

# SUSITNA-WATANA HYDROELECTRIC PROJECT

## Formal ILP Proposed Study Plan Review

August 15, 2012

Prepared by R2 Resource Consultants



# Fish and Aquatic Resources

## Proposed Studies

- Characterization of Aquatic Habitats in the Susitna River with Potential to be Affected by the Susitna-Watana Project
- Fish Distribution and Abundance in the Upper Susitna River
- Fish Distribution and Abundance in the Middle and Lower Susitna River
- Salmon Escapement Study

# Fish and Aquatic Resources

## Proposed Studies

- Eulachon Distribution and Abundance in the Susitna River Study
- Cook Inlet Beluga Whale Study
- The Future Watana Reservoir Fish Community and Risk of Entrainment Study
- Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries
- Genetic Baseline Study for Selected Fish Species

# Fish and Aquatic Resources

## Proposed Studies

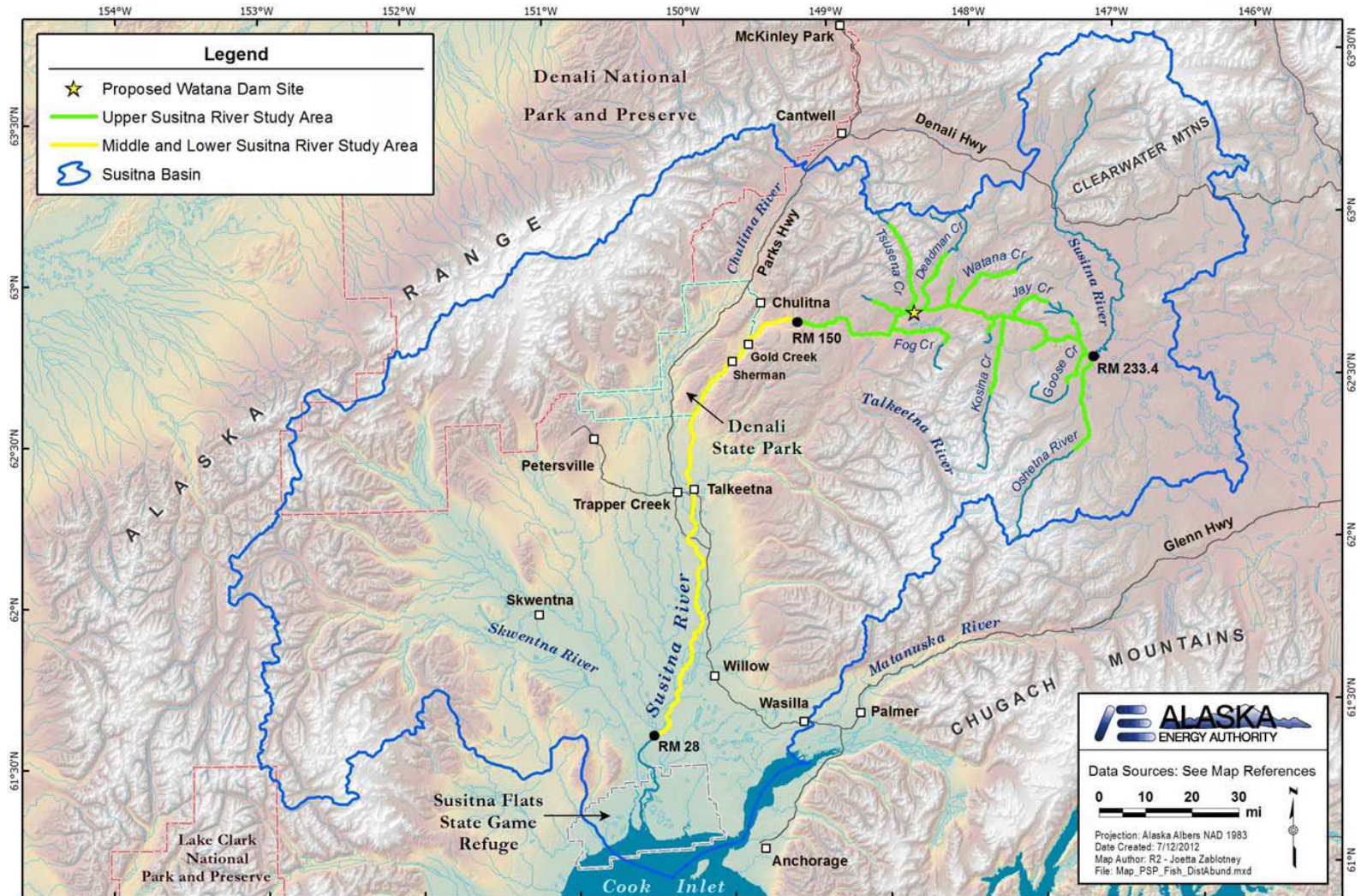
- Aquatic Resources Study within the Access Alignment, Transmission Alignment, and Construction Area
- Analysis of Fish Harvest in and Downstream of the Susitna-Watana Hydroelectric Project Area
- River Productivity Study
- Fish Passage Feasibility at Watana Dam

# Aquatic Habitat Characterization Study – Goals and Objectives

- Characterize existing upper mainstem and tributary habitat within proposed inundation zone.
- Characterize middle and lower mainstem, channel margin, and off-channel habitats.
- Characterize tributary and lake habitat upstream of proposed dam to Oshetna River that is accessible to fish.



# Habitat Characterization - Study Area



# Aquatic Habitat Characterization - Methods

- Aerial videography for entire river
- Field-based assessment in middle and upper river
- Habitats mapped to the meso-habitat level
- Meso-habitats subsampled for field assessment
- Ground-based habitat surveys include:
  - Reach-scale description of channel morphology
  - Stream survey (USFS Tier III)
  - Location & description of special habitat features
- Aerial videography being tested in 2012



# Fish Distribution and Abundance in Upper, Middle and Lower Susitna – Goals and Objectives

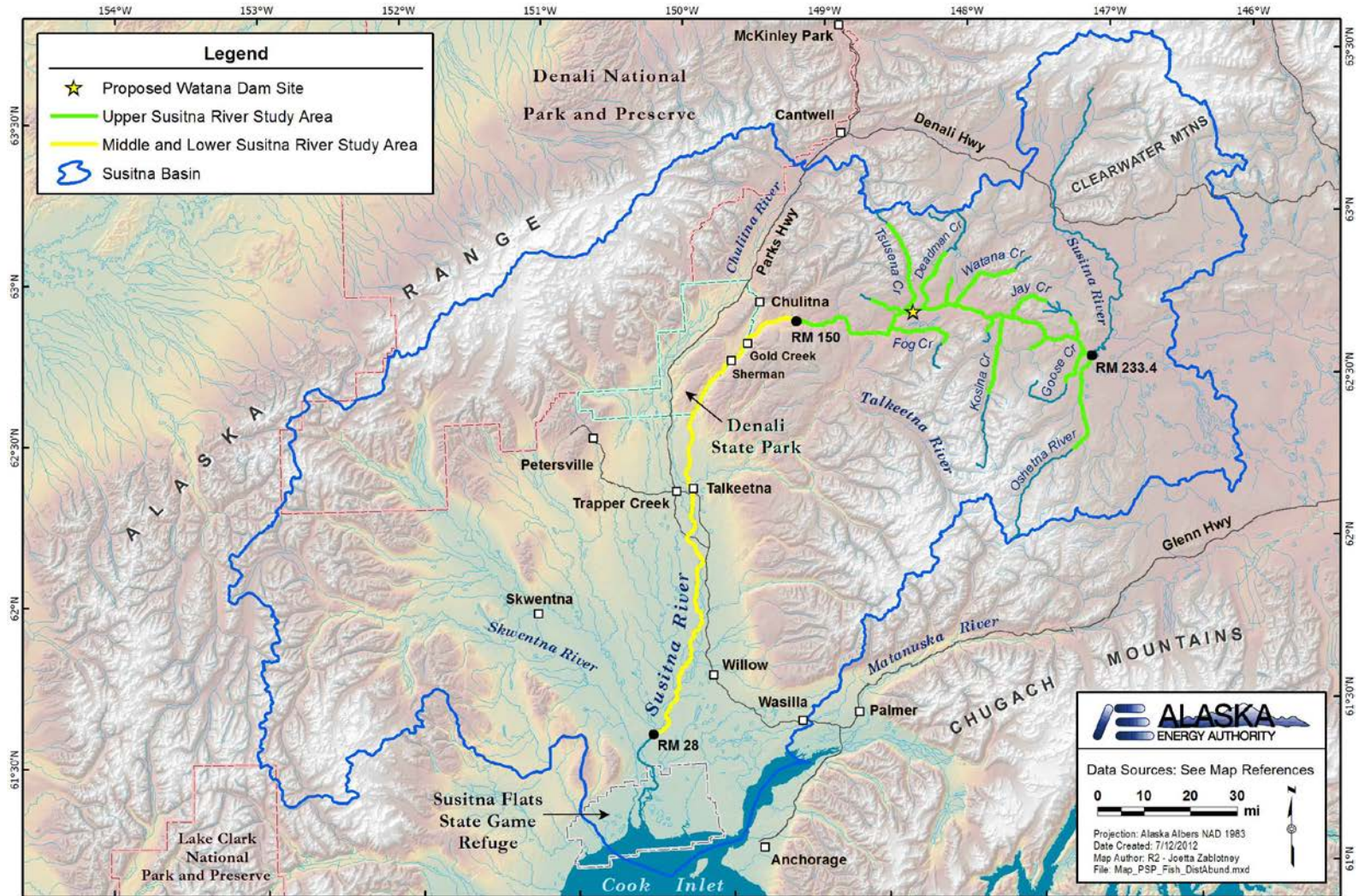
- Seasonal freshwater distribution, relative abundance, and fish-habitat associations
  - Adult and juvenile resident fishes
  - Juvenile anadromous salmonids
  - Non-salmon anadromous species
  - northern pike
- Upper river Dolly Varden and humpback whitefish: anadromous or resident life histories?
- Outmigration timing



# Fish Distribution and Abundance in Upper, Middle and Lower Susitna – Goals and Objectives (continued)

- Characterize the age structure, growth, and condition
- Seasonal movements of rainbow trout, Dolly Varden, whitefish, northern pike, burbot, and Pacific lamprey (if present)
- Support the Genetic Baseline Study
- Support the Mercury Assessment and Potential for Bioaccumulation Study

# Fish Distribution/Abundance - Study Area



# Fish Distribution/Abundance – Methods

- Passive and active sampling
  - Gill nets, electrofishing, angling, trot lines, minnow traps, snorkeling, outmigrant traps, beach seines, fyke nets, fishwheels (Lower and Middle River only), DIDSON, video
- Radiotelemetry targets
  - 30 fish of each species in the Upper River
  - 10 fish of each species from 5 habitat types in the Middle and Lower River



# Fish Distribution/Abundance – Methods (continued)

- PIT tagging fish >60 mm
  - All juvenile salmon, rainbow trout, Arctic grayling, Dolly Varden, burbot, longnose sucker, and whitefish
  - Antenna arrays
    - Upper River
      - 6 sites during open water period
      - 3 sites during winter months on experimental basis
    - Lower and Middle River
      - Up to 10 sites during open water period
      - 5 sites during winter months



# Fish Distribution/Abundance – Expected Results

- Baseline information
- Susitna-specific life history information
- Species/lifestage periodicity
- Seasonal species/lifestage/habitat associations

# Fish Distribution and Abundance Study – Relationship to other Studies

- Instream Flow
- Genetic Baseline Study for Selected Fish Species
- Mercury Assessment and Potential for Bioaccumulation Study

# Fish Distribution and Abundance Study – SR/PSP Discrepancies

- PSP and USFWS/NMFS study requests organized differently
  - “Early Life History and Juvenile Fish Distribution and Abundance in the Susitna River”; similar study requests from USFWS and NMFS
  - “Adult and Juvenile Non-salmon Anadromous, Resident and Invasive Fish Studies in the Susitna River basin (RM 0 - RM 233)” study requested by USFWS
  - PSP organized as two studies, one for Upper River, one for Lower and Middle River

# Fish Distribution and Abundance Study – SR/PSP Discrepancies (continued)

- Egg incubation component in study request not in the PSP
- AEA is not proposing use of SCUBA diving as a winter survey method
- PSP does not include a seasonal diet component (USFWS request)
- PSP does not include an evaluation of relative contribution of marine-derived nutrients to the Susitna River ecology (USFWS request)
- PSP does not include a resource valuation component (USFWS request)
- Geographic scope in PSP is upstream of RM 28 (Yentna R. confluence)
- Eulachon river use in study request addressed in separate study
- Evaluation of stranding in study request addressed in Instream Flow Study rather than this study

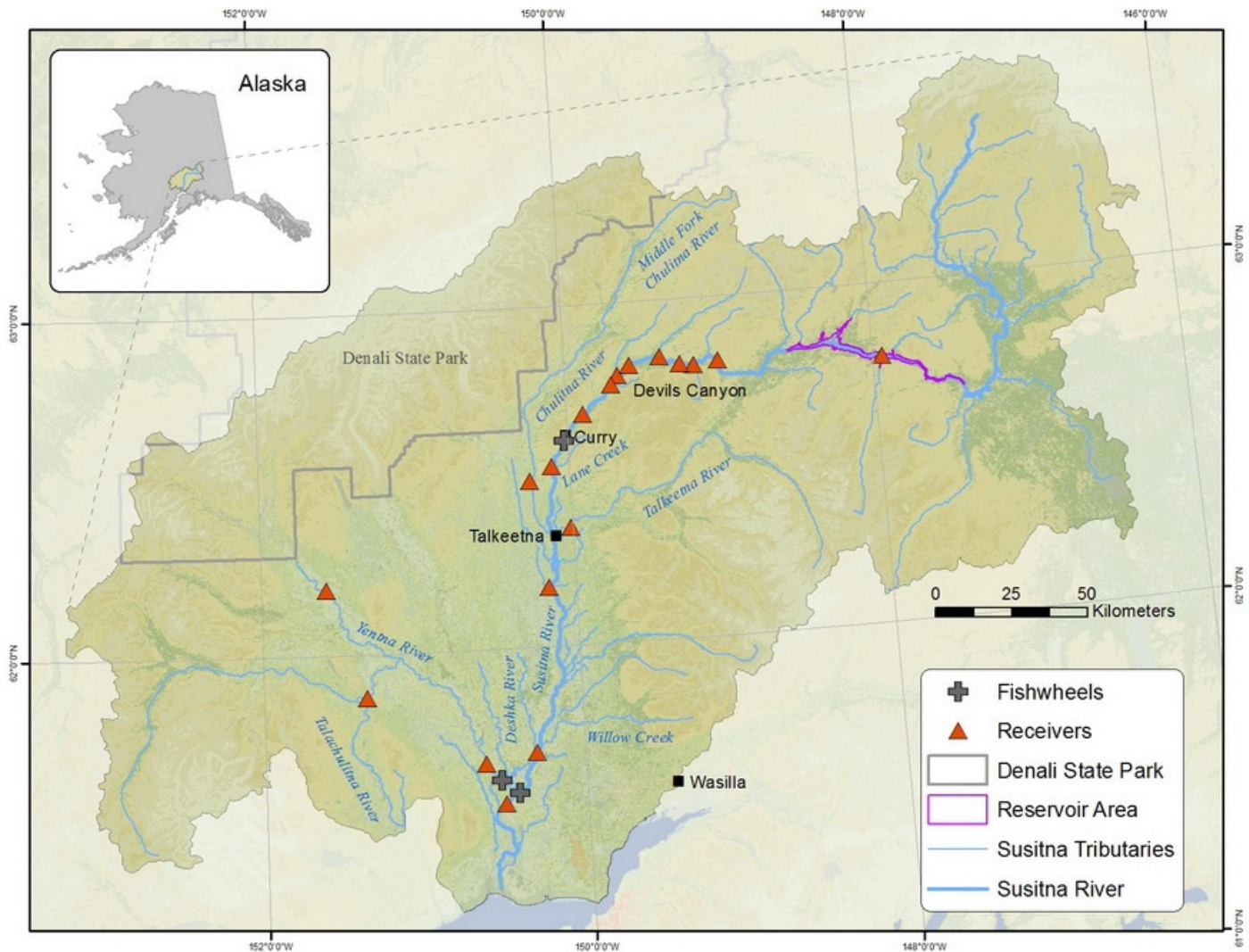




# Salmon Escapement Study – Goals and Objectives

1. Capture, tag, and track adults of all 5 species of salmon
2. Characterize migration behavior and spawning locations
3. Characterize behavior in and above Devils Canyon
4. Document spawning locations in mainstem habitats, including in turbid water
5. Compare 2012-2014 to 1983-1985 studies
6. Apportion numbers of adult Chinook spawners among mainstem and tributaries
7. Collect tissue samples to support genetic baselines
8. Estimate system-wide escapement of Chinook & coho

# Salmon Escapement - Study Area



# Salmon Escapement - Methods

- Use fishwheels to capture adult salmon in lower and middle river; radio tag fish in both locations
- Track salmon (aerial, boat, fixed stations) to describe behavior, timing, distribution, habitat use
- Estimate system-wide escapement of Chinook and coho salmon
- Compare 2012-2014 results to 1981-1985 studies
- Help develop genetic database

# Salmon Escapement – Expected Results

- Chum, pink, and sockeye salmon - run timing, habitat use, spawning locations, distribution in middle and upper river
- Chinook and coho – same, but also in lower river
- Chinook and coho – system-wide estimates of escapement and tributary apportionment
- Passage of salmon above Devils Canyon
- Provide data on habitat use and characteristics to other studies (e.g., instream flow analysis)
- Provide information for assessing potential impact of habitat alteration and loss

# Salmon Escapement – Relationship to Other Studies

- Adult salmon capture and tracking:
  - Allows collection of tissue samples for genetic baseline (7.14)
  - Provides locations of holding, spawning habitat to help with barrier (7.12) and instream flow (6.5) studies
- Designed to compare, contrast with historical results/syntheses (1983-1985)

# Salmon Escapement – Summary of 2012 Activities

- Successfully operated fishwheels in lower and middle river
- Captured, tagged, and tracked all five species in lower and middle; tracked fish in the upper river
- Radio telemetry was effective for locating and characterizing behavior of salmon in all areas
- Documented tributary vs. mainstem use, movement into and above Devils Canyon, spawning aggregations, etc.
- Logistically and technically challenging, but feasible, and 2012 will add a full year of additional data to the 2013-14 dataset.

# Salmon Escapement – SR/PSP Discrepancies

All ADFG comments/requests addressed.

NGOs – no comments cataloged for escapement, genetics

Remaining NMFS and USFWS comments/requests:

1. System-wide escapement, distribution, habitat use for pink, chum, sockeye.
  - Adequately addressed previously? Chum and sockeye each been done in recent years, plus in 1980s.
2. Use visual aerial surveys for distribution of escapement.
  - Utility for impact assessment of the Project?
3. Expand genetics work from Chinook to all salmon species
  - Useful insight from 2012 results?



# Eulachon Distribution and Abundance Study – Goals and Objectives

1. Determine the timing and duration of the spawning migration of eulachon in the Susitna River;
2. Determine eulachon spawning site distribution;
3. Identify and characterize eulachon spawning habitats;
4. Evaluate the density of eulachon at spawning habitats;
5. Document lengths, weights, and age structure of the eulachon population;
6. Collect genetic baseline samples to support ADF&G's stock analysis; and
7. Document incidental observations of marine fish species.







# Eulachon Distribution and Abundance

## Methods

- DIDSON and side-scan sonar
  - Distribution
  - Abundance
  - Run Timing
  - Spawning locations
- Boat electrofishing and/or tow netting to collect fish to sample:
  - Weight
  - Length
  - Age structure
- Spawning habitat characterization



# Eulachon Distribution/Abundance – Summary of 2012 Activities

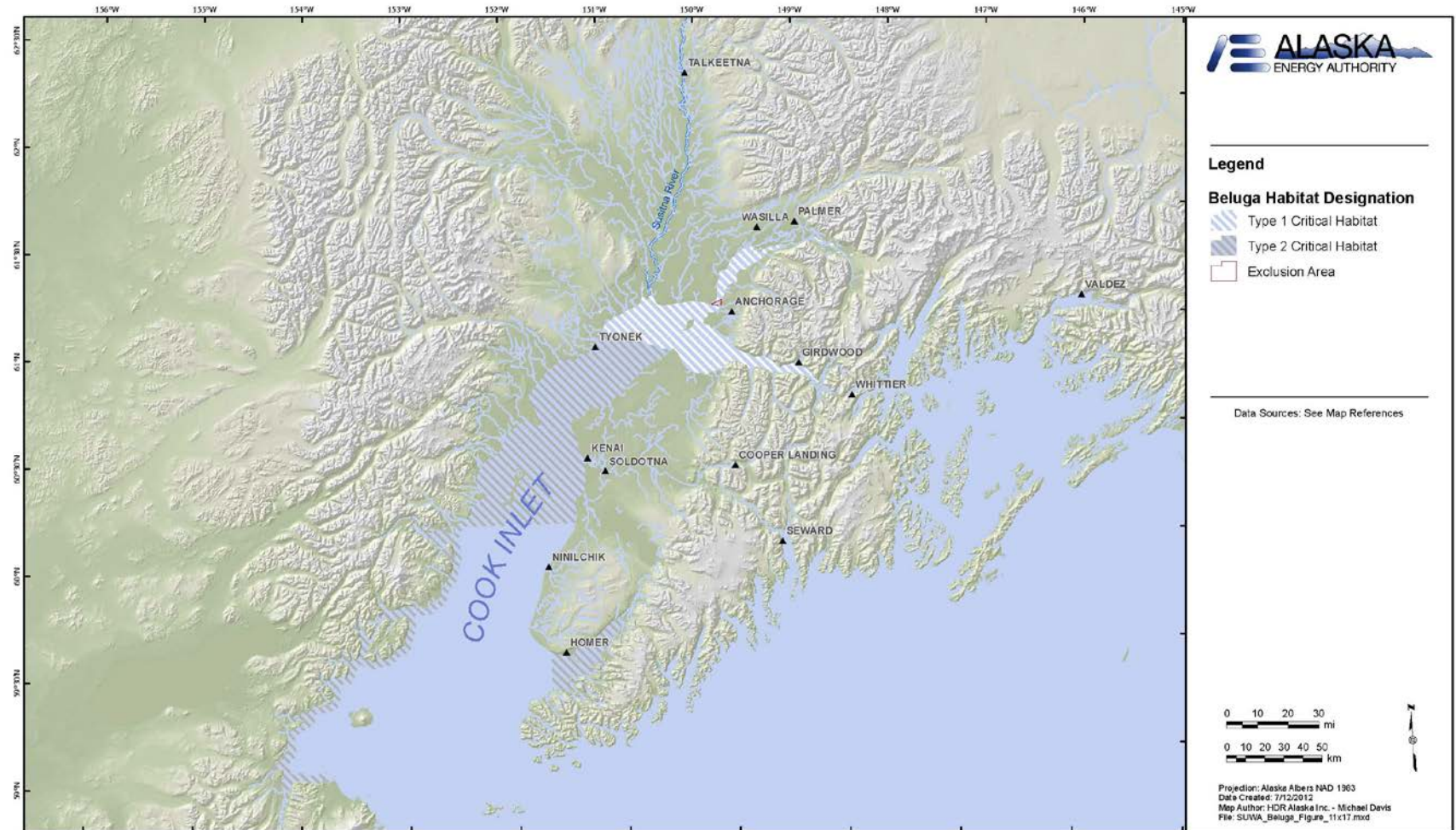
- Compilation of a white paper summarizing life history and habitat requirements of eulachon in glacial systems
- Current reports indicate the eulachon run may only have one peak and occur during a short time frame than during the 1980s

# Cook Inlet Beluga Whale Study – Goals and Objectives

1. Document the presence of all marine mammals in the Susitna River delta, focusing on CIBWs distribution within Type 1 critical habitat;
2. Determine marine mammal utilization of the Susitna River, focusing on the upstream extent of CIBWs; and
3. Evaluate the relationships between potential hydropower-related changes in the lower Susitna River, CIBW in-river movements, and CIBW prey availability.



# Cook Inlet Beluga Study Area



# Cook Inlet Beluga Whale Study

## Methods

- Remote camera systems
  - Still cameras and live-feed video
- Monthly aerial surveys
  - One in late April (or ice-out)
  - Two in May
  - One in June (in addition to the NMFS survey)
  - One in July
  - One in September
  - One in October
- Models to be used for impact analysis have not been determined

# Future Reservoir Fish Community and Risk of Entrainment Study – Goals

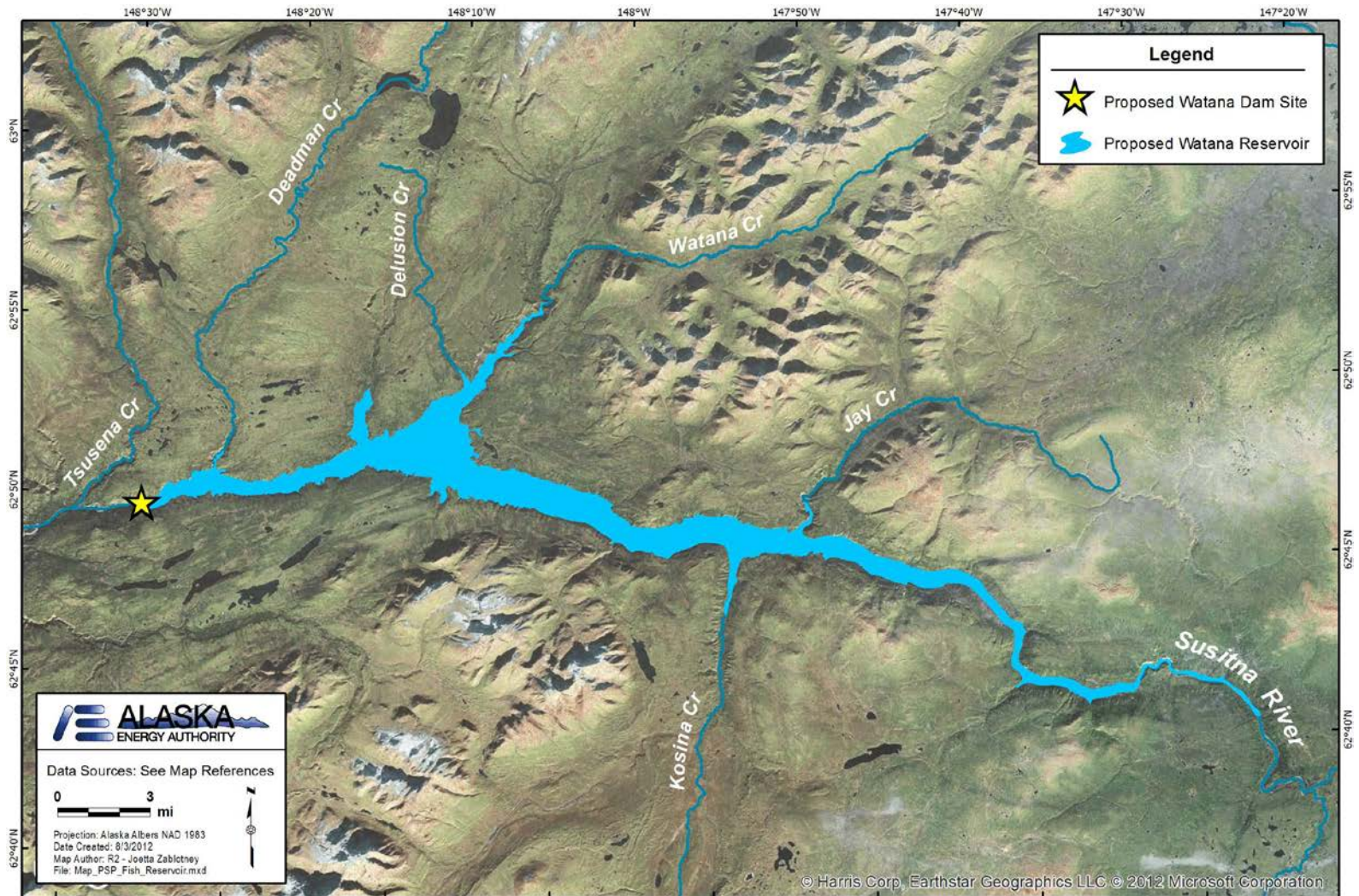
- To predict the fish community that will develop in the Project reservoir based on the existing species and the habitat that will be created in the inundation zone, and to characterize the potential loss from entrainment.

# Future Reservoir Fish Community and Risk of Entrainment Study – Objectives

1. Develop scenarios for anticipated daily and seasonal changes in reservoir habitat characteristics
2. Develop scenarios for future reservoir fish communities based on current Upper Reach fish species composition
3. Characterize potential management options for the reservoir fishery
4. Conduct a qualitative desktop analysis on the potential for entrainment of fish species inhabiting the proposed reservoir



# Future Reservoir Fish - Study Area

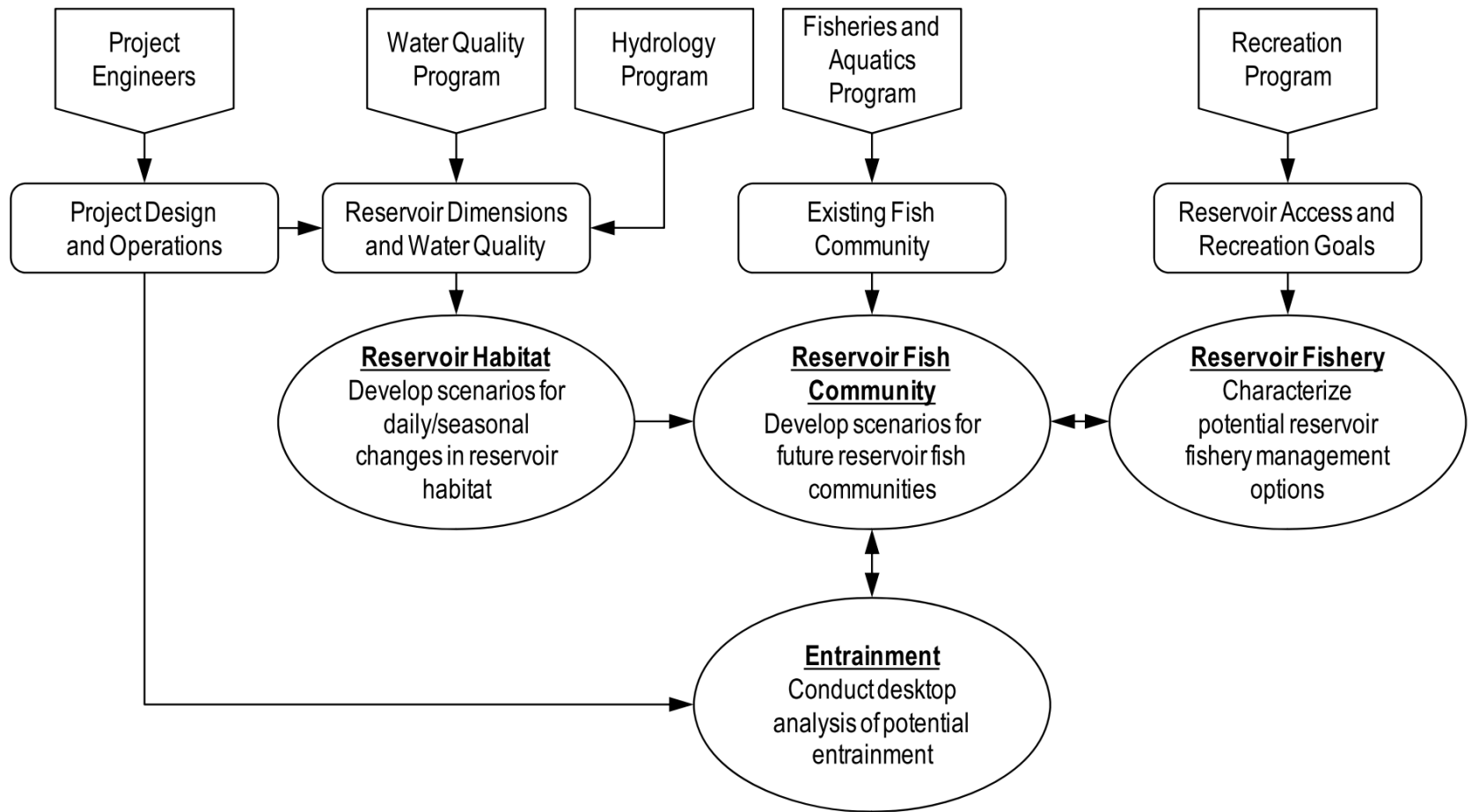


# Future Reservoir Fish - Methods

- Based on LiDAR data and a series of transects, adapt an existing model, or develop new unsteady flow hydraulic model of the proposed reservoir
- Development of a water temperature model of the proposed reservoir (EFDC)
- Collection of data and literature addressing existing fish species and their preferences/characteristics, entrainment risks, turbidity thresholds, etc.
- Analysis on information on public access and recreational goals for the reservoir (2014)
- Desktop Entrainment Analysis (2014)



# Future Reservoir Fish & Entrainment Study – Relationship to other Studies



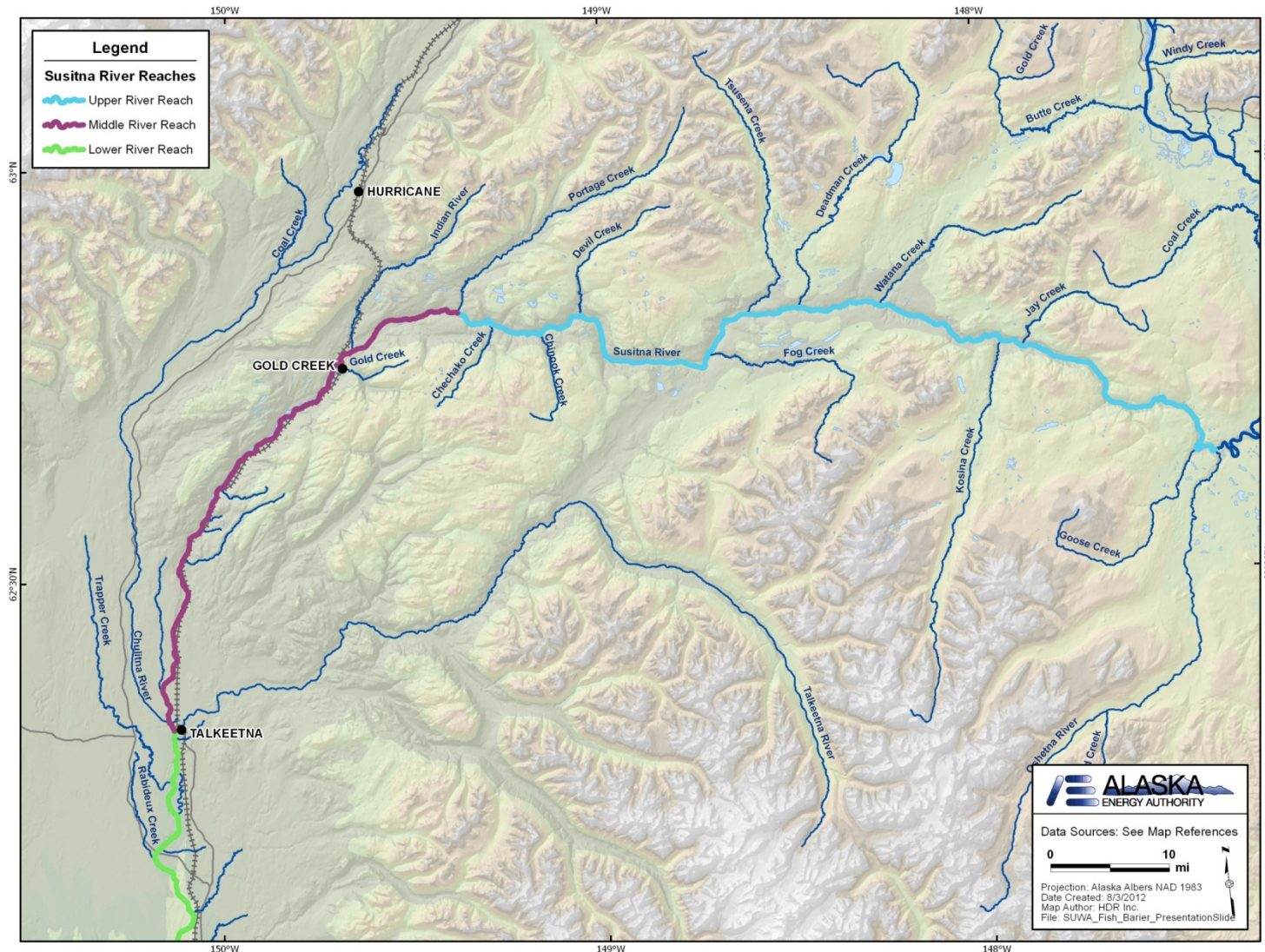
# Fish Passage Barriers Study – Goal

- To evaluate the potential effects of Project-induced changes in river flow on fish access into, within, and out of suitable habitats in the Upper and Middle Susitna River.

# Fish Passage Barriers Study – Objectives

1. Locate and categorize all existing fish passage barriers located in selected tributaries;
2. Identify the type and characterize the physical nature of any existing fish barriers within the Project hydrologic zone of influence;
3. Evaluate the potential changes to existing fish barriers within the Project hydrologic zone of influence; and
4. Evaluate the potential creation of fish passage barriers within existing habitats related to future flow conditions, water surface elevations, and sediment transport.

# Fish Passage Barriers - Study Area



# Fish Passage Barriers - Methods

- Potential barriers will be located using existing information and new ground and aerial field surveys, and evaluated and categorized based on established scientific methods and criteria and in consultation with the Aquatics TWG.
- Study method components include:
  - Identification of fish species to be included in study.
  - Defining passage criteria for identified fish species.
  - Selection of specific study sites and representative study sites.
  - Conducting field studies.
  - Coordination with results of IFS and geomorphic models.
  - Evaluation of potential effects of altered fluvial processes on fish passage in sloughs, side channels, and at tributary mouths.



# Fish Passage Barriers – Relationship to other Studies

Will rely on information from several other studies including:

- *2012 Upper Susitna River Fish Distribution and Habitat Study*
- *2013 -2014 Susitna-Watana Instream Flow Study*
- *2013-2014 Geomorphology Study and Fluvial Geomorphology Modeling below Watana Dam*





# Genetic Baseline Study – Goals and Objectives

## Goal:

Collect fish tissues in project area for future research and to provide insight into Chinook salmon habitat use.

## Objectives:

1. Develop fish tissue archive from middle and upper river.
2. Contribute samples to ADFG genetic marker development.
3. Assess potential for mixed-stock analysis of Chinook.
4. Estimate proportion of lower-river juvenile Chinook in 2013 and 2014 that originate in middle and upper river.

# Genetic Baseline - Methods

- Collect tissue samples from adult salmon above Three Rivers (including Chinook above Devils Canyon) and ~21 other fish species in middle and upper river.
- Archive and analyze select samples at ADFG genetics lab.
- Evaluate existing and 2012 Chinook samples; if middle and upper river stocks can be distinguished from others, sample juveniles elsewhere in Susitna watershed in 2013 – 2014.
  - Estimate proportion of Chinook in lower river that originate from middle and upper Susitna River.



# Genetic Baseline – Expected Results

- Archive of genetic tissue from ~21 non-salmon species, allowing comparisons among stocks and to genetic structure of future populations.
- Further development of genetic baselines for all salmon species.
- Characterization of possible Chinook salmon subpopulations in upper and middle river.
- Evaluate potential for using Chinook salmon genetics as a marker to estimate system-wide abundance and apportionment.

# Genetic Baseline – Relationship to Other Studies

- Salmon escapement (PSP 7.7)
  - PSP 7.7 will provide information and research platforms needed for fish tissue collecting.
  - PSP 7.14 may provide alternate means of estimating Chinook escapement in future years.
- Will employ PSP 7.5 and 7.6 as research platforms for collecting various species.
- Foundational data for future population genetic studies.

# Genetic Baseline – Summary of 2012 Activities

- Using radiotelemetry (PSP 7.7) to locate salmon in middle and upper river.
- Sampling salmon with effort proportion to ADFG archive and analysis needs.
- ADFG analyzing Chinook salmon to assess inter-stock variation and uniqueness.
- Non-salmon species collected opportunistically towards overall target size for 2012-2014.



# Genetic Baseline Study – SR/PSP Discrepancies

All ADFG comments/requests addressed.

FWS and NMFS requested expansion to include fraction of all salmon originating upstream of Devils Canyon.

- 2012-2014 will assess fish presence and feasibility of methods.
- ADFG will be sampling any salmon found above Devils Canyon to establish a baseline from which estimates might be possible.
- Not technically possible if fish above Devils Canyon are not sufficiently unique from middle river populations (e.g., Portage Creek).

No other comments cataloged on topic.

# Access and Alignment Study – Goals

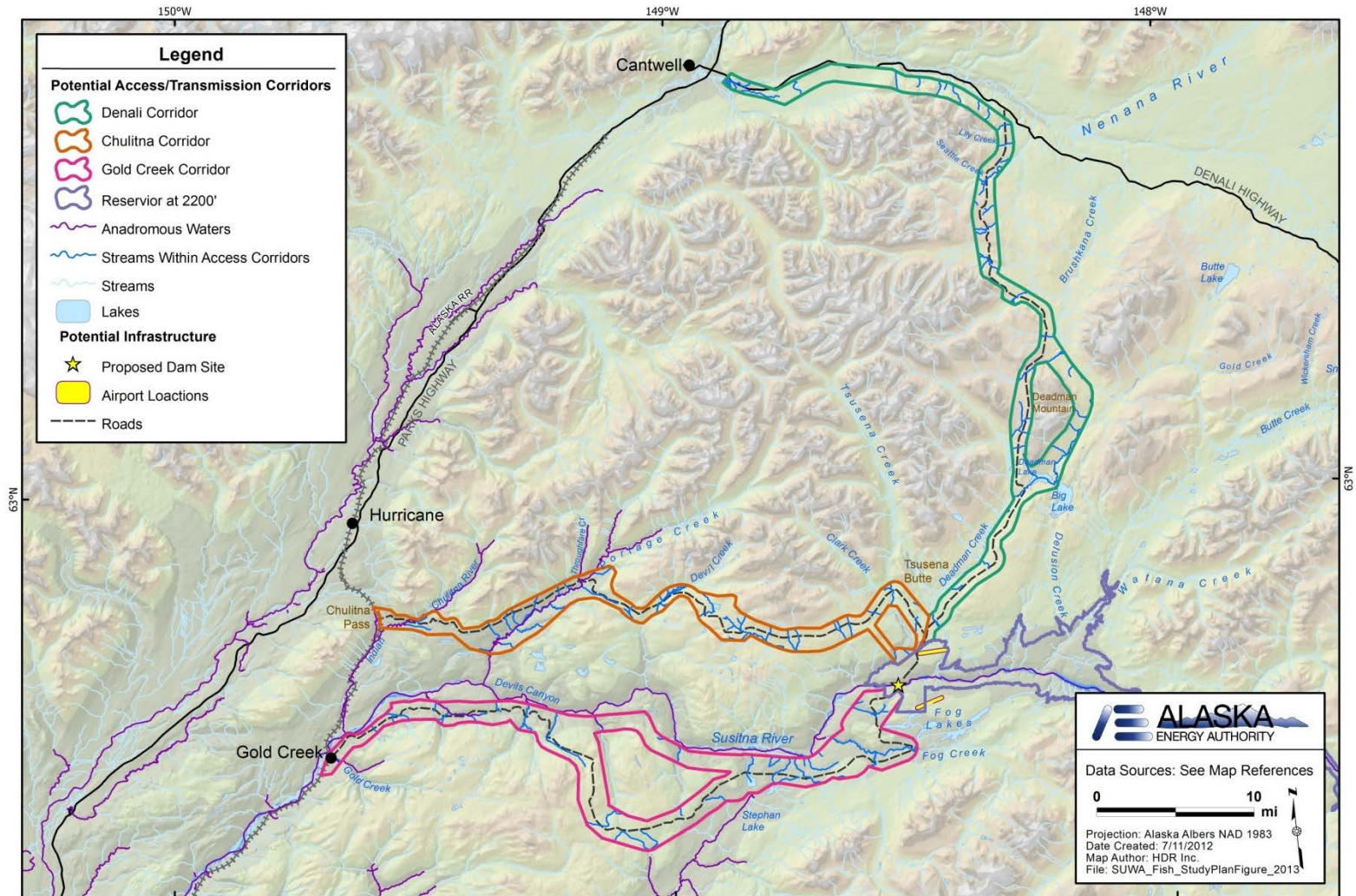
- Characterize baseline conditions of the aquatic habitat and fish populations in the vicinity of the proposed Project's infrastructure.
- Evaluate the potential for the proposed Project's infrastructure to affect these resources.
- Provide data for determining the least environmentally damaging alternative for purposes of issuance of a Section 404(c) permit.
- Provide data for developing any necessary protection, mitigation and enhancement measures.

# Access and Alignment Study – Objectives

1. Characterize the aquatic habitats and fish assemblages at potential stream crossings within a 200-meter (650-foot) buffer zone along proposed access road and transmission line alignments; and
2. Describe aquatic habitats and species present within the construction area for the dam and related hydropower facilities.



# Access and Alignment - Study Area



# Access and Alignment - Methods

- Synthesize Existing Information
- Identify and Prioritize Field Data Collection Sites
- Field Data Collection
  - Collect Aquatic Habitat
  - Collect Fish Population Data



# Project Area Fish Harvest Study – Goals and Objectives

1. Describe baseline harvest levels and harvest locations for commercial, sport, personal use, and subsistence fisheries for Susitna River origin resident and anadromous fish; and
2. Describe the potential for the Project to alter harvest levels and opportunities on Susitna River origin resident and anadromous fish based on potential Project-induced changes in fish abundance and distribution from flow- and habitat-related changes as estimated from other Project studies.



# Fish Harvest - Methods

Compilation and apportionment of ADF&G:

- commercial harvest records,
- harvest and effort from sport fisheries,
- harvest and effort from personal use fisheries, and
- subsistence harvest data



# River Productivity Study – Goal

- To evaluate the effects of Project-induced changes in flow and the interrelated environmental factors upon the benthic macroinvertebrate and algal communities in the lower, middle, and upper Susitna River.

# River Productivity Study – Objectives

1. Literature review - hydropower impacts on benthic macroinvertebrates and algal communities;
2. Characterize the pre-Project communities re species composition and abundance in the middle and upper river;
3. Estimate benthic macroinvertebrates drift in selected habitats;
4. Conduct a literature/data search to identify existing river systems that could act as surrogates in evaluating future changes to productivity;

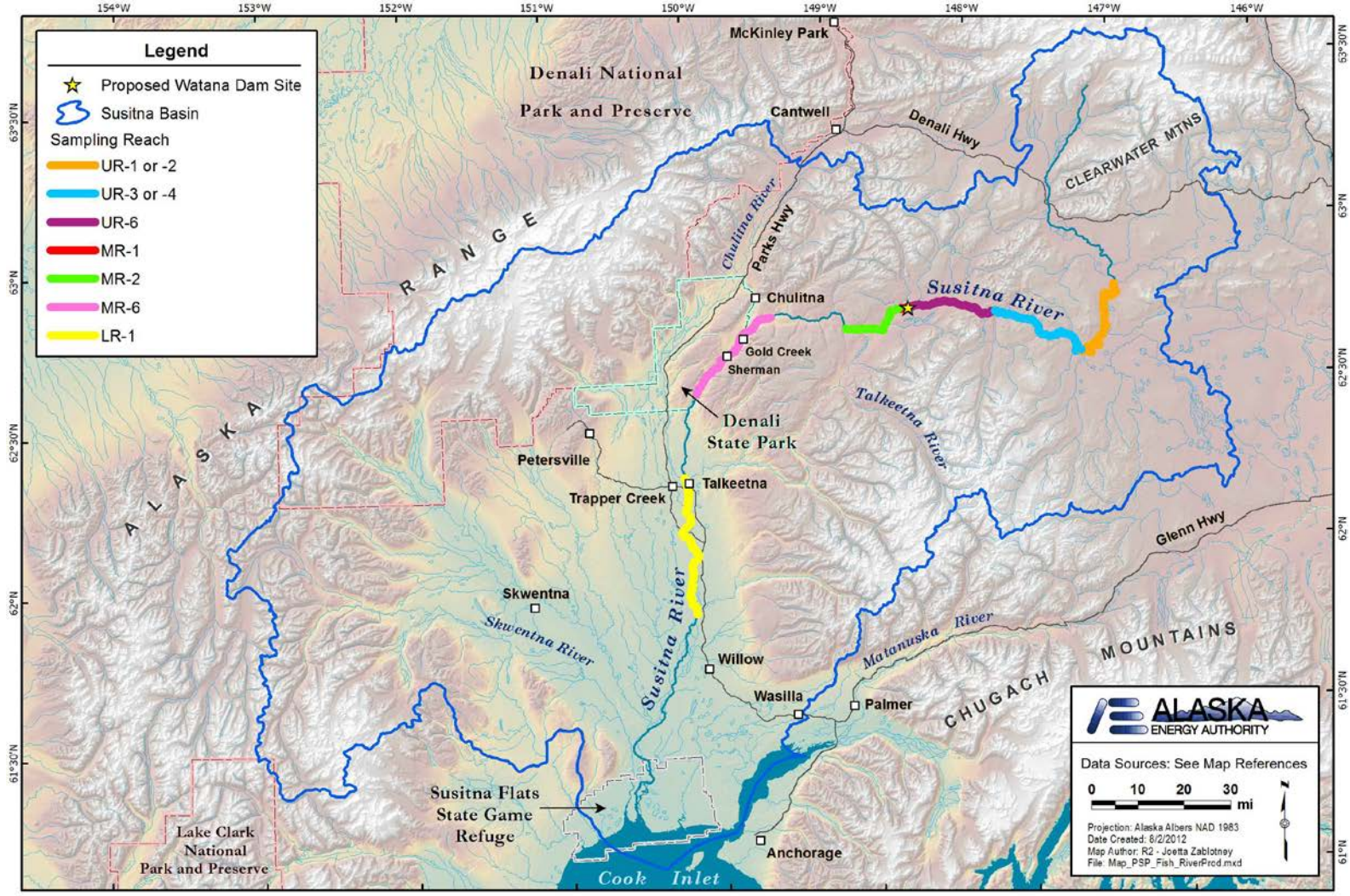


# River Productivity Study – Objectives (continued)

5. Conduct a review re feasibility of a trophic analysis;
6. Generate habitat suitability criteria for benthic macroinvertebrates;
7. Characterize the macroinvertebrate compositions in the diets of representative fish species;
8. Characterize organic matter in the lower, middle, and upper Susitna River; and
9. Estimate benthic macroinvertebrate colonization rates in the middle and lower reaches



# River Productivity - Study Area





# River Productivity - Methods

- 27 sampling sites above and below the proposed dam site, located at or near ISF transects.
- Seasonal sampling in riffle habitats within mainstem habitat types
- Variety of sampling methods: stream samplers, drift nets, artificial substrates, etc...
- Collection and processing compatible with Alaska studies, and will consider state and federal protocols.

# River Productivity – Expected Results

- Descriptive metrics commonly used in aquatic ecological studies (density, taxa richness, diversity, etc.).
- Benthic community compositions, structure, distribution, colonization rate, and their availability to the food web.
- Begin to predict the effects of river regulation on benthic communities.

# River Productivity Study – Relationship to other Studies

- Instream Flow Team: Locate sampling sites at or near ISF transects, to correlate benthic data with additional environmental data for HSC development.
- Fish study teams: Fish gut collection efforts.
- Water Resources: As part of review of trophic analysis, investigate ability of the river water quality model to predict changes in primary productivity in the Susitna River with changes in turbidity and temperature.



# River Productivity Study – SR/PSP Discrepancies

- PSP Objective 4 and Study Request Objective 7: Both concern the need for appropriate “reference” or “surrogate” sites. The PSP proposes a literature-based approach. The Study Request proposes additional sampling efforts on the Talkeetna and Chulitna rivers.
- PSP Objective 5 (Trophic Analysis Feasibility Study): The PSP proposes investigating the feasibility of conducting a site-specific trophic analysis, whereas the study request commits to conducting the analysis.



# Watana Dam Fish Passage Feasibility Study – Goals and Objectives

## Goal:

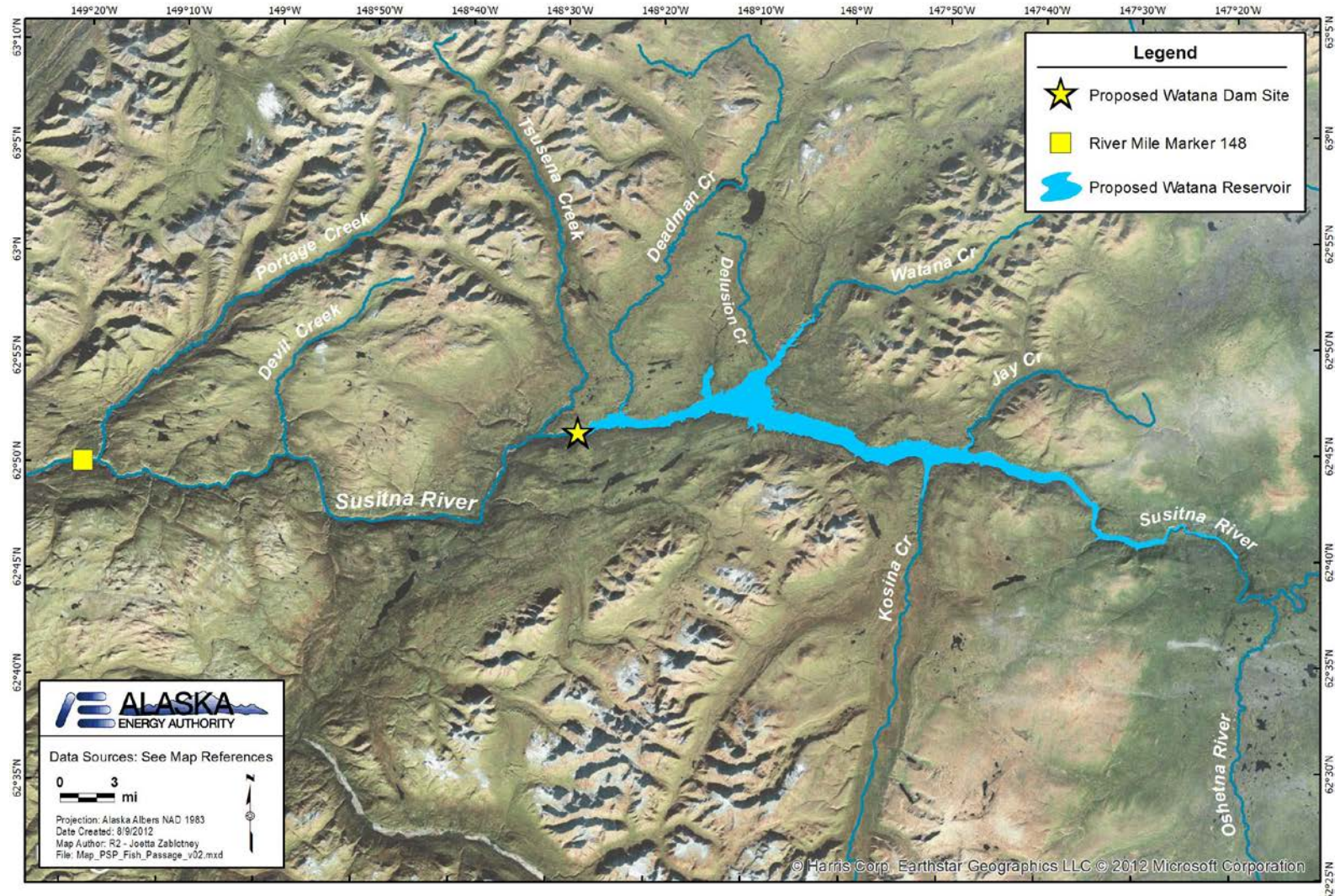
- To determine the feasibility of developing upstream and downstream passage facilities at Watana Dam.

## Objective:

- To compile existing information to support future discussions of potential fish passage measures with licensing participants during the FERC process.



# Fish Passage Feasibility - Study Area



# Fish Passage Feasibility - Methods

- AEA to identify a Fish Passage Workgroup;
- Methods for determining biological assumptions and feasibility developed cooperatively;
- Tasks
  - Compile, review, and summarize information;
  - Site reconnaissance;
  - Define and document a development process;
  - Develop conceptual alternatives;
  - Refine and evaluate conceptual alternatives.



# Watana Dam Fish Passage Feasibility Study – Relationship to other Studies

Data collected in 2012 fish and ISF studies will inform passage feasibility :

- Distribution and migratory timing of anadromous and resident fishes
- Relative abundance of anadromous and resident fishes above the proposed dam site
- Flows
- Water quality
- Fish passage barriers



# Watana Dam Fish Passage Feasibility Study – SR/PSP Discrepancies

- NMFS, USFWS require the following steps to obtain information needed for feasibility planning for fish passage design:
  - site reconnaissance
  - development of conceptual alternatives
  - collection of baseline biological information site information, and
  - project operations information sufficient to determine the need to prescribe fish passage
- NMFS Fish Passage Feasibility Review Requirements :
  - Reconnaissance study
  - Conceptual alternatives study
  - Feasibility study
  - Preliminary design
  - Detailed design

