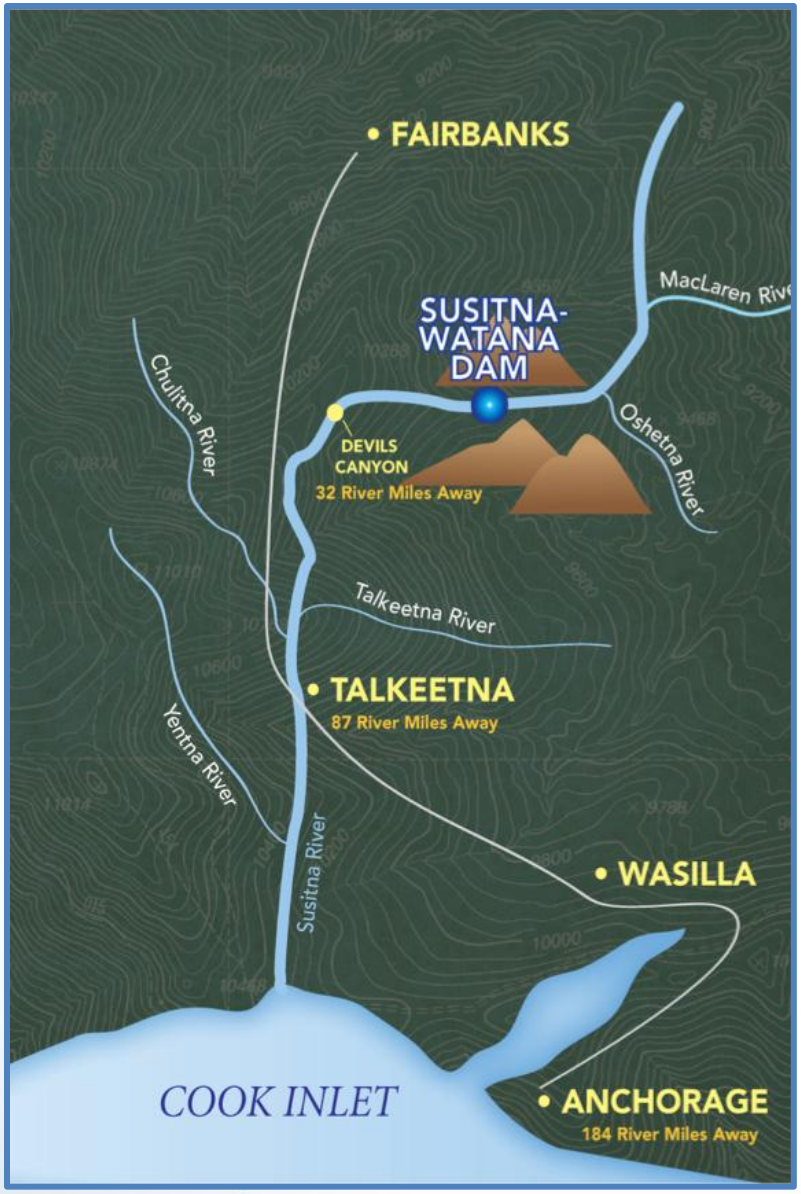


Technical WorkGroup Meeting

Fish and Aquatics Instream Flow

PSP to RSP Updates

24 October 2012

Prepared by R2 Resource Consultants

SUSITNA-WATANA HYDRO *Clean, reliable energy for the next 100 years.*

Instream Flow – Fish and Aquatics: Topics for Discussion

- Recap of Site Reconnaissance – October 2-3
- Overview of Comments and Responses (some selected examples provided)
- PSP → RSP Headings Comparison (i.e. Devil in the Details
- Schedule Refinement
- Study Interdependencies
- Other

October 3-4, 2012

TWG Instream Flow Site Tour

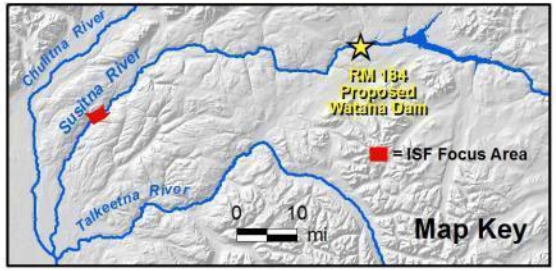
SUSITNA-WATANA HYDRO *Clean, reliable energy for the next 100 years.*

Legend

- Instream Flow Focus Area (Upper and Lower Extent)
- Flow Arrow
- River Mile Index (1981)

ALASKA ENERGY AUTHORITY

0 1,000 Feet



Projection: Alaska Albers NAD 1983
Date Created: 10/17/2012
Map Author: R2 - Joetta Zablotney
File: Map_PSP_ISF_FocusAreas.mxd

Data Sources: See Map References
Orthophoto Source: 2011 Matanuska-Susitna Borough LiDAR & Imagery Project

Active Spawning in 2012


MAHAY'S

Legend

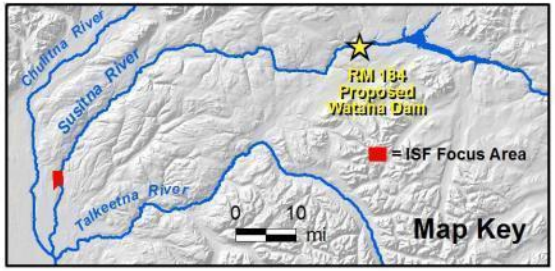
- Instream Flow Focus Area (Upper and Lower Extent)
- Flow Arrow
- River Mile Index (1981)

ALASKA ENERGY AUTHORITY

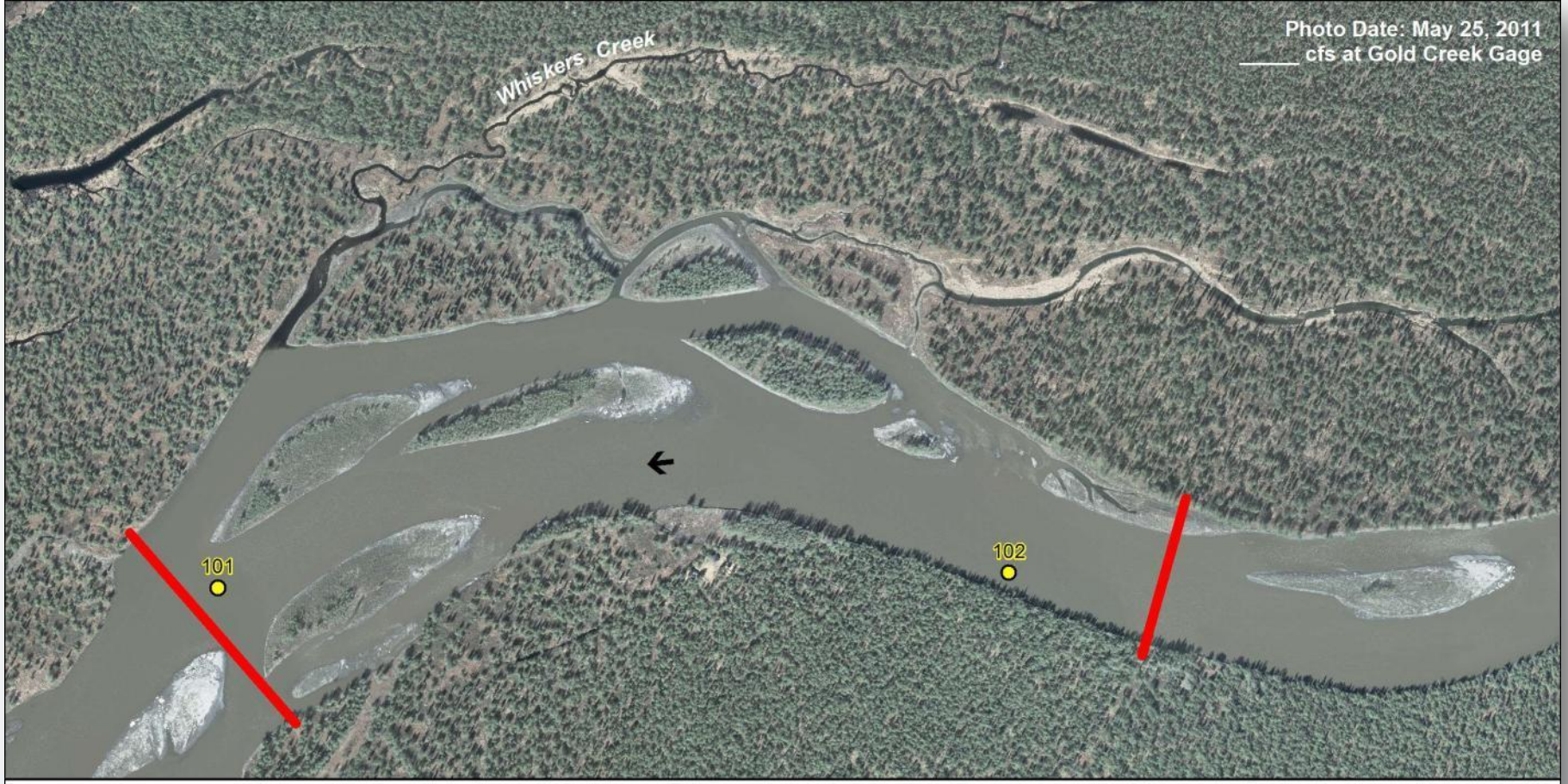
0 1,000 Feet

Projection: Alaska Albers NAD 1983
Date Created: 10/17/2012
Map Author: R2 - Joetta Zablotney
File: Map_PSP_ISF_FocusAreas.mxd

Data Sources: See Map References
Orthophoto Source: 2011 Matanuska-Susitna Borough LiDAR & Imagery Project



SUSITNA-WATANA HYDRO *Clean, reliable energy for the next 100 years.*



Legend

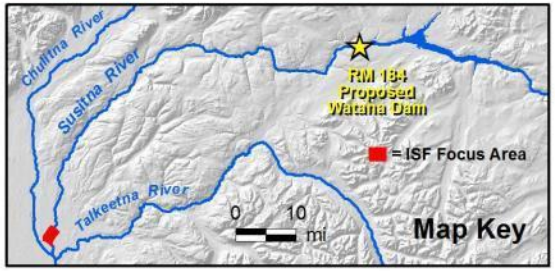
- Instream Flow Focus Area (Upper and Lower Extent)
- Flow Arrow
- River Mile Index (1981)

ALASKA ENERGY AUTHORITY

0 1,000 Feet

Data Sources: See Map References
Orthophoto Source: 2011 Matanuska-Susitna Borough LiDAR & Imagery Project

Projection: Alaska Albers NAD 1983
Date Created: 10/17/2012
Map Author: R2 - Joetta Zablotney
File: Map_PSP_ISF_FocusAreas.mxd

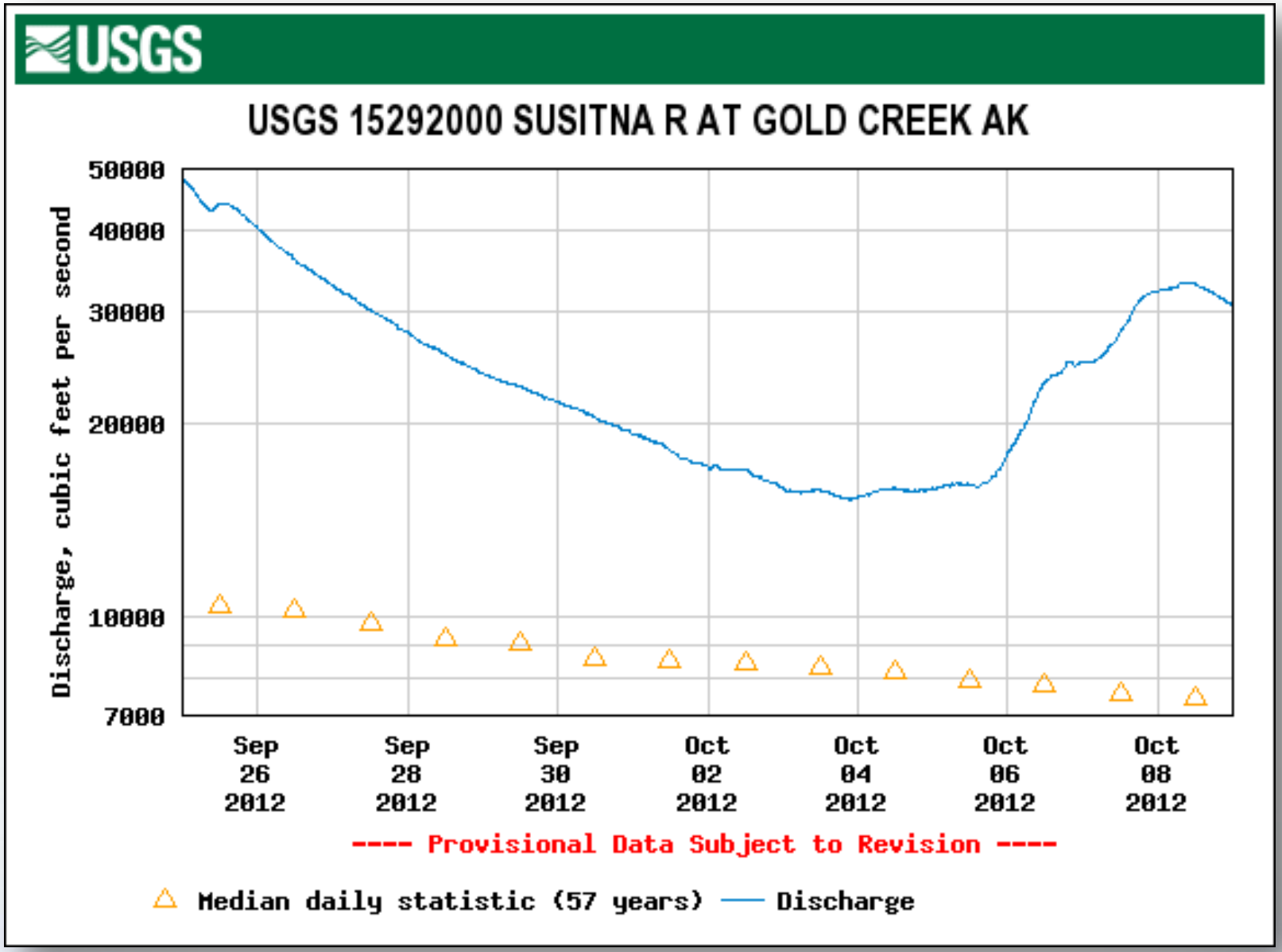


Upwelling Areas

SUSITNA-WATANA HYDRO *Clean, reliable energy for the next 100 years.*


SOTAR
ELITE


YAMAHA


USGS
USGS 15292000 SUSITNA R AT GOLD CREEK AK
Discharge, cubic feet per second
50000
40000
30000
20000
10000
7000
Sep 26 2012
Sep 28 2012
Sep 30 2012
Oct 02 2012
Oct 04 2012
Oct 06 2012
Oct 08 2012
---- Provisional Data Subject to Revision ----
Median daily statistic (57 years)
Discharge

Some Comments/Responses

Comments: Habitat Site Selection

Consultation Table Page Number	Licensing Participant	Agency	Date of Comment	Comment Via
8-3	Joe Klein	ADF&G	8/23/2012	Email
8-4	Joe Klein	ADF&G	8/23/2012	Email
8-6	Joe Klein	ADF&G	8/23/2012	Email
8-7	Betsy McCracken	USFWS	9/1/2012	Email
8-12	Mike Buntjer	USFWS	9/7/2012	Emailed Word Doc
8-13	Eric Rothwell	NMFS	9/12/2012	Email
8-14	Eric Rothwell	NMFS	9/12/2012	Email
8-15	Joe Klein	ADF&G	9/18/2012	Email

Comments: Habitat Model Selection

Consultation Table Page Number	Licensing Participant	Agency	Date of Comment	Comment Via
8-1	Joe Klein	ADF&G	8/23/2012	Email
8-5	Joe Klein	ADF&G	8/23/2012	Email
8-6	Joe Klein	ADF&G	8/23/2012	Email
8-8	Betsy McCracken	USFWS	9/1/2012	Email
8-16	Joe Klein	ADF&G	9/18/2012	Email
8-17	Eric Rothwell	NMFS	10/1/2012	Meeting with R2

Comments: Study Integration

Consultation Table Page Number	Licensing Participant	Agency	Date of Comment	Comment Via
8-1	Joe Klein	ADF&G	8/2/2012	Email
8-9	Betsy McCracken	USFWS	9/7/2012	Email
8-16	Joe Klein	ADF&G	9/18/2012	Email

Comments: Winter Fish Habitats

Consultation Table Page Number	Licensing Participant	Agency	Date of Comment	Comment Via
8-10	Mike Buntjer	USFWS	9/7/2012	Emailed Word Doc
8-11	Mike Buntjer	USFWS	9/7/2012	Emailed Word Doc

Comments: Stranding & Trapping

Consultation Table Page Number	Licensing Participant	Agency	Date of Comment	Comment Via
8-3	Joe Klein	ADF&G	8/23/2012	Email
8-10	Mike Buntjer	USFWS	9/7/2012	Emailed Word Doc
8-16	Joe Klein	ADF&G	9/27/2012	Meeting with R2

PSP→ RSP Headings

PSP and RSP Consistent Primary Headings

8.0 FISH AND AQUATICS INSTREAM FLOW STUDY

8.1 Introduction

8.2 Nexus between Project Construction / Existence / Operations and Effects on Resources to be Studies

8.3 Resource Management Goals and Objectives

8.4 Summary of Consultation with Agencies, Alaska Native Entities, and Other Stakeholders

8.5 Fish and Aquatics Instream Flow Study

- **8.5.1 General Description of the Study**
- **8.5.2 Existing Information and Need for Additional Information**
- **8.5.3 Study Area**
- **8.5.4 Study Methods**
- **8.5.5 Consistency with Generally Accepted Scientific Practice**
- **8.5.6 Schedule**
- **8.5.7 Level of Effort and Cost**
- **8.5.8 Literature Cited**
- **8.5.9 Tables**
- **8.5.10 Figures**

RSP Expanded Existing Information Section

8.5.2 Existing Information and Need for Additional Information

8.5.2.1 Habitat Distribution

8.5.2.2 Fish Distribution and Abundance

8.5.2.3 Salmonid Spawning and Incubation

8.5.2.4 Study Site Selection

8.5.2.5 HSC/HSI

8.5.2.6 Winter Studies

8.5.2.7 Periodicity

8.5.2.8 Instream Flow Methods and Models

PSP Technical Headings

8.5.4 Study Methods

- 8.5.4.1 IFS Analytical Framework
- 8.5.4.2 Habitat Mapping
- 8.5.4.3 Hydraulic Routing and Hydrologic Data Analysis
- 8.5.4.4 Habitat Suitability Criteria Development
- 8.5.4.5 Habitat-Specific Models Development
  - Hydraulic – Habitat Model Integration
  - Habitat Weighted Usable Area/Habitat Metrics
  - Effective Habitat and Varial Zone Modeling
  - Fish Passage/Off-channel Connectivity
  - Temporal Habitat Analyses

RSP Technical Headings

8.5.4 Study Methods

8.5.4.1 IFS Analytical Framework

8.5.4.2 River Stratification and Study Area Selection

8.5.4.3 Hydraulic Routing

8.5.4.4 Hydrologic Data Analysis

- *Data Collection*
- *Data Analyses*
- *IHA and EFC*

8.5.4.5 Habitat Suitability Criteria Development

- *Habitat Suitability Curves (HSC)*
- *Habitat Suitability Index (HSI)*
  - *Winter Habitat Use*
  - *Stranding*
  - *Trapping*
  - *Spawning and Incubation*
- *Periodicity*

RSP Technical Headings

8.5.4.6 Habitat-Specific Model Development

Habitat Model Selection

Physical and Hydraulic Data Collection

Hydraulic Model Calibration

Weighted Usable Area Habitat Metrics

Effective Spawning/Incubation Habitat Analyses

Varial Zone Modeling

- *Fish (Stranding and Trapping)*
- *Aquatic Productivity*

Fish Passage/Off-channel Connectivity

8.5.4.7 Temporal and Spatial Habitat Analyses

8.5.4.8 Instream Flow Study Integration

Schedule Refinement

Fish and Aquatics Instream Flow Study Schedule

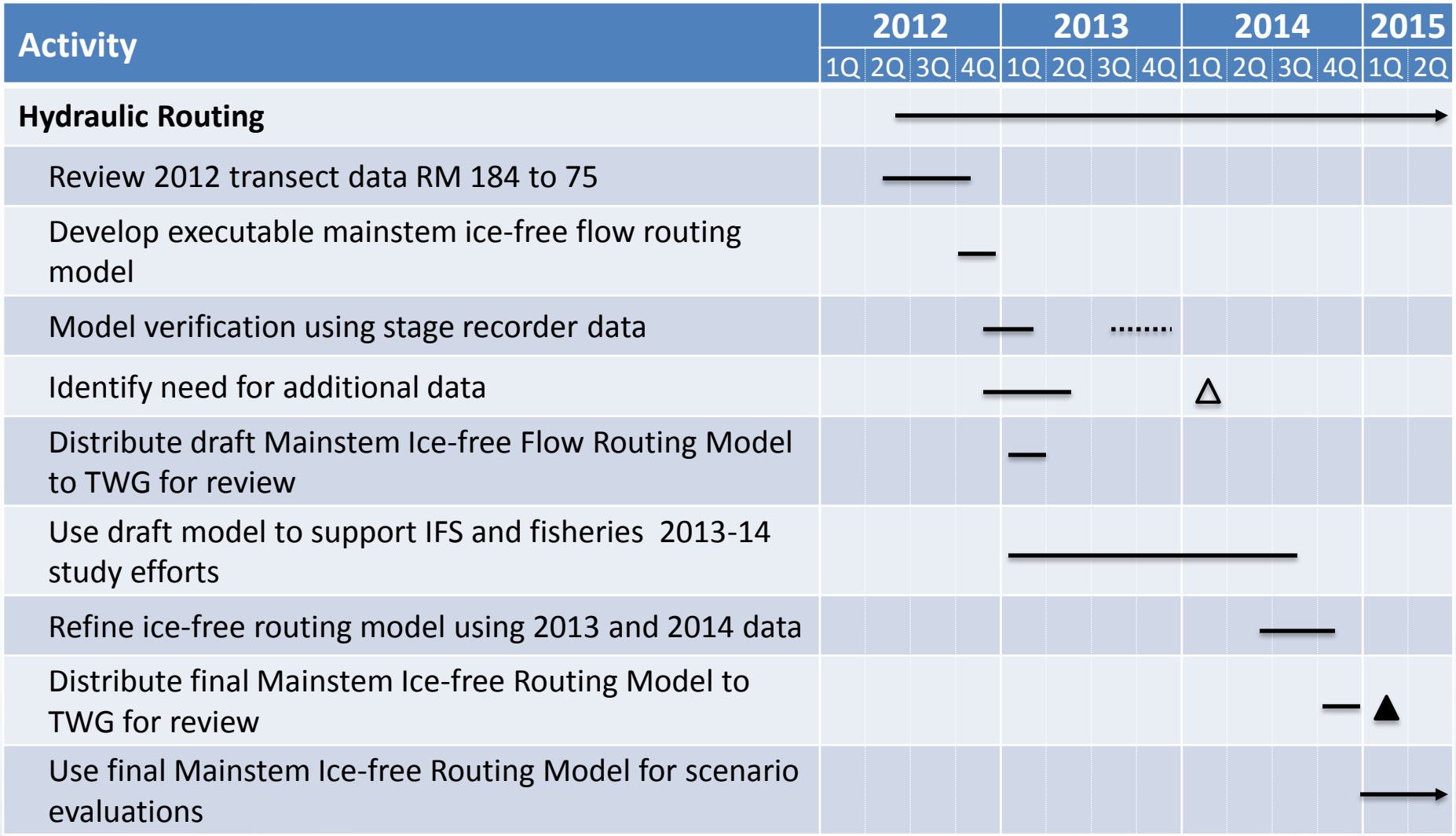
Activity	2012				2013				2014				2015	
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q
Study Area Selection (Focus and Supplemental Areas)														
Compile aquatic habitat (RSP Sec 9.09) and geomorphology (Sec 6.5) characterization study results														
Identify proposed Focus Areas														
Refine Focus Areas and identify supplementary area if needed for any underrepresented habitats														
TWG confirmation of 2013 areas														
Review available data and modify or add Focus Areas and supplementary sampling areas														
TWG review and confirmation of additional areas in 2014 as needed														
TWG review of proposed area weighting factors to extrapolate modeled to non-modeled areas														
TWG meeting on area weighting														

Planned Activity
Follow-up Activity
Initial Study Report
Updated Study Report

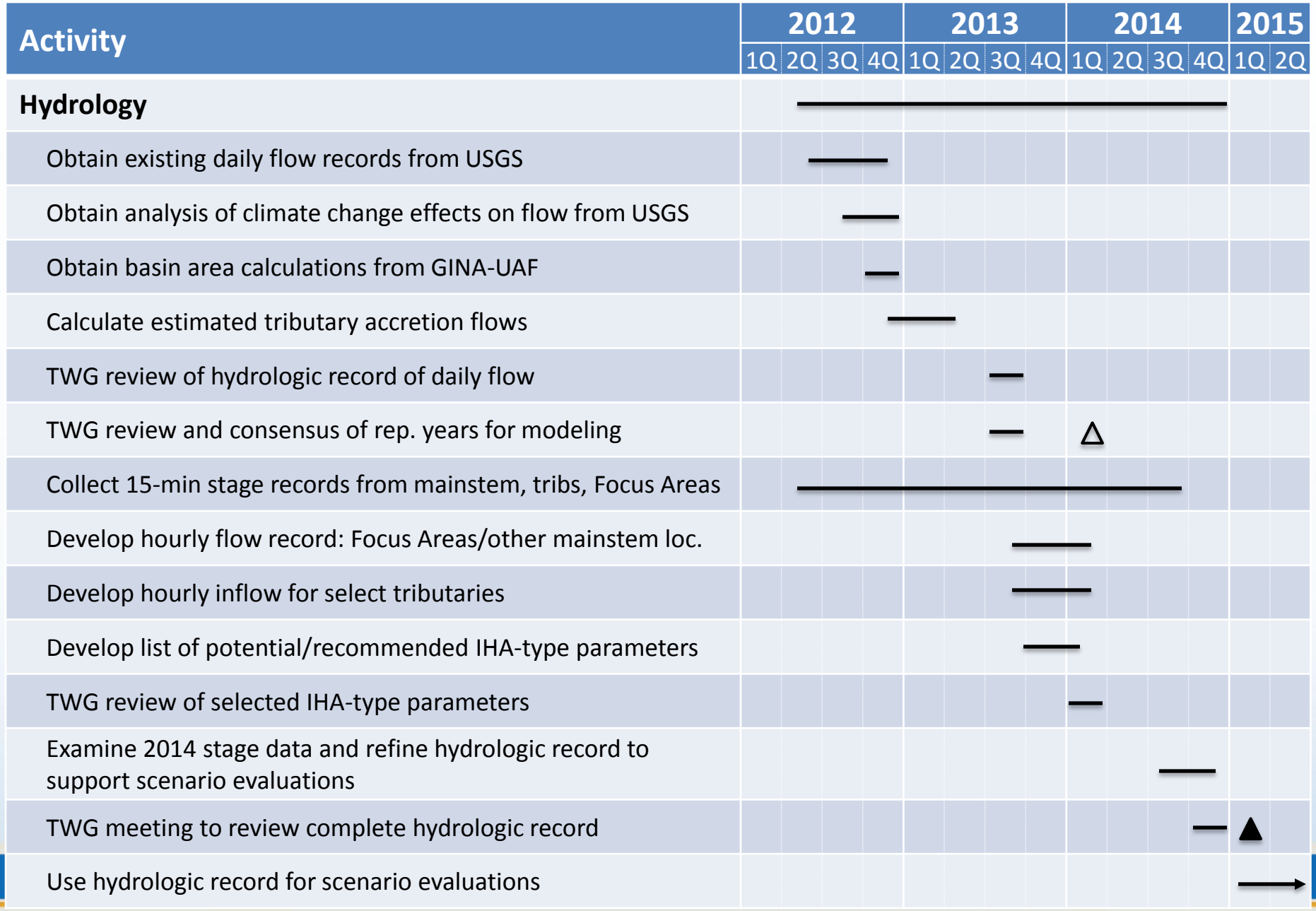
Fish and Aquatics Instream Flow Study Schedule (cont.)

Activity	2012				2013				2014				2015	
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q
Review of 1980s Data and Information														
Model Selection by habitat type (2-D, 1-D, etc.)														
Propose habitat models for Focus Areas and supplemental area														
TWG review and meeting on habitat model selection														

Fish and Aquatics Instream Flow Study Schedule (cont.)



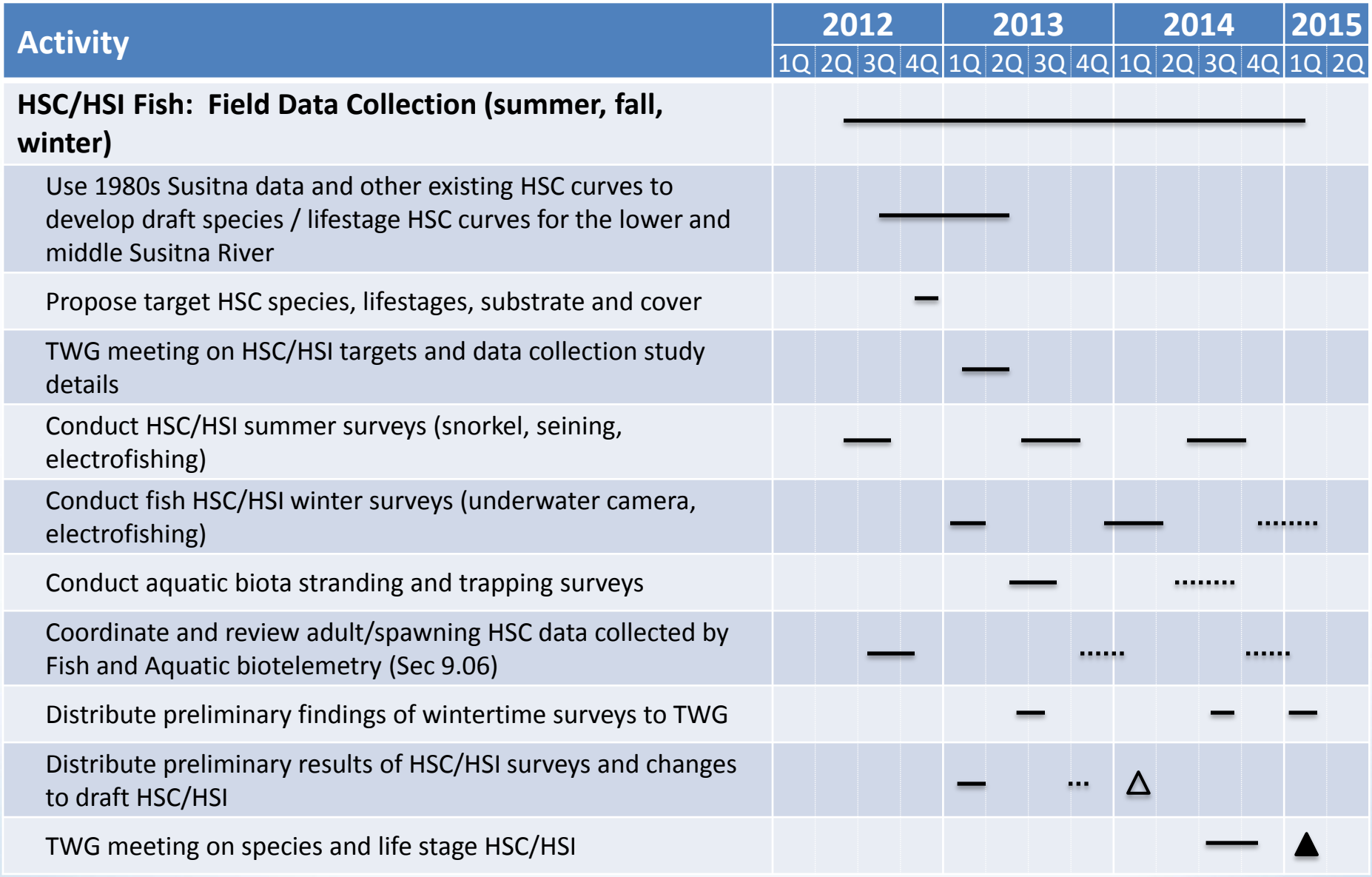
Fish and Aquatics Instream Flow Study Schedule (cont.)



Fish and Aquatics Instream Flow Study Schedule (cont.)

Activity	2012				2013				2014				2015	
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q
Periodicity														
Review draft species and lifestage periodicity data developed under Fish Distribution and Abundance (Sec 9.06)														
Identify specific HSC/HSI periodicity data needs														
Distribute HSC/HSI periodicity to TWG														
TWG meeting on HSC/HSI periodicity used to model scenarios														

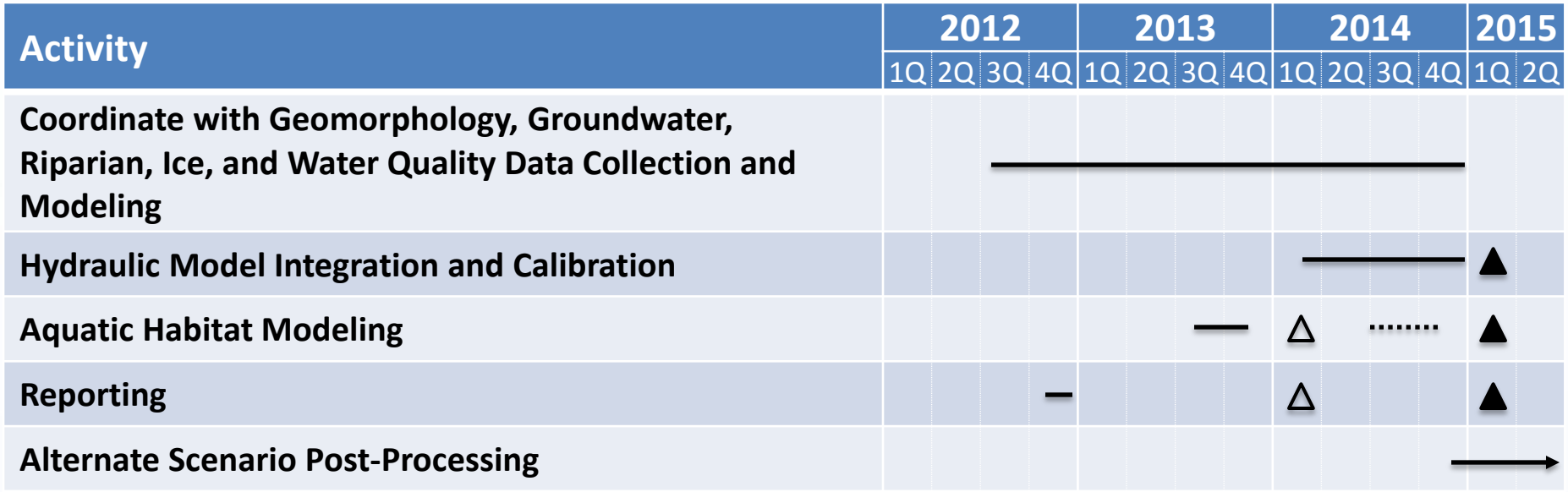
Fish and Aquatics Instream Flow Study Schedule (cont.)



Fish and Aquatics Instream Flow Study Schedule (cont.)

Activity	2012				2013				2014				2015	
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q
Collect Physical and Hydraulic Data for Habitat Modeling					——	——	——	——	——	——	——	——		
Collect data for digital terrain model					——	——	——			·····	·····	·····		
Collect x-section and stage:discharge data at Focus Areas and supplemental areas					——	——	——			·····	·····	·····		
Collect substrate/cover data at Focus Areas and supplemental areas							——			·····	·····	·····		
Provide summaries of data collection efforts									△				▲	

Fish and Aquatics Instream Flow Study Schedule (cont.)

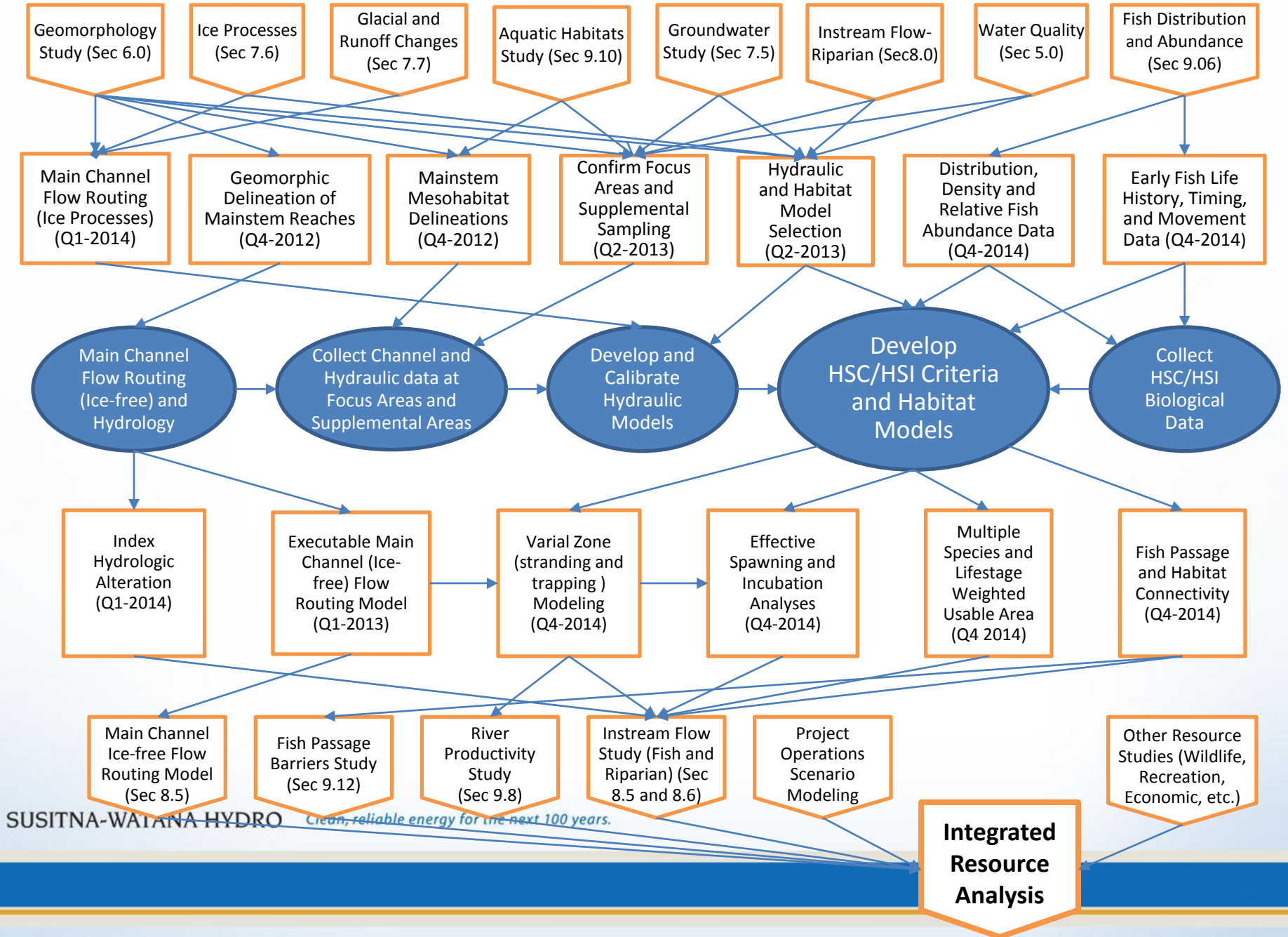


Fish and Aquatics Instream Flow Study Schedule (cont.)

Activity	2012				2013				2014				2015	
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q
Review of 1980s Data and Information														
Model Selection by habitat type (2-D, 1-D, etc.)														
Propose habitat models for Focus Areas and supplemental area														
TWG review and meeting on habitat model selection														

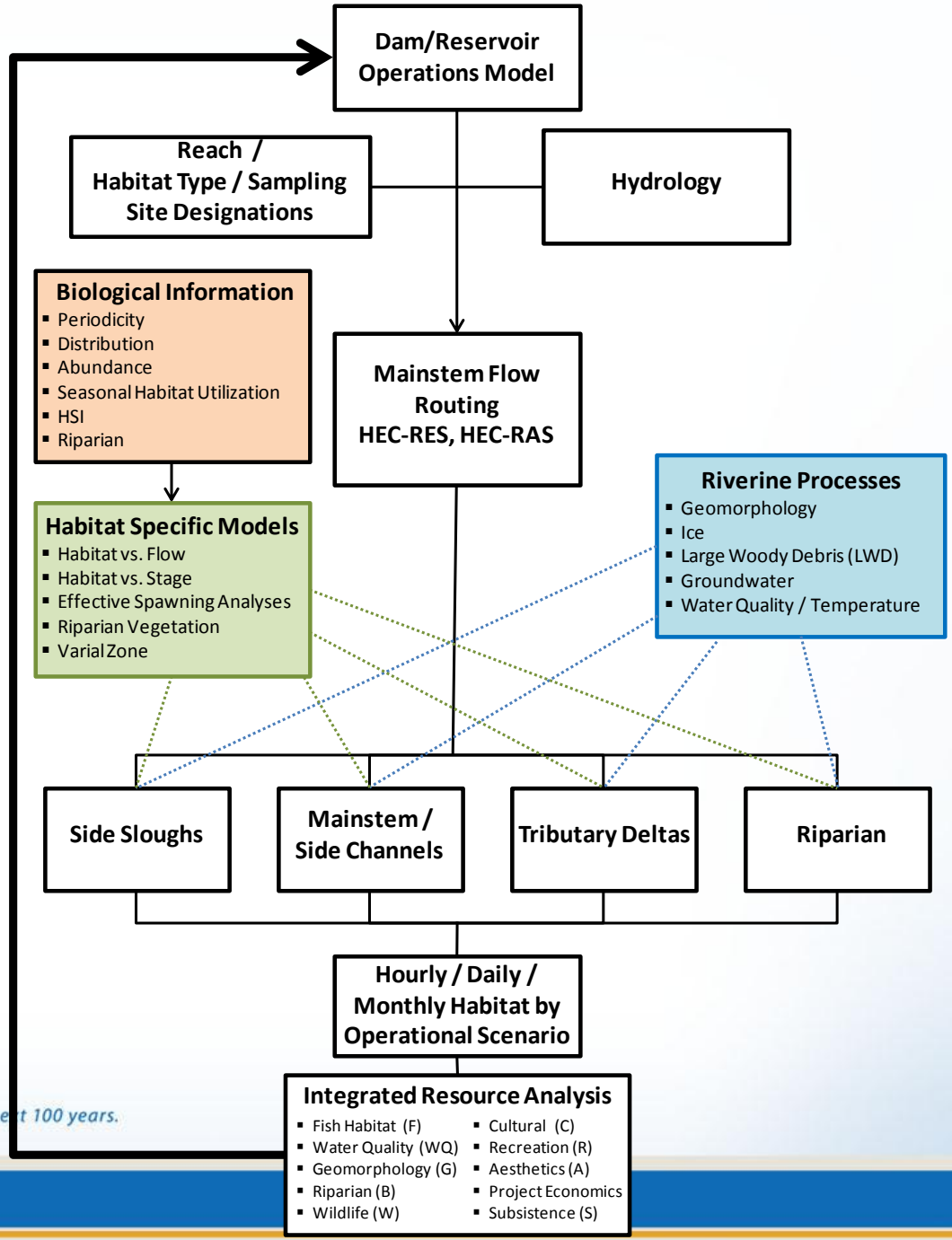
Study Interdependencies

STUDY INTERDEPENDENCIES FOR FISH AND AQUATICS INSTREAM FLOW STUDY



Analytical Framework for the Susitna –Watana Instream Flow Study (IFS)

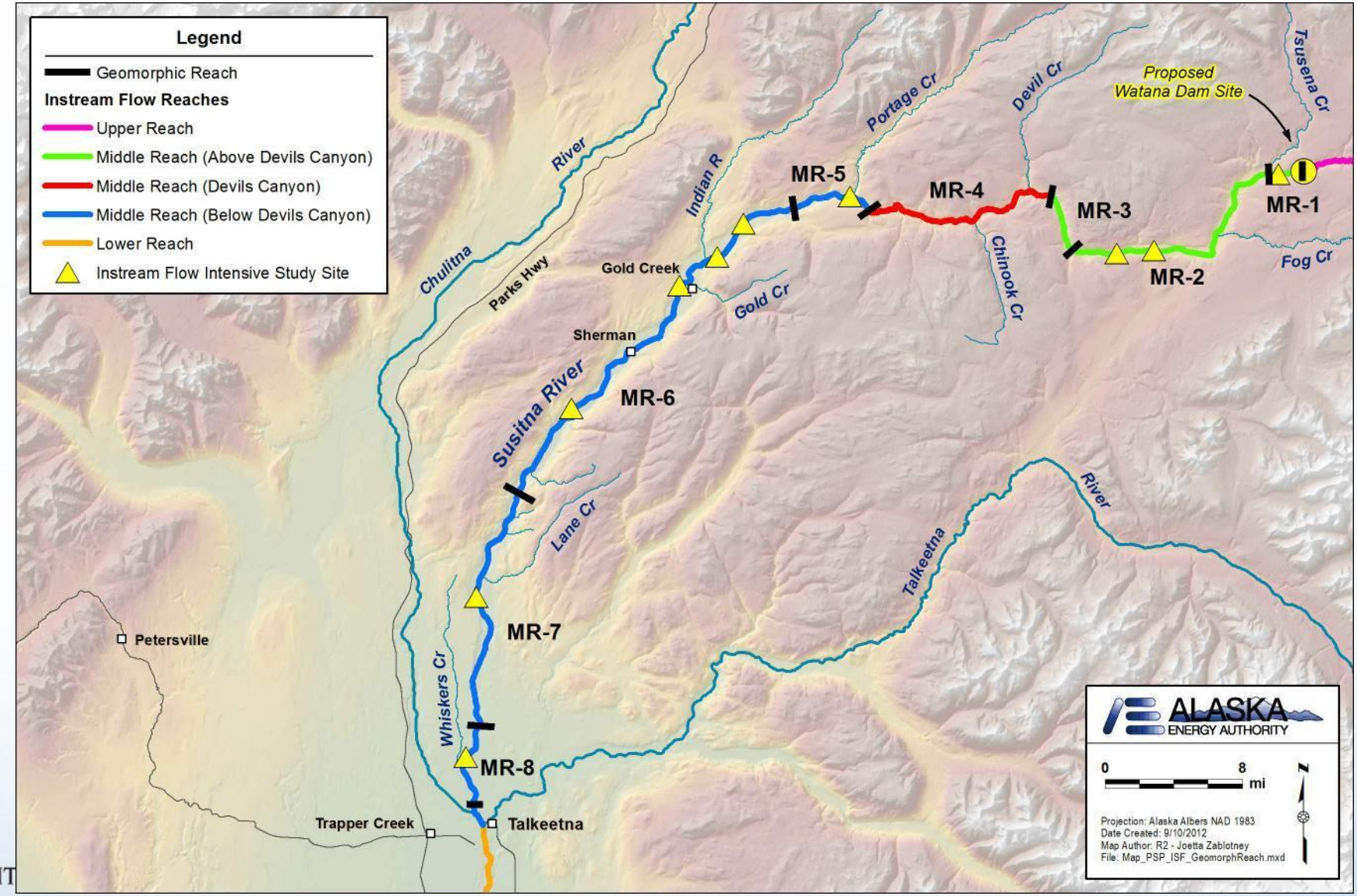
- Models represent the core tools to assess changes in aquatic habitats under alternative Project operational scenarios



Focus Area Selection-Instream Flow: Fish-Aquatics

- Stratification
  - Segment → Geomorphic Reach → Mainstem Habitat Type → Mesohabitat Types (Main channel only)(pool, riffle, run, etc.) → Lateral (Edge) Habitats (see example – photo)
- Site/Area Selection
  - Representative Reach – Applicability to Susitna - YES
  - Critical Reach – Applicability to Susitna - YES
  - Random – Applicability to Susitna - YES
- Focus Areas (10 in Middle Segment; x In Lower Segment

Focus Area Study Sites

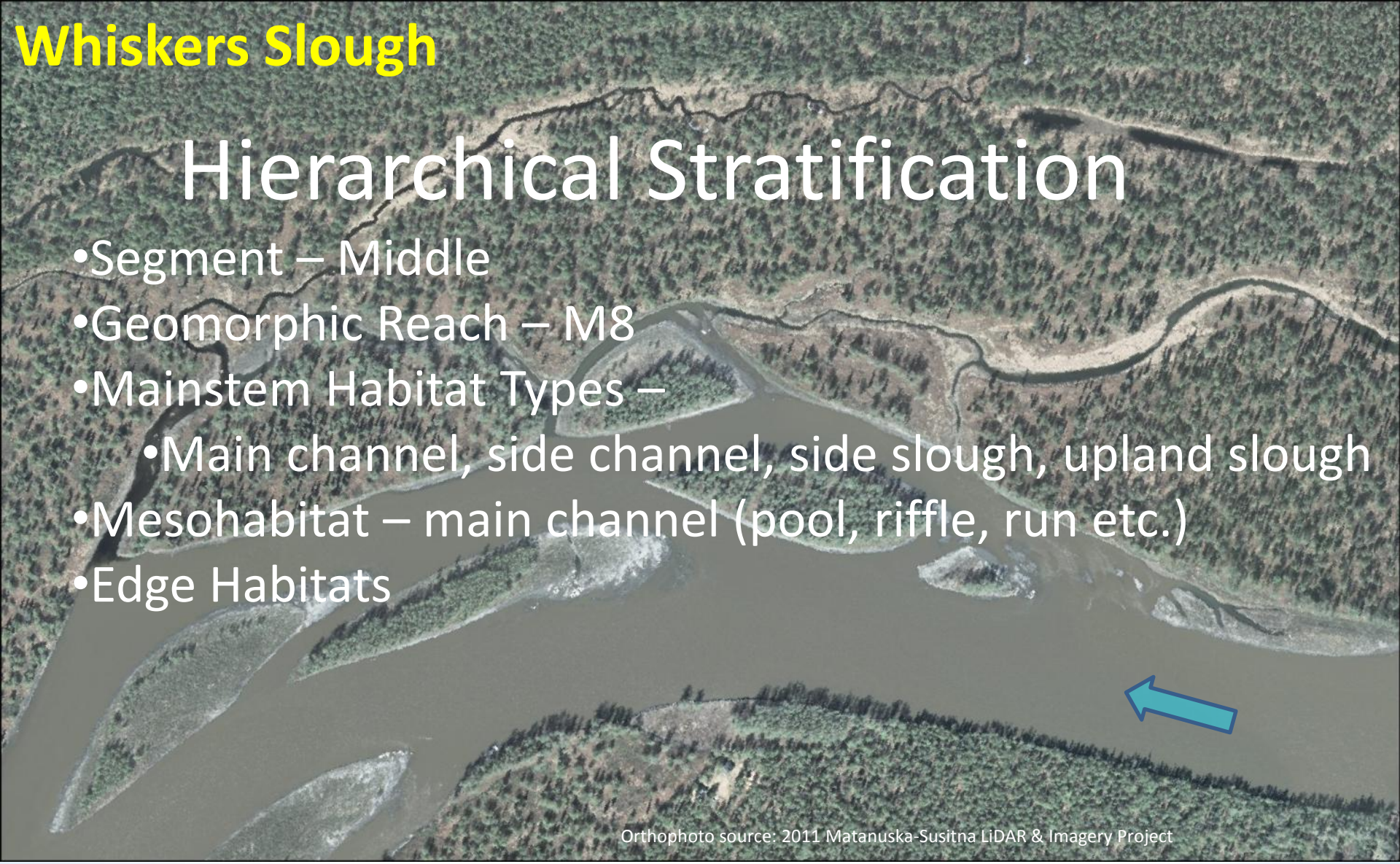


SUSIT

Whiskers Slough

Hierarchical Stratification

- Segment – Middle
- Geomorphic Reach – M8
- Mainstem Habitat Types –
  - Main channel, side channel, side slough, upland slough
- Mesohabitat – main channel (pool, riffle, run etc.)
- Edge Habitats

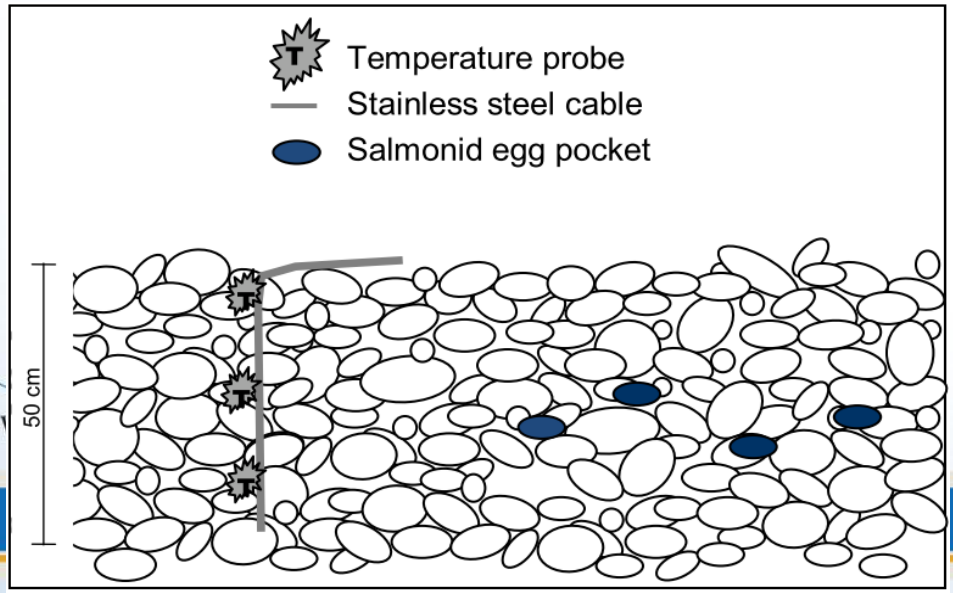


Orthophoto source: 2011 Matanuska-Susitna LiDAR & Imagery Project

Pilot Winter Studies

Pilot Winter Studies

- Objectives:
  1. Monitor intergravel temperature and DO conditions in and near known spawning areas (determine egg incubation conditions (and estimate emergence times) and collect data that will assist in determining how these conditions may change relative to flow regulation)
     - *Information important for understanding spatially distinct patterns of egg incubation and fry emergence timing and duration that can be used in evaluating potential project operational effects*



Pilot Winter Studies

- Objectives (continued):
  2. Monitor intergravel temperatures proximal to upwelling areas and within main channel
     - Useful for understanding groundwater/surface water interactions
  3. Define zones of groundwater influence – installation and monitoring of piezometers
  4. Evaluate juvenile fish behavior, habitat utilization, and relative abundance during winter conditions (under ice and open water threads)
     - *Information important for understanding current use patterns and potential project operational effects*

Pilot Winter Studies

- Objectives (continued):

5. Pilot study - Test different monitoring devices and sampling approaches:
   - Temperature: Onset TidbiT v2, TinyTag, Remote, FLIR Handheld
   - DO: Onset Combination Temperature and DO recorder (HOBO Dissolved Oxygen Logger - U26-001; YSI, others)
   - UW Cameras, including DIDSON
   - Pressure transducers/stage recorders
   - Piezometers
   - Fish sampling approaches: minnow traps, trot lines, etc.
6. Expand studies in 2013 (other seasonal monitoring)