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SUSITNA-WATANA HYDRO

PART A - APPENDIX A: CONTINUOUS TEMPERATURE MONITORING

Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Baseline Water Quality Study
Study Plan Section 5.5

Part A - Appendix A
Continuous Temperature Monitoring

Initial Study Report

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

URS Corporation/Tetra Tech, Inc.

June 2014

1.0 INTRODUCTION

Collection of continuous water temperature data began in July 2012, and continues through the winter of 2013/14. Additional systems were installed during the 2013 field season, and some equipment was lost and replaced during routine site visits conducted during the ice free period (June through October). A summary of each site complete with photos, GPS coordinates, aerial images, and installation/maintenance field notes are included below in Figure A-1 through Figure A-37. Blue flags in each figure indicate 2012 installation locations and red flags indicate 2013 installation locations. Table A-1 through Table A-37 depict thermistor installation and download dates. In some cases not all sites were accessible due to river stage or icing. The buoy system thermistors were accessed by either pulling the metal cable attached to the bank until the anchor could be lifted, or lifting the buoy and thermistor string from the side of the boat.

Temperature plots depicting the water temperature data logging results for each of the temperature monitoring sites can be found in Appendix B.

1.1 PRM 19.9 – Susitna above Alexander Creek

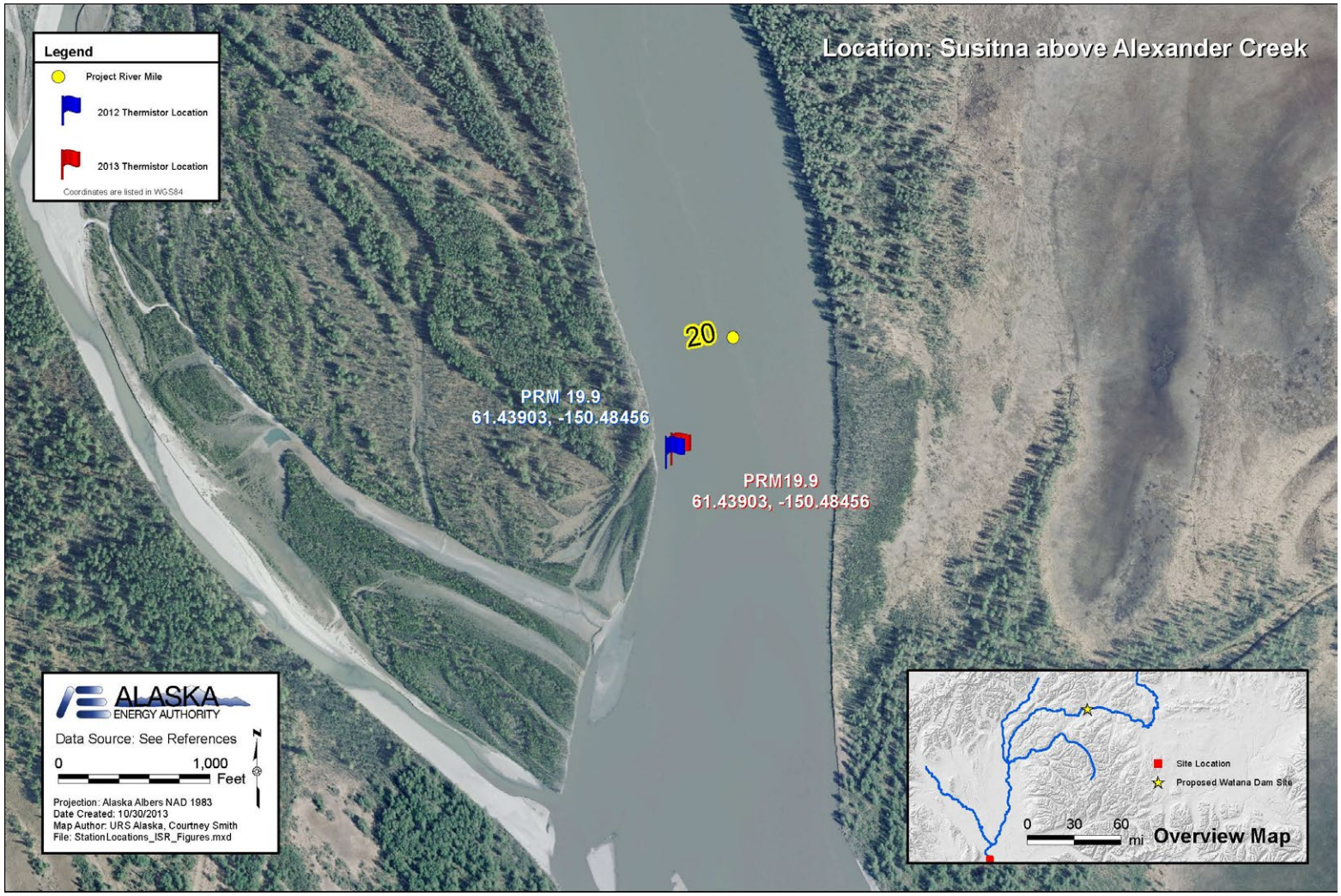

Figure A-1a. Map of PRM 19.9 Site – Susitna above Alexander Creek (NAD 83 Coordinates. 61.43903° N, -150. 48456° W)

Table A-1. Installation and Download Notes – PRM 19.9 – Susitna above Alexander Creek

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 27, 2012	10174174	2 ft	7/27/12 – The system was deployed approximately 800 ft upriver of the proposed location due to an absence of anchoring trees or rocks. The buoy was located approximately 75 ft from the RB, along eddy fence in approximately 10 ft of water. This site was not visited again until June 2013.
	10174175	5 ft	
	10174172	10 ft	
	10174173	17 ft	
June 15, 2013	10174163	2 ft	6/15/13 – 2012 equipment found to be in place and intact. Down load successful. Logging stopped on 4/24/13 – data gap until 6/15/13. 8/29/13 – Anchor stuck. Only top 2 thermistors downloaded. Deployed replacement string with 2 new thermistors. 9/17/2013 – Removed original string that had been stuck. Downloaded all thermistors and removed buoy strings.
	10174164	5 ft	
	10174166	10 ft	
	10174188	17 ft	
August 29, 2013	10174200	5 ft	
	10174201	1.5 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	7/27/12 – Pipe mounting infrastructure is absent along the lower reaches of the river. Highly eroded and unstable banks eliminate trees as a potential mounting location. Near shore water is also very shallow requiring a substantial length of cable housing to be required.
Overwinter Installation			
Sept. 17, 2013	10174200	--	9/17/2013 – Installed overwinter system

Photo A-1b. Location of anchor-buoy system at PRM 19.9 – Susitna above Alexander Creek

Photo A-1c. Constructing new buoy string for 2013 deployment at PRM 19.9

1.2 PRM 29.9 – Susitna River at Susitna Station

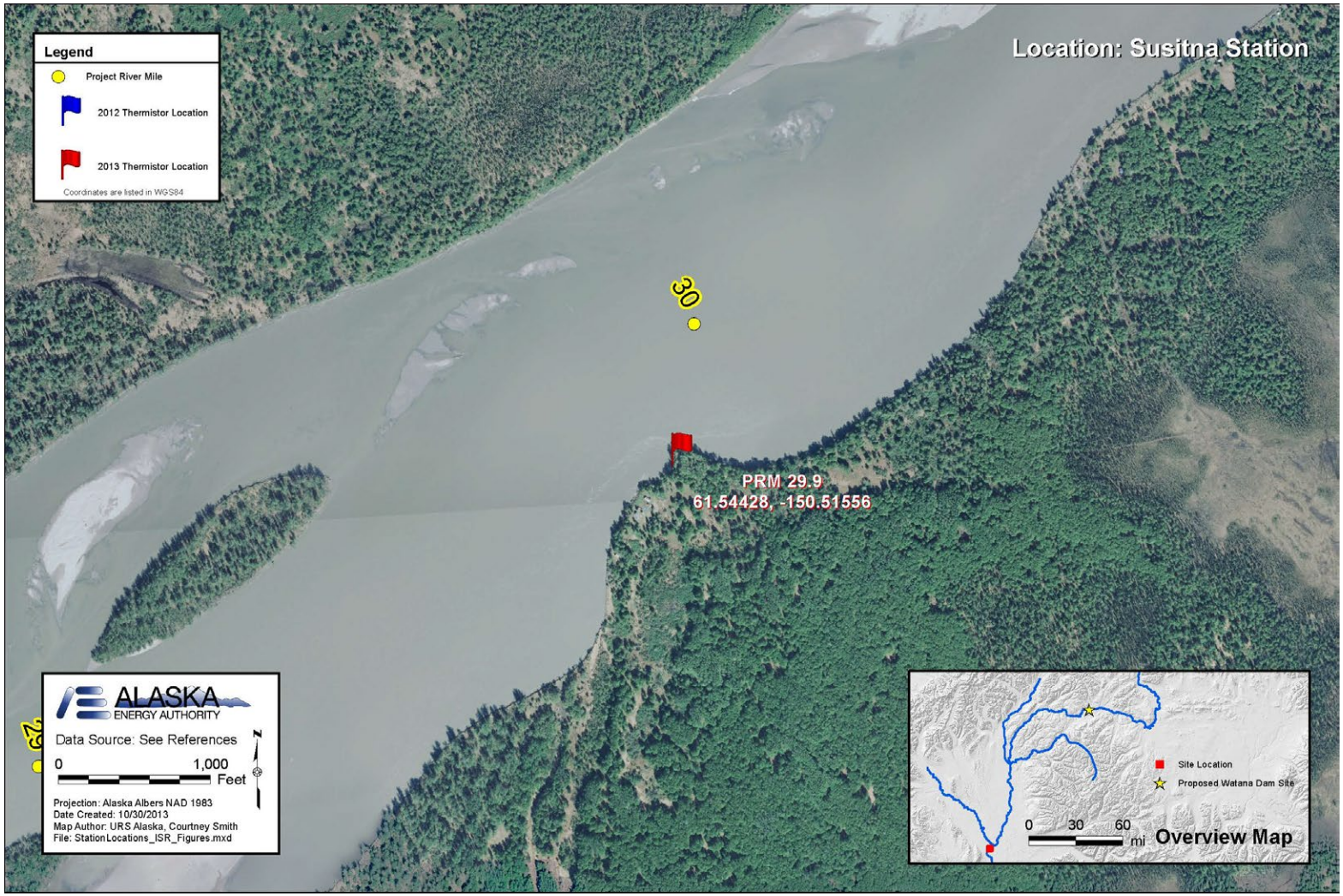

Figure A-2a. Map of PRM 29.9 Site – Susitna River at Susitna Station (NAD 83 Coordinates. 61.54428° N, -150. 51556° W)

Table A-2. Installation and Download Notes – PRM 29.9 – Susitna River at Susitna Station

Date Deployed	Thermistor Number	Depth (distance from anchor point)	Maintenance and Download Notes
Anchor and Buoy Installation			
2012	--	--	7/27/12 – No system deployed
June 15, 2013	10174181	6 ft	6/15/13 – Thermistor string consisting of anchor-cable system with 20 ft of cable bolted to a rock face. The system was deployed in 24 ft of water at the base of the rock face. Downloads occurred on 6/25, 7/13, 7/20, 8/02, 8/29, and 9/17/2013.
	10174203	10 ft	
	10174204	14 ft	
	10174205	18 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	Based on the survival rate of pipe systems installed in 2012 it was decided not to install a pipe system at this location.
Overwinter Installation			
Sept. 17, 2003	See above	See above	Overwinter system consists of original thermistor string.

Photo A-2b. River temperature monitoring location PRM 29.9 – Susitna Station

Photo A-2c. Anchor point for thermistor string on left and USGS temp monitoring equipment on right. PRM 29.9 – Susitna Station

1.3 PRM 32.5 – Yentna River

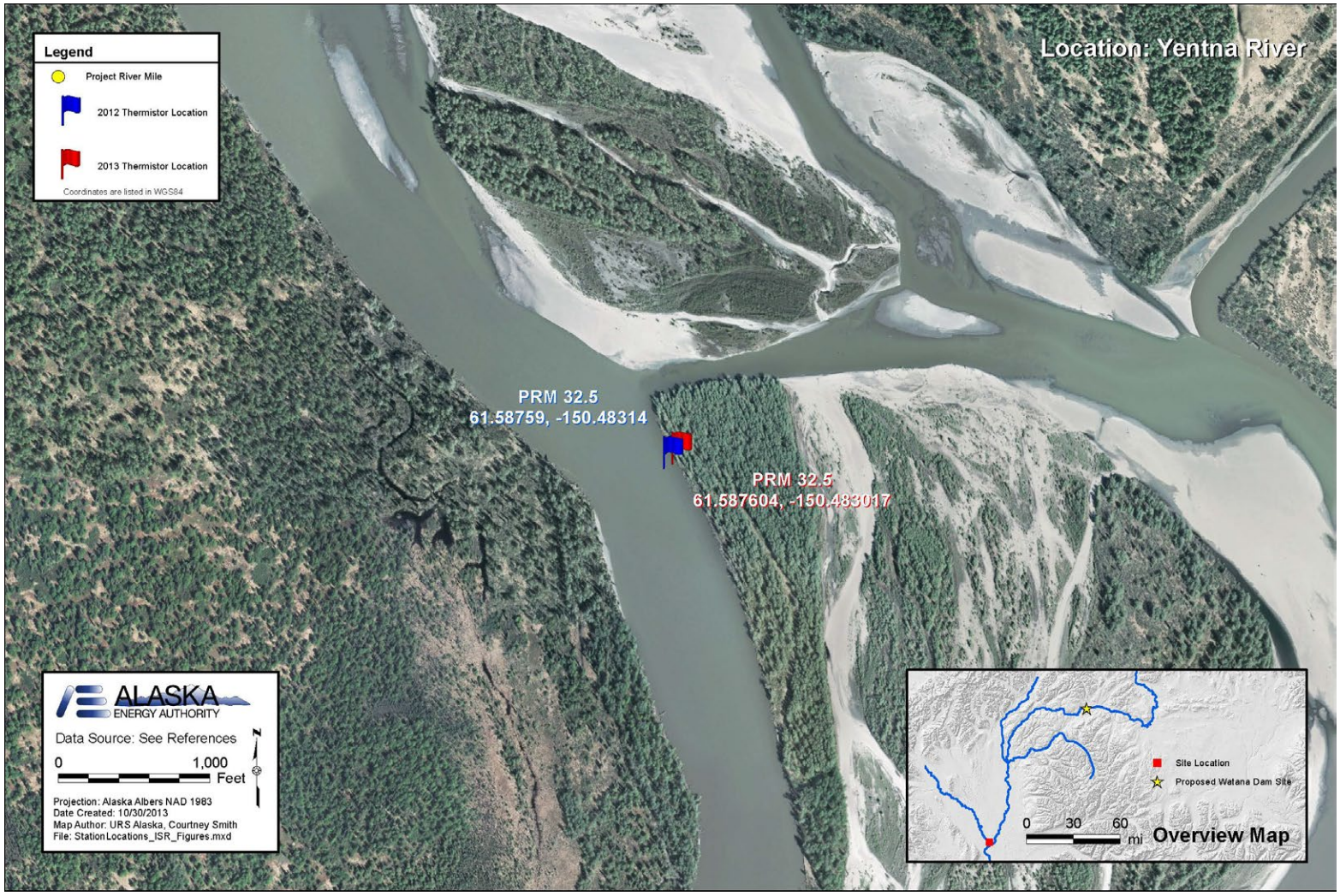

Figure A3a. Map of Site 32.5 – Yentna River (NAD 83 Coordinates: 61.587604° N, -150.483017° W)

Table A-3. Installation and Download Notes – PRM 32.5 – Yentna River

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
August 27, 2012	10174200	2 ft	7/27/12 – Water velocities flowing through the proposed location are quite low and water depth at the time of the site visit was likely less than 4 ft. The proposed location was not navigable by boat. The actual installation location was chosen to be in the main channel 40 ft from the LB of the main branch, along eddy fence in 9 ft of water. This site was not visited again until June 2013.
	10174201	7 ft	
	10174202	15 ft	
	10174199	23 ft	
June 16, 2013	10174206	2 ft	6/15/13 – 2012 system found to be present and intact. Logging stopped on 4/24/13 – data gap until 6/15/13. Downloaded system and deployed new thermistor string at same location. Downloads occurred on 6/25, 7/13, 7/20, 8/02, 8/29, and 9/17/2013.
	10174207	7 ft	
	10174208	15 ft	
	10174212	23 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	Pipe mounting infrastructure is absent along the lower reaches of the river. Highly eroded and unstable banks eliminate trees as a potential mounting location.
Overwinter Installation			
Sept. 17, 2013	10174212	--	Installed overwinter system

Photo A-3b. Deployed anchor-buoy off the LB of Main Channel at PRM 32.5 – Yentna River

Photo A-3c. Onset® Tidbit water temperature data logger

1.4 PRM 33.6 – Susitna above Yentna River

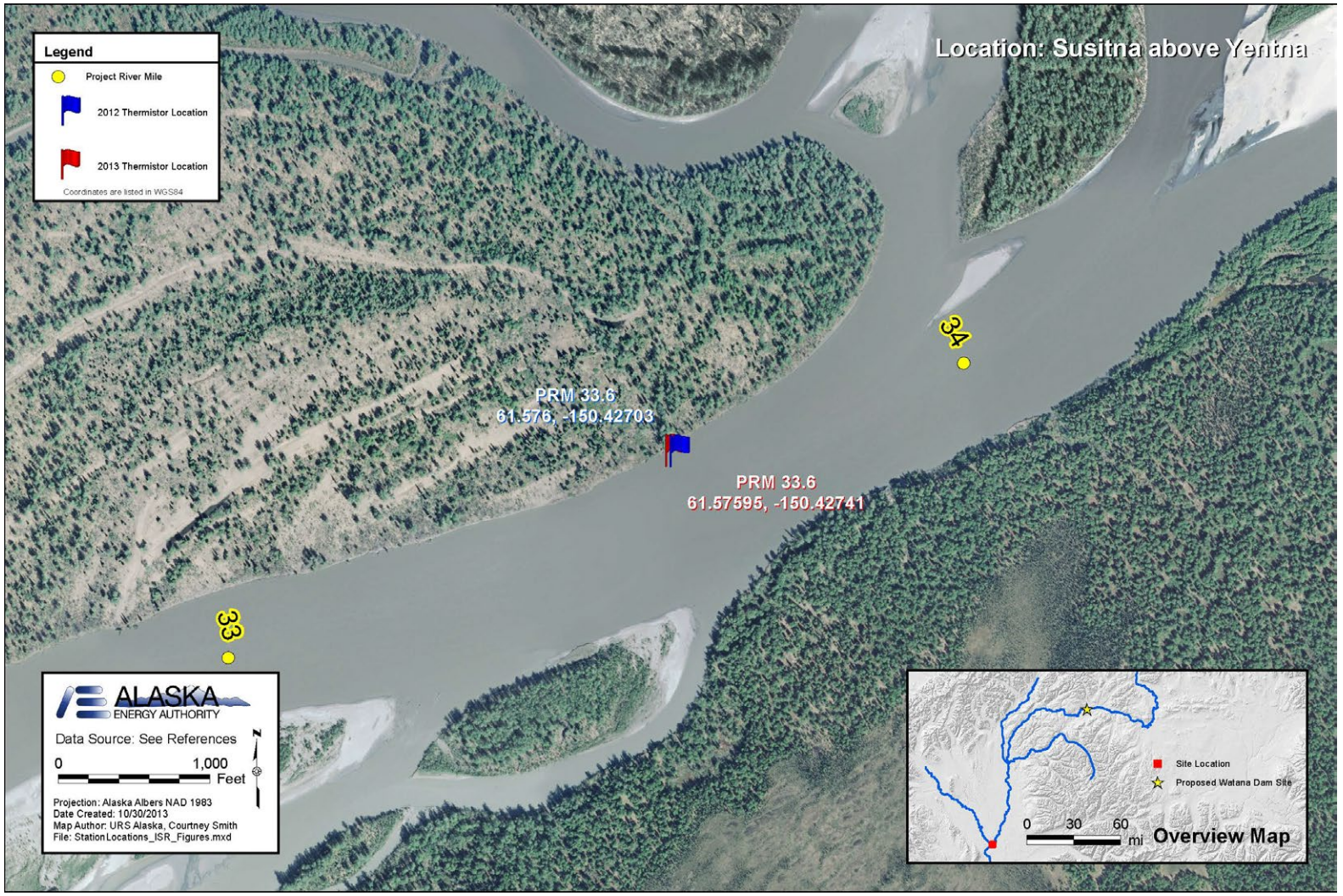

Figure A-4a. Map of Site 33.6 – Susitna above Yentna River (NAD 83 Coordinates: 61.57595° N, -150.42741° W)

Table A-4. Installation and Download Notes – PRM 33.6 – Susitna above Yentna River

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 27, 2012	10174185	2 ft	7/27/12 – The buoy is deployed in the same vicinity as the proposed location approximately 50 ft from the RB, along eddy fence in approximately 9 ft of water. The river gradient is quite low through this reach and eddy currents are not as obvious as locations upriver. This site was not visited again until June 2013.
	10174187	8 ft	
	10174186	16 ft	
	10174188	18 ft	
June 16, 2013	10174213	2 ft	6/15/13 – 2012 system found to be present but pinned under the fallen anchor tree – No 2012 Data. New system deployed. Downloads occurred on 6/25, 7/13, 7/20, 8/02, and 8/29. 9/17/2013 – Downloads for Thermistors 214 and 233 were not successful. (Discovered after returning to Anchorage.)
	10174214	8 ft	
	10174215	14 ft	
	10174233	20 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	Pipe mounting infrastructure is absent along the lower reaches of the river. Highly eroded and unstable banks eliminate trees as a potential mounting location.
Overwinter Installation			
Sept. 17, 2013	10174233	--	Installed overwinter system. (Possibly Malfunctioning)

Photo A-4b. Deploying anchor-buoy off LB at PRM 33.6 – Susitna above Yentna River

Photo A-4c. Deployed anchor-buoy off LB at PRM 33.6 – Susitna above Yentna River

1.5 PRM 45.1 – Deshka River

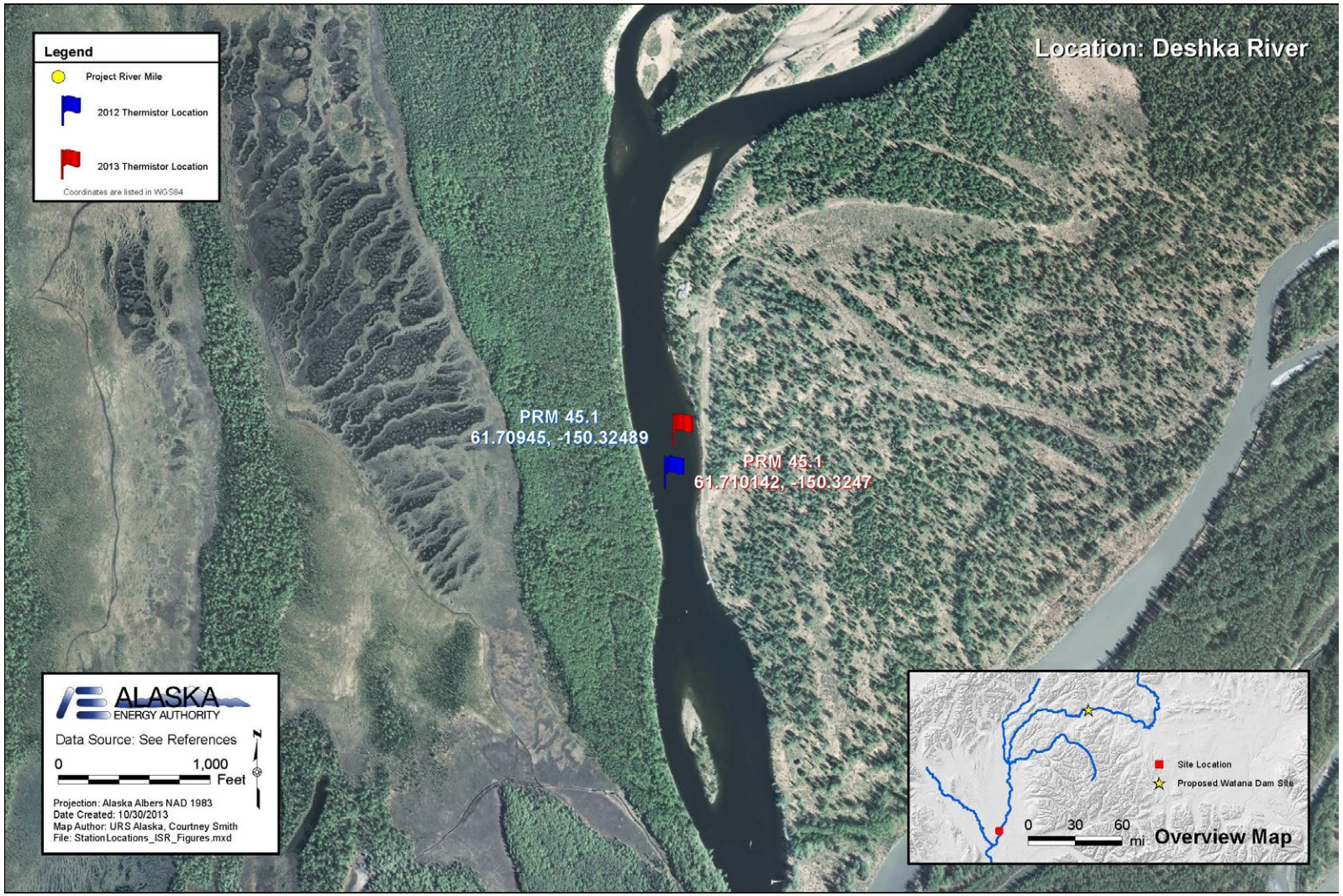

Figure A-5a. Map of Site PRM 45.1 – Deshka River (NAD 83 Coordinates: 61.710142° N, -150.3247° W)

Table A-5. Installation and Download Notes – PRM 45.1 – Deshka River

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 27, 2012	10174274	2 ft	7/27/12 – The buoy is deployed at the proposed location at mid-channel, 10 ft off the left bank side of the float plane runway in 10 ft of water. The site is a popular recreational fishing spot with frequent boat and plane traffic. Water velocities are quite low. The buoy was deployed without a shore-attached anchor line as it would provide an obstacle for boats and a target for vandalism. This site was not visited again until June 2013.
	10174277	5.5 ft	
	10174275	8.5 ft	
	10174276	10 ft	
June 15, 2013	10174234	2 ft	6/15/13 – 2012 system found intact at the mouth of the Deshka River. Retrieved and downloaded. Data logging stopped on 4/24/13 – Data Gap until 6/15/13. New system deployed at original location. Downloads occurred on 6/25, 7/13, 7/20, 8/02, 8/29, and 9/17/13. 9/17/2013 – Left system in place as is as overwinter system.
	10174243	5.5 ft	
	10174258	8.5 ft	
	10174261	10 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	A bank-mounted permanent station is not possible in this location due to private property and high traffic volume in the summer as well as a lack of mounting infrastructure.
Overwinter Installation			
Sept. 17, 2013	2013 String	2013 String	Left anchor-buoy system in place as is as overwinter system.

Photo A-5b. Location of 2013 buoy string off LB at PRM 45.1 – Deshka River

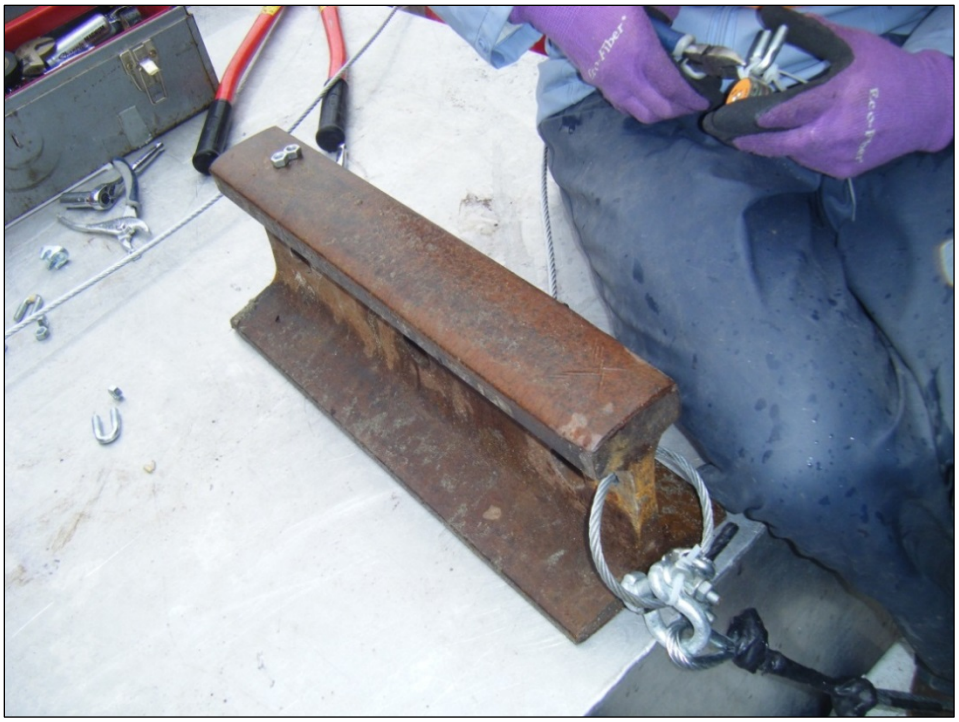

Photo A-5c. Typical 60 lb anchor used for all Installations

1.6 PRM 59.9 – Susitna

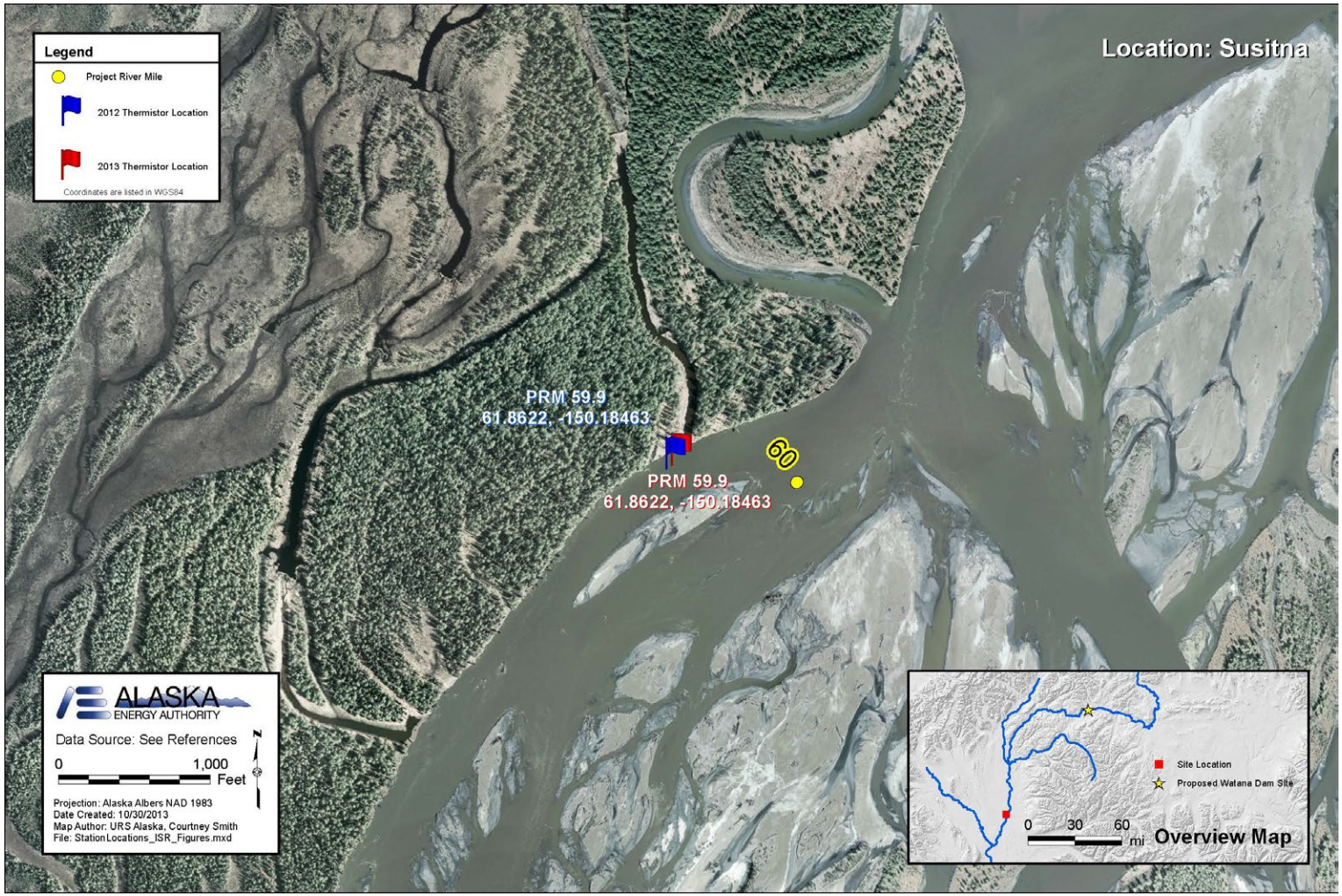

Figure A-6a. Map of Site 59.9 – Susitna (NAD 83 Coordinates: 61.86224° N, -150. 18463° W)

Table A-6. Installation and Download Notes – PRM 59.9 – Susitna

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 27, 2012	10174306	2 ft	7/27/12 – The proposed location was no longer accessible by boat. The channel in this reach has likely changed since the 1980's study on which the proposed location is based on. An alternative location was chosen. The system is anchored to shore with a cable, approximately 20 ft off RB, at the eddy fence in approximately 7 ft of water. This site was not visited again until June 2013.
	10174303	6 ft	
	10174305	10 ft	
	10174304	14 ft	
June 15, 2013	10174279	2 ft	6/15/13 – 2012 Anchor and safety cable present but thermistor string gone. No 2012 data recovered. New system deployed at original location. Data logging began on 6/15/13. Downloads occurred on 6/25, 7/13, 7/20, 8/02, 8/29 and 9/17/13 – Removed buoy string to install overwinter system.
	10174281	7 ft	
	10174285	13 ft	
	10174286	18 ft	
Bank-Mounted Pipe Installation			
July 27, 2012	10174210	15.5 ft	The 21 ft housing pipe is fastened to a series of alder trees using two pipe brackets and lag bolts. One thermistor is attached to a loop at the end of the cable.
	10174211	20.5 ft	
Overwinter Installation			
Sept. 17, 2013	10174286	--	Installed overwinter system.

Photo A-6b. Buoy Installed at PRM 59.9 – Susitna

Photo A-6c. Pipe Installed in 2012 at PRM 59.9 – Susitna

1.7 PRM 87.8 – Susitna at Parks Highway East

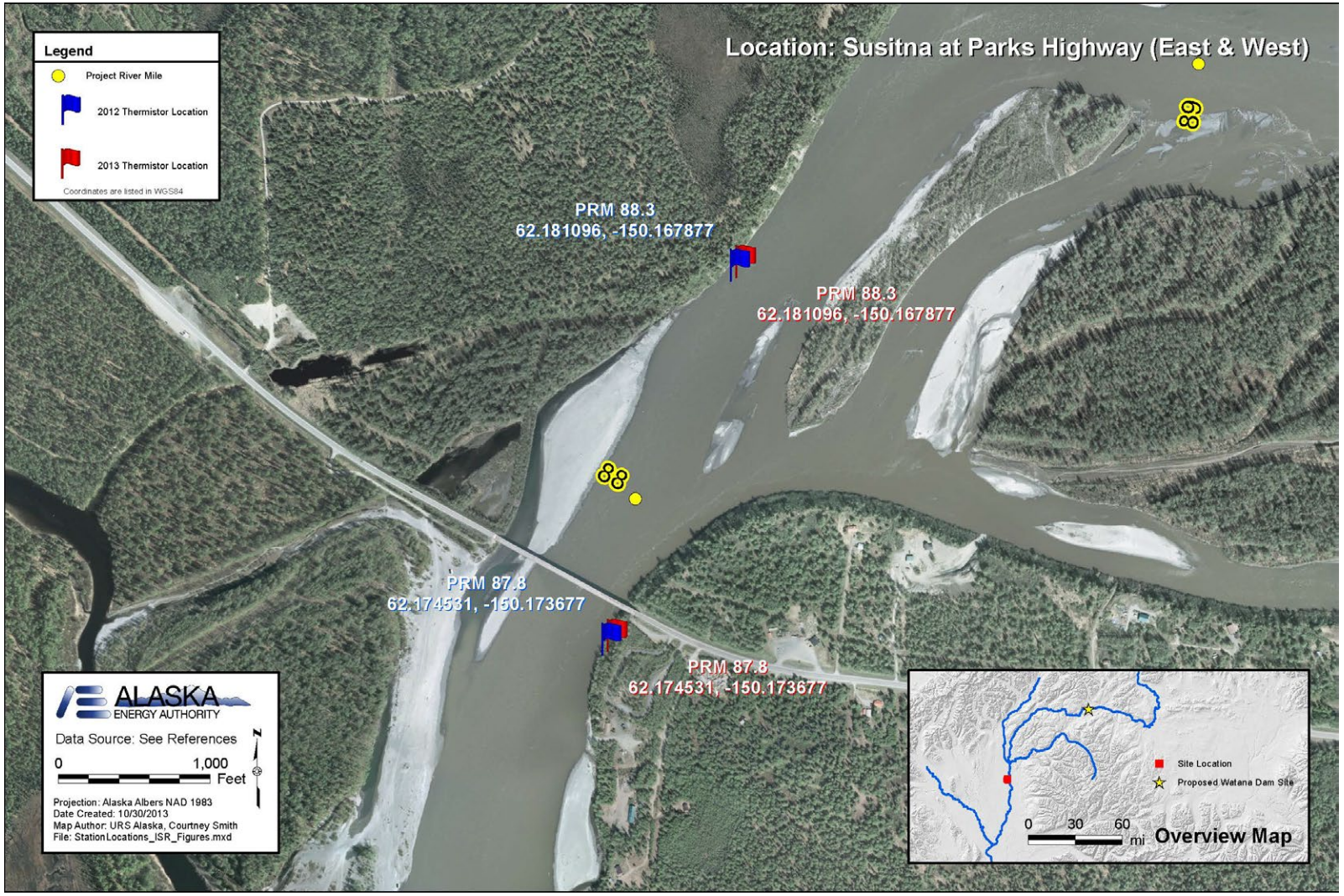

Figure A-7a. Map of Site 87.8 – Susitna at Parks Highway East (NAD 83 Coordinates: 62.174531° N, -150. 173677° W)

Table A-7. Installation and Download Notes – PRM 87.8 – Susitna at Parks Highway East

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 20, 2012	10174236	2 ft	7/20/12 – Deployed at the proposed location just south of the Parks Highway Bridge, 50 ft from the LB, along eddy fence in approximately 7 ft of water. The system is anchored to a boulder. 8/28/12 – River high, no buoy located, anchor stuck could not pull up. Pipe downloaded. 9/28/12 – Buoy system pushed to bank, tangled in wood and debris. Pipe silted in bottom 7 ft. System fixed and redeployed. Data downloads completed. 10/16/12 – Downloaded and removed initial buoy string with multiple data loggers. Replaced with winter, single data logger system (233). Downloaded and extended pipe to 17 ft due to dropping water level.
	10174235	4 ft	
	10174233	6 ft	
June 14, 2013	10174236	2 ft	6/14/13 – New system deployed in same location as 2012 system. Downloads occurred on 7/09, 7/31, 8/28, and 9/20/13. 9/20/13 – Removed system for winter.
	10174235	6 ft	
	10174300	10 ft	
Bank-Mounted Pipe Installation			
July 20, 2012	10174234	--	The housing 14 to 17 ft pipe was mounted on the left bank due south from the Parks Highway Bridge. The pipe housed 13 ft of cable with a thermistor attached to a loop at the end. 10/16/12 – Downloaded pipe thermistor. Thermistor encased in frozen silt. Pipe extended 3 ft to reach water.
June 14, 2013	10174234	--	Pipe system was present but broken and lower section gone. Removed pipe and did not redeploy. Thermistor downloaded.
Overwinter Installation			
Oct. 10, 2012	10174233	--	10/10/12 – Installed overwinter system. 6/14/13 – Overwinter system located and downloaded. Removed from site.
Sept. 20, 2013	10174300	--	Installed overwinter system.

Photo A-7b. Buoy and pipe Installations at PRM 87.8 – Susitna at Parks Highway East

Photo A-7c. Pipe Installation at PRM 87.8 – Susitna at Parks Highway East

1.8 PRM 88.3 – Susitna at Parks Highway West

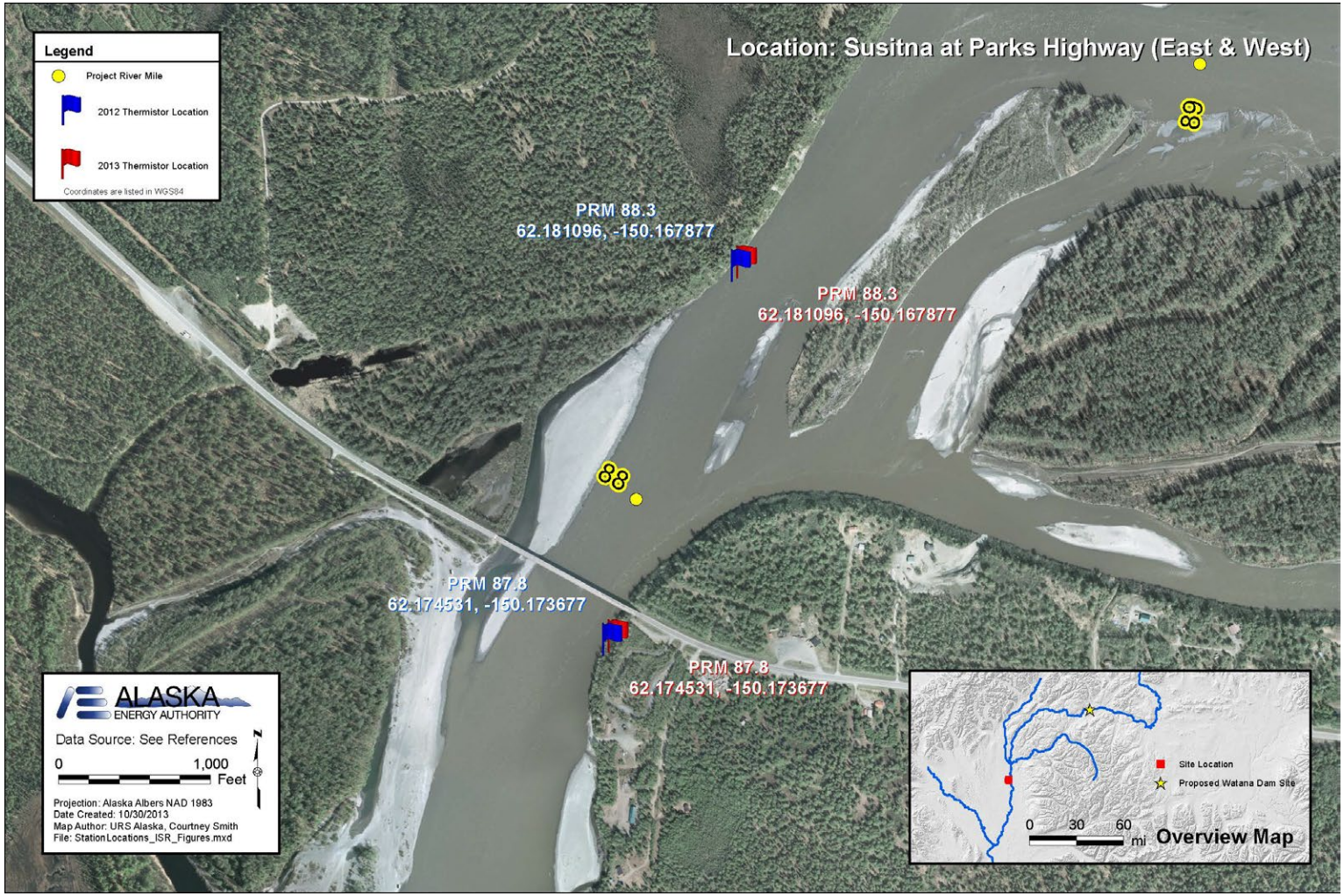

Figure A-8a. Map of Site 88.3 – Susitna at Parks Highway West (NAD 83 Coordinates: 62. 181096° N, -150.167877° W)

Table A-8. Installation and Download Notes – PRM 88.3 – Susitna at Parks Highway West

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 20, 2012	10174230	2 ft	7/20/12 – The buoy is deployed just north of the Parks Highway Bridge, 30 ft from the RB, along eddy fence in approximately 7 ft of water. 8/28/12 – Downloaded both pipe and buoy systems. 9/28/12 – Buoy pushed to bank, tidbits still in water. Data downloads complete. 10/16/12 – Downloaded and removed initial buoy string with multiple data loggers. Replaced with winter, single data logger system. Downloaded pipe system.
	10174229	4 ft	
	10174231	6 ft	
June 14, 2013	10174230	2 ft	6/14/13 – New system deployed in same location as 2012 system. Downloads occurred on 6/20, 7/09, 7/31, 8/28, and 9/20/13. 9/20/13 – Removed system for winter.
	101742229	6 ft	
	10174184	10 ft	
Bank-Mounted Pipe Installation			
July 20, 2012	10174232	--	The 10 ft housing pipe is mounted on the right bank due north from the Parks Highway Bridge. The pipe houses 9 ft of cable with a thermistor attached to a loop at the end. 9/28/12 – Downloaded pipe thermistor. 10/16/12 – Downloaded pipe thermistor.
July 09, 2013	10174232	--	Pipe system located and downloaded. Pipe lower section was damaged, but thermistor was intact. Pipe components were removed and not redeployed after downloading thermistor.
Overwinter Installation			
Oct. 10, 2012	10174231	--	10/20/12 – Installed overwinter system. 6/14/13 – Overwinter system located and downloaded. Removed from site.
Sept. 20, 2013	10174184	--	9/20/13 – Installed overwinter system.

Photo A-8b. Buoy System at PRM 88.3 – Susitna at Parks Highway West

Photo A-8c. Pipe System at PRM 88.3 – Susitna at Parks Highway West

1.9 PRM 99.2 – LRX1

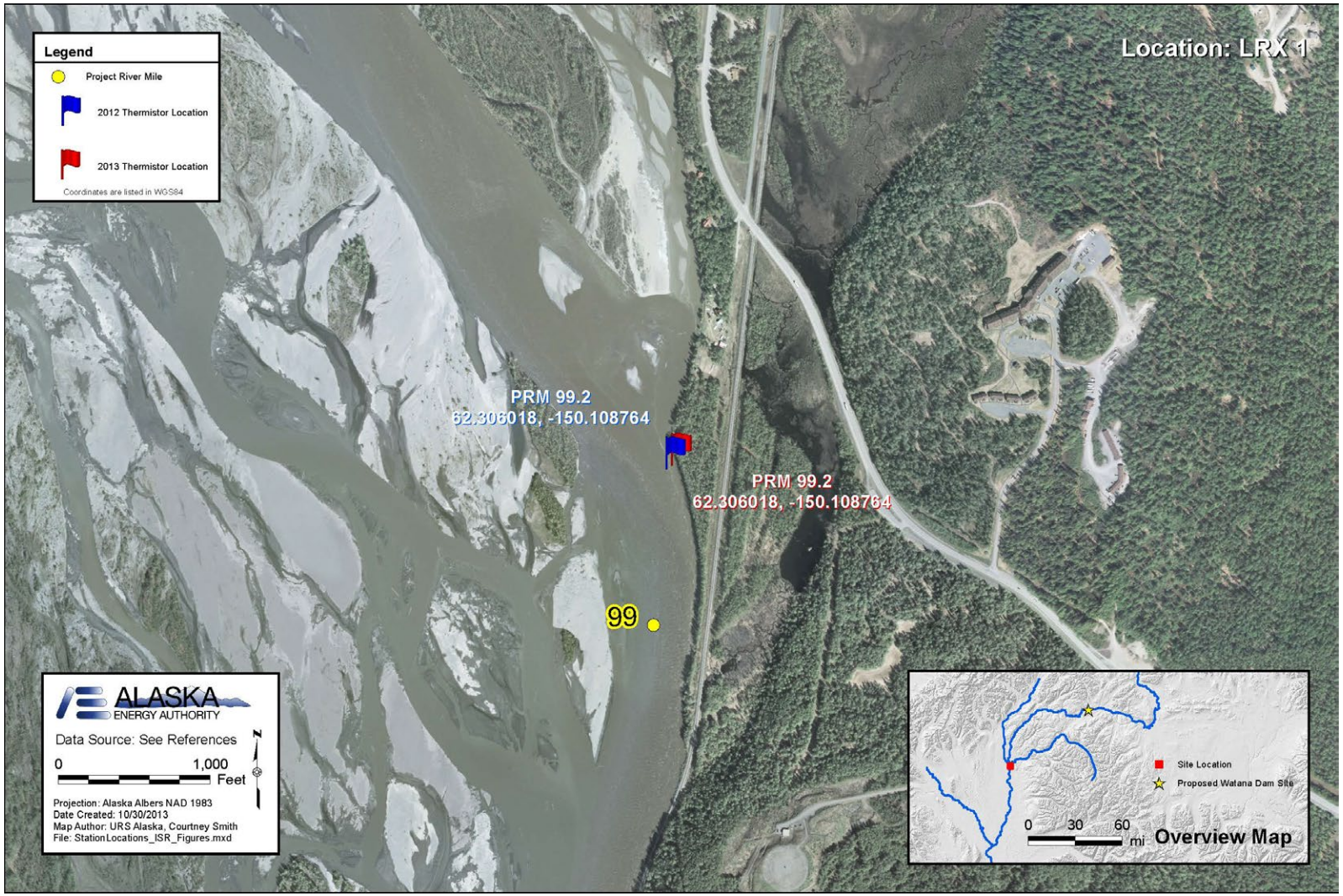

Figure A-9a. Map of Site 99.2 – LRX1 (NAD 83 Coordinates: 62.306018° N, -150. 108764° W)

Table A-9. Installation and Download Notes – PRM 99.2 – LRX1

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 20, 2012	10174244	2 ft	7/20/12 – The buoy is deployed at the approximate proposed location just north of the Parks Highway Bridge. The buoy was deployed 30 ft from the RB, along eddy fence in approximately 7 ft of water. 8/28/12 – Downloaded both pipe and buoy systems. 9/28/12 – Buoy pushed to bank, tidbits still in water. Data downloads complete. Lost Shuttle and several data files in river. 10/16/12 – Downloaded and removed initial buoy string with multiple data loggers. Replaced with winter, single data logger system. Downloaded pipe system.
	10174246	4 ft	
	10174245	6 ft	
June 14, 2013	10174196	2 ft	6/14/13 – New system deployed in same location as 2012 system. 6/20/13 – Winched in and downloaded system. 7/09/13 – Downloaded system. 7/31/13 – Snapped safety cable while attempting to retrieve. Lost all thermistors and data. Buoy string data gap from 7/9/13 to 7/31/13.
	10174198	10 ft	
	10174224	15 ft	
July 31, 2013	10174172	2 ft	7/31/13 – Deployed new system 20 yards downstream. 9/19/13 – System stuck and cannot be removed. Left buoy and stuck string in place. Buoy string data gap from 8/28/13 to present.
	10174173	5 ft	
	10174174	9 ft	
	10174175	12 ft	
Bank-Mounted Pipe Installation			
July 20, 2012	10174243	--	The 13.5 ft housing pipe is fastened to a boulder on left bank. The pipe houses 12 ft of cable with a thermistor attached at the end. 9/28/12 – Lost Shuttle with several data files in river.
June, 14 2013	10174241	--	Downloaded and replaced 2012 pipe system thermistor (243) with 2013 thermistor (241). Continuous pipe thermistor data from 9/28/12 to 9/19/13. Pipe system downloaded: 7/09, 7/31, 8/28, and 9/19/13.
Overwinter Installation			
Oct. 16, 2012	10174231	--	Installed overwinter system. 6/14/13 – Overwinter system present but stuck. Could not retrieve.
Sept. 19, 2013		--	No overwinter system installed. Could not retrieve anchor/buoy string and have lost more than one string in this location.

Photo A-9b. Buoy system at PRM 99.2 – LRX1

Photo A-9c. Pipe system at PRM 99.2 – LRX1

1.10 PRM 102.8 – Talkeetna River

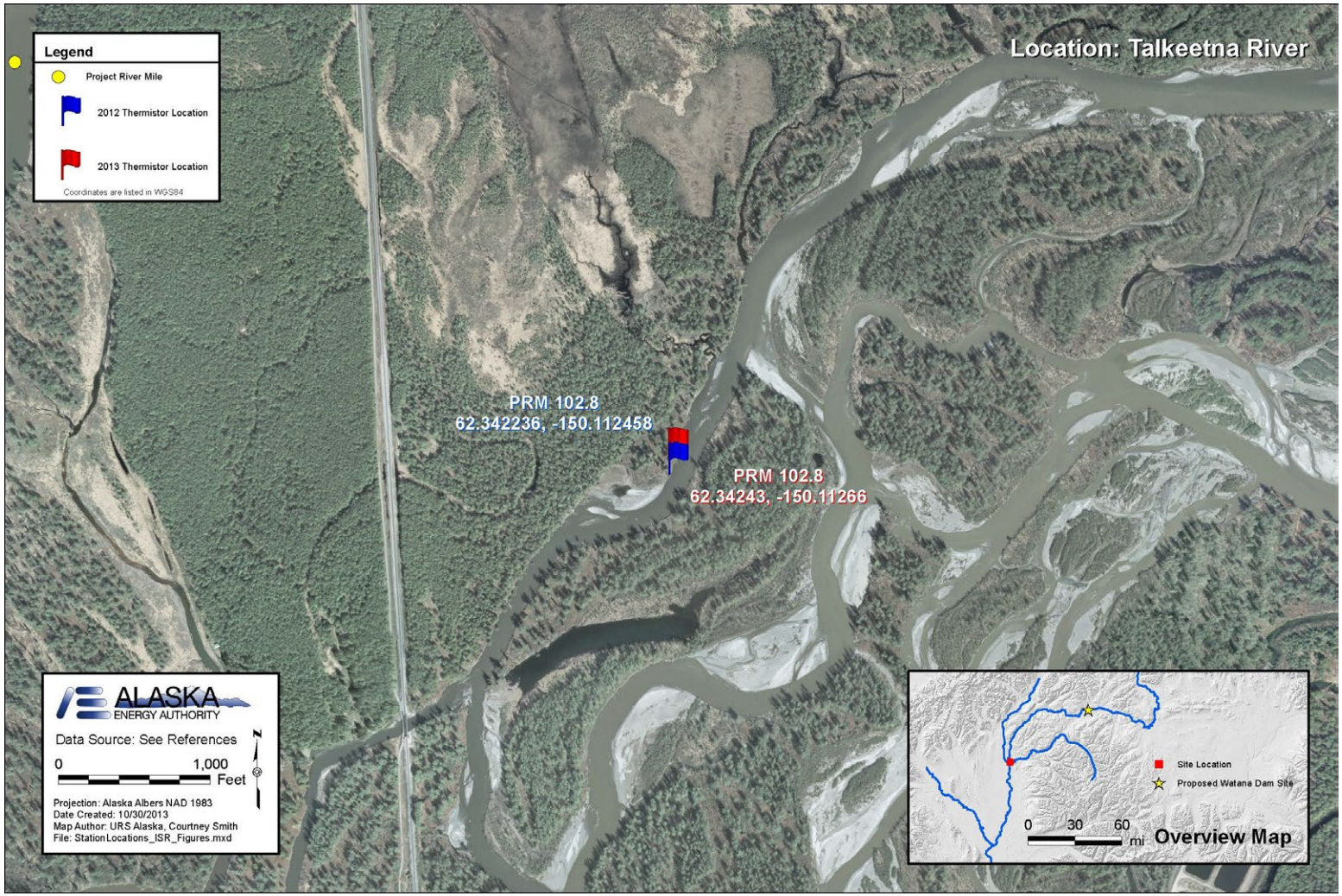

Figure A-10a. Map of Site 102.8 – Talkeetna River (NAD 83 Coordinates: 62.34243° N, -150.11266° W)

Table A-10. Installation and Download Notes – PRM 102.8 – Talkeetna River

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 21, 2012	10174239	1.5 ft	7/21/12 – The buoy is deployed a few hundred feet upriver of the proposed location due to an absence of anchoring trees or rocks, 20 ft from the RB, along eddy fence in approximately 5 to 6 ft of water. 8/28/12 – Talkeetna River very high, >5 ft raise, buoy and pipe system under water unable to locate with high flow, no download. 9/28/12 – System gone, bank washed out, buoy and pipe gone. Bank cut 10 plus feet out. No buoy string data recovered in 2012.
	10174238	3 ft	
	10174240	4.5 ft	
June 13, 2013	10174177	2 ft	6/13/13 – Installed new system downloads on 6/20, 7/09, 7/18, 8/01, 8/28, and 9/19. 8/28/13 – Replaced thermistor no. 183 with no. 199. Download issue resolved at field office. 9/19/13 – Removed buoy system for winter.
	10174179	5 ft	
	10174183 10174199	8 ft	
Bank-Mounted Pipe Installation			
July 21, 2012	Unknown	--	Pipe system was lost during flooding and not redeployed.
Overwinter Installation			
Oct. 15, 2012	10174313	--	10/15/12 – Installed overwinter system at location of original deployment. 6/13/13 – Recovered and downloaded overwinter system. Data gap – logging stopped on 5/25/13. Replaced with new buoy string.
Sept. 19, 2013	10174199	--	Installed overwinter system.

Photo A-10b. Buoy and pipe system at PRM 102.8 – Talkeetna River

Photo A-10c. Retrieval of thermistor from 2012 overwinter system at PRM 102.8 – Talkeetna River

1.11 PRM 118.6 – Chulitna River

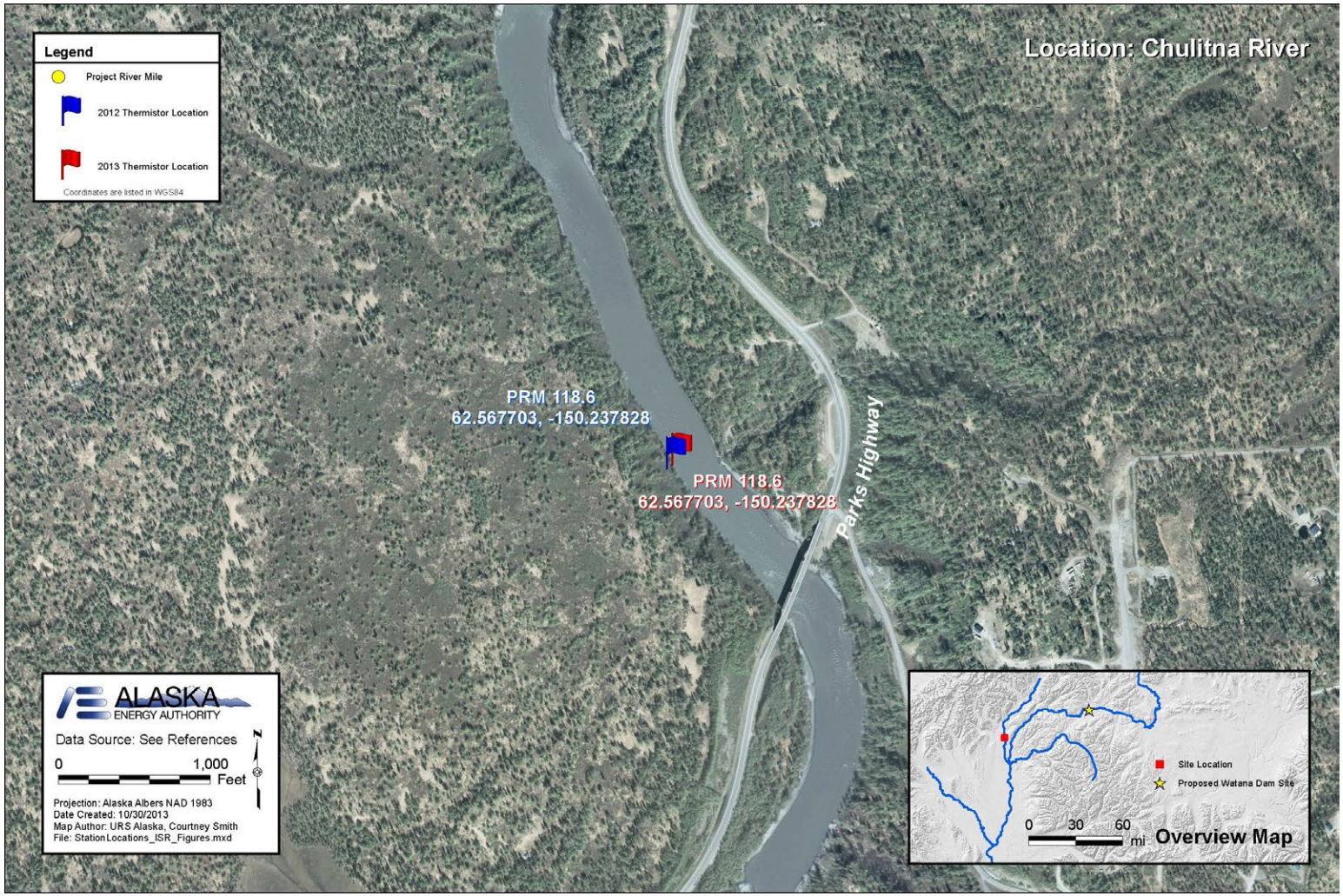

Figure A-11a. Map of Site 118.6 – Chulitna River (NAD 83 Coordinates: 62.567703° N, -150.237828° W)

Table A-11. Installation and Download Notes – PRM 118.6 – Chulitna River

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 25, 2012	10174254	2 ft	7/25/12 – The buoy is deployed approximately 0.4 miles downriver of the proposed location, just north of the Parks Highway Bridge due to an absence of anchoring trees or rocks, as well as property access issues. The system was deployed 50 ft from the RB, along an eddy fence in 14 ft of water. The system is anchored to shore with a cable, looped around a cottonwood tree. 10/17/12 – Both systems downloaded. Buoy system had moved up against shore due to flooding. Initial buoy system was removed and replaced with single data logger winter system.
	10174228	9 ft	
	10174257	16 ft	
	10174182	23 ft	
	10174209	29 ft	
June 14, 2013	10174254	2 ft	6/14/13 – Installed new system. Downloads occurred on 6/24, 7/12, 7/16, 8/01, 8/17, 8/28, and 9/20/13. 7/16/13 – Last download on thermistor #182. (Assumed lost.) 9/20/13 – Anchor and buoy on bank. Significant water level drop – thermistors out of water for unknown amount of time. Removed system for winter.
	10174228	9 ft	
	10174257	16 ft	
	10174182	23 ft	
	10174260	26 ft	
Bank-Mounted Pipe Installation			
July 25, 2012	10174258	5 ft	The 14 ft housing pipe is fastened to a boulder slightly upstream of the buoy. The pipe houses 13 ft of cable with thermistors attached to the cable along intervals. 10/17/12 – The top thermistor in pipe was out of water and in cased in frozen silt. Lower thermistor was in approx. 1 foot of water. Additional 7 foot section of pipe added to pipe setup (20") and cable lengthen to 18 ft). 6/14/13 – Located pipe. Downloaded and replaced thermistors.
	10174181	9 ft	
	10174180	14 ft	
June 14, 2013	10174242	9 ft	6/14/13 – Installed new thermistor string in pipe. Downloads occurred on 6/24, 7/12, 8/01, 8/17, 8/28, and 9/20/13. 9/20/13 – Pipe lower section is missing – Cable dangling from pipe with lower thermistor still in water.
	10174255	14 ft	

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Overwinter Installation			
Oct. 17, 2012	10174242	--	10/17/12 – Deployed overwinter system. 6/14/13 – Overwinter system lost due to ice scour during winter 2012/13.
Sept. 20, 2013	10174260	--	Deployed overwinter system.

Photo A-11b. Buoy at PRM 118.6 – Chulitna River

Photo A-11c. Pipe mounted at PRM 118.6 – Chulitna River

1.12 PRM 107.0 – Talkeetna

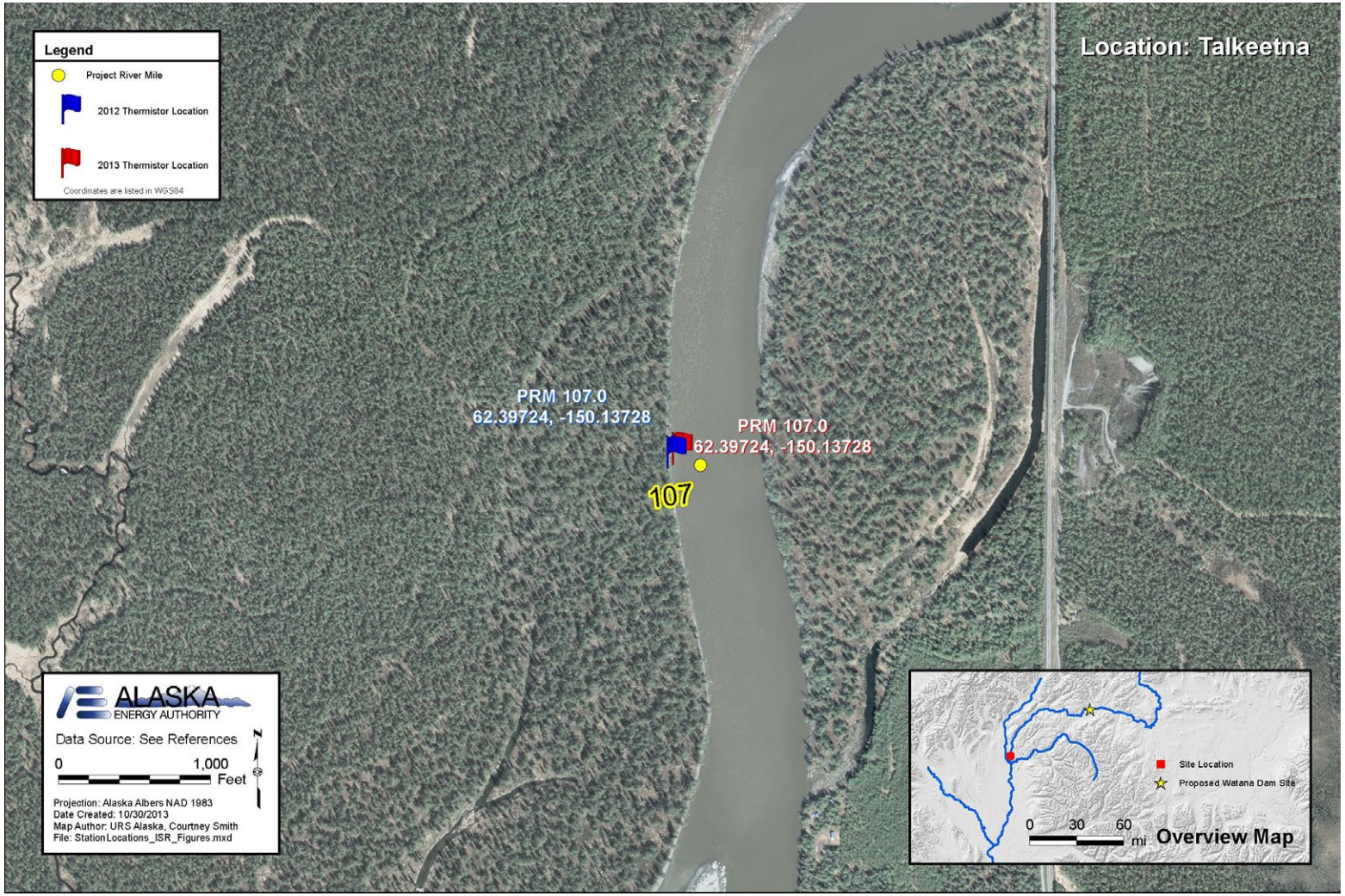

Figure A-12a. Map of Site 107.0 – Talkeetna (NAD 83 Coordinates: 62.39724° N, -150.13728° W)

Table A-12. Installation and Download Notes – PRM 107.0 – Talkeetna

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 21, 2012	10174247	2 ft	7/21/12 – The buoy is deployed at the proposed location, 100 ft from the RB, along eddy fence in approximately 6 ft of water. The system is anchored to shore with a cable, looped around a cottonwood tree and secured with cable clamps. 9/27/12 – Buoy missing. Replaced system was still intact and tidbits probes data was downloaded. 10/23/12 – Buoy system intact. Downloaded and removed initial buoy string with multiple data loggers. Replaced with winter single data logger system.
	10174250	4 ft	
	10174249	6 ft	
June 13, 2013	10174177	2 ft	6/13/13 – Installed new system. Downloads on 6/20, 7/09, 7/18, 7/31, 8/25, 8/28, and 9/18. 8/25/13 – System found high and dry on the beach. 9/18/13 – Buoy lost. Thermistors were on river bottom. Removed system for winter.
	10174250	5 ft	
	10174176	8 ft	
Bank-Mounted Pipe Installation			
July 21, 2012	10174248	--	The housing pipe is fastened to a rock with three pipe brackets and lag bolts. The pipe houses 6.5 ft of cable with a thermistor attached to a loop at the end. Pipe Length: 7 ft. 10/23/12 – Pipe system dry and data logger cable was frozen in pipe could not remove for download. Left pipe in place.
Overwinter Installation			
Oct. 23, 2012	10174249	--	Installed overwinter system. 6/13/13 – Overwinter system lost due to ice scour during winter 2012/13.
Sept. 18, 2013	10174176	--	Installed overwinter system.

Photo A-12b. Buoy at PRM 107.0 – Talkeetna

Photo A-12c. Installing buoy system at PRM 107.0 – Talkeetna

1.13 PRM 116.7 – LRX18

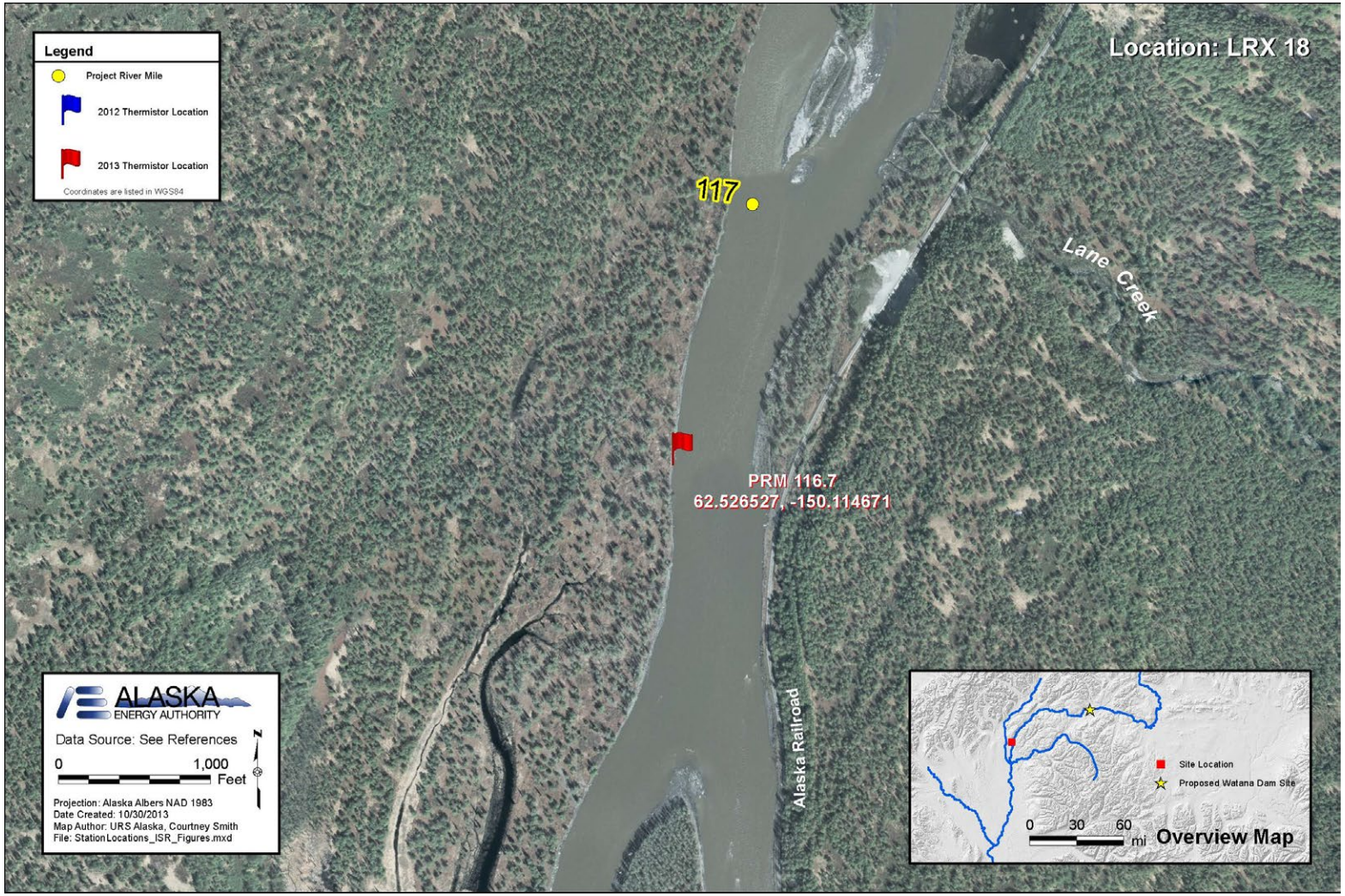

Figure A-13a. Map of Site 116.7 – LRX18 (NAD 83 Coordinates: 62.526527° N, -150.114671° W)

Table A-13. Installation and Download Notes – PRM 116.7 – LRX18

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 21, 2012	10174252	2 ft	7/21/12 – The buoy is deployed near the proposed location off the RB, along eddy fence in approximately 10 ft of water. The system is anchored to a cottonwood tree. 8/27/12 – Buoy system was in good condition and was downloaded. 9/27/12 – Buoy system came loose from anchor during flood but was found dry on bank down river and retrieved. Data logger 252 was missing remaining loggers were downloaded. System was not replaced due to lack of good anchor point.
	10174253	7 ft	
	10174251	14 ft	
June 13, 2013	10174253	2 ft	6/13/13 – Installed new system. Data gap from 9/27/12 to 6/13/13. Downloads on 6/20, 7/11, 7/18, 7/31, 8/01, 8/28, and 9/18. 9/18/13 – Removed system for winter.
	10174314	6.5 ft	
	10174251	11 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	Pipe mounting infrastructure is absent. Shore was very shallow and gravelly with few downed trees that would be safe for pipe attachment. This type of installation would be susceptible to equipment loss during ice break up.
Overwinter Installation			
2012	--	--	No overwinter system installed.
Sept. 18, 2013	10174251	--	Installed overwinter system.

Photo A-13b. Buoy system installed at PRM. 116.7 – LRX18

Photo A-13c. Preparing to Deploy buoy system

1.14 PRM 124.2 – Curry Fishwheel Camp

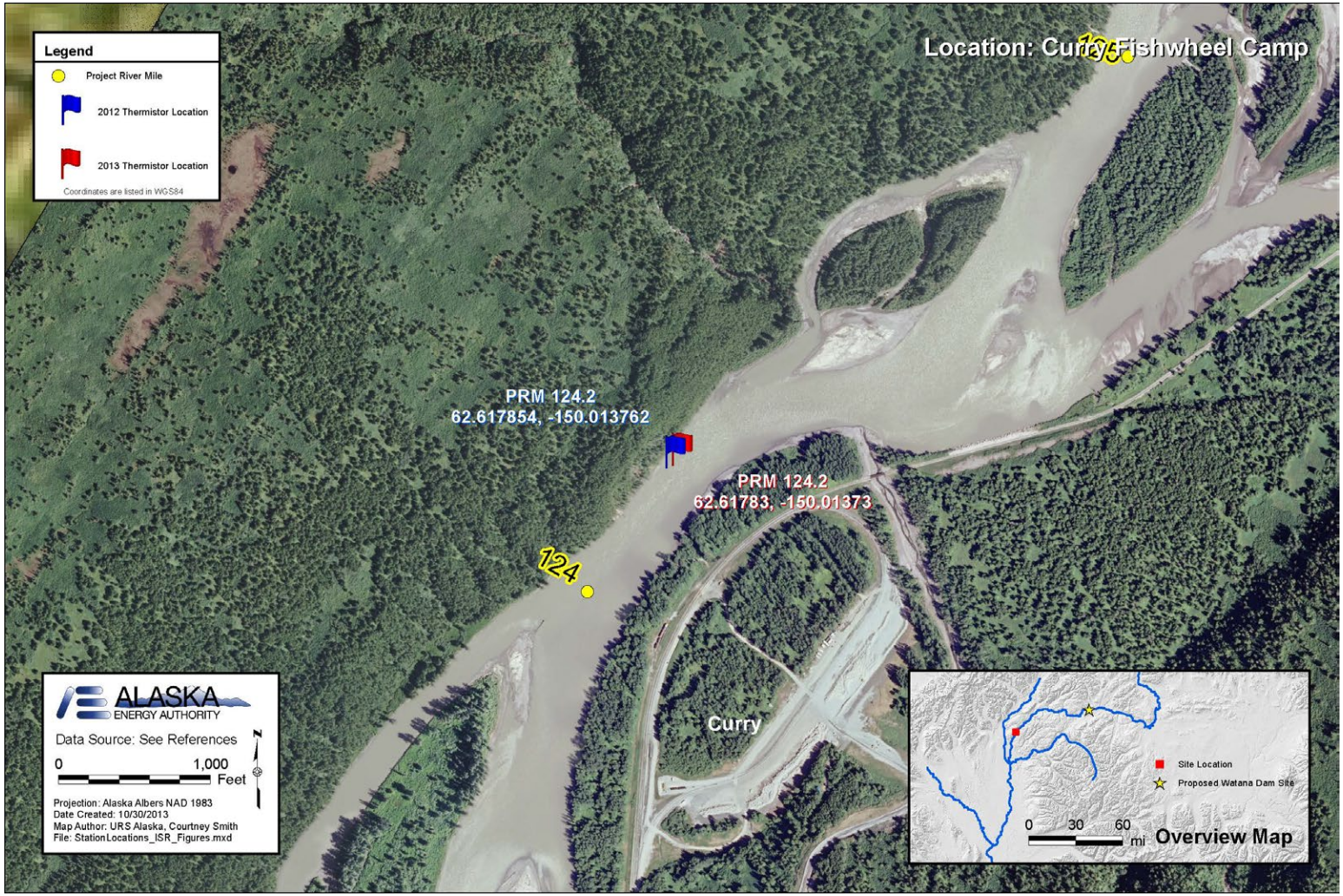

Figure A-14a. Map of Site 124.2 – Curry Fishwheel Camp (NAD 83 Coordinates: 62.61783° N, -150.01373° W)

Table A-14. Installation and Download Notes – PRM 124.2 – Curry Fishwheel Camp

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 22, 2012	10174266	2 ft	7/22/12 – The buoy is deployed upriver and on the right bank near the proposed location. The system is anchored to shore with a cable, looped around a pipe bracket and was deployed 40 ft from the RB, along eddy fence in approximately 8 ft of water. 8/27/12 – System downloaded. 9/27/12 – Buoy missing, replaced. System still intact, tidbits downloaded. 10/23/12 – Attempted to visit with helicopter. No landing zone – no buoy visible.
	10174267	11 ft	
	10174269	19 ft	
June 13, 2013	10174297	2 ft	6/13/13 – Old system not found. Data gap from 9/27/12 to 6/13/13. New system deployed in same location as 2012 system. Additional downloads occurred on 6/20, 7/11, 8/01, 8/27, and 9/18/13. 8/27/13 – System found to be washed into bank and out of the water. 9/18/13 – Removed system for winter. Replaced anchor loop.
	10174298	10 ft	
	10174299	17 ft	
Bank-Mounted Pipe Installation			
July 22, 2012	10174268	--	7/22/12 – The 14 ft pipe houses 13 ft of cable with a thermistor attached by zip ties to a loop at the end. The pipe is submerged 8 ft in the water. 8/28/12 – Pipe located and downloaded. 9/27/12 – Pipe located and downloaded. 10/23/12 – Attempted to visit with helicopter. No landing zone – pipe in place and lower section in river.
July 23, 2013	--	--	Pipe system not visible and not replaced. No pipe data after 9/27/12.
Overwinter Installation			
2012	--	--	No overwinter system installed.
Sept. 18, 2013	10174299	--	Installed overwinter system.

Photo A-14b. Buoy system installed at PRM 124.2 – Up-River of Curry Fishwheel Camp

Photo A14-c. PRM 124.2 – Pipe system at Curry Fishwheel Camp

1.15 PRM 129.6 – Slough 8A

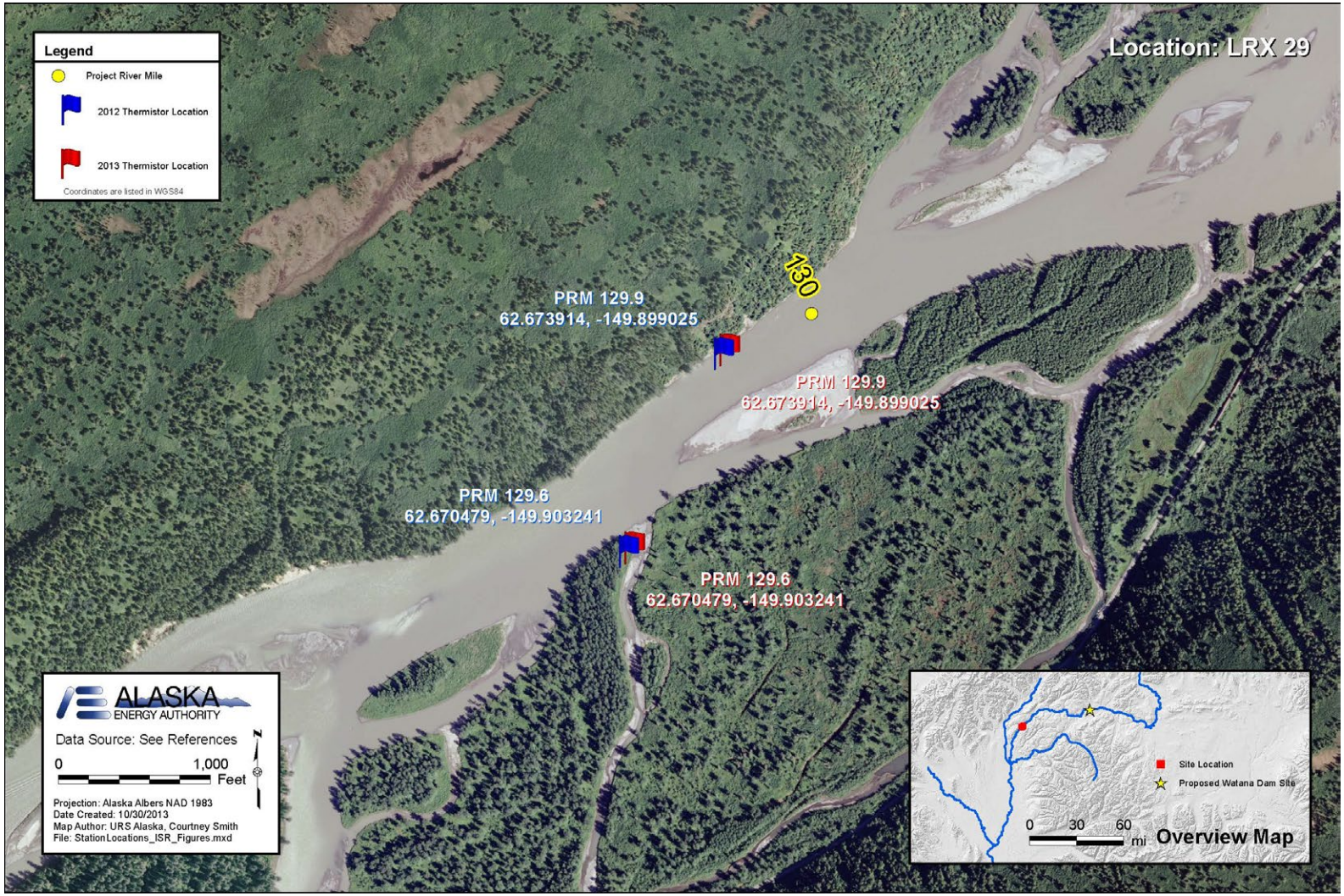

Figure A-15a. Map of Site 129.6 – Slough 8A (NAD 83 Coordinates: 62.670479° N, 149.903241° W)

Table A-15. Installation and Download Notes – PRM 129.6 – Slough 8A

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 23, 2012	10174265	2 ft	7/23/12 – The buoy was deployed near the proposed location 20 ft from the RB of the slough. The system was anchored to shore with a duck-billed anchor hammered into the sand. 8/27/12 – Bank washed out due to flooding. System lost. 10/15/12 – Buoy with complete data logger string was found downstream of slough – time in/out of water unknown. System was retrieved and downloaded. 10/23/12 – Helicopter flyby. The side channel where system was deployed was observed to be almost dry. No winter system deployed.
	10174264	5 ft	
	10174263	7 ft	
June, 13, 2013	10174264	2 ft	6/13/13 – No data from 10/15/12 to 6/13/13. New system deployed in same location as 2012 system. Downloads occurred on 6/20, 7/11, 8/01, 8/27, and 9/18/13. 9/18/13 – Water level in slough dropped and system was only in 6" to 12" of water. Removed system for winter.
	10174265	4.5 ft	
	10174263	7 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	No system installed due to lack of anchor points and shallow water level in slough.
Overwinter Installation			
2012	--	--	No overwinter system installed.
Sept. 18, 2013	10174263	--	Overwinter system installed.

Photo A-15b. Buoy at PRM 129.6 – Slough 8A

Photo A-15c. Installing buoy system at PRM 129.6 – Slough 8A

1.16 PRM 129.9 – LRX29

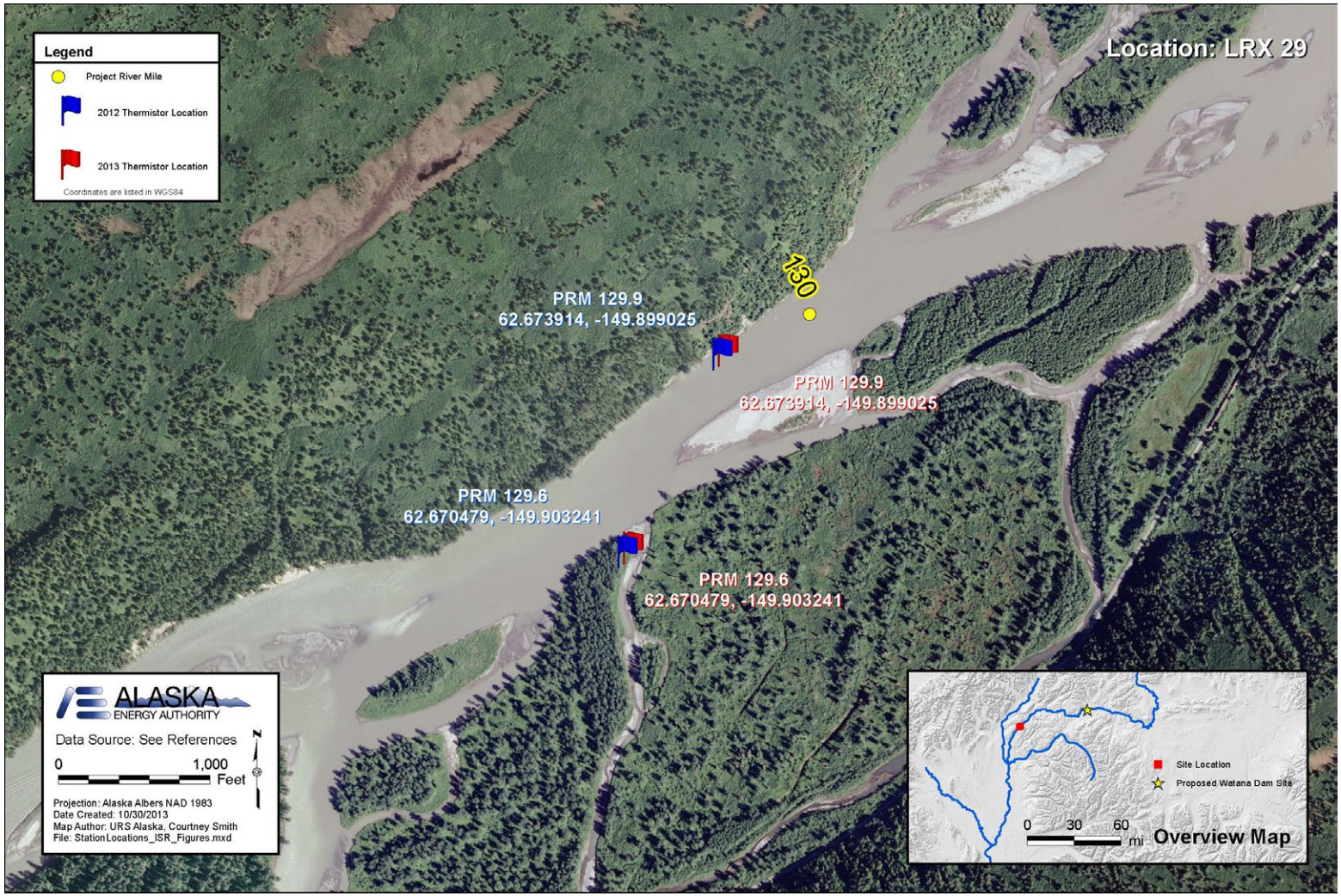

Figure A-16a. Map of Site 129.9 – LRX29 (NAD 83 Coordinates: 62.673914 ° N, -149.899025° W)

Table A-16. Installation and Download Notes – PRM 129.9 – LRX29

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 22, 2012	10174217	2 ft	7/22/12 – The buoy is deployed at the proposed river mile on the left bank (originally proposed to be right bank) due to an absence of anchoring trees or rocks. The buoy was placed along eddy fence in approximately 7 ft of water. The system is secured to a boulder. 8/27/12 – Downloaded system. Buoy missing. 9/27/12 – Replaced Buoy and downloaded data loggers. 10/23/12 – Buoy system intact. Downloaded and removed initial buoy string with multiple data loggers.
	10174216	8 ft	
	10174218	14 ft	
June 12, 2013	10174171	2 ft	6/1212 – New system deployed in same location as 2012 system. Downloads occurred on 6/20, 7/11, 8/01, 8/27, and 9/19/13. 9/19/13 – Removed system for winter.
	10174216	9.5 ft	
	10174218	17 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	Pipe mounting infrastructure was absent at this site.
Overwinter Installation			
Oct. 23, 2012	10174218	--	10/23/12 – Installed overwinter system. 6/12/13 – Overwinter system not located. 6/20/13 – Overwinter system recovered and downloaded.
Sept. 19, 2013	10174171	--	9/19/13 – Installed overwinter system.

Photo A-16b. Buoy location at PRM 129.9 – LRX29

Photo A-16c. Installing buoy at PRM 129.9 – LRX29

1.17 PRM 132.7 – Slough 9

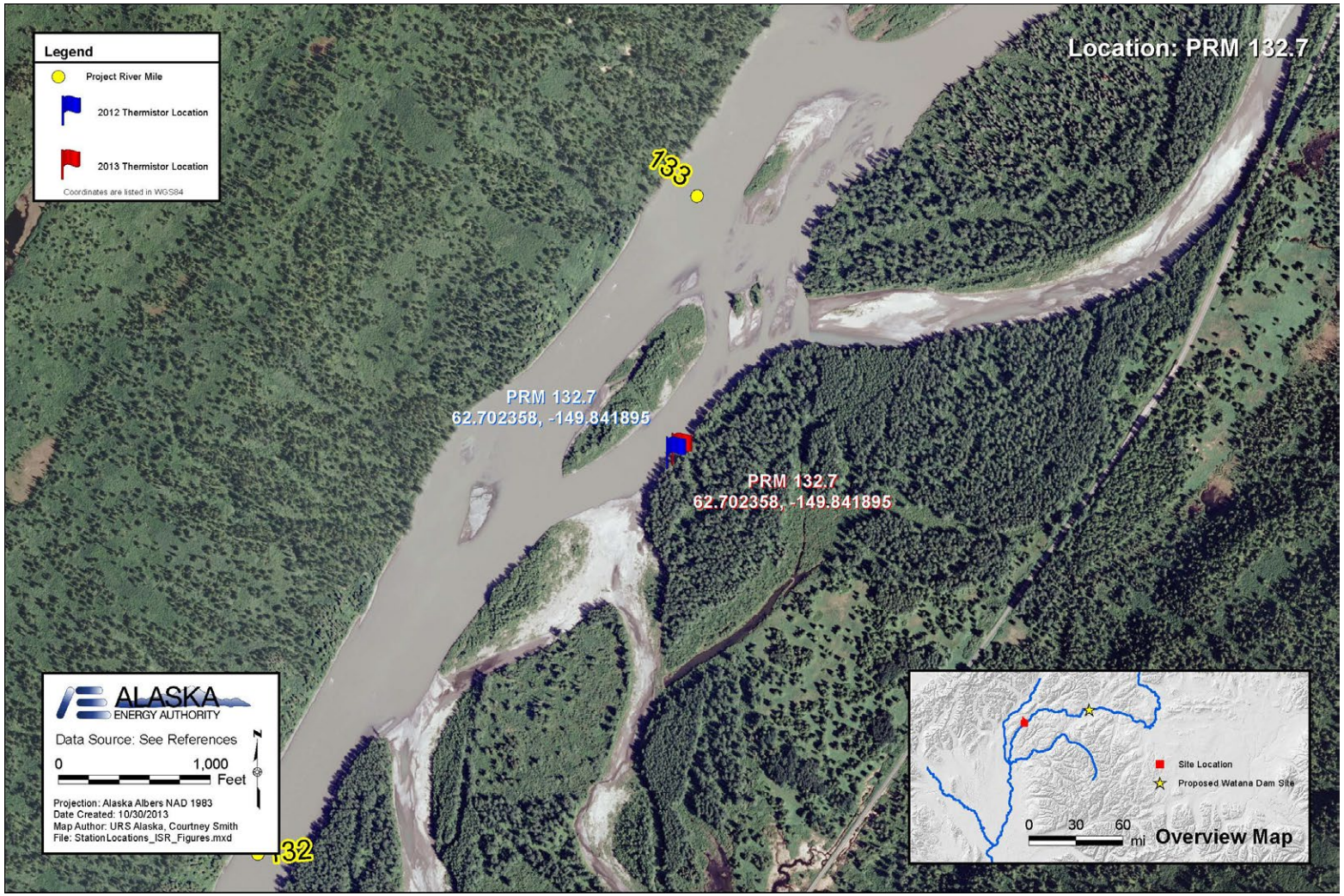

Figure A-17a. Map of Site 132.7 – Slough 9 (NAD 83 Coordinates: 62.702358° N, -149.841895° W)

Table A-17. Installation and Download Notes – PRM 132.7 – Slough 9

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 22, 2012	10174220	2 ft	7/22/12 – The buoy is deployed in the proposed location, about 1/3 of the channel width into the slough, in approximately 4 ft of water. The system is anchored to shore with a duck-billed anchor buried into the ground. The slough is extremely shallow. 9/27/12 – System pushed towards shore, all tidbits still in water, system intact. 10/23/12 – Buoy system intact, buoy frozen in ice but data loggers in 1 ft of flowing water. System removed. No winter system deployed – too shallow.
	10174219	4 ft	
June, 13, 2013	10174220	2 ft	6/13/12 – New system deployed in same location as 2012 system. Data gap from 10/23/12 to 6/13/13. Additional downloads on 6/20, 7/11, 8/01, 8/27, and 9/18/13. 9/18/13 – Buoy flat – thermistors not significantly affected. Removed system for winter.
	10174219	7 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	The slough is very shallow; there is not enough water for a thermistor mounted in a pipe to be covered, especially during icing and periods of low flow.
Overwinter Installation			
2012	--	--	No overwinter system installed.
Sept, 18, 2013	10174219	--	Installed overwinter system.

Photo A-17b. Buoy at PRM 132.7 – Slough 9

Photo A-17c. Maintenance and download of buoy system at PRM 132.7 – Slough 9

1.18 PRM 134.1 – LRX35

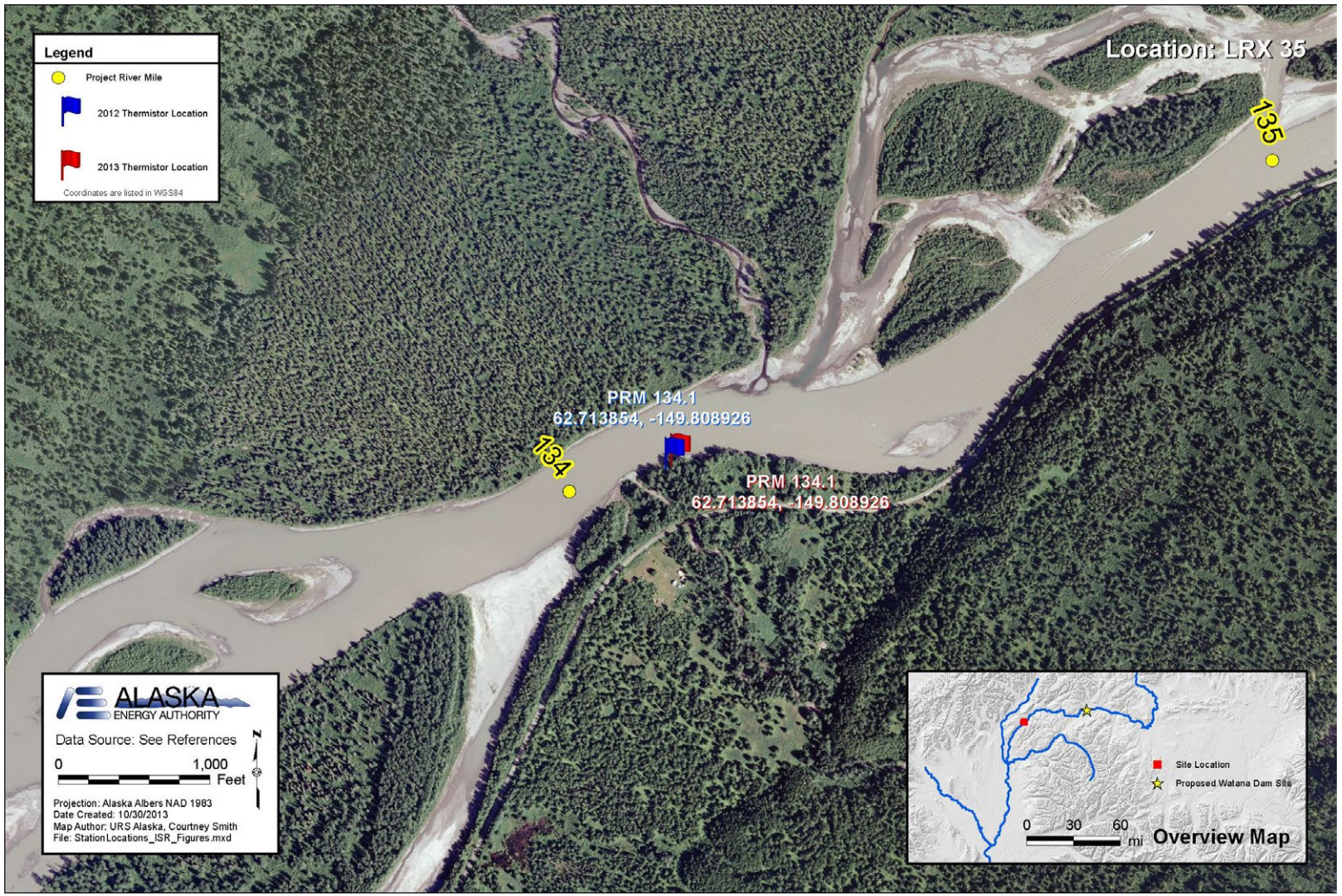

Figure A-18a. Map of Site 134.1 – LRX35 (NAD 83 Coordinates: 62.841895° N, -149.808926° W)

Table A-18. Installation and Download Notes – PRM 134.1 – LRX35

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 22, 2012	10174222	2 ft	7/22/12 – The buoy was deployed near the proposed location site, 200 ft above the confluence of Sherman Creek on the left bank, and 500 ft below the 5th of July creek on the right bank. The buoy was located 30 ft from the LB, along eddy fence in approximately 10 ft of water. The system was anchored to a large boulder. 8/28/12 – System downloaded 9/27/12 – System intact but swung closer to shore. 10/23/12 – Buoy and shore cable iced in but data loggers were ice free in approx. 2.5 feet of flowing water. Downloaded top two tidbits removed buoy and redeployed.
	10174262	8 ft	
	10174221	14 ft	
	10174223	20 ft	
July 12, 2013	10174197	2 ft	7/12/13 – New anchor and buoy system deployed. 2012 system may still be present but under water. Downloads occurred on 6/20, 7/11, 8/01, 8/27, and 9/18. 9/18/13 – Removed system and replaced with overwinter set up. Also recovered 2012 buoy string w/ all thermistors intact. Downloads successful – data logging stopped on 7/21/13. (No data gap.)
	10174321	8 ft	
	10174322	12 ft	
	10174323	16 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	No installed due to lack of pipe mounting infrastructure.
Overwinter Installation			
Oct. 23, 2012	10174222	--	10/23/12 – Entire anchor-buoy system and safety cable frozen in shore ice and cannot be completely removed. Download top 2 thermistors, remove buoy, and redeployed as overwinter system.
	10174262		
	10174221		
	10174223		
Sept. 18, 2013	10174323	--	9/18/13 – Found overwinter system deployed in 2012. Downloaded system and removed from site. 9/18/13 – Installed new overwinter system.

Photo A-18b. Buoy at PRM 134.1 – LRX35

Photo A-18c. PRM 134.1 Buoy system prior to retrieval and download on 10/23/12

1.19 PRM 140.0 – Susitna near Gold Creek

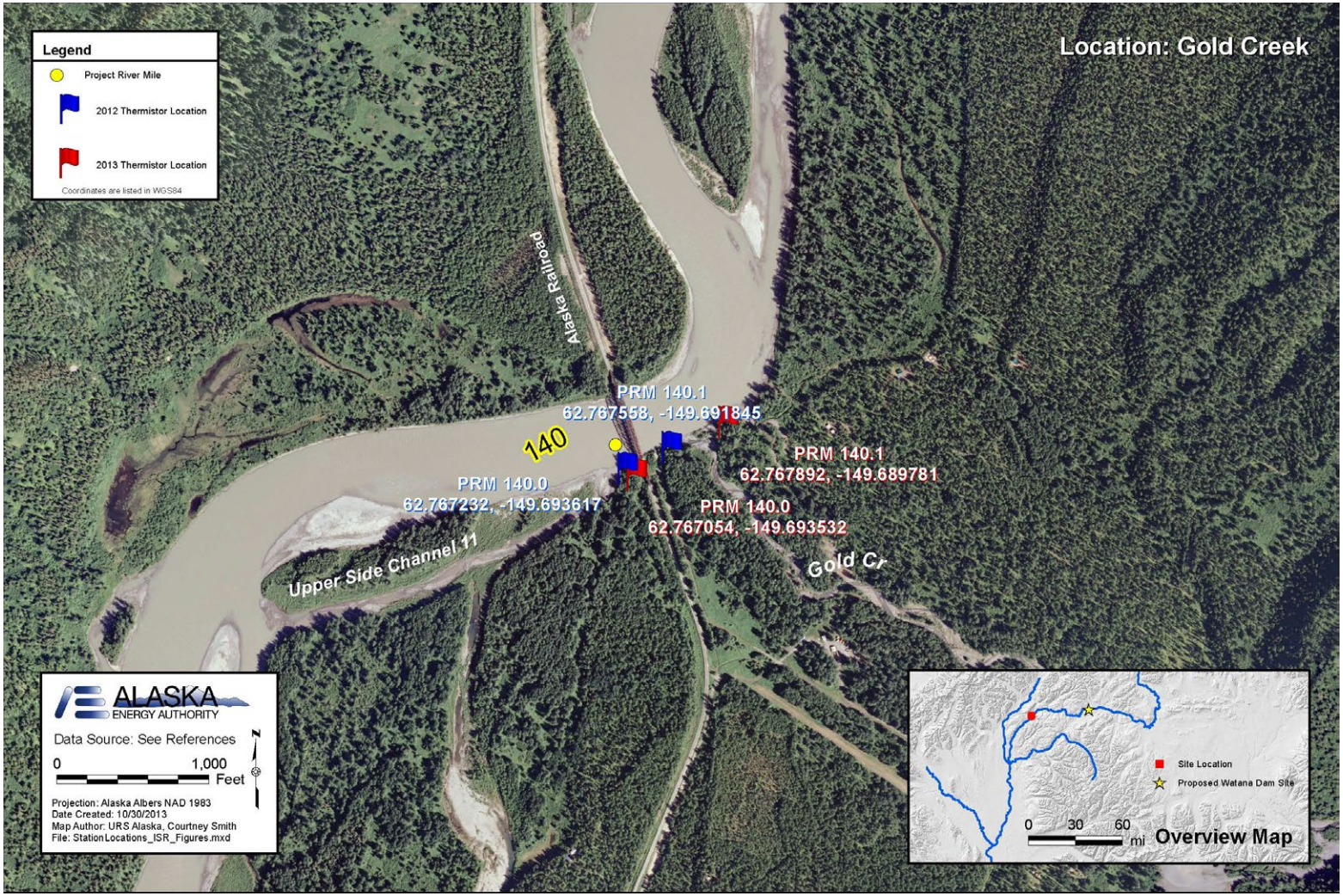

Figure A-19a. Map of Site 140.0 – Susitna near Gold Creek (NAD 83 Coordinates: 62.767054° N, -149.693532° W)

Table A-19. Installation and Download Notes – PRM 140.0 – Susitna near Gold Creek

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
August 28, 2012	10174292	2 ft	8/28/12 – The buoy is deployed at the proposed location, 30 ft from the LB, along eddy fence in approximately 5 ft of water. The buoy was attached to 10 ft of cable with three thermistors spaced at even intervals and attached with wire. 9/27/12 – System intact but swung closer to shore. 10/22/12 – Buoy missing but data logger string intact. Downloaded and removed initial buoy string with multiple data loggers. Buoy found downstream and retrieved.
	10174293	4 ft	
	10174294	6 ft	
	10174295	8 ft	
June 12, 2013	10174293	2 ft	6/12/13 – Bank erosion requires that site be moved 20 ft down river from 2012 location. Data gap from 10/22/12 to 6/12/13. New anchor and buoy system deployed. 9/18/13 – Removed system and replaced with overwinter set up.
	10174294	5 ft	
	10174295	8 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	Pipe mounting infrastructure is absent at this site due to the lack of good bracket mounting location.
Overwinter Installation			
Oct. 22, 2012	10174292	--	10/22/12 – Installed overwinter system.
Sept. 18, 2013	10174295	--	6/12/13 – Site covered with sweepers/debris. Unable to retrieve. 9/18/13 – Installed overwinter system.

Photo A-19b. Buoy at PRM 140.0

Photo A-19c. Buoy system ready for deployment at PRM 140.0

1.20 PRM 140.1 – Gold Creek

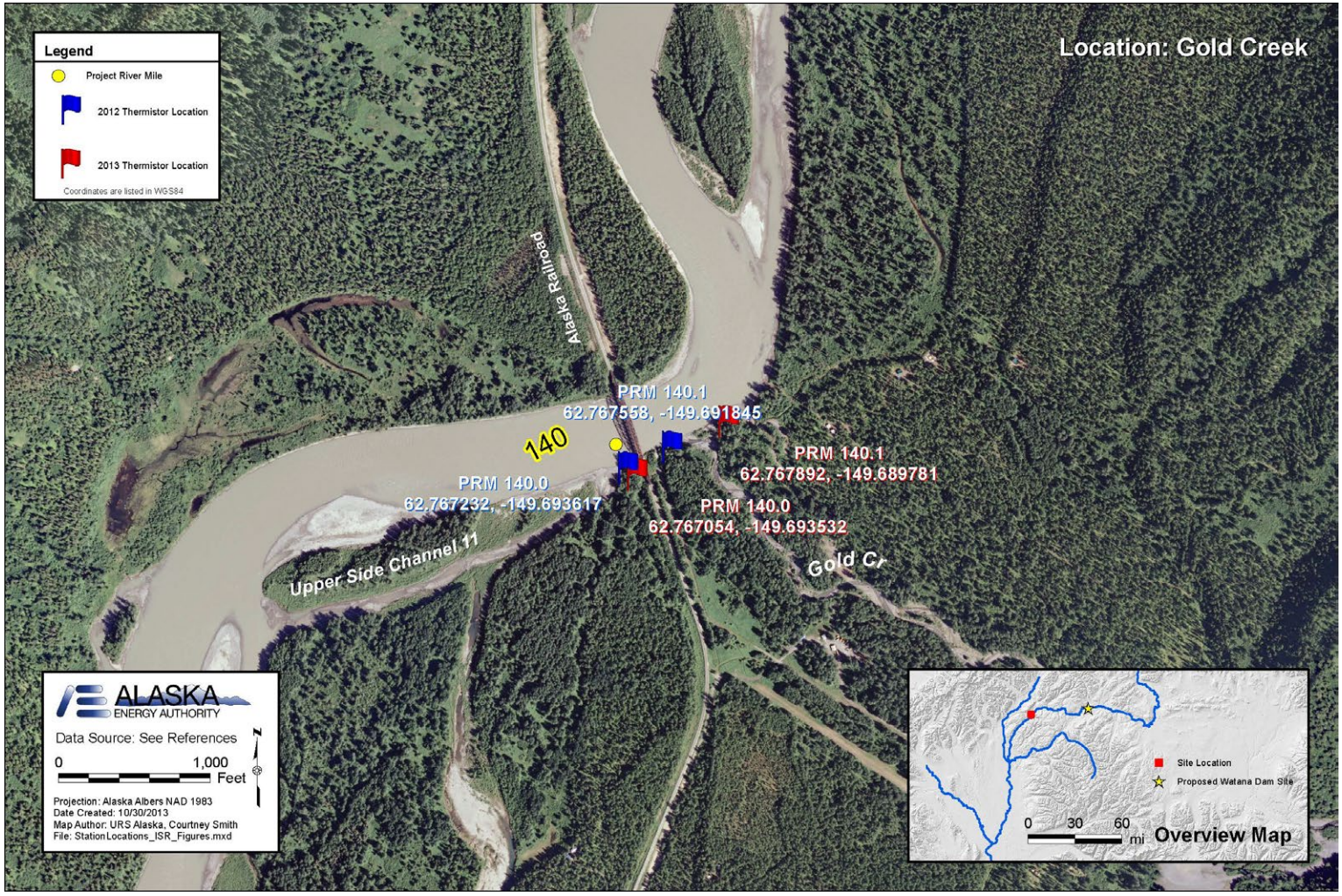

Figure A-20. Map of Site 140.1 – Gold Creek (NAD 83 Coordinates: 62.767892° N, -149.689781° W)

Table A-20. Installation and Download Notes – PRM 140.1 – Gold Creek

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
August 28, 2012	10174310	2 ft	8/28/12 – The buoy is deployed at the proposed location, 30 ft from the LB, along eddy fence in approximately 8 ft of water. The buoy was attached to 20 ft of cable holding three thermistors. 9/27/12 – Equipment missing, entire bank seems to have cut out. Site above bridge/below Gold Creek. No 2012 data.
	10174311	10 ft	
	10174312	18 ft	
June 12, 2013	10174167	2 ft	6/12/13 – New anchor and buoy system deployed. 7/10/13 – System had moved into shallow water. Redeployed in deeper water. Downloads on 6/20, 7/10, 7/31, 8/27, and 9/18. 9/18/13 – Removed system and replaced with overwinter set up.
	10174168	9 ft	
	10174170	16 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	Pipe mounting infrastructure is absent at this site due to the lack of good bracket mounting location.
Overwinter Installation			
2012	--	--	No overwinter system installed. No 2012 data.
Sept. 18, 2013	10174170	--	Installed overwinter system.

Photo A-20b. Buoy at PRM 140.1 – Gold Creek

Photo A-19c. Downloading Tibit thermistor with ONSET data shuttle

1.21 PRM 141.0 – Slough 16B

Figure A-21a. Map of Site 141.0 – Slough 16B (NAD 83 Coordinates: 62.780204° N, -149.68536° W)

Table A-21. Installation and Download Notes – PRM 141.0 – Slough 16B

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
August 28, 2012	10174307	2 ft	8/28/12 – The buoy system is anchored to shore with 18 ft of cable near the proposed location. The buoy is located 30 ft from the LB, along eddy fence in approx. 7 ft of water. 9/27/12 – System intact, entirely out of water. Anchor tree almost pulled out. Thermistors downloaded and redeployed. 10/22/12 – Buoy system intact but completely out of water. System retrieved and downloaded. Not redeployed due to excessive ice cover.
	10174308	9 ft	
	10174309	16 ft	
June 12, 2013	10174307	2 ft	6/12/13 – Site location was moved to just upstream from river mouth and deployed. Data gap from 10/22/12 to 6/12/13. Downloads on 6/20, 7/10, 7/31, 8/27, and 9/18/13. 9/18/13 – Removed system and replaces with overwinter set up.
	10174308	9 ft	
	10174309	16 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	Pipe mounting infrastructure is absent at this site due to the lack of good bracket mounting location.
Overwinter Installation			
2012	--	--	No winter system installed.
Sept 18, 2013	10174309	--	Overwinter system installed

Photo A-21b. Buoy at PRM 141.0

Photo A-21c. Assembly of typical buoy string

1.22 RM 142.2 – Indian River

Figure A-22a. Map of Site 142.2 – Indian River (NAD 83 Coordinates: 62.78635° N, -149.65878° W)

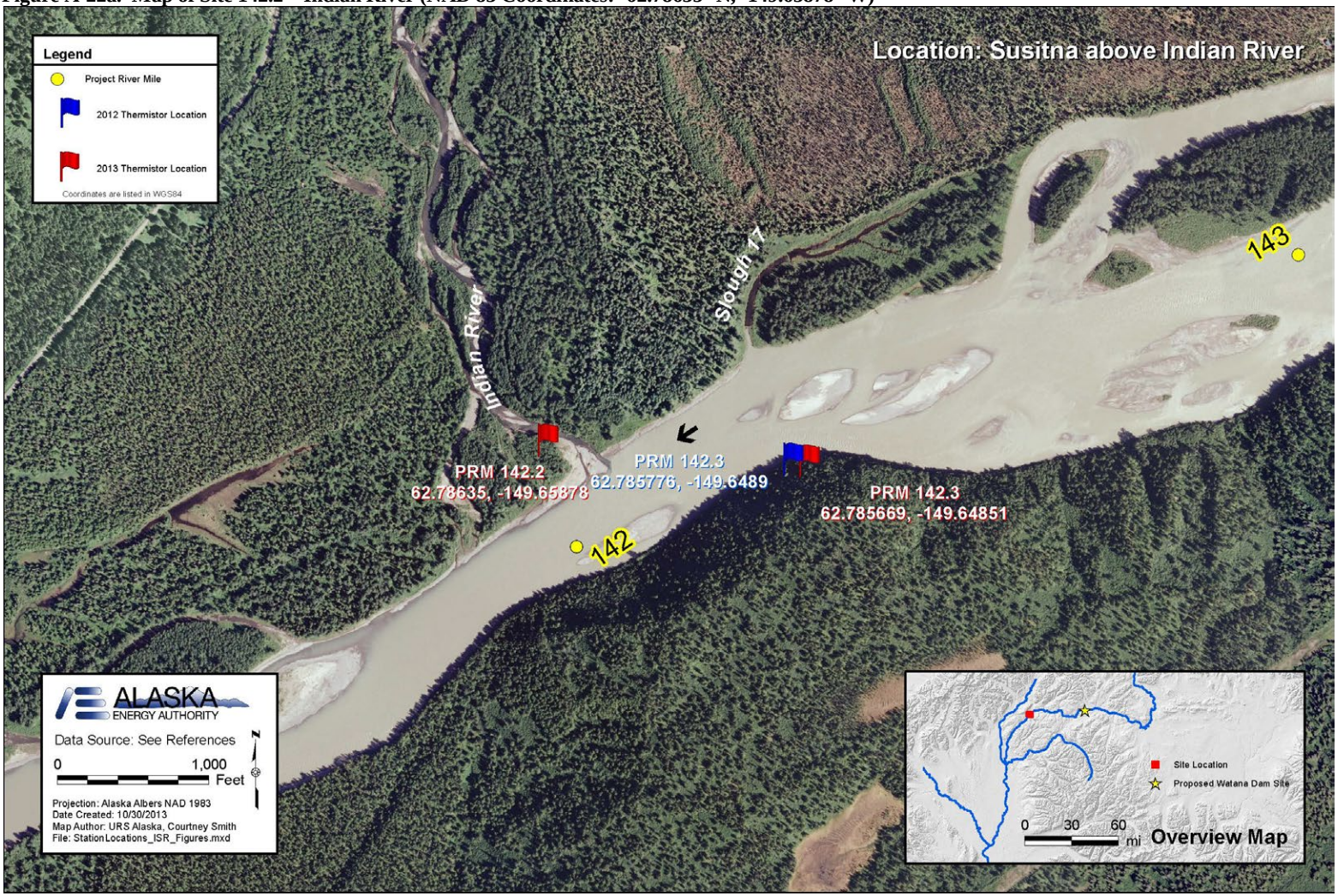

Table A-22. Installation and Download Notes – RM 142.2 – Indian River

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
2012	--	--	A buoy was not deployed at the proposed location due to shallow water levels and boat inaccessibility. No 2012 data.
June 11, 2013	10174316	2 ft	6/11/13 – Site location was moved to just upstream from river mouth and anchor and buoy system was deployed. Downloads occurred on 6/20, 7/10, 7/31, 8/27, and 9/18/13. 9/18/13 – Removed system and replaced with overwinter system.
	10174315	4 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	A pipe system was not deployed at this location due to boat inaccessibility and shallow water levels.
Overwinter Installation			
Sept. 18, 2013	10174315		Installed overwinter system.

Photo A-22b. Deploying anchor-buoy at PRM 142.2 – Indian River

Photo A-22b. Deployed anchor-buoy at PRM 142.2 – Indian River

1.23 PRM 142.3 – Susitna above Indian River

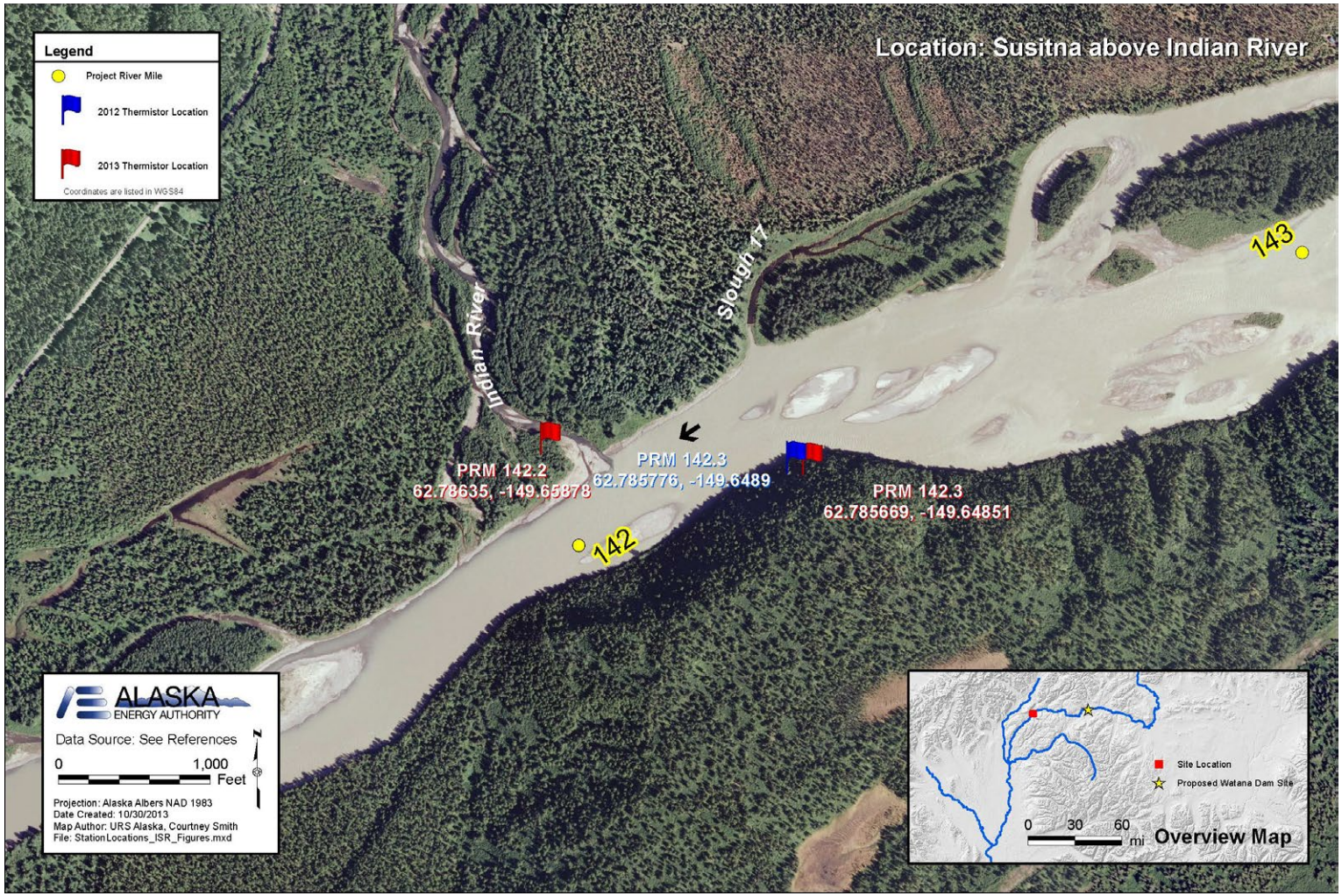

Figure A-23a. Map of Site 142.3 – Susitna above Indian River (NAD 83 Coordinates: 62.785776° N, -149.6489° W)

Table A-23. Installation and Download Notes – PRM 142.3 – Susitna above Indian River

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy			
July 23, 2012	10174225	2 ft	7/23/12 – The buoy is deployed at the proposed location, 30 ft from the LB, along eddy fence in approximately 6 ft of water. 8/28/12 – Downloaded both buoy and pipe systems 9/27/12 – Buoy missing but replaced. One thermistor (227) was missing and not replaced – no data after 8/28/12. Both systems downloaded. 10/22/12 – Downloaded and removed initial buoy string with multiple data loggers.
	10174224	7 ft	
	10174227	12 ft	
June 30, 2013	10174231	2 ft	6/11/13 – Could not pull overwinter system deployed in 2012. No new system deployed. 6/30/13 – Removed overwinter system and replaced with new anchor – buoy system. 9/18/13 – Removed anchor-buoy system and replaced with overwinter set up.
	10174313	6 ft	
	10174225	10 ft	
Bank-Mounted Pipe Installation			
July 23, 2012	10174226	9.5 ft	The 14 ft housing pipe with 10 ft of cable and single thermistor. 10/23/12 – Pipe was high and dry and tidbit cable was frozen in pipe and could not be removed, no download. 6/20/13 – Pipe thermistor downloaded. 6/24/13 – Pipe system located but could not be opened for download. Additional downloads occurred on 7/10, 7/31, 8/27, and 9/18/13. 9/18/13 – Pulled and down loaded thermistor. Pipe silted in – could not redeploy thermistor for winter.
Overwinter Installation			
Oct. 23, 2012	10174225	--	Installed overwinter system. 6/11/13 – Could not pull overwinter system. 6/24/13 – Overwinter system recovered and redeployed temporarily during water sampling operations. 6/30/13 – Removed overwinter system and replaced with buoy string.
Sept. 18, 2013	10174225	--	Installed overwinter system.

Photo A-23b. Buoy and pipe systems at PRM 142.3 – Susitna above Indian Creek

Photo A-23c. PRM 142.3 – Pipe mounted system at Susitna above Indian Creek

1.24 PRM 143.6 – Slough 19

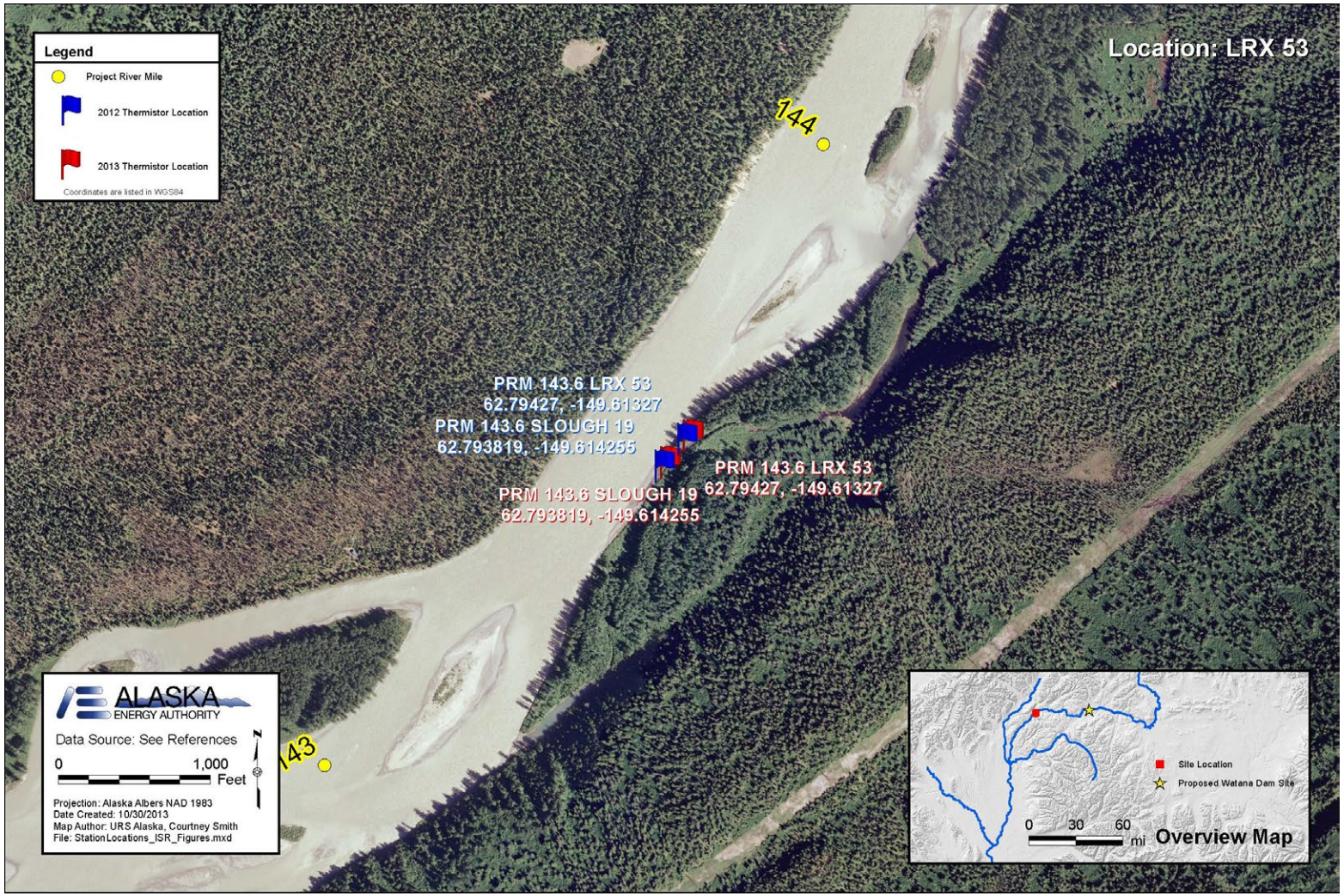

Figure A-24a. Map of Site 143.6 – Slough 19 (NAD 83 Coordinates: 62.793819° N, -149. 614255° W)

Table A-24. Installation and Download Notes – PRM 143.6 – Slough 19

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 23, 2012	10174190	2 ft	7/23/12 – The buoy is deployed at the proposed location off the left bank of the slough, 20 ft from the LB, in shallow water. The slough is quite shallow, so only a buoy and anchor system was deployed. The safety cable was anchored to a large rock. 8/27/12 – System downloaded and re-deployed. 9/27/12 – System intact but had moved into shallow water. System downloaded and redeployed. 10/22/12 – System intact but dry and encased in ice. System was downloaded and removed from the river.
	10174288	4 ft	
	10174189	6 ft	
June 11, 2013	10174190	2 ft	6/11/13 – Data gap from 10/22/12 to 6/11/13. Deployed new system at previous location. Downloads occurred on 7/10, 7/31, 8/27, and 9/18/13. 9/18/13 – Removed anchor-buoy system and replaced with overwinter set up.
	10174288	1 ft	
	10174317	3 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	Pipe mounting infrastructure is absent. Water level is very shallow requiring a substantial length of housing to be required.
Overwinter Installation			
2012	--	--	No winter system deployed.
Sept. 18, 2013	10174288	--	Installed overwinter system.

Photo A-24a. Anchor point for 2012 buoy system at PRM 143.6 – Slough 19

Photo A-24c. 2013 deployment location for buoy system at PRM 143.6 – Slough 19

1.25 PRM 143.6 – LRX53

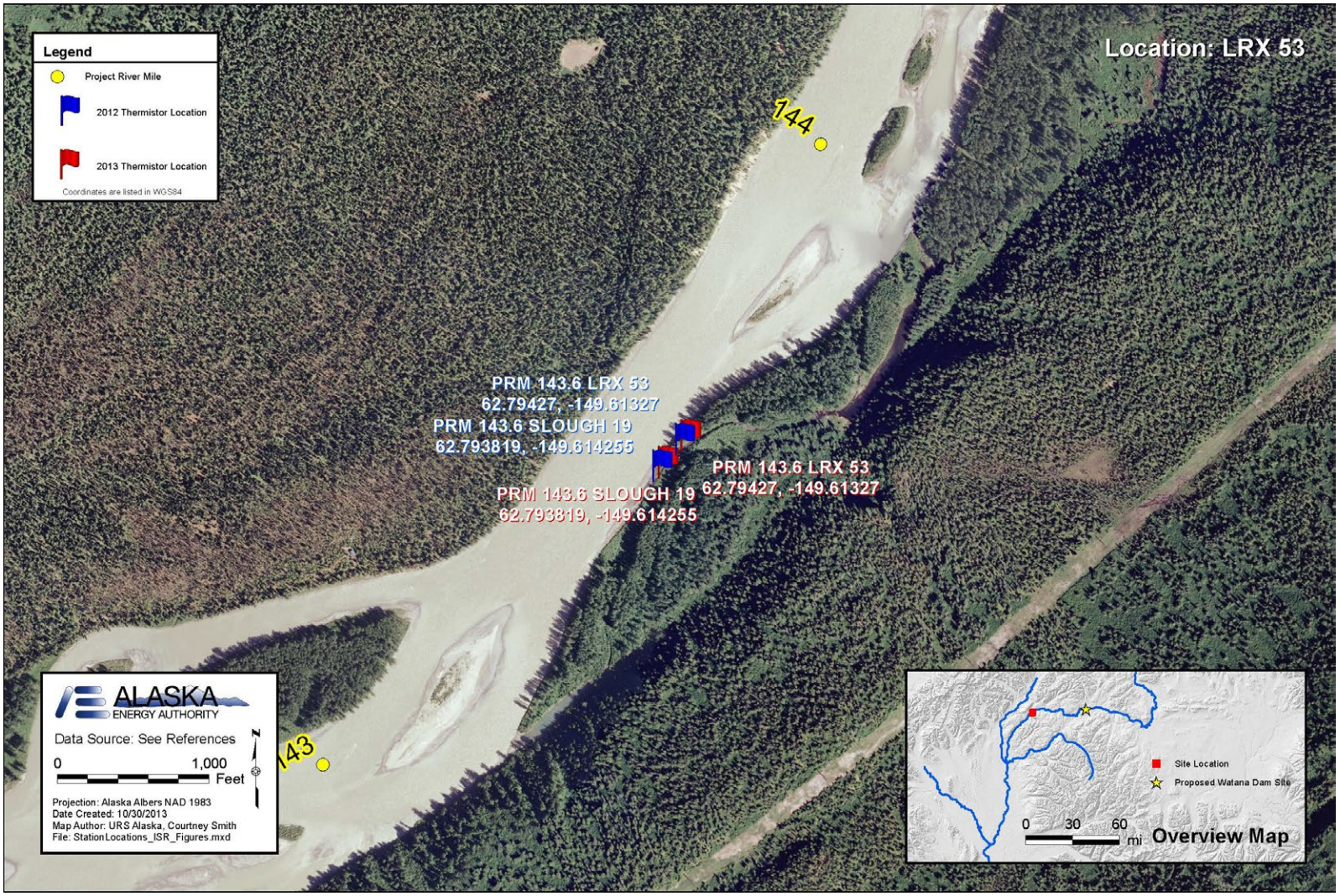

Figure A-25a. Map of Site 143.6 – LRX53 (NAD 83 Coordinates: 62.79427° N, -149.61327° W)

Table A-25. Installation and Download Notes – PRM 143.6 – LRX53

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 23, 2012	10174282	2 ft	7/23/12 – The buoy is deployed at the proposed location, 75 ft from the LB, along eddy fence in approximately 9 ft of water. The immediate bank is a highly unstable cut bank. 8/27/12 – Buoy missing but was found downstream and reattached. System was downloaded and redeployed. 9/27/12 – System was found high and dry on river bank. System downloaded and redeployed. 10/22/12 – System intact but found to be in shallow water. Downloaded and removed initial buoy string with multiple data loggers.
	10174283	8 ft	
	10174191	14 ft	
June 11, 2013	10174283	3 ft	6/11/13 – Overwinter system deployed in 2012 and 20 ft of river bank is gone. Data gap from 10/22/12 to 6/11/13. Deployed new system. Downloads on 7/10, 7/31, 8/27, and 9/18/13. 9/18/13 – Removed anchor-buoy system and replaced with overwinter set up.
	10174318	8 ft	
	10174320	15 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	Pipe mounting infrastructure is absent at this site due to highly unstable cut banks. A pipe was not mounted here since there were no rocks or downed trees near the river to fasten to, and to prevent equipment loss.
Overwinter Installation			
Oct. 22, 2012	10174191	--	10/22/12 – Installed overwinter system. 6/11/13 – System lost due to ice scour.
Sept. 18, 2013	10174318	--	Installed overwinter system.

Photo A-25b. Buoy system at PRM 143.6 – LRX53

Photo A-25c. Attaching thermistor string to buoy system anchor

1.26 PRM 145.6 – Slough 21

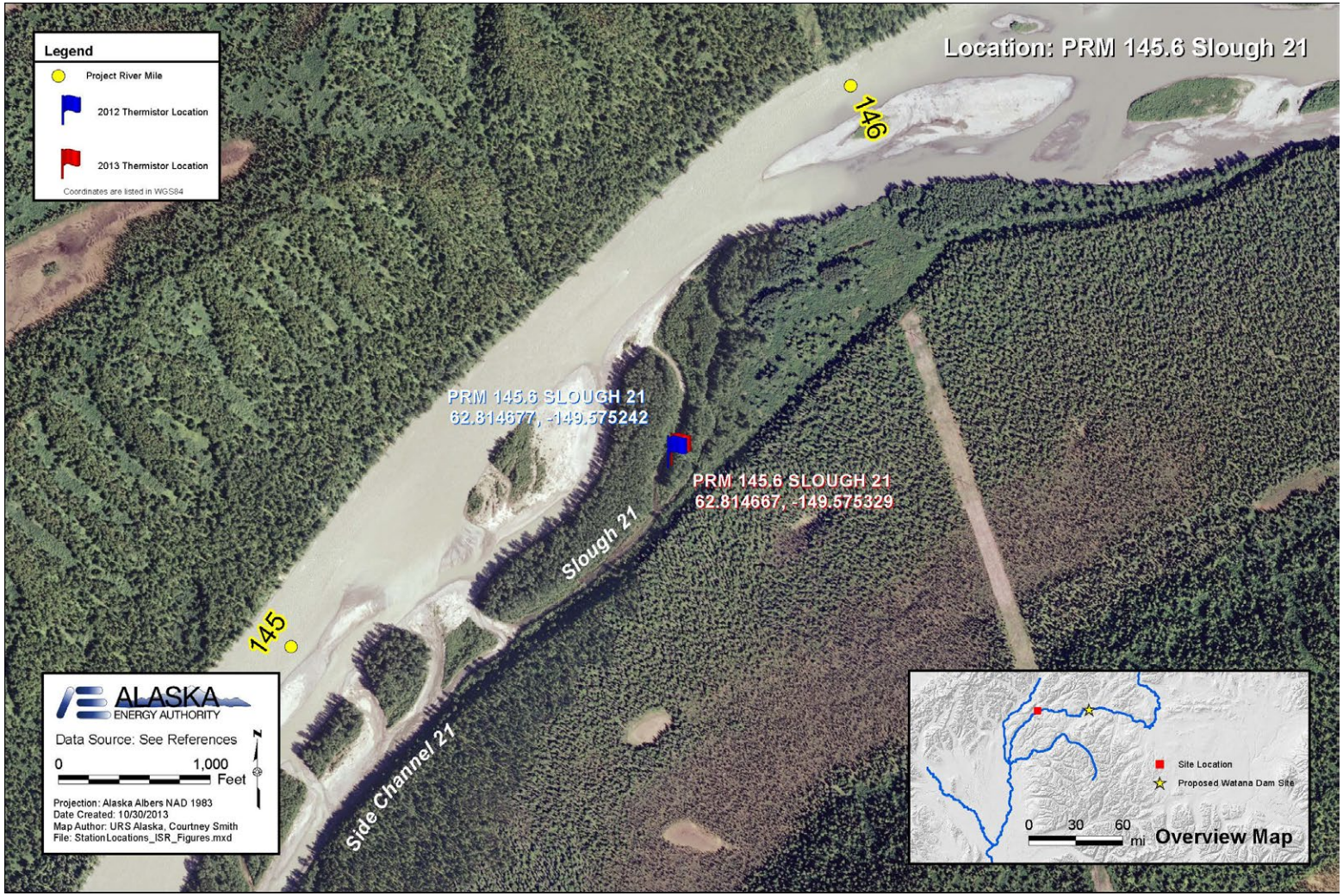

Figure A-26a. Map of Site 145.6 – Slough 21 (NAD 83 Coordinates: 62.814667° N, -149.575329° W)

Table A-26. Installation and Download Notes – PRM 145.6 – Slough 21

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
August 28, 2012	10174302	1.5 ft	8/28/12 – A thermistor and anchor with no buoy or anchor line attached was deployed at this site. The site was moved 400 ft past the proposed site which was a dry river channel. This is a still water slough with a depth of 2 ft and a beaver dam at the south end. 9/27/12 – Slight water flow. Thermistor downloaded. 10/22/12 – System present and in approx. 2 feet of water. Downloaded and redeployed.
June 11, 2013	10174319	1.5 ft	6/11/13 – System deployed in 2012 could not be located. Deployed new system with downloads on 7/10, 7/31, 8/27 and 9/18/13. 7/10/13 – System deployed in 2012 located, downloaded and removed from the site. (No data gap) 9/18/13 – Thermistor downloaded and placed in overwinter set-up.
Bank-Mounted Pipe Installation			
Not Installed			A pipe was not deployed at this site because the slough was shallow with still water, which will quickly freeze solid in the winter, and lacked bank-mounting structure.
Overwinter Installation			
Sept. 22, 2012	10174302	2 ft	Original system was left in place.
Sept. 18, 2013	10174319	1.5 ft	Thermistor placed in overwinter set-up and redeployed.

Photo A-26b. Buoy installation site at PRM 145.6 – Slough 21

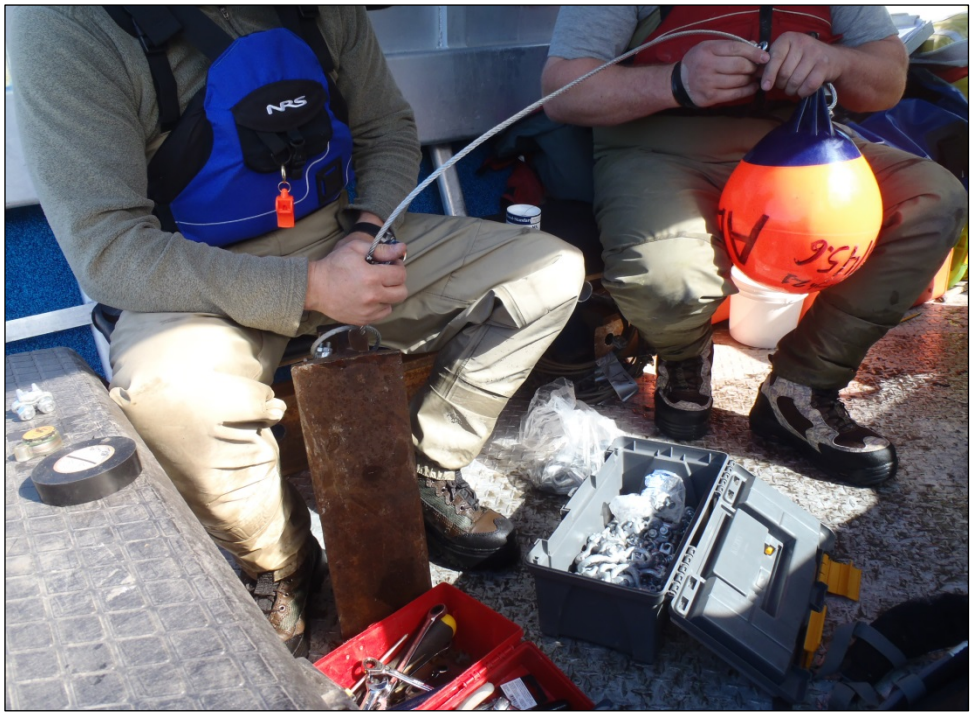

Photo A-26c. Assembly of buoy system installed at PRM 145.6 – Slough 21

1.27 PRM 152.2 – Susitna below Portage Creek

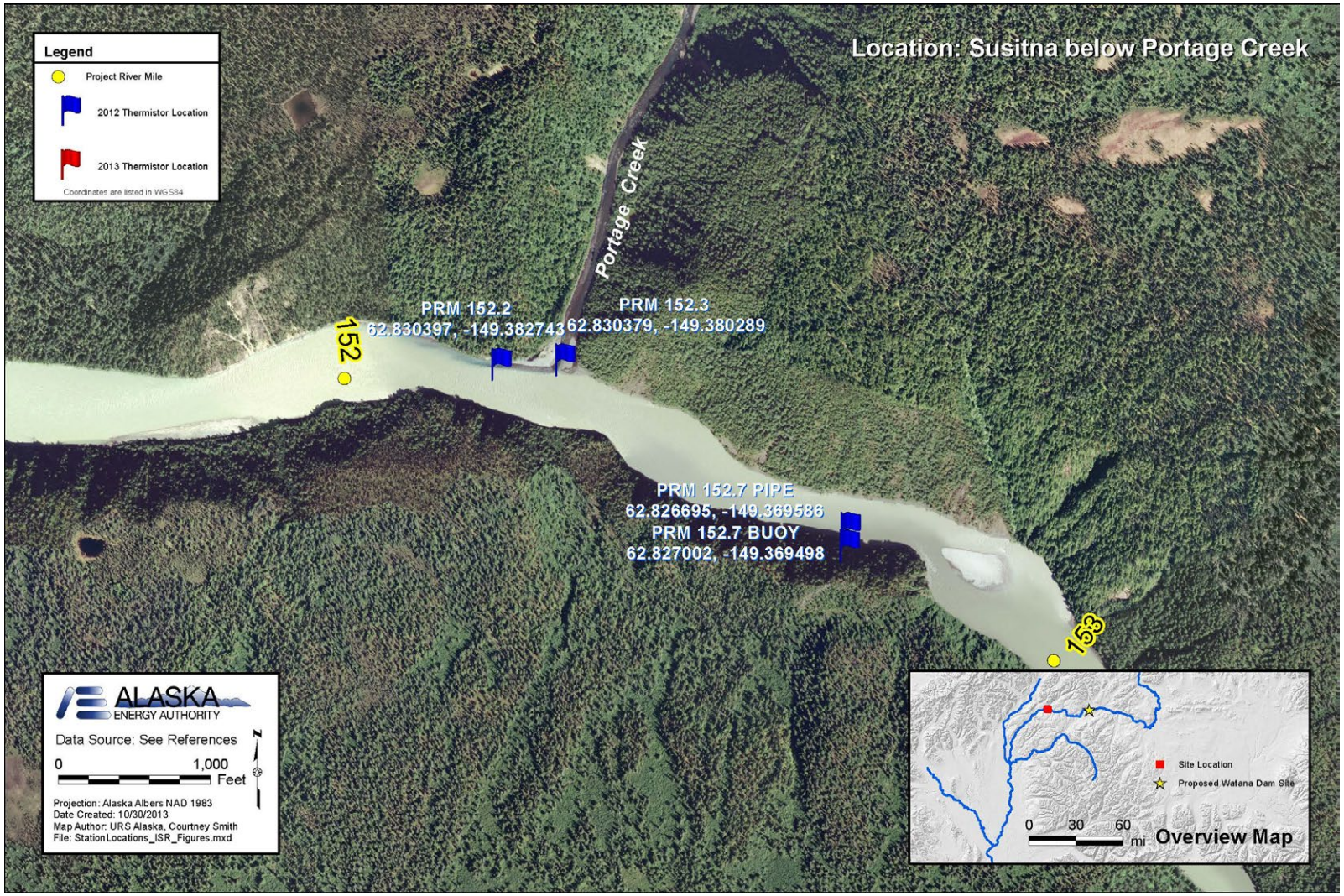

Figure A-27a. Map of Site 152.2 – Susitna below Portage Creek (NAD 83 Coordinates: 62.830397° N, -149.382743° W)

Table A-27. Installation and Download Notes – PRM 152.2 – Susitna below Portage Creek

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 24, 2012	10174164	2 ft	7/24/12 – The buoy is deployed at the proposed location below Portage Creek, 60 ft from the RB, along eddy fence in approximately 12 ft of water. 8/28/12 – System downloaded. Buoy moved to shore but still in water. 9/27/12 – System downloaded. October 22, 2012 – Buoy System present and in approx. 2 feet of water. Downloaded and removed system.
	10174163	11 ft	
	10174166	20 ft	
2013	No Data	--	Site could not be accessed during the 2013 field season due to land ownership access issues. Current status of equipment deployed in 2012 is unknown.
Bank-Mounted Pipe Installation			
July 24, 2012	10174165	16.5 ft	7/24/12 – The 17 ft housing pipe is fastened to a boulder located slightly upstream of the buoy. The pipe houses 16.5 ft of cable with a thermistor attached by zip ties to a loop at the end. 8/28/12 – Pipe downloaded. Hard to pull cable, cable clamps removed and tidbits reattached with wire. 9/27/12 – Pipe buried in 7 ft of gravel/silt. No pipe data after 9/27/12. 10/22/12 – Internal cable is frozen in and cannot be removed for download. Leave system in place.
2013	--	--	Site could not be accessed during the 2013 field season due to land ownership access issues. Current status of equipment deployed in 2012 is unknown.
Overwinter Installation			
2012	--	--	No winter system deployed due to shallow and icy river conditions.

Photo A-27b. Buoy and pipe systems at PRM 152.2 – Susitna below Portage Creek

Photo A-27c. Pipe system at PRM 152.2 – Susitna below Portage Creek

1.28 PRM 152.3 – Portage Creek

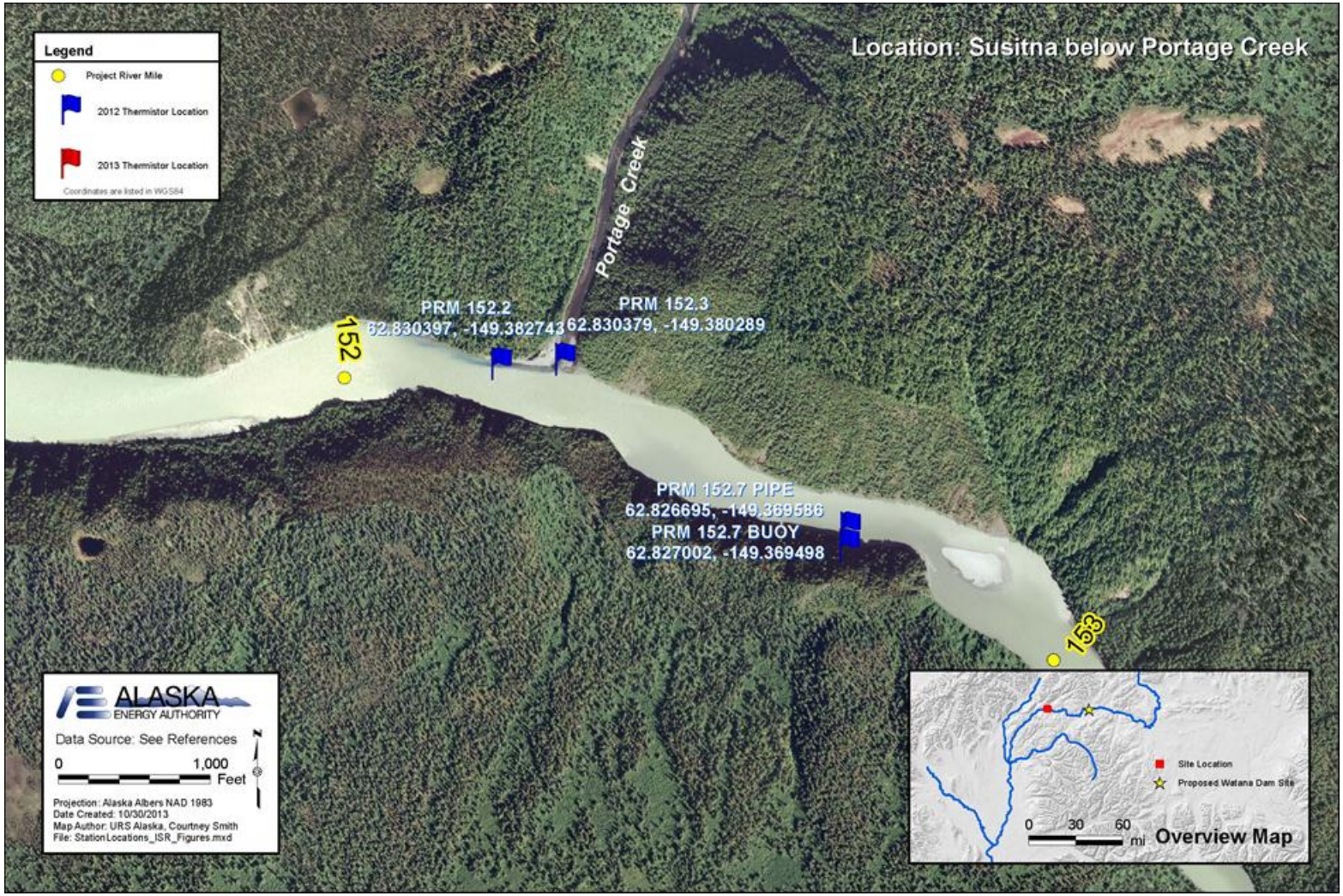

Figure A-28a. Map of Site 152.3 – Portage Creek (NAD 83 Coordinates: 62.830379° N, -149.380289° W)

Table A-28. Installation and Download Notes – PRM 152.3 – Portage Creek

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
August 28, 2012	10174301	2 ft	8/28/12 – A single thermistor is attached to 2 ft of cable and deployed at the proposed location in Portage Creek without a buoy. The system is positioned in a deep hole and anchored to a nearby boulder. 9/27/12 – Creek channel changed and overtook anchor rock. Successful download and redeploy. 10/22/12 – System intact, shallow water, download and redeploy.
2013	No Data	--	Site could not be accessed during the 2013 field season due to land ownership access issues. Current status of equipment deployed in 2012 is unknown.
Bank-Mounted Pipe Installation			
Not Installed	--	--	A pipe system was not installed at this site due to the shallowness of Portage Creek and the lack of anchor points.
Overwinter Installation			
2012	--	--	No winter system deployed due to shallow and icy river conditions.

Photo A-28b. Buoy installation at PRM 152.3 – Portage Creek

1.29 PRM 152.7 – Above Portage Creek

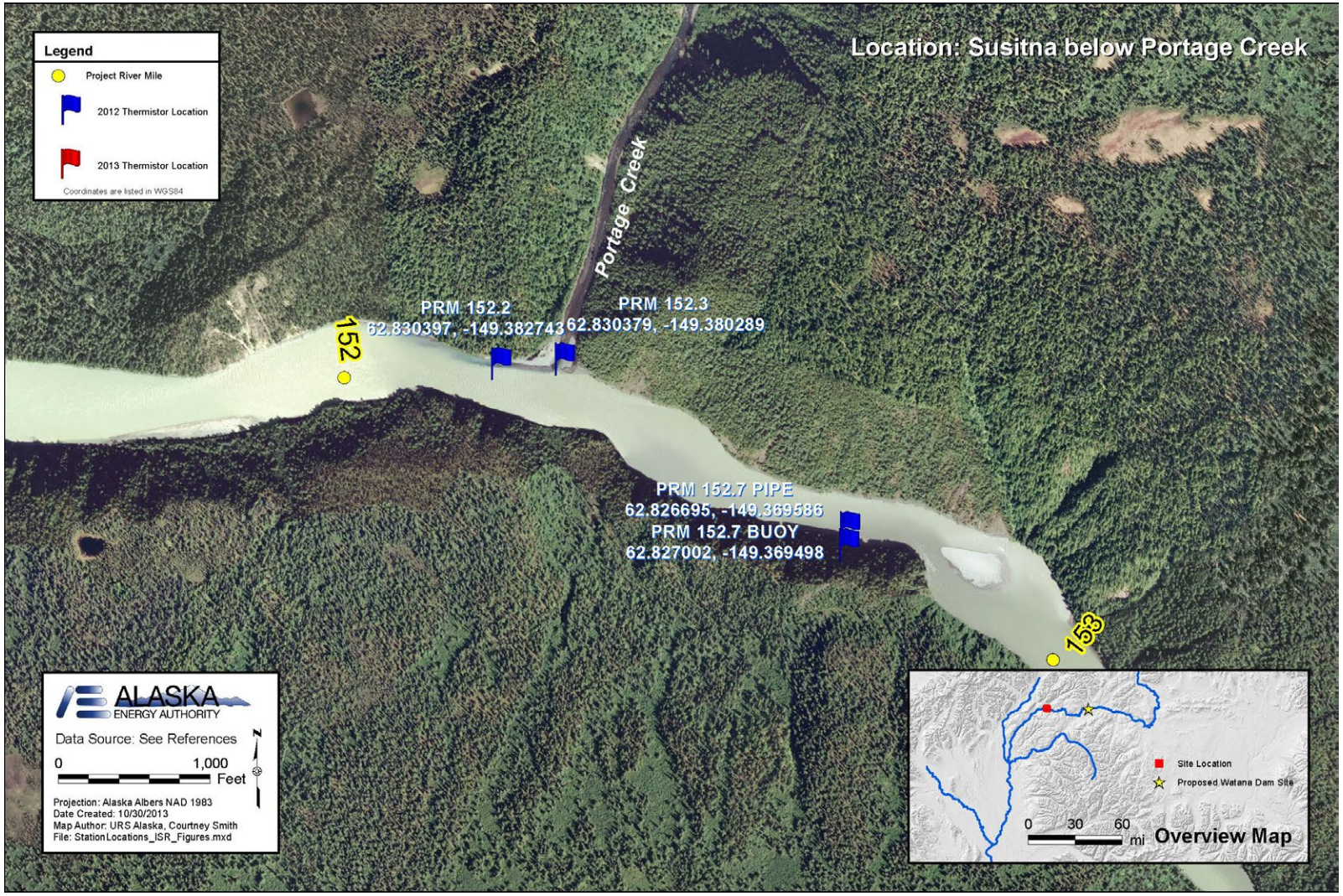

Figure A-29a. Map of Site 152.7 – Above Portage Creek (NAD 83 Coordinates: 62.827002° N, -149.827002° W)

Table A-29. Installation and Download Notes – PRM 152.7 – Above Portage Creek

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
July 24, 2012	10174192	2 ft	7/24/12 – The buoy is deployed at the proposed location near the mouth of Portage Creek, 50 ft from the LB, along eddy fence in approximately 10 ft of water. The system is anchored to a boulder on shore. 8/28/12 – Buoy missing and replaced. System downloaded. 9/27/12 – Downloaded system. No data after this date. 10/22/12 – Helicopter flyby. Pipe system was visible but appeared to be dry. Buoy system was not visible.
	10174193	10 ft	
	10174194	18 ft	
2013	No Data	--	Site could not be accessed during the 2013 field season due to land ownership access issues. Current status of equipment deployed in 2012 is unknown.
Bank-Mounted Pipe Installation			
July 24, 2012	10174169	13 ft	7/24/12 – The 14 ft housing pipe is fastened to a rock slightly upstream of the buoy. The pipe houses 13 ft of cable with 3 thermistors. 8/28/12 – Download thermistors and re-assemble thermistor string; replace thermistor 278 with thermistor 168 (never successfully downloaded 168). 9/27/12 – Download thermistors.
	10174271	9 ft	
	10174278	5 ft	
	10174168	5 ft	
Overwinter Installation			
Not Installed	--	--	No overwinter system was installed at this site.

Photo A-29b. Buoy location at PRM 152.7 – Above Portage Creek

Photo A-29c. Pipe installation at PRM 152.7 – Above Portage Creek

1.30 PRM 168.1 – Susitna

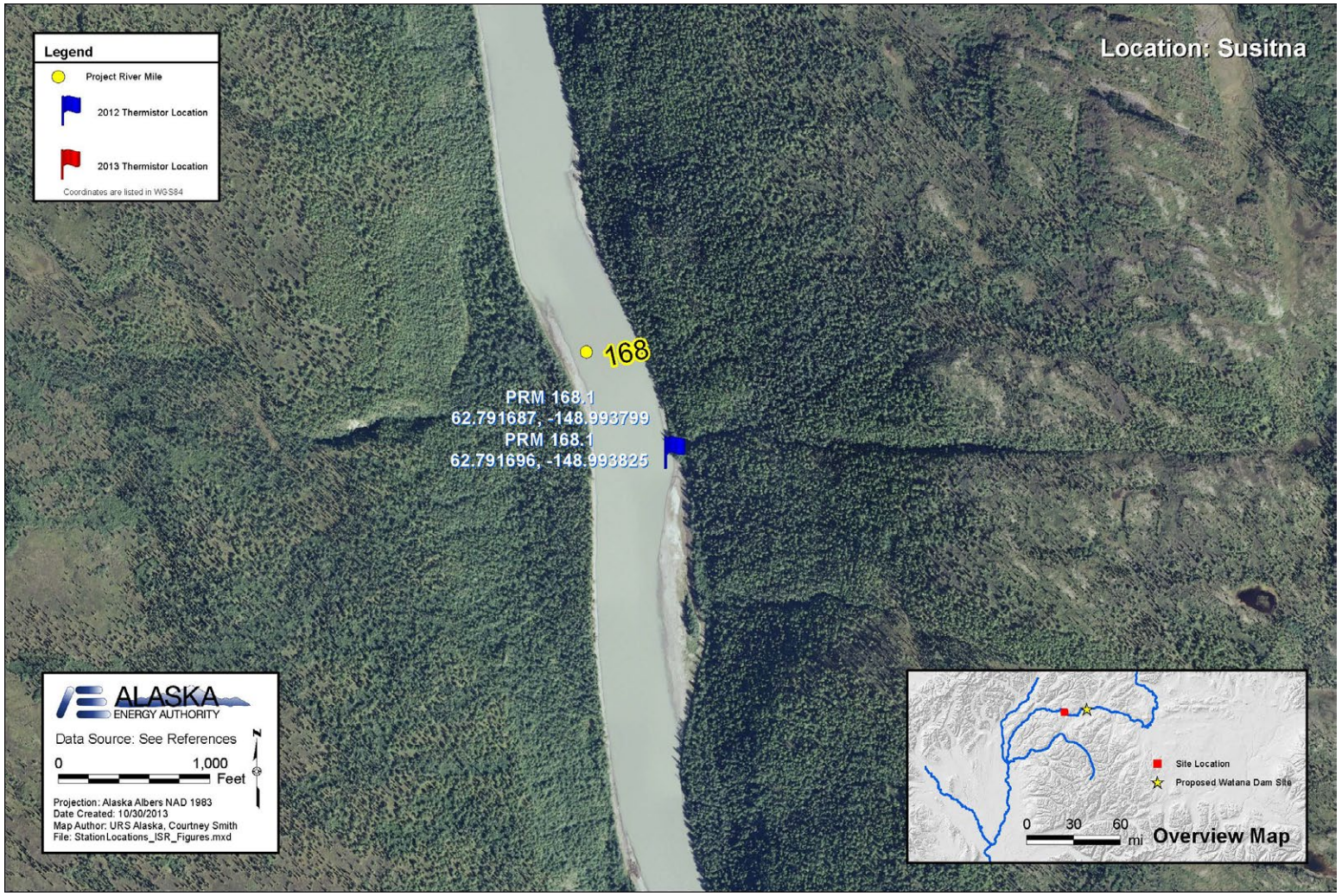

Figure A-30a. Map of Site 168.1 – Proposed Location – Susitna (NAD 83 Coordinates: 62.791696° N, -148. 993825° W)

Table A-30. Installation and Download Notes – PRM 168.1 – Susitna

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
2012	--	--	No anchor-buoy system due to lack of helicopter landing zones.
2013	--	--	Site could not be visited due to land ownership access issues.
Bank-Mounted Pipe Installation			
Not Installed	--	--	No anchor-buoy system due to lack of helicopter landing zones.
Overwinter Installation			
Sept 26, 2012	10174**291**	--	Overwinter system only installed in 6 ft of water. System has not been downloaded since installed. No Data.
2013	--	--	Site could not be visited due to land ownership access issues.

Photo A-30b. Overwinter system being deployed at PRM 168.1

Photo A-30c. Installing thermistor in overwinter system.

1.31 PRM 183.1 – Susitna below Tsusena Creek

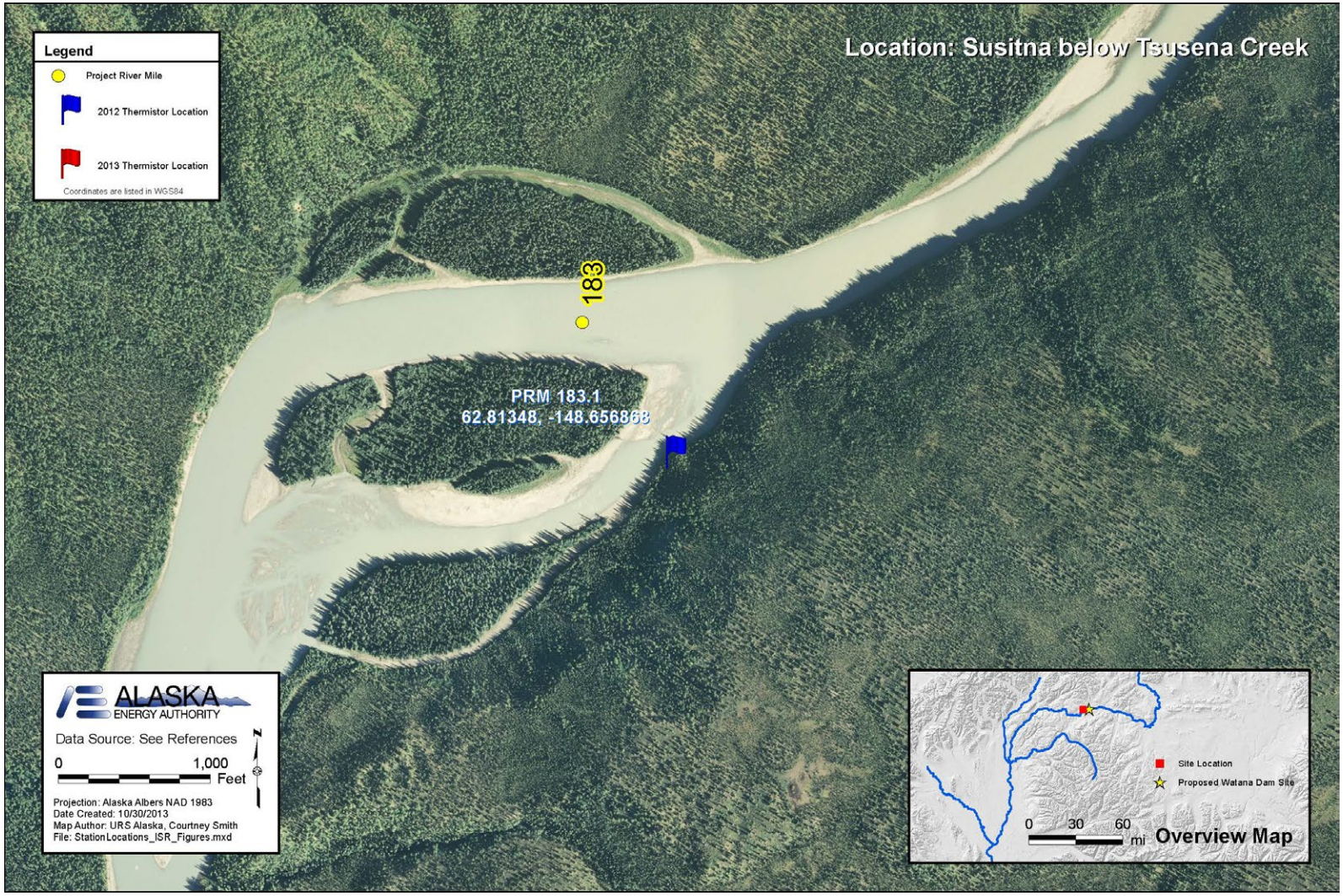

Figure A-31a. Map of PRM 183.1 – Susitna below Tsusena Creek (NAD 83 Coordinates: 62.81348° N, -148.656868° W)

Table A-31. Installation and Download Notes – PRM 183.1 – Susitna below Tsusena Creek

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
August 29, 2012	10174286	2 ft	8/29/12 – Three thermistors attached to an 8 ft buoy cable with wire and cable clamps were deployed at this location. The system was deployed in an 8 ft deep back eddy. 9/25/12 – System intact. Downloaded and removed initial buoy string with multiple data loggers. Redeploy lower thermistor on overwinter set-up.
	10174285	4 ft	
	10174284	6 ft	
2013	--	--	Site could not be visited due to land ownership access issues.
Bank-Mounted Pipe Installation			
Not Installed	--	--	Pipe mounting infrastructure is absent at this site due to deep water and inability to safely mount a pipe.
Overwinter Installation			
Sept. 25, 2012	10174284	--	Installed overwinter system. No Data.
2013	--	--	Site could not be visited due to land ownership access issues.

Photo A-31b. Buoy at PRM 183.1 – Susitna below Tsusena Creek

Photo A-31c. Buoy at PRM 183.1 – Susitna below Tsusena Creek

1.32 PRM 184.8 – Tsusena Creek

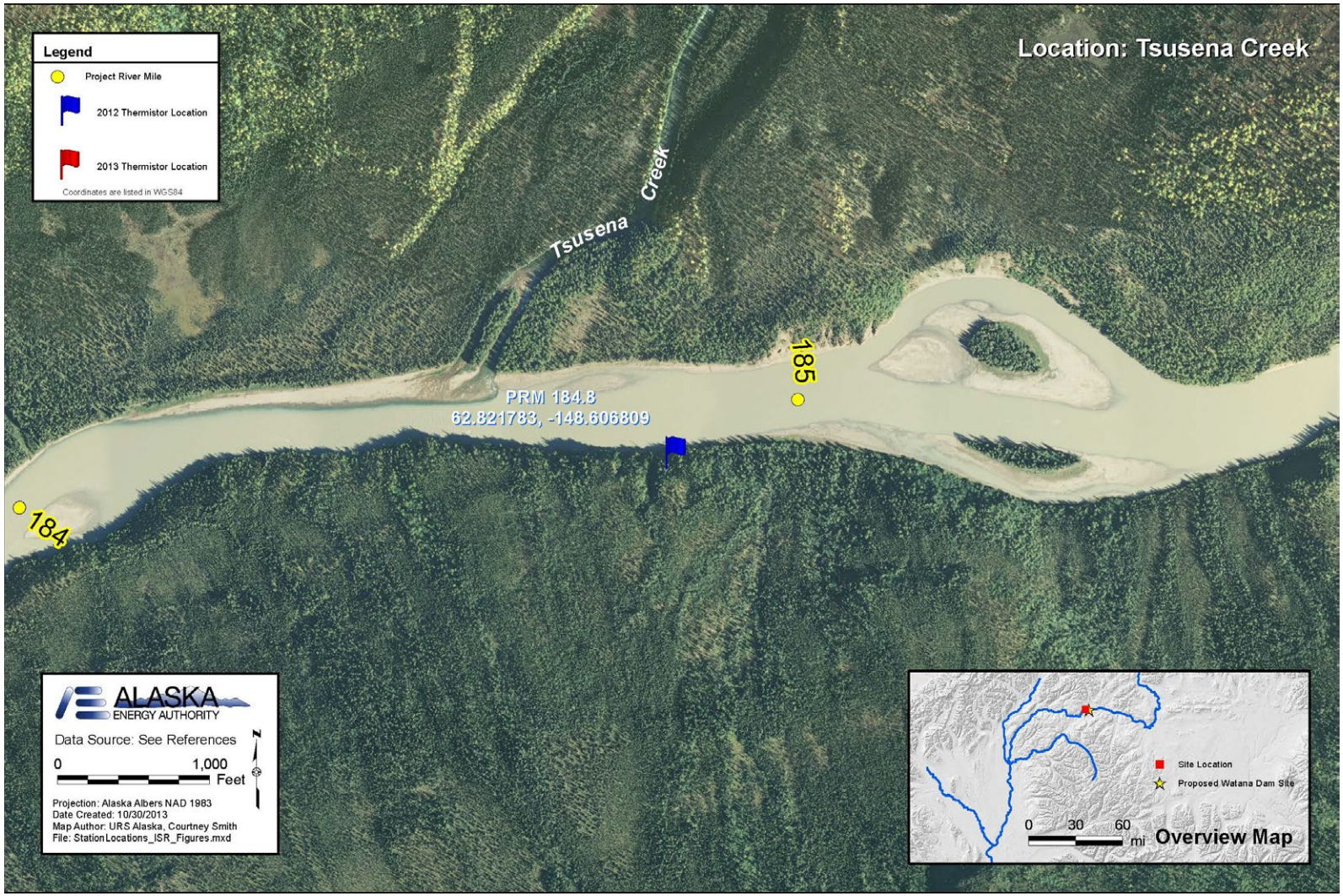

Figure A-32a. Map of Site 184.8 – Tsusena Creek (NAD 83 Coordinates: 62.821783° N, -148.606809° W)

Table A-32. Installation and Download Notes – PRM 184.8 – Tsusena Creek

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
Not Installed	--	--	No installation due to the lack of helicopter landing zones in the site area during normal summer river conditions.
Bank-Mounted Pipe Installation			
Not Installed	--	--	Pipe mounting infrastructure is absent at this site due to highly unstable cut banks.
Overwinter Installation			
Sept. 26, 2012	10174290	--	Cable attached to birch tree. System has not been downloaded since install. No Data.
2013	No Data	--	Site could not be visited due to land ownership access issues.

Photo A-32b. Overwinter system prior to deployment at PRM 184.8 – Tsusena Creek

Photo A-32c. Attaching Tidbit temperature data recorder to thermistor string

1.33 PRM 187.2 – Susitna at Watana Dam Site

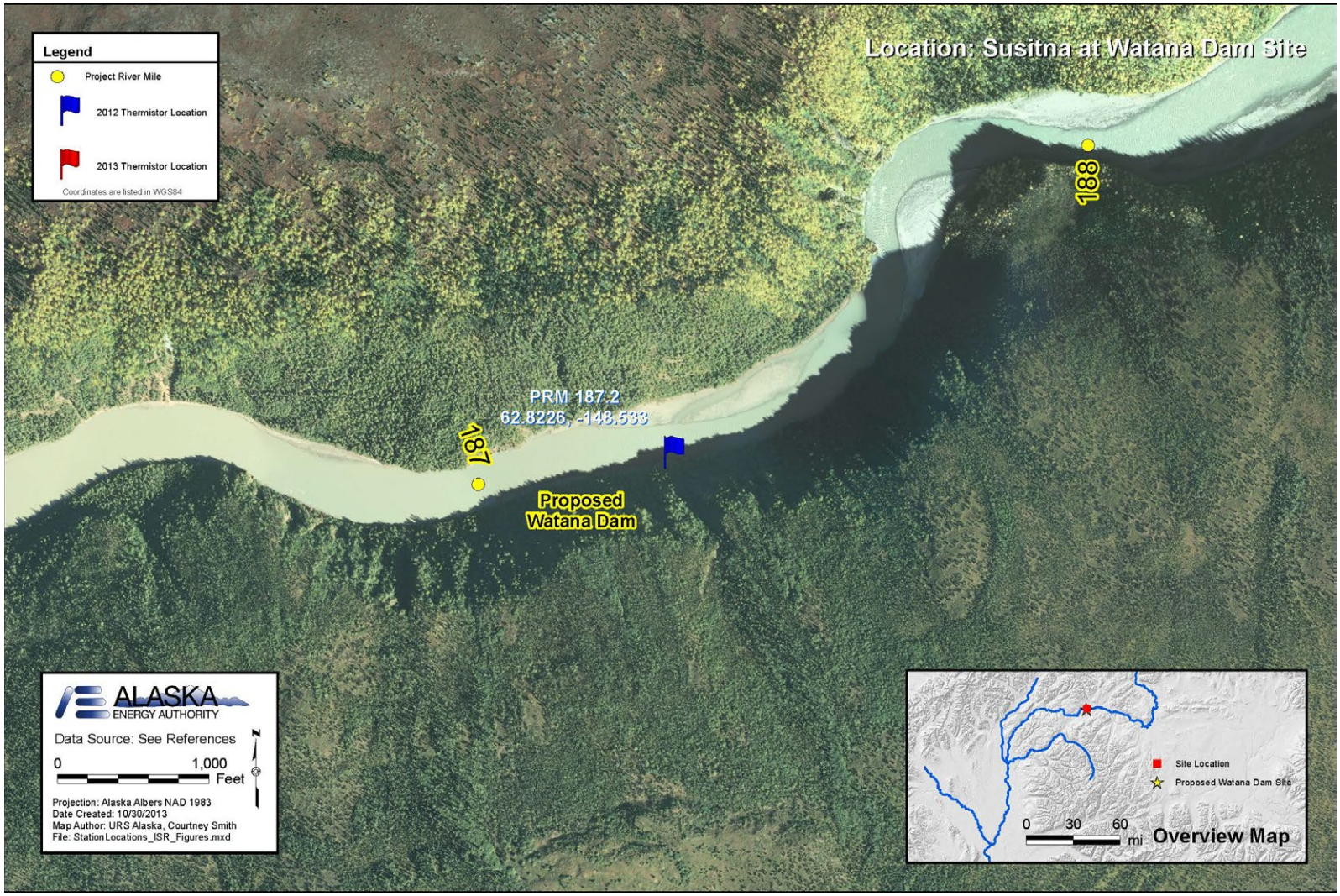

Figure A-33a. Map of Site 187.2 – Susitna at Watana Dam Site (NAD 83 Coordinates. 62.8226° N, -148.533° W)

Table A-33. Installation and Download Notes – PRM 187.2 – Susitna at Watana Dam Site

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
Not Installed	--	--	No installation due to the lack of helicopter landing zones in the site area during normal summer river conditions.
Bank-Mounted Pipe Installation			
Not Installed	--	--	Pipe mounting infrastructure is absent at this site due to highly unstable cut banks.
Overwinter Installation			
Sept. 26, 2012	10174289	--	System has not been downloaded since install. No Data.
2013	No Data	--	Site could not be visited due to land ownership access issues.

Photo A-33b. Preparing to deploy overwinter system at PRM 187.2 – Watana Dam Site

Photo A-33c. Overwinter system ready for deployment at PRM 187.2 – Watana Dam Site

1.34 PRM 196.8 – Watana Creek

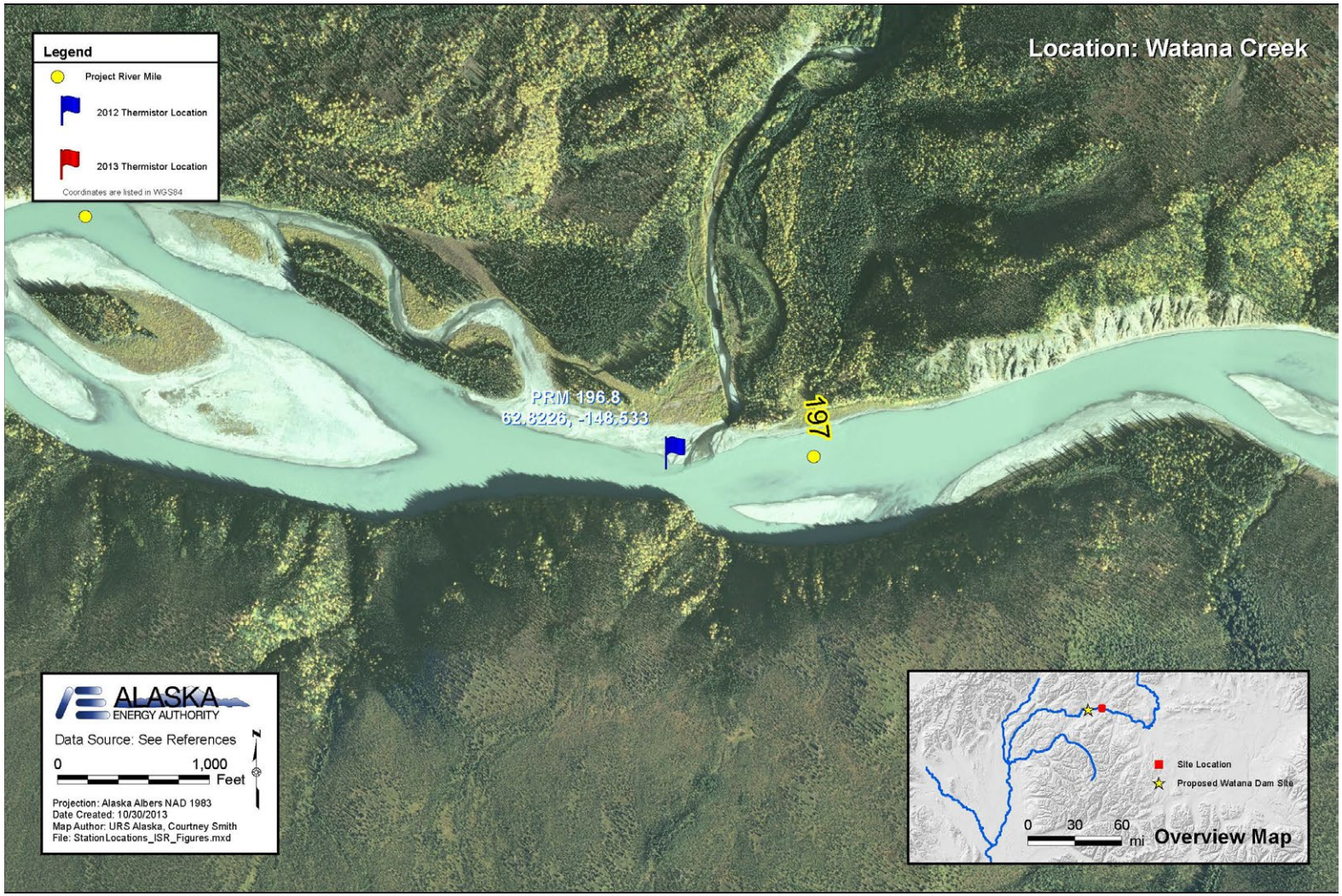

Figure A-34. Map of Site 196.8 – Watana Creek (NAD 83 Coordinates: 62.8296° N, -148.259° W)

Table A-34. Installation and Download Notes – PRM 196.8 – Watana Creek

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
2012	No Data	--	No system was deployed at this site. The site shown on the map at the mouth of the creek has an extremely wide gravel bar. If installed, the safety cable will be lost due to its length. The creek contains high amounts of fine sediment that have deposited at the mouth in the location marked for deployment. The water level at this point is extremely deep as well. If deployed the system would likely be silted in and irretrievable.
2013	No Data	--	No system installed at this site due to land ownership access issues.
Bank-Mounted Pipe Installation			
Not Installed	--	--	Pipe mounting infrastructure is absent at this site due to high amounts of silt and a gravel sand bar with no large objects for the pipe to be anchored. The large amounts of silt would cause the pipe to become silted in.
Overwinter Installation			
No overwinter system was installed at this site.			

1.35 PRM 209.2 – Kosina Creek

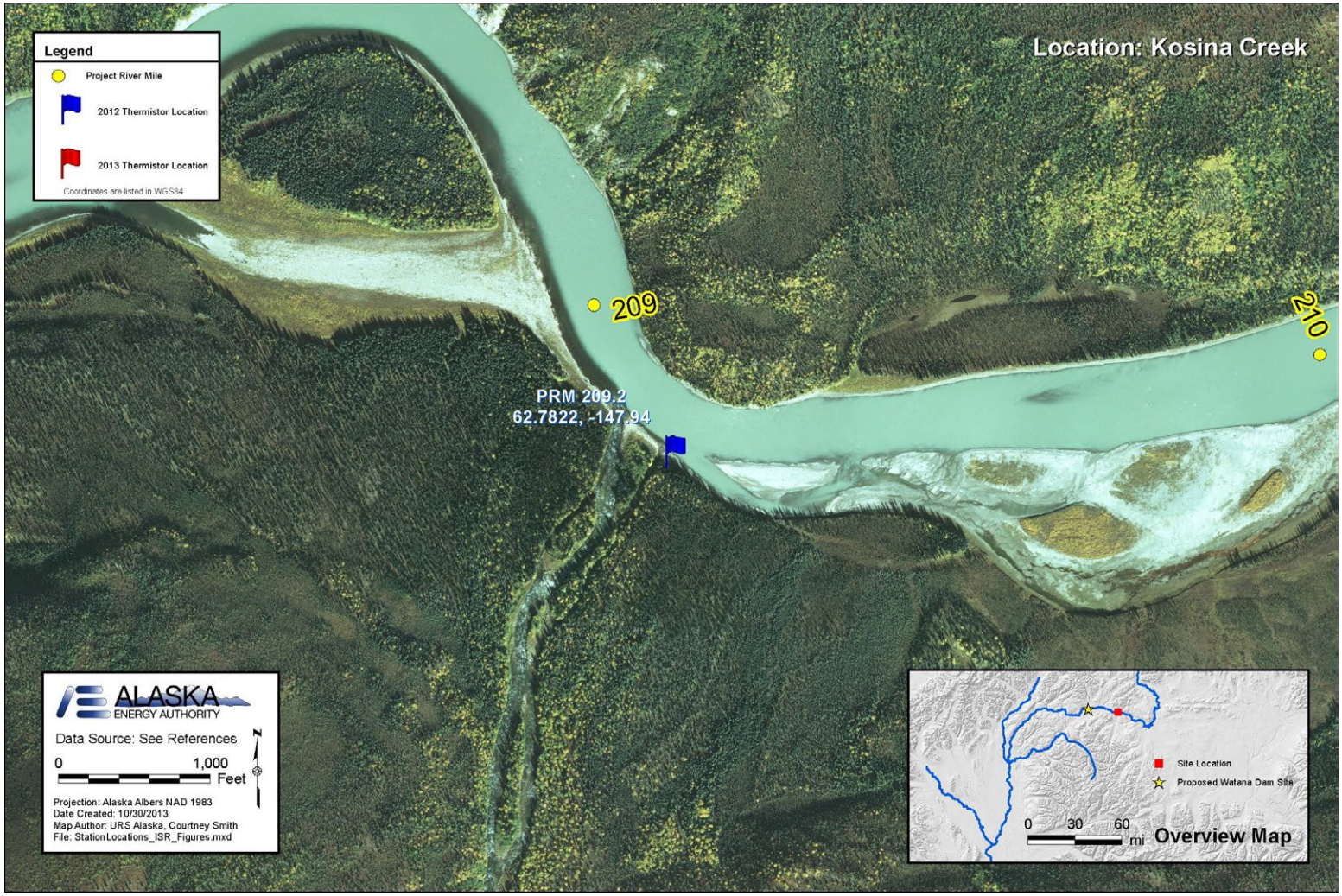

Figure A-35a. Map of Site 209.2 – Kosina Creek (NAD 83 Coordinates: 62.7822° N, -147.940° W)

TableA-35. Installation and Download Notes – PRM 209.2 – Kosina Creek

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
August 30, 2012	10174281	2 ft	8/30/12 – Deployed in the main river at upstream channel of creek at mapped location in 4 to 5 feet of water. 9/25/12 – Downloaded and removed initial buoy string with multiple data loggers.
	10174280	4 ft	
July 2, 2013	10356411	2 ft	No system installed at this site due to land ownership access issues. Additional downloads on 7/22, 8/31 and 9/20/13. 9/20/13 – Removed system for winter.
	10356412	6 ft	
	10356413	10 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	7/2/13 – Removed overwinter system and installed new anchor-buoy system.
Overwinter Installation			
Sept. 25, 2012	10174280	--	9/25/12 – Installed overwinter system. 7/2/13 – Recovered and removed overwinter system. Downloaded thermistor back at field office. Data logging stopped on 6/24/13 – data gap until 7/2/13 buoy deployment.
Sept. 20, 2013	10356413	--	Installed overwinter system.

Photo A-35b. Buoy location at PRM 209.2 – Kosina Creek

Photo A-35c. Overwinter system installed at PRM 209.2 – Kosina Creek

1.36 M 225.5 – Susitna near Cantwell

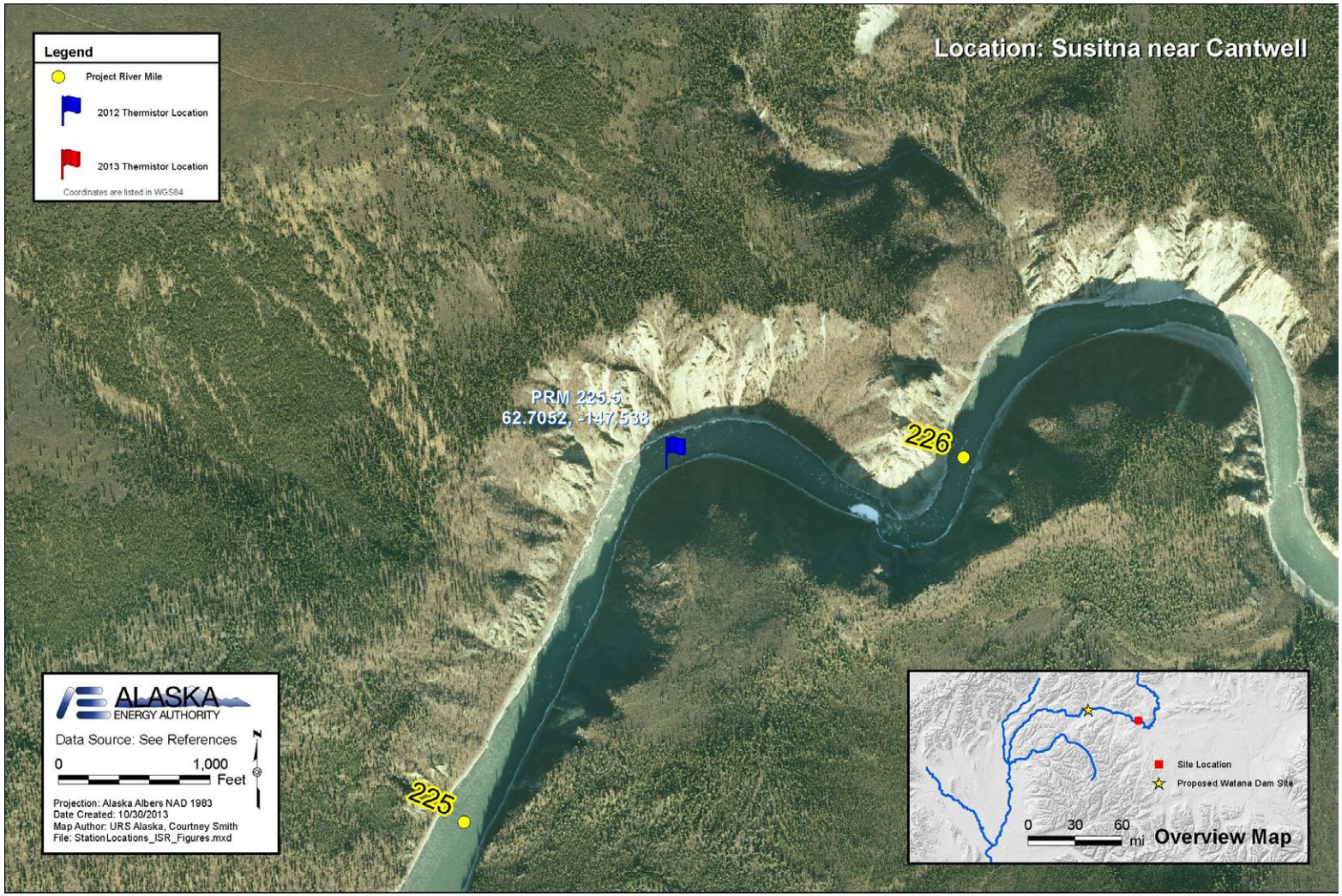

Figure A-36a. Map of Site 225.5 – Susitna near Cantwell (NAD 83 Coordinates: 62.7052° N, -147.538° W)

Table A-36. Installation and Download Notes – M 225.5 – Susitna near Cantwell

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
Not Installed	--	--	No installation at this site due to the lack of helicopter landing zones.
Bank-Mounted Pipe Installation			
Not Installed	--	--	No installation at this site due to the lack of helicopter landing zones.
Overwinter Installation			
Not Installed	--	--	No installation at this site due to the lack of helicopter landing zones.

1.37 PRM 235.2 – Oshetna Creek

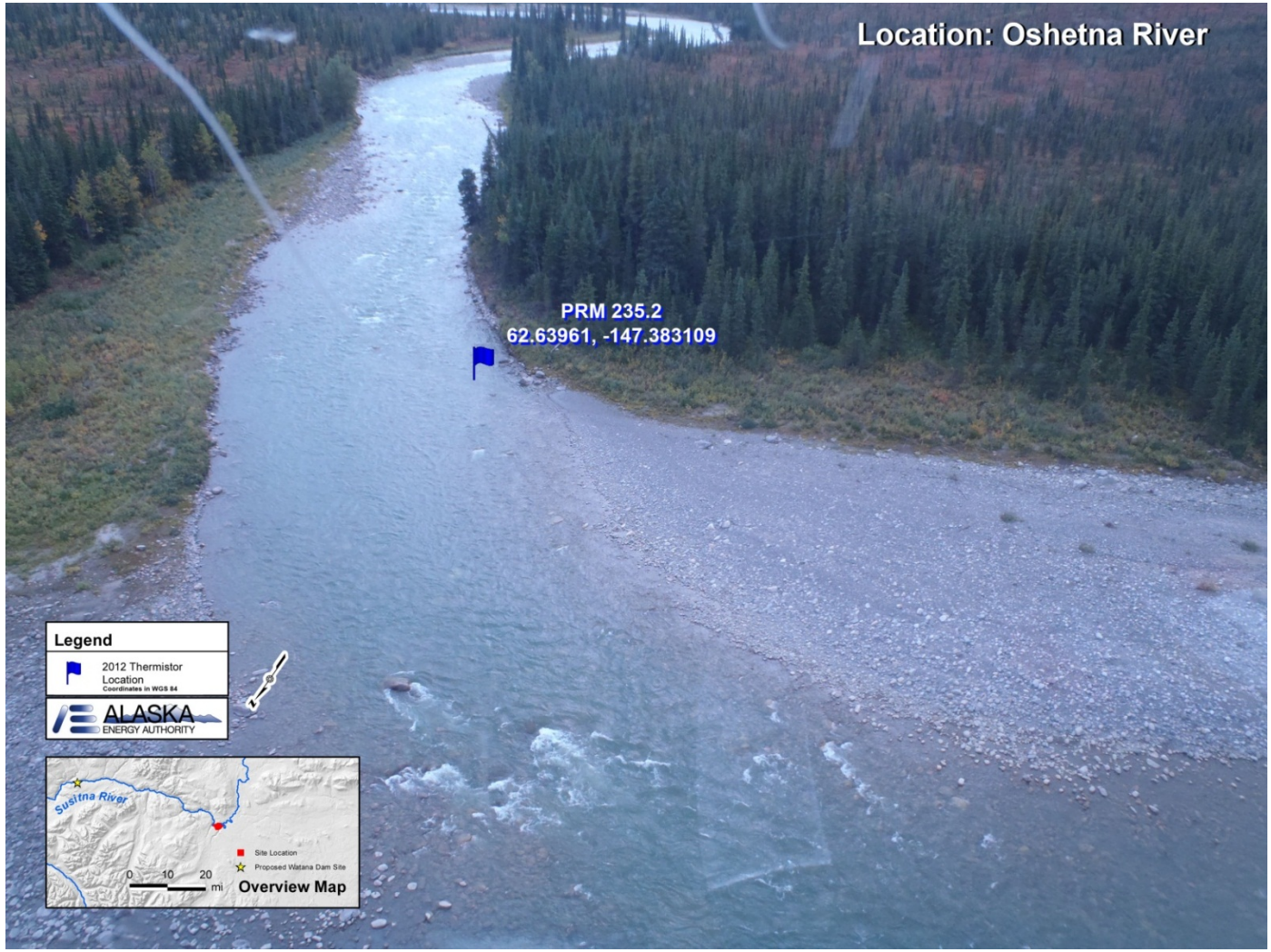

Figure A-37a. Map of Site 235.2 – Oshetna Creek (NAD 83 Coordinates: 62.63961° N, -147.383109° W)

Table A-37. Installation and Download Notes – PRM 235.2 – Oshetna Creek

Date Deployed	Thermistor Number	Depth (distance from buoy)	Maintenance and Download Notes
Anchor and Buoy Installation			
August 30, 2012	10174279	1 ft	8/30/12 – Two thermistors attached to a buoy by 6 ft of cable were deployed at this site. The system was deployed at the proposed location in the deepest area that could be found in creek approximately 100 ft up creek from mouth in 4 ft of water. 9/25/12 – System intact but had moved down stream slightly but in at least 2 feet of water. Downloaded and removed initial buoy string with multiple data loggers. Thermistor #10174279 would not download in field.
	10174278	5 ft	
July 2, 2013	10356408	2 ft	7/02/13 – Deployed new thermistor buoy string at same location. Downloads occurred on 7/22, 8/31, and 9/20/13. 9/20/13 – Removed system for winter.
	10356409	6 ft	
	10356410	10 ft	
Bank-Mounted Pipe Installation			
Not Installed	--	--	Pipe mounting infrastructure is absent at this site due to the lack of good bracket mounting location.
Overwinter Installation			
Sept. 25, 2012	10174278	--	9/25/12 – Installed overwinter system using bottom thermistor from buoy string. 7/2/13 – Recovered overwinter system. Remove system to replace with buoy string. Downloaded thermistor back at field office. Data logging stopped on 6/24/13 – data gap until 7/2/13 buoy deployment.
Sept. 20, 2013	10356410	--	Installed overwinter system.

Photo A-37b. 2013 Buoy system installed at PRM 235.2 – Oshetna Creek

Photo A-37c. 2012 Buoy System Installed at PRM 235.2 – Oshetna Creek