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SUSITNA-WATANA HYDRO

Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Geology and Soils Resources
Study Plan Section 4 Introduction

Final Study Plan

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

July 2013

4. GEOLOGY AND SOILS

This study plan will review the existing information on the Susitna-Watana Project (Project) area regarding geology and soils and gather additional information in order to define the geologic, geotechnical, seismic, and foundation conditions at the sites of Project works (e.g., dam, reservoir, access road and T-Line corridors, construction camps, and materials borrow sites). This information will be used to support development of the Project design, with an emphasis on minimizing risks to dam safety. In general, the study tasks will include field investigations, laboratory testing, instrumentation, review of existing studies, studies and assessments, use of digital imagery, and engineering analyses to characterize the conditions, limitations, and constraints for the Susitna-Watana Project in the Project area. The study will also identify impacts of Project construction and operation, such as reservoir impoundment, thawing of frozen soils and bedrock, soil erosion along the reservoir rim, slope stability, excavation, and spoil disposal, on environmental resources.

4.1. Introduction

A Susitna Hydroelectric Project was proposed by the Alaska Power Authority (now the Alaska Energy Authority [AEA]) in the early 1980s. That project was to be composed of two major dams (the Watana Dam and Devils Canyon Dam) constructed in three stages. A draft Environmental Impact Statement was prepared by the Federal Energy Regulatory Commission (FERC), but the application was subsequently withdrawn. The current proposed Project dam is located at river mile (RM) 184, the same location as that of the previously proposed Watana Dam.

The Project is anticipated to include a high concrete arch dam constructed using roller-compacted concrete (RCC) construction methods. The Project will also include a large reservoir, a spillway, cofferdams, diversion tunnels, integrated penstocks and powerhouse, construction and permanent housing, borrow and quarry areas, transmission lines, access roads, and staging and stockpile areas. Each of these features will have an impact on, or will be impacted by, geology and soils over the course of design, construction, and operation of the Project.

4.2. Nexus Between Project Construction / Existence / Operations and Effects on Resources to be Studied

The soil and geological characteristics of the Project area will affect Project design, construction, operation, and maintenance because the Project facility foundations are integral to the soil and rock features of the area and also will serve as raw materials for some Project components. Also, Project design, construction, and operation, including the dam and reservoir, access road, transmission line, and construction camp/village, may affect geological resources by exposing soils and rock to new surface erosional forces, could change the stability of soil and rock slopes, change river sediment load, trigger seismic events earlier, and/or the reservoir could impound potential mineral resources, if present.

Considerations of geology and soil conditions in planning for Project construction, operation, and maintenance will include, but are not limited to the following:

- Proper disposal of spoils from the excavations.
- Geologic features in the foundation that may require additional excavation and foundation treatment.
- Identification of poor rock conditions or the presence of geologic features in the diversion tunnel excavation that may require support and/or lining (e.g., type and thickness).
- Design of rock cut-slopes on the right abutment, particularly in the downstream portal area.
- Identification of seismic sources and design of structures for seismic loading.
- Ice-filled discontinuities in the rock foundation beneath and in the abutments of the dam.
- Design of cut-off walls in the cobble and boulder alluvium beneath the cofferdams.
- Road, transmission tower footing, or camp foundation design to address subsidence due to poor soil conditions or thawing soil.
- Triggering of seismic events in the reservoir proper due to load of the reservoir on the landscape.
- Reservoir sedimentation due to glacial melt and possible surging glacier event.
- Changes to sediment load in the tailwater, downstream of the proposed dam.
- Stability of reservoir slopes due to mass wasting potential, thawing permafrost, and higher pore pressures.

Potential impact mechanisms for soils and geologic features are as follows:

- Soil erosion from slope instability along the reservoir rim due to presence of fine-grained soils and thawing permafrost (discontinuous).
- Seismic activity due to the deep, large reservoir.
- Changes to river channel geomorphology based on reservoir operation.
- Seepage through abutments just upstream of the dam causing piping and soil erosion.
- Soil erosion and slope instability along access road cuts and stream/creek crossings.
- Impoundment of mineral resources.

4.3. Resource Management Goals and Objectives

No Alaskan Native resource management goals have been identified other than the provisions identified under the Alaskan Native Claims Settlement Act (ANCSA) dealing with provision of access to mineral resources. FERC's regulations require the Exhibit E environmental document to include a detailed description of the project's impacts on affected resources, including the information included in the Pre-Application Document (PAD) and developed under the applicant's approved study plan (18 CFR 5.18(b)(5)(ii)(A)). The PAD must include a description of the geology and soils "of the proposed project and surrounding area" and a description of "mineral resources at the project site" (18 CFR 5.6(d)(3)(ii)(A)). The environmental analysis must also include an evaluation of beneficial and adverse effects of the proposed project on affected resources and mitigation measures if appropriate (18 CFR 5.18(b)(5)(ii)(B) and (C)). FERC's Scoping Document 2 (SD2) states that its Environmental Impact Statement (EIS) will include evaluation of the "effects of project construction and operation on access to proven or probable mineral deposits" (SD2, Section 4.2.1). FERC's

regulations also require the License Application to include Exhibit F, the supporting design report to show that the project structures are safe and adequate to fulfill their stated functions (18 CFR 5,18(a)(5)(ii) and 4.41(g)(3)).

4.4. Summary of Consultation with Agencies, Alaska Native Entities, and Other Licensing Participants Regarding Revised Study Plan Development

Specific consultation regarding geology and soils study planning has been limited to informal discussion with the Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys, during 2011 as part of planning the geotechnical and seismic investigations for the Project and the Alaska Earthquake Information Center for monitoring and detection of local earthquakes in the state seismograph network. Soil erosion and the potential for reservoir sedimentation and other issues have been discussed in Technical Workgroup (TWG) meetings, and the aquatic aspects of sediments are being addressed in the Geomorphology Study (Section 6.5). In FERC's May 31, 2012 filing of requests for studies and comments on preliminary study plan, a geology and soils assessment study was requested. In addition, Cook Inlet Region, Inc. (CIRI) has submitted a study request (filed May 30, 2012) for a minerals resource assessment that states that "CIRI owns or is entitled to receive conveyance of significant subsurface interests with the area that would be affected by the proposed Project." Both the FERC and CIRI study requests correspond to AEA's proposed geology and soils characterization study, and through this study plan AEA is attempting to meet the expectations and objectives of those study requests.

Summary tables of comments and responses from formal comment letters filed with FERC through November 14, 2012 were provided in the Revised Study Plan (RSP), Appendix 1, filed December 14, 2012. Copies of the formal FERC-filed comment letters were included in RSP Appendix 2. In addition, a single comprehensive summary table of comments and responses from consultation, dated from Proposed Study Plan (PSP filing) (July 16, 2012) through release of Interim Draft RSPs, were provided in RSP Appendix 3. Copies of relevant informal consultation documentation were included in RSP Appendix 4, grouped by resource area.

Consultation subsequent to the filing of the RSP is described within each Final Study Plan (FSP).