:

- Synthesize the 1980s instream flow study information and evaluate the applicability of the studies to the current Project;
- Select study sites in coordination with the Botanical Riparian Study 2012 field surveys and the Instream Flow, Geomorphology, and Ice Processes Studies;
- Quantify potential changes in riparian vegetation (recruitment patterns, encroachment, species composition, and vegetation succession), including the spatial extent of vegetation change throughout the Project Study area;
- Develop a modeling approach with the Geomorphology and Ice Processes Study teams to understand interactions between riparian vegetation, flow regime, sediment regime, and ice regime on channel and floodplain geomorphology and riparian vegetation;
- Provide riparian vegetation model output for analyzing the effects geomorphological and riparian vegetation change will have on instream flow aquatic and riparian/wildlife habitat;
- Coordinate instream flow study data needs across resource disciplines and studies; and

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3. 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). This portion of the river has been characterized into three segments corresponding to an Upper River segment representing that portion of the watershed above the Watana Dam site at River Mile 184; a Middle River segment (extending from RM 184 downstream through Devil Canyon ending at RM 94 and the confluence of the Chulitna River) representing the section of river immediately below the Project that would likely experience the greatest effects of flow regulation caused by Project operations; and a Lower River segment (segment extending from the Chulitna River (RM 94) to Cook Inlet (RM 0)) that is over 90 miles below the Project and which receives inflows from two large river systems that would likely serve to mollify to some extent the effects of flow regulation (Figure 1). These segments were described in the Aquatics Data Gap Report prepared by HDR (2011).

4. EXISTING INFORMATION

Information for the study area includes, but is not limited to, recent and historic aerial photography; riparian vegetation surveys and characterizations from recent and early 1980s studies; and riparian vegetation succession conceptual models developed from the 1980s data. Of primary importance to the Riparian Study is the previous vegetation mapping and successional dynamics studies by McKendrick et al. (1982), Collins and Helm (1997), and Helm and Collins (1997). These previous works will serve as a baseline for developing a stratified sampling scheme for the riparian vegetation surveys. The riparian study modeling efforts will build upon the Collins and Helm (1997) riparian vegetation succession conceptual model.

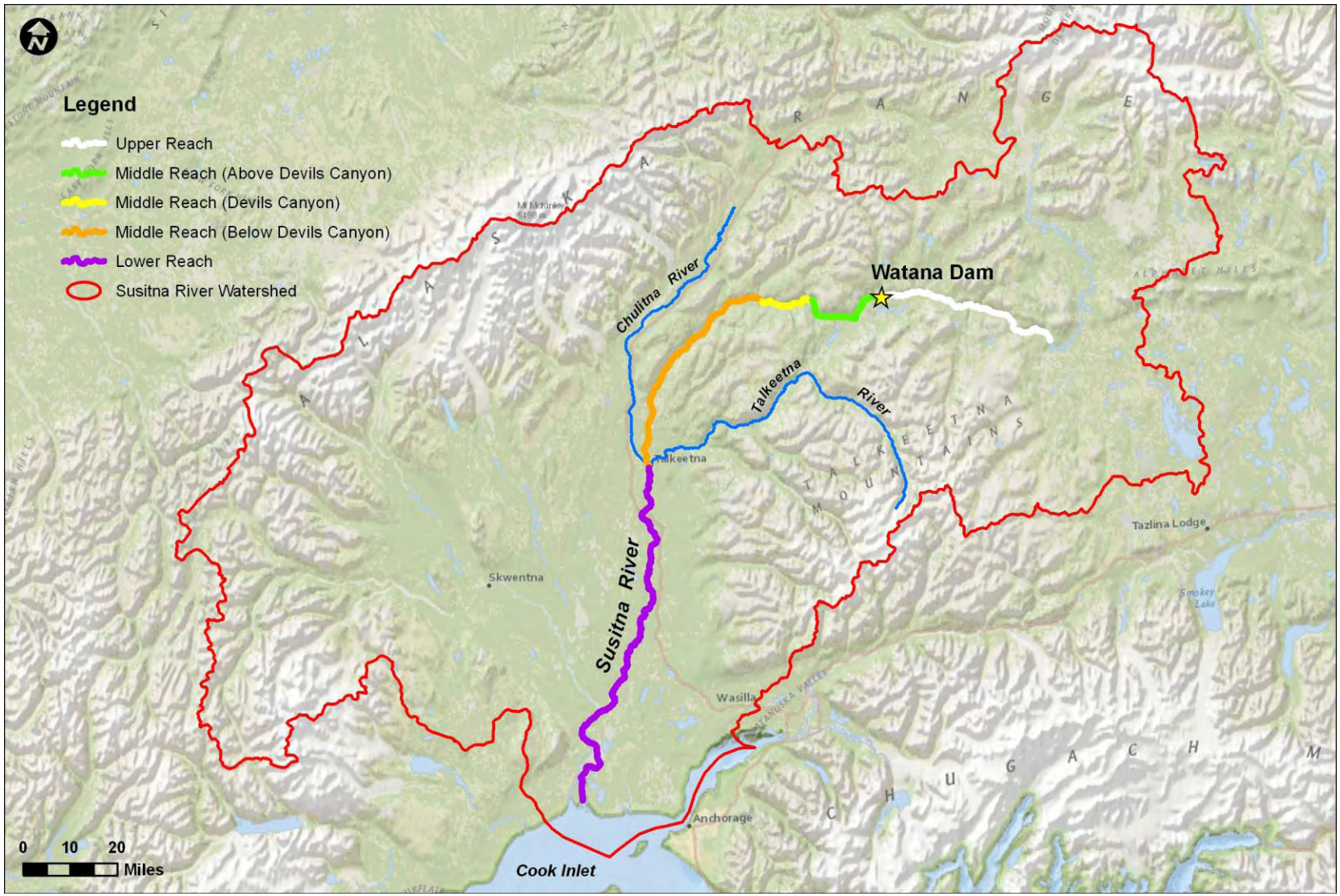

Figure 1. Map of the Susitna River influenced by Susitna-Watana Hydroelectric Project

5. METHODS AND ANALYSIS

The 2012 study has been organized into the following 9 sub-tasks.

- Sub-task 1: Review of 1980s Riparian Vegetation Study Documents
- Sub-task 2: Develop Riverine/Riparian Process Domain Classification
- Sub-task 3: Coordination with Instream Flow, Geomorphology and Ice Process Teams to Develop Physical Process Modeling Approach and Methods
- Sub-task 4: Coordination with Botanical Riparian Study to refine riparian vegetation classification and survey sampling protocols
- Sub-task 5: Review/Identify Off-channel Water Body and Wetland Classification
- Sub-task 6: 2012 Riverine/Riparian Intensive Study Site Selection
- Sub-task 7: Develop Groundwater / Surface Water Study Plan
- Sub-task 8: Develop Large Woody Debris Technical Memorandum
- Sub-task 9: Develop 2013-2014 Study Plan

These sub-tasks are described further below. A schedule for completion of the 2012 study is provided at the end.

5.1 SUB-TASK 1: REVIEW OF 1980S RIPARIAN VEGETATION STUDY DOCUMENTS

This subtask will focus on the identification, compilation and review of all of the key 1980s instream flow riparian study documents. A number of riparian and vegetation mapping resources for the project area were identified as part of the preparation of the PAD, which was prepared to identify data gaps and prioritize the field effort. Of primary importance to the Riparian Study are the previous vegetation mapping and successional dynamics studies by McKendrick et al. (1982), Collins and Helm (1997), and Helm and Collins (1997). These previous works will serve as a baseline for developing a stratified sampling scheme and provide a conceptual framework upon which to build our vegetation classification and models for predicting downstream effects.

5.2 SUB-TASK 2: DEVELOP RIVERINE/RIPARIAN PROCESS DOMAIN CLASSIFICATION

An approach to stratifying the 185 mile Susitna River Project Area into riverine/riparian process domains is critical for Riparian modeling efforts. This river stratification approach is similar to, and will be coordinated with, the aquatic habitat river stratification process. The

riverine/riparian stratification will be focused on identifying specific channel and floodplain process domains for identification of intensive reach sampling study sites. For example, moderately and unconfined alluvial channels, highly constrained canyon, and braided estuarine river segments represent some of the diversity of riparian floodplain types throughout the Susitna River. An approach for classification will be developed in coordination with the Instream Flow, Geomorphology, Ice Processes, and Botanical Riparian Study teams. A draft classification protocol will be presented to the Working Group for review and comment.

5.3 SUB-TASK 3: COORDINATION WITH INSTREAM FLOW, GEOMORPHOLOGY AND ICE PROCESS TEAMS TO DEVELOP PHYSICAL PROCESS MODELING APPROACH AND METHODS

Development of the approach to physical processes study design, modeling, and methods will be coordinated closely with the Instream Flow, Geomorphology and Ice Processes Study Teams. The integrated physical process and plant succession model will be based upon: (1) physical modeling studies of select intensive study reaches representative of Susitna Project Area riverine process domains (Montgomery 1999), (2) HEC-RAS, HEC-GEORAS modeling of river stage / discharge and floodplain terrain inundation relationships for the intensive study reaches, (3) groundwater / surface water interaction modeling of floodplain shallow alluvial aquifer and surface water relationships, and (4) spatially explicit survey, mapping and analysis of the riparian floodplain plant communities' composition, structure, and location throughout the study area (Botanical Riparian Study results). The intensive study reaches will be selected to represent the range of riverine process-domains within the study area in coordination with the Instream Flow, Geomorphology, Ice Processes, and Botanical Riparian Study teams. The physical and plant succession modeling will be designed to scale-up from the intensive reach to the process domain scale for estimation of hydroregulation effects throughout the Project Study Area.

5.4 SUB-TASK 4: COORDINATION WITH BOTANICAL RIPARIAN STUDY TO REFINE RIPARIAN VEGETATION CLASSIFICATION AND SURVEY SAMPLING PROTOCOLS

Riparian vegetation sampling protocols for the Instream Flow Riparian Study will be coordinated and refined in collaboration with the Botanical Riparian Study Team lead, Dr Aaron Wells. Riparian vegetation characterization and sampling approach will vary between the two studies and the sampling designs will need to overlap such that the results of the intensive riparian modeling may be scaled-up to the entire Project Area. Additionally, coordination concerning the types of geomorphic measurements taken at the broad Project Area wide botanical riparian surveys with the riparian modeling efforts is critical to the projects modeling results.

5.5 SUB-TASK 5: REVIEW/IDENTIFY OFF-CHANNEL WATER BODY AND WETLAND CLASSIFICATION

In coordination with the Botanical Riparian Study and Instream Flow Study a classification scheme for off-channel water bodies and riparian wetlands will be reviewed and refined. Off-channel water bodies include: secondary channels, sloughs, beaver ponds, lacustrine depressions, palustrine emergent marshes, among others. It is critical for continuity of the overall research efforts that a standardized classification system is agreed upon by coordination between Geomorphology, Ice Processes, Instream Flow, Botanical Riparian and Wildlife Teams. This approach will be presented to the Working Group for review and comment.

5.6 SUB-TASK 6: RIVERINE/RIPARIAN INTENSIVE STUDY SITE SELECTION

Although preliminary riverine/riparian process domains (river segments/sites) can be identified from existing information and photography, a field visit will be necessary to confirm on-the-ground conditions for both study reach selection and 2013/2014 field sampling designs. A two-day helicopter supported field reconnaissance trip is planned in coordination with the Botanical Riparian Study 2012 field work being led by Drs. Aaron Wells and Kevin Fetherston. Drs. Fetherston and Wells will be joined by Dr. Paul DeVries, R2's fluvial geomorphologist, for two days of reconnaissance survey of the entire Susitna Project Area. The objectives of the reconnaissance survey are to (1) become familiar with on-the-ground conditions throughout the Project Study Area, and (2) rapidly survey the Project Area for potential intensive study reaches for the 2013-2014 Instream Flow Riparian Study. This field work is critical to finalizing the details of the 2013-2014 Instream Flow Riparian Study design and modeling efforts.

Results of this sub-task will be presented in a Technical Memorandum that presents a preliminary approach(s) to (1) segment/reach scale river stratification, (2) intensive reach study site selection, and (4) approaches for expansion of intensive reach site results to river segments and the Project area. This approach will be presented to the Working Group for review and comment.

5.7 SUB-TASK 7: DEVELOP GROUNDWATER / SURFACE WATER INTERACTION STUDY PLAN

Robert Henszey, US Fish and Wildlife Service, and other agency participants, requested during the first Instream Flow working group conference call March 7th that R2 develop a study plan to investigate the potential impacts to floodplain vegetation due to alterations of floodplain shallow aquifer groundwater levels resulting from changes in natural flow regime as a result of dam hydroregulation of the Susitna River. In response to this request, and with the approval of AEA representatives on the conference call, R2 has developed the following Groundwater/Surface

Water Interaction Study Design proposal. R2 will collaborate with Michael Lilly, Geo-Watersheds Scientific, Fairbanks, in development of a study approach to analyzing groundwater / surface water interactions within the Susitna Project Area. The field sampling supporting the modeling will be conducted at the riparian intensive study reaches. Specific tasks will include:

- Literature review
- Development of groundwater modeling approach
- Develop groundwater/surface water modeling interface
- Coordination with riparian intensive reach selection process
- Develop remote field site sampling methodology
- Coordination with instream flow and geomorphology modeling efforts

5.8 SUB-TASK 8: DEVELOP LARGE WOODY DEBRIS TECHNICAL MEMORANDUM

Kathy Dubé, Watershed GeoDynamics, study lead for the Geomorphology Large Wood Study requested Dr. Fetherston provide an on-the-ground reconnaissance survey of large wood within the Susitna River Project Area during the 2012 riparian study field work. He has an extensive background and experience studying the role of large wood in Coastal Pacific Rivers.

While conducting the Instream Flow Riparian reconnaissance survey and Botanical Riparian survey field work Dr. Fetherston will provide photographic documentation of the role and function of large wood within the Susitna River system. Large wood functions may include formation of stable log jams and scour pools, channel splitting, island formation, and bank protection. In addition to documenting the role of wood he will take measurements of a number of stable "key member pieces" of log jams to characterize the dimensions of geomorphically active wood in the Susitna. Measurements will include: size (diameter and length) and observation of root wad condition. He will summarize his large wood field survey findings in a technical memorandum for use by the Geomorphology Study team in finalizing details of the 2013-2014 large wood study plan.

5.9 SUB-TASK 9: DEVELOP 2013-2014 INSTREAM FLOW RIPARIAN STUDY PLAN

A formal 2013-2014 Study Plan will be developed through consultation with AEA, FERC and the licensing participants that is based on results from Sub-tasks 1-8 above.

6. NEXUS BETWEEN PROJECT OPERATIONS AND EFFECTS ON RESOURCES

Project construction and operation will modify the flow, and sediment regimes of the Susitna River downstream of the proposed Watana Dam. These modified regimes will affect the amount and distribution (temporal and spatial) of riparian/floodplain vegetation habitat and floodplain forming processes. The 2013-2014 Instream Flow Riparian Study will quantify the response of riparian/floodplain habitats to Project induced change to operationally altered flow hydroregime, and other parameters, as appropriate. Results of the 2013-2014 Instream Flow Riparian Study will be used to evaluate potential Project impacts and develop potential Protection, Mitigation and Enhancement measures (PM&Es).

The 2013/2014 instream flow riparian efforts will be coordinated with other studies to identify areas of mutual interest and shared analysis. Specifically these include: fish habitat utilization studies; wildlife studies; ice processes studies; geomorphology studies; and botanical riparian studies.

7. PRODUCTS

Study products to be delivered in 2012, include:

- Final 2012 Study Plan (this plan)
- Draft Technical Memoranda including those pertaining to:
    - Conceptual riparian physical process and vegetation succession model for Susitna River
    - Life history strategy matrix for common riparian species
    - River reach maps for potential and selected intensive riparian study sites
    - Physical process modeling approach including: hydraulic, geomorphology, ice processes, and groundwater/surface water interactions
    - Groundwater/Surface Water Interaction Study Plan
    - Vegetation sampling and modeling design coordination with wildlife modeling efforts
    - Project operations modeling approach integrating hydraulics, geomorphology, ice processes and groundwater
    - Detailed riparian vegetation sampling approach and design for intensive study sites
    - Large Woody Debris 2012 Riparian Field Reconnaissance Report
    - Others
- 2013-2014 Susitna-Watana Instream Flow Riparian Study Plan

- Data -All original data collected in the field in 2012 will be QC'ed and delivered to AEA. The data will be entered into the Instream Flow relational database, QC'ed and delivered to AEA
- Final 2012 Technical Memo – technical memo summarizing all of the 2012 results will be prepared and 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

8. SCHEDULE

It is anticipated that the 2012 Instream Flow Riparian Planning Study would be completed in accordance with the following schedule. However, the schedule is subject to refinement and revision based on further discussion with the Working Group, review of the 1980s data, and coordination efforts with other resource specialists.

- Final Draft 2013-2014 Study Plan Outline – March 20, 2012
- Draft 2013-2014 Instream Flow Riparian Proposed Study Plan – April 27, 2012
- Final 2013-2014 Instream Flow Riparian Proposed Study Plan – May 21, 2012
- Draft Technical Memorandum – June 29, 2012
- Draft 2013-2014 Instream Flow Riparian Revised Study Plan – August 15, 2012
- Final 2013-2014 Instream Flow Riparian Revised Study Plan – September 24, 2012
- Final Study Plan based on FERC approval – December 2012

9. REFERENCES

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