2. SCOPE OF WORK

2.1. Evolution of Plan of Study

The purpose of this feasibility study is to define all aspects of the Project in sufficient detail to support the State's decision process regarding project development, and further to support eventual submission of a FERC license application. This Engineering Feasibility Report documents the status of all engineering work undertaken through December 2014. The Engineering Feasibility Report may be supplemented or modified at the completion of required future geotechnical investigations, which will include excavation of adits, additional foundation boreholes, in-situ testing, etc.

All engineering work undertaken for the feasibility report has utilized, to the extent possible, the results of the engineering studies carried out during feasibility study and licensing work that were performed in the 1970s through the mid-1980s. Some items, such as the dam type selection, probable maximum flood (PMF) studies, and the previous sizing of the generating units are now not applicable, and thus have been updated.

In addition, in order to properly focus the environmental studies needed to support the license application, some project definition work was accelerated to reduce the number of alternatives for detailed analyses. Other studies have also been completed to address specific issues that have arisen. An overview of the scope of work for the current phase of study is given below.

2.2. Hydrology

Hydrological studies include:

- Development of a 61-year Watana Dam inflow data set to use in reservoir operation simulation modeling studies;
- Establish a meteorological network in the upper Susitna Basin, from Gold Creek to the Alaska Range (by others), to develop an understanding of the weather parameters;
- Perform maximization and transposition analysis of selected historic storms to provide data toward development of a site-specific PMP study to update the work performed during the 1980s feasibility studies;
- Perform flood frequency analysis, and sub-basin segmentation, and develop a rainfall-runoff model of the Susitna River upstream of Gold Creek. Apply the model to recreate previous PMF studies, initiate calibration of the model to historic floods, and determine

the 100-year and probable maximum snowpack depths and areal distribution all to support derivation of the PMF inflow to the reservoir;

- Confirmation of the diversion flood magnitude to be used to size temporary diversion facilities for project construction; and,
- Derivation of the pre-project and post-project flow variations in the Susitna River downstream of the dam and powerhouse.

2.3. Power Studies

Power studies include:

- Determination of the available average and firm energy from the project for different reservoir sizes and power plant capacities;
- Modeling the effect of projected reservoir operation and power plant discharges on downstream river stage and flow;
- Preliminary assessment of climate change effects on energy generation;
- Determination of the available, average, and firm energy for various operating scenarios including load-following, base load, intermediate load-following, and run-of-river operation; and,
- Modeling of the operation of the project in conjunction with the rest of the integrated Railbelt utilities' electrical system based on Susitna-Watana generation data provided by Slater Consulting.

2.4. Geotechnical Exploration and Characterization

Geotechnical tasks include:

- Preparation and inception of site investigation programs to supplement the 1980s work;
- Supervision of the field exploration program;
- Data compilation and analysis;
- Establish geotechnical instrumentation network in the dam site area;
- Interpretation of the geological and geotechnical investigations of the foundations for the dam and powerhouse and surrounding areas;
- Preparation of a Geotechnical Data Report; and

- Update terrain unit mapping (regional geology) and preparation of a preliminary reservoir slope stability assessment.

A significant site investigation program was planned for 2013 and 2014, including at least one adit in the right abutment at the dam site. Due to circumstances beyond the control of the engineering team, this site investigation program at the dam site had to be postponed, so this draft report has been compiled based on information gathered prior to December 2014.

2.5. Seismic Studies

Seismic studies include:

- Establishment of a seismic monitoring network at the project site;
- Paleoseismic investigation and seismic source characterization;
- Site Specific Seismic Hazard Assessment; and,
- Reservoir Triggered Seismicity Assessment.

2.6. Development of Layout and Design

Layout studies include:

- Analysis of the type of dam and project layout to assess which is most economic; Earth Core Rockfill Dam, Concrete Faced Rockfill Dam, or Roller Compacted Concrete Dam;
- Verification of location, plan and cross-section of the selected dam;
- Verification of the number and size of generating units;
- Verification of the number, size and optimization of diversion tunnel(s);
- Verification of the normal maximum operating level, range of annual reservoir drawdown and dam height;
- Preliminary structural and thermal analyses of the dam;
- Verification of spillway size and configuration;
- Verification of size and optimization of environmental release facilities; and,
- Development of preliminary design criteria and assumptions.

2.7. Access

Access studies include:

- Reconnaissance studies of various alternative access road (and railway) alignments to the project site that were identified for the Alaska Energy Authority (AEA) by Alaska Department of Transportation and Public Facilities (ADOT&PF);
- Further definition of the potential access routes, and selection of the associated environmental study corridors;
- Preliminary design of a railroad off-loading facility from the Alaska Railroad Corporation (ARRC) to the potential road access route; and,
- Selection of the location and the design of an airstrip and associated facilities at the project site.

2.8. Transmission

Studies associated with the power delivery from the Project to the interconnected system include:

- Evaluation of future system improvements necessary on the Railbelt intertie, whether Susitna-Watana is built or not (performed under a separate contract to AEA).
- System studies to:
  - verify load flow in the system;
  - verify the maximum size of units that can be installed at Susitna-Watana without significant destabilizing of the system during load variances; and,
  - verify system improvements necessary to accept Susitna-Watana power.
- Determination of three alternative transmission corridors, each close to the potential access road alignments (to lower total costs).
- Interconnection substation layouts.

The work carried out under this evaluation relating to system improvements on the Railbelt intertie was preliminary in nature. In 2013, a second more detailed study was initiated separately.

2.9. Surveys

The early stages of the project analysis relied upon data that was developed as part of the 1980s study. The dam analysis and hydrological assessments were limited to the quality of the data.

The topographic data used was hand digitized from paper copies of the 1980s topographic survey. For the first reconnaissance study of the roads, the survey used Horizontal North American Datum of 1927 and National Geodetic Vertical Datum of 1929). Contour intervals were 100 ft.

After this initial work was completed, the first topographic data became available using the Interferometric Synthetic Aperture Radar Elevation Data (IFSAR) elevation data and the MatSu-North Susitna Bare Earth Data using Horizontal North American Datum of 1983 and North American Vertical Datum of 1988. The IFSAR data had a vertical accuracy of +/- 10 ft. (+/- 3 meters). A secondary scope of work was initiated to transfer all applicable data to the new, more accurate, topography and to recalibrate the survey coordinate system.

2.10. Site Facilities

Studies of the facilities required to support construction and subsequent operation and maintenance include:

- Preliminary layouts of the temporary field investigation and construction camps;
- Layout of permanent operators' village; and,
- Layout of water supply, fire water, wastewater collection and treatment, roads, solid waste disposal etc. together with associated infrastructure.

2.11. Construction Cost Estimates and Schedules

Tasks associated with estimating include:

- Construction planning, including matters such as quarry development, excavation planning, sequencing/staging and materials supply chain, etc.;
- Identification of risk elements;
- Derivation of a cost estimate for the whole project construction at the time of submission of the Pre-Application Document (December 2011 / January 2011);
- Preparation of a schedule for development and construction of the selected project configuration;
- Probabilistic analysis of the schedule to determine likely finish dates and to highlight areas of project development and design upon which to focus as priorities;
- Development of cost estimate assumptions;

- Further cost estimation after 12 months of preliminary design development (December 2012);
- Further cost estimation, using a "joint venture" approach in December 2013;
- Probabilistic analysis of the cost estimates in 2012, 2013 and 2014 to assess range of probable costs; and,
- Final Opinion of Probable Construction Cost of the chosen feasibility level design, at 2014 prices.

There has been engineering judgment (and conservatism) used in the selection of geotechnical parameters relating to the design, and ranges have been used in the cost estimate reflecting uncertainties, for example, bedrock surfaces. It is therefore important that this report is updated when the results of drilling, seismic profiling, structural geologic mapping, and the adit construction, mapping and testing becomes available.