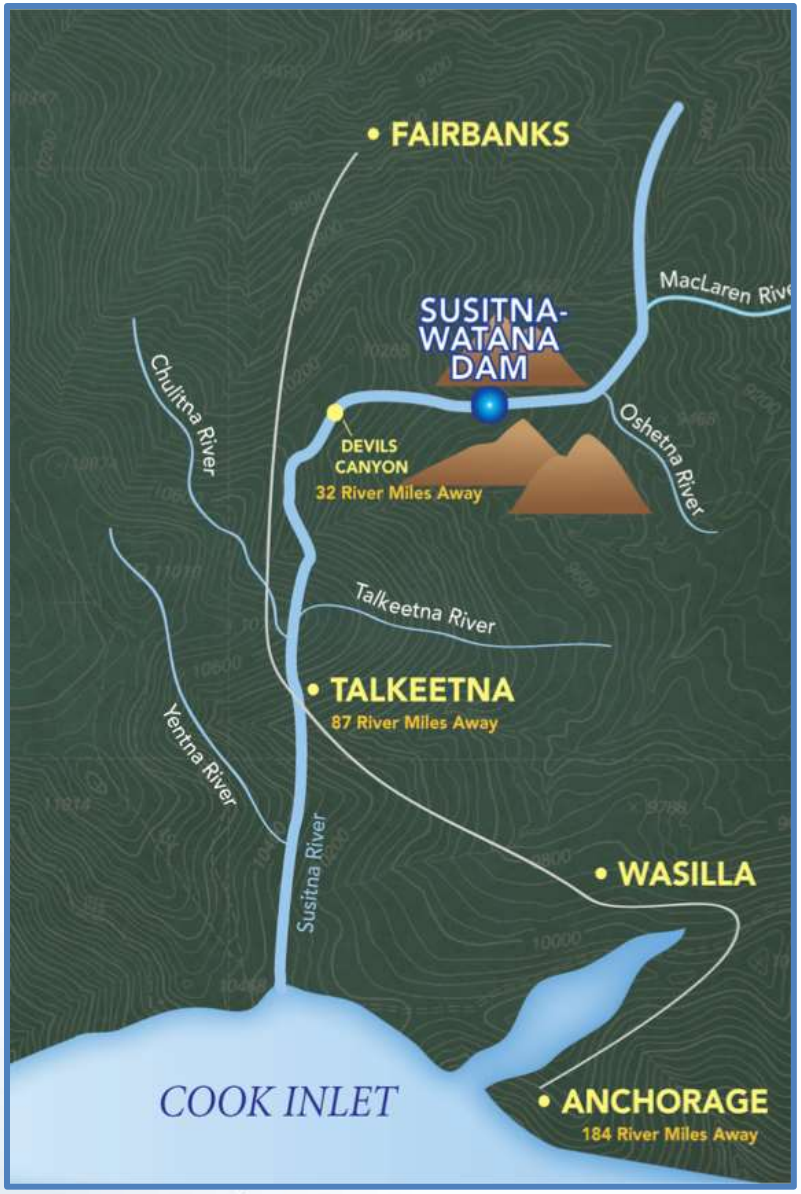


Technical WorkGroup Meeting

Q3 2013 TWG

Riparian IFS

Q3 Update

24 September 2013

Prepared by R2 Resource Consultants

RSP 8.6 RIFS – Presentation Overview[2]

- *Q3 2013 Update: Review of Q3 Riparian IFS Tasks*
- *Revised Study Plan FERC Determination Recommendations*
  - *Revised field methods based upon FERC determination*
- *Field Operations Update*
- *RIFS Study Plan Variances*
- *Q4 2013 Next Steps*

RSP 8.6 FERC April 1 SPD Recommendation - Revised Field Methods

1. *"We recommend that the study plan be modified to require AEA to sample seedling establishment following the initial spring peak flows (e.g., July) and again in September in 2013 and 2014."*
2. *"We recommend that the study plan be modified to specify that sediment grain size measurements would be based on samples taken at soil horizons, rather than at equal depth increments."*

RSP 8.6 RIFS – Q3 2013 Update

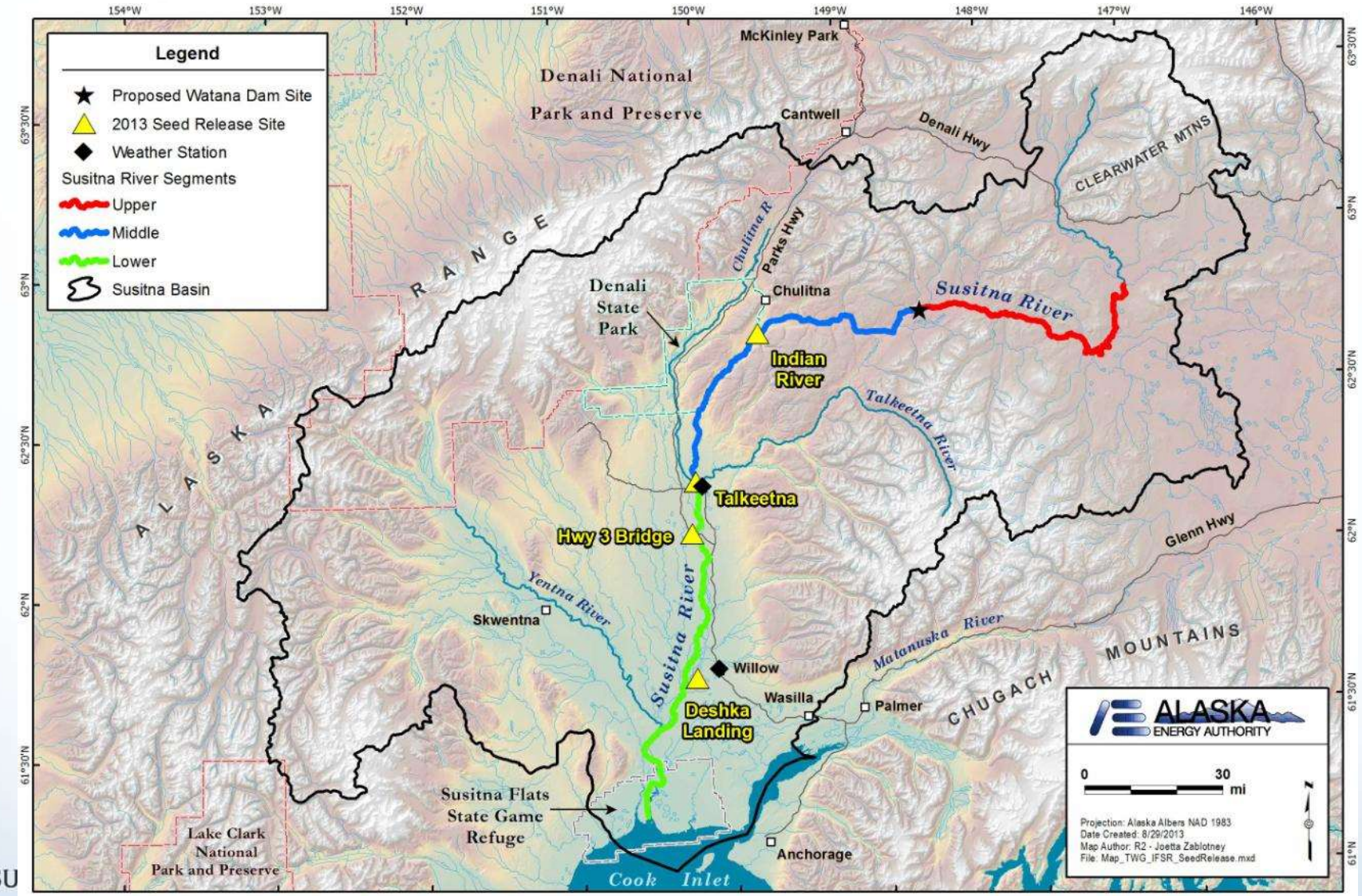
Activity	2013			
	Q 1	Q 2	Q 3	Q 4
Critical review of 1980s Susitna River Data, Current Scientific research concerning hydro project floodplain vegetation effects; and unimpacted, natural floodplain vegetation research.				
Implement Groundwater / Surface Water Installation and Sampling				
Riparian Vegetation: Field data collection				
Seed Dispersal Study				
Tree Ice Scar Mapping				
Focus Area vegetation mapping and sampling				
Dendrochronology sampling				
Soil Sampling, Sediment Dating and Analysis				
Develop GW/SW models				
Develop vegetation flow-response models				

RSP 8.6 RIFS Field Operations

Field operations began in Q2 and continued throughout Q3 for all RIFS studies:

- Seed dispersal study
- Seedling establishment study
- Vegetation and dendrochronology sampling
- Sediment stratigraphy study
- Tree ice scar – ice effects surveys
- Riparian GW/SW study

8.6 RIFS – Seed Dispersal Study Site Locations



RSP 8.6 RIFS – Seed Dispersal Study

Site Name	Number of Shrubs	Shrub Species	Number of Trees	Tree Species
Deshka Landing	12	*Salix alaxensis* & *Salix barclayi*	6	*Populus balsamifera*
Highway 3 Bridge	6	*Salix alaxensis* & *Salix sitchensis*	6	*Populus balsamifera*
Talkeetna	6	*Salix barclayi*	6	*Populus balsamifera*
Indian River	12	*Salix alaxensis* & *Salix sitchensis*	6	*Populus balsamifera*


Talkeetna Site

8.6 RIFS – Seed Dispersal Study

Data Collected	Collection Site
Number of open catkins	All
Shrub height	All
Tree DBH	All
Local temperature (15 minute intervals)	Deshka Landing Highway 3 Bridge

Dates of collection: June 6 to July 30, 2013

Hobo Temperature Sensor

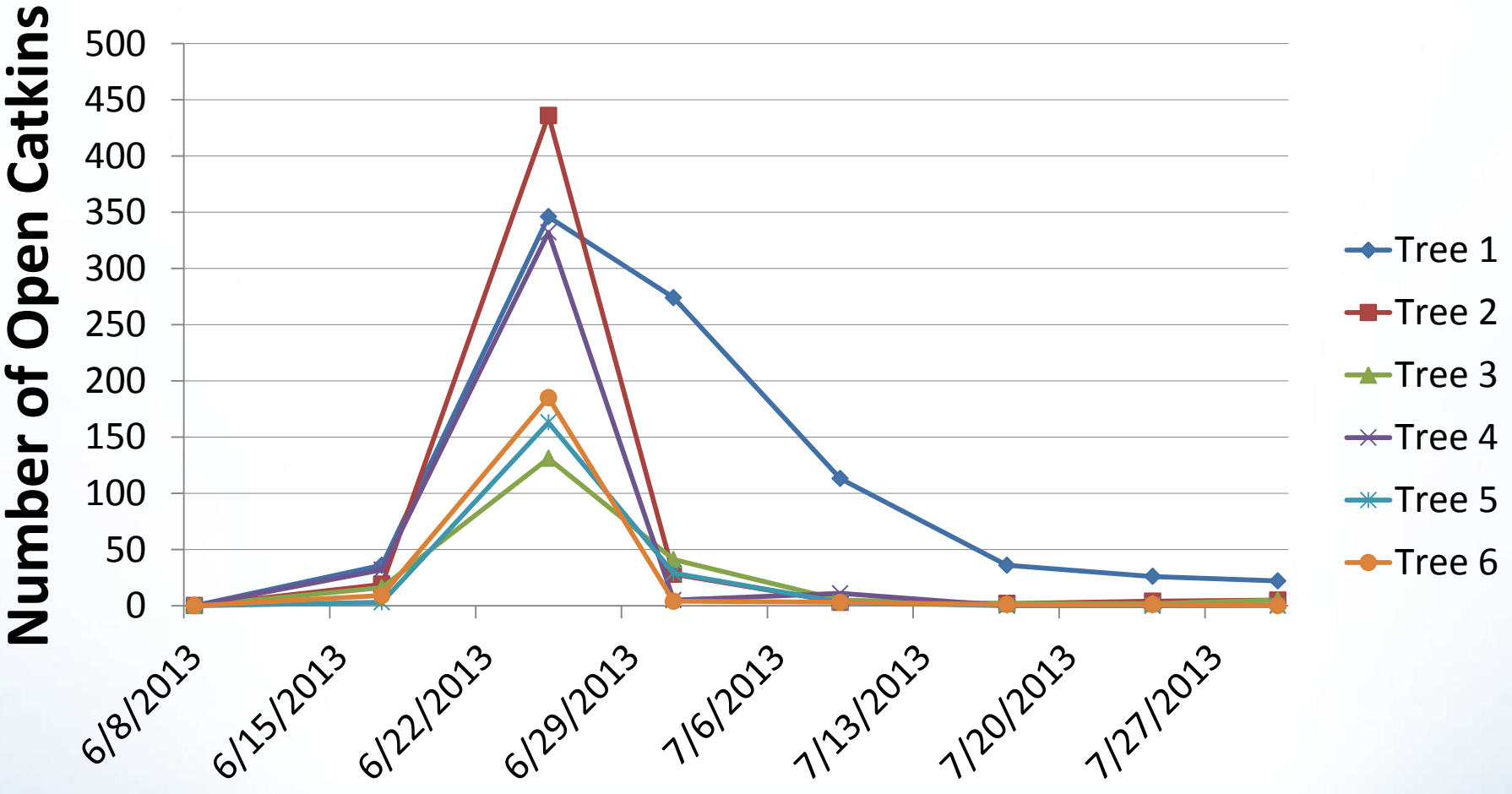
RSP 8.6 RIFS – Seed Dispersal Study

Cottonwood

Cottonwoods

Willows

Balsam poplar seed release – Deshka Landing



Sampling Period June 8 – July 30, 2013

RSP 8.6 RIFS – Seedling Establishment Study Update

RSP 8.6 RIFS – Seedling Establishment Study Update

- Conducted Focus Area seedling reconnaissance surveys
- Finalized seedling study design for Balsam poplar, willow species, white spruce and paper birch.
- “0+” (2013) seedlings sampled in transects located normal to channel in geomorphically representative channel margin locations
- White spruce and paper birch sampled in 8 meter wide belt transects

RSP 8.6 RIFS – Seedling Establishment Balsam poplar and Willow study

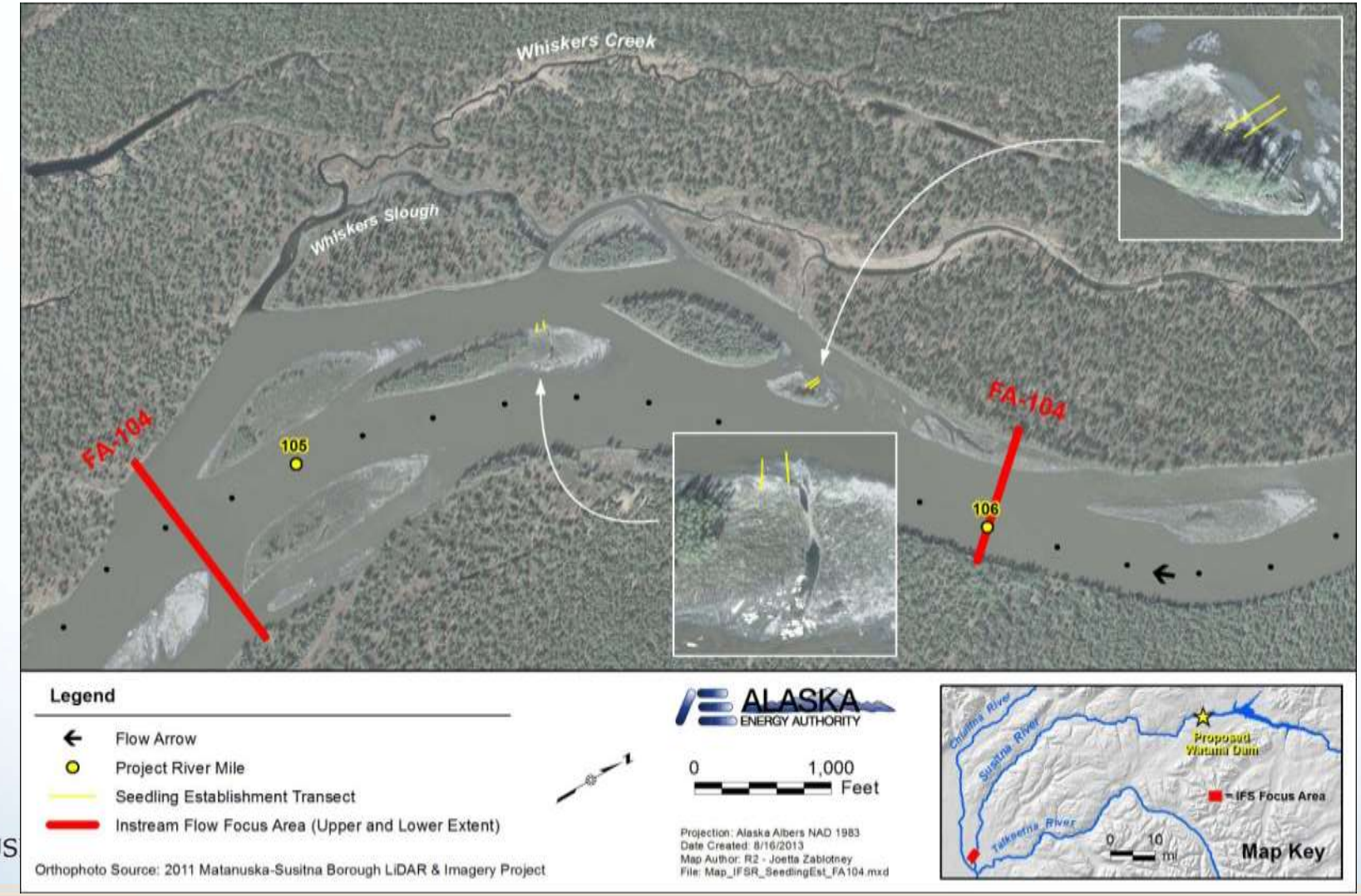
- Counted 0+ Balsam poplar and willow seedlings in 0.25x0.25m plots in late July, early August
- Re-sampled seedling survival in mid-September
- Recorded surface substrate type
- Measured depth to probe refusal (gravel/cobble strata)
- Surveyed plot elevations
- Isotope sampling: seedlings, sediment, groundwater, surface water, precipitation

RSP 8.6 RIFS – Seedling Establishment Balsam poplar and Willow study

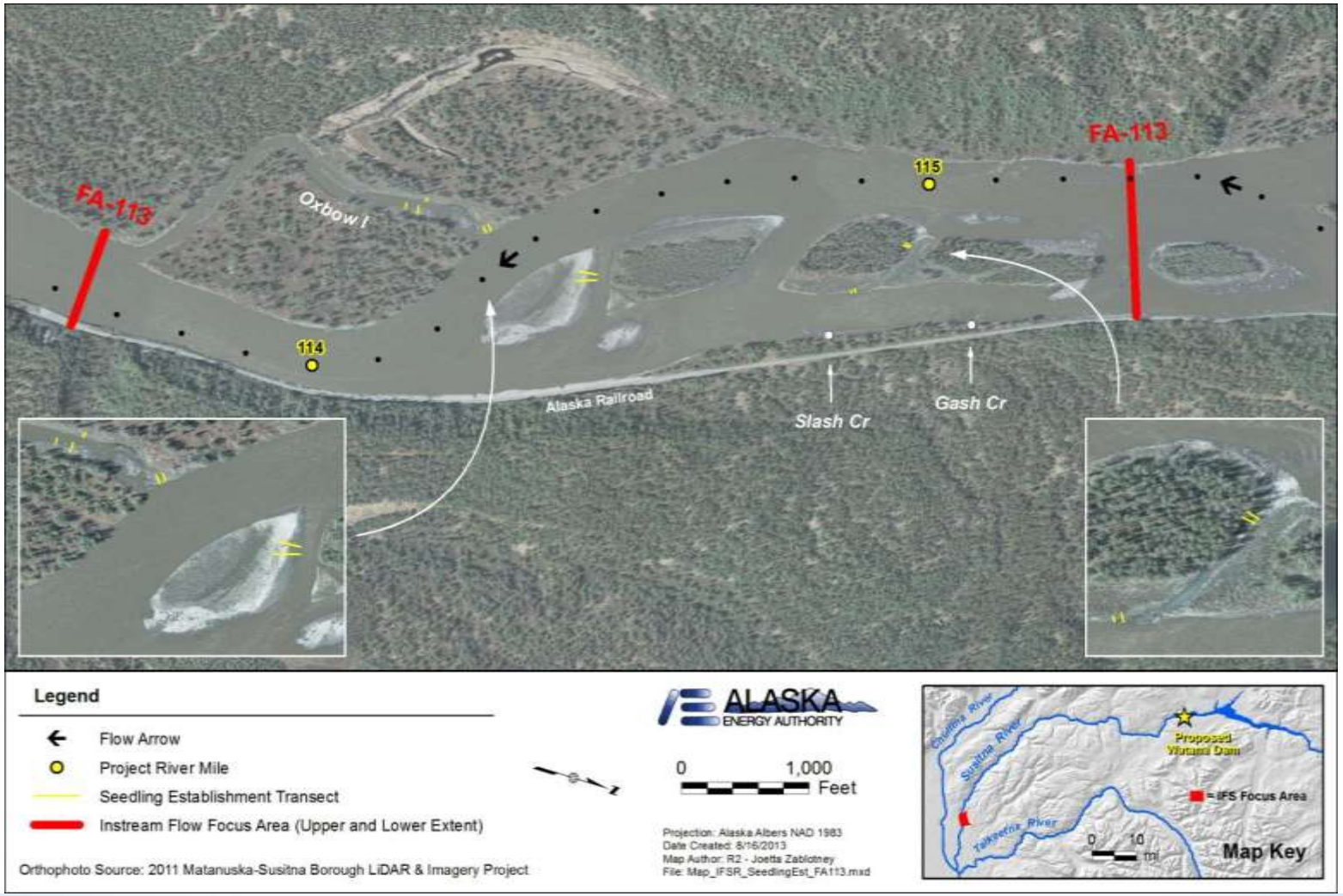
River Mile	Focus Area	Number of Transects	Number of Plots
104	Whiskers Slough	5	114
113	Lane Creek	12	222
128	Skull Creek	8	194
138	Gold Creek	4	126
144	Side Channel 21	6	168

0+ (2013) seedlings

Seedling Establishment Transect Terrain Locations at FA-104

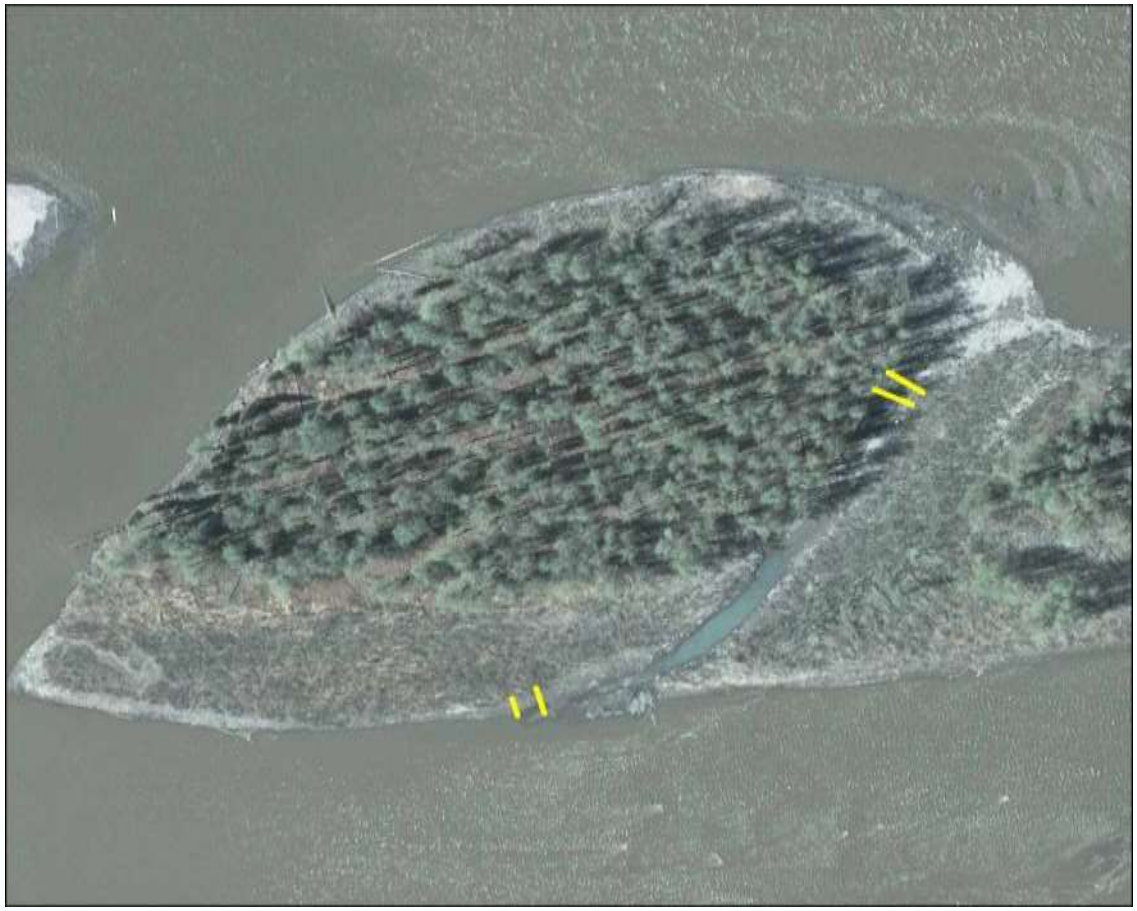


Seedling Establishment Transect Locations at FA-113



Head of Mid-channel Island and Slough Terrain Locations at FA-113

Side Channel and Slough Terrain Locations at FA-113



Seedling Establishment Transect Locations at FA-128

Slough and Slough Confluence Terrain Locations at FA-128

Seedling Establishment Transect Locations at FA-138

Seedling Establishment Transect Locations at FA-144

RSP 8.6 RIFS – Seedling Establishment

Collection Overview

- 17 Sites
- 35 Transects
- 824 Plots
- 49,196 Seedlings

Sites Stratified by

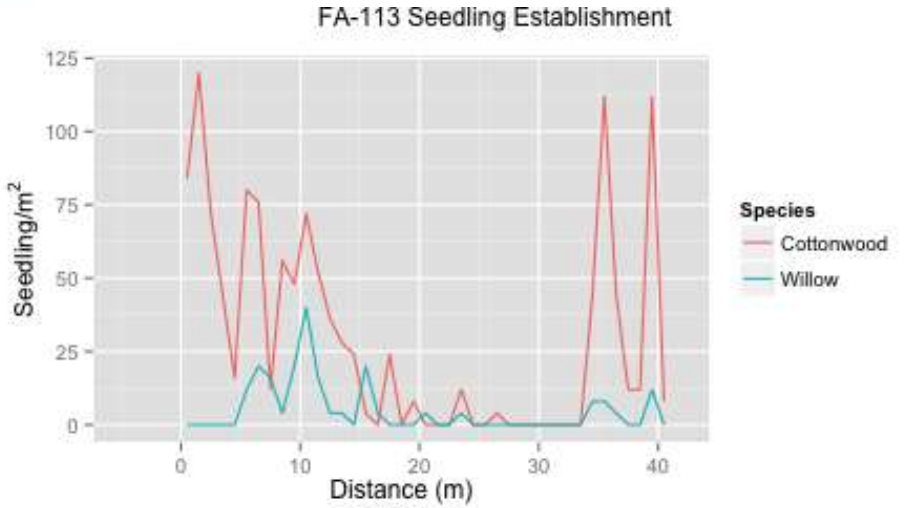
- River Position
  - Island or Slough
- Substrate
- River Mile

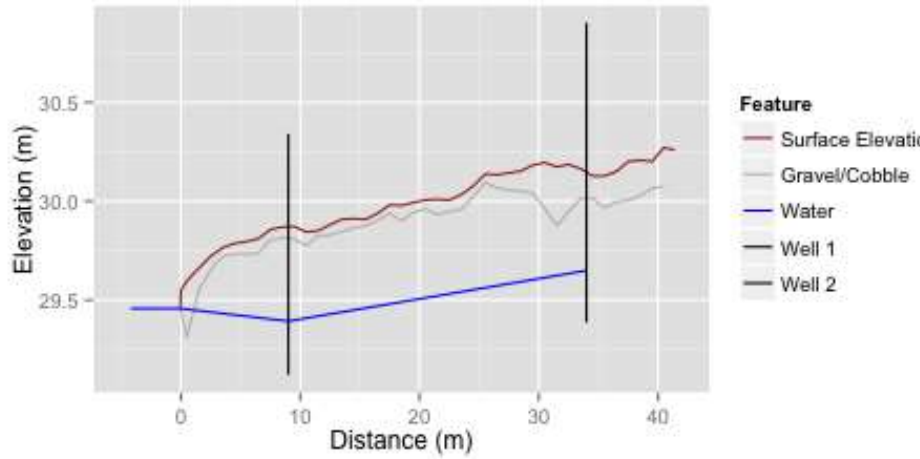
Data Collection	
Data Collected	**Future Collection**
Seedling Counts • Cottonwood • Willow	Substrate Particle Size
	Soil Moisture
Substrate Cover	Isotopic Signature • Plant Xylem • River Water • Precipitation • Groundwater
Vegetation Cover	
Depth to Refusal	
SW/GW Elevation	

RSP 8.6 RIFS – Seedling Establishment

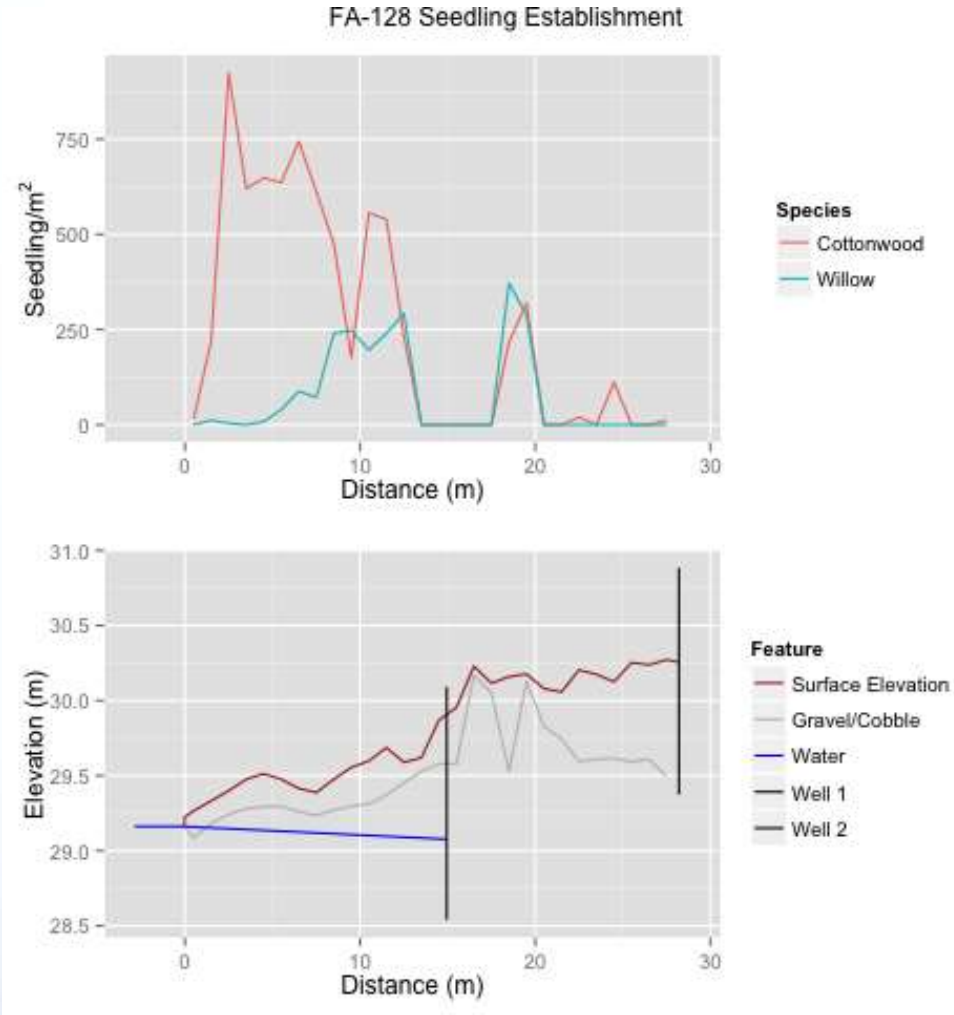
Groundwater well installation and measurement

RSP 8.6 RIFS – Seedling Establishment



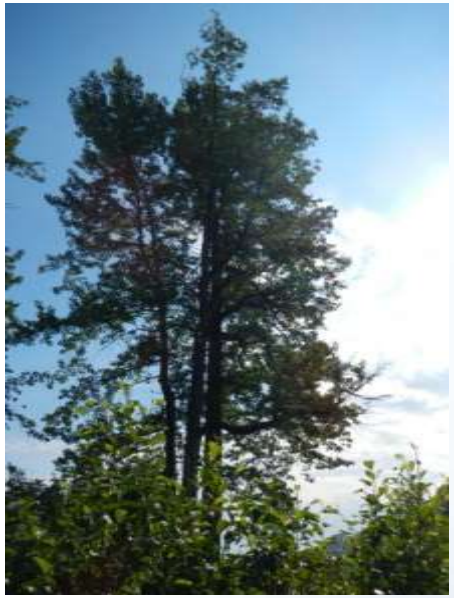


RSP 8.6 RIFS – Seedling Establishment



RSP 8.6 RIFS – Vegetation and Dendrochronology Sampling Update

Team	Data Collection Phase	Data Collected
ABR	Floristic and soil description	
R2	Tree and shrub stand description	Tree DBH by species Shrub DBH by species
	Collection of tree cores and shrub cookies	2 cores/cookies at 2 of each species Soil texture at each tree/shrub Sediment deposition: Depth from root collar to core/cookie Depth from root collar to sediment

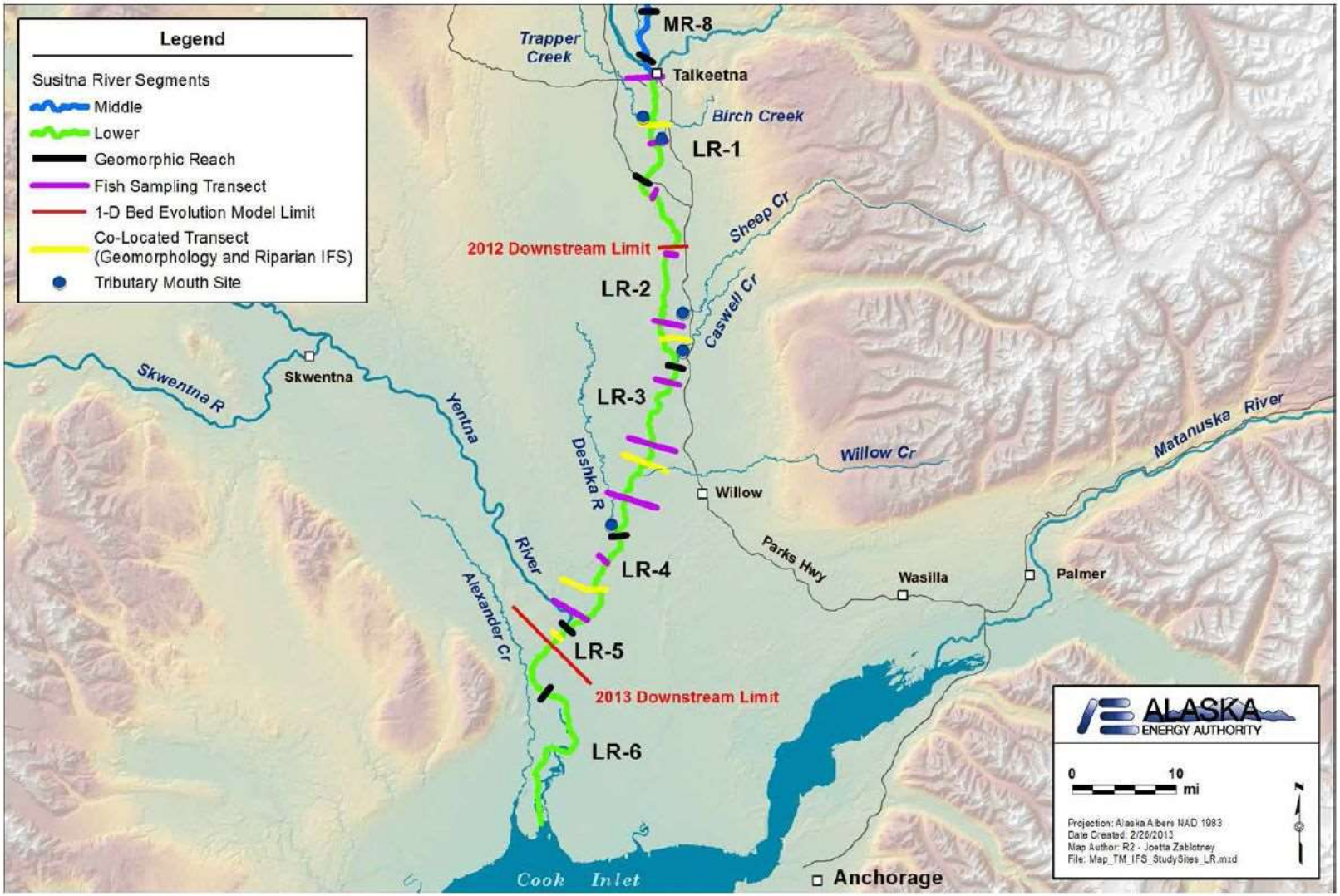


RSP 8.6 RIFS – Vegetation and Dendrochronology Sampling Update

RSP 8.6 RIFS – Middle and Lower River Vegetation and Dendrology Sampling

- Middle River FA's 104, 115, 128 & 138
- Spruce recruitment plots at FA mid-channel islands
- Lower River Riparian Transect Plots
  - Four Lower River Transects
  - Dendrology plots at both groundwater well stations and ABR Riparian Vegetation Study plots

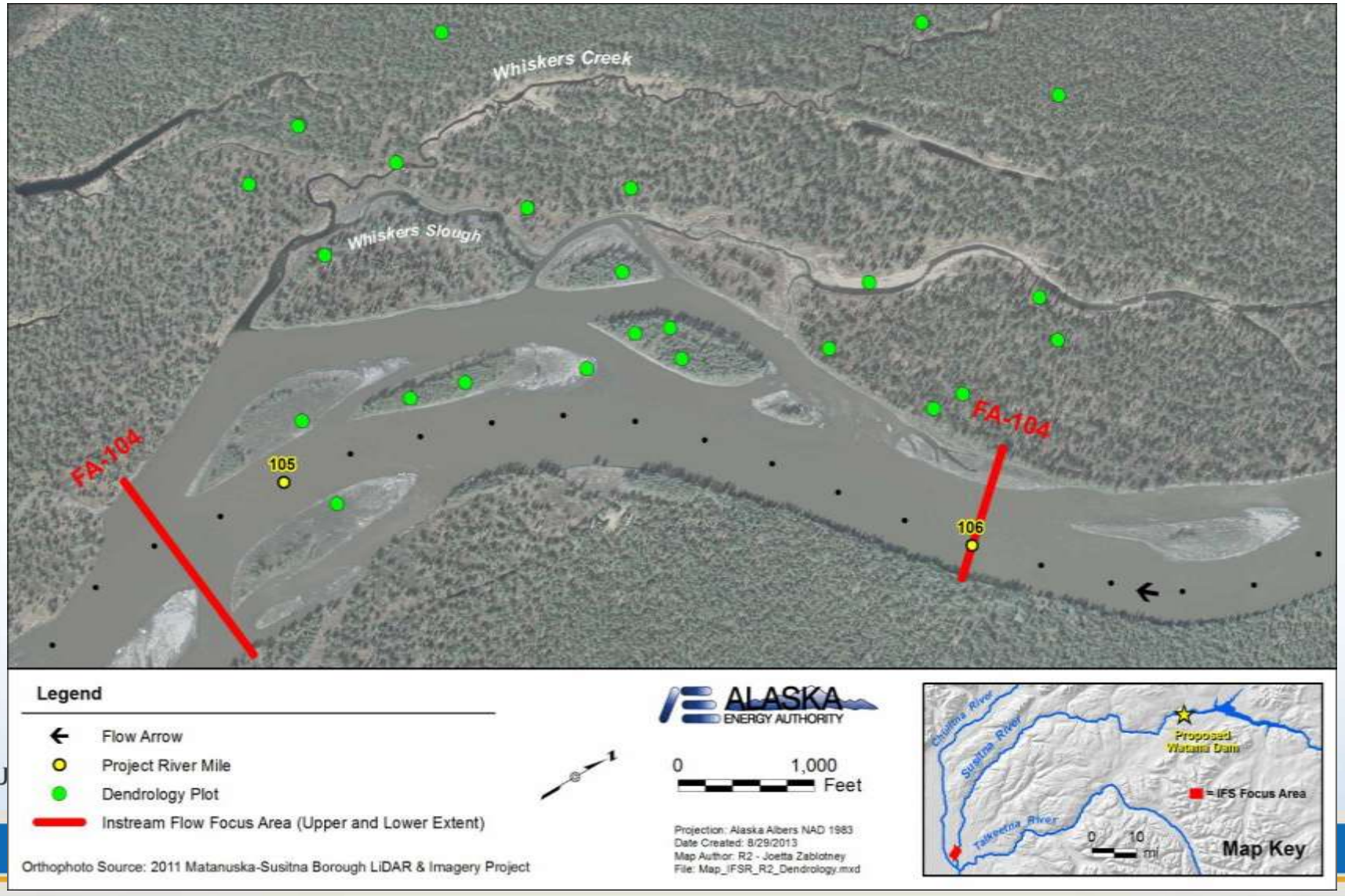
RSP 8.6 RIFS Lower River Transect Locations



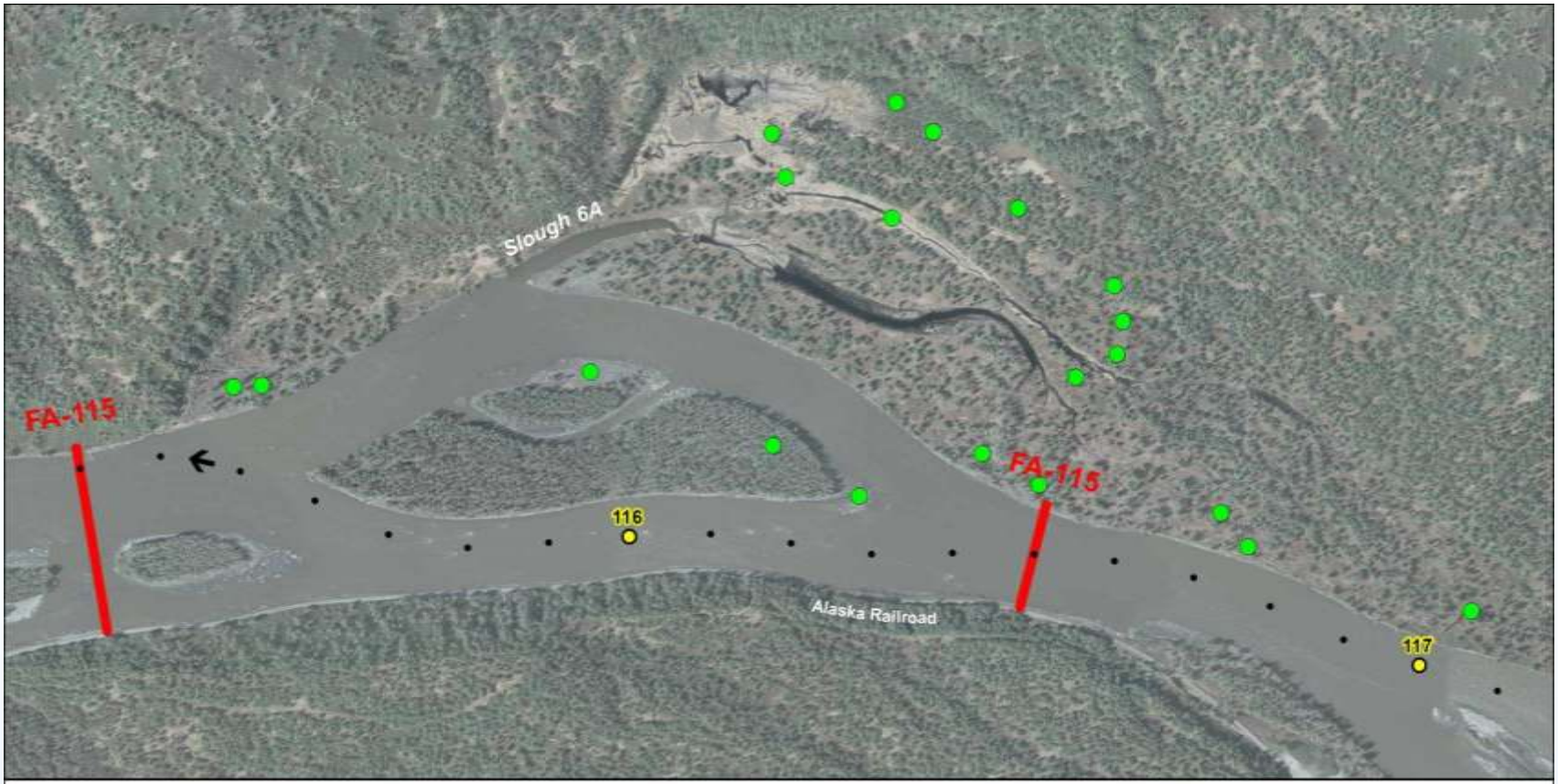
SUSIT

Figure 20. Map of the Lower Segment of the Susitna River depicting the six Geomorphic Reaches and locations of proposed 2013 study areas for geomorphology, instream flow–fish, instream flow-riparian and fish distribution and abundance.

Dendrology Plot Locations
FA-104



Dendrology Plot Locations
FA-115



Legend

- Flow Arrow
- Project River Mile
- Dendrology Plot
- Instream Flow Focus Area (Upper and Lower Extent)

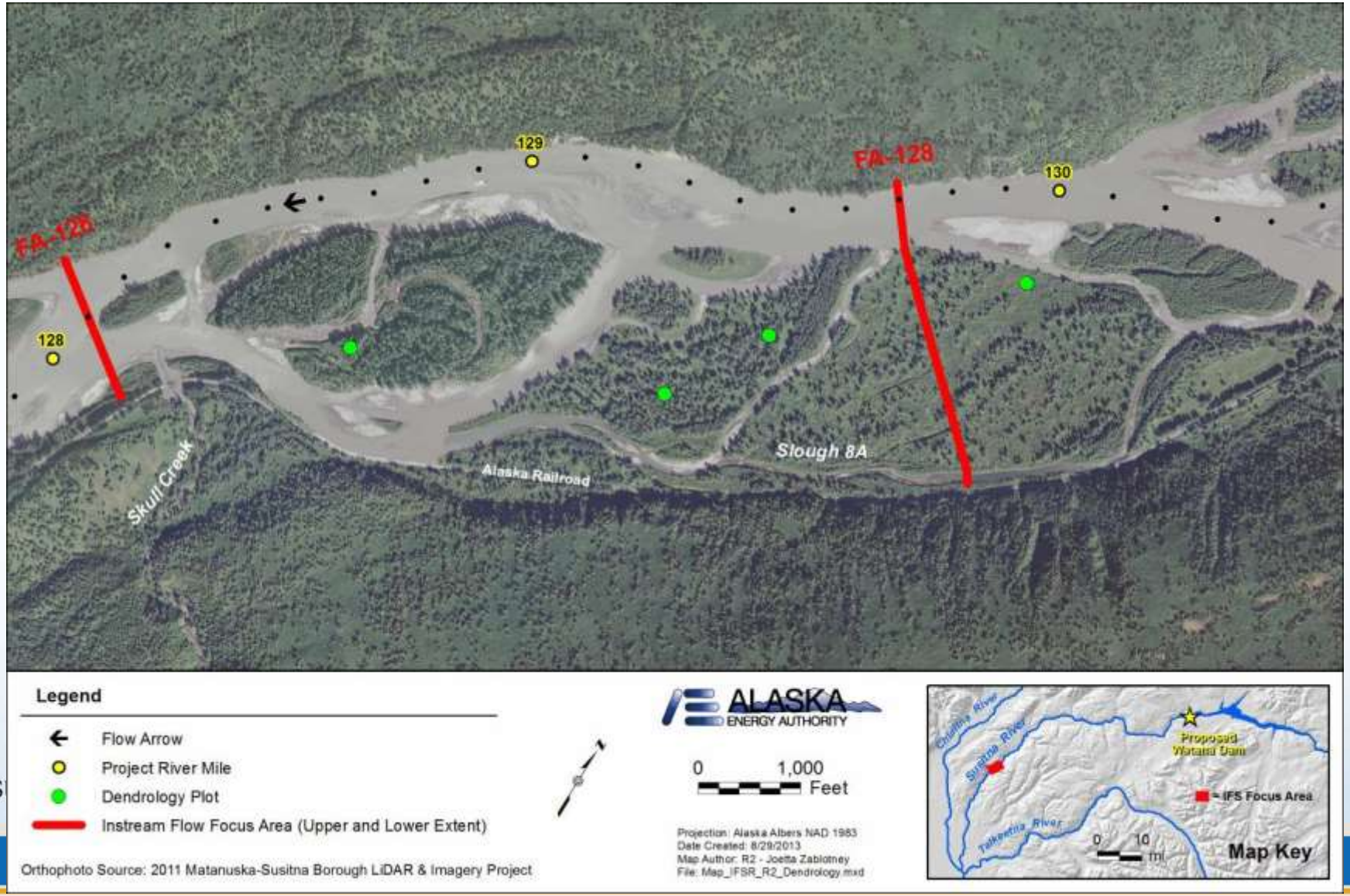
Orthophoto Source: 2011 Matanuska-Susitna Borough LiDAR & Imagery Project

ALASKA ENERGY AUTHORITY

0 1,000 Feet

Projection: Alaska Albers NAD 1983
Date Created: 8/29/2013
Map Author: R2 - Joetta Zablotney
File: Map_IFSR_R2_Dendrology.mxd

Dendrology Plot Locations
FA128



RSP 8.6 RIFS – Sediment Stratigraphy Geochronology Using ^{210}Pb, ^{137}Cs & Dendrochronology

Study Objective:

- Measure the rates of sediment deposition, and floodplain development

- 2013 floodplain sediment sample method comparison
  - Floodplain soil trenches excavated to gravel / cobble layer (historic channel bed)
  - Soil cores sampled
- Grain size analyses will be conducted on samples taken at soil horizons
- Direct dating of fluvial sediments will be conducted using isotopic techniques, including ^{137}Cs and ^{210}Pb
- Dendrochronologic techniques will be used to age trees and current floodplain surfaces at each soil trench and core site.

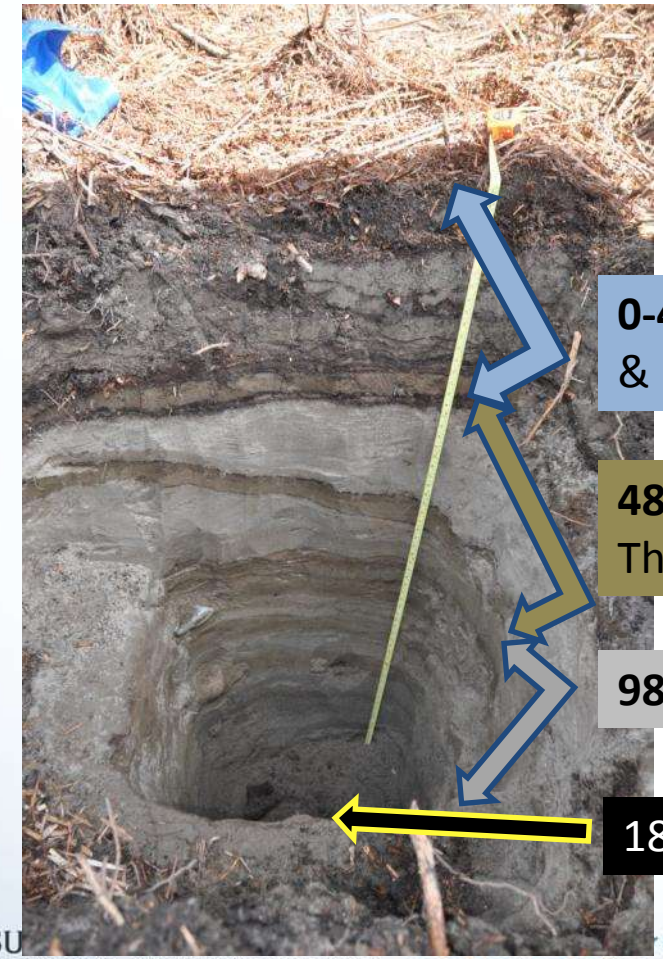
RSP 8.6 RIFS – Sediment Stratigraphy Geochronology Using ^{210}Pb, ^{137}Cs & Dendrochronology

- 2013 objective is to test utility of geochronology isotope dating techniques
- Comparative sampling approach trench and soil cores
- Dendrochronologic techniques will be used to age trees and current floodplain surfaces at each soil trench and core site.
- Laboratory results will dictate 2014 study design
- 2013 question to answer:
  - Is there enough clay fraction in Susitna River floodplain sediment to use ^{210}Pb isotope for dating?

Whiskers Slough Focus Area 104

Riverine Loamy Spruce-Birch Forest Ecotype

Sampled May 20, 2013



General Soil Stratigraphy

0-48cm Surface Organic Mat & Loamy Mantle

48-98cm Stratified Sands & Thin Buried Organic Horizons

98-183cm Stratified Sands

183cm+ Gravel & Cobble Bed

General Site History

4th – Forest Establishment; Infrequent Flooding

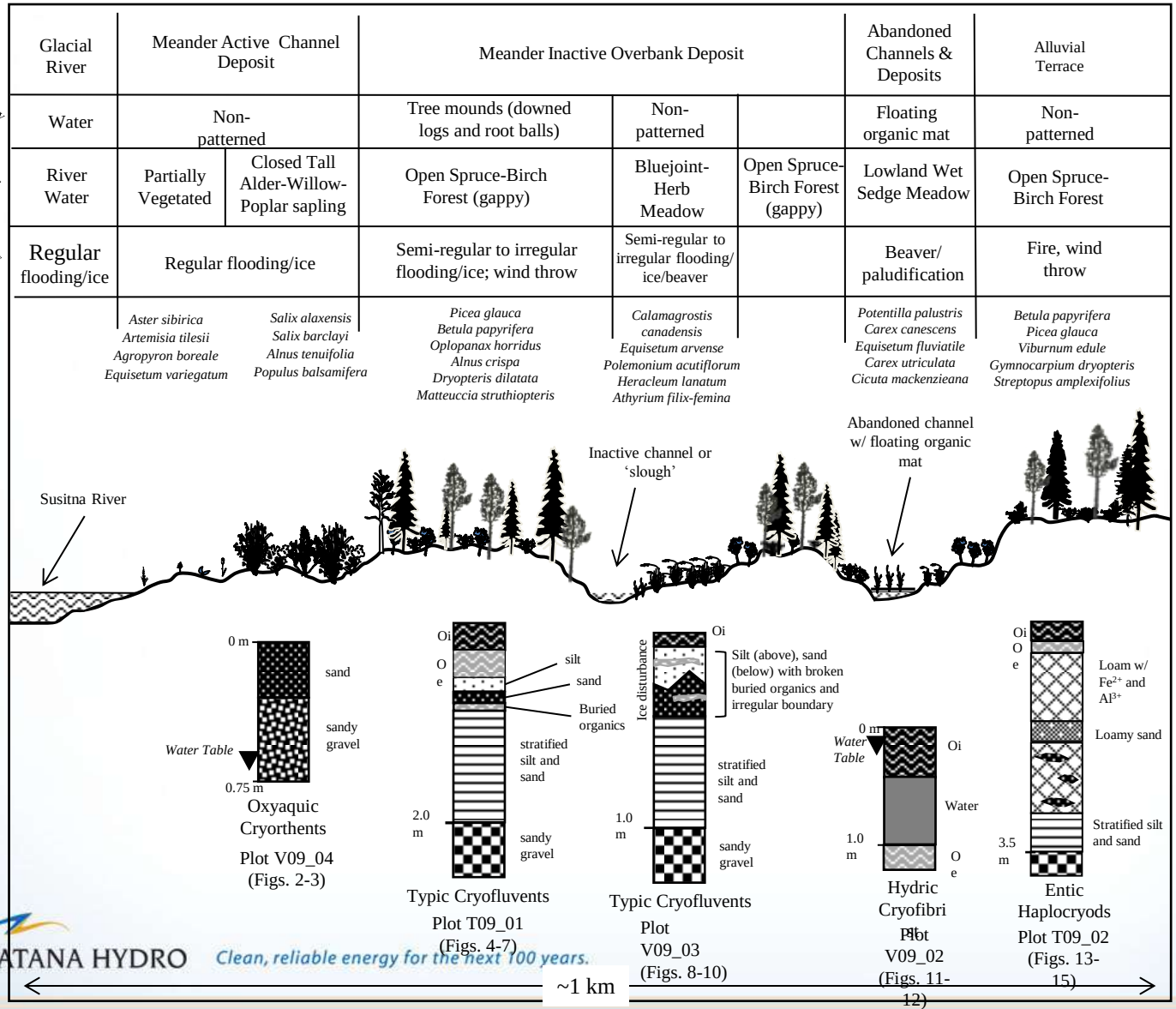
3rd- Vegetation Establishment; Frequent Flooding

2nd – Island Formation; Very Frequent Flooding

1st – Original River Bed; Permanent Flooding

SU ... the next 100 years.

TYPICAL FLOODPLAIN CROSS SECTION Whiskers Slough

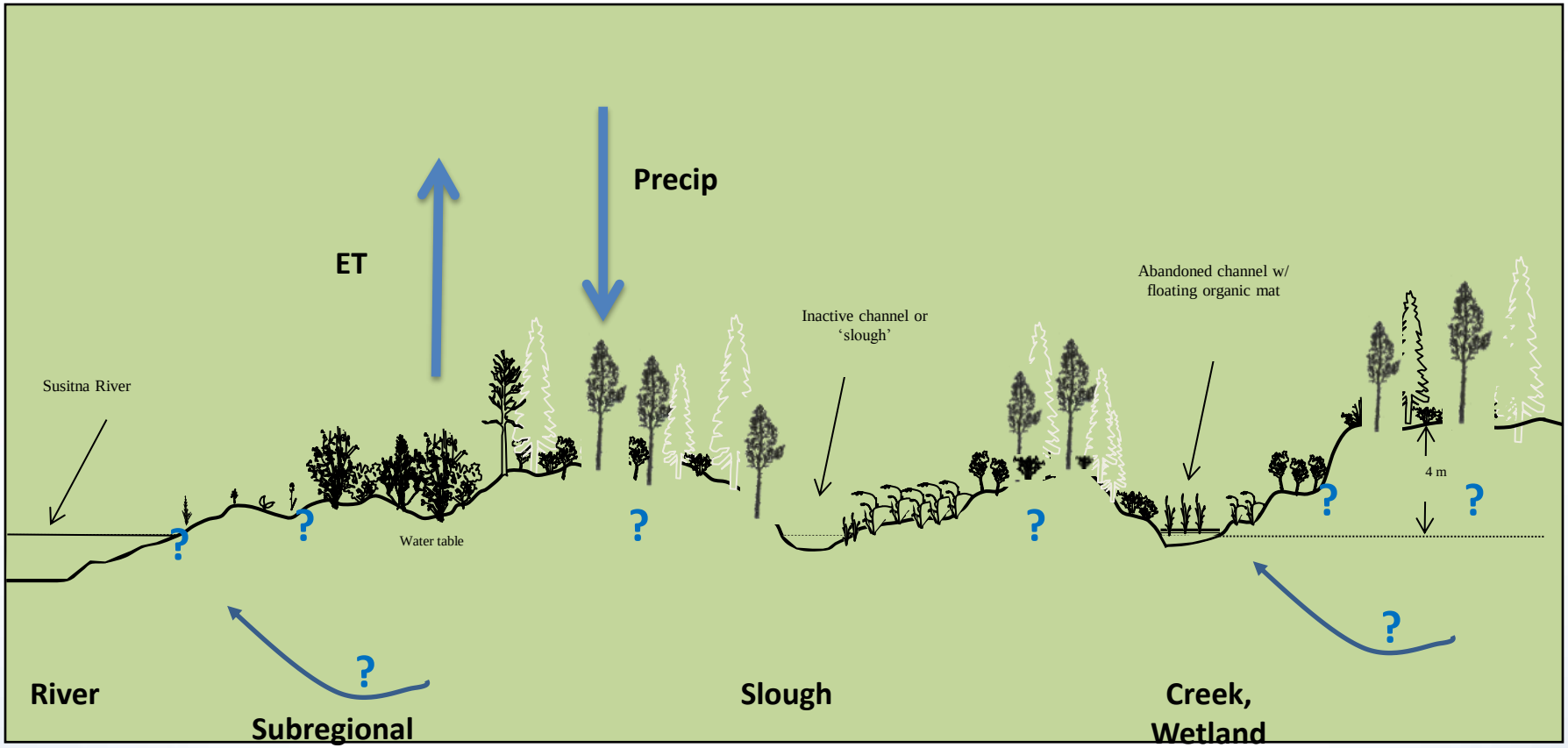


RSP 8.6 RIFS – Riparian Groundwater / Surface Water Study Update

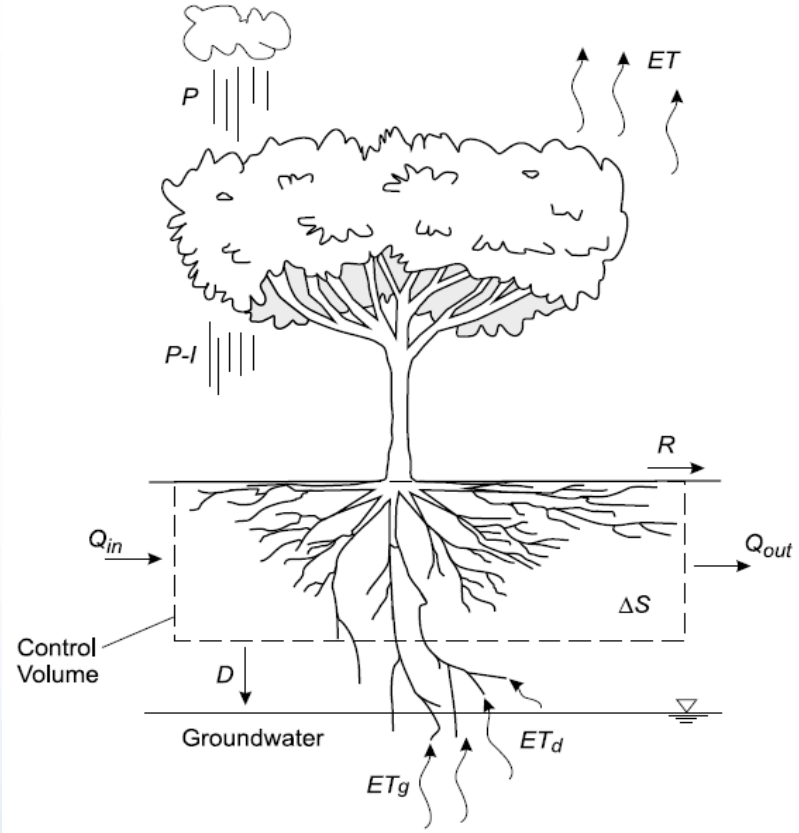
Study objective

"Characterize natural floodplain vegetation groundwater and surface water maintenance hydroregime. Develop a predictive model to assess potential changes to natural hydroregime and potential floodplain vegetation change."

RSP 8.6 RIFS – Riparian GW/SW Study Update

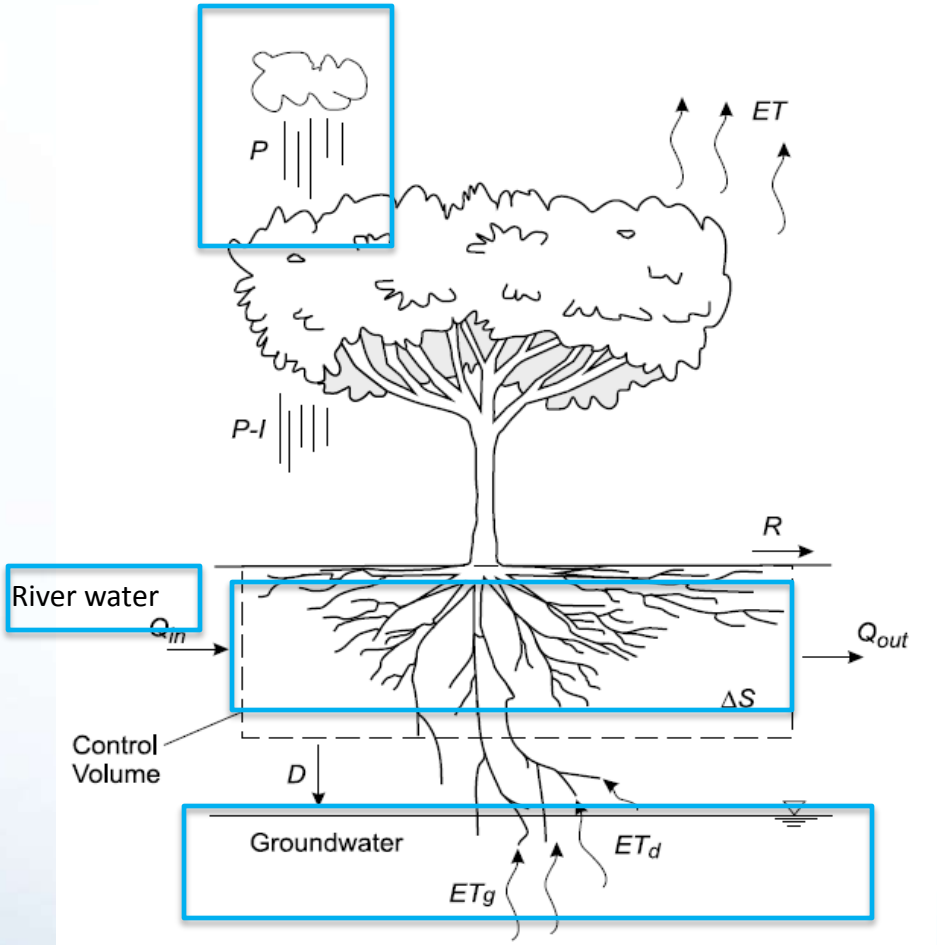


Groundwater / Surface water Study Design-Objective



1. Where and what water source are plants species utilizing?
2. How will changes GW and SW elevation effect how plant species utilize these water sources?

RSP 8.6 RIFS – Riparian GW/SW Study- Plant Water Source



- Our first objective was to determine the water source of riparian plant
- We collected water samples from the following sources
  - Plant matter
  - Precipitation
  - Rivers
  - Sloughs
  - Soil
  - Groundwater

RSP 8.6 RIFS – Riparian GW/SW Study Update-Plant Isotope

Leaf out

Mid Season

Next up pre-senescence!!!

RSP 8.6 RIFS – Riparian GW/SW Study Update- Water Isotope Study

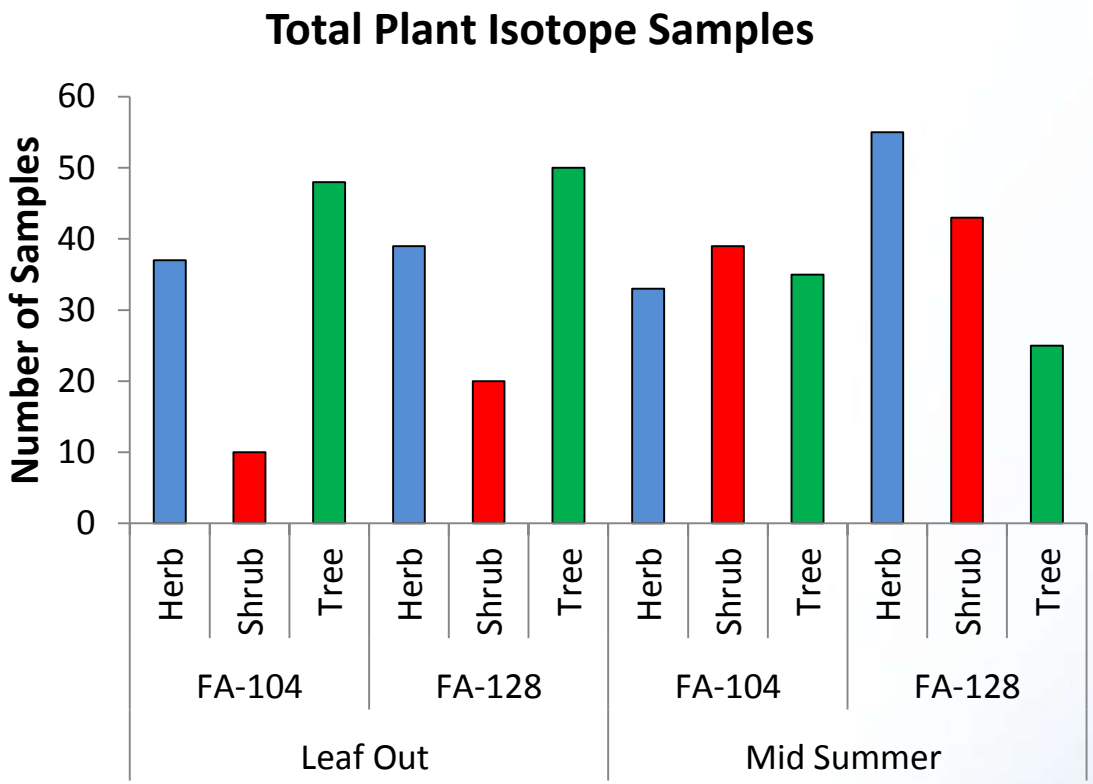
- We focused our sampling at Focus Areas 104 and 128
- Sampling in the following cover types:
  - Open Alder
  - Spruce-Birch floodplain
  - Cottonwood stands
  - Alder-Salix-Cottonwood
  - Spruce-Birch terrace

RSP 8.6 RIFS – Riparian GW/SW Study Update-Plant Isotope

- Sampled FA-104 and FA-128
- Leaf-out period sampled during early June 4-8, 2013
- Sampled mid summer period from July 15-21, 2013
- Focused on dominate species across the focus area

RSP 8.6 RIFS – Riparian GW/SW Study Update - Plant Isotope

Functional Type	Scientific Name
Shrub	Alnus crispa
Shrub	Alnus tenuifolia
Tree	Betula papyrifera
Herb	Calamagrostis canadensis
Herb	Dryopteris dilatata americana
Herb	Epilobium angustifolium
Herb	Matteuccia struthiopteris
Herb	Oplopanax horridus
Tree	Picea glauca
Tree	Populus balsamifera
Shrub	Rosa acicularis
Shrub	Rubus idaeus
Herb	Rubus pedatus
Shrub	Salix alaxensis
Shrub	Salix barclayi
Shrub	Salix bebbiana
Herb	salix sitchensis
Shrub	Viburnum edule



RSP 8.6 RIFS – Riparian GW/SW Study Update

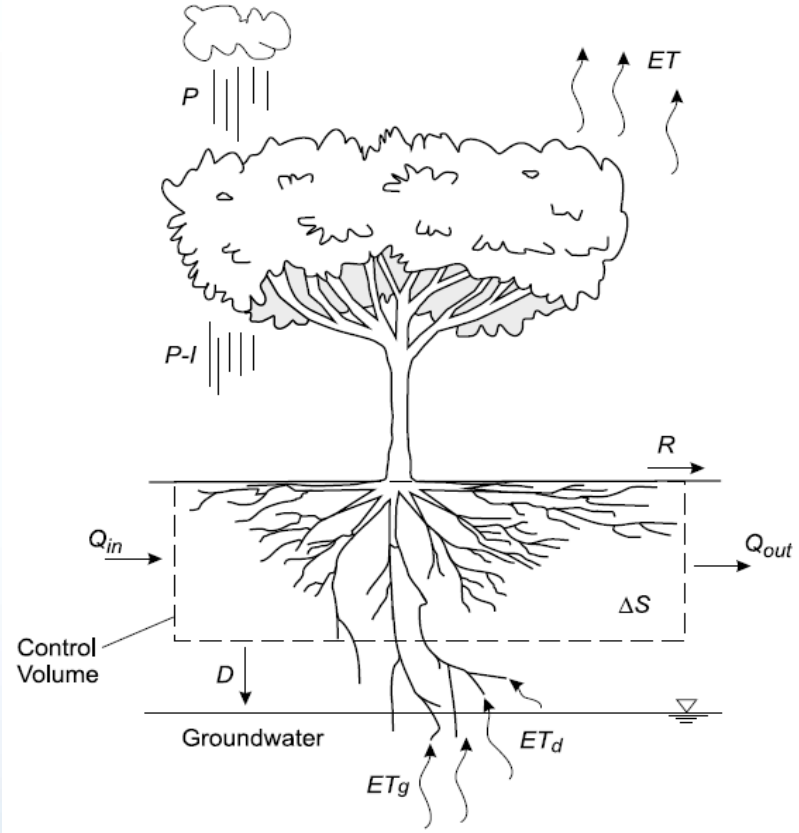
- Soil samples were taken at depths from 0 to 150 cm.
- Two samples were taken from each cover type
- One core was used for soil water isotope samples
- The second core was used root sampling

RSP 8.6 RIFS – Riparian GW/SW Study Update

- Precipitation is samples are being collected at FA-104, FA-128 and in Talkeetna
- Slough, side channel, and main channel water samples are collected
- Groundwater samples will be collected in September with the completion of well installation

Oil-type Precipitation collector

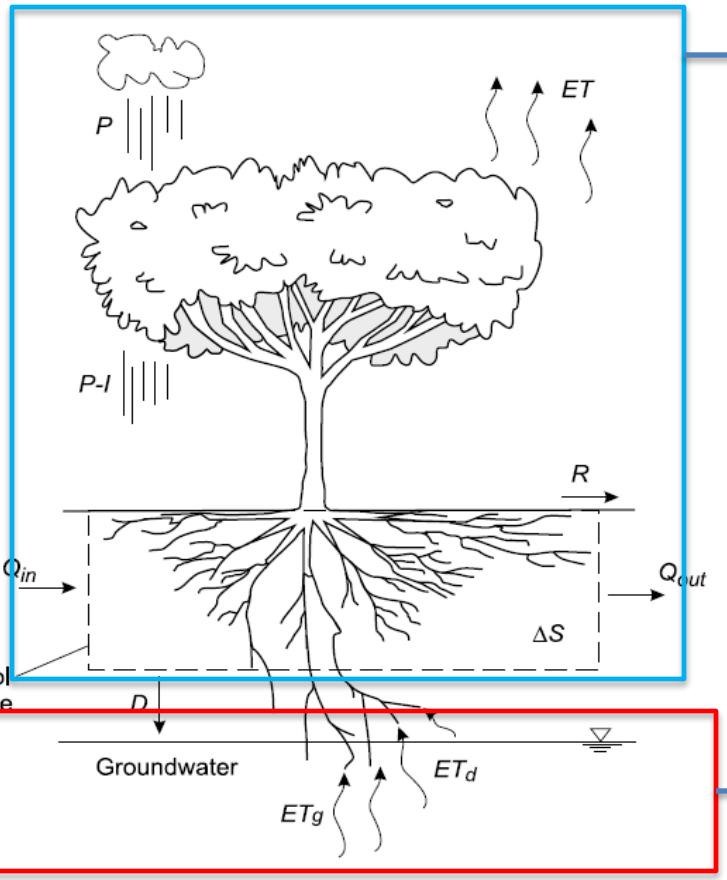
RSP 8.6 Groundwater / Surface water Study Design-Objective



1. Where and what water source are plants species utilizing?

2. **How will changes GW and SW elevation effect how plant species utilize these water sources?**

RSP 8.6 Groundwater / Surface water Study Design-Objective



Riparian Study

To answer our second objective, we need to observe the relationship between plant water use (ET) and water sources (soil water, surface water, and groundwater).

Groundwater Study

RSP 8.6 Groundwater / Surface water Study Design-ET

- Herbaceous transpiration was measured using handheld porometers
- Tree transpiration was measured with sap flow sensors
- ET modeling will be done with the Penman-Monthieth equation
- Soil water was measured with the used of soil volumetric sensors

RSP 8.6 RIFS – Porometer

What we have completed as of August 30th

Number of porometer measurements made in June and July

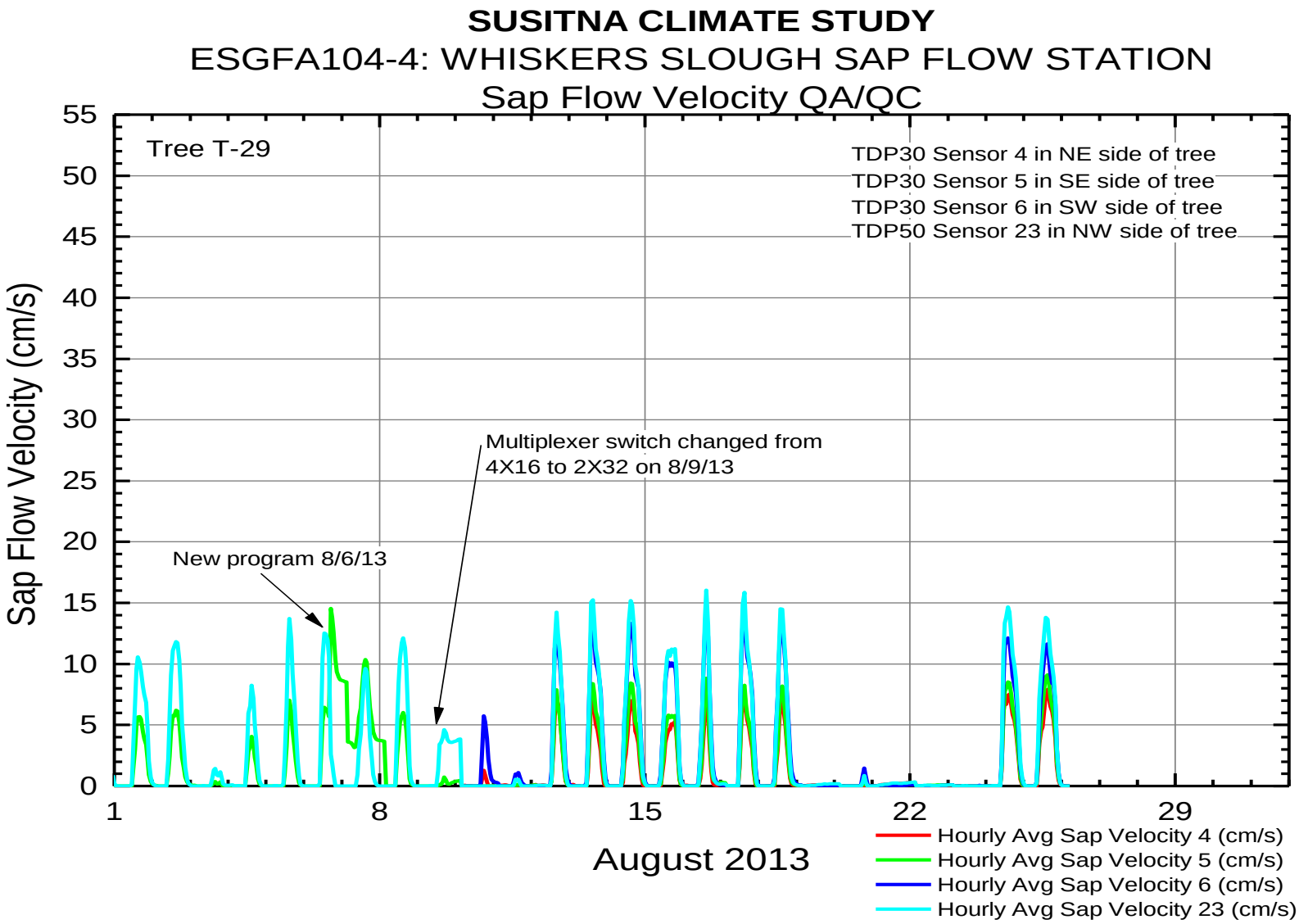
	Herb	Shrub	Tree	Grand Total
June	715	745	71	1531
July	1016	1012	8	2035
Grand Total	**1731**	**1757**	**79**	**3566**

- Additional measurements were made in early September

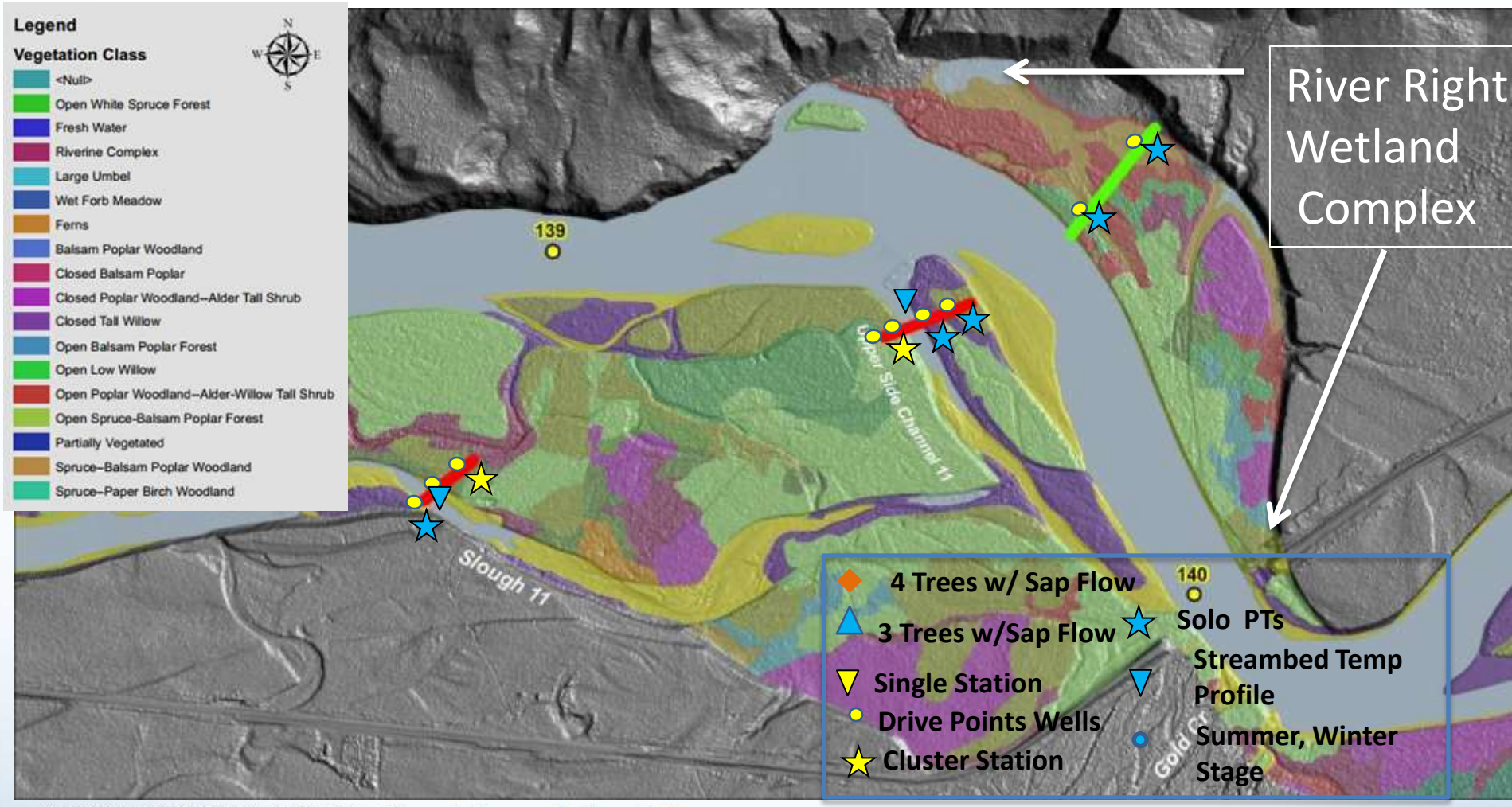
RSP 8.6 RIFS – Riparian GW/SW Study- Sap Flow

- Currently sap flow monitoring is occurring at FA-104 and FA-128
- The following trees have been wired up
  - Alder species
  - Cottonwood
  - Paper Birch
  - White Spruce
  - Willow species
- Sap flow monitoring will continue until the first week of October and resume in late March

RSP 8.6 RIFS –Sap Flow Velocity Preliminary Data



RSP 8.6 RIFS – Gold Creek FA-138 2013 Floodplain Wetland Groundwater / Surface Water Hydrological Assessment



RSP 8.6 Gold Creek FA-138
2013 Floodplain Wetland Groundwater / Surface Water Hydrological Assessment

Beaver dam emergent wetland

Abandoned slough emergent wetland

RSP 8.6 RIFS – Potential Change to Section 8.6.3.6.1

- *Groundwater / Surface Water Modeling sites.*
  - *RSP Section 8.6.3.6.1* calls for*:* "A physical model of GW/SW interactions will be developed for all Focus Area sites to model floodplain plant community GW/SW relationships."
  - FA 138 floodplain wetland complex GW/SW modeling needs are being assessed to determine the strength of hydrologic linkage between Susitna River and adjacent floodplain wetland complex.
  - If 2013 GW/SW measurements indicate no linkage, it is proposed that a MODFLOW GW/SW model will not be developed for FA 138.
  - GW/SW linkage analytical methods and preliminary 2013 results are presented in the Groundwater TWG presentation today.
  - MODFLOW GW/SW physical modeling at Riparian FA's 104, 115, 128 will be unchanged.

RSP 8.6 RIFS – Ice Scar Study Update

Tree Ice Scar Survey Mapping and Dendrochronology is On-going

Mid-late September

RSP 8.6 RIFS – Variances

- There were no variances to the RIFS study plan in Q3.

RSP 8.6 RIFS – Q4 2013 Next Steps

Activity	2013			
	Q 1	Q 2	Q 3	Q 4
Critical review of 1980s Susitna River Data, Current Scientific research concerning hydro project floodplain vegetation effects; and unimpacted, natural floodplain vegetation research.				
Implement Groundwater / Surface Water Installation and Sampling				
Riparian Vegetation: Field data collection				
Seed Dispersal Study				
Tree Ice Scar Mapping				
Focus Area vegetation mapping and sampling				
Dendrochronology sampling				
Soil Sampling, Sediment Dating and Analysis				
Develop GW/SW models				
Develop vegetation flow-response models				