

# SUSITNA-WATANA HYDROELECTRIC PROJECT

## Formal ILP Proposed Study Plan Review

August 17, 2012

Tetra Tech, URS and Watershed  
Geodynamics



# Water Resources Proposed Studies

- Geomorphology Study (5.8)
- Fluvial Geomorphology Modeling below Watana Dam Study (5.9)

# Geomorphology Study

## Goals and Objectives

### GOAL

- Evaluate the effects of the Project on the geomorphology and dynamics of the Susitna River, which in turn will inform the analysis of potential project-induced impacts to channel formation processes and aquatic habitats
- Results of this study along with Fluvial Geomorphology Modeling below Watana Dam will be used to predict the potential alteration of channel morphology



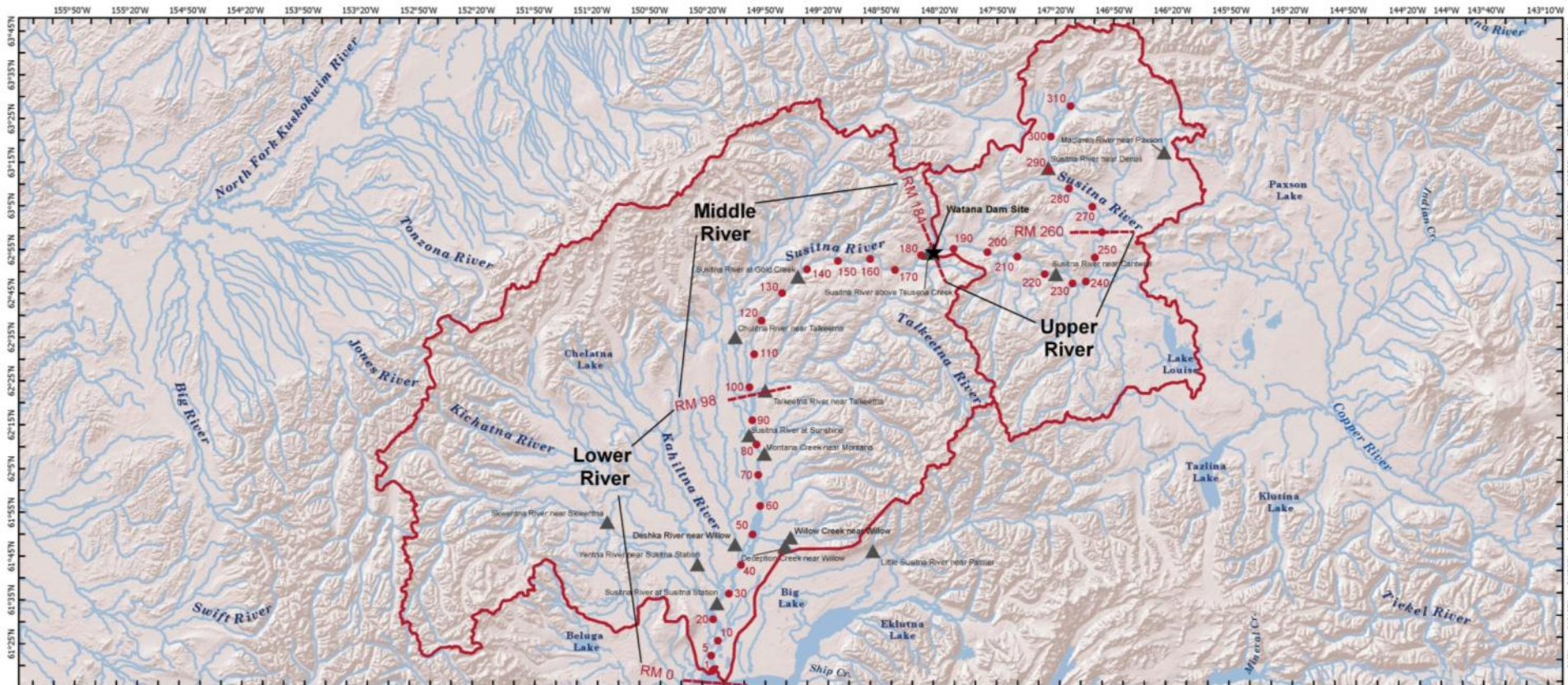
# Geomorphology Study

## Goals and Objectives

### OBJECTIVES

- Determine geomorphic characteristics and functions under existing conditions including formation and maintenance of aquatic and channel margin habitats
- Identify the magnitudes of changes in the controlling variables and how these will affect existing channel morphology in the identified reaches downstream of the dam
- Determine the likely changes to existing habitats through time and space

# Geomorphology Study Area



## Legend

- ★ Watana Dam Site
  - ▲ Gaging Stations
  - Susitna River Mile (10 mile interval)
  - Basin Boundary
  - River Reach Boundaries:
    - Lower River (RM 0 to RM 98)
    - Middle River (RM 98 to RM 184)
    - Upper River (RM 184 to RM 260)
- Data Sources: See Map References

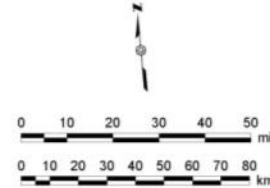
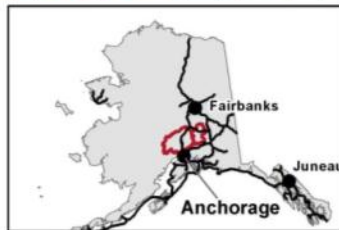
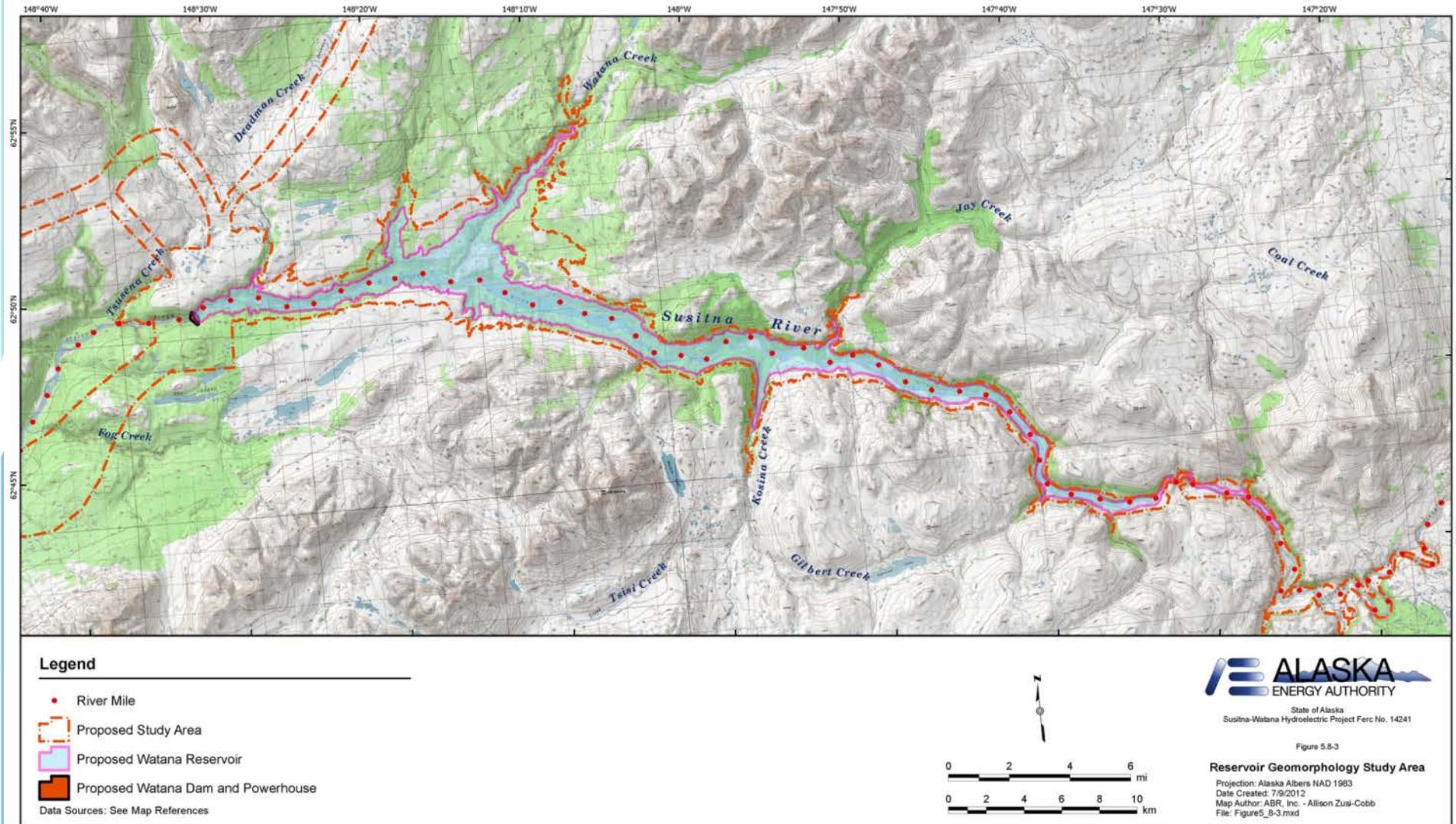
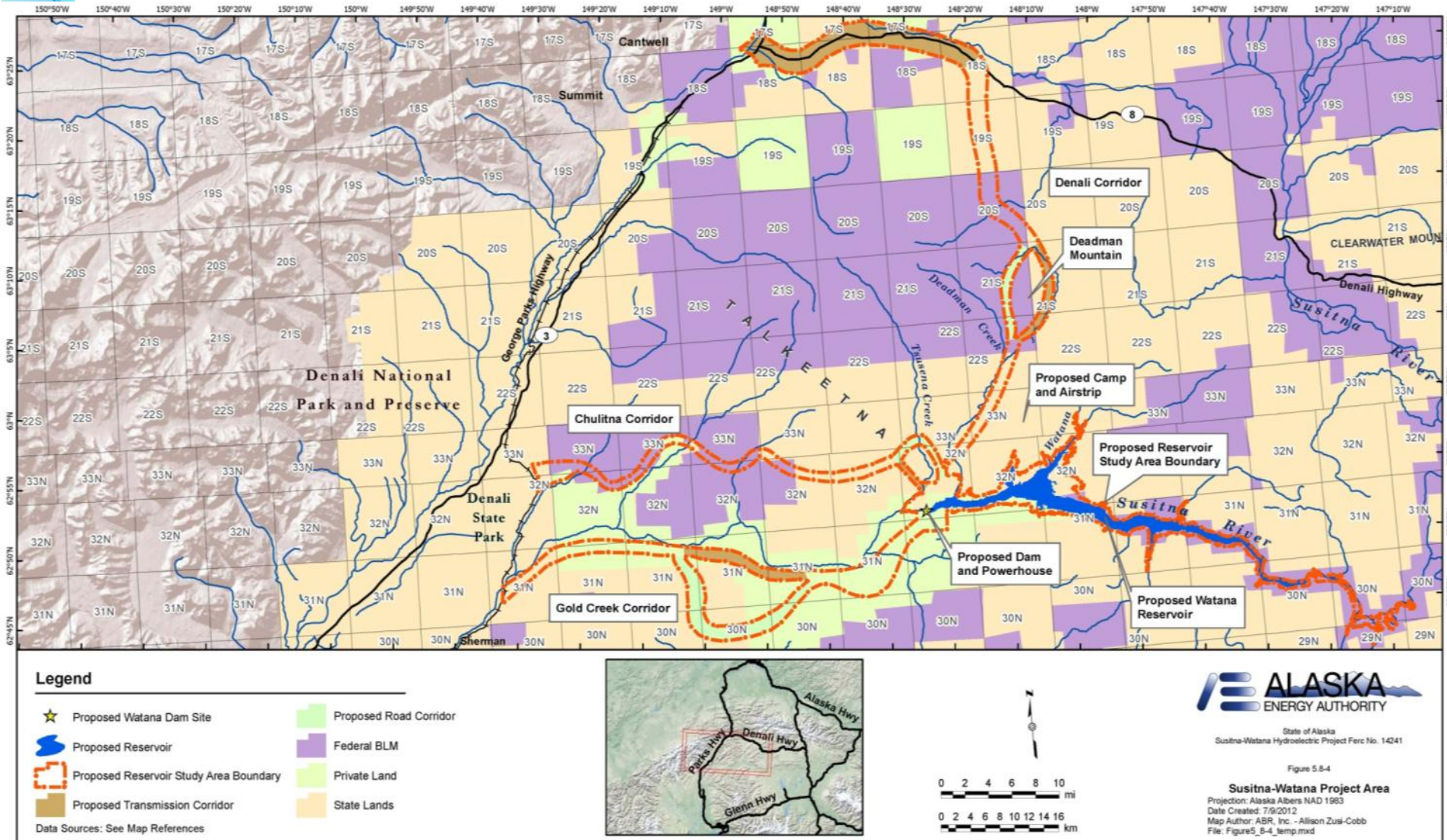


Figure 5.8-1  
**Susitna River Geomorphology Study Area and Large-Scale River Reaches**  
 Projection: Alaska Albers NAD 1983  
 Date Created: 7/8/2012  
 Map Author: ABR, Inc. - Allison Zusi-Cobb  
 File: Figure5\_8-1.mxd

# Geomorphology Study Area – Reservoir Geomorphology



# Geomorphology Study Area – Stream Crossings along Transmission Lines and Access Alignments



# Geomorphology Study Methods

1. Delineate geomorphically similar river segments
2. Bedload and suspended load data collection (USGS)
3. Sediment supply and transport Middle and Lower River
4. Assess geomorphic change Middle and Lower rivers
5. Riverine habitat area vs. flow relationship Middle river
6. Reconnaissance level assessment of project effects on lower river channel
7. Riverine habitat area vs. flow Lower River
8. Reservoir geomorphology
9. Large woody debris
10. Geomorphology of stream crossings along transmission lines and access alignments





# Study Requests Related to Geomorphology

- Agency formal requests
  - U.S. Fish and Wildlife Service
  - NOAA / NMFS
- Other formal requests
  - Natural Resources Defense Council
  - Center for Water Advocacy
- Related requests
  - Recreation/Boating (FERC, NPS)



# Geomorphology Study Expected Results

- Fluvial geomorphic characterization of the Project-affected river channels
- Characterization of pre- and post-project sediment transport and supply conditions
- Assess stability/changes in riverine geomorphic features and aquatic habitat types (1980s vs. present)
- Characterize the surface area vs. flow for aquatic habitat types
- Reconnaissance level assessment of potential Project effects on the Lower River channel

# Geomorphology Study Expected Results

- Characterize the reservoir geomorphology
  - Trap efficiency, rate of sedimentation and altered sediment supply from reservoir
  - Shoreline erosion
  - Characterization of tributary delta formation
- Large woody debris
  - Estimation of current large woody debris supply and identification of current functions
  - Discussion of potential for the Project to affect large woody debris and transport in the Susitna River

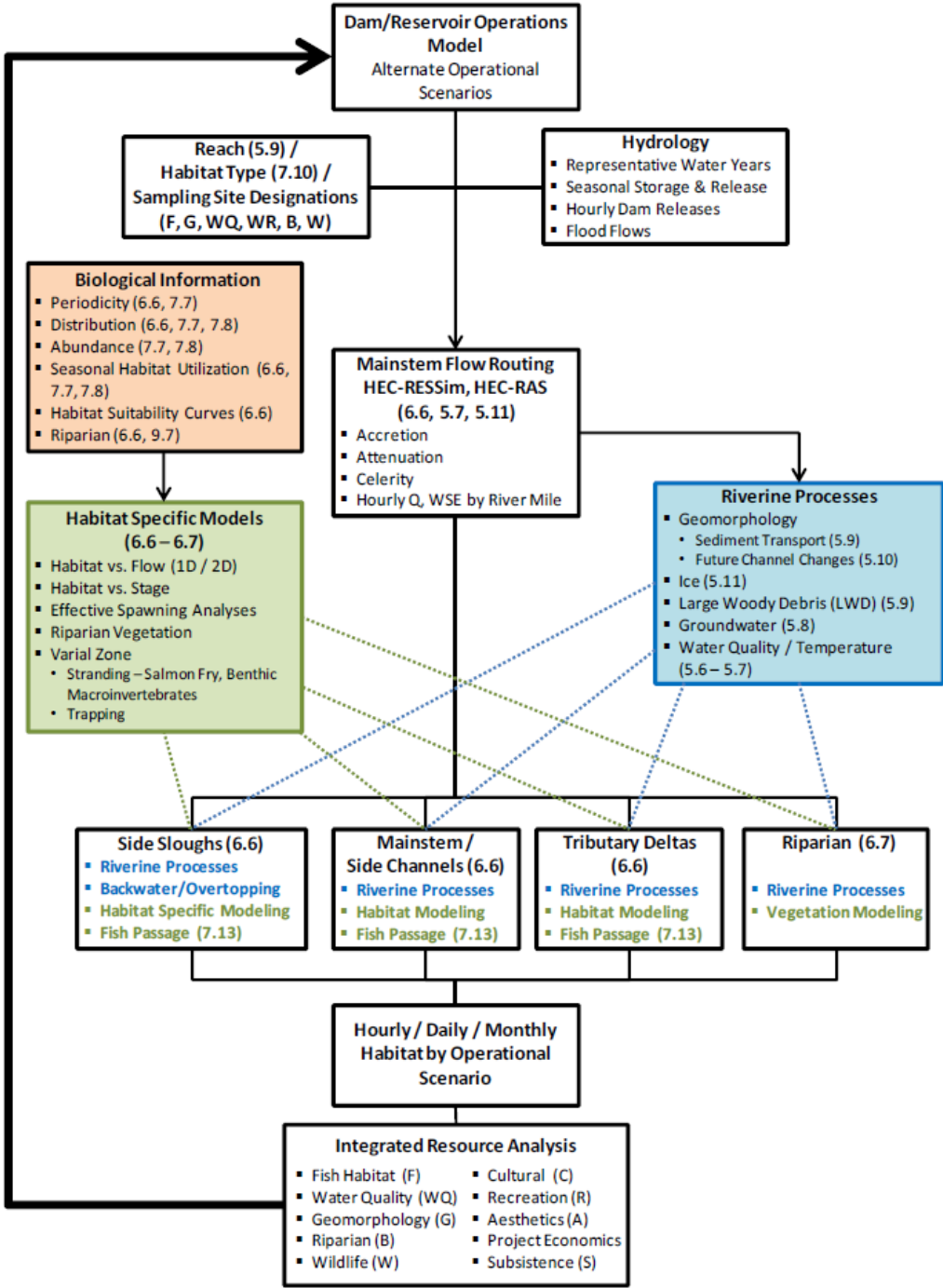


# Geomorphology Study Expected Results

- 2012 results – refine RSP
  - Reconnaissance level assessment of project effects on Lower River channel (inform extent of Lower River modeling)
- 2012 results – feed into other studies
  - Reach delineation (assist in stratification & site selection for IFS)
  - Aerial analysis 1983 to 2012 (site selection, site stability and relative proportion of meso-habitats)
- 2013 results – refine 2014 studies
  - 1D sediment transport model (further inform extent of Lower River modeling for Fluvial Geomorphology Modeling Study and IFS)
  - Expanded aerial analysis (site selection, site stability and relative proportion of meso-habitats)

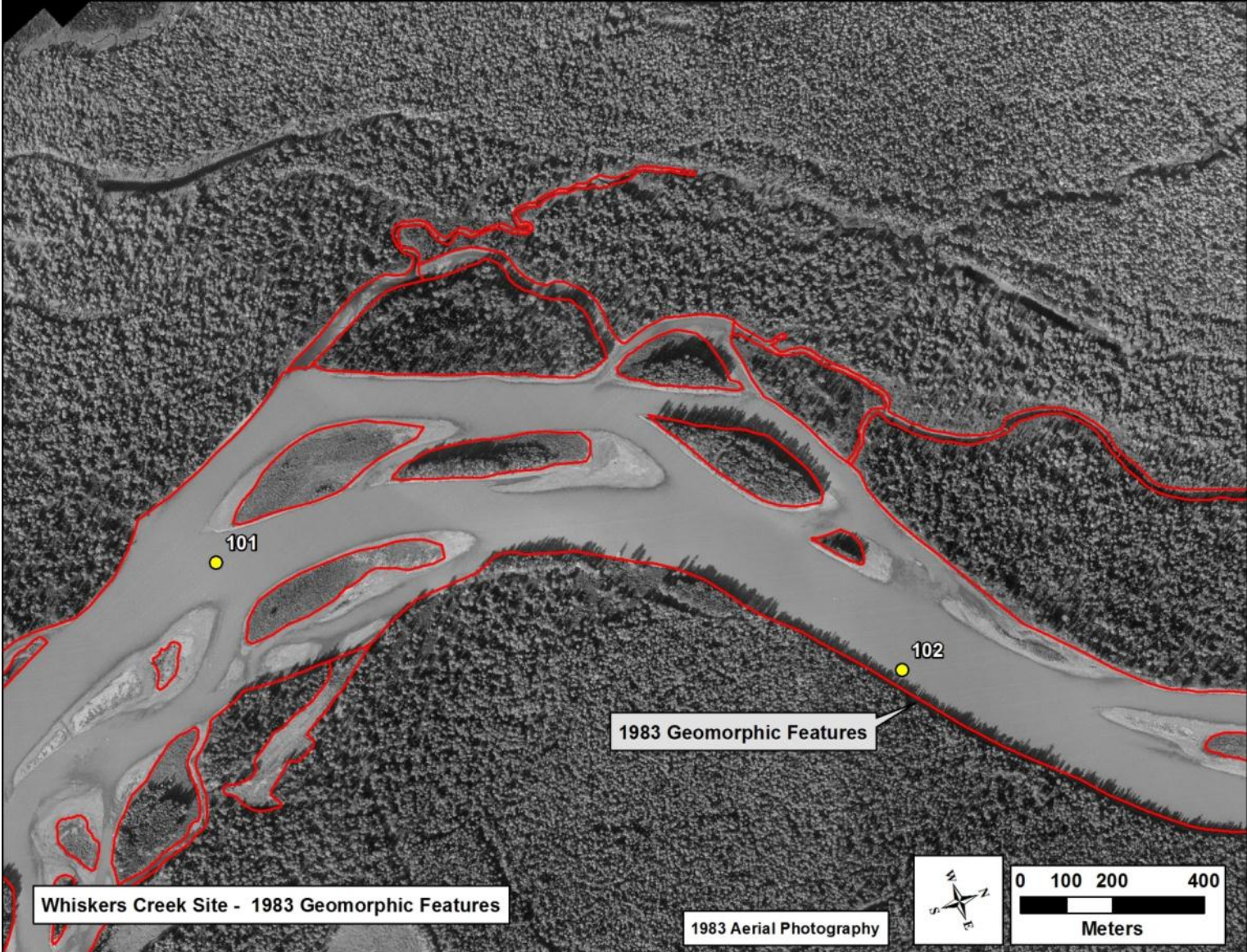


# Geomorphology Study Relationship to other Studies



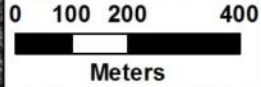
Interrelationships between Studies for Integrated Resource Analysis

# Geomorphology Study Relationship to other Studies



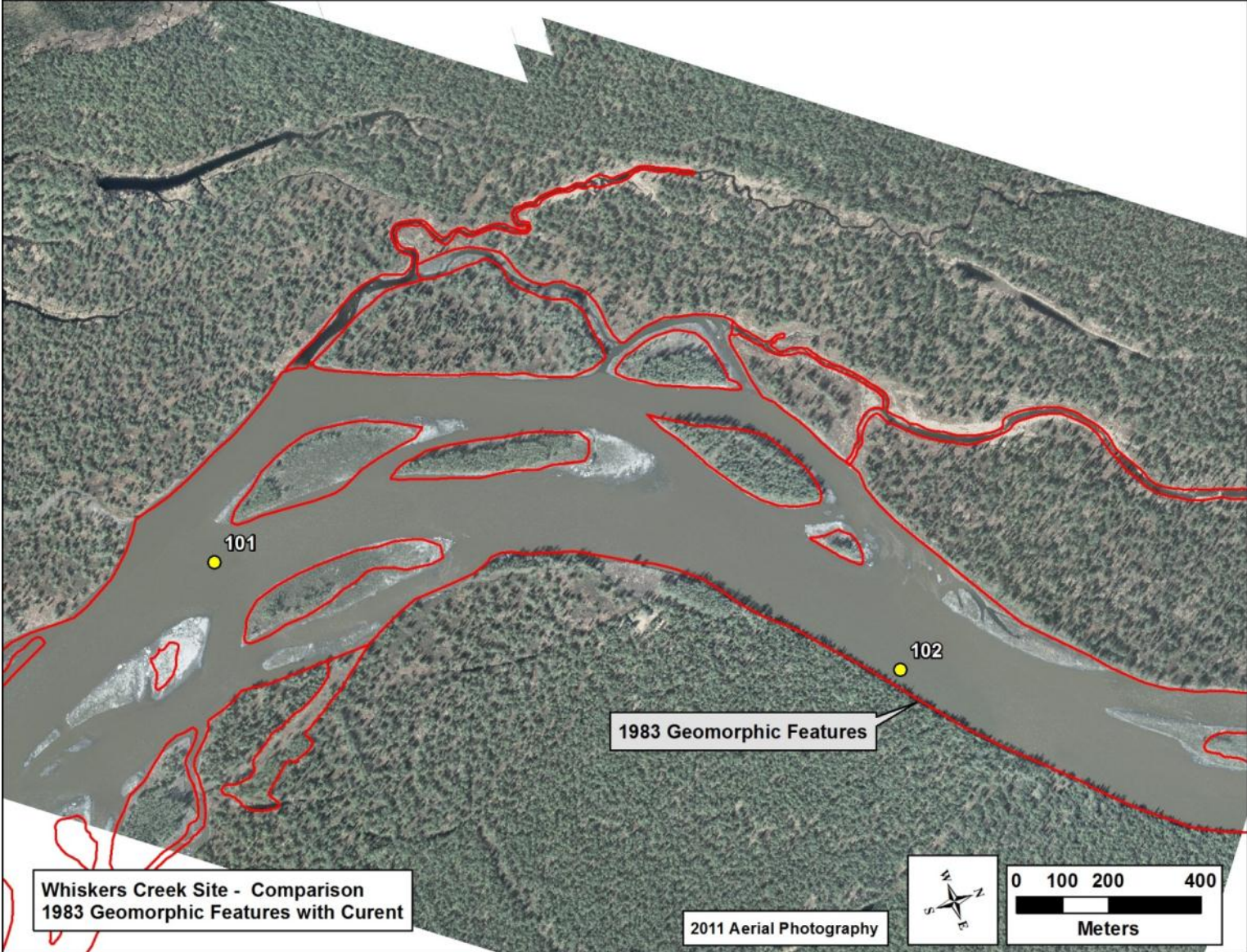
Whiskers Creek Site - 1983 Geomorphic Features

1983 Aerial Photography



ASKA  
BY AUTHORITY

# Geomorphology Study Relationship to other Studies



# Geomorphology Study Relationship to other Studies - Schedule

<b>Study Component</b>	<b>Est. Completion</b>
<b>1 Geomorphic River Segment Delineation</b>	Summer 2012
<b>2 Sediment Data Collection</b>	Summer 2012
<b>3 Sediment Supply and Transport Assessment</b>	Sum 2012/ Fall 2013
<b>4 Geomorphic Change Middle and Lower River</b>	Summer 2012
<b>5 Riverine Habitat Middle River</b>	Winter 2012
<b>6 Recon Assessment Lower River Project Effects</b>	Summer 2012
<b>7 Riverine Habitat Lower River</b>	Winter 2012
<b>8 Reservoir Geomorphology</b>	Spring 2014
<b>9 Large Woody Debris</b>	Summer 2014
<b>10 Geomorphology of Stream Crossings</b>	Summer 2014





# Geomorphology Study Summary of 2012 Activities

- 2012 aerial acquisition & analysis (23k, 12.5k and 5.1k cfs)
  - Acquisition initiated for 23k cfs
  - Difficulty – cloud cover / river flow target
- 1980s aerial
  - 12,500 cfs orthorectified aerial developed for 1983
  - Above RM 155 – July 1980 (Q ~30kcfs)
- Geomorphic reach delineation
  - Initial delineation performed
- Needs
  - USGS extended flow record
  - Initial with-Project flows



# Geomorphology Study Discussion

- Use of tracers to characterize bed material mobilization (USFWS)
- Recreational boating considerations (NPS and FERC)
- Glacial surge contribution to reservoir sediment loading (FERC)
- Reconnaissance level trigger for downstream extent of modeling – Grant et al. 2003
- Others?



# Fluvial Geomorphology Modeling Below Watana Dam

## Study Goals and Objectives

### GOAL

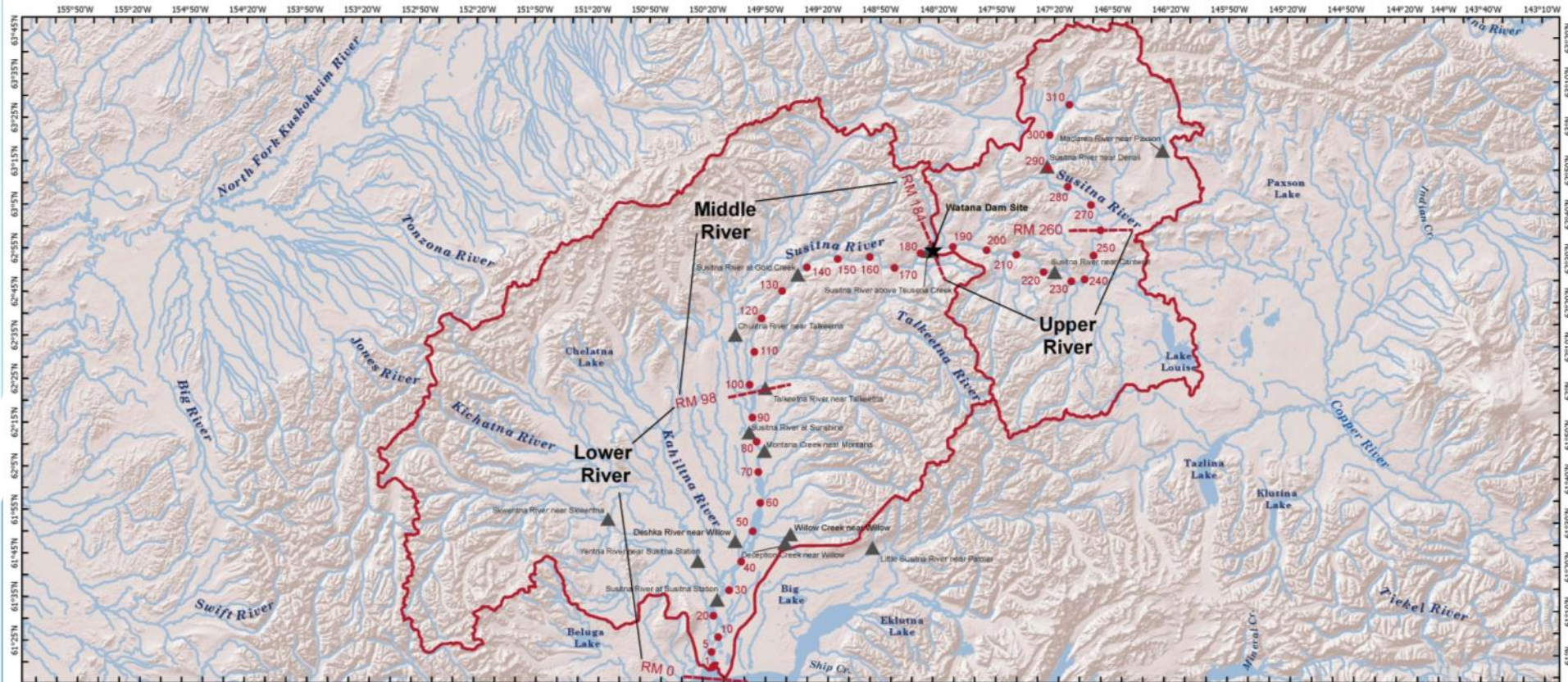
- Model the effects of the proposed Susitna-Watana Hydroelectric Project on the fluvial geomorphology of the Susitna River

### OBJECTIVES

- Model channel formation processes in the Susitna River downstream of the proposed Watana Dam site
- Estimate the potential for channel change for with-Project operations
- Coordinate with other studies to provide channel output data



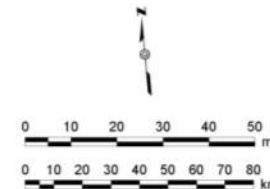
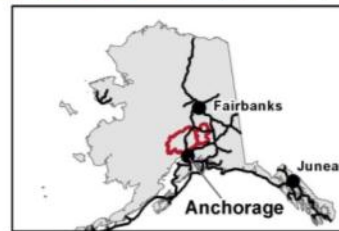
# Fluvial Geomorphology Modeling Study Area



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Data Sources: See Map References



State of Alaska  
Susitna-Watana Hydroelectric Project Ferc No. 14241

Figure 5.8-1

Susitna River Geomorphology Study Area  
and Large-Scale River Reaches

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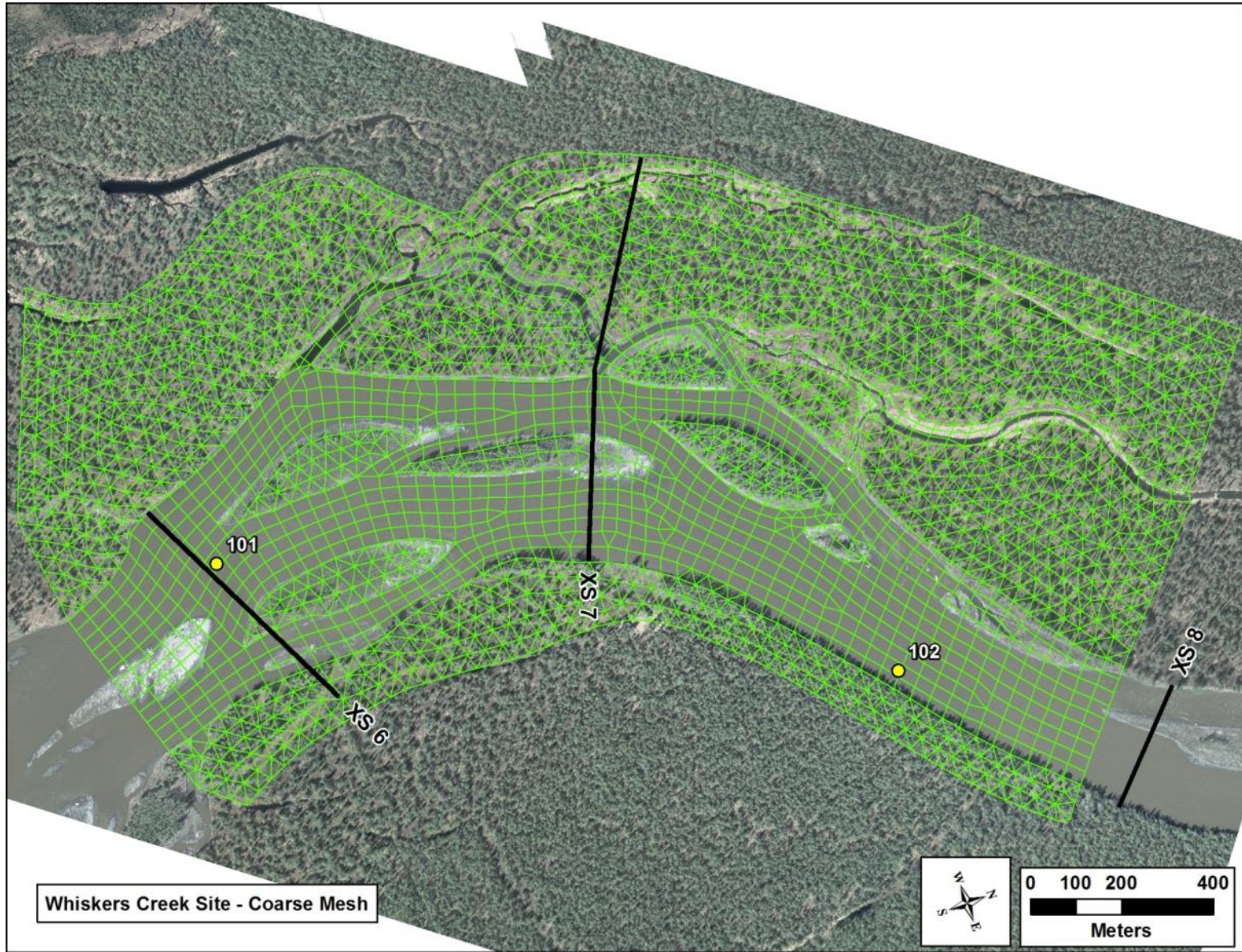
# Fluvial Geomorphology Modeling Study Methods

- Bed evolution model development, coordination and calibration
  - Development of modeling approach (1D & 2D/ reach vs. local scale)
  - Model selection
  - Detailed/intensive study sites
  - Model calibration
  - Tributary delta modeling
  - Wintertime modeling and load-following



# Fluvial Geomorphology Modeling Study

## Intensive/Detailed Modeling Site



# Fluvial Geomorphology Modeling Study Methods (cont.)

- Model Existing and with-Project conditions
  - 50 year 1D model simulation period
  - Portion of representative annual hydrographs (wet, dry and average for warm and cold PDO)
  - Synthesis of reach-scale and local-scale analysis
  - Interaction with other studies (flow routing, instream flow, riparian instream flow, ice processes and fish study)
- Coordination of model output

# Study Requests Related to Fluvial Geomorphology Modeling

- Agency formal requests
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- Other formal requests
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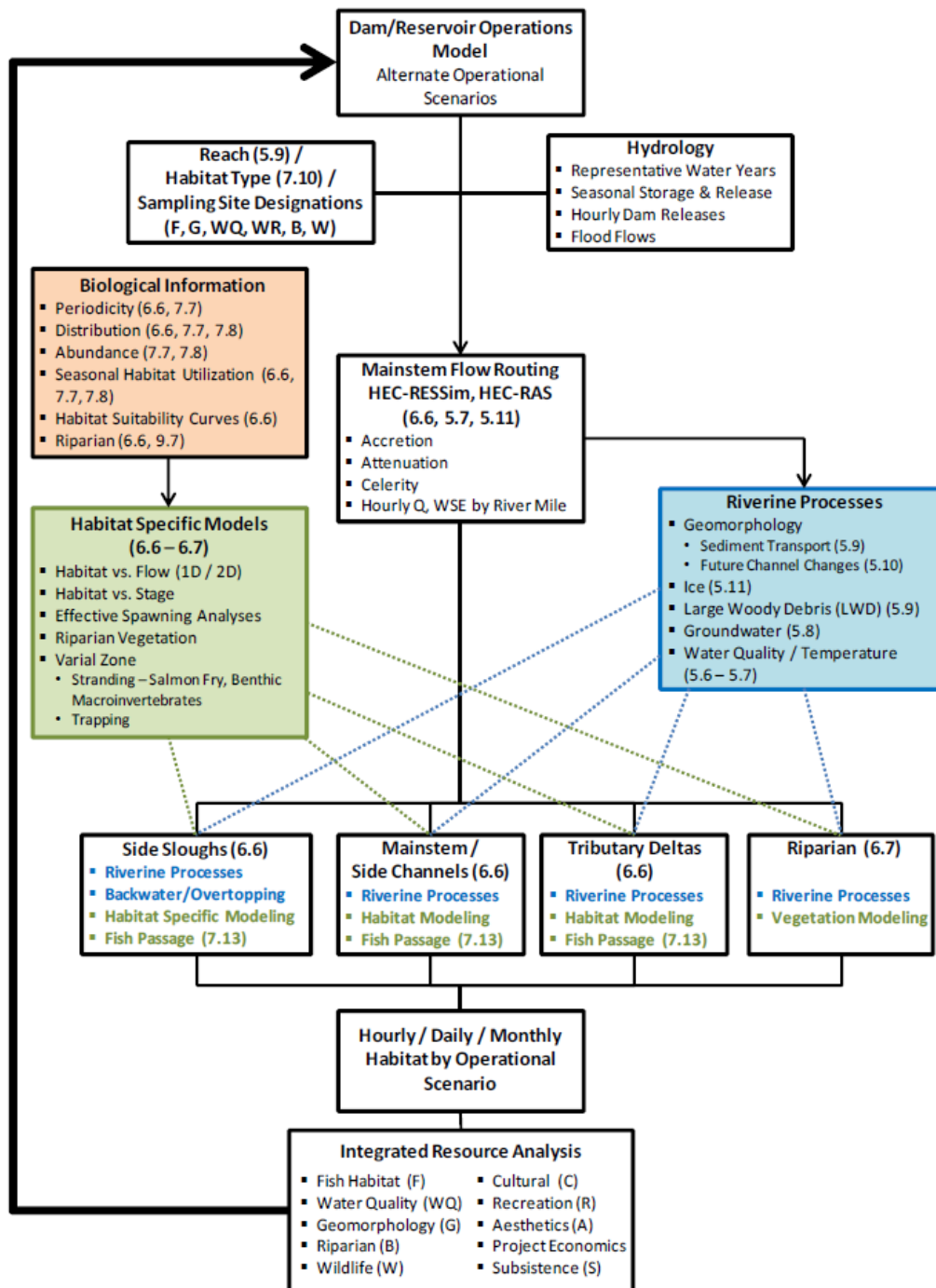
# Fluvial Geomorphology Modeling

## Expected Results

- Technical memorandum with selection of the 1D and 2D sediment-transport models
- Calibrated 1D mobile-boundary sediment-transport model from Watana Dam to Sunshine Station (RM 84)
- Calibrated 2D mobile-boundary sediment transport models for intensive study sites
- Results of 1D and 2D model runs for their respective time periods for existing and with-project conditions
- Integration of modeling results and geomorphic assessment to estimate Project effects on the fluvial geomorphology of the Susitna River to support analysis of potential changes in instream flow and riparian habitat



# Fluvial Geomorphology Modeling Relationship to other Studies



Interrelationships  
between Studies for  
Integrated Resource  
Analysis

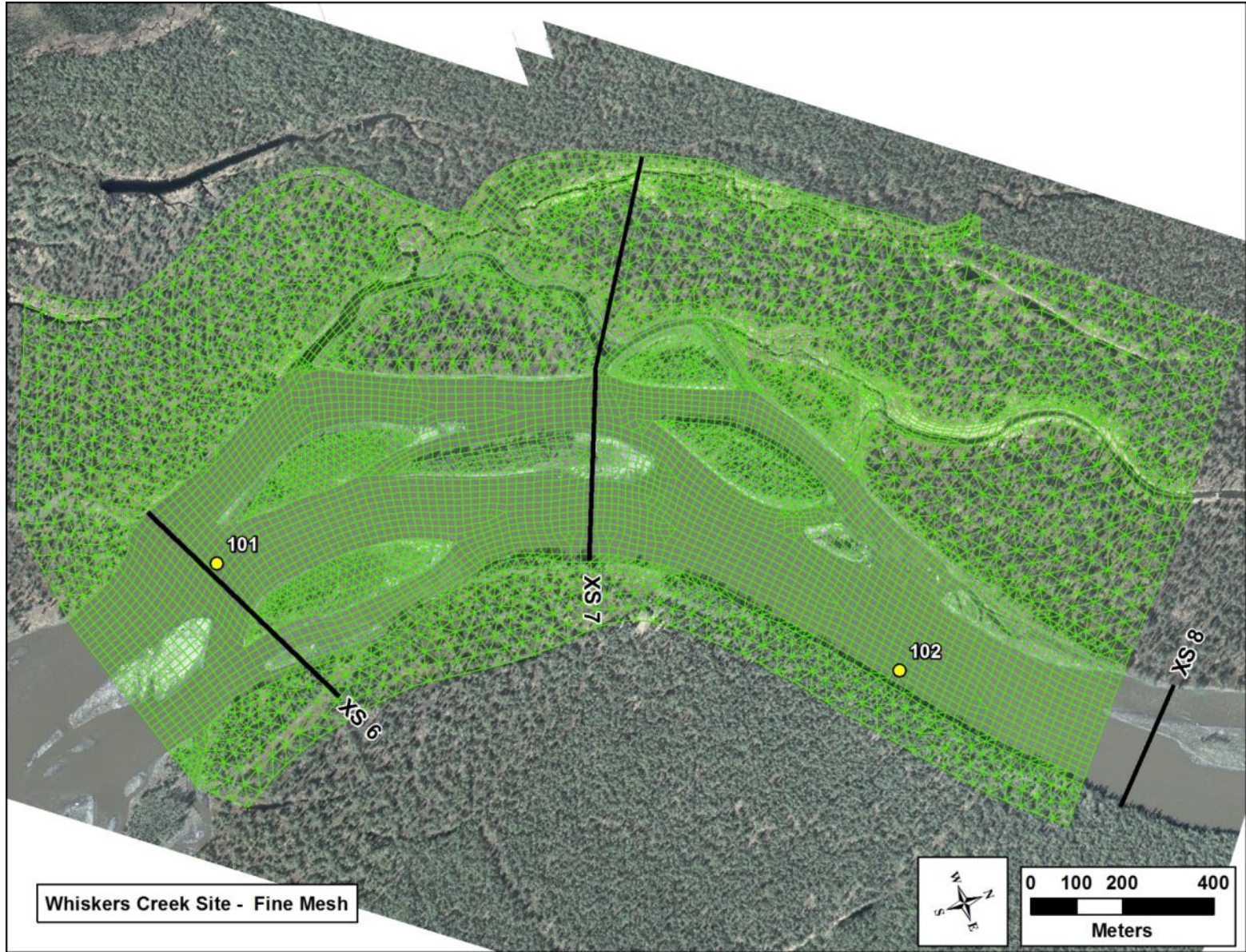
# Fluvial Geomorphology Modeling Study Relationship to other Studies - Schedule

Component	Task	Subtask	Estimated Completion
<b>Bed Evolution Model Development, Coordination and Calibration</b>	Development of Bed Evolution Modeling Approach and Model	Develop Approach	Fall 2013
		Develop Model	Winter 2013
	Coordination with other Studies on Processes Modeled	-	Winter 2013
	Calibration/Validation of Model	-	Spring 2014
<b>Model Existing and with-Project Conditions</b>	Model Existing Conditions	-	Summer 2014
	Model with-Project Conditions	-	Fall 2014
<b>Coordination on Model Output</b>	-	-	Fall 2014



# Fluvial Geomorphology Modeling Study

## Relationship to other Studies



# Fluvial Geomorphology Modeling Study

## Summary of 2012 Activities

- All 2012 geomorphology related tasks are in the Geomorphology Study.



# Fluvial Geomorphology Modeling Study

## Discussion

- Use of 1D and 2D approach / reach and local scale
  - Model selection
  - Number of intensive sites
  - Site selection
- Downstream extent of 1D and 2D modeling
  - Current proposal
  - Triggers
- Wintertime flows and load-following
- Others?

