

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

**Geology and Soils Characterization Study  
Study Plan Section 4.5**

**Initial Study Report  
Part C: Executive Summary and Section 7**

Prepared for

Alaska Energy Authority



**SUSITNA-WATANA HYDRO**

*Clean, reliable energy for the next 100 years.*

Prepared by

MWH

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## TABLE OF CONTENTS

**Executive Summary ..... ii**

**7. Completing the Study ..... 1**

    7.1. Proposed Methodologies and Modifications ..... 1

        7.1.1. Decision Points from Study Plan ..... 1

        7.1.2. Modifications to Study Plan..... 1

    7.2. Schedule ..... 2

    7.3. Conclusion ..... 3

    7.4. Figures..... 4

## LIST OF FIGURES

Figure 7.2-1 Exploration Program Plan, 2014..... 5

## EXECUTIVE SUMMARY

Geology and Soils Characterization Study 4.5	
Purpose	Identify and document the geology and soils resources at the dam site and reservoir areas, evaluate the potential impacts of Project construction and operation, develop mitigation measures, and acquire data to support design of the Project.
Status	Field data collection and studies have begun; however, certain elements of the field investigation and testing program were deferred to a later date. Field activities included reconnaissance geologic mapping for development of regional geology, evaluation of reservoir slope stability, assessment of mineral resources, etc.
Study Components	The key study methods include field site investigations, drilling and sampling, downhole testing and instrumentation, and instrumentation monitoring; geologic mapping of the dam site and reservoir areas; geologic characterization and identification of construction material sources; assessment of seismic hazards, mineral resources, and reservoir slope stability; monitoring of earthquake events in the Project area; and geologic and engineering analysis. Other exploration methods may be employed as warranted.
2013 Variances	Land access restrictions in 2013 limited ground studies on Cook Inlet Regional Working Group (CIRWG) lands that were scheduled to be undertaken. This restriction largely impacted geologic mapping, geotechnical exploration and testing (e.g., drilling, geophysical surveys, geo-instrumentation monitoring), and the seismic hazard study. Consequently, the field exploration and testing program will be deferred to 2014 and 2015 study seasons.
Steps to Complete the Study	AEA will continue to implement this study in 2014 and 2015 with no modifications to the FERC-approved Study Plan. In 2014 field investigations will include geologic mapping, instrumentation and other activities as outlined in the Study Plan. These activities will continue into 2015. As described in the ISR Overview, AEA has added the Denali East Option road and transmission line alternative corridor to the study area. Data collection will continue, as provided in the Study Plan to complete remaining data needs for major study components including: regional geologic and mineral analysis, geologic and geotechnical testing program, reservoir triggered seismicity, and reservoir slope stability.

Geology and Soils Characterization Study 4.5	
Highlighted Results and Achievements	The regional geologic studies and terrain unit analysis update (Regional Geologic Analysis) were completed. The mineral resources assessment study and the preliminary reservoir slope stability studies will require additional field effort in 2015. A partial program of core drilling, sampling, and testing has been conducted at the dam site (2011–2012). A long-term earthquake monitoring network has been established and data on events are being collected. Seismic hazard studies are in progress with a preliminary probabilistic seismic hazard assessment (PSHA) and reservoir triggered seismicity studies completed and the crustal seismic source characterization study is underway.

## **7. COMPLETING THE STUDY**

### **7.1. Proposed Methodologies and Modifications**

To complete this study, the study team will implement the methods in the Study Plan, with no modifications. To summarize these activities, AEA will:

- Continue geologic mapping associated with regional geology development, mineral resources and claims, reservoir rim stability, and a continuation of geologic mapping as needed for lineaments and geologic features (potential fracture and shear zones) and evaluation of rock displacement or rupture in the dam site area;
- Continue geophysical surveys to identify top of rock surface and to characterize the general soil and rock conditions;
- Continue to investigate mineral resources and claims on those lands not accessed in 2013; select rock samples for testing; and identify aggregates sources along potential corridors;
- Continue geotechnical instrumentation monitoring with re-installation of data loggers for resuming the data collection for groundwater and ground temperature;
- Finalize reservoir slope stability analyses; and
- Complete geologic analyses of the road and transmission corridors.

#### **7.1.1. Decision Points from Study Plan**

There were no decision points in the FERC-approved Study Plan to be evaluated for this study following completion of 2013 work.

#### **7.1.2. Modifications to Study Plan**

To complete this study, the study team will implement the methods in the Study Plan with no modifications to methods. However, the study area has changed from that described in the RSP (Section 4.5.3). As described in the ISR Overview and depicted in Figure 1, AEA has added the Denali East Option road and transmission line corridor to the study area. The study team will collect relevant geologic information for this additional area to help ensure the geologic and soil conditions are adequate for construction of road and transmission facilities.

As noted in ISR Section 4.2, based on the approved study plan, the methods of field investigations and testing associated with this study plan were planned to begin in 2013 but have been rescheduled in 2014 and 2015. Essentially, the dam site work tasks have been delayed by 12 months but with access to the site available, the work will now commence in 2014. The field methods to be performed in support of the Study Plan were to be executed during the period from 2013 to 2014. However, due to the 2013 land access restrictions, those field activities in the will be initiated in 2014 and will continue in 2015.

## 7.2. Schedule

The field site investigations and testing and studies planned for 2014 include:

- Geologic Mapping –summer mapping to be scheduled prior to leaf-out and after leaves have fallen (May and September) for geologic mapping on the abutments at the dam site. Focus is lineaments and geologic features (potential fracture and shear zones) and potential of rock displacement or rupture in the dam site area.
- Geophysical Surveys – surface geophysical surveys to identify top of rock surface and to characterize the general soil and rock conditions; optimize locations of borings where possible
- Drilling at Dam Site – core drilling, water pressure testing, downhole televiewer (COBOL), installation of geotechnical instrumentation; select rock core samples for testing. Four core holes totaling approximately 1750 LF of drilling (Figure 7.2-1).
- Geotechnical instrumentation monitoring will continue with re-installation of data loggers for resuming the data collection for groundwater and ground temperature.
- Seismic hazard study – continuation of the lineament mapping and analysis related to the crustal seismic source evaluation and continue data collection efforts for seismic events (see ISR 16.6).

The field investigations plans for 2015 will include:

- Geologic Mapping – summer mapping to be scheduled prior to leaf-out and after leaves have fallen (May and September) for geologic mapping associated with regional geology development, mineral resources and claims, reservoir rim stability, and a continuation of geologic mapping as needed for lineaments and geologic features (potential fracture and shear zones) and evaluation of rock displacement or rupture in the dam site area.
- Drilling – evaluation of reservoir rim stability, test sections along Susitna River near Watana Creek confluence and along Watana Creek.
- Mineral resources – investigate mineral resources and claims on those lands not accessed in 2013. Select rock samples for testing; identify aggregates sources along potential corridors.
- Geotechnical instrumentation monitoring will continue with re-installation of data loggers for resuming the data collection for groundwater and ground temperature.
- Seismic hazard study – dependent upon the outcome of the 2014 investigations, additional detailed evaluation of certain lineaments and geologic features relative to sympathetic rupture may be required and may include other methods. In addition, data collection efforts of seismic events will continue.

Additional field site investigations and testing in support of the engineering feasibility evaluation will continue in future years. See ISR Study 16.6 for additional information on the seismic hazard study plan.

### 7.3. Conclusion

Continued implementation of the Geology and Soils Characterization Study is planned for 2014 and 2015 with no modification of the FERC-approved Study Plan. This study will continue to baseline spatial data to the cultural and botanical resources studies. AEA expects the approved Study Plan objectives for this study to be fully achieved, and the results of this study will be reported in the USR.

Due to the nature of the field site investigation and testing programs, the investigation efforts will continue to be optimized based on the data obtained and on-going geologic and seismic hazard interpretations. For example, as geologic mapping and earlier drilling is completed, the location and depth of future drill holes and planned and/or in situ testing may be modified. Additionally, review of the work efforts and field data by the Board of Consultants may lead to further optimization. However, no specific decision points are planned.

Geologic investigations and studies are ongoing with progress made on geologic characterization at the dams site, investigation and testing of potential construction material sources to be used in the dam construction, updates to the terrain unit analysis and completion of a preliminary assessment of reservoir slope stability using the recently acquired LiDAR imagery data, installation of instrumentation to obtain data on the hydrogeologic and thermal conditions in the dam site proper as well as a long-term earthquake monitoring system for the immediate Project area, seismic hazard studies are underway (see ISR 16.6), a preliminary assessment of reservoir triggered seismicity has been nearly completed and a preliminary mineral resource evaluation has been made of the reservoir area and potential access and transmission corridors for the Project.

The geology and soils study plan is being implemented as a phased program. The field investigation program has included some geologic mapping, core drilling and sampling, in situ testing (water pressure testing) and downhole logging, and geo instrumentation installation in the dam site and proposed rock quarries (e.g., Quarry A, M) to build upon on the geologic database started in the 1970s and 1980s. Rock samples have been obtained and various laboratory tests have been performed to determine the engineering properties of the bedrock in the dam site and quarry areas. In the reservoir and broader Project areas, various studies have been conducted or are ongoing to characterize the geology and soil conditions in these areas including geologic mapping, terrain analysis, mineral resources assessment, identification of metal and non-metallic sources as well as documenting the claims and prospects that may be impacted by the Project, and geomorphic evaluation of historical and the future potential for mass wasting in the proposed reservoir area.

A long-term earthquake monitoring network has been established and data on events are being collected. Seismic hazard studies are in progress with a preliminary probabilistic seismic hazard assessment (PSHA) and reservoir triggered seismicity studies completed and the crustal seismic source characterization study is underway. See Seismic Hazard Study (ISR Study 16.6).

In 2013, a partial field program was undertaken of reconnaissance level geologic mapping associated with the above-referenced studies with ground access limited to state and federal lands only. The land access restriction resulted in postponement of planned geologic mapping and geotechnical subsurface investigations and in the dam site and along project infrastructure corridors and geologic mapping and studies associated with the seismic hazard and mineral resources efforts. The 2014 field program includes the rescheduling of some of the various field investigations and studies originally planned for 2013. In addition, geo instrumentation will be reestablished and the earthquake monitoring system will be maintained and operated. However, with the delay in certain field activities, data compilation and interpretation will potentially continue in 2014 and 2015.

#### **7.4. Figures**



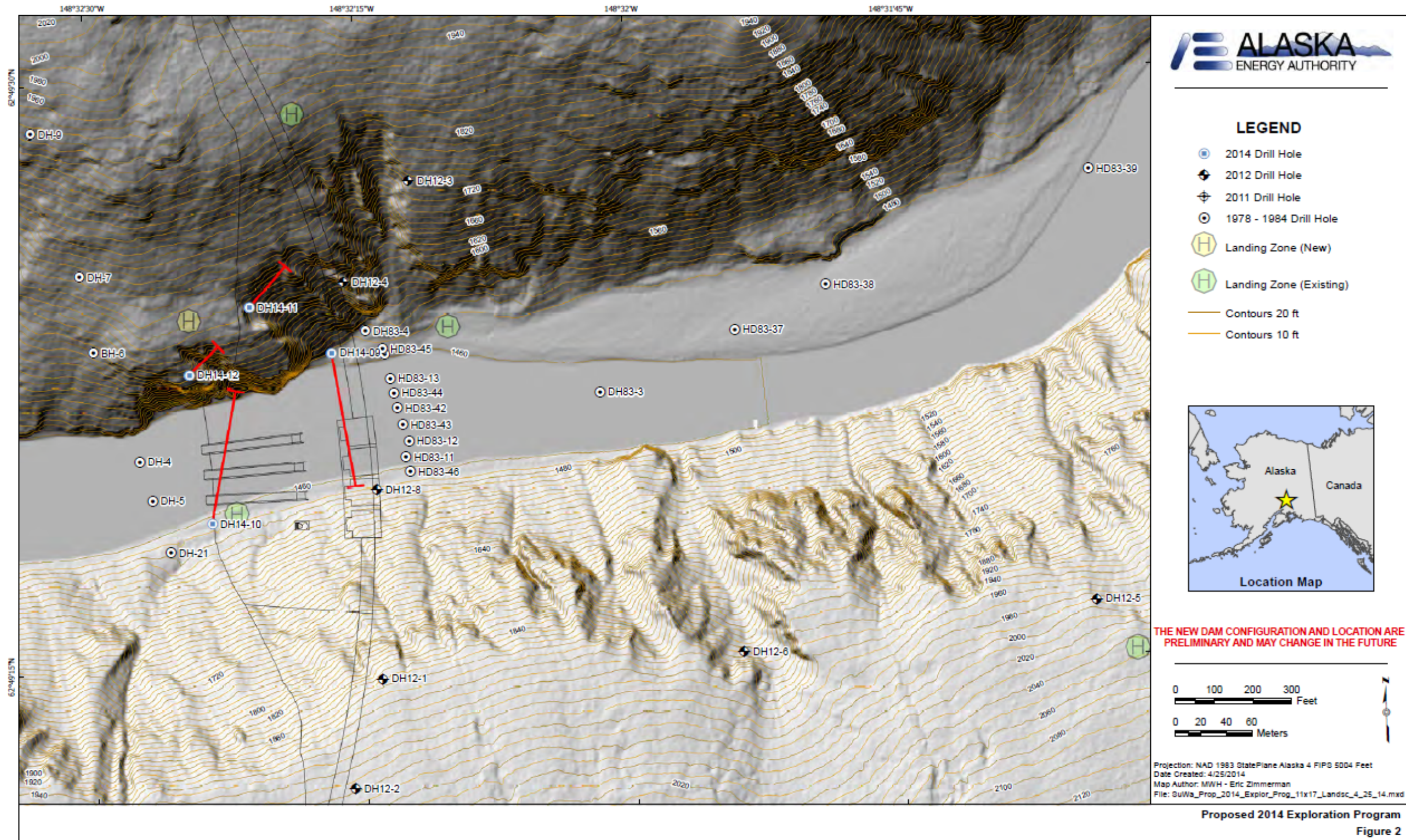


Figure 7.2-1 Exploration Program Plan, 2014.