

**Susitna-Watana Hydroelectric Project
(FERC No. 14241)**

**Riparian Vegetation Study Downstream of the
Proposed Susitna-Watana Dam
Study Plan Section 11.6**

**Part D: Supplemental Information to
June 2014 Initial Study Report**

Prepared for

Alaska Energy Authority



SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

ABR, Inc.—Environmental Research & Services

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1. INTRODUCTION

Section 1 (Part A) of the June 2014 ISR for Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam (Study Plan 11.6) details the development of this study from the Revised Study Plan (RSP) in 2012, through the end of the 2013 study season. Section 7 of the ISR (Part C), filed in June 2014, sets forth AEA's plan and schedule, at that time, for completing this study and meeting the objectives of the RSP.

As detailed in Section 2.2 of the ISR Part D Overview, various circumstances have required AEA to extend the original timeframe for completing the Commission-approved Study Plan. However, AEA has made meaningful progress with Study 11.6 since the filing of the ISR in June 2014. As detailed below, AEA's recent activities for Study 11.6 have consisted of the following:

- In 2014 and 2015, the digital mapping of Integrated Terrain Unit (ITU) variables was continued. This work is now complete, with several map review and revision tasks remaining to be completed before final map products can be prepared (see Sections 3 and 8 below).
- In September 2014 and 2015, this study team and the Riparian Instream Flow (Study 8.6) study team conducted field work to collect additional sediment cores and sediment stratigraphy data for the floodplain sediment stratigraphy component of the Riparian Vegetation Study.
- Laboratory work to estimate riparian sediment layer ages for samples collected in 2013 and 2014 was conducted in 2014.
- On October 17, 2014, AEA held an ISR meeting to update licensing participants on the status of the Riparian Vegetation Study.
- The study team prepared the Riparian Vegetation Groundwater / Surface Water Study Sampling Design Technical Memorandum (Appendix A of the Study Implementation Report for the Riparian Instream Flow Study (Study 8.6)).
- The Study Implementation Report for Study 11.6, which summarizes the results of the field surveys conducted in 2014 and the riparian vegetation mapping work conducted in 2014 and 2015, was prepared in October 2015. The results of the field surveys conducted in September 2015 have not yet been reported.

The primary purpose of this Part D Supplemental Information to the ISR is to report on the implementation of the Study Plan from the filing of the ISR in June 2014 through the filing of this ISR Part D. In light of this additional implementation, this Part D also identifies AEA's plans for completing Study 11.6 in a manner that meets the objectives of the Commission-approved Study Plan.

2. BACKGROUND

2.1. Purpose of Study

The goals of the study are to: (1) prepare maps of existing, local-scale riparian ecosystems (riparian ecotypes), wetlands, and wildlife habitat types in areas downstream from the proposed Project dam site; (2) characterize sedimentation, vegetation succession, and vegetation-soil-landscape relationships; and (3) coordinate with the Riparian Instream Flow Study (Riparian IFS, Study 8.6) and other closely related studies to provide complimentary data products to support the development of a spatially-explicit model to predict potential changes to downstream riparian floodplain vegetation due to expected Project modifications of flow, sedimentation, groundwater, and ice processes (to be developed in the Riparian IFS; see ISR Part D for Study 8.6). The mapping prepared in this study will be used to assess the impacts to riparian ecotypes, wetlands, and wildlife habitats (see ISR Part D for Study 10.19, Evaluation of Wildlife Habitat Use) in areas downstream from the proposed Project dam site, and to develop possible protection, mitigation, and enhancement (PM&E) measures to address any identified effects.

The study objectives are established in RSP Section 11.6.1:

- Classify, delineate, and map riparian ecotypes, wetlands, and wildlife habitats downstream from the Watana Dam site;
- Characterize the role of erosion and sediment deposition in the formation of floodplain surfaces, soils, and vegetation using a combination of soil stratigraphic descriptions, sieve analysis, and several complimentary sediment dating techniques;
- Quantify and describe Susitna River riparian vegetation communities using a combination of basic statistical summaries (e.g., basal area, density, stand age) and multivariate statistical techniques (e.g., cluster analysis, ordination, sorted tables), which will be used to develop a series of conceptual models of floodplain vegetation succession building from models developed for the Susitna River by researchers working in the 1990s; and

Coordinate closely in the implementation of the Riparian IFS (Study 8.6), Groundwater Study (Study 7.5), Ice Processes in the Susitna River Study (Study 7.6), and Fluvial Geomorphology Modeling below Watana Dam Study (Study 6.6) to provide necessary and complimentary data, including vegetation successional models and mapping in support of a spatially-explicit model (to be developed in the Riparian IFS; see Study 8.6) to predict potential impacts to downstream riparian floodplain vegetation due to Project alterations of existing conditions downstream of the Project dam site.

2.2. Study Components

This study consists of the following components:

- Vegetation and soil sampling in the field.
- Laboratory analyses for sediment aging.

- ITU mapping of ecosystem components.
- Derivation of riparian ecotypes, wetlands, and wildlife habitats from the field and ITU mapping data.
- Modeling of natural (pre-development) successional pathways for riparian vegetation.

3. STATUS, HIGHLIGHTED RESULTS, AND ACHIEVEMENTS

This multi-year study was initiated in 2012 with preliminary field survey and riparian mapping work; results of that work are reported in the 2012 technical memorandum for this study, *Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam*. The following tasks were completed in 2013 and reported in Part A of the ISR for Study 11.6:

- The second and full year of field work was successfully completed with surveys in May through August 2013. This included surveys of Ecological Land Survey (ELS) plots and ITU mapping plots to collect ground-reference data used to support the mapping of riparian ecotypes, wetlands, and wildlife habitats in the study area. It also included soil stratigraphy work and the sampling of soil cores for sediment aging analyses.
- The digital mapping of ITU variables (geomorphic unit, surface forms, vegetation type, poplar size class, and disturbance classes) in the study area was continued in 2013.
- A set of draft riparian ecotypes in three example Focus Areas (FAs) was prepared for review by licensing participants.
- Maps of draft geomorphic units, surface forms, vegetation types, poplar size classes, and disturbance classes in the three example FAs also were prepared for review by licensing participants.

The study team has completed the following activities for Study 11.6 since the June 2014 filing of the ISR:

- In 2014 and 2015, the digital mapping of ITU variables used to develop riparian ecotypes, wetland types, and wildlife habitats in the study area was continued. This work is now complete, but several map review and revision tasks remain to be completed before final map products can be prepared (see Sections 8 below).
- In late September 2014, the study team collected additional sediment cores for the floodplain sediment stratigraphy component of the Riparian Vegetation Study.
- Laboratory geochronology analyses to estimate sediment layer ages for the sediment cores collected in 2013 and 2014 were conducted in 2014.
- On October 17, 2014, AEA held an ISR meeting to update licensing participants on the status of the Riparian Vegetation Study.

- The study team prepared the *Riparian Vegetation Groundwater / Surface Water Study Sampling Design Technical Memorandum* to the Project SharePoint site (Appendix A of the SIR for the Riparian IFS (Study 8.6)).
- In late September 2015, the study team conducted field surveys to describe soil stratigraphy at field plots where sediment samples for sediment cores were previously collected but soil stratigraphy data were not.
- The SIR for Study 11.6, which summarizes the results of the field surveys conducted in 2014 and the riparian vegetation mapping work conducted in 2014 and 2015, was prepared in October 2015. The results of the field surveys conducted in September 2015 have not yet been reported.

4. SUMMARY OF STUDY 11.6 DOCUMENTS

Since filing of the RSP in 2012, AEA and FERC have prepared several documents pertaining to this study. To aid review by FERC staff and licensing participants, each of these documents is listed below. Each of these documents is accessible on AEA's Project licensing website (<http://www.susitna-watanahydro.org/type/documents/>) by clicking on the entry in the "Link" column in the table. In addition, these documents are available on FERC's eLibrary system (<http://www.ferc.gov/docs-filing/elibrary.asp>), in Docket No. P-14241.

Title	Date	Description	Link
11.6. Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam (Revised Study Plan)	12/14/2012	This document presents the plan for this study, including goals, objectives, the study area, and proposed study methods for riparian vegetation.	RSP for Study 11.6
Selection of Focus Areas and Study Sites in the Middle and Lower Susitna River for Instream Flow and Joint Resource Studies – 2013 and 2014 (Technical Memorandum)	3/1/2013	Technical memorandum describing vegetation sampling strategy for Study 11.6 and selection of FAs and sampling sites for all riparian studies.	Mar. 2013 TM for Study 11.6
Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam (2012 Technical Memorandum)	3/4/2013	Technical memorandum, describes 2012 field survey and mapping status.	Feb. 2013 TM for Study 11.6
FERC Study Plan Determination for Study 11.6	4/1/2013	This document presents FERC approval of Study 11.6, which approved AEA's Revised Study Plan with additional recommendations.	FERC SPD for Study 11.6
Technical Memorandum: Riparian Instream Flow, Groundwater, and Riparian Vegetation Studies (FERC Determination Response)	7/1/2013	Technical memorandum discussing revised and more intensive plot-allocation strategy for vegetation and soil sampling in FAs in response to FERC's SPD recommendations.	Jul. 2013 TM for Study 11.6

Title	Date	Description	Link
Draft Initial Study Report for Study 11.6	2/3/2014	This draft of the ISR summarized the study methods and variances during the 2013 study season, and presented preliminary data collected for Study 11.6. This draft ISR was later republished as Part A of the final ISR.	Draft ISR for Study 11.6 (File 1) Draft ISR for Study 11.6 (File 2)
Draft Initial Study Report for Study 11.6	6/3/2014	This document is the Initial Study Report (Parts A, B and C) for Study 11.6. Part A republishes the Draft ISR. Part B identifies supplemental information and errata in Part A. Part C presents study modifications and plans for completing the study.	ISR Part A for Study 11.6 ISR Part B for Study 11.6 ISR Part C for Study 11.6
Initial Study Report Meetings, October 17, 2014	11/15/2014	Transcripts and AEA's agenda and PowerPoint presentations for the ISR meeting concerning the Project riparian studies filed by AEA.	Transcripts from ISR Meeting Materials from ISR Meeting
Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam – 2014-2015 Study Implementation Report	11/6/2015	2014-2015 Study Implementation Report: a summary of field survey results from 2014 and ITU mapping in 2014 and 2015.	2014-2015 SIR for Study 11.6
Riparian Instream Flow Study (Study 8.6) – 2014-2015 Study Implementation Report, Appendix A – Riparian Vegetation Groundwater / Surface Water Study Sampling Design	11/4/2015	Appendix A to Study Implementation Report for the Riparian IFS (Study 8.6), discusses additional vegetation sampling methods to be used in association with selected riparian groundwater/surface water transects.	2014-2015 SIR Appendix A for Study 8.6 (File 1) 2014-2015 SIR Appendix A for Study 8.6 (File 2) 2014-2015 SIR Appendix A for Study 8.6 (File 3)

5. NEW STUDY DOCUMENTATION SUPPLEMENTING THE ISR

The following table identifies and describes additional reports and other documents that update, refine, or otherwise supplement certain sections of the ISR pertaining to this Study 11.6, during AEA's continued implementation of the Study Plan since the ISR was filed in June 2014.

ISR Reference	Description
Part A, Section 4	This Section is supplemented by the Study Implementation Report for Study 11.6 (Sections 4 and 7.2), which describe the study methods implemented in 2014 and a proposed modification in methods, respectively.
Part A, Section 5	This Section is supplemented by the Study Implementation Report for Study 11.6 (Section 5), describing the results of the 2014 and 2015 study plan implementation.

6. VARIANCES

6.1. 2013 Study Season

The following variances are reported in the June 2014 ISR:

- As agreed to through consultation with the Technical Workgroup, the allocation of ELS plots in FAs was changed from that described in the RSP (Section 11.6.4.2.1) so that both the size of FAs and the number of ecotypes in each FA are incorporated into the stratified random plot-allocation process. Additionally, directed sampling in Satellite Areas was used to target those ecotypes under-represented in FAs (RSP Section 11.6.4.2.1). The effect of this variance is that more intensive sampling occurred (a greater number of ELS plots was surveyed in more ecotypes), which will result in a better understanding of riparian vegetation and soils in the study area.
- The sampling interval along vegetation sampling lines on ELS plots was doubled from 0.5 m (1.6 ft), as described in the RSP (Section 11.6.4.2.4), to 1.0 m (3.3 ft). This modification served to improve the accuracy of the sampling for vegetation cover by minimizing the recording of the same plants at different sample points. This larger sampling interval also necessitated a larger sampling radius (23 m [75 ft]) for the ELS plots.
- The groundwater instrumentation was placed just outside of ELS plots instead of in the plot centers as described in the RSP (Section 11.6.4.2.4). This modification was implemented because installing the large groundwater instrumentation in the ELS plot centers would have resulted in excessive disturbance of vegetation. Moving the groundwater instrumentation to the ELS plot boundaries preserved the plots' utility for possible long-term monitoring studies and still allowed for co-located collection of field data on vegetation, soils, and groundwater.

6.2. 2014 – 2015 Study Season

As noted in Section 4 of the 2014 Study Implementation Report for this study, AEA encountered no variances when implementing this study in 2014 and 2015.

7. STUDY PLAN MODIFICATIONS

7.1. Modifications Identified in ISR

Section 7 of the ISR (Part C) details modifications for this study following the 2013 study season. These modifications are generally summarized as follows:

- As agreed to through consultation with the Technical Workgroup, the allocation of ELS plots in FAs was changed from that described in the RSP (Section 11.6.4.2.1) so that both the size of FAs and the number of ecotypes in each FA are incorporated into the stratified random plot-allocation process. Additionally, directed sampling in Satellite Areas was

used to target those ecotypes under-represented in FAs (RSP Section 11.6.4.2.1). The effect of this variance is that more intensive sampling occurred (a greater number of ELS plots was surveyed in more ecotypes), which will result in a better understanding of riparian vegetation and soils in the study area. This change was implemented as a variance in 2013 (see Section 6.1 above).

- The sampling interval along vegetation sampling lines on ELS plots was doubled from 0.5 m (1.6 ft), as described in the RSP (Section 11.6.4.2.4), to 1.0 m (3.3 ft). This modification served to improve the accuracy of the sampling for vegetation cover by minimizing the recording of the same plants at different sample points. This larger sampling interval also necessitated a larger sampling radius (23 m [75 ft]) for the ELS plots. This change was implemented as a variance in 2013 (see Section 6.1 above).
- The groundwater instrumentation was placed just outside of ELS plots instead of in the plot centers as described in the RSP (Section 11.6.4.2.4). This modification was implemented because installing the large groundwater instrumentation in the ELS plot centers would have resulted in excessive disturbance of vegetation. Moving the groundwater instrumentation to the ELS plot boundaries preserved the plots' utility for possible long-term monitoring studies and still allowed for co-located collection of field data on vegetation, soils, and groundwater. This change was implemented as a variance in 2013 (see Section 6.1 above).

7.2. Modifications Identified since the June 2014 ISR

As detailed in the Study Implementation Report for this study, AEA plans to implement one modification to the methods for this study. This modification is summarized below:

- In addition to co-located ELS plots and groundwater wells (RSP Section 11.6.4.2.4), to collect vegetation data along the full length of groundwater/surface water (GW/SW) transects, a series of rapid vegetation transects (RVTs) will be established in four FAs in the Middle River and along four riparian transects in the Lower River at which there are GW/SW transects and groundwater wells. As detailed in the *Riparian Vegetation Groundwater / Surface Water Study Sampling Design Technical Memorandum* (R2 and ABR 2014; now Appendix A in the SIR for Study 8.6), a set of RVTs will be sampled in each mapped riparian ecotype along each GW/SW transect. Sampling along RVTs will involve the same point-intercept sampling procedures used on ELS plots (see Study 11.6, ISR, Part A, Section 4.2.5) but the RVTs will be smaller in size (25 meters in length) and will be oriented perpendicular to each GW/SW transect. The additional data from the RVTs will be combined with those from the ELS plots to model plant frequency response curves along GW/SW gradients. This modification will assist in achieving the study objectives by increasing the confidence in characterizing the relationship between GW/SW gradients and plant community composition in the study area (to be developed in Study 8.6). The modification also will provide more data for use in modeling the predicted changes in riparian vegetation due to alterations in GW/SW gradients as a result of Project development.

8. STEPS TO COMPLETE THE STUDY

In light of the variances and modifications described above, the steps necessary for AEA to complete this study are summarized below. As necessary and appropriate, these steps have been updated from those appearing in Section 7 of the ISR (Part C).

- Sample plot locations will be determined and field ground-reference surveys will be conducted in portions of the study area not yet sampled (RSP Section 11.6.4.2).
- Additional vegetation sampling using rapid field methods (see Appendix A to the SIR for Study 8.6) will be conducted along selected riparian GW/SW transects in the Middle and Lower River.
- The draft ITU mapping in the study area will be reviewed for consistency with the field data from all study years and revised as necessary to prepare a final ITU map layer (RSP Section 11.6.4.3).
- Field data from all study years will be combined and analyzed to update the current ecotype classification and refine the list of acceptable ITU component classes used in defining riparian ecotypes (RSP Section 11.6.4.3).
- Wildlife habitat and wetland types will be derived from the ITU map data in coordination with the study teams for the Vegetation and Habitat Mapping Study in the Upper and Middle Susitna Basin (Study 11.5) and the Wetland Mapping Study in the Upper and Middle Susitna Basin (Study 11.7) (RSP Section 11.6.4.3).
- A spatial join in GIS to match and merge the polygon boundaries mapped in this study with those in the adjacent study areas for Studies 11.5 and 11.7 will be completed so as to facilitate the preparation of Project-wide maps of wildlife habitats and wetlands (RSP Section 11.6.4).
- Laboratory geochronology analyses to age sediment layers in the core samples collected in the study area (RSP 11.6.4.2.5) will be completed by staff at the University of Exeter.
- Natural riparian vegetation successional models will be prepared for use in the modeling of post-development changes in riparian vegetation (RSP Sections 11.6.4.4 and 11.6.7).
- The study team will provide data to and collaborate with researchers for the Riparian IFS (Study 8.6) in the modeling of post-development changes in riparian vegetation.