

Susitna-Watana Hydroelectric Project Document

ARLIS Uniform Cover Page

<p>Title:</p> <p>Characterization and mapping of aquatic habitats (Study 9.9), 2013 and 2014 aquatic habitat mapping field season completion progress, technical memorandum</p>		<h1>SuWa 233</h1>
<p>Author(s) – Personal:</p>		
<p>Author(s) – Corporate:</p> <p>R2 Resource Consultants, Inc.</p>		
<p>AEA-identified category, if specified:</p> <p>September 17, 2014 technical memorandum filings</p>		
<p>AEA-identified series, if specified:</p>		
<p>Series (ARLIS-assigned report number):</p> <p>Susitna-Watana Hydroelectric Project document number 233</p>		<p>Existing numbers on document:</p>
<p>Published by:</p> <p>[Anchorage, Alaska : Alaska Energy Authority, 2014]</p>		<p>Date published:</p> <p>September 2014</p>
<p>Published for:</p> <p>Prepared for Alaska Energy Authority</p>		<p>Date or date range of report:</p>
<p>Volume and/or Part numbers:</p> <p>Attachment E</p>		<p>Final or Draft status, as indicated:</p>
<p>Document type:</p> <p>Technical memorandum</p>		<p>Pagination:</p> <p>ii, 15 p.</p>
<p>Related work(s):</p> <p>Cover letter to this report: Susitna-Watana Hydroelectric Project, FERC Project no. 14241-000; Initial filing of September 2014 technical memoranda. (SuWa 228)</p> <p>Attachments A-D and F-J (SuWa 229-232 and S34-238)</p>		<p>Pages added/changed by ARLIS:</p> <p>Added cover letter</p>
<p>Notes:</p>		

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September 17, 2014

Ms. Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Re: Susitna-Watana Hydroelectric Project, Project No. 14241-000

Initial Filing of September 2014 Technical Memoranda

Dear Secretary Bose:

By letter dated January 28, 2014, the Federal Energy Regulatory Commission (Commission or FERC) extended the procedural schedule for the preparation and review of the Initial Study Report (ISR) for the proposed Susitna-Watana Hydroelectric Project, FERC Project No. 14241 (Project).¹ In particular, the Commission's January 28 letter established a deadline of June 3, 2014 for the Alaska Energy Authority (AEA) to file the ISR, and provided a 120-day period for licensing participants to review the ISR prior to the ISR meetings, which are scheduled to begin the week of October 13.² The purpose of this filing is to provide several technical memoranda to Commission Staff and licensing participants prior to the ISR meetings.

As required by the Commission's January 28 letter, AEA filed the ISR with the Commission on June 3. Among other things, the ISR detailed AEA's planned work during the 2014 field season.³ As AEA was preparing this 2014 work plan, it recognized that data gathered during the 2014 field season, together with other study work conducted prior to the October 2014 ISR meetings, could assist Commission Staff, AEA, and other licensing participants in developing the Project's licensing study program for 2015. For this reason, the ISR provided for AEA to prepare certain technical memoranda and other information based on 2014 work.

AEA recognizes that Commission Staff and licensing participants need a reasonable amount of time prior to the ISR meetings to review this additional information. AEA and licensing participants consulted with Commission Staff on this

¹ Letter from Jeff Wright, Federal Energy Regulatory Commission, to Wayne Dyok, Alaska Energy Authority, Project No. 14241-000 (issued Jan. 28, 2014) [hereinafter, "January 28 letter"].

² The full schedule for the ISR meetings appears in Section 1.5 of the ISR, as well as on AEA's licensing website, <http://www.susitna-watanahydro.org/meetings/>.

³ E.g., Initial Study Report § 1.3 & Table 3, Project No. 14241-000 (filed June 3, 2014) [hereinafter, "ISR"].

matter, and Staff directed that any additional information should be filed with the Commission and made available to licensing participants no later than 15 days prior to the ISR meetings, consistent with the typically applicable deadline under the Commission's Integrated Licensing Process regulations.⁴

With this letter, AEA is filing and distributing the first set of technical memoranda and other information generated during the 2014 study season, as described below. As part of its continued implementation of the study plan, AEA expects to file certain additional technical memoranda prior to October 1, 2014, in accordance with Commission Staff direction.

This first set of technical memoranda and other information consists of the following:

- *Attachment A: Proposal to Eliminate the Chulitna Corridor from Further Study.* As explained in the ISR, throughout the licensing process AEA has continually evaluated its proposal for Project development based on environmental review, technical feasibility, practical considerations, and other factors. As part of this iterative process, AEA notified the Commission and licensing participants in the ISR that it was evaluating whether to continue study of the Chulitna Corridor.⁵ Attachment A details AEA's conclusion that development of the Chulitna Corridor is not a reasonable alternative, and therefore AEA proposes to eliminate the corridor from further study. AEA seeks any comments or information on this proposal from federal and state resource agencies and other participants in the licensing process.
- *Attachment B: Ice Processes in the Susitna River Study (Study 7.6), Detailed Ice Observations October 2013 – May 2014 Technical Memorandum.* The ISR indicated that AEA would provide a summary of the 2014 break-up observations.⁶ This technical memorandum describes all field activities and observations between October 16, 2013 and May 15, 2014 for the Ice Processes in the Susitna River Study (Study 7.6).
- *Attachment C: Study of Fish Distribution and Abundance in the Upper Susitna River (Study 9.5), Proposed 2015 Modifications to Fish Distribution and Abundance Study Plan Implementation Technical Memorandum.* Based on AEA's experience in implementing the study plan for the Study of Fish Distribution and Abundance in the Upper Susitna River (Study 9.5) during 2014, this technical memorandum proposes to continue certain modifications to the implementation of this study during 2015.

⁴ See 18 C.F.R. § 5.15(c)(2).

⁵ See ISR, ISR Overview § 1.4.

⁶ See *id.*, Ice Processes in the Susitna River Study, Study Plan 7.6, Part C § 7.2.

- Attachment D: *Study of Fish Distribution and Abundance in the Middle and Lower Susitna River Study (Study 9.6), 2013-2014 Winter Fish Study Technical Memorandum*. At the time the ISR was filed, AEA was still in the process of conducting data entry, quality control, and analysis of winter sampling for this study. AEA reported in the ISR that it would develop plans for completing this study in a technical memorandum to be filed with the Commission.⁷ This technical memorandum fulfills this commitment and sets forth AEA's proposal for winter efforts, including proposed methodologies and modifications.
- Attachment E: *Characterization and Mapping of Aquatic Habitats (Study 9.9), 2013 and 2014 Aquatic Habitat Mapping Field Season Completion Progress Technical Memorandum*. In the ISR, AEA reported that its 2014 activities for the Characterization and Mapping of Aquatic Habitats Study (Study 9.9) would consist of various ground-truthing surveys and collection of habitat information for the 12 lakes within the potential reservoir inundation zone.⁸ This technical memorandum reports on these activities.
- Attachment F: *Eulachon Run Timing, Distribution, and Spawning in the Susitna River (Study 9.16), 2015 Proposed Eulachon Spawning Habitat Study Modifications Technical Memorandum*. After reviewing the 2013 and 2014 results from the Cook Inlet Beluga Whale Study (Study 9.17) and discussing the results with the National Marine Fisheries Service, AEA has determined that additional data are needed regarding eulachon spawning habitats. This technical memorandum describes a proposed modification to the Study of Eulachon Run Timing, Distribution and Spawning in the Susitna River (Study 9.16) to include an assessment of eulachon spawning habitats.
- Attachment G: *Fish and Aquatics Instream Flow Study (Study 8.5), Evaluation of Relationships between Fish Abundance and Specific Microhabitat Variables Technical Memorandum*. Consistent with the Commission's study plan determination,⁹ this technical memorandum provides a detailed evaluation of the comparison of fish abundance measures with specific microhabitat variable measurements where sampling overlaps. This memorandum is used to determine whether a relationship between a specific microhabitat variable and fish abundance is evident.
- Attachment H: *Fish and Aquatics Instream Flow Study (Study 8.5), 2013-2014 Instream Flow Winter Studies Technical Memorandum*. In the ISR, AEA reported that it would distribute its finding concerning the 2013-2014

⁷ See *id.*, Study of Fish Distribution and Abundance in the Middle and Lower Susitna River Study, Study Plan 9.6, Part C § 7.1.2.5.

⁸ See *id.*, Characterization and Mapping of Aquatic Habitats, Study Plan 9.9, Part C § 7.1.

⁹ See Study Plan Determination on 14 Remaining Studies for the Susitna-Watana Hydroelectric Project, Appendix B at B-84 to B-86, Project No. 14241-000 (issued Apr. 1, 2013).

winter activities in 2014.¹⁰ This technical memorandum describes the methods applied, and data and information collected, as part of the Instream Flow Study 2013-2014 winter studies.

- Attachment I: *Geomorphology Study (Study 6.5), Susitna River Historical Cross Section Comparison (1980s to Current) Technical Memorandum*. As specified in Revised Study Plan Section 6.5.4.1.2.3, this technical memorandum describes changes within the main and side channels of the Susitna River by comparing historical survey data from the 1980s with survey data from the current Project.
- Attachment J: *Geomorphology Study (Study 6.5), 2014 Update of Sediment-Transport Relationships and a Revised Sediment Balance for the Middle and Lower Susitna River Segments Technical Memorandum*. The purpose of this technical memorandum is to update the sediment load rating curves and preliminary estimates of the overall sediment balance in the Middle and Lower River segments under pre-Project conditions that were initially provided in “Development of Sediment-Transport Relationships and an Initial Sediment Balance for the Middle and Lower Susitna River Segments,” (Tetra Tech, Inc. 2013a). This update is based on additional data collected by the U.S. Geological Survey in 2012 and 2013.

AEA appreciates the opportunity to provide this additional information to the Commission and licensing participants, which it believes will be helpful in determining the appropriate development of the 2015 study plan as set forth in the ISR. If you have questions concerning this submission please contact me at wdyok@aidea.org or (907) 771-3955.

Sincerely,



Wayne Dyok
Project Manager
Alaska Energy Authority

Attachments

cc: Distribution List (w/o Attachments)

¹⁰ See ISR, Fish and Aquatics Instream Flow Study, Study Plan 8.5, Part C § 7.5.2.

**Susitna-Watana Hydroelectric Project
(FERC No. 14241)**

**Characterization and Mapping of Aquatic Habitats
(Study 9.9)**

**2013 and 2014 Aquatic Habitat Mapping
Field Season Completion Progress
Technical Memorandum**

Prepared for

Alaska Energy Authority



SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

R2 Resource Consultants, Inc.

September 2014

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LIST OF ACRONYMS AND SCIENTIFIC LABELS

Abbreviation	Definition
AEA	Alaska Energy Authority
ARRC	Alaska Railroad Corporation
BW	Backwater
CIRWG	Cook Inlet Region Working Group
CWP	Clearwater Plume
FERC	Federal Energy Regulatory Commission
ft	feet
GIS	Geographic Information System. An integrated collection of computer software and data used to view and manage information about geographic places, analyze spatial relationships, and model spatial processes.
ha	hectare
HW	headwaters
ILP	Integrated Licensing Process
ISR	Initial Study Report
km	kilometer
m	meter
MR	Middle River Segment of the Susitna River
NHD	National Hydrography Database
NI	No Information
NS	No Survey
PRM	Project River Mile
Project	Susitna-Watana Hydroelectric Project (FERC No.14241)
QC	Quality Control
RSP	Revised Study Plan
TM	Technical Memorandum
UR	Upper River
ZHI	Zone of hydrologic influence

1. BACKGROUND

The Initial Study Report (ISR) for Study 9.9 (Part C Section 7.1), the Characterization and Mapping of Aquatic Habitats, outlined six activities required to complete the Study Plan (AEA 2014). This Technical Memorandum (TM) presents an update on completion of those activities originally described in the RSP Section 9.9.5 (AEA 2012) including: (1) ground-truthing surveys by macrohabitat type in the Upper River mainstem; (2) ground-truthing surveys by macrohabitat type in the Middle River mainstem; (3) ground surveys of select Upper River tributaries; (4) ground surveys of select Middle River tributaries; (5) ground-truthing surveys to complete 100 percent coverage of mesohabitat mapping within Focus Areas; and (6) collecting relevant additional habitat information on a lake-by-lake basis for the 12 lakes identified within the potential reservoir inundation zone.

During preparation of the ISR, preliminary examination of the 2013 data suggested that although target flows were not universally achieved during ground surveys, conflicts between remote-line mapping or videoed habitat calls and ground-survey habitat calls were infrequent. Results of this analysis are presented in this TM for all 2013 ground-surveyed macrohabitats; a final revision including 2014 ground-surveys will be presented in the Updated Study Report (USR).

2. STUDY ELEMENT COMPLETION UPDATE

Remote line mapping of habitats for the study area was completed in 2012 using a hierarchically-nested habitat typing system that was adapted to the identification levels deemed feasible based on the available aerial imagery (ISR Table 9.9.1.1-1, Appendix A). During 2013 and 2014, field surveys were conducted in Upper River (UR) and Middle River (MR) tributaries and mainstem habitats. Habitat surveys were also planned in 12 lakes known to be located within the Project inundation zone (ISR Section 5.1.3; AEA 2014). Following additional data quality control (QC), the status of surveys conducted in 2013 has been updated from the ISR and is combined in this TM with a description of the completion of this study element in 2014.

2.1. Upper River Mainstem Surveys

For all mainstem ground-surveys, AEA implemented the methods as described in the Study Plan, with the exception of the variances described in ISR Section 4.2.4 (AEA 2014). For each macrohabitat category, seven habitat units were selected, or all habitat units if less than seven existed or were accessible. Within single main channel habitat, field crews identified seven of each mesohabitat for ground-truthing and characterization, or all habitat units if less than seven existed or were accessible. In 2013, FERC determined that clearwater plumes and backwaters be moved from macrohabitat category Level 3 to mesohabitat category Level 4 and be given “special consideration” (April 1, 2013, FERC SPD). Accordingly, seven of each of these mesohabitats were selected for ground-truthing and characterization, or all habitat units if less than seven existed or were accessible.

Thirty habitat units were fully or partially mapped during 2013. This included seven main channel riffles, six main channel glide/runs, six split main channels, six side channels, three side sloughs, and two upland sloughs. In 2014, field crews surveyed one main channel glide/run, one

split main channel, one side channel, four upland sloughs, four side sloughs, seven tributary mouths, and one backwater habitat. The surveys conducted during 2014 completed all targets for ground-truthing in mainstem habitats in the Upper River (Table 2.1-1). Multiple split main channel habitats and main channel pools did not occur above Devils Canyon and both backwater and clearwater plume habitats were scarce in the Upper River. So, even though seven replicates were not completed, all available habitat units have been surveyed. Single main channel rapids were judged unsafe to access and these habitats were not surveyed.

2.2. Middle River Mainstem Surveys

The random selection of habitats in the Middle River mainstem paralleled that in the Upper River (see Section 2.1 above). In addition to randomly selected habitats, all macrohabitat segments identified within Focus Areas were to be ground-mapped and characterized. For all ground-surveys, AEA implemented the methods as described in the Study Plan with the exception of the variances described in ISR Section 4.2.4 (AEA 2014).

In the Middle River, all survey targets for habitat units have been met (Table 2.2-1), with the exception of the special mesohabitat backwater for which only six habitat units were available and accessible (one additional backwater was located but was judged unsafe to access by boat operators).

2.3. Upper River Tributary Surveys

The Study Plan provided that a total of 25 tributaries within the proposed reservoir inundation zone and three tributaries located upstream of the inundation zone would be ground-surveyed according to the methods summarized in the ISR in Section 4 (AEA 2014). By the end of the 2013 field season, nine tributaries were fully habitat mapped with partial surveys in an additional two tributaries. The tributary mapping effort in the Upper River was completed in 2014, with ground surveys in 16 tributaries as well as the two tributary surveys begun in 2013. A single small primary tributary (unnamed tributary at PRM 226.2) and two geomorphic reaches within other tributaries (Unnamed Tributary 206.3-2 and Unnamed Tributary 194.8-2) that had been selected for surveying were determined to be inaccessible for safety reasons and were excluded from the survey population. Thus, 27 tributaries in total were surveyed in the Upper River with surveys for two of these spanning the 2013 and 2014 field seasons (Table 2.3-1).

2.4. Middle River Tributary Surveys

In the Middle River segment, a total of eight tributaries within and upstream of Devils Canyon were selected for ground mapping. These tributaries were also among those that were videographed in 2012. An additional 20 tributaries known to contain populations of anadromous and resident fishes were selected within the zone of hydrologic influence (ZHI) of the Project below Devils Canyon; nine of these occurred within Focus Areas and 11 were outside of Focus Areas. In total, 28 Middle River tributaries were identified for survey in the Study Plan.

During 2013, field crews fully surveyed seven tributaries and partially surveyed one tributary according to the methods outlined in ISR Section 4 (AEA 2014). In 2014, field crews fully mapped 20 tributaries and completed one tributary survey begun in 2013 using these same methods (Table 2.4-1). Thus, ground-truthing was completed in all 28 targeted tributaries.

2.5. Focus Area Surveys

The Study Plan provided that 100 percent of line-mapped arcs within Focus Areas would be ground-truthed as part of the Habitat Study. In 2013, 108 macrohabitat units within Focus Areas were mapped, and this effort was completed during 2014 with an additional 25 macrohabitat units mapped within Focus Areas.

2.6. Lake Surveys

There are 12 lakes currently known to be within the zone of reservoir inundation, according to the National Hydrography Database (NHD). These lakes were located, mapped, and identified in the Project GIS database (Table 2.6-1); elevation, surface area, and perimeter were calculated, and the presence or absence of surface water connection to the Susitna River was noted.

Over the 2014 field season, surveys of additional limnological parameters were made in each of these 12 lakes. For each survey, a crew of two surveyed transects both along and across the long axis of each lake. Five stations were established on each transect (start and end, plus three equally spaced points along each transect). Measurements of pH, water clarity, percent dissolved oxygen, temperature, average and maximum depth, and percent littoral area were completed along depth profiles with measurements at the surface and every 0.5 m (1.6 ft). The lakes surveyed are shown by number in ISR Figure 9.9.4.2-1 and in ISR Table 9.9.4.2-2. Summaries of lake habitat characteristics will be presented in the USR.

3. GROUND-TRUTHING ANALYSIS

A determination of whether remote line mapping is sufficiently accurate depends upon the degree and magnitude of difference between mesohabitat calls made during ground-truthing field surveys and remote calls. An interim assessment of the accuracy of the remote line mapping was conducted using data from 2013 field surveys. A full assessment based on 2013 and 2014 field surveys in combination will be presented in the USR.

3.1. Macrohabitat Variation

Over the 2013 field season, survey crews classified habitats in a total of 175 habitat segments, including Focus Area and randomly selected mainstem macrohabitats (Table 3.1-1). Field macrohabitat calls for these segments were subsequently compared with the classifications made during the remote line mapping exercise to identify possible variations. Of these 175 comparisons, there were four survey lines (three in the MR and one in the UR) where field crew habitat calls were judged more valid than the original line mapping call. These included one side channel that field crews identified as a split main channel, and three side channels identified by field crews as side sloughs. A desktop review of these variations concluded that these represented instances where the field survey assessment was made closer to target flows than occurred with the imagery underlying the original line mapping macrohabitat call. Thus, four variations out of 175 macrohabitat calls represent the current error rate associated with the comprehensive remote line mapping.

3.2. Single Main Channel Mesohabitat Variation

Single main channel habitats were selected separately from other mainstem macrohabitat types to adjust for indeterminacy of practical survey start and end points in these habitats. Nineteen of the 36 single main channel habitats surveyed across the Upper and Middle River segments were classified with a different mesohabitat than had been assigned during the 2012 remote line mapping. In all but two instances, this discrepancy was an artifact of field crews using finer habitat divisions resulting in the identification of sequences of riffles and runs where remote line mapping had identified a single mesohabitat. The remaining two cases were a glide and a riffle determined by field crews to be a riffle and a glide, respectively. AEA judged this kind of habitat difference between remote line mapping and field calls to be due to the inherent subjectivity of distinctions between these mesohabitat types in combination with flow variation and localized channel change in the two years between remote mapping and field surveys. Thus, no revisions to line mapping were needed.

4. SUMMARY

The intent of the field mapping effort was to ground-truth a random sample of habitat classifications from the remote line mapping database across both the Upper and Middle River, to provide classifications in habitats that were difficult to survey using remote line mapping methods (e.g., tributaries and off-channel habitats), and to provide detailed habitat characterization of Focus Areas.

All Habitat Mapping field tasks described in the Study Plan have been completed. AEA expects to complete the FERC-approved Study Plan through the filing of the Updated Study Report by February 1, 2016, in accordance with the Integrated Licensing Process (ILP) schedule issued by FERC on January 28, 2014. AEA expects the USR will be filed in February 2016 and will contain an updated ground-truthing comparison of habitat classification from remote line mapping that is comprehensive of both 2013 and 2014 ground-surveys; characterization of macro- and mesohabitats using measured habitat metrics; and a complete and updated set of photographic base maps for all mapped locations.

5. REFERENCES

Alaska Energy Authority (AEA). 2012. Revised Study Plan: Susitna-Watana Hydroelectric Project FERC Project No. 14241. December 2012. Prepared for the Federal Energy Regulatory Commission by the Alaska Energy Authority, Anchorage, Alaska. <http://www.susitna-watanahydro.org/study-plan>.

Alaska Energy Authority (AEA). 2014. Characterization and Mapping of Aquatic Habitats Study Plan Section 9.9. Susitna-Watana Hydroelectric Project FERC Project No. 14241. Prepared for the Federal Energy Regulatory Commission by the Alaska Energy Authority, Anchorage, Alaska.

Federal Energy Regulatory Commission (FERC). Office of Energy Projects. 2013. April 01, 2013. Study Plan Determination for the Susitna-Watana Hydroelectric Project No 14241-000.

6. TABLES

Table 2.1-1. Randomly selected Upper River mainstem habitats outside of Focus Areas, mapped and characterized during 2013 and 2014.*

Habitat	UR-3		UR-4		UR-5		UR-6		TOTALS
	2013	2014	2013	2014	2013	2014	2013	2014	
Main Channel - Riffle	5		1				1		7
Main Channel - Glide or Run	4		2					1	7
Split Main Channel			4		1		1	1	7
Multiple Split Main Channel									0
Side Channel			3			1	3		7
Side Slough	1		2	2				2	7
Upland Slough			2*	3				1	6
Tributary Mouth		3		1		2		1	7
<i>Special mesohabitats</i>									
Backwater				1					1
Clearwater Plume									0

Notes:

*One partial survey completed in 2014

Table 2.2-1. Randomly selected Middle River mainstem habitats mapped and characterized during 2013 and 2014.

Habitats	MR-2		MR-3		MR-4		MR-5		MR-6		MR-7		MR-8		TOTALS
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	
Main Channel – Riffle	1	1							1	1	1	2 ⁺			7
Main Channel - Glide or Run			1						2		1	1 ⁺	1	1	7
Split Main Channel			1				1		1		3		1		7
Multiple Split Main Channel									2	1			4		7
Side Channel			1						2	1	1		2		7
Side Slough									3	2 ⁺	1 [*]	1			7
Upland Slough		1							3	1	2				7
Tributary Mouth		2		2						2		1 ⁺			7
<i>Special mesohabitats</i>															
Backwater		1				NS			1	2		1		1	6
Clear Water Plume		2		1						3 ⁺		1 ⁺			7

Notes:

NS: No Survey. Habitat was judged not accessible by boat operators – Inside Devils Canyon

⁺survey in progress, September 2014

^{*}One partial survey, completed in 2014

Table 2.3-1. Upper River (UR) tributary table showing all tributary geomorphic reaches, gradient, basin area, private land ownership, and 2013 survey status.

Mainstem Geomorphic Reach	Tributary Name	Selection Category	Tributary Order ²	Tributary Geomorphic Reach or Site ID	Project River Mile	End of Survey Elev. (ft)	Approx. Drainage Area (km ²)	Approx. Length (km)	Total Grad. (%)	Ground survey 2013	Ground survey 2014
UR-2	Oshetna River ¹	Above Inundation Zone	1	Oshetna-1	235.1	3,000	885.1	89.48		Y	
				Oshetna-2						Y	
				Oshetna-3 ³						Y	
UR-2	Black River ¹	Above Inundation Zone	2	Black-1	12.6 (LB)	3,000	NI	NI		Y	
				Black-2						Y	
				Black-3 ³						Y	
UR-3	Goose Creek ¹	Above Inundation Zone	1	Goose-1	232.8	3,000	167.2	40.56		Y	
				Goose-2						Y	
				Goose-3 ³						Y	
Proposed reservoir full pool (2050' NAVD88) upper extent											
UR-3	Unnamed 230.8	small primary	1	H230.8-22H	230.8	2,200	1	2.19	11		Y
UR-3	Unnamed 230.2	small primary	1	H230.2-22H	230.2	2,200	0.4	0.72	19		Y
UR-3	Unnamed 230.1	small primary	1	H230.1-22H	230.1	2,200	4.3	5.39	7		Y
UR-3	Unnamed 228.5	small primary	1	H228.5-22H	228.5	2,200	75.1	25.39	5		Y
UR-3	Unnamed 226.2	small primary	1	H226.2-22H	226.2	2,200	5.9	4.50	10		NS
UR-4	Unnamed 219.6	small primary	1	H219.6-22H	219.6	2,200	8.4	7.28	8		Y
UR-4	Unnamed 214.4	small primary	1	H214.4-22H	214.4	2,200	1.7	2.44	23		Y
UR-4	Jay Creek ¹	Inundation Zone	1	Jay-1	211.0	3,000	99.5	31.54		Y ⁴	
				Jay-2						Y ⁴	
				Jay-3						Y ⁴	
				Jay-4 ³						Y	
UR-4	Kosina Creek ¹	Inundation Zone	1	Kosina-1	209.1	3,000	644.1	63.57		⁴	
				Kosina-2						Y ⁴	
				Kosina-3						⁴	
UR-4	Tsis Creek ¹	Inundation Zone	2	Tsisi-1 ³	7.2 (LB)	3,000	NI	NI		Y	
				Tsisi-2 ³						Y	
UR-4	Unnamed 208.6	small primary	1	H208.6-22H	208.6	2,200	5.0	7.52	8		Y
UR-5	Unnamed 207.4	small primary	1	H207.4-HW1	207.4	HW	1.1	2.50	14		Y
UR-5	Unnamed 207.4 RB-1	small primary	2	H207.4-HW2	207.4	HW		NI			Y

Table 2.3-1. Upper River (UR) tributary table showing all tributary geomorphic reaches, gradient, basin area, private land ownership, and 2013 survey status. (continued)

Mainstem Geomorphic Reach	Tributary Name	Selection Category	Tributary Order ²	Tributary Geomorphic Reach or Site ID	Project River Mile	End of Survey Elev. (ft)	Approx. Drainage Area (km ²)	Approx. Length (km)	Total Grad. (%)	Ground survey 2013	Ground survey 2014
UR-5	Unnamed 206.3	Inundation Zone	1	206.3-1	206.3	2,200	49.9	11.96		Y	
				206.3-2							NS
				206.3-3						Y	
UR-5	Unnamed 204.5	Inundation Zone	1	204.5-1	204.5	2,200	49.9	9.98		*	Y
				204.5-2						*	Y
UR-6	Unnamed 198.9	small primary	1	H198.9-22H	198.9	2,200	1.2	3.36	13	*	Y
UR-6	Unnamed 198.4 LB-1	small primary	2	H198.4-HW	198.4	HW		NI		*	Y
UR-6	Unnamed 197.7	Inundation Zone	1	197.7-1	197.7	2,200	49.9	8.69		*	Y
				197.7-2						*	Y
				197.7-3						*	Y
UR-6	Unnamed 197.7 RB-1	small primary	2	H197.7-22T	197.7	2,200		NI		*	Y
UR-6	Watana Creek ¹	Inundation Zone	1	Watana-1	196.9	3,000	281.3	43.29		Y ^{4*}	
				Watana-2						Y ⁴	
				Watana-3 ³						Y	
UR-6	Watana RB-1	small primary	2	H196.9-HW1	196.9	HW		NI			Y
UR-6	Watana LB-1.1.1	small primary	4	H196.9-HW2	196.9	HW		NI			Y
UR-6	Watana Tributary ¹	Inundation Zone	2	Watana Trib-1 ³	8.7 (RB)	3,000	NI	NI		Y	
				Watana Trib-2 ³						Y	
UR-6	Unnamed 194.8	Inundation Zone	1	194.8-1	194.8	HW	199.6	11.43		*	Y
				194.8-2						*	NS
				194.8-3						Y	
				194.8-4						Y	
UR-6	Deadman Creek ¹	Inundation Zone	1	Deadman-1	189.4	3,000	281.8	67.43		*	Y
				Deadman-2						*	Y
				Deadman-3						Y	
				Deadman-4						Y	
				Deadman-5						Y	
				Deadman-6						Y	

Table 2.3-1. Upper River (UR) tributary table showing all tributary geomorphic reaches, gradient, basin area, private land ownership, and 2013 survey status. (continued)

Notes:

- 1 Tributary mapped using aerial videography.
- 2 Tributary Category indicates ranked distance from the mainstem Susitna River (i.e., 1 = primary tributary to the Susitna River, 2 = tributary to a number 1 tributary)
- 3 Tributary Geomorphic Reach only partially video-mapped or not video mapped. See ISR Table 4.1-3 for spatial range of videography survey.
- 4 All or part of tributary geomorphic reach survey conducted during 2012

NI: No information available at this time.

NS: No survey

* private land CIRWG

Table 2.4-1. Middle River (MR) tributary geomorphic reaches selected for field-survey, basin area, private land ownership, and 2013 survey completion status.

Mainstem Geomorphic Reach	Tributary Name (ID)	Tributary Order ²	Tributary Geomorphic Reach or Site ID	Project River Mile	End of Survey Elev. (ft)	Approx. Drainage Area (km ²)	Approx. Length (km)	Focus Area	Ground survey 2013	Ground survey 2014
MR-2	Tsusena Creek ¹	1	Tsusena-1	184.6	ZHI	145.3	49.41	NA	*	Y
			Tsusena-2					NA		NS
MR-2	Unnamed 184.0 ¹	1	184.0-1	184.0	ZHI	<31	16.74	NA	*	Y
			184.0-2					NA	*	NS
MR-2	Fog Creek ¹	1	Fog-1	179.3	3,000	147.2	44.74	NA	*	Y
			Fog-2					NA	*	Y
			Fog-3					NA	*	Y
			Fog-4 ³					NA	Y	
MR-2	Unnamed 173.8	1	H173.8-ZHI	173.8	ZHI	NI	NI	FA-173 (Stephan Lake Complex)	Y*	
MR-2	Unnamed 174.3	1	H174.3-ZHI	174.3	ZHI	NI	NI	FA-173 (Stephan Lake Complex)	*	Y
Devils Canyon Upper Extent (PRM 166.1)										
MR-4	Devil Creek ¹	1	Devil-1	164.8	ZHI	74.8	25.43	NA	*	Y
MR-4	Chinook Creek ¹	1	Chinook-1	160.5	3,000	24.7	17.06	NA	Y*	
			Chinook-2 ³					NA	Y	
MR-4	Cheechako Creek ¹	1	Cheechako-1	155.9	barrier	36.4	17.22	NA	*	Y
Devils Canyon Lower Extent (PRM 153.9)										
MR-5	Portage Creek	1	H152.3-ZHI	152.3	ZHI	178.6	0.31	FA-151 (Portage Cr)	*	Y
MR-6	Jack Long Creek	1	H148.3-ZHI	148.3	ZHI	NI	0.05	NA	*	Y
MR-6	Unnamed 144.6	1	H144.6-ZHI	144.6	ZHI	NI	0.02	FA-144 (Slough 21)		Y
MR-6	Indian River	1	H142.1-ZHI	142.1	ZHI	86.2	0.23	FA-141 (Indian River)	Y	
MR-6	Gold Creek	1	H140.1-ZHI	140.1	ZHI	23.7	0.24	NA	Y	
MR-6	Fourth of July Creek	1	H134.3-ZHI	134.3	ZHI	NI	0.19	NA		Y

Table 2.4-1. Middle River (MR) tributary geomorphic reaches selected for field-survey, basin area, private land ownership, and 2013 survey completion status. (continued)

Mainstem Geomorphic Reach	Tributary Name (ID)	Tributary Order ²	Tributary Geomorphic Reach or Site ID	Project River Mile	End of Survey Elev. (ft)	Approx. Drainage Area (km ²)	Approx. Length (km)	Focus Area	Ground survey 2013	Ground survey 2014
MR-6	Sherman Creek	1	H134.1-ZHI	134.1	ZHI	NI	0.03	NA		Y
MR-6	Skull Creek	1	H128.1-ZHI	128.1	ZHI	NI	0.06	FA-128 (Slough 8A)	**	ARRC – in progress
MR-6	Fifth of July Creek	1	H127.3-ZHI	127.3	ZHI	NI	0.02	NA		Y
MR-6	Deadhorse Creek	1	H124.4-ZHI	124.4	ZHI	6.5	0.29	NA		Y
MR-7	Little Portage Creek	1	H121.4-ZHI	121.4	ZHI	2.4	0.19	NA	**	ARRC – in progress
MR-7	McKenzie Creek	1	H120.2-ZHI	120.2	ZHI	2.3	0.03	NA		Y
MR-7	Lower McKenzie Creek	1	H119.7-ZHI	119.7	ZHI	NI	0.26	NA	**	ARRC – in progress
MR-7	Lane Creek	1	H117.2-ZHI	117.2	ZHI	10.4	0.18	NA		Y
MR-7	Unnamed 115.4	1	H115.4-ZHI	115.4	ZHI	NI	0.19	FA-115 (Slough 6A)	Y	
MR-7	Gash Creek	1	H115.0-ZHI	115.0	ZHI	NI	0.02	FA-113 (Oxbow 1)	**	ARRC – in progress

Table 2.4-1. Middle River (MR) tributary geomorphic reaches selected for field-survey, basin area, private land ownership, and 2013 survey completion status. (continued)

Mainstem Geomorphic Reach	Tributary Name (ID)	Tributary Order ²	Tributary Geomorphic Reach or Site ID	Project River Mile	End of Survey Elev. (ft)	Approx. Drainage Area (km ²)	Approx. Length (km)	Focus Area	Ground survey 2013	Ground survey 2014
MR-7	Slash Creek	1	H114.9-ZHI	114.9	ZHI	NI	0.03	FA-113 (Oxbow 1)	**	ARRC – in progress
MR-7	Unnamed 113.7	1	H113.7-ZHI	113.7	ZHI	NI	NI	FA-113 (Oxbow 1)	**	ARRC – in progress
MR-7	Chase Creek	1	H110.5-ZHI	110.5	ZHI	NI	0.27	NA	Y	
MR-8	Whiskers Creek	1	H105.1-ZHI	105.1	ZHI	17.2	0.53	FA-104 (Whiskers Slough)	Y	

Notes:

- 1 Tributary mapped using aerial videography
- 2 Tributary category indicates ranked distance from the mainstem Susitna River (i.e., 1 = primary tributary to the Susitna River, 2 = tributary to a number 1 tributary)
- 3 Tributary geomorphic reach only partially video-mapped or not video-mapped. See ISR Table 4.1-3 for spatial range of videography survey.
- NI No information available at this time
- NS No Survey. Tributary reach is above the elevation of the study area; accordingly, data were not collected.
- * private land: CIRWG** private land: ARRC

Table 2.6-1. Lakes in the Upper River located within the inundation zone, and habitat metrics obtained from the Project GIS database.

Lake ID ¹	Perimeter (m)	Elevation (m)	Area (ha)	Surface water connection
Lake 1	260	534	0.23	Yes
Lake 2	543	533	0.68	Yes
Lake 3	1001	547	3.37	Yes
Lake 4	441	622	1.15	No
Lake 5/Sally Lake	3009	620	22.99	Yes
Lake 6	399	612	0.89	No
Lake 7	467	487	1.48	Indeterminate
Lake 8	211	619	0.30	No
Lake 9	419	543	1.15	Yes
Lake 10	144	597	0.16	No
Lake 11	198	621	0.20	No
Lake 12	391	612	0.72	No

Notes:

- 1 Lakes are numbered from upstream to downstream.

Table 3.1-1. Total number of macrohabitat units and special mesohabitat units ground-truthed both inside and outside of Focus Areas during 2013 field surveys.

Macrohabitat	Focus Area	Random Selection outside of FA	Grand Total
Middle River	108	37	145
Single Main Channel	15	8	23
Multiple Split Main Channel	10	6	16
not assigned - BW	2	1	3
not assigned - CWP	1		1
Side Channel	40	6	46
Side Slough	12	4	16
Split Main Channel	11	7	18
Tributary Mouth	2		2
Upland Slough	15	5	20
Upper River		30	30
Single Main Channel		13	13
Side Channel		6	6
Side Slough		3	3
Split Main Channel		6	6
Upland Slough		2	2
Grand Total	108	67	175

Notes:

BW = Backwater

CWP = Clearwater Plume