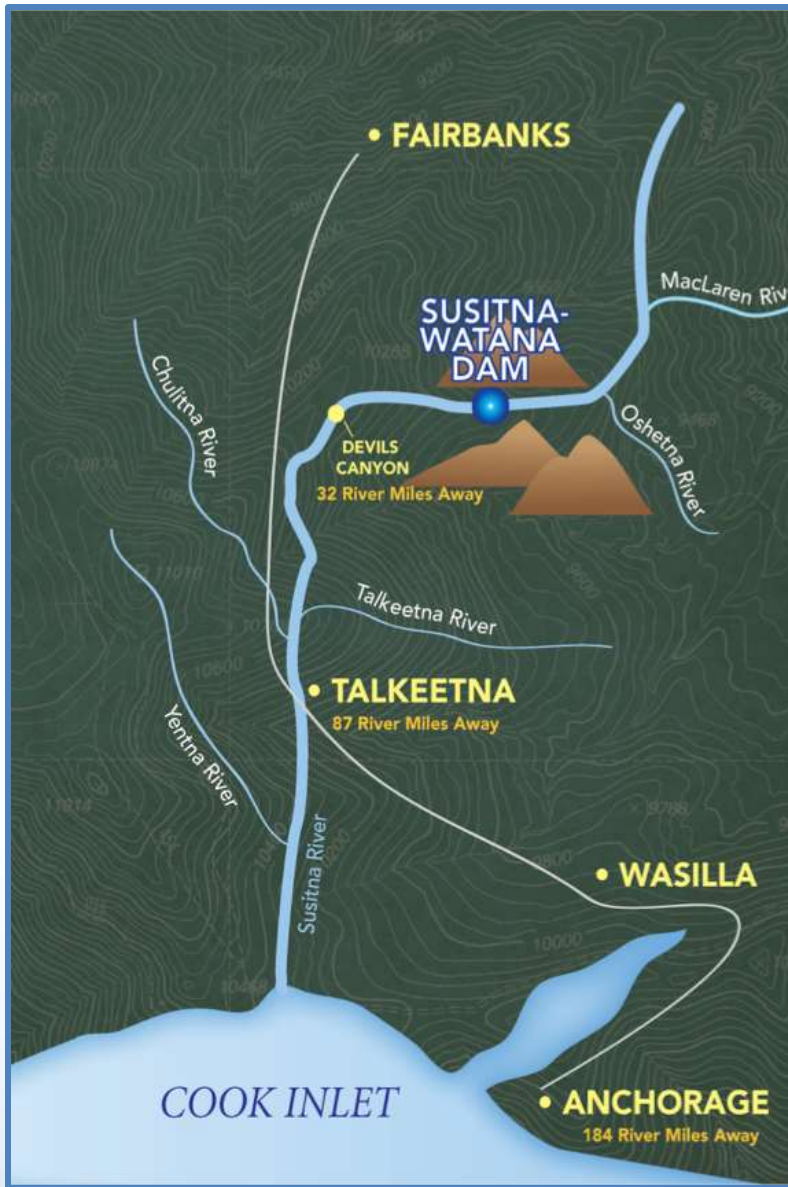


Technical WorkGroup Meeting Q3 2013 TWG

Geomorphology Studies

September 25, 2013

Prepared by
Tetra Tech. Inc.
Watershed GeoDynamics



RSP 6.5 and 6.6 Presentation Overview ²

- *Q3 2013 Data Collection*
 - *Field verify mapping of paleo/relic geomorphic features (RSP 6.5.4.1.2.3)*
 - *USGS Sediment Transport Data Collection (RSP 6.5.4.2)*
 - *Aerial Photographs (RSP 6.5.4.4 and 6.5.4.7)*
 - *LiDAR (RSP 6.6.4.1.2.9 and Modeling Approach TM)*
 - *Large woody debris surveys (LWD) (RSP 6.5.4.9)*
 - *1-D Modeling Data Collection (RSP 6.6.4.1.2.9.1)*
 - *Cross section data*
 - *Bed material sampling*
 - *Tributary Surveys (RSP 6.6.4.1.2.9.3)*

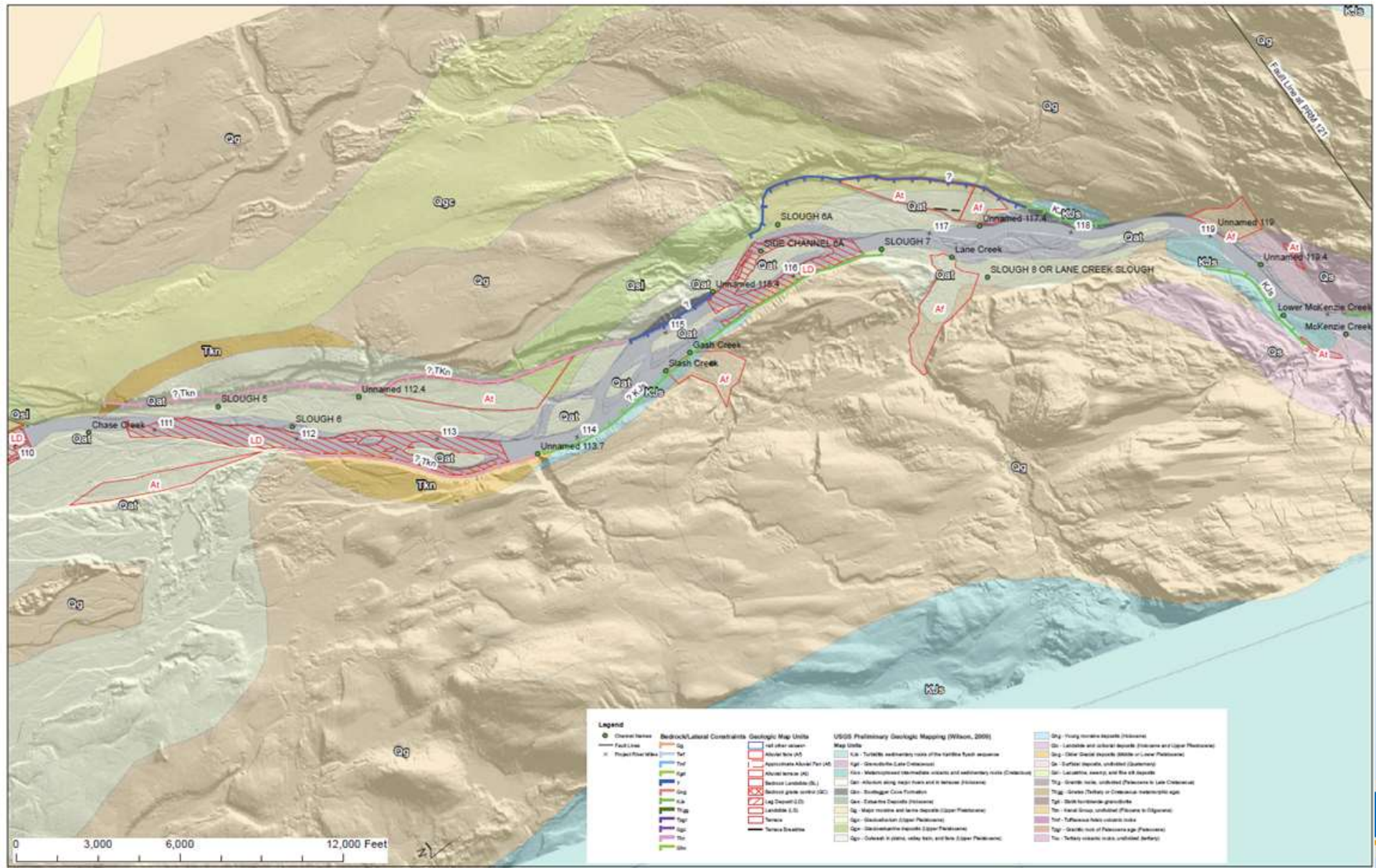
Presentation Overview (Cont.)

3

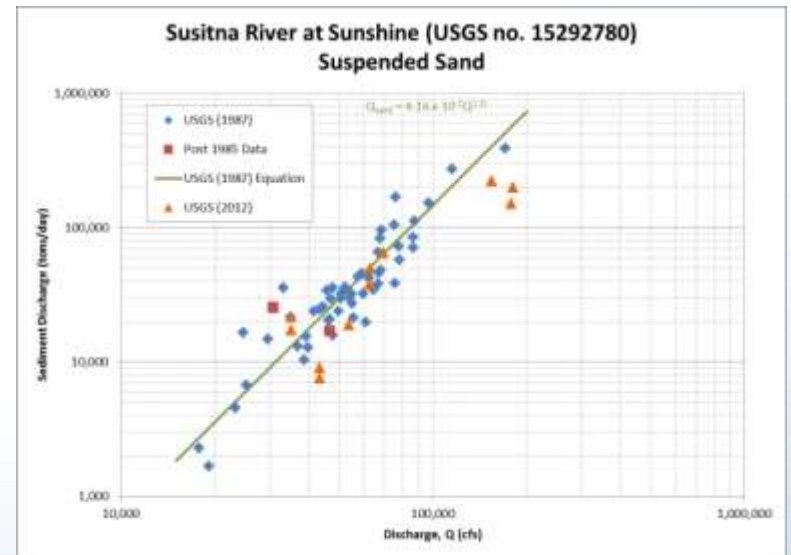
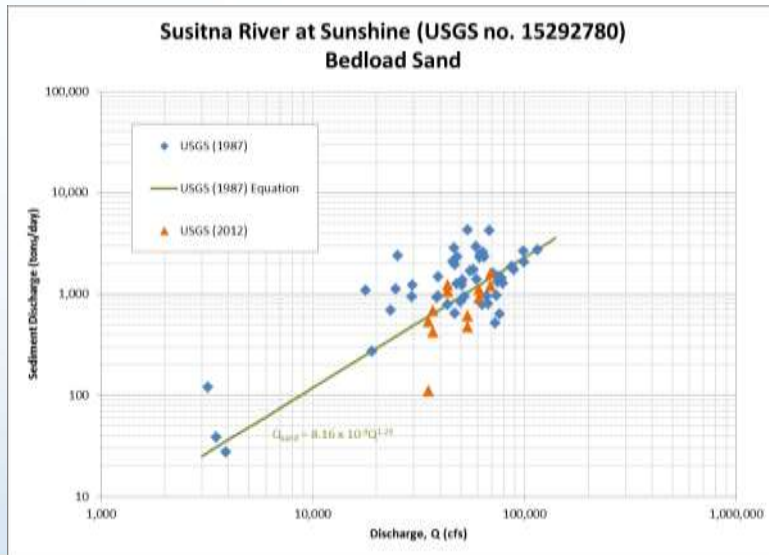
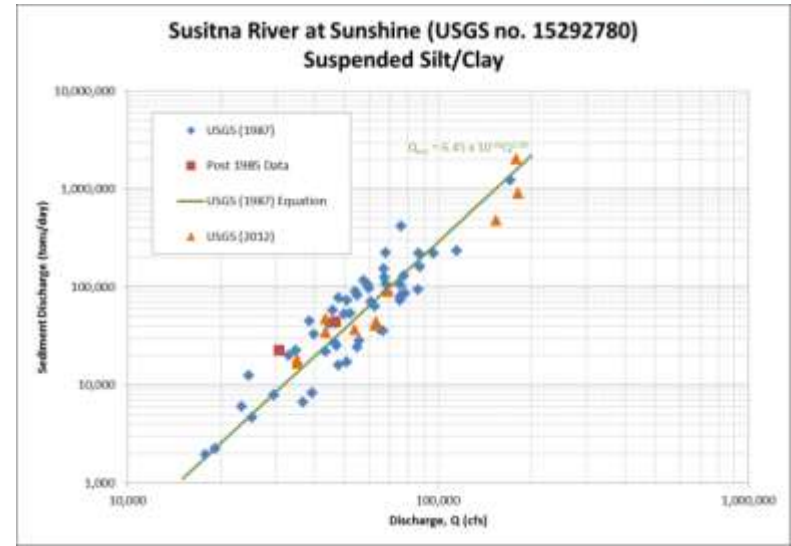
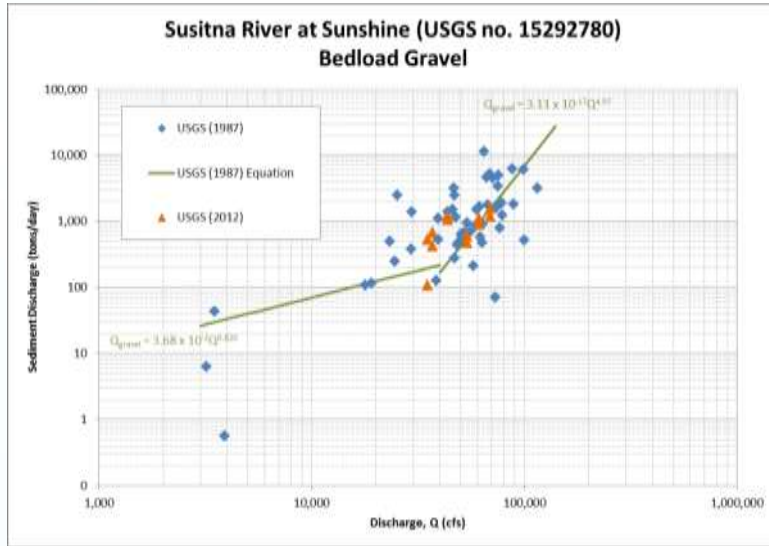
- *2-D Modeling / Focus Area (RSP6.6.4.1.2.9.2)*
 - *Bathymetry and topography*
 - *Bed material sampling*
 - *Geomorphic mapping and assessment*



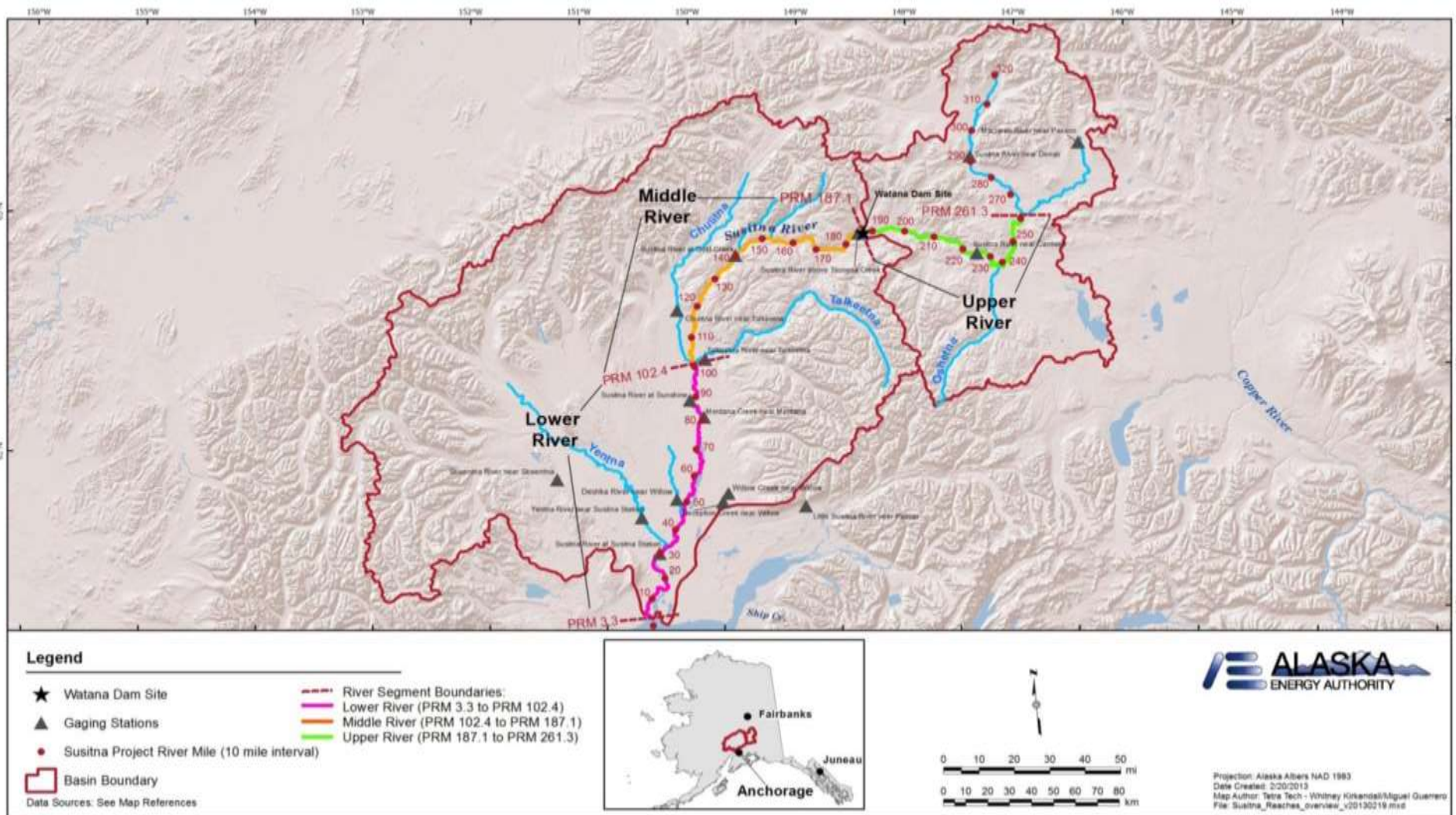
Field Verify Mapping of Paleo/Relic Features (RSP 6.5.4.1.2.3)



USGS Sediment Transport Data Collection 1980s and Current (RSP 6.5.4.2)

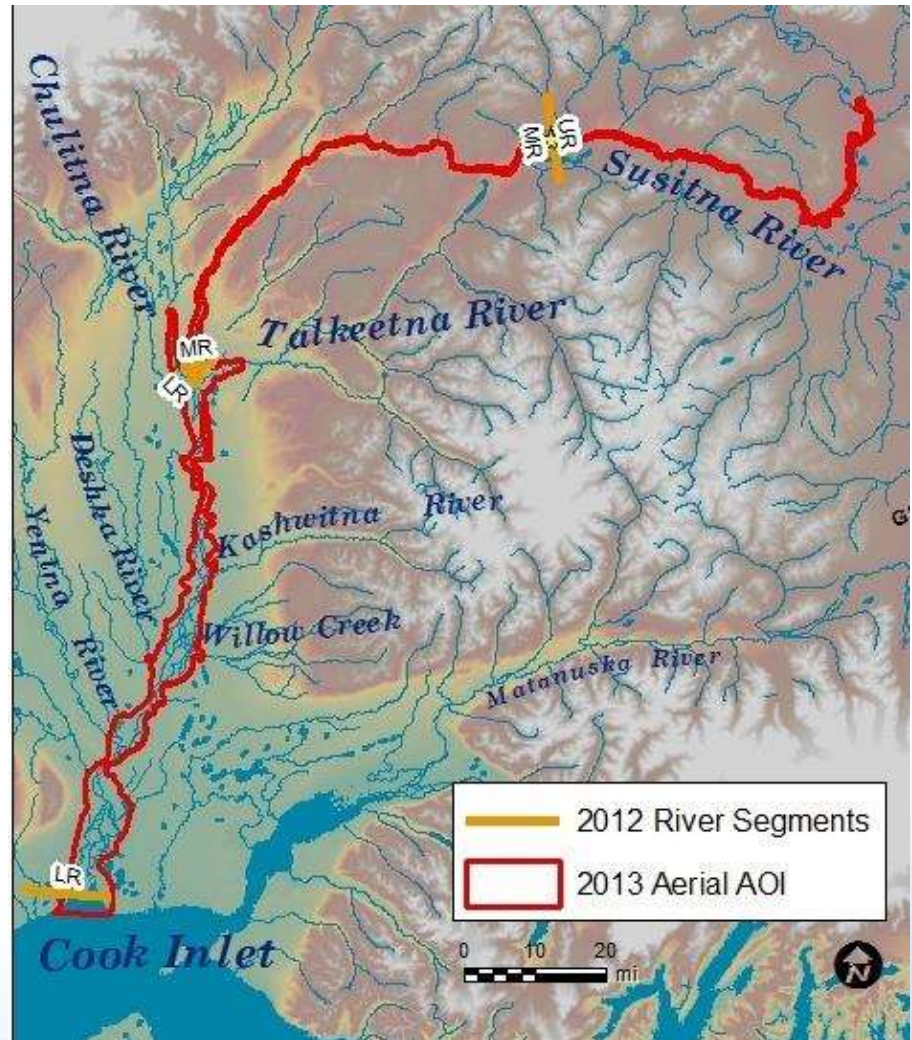


Susitna River –Aerial Photo Acquisitions (RSP 6.5.4.4, 6.5.4.5 and 6.5.4.7)



Collection of 2013 Aerials (RSP 6.5.4.4 and 6.5.4.7)

- *Collect complete UR, MR and LR*
 - *Target 12,500 cfs Gold Creek (MR and UR)*
 - *Target 40,000 cfs Sunshine (LR) (36,600 cfs in RSP)*
 - *Goal is to collect aerials at flows w/in 10% of target Q*



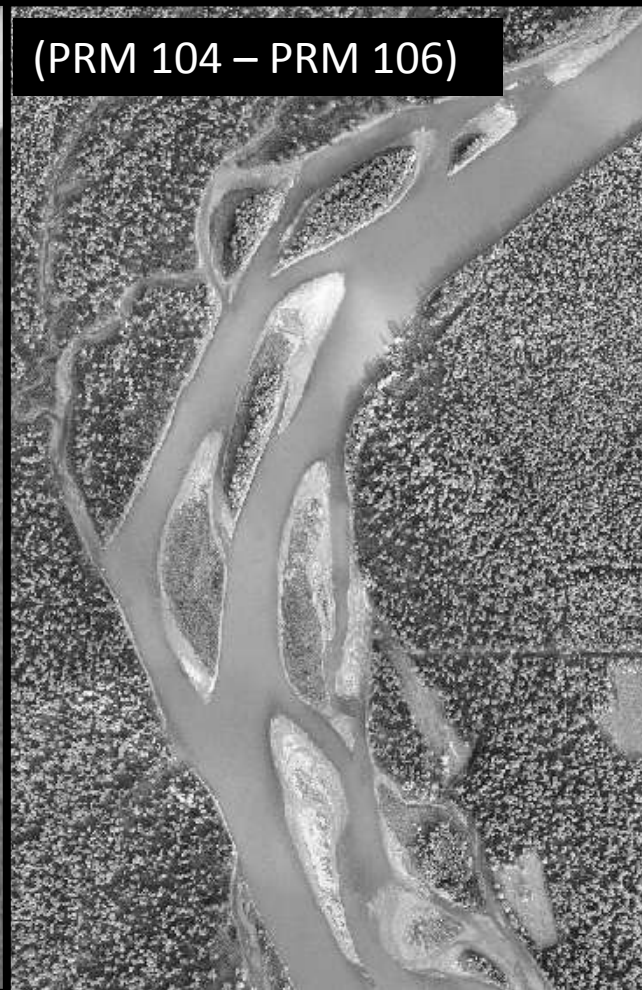
Acquire and Process 1950s Aerials for MR and LR (RSP 6.5.4.4)

8

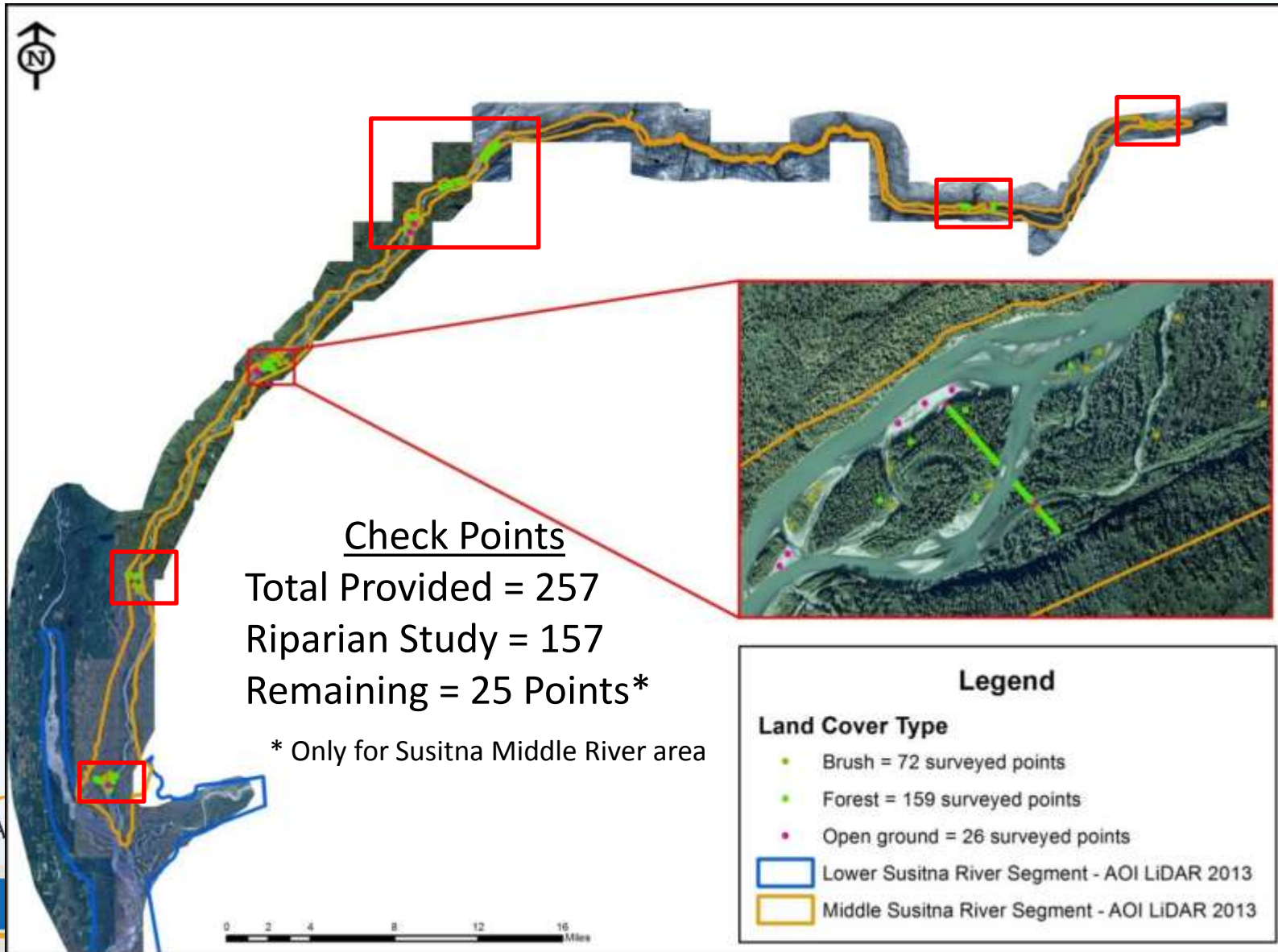
May 25, 1951
8,810 cfs @ Gold Creek

September 11, 1983
12,500 cfs @ Gold Creek

September 10, 2012
12,900 cfs @ Gold Creek



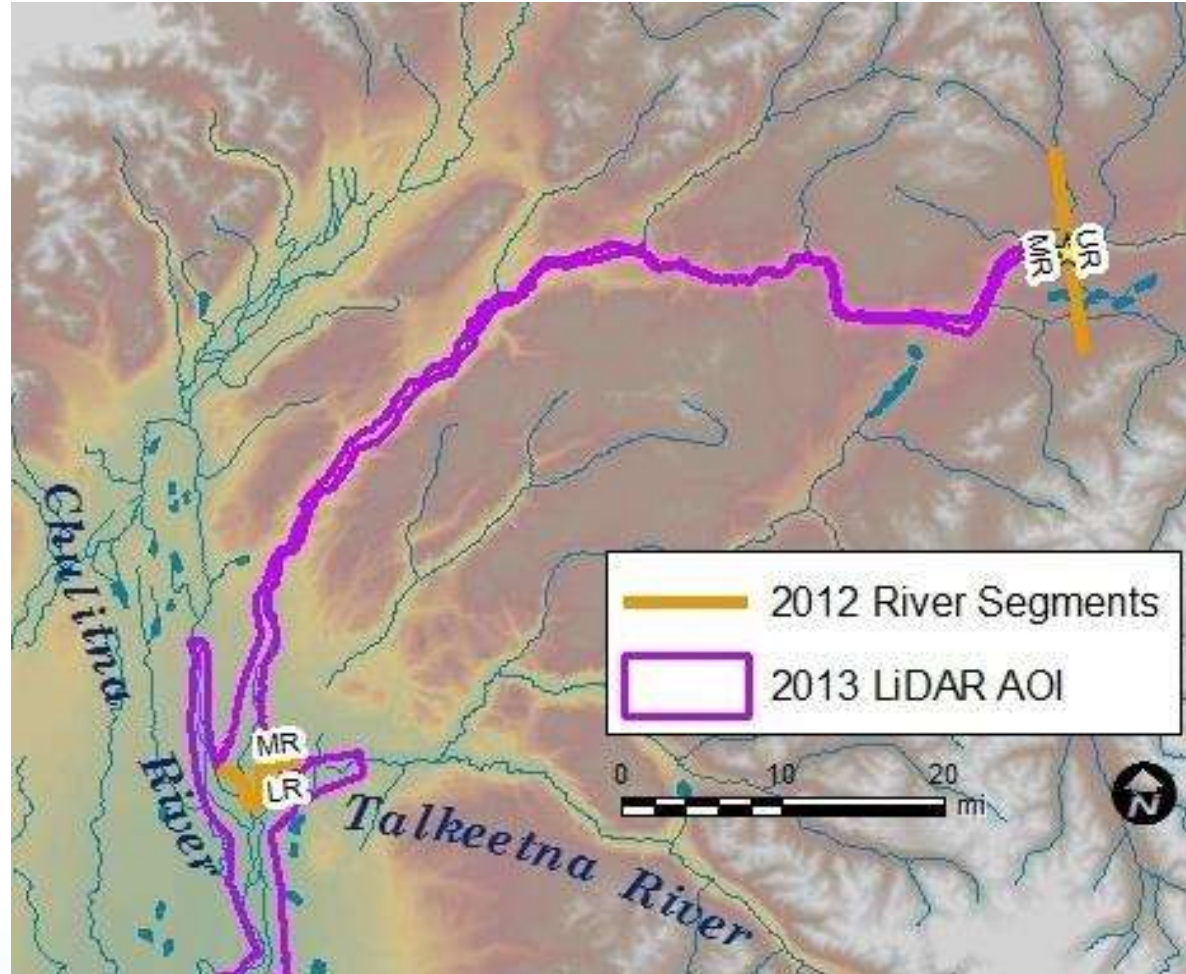
LiDAR Verification: Land Survey Check Points by Cover Type Map (RSP 6.6.4.1.2.9)



2013 High Density LiDAR Acquisition (Modeling Approach TM)

10

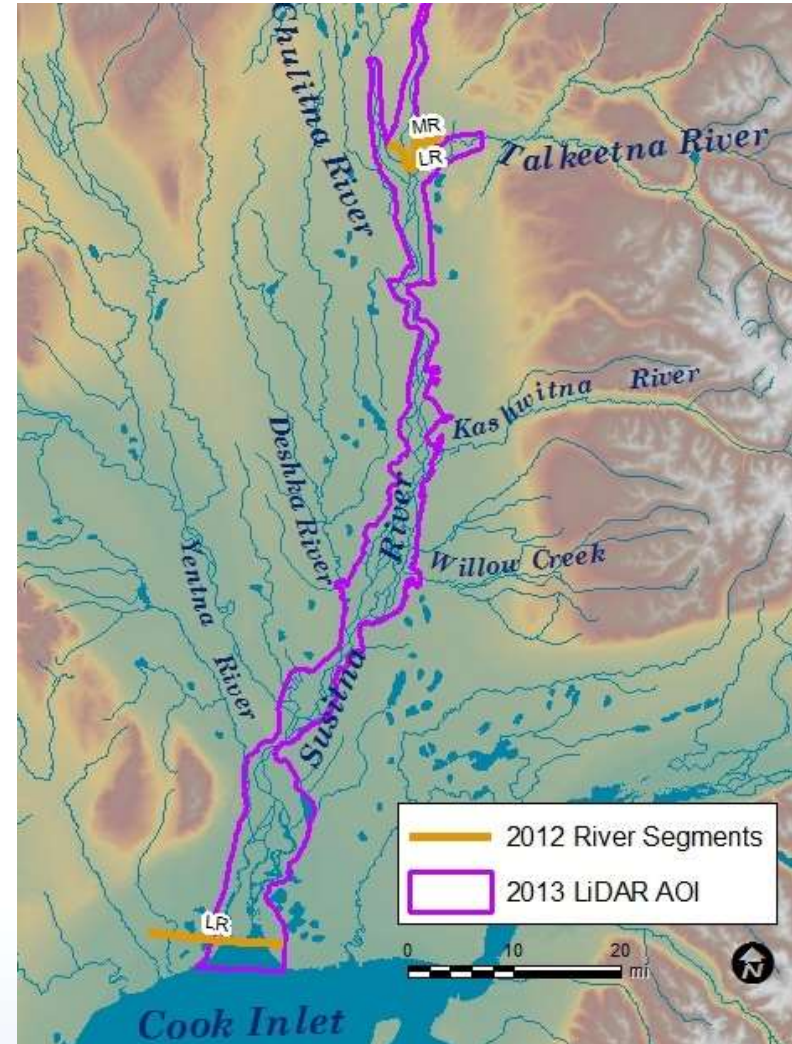
- *Purpose: Provide above water topo for MR & LR*
 - *1-D cross sections*
 - *Focus Areas*
 - *Support engineering (UR)*



2013 High Density LiDAR Acquisition: Characteristics (Modeling Approach TM)

11

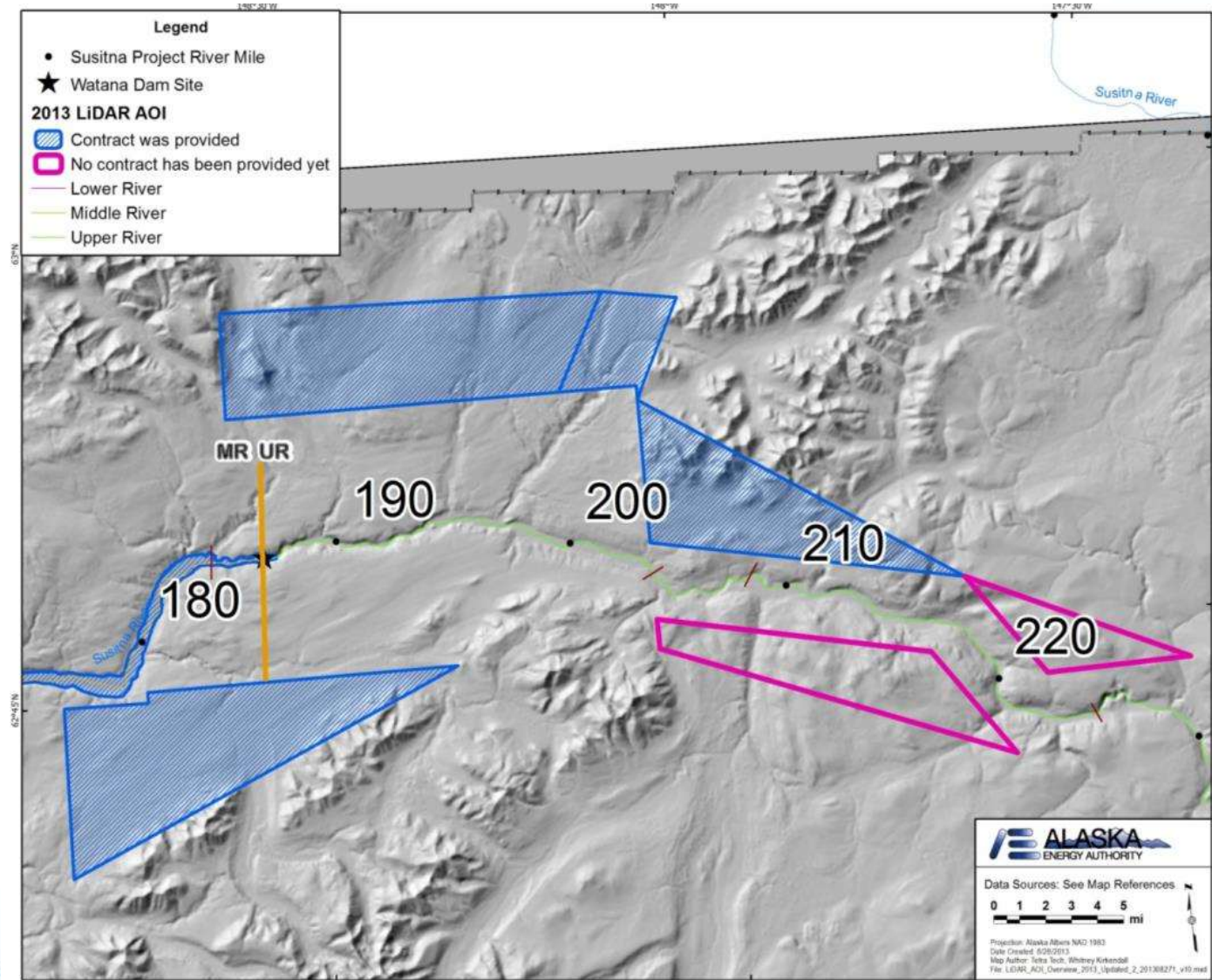
- *2011 MatSu Borough:*
 - 1 pts/m² (0.6 actual)
- *2013:*
 - 9 pts/m²
- *Target accuracy*
 - Exposed bed: 0.5 ft.
 - Flood Plain: 1 ft.
- *Collect at low flow*
 - < 17k cfs MR (Gold Cr)
 - < 55k cfs LR (Sunshine)
 - < 15k cfs Chulitna (Ch.)
 - < 20k cfs Talkeetna (Gold Cr.)
 - Low Tide for LR bl. PRM 17



2013 High Density LiDAR Acquisition: UR Additions (RSP 16.6 Seismic Study)

12

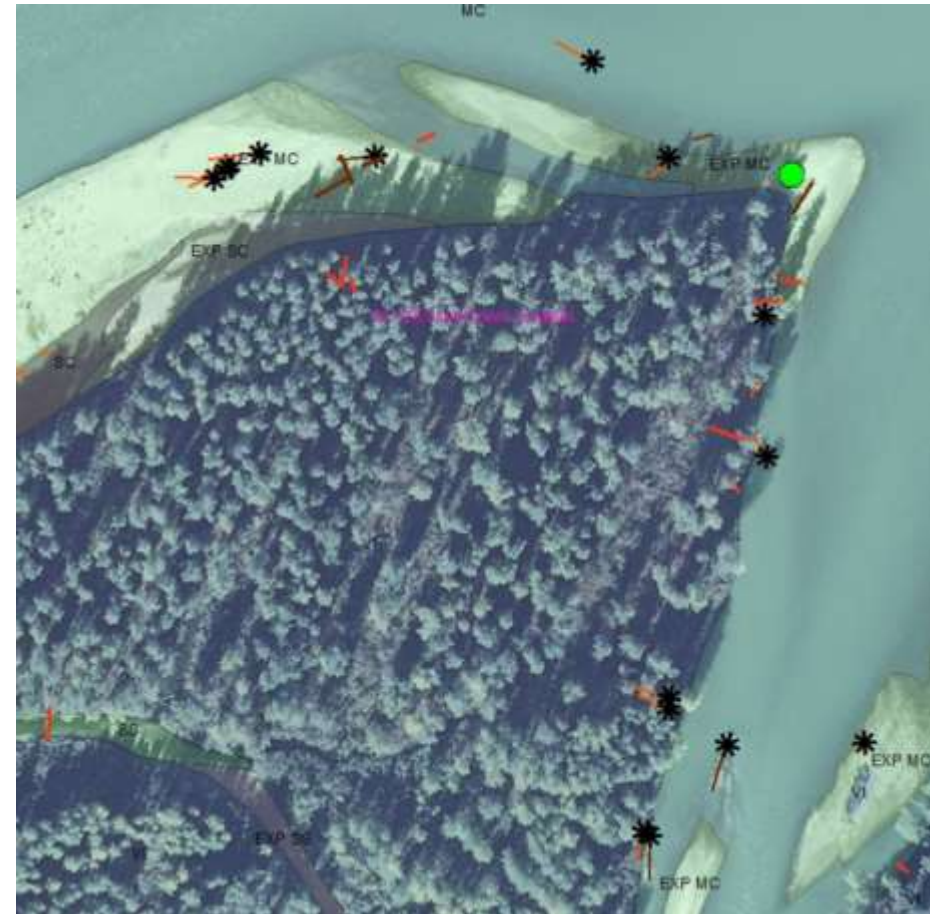
- *Additional 186 sq. mi of LiDAR for the Site Specific Seismic Hazard Study*
- *Help identify seismic sources*
- *Not covered by 2011 MatSu*



Large Wood Debris Study – Field Inventory (RSP 6.5.4.9)

13

Field inventory of 7 Focus Areas and 10 additional areas in Middle and Lower River; over 1,000 single pieces of wood and 200 log jams surveyed as of September 1, 2013



Large Wood Debris Study – Initial Observations (RSP 6.5.4.9)

14

Input mechanisms: bank erosion, ice, beavers



Balsam Poplar prevalent species (over 50%)
Lots of fresh wood (25% still have leaves)
Wood very mobile in main channel

Large Wood Debris Study – Initial Observations (RSP 6.5.4.9)



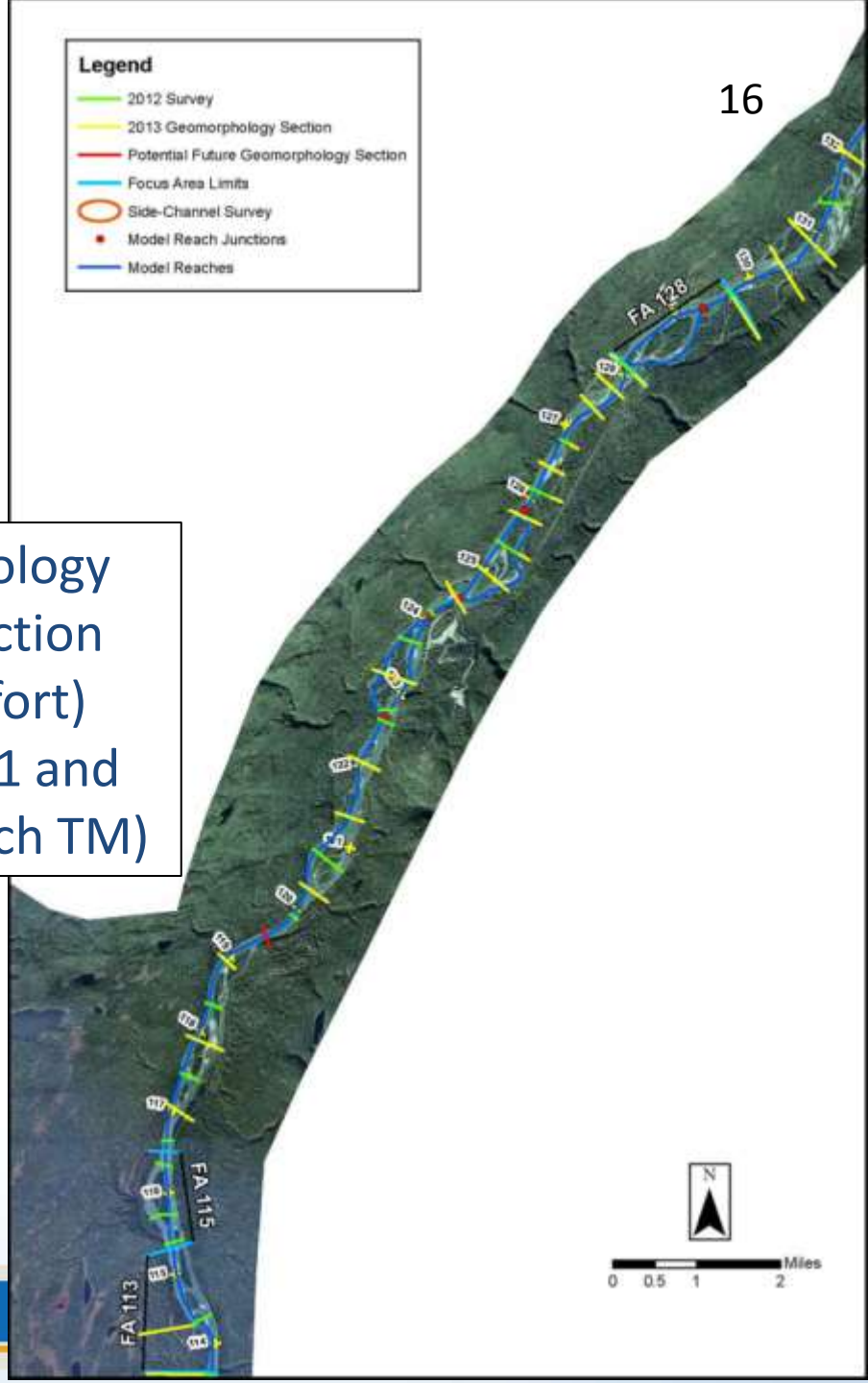
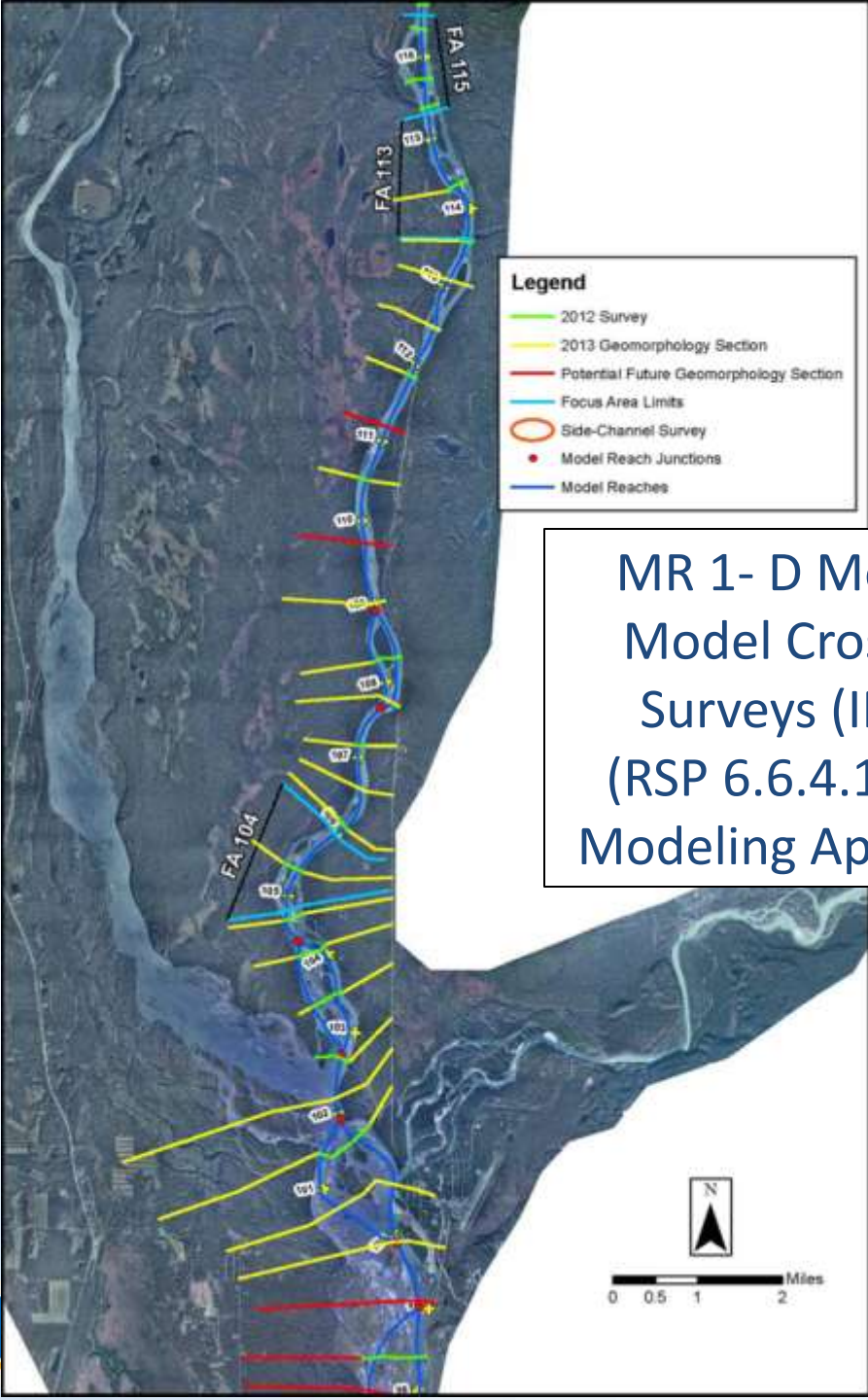
Geomorphic effects unclear in main channel; wood mobile; local hydraulic effects (scour pools around large root wads)



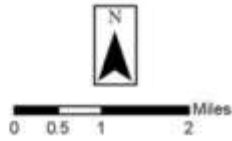
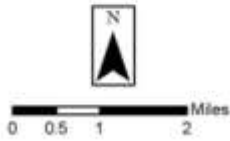
Sloughs/small side channels – wood more stable/effective – aquatic cover



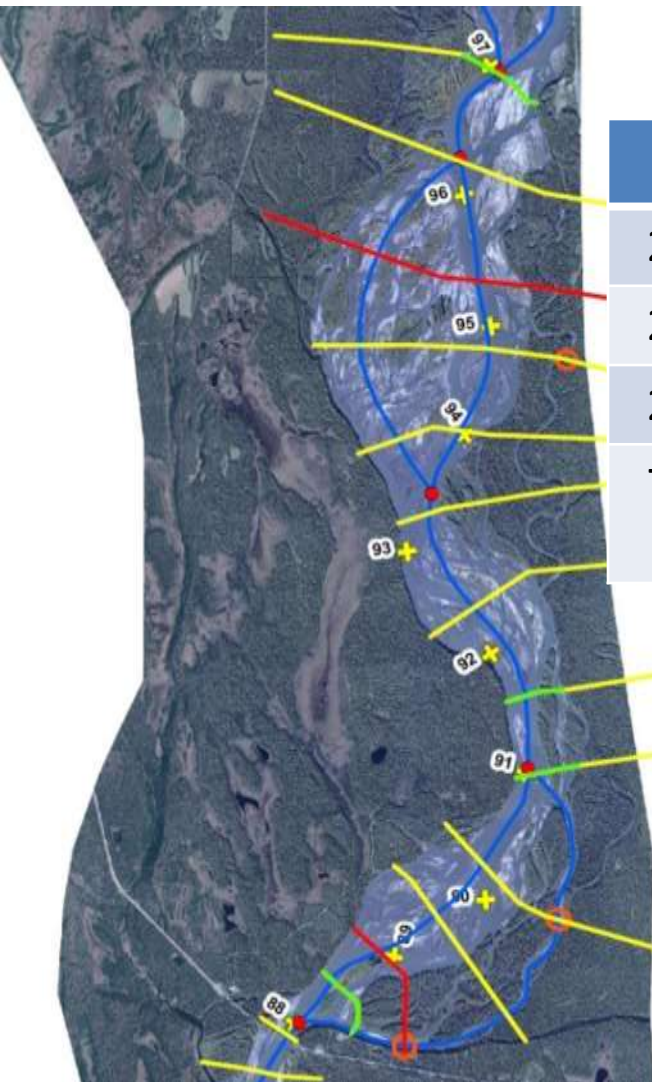
Jams found on most apex bars, also on sides of channels if wood is lodged on obstructions.



MR 1- D Morphology
 Model Cross Section
 Surveys (IFS-Effort)
 (RSP 6.6.4.1.2.9.1 and
 Modeling Approach TM)



1-D Cross Section Lower River and Three Rivers Confluence (IFS-Effort) (Modeling Approach TM)

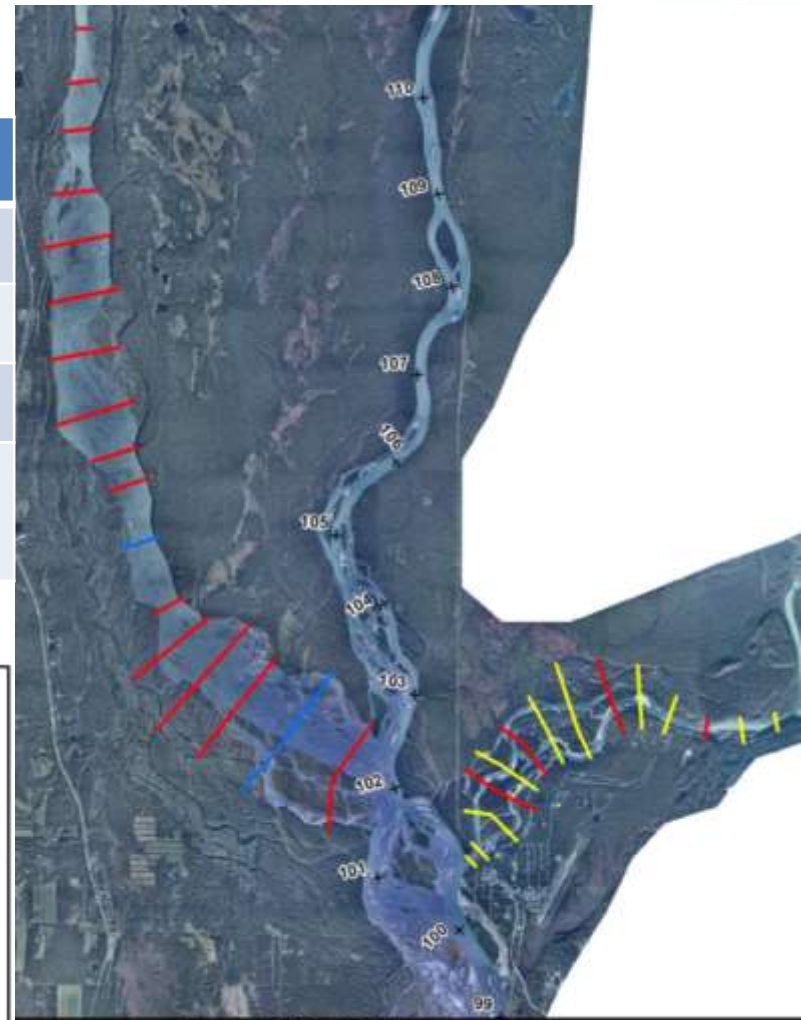


of Cross Sections Surveyed

	MR	LR
2012	75	13
2013	31	51
2014	0-12	14-30
Total	120-136	64-76

Legend

- 2012 Survey
- 2013 Geomorphology Section
- 2014 Geomorphology Section
- Focus Area Limits
- Side-Channel Survey
- Model Reach Junctions
- Model Reaches



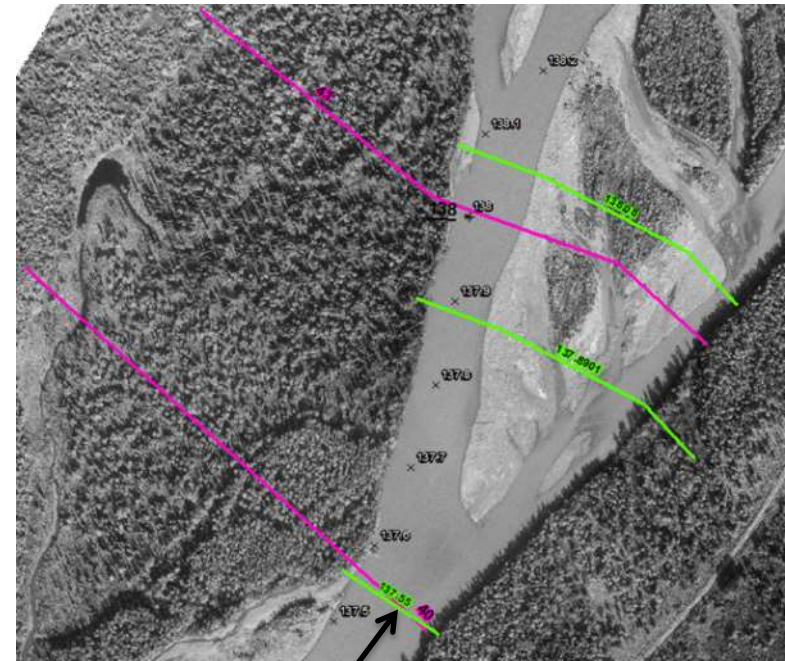
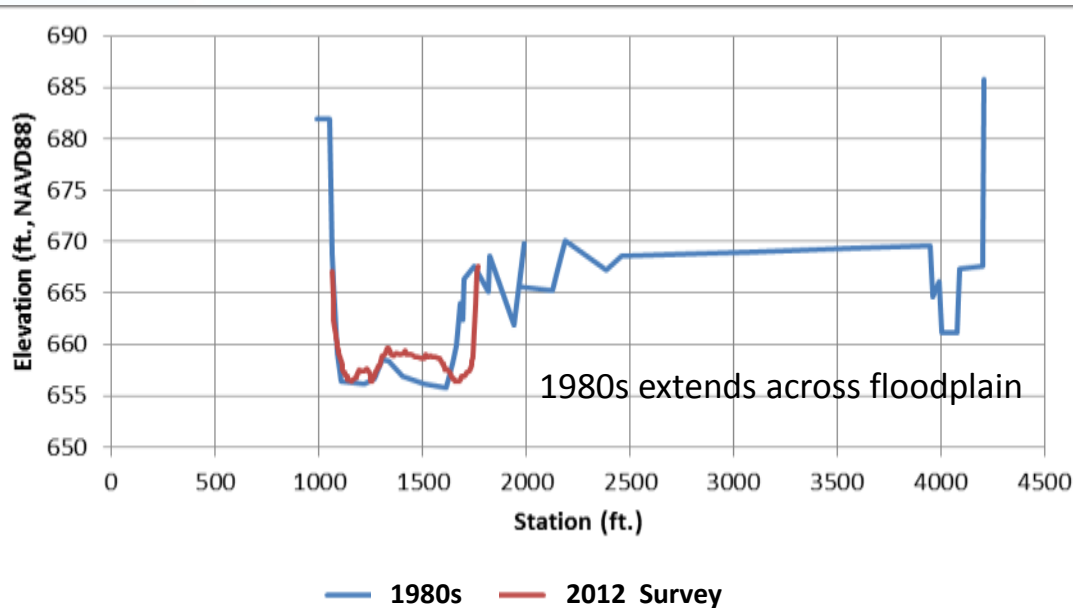
TETRA TECH

- LDAR Sections (Chulhna) or Potential Future Sections (Talkeetna)
- 2013 Talkeetna Cross Sections
- 2013 Chulhna Cross Sections

0 0.5 1 2 Miles

Example 2012 Cross Section Plot and Comparison with 1980s (RSP 6.6.4.1.2.9.1)

Cross Section Comparison Plot



Section 137.55

Cross Section Observations (RSP 6.6.4.1.2.9.1)



- *Floodplain n -value estimate*
- *At select sections*
 - *Upper bank material sample*
 - *Lower bank pebble count*
 - *Water surface elevation survey*

Bed Material Sampling: Pebble Counts for Surface Samples (RSP 6.6.4.1.2.9.1) 20



Performed at the head of bars 3 locations that follow lines of flow/embrication



100' tapes are laid out along the bars for measurements

Median axis measured with a gravelometer



Field Sieve Subsurface Samples (RSP 6.6.4.1.2.9.1)

21



1. *Collect subsurface sample*
2. *Weigh samples*
3. *Sieve 64mm to 16mm, gravel-ometer for plus 64mm*



4. *Weigh minus 16 and subsample to lab*



Subsurface Bed Material Data Reduction (RSP 6.6.4.1.2.9.1)

Field Sieve Data Sheet

SUSITNA-WATANA HYDRO

Rate: _____ Station: _____ Date: **MR. L. W. MC. MM**

Dist/Town: **WILMIST** PRR: **MC.2**

Field Book #: **113** Comments: **Bole**

Sample Location: **Barbed**

Station/Job: **Substation** Bore: **Tab. Pen.** Tab. Char: _____

Weather: **GPS 1**

(1)	(2)	(3)	(4)
Bucket #	Bucket Vol (Bu)	Bucket Weight (Bu)	Sample Wt (Bu)
1	17	50.1	55.4
2	17	55.7	54.0
3	17	53.8	56.7
4	17	51.2	48.5
5	17	73.8	71.9
6	17	65.5	53.2
7			
8			
9			
10			
Total	98.2	414.6	404.4

Estimated D₁₀ (mm) _____
Sample Depth (ft) **2**
Wt of the Sample (lb) **404.4**

Number	Description
100	substation sample location
101	alt to top of bore of bar
102	alt to bot of bar
103	substation hole location

Additional Photos in Field Book # _____

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sieve Size (mm)	Container Wt (Bu)	Wt 1 (Bu)	Wt 2 (Bu)	Total Wt (Bu) (Container + material)	Container Wt (Bu)	Substrate Weight (Bu)	Cumulative Wt of Sample (Bu)
3/8"							
250"	17	25.8				25.8	25.8
100"	17	59.8				59.8	85.6
100"	17	9.4				7.7	93.3
50#	17	49.8				26.7	120.0
44#	17	33.6				26.9	146.9
40#	17	35.7				24.8	171.7
30#	17	32.2				31.2	202.9
20#	17	27.0				25.1	228.0
10#	17	23.8				21.7	249.7
Minus#	50.4	215.2				146.9	396.6
Total	98.2	414.6				404.4	
Substrate	17	23.8					

*Larger sieves tested by 100-umty per substandard

Field Sieve Data Sheet

TERRA FIRMA TESTING

11201 Olive Lane, Annapolis, MD 21401
Telephone: (307) 344-8934 Fax: (307) 246-8933 www.tfg.com

Laboratory Testing / Geotechnical Monitoring

PROJECT CLIENT: **Terra Tech, Inc.**

PROJECT NAME: **Substa - Wiland Hydr**

PROJECT NO: **2470-13**

SAMPLE LOCATION: **Substa B**

SAMPLE NO/DEPTH: **PRB 143.3 Subsurface (1.0m)**

DESCRIPTION: **Flowing gas sand at gravel**

DATE TESTED: **01/02/13**

TESTED BY: **JA**

REVIEWED BY: **Non Career C.E.T.**

% FIN #200: 51.4	USC: SP
% SAND: 62.2	FC: _____
% S&L: 3.4	LL/mm: 8.8
% CLAY: 8.0	PL/mm: 8.0

ASTM D155 (Liquid Limit) **not**

ASTM D2487 (Shrinkage) **not**

CPTSDM/C% correction _____

Dry Weight (kg/lb) **8547**

PARTICLE SIZE ANALYSIS

As Per Order

NO.	SEIVE	TOTAL %
1	75#	100
2	100#	99.6
3	150#	99.2
4	200#	98.6
5	250#	98.2
6	300#	97.8
7	350#	97.4
8	400#	97.0
9	450#	96.6
10	500#	96.2
11	600#	95.8
12	700#	95.4
13	800#	95.0
14	900#	94.6
15	1000#	94.2
16	1180#	93.8
17	1360#	93.4
18	1500#	93.0
19	1750#	92.6
20	2000#	92.2
21	2500#	91.8
22	3000#	91.4
23	3500#	91.0
24	4000#	90.6
25	4750#	90.2
26	5500#	89.8
27	6500#	89.4
28	7500#	89.0
29	8500#	88.6
30	10000#	88.2

MOISTURE-CHEMISTRY RELATIONSHIP

As Per Order

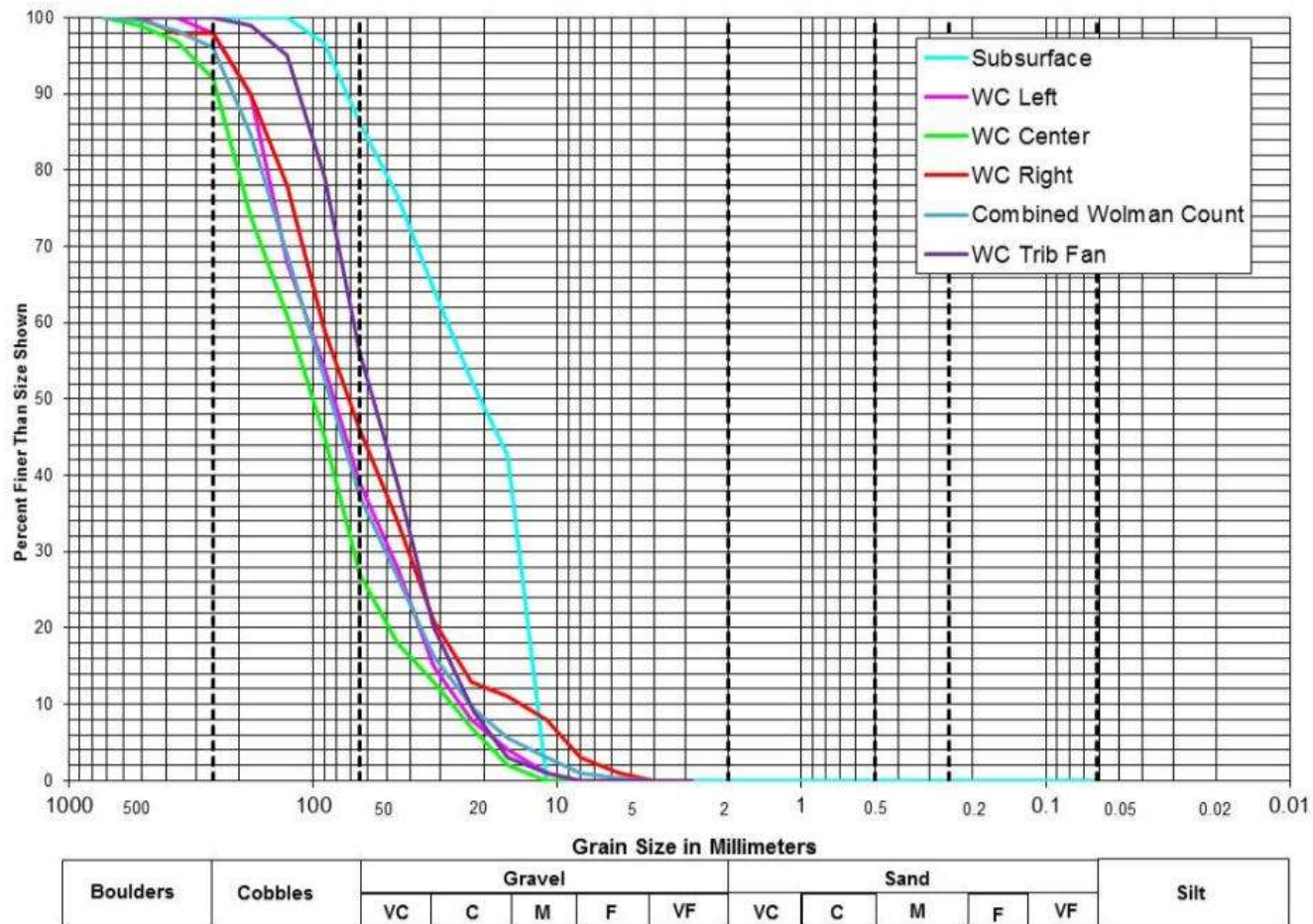
HYDROMETER RESULT

WATER CONTENT (%)	LIQUIDITY INDEX
1	0.0000
2	0.0001
3	0.0002
4	0.0003
5	0.0004
10	0.0008
20	0.0016
30	0.0024
40	0.0032
50	0.0040
60	0.0048
70	0.0056
80	0.0064
90	0.0072

Atterberg Limits (ASTM D 155)
Liquid Limit (ASTM D 155) _____
Plasticity Index (ASTM D 155) _____

Lab Data Sheet

Plotted Surface and Subsurface Samples (RSP 6.6.4.1.2.9.1)



Tributary Surveys for 1-D and 2-D Model (RSP 6.6.1.2.9.3)²⁴



- *Purpose – Provide sediment load to 1-D and 2-D models of the mainstem and FAs*
- *Collect surface and subsurface samples to characterize the stream and the fan (if fan is present)*
- *Survey cross sections in tributary channel to develop 1-D hydraulics for bed load estimate*
- *Survey profile of fan if present*

MR FGM: Tributary Deltas (RSP 6.6.4.1.2.9.3)

Tributary Name	PRM	Bank	Geo. Reach	Focus Area	Sed. Input only	1-D or 2-D
Tsusena Creek	184.6	RB	MR-2		X	1-D
Fog Creek	179.3	LB	MR-2		X	1-D
Unnamed	174.3	LB	MR-2	FA173		2-D
Unnamed	173.8	RB	MR-2	FA173		2-D
Portage Creek	152.3	RB	MR-5	FA151		2-D
Unnamed*	144.6	LB	MR-6	FA144		2-D
Indian River*	142.1	RB	MR-6	FA141		2-D
Gold Creek*	140.1	LB	MR-6		X	1-D
Skull Creek*	128.1	LB	MR-6	FA128		2-D
Lane Creek*	117.2	LB	MR-7		X	1-D
Unnamed*	115.4	RB	MR-7	FA115		2-D
Gash Creek*	115.0	LB	MR-7	FA113		2-D
Slash Creek*	114.9	LB	MR-7	FA113		2-D
Unnamed*	113.7	LB	MR-7	FA113		2-D
Whiskers Creek*	105.1	RB	MR-8	FA104		2-D

* Tribs that will be analyzed in 2013

LR FGM: Tributaries (Modeling Approach TM) 26

Tributary Name	PRM	Bank	Geo. Reach	Focus Area	Sed. Input only	1-D or 2-D
Trapper Creek*	94.5	RB	LR-1			1-D
Birch Creek*	92.5	LB	LR-1			1-D
Sheep Creek	69.5	LB	LR-2			1-D
Caswell Creek	67.0	LB	LR-2			1-D
Deshka River*	45.0	RB	LR-3			1-D

* Tribs that will be analyzed in 2013

FA Topo and Bathy Surveys (IFS Effort): Survey Resolution and ADCP 27 Calibration Transects – 2-D Model (RSP 6.6.4.1.2.9.2)



2-D Calibration
Transects

Instream Flow Focus Area (Upper and Lower Extent)

128

129

PA-128

PA-128

Skull Creek

Slough 8A

Alaska Railroad

Legend

-  2-D Fine Mesh
-  2-D Coarse Mesh
-  2-D Coarse Mesh (Upland)
-  Flow Arrow
-  Project River Mile



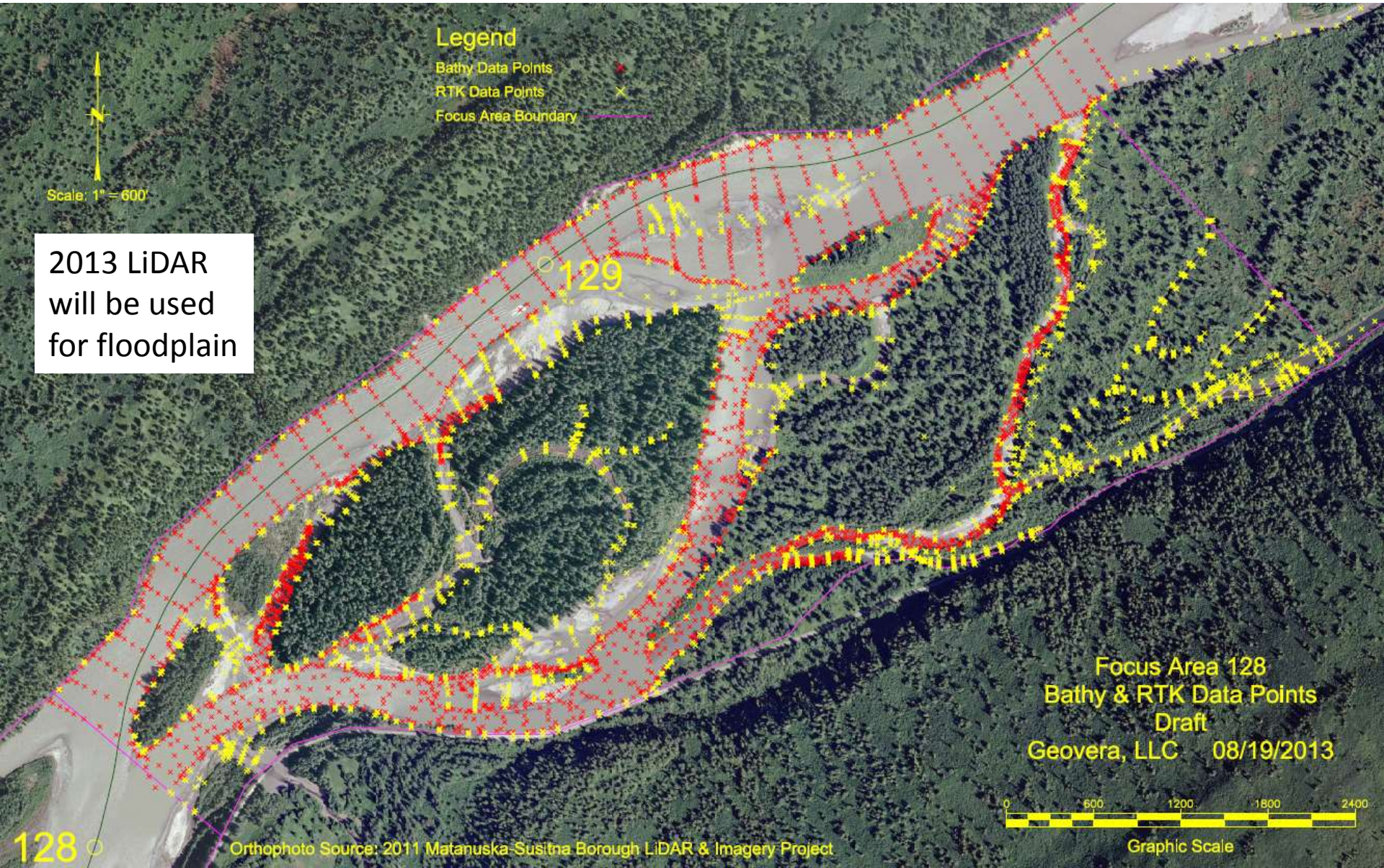
Projection: Alaska Albers NAD 1983
Date Created: 6/25/2013
Map Author: R2 - Joetta Zabolney
File: Map_IFS_FocusAreas_Mesh.mxd



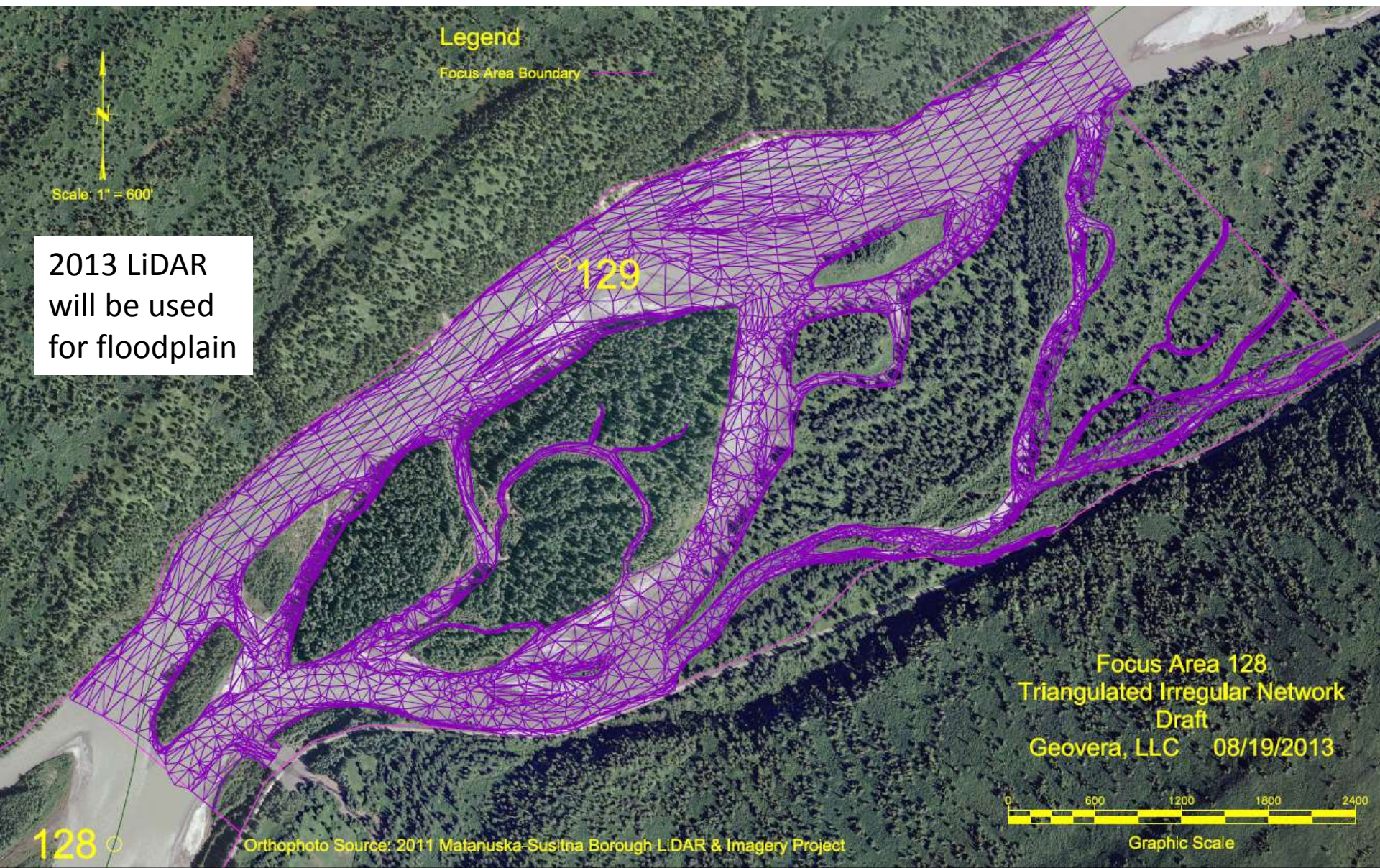
Map Key

FA Topographic and Bathymetric Surveys (IFS Effort)

Survey Points (RSP 6.6.4.1.2.9.2)



FA Topographic and Bathymetric Surveys (IFS effort) Triangulated Irregular Network (TIN) (RSP 6.6.4.1.2.9.2)



Legend

Focus Area Boundary

Scale: 1" = 600'

2013 LiDAR
will be used
for floodplain

129

Focus Area 128
Triangulated Irregular Network
Draft
Geovera, LLC 08/19/2013

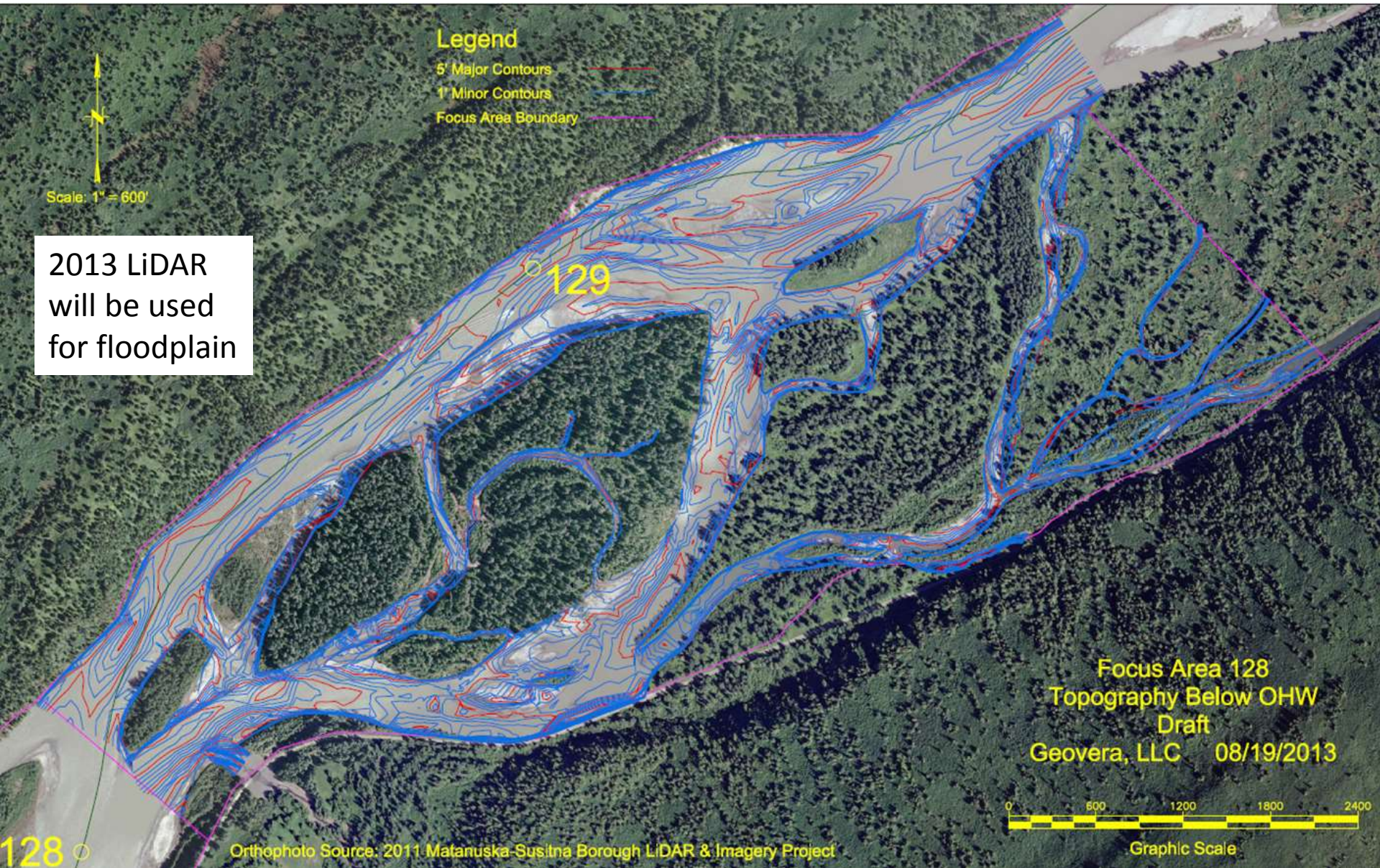


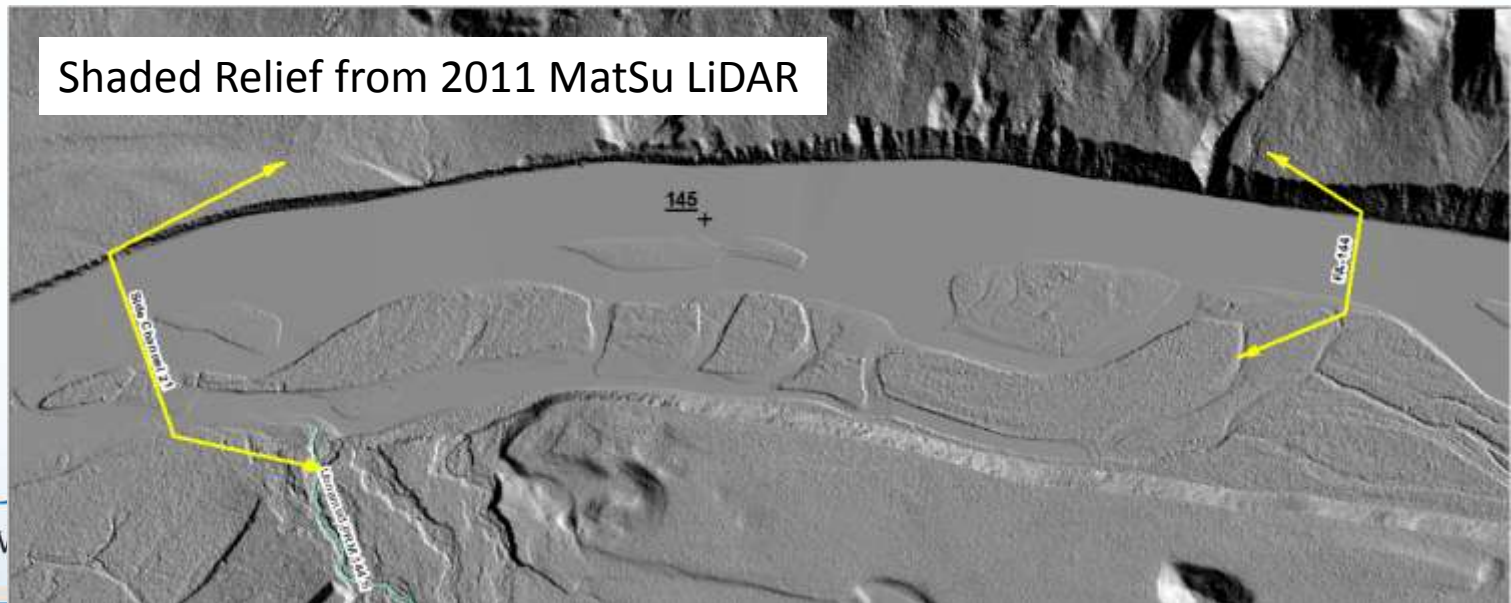
Graphic Scale

128

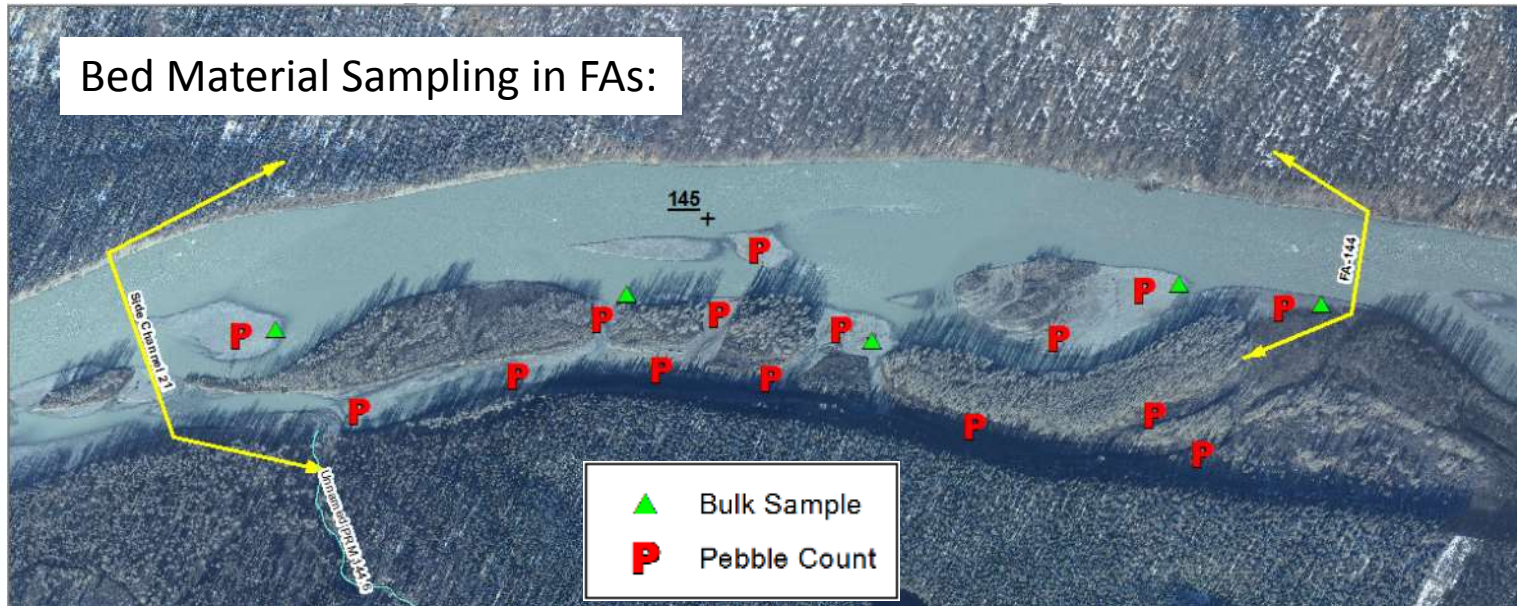
Orthophoto Source: 2011 Matanuska-Susitna Borough LiDAR & Imagery Project

FA Topographic and Bathymetric Surveys (IFS effort) Contour Map (TIN) (RSP 6.6.4.1.2.9.2)



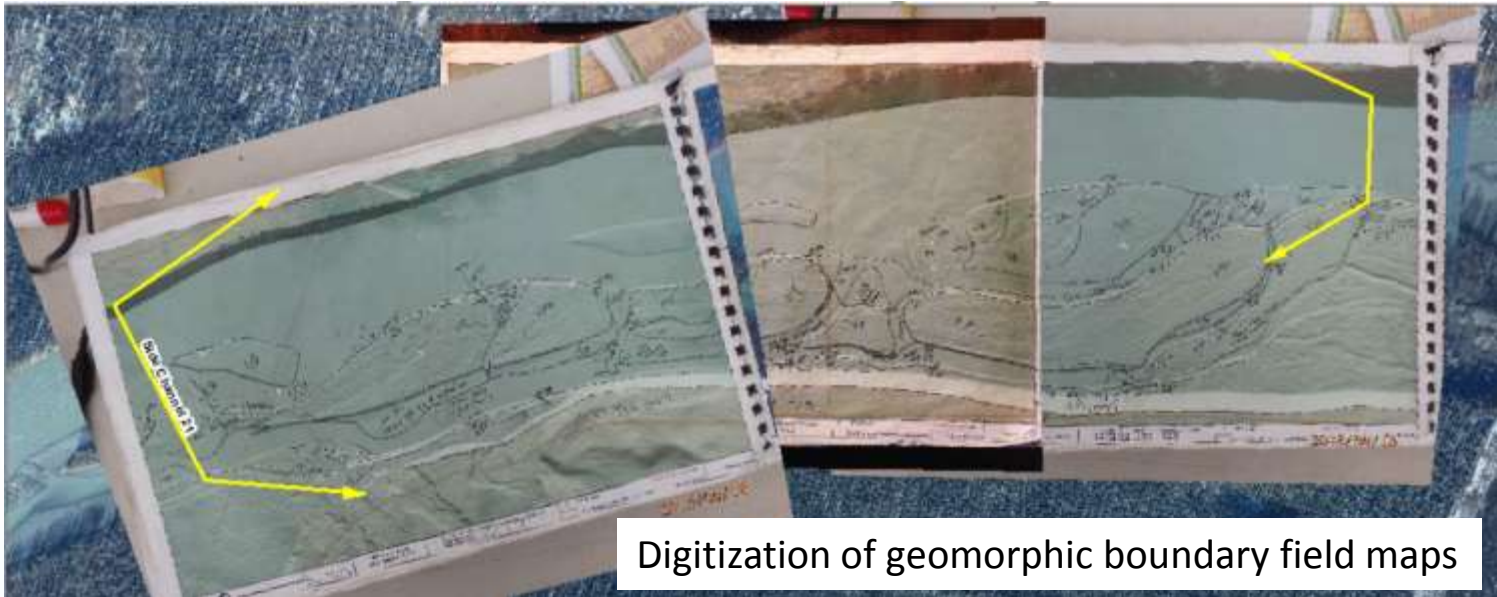


Bed Material Sampling in FAs:

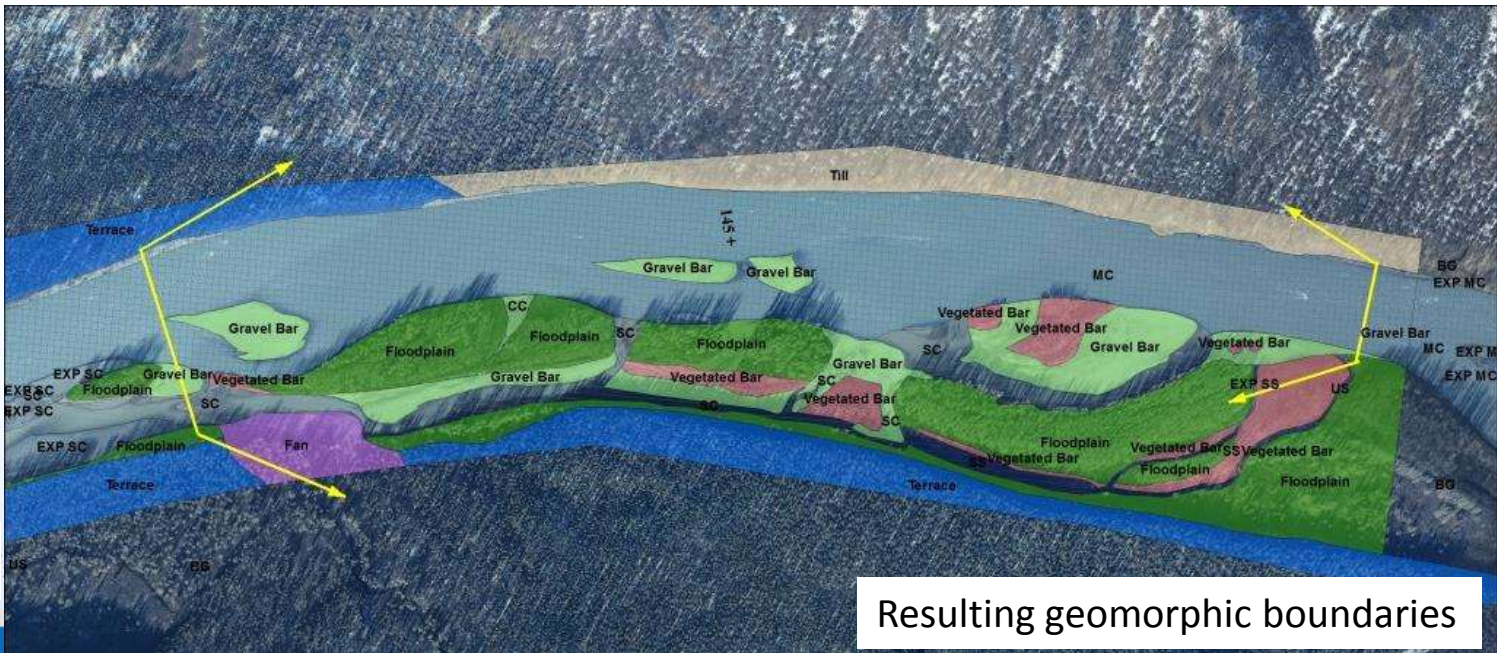


Waypoints of WSE:





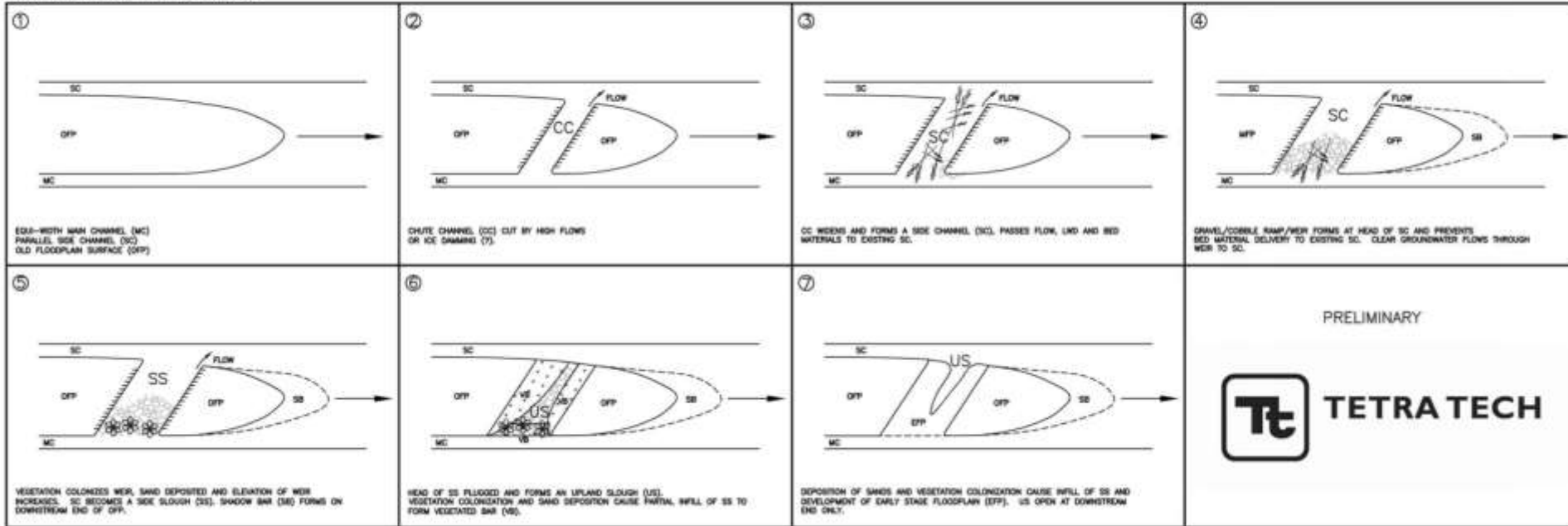
Digitization of geomorphic boundary field maps



Resulting geomorphic boundaries

Identification of Geomorphic Processes - Example Geomorphic Process Model (preliminary) Side Channel and Side Slough Dynamics (RSP 6.5.4.1 and 6.5.4.11)

SIDE CHANNEL AND SIDE SLOUGH DYNAMICS
 SUSITNA RIVER, MIDDLE REACH



Variance – Collect 2013 LiDAR Rather Than Using³⁵ 2011 MatSu Borough (RSP 6.6.4.1.2.9)

- *RSP indicated 2011 MatSu Borough LiDAR would be used to develop the floodplain portion of the FAs and 1-D cross sections*
- *Based on LiDAR Verification, decision made to collect higher resolution LiDAR in 2013*

Variance - Use of LiDAR for Macrohabitat Area: Results and Difficulties with Aerials (RSP 6.5.4.5 MR and 6.5.6.7 LR)

- *2012 could not collect aerials at all target flows*
 - *Flow conditions*
 - *Weather conditions*
- *Comparison at 12,500 cfs indicated appreciable differences in habitat areas*
 - *Some features shifted classification*
 - *Side channel => side slough*
 - *Side Slough => side channel*
 - *Area changes due to geomorphic processes*



Variance - Use of LiDAR for Macrohabitat Area: Advantages of LiDAR & Hydraulic Based Approach (RSP 6.5.4.5 MR and 6.5.6.7 LR)

37

- *LiDAR less susceptible to flow conditions*
 - *Single flight required*
- *LiDAR less susceptible to weather*
 - *Can penetrate thin cloud cover*
 - *Sun angle not an issue*
 - *Can be flown at night*
- *Consistent with modeling approach in Focus Areas*

Large Wood Debris – Variances (RSP 6.5.4.9)

- *High flow midway through data collection provided additional information on wood transport:*
 - *Small debris became mobile at approximately 30,000 cfs at Gold Creek gage; large trees started to move at approximately 40,000 cfs*
 - *Wood in some Focus Areas already inventoried was re-checked after August high flow to determine if wood pieces moved or not*

Next Steps

- Aerial and LiDAR (RSP 6.5.4.4 and Modeling Approach TM)
 - Process information
 - Distribute to studies
- Large Woody Debris (RSP 6.5.4.9)
 - Analyze 2013 field data
 - Digitize wood/jams from autumn 2013 aerials if available
- USGS Sediment Transport Data (RSP 6.5.4.2)
 - Receive 2013 data
 - Compare with 2012 and 2013 with 1980s
 - Identify need for 2014 data
- 1-D model (RSP 6.6.4.1 and Modeling Approach TM)
 - Compile and reduce all 2013 field data (RSP 6.6.4.1.2.9.1)
 - Develop 1-D tributary models (RSP 6.6.4.1.2.6)
 - Initiate 1-D HEC-6T morphology model development (RSP 6.6.4.1.2.5)
 - Initial 1-D morphology model run end of Q1 2014 (Modeling Approach TM)



Next Steps (Cont.)

- 2-D Morphology Model (Focus Areas) (RSP 6.6.4.1)
 - Compile and reduce all 2013 field data (RSP 6.6.4.1.2.9.2)
 - Develop hydraulic models for FA-104 and FA-128 (Dec 2013) (RSP 6.6.4.1.2.5)
 - Develop morphology models for FA-104 and FA-128 end Q1 2014 (RSP 6.6.4.1.2.5 and Modeling Approach TM))
 - Final selection of 2-D morphology model , either River2D or SRH-2D end of Q1 2014 (RSP 6.6.4.1.2.1 and Modeling Approach TM)
- Develop Initial Study Report for Geomorphology Study (6.5) and Fluvial Geomorphology Modeling Study (6.6)



END

