

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

**Probable Maximum Flood (PMF) Study
Study Plan Section 16.5**

**Part D: Supplemental Information to
June 2014 Initial Study Report**

Prepared for

Alaska Energy Authority



SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

MWH

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1. INTRODUCTION

Section 1 (Part A) of the June 2014 ISR for this Probable Maximum Flood (PMF) Study (Study Plan 16.5) details the development of this study from the Revised Study Plan (RSP) in 2012, through the end of the 2013 study season. Section 7 of the ISR (Part C), filed in June 2014, describes the PMF Study as complete, subject to inclusion of any additional responses to potential comments from the BOC and others, which would be addressed in the USR and meet the objectives of the RSP.

The primary purpose of this Part D Supplemental Information to the ISR is to confirm that this PMF Study is complete as no comments have been received.

2. BACKGROUND

2.1. Purpose of Study

The goal of the study is to develop the inflow design flood (the PMF) for Watana Dam. The PMF inflow hydrograph will be routed through the reservoir and be used to size the spillway and to subsequently determine the crest level of the dam to ensure flood safety of the dam. The PMF results from the Probable Maximum Precipitation (PMP), which is also developed as a part of this study, and other coincident conditions including snowmelt.

The study objectives are established in RSP Section 16.5.1:

- Develop a site-specific PMP to be used for the derivation of the PMF including both a temporal and spatial distribution of rainfall;
- Model the runoff through the project drainage basin to produce the PMF inflow, including snowmelt considerations for the Project reservoir;
- Route the PMF inflow through the Project to obtain the PMF outflow and maximum flood elevation at the dam;
- Determine the required outlet capacity to safely route the PMF through the reservoir;
- Determine the freeboard allowance; and
- Use the Board of Consultants (BOC) for technical review during development and performance of the site-specific studies.

2.2. Study Components

The major study components include the following: (1) data acquisition of meteorological, hydrological, and snow data, (2) historical data analysis, (3) review of previous Susitna PMF studies, (4) a field visit, (5) study reviews by a Board of Consultants, (6) runoff model selection, (7) runoff model calibration and verification, (8) development of a site specific PMP, (9)

development of snowpack and other conditions coincident with seasonal PMP storms, (10) reservoir routing of the PMF, (11) spillway sizing, (12) freeboard analysis, and (13) Reporting.

3. STATUS, HIGHLIGHTED RESULTS, AND ACHIEVEMENTS

The following tasks were completed in 2013 and reported in Part A of the June 2014 ISR for Study 16.5:

- Site-specific PMP and report.
- Runoff model historic flood calibration and verification.
- Intermediate flood routing to determine the reservoir level at which the spillway gates begin to open.
- Development of alternative coincident conditions for the PMF.
- PMF inflow hydrograph model runs for alternative PMP temporal distributions, various seasonal PMP and snowpack cases, and several PMF sensitivity runs.
- Reservoir routing of the alternative PMF inflow hydrographs to determine the critical PMF case.
- Spillway sizing.
- Freeboard analysis.
- Comparisons of the current PMF with previous Susitna PMF studies.
- Completion of a Final Draft PMF Report.
- Hold an ISR study report meeting on October 22, 2014.

Draft PMF and PMP reports were provided to the Independent Board of Consultants (BOC) prior to the April 2-4, 2014 BOC meeting. Written comments from the BOC have been addressed in the Final Draft PMF Study filed June 3, 2014.

Data gathering to develop the rainfall-runoff model to develop and route the PMF has been completed and the available data was adequate. Development and distribution of the antecedent snowpack has been completed. Calibration and verification of hydrograph parameters was completed. Development of the monthly PMF inflow hydrographs and determination of the critical PMF inflow condition followed development of the seasonal PMP values.

All thirteen PMF Study Components identified above have been completed. Completion of the PMF Study enables finalization of the feasibility-level configuration of Watana Dam and allows the dam studies to proceed to more detailed design phases.

This study was reported as complete in the June 2014 ISR. Thus, there are no new results or achievements to report for this completed study.

4. SUMMARY OF STUDY 16.5 DOCUMENTS

Since filing of the RSP in 2012, AEA and FERC have prepared several documents pertaining to this study. To aid review by FERC staff and licensing participants, each of these documents is listed below. Each of these documents is accessible on AEA's Project licensing website (<http://www.susitna-watanahydro.org/type/documents/>) by clicking on the entry in the "Link" column in the table. In addition, these documents are available on FERC's eLibrary system (<http://www.ferc.gov/docs-filing/elibrary.asp>), in Docket No. P-14241.

Title	Date	Description	Link
16.5 Probable Maximum Flood Study (Revised Study Plan),	12/14/2012	This document presents the plan this study, including goals, objectives, the study area, and proposed study methods for the probable maximum flood study.	RSP for Study 16.5
FERC Study Plan Determination for Study 16.5	2/1/2013	This document presents FERC approval of Study 16.5, which approved AEA's Revised Study Plan with no recommended adjustments.	FERC SPD for Study 16.5
Draft Initial Study Report for Study 16.5	2/3/2014	This draft of the ISR summarized the study methods and variances during the 2013 study season, and presented preliminary data collected for Study 16.5. This draft ISR was later republished as Part A of -the final ISR.	Draft ISR for Study 16.5
Initial Study Report for Study 16.5	6/3/2014	This document is the Initial Study Report (Parts A, B and C) for Study 16.5. Part A republishes the Draft ISR. Part B identifies supplemental information and errata in Part A. Part C presents study modifications and plans for completing the study.	ISR Part A for Study 16.5 ISR Part B for Study 16.5 ISR Part C for Study 16.5 (File 1) ISR Part C for Study 16.5 (File 2)
Initial Study Report Meetings, October 22, 2014	11/14/2014	Transcripts and AEA's agenda and PowerPoint presentations for the ISR meeting concerning the PMF study.	Materials from ISR Meeting Transcripts from ISR Meeting

5. NEW STUDY DOCUMENTATION SUPPLEMENTING THE ISR

Because the work and data analysis for this study was complete as of the filing of the June 2014 ISR, no additional reports or documents are available to supplement the ISR for Study 16.5.

6. VARIANCES

6.1. 2013 Study Season

The following variances are reported in the June 2014 ISR.

- Archived USGS hourly streamflow records for selected floods were requested but not received. USGS daily streamflow records are available at all gages in the watershed for the period of record, and 15-minute flow data is available for the September 2012 flood. Due to the large area of the watershed and the significant snowmelt component of most floods, flood hydrographs occur over periods of 10 to 20 days, or even longer. Instantaneous annual maximum peak flows are also available. This amount of streamflow data is considered adequate to fully meet the hydrograph calibration and verification objectives of the PMF study.
- Subsequent to the Commission's February 1 SPD, the 1984 Susitna PMF study became available. It was included in the review of previous PMF studies in the same manner as the 1982 Susitna PMF study so that a comprehensive background of PMF studies for the Susitna could be used to inform and verify the current study approach. As a historical note, two of the largest seven floods of record at the USGS streamflow gaging station at Gold Creek have occurred (September 2012 and June 2013) since filing of the PMF study plan, although peak flow rates are preliminary and subject to change by the USGS. The June 2013 flood is not used in this study because it occurred after selection and meteorological data analysis began of the storms associated with the floods used for runoff model calibration and verification.
- The calibration and verification of hydrograph parameters normally involves the collection of meteorological and flow data for three flood periods. Analysis of flood records as the PMF study proceeded revealed that there have been two fundamentally different and seasonally separated flood generating scenarios, one resulting primarily from rainfall, the other primarily from snowmelt. It could not be determined in advance which of these flood generating scenarios would ultimately be the critical condition for the PMF. Therefore, three floods of each type (total of six) were selected for calibration and verification. This resulted in an initially unanticipated increase in data acquisition and calibration effort, although it was considered to be necessary for a reliable determination of the PMF.

6.2. 2014 Study Season

Because AEA did not implement this study in 2014, no variances were encountered.

7. STUDY PLAN MODIFICATIONS

7.1. Modifications Identified in ISR

No study plan modifications were noted in the ISR.

7.2. Modifications Identified since the June 2014 ISR

AEA plans no modifications of the methods of this study, as this study is now complete.

8. STEPS TO COMPLETE THE STUDY

The field work, data collection, data analysis, and reporting for this study successfully met all study objectives in the FERC-approved Study Plan. In light of the results and variances described above, AEA has completed this study.