
Pre-Application Document

Susitna-Watana Hydroelectric Project

FERC Project No. 14241



Alaska Energy Authority



December 2011

VOLUME I OF II

EXECUTIVE SUMMARY

The Alaska Energy Authority (AEA) is filing this Notice of Intent (NOI) and Pre-Application Document (PAD) with the Federal Energy Regulatory Commission (FERC, or Commission) for an original license for the Susitna-Watana Hydroelectric Project, FERC No. 14241 (“Susitna-Watana Project”, or “Project”). As proposed, the Project would include construction of a dam, reservoir and power plant on the Susitna River starting at river mile (RM) 184, approximately 34 miles (mi) upstream of Devils Canyon. Transmission lines connecting into the existing Railbelt transmission system and an access road would also be constructed. The FERC License Application is scheduled for filing on or about September 2015.

Organization of the PAD

This PAD contains the following information, as required under Title 18 of the Code of Federal Regulations (CFR 18), § 5.6, which provides FERC’s licensing regulations governing major hydroelectric projects:

Section 1 – Introduction, provides a brief overview of the proposed Project and the contents of this PAD;

Section 2 – Process Plan, Schedule, and Communications Protocol, provides a description and schedule of the FERC licensing process and AEA’s intended approach to communications with stakeholders and record keeping during that process;

Section 3 – Project Location, Facilities, and Operation, describes in detail the proposed facilities and their operational characteristics in terms of reservoir levels, power output, plant discharges, etc, and a proposed timetable for Project development;

Section 4 – Description of Existing Environment and Resource Impacts, provides information about the Project area, and a description of the affected environment in terms of the various resources to be studied, and impacts to be assessed as part of the FERC licensing effort; references to sources of information or relevant studies are provided at the end of each resources section;

Section 5 – Preliminary Issues and Studies List, identifies issues that may be important to the assessment of Project impacts and provides an initial list of potential studies, along with an indication as to possible resource impact mechanisms and mitigation approaches;

Section 6 – Summary of Contacts, provides information documenting resource agency and key stakeholder communications that have taken place during the formulation of this PAD;

Appendices, contain selected environmental data, site photographs, and other information compiled either during the 1980’s or more recently, and deemed relevant to

the understanding of the proposed Project and its potential impacts on a number of key resources.

Background

A larger scale “Susitna Hydroelectric Project” was proposed by the Alaska Power Authority (AEA’s prior name) in the early 1980s (FERC Project No. 7114). That Project was to be composed of two major dams (the Watana Dam and Devils Canyon Dam) constructed in three stages over a period of two decades, to serve the growing electricity needs in the Railbelt (Southcentral) region. The state conducted extensive engineering and environmental studies and filed an application for license with FERC; FERC prepared a draft Environmental Impact Statement (EIS). Despite the extensive work that was conducted at the time, development efforts were halted in 1986 because of a significant reduction in oil prices leading to a drop in State revenue, coupled with discovery of large quantities of low cost, stranded gas in the Cook Inlet area. As explained below, the situation has changed since 1986 and the State and Railbelt utilities have determined there is a present need for the Project. The currently proposed Susitna-Watana Project will be constructed at the same location as the former Alaska Power Authority Susitna Project’s Watana development, although smaller. It does not include a Devils Canyon development.

When the prior project ended, APA had just completed preparation of a draft amendment to its previous license application (dated 1985) and closed the project out by preparing an extensive index and bibliography of documents. This record provides a wealth of useful information relevant to the planning and licensing of the current AEA proposed Project.

Future Railbelt Energy Needs

Much of the generation and transmission infrastructure of the Railbelt region of Alaska is aging and is at or near its time for replacement. The Railbelt is generally defined as the service areas of six regulated public utilities: Anchorage Municipal Light & Power (ML&P), Chugach Electric Association (Chugach), Golden Valley Electric Association (GVEA), Homer Electric Association (HEA), Matanuska Electric Association (MEA), and the City of Seward Electric System (SES). This region covers a significant area of the State and contains the majority of the State’s population and economic activity; it extends from Homer to Fairbanks and includes major metropolitan areas such as Anchorage, Fairbanks, and the Mat-Su Valley.

Even if very low future electricity demand increases are assumed for the Railbelt region, retirement of older generating units will require substantial new generation capacity to be constructed over the next two decades to meet demands and provide system reserves. Concern over both the future cost and supply of fuel for generation in Southcentral and Interior Alaska, and the projected high capital costs of new projects, caused the State Legislature in 2008 to task AEA with developing a Regional Integrated Resource Plan (RIRP) and reevaluating hydroelectric power from the Susitna River.

The 2010 RIRP is a long range conceptual generation and transmission plan for the Railbelt to minimize future power supply costs, and maintain or improve on current levels of power supply

reliability. The intent of the RIRP was to include a diverse portfolio of power supply, and reliable, stable priced electrical energy for the 50 year planning horizon.

In 2010, the Alaska State Legislature passed legislation establishing a State energy policy and expressing intent that the State obtains 50 percent of its electrical generation from renewable and alternative energy sources by 2025. Hydropower currently provides approximately 19 percent of the electrical energy used in Alaska (11 percent in the Railbelt). While the situation continues to change on an annual basis, the RIRP studies concluded that the Railbelt could not achieve the 50 percent renewable goal without a new, large hydroelectric project.

The 2010 Legislature provided funding to AEA for the preliminary planning, conceptual design, and start of permitting and field work for hydroelectric projects along the Railbelt. In November, 2010, the AEA issued a Preliminary Decision Document (PDD) determining that the Susitna Hydroelectric Project – identified as the Watana site on the Upper Susitna River – was to be the primary large hydroelectric project for the State to pursue to help meet the State’s renewable energy resources goals. The PDD recommended that engineering and environmental studies be conducted for the Susitna-Watana Project. The significant amount of winter reservoir storage provided by the Project would enable it to provide needed firm energy during the critical winter months when electricity demands are highest. It would reduce natural gas deliverability problems, increase generation diversity, and the new generation supplied would also help to replace older generation which will be retired prior to Project completion. In addition, it would make a substantial contribution to the State’s goal of 50 percent renewable electrical generation.

The AEA is currently working with the Railbelt utilities to update the previous RIRP in order to reflect changes in planned unit additions and retirements for the utilities that were assumed in the initial modeling. The Susitna-Watana Project is a key resource that is factored into individual Railbelt utilities’ expansion plans as a resource available to meet projected electrical loads in the 2023-2025 time frame. In conjunction with the RIRP update, additional transmission system stability and reliability modeling is planned for early 2012. Results from both of these activities will provide input to future Project sizing studies, finalization of design and operational parameters for the Susitna-Watana Project, and determination of how the Project will best integrate into the Railbelt electrical system.

Description of the Proposed Project

The AEA initiated studies of the Susitna-Watana Hydroelectric Project in January 2011. 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. The sizing and number of units may change as a result of further transmission system studies. The unit size may be as low as 100 MW to ensure Railbelt electrical system reliability.

The Project has three possible alternatives for access roads and transmission lines. Two of the alternatives would accommodate east-west running transmission lines in combination with a new site access road connecting to the Anchorage-Fairbanks Intertie Transmission line and the Alaska Railroad. One of these corridors, designated as the Chulitna Corridor, would run north of the Susitna River, and extend to the Chulitna siding area. The other alternative, designated as the Gold Creek Corridor, would run south of the Susitna River, and extend to the Gold Creek area. A third corridor, designated as the Denali Corridor, would run due north, connecting the Project site to the Denali Highway by road over a distance of about 44 mi. If a transmission line is constructed along this corridor, it would be extended westward along the existing Denali Highway and connect to the Alaska Intertie near Cantwell.

The current plan is to operate the Project in a load-following mode such that firm energy is maximized during the critical winter months of November through April each year to meet Railbelt utility load requirements. To accomplish this, the reservoir would be drafted annually by an average of about 120 ft; the maximum annual drawdown would be approximately 150 ft, and this would occur about once in 50 years. Minimum instream flow releases would be made through either the powerhouse or low level outlet works. Flow discharges through the powerhouse under this operating plan would range from the minimum required instream flow release (yet to be determined) to a high of about 14,500 cfs (based on 600 MW nominal installed capacity) during times of maximum power generation. On rare occasions when the power plant is off line during emergency outages, instream flow releases would be made through the low-level outlet works in Watana dam. Daily power generation during the peak winter months would average about 6,000 MWh and powerhouse discharges would average approximately 6,700 cfs during that time.

For load following purposes, powerhouse discharges are expected to vary over a 24-hour period during the peak winter months, typically ranging from a low of 3,000 cfs to a high of 10,000 cfs. They could be as high as 14,500 cfs (at maximum plant output based on a 600 MW project) for short periods of time during the day to meet load spikes. The daily flow variation may be constrained because of environmental needs. For a Base Case preliminary test case operating plan, initial model runs have been made using the Case E-VI minimum instream flow criteria developed during the 1980s project studies. Those criteria specified a minimum wintertime flow release of 2,000 cfs and a minimum summertime flow release of varying amounts at or above about 9,000 cfs.

The average annual generation from the Project is estimated to be about 2,500,000 MWh. This amount is equivalent to about half of the current annual Railbelt generation. The Project would produce an average of about 250 MW of firm power capacity from November through April but the output could vary from about 100 MW to 500 MW for shorter durations. Approximately 44 percent of the Project's energy output, 1,100,000 MWh, would be delivered to meet electrical load demands during the months of November through April, when Railbelt electricity needs are at their highest levels.

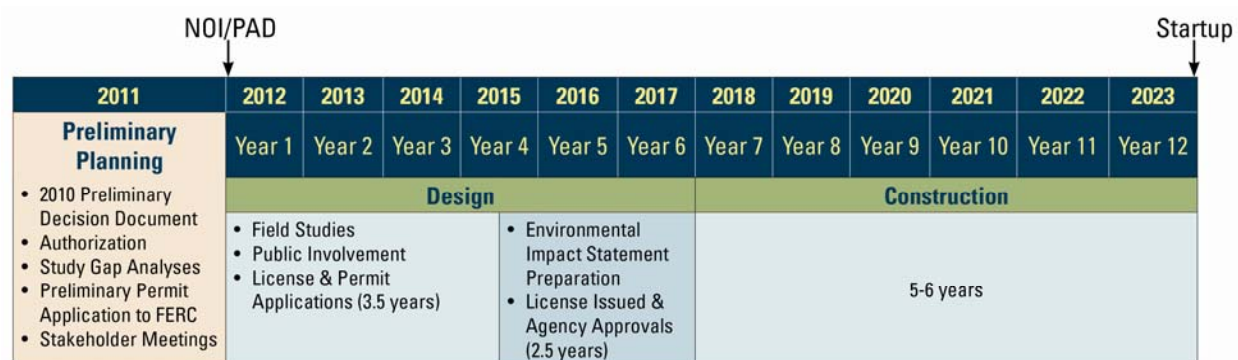
1980s Studies and Current Gap Analyses

In the early 1980s extensive environmental, geological, engineering and economic studies were conducted, and APA completed a feasibility report for a three-stage hydroelectric development on the Susitna River. However as noted above, development efforts were halted in 1986, and no further work was performed until 2008 when the project was rekindled by the State of Alaska. An extensive body of studies was documented during the 1980s, including more than 3,500 individual study reports. This information is archived along with the APA index and bibliography, by the Alaska Resource Library Information System (ARLIS). The most relevant data and reports have been recovered and reviewed by AEA and its consultants in order to identify data gaps, and assess the validity of this earlier planning effort for use in current Project evaluations. Data gap analyses have been completed in the areas of aquatic resources, wildlife resources, cultural resources, subsistence and recreation and socioeconomics. These gap analyses are helping to inform AEA regarding the extent to which additional studies to support an updated environmental analysis and subsequent FERC license application are needed.

Overview of FERC’s Integrated Licensing Process

AEA is embarking on its formal licensing process starting with the filing of its Notice of Intent and this Pre-Application Document. AEA has determined it would not seek any early waivers and would follow the Integrated Licensing Process (ILP) as the most appropriate licensing process for the Susitna-Watana Hydroelectric Project. The reasons for this include the ILP’s defined structure and timeframes, formal study plan determination, and early NEPA scoping. AEA intends, moreover, to offer ample opportunities for public and agency input throughout the process, and has already followed this approach by initiating informal consultation with resource agencies and the public before filing of the Notice of Intent and Pre-Application Document.

There are a variety of engineering feasibility, geotechnical, and environmental studies currently underway. Many other studies and information gathering activities are now being planned. It is expected that licensing could take up to five to six years to complete, however AEA is looking for ways to expedite the timelines for planning, design, and construction of this Project in order to comply with Legislative energy goals and help stabilize long term energy supply for the Railbelt. The ILP culminating in a licensing decision by FERC, as well as the process of obtaining other regulatory approvals, would comprise the first six years of the development schedule. License implementation and construction would take an estimated five to six additional years as shown in the ensuing diagram.



Under the ILP, upon completion of NEPA scoping, the applicant must file a Proposed Study Plan (PSP) that includes detailed plans for each study it proposes to perform. For the Susitna-Watana Project this PSP is currently being drafted, and is slated for filing in June 2012. Prior to completion of the PSP, AEA will engage stakeholders in workgroups centered on aquatic resources, water resources, terrestrial resources, and social sciences disciplines including a cultural resources workgroup in order to inform development of the PSP.

Within 30 days from completion of the PSP, AEA will hold a formal study plan meeting, and subsequent workgroup meetings open to all interested participants who may file comments on the PSP. AEA will then file a Revised Study Plan; and absent any formal disputes, FERC will approve the Study Plan on or about November 29, 2012, directing AEA to perform the studies FERC determines necessary and appropriate.

At the conclusion of each field study season, AEA will file a Study Report with FERC that describes the progress in performing the studies, and identifies any variances and modifications, including the potential need for new studies. All interested parties have an opportunity to collaborate with AEA to discuss each report and file comments with FERC before FERC makes a determination regarding any proposed modifications. The final Pre-Application activity phase will commence when AEA files either a Draft License Application or a Preliminary Licensing Proposal (PLP), followed by a Final License Application (FLA). Interested parties will have 90 days to file comments on the PLP or Draft License Application.

Post-Filing activities for the Project will commence once AEA files its FLA and FERC tenders the application. During the Post-Filing activities FERC will: 1) determine if the application is complete and ready for processing, and request additional information from AEA if needed; 2) prepare an Environmental Impact Statement (EIS) consistent with NEPA; and 3) make a decision on issuance of the license, including license terms and conditions deemed appropriate under the Federal Power Act and other federal laws. In this process the public is notified and allowed to participate through commenting on FERC's NEPA document.

In summary, for the Susitna-Watana Project members of the public can expect to have multiple opportunities to participate in the licensing process through:

- Getting placed on mailing lists and accessing licensing information through each stage of the process.
- Providing written comments to FERC and all other parties at any time documenting concerns with, or support for the Project.
- Providing oral comments and asking questions of FERC staff and AEA at public scoping meetings, site visits, and in other technical meetings.
- Submitting study requests and participating in workgroups during study plan development.

AEA will utilize its licensing website <http://www.susitna-watanahydro.org> to keep stakeholders apprised of these opportunities throughout the licensing process. Interested parties should check the website regularly for updates or new information or events.

Key Resource Issues and Potential Impacts

Based on review of existing information, data gap analyses and preliminary discussions with agencies and other stakeholders (“licensing participants”), AEA has identified a number of potential issues for the Project licensing. The issues for each resource area, and the corresponding study needs, are described in Section 5 and are described briefly below. This listing identifies the high-level preliminary issue topics that will continue to be developed and refined through the ILP and preparation of the Study Plan for the Project. Some topics may drop out and other topics may be added.

The identified study needs indicate those studies that AEA currently anticipates including in its PSP, to be filed in June 2012 in accordance with requirements of FERC’s ILP. The PSP will present detailed scope, objectives, and methodologies for each proposed study. AEA intends to hold a series of resource workgroup meetings through the formal study planning phase in 2012 to facilitate consultation with licensing participants on development of the study designs for inclusion in the PSP and subsequently the Revised Study Plan (RSP). The study designs will maximize the use of data from the earlier proposed APA Susitna Hydroelectric Project.

The Susitna-Watana Project would be located in a remote region of Alaska with abundant natural resources. As such, it can be expected that it will have certain impacts on these resources both during its construction and over the long-term operation. Some impacts may be beneficial and others may be adverse. Issues to be evaluated and potential Project-related impacts will likely include the following, among others:

- **Geology and Soils Issues**, covering direct short-term effects of construction activities on the landscape as well as long-term effects of project operation, including altered river flows and reservoir fluctuations. Potential impacts to be analyzed may include reservoir induced seismicity, reservoir bank instability, sediment transport blockage, surface soil erosion, and downstream river channel aggradation and other morphological changes affecting habitat quality.
- **Water Resources Issues**, covering flow timing and quantity changes, river ice formation, and changes in downstream flows and water levels. Potential impacts to the resources described below would result from changes in the natural river flow regime below the dam and the change from a free-flowing river to a reservoir for 39 miles.
- **Water Quality Issues**, including effects of Project construction and long-term operation on key water quality parameters such as turbidity, temperature, dissolved solids, nutrients, and dissolved gas. Potential impacts might involve changes in water temperature affecting aquatic species and overall water quality changes impacting aquatic and terrestrial habitats. It is possible a reduction in turbidity downstream of the dam could be a benefit to some fishery resources.
- **Geomorphology Issues**, covering sediment transport, changes in upstream and downstream river channel morphology and shoreline erosion. Potential impacts might involve changes in aquatic habitat in the middle and lower Susitna River, changes in spawning due to altered river morphology, and reduced sediment loading and woody debris as a result of dam construction blocking transport.
- **Fisheries Resource Issues**, including changes to aquatic habitats, evaluation of fish distribution, composition, and abundance, impacts related to fluctuating river flows, fish

migration considerations, instream flow requirements, and impacts to special status species. Potential changes might include enhanced quality of downstream habitat through moderation of natural high flows. There may also be changes to riverine habitat, varying access to spawning sloughs, and impediments to salmon migration.

- **Wildlife Resource Issues**, including alteration and/or loss of habitat, effects of the reservoir, roads and transmission lines on wildlife movement and migration patterns, potential increased mortality, and impacts to special status species. Potential impacts might include loss of habitats, habitat degradation, hazards/barriers to animal movements and migration, and effects of an expected gradual increase in human use of the area due to increased access. There could also be adverse effects on rare, threatened and endangered (RTE) animal species from habitat alterations.
- **Botanical Resource Issues**, including changes to vegetation, wetlands, and riparian assemblages, and potential impacts to special status species. Potential impacts might include loss of wetlands and riparian habitats from construction of the reservoir and other project features, and from changes in the natural, historic river flow patterns. Although there are no ESA-listed plant species, there is a potential for adverse effects on rare or sensitive species if they are found in the Project area.
- **Recreation, Land Use and Aesthetic Issues**, including direct short-term effects of construction activities as well as long-term effects of Project operation, including altered river flows and reservoir fluctuations. Potential impacts might include changes in river access and downstream navigation during certain periods, winter use of the river corridor, effects on fishing, hunting and trapping opportunities, changes in future land use and ownership due to increased access to the area, visibility of the dam, powerhouse, roads and transmission lines from important viewpoints, and visual effects of fluctuating reservoir elevations throughout the year.
- **Cultural Resource Issues**, covering construction and operation effects on cultural resource sites, including prehistoric, protohistoric or historic properties. Potential impacts might include inadvertent site damage or alteration during Project construction, vandalism, inundation of known sites by the reservoir, and adverse effects of increased human use on traditional spiritual areas. Aesthetic changes to a surrounding historic landscape may also affect the historic and cultural significance of a property.
- **Subsistence Resource Issues**, covering changes in subsistence fishing and hunting opportunities due to Project-related effects on fish and wildlife populations. Subsistence activities would be affected if there was a change in animal populations, or distribution of animals, if the Project changed access to subsistence resources, or if it disrupted traditional subsistence activities.
- **Socioeconomic and Transportation Resource Issues**, including those related to Project construction activities and long-term operation. Potential impacts might include demands on resources and local economic effects of a large construction workforce rapidly being mobilized and then demobilized when construction is completed, increased visitation to the area both during construction and as a result of the Project's presence, and secondary land development impacts on the area's economy. Potential beneficial effects include creation of jobs, increased economic activity, and long-term lower cost electricity.

Potential Resource Protection Measures (Environmental Commitments)

The AEA is committed to mitigating adverse impacts of the Project and providing enhancements to environmental resources when possible. As part of its FERC Licensing Proposal the AEA will work toward development of comprehensive resource management plans for protection and enhancement of environmental resources including:

- Sediment and Erosion Control Plan
- Revegetation Plan
- Historic Properties Management Plan
- Instream Flow Release Plan
- Recreation Development and Management Plan
- Road and Access Management Plan

In addition, resource protection and enhancement measures will be an important aspect of Project planning and design efforts. Measures already under consideration include:

- Using best management practices (BMPs) to minimize or prevent adverse impacts associated with Project construction activities.
- Avoiding impacts through designing Project features or scheduling construction activities to prevent loss of resources.
- Minimizing impacts on river habitat by controlling and managing power plant flow releases to maintain spawning habitats.
- Rectifying fisheries impacts by restoring disturbed areas to provide fish habitat and reestablishing fish in restored areas.
- Reducing or eliminating impacts over time through monitoring, maintenance, and proper training of Project personnel.
- Rehabilitating altered habitat where possible or managing resources on Project or nearby public lands to increase habitat value.
- Prohibiting public access to the Project area during construction, and prohibiting hunting, fishing, and trapping by employees and their families in the Project area during construction.
- Adjusting site access roads to avoid site-specific habitat loss or disturbance of wildlife.
- Implementing waste-control measures, educational measures, and strict enforcement of state regulations prohibiting intentional feeding to avoid creating attractive nuisances that result in the destruction of animals.
- Adjusting placement of the Watana construction camp and permanent housing sites to avoid habitat loss and disturbance of spring brown bear and fall moose concentration areas near Tsusena Butte.
- Minimizing wetland impacts from project construction by minimizing volume requirements for borrow extraction, which would reduce the overall project footprint.
- Using local borrow and quarry sites near the Watana dam construction area to minimize the length of haul roads and centralizing areas of disturbance.
- Designing, siting, and aligning all facilities to avoid wetlands to the maximum extent feasible.

- Marking private property and educating workers on avoiding private property without permission.
- Consolidating structures to minimize the amount of disturbance and need for rehabilitation and site facilities to minimize vegetative clearing.
- Developing and implementing soil erosion control and revegetation plans.
- Screening material borrow sites from significant view corridors where practical.
- Transmission line routing to minimize views of transmission line.
- Developing cultural resource protection, mitigation and enhancement measures in consultation with the appropriate agencies and entities to ensure effective resource management and recovery; include avoidance; preservation in place; data recovery; monitoring; and a public interpretation and education program.
- Developing protection measures for archaeological resources in accordance with the basic principles contained in the Advisory Council on Historic Preservation's "Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites".
- Avoiding large and rapid population influxes into communities, especially small local communities.
- Avoiding large traffic increases on the Denali and Parks Highways. This will help prevent increases in traffic accidents and animal road kills.
- Providing housing and related facilities for Project workers located near the Project construction site, in order to avoid large population influxes into nearby communities.
- Developing and implementing an Impact Management Program to reduce adverse socioeconomic impacts caused by the Project.

Early Start 2012 Studies

Following is a list of studies proposed to start in early 2012. The AEA is proposing to start these studies early for a number of reasons. It will take almost a year from issuance of the PAD to FERC's Study Plan approval. This is a year of potential environmental data collection that will be lost if AEA waits for FERC's Study Plan Determination to start collecting data. This additional year of data collection is critical for some of the studies. In addition, obtaining the information in 2012 will help inform and focus the Study Plan . Starting early would also be useful if the weather, runoff, or other environmental factors result in abnormal conditions in subsequent years.

Fisheries:

- Synthesis of Existing Fish Data
- Susitna River Salmon Run Apportionment Study
- Middle River Habitat Utilization Study
- Study of Chinook Salmon Presence Above Devils Canyon
- Instream Flow Planning Study

Water Quantity and Quality:

- HEC ResSim Model Development
- Collection of Cross-Sectional Transect Data in Middle and Lower River Reaches
- Review of Existing Water Temperature Data and Models
- Documentation of Susitna River Ice Breakup and Formation

Sediment Transport and Geomorphology:

- Determination of Bedload and Suspended Sediment Loads at Selected River Gaging Stations
- Geomorphic Assessment of the Middle River Reach Using Aerial Photos

Wildlife Studies:

- Wildlife Habitat Use and Movement
- Past and Current Big Game and Furbearer Harvest Study
- Eagle and Raptor Nest Study

Botanical Studies:

- Vegetation and Wildlife Habitat Mapping Study
- Wetland Mapping Study

There will also be ongoing information gathering in the areas of Cultural Resources and Recreation during the 2012 study season.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	ES-1
List of Tables	vi
List of Figures.....	x
List of Acronyms and Scientific Labels	xiv
1. Introduction.....	1-1
1.1. Project Need.....	1-1
1.2. Project Summary.....	1-4
1.3. Document Organization.....	1-5
2. Process Plan, Schedule, and Communications Protocol.....	2-1
2.1. Overview of Licensing Approach and Early Consultation.....	2-1
2.2. Process Plan and Schedule.....	2-2
2.3. Communications and Document Distribution	2-6
2.3.1. Maintenance of the Public Reference File	2-6
2.3.2. Licensing Website.....	2-7
2.3.3. ILP Meetings.....	2-8
2.3.4. ILP Documentation.....	2-8
2.3.5. Distribution of Licensing Documentation	2-9
2.3.6. Communications with FERC staff.....	2-9
2.4. Work Group Structure for Pre-Filing Technical Efforts.....	2-10
2.5. Development of a Licensing Study Program	2-11
3. Project Location, Facilities, and Operation.....	3-1
3.1. Authorized Agents for the Applicant.....	3-1
3.2. Project Location	3-1
3.3. Proposed Project Facilities.....	3-1
3.3.1. Project Structures	3-2
3.3.2. Reservoir Data	3-18
3.3.3. Turbines and Generators.....	3-18
3.3.4. Appurtenant Mechanical and Electrical Equipment	3-20

3.3.5.	Transmission Facilities	3-22
3.3.6.	Description of Transmission and Interconnection Facilities	3-22
3.5.1.	Proposed Project Operations.....	3-30
3.5.2.	Proposed Project Generation.....	3-33
3.5.3.	Effects of Hydrologic Change	3-45
4.	Description of Existing Environment and Resource Impacts.....	4-1
4.1.	Summary.....	4-1
4.2.	Basin Overview.....	4-5
4.2.1.	Major Land Uses and Demography	4-5
4.2.2.	Major Water Uses	4-8
4.2.3.	Lakes and Dams	4-8
4.2.4.	Tributaries and Streams	4-10
4.2.5.	Climate.....	4-10
4.2.6.	References.....	4-11
4.3.	Geology and Soils.....	4-11
4.3.1.	Regional Geology	4-11
4.3.2.	Seismic Geology.....	4-13
4.3.3.	Watana Dam Site Geologic Conditions	4-15
4.3.4.	Overburden and Project Area Soils.....	4-18
4.3.5.	Reservoir Shoreline and Downstream River Banks.....	4-19
4.3.6.	Geologic Conditions and Project Excavations.....	4-21
4.3.7.	Potential Adverse Impacts	4-21
4.3.8.	Potential Protection, Mitigation, and Enhancement	4-22
4.3.9.	References.....	4-24
4.4.	Water Resources	4-25
4.4.1.	Drainage Basin Hydrology	4-26
4.4.2.	Existing and Proposed Water Uses.....	4-43
4.4.3.	Water Quality.....	4-45
4.4.4.	Ice Dynamics	4-57
4.4.5.	Bedload and Suspended Sediments	4-59
4.4.6.	Potential Access and Transmission Corridors	4-68
4.4.7.	Potential Adverse and Positive Impacts.....	4-68

4.4.8.	Potential Protection, Mitigation, and Enhancement	4-75
4.4.9.	References.....	4-76
4.5.	Fish and Aquatic Resources.....	4-87
4.5.1.	Introduction.....	4-87
4.5.2.	Existing Fish and Aquatic Communities	4-89
4.5.3.	Federally Designated Habitats	4-116
4.5.4.	Potential Adverse and Positive Impacts.....	4-117
4.5.5.	Potential Protection, Mitigation, and Enhancement	4-121
4.5.6.	References.....	4-122
4.6.	Wildlife and Botanical Resources.....	4-126
4.6.1.	Introduction.....	4-126
4.6.2.	Wildlife	4-128
4.6.3.	Botanical Resources.....	4-171
4.6.4.	Potential Adverse and Positive Impacts.....	4-195
4.6.5.	Potential Protection, Mitigation, and Enhancement	4-206
4.6.6.	References.....	4-209
4.7.	Wetlands, Riparian, and Littoral Resources	4-226
4.7.1.	Introduction.....	4-226
4.7.2.	Potential Adverse and Positive Impacts.....	4-232
4.7.3.	Potential Protection, Mitigation, and Enhancement	4-235
4.7.4.	References.....	4-236
4.8.	Rare, Threatened and Endangered Species.....	4-242
4.8.1.	Plant Species	4-242
4.8.2.	Special Status Birds	4-243
4.8.3.	Special Status Mammals.....	4-248
4.8.4.	Special Status Fish	4-252
4.8.5.	Special Status Amphibians and Reptiles.....	4-253
4.8.6.	Essential Fish Habitat	4-253
4.8.7.	Relevant Biological Opinions, Status Reports, and Recovery Plans	4-254
4.8.8.	Potential Adverse and Positive Impacts.....	4-255
4.8.9.	Potential Protection, Mitigation, and Enhancement	4-257
4.8.10.	References.....	4-257

4.9.	Aesthetic Resources	4-265
4.9.1.	Existing Aesthetic Resource Conditions.....	4-267
4.9.2.	Potential Adverse and Positive Impacts.....	4-272
4.9.3.	Potential Protection, Mitigation, and Enhancement	4-274
4.9.4.	References.....	4-277
4.10.	Recreation and Land Use	4-277
4.10.1.	Introduction.....	4-277
4.10.2.	Current Recreational Use of the Region and Project Vicinity .	4-287
4.10.3.	Recreation-Related Goals and Needs.....	4-296
4.10.4.	Protected River Segments	4-302
4.10.5.	National Trails System and Wilderness Areas.....	4-303
4.10.6.	Shoreline Buffer Zones and Adjoining Land Uses	4-303
4.10.7.	Land Uses and Management	4-303
4.10.8.	Potential Adverse and Positive Impacts.....	4-308
4.10.9.	Potential Protection, Mitigation, and Enhancement	4-312
4.10.10.	References.....	4-314
4.11.	Cultural and Subsistence Resources	4-317
4.11.1.	Cultural Resources	4-317
4.11.2.	Subsistence Resources	4-321
4.11.3.	Applicable Laws and Regulations	4-322
4.11.4.	Potential Adverse and Positive Impacts.....	4-327
4.11.5.	Existing Discovery Measures	4-329
4.11.6.	Affected Tribes and Populations.....	4-336
4.11.7.	Potential Protection, Mitigation and Enhancement	4-338
4.11.8.	References.....	4-342
4.12.	Socioeconomic Resources	4-352
4.12.1.	Introduction.....	4-352
4.12.2.	Land Use and Real Estate	4-354
4.12.3.	Demographics	4-356
4.12.4.	Public Sector (Taxes and Services).....	4-368
4.12.5.	Electricity	4-375
4.12.6.	Potential Adverse and Positive Impacts.....	4-377
4.12.7.	Potential Protection, Mitigation, and Enhancement	4-378

4.12.8.	References.....	4-380
4.13.	Alaska Native Resources	4-382
4.13.1.	Introduction.....	4-382
4.13.2.	Alaskan Native Consultation	4-382
4.13.3.	Potential Impacts.....	4-388
4.13.4.	Potential Protection, Mitigation, and Enhancement	4-389
4.14.	Transportation.....	4-391
4.14.1.	Introduction.....	4-391
4.14.2.	Roads.....	4-391
4.14.3.	Rail.....	4-391
4.14.4.	Aviation.....	4-392
4.14.5.	Potential Adverse and Positive Impacts.....	4-394
4.14.6.	Potential Protection, Mitigation and Enhancement	4-394
4.14.7.	References.....	4-395
5.	Preliminary Issues and Studies List	5-1
5.1.	Development of Preliminary Issues and Studies	5-1
5.2.	Preliminary Issues and Information Needs.....	5-10
5.2.1.	Water Resources Issues.....	5-11
5.2.2.	Water Quality Issues.....	5-13
5.2.3.	Geomorphology/Geology/Soils Issues.....	5-16
5.2.4.	Fish and Aquatic Resource Issues.....	5-18
5.2.5.	Wildlife Resource Issues.....	5-23
5.2.6.	Botanical Resource Issues.....	5-34
5.2.7.	Aesthetic Resource Issues.....	5-38
5.2.8.	Recreation and Land Use Resource Issues	5-40
5.2.9.	Cultural Resource Issues.....	5-44
5.2.10.	Subsistence Resource Issues.....	5-46
5.2.11.	Socioeconomic and Transportation Issues.....	5-48
5.3	Relevant Plans.....	5-56
6.	Summary of Contacts	6-1

APPENDICES (SEE VOLUME II)

- Appendix 4.4-1 Existing Water Quality Data for the Susitna River and Tributaries
- Appendix 4.6-1 Wildlife Habitat Scores
- Appendix 4.9-1 Photographs
- Appendix 4.9-2 Landscape Character Type Descriptions
- Appendix 4.9-3 Notable Natural Features Photographs
- Appendix 4.9-4 Aesthetic value and Visual Absorption Capability Ratings
- Appendix 4.10-1 ANCSA 17(b) Easement Maps
- Appendix 4.13-1 Corporation and Tribe Contact Information
- Appendix 6-1 Pre-PAD Correspondence and Meeting Notes
- Appendix 6-2 Susitna-Watana Project Contact List

LIST OF TABLES

- Table 2.2-1 Susitna-Watana Proposed Process Plan and Schedule
- Table 2.3-1 Documents Distribution Guidelines
- Table 4.3-1 Potential geology and soils impact issues.
- Table 4.3-2 Proposed protection, mitigation, and enhancement measures.
- Table 4.4-1 Reach segmentation for the Susitna River basin water quality analysis
- Table 4.4-2 USGS streamflow gages in the Susitna watershed
- Table 4.4-3 Average monthly flows (cfs) at USGS gages in the Susitna watershed
- Table 4.4-4 Average flows (cfs) at USGS Gage 15292000 – Susitna River at Gold Creek
- Table 4.4-5 Average Flows (cfs) at USGS Gage 1529150 – Susitna River near Cantwell
- Table 4.4-6 Estimated Monthly Average Flow (cfs) at the Watana Dam Site
- Table 4.4-7 Percent flow contribution of Susitna River locations to flow at the Susitna Station USGS gage (RM 25.8).
- Table 4.4-8 Alaska State Water Quality Standards for the Protection of Aquatic Life and Wildlife (18 AAC 70, May 2011).
- Table 4.4-9 Alaska State Water Quality Standards for Toxics and Other Deleterious Organic and Inorganic Substances (December 2008).

- Table 4.4-10 Location of water quality criteria exceedances in the Susitna River drainage.
- Table 4.4-11 Available toxics threshold concentrations that affect select fish species known to occur in the Susitna River drainage.
- Table 4.4-12 Location of water quality conditions that present potential bioaccumulation of toxics in fish species in the Susitna River drainage.
- Table 4.4-13 Suspended sediment at Gold Creek – May to September 1952.
- Table 4.4-14 1981 bedload transport data Susitna River Basin
- Table 4.4-15 1982 turbidity and suspended sediment analysis
- Table 4.4-16 Susitna River at Gold Creek – monthly summary of suspended sediment, Wy 1953
- Table 4.5-1 Summary of life history, known Susitna River usage, and known extent of distribution of fish species within the lower, middle, and upper Susitna River reaches (From ADF&G 1981 a, b, c, etc.).
- Table 4.5-2 Sockeye salmon in-river abundance estimates from Yentna River and Susitna Riverb sonar counts, 1973 through 2009.
- Table 4.5-3 Sockeye salmon in-river abundance estimates from Yentna River and Susitna River mark recapture studies, 1974 through 2008.
- Table 4.5-4 Sockeye salmon in-river abundance estimates from Yentna River and Susitna River lake outlet weir counts, 1973 through 2009.
- Table 4.5-5 Susitna River Chinook salmon escapement index counts derived from peak aerial and foot surveys of index streams, 1979 through 2006.
- Table 4.5-6 Susitna River Coho salmon in-river abundance derived from sonar and weir counts and from peak aerial and foot surveys of index streams, 1981 through 2006 (Ivey 2009).
- Table 4.5-7 Arctic grayling population estimates in the Upper Susitna River Reach proposed impoundment zone, during 1981 and 1982.
- Table 4.6-1 Terrestrial mammal species reported to occur in the Susitna River basin (reprinted from ABR 2011b).
- Table 4.6-2 Bird species recorded, or likely to occur, in the Susitna River basin (reprinted from ABR 2011b).
- Table 4.6-3 Extent and relative abundance of vegetation types mapped in the upper and middle Susitna River basin for the original Susitna Hydroelectric Project.

- Table 4.6-4 Invasive vascular plant species that may occur in areas disturbed during development of the proposed Susitna–Watana Hydroelectric Project.
- Table 4.6-5 Potential impacts of the proposed Susitna–Watana Hydroelectric Project on terrestrial wildlife and botanical resources (adapted from LGL 1985a).
- Table 4.6-6 Acreage of vegetation types expected to be lost to Stage I (Low Watana) development for the original Susitna Hydroelectric Project (reproduced from APA 1985a).
- Table 4.7-1 Wetlands (NWI classes) mapped for the APA Susitna Hydroelectric Project (adapted from USFWS 1984).
- Table 4.7-2 Acreage of wetland types expected to be lost to APA Project Stage I (Low Watana) development (reproduced from APA 1985).
- Table 4.8-1 Rare vascular plant taxa that have been collected in a broad region of Southcentral Alaska, including the Susitna River drainage.
- Table 4.8-2 Special status bird species that may occur in the study area.
- Table 4.9-1 Aesthetic Impact Potential Composite Ratings.
- Table 4.11-1 GMU 13 big game regulations.
- Table 4.11-2 Summary of the number of known cultural resources and NRHP eligible sites within 5 mi of each potential area of impact.
- Table 4.11-3 Summary data for all resources harvested by Project area communities.
- Table 4.11-4 List of Tribes and populations in Project area.
- Table 4.11-5 Total potential subsistence population in Project area.
- Table 4.12-1 Policy PO1-4; Park and open space levels of service.
- Table 4.12-2 Populations of the CDPs, Boroughs and Railbelt in the Project study area.
- Table 4.12-3 Populations of the CDPs, Boroughs and Railbelt in the Project study area, by race and ethnicity.
- Table 4.12-4 Populations of the CDPs, Boroughs and Railbelt in the Project study area, by gender and age.
- Table 4.12-5 Incomes in the CDPs, Boroughs and Railbelt in the Project study area.
- Table 4.12-6 Employment in the CDPs, Boroughs and Railbelt in the Project study area, by occupation.

Table 4.12-7 Employment in the CDPs, Boroughs and Railbelt in the Project study area.

Table 4.12-8 Employment in the CDPs, Boroughs and Railbelt in the Project study area, by industry.

Table 4.12-9 Schools in the MSB school district near the Project site.

Table 4.12-10 Denali Borough budget for fiscal year 2012.

Table 4.12-11 MSB estimated expenditures for federal year 2011.

Table 4.12-12 MSB estimated revenues for federal year 2011.

Table 4.13-1 Federally-recognized Tribes (25 CFR § 86) within the Project impact area by region.

Table 5.1-1 Summary of identified resource issues and corresponding studies, Susitna-Watana Hydroelectric Project licensing.

Table 5.2-1 Summary of Subsistence Data Gaps

Table 5.2-1 Summary of subsistence data gaps.

Table 5.2-2 Potential Socioeconomic Issues Related to the Proposed Project.

Table 5.2-3 Summary of Socioeconomic Data Gaps.

Table 5.2-4 Transportation Issues Related to the Proposed Project.

Table 5.2-5 Summary of Transportation Data Gaps.

Table 6-1 Summary of communications with stakeholders since January 2011.

LIST OF FIGURES

- Figure 1-1 Susitna-Watana Project Area
- Figure 2-1 Susitna-Watana Licensing Schedule Summary
- Figure 3.3-1 Site Plan
- Figure 3.3-2 Low Level Outlet
- Figure 3.3-3 Outlet Spillway
- Figure 3.3-4 Power Intake Structure
- Figure 3.3-5 Powerhouse
- Figure 3.3-6 Typical Road Details
- Figure 3.3-7 One Line Diagram
- Figure 3.3-8 Transmission Line Route and Typical Details
- Figure 3.4-1 Project Development Schedule
- Figure 3.5-1 Daily Reservoir Elevation (ft) for Selected Years
- Figure 3.5-2 Reservoir Elevation (ft) for the Driest Period
- Figure 3.5-3 Average Monthly Natural and Regulated Flows and Environmental Flow Requirements at Gold Creek
- Figure 3.5-4 Railbelt Utilities Typical January Day Load Shape
- Figure 3.5-5 Projected Railbelt Electrical Demands
- Figure 3.5-6 Annual Average Energy Generation (MWh)
- Figure 3.5-7 Monthly Average Energy Generation (MWh)
- Figure 3.5-8 Railbelt Monthly Energy Demand Pattern Compared with Reservoir Inflow Pattern
- Figure 3.5-9 Daily Power Output (MW) for Selected Years
- Figure 3.5-10 Daily Powerhouse Discharge for Selected Years
- Figure 3.5-11 Daily Outlet Releases at Watana Dam for Selected Years (cfs)

- Figure 3.5-12 Natural and With-Project Flows at Watana
- Figure 3.5-13 Natural and With-Project Flows at the Gold Creek USGS Gage
- Figure 3.5-14 Natural and With-Project Flows at the Sunshine USGS Gage
- Figure 3.5-15 Natural and With-Project Flows at Susitna Station USGS Gage
- Figure 3.5-16 April Recorded Flows (cfs) – Susitna River at Gold Creek
- Figure 3.5-17 June Recorded Flows (cfs) – Susitna River at Gold Creek
- Figure 3.5-18 Annual Recorded Flows (cfs) – Susitna River at Gold Creek
- Figure 3.5-19 April Recorded Flows (cfs) – Susitna River at Gold Creek
- Figure 3.5-20 Change in Annual Mean Runoff (mm/day) for the Period 2080-2099
- Figure 4.1-1 Project Study Area at Dam Site
- Figure 4.1-2 Susitna River Schematic
- Figure 4.2-1 Susitna River Hydrologic Features
- Figure 4.4-1 Susitna River Drainage Basin Boundary and Streamflow Gage Locations
- Figure 4.4-2 Susitna watershed USGS flow data – chronological availability.
- Figure 4.4-3 Susitna River Flow Frequency at Gold Creek.
- Figure 4.4-4 Susitna River Flow Frequency at Cantwell.
- Figure 4.4-5 Estimated Susitna River Flow Duration at Watana Dam Site for Low Flow Months based on Gold Creek Gage Measurements, 1949-2010.
- Figure 4.4-6 Estimated Susitna River Flow Duration at Watana Dam Site for High Flow Months based on Gold Creek Gage Measurements, 1949-2010.
- Figure 4.4-7 Susitna River Flow Duration at Watana for Low Flow Months.
- Figure 4.4-8 Percent flow contribution of Susitna River locations to flow at the Susitna Station USGS gage.
- Figure 4.4-9 Average annual recorded flows (cfs) – Susitna River at Gold Creek.
- Figure 4.4-10 February recorded flows (cfs) – Susitna River at Gold Creek.
- Figure 4.4-11 April recorded flows (cfs) – Susitna River at Gold Creek.

Figure 4.4-12 June recorded flows (cfs) – Susitna River at Gold Creek.

Figure 4.4-13 Average annual recorded flows (cfs) – Susitna River at Gold Creek.

Figure 4.4-14 Susitna River Channel Morphology at River Mile 91 from August 1984 and 2011.

Figure 4.5-1 Locations of fish wheel capture sites, weirs, and radio tracking stations and final locations of radio-tagged sockeye salmon based on 2008 aerial surveys in the Susitna River. Image copied from Yanusz 2011.

Figure 4.5-2 Movement of radio-tagged Chinook salmon 660-1 in the Susitna River drainage during June and July, Adult Anadromous Investigations. Source: ADF&G 1983a

Figure 4.5-3 Final locations of 300 radio-tagged coho salmon based on 2009 aerial surveys in the Susitna River. Image copied from Merizon 2009.

Figure 4.5-4 Final locations of 239 radio-tagged chum salmon based on 2009 aerial surveys in the Susitna River. Image copied from Merizon 2009.

Figure 4.5-5 Essential Fish Habitat for the Susitna River Drainage.

Figure 4.6-1 Regional Overview of the Susitna River Basin and Subbasins

Figure 4.6-2 Game Management Units and Subunits in and near the Susitna River Basin

Figure 4.6-3 Moose Study Area

Figure 4.6-4 Moose Movement

Figure 4.6-5 Moose Overwintering

Figure 4.6-6 Moose Calving Areas

Figure 4.6-7 Radio-collared Moose

Figure 4.6-8 Caribou Historic Range

Figure 4.6-9 NCH Population Estimates

Figure 4.6-10 Radio-collared Caribou during Calving Period

Figure 4.6-11 Nelchina Caribou Migratory Routes

Figure 4.6-12 Dall Sheep Study Area

Figure 4.6-13 Black Bear Habitat

Figure 4.6-14 Wolverine Ranges

Figure 4.6-15 Fox Dens

Figure 4.6-16 Waterfowl Lakes

Figure 4.6-17 Extent of Regional Land-cover and Vegetation Mapping in the Susitna River Basin

Figure 4.6-18 Vegetation Succession

Figure 4.7-1 Wetlands Mapped in the Western Portion of the Proposed Watana Reservoir Study Area

Figure 4.7-2 Wetlands Mapped in the Eastern Portion of the Proposed Watana Reservoir Study Area

Figure 4.8-1 Cook Inlet beluga whale critical habitat

Figure 4.9-1 Physiographic Regions

Figure 4.9-2 Landscape Character Types

Figure 4.10-1 Southcentral Alaska Recreational Amenities

Figure 4.10-2 George Parks Highway Recreational Amenities

Figure 4.10-3 Denali Highway Recreational Amenities

Figure 4.10-4 Susitna Area Plan Boundaries

Figure 4.12-1 Project Area

Figure 4.12-2 Matanuska-Susitna Borough Fire Service Areas

Figure 4.12-3 Electrical Utility Service Areas

Figure 4.14-1 Public Use Airports

LIST OF ACRONYMS AND SCIENTIFIC LABELS

ABBREVIATION	DEFINITION
AAC	Alaska Administrative Code
AC	Alternating current
ACHP	Advisory Council on Historic Preservation
acre-feet	Ac-ft
ACS	American Community Survey
ACSR	Aluminum conductor steel reinforced
AD	<i>Anno Domini</i>
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
ADOT&PF	Alaska Department of Transportation and Public Facilities
ADOTPFGR	ADOT Central Region Planning
ADOTPFNR	ADOT Northern Region Planning
AEIDC	Arctic Environmental Information and Data Center
AFB	Air Force Base
AHRS	Alaska Heritage Resources Survey
AHMG	Alaska Habitat Management Guides
Ahtna	Ahtna, Inc.
AKNHP	Alaska Natural Heritage Program
AMP	Airport Master Plan
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act of 1980
AP	Acid potential
APA	Alaska Power Authority
APE	Area of potential effect
APLICs	Alaska Public Lands Information Centers
ARRC	Alaska Railroad Corporation
AS	Alaska Statutes
ASCP	Alaska Shorebird Conservation Plan
ASG	Alaska Shorebird Group
AST	Alaska State Trooper
ASTM	American Society for Testing and Materials
ATV	All-terrain vehicle

AVC	Alaska Vegetation Classification
BCC	Birds of conservation concern
BDPs	Best development practices
BIA	U.S. Department of the Interior, Bureau of Indian Affairs
BLM	U.S. Department of the Interior, Bureau of Land Management
BLM-S	BLM sensitive species
BLM-W	BLM watch list species
BMC	Birds of management concern
BMPs	Best management practices
BOD	Biochemical oxygen demand
BOF	Alaska Board of Fisheries
BP	Before present
BPIFWG	Boreal Partners in Flight Working Group
BPLUD	Mat-Su Borough Planning and Land Use Department
CATC	CIRI Alaska Tourism
CDP	Census-designated place
CEII	Critical energy infrastructure information
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CIBW	Cook Inlet Beluga Whales
CIRI	Cook Inlet Region, Inc.
cm	Centimeter
CNIPM	Alaska Committee for Noxious and Invasive Plants Management
CO	Carbon monoxide
COY	Cubs of the year
CSIS	ADF&G Community Subsistence Information System
DBSD	Denali Borough School District
DC	Direct current
DCCED	Alaska Department of Commerce, Community, and Economic Development
DEED	Alaska Department of Education and Early Development
DHHS	Alaska Department of Health and Social Services
DIDSON	Dual Frequency Identification Sonar
DO	Dissolved oxygen
DOI	U.S. Department of the Interior
Doyon	Doyon, Ltd.

DPOR	ADNR Division of Parks and Outdoor Recreation
DSM	Demand Side Management
EARMP	East Alaska Resource Management Plan
EE	Energy Efficiency
EFH	Essential fish habitat
EIM	Environmental Information Management
EIS	Environmental Impact Statement
El.	Elevation
EMS	Emergency medical services
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
et al.	" <i>et alia</i> "; and the rest
FAA	Federal Aviation Administration
ft	Feet
ft MSL	Feet Mean sea level
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHA	USDOT Federal Highway Administration
FMP	Fishery Management Plan
fps	Feet per second
FR	Federal Register
FS	Featured species
FSA	Fire Service Area
FY	Fiscal Year
g	Gram
G2G	Government-to-government
GIS	Geographic Information System
GMP	General Management Plan
GMU	Game Management Unit
GPS	Global positioning system
GU	Globally unrankable
GVEA	Golden Valley Electric Association
HDR	HDR Alaska, Inc.; HDR, Inc.
HEA	Homer Electric Association
HRA	Historical Research Associates

IFRR	Instream Flow Relationships Report
ILP	Integrated Licensing Process
in	Inch
IPCC	Intergovernmental Panel on Climate Change
ISER	University of Alaska Anchorage Institute for Social and Economic Research
ISR	Initial study report
KABATA	Knik Arm Bridge and Toll Authority
kcmil	Circular mils
kg	Kilogram
km	Kilometer
km ²	Kilometer(s) squared
kV	Kilovolt
L	Liter(s)
licensing participants; Participants	Agencies, ANSCA corporations, Alaska Native entities and other stakeholders
LRTP	Long Range Transportation Plan
LOEL	Lowest Observable Effect Level
LWCF	Land and Water Conservation Fund
m	Meter(s)
M	Million
m ²	Square meter(s)
MAPS	Monitoring Avian Productivity and Survivorship
Mat-Su	Matanuska Susitna
MBTA	Migratory Bird Treaty Act
MEA	Matanuska Electric Association
mg	Milligram
mg/L	Milligrams per liter
mi ² ; sq.mi.	Square mile(s)
mi	Mile(s)
ml	Milliliter(s)
ML&P	Anchorage Municipal Light and Power
mm	Millimeter(s)
MON	Museum of the North
MP	Mile post
mph	Miles per hour
M.S.	Master of Science

MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSB	Matanuska-Susitna Borough
MSL	Mean sea level
MVA	Megavolt-Ampere
MW	Megawatts (one million watts)
MWh	Megawatt hour
n/a	Not applicable <i>or</i> not available
NAAQS	National Ambient Air Quality Standards
NAWCP	North American Waterfowl Conservation Plan
NAWMP	North American Waterfowl Management Plan
NCI	Northern Cook Inlet
n.d.	No date
NCM	Newton Centimeter
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NLCD	National Land Cover Dataset
NLUR	Northern Land Use Research
NMFS	NOAA National Marine Fisheries Service
No.	Number
NO ₂ ; NO ₂	Nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOEL	No Observed Effects Level
NOI	Notice of intent
NPCA	National Parks Conservation Authority
NPS	U.S. Department of the Interior, National Park Service
NRC	Natural Resources Consulting
NRCS	USDA Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTU	Nephelometric turbidity unit
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
O ₃	Ozone
O&M	Operations and maintenance
OHV	Off-highway vehicle

ORV	Off-road vehicle
PAD	Pre-Application Document
Pb	Lead
PCE	Primary Constituent Elements
PDD	Preliminary Decision Document
PHABSIM	Physical Habitat Simulation
PhD	Doctor of Philosophy
PL	Public Law
PLC	Programmable logic controller
PLP	Preliminary license proposal
PM	Particulate matter
PM _{2.5} ; PM2.5	Particulate matter up to 2.5 microns in diameter
PM ₁₀ ; PM10	Particulate matter up to 10 microns in diameter
PM&E	Protection, mitigation and enhancement
PMF	Probable maximum flood
lb	Pound
POW	Palustrine open water (ponds under 20 ac)
ppb	Parts per billion
Project	Susitna-Watana Hydroelectric Project
PSD	Prevention of Significant Deterioration
PSP	Proposed Study Plan
RASP	Regional Aviation System Plan
RCC	Roller compacted concrete
Rd	Recreation-dispersed
RIRP	Railbelt Integrated Resources Plan
RM	River mile
ROS	Recreational opportunity spectrum
RS	Revised statute
RSP	Revised study plan
RTE	Rare, threatened and endangered
s	Second
SANPCC	Southcentral Alaska Northern Pike Control Committee
SaSI	Salmonid Stock Inventory
SB	Senate bill

SCORP	Statewide Comprehensive Outdoor Recreation Plan
SCRO	ADNR South Central Regional Office
SD1	Scoping document 1
SD2	Scoping document 2
SDVCSC	South Denali Visitor Center Steering Committee
SES	City of Seward Electric System
sf; ft ²	Square foot (feet)
SHP	APA Susitna Hydroelectric Project
SHPO	State Historic Preservation Officer
SMAP	Susitna Matanuska Area Plan
SMP	Shoreline Management Plan
SO ₂ ; SO ₂	Sulfur dioxide
SpUD	Special use district
SQL	Standard query language
SRMAs	Special Recreation Management Areas
STB	Surface Transportation Board
SVO	Successor Village Organizations
SWHP	Susitna-Watana Hydroelectric Project
TCP	Traditional cultural property
TCW	Talkeetna Mountains and Chulitna-Watana Hills
TDG	Total dissolved gas
TDS	Total dissolved solids
TEK	Traditional Environmental Knowledge
TOC	Total organic carbon
TSP	Total suspended particulate
UAAES	University of Alaska Agriculture Experiment Station
UAFAFES	University of Alaska Fairbanks Agricultural and Forestry Experiment Station
UCG	Underground coal gasification
U.S., US	United States
USACE	U.S. Army Corps of Engineers
U.S.C.; USC	U.S. Code
USCB	U.S. Department of Commerce, Census Bureau
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USFS	USDA, Forest Service

USFWS	USDOI, Fish and Wildlife Service
USGS	USDOI, Geological Survey
USR	Updated study report
USSCP	U.S. Shorebird Conservation Plan
VFD	Volunteer Fire Department
VHF	Very high frequency
VOC	Volatile organic compound
VRM	Visual Resource Management system
WDFW	Washington Department of Fish and Wildlife
WSR	Wild and Scenic River
yd	Yard(s)
¹⁴ C	Carbon 14
°C	Degrees Celsius
°F	Degrees Fahrenheit
µg	Microgram
µg/L	Micrograms per liter
µg/m ³	Microgram per cubic meter
µL	Microliter(s)