11.1. Vegetation and Wildlife Habitat Mapping Study

11.2. Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam

11.2.1. General Description of the Proposed Study

The riparian vegetation study involves two primary activities. First, AEA will identify and map current riparian (successional) vegetation, wetlands, and wildlife habitat types in riparian areas along the Susitna River downstream from the proposed Project dam site. This activity will involve both a field effort (to ground-truth the photosignatures on the aerial photography and remote-sensed imagery to be used in the mapping), and an office-based effort to map riparian vegetation, wetlands, and wildlife habitats digitally in GIS. Secondly, the riparian vegetation study will be coordinated with studies of physical processes in downstream areas of the Susitna River (primarily the instream flow, groundwater, ice processes, and fluvial geomorphology studies) so as to collect the necessary data to enable predictions of how development of the Project could alter downstream riparian areas. This second activity will involve resurveying, if possible, sites that were studied for successional vegetation along the Susitna River in the 1980s and 1990s, and collecting current information on successional dynamics at sites that also will be studied for physical processes (as above). In the riparian vegetation study, AEA will use both biological and physical data to predict and assess the extent to which riparian vegetation, wetlands, and wildlife habitats could be affected in areas downstream from the proposed dam.

11.2.1.1. Study Goals and Objectives

The overall goals of the riparian vegetation study are to prepare baseline maps of local-scale riparian ecosystems (riparian ecotypes), wetlands, and wildlife habitat types in areas downstream from the proposed for the Project dam site, and to assess the extent to which the Project will alter vegetation succession, wetlands, and wildlife habitats in riparian areas of the Susitna River. The riparian vegetation study will be closely coordinated with other studies of downstream effects (instream flow, groundwater, ice processes, and fluvial geomorphology) to enable predictions of change in riparian areas. The mapping prepared in this study will be used in assessing impacts to riparian ecotypes, wetlands, and wildlife resources (see Section 10.19) in areas downstream from the proposed dam, and in considering any possible protection, mitigation, and enhancement (PM&E) measures to address any identified effects.

The specific objectives of the riparian vegetation study are to:

- Identify, delineate, and map riparian ecotypes, wetlands, and wildlife habitats downstream from the Watana Dam site;
- In coordination with the instream flow, ice processes, and riverine geomorphology studies, characterize the physical and ecological processes downstream from the Watana Dam site that are likely to affect vegetation succession in riparian areas; and
- Predict potential changes in riparian areas due to Project construction and operations, including changes to vegetation successional pathways, riparian ecotypes, wetlands, and

wildlife habitats, which could result from alterations in instream flow, ice processes, and riverine geomorphology.

This multi-year study is being initiated in 2012 and will continue in 2013 and 2014. Results from the 2012 work will be used to: (1) fine-tune the field investigations and mapping efforts for the existing conditions found in the Project area, and (2) customize the mapping work (e.g., study area) and change-prediction models to reflect further refinements in the design of the Project.

11.2.2. Existing Information and Need for Additional Information

Several riparian and vegetation mapping resources for the Project area were identified in the Pre-Application Document (PAD) (AEA 2011). Of primary importance to the riparian vegetation study are the previous vegetation mapping and vegetation successional dynamics studies by McKendrick et al. (1982), UAFAFES (1985), Collins and Helm (1997), and Helm and Collins (1997), which provide information on vegetation successional processes in areas downstream of the two dams proposed in the APA Project in the 1980s. Summary information on riparian processes in those downstream areas, derived from McKendrick et al. (1982) and UAFAFES (1985), is found in APA (1985). These previous studies will serve as a baseline for developing a sampling scheme for the riparian vegetation study proposed here (study plots from the 1980s and 1990s will be resampled if possible; see Section 11.6.4), and will provide a conceptual framework upon which to build a vegetation succession classification and develop predictive models for assessing the downstream effects of the proposed Project on riparian habitats.

Wetlands were mapped for the APA Project in the 1980s through a cooperative agreement between U.S. Fish and Wildlife Service (USFWS) and the APA to produce a preliminary wetlands map for the APA Project area. Those wetlands map data were based on the vegetation mapping completed by McKendrick et al. (1982), with some additional modification using stereoscopic photo-interpretation, and are now a part of the National Wetlands Inventory (NWI; USFWS 1984). The Alaska Vegetation Classification (AVC; Viereck and Dyrness 1980) vegetation classes that were mapped in the early 1980s were cross-referenced and converted into wetlands classes using the classification scheme of Cowardin et al. (1979). The NWI data from the 1980s cover the current Project area and are expected to be available in digital format sometime in 2012. Those NWI data will help in understanding the types of wetlands that occur in the riparian vegetation study area, but the mapping is coarse-scale (1:63,360 scale) and will not be sufficient for determining effects on wetland resources (e.g., when mapping at the 1:63,360 scale, small drainages and other small wetland habitats are often overlooked). Because those NWI data are nearly 30 years old, and because riparian conditions have almost certainly changed in specific areas over that period, an updated map of riparian wetlands will be needed for the current Project.

Current, high-resolution orthophoto imagery, which will be used for the on-screen mapping work, is available for most of the riparian vegetation study area. Moderate-resolution imagery, which was used to support the allocation of transects and study plots during the 2012 field studies, fills the remaining gaps in the study area. Additional high-resolution aerial imagery for the Project area will be needed for the mapping of riparian ecotypes and wildlife habitats, and is expected to be acquired in summer 2013; that imagery likely will be available in late 2013.

11.2.3. Study Area

The riparian vegetation study area will overlap with the vegetation, wildlife habitat, and wetlands mapping study areas between the proposed dam site and Gold Creek, but the primary focus for the riparian vegetation study will be on riparian areas along the Susitna River and its tributaries below the dam site, which are expected to be altered by changes in stream flow, groundwater, ice processes, and fluvial geomorphology from construction and operation of the proposed dam.

A preliminary study area for the riparian vegetation study is presented in Figure 11.6-1. The final proposed study area for the mapping of riparian ecotypes, wetlands, and wildlife habitats in the riparian vegetation study will be defined in consultation with licensing participants over the course of developing this study plan in 2012. The study area will include those riparian areas downstream of the proposed dam site to a point at which the effects of altered flow regimes expected in the Susitna River would not be ecologically significant (i.e., the expected flow alterations would be overridden by the input from other rivers and/or the effects of tidal fluctuations from Cook Inlet). This downstream location will be determined (in the riparian instream flow study; see Section 8.6) by modeling the flow alterations expected to occur after construction of the proposed dam. Preliminary indications are that this flow attenuation point could occur just downstream of the confluence of the Susitna and Chulitna rivers near Talkeetna. As a starting point for delineating the lateral extent of the riparian vegetation study area, the extent of riverine physiography along the Susitna River will be mapped. Riverine physiography includes those areas of the valley bottom directly influenced by semi-regular to irregular overbank flooding (~5–25 year intervals), and will include off-channel water bodies). Riverine physiography will be mapped by photointerpretation of fine-scale aerial photography and satellite imagery for the Sustina River and is expected to be completed in late October or early November 2012. The riverine physiography map then will be reviewed by the principal investigators leading other riverine studies for the Project (e.g., instream flow, fluvial geomorphology, groundwater, ice processes). Comments from the review will be incorporated into a revised draft study area map. The revised draft map then will be sent out for management agency review and comment. Comments from the agencies and any necessary alterations will be incorporated into the final riparian vegetation study area map, which will serve as the study area for both the riparian vegetation and riparian instream flow studies in 2013 and 2014. The goal is to include this revised study area map in the final version of the RSP before submission to FERC in December 2012. If that goal cannot be met, the process for completing the updates to the riparian vegetation study area in early 2013 will be clearly articulated in the RSP before submission to FERC.

11.2.4. Study Methods

An integrated approach to the mapping of riparian ecotypes, wetlands, and wildlife habitats will be used based on methods developed for Ecological Land Surveys (ELS) studies conducted in tundra, boreal forest, and coastal regions in Alaska over the past 15 years (see Jorgenson et. al. 2002 for an example study in Southcentral Alaska). This integrated mapping approach involves mapping terrain units such as vegetation type, successional stage, geomorphology, and surface-form type, and then combining them into units with ecological importance (in this case riparian ecotypes, wetlands, and wildlife habitats, see below).

The method of combining various ITUs allows for the preparation of a number of thematic maps depending on the specific study needs. For the riparian vegetation study, a riparian ecotype map, a wetlands map, and a wildlife habitat map, each based on the best combinations of ITUs, will be prepared. The mapping of wildlife habitats in the riparian vegetation study will be conducted in coordination with the vegetation and wildlife habitat mapping study (see Section 11.5) to derive a seamless map of wildlife habitats that apply project-wide. Similarly, the mapping of wetlands will be conducted in coordination with the wetland mapping study so that wetlands in the riparian vegetation study can be classified in the same manner as those in the wetland mapping study (see Section 11.7), resulting in a single Project-wide wetland map. In the mapping of riparian ecotypes and in the study of riparian vegetation succession, the vegetation succession study plots studied in the 1980s and 1990s by McKendrick et al. (1982), UAFAFES (1985), Collins and Helm (1997), and Helm and Collins (1997) will be relocated where possible and sampled. The sampling of previously studied sites will help inform our interpretation of successional dynamics in the Susitna River floodplain.

11.2.4.1. Develop Mapping Materials from Historical and Current Data

Data sources that may be used for the mapping of riparian ecotypes and wildlife habitats include vegetation mapping and vegetation succession studies conducted in the Susitna River drainage by McKendrick et al. (1982), UAFAFES (1985), Collins and Helm (1997), Helm and Collins (1997). For wetlands, NWI data for the Project area, which was developed in the 1980s, should be available sometime in 2012. Additional data include soil surveys, digital elevation data, the National Hydrography Dataset (USGS 1999), and other map products that may have been produced for the area as part of other studies. These data will be compiled and reviewed and, if possible, included as a map layer in ArcGIS to assist the mapping efforts.

The available, high- and moderate-resolution aerial imagery for the project area will be acquired for use in the mapping effort. Additional, fine-scale, recent imagery will be needed to complete the mapping in this multi-year study, and it is expected that imagery will be available in late 2013.

11.2.4.2. Field Surveys

Ground-reference plots to be surveyed will be selected to cover the range of riparian habitats identified by photointerpretation of aerial imagery signatures on the high- and moderate-resolution imagery noted above. For the 2013 and 2014 field seasons, the preliminary mapping of riparian ecotypes, wetlands, and wildlife habitats (which is being prepared in 2012; see Section 11.6.4.3) will be used to design a stratified random sampling scheme to preselect potential study plots within riparian habitats. The objective will be to sample multiple map polygons for each riparian, wetland, and wildlife habitat type, incorporating as much replication as possible within the time and funding constraints for this work. Study plot selection will also be coordinated with researchers conducting the instream flow, groundwater, ice processes, and fluvial geomorphology studies to try to co-locate study plots, as much as possible, so that the measured riparian habitat parameters can be related to existing conditions for instream flow, groundwater, ice processes, and geomorphology on a site-by-site basis. These coordinated baseline data will help in the prediction of changes in riparian habitats due to construction and potential Project operations. Additionally, when selecting study plots, as many of the historical

(1980s and 1990s) vegetation succession study plots will be relocated and sampled as possible (see below).

In 2012, the field ground-reference work was completed in two phases. In Phase 1, a helicopter-assisted reconnaissance of the Susitna River from Talkeetna to Willow took place in mid-June. The primary objective of the reconnaissance survey was to determine the feasibility of relocating the vegetation succession study plots originally established by McKendrick et al. (1982) and Collins and Helm (1997) for potential resampling, and to identify potential focus areas for the 2013–2014 studies.

Phase 2 of the 2012 field sampling occurred in late June–early July and included sampling of preselected study plots in conjunction with the data collection efforts for the instream flow study. Riparian habitats were sampled using ITU mapping transects, along which ecosystem characterization and mapping verification data were collected.

In 2013–2014, field sampling will occur from late June to early September and will include three components: (1) ITU mapping transects will continue to be used to further refine ecosystem classification and mapping, (2) intensive study reach transects will be sampled in coordination with the plant community successional model component of the riparian instream flow study, and (3) rates of sedimentation across the Susitna River floodplain will be quantified using field stratigraphic descriptions and standard laboratory sediment dating methods. The methods for each of the above components of the riparian vegetation surveys are provided below.

ITU Mapping Transects

When sampling ITU mapping transects, the data necessary to describe the ecosystem components used in the subsequent ITU mapping will be collected. ITU mapping transects will be oriented perpendicular to the Susitna River channel so as to cross various floodplain surfaces and patches of riparian vegetation in different successional stages. Five to ten circular plots of 10-meter (33-foot) radii will be sampled along each transect, each on a distinct floodplain surface and in a distinct vegetation type. The following variables will be recorded at each ITU mapping plot:

- Geo-referenced plot location (< 3-m accuracy);
- Site variables, including physiography, geomorphic unit, surface form, elevation, aspect, and slope;
- Vegetation structure and plant community composition to classify vegetation types to Level IV of the AVC (Viereck et al. 1992);
- Ages (cross section cuttings or cores) and height of dominant woody plants (three representative samples from the modal size class of the dominant species in the stand);
- Shallow soil pits will be dug to categorize drainage and soil moisture; soil hydrologic variables, including depth of water above or below ground surface, depth to saturated soil, pH, and electrical conductivity (EC); and soil depositional profiles; and
- Wildlife sign such as winter or summer browse marks, nests, dens, droppings, singing birds, carcasses, tracks, and burrows.

Intensive Study Reaches

For use at the intensive study reach transects, in early 2012, the adequacy of the methods of McKendrick et al. (1982), Collins and Helm (1997), and Helm and Collins (1997) for collecting the data necessary to describe vegetation successional stages were reviewed by the riparian

vegetation and riparian instream flow study leads. Starting in late 2012 through early 2013, the intensive study reaches methods will be modified in coordination with the riparian instream flow study. Presently, the intensive study reach transect methods are as follows. The intensive transects will be located so as to cross patches of riparian vegetation in different successional stages, and circular plots will be sampled along each transect. Five to ten plots will be placed along each intensive transect. Variably sized circular study plots will used to sample tree density (by size class; see below) and to collect the other vegetation data. The following variables will be recorded at each intensive successional study plot:

- Geo-referenced plot locations (< 3-m accuracy);
- Site variables, including physiography, geomorphic unit, surface form, elevation, aspect, and slope;
- Vegetation structure and plant community composition to classify vegetation types to Level IV of the AVC (Viereck et al. 1992);
- Density and DBH of tree species using variably sized circular plots, to include 11.3 m radius (DBH ≥ 5 cm) and 5.6 m radius (DBH < 5 cm);
- Shrub density will be measure using the line intercept method along two 6-meter transects placed perpendicular to one another in the center of the tree plot, with each transect aligned along the cardinal directions;
- Ages (cross section cuttings or cores) of dominant woody plants (one to two representative samples from the modal size class of the dominant species in the stand);
- Shallow soil pits will be dug to categorize drainage and soil moisture—soil hydrologic variables, including depth of water above or below ground surface, depth to saturated soil, pH, and electrical conductivity (EC) will be measured, and soil depositional profiles described;
- Additional soils data to be collected includes dominant soil texture in upper 40 cm, thickness of surface organics, cumulative thickness of organic material in upper 40 cm, depth to water table, and thaw depth; and
- Wildlife sign such as winter or summer browse marks, nests, dens, droppings, singing birds, carcasses, tracks, and burrows.

The shape of the study plots on both the ITU mapping and intensive study reach transects may vary depending on the shape of the vegetation stand being sampled. However, the same absolute area will be sampled in all cases. All field data will be recorded digitally in the field using a standardized data entry form on an Android tablet computer designed to link directly to a relational database (Microsoft Access).

Sediment Aging

- In the riparian vegetation study, field stratigraphic descriptions will be prepared and soil samples collected for use in quantifying rates of sedimentation on the Susitna River floodplain. Sedimentation aging will occur in soil pits dug down to the original channel's gravel/cobble surface at all intensive study reach plots and at a subset of ITU mapping plots (the latter will be selected using a stratified, random sampling design). The original gravel/cobble surface (historic channel bed) can be identified as a continuous layer of gravelly/cobble sands (for practical purposes, this layer will be considered continuous when ≥ 40 cm thick). General methods are as follows. Floodplain soil pits will be excavated from the surface to the original gravel/cobble layer and soil stratigraphy will

be described and measured using standard NRCS field techniques (Schoeneberger et al. 2002). Standard sediment grain-size sieve analysis will be conducted on the entire sediment profile.

- Direct dating of fluvial sediments will be conducted using isotopic techniques, including, but not limited to, 137Cs and 210Pb measurements as described in Stokes and Walling (2003).

- In the riparian instream flow study, dendrochronologic techniques will be used to age trees and current floodplain surfaces at each soil pit as described by Fritts (1976). The results of the dendrochronology analyses will be used to corroborate the results obtained from sediment aging.

11.2.4.3. ITU Mapping of Downstream Riparian Areas

Following the field surveys in 2012, preliminary mapping of local-scale riparian ecosystems (riparian ecotypes) will be conducted by photointerpretation of the current aerial imagery available for the study area, and by making use of the ground-reference data collected in summer 2012. As noted above, riparian ecotypes are proposed to be mapped using an ITU approach. A minimum mapping size of 1 acre for terrestrial polygons and 0.25 acres for waterbodies is proposed. ITU map polygons will be attributed with geomorphology (e.g., Braided Active Overbank Deposit); surface form (e.g., Mid-channel Bar); vegetation class (e.g., Open Balsam Poplar Forest), and successional stage (e.g., young poplar, old poplar). Riparian vegetation in this study will be mapped to the Level IV of the AVC (Viereck, et al. 1992) with adjustments, as needed, for early successional riparian stages following Helm and Collins (1997). Following the mapping, the ITU codes will be aggregated into a set of preliminary riparian ecotypes based on the combination of ITUs that best represents the local-scale riparian habitats in the areas mapped.

Preliminary mapping of local-scale wetland ecosystems (wetland ecotypes) also will be mapped using the ITU approach in late 2012, but wetland ecotypes will be delineated separately, if needed, by photointerpretation so as to fit the wetland classification that will be used for the rest of the Project area (see Section 11.7). In particular, if there are wetlands in the floodplain of the Susitna River downstream of the proposed dam that are not represented in the wetlands mapping conducted in the upper Susitna basin, the existing wetlands mapping for lower elevations in the Matanuska-Susitna Borough (see http://cookinletwetlands.info/) will be consulted so as to map similar wetland types.

The objective of the wetlands mapping in the riparian vegetation study is to prepare a map of wetlands for downstream riparian areas following the same classification system used in the upper Susitna basin, and which can be cross-walked to the existing wetlands mapping for other areas in the Matanuska-Susitna Borough (see Section 11.7 for more information). During consultation with resource management agencies, it was agreed that AEA will map wetlands as part of the riparian vegetation study, but will not conduct formal field wetland determinations in areas downstream of the proposed dam, (see Section 9.6 in AEA 2012). The U.S. Army Corps of Engineers has determined that no wetlands will be filled in the riparian areas downstream of the dam; therefore, wetlands mapping will not be needed for the Clean Water Act Section 404 dredge and fill permit. The wetlands mapping in the riparian vegetation study will be prepared to

help in understanding how the downstream effects of alterations in instream flow, ice processes, and riverine geomorphology may affect wetlands in the floodplain of the Susitna River.

In late 2012, preliminary wildlife habitat types in downstream riparian areas will be mapped based on the ITU mapping described above, but will be derived using a separate aggregation of ITU parameters that specifically addresses the important elements of wildlife habitat use (see Section 11.5 for more information).

All the mapping of riparian areas will be conducted on-screen in GIS and will make extensive use of the field ground-reference data so that photosignatures are accurately interpreted. This mapping will be an on-going process and is expected to occur in 2012, 2013, and 2014. It is possible that the mapping of the full study area may not be completed until 2014. Once substantial progress has been made on the ITU mapping, however, a preliminary set of riparian ecotypes, wetland ecotypes, and wildlife habitat types will be prepared for review. This review will occur in both 2013 and 2014, and the preliminary set of riparian ecotypes, wetland ecotypes, wildlife habitat types will be presented in the Initial Study Report and Updated Study Report for review before being finalized.

11.2.4.4. Impact Assessment: Predicting Changes in Riparian Areas

Impacts in riparian areas are expected to occur in the form of spatial and temporal changes in riparian habitats because of changes in instream flow, ice processes, and riverine geomorphology in the floodplain of the Susitna River downstream of the proposed dam. Potential impacts could include alterations in hydrology (reduced or increased flooding), reduced or increased sediment deposition/erosion, and reduced or increased ice scour during buildup and breakup. These effects could then result in changes in geomorphic features, plant species diversity, vegetation composition, and vegetation succession. These effects would all be considered indirect impacts of the construction and operation of the dam.

In the riparian vegetation study, AEA proposes to sample intensive successional study plots in the same stream reaches in which intensive sampling will occur in both the instream flow and riverine geomorphology studies. In sampling these co-located study plots, a multidisciplinary data set will be established that will be used to correlate existing conditions of flow and geomorphology with riparian habitats. These data will provide the baseline from which predicted changes in flow, ice processes, and riverine geomorphology can be used to predict changes in riparian habitats. In large measure, the prediction of changes in riparian habitats will involve determining, from the expected patterns of change in flooding and ice scour, how much of the riparian zone will transition from one successional stage to another. For example, with reduced flooding and ice scour (which are possible from moderated flows below the dam during the summer), the proportion of the river floodplain in the early stages of plant succession would be expected to be reduced while areas in the mid and late successional stages would increase in occurrence. In the riparian vegetation study, data will be collected in those portions of the Susitna River in which changes in flow, ice processes, and riverine geomorphology are expected to occur, and this information will be used to map the predicted changes in vegetation successional stages by river segment. This same approach will be used to map the predicted changes in wetlands and wildlife habitat types due to changes in flow, ice processes, and riverine geomorphology. The timing of these changes also will be predicted based on the intensity of the expected physical alterations in riparian areas and the time periods for persistence of the various vegetation successional stages.

11.2.4.5. Reporting and Data Deliverables

The reports and data deliverables for this study include:

- **Electronic copies of field data.** A geospatially-referenced relational database of historic data and data collected during the 2012–2014 field seasons, including representative photographs of riparian ecotypes, wetland ecotypes, and wildlife habitat types will be prepared. Naming conventions of files and data fields, spatial resolution, map projections, and metadata descriptions will meet the data standards to be established for the Project.
- **Vegetation and wildlife habitat maps in ArcGIS and PDF formats.** The preliminary and final maps of riparian ecotypes, wetland ecotypes, and wildlife habitat types will be developed and delivered according to the schedule indicated below. Naming conventions of files and data fields, spatial resolution, map projections, and metadata descriptions will meet the data standards to be established for the Project.
- **Initial Study Report and Updated Study Report.** The riparian vegetation study results in the Initial and Updated study reports will be presented according the schedule indicated below. The reports will include descriptions of the riparian ecotypes, wetland ecotypes, and wildlife habitat types identified; a summary table (acreages) of the riparian ecotypes, wetland ecotypes, and wildlife habitat types represented in the mapping effort; and predictions of the expected changes in riparian areas due to Project development. The Initial Study Report will include recommendations for the 2014 field survey effort. Both reports also will include field plot photos including site, ground, and soil photographs for each plot surveyed.

11.2.5. Consistency with Generally Accepted Scientific Practice

The riparian vegetation study will be conducted using standard methods for the mapping of vegetation, wetlands, and terrain features (onscreen digitizing in GIS over digital aerial imagery). The mapping will be based on intensive ground-reference information, and the field data will be collected using the same methods used in the 1980s and 1990s so that the current data are comparable. These field methods are still appropriate for classifying successional vegetation types. A multivariate, ITU mapping approach (following Jorgenson et al. 2002) will be used for the mapping of wildlife habitats, and the derivation of wildlife habitats will be conducted following methods successfully used for the mapping of wildlife habitats for other recent projects in Alaska (e.g., ABR 2008, Schick and Davis 2008, PLP 2011). The prediction of change in riparian areas will be done in coordination with other studies of physical processes in riverine areas to help determine accurate relationships between physical changes and alterations in riparian habitats.

11.2.6. Schedule and Study Interdependencies

See Table 11.6-1 for schedule information for the riparian vegetation study and Figure 11.6-2 for information on the relationships between the riparian vegetation study and other Project studies.

11.2.7. Level of Effort and Cost

The riparian vegetation study is planned as a three-year effort, with field sampling conducted each year by four observers (two crews of two each) during the summers of 2012, 2013, and 2014. Surveys would be conducted for 14 to 18 days in each year, depending on the needs for additional ground-verification data (less extensive field surveys may be needed in 2014 as the mapping of the study area progresses). The riparian vegetation study will involve extensive, office-based activities to delineate the boundaries of various ITUs (e.g., vegetation, geomorphic type, surface form, disturbance type) in a GIS and to prepare study reports.

Total costs in 2013 are estimated to be on the order of $500,000. In 2014, a more limited field survey is expected, to focus on complex areas or areas where the field survey coverage is insufficient. Total costs in 2014 are estimated to be roughly $400,000.

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11.2.9. Tables

Table 11.6-1. Schedule for implementation of the riparian vegetation study.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Preparation of riverine physiography map to help define the study area				——									
Riparian/wetland/habitat mapping and field plot selection					——	——							
Field surveys						——	——						
Riparian/wetland/habitat map revisions							——	——					
Initial Study Report								——	Δ				
Delivery of field data and preliminary riparian/wetland/habitat maps								——					
Riparian/wetland/habitat mapping and field plot selection for remaining unmapped areas									——	——			
Field surveys										——	——		
Final riparian/wetland/habitat map revisions											——	——	
Updated Study Report												——	▲
Delivery of final field data and final riparian/wetland/habitat maps												——	

Legend:

——Planned Activity
----- Follow up activity (as needed)
Δ Initial Study Report
▲ Updated Study Report

11.2.10. Figures

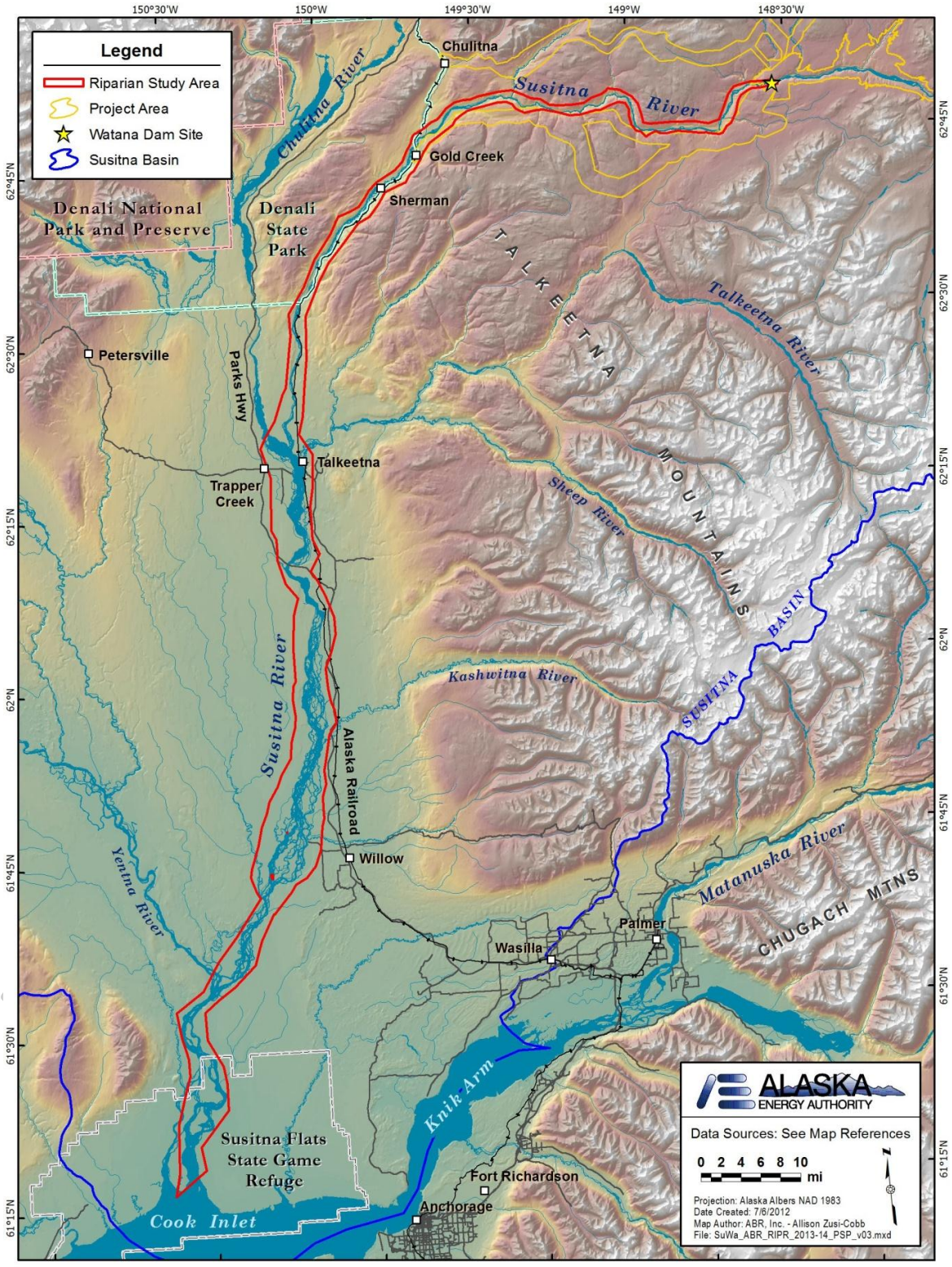

Figure 11.6-1. Preliminary riparian vegetation study area for 2013 and 2014 in the Susitna basin. NOTE: This figure will be updated to illustrate the final proposed study area when agreement is reached on the boundaries to be used (see text).

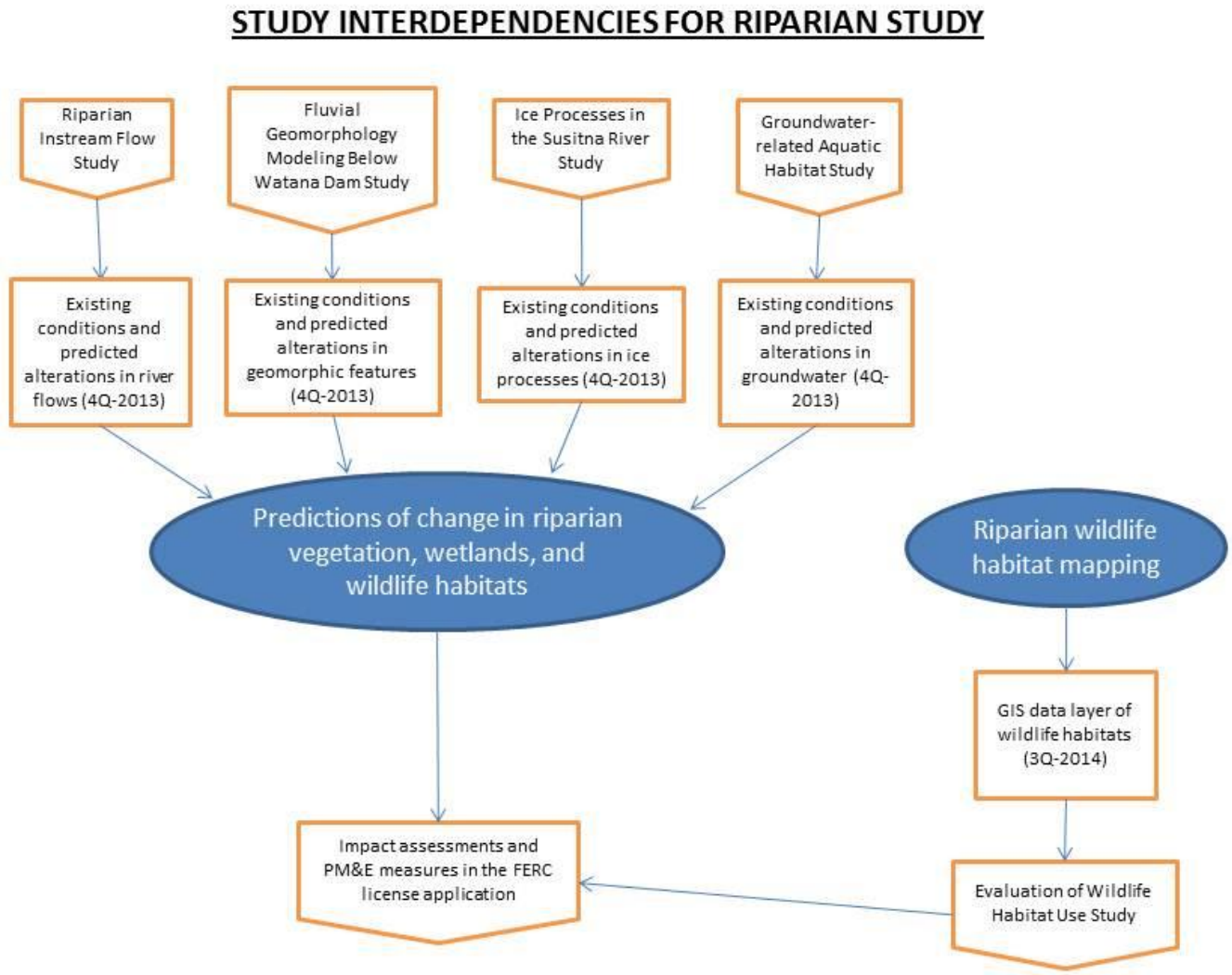

Figure 11.6-2. Study interdependencies for the riparian vegetation studyg