

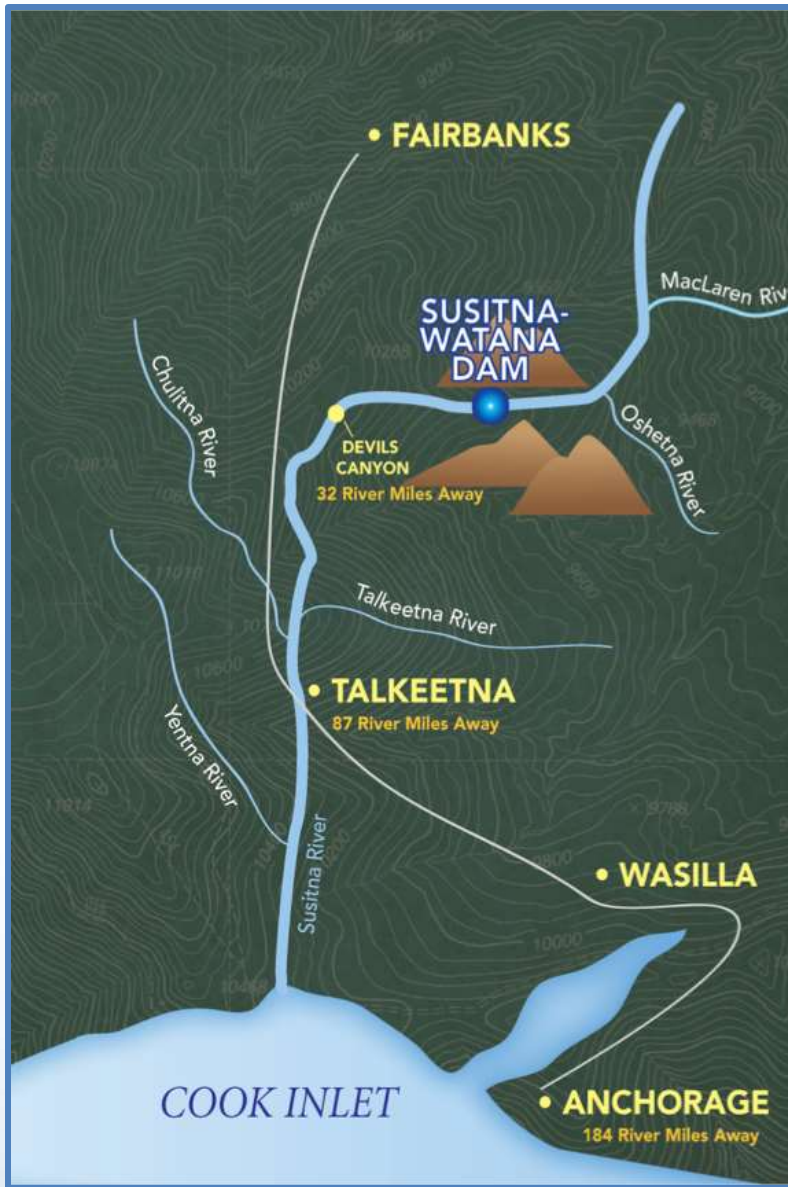
Technical WorkGroup Meeting

Water Quality Studies

Baseline Monitoring, Focus Areas, and Modeling

December 2, 2013

Prepared by Tetra Tech, Inc.
and URS

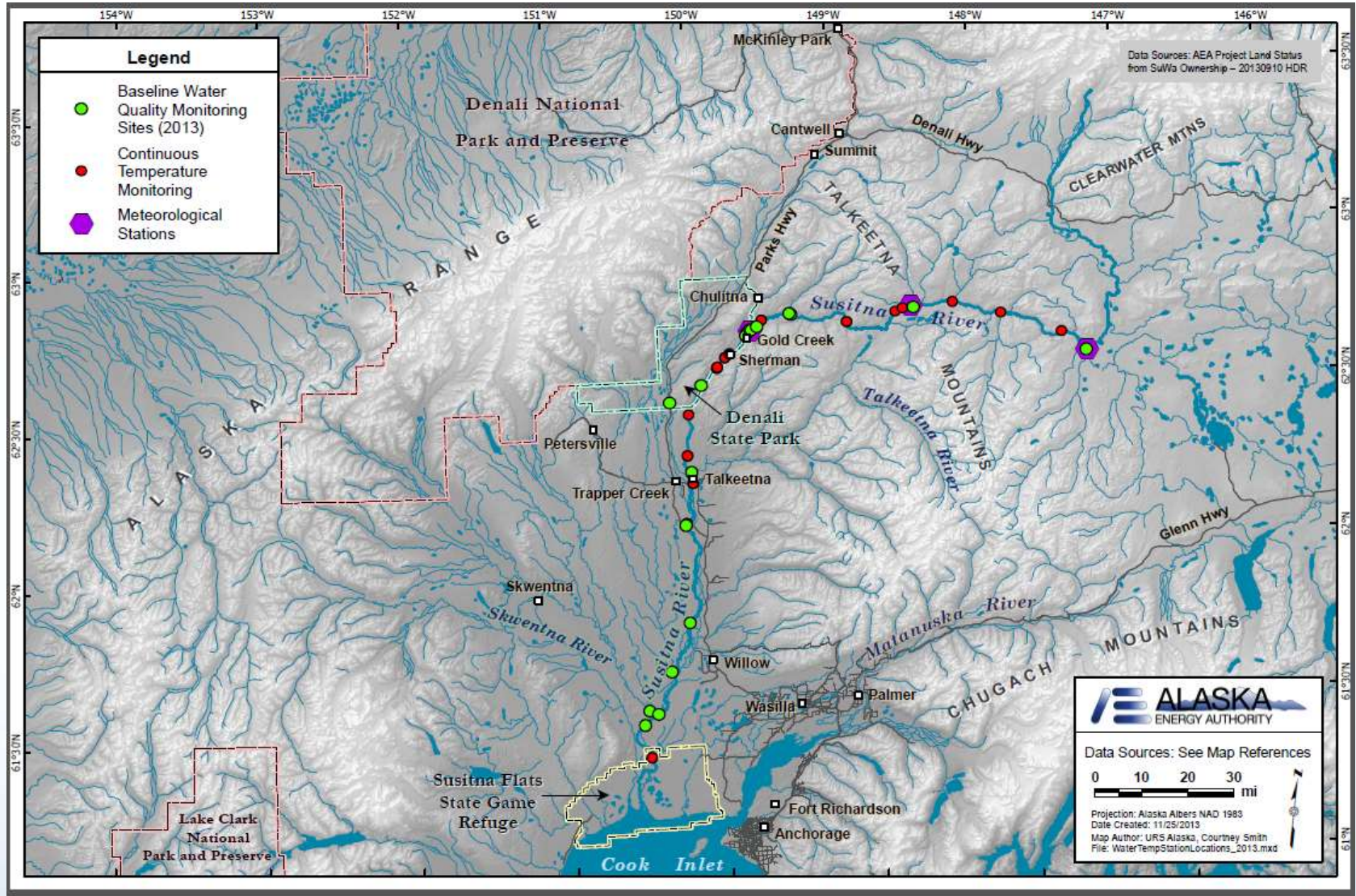


2013 Water Quality Monitoring Activities Completed

- *Baseline Water Quality Study*
(RSP Section 5.5.4.4)
 - *June – September; monthly monitoring*
 - *Water Quality Characterization in Focus Areas*
- *(RSP Section 5.5.4.5)*
 - *July-August; bi-weekly monitoring*
 - *Sediment Samples for Mercury/Metals in the Reservoir Area*
- *(RSP Section 5.5.4.6)*
 - *Sediment collection & fish tissue collection*
- *Baseline Metals Levels in Fish Tissue (RSP Section 5.5.4.7)*
 - *Fish tissue collection*
 - *Vegetation Collection*
- *Water Temperature Data Collection (RSP Section 5.5.4.1)*
 - *Lower, Middle, Upper River (June-September)*

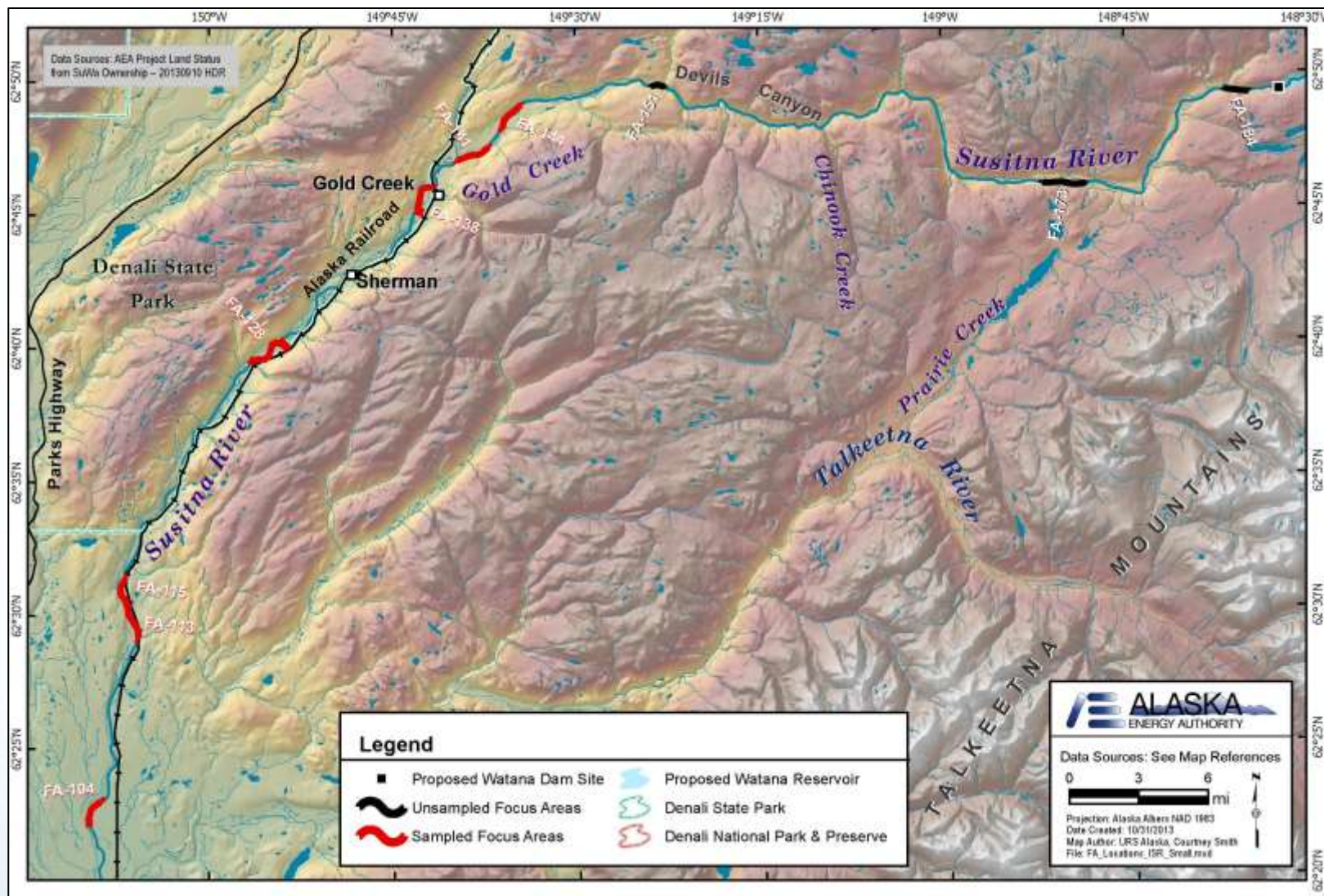


Completed Data Collection: Large-Scale Monitoring



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Completed Data Collection: Focus Areas



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

Data Management

(Section B.10 from Attachment 5-1 in RSP Section 5.8)

- *Flow of data:*
 - *Step 1. Field Collection*
 - *Step 2. Laboratory Analysis*
 - *Step 3. Lab QA*
 - *Step 4. Database entry*
 - *Step 5. DQO Check*
 - ***Step 6. Qualification of Data***
 - ***Step 7 Impact on data use & interpretation***
- *Develop assumptions for use in modeling water quality conditions* (Section B.10.1 from Attach. 5-1 in RSP Section 5.8)

Data Qualification/Clarification

(Section D.1 from Attachment 5-1 in RSP Section 5.8)

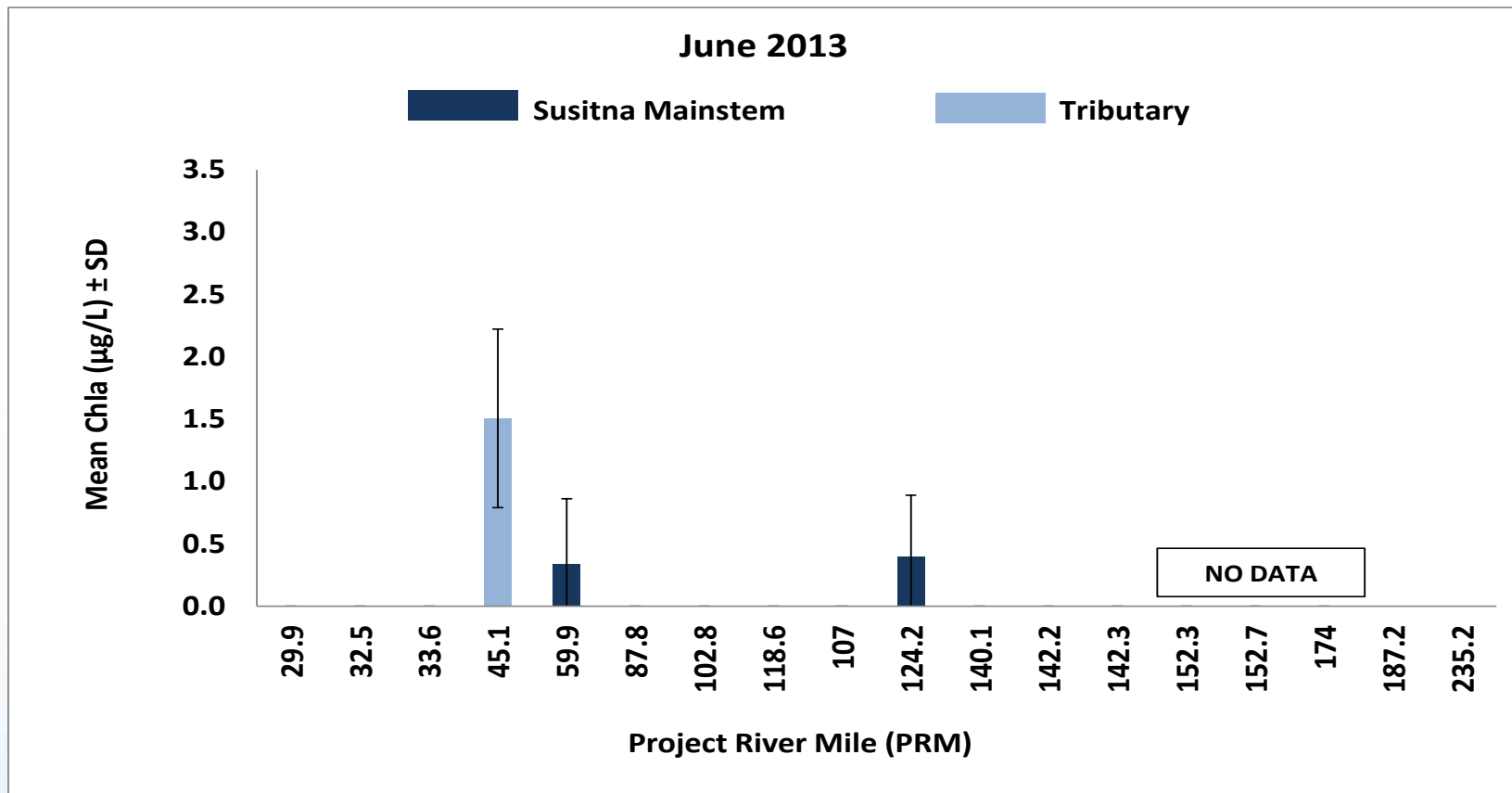
- *Describe nutrient and toxics dynamics (auditing lab results)*
(Section D.2.2 from Attach. 5-1 in RSP Section 5.8)
 - *Do water quality parameters add up?*
 - *Are there unusually low/high concentrations or results?*
 - *Do field technique and lab performance meet expectations?*
 - *Are results within expected range of condition?*
(from historic data and similar settings)
 - *Identify complexes of parameters that sequester nutrients/toxics.*
(Fe, Ba, Mn)
- *Validate data prior to use in calibrating the water quality model*
(Section D.2.2 from Attach. 5-1 in RSP Section 5.8)
 - *Describe complexes that sequester toxics, nutrients, mercury*

Data Analysis

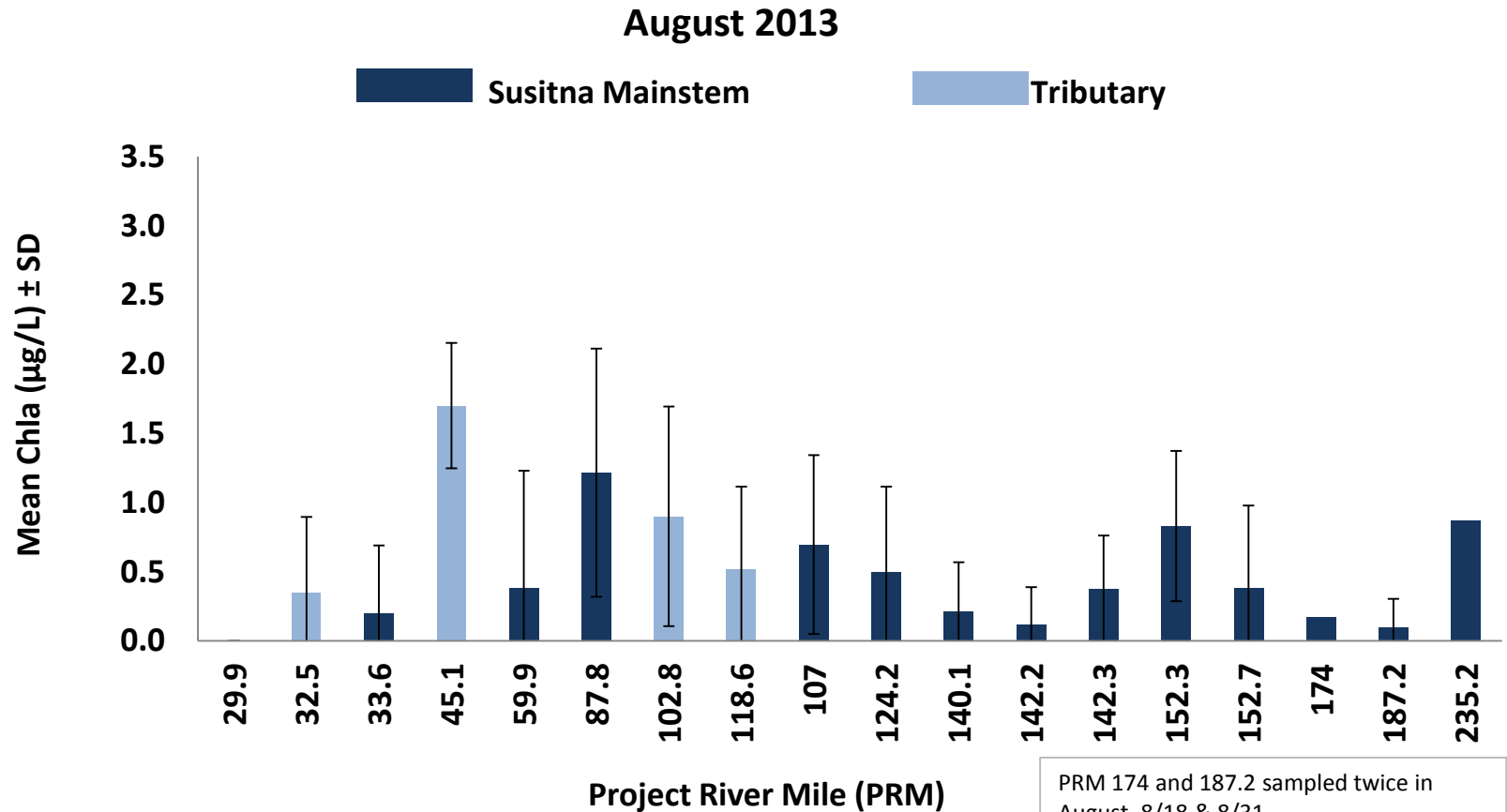
- All lab data received by September 30th, 2013 has been graphed and is currently undergoing QA/QC checks.
- All Lab data received after 30 September is currently undergoing QA/QC checks.
- All lab data, except for chlorophyll *a*, is provisional.
- Lab split sample results have been analyzed.



Baseline Monthly Monitoring Chlorophyll *a* Results- June 2013

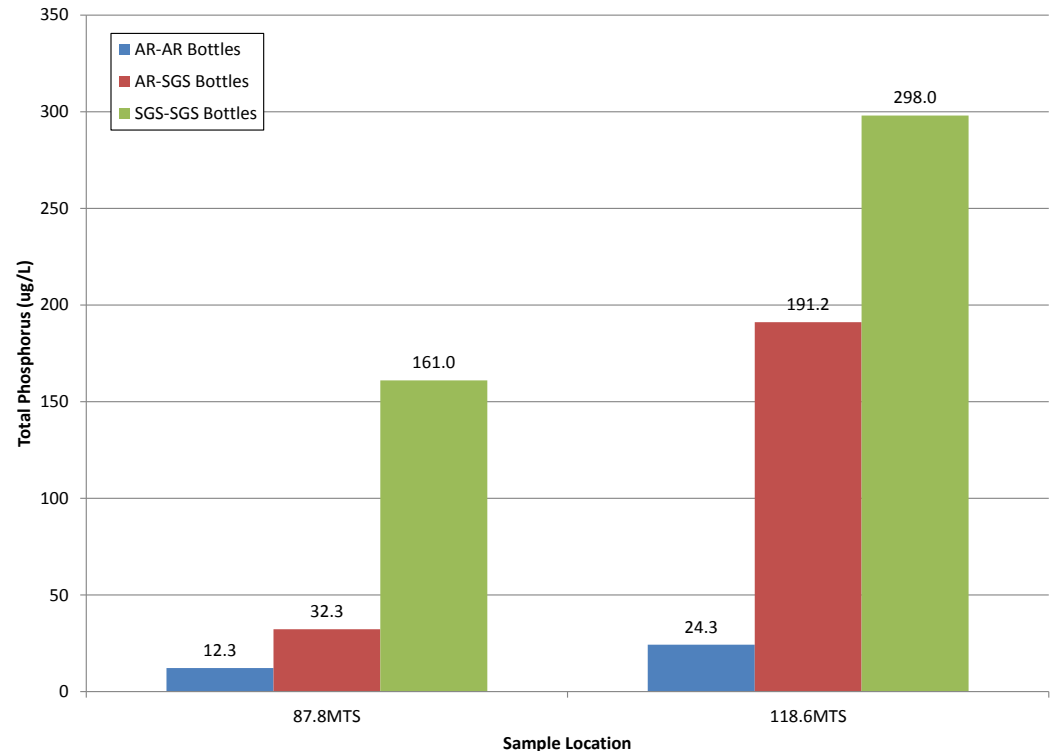


Baseline Monthly Monitoring Chlorophyll *a* Results- August 2013



Data Analysis- Lab Data and Split Samples

- TP Concentrations are much higher in SGS bottles than in AR bottles and in AR run SGS bottles.



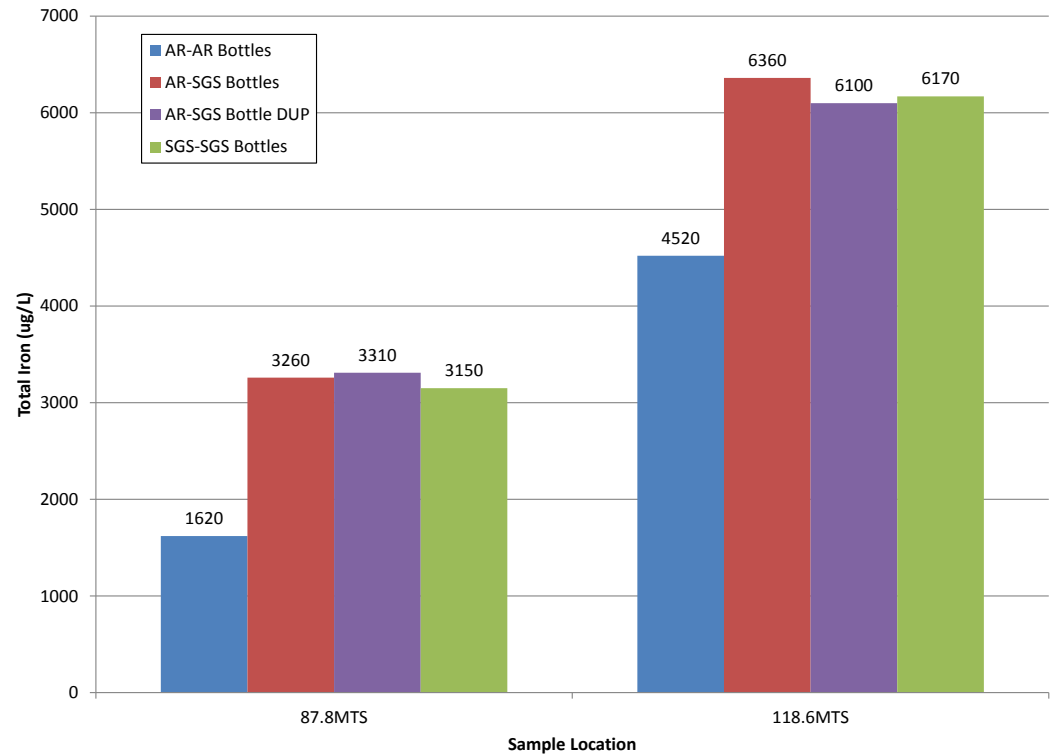
TP ~ Total Phosphorus

AR ~ Aquatic Research Laboratory

SGS ~ SGS Analytical Laboratory

Data Analysis- Lab Split Samples

- Total metals concentrations are higher in SGS bottles than in AR bottles possibly due to preservative.

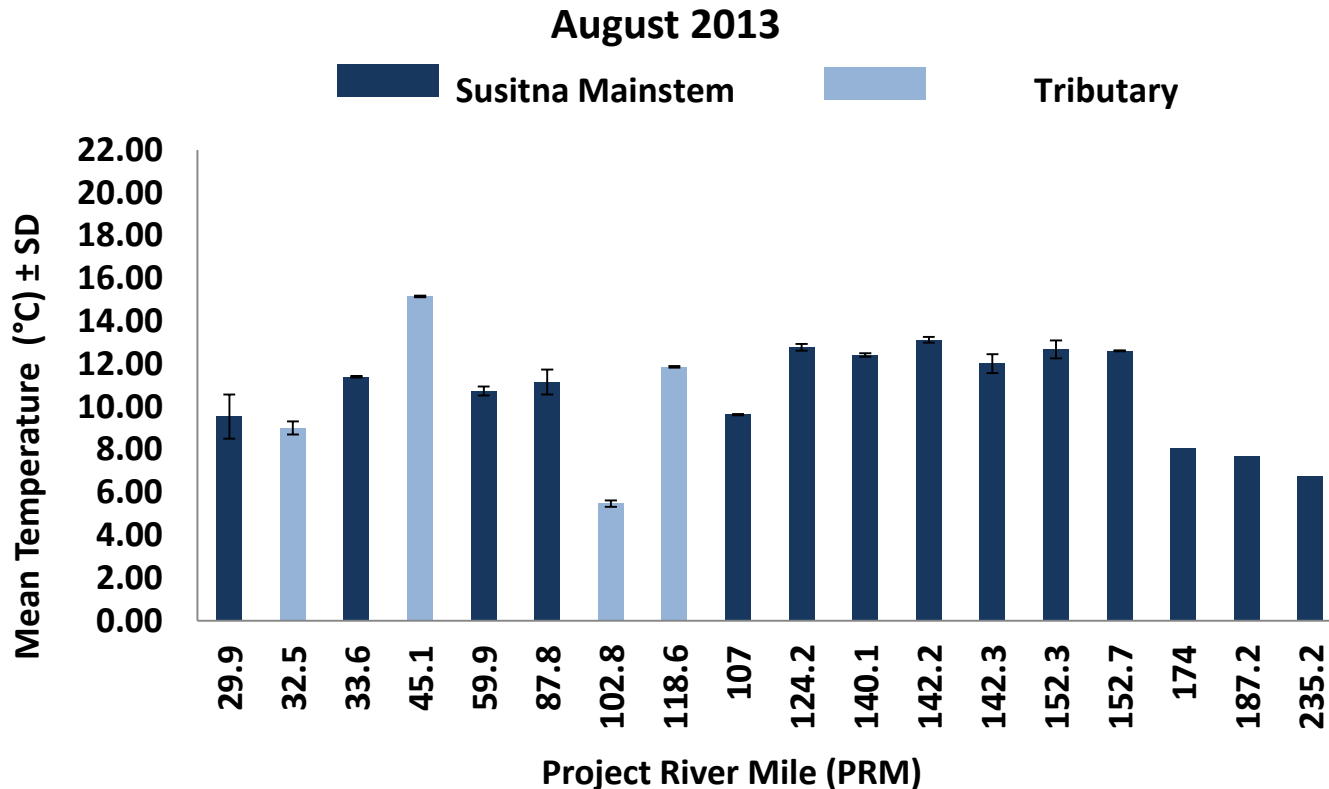


AR ~ Aquatic Research Laboratory
SGS ~ SGS Analytical Laboratory

Baseline WQ Monitoring Field Data Results

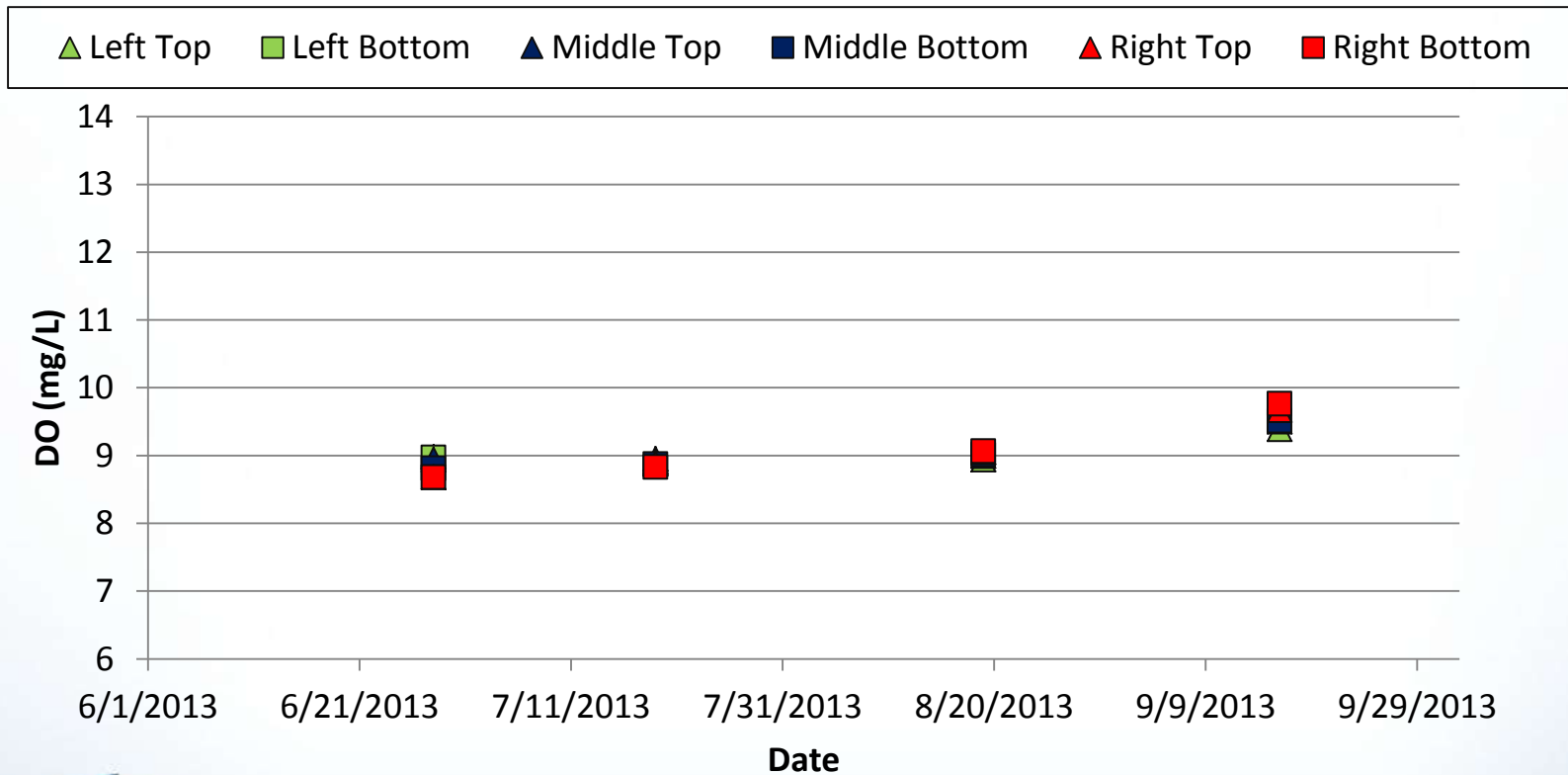
- All field data except for Turbidity (June-September) and pH for June was graphed and has been QA/QC'ed.
 - Turbidity is undergoing QA/QC and is provisional.
 - pH collected in June 2013 was invalid due to instrumentation error.
- Data was graphed by PRM for the entire 2013 study period with standard deviation.
- Data was also plotted on a scatter plot for each site.
- Data includes: temperature, pH, DO, conductivity, redox potential, and absolute and true color.

Example Field Data Graphs by PRM for Temperature (grab) in August 2013



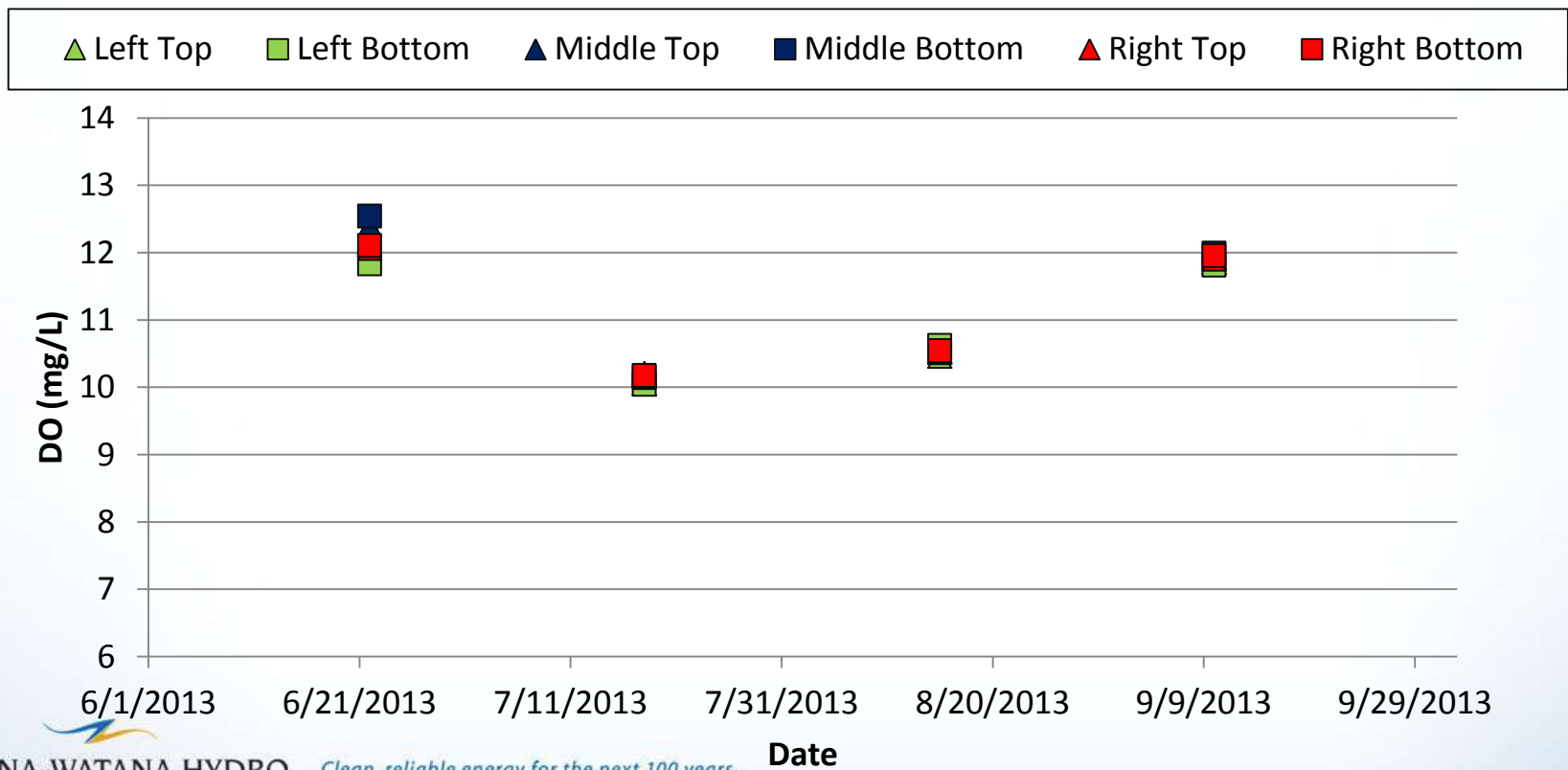
Dissolved Oxygen Concentrations for the Deshka River, 2013

PRM 45.1 Deshka River



Dissolved Oxygen Concentrations for Curry Fishwheel Camp, 2013

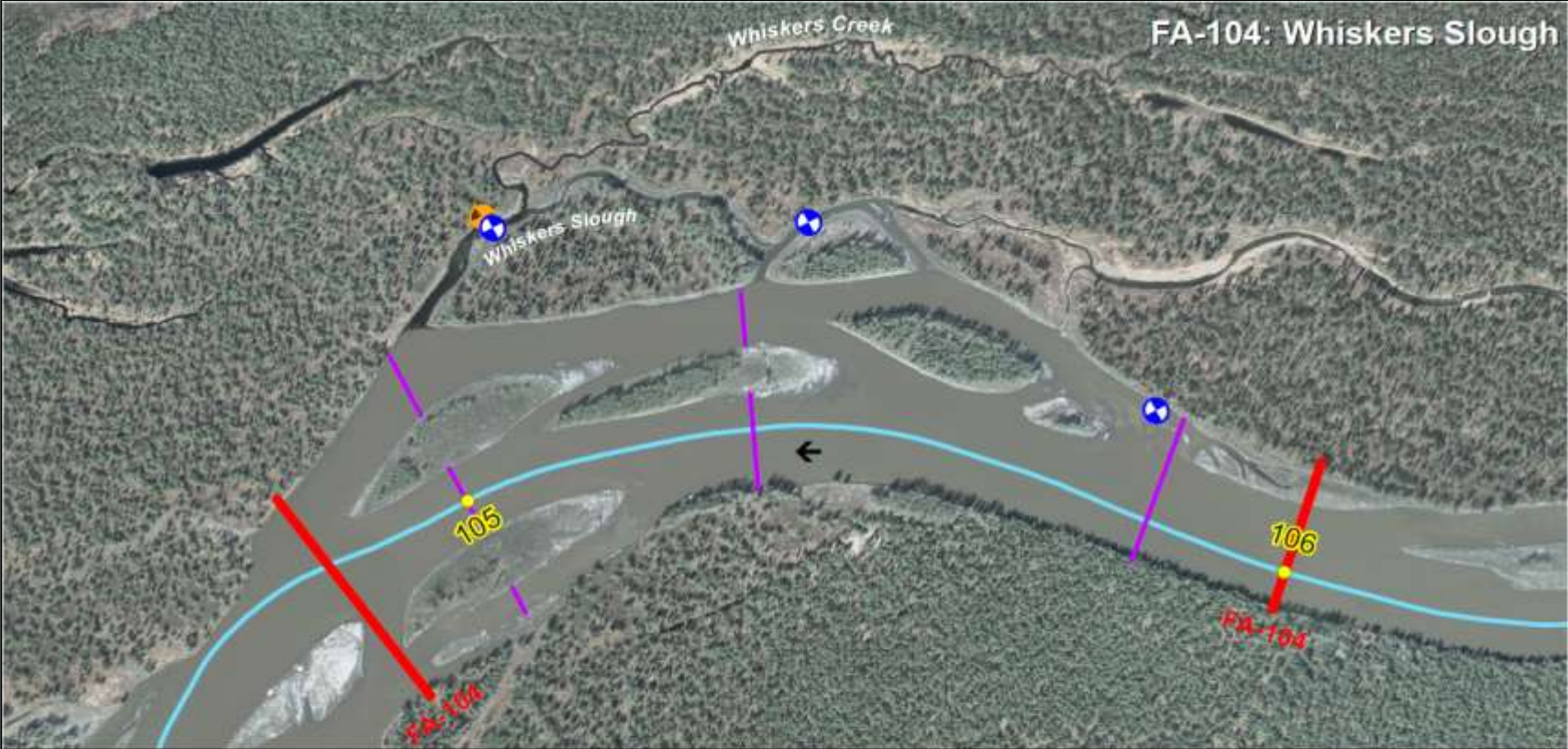
PRM 124.2 Curry Fishwheel Camp



Focus Area Monitoring Field Data Results

- Focus Area field data was graphed by transect and point sample location in the Focus Area from downstream to upstream with standard deviation.
- Point sample field data was graphed by the distance from the point sample the parameters were collected.
- Longitudinal profiles were graphed for Focus Area 115: Lane Creek
- Focus Area field data results include: temperature, pH, DO, conductivity, and redox potential.
- Turbidity is provisional at this time.

Focus Area 104: Whiskers Slough



Legend

- ← Flow Arrow
- ☉ Project River Mile
- ⊕ Point Sample
- ▣ Depth Profile
- ⊙ Ground Water Wells
- Surface Water Transects
- Instream Flow Focus Area (Upper and Lower Extents)
- Susitna River Mainstream Channel

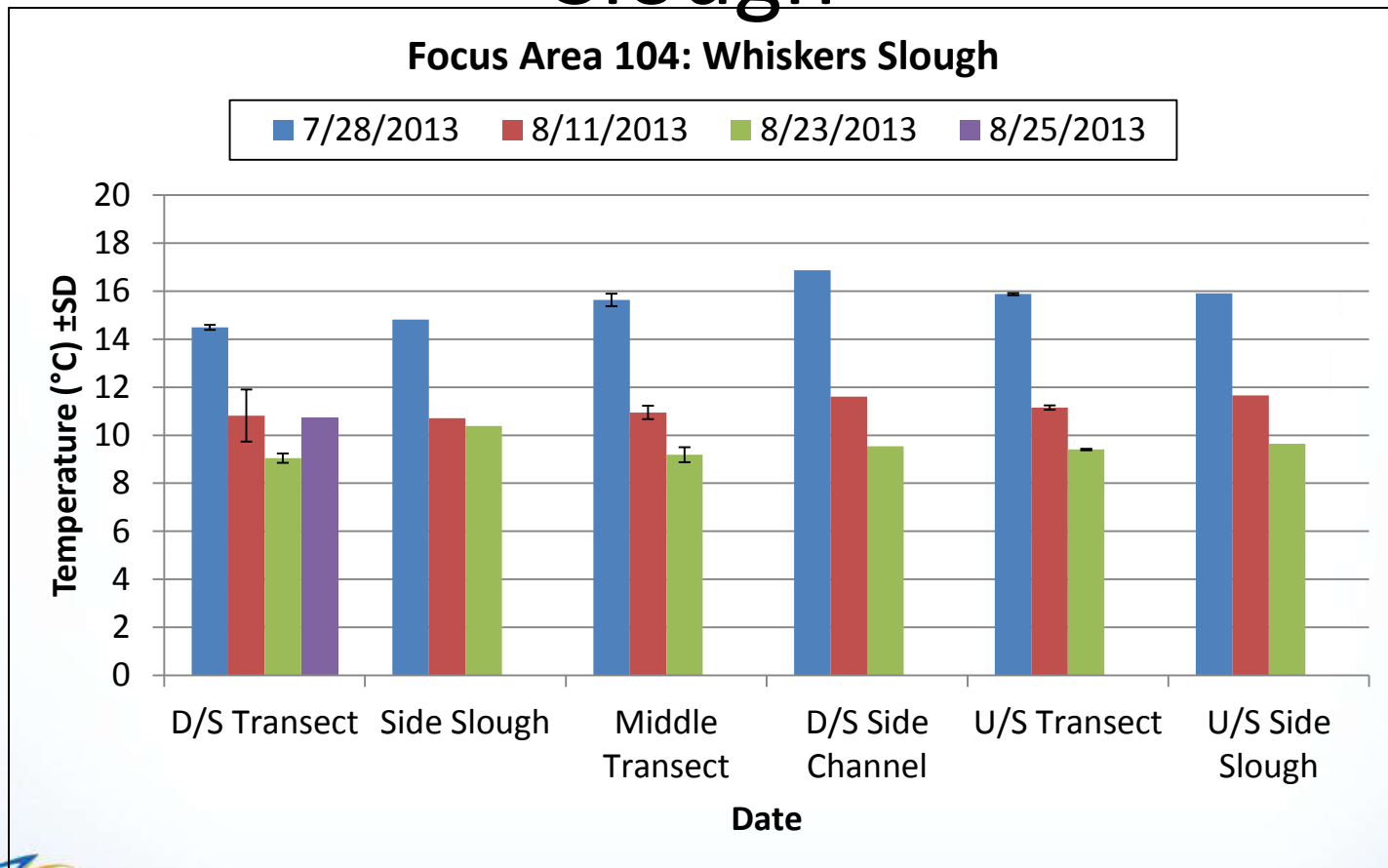
Data Source: See References
 Orthophoto Source: 2011 Matanuska-Susitna Borough LIDAR & Imagery Project

0 1,000 Feet

Projection: Alaska Albers NAD 1983
 Date Created: 11/25/2015
 Map Author: URS Alaska, Courtney Smith
 File: Map_IFS_FocusAreas_HabWQ_ISR.mxd

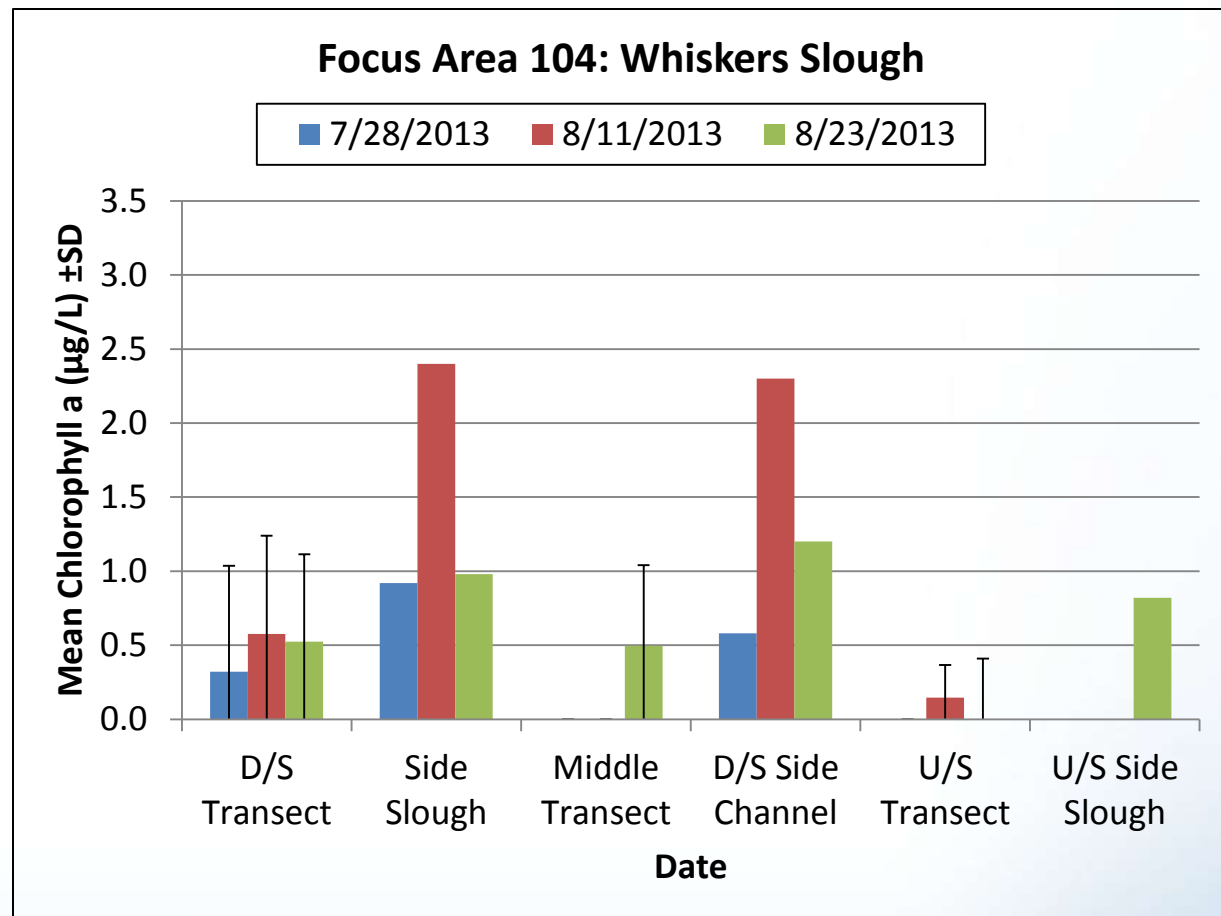


Example Focus Area Temperature Graph for Focus Area 104: Whiskers Slough

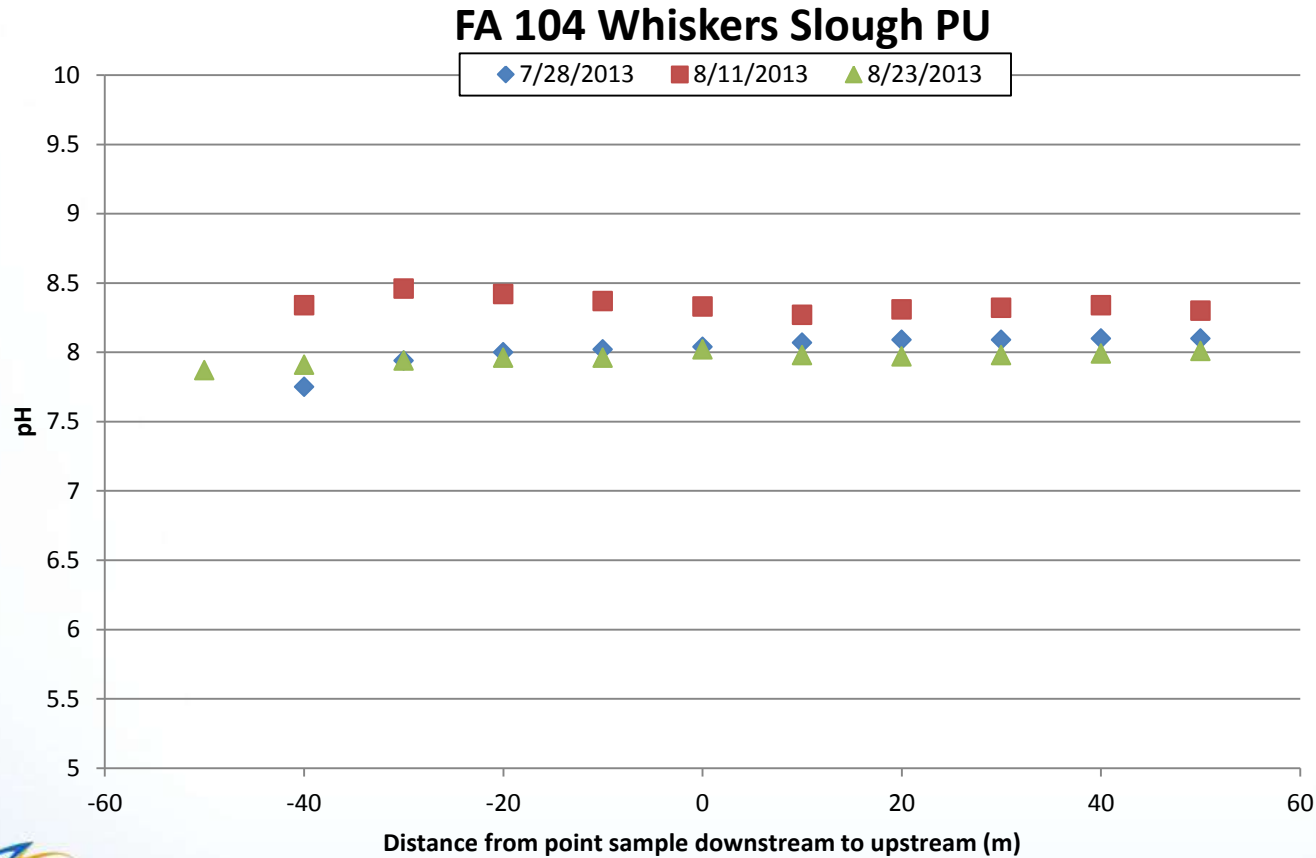


Focus Area Lab Data- Chlorophyll *a* in Focus Area 104: Whiskers Slough

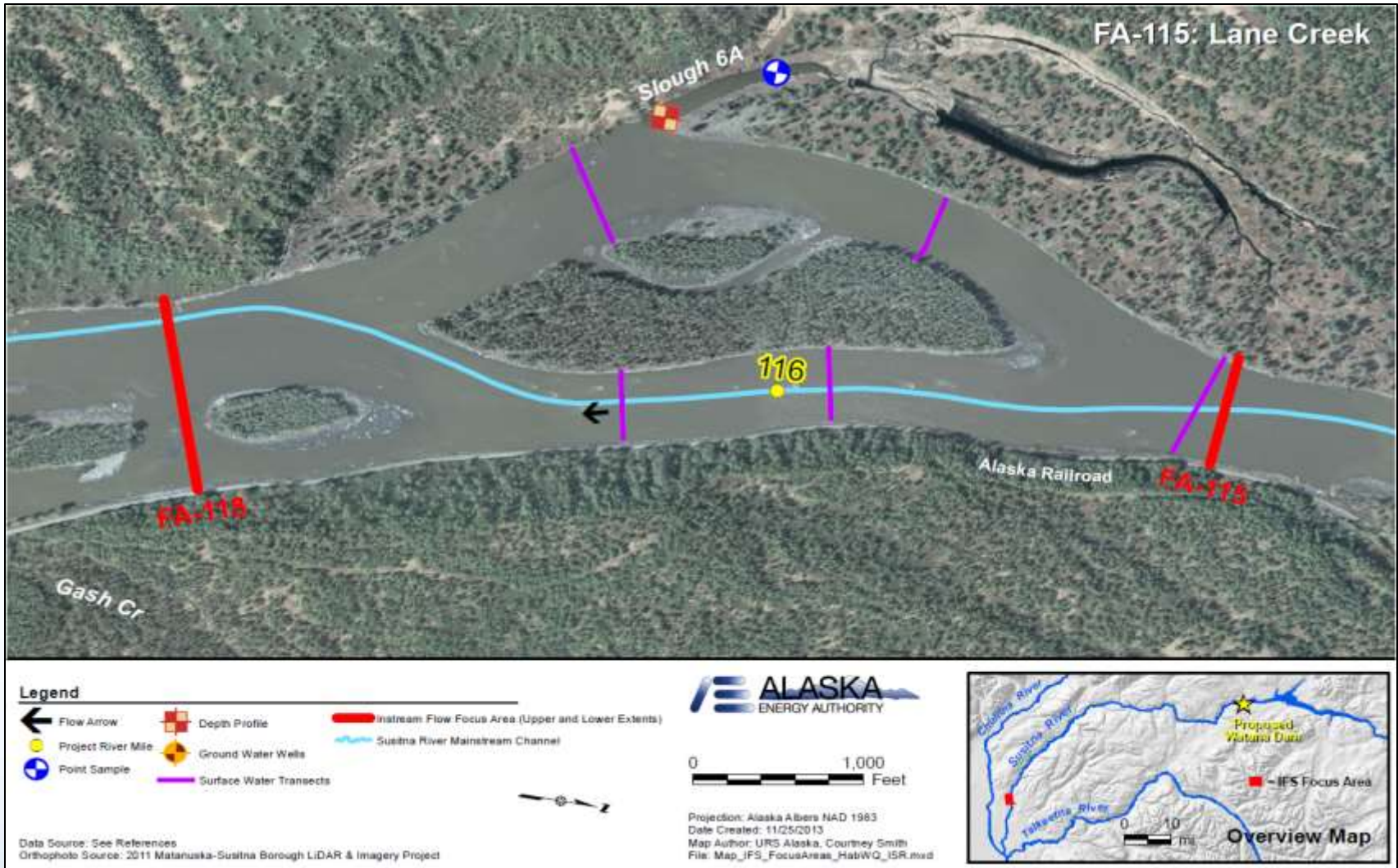
- All other lab data is provisional and being QA/QC'ed except for Chlorophyll *a*.



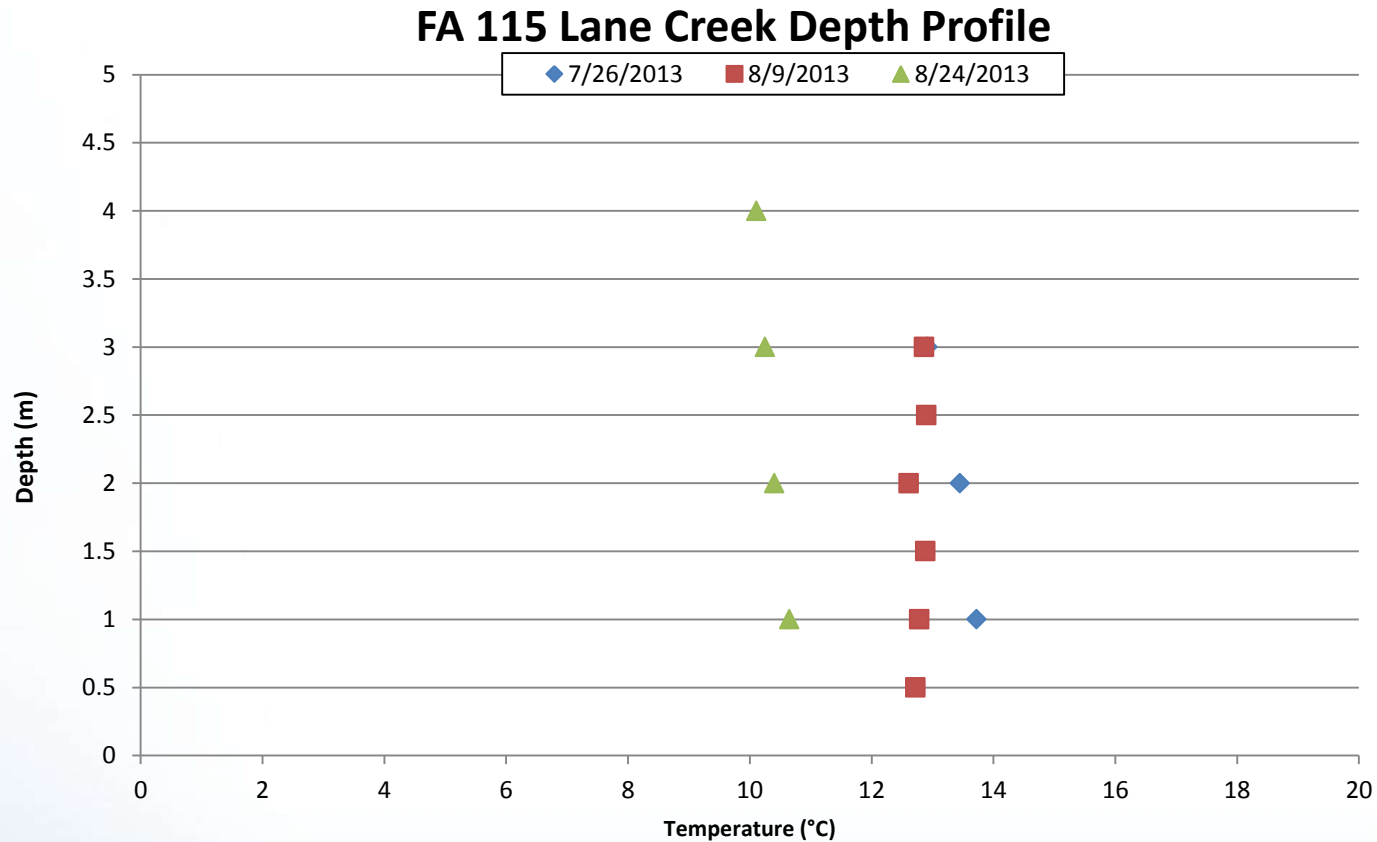
Focus Area 104: Whiskers Slough Point Sample Upstream pH Results



Focus Area 115: Lane Creek



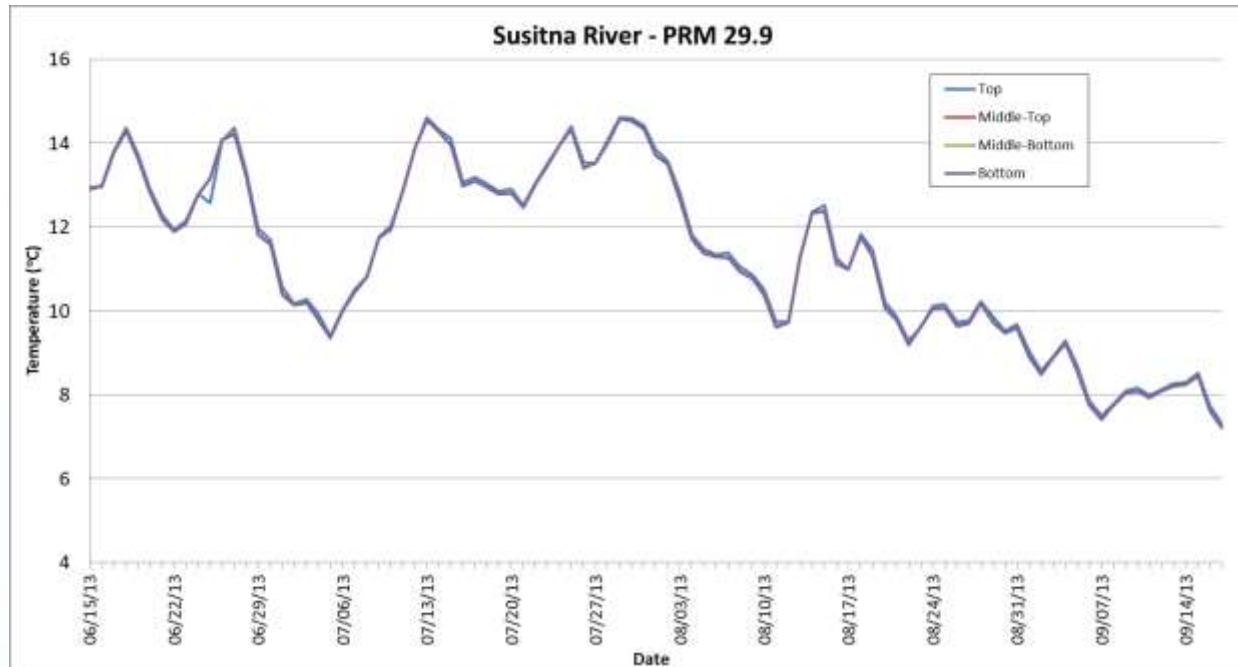
Focus Area 115: Lane Creek Temperature Depth Profile



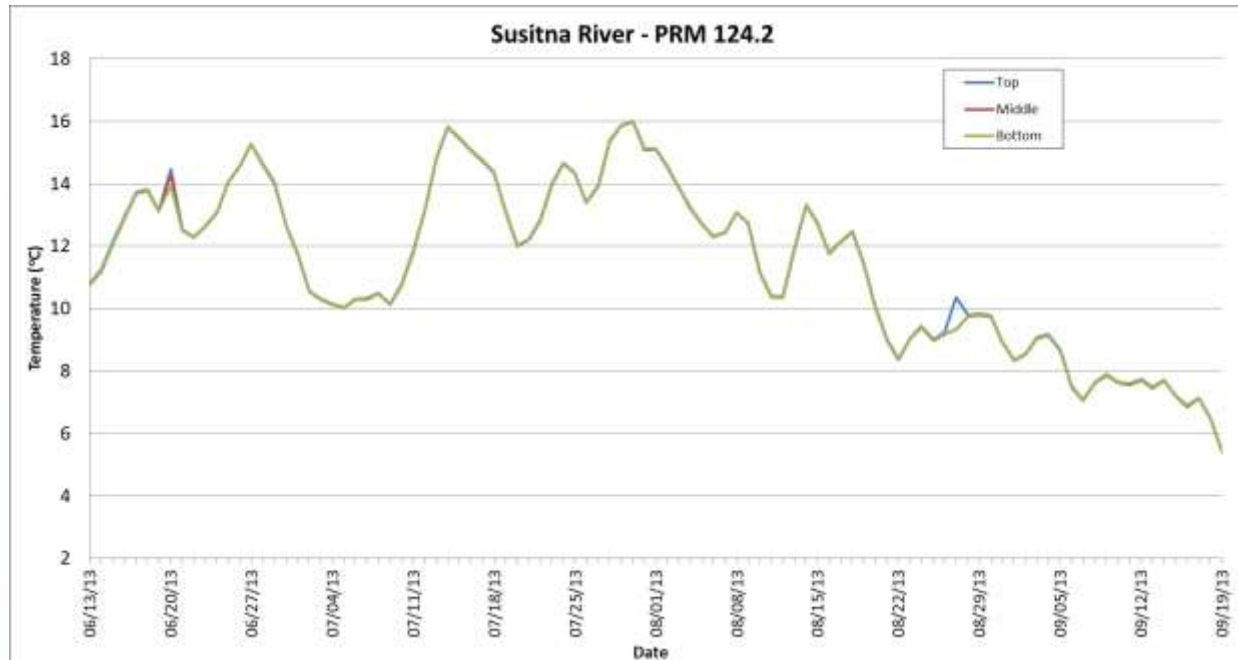
Status of Continuous Temperature Monitoring Results

- 2013 results passed through Quality Assurance review; finalized
- 2013 monitoring sites winterized and will be retrieved June 2014

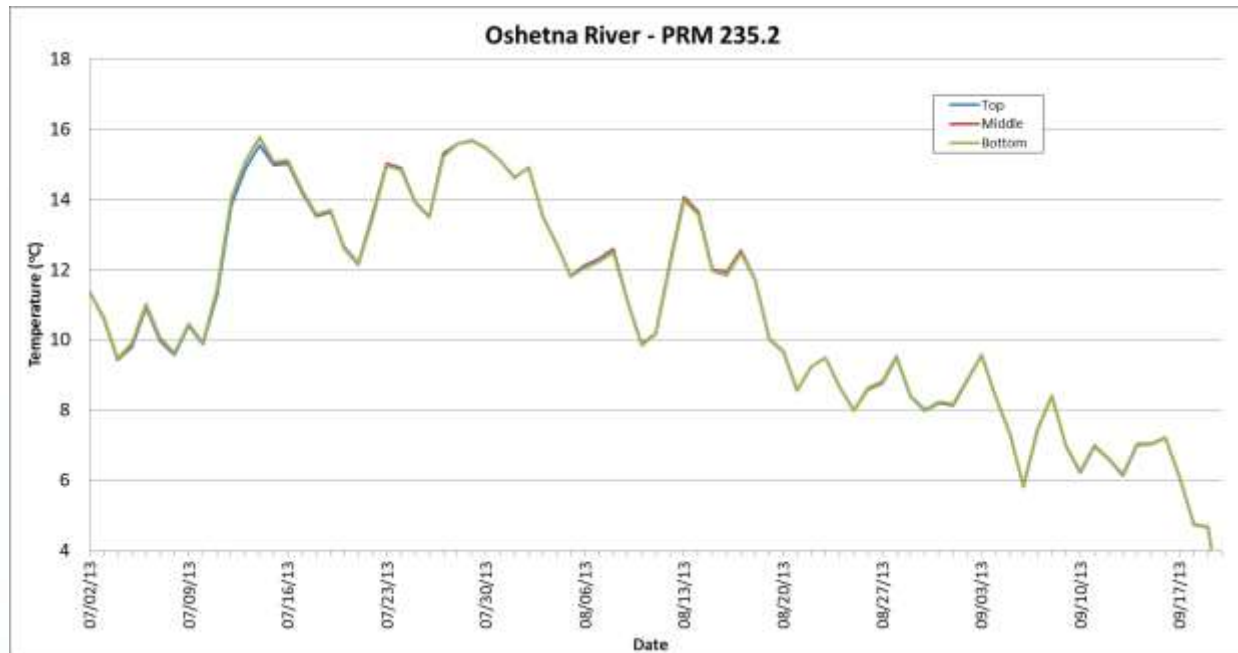
Continuous Temperature Monitoring Results



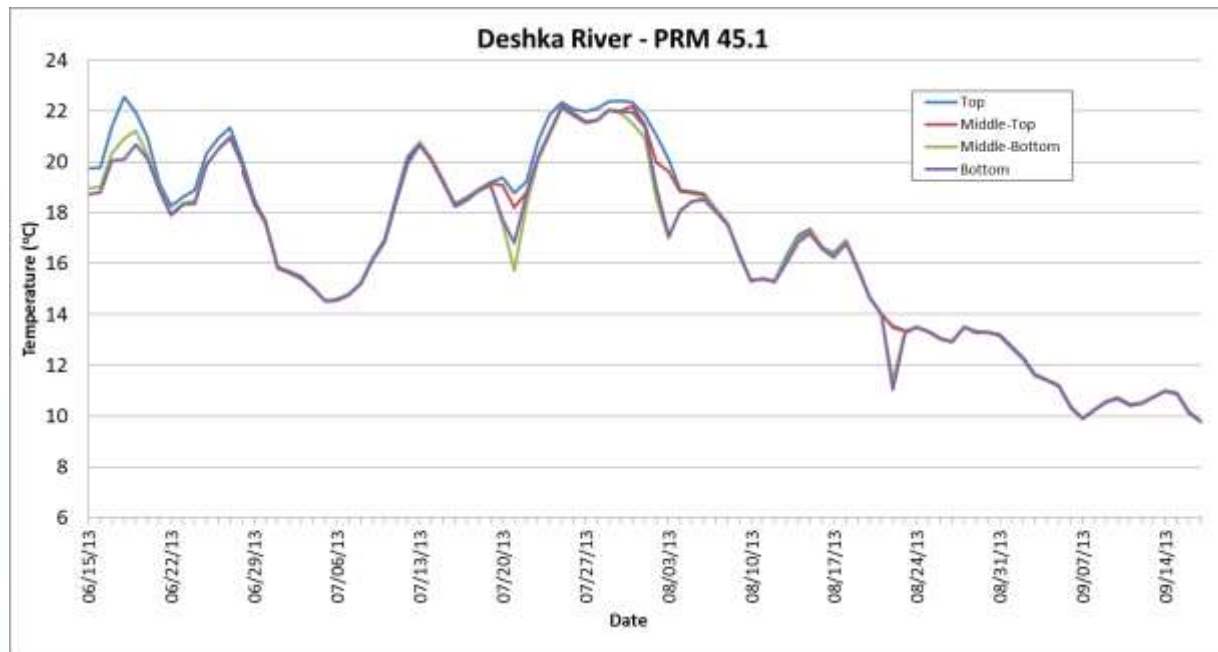
Continuous Temperature Monitoring Results



Continuous Temperature Monitoring Results



Continuous Temperature Monitoring Results



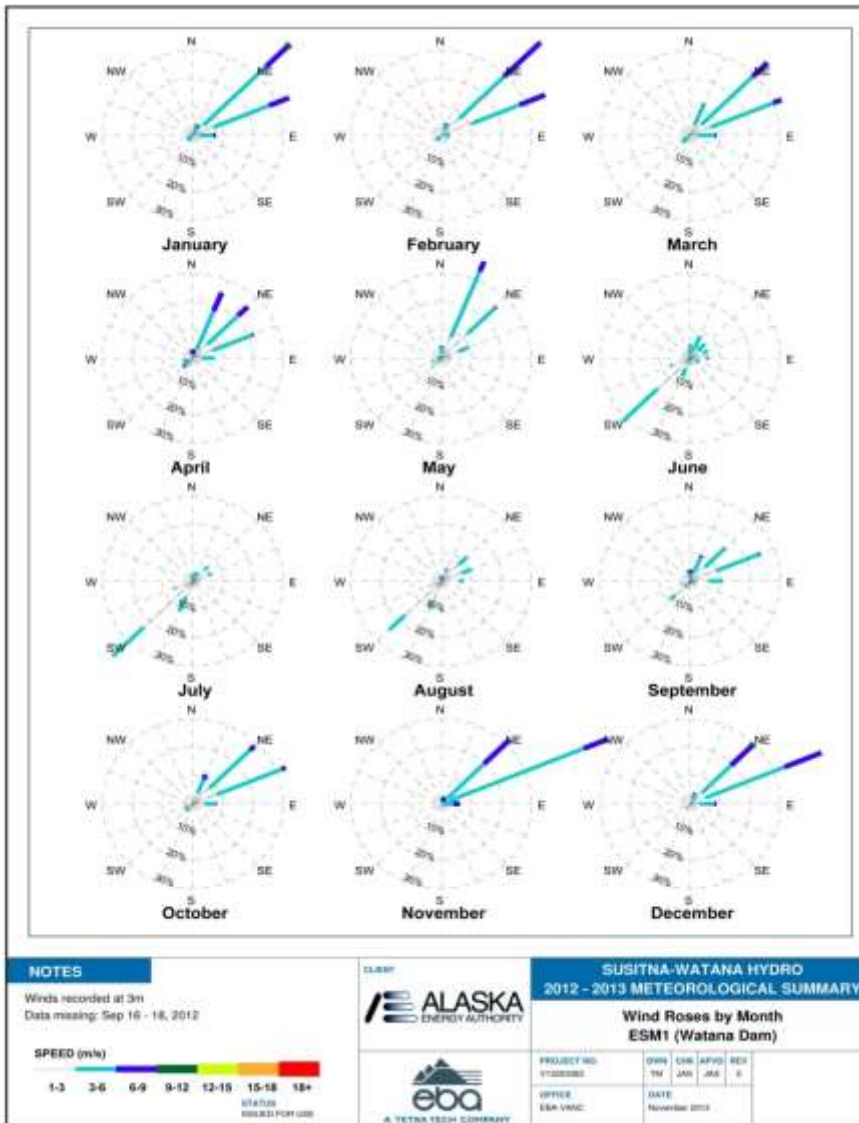
MET Station Results

- 15 month period of record
- First MET Station deployed August 2012
- Data through Quality Assurance Review

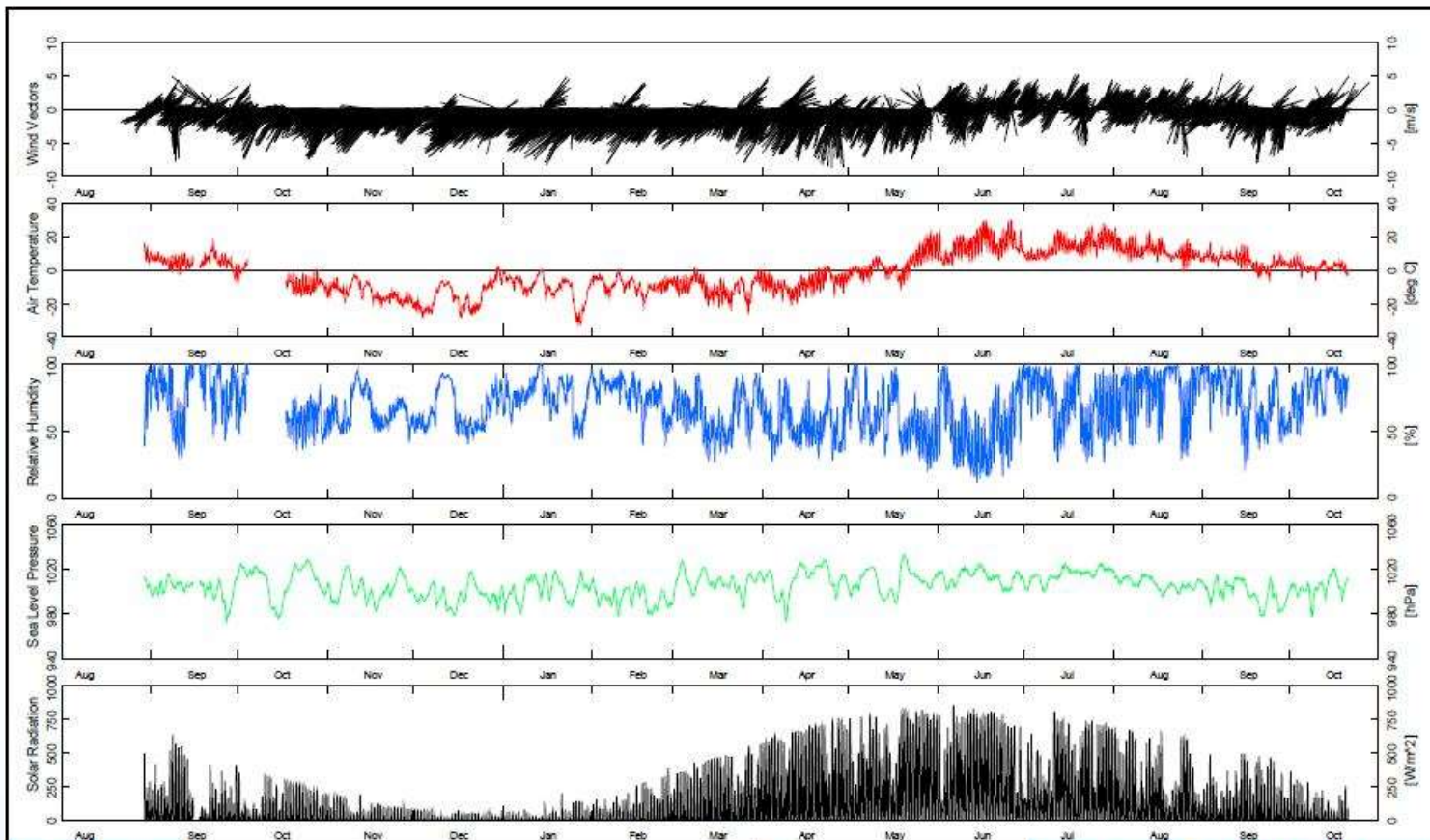
MET Station Results “Wind Roses”

Watana Dam Site MET Station

- Fall/Winter wind from the northeast
- Spring/Summer wind from southwest



MET Station Results: Watana Dam



Wind Vectors

Air Temp.

Rel. Humid.

Sea Level Press.

Solar Radiation

NOTES

STATUS
ISSUED FOR USE

CLIENT



A TETRA TECH COMPANY

SUSITNA-WATANA HYDRO

2012 - 2013 METEOROLOGICAL SUMMARY

ESM1 (Watana Dam) Winds and Weather
Aug 2012 - Oct 2013

PROJECT NO.
V13203082

DWN
TM

CHK
JAS

APVD
JAS

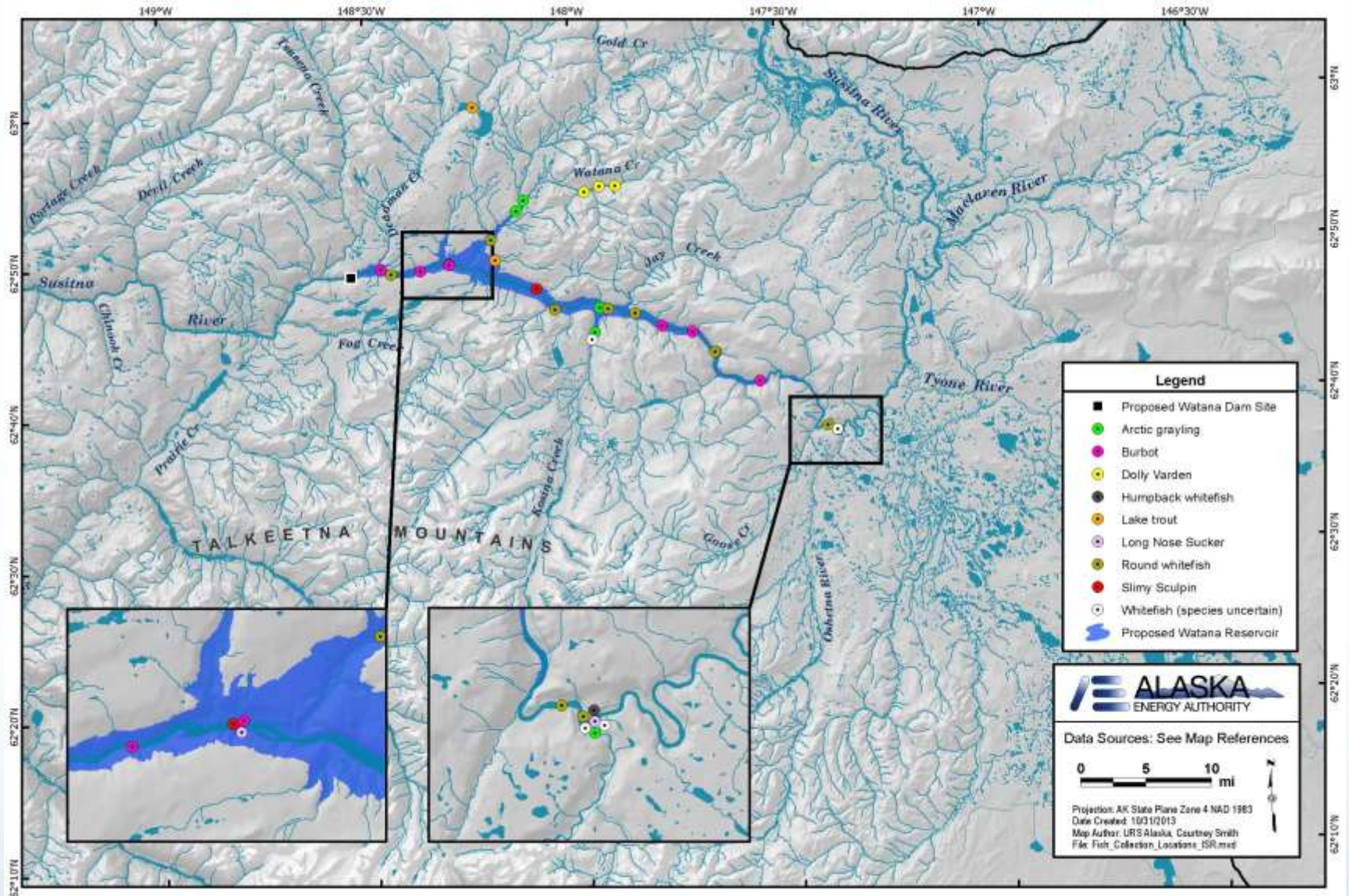
REV
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OFFICE
EBA-VANC

DATE

November 2013

Mercury Assessment: Collection of Fish Samples



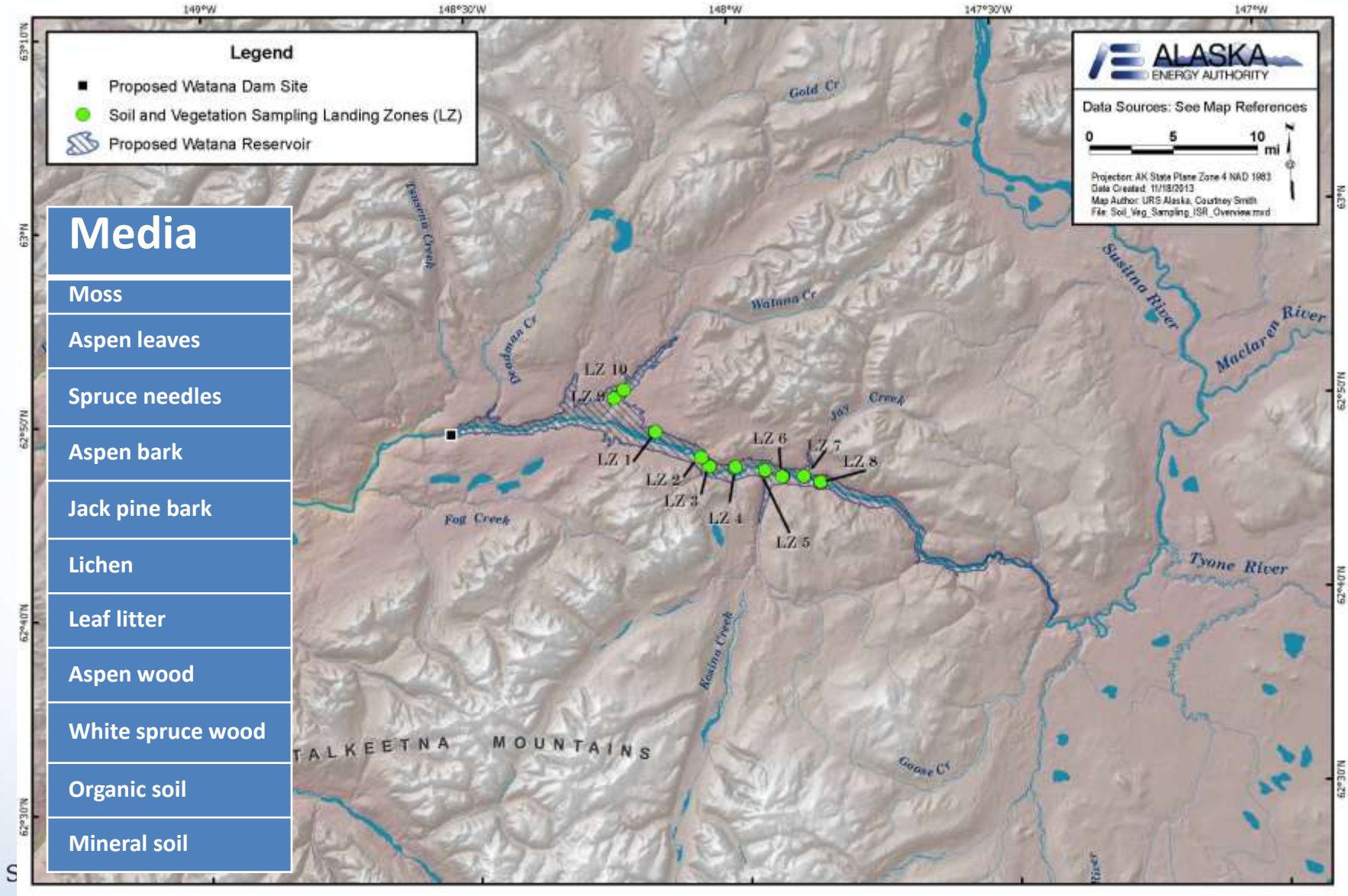
SUSITNA-WATANA HYDRO *Clean, reliable energy for the next 100 years.*

Mercury: Example for Lake Trout

Fish Length (mm)	Fish Weight (g)	Estimated Age (yr.)	LATITUDE	LONGITUDE	PRM	Drainage	Sample Date	% Solids
510	1806	14	62.8381	-148.1907	194.1	Sally Lake	8/5/2012	22.08
430	1082	8	62.8381	-148.1907	194.1	Sally Lake	8/5/2012	28.66
625	2200	26	63.0076	-148.2364	NA	Deadman Lake	09/20/13	21.83
450	1000	9	63.0076	-148.2364	NA	Deadman Lake	09/20/13	25.94
460	1000	9	63.0076	-148.2364	NA	Deadman Lake	09/20/13	27.29
590	1600	22	63.0076	-148.2364	NA	Deadman Lake	09/20/13	20.12
455	800	9	63.0076	-148.2364	NA	Deadman Lake	09/20/13	22.63
355	1300	6	63.0076	-148.2364	NA	Deadman Lake	09/20/13	22.39
380	500	7	63.0076	-148.2364	NA	Deadman Lake	09/20/13	22.91



Mercury Assessment: Collection of Vegetation and Soils

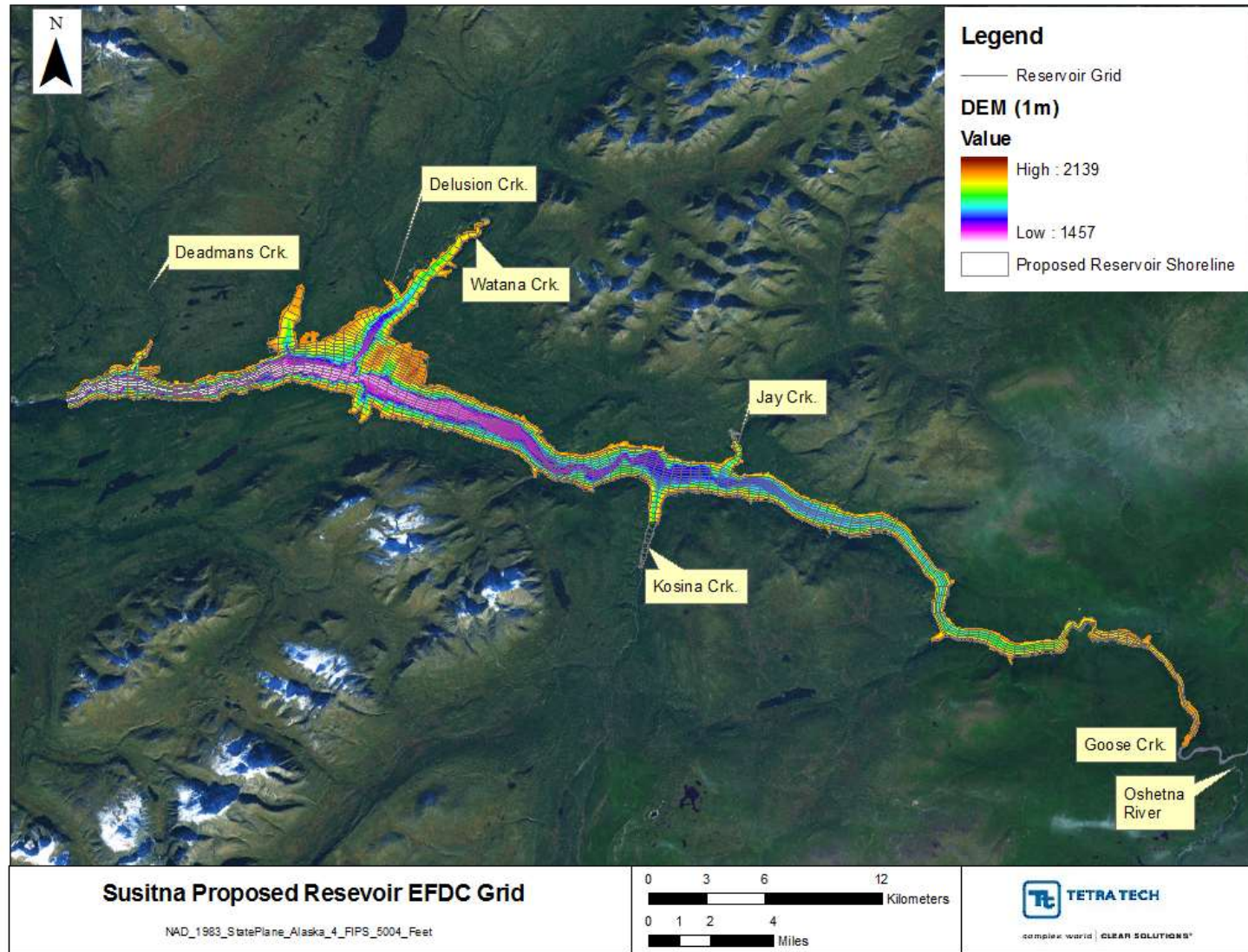


Status of the Reservoir Model

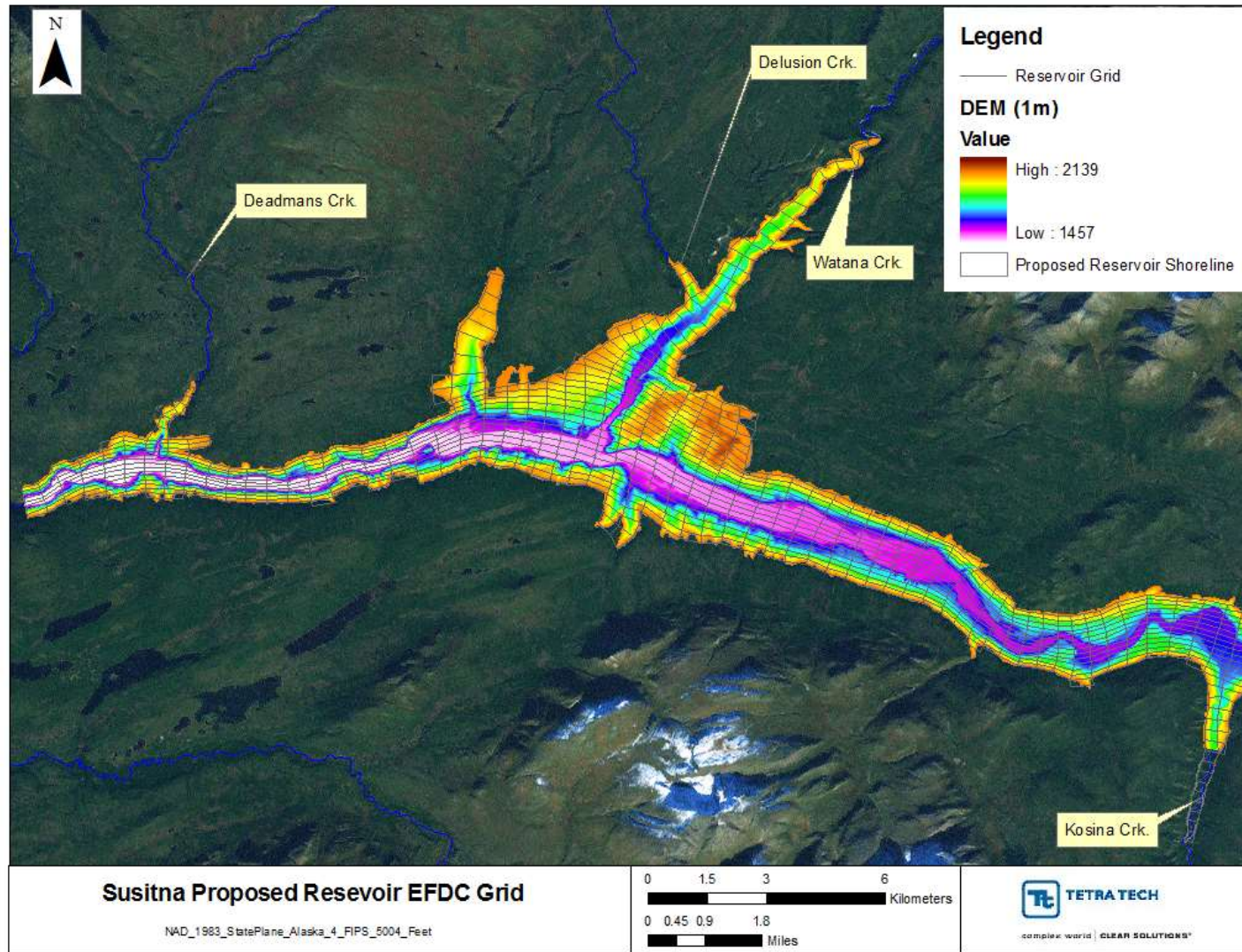
- *Spatial model configuration completed*
- *Simulated 1984 operational scenario to demonstrate model's ability to represent 150 ft plus pool fluctuations and drying and wetting of shallow areas*
- *Preliminary temperature simulations underway*
 - *Investigate vertical resolution to represent summer thermal stratification*
 - *Evaluation of simple versus complex ice processes models*
- *In progress*
 - *Configuration of nutrient cycling and mercury models*
 - *Configuration of suspended solids transport for trapping simulation*



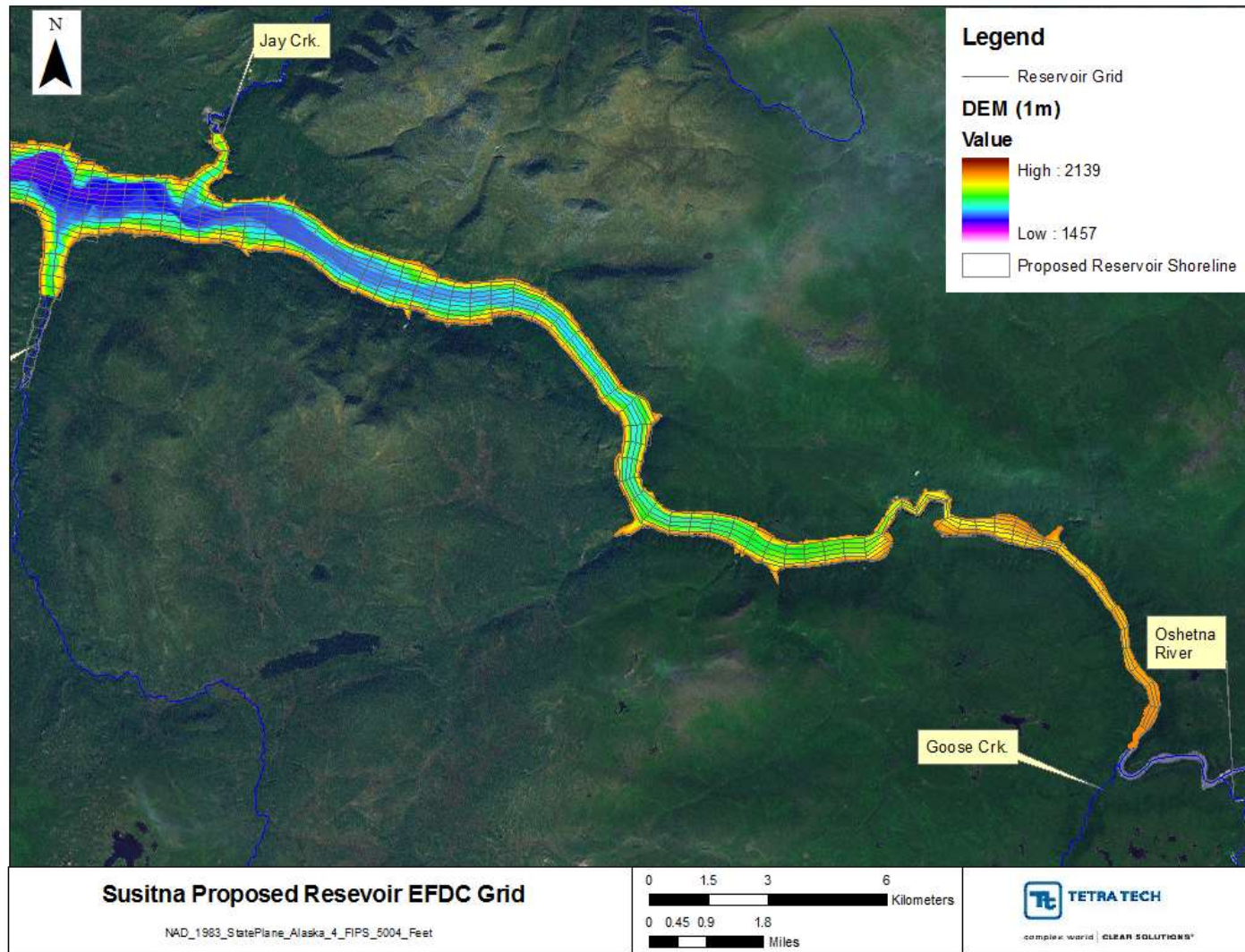
Reservoir Model Horizontal Grid



Reservoir Model Horizontal Grid



Reservoir Model Horizontal Grid



SUSITNA

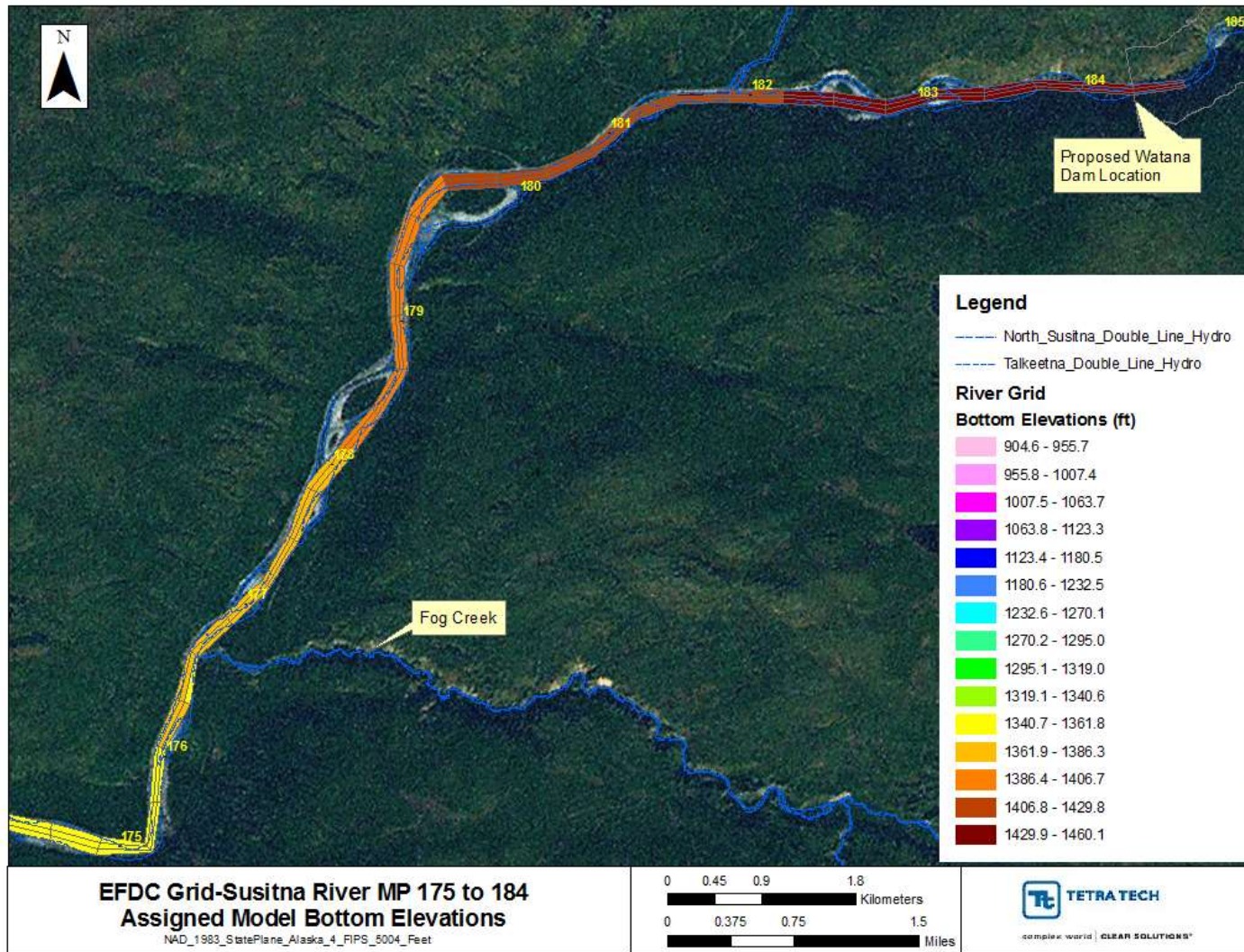
Status of the River Model

- *Base spatial model configuration completed*
 - *From reservoir to below PRM 80*
- *Simulated 2012 observational/calibration period and 1984 operational scenario*
- *Preliminary temperature simulations underway*
 - *Full year simulation using assumed ice-on and ice-off dates*
 - *Preliminary calibration to 2012 observations*
- *In progress*
 - *Refinement of base spatial configuration*
 - *Developing Focus Area grids for nesting into base configuration*



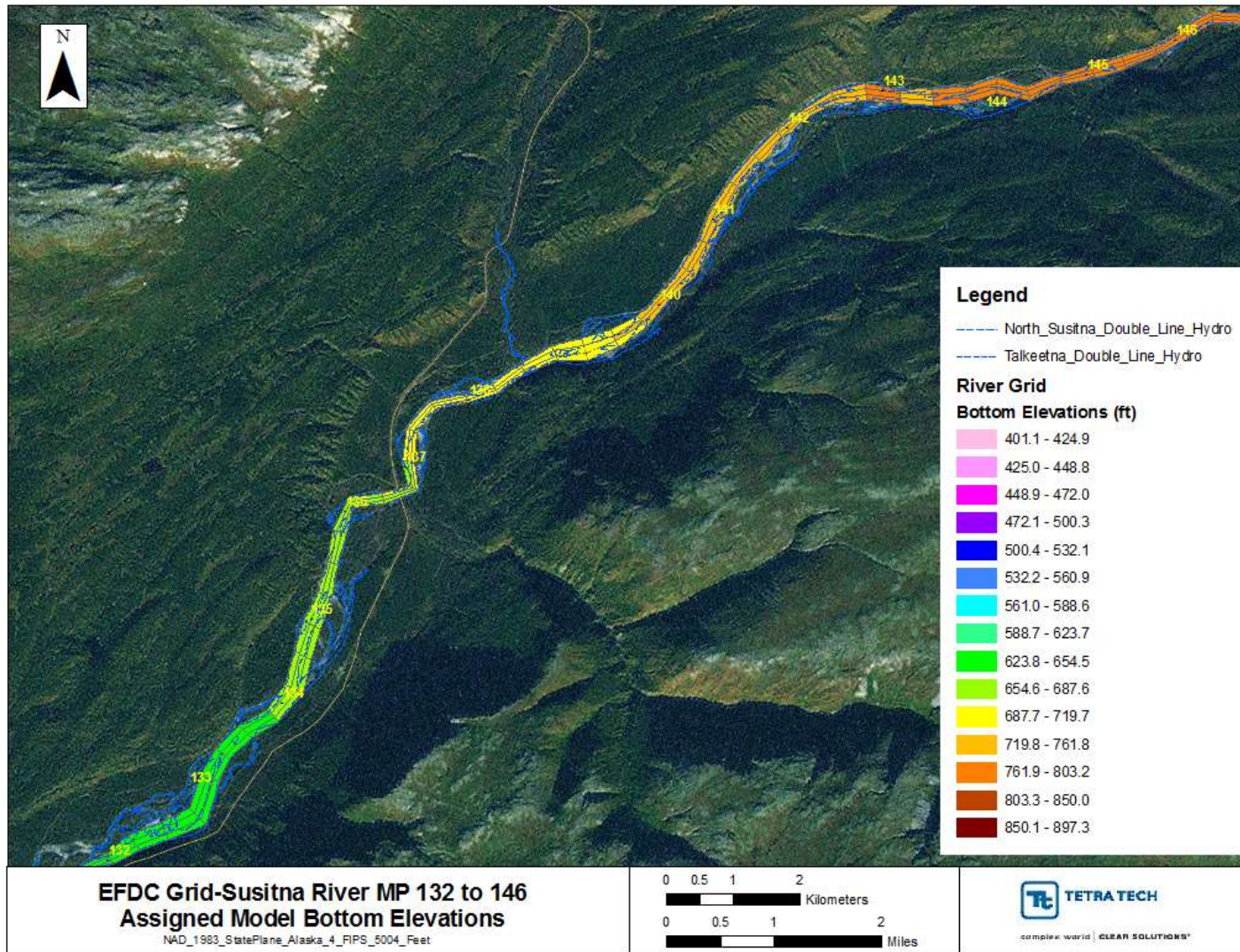
River Model Coarse Horizontal Grid

(secondary channels not shown)



River Model Coarse Horizontal Grid

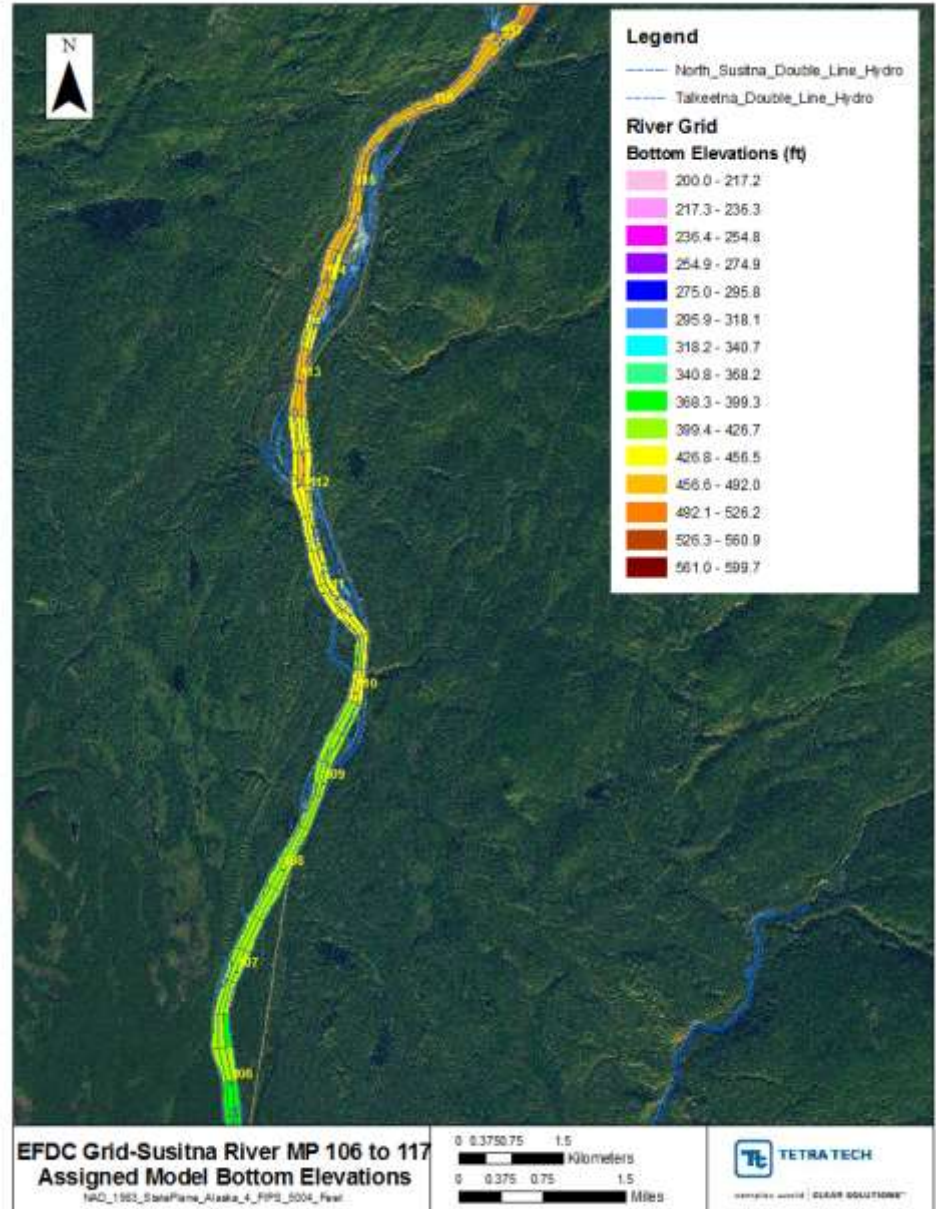
(secondary channels not shown)



SUSIT

River Model Coarse Horizontal Grid

(secondary channels not shown)

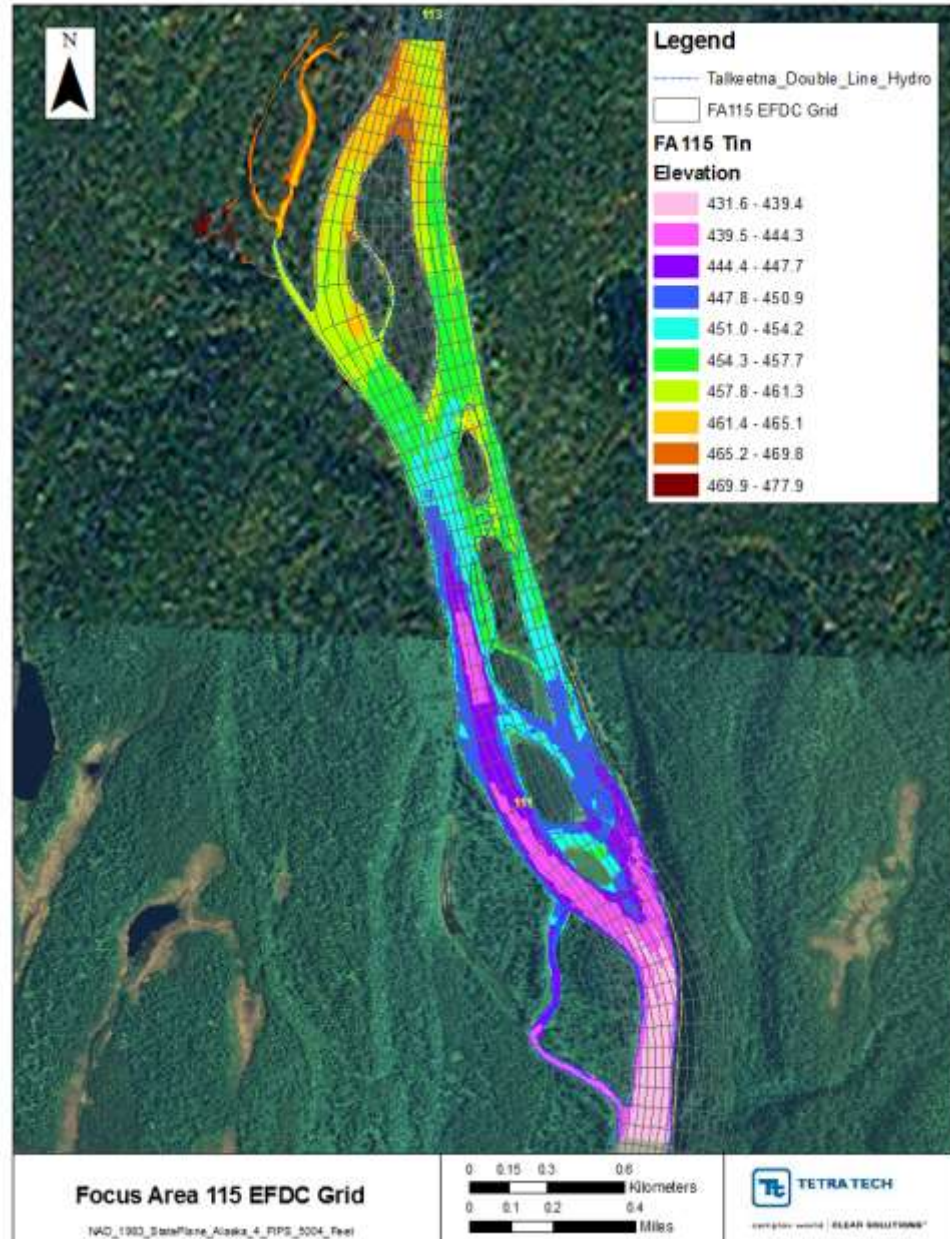
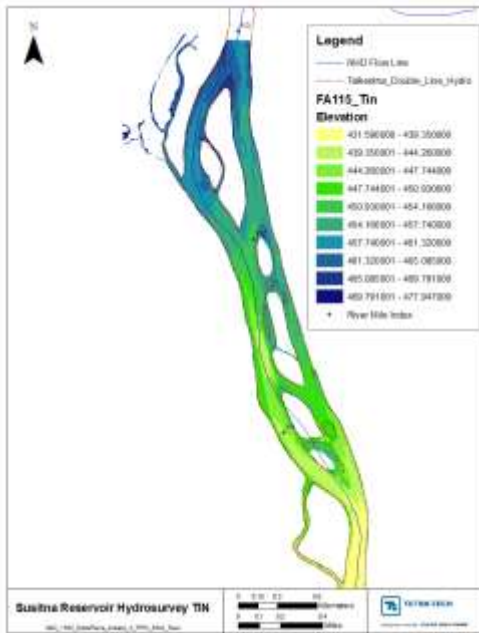


River Model Spatial Resolution Enhancement for Focus Areas

- *River model domain and resolution*
 - *Coarse resolution: 500 m longitudinally, 3 cells across main channel*
 - *Medium resolution: 250 m longitudinally, 5 cells across main channel*
 - *Finer resolution for Focus Areas*
- *Example Focus Area grid on following slides*
 - *Approximately 100 m longitudinally and 30 m laterally*
 - *Final resolution will be based on sensitivity to water quality constituent gradients in focus areas*



Example Grid in FA-115 (Slough 6A)



Variations from RSP

- *Baseline Water Quality Study*
- (RSP Section 5.5.4.4)
 - *WQ samples collected above the dam were often collected by helicopter as point samples*
 - *A YSI meter was used to collect in-situ parameters in June rather than a Hach MS5*
 - *4 of 10 sediment/pore water samples collected for metals analysis*
- *Water Quality Characterization in Focus Areas*
(RSP Section 5.5.4.5)
 - *Groundwater wells co-located with groundwater studies in select areas (within well clusters);*
 - *3 transects within each FA*
 - *7 FAs instead of 10 due to access issues*
 - *Greater number of points sampled along each transect*
 - *Addition of surface water point samples in sloughs and side channels*
 - *Addition of longitudinal profiling of field water quality measurements*
- *Water Temperature Data Collection*
(RSP Section 5.5.4.1)
 - *Logging interval from October 2013 through June 2014 will be 30-minutes (instead of 15 minutes);*
 - *2012-2013 winter temperature collection terminated in April 2013; data storage capacity used up with 15-minute logging intervals*
 - *Continuous temperature monitoring not conducted at PRM 152.2 and 196.8 due to access issues.*

2014 Planned Study Activities

- Baseline Water Quality -
 - Met Station data collection (continuous)
 - Temperature data collection (continuous)
 - Winter baseline water quality sampling (January 2014 and March 2014)
 - Data management and quality assurance evaluation (continuous)
 - July - September Baseline TP and metals sampling
 - July- August Focus Areas requiring access permits (3 FAs)
 - Split sediment sample in 2014 for QA/QC check
 - Comparison of historic USGS results to current Study results

Baseline WQ Study Schedule

Activity	2012				2013				2014				2015	
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	
Thermal Imaging (one survey)				—										
MET Station Installation and Data Collection			—————											
QAPP/SAP Preparation and Review			—————											
Deployment of Temperature Monitoring Apparatus			—————											
Water Quality Monitoring (monthly)						—————		—			—————			
Sediment Sampling							—					—		
Fish Tissue Sampling			—				—							
Data Analysis and Management				—————										
Initial Study Report										△				
Updated Study Report													▲	

2014 Planned Study Activities

- Mercury Assessment
 - Collect additional Total mercury water and sediment samples June-September 2014
 - Data management and quality assurance evaluation (continuous)
 - Conduct pathway analysis
 - Inform EFDC mercury model development
 - Construct phosphorus release and Harris/Hutchinson models for comparison to EFDC model outputs
- Model Calibration (Water Quality)
 - Continue with parameterization
 - Calibrate internal Hydraulic Routing Model
 - Practice runs with continuous temperature data

2014 Planned Field Data Collection

- *Complete Remaining Monitoring Activity*
 - *Baseline WQ Study (RSP Section 5.5.4.4)*
 - *Visit site locations requiring access permits*
 - *June through September metals and TP/TKN sample collection*
 - *Collect remaining sediment/pore water samples (6 sites remaining)*
 - *Split water and sediment samples in 2014 for QA/QC check*
 - *Water Quality Characterization in Focus Areas (RSP Section 5.5.4.5)*
 - *Additional groundwater sampling from wells not yet installed during 2013 field season*
 - *Visit site locations requiring access permits*
 - *Water Temperature Data Collection/MET Stations (RSP Section 5.5.4.1)*
 - *On-going data collection (3-year effort from 2012)*

