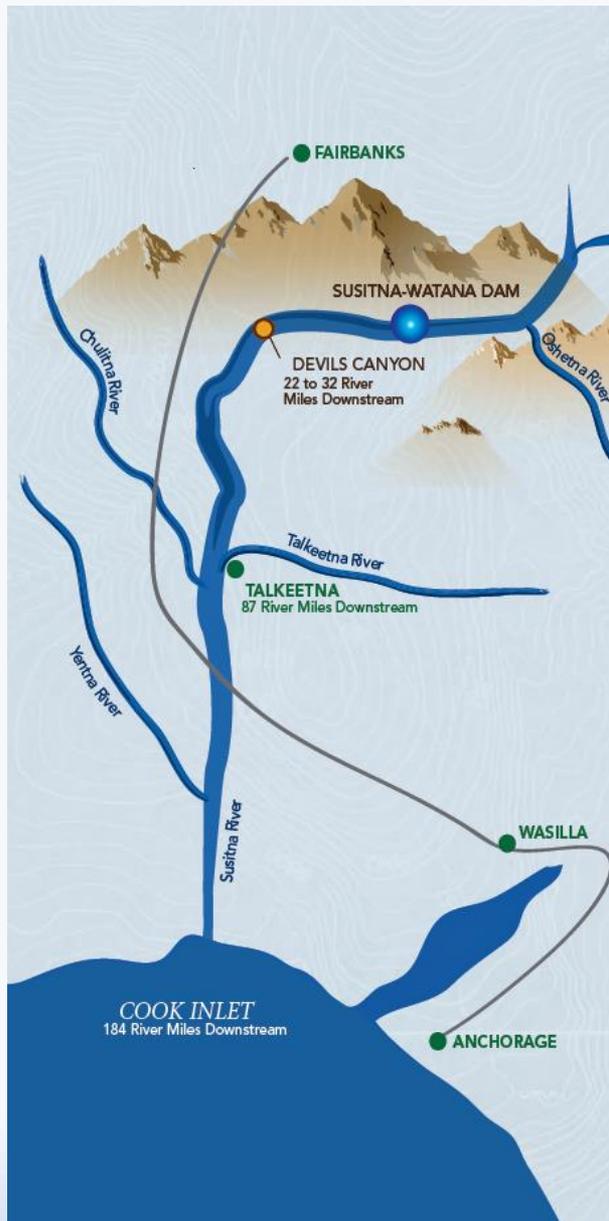


# Initial Study Report Meeting

## *Study 7.6 Ice Processes in the Susitna River*

*March 24, 2016*

Prepared by HDR



# Study 7.6 Status

## ISR Documents (ISR Part D, Section 4)

- Initial Study Report Part A, B, and C (Jun 3, 2014)
- Detailed Ice Observations October 2013 – May 2014 Tech Memo (Sept 17, 2014)
- 2014 – 2015 Study Implementation Report (Nov 6, 2015)
- ISR Part D (Nov 6, 2015)

## Status

- Completed observations and documentation of freeze-up and break-up during 2012–2014 between tidewater and the Oshetna River confluence (PRM 235.2) and incorporated historical data.
- Completed literature review of existing cold regions hydropower project operations and effects and model capabilities.
- Completed assessment of operational effects on Lower River.
- Modeling of Middle River (River1D) and Focus Areas (River2D) completed for open water and ongoing for ice conditions.

## Study 7.6 Objectives

- Document the timing, progression, and physical processes of freeze-up and break-up during 2012–2014 between tidewater and the Oshetna River confluence (PRM 235.2 [RM 233.4]), using historical data, aerial reconnaissance, stationary time-lapse cameras, and physical evidence
- Determine the potential effect of Project alternative operational scenarios on ice processes downstream of Watana Dam using modeling and analytical methods
  - Develop a modeling approach for quantitatively assessing ice processes in the Susitna River
  - Calibrate the model based on existing conditions. Use the model to determine the extent of the open water reach downstream of Watana Dam during Project operations
  - Use the model to determine the changes in timing and ice-cover progression and ice thickness and extent during Project operations

## Study 7.6 Objectives

- Develop detailed models and characterizations of ice processes at instream flow Focus Areas in order to provide physical data on winter habitat for the Fish and Aquatics Instream Flow Study (Study 8.5)
- Provide observational data of existing ice processes and modeling results of post-Project ice processes to the Fluvial Geomorphology Modeling below Watana Dam Study (Study 6.6), Groundwater Study (7.5), Instream Flow Studies (Studies 8.5-8.6), Fish and Aquatics Study (Study 9.12), Riparian Vegetation Study Downstream of the Proposed Susitna-Watana Dam (Study 11.6), Recreation and Aesthetics Studies (12.5-12.7), and Socioeconomic and Transportation Study (Study 15.7)
- Research and summarize large river ice processes relevant to the Susitna River, analytical methods that have been used to assess impacts of projects on ice-covered rivers, and the known effects of existing hydropower operations in cold climates

## *Study 7.6 Components*

- Aerial Reconnaissance (ISR Part A, Section 4.1; 4)
- Time-Lapse Camera Monitoring (ISR Part A, Section 4.2; 4)
- Ice Measurement Data (ISR Part A, Section 4.3; 7)
- Other Field Data (ISR Part A, Section 4.4; 8)
- River1D Ice Process Model Development for Existing Conditions (ISR Part A, Section 4.5; 8)
- Lower River Assessment (ISR Part A, Section 4.6; 9)
- Review and Compilation of Existing Cold Regions Hydropower Project Operations and Effects (ISR Part A, Section 4.7; 10)

## *Study 7.6 Variances*

No significant variances have been made. Minor variances pertaining to the originally proposed time-lapse camera locations in Section 4.2 of the RSP have been made to provide for improved coverage and views of freeze-up and break-up processes. **(ISR Part D, Section 6)**

The number of flights and video coverage obtained during the freeze-up through breakup period in 2013-2014 provided adequate coverage of the ice processes and ice-covered conditions to meet the study objectives.

# Summary of Results

## (ISR Part A – Section 5)

- **Breakup observations (2012 and 2013) and Freeze-up observations (2012)** from the mouth to the Oshetna River (PRM 0-235.2) by aerial reconnaissance and time-lapse cameras (ISR Part A, Appendix A)
- **Mapping of thermal and velocity open leads** from the mouth to the Oshetna River (PRM 0-235.2) by aerial reconnaissance made during 2012 and 2013 (ISR Part A, Appendix A)
- **Ice thickness, elevation, and winter discharge measurements** at nine Instream Flow water level recording stations in coordination with Study 8.5 during 2013 and 2014 (ISR Part A, Appendix B)
- **River1D model developed** for PRM 80-187.2 for 88 measured cross sections
- Proof-of-Concept Meeting held in April 2014 (ISR Part A, Appendix D); FA-128 (Slough 8A) River2D model example
- **Assessment of Lower River water elevations under conditions of increased discharge during winter completed at Sunshine and Susitna Station** (ISR Part A, Appendix A)
- **Review and compilation of existing cold regions hydropower project operations and effects** including degree of success of using various modeling techniques (ISR Part A, Appendix C)

# Summary of Results

*(Detailed Ice Observations TM, Sept 17, 2014; SIR, Nov 6, 2015)*

- **Breakup observations (2014) and Freeze-up observations (2013)** from the mouth to the Oshetna River (PRM 0-235.2) by aerial reconnaissance and time-lapse cameras made during 2014 **(Sept 17, 2014 TM)**
- **Mapping of thermal and velocity open leads** from the mouth to the Oshetna River (PRM 0-235.2) by aerial reconnaissance made during 2014 **(Sept 17, 2014 TM)**
- **Development of an alternate format to graphically present the freeze-up progression and open lead survey data (SIR, Appendix A)**
- **River1D ice processes model modified with new measured cross sections and calibrated for open water conditions (SIR, Appendix B)**
- **River2D model developed for FA-128 (Slough 8A) (SIR, Appendix C) calibrated for open water conditions**

# *AEA Proposed Modifications*

*(ISR Study 7.6, Part D – Section 7)*

## **Clarification of Proposed Modifications presented in ISR Part D, Section 7.1**

### **Time Lapse Cameras**

- The RSP indicated time lapse cameras would be located at FA-151 (Portage Creek) and FA-184 (Watana Dam). A remote telemetered camera installed at ESS55 near the mouth of Portage Creek provided suitable images, fully meeting the study objectives. The ice conditions at the Watana Dam site were obtained through the aerial video flights during freeze-up, the open lead surveys, and breakup, which provided adequate coverage of FA-184 (Watana Dam) to meet the study objectives.
- As the objective of documentation of the timing, progression, and physical processes of freeze-up and break-up during 2012–2014 between tidewater and the Oshetna River confluence has now been completed, the proposed modifications in ISR Part D, Section 7.1 regarding time lapse cameras are considered variances, and not proposed modifications.

# *AEA Proposed Modifications*

*(ISR Study 7.6, Part D – Section 7.2)*

- Development of alternate visualizations of the freeze-up progression and open lead survey data (Sept 17, 2014 TM; SIR Appendix A).
- Additional field measurements of ice thickness, snow depth, and water surface elevation taken during the winter at FA-128 (Slough 8A) to assist in calibration of the River1D and River2D modeling efforts.

# Steps to Complete Study 7.6

*(ISR Part D, Section 8)*

- **River1D Ice Processes Model**
  - Complete the ice-covered calibration for existing conditions, including updates to available data from all field studies
  - Simulate existing and Project alternative operational scenarios for the 50-year hydrologic record during ice-covered periods
  - Coordinate with other studies to provide information on jam locations, water elevations, and flooded areas (Studies 6.6, 7.5, 8.5, and 8.6)
- **River2D models of the Focus Areas (FA)**
  - Develop and calibrate models for other FA's as geometric data becomes available
  - Utilize models to simulate depth and velocity during ice-covered periods using cold, warm, and average representative years of the hydrologic record
- **Model Analysis**
  - Conduct model accuracy and error analyses for the River1D and River2D modeling efforts

## *Licensing Participants Proposed Modifications to Study 7.6?*

- Agencies
- CIRWG members and Ahtna
- Public