Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Characterization and Mapping of Aquatic Habitats
Study Plan Section 9.9

Initial Study Report
Part A: Sections 1-6, 8-10

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

R2 Resource Consultants, Inc.

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LIST OF ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

Abbreviation	Definition
ADF&G	Alaska Department of Fish & Game
AEA	Alaska Energy Authority
ARRC	Alaska Railroad Corporation
BFD	measured bankfull depth
BFW	measured or estimated bankfull width
cfs	Cubic Feet per Second
CIRWG	Cook Inlet Region Working Group
FA	Focus Area
FERC	Federal Energy Regulatory Commission
ft	feet
GIS	Geographic Information System
IFSAR	Interferometric Synthetic Aperture Radar
ISR	Initial Study Report
LB	Left Bank – looking downstream
Level 3	Mainstem Habitat
Level 4	Mainstem and Tributary Mesohabitat
LiDAR	Light Detection and Ranging. An optical remote sensing technology that can measure the distance to a target; can be used to create a topographic map.
LWD	Large Woody Debris
m	meter(s)
mi	mile(s)
NHD	National Hydrography Database
PRM	Project River Mile
RB	Right Bank – looking downstream
RM	River Mile(s) referencing those of the 1980s APA Project
RSP	Revised Study Plan
SPD	Study Plan Determination
TWG	Technical Workgroup
USFS	United States Forest Service
USGS	United States Geological Survey
USR	Updated Study Report
yd	yard
ZHI	Zone of Hydrologic Influence

1. INTRODUCTION

On December 14, 2012, Alaska Energy Authority (AEA) filed its Revised Study Plan (RSP) with the Federal Energy Regulatory Commission (FERC or Commission) for the Susitna-Watana Hydroelectric Project (FERC Project No. 14241) which included 58 individual study plans (AEA 2012a). Included within the RSP was the Characterization and Mapping of Aquatic Habitats, Section 9.9. RSP Section 9.9 focuses on describing the aquatic habitats of the Susitna River using a specific hierarchical and nested classification system based on historic and current data.

On February 1, 2013, FERC staff issued its study determination (February 1 SPD) for 44 of the 58 studies, approving 31 studies as filed and 13 with modifications. FERC requested additional information before issuing a SPD on the remaining studies. On April 1, 2013 FERC issued its study determination (April 1 SPD) for the remaining 14 studies; approving 1 study as filed and 13 with modifications. RSP Section 9.9 was one of the 13 approved with modifications. In its April 1 SPD, FERC recommended the following:

Edge Habitat

> *We recommend that AEA remove the level 5 calculation of edge habitat from the habitat classification system.*

Backwater and Beaver Dam Habitats

> *We recommend changing the classification of backwater, beaver complex, and clearwater plume habitats from level 3 (mainstem habitat) to level 4 (mainstem and tributary mesohabitats).*

Classification of Upper River Tributaries

> *We recommend that AEA consult with the TWG and file no later than June 30, 2012, the following information to quantify small and low-order tributaries in the Upper River study area:*
>
> *1) A detailed description of the specific methods to be used for selecting a representative sample of small and low-order Upper River tributaries for aquatic habitat mapping.*
>
> *2) Documentation of consultation with the TWG, including how its comments were addressed.*

Habitat Mapping at Multiple Flows

> *We recommend modifying the study plan to have AEA identify and give specific consideration to backwater habitats, as defined by the agencies (i.e., the confluence of off-channel habitats with main channel habitats), as a unique habitat feature and ensure a representative subsample of these locations when selecting transect locations for one-dimensional or two-dimensional aquatic habitat modeling within Middle River and Lower River instream flow study sites.*

Classification of Middle and Lower River Tributaries

We recommend modifying the study plan to have AEA classify Middle River tributary reaches within the zone of hydrologic influence into geomorphic reaches based on tributary basin drainage area and stream gradient to provide a general understanding of the relative potential value to fish and aquatic resources, and report on these attributes in the initial and updated study reports.

Habitat Mapping and Ground-Truthing

We recommend that AEA provide a detailed description of methods and results of 2012 and 2013 habitat mapping in the initial study report, including a complete set of photographic base maps delineating macrohabitats (level 3) and mesohabitats (level 4) for all mapped locations.

Following the first study season, FERC's regulations for the Integrated Licensing Process (ILP) require AEA to "prepare and file with the Commission an initial study report describing its overall progress in implementing the study plan and schedule and the data collected, including an explanation of any variance from the study plan and schedule." (18 CFR 5.15(c)(1)) This Initial Study Report on Characterization and Mapping of Aquatic Habitats has been prepared in accordance with FERC's ILP regulations and details AEA's status in implementing the study, as set forth in the FERC-approved RSP and as modified by FERC's April 1 SPD and includes the Characterization and Mapping of Aquatic Habitats Technical Memorandum (HDR 2013) filed with the Commission on July 16, 2013 (collectively referred to herein as the "Study Plan").

2. STUDY OBJECTIVES

The study objectives were established in the Study Plan (RSP Section 9.9.2) and are described below.

Upper River Habitats:

1. Characterize and map Upper River tributary and lake habitats for the purpose of evaluating the potential loss or gain in available fluvial and lacustrine habitat that may result from dam construction and inundation by the reservoir.
2. Characterize and map Upper River tributary and lake habitats for the purposes of informing other studies including Fish Distribution and Abundance in the Upper Susitna River (Study 9.5) and River Productivity (Study 9.8).
3. Characterize and map the Upper River mainstem (understood hereafter to encompass both main channel and off-channel habitats) upstream from the Watana dam site to the confluence with the Oshetna River:
    i. To provide baseline data for the purpose of evaluating the potential loss or gain in accessible available fluvial and lacustrine habitat that may result from dam construction and inundation by the reservoir.
    ii. To inform other studies including Fish Distribution and Abundance in the Upper Susitna River (Study 9.5), River Productivity (Study 9.8), and Future Watana Reservoir Fish Community and Risk of Entrainment (Study 9.10).

Middle River Habitats:

1. Characterize and map the Middle River mainstem from the Chulitna River confluence to the proposed Watana Dam site, including tributaries within the zone of hydrologic influence (ZHI) and the Focus Areas:
    i. To provide baseline data for the purpose of evaluating the potential loss or gain in accessible available fluvial habitat that may result from flow regulation below the proposed Watana Dam.
    ii. To inform other studies including Fish Distribution and Abundance in the Middle and Lower Susitna River (Study 9.6), River Productivity (Study 9.8), and Instream Flow (Study 8.5).

Lower River Habitats:

1. Characterize and map the Lower River mainstem from the upper extent of tidal influence upstream to the Three Rivers Confluence:
    i. To provide baseline data for the purpose of evaluating the potential loss or gain in available fluvial habitat that may result from flow regulation below the proposed Watana Dam.
    ii. To inform other studies including Fish Distribution and Abundance in the Middle and Lower Susitna River (Study 9.6), River Productivity (Study 9.8), and Instream Flow (Study 8.5).

3. STUDY AREA

As established by the Study Plan (RSP Section 9.9.4) and modified as described below, the study area encompasses the mainstem Susitna River from the Oshetna River confluence at PRM 235.1 downstream to the upper extent of tidal influence. The mainstem study area is divided according to geomorphic/hydrologic river segments; the Upper River, Middle River, and Lower River (see Figure 3-1). The study area also encompasses tributaries in the Upper and Middle River. Note that the study area for selected Upper River tributaries has been modified in accordance with the Characterization and Mapping of Aquatic Habitats Technical Memorandum which was reviewed by the agencies and filed with FERC on July 16, 2013 (HDR 2013).

The study area for habitat mapping and characterization is as follows:

- **Upper River**
    - Tributaries: For selected streams in watersheds known to support Chinook salmon, the habitat mapping study area extends up to 3,000 ft elevation, unless a permanent impassable barrier exists between 2,200 and 3,000 ft elevation. If a barrier exists within this range, surveys will stop at the barrier. In watersheds not known to support Chinook salmon, the habitat mapping study area will terminate at 2,200 ft elevation regardless of the presence of a barrier below this elevation.

- Mainstem: Mainstem habitats from the Oshetna River confluence at PRM 235.1 to the proposed dam site at PRM 187.1 and focused on habitats within the inundation zone of the proposed reservoir.
- Lakes: Lakes within the proposed reservoir inundation.

- **Middle River:**
  - For selected tributaries above Devils Canyon known to support Chinook salmon, the study area extends up to 3,000 ft elevation or the first impassable barrier, whichever is less.
  - For all other selected tributaries in the Middle River, the study area extends from the confluence with the mainstem or off-channel up to the upper limit of the zone of hydrologic influence (ZHI).
  - Mainstem habitats of the Susitna River from PRM 187.1 downstream to the Chulitna River confluence at PRM 102.4
- **Lower River:**
  - The Lower Susitna River from PRM 102.4 to the upper extent of tidal influence.[1]

4. METHODS

This section of the ISR provides an updated and more detailed description of the methods relied upon to meet the Study Plan objectives. To the extent that the methods have varied from the method described in the Study Plan, those variances are described below.

4.1. General Overview of Habitat Mapping Methods

The Susitna River from the Oshetna River to its mouth (Upper, Middle and Lower River segments combined) includes 235 miles of river and substantially more stream distance when the lengths of side channels, braided channels, and sloughs are included. Ground-based habitat data collection along the entire river is impractical due to the complexity of channel plan form, the linear extent, and the remoteness of the river. For these reasons, an analysis of aerial imagery was combined with ground-based habitat data collection covering a representative proportion of river habitats to form a habitat characterization of the river. In addition, the ten Focus Areas that

[1] The Study Plan (RSP Section 9.9.4) provided that AEA would consider the study area for the Lower River segment to extend from PRM 235.1 downstream to the upper extent of tidal influence, and noted this as approximately RM 28. Instead AEA adjusted the study area for the Lower River segment to extend from PRM 235.1 to PRM 3.3. Mapping and characterization in the Lower River segment has been completed (see Section 4.4) using information from the Geomorphology Study (ISR 6.5). This change in study area boundaries for the Lower River will allow AEA to better meet the objective of mapping and characterizing habitat in this river segment by aligning boundary descriptions between these studies.

were identified and described in the Technical Memorandum: Adjustments to Middle River Focus Areas (R2 Resource Consultants 2013a) were targeted for 100 percent mapping coverage using both aerial imagery and ground-based surveys. This combination of methods allowed for optimum spatial coverage of river habitats in concert with efficient collection of detailed data at selected habitats. Habitat characterization methods were tailored to accommodate variations in channel size and overall stream length. This approach used various mapping methods and tools to meet multiple study objectives and provides the best possible coverage and characterization of river habitats in a large, complex river basin.

Because potential project effects are different in different geomorphic segments of the river, habitat mapping methods were differentiated within the study area first by major geomorphic segment (Upper River, Middle River, and Lower River). Methods were further differentiated by tributary, main channel, off-channel and lake habitat to accommodate the major differences in morphology and hydrology among these habitats. Habitat data collected in this study used the Susitna-Watana Hydroelectric Project habitat classification system (Table 1.1-1) developed during the 2012 study design and planning process as well as standard protocols outlined in the USFS Aquatic Habitat Surveys Protocol (USFS 2001).

Preliminary segment-specific data based on 2012 and 2013 study efforts are reported using tables of macro- and mesohabitat type frequency and summary tables of select measured mesohabitat characteristics (Section 5).

4.1.1. Remote line mapping using Aerial Imagery

During the 2012 remote line mapping effort, data derived from aerial imagery were supplemented with information from video mapping to generate a geospatial database within a GIS (geographic information systems) framework. Remote line mapping of habitats in the study area was completed using a hierarchically-nested habitat typing system that was adapted to the identification levels deemed feasible based on the available aerial imagery (Table1.1-1, Appendix A). The habitat classification hierarchy was composed of four levels representing: (1) major hydrologic segment; (2) geomorphic reach (RSP 6.5.4.1.2.2 and RSP Table 6.5-1); (3) macrohabitat type (Table 1.1-1); and (4) mesohabitat type (Mainstem, Table 1.1-1; Tributary, Table 1.1-2).

For remote line mapping, all main channel habitats were identified to Level 4 mesohabitat type (riffle, pool, run, etc.). Mapping main channel habitats to the mesohabitat level from remote imagery was challenging for certain habitat types that included differentiating run and glide habitat and identifying pool habitat. Run and glide habitat was closely examined through aerial stills and videography to make a professional judgment of the habitat type; however, wind-waves and glare can confound the typing of these habitats. Pool habitat required identifying a hydraulic control and was only found in the Devils Canyon area, where the control was very obvious. Small, less obvious pools may have not been identified from this methodology.

Off-channel habitat (which includes side and upland sloughs) and most tributaries were classified to Level 3 (macrohabitat). These units were not classified into mesohabitats in the remote line-mapping due to the lack of resolution of aerial imagery and the confounding presence of shadows or riparian cover. To address this issue, a subset of 10 primary and 3 secondary

tributaries were habitat typed to Level 4 (mesohabitat) using the results of the 2012 videography as discussed in Section 4.1.1.2 and further described in Appendix 2 of the Fish Distribution and Abundance Implementation Plan (R2 Resource Consultants 2013b). An additional 15 smaller primary and secondary tributaries were identified for ground surveys following the FERC April 1 SPD and in consultation with the TWG via agency review of the Technical Memorandum: Characterization and Mapping of Aquatic Habitats (HDR 2013) during July of 2013. During the 2013 field effort, off-channel habitats were specifically targeted during the random selection of habitat units for field surveys to characterize these habitats to the level of mesohabitat (Sections 4.2.2 and 4.3.2). Field data will be available after 2013 to verify aerial imagery and video typing. If large discrepancies in the proportion of habitat types are apparent upon comparing remote and field mapping data; these results will be presented in the Updated Study Report (USR).

4.1.1.1. *GIS Habitat Mapping*

A linear network was created in GIS by drawing vector-lines (segments) along the stream channel center line as viewed by aerial imagery or LiDAR. This reference imagery was collected at river flows generally ranging from 10,000 to 12,000 cfs, which was subsequently considered representative of relatively low to moderate flow levels. Mainstem habitats were uniquely identified and delineated into segments. Divided channels were assigned multiple segments. The lengths of the segments were based on mesohabitat classifications for the main channel and macrohabitat classifications for off-channel habitats (Table 1.1-1). Each individual vector line segment in the GIS was thus associated with a length and a hierarchical-tiered habitat classification. Not all lines were connected into a contiguous or flow-based network. Note that since there could be multiple macrohabitat types laterally distributed within the floodplain, the total length of habitat identified during remote line mapping could have been considerably longer than the length of each geomorphic reach.

While mapping the mainstem in GIS, tributaries also were delineated in the aerial imagery up to 0.5 mi from the centerline of the main channel or off-channel confluence. Tributaries were differentiated from upland sloughs based on their gradient characteristics and whether they originated above the floodplain. The exact locations of some tributary segments were difficult to determine using the available imagery in heavily forested areas. These locations were estimated based on visual cues in the canopy. Tributary mouths were mapped using a single line segment showing the length of the wetted area of the tributary mouth that extended from the vegetation line out to the edge of the gravel bank. In some of the larger tributaries, the mouth habitat was extended inland beyond the vegetation line based on visible habitat breaks between the tributary channel and the alluvial gravel areas at the mouth.

Within the Upper River tributaries, macrohabitats were mapped from aerial imagery. Matanuska-Susitna Borough LiDAR and imagery were available for the lower extent of many tributaries. However, overhanging vegetation, shadows and other environmental conditions limited characterization of mesohabitats from these sources. In higher elevations within tributaries, mesohabitat characterization was not possible from aerial imagery due to a lack of high resolution photography. A subset of 17 tributaries was thus selected for mesohabitat typing by videography as described in Section 4.1.1.2.

Aerial imagery, was used to further classify mainstem habitat into mesohabitats (Table 1.1-1). Aerial still imagery was viewed at a range of scales from 1:1,000 to 1:12,000 and 2012 videography was referenced as needed. All habitat units were identified using a mid-channel line, which was measured to provide habitat length (HDR Alaska, Inc. 2013a, Appendix B). In channels that were only partially inundated or where water was present in sloughs, the line segments followed the wet areas. AEA has estimated macro- and mesohabitat frequency within main channel, off-channel and tributary study areas based on these data (HDR Alaska 2013a, Appendix B).

Main channel macrohabitats in the Susitna River were classified as single main channel when only a single dominant channel was present; split main channels when the flow was dispersed into two relatively evenly sized channels where the bar or island separating the channels was not vegetated; and multiple split main channels when the main channel split into three or more separate channels each carrying a significant portion of the flow.

Side channels were completely inundated with turbid water (or contained portions that held turbid water), connected at both upstream and downstream ends to the main channel, and flowing around a permanently vegetated island. The dry portions of the channel were delineated based on substrate and a lack of any vegetation, indicating that water periodically inundated the channel during higher flow periods. The distance that the side channel line segments extended into the main channel was determined by an estimation of the continuation of the vegetated or high water shoreline on either side of the mouth of the side channel. The presence of clear or turbid water was used as a main indicator to differentiate between sloughs and side channels.

Side sloughs had clear water and were only connected at the top of the channel to the main channel at high flows. These areas could be partially dry but showed evidence that they were inundated regularly during high flows by lack of vegetation. Upland sloughs had similar characteristics in that the water was relatively clear, but these were not open to the main channel at both ends as indicated by the presence of vegetation in the area between the upstream end of the slough and the main channel.

Mesohabitats were classified from interpretation of both the GIS imagery and aerial video. Riffles were distinguished from areas of wind waves or standing waves by the presence of white water and protruding boulders in the area that indicated the water was relatively shallow and passed over cobbles and boulders. Whitewater in a reach was classified as a run if only one or two protruding boulders were producing isolated areas of turbulence.

Several controls were established to ensure that the remote habitat mapping effort was both precise and accurate. Examples of specific aerial images of habitat types were created, reviewed and confirmed by the technical lead and provided a voucher reference to help identify habitat types. Final habitat typing was reviewed by the technical lead to ensure consistent and accurate habitat mapping.

The exact location of habitat boundaries, such as the boundary between a riffle and run/glide, often required professional judgment on the part of the mapper. Due to lack of resolution in the aerial imagery and shadows along the left bank of the river, some habitat features such as tributary mouths were confirmed by using aerial video as a secondary reference (Section 4.1.1.2). Aerial video was also used to confirm the more permanent gravel bars that showed some vegetation, which was sometimes not evident in the aerial imagery. If the aerial video indicated a bar had vegetation on it, but vegetation was not evident in the aerial imagery, the

island was considered vegetated and the main channel line segment was separated into a main channel segment containing the dominant portion of flow and a side channel segment around the island.

Additional details on methods associated with the creation of the remote line mapping habitat characterizations are available in previously filed technical memos (HDR Alaska, Inc. 2013a, Appendix B).

4.1.1.2. *Aerial Video Data Collection and Analysis*

Low altitude aerial video was collected for the Upper River from PRM 187.1 to PRM 235.4, the Middle River from PRM 102.4 to PRM 187.1, and a short section of the Lower River from PRM 68.0 to PRM 83.5. The study area for the tributary component of the 2012 Aerial Video Habitat Mapping (HDR Alaska, Inc. 2013b, R2 Resource Consultants, Inc. 2013b) included 16 tributary streams above Devils Canyon upstream to and including the Oshetna River. All tributaries above Devils Canyon with documented Chinook salmon presence were included within the videography study area (Tables 4.1-1 and 4.1-2).

Because habitat delineation was not always possible from remote imagery, a mesohabitat frequency analysis was completed for a subset of habitat in 16 videotaped tributaries (Table 4.1-1) using a systematic random sample of the video recording as described in the Study Plan (RSP Section 9.9.5.3.1). Videography collected in the Upper and Middle River mainstem was used as supplemental information in support of habitat characterization from remote imagery.

Aerial video was collected over a period of six days from September 7 to September 12, 2012 during optimal conditions that preceded a major flooding of the Susitna River in mid-September. Videotaping of main channel and off-channel habitats of the Susitna River and tributaries was scheduled in early September 2012 to coincide with late summer base-flow conditions, high water clarity, leaf drop and the possibility of a sustained high pressure, clear weather window. These conditions were achieved (HDR Alaska, Inc. 2013a).

Aerial video coverage within the study tributaries generally extended from the confluence with the Susitna River, or with the primary tributary, upstream to an elevation of approximately 3,000 ft. In tributaries in the Upper River not known to support Chinook salmon, video mapping terminated at approximately 2,200 ft elevation. For non-Chinook tributaries in the Middle River above Devils Canyon, video mapping terminated at the first anadromous barrier. Devil Creek, a Middle River tributary, was videotaped upstream to the impassable barrier at approximately RM 2.2.

Within each tributary reach, (as delineated in Section 4.1.2.1.2), mesohabitat frequency analysis from video was used to identify primary mesohabitat types, defined as those comprising more than 10 percent of the total frequency of mesohabitat types observed by reach (Table 4.1-3). These primary mesohabitats were then used to set sampling targets for the 2013 ground-mapping exercise within identified tributaries (Section 4.2.1).

Additional details of videography methods, analysis and interpretation are included in Appendix 2 of the Fish Distribution and Abundance Implementation Plan (HDR Alaska, Inc. 2013a); detailed results are also available in Initial Results Aerial Video Habitat Mapping of Susitna

River Tributaries from the Upper Extent of Devils Canyon to the Oshetna River (R2 Resource Consultants, Inc. 2013b).

4.1.2. Overview of Ground Mapping Survey Protocols

The intent of the ground mapping effort was to provide mesohabitat classifications in habitats that were difficult to survey using remote line mapping methods (e.g. tributaries and off-channel habitats), to provide detailed habitat characterization of Focus Areas, and to ground-truth a random sample of macro and mesohabitat classifications from the remote line mapping database. Field surveys used the same hierarchically-nested habitat typing system developed for use during the remote line mapping exercise (Tables 1.1-1 and 1.1-2). This overview describes the general methods applied to habitat mapping and surveys overall. River segment-specific variations in methods are presented in Sections 4.2, 4.3, and 4.4 for the Upper River, Middle River and Lower River, respectively.

4.1.2.1. *Geomorphic Reach Delineation*

4.1.2.1.1. Mainstem Susitna River

The Susitna River was categorized into Geomorphic Reaches as part of the Geomorphology Study (Study 6.5) and consisted of six reaches for the Upper River Segment (UR-1 through UR-6), eight reaches for the Middle River Segment (MR-1 through MR-8), and six reaches for the Lower River Segment (LR-1 through LR-6) (Section 5.1.2 in ISR Study 6.5 and Figure 3-1). The geomorphic reach breaks were based in part on the following five factors: 1) planform type (single channel, island/side channel, braided); 2) confinement (approximate extent of floodplain, off-channel features); 3) gradient; 4) bed material / geology; and 5) major river confluences.

4.1.2.1.2. Tributaries

Using desktop tools, including IFSAR topographic contour data, U.S. Geological Survey (USGS) topographic maps, aerial video, and information from reconnaissance flights, tributaries were segmented into geomorphic reaches. Reach breaks were identified using the following criteria:

1. Gradient reach break: a significant transition in slope of valley or channel;
2. Confinement reach break: a significant transition in bankfull width:valley width or wetted:bankfull width ratios;
3. Hydrologic reach break: a tributary confluence where the tributary appeared to contribute more than 10 percent of total flow to the main channel or parent tributary. A segment boundary was not placed where downstream channel characteristics were primarily controlled by bedrock rather than fluvial processes.

4.1.2.2. *Field Methods*

Habitat metrics were collected using a modified U.S. Department of Agriculture, Forest Service (USFS) Tier I through Tier III stream habitat survey protocol (USFS 2001). Some of the habitat metrics listed in the USFS protocol assume that the stream being surveyed is wadeable; however, many of the tributaries and mainstem habitat units selected for ground surveys were only

wadeable along stream margins. Modifications were made to accommodate non-wadeable stream reaches.

The following habitat metrics were collected for each selected tributary geomorphic reach, and for each mainstem habitat unit:

Habitat Metrics

- Mesohabitat unit type (Tables 1.1-1 and 1.1-2)
- GPS location of channel measurements
- Measured or estimated gradient
- Measured unit length (range finder or remote using GIS)
- Measured or estimated bankfull width (BFW) (three measurements per unit)
- Measured average wetted width (three measurements per unit)
- Measured bankfull depth (BFD) of unit (three measurements per unit)
- Measured or estimated wetted maximum depth (thalweg) (three measurements per unit)
- Estimated percent substrate composition within wetted width of unit
- If pool, estimated or measured maximum depth
- If pool, estimated or measured pool crest depth
- If pool, identified structural feature forming the pool
- Large woody debris (LWD) count within wetted width of unit
- Estimated percent undercut, each bank in unit
- Estimated percent erosion, each bank in unit
- Type and percent in-stream cover in unit
- Estimated percent riparian vegetation cover in unit
- Dominant riparian vegetation type for each unit
- Photograph of each unit

Field surveys were conducted by two- or three-person survey crews. Each survey crew consisted of a qualified lead biologist and field technician(s). To the extent possible, field surveys were conducted at flows similar to those recorded during the capture of aerial video and reference photographs (Figure 4.1-1).

Mainstem survey start and end points for the randomly selected macro- and mesohabitat units were determined from GIS waypoints obtained from the GIS database prior to field efforts commencing (Sections 4.2.2 and 4.3.2; Appendices C and D). Habitat units within mainstem and tributary surveys were sequentially numbered as encountered from downstream to upstream.

Tributary ground survey start and end points were based on those detailed for video-mapping in tributaries (section 4.1.1.2) but are simplified; there is no distinction between end points in streams with or without Chinook presence. Accordingly, tributary ground survey reaches originated in the lowest geomorphic reach of the tributary just upstream of the ordinary high water line of the mainstem Susitna and progressed in an upstream direction. In Upper River tributaries ground surveys ended at 3,000 ft or if a permanent impassable barrier was encountered upstream of the 2,200-ft elevation point (Table 4.1-1). Permanent impassable

barriers encountered downstream from the 2,200-ft elevation point were documented and barrier measurements were taken. In Middle River tributaries above Devils Canyon, ground surveys also ended at 3,000 ft or if a permanent impassable barrier was encountered, whichever came first (Table 4.1-1); where permanent impassable barriers were encountered these were documented and barrier measurements were taken and the survey continued. For tributary surveys in the Middle River below Devils Canyon, surveys were conducted within the length of stream within the zone of hydrologic influence of potential Project operations (Table 4.1-2).

When split or multiple split main channels were encountered in mainstem surveys, the channel identified by the remote line was surveyed and the estimated percent of flow in that channel was recorded. When split main channels were encountered in tributaries, both channels were surveyed with the channel containing an estimated majority of flow categorized as primary, and the other categorized as secondary. Mesohabitat units in the primary channel were categorized as primary units and were numbered sequentially as part of the main tributary channel survey. Mesohabitats within secondary channels were recorded separately. When multiple split main channels were encountered in tributaries (more than two dominant channels), each channel was photographed; however, only the primary and secondary channels were surveyed. Side channels were identified as entering from the left (LB) or right bank (RB, looking downstream). The inlet and outlet of each side channel was documented using waypoints, photographs, and descriptions.

The Susitna River mean daily discharge was obtained from the nearest downstream USGS stream gage for each field survey date. In addition, relative flow levels in each mesohabitat on the day of the survey were estimated using the following qualitative categories:

- **Dry:** No surface water visible,
- **Puddled:** Series of isolated pools connected by surface trickle or visible subsurface flow (e.g., wetted substrates),
- **Low Flow:** Surface water flowing across 50 to 75 percent of the BFW,
- **Moderate Flow:** Surface water flowing across 75 to 90 percent of the BFW,
- **High Flow:** Stream flowing completely across BFW, but not at BFW.

4.1.2.3. *Special Habitat Features*

For 2013 field surveys, special habitat features were defined as tributaries, seeps, and springs that contributed tributary or groundwater to the mainstem and temporary (e.g., subsurface flow, perched debris jams, perched culverts) or permanent barriers to upstream fish migration. Backwater habitats, beaver complexes and clearwater plumes were considered Level 3 macrohabitats during the development of the study plan and then were re-assigned as Level 4 mesohabitats (following the directive in the April 1, SPD). Backwaters, beaver complexes and clearwater plumes were also treated as special habitat features and along with the features described above, were specifically noted when encountered in the course of field survey efforts. Additional data pertinent to these features (e.g. width of the feature in addition to channel wetted width) were noted on field forms. A GPS waypoint was recorded and a photograph taken of each special feature.

For features classified as stream barriers only cursory information was collected under the Habitat Mapping study, as most of the formalized barrier survey data are being collected under the Fish Passage Barrier Study (ISR Study 9.12). The following information was recorded:

- Barrier type (beaver dam, debris dam, vertical falls, chute/cascade, boulder, other),
- Temporal nature (ephemeral or permanent),
- Maximum height of falls or biggest single step if cascading,
- Maximum depth of plunge pool,
- Chute/cascade gradient and length,
- Length of feature.

4.1.2.4. *Mapping near reference flows*

Flows in the Susitna River as measured at the Gold Creek gage were generally higher than those recorded during videography and imagery used for remote line mapping although they were within target upper flows established during operational planning to guide field efforts (Figure 4.1-1). Field surveys in 2013 were conducted in a roughly downstream to upstream manner throughout the field season; flows during surveys in Middle River reaches were closer to target or reference flows than the Upper River surveys conducted in the later portion of the field effort (Figure 4.1-1).

4.2. Upper River Habitat Mapping

AEA implemented the methods as described in the Study Plan with the exception of the variances described in Section 4.2.4. Following completion of the 2012 remote line mapping effort (Section 4.1.1), field surveys were conducted to ground-truth Upper River habitat to the mesohabitat level (Section 4.1.2). Due to the vast extent of the Upper River, sub-sampling during ground-truthing was required. For 2013, surveys were initially planned for a total of 42 randomly selected mainstem macrohabitat units, 42 single main channel mesohabitat units, 25 tributaries within the proposed reservoir inundation zone, and three tributaries (two primary, one secondary) located upstream of the inundation zone. The Upper River inundation zone tributaries targeted for field surveying included 10 primary tributaries that were also selected for fish distribution and abundance sampling and had been previously video surveyed (Section 4.1.1.2) and 15 additional small primary and secondary tributaries selected in response to the FERC April 1 SPD and consultation with the TWG following review of the Technical Memorandum: Characterization and Mapping of Aquatic Habitats (HDR 2013). The Upper River tributaries selected and those surveyed during the 2013 field season are listed in Table 4.1-1.

4.2.1. Tributaries in the Upper River

4.2.1.1. *Primary Tributaries*

During 2012, select Upper River tributaries were mapped using a combination of low-altitude aerial video (10 tributaries, Table 4.1-1) and limited on-the-ground field surveys in a subset of those videographed tributaries (reaches of Watana Creek, Jay Creek and Kosina Creek). Details of methods and the results of those 2012 preliminary field surveys were presented in 2012 Upper

Susitna River Fish Distribution and Habitat Study – Habitat Report (HDR Alaska, Inc. 2013b). These tributaries, together with additional tributaries that were not conducive to aerial video mapping (Section 4.2.1.1) were ground surveyed during the 2013 field effort (Figure 4.1-2).

Continuous habitat surveys were conducted within each delineated geomorphic reach (Section 4.1.2.1.2) of each selected tributary. Habitat surveys were conducted over a distance equivalent to at least 20 consecutive channel widths, with the goal of sampling at least five units of each of the primary mesohabitat types occurring in the geomorphic reach. Primary mesohabitats were determined from the video frequency analysis previously described (Table 4.1-3 and Section 4.1.1.2). The 20-channel-width section within each tributary geomorphic reach was selected based on accessibility to multiple and varied mesohabitat types. Survey distance was extended, either contiguously or at another location in the geomorphic reach, to ensure inclusion of five replicates per primary habitat type. If accessible by foot or helicopter and within the 20 channel width survey length, e.g. not in the bottom of a gorge, non-primary habitats were also surveyed to the extent possible.

Access by helicopter or cross-country to points along the stream was problematic because many tributaries were heavily forested. The starting and ending points for field surveys during 2013 were largely dependent on accessibility and could not be randomly selected. Many streams were accessed by helicopter via a landing zone along the Susitna River near the mouth of the tributary. In the lowest geomorphic reach of each primary tributary, surveyors started the mapping section just upstream of the ordinary high water line of the mainstem Susitna River. Upstream geomorphic reaches were surveyed if access and maneuverability within or along the stream was determined to be safe. Safeness of landing zones was determined by the helicopter pilot. Reasonableness of conducting the survey was determined by the field crew lead and was dependent on the distance and difficulty of cross country travel from the helicopter landing zone to the stream section to be mapped. Conditions preventing access were documented.

A total of 11 (of 13) primary or large tributaries have been fully or partially ground-surveyed and mapped to the mesohabitat scale (Table 4.1-1).

4.2.1.2. *Smaller and secondary tributaries within the Upper River inundation zone*

Most small tributaries in the Upper River inundation zone are obscured from overhead view due to a closed canopy of riparian vegetation and thus were not mapped using aerial imagery. Fifteen of these tributaries were added to those selected for ground-surveys in response to the FERC April 1, 2013 SPD and consultation with the TWG (Table 4.1-1). Survey protocols for these smaller tributaries are the same as those used in larger tributaries in the Upper River (Section 4.2.1.1).

4.2.2. Mainstem habitats in the Upper River

Upper River mainstem habitat was remote line-mapped using a hierarchically-nested habitat typing methodology based on assessment of aerial still imagery, LiDAR, and aerial videography as described in Section 4.1.1. Reaches UR-1 and UR-2 were classified solely as mainstem (main channel, off-channel), or tributary habitat. UR-3 through UR-6 were classified to the

mesohabitat level using the available remote imagery (Section 4.1.1.1) with supplemental information provided from videography (Section 4.1.1.2).

Upper River field surveys were conducted in 2013 in accordance with the methods outlined in Section 4.1.2. The random selection of habitat units for ground-truthing proceeded in two ways. For single main channel habitat (which lacked obvious survey start and end points) seven units of each mesohabitat type (or all if less than seven were available) were targeted at random for ground-truthing of the remote line mapping mesohabitat call and collection of habitat metrics (Section 4.1.2.2). In all other habitat types, macrohabitat length could be determined prior to the field effort and so seven units (or all if less than seven available) of these mainstem macrohabitat types (split main channel, multiple split main channel, side channel, tributary mouth, side slough, upland slough) were targeted at random for ground-truthing of both macro and mesohabitat (Level 3 and Level 4) and collection of habitat metrics. For the targeted upland and side sloughs, the study teams attempted to locate at least two of each slough type that had an associated beaver complex. Altogether, field surveys to ground-truth habitat that had been previously typed by remote imagery were planned for a total of 42 single main channel mesohabitat units and 42 randomly selected mainstem macrohabitat units within the Upper River. However, the final selection of habitat units was drawn from habitat units that both existed and were accessible; thus, the pool of available habitats was less than the targeted selection and included only 21 available mesohabitats within single main channels and 27 macrohabitat units of other types (Table 4.2-1).

Within single main channel macrohabitat, all targeted and existing mesohabitats were mapped during the 2013 field effort (7 riffles, 7 run/glide units). Pools were not present within single main channel habitats of the Upper River. While rapids did occur, the consensus of field crew leaders and boat drivers was that these habitats could not be safely surveyed. Macrohabitat units other than single main channel were selected to be surveyed to the extent that they were present on the riverscape (Table 4.2-1). Multiple split main channel habitats and upland or side sloughs with beaver influence could not be located within the Upper River. Among habitats that were both targeted and available, field crews surveyed 6 of 7 split main channel units, 4 of 7 targeted side sloughs and 3 of 6 targeted upland sloughs (Table 4.2-1). Field crews completed 6 of 7 targeted side channels noting that one of the selected side channels could not be surveyed due to a dangerous rapid across the access point.

The special habitat features, including backwaters, beaver complexes and clearwater plumes, were scarce in the Upper River, although clearwater plume habitat was present in UR-3 and UR-4 (Appendix B). Only one backwater habitat was identified during the remote line mapping in the Upper River. These mesohabitat units did not occur within single main channel habitat and, thus, were not targeted during the random selection procedure.

4.2.3. Lakes within the Upper River Inundation Zone

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 4.2-2); elevation, surface area, and perimeter, were calculated and the presence or absence of surface water connection to the Susitna River was noted. The lakes identified are shown by number in Figure 4.2-1 and in Table 4.2-2.

4.2.4. Variances from the Study Plan

AEA fully implemented the FERC approved study methods with the exception of the following three variances.

4.2.4.1. *Access Limitations*

The Study Plan (RSP Sections 9.9.5.3.2 and 9.9.5.4) provided that AEA would characterize and map a random subsample of main channel, off-channel and tributary habitats assuming full access to the Susitna drainage basin. Additional selection of smaller and secondary tributaries was discussed in the July 2013 technical memo Characterization and Mapping of Aquatic Habitats (HDR 2013b). Instead AEA initiated surveys in 2013 to characterize and map a subset of the initially randomly-selected habitats that were not located on Cook Inlet Regional Working Group (CIRWG) lands. This access restriction, in addition to uncontrollable access limitations due to high velocity water, rapids, canyons or other physical barriers, resulted in incomplete spatial coverage and reduced sample sizes across Upper River mainstem and tributary habitats as detailed below.

AEA will map and characterize all habitat units in both Upper River mainstem and selected tributaries in the next study year to meet study objectives.

4.2.4.1.1. Mainstem Habitats

Restricted access to CIRWG lands constrained the total stream length sampled and a limited number of mainstem habitats were judged unsafe due to safety considerations. However, coverage of mainstem habitats selected was nearly complete. Mainstem units that could not be sampled due to restricted CIRWG land access or safety concerns were approximately 8 percent of the total planned in the Upper River (Table 4.2-1). The upstream and downstream boundaries (as project river miles) of mainstem habitat that were inaccessible due to either CIRWG land or safety considerations are provided in Table 4.2-3.

4.2.4.1.2. Tributaries

Approximately 18 percent of the tributary geomorphic reaches that were selected for ground mapping had CIRWG land access restrictions; these are identified in Table 4.1-1. Certain segments of selected Upper River tributaries were accessible for short distances that occurred on public lands. In total, 3 tributaries were not surveyed (197.7, Watana Creek RB-1 and Watana Creek LB 1.1.1) and 3 tributaries were partially surveyed (204.3-LB, 194.8-RB and Deadman Creek) due to access limitations.

4.2.4.2. *Special Habitat Features*

The Study Plan Determination provided that backwater habitats, beaver complexes and clearwater plumes be considered as Level 3 habitats (mesohabitats) under AEA's nested hierarchical classification scheme (SPD B-210; Table 1.1-1) and that backwater habitats be identified and given specific consideration within the Study Plan (SPD B-212). Instead AEA identified each of these as special habitat features (RSP Section 9.9.5.3.2.2) requiring additional consideration. These three habitats were not nested hierarchically as other mesohabitats were,

but rather tended to occur in association with a smaller subset of macrohabitat types (clearwater plumes were typically associated with tributary mouths; beaver complexes and backwaters with side or upland sloughs).

As special habitat features these were mapped using analogous methods to mesohabitat units but with modifications to characterize the features of particular interest (e.g., width of the clearwater plume was measured rather than the wetted width of the channel). By identifying these habitats as special habitat features, AEA will better meet the study objectives of characterizing and mapping habitats for the purposes of informing other studies, particularly the Upper River Fish Distribution and Abundance Study (Study 9.5) since these are habitats of note for fishes. This variance will also allow AEA to target these habitats for "specific consideration" as recommended by FERC in the Study Plan Determination (SPD B-212).

During 2012 remote line mapping of the Upper River, clearwater plumes were rare and identified only in UR-3 and UR-4 (HDR Alaska, Inc. 2013a, Appendix B); backwater habitats were also rare and present only in UR-4 (Appendix B), whereas beaver complexes were not identified in the Upper River. These habitats were not encountered during 2013 field surveys of randomly selected macrohabitats in the Upper River. AEA did not specifically target these habitats in the Upper River as they were not representative of mesohabitat characteristics in that segment of the river. Extensive field surveys of each of these features have been conducted in the Middle River both within and outside of Focus Areas (Section 4.3.3.2). This mapping effort in the Middle River, where these features are more common, has allowed AEA to meet the objective of considering these habitats as special mesohabitat features and giving backwater habitats in particular "special consideration."

4.2.4.3. *Ground Survey Flow Conditions*

The Study Plan (RSP Section 9.9.5.3.2) provided that ground mapping for Upper River tributaries would be done at low to moderate flows similar to those which occurred during aerial videography to allow for similar habitat calls for the two methods. Instead the study teams mapped habitats in both tributaries and mainstem habitats during all windows of accessibility in terms of both flow levels and weather conditions (Section 4.1.2.4); flow levels at the Gold Creek gage during the 2013 field mapping season are shown in Figure 4.1-1.

This variance from the approved study methods was a consequence of unpredictable flow throughout the season and could not be avoided even with careful planning. AEA realized that it would be very difficult to map the large amount of habitat, particularly in the Middle River, within the short time window where Susitna River flows were between the 10,000 and 12,000 cfs (Figure 4.1-2). Accordingly, AEA prioritized mapping of habitats more likely to be altered by high flow conditions. Side sloughs were given highest priority for low flow mapping in order to minimize mapping during potential breaching flows; the target upper flow for mapping in side sloughs was approximately 18,000 cfs. During the 2013 field effort, 19 side sloughs (out of 22) were mapped at flows less than about 21,000 cfs; 3 side sloughs were mapped at a high flow of 30,700 cfs (Table 4.2-4). Main channel habitats were consistently mapped at flows less than about 25,000 cfs with just under 20 percent of habitats mapped at higher flows up to a maximum of 31,400 cfs (Table 4.2-4). Upland slough habitats were almost entirely mapped at flows less

than 30,000 cfs with just three (of 29) upland sloughs mapped at a high flow of 31,400 cfs (Table 4.2-4).

Determining whether ground-truthing at the range of flows encountered during field surveys in 2013 was adequate to meet the study objectives is dependent on the degree and magnitude of difference in the resulting habitat calls. Preliminary examination of the data suggests 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. The infrequency of these differences despite greater than planned for disparity in mapping flows supports AEA's belief that the objective of ground-truthing remote-line mapping habitat calls has been met. Details of the degree of discrepancy will be presented in the Updated Study Report.

4.3. Middle River Habitat Mapping

AEA implemented the methods as described in the Study Plan with the exception of the variances described in Section 4.3.3. As described in Section 4.1.2.1.1, the Middle River was divided into eight geomorphic reaches. In 2012, remote line mapping was applied to the entire Middle River segment as per the methods described in Section 4.1.1. In 2013, field surveys were conducted in selected tributaries of the Middle River segment and in randomly selected mainstem habitat units following the same selection procedure described for the Upper River (Section 4.2.2; Table 4.2-1).

4.3.1. Tributaries in the Middle River

Matanuska-Susitna Borough LiDAR and imagery were available for the lower extent of many tributaries within the study area, however, overhanging vegetation, shadows and other environmental conditions limited characterization of mesohabitats from these sources in 2012. In higher elevations within tributaries, mesohabitat characterization was not possible from aerial imagery due to lack of high resolution photography. Subsequently, a subset of seven tributaries in the Middle River segment within or above Devils Canyon was selected for mesohabitat typing by videography as described in Section 4.1.1.2 (Table 4.1-2).

A total of six tributaries outside of Focus Areas within and upstream of Devils Canyon in the Middle River were selected for ground mapping in 2013 (Tsusena Creek, 184.0-RB, Fog Creek, Devil Creek, Chinook Creek, Cheechako Creek). These tributaries were also among those that were videographed in 2012. Two additional tributaries are located in FA-173 (Stephan Lake Complex) in the Middle River above the lower extent of Devils Canyon. These tributaries were divided into geomorphic reaches based on tributary basin drainage area and stream gradient according to criteria described in Section 4.1.2.1.2. Three of these tributaries have been partially ground-truthed (173.8-RB, Fog Creek, Chinook Creek). Habitat classifications within these tributaries were ground-truthed according to the same methods described for Upper River tributaries (Section 4.2.1).

An additional 20 tributaries that were known to contain populations of anadromous and resident fishes were selected within the zone of hydrologic influence (ZHI) of the proposed Project below Devils Canyon; nine occurred within Focus Areas and 11 were outside of Focus Areas. In 2013, reaches that were within the zone of hydrologic influence in these tributaries were ground

mapped following field protocols described in Section 4.2.1. Of the 11 tributaries outside of Focus Areas selected for field survey in the Middle River segment below Devils Canyon, a total of four tributaries have been fully or partially ground-surveyed and mapped to the mesohabitat scale (Table 4.1-2). Four of the nine tributaries within Focus Areas below Devils Canyon have been fully or partially ground-surveyed.

4.3.2. Mainstem Habitats in the Middle River

In 2012, remote line mapping for the Middle River mainstem occurred in an identical fashion as the Upper River mainstem habitats as described in Section 4.1.1. In addition to the remote mapping, field surveys were conducted in 2013 in accordance with the methods outlined in Section 4.1.2.

In 2013, nine of the 10 Focus Areas in the Middle River were ground-mapped to the mesohabitat level. Due to lack of permission to access private lands, a limited number of habitat units within portions of Focus Areas FA-128 (Slough 8A) and FA-173 (Stephan Lake Complex), and all of FA-151 (Portage Creek), were not ground-truthed in 2013 (Table 4.3-1). The remotely-mapped line segments were used as a starting point to guide field sampling and unmapped features were added as encountered.

Outside of Focus Areas, Middle River mainstem habitat was ground-mapped by selecting a random subset of remote line-mapped macro- and mesohabitats using the methods and selection criteria described in Section 4.2.2. As in the Upper River, the pool of available and accessible habitats was less than the targeted selection and included 23 mesohabitats within single main channels and 35 units of other macrohabitat types. In addition, private lands limited AEA access to some targeted habitat units. Planned versus available habitats and habitat units ground-mapped in the Middle River mainstem during the 2013 field season are presented in Table 4.2-1.

In the SPD, FERC directed AEA to identify backwater habitat and give this feature specific consideration (SPD B-212). The 10 Focus Areas included a diversity of side channels, side sloughs, and tributary mouths, which often contained a variety of backwater habitats at off-channel and tributary mouths in the Middle River. During 2013, aquatic habitat field surveys included measurement and characterization of all backwater features within Middle River Focus Areas. The 2-D habitat modeling effort being conducted in Focus Areas, as described in the ISR for Study 8.5, will allow for habitat-flow relationships to be developed in Focus Areas by macrohabitat and by select mesohabitat (e.g. backwaters). Clearwater plumes and beaver complexes were treated in the same manner as in the Upper River (Sections 4.1.2.3 and 4.2.2).

4.3.3. Variances from the Study Plan

AEA fully implemented the FERC approved study methods with the exception of the following three variances.

4.3.3.1. *Access Limitations*

The Study Plan (RSP Sections 9.9.5.3.2 and 9.9.5.4) provided that AEA would characterize and map a random subsample of mainstem and tributary habitats assuming full access to the Susitna drainage basin. Additional selection of smaller and secondary tributaries was discussed in the

July 2013 technical memo Characterization and Mapping of Aquatic Habitats (HDR 2013b). Instead AEA initiated surveys in 2013 to characterize and map a subset of the initially randomly-selected habitats that were not located on private lands. This restriction, in addition to access limitations associated with sites deemed unsafe due to rapidly flowing water, canyons or other physical barriers resulted in incomplete spatial coverage and reduced sample sizes across Middle River mainstem and tributary habitats as detailed below.

AEA will map and characterize all targeted habitat units in both the Middle River mainstem and selected tributaries in the next study year to meet study objectives.

4.3.3.1.1. Mainstem Habitats

Limited access to private lands constrained the total area sampled. However, survey coverage of targeted mainstem habitats during 2013 field surveys was nearly complete. Targeted mainstem units that could not be mapped due to restricted access comprised approximately 14 percent of the total target in the Middle River; areas of the river where selected habitat units were not mapped due to either restricted access to private lands or safety considerations are identified in Table 4.2-3; the majority of these areas were located or only accessible either within Devils Canyon throughout MR-4 or on CIRWG (dominantly above Devils Canyon) or ARRC lands (dominantly below Devils Canyon).

4.3.3.1.2. Tributaries

Certain segments of Middle River tributaries dominantly on CIRWG lands were accessible for short distances. Portions of 26 Middle River tributaries covering 32 tributary geomorphic reaches were inaccessible to field crews (Table 4.1-2). Eleven of 14 or approximately 79 percent of tributary geomorphic reaches (in 8 tributaries) above the lower extent of Devils Canyon were located on CIRWG lands. Of these, Devil Creek, Chinook Creek and Cheechako Creek are located within Devils Canyon and were not mapped due to safety considerations; these three tributaries also run at least partially through CIRWG lands (Table 4.1-2).

Thirteen of the 20 tributaries (including those within Focus Areas) below Devils Canyon were located on private lands or 65 percent of tributary geomorphic reaches below Devils Canyon.

Tributary geomorphic reaches that were targeted for ground mapping but could not be sampled due to access or safety issues are shown in Table 4.1-2.

4.3.3.2. *Special Habitat Features*

The April 1, SPD provided that backwater habitats, beaver complexes and clearwater plumes be considered as Level 3 habitats (mesohabitats) under AEA's nested hierarchical classification scheme (SPD B-210, Table 1.1-1) and that backwater habitats be identified and given specific consideration within the Study Plan (SPD B-212). Instead AEA identified each of these as special habitat features (RSP Section 9.9.5.3.2.2) requiring additional consideration. These three habitats were not nested hierarchically as mesohabitats were, but rather tended to occur in association with a smaller subset of macrohabitat types (clearwater plumes were typically associated with tributary mouths; beaver complexes and backwaters with side or upland sloughs). As special habitat features these were mapped using analogous methods to

mesohabitat units but with modifications to capture the features of particular interest (e.g. width of the plume was measured rather than the wetted width of the channel).

Special habitat features were mapped as they were encountered in field surveys during the 2013 mapping effort. A total of 20 backwater mesohabitats, 33 beaver complexes and 9 clearwater plumes were identified in the Middle River. These habitats were not encountered during field surveys of randomly selected macrohabitat units in the Middle River. Although these habitats were not targeted by the random selection protocol implemented during 2013, by identifying these habitats as special habitat features, AEA will better meet the study objectives of characterizing and mapping habitats for the purposes of informing other studies, particularly the Study of Fish Distribution and Abundance in the Middle and Lower Susitna River (ISR Study 9.6) since clearwater plumes, beaver complexes and backwaters are habitats of note for fish. This variance will further allow AEA to target these habitats for "specific consideration" as recommended in FERC's April 1 SPD (SPD B-212).

4.3.3.3. *Ground Survey Flow Conditions*

The Study Plan (RSP Section 9.9.5.3.2) provided that ground mapping for Upper River tributaries would be done at low to moderate flows similar to those which occurred during aerial videography to allow for similar habitat classification from the two methods. Instead study teams mapped habitats in both tributaries and mainstem habitats during all windows of accessibility in terms of both flow levels and weather conditions (Section 4.1.2.4); flow levels at the Gold Creek gage during the 2013 field mapping season are shown in Figure 4.1-1.

This variance from the proposed study methods was a consequence of unpredictable flow throughout the season that could not have been avoided even with careful planning. AEA realized that it would be very difficult to map the large amount of habitat, particularly in the Middle River, within the short time window where Susitna River flows were between 10,000 and 12,000 cfs (Figure 4.1-1). AEA prioritized mapping of habitats more likely to be altered by high flow conditions. Side sloughs were prioritized for low flow mapping in order to minimize mapping during potential breaching flows; the target upper flow for mapping in side sloughs was approximately 18,000 cfs. During the 2013 field effort, 19 side sloughs (of 22) were mapped at flows less than approximately 21,000 cfs; 3 side sloughs were mapped at a high flow of 30,700 cfs (Table 4.2-3). Main channel habitats were prioritized for mapping at flows below 25,000 cfs and were consistently mapped at this discharge level with just under 20 percent of habitats mapped at higher flows up to a maximum of 31,400 cfs (Table 4.2-3). Upland slough habitats were considered lowest priority for low flow mapping and were to be mapped under flow conditions of 30,000 cfs or less; these were almost entirely mapped to this criteria with just 3 (of 29) upland sloughs mapped at a high flow of 31,400 cfs (Table 4.2-3).

Determining whether ground-mapping at the range of flows encountered during field surveys in 2013 was adequate to meet the study objectives is dependent on the degree and magnitude of difference in the resulting habitat classification. Preliminary examination of the data suggest that although target flows were not universally achieved during field surveys, conflicts between remote-line mapping or videoed habitat classification and ground survey habitat classification were infrequent. The infrequency of these differences *despite* greater than planned for disparity in mapping flows supports the belief that the study goal of ground-truthing remote-line mapping

habitat calls to meet the objective of characterizing habitats has been met. Details of the degree of discrepancy will be presented in meetings of the TWG and in the Updated Study Report.

4.4. Lower River Habitat Mapping

AEA implemented the methods as described in the Study Plan with no variances. The Geomorphology Study (Study 6.5, see RSP section 6.5.4.4.2.2) used existing LiDAR and aerial imagery from the Matanuska-Susitna Borough LiDAR and Imagery Project to map the Lower River. The Reconnaissance-Level Geomorphic and Aquatic Habitat Assessment of Potential Effects on the Lower River Study (HDR Alaska, Inc. 2013b) was used to delineate different geomorphic features in the mainstem Lower Susitna River. As part of that study, aerial photographs from the 1980s and 2012 were reviewed to delineate all geomorphic features within the Lower River floodplain. The habitat classification definitions followed those employed by Ashton and Trihey (1985), and included main channel, side channel, bar islands, side sloughs, upland sloughs, tributary channels, tributary mouths, tributary deltas and additional open water areas.

As described in the Study Plan (RSP 9.9.5.4.3), it was impractical to map the entire river segment beyond Level 3 (macrohabitat) because of the very large size and channel complexity of the Lower River (Figure 4.4-1). The result of the test videography completed for a short segment of the Lower River showed that a height of 400 ft or lower with three to five flight paths would be necessary to visually differentiate mesohabitat types in the Lower Susitna River segment. Further, several parallel paths would be extremely difficult to track even with the use of GPS and would be very difficult to follow during review of the video. In summary, the review of the test section concluded that aerial videotaping was not a practical method for habitat mapping the Lower River.

5. RESULTS

This section of the ISR provides a detailed description of the results of the Study Plan to date by major river segment. Within each river segment the outcomes of both remote line mapping and ground surveys in both mainstem and tributary habitats are provided.

5.1. Upper River

The results of both remote line mapping and ground surveys in mainstem habitat units, tributary reaches and lakes within the Upper River inundation zone are described in this section using a combination of habitat distribution and frequencies. Results include a broad overview of average habitat metrics within each mesohabitat unit type and for these metrics grouped by macrohabitat designation. Macrohabitat summaries represent the average of habitat metrics in all surveyed mesohabitats within that macrohabitat type and as such represent a subset of the average conditions that may be present across an entire macrohabitat type.

5.1.1. Tributaries in the Upper River

The results presented for tributaries in the Upper River include information previously summarized in technical memorandum for remote line mapping (HDR 2013b, R2 Resource Consultants, Inc. 2013b, Appendix B); summaries of habitat distributions and metrics from ground surveys conducted during 2012 (HDR Alaska, Inc. 2013b); and results from ground surveys conducted during 2013, the most recent year of study.

5.1.1.1. *Habitat Distribution from Remote Line Mapping (Aerial and Video)*

Preliminary tributary geomorphic reach classes were established using aerial video and contour maps. Additional information will be reviewed (e.g., aerial photos, habitat mapping photos, and data collected during 2013 fisheries studies and ground-truthing habitat surveys) and used in the final designation of the reach types to be reported in the Updated Study Report. For this reason, the classification of type and the number of geomorphic reaches is considered preliminary.

The primary product of video mapping was a mesohabitat frequency estimate for the selected tributaries. The results of the habitat frequency analysis from videography for selected Upper River tributaries are summarized in Table 4.1-3; additional details were presented in Appendix 2 of the *Fish Distribution and Abundance Implementation Plan* (R2 Resource Consultants, Inc. 2013b). Results are presented by study area tributary and include mesohabitat frequency analysis, distribution of mesohabitat types by river mile and tributary geomorphic reach; and photographs that provide a visual reference of some of the more prominent habitat types and the general character of each tributary (R2 Resource Consultants, Inc. 2013b).

5.1.1.2. *Habitat Distribution from Ground Surveys*

During 2012, preliminary ground-mapping was conducted in several reaches of Jay, Kosina and Watana creeks. The relative frequency of each mesohabitat unit type based on length was calculated. Details and summary statistics for mesohabitat units within this preliminary effort were presented in *2012 Upper Susitna River Fish Distribution and Habitat Study: Habitat Report* (HDR Alaska, Inc. 2013b). Overall, the mesohabitat type composition between main channels and side channels in these three tributaries appeared to be driven by the different hydrologic regimes as would be expected within the two channel types. Main tributary channels were dominated by riffle and run mesohabitats whereas tributary side channels contained a greater diversity of mesohabitat types (HDR Alaska, Inc. 2013b).

During the 2013 ground survey effort, a total of 11 tributaries that had been mesohabitat mapped using videography (Section 4.1.1.2) were ground-mapped to the mesohabitat level (Table 4.1-1). The total length surveyed within these Upper River tributaries during 2013 was 32,753 m (20.4 mi) with an average survey length of 1,170 m (0.73 mi) within each tributary geomorphic reach (Table 5.1-1). A comparison of mesohabitat characterization from those field surveys against habitat classifications made using 2012 remote line mapping and videography will be presented in the Updated Study Report.

Mesohabitats in these tributaries were largely composed of boulder riffle, riffle, and run mesohabitats representing 27 percent, 22 percent, and 20 percent of the total length of tributary

habitat surveyed respectively (Table 5.1-1). Descriptive summary statistics for select habitat metrics by mesohabitat within Upper River tributaries surveyed during the 2013 field effort are presented in Tables 5.1-2 through 5.1-6. Data for all habitat metrics will be comprehensively summarized in the Updated Study Report.

Average habitat characteristics included mean gradients (outside of alcoves, beaver ponds and percolation channels) ranging from 0.2 percent in pools to 8.9 percent in cascades. Overall mean bankfull width in all mesohabitats surveyed was 21 m (23 yd) with a range from 1 m (1.1 yd) in alcoves to 27 m (29.5 yd) in riffles; overall mean wetted width was 18 m and ranged from 1 m (1.1 yd) in alcoves to 24 m (26.3 yd) in glide and riffle mesohabitats. Overall mean bankfull depth was 0.9 m (1 yd) and ranged from 0.4 m (1.3 ft) in alcoves to 1.4 m (1.5 yd) in pool mesohabitats; overall mean thalweg depth was 0.7 m (2.3 ft) and ranged from 0.2 m (0.7 ft) in percolation channels to 0.9 m (1 yd) in beaver ponds, glides and pool mesohabitats.

5.1.2. Mainstem Habitats in the Upper River

The results presented below for mainstem habitats in the Upper River include information previously summarized in technical memoranda for remote line mapping (HDR 2013b, R2 Resource Consultants, Inc. 2013b, Appendix B); summaries of habitat distributions and metrics from ground surveys conducted during 2012 (HDR Alaska, Inc. 2013b); and results from ground surveys conducted during 2013, the most recent year of study.

5.1.2.1. *Habitat Distribution from Remote Line Mapping (Aerial and Video)*

An assessment of the remote line-mapping habitat characterization through videography in the Upper River indicated that channel type was similar across geomorphic reaches. Approximately 70 percent of the riverine habitat was classified as main channel, 0 to 11 percent as off-channel habitat, and roughly 25 percent as lower reaches of tributaries (Appendix B). Detailed methods, analysis and results from the 2012 remote line mapping exercise in the Upper River are presented in the technical memorandum *Upper Susitna River Segment Remote Line Habitat Mapping* (Appendix B).

5.1.2.2. *Habitat Distribution from Ground Surveys*

The total length of macrohabitat surveyed within the Upper River mainstem during 2013 was 6,011 m (3.7 mi) composed of 842 m (0.52 mi) of split main channel, 64 m (0.4 mi) of multiple split main channel, and 2,651 m (1.65 mi) of side channel (Table 4.2-1). Total lengths for habitat characterized as a single main channel was not recorded on field forms; these unit lengths will be determined from survey waypoints, assessed using GIS and presented in the Updated Study Report. Excluding single main channel, the most common Upper River mainstem habitat was side channel which represented 44 percent of the total measured habitat by length (Table 5.1-7).

Descriptive statistics for select habitat metrics summarized by macrohabitat within Upper River mainstem habitat units surveyed during the 2013 field effort are presented in Tables 5.1-8 through 5.1-12. Data for all habitat metrics will be comprehensively summarized in the Updated Study Report. Gradient was lowest in side slough macrohabitats with a mean gradient of 0.4 percent and was highest in multiple split main channels where the mean gradient was 2.0

percent. Bankfull width ranged from 7 m (7.7 yd) in upland sloughs to 177 m (193.6 yd) in single main channels; wetted widths ranged from 6 m (6.6 yd) in upland sloughs to 159 m (173.9 yd) in single main channel. Average thalweg depth ranged from 0.4 m (1.3 ft) in side sloughs to 3.4 m (3.7 yd) in single main channel; bankfull depth averaged 0.5 m (1.6 ft) in side sloughs and 2.4 m (2.6 yd) in single main channel macrohabitat.

Mesohabitat in the Upper River mainstem was largely composed of riffle, run, and glide habitats which formed 29 percent, 25 percent, and 23 percent respectively of the total length of habitat surveyed (Table 5.1-13). Backwaters, clearwater plumes and beaver complexes were not encountered during mainstem surveys in the Upper River. Descriptive statistics for select habitat metrics summarized by mesohabitat within Upper River mainstem habitat units surveyed during the 2013 field effort are presented in Tables 5.1-14 through 5.1-18. Average habitat characteristics (excluding values for dry mesohabitat) included mean gradient ranging from 0.1 percent in pool mesohabitat to 1.8 percent in riffle mesohabitat. Bankfull width ranged from 8 m (8.7 yd) in pools to 131 m (143 yd) in run mesohabitat; wetted widths ranged from 8 m (8.7 yd) in pools to 110 m (120.3 yd) in run mesohabitat. Average thalweg depth ranged from 0.7 m (2.3 ft) in glides to 2.5 m (8.2 ft) in run mesohabitat; average bankfull depth ranged between 0.7 m (2.3 ft) in glide and 1.8 m (5.9 ft) in run mesohabitat.

5.1.3. Lakes Within the Upper River Inundation Zone

Elevations of the 12 lakes within the Project inundation zone ranged from 487 m (1,598 ft) to 622 m (2,042 ft), the average perimeter and area were 623 m (2,043 ft) and 2.78 hectares (6.87 acres) respectively. Five lakes had a surface water connection to the Susitna River visible from the GIS layer (Table 4.2-2). Additional habitat parameters will be collected during the next year of study.

5.2. Middle River

The results of both remote line mapping and ground surveys in mainstem habitat units and tributary reaches within the Middle River are described in this section using a combination of habitat distribution and frequencies. Results include a broad overview of average habitat metrics within each mesohabitat unit type and grouped by macrohabitat classification. Macrohabitat summaries represent the average of habitat metrics in surveyed mesohabitats within that macrohabitat type and as such represent a subset of the average conditions that may be present across an entire macrohabitat type.

5.2.1. Tributaries in the Middle River

The results presented for tributaries in the Middle River include information previously summarized in technical memorandum for remote line mapping (HDR 2013b, R2 Resource Consultants, Inc. 2013a, b, HDR Alaska, Inc. 2013a) and results from ground surveys conducted during 2013, the most recent year of study.

5.2.1.1. *Habitat Distribution from Remote Line Mapping (Aerial and Video)*

Preliminary geomorphic classes and the results of mesohabitat frequency analysis for videography within Middle River segment tributaries upstream of Devils Canyon are summarized in Table 4.1-3 and further detailed in Appendix 2 of the *Fish Distribution and Abundance Implementation Plan* (R2 Resource Consultants, Inc. 2013b). Results are presented by study area tributary and include mesohabitat frequency analysis, distribution of mesohabitat types by river mile and tributary geomorphic reach; and photographs providing a visual reference of some of the more prominent habitat types and the general character of each tributary.

5.2.1.2. *Habitat Distribution from Ground Surveys*

During the 2013 field effort, habitat surveys were conducted in eight Middle River tributaries; three of these were above Devils Canyon and were surveyed in the manner of Upper River tributaries (Section 4.1.2) and five tributaries were below Devils Canyon and were surveyed only within the zone of hydrologic influence (ZHI) (Section 4.3.1) during the 2013 field effort (Table 4.1-2). These surveys included two Middle River tributaries that were also mesohabitat mapped using videography during 2012 (Section 4.1.1.2) (Fog Creek and Chinook Creek, Table 4.1-2). The average length of geomorphic reach surveyed was 849 m (0.53 mi) and a total of 7,488 m (4.65 mi) were surveyed within these Middle River tributaries during 2013 (Table 5.1-1). A comparison of mesohabitat characterization from field surveys in videographed tributaries against habitat classifications made using 2012 remote line mapping and videography will be presented in the Updated Study Report.

Overall mesohabitats in these Middle River tributaries were largely composed of boulder riffle, riffle, and pool mesohabitats representing 22 percent, 21 percent, and 18 percent of the total length of tributary habitat surveyed respectively (Table 5.1-1). Descriptive summary statistics for select habitat metrics by mesohabitat within Middle River tributaries surveyed during the 2013 field effort are presented in Tables 5.1-2 through 5.1-6. Data for all habitat metrics will be comprehensively summarized in the Updated Study Report.

Average habitat characteristics included mean gradients (outside of alcove and beaver pond mesohabitats which had a mean gradient of 0 percent) ranging from 0.5 percent in glides to 4.4 percent in cascade mesohabitats, the overall mean gradient in these tributaries was 1.7 percent. Overall mean bankfull width in all mesohabitats surveyed was 10 m (10.9 yd) with a range from 3 m (3.3 yd) in both alcove and percolation channel mesohabitats to 17 m (18.6 yd) in run mesohabitats. Overall mean wetted width was 6 m (6.6 yd) and ranged from 2 m (2.2 yd) in alcove and percolation channel mesohabitats to 8 m (8.8 yd) in cascade mesohabitats. The overall mean bankfull depth was 0.7 m (2.3 ft) and ranged from 0.3 m (1 ft) in percolation channels to 0.9 m (1 yd) in pool mesohabitats; overall mean thalweg depth was 0.5 m (1.6 ft) and ranged from 0.1 m (0.3 ft) in percolation channels to 0.7 m (2.3 ft) in cascade mesohabitats.

5.2.2. Mainstem Habitats in the Middle River

The results presented for mainstem habitat in the Middle River include information previously summarized in technical memoranda for remote line mapping (R2 Resource Consultants, Inc.

2013a, HDR Alaska, Inc. 2013a) and results from ground surveys conducted during 2013, the most recent year of study.

5.2.2.1. *Habitat Distribution from Remote Line Mapping (Aerial and Video)*

Analysis of macrohabitat distribution from the 2012 remote line mapping indicated that mainstem habitat varied by geomorphic reach and generally increased in complexity from upstream to downstream locations (HDR Alaska, Inc. 2013a). Single main channel represented the majority of habitat from the proposed dam site (MR-1) through Devils Canyon (MR-5). Downstream of Devils Canyon (i.e., MR-6 to MR-8), channel types were broadly distributed across channel categories; single main channel habitat was not the majority in any of those reaches. Downstream reaches contained multiple split main channel habitat and many side channels.

Mesohabitats in the main channel assessed from the 2012 remote line mapping were generally dominated by a mixture of run and glide habitats. Clearwater plume habitats were located in reaches MR-2, MR-3, MR-5, and MR-7, with the most being in reach MR-2; beaver dams were rarely present in side slough habitat, and slightly more prevalent in upland sloughs and were only observed in reaches MR-6 and MR-7. Backwater habitat was also relatively rare and primarily present in the lower reaches from MR-6 through MR-8. Additional details of methods, analysis and results of macrohabitat distribution assessed during 2012 remote line mapping are presented in *Middle Susitna River Segment Remote Line Habitat Mapping Technical Memorandum* (HDR Alaska, Inc. 2013a).

5.2.2.2. *Habitat Distribution from Ground Surveys*

The total length of macrohabitat units surveyed within the Middle River mainstem during 2013 both inside and outside Focus Areas (FAs) was 42,554 m (26.4 mi). This was composed of 2,708 m (1.68 mi) of single main channels, 3,511 m (2.18 mi) of split main channel, 3,982 m (2.47 mi) of multiple split main channels, 11,404 m (7.09 mi) of side channels, 6,178 m (3.84 mi) of upland sloughs, and 203 m (0.13 mi) of tributary mouth habitat (Table 5.1-7). Total lengths for some macrohabitat units were not recorded on field forms; these unit lengths will be determined from survey waypoints, assessed using GIS and presented in the Updated Study Report. The most common Middle River mainstem macrohabitat outside of Focus Areas was multi-split main channel which represented 22 percent of the total measured habitat by length (Table 5.1-7).

Descriptive statistics for select habitat metrics summarized by macrohabitat within all Middle River mainstem habitat units surveyed during the 2013 field effort are presented in Tables 5.1-8 through 5.1-12. Outside of Focus Areas, gradient was lowest in upland sloughs where the mean gradient was 0.0 percent whereas gradient was highest in side channel macrohabitat where the mean gradient was 0.8 percent. Bankfull widths ranged from 12 m (13.1 yd) in upland slough to 179 m (195.8 yd) in single main channel. Wetted widths ranged from 5 m (5.5 yd) in upland slough macrohabitat to 179 m (195.8 yd) in single main channel. The average thalweg depth ranged from 0.3 m (1 ft) in upland slough macrohabitat to 2.5 m (8.2 ft) in single main channels; average bankfull depths ranged from 0.9 m (3 ft) in side slough macrohabitat to 2.3 m (7.5 ft) in

single main channel macrohabitat. Data for all habitat metrics averaged for each macrohabitat type will be comprehensively summarized in the Updated Study Report.

Outside of Focus Areas, field surveyed mesohabitats in the Middle River mainstem consisted dominantly of run habitat which formed 34 percent of the total length of habitat surveyed (Table 5.1-13). A total of 3 backwater mesohabitats were identified and these formed just 2 percent of the total length of habitat surveyed in the Middle River segment. A total of 3 beaver complexes and 1 clearwater plumes were identified. A comparison of mesohabitat characterization from field surveys to habitat classifications made during remote line mapping and videography will be presented in the Updated Study Report.

Descriptive statistics for select habitat metrics summarized by mesohabitat within Middle River mainstem habitat units surveyed during the 2013 field effort (excluding Focus Areas) are presented in Tables 5.1-14 through 5.1-18. Data for all habitat metrics will be comprehensively summarized in the Updated Study Report. Average habitat characteristics (excluding values from dry habitats) included mean gradients ranging from 0 percent in pool mesohabitat to 1.2 percent in riffle mesohabitat. Bankfull widths ranged from 17 m (18.6 yd) in pools to 152 m (166.2 yd) in run habitats; wetted widths ranged from 7 m (7.7 yd) for pool mesohabitats to 118 m (129.1 yd) in run mesohabitats. The average thalweg depth ranged from 0.4 m (1.3 ft) in pools to 1.8 m (5.0 ft) in run mesohabitats; average bankfull depths ranged between 1.0 m (3.3 ft) in pools and 1.8 m (5.9 ft) in run mesohabitats.

Habitat metrics collected in Focus Areas were generally similar to those in non-Focus Areas. Within Focus Areas, ground-surveyed macrohabitats consisted primarily of side channel and side slough habitats which formed 38 percent and 25 percent by length respectively of the total length of habitat surveyed. Select habitat metrics summarized by macrohabitat with Focus Area included mean gradients ranging from 0.3 percent in single main channel to 1.0 percent in tributary mouth. Bankfull width ranged from 9 m (9.8 yd) in upland slough to 181 m (198 yd) in single main channel; wetted widths ranged from 6 m (6.6 yd) in both upland slough and tributary mouth to 116 m (126.9 yd) in single main channel. Average thalweg depth ranged from 0.3 m (0.98 ft) in tributary mouths to 1.6 m (5.2 ft) in single main channel; average bankfull depths ranged between 0.6 m (1.97 ft) in tributary mouths and 2.0 m (6.6 ft) in single main channel channels.

For Focus Areas alone, ground-surveyed mesohabitats (Tables 5.1-13 through 5.1-18), consisted primarily of pool, riffle, and glide habitats which formed 22 percent, 22 percent, and 17 percent respectively of the total length of habitat surveyed. Select habitat characteristics included mean gradient ranging from 0.1 percent in pool to 1.3 percent in riffle mesohabitats. Bankfull width ranged from 21 m (23 yd) in pools to 98 m (107.2 yd) in runs; wetted widths ranged from 12m (13.1 yd) in pool to 85 m (93 yd) in run mesohabitat. Average thalweg depth ranged from 0.5 m (1.6 ft) in pools and riffles to 1.3 m (4.3 ft) in run mesohabitats; average bankfull depth ranged between 0.9 m (3 ft) in pools and 1.7 m (5.6 ft) in run mesohabitat. Backwaters, beaver complexes and clearwater plumes respectively averaged 26 m (28.4 yd), 17 m (18.6 yd) and 185 m (202 yd) in bankfull width; 13 m (42.7 yd), 9 m (9.8 yd), and 3 m (3.3 yd) in wetted width; 0.5 m (1.6 ft), 0.8 m (2.6 ft) and 0.2 m (0.7 ft) in thalweg depth; and 1.0 m (3.3 ft), 1.3 m (4.3 ft) and 0.8 m (2.6 ft) in bankfull depth.

A total of 17 backwaters were identified and these formed 6 percent of the total length of habitat surveyed within Focus Areas; 20 beaver complexes and 7 clearwater plumes were identified within Focus Areas (Table 5.1-13).

5.3. Lower River

Results from the 2012 video imagery confirmed that the Lower River appeared to contain only two mesohabitat types (glides and riffles; Table 4.4-3 in R2 Resource Consultants, Inc. 2013b). The low gradient and aggraded gravel bed of the Lower River was generally not conducive to the formation of other mesohabitat types such as pools or runs, although they may have been present in very low numbers. The review of the test section flown for videography during 2012 concluded that aerial videotaping was not a practical method for habitat mapping the Lower River (R2 Resource Consultants 2013b); field surveys in this area would be prohibitively costly and logistically complex.

6. DISCUSSION

This study was conducted to characterize and map aquatic habitat at finer scales than did the 1980s studies, including to the mesohabitat level in both mainstem and tributary habitats. The initial results of the remote line mapping and videography components of the study provide an index of the frequency and proportion of mainstem and tributary habitats within the Upper and Middle Susitna River segments. The resolution of the data varied based on the size and visibility of each habitat unit and relied upon the professional interpretation of biologists, nonetheless this provided a tool that allowed informed decisions and planning for representing the Middle River for instream flow (ISR Study 8.5) and fish distribution studies (ISR Studies 9.5 and 9.6) during 2013 and a basis for developing a survey protocol for field confirmation of habitat calls.

The completion of remote line mapping and interpretation of videography represented only a small portion of habitat mapping study activity for 2013. Significant on-the-ground activity was conducted in 2013 that expanded the resolution and working knowledge of available habitat in the Susitna River and surrounding tributaries. Further details of those efforts will be combined with the next study season's field efforts to provide a complete and ground-truthed representation of the macro- and meso-habitat distribution and character of the Susitna River in the Updated Study Report.

6.1. Study Coordination and Updates

Multiple studies collected field data in 2013 to better refine habitat mapping databases. For example, the Fish Distribution and Abundance Studies (ISR Study 9.5 and 9.6) collected limited amounts of habitat data at fish sampling sites, and Geomorphology studies (ISR Studies 6.5 and 6.6) mapped Focus Areas. A GIS analysis is ongoing to map and compare mesohabitat calls collected by the fish and habitat crews.

As described in the ISR for Study 8.5, the 2-D model framework developed for the Instream Flow Study will model all off-channel and tributary confluences where backwater habitats are generally formed – no further directed sampling of this habitat type is proposed. The data on

backwater habitats generated by the 100 percent coverage of Focus Areas during ground surveys will be used in the Fish and Aquatics Instream Flow Study (ISR Study 8.5) to specifically include these habitat types in Middle River Focus Area 2D modeling.

7. COMPLETING THE STUDY

[Section 7 appears in the Part C section of this ISR.]

8. LITERATURE CITED

Alaska Department of Fish and Game (ADF&G). 1983. Su Hydro draft basic data report, volume 4, part 1. ADF&G Su Hydro Aquatic Studies Program, Anchorage, Alaska.

Alaska Energy Authority AEA. 2012a. 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.

Ashton, W.W., and E.W. Trihey. 1985. Assessment of Access by Spawning Salmon into Tributaries of the Lower Susitna River. R&M Associates and E.W. Trihey and Associates, Final Report to Alaska Power Authority. 66 pp.

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.

HDR. 2013. Characterization and Mapping of Aquatic Habitats Technical Memorandum: Susitna-Watana Hydroelectric Project FERC Project No. 14241. July 2013. http://www.susitna-watanahydro.org/wp-content/uploads/2013/09/TechMemoCharacterizationMappingOfAquaticHabitats.pdf

HDR Alaska, Inc. 2013a. Middle Susitna River Segment Remote Line Habitat Mapping Memorandum: Susitna-Watana Hydroelectric Project FERC Project No. 14241. January 2013.

HDR Alaska Inc, 2013b. 2012 Upper River Susitna River Fish Distribution and Habitat Study – Habitat Report: Susitna-Watana Hydroelectric Project FERC Project No. 14241. February 2013. http://www.arlis.org/docs/vol1/Susitna2/1/SuWa189.pdf

Moore, K.M.S., K.K. Jones, and J.M. Dambacher. 2006. Aquatic Inventories Project: Methods for Stream Habitat Surveys. Oregon Department of Fish and Wildlife, Corvallis, Oregon.

R2 Resource Consultants, Inc. 2013a. Technical Memorandum: Adjustments to Middle River Focus Areas: Susitna-Watana Hydroelectric Project FERC Project No. 14241. May 2013. http://www.susitna-watanahydro.org/wp-content/uploads/2013/05/SuWa_R2_TM-FocusAreasAdjustments.pdf

R2 Resource Consultants, Inc. 2013b. Susitna River Fish Distribution and Abundance Implementation Plan: Susitna-Watana Hydroelectric Project FERC Project No. 14241. March 31, 2013 including HDR prepared Appendix 2, Initial Results Aerial Video Habitat Mapping of Susitna River Tributaries from the Upper Extent of Devils Canyon to the Oshetna River, January 2013. http://www.susitna-watanahydro.org/wp-content/uploads/2013/09/SuWa-FSP-2013-Section-09.05-FDAUP.pdf

Trihey, E.W. 1982. Preliminary assessment of access by spawning salmon to side slough habitat above Talkeetna. Susitna Hydroelectric Project Doc. No. 134. 24 pp.

U.S. Forest Service (USFS). 2001. Chapter 20 – Fish and Aquatic Stream Habitat Survey. FSH 2090-Aquatic Habitat Management Handbook (R-10 Amendment 2090.21-2001-1).

9. TABLES

Table 1.1-1. Nested and tiered habitat mapping units and categories for macrohabitats and mainstem channel mesohabitats.

Level	Unit	Grouping	Category	Definitions
1	Major Hydrologic Segment	Segments	Upper, Middle, Lower River	*Upper River* – PRM –187.1 – 261.3 (habitat mapping extended up to mainstem PRM 235.1 and included the Oshetna River. *Middle River* - PRM –102.4 – 187.1 *Lower River* - PRM 0 – 102.4
2	Geomorphic Reach	Upper River Segment	6 reaches	Geomorphic reaches that uniquely divide the Major Hydrologic Segments based on geomorphic characteristics.
		Middle River Segment	8 reaches	
		Lower River Segment[1]	6 reaches	
3	Macrohabitat	Main Channel Habitat	Single Main Channel	Single dominant main channel.
			Split Main Channel	Two dominant channels.
			Multiple Split Main Channel	Three or more distributed dominant channels.
			Side Channel	Channel that is turbid and connected to the active main channel but represents non-dominant proportion of flow[1]
			Tributary Mouth	Clear water areas that exist where tributaries flow into Susitna River main channel or side channel habitats (upstream Tributary habitat will be mapped as a separate effort).
		Off-Channel Habitat[2]	Side Slough	Overflow channel contained in the floodplain, but disconnected from the main channel.
			Upland Slough	Similar to a side slough, but contains a vegetated bar at the head that is rarely overtopped by mainstem flow. Has clear water.[1.]
		Tributary Habitat	Single Channel	Single dominant channel
			Split Channel	Two dominant channels
			Channel complex	Three or more distributed dominant channels

Table 1.1-1. (continued)

Level	Unit	Grouping	Category	Definitions
4	Mesohabitat	Fast water	Rapid	Swift, turbulent flow including small chutes and some hydraulic jumps swirling around boulders. Exposed substrate composed of individual boulders, boulder clusters, and partial bars. Lower gradient and less dense concentration of boulders and white water than Cascade. Moderate gradient; usually 2.0-4.0 percent slope.[2]
			Riffle	A fast water habitat with turbulent, shallow flow over submerged or partially submerged gravel and cobble substrates. Generally broad, uniform cross-section. Low gradient; usually 0.5-2.0 percent slope.[2]
			Run	A habitat area with minimal surface turbulence over or around protruding boulders with generally uniform depth that is generally greater than the maximum substrate size.[2] Velocities are on border of fast and slow water. Gradients are approximately 0.5 percent to less than 2 percent. Generally deeper than riffles with few major flow obstructions and low habitat complexity.[2]
			Glide	An area with generally uniform depth and flow with no surface turbulence. Low gradient; 0-1 percent slope. Glides may have some small scour areas but are distinguished from pools by their overall homogeneity and lack of structure. Generally deeper than riffles with few major flow obstructions and low habitat complexity.[2]
		Slow Water	Pool	Slow water habitat with minimal turbulence and deeper due to a strong hydraulic control.
		Special Habitat Feature	Clearwater Plume	Discharge from a tributary that forms a pronounced area of clearwater, in contrast to the turbid water of the main channel, along the main channel shoreline. The length, breadth, and depth of the clearwater plume depend on the relative discharge between the tributary and the main channel, relative turbidity, and on mixing conditions along the shoreline. A clear water plume will be mapped as if it were a separate mesohabitat type.
			Backwater	Found along channel margins and generally within the influence of the active main channel with no independent source of inflow. Water is not clear. A backwater will be mapped as if it were a separate mesohabitat type.
			Beaver Complex	Complex ponded water body created by beaver dams. A beaver dam will be mapped as if it were a separate mesohabitat type.
		Tributary Mesohabitat		Tributary mesohabitats were typed using the classification system described in Table 1.1-2

Notes:

1 For the purposes of this ISR, classification of the Lower River segment stopped at Level 2. A classification system for the Lower River segment is still in development pending determination of Project effects in the Lower River.

2 All habitat within this designation received an additional designation of whether water was clear or turbid within the database.

3 The terms Side Channel, Slough, and Upland Slough are similar but not necessarily synonymous with the terms for macrohabitat type as applied by Trihey (1982) and ADF&G (1983).

4 All slough habitat will have an associated area created during the mapping process to better classify size.

5 Adapted from Moore et al. 2006.

Table 1.1-2. Nested and Tiered Habitat Mapping Units and Hydraulic Categories Used for Mesohabitats in Tributary Surveys.

Macrohabitat (# of channels)	Hydraulic Type	Mesohabitat Type	Definition
Main channel (1 channel) Split main channel (2 channels) Multiple split main channel (3 or > channels)	Fast Water	Falls	Steep near vertical drop in water surface elevation greater than approximately 5 feet over a permanent feature, generally bedrock.
		Cascade	A fast water habitat with turbulent flow; many hydraulic jumps, strong chutes, and eddies and between 30-80 percent white water. High gradient; usually greater than 4 percent slope. Much of the exposed substrate composed of boulders organized into clusters, partial bars, or step-pool sequences. [1]
		Chute	An area where most of the flow is constricted to a channel much narrower than the average channel width. Laterally concentrated flow is generally created by a channel impingement or a laterally asymmetric bathymetric profile. Flow is fast and turbulent.
		Rapid	Swift, turbulent flow including small chutes and some hydraulic jumps swirling around boulders. Exposed substrate composed of individual boulders, boulder clusters, and partial bars. Lower gradient and less dense concentration of boulders and white water than Cascade. Moderate gradient; usually 2.0-4.0 percent slope, occasionally 7.0-8.0 percent. [1]
		Boulder Riffle	Same flow and gradient as Riffle but with numerous boulders that can create sub-unit sized pools or pocket water created by scour.
		Riffle	A fast water habitat with turbulent, shallow flow over submerged or partially submerged gravel and cobble substrates. Generally broad, uniform cross-section.[1] Low gradient; usually 0.5-2.0 percent slope, rarely up to 6 percent.
		Run/Glide	A habitat area with minimal surface turbulence with generally uniform depth that is greater than the maximum substrate size.[1] Velocities are on border of fast and slow water. Gradients are approximately 0 to less than 2 percent. Generally deeper than riffles with few major flow obstructions and low habitat complexity.[1]
	Slow Water	Pool	A slow water habitat with a flat surface slope and low water velocity that is deeper than the average channel depth. Substrate is highly variable. [1]
		Pool subtypes	Straight Scour Pool: Formed by mid-channel scour. Generally with a broad scour hole and symmetrical cross-section.[1]
			Plunge Pool: Formed by scour below a complete or nearly complete channel obstruction (logs, boulders, or bedrock). Pool must be Substrate is highly variable. Frequently, but not always, shorter than the active channel width.[1]
			Lateral Scour Pool: Formed by flow impinging against one stream bank or partial obstruction (logs, root wad, or bedrock). Asymmetrical cross-section. Includes corner pools in meandering lowland or valley bottom streams.[1]
			Backwater Pool: Found along channel margins; created by eddies around obstructions such as boulders, root wads, or woody debris. Part of active channel at most flows; scoured at high flow. Substrate typically sand, gravel, and cobble. Generally not as long as the full channel width. [1]
		Beaver Pond	Water impounded by the creation of a beaver dam. Maybe within main, side, or off-channel habitats. [1]
		Alcove	An off-channel habitat that is laterally displaced from the general bounds of the active channel and formed during extreme flow events or by beaver activity; not scoured during typical high flows. Substrate is typically sand and organic matter. Generally not as long as the full channel width. An alcove is differentiated from a backwater being more protected and not scoured at high flows whereas a backwater is part of the active channel and is scoured at high flows [1]
	Off-channel	Percolation channel	A slough characterized by groundwater percolation through the floodplain that comes from main stream channel. Upstream surface connection to active channel cut off due to accumulation of sediment/debris at the upstream end. Upstream surface water connection to the active channel present only during high flows.

Table 4.1-1. Upper River Tributary Table Showing all Tributary Geomorphic Reaches, Gradient, Basin Area, Private Land Ownership, and 2013 Survey Status.

Mainstem Geomorphic Reach	Tributary Name (ID)	Tributary Category[2]	Tributary Geomorphic Reach	Project River Mile	End of Survey Elev. (ft)	Approx. Drainage Area (km²)	Approx. Length (km)	Total Grad. (%)	Ground survey
UR-3	Oshetna River – LB[1]	1	Oshetna-1	235.1	3,000	885.1	89.48		y
			Oshetna-2						y
			Oshetna-3[3]						y
UR-3	Black River - LB[1]	2	Black-1	12.7 (LB)	3,000	NI	NI		y
			Black-2						y
			Black-3						y
UR-3	Goose Creek – LB[1]	1	Goose-1	232.8	3,000	167.2	40.56		y
			Goose-2						y
			Goose-3[3]						y
Proposed reservoir full pool									
UR-3	230.7	1		230.8		1	2.19	11	
UR-3	230.2	1		230.2		0.4	0.72	19	
UR-3	230.1	1		230.1		4.3	5.39	7	
UR-3	228.5	1		228.5		75.1	25.39	5	
UR-3	226.2	1		226.2		5.9	4.50	10	
UR-3	219.6	1		219.6		8.4	7.28	8	
UR-3	214.4	1		214.4		1.7	2.44	23	
UR-4	Jay Creek - RB[1]	1	Jay-1	211.0	3,000	99.5	31.54		y[4]
			Jay-2						y[4]
			Jay-3						y
			Jay-4						y
UR-4	Kosina Creek - LB[1]	1	Kosina-1	209.1	3,000	644.1	63.57		y[4]
			Kosina-2						y[4]
			Kosina-3						y[4]
UR-4	Tsisi Creek - LB[1]	2	Tsisi-1[3]	7.4 (LB)	3,000	NI	NI		y
			Tsisi-2[3]						y
UR-4	208.6	1		208.6		5.0	7.52	8	
UR5	207.4 - RB	1		207.4		1.1	2.50	14	
UR-5	207.4 RB-1			207.4	2,200		NI		
UR-5	206.3 - LB	1	206.3-1	206.3	3,000	49.9	11.96		y
			206.3-2						y
			206.3-3						y
UR-5	204.3-LB	1	204.3-1	204.3	3,000	49.9	9.98		*
			204.3-2						
UR-6	198.9	1		198.9		1.2	3.36	13	
UR-6	198.4 LB -1	2		198.4	2,200		NI		
UR-6	197.7	1	197.7-1	197.7	3,000	49.9	8.69		*
			197.7-2						*
			197.7-3						*
UR-6	197.7 RB-1	2		197.7	2,200		NI		
UR-6	Watana Creek[1]	1	Watana-1	196.9	3,000	281.3	43.29		y[4]*
			Watana-2						y[4]
			Watana-3[3]						y[4]
UR-6	RB 1	2		196.9	1,850		NI		*
UR-6	LB 1.1.1	4		196.9	2,000		NI		*
UR-6	Watana Tributary - RB[1]	2	Watana Trib-1[3]	8.7 (RB)	3,000	NI	NI		y
			Watana Trib-2[3]						y
UR-6	194.8 - RB	1	194.8-1	194.8	3,000	199.6	11.43		*
			194.8-2						y
			194.8-3						y
			194.8-4						y
UR-6	Deadman Creek - RB[1]	1	Deadman-1	189.4	3,000	281.8	67.43		*
			Deadman-2						*
			Deadman-3						y
			Deadman-4						y
			Deadman-5						y
			Deadman-6						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 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.
* Private land CIRWG

Table 4.1-2. . Middle River Tributary Geomorphic Reaches Selected for Field-Survey, Gradient, Basin Area, Private Land Ownership, and 2013 Survey Completion Status.

Mainstem Geomorphic Reach	Tributary Name (ID)	Tributary Category[2]	Tributary Geomorphic Reach	Project River Mile	End of Survey Elev. (ft)	Approx. Drainage Area (km²)	Approx. Length (km)	Focus Area	Ground survey 2013
MR-2	Tsusena Creek - RB[1]	1	Tsusena-1	184.6	barrier	145.3	49.41	NA	*
			Tsusena-2					NA	
MR-2	184.0 - RB[1]	1	184.0-1	184.0	barrier	<31	16.74	NA	*
			184.0-2					NA	*
MR-2	Unnamed - LB	NI	NA	174.3	upper extent of ZHI	NI	NI	FA-173 (Stephan Lake Complex)	*
MR-2	173.8 - RB	NI	NA	173.8	upper extent of ZHI	NI	NI	FA-173 (Stephan Lake Complex)	y*
MR-2	Fog Creek - LB[1]	1	Fog-1	179.3	3,000	147.2	44.74	NA	*
			Fog-2					NA	*
			Fog-3					NA	*
			Fog-4[3]					NA	y
Devils Canyon upper extent									
MR-4	Devil Creek - RB[1]	1	Devil-1	164.8	barrier	74.8	25.43	NA	*
MR-4	Chinook Creek - LB[1]	1	Chinook-1	160.5	3,000	24.7	17.06	NA	y*
			Chinook-2[3]					NA	y
MR-4	Cheechako Creek - LB[1]	1	Cheechako-1	155.9	barrier	36.4	17.22	NA	*
Devils Canyon lower extent									
MR-5	Portage Creek		NA	152.3	upper extent of ZHI	178.6	0.31	FA-151 (Portage Cr)	*
MR-6	Jack Long Creek		NA	148.3	upper extent of ZHI	NI	0.05	NA	*
MR-6	Unnamed		NA	144.6	upper extent of ZHI	NI	0.02	FA-144 (Slough 21)	
MR-6	Indian River		NA	142.1	upper extent of ZHI	86.2	0.23	FA-141 (Indian River)	y
MR-6	Gold Creek		NA	140.1	upper extent of ZHI	23.7	0.24	NA	y
MR-6	Fourth of July Creek		NA	134.3	upper extent of ZHI	NI	0.19	NA	
MR-6	Sherman Creek		NA	134.1	upper extent of ZHI	NI	0.03	NA	**
MR-6	Skull Creek		NA	128.1	upper extent of ZHI	NI	0.06	FA-128 (Slough 8A)	**
MR-6	Fifth of July Creek		NA	127.3	upper extent of ZHI	NI	0.02	NA	
MR-6	Deadhorse Creek		NA	124.4	upper extent of ZHI	6.5	0.29	NA	**
MR-7	Little Portage Creek		NA	121.4	upper extent of ZHI	2.4	0.19	NA	**
MR-7	McKenzie Creek		NA	120.2	upper extent of ZHI	2.3	0.03	NA	**
MR-7	Lower McKenzie Creek		NA	119.7	upper extent of ZHI	NI	0.26	NA	**
MR-7	Lane Creek		NA	117.2	upper extent of ZHI	10.4	0.18	NA	**
MR-7	Unnamed		NA	115.4	upper extent of ZHI	NI	0.19	FA-115 (Slough 6A)	y**
MR-7	Gash Creek		NA	115.0	upper extent of ZHI	NI	0.02	FA-113 (Oxbow 1)	**
MR-7	Slash Creek		NA	114.9	upper extent of ZHI	NI	0.03	FA-113 (Oxbow 1)	**
MR-7	Unnamed		NA	113.7	upper extent of ZHI	NI	NI	FA-113 (Oxbow 1)	y**
MR-7	Chase Creek		NA	110.5	upper extent of ZHI	NI	0.27	NA	y
MR-8	Whiskers Creek		NA	105.1	upper extent of 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 Table 4.1-3 for spatial range of videography survey
NI No information available at this time
* private land: CIRWG
** private land: ARRC

Table 4.1-3. Tributary geomorphic reach mesohabitat frequency and composition derived from videography 2012.

Tributary	Geomorphic Reach	Alcove		Beaver Pond		Boulder Riffle		Cascade		Chute		Falls		Percolation		Pool		Rapid		Riffle		Run/Glide		Split		Out-of-view		All Units
		n	Percent	n	Percent	n	Percent	n	Percent	n	Percent	n	Percent	n	Percent	n	Percent	n	Percent	n	Percent	n	Percent	n	Percent	n	Percent	n
Upper River																												
Oshetna River	Oshetna-1	0	0	0	0	86	42	0	0	1	0	0	0	0	0	4	2	15	7	50	25	46	23	2	1	4	NA	208
	Oshetna-2	0	0	16	25	21	33	0	0	0	0	0	0	0	0	0	0	1	2	9	14	1	2	15	24	9	NA	72
	Oshetna-3[1]	0	0	0	0	36	18	0	0	0	0	0	0	0	0	7	4	3	2	38	19	67	34	44	23	25	NA	220
Black River	Black-1	0	0	0	0	7	12	0	0	0	0	0	0	0	0	1	2	0	0	1	2	20	34	29	50	0	NA	58
	Black-2	0	0	0	0	15	42	0	0	0	0	0	0	0	0	3	8	1	3	3	8	8	22	6	17	0	NA	36
	Black-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	0
Goose Creek	Goose-1	0	0	0	0	43	28	1	1	0	0	0	0	0	0	3	2	37	24	1	1	39	25	32	21	2	NA	158
	Goose-2	0	0	0	0	31	34	0	0	0	0	0	0	0	0	2	2	9	10	1	1	33	36	16	17	0	NA	92
	Goose-3	No Data																										
Proposed reservoir full pool																												
Jay Creek	Jay-1	0	0	0	0	11	21	0	0	0	0	0	0	0	0	2	4	5	9	8	15	13	25	14	26	0	NA	53
	Jay-2	0	0	0	0	52	34	3	2	4	3	0	0	0	0	6	4	26	17	16	11	32	21	13	9	4	NA	156
	Jay-3	0	0	0	0	20	12	0	0	0	0	0	0	0	0	16	9	9	5	13	8	84	49	28	16	5	NA	175
	Jay-4	0	0	0	0	4	5	0	0	0	0	0	0	0	0	11	13	2	2	13	16	44	53	9	11	1	NA	84
Kosina Creek	Kosina-1	0	0	0	0	18	8	0	0	0	0	0	0	0	0	4	2	104	49	0	0	27	13	59	28	21	NA	233
	Kosina-2	0	0	0	0	18	8	0	0	0	0	0	0	0	0	4	2	104	49	0	0	27	13	59	28	21	NA	233
	Kosina-3	0	0	0	0	60	28	0	0	0	0	0	0	0	0	3	1	3	1	16	7	61	28	75	34	0	NA	218
Tsisi Creek	Tsisi-1[2]	0	0	0	0	50	38	4	3	0	0	0	0	0	0	0	0	56	43	0	0	2	2	18	14	0	NA	130
	Tsisi-2[3]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	0
Unnamed 206.3	206.3-1	No Data																										
	206.3-2	No Data																										
	206.3-3	No Data																										
Unnamed 204.3	204.3-1	No Data																										
	204.3-2	No Data																										
Unnamed 197.7	197.7-1	No Data																										
	197.7-2	No Data																										
	197.7-3	No Data																										
Watana Creek	Watana-1	0	0	0	0	20	5	0	0	0	0	0	0	0	0	14	4	30	8	30	8	208	55	75	20	7	NA	384
	Watana-2	0	0	0	0	11	6	1	1	2	1	0	0	0	0	7	4	66	35	6	3	57	30	37	20	3	NA	190
	Watana-3[4]	0	0	0	0	9	13	0	0	0	0	0	0	0	0	0	0	3	4	5	7	10	14	43	61	2	NA	72
Watana Trib	Watana Trib-1[5]	0	0	0	0	10	10	0	0	0	0	0	0	0	0	1	1	3	3	1	1	78	74	12	11	0	NA	105
Unnamed 194.8	194.8-1	No Data																										
	194.8-2	No Data																										
	194.8-3	No Data																										
	194.8-4	No Data																										
Deadman Creek	Deadman-1	0	0	0	0	1	13	0	0	0	0	0	0	0	0	1	13	6	75	0	0	0	0	0	0	0	NA	8
	Deadman-2	0	0	0	0	0	0	14	50	6	21	2	7	0	0	3	11	3	11	0	0	0	0	0	0	1	NA	29
	Deadman-3	0	0	0	0	21	30	2	3	0	0	0	0	0	0	5	7	32	46	0	0	0	0	10	14	0	NA	70
	Deadman-4	0	0	0	0	28	22	0	0	0	0	0	0	0	0	6	5	21	16	12	9	34	26	29	22	1	NA	131
	Deadman-5	0	0	0	0	19	31	0	0	0	0	0	0	0	0	2	3	25	40	0	0	13	21	3	5	1	NA	63
	Upper River Total	**0**	**0**	**16**	**0**	**591**	**19**	**25**	**2**	**13**	**1**	**2**	**0**	**0**	**0**	**105**	**4**	**564**	**18**	**223**	**6**	**904**	**23**	**628**	**18**	**107**	**NA**	**3,178**
Middle River																												
Tsusena Creek	Tsusena-1	0	0	0	0	2	3	1	1	0	0	0	0	0	0	1	1	37	50	0	0	18	24	15	20	0	NA	74
	Tsusena-2	0	0	0	0	0	0	8	16	4	8	0	0	0	0	6	12	18	35	0	0	12	24	3	6	1	NA	52
Unnamed 184.0	184.0-1	0	0	0	0	2	6	5	14	0	0	0	0	0	0	1	3	21	60	0	0	5	14	1	3	0	NA	35
	184.0-2	0	0	0	0	0	0	12	26	2	4	1	2	0	0	0	0	24	52	0	0	7	15	0	0	3	NA	49
Fog Creek	Fog-1	0	0	0	0	3	8	0	0	0	0	0	0	0	0	2	5	3	8	2	5	2	5	27	69	0	NA	39
	Fog-2	0	0	0	0	25	21	11	9	5	4	0	0	0	0	15	13	51	43	7	6	1	1	5	4	1	NA	121
	Fog-3	0	0	0	0	83	15	0	0	0	0	0	0	0	0	53	10	18	3	164	30	125	23	106	19	34	NA	583
	Fog-4[6]	0	0	0	0	5	26	0	0	0	0	0	0	0	0	1	5	7	37	2	11	0	0	4	21	2	NA	21
Fog Trib	Fog Trib-1[7]	0	0	0	0	2	1	46	18	6	2	0	0	0	0	5	2	105	41	1	0	41	16	51	20	5	NA	262
Upper extent of Devils Canyon																												
Chinook Creek	Chinook-1	0	0	0	0	2	2	20	17	14	12	0	0	0	0	5	4	63	54	0	0	12	10	0	0	21	NA	137
	Chinook-2[8]	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	22	42	2	4	11	21	16	31	7	NA	59
Cheechako Creek	Cheechako-1	0	0	0	0	4	5	19	26	9	12	3	4	0	0	11	15	21	28	0	0	7	9	0	0	8	NA	82
Lower extent of Devils Canyon																												
	Middle River Total	**0**	**0**	**0**	**0**	**134**	**7**	**136**	**11**	**50**	**4**	**4**	**0**	**0**	**0**	**100**	**5**	**431**	**39**	**178**	**4**	**247**	**13**	**233**	**15**	**82**	**NA**	**1,595**

[1]Video went to TRM 15.6 but reach extends to TRM 25.6
[2]Video stops at RM 2.7 so habitat frequencies in table above only go from RM 0.1 to RM 2.7 (not full reach length of 3.5).
[3]No video, channel form is assumed based on topography and location within the watershed.
[4]Video stops at RM 17.25, habitat frequencies in table above only go from RM 14.41 to RM 17.25 (not full reach length of 21.5). The helicopter video only extends to RM 17.25 but it is assumed the rest of the reach continues in the same character.
[5]Video stops at RM 2.95, habitat frequencies in table above only go from RM 0.1 to RM 2.95 (not full reach length of 10.7). After the helicopter video ends, it is assumed the channel continues in the same character to RM 4.6, where it splits. The main channel is assumed to go to the right through the broad valley up to the drainage break into Butte Creek.
[6]Helicopter did not extend to 3,000 ft elevation but same character is inferred and stream just gets smaller. This reach was only mapped to RM 17.975 so habitat above this point is not included.
[7]Video mapping only goes to RM 7.38, habitat units after RM 7.38 not included.
[8]Video mapping only goes to RM 7.1 habitat units above RM 7.1 are not included.

Table 4.2-1. Randomly selected Upper and Middle River mainstem habitats versus those surveyed during 2013.

Remote Habitat Type	Mesohabitat Replicate	Geomorphic Reach														Total Selected 2013[1]	Total Surveyed 2013
		2		3		4*		5		6		7		8			
		Surv.	Not Surv.	Surv.	Not Surv.	Surv.	Not Surv.	Surv.	Not Surv.	Surv.	Not Surv.	Surv.	Not Surv.	Surv.	Not Surv.		
Upper River																	
Main Channel	UR Rapid[2]			0	3			0	1	0	3					7	0
	UR Riffle			5	0	2	0									7	7
	UR Glide or Run			4	0	2	0			1	0					7	7
Split Main Channel	-					4	0	1	0	1	1					7	6
Side Channel	-					3	0			3	1					7	6
Side Slough	-			1	0	2	2			0	2					7	3
Upland Slough	-					3	2			0	1					6	3
	Upper River Total			**10**	**3**	**16**	**4**	**1**	**1**	**5**	**8**					**48**	**32**
Middle River																	
Main Channel	MR Rapid[2]					0	7									7	0
	MR Pool[2]					0	2									2	0
	MR Riffle	1	0	1	0	0	3			1	0	1	0			7	4
	MR Glide or Run			1	0	0	1			2	0	2	0	1	0	7	6
Split Main Channel	-			1	0			1	0	2	1	1	0	1	0	7	6
Multi Split Main Channel	-									3	0			4	0	7	7
Side Channel	-			1	0					2	1	1	0	2	0	7	6
Side Slough	-									4	1	1	0			6	5
	Beaver Complex											1	0			1	1
Upland Slough	-									2	0	2	1			5	4
	Beaver Complex									1	1					2	1
	Middle River Total	**1**	**0**	**4**	**0**	**0**	**13**	**1**	**0**	**17**	**4**	**9**	**1**	**8**	**0**	**56**	**39**

Notes:
1 Total number of habitat units selected and existing by river segment
2 All mainstem Susitna River rapids and pools were deemed unsafe to access and were not surveyed
* All habitat units in Middle River geomorphic reach 4 are within or near Devils Canyon, were deemed unsafe and will not be ground surveyed

Table 4.2-2. 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 (ft)	Area (ha)	Surface water connection
Lake 1	260	1,752	0.23	Yes
Lake 2	543	1,750	0.68	Yes
Lake 3	1001	1,796	3.37	Yes
Lake 4	441	2,042	1.15	No
Lake 5/Sally Lake	3009	2,034	22.99	Yes
Lake 6	399	2,008	0.89	No
Lake 7	467	1,598	1.48	Indeterminate
Lake 8	211	2,030	0.30	No
Lake 9	419	1,782	1.15	Yes
Lake 10	144	1,958	0.16	No
Lake 11	198	2,038	0.20	No
Lake 12	391	2,008	0.72	No

Note:
1 Lakes are ordered from most upstream to most downstream.

Table 4.2-3 Project River Mile ranges for areas not surveyed due to access restrictions due to private land and safety considerations.

PRM Start	PRM End	Access Limitation	Focus Area
Upper River			
Proposed reservoir full pool			
225.2	226.6	Safety/confined channel	
196.6	196.8	Private CIRWG land	
194.5	194.7	Private CIRWG land	
193.4	193.7	Private CIRWG land	
187.6	189.3	Safety/confined channel	
Middle River			
178.3	178.5	Private CIRWG land	
176.2	176.8	Private CIRWG land	
173.6	175.4	Private CIRWG land	FA-173 (Stephan Lake Complex)
Devils Canyon Upper Extent			
153.9	166.1	Devils Canyon	
Devils Canyon Lower Extent			
151.8	152.7	Private CIRWG land	Includes FA-151 (Portage Creek)
147.6	148.1	Private CIRWG land	
128.1	128.6	Private ARRC land	FA-128 (Slough 8A)
126.8	123.4	Private ARRC land	
108.6	109.0	Private ARRC land	

Table 4.2-4. Range of mean daily flows at the USGS 15292000 Susitna River at Gold Creek real time streamflow gage during 2013 ground surveys.

Geo. Reach	Focus Area	Ground Macrohabitat Count	<18,000 cfs	18,000-25,000 cfs	25,000-30,000 cfs	>30,000 cfs	No Information
Upper River							
UR-3	NA	Main Channel				9	
		Side Slough[6]				1	
UR-4	NA	Main Channel			3	3	
		Split Main Channel			2	1	
		Side Channel		1		1	
		Side Slough[6]		2		1	
		Upland Slough		2		1	
UR-5	NA	Split Main Channel				1	
UR-6	NA	Main Channel			1		
		Split Main Channel			1		
		Multi Split Main Channel			1		
		Side Channel			1	1	
	Upper River Total			**5**	**9**	**19**	
Middle River							
MR-1	FA-184 (Watana Dam)	Main Channel				1	
		Side Channel				2	
MR-2	FA-173 (Stephan Lake Complex)	Main Channel				1	
		Side Channel	3	4			
		Tributary Mouth	1				
		Side Slough		1	1	3	
	NA	Main Channel			1		
MR-3	NA	Main Channel			2		
		Split Main Channel			2		
Devils Canyon							
MR-5	NA	Split Main Channel		1			
MR-6	FA-144 (Slough 21)	Main Channel		2			
		Multi Split Main Channel		2			
		Side Channel		1			
		Side Slough		2			1
		Upland Slough		1			
		Not Recorded		1			
	FA-141 (Indian River)	Main Channel		3			
		Multi Split Main Channel		6			
		Side Channel		3			
		Tributary Mouth		1			
		Upland Slough	4	2			
		Not Recorded					1
	FA-138 (Gold Creek)	Main Channel		1			
		Split Main Channel		1			
		Multi Split Main Channel		2			
		Side Channel		2			
		Side Slough		1			
		Upland Slough		2			
		Not Recorded		6			1
	FA-128 (Slough 8A)	Main Channel	1				
		Side Channel	3	6			2
		Tributary Mouth	1				
		Side Slough	1				
		Upland Slough		3			
		Not Recorded					1
	NA	Main Channel	2	1			
		Multi Split Main Channel	2	2			
		Side Channel	2				
		Side Slough	1	4			
		Upland Slough		3			
		Not Recorded					1
MR-7	FA-115 (Slough 6A)	Split Main Channel	2				3
		Side Slough	1				
		Upland Slough		3			1
		Not Recorded					2
	FA-113 (Oxbow 1)	Main Channel	1				
		Split Main Channel	11				
		Side Channel	1				
		Side Slough	4				
		Upland Slough	3				
		Not Recorded	1				
	NA	Main Channel	3				
		Split Main Channel	1				
		Side Channel	1				
		Side Slough	3				
		Upland Slough	2				
MR-8	FA-104 (Whiskers Slough)	Main Channel	1				
		Split Main Channel	1				
		Side Channel	9	1			
		Side Slough	5	5			
		Upland Slough		2			
	NA	Main Channel	1				
		Split Main Channel		1			
		Multi Split Main Channel		5			
		Side Channel		2			
	Middle River Total		**72**	**83**	**6**	**7**	**13**

Notes:
1 Range: 15,400-17,700 cfs, 2Range: 18,300-21,700 cfs, 3Range: 25,900-29,500 cfs, 4Range: 30,700-31,400 cfs
5 No date or flow information available from field data.
6 Side Sloughs in the Upper River were evaluated prior to surveys to ensure that the head of the unit was not breached during flows > 18,000 cfs at the Susitna River at Gold Creek gage.

Table 4.3-1. Focus Area habitats surveyed during 2013, and those required for survey in the next year of study to complete 100 percent sampling.

Geomorphic Reach	Focus Area	Main Channel		Split Main Channel		Multi Split Main Channel		Side Channel		Tributary Mouth		Side Slough		Upland Slough		Backwater		Clearwater Plume		No Remote Mapping[1]		TOTAL	
		2013	To be surveyed	2013	To be surveyed	2013	To be surveyed	2013	To be surveyed	2013	To be surveyed	2013	To be surveyed	2013	To be surveyed	2013	To be surveyed	2013	To be surveyed	2013	To be surveyed	2013	To be surveyed
MR-1	FA-184 (Watana Dam)	1	0					2	0													**3**	**0**
MR-2	FA-173 (Stephan Lake Complex)	1	0					5	0	1	0	3	1	0	2					4	0	**14**	**3**
MR-5	FA-151 (Portage Cr)	0	1							0	1							0	1			**0**	**3**
MR-6	FA-144 (Slough 21)	4	0					1	7			1	0	3	0							**9**	**7**
	FA-141 (Indian River)	2	1			6	0	0	2	1	0			4	0	1	0	1	0	1	0	**16**	**3**
	FA-138 (Gold Creek)	1	0			2	1	3	0			1	0	2	2					1	1	**10**	**4**
	FA-128 (Slough 8A)	1	0					8	2	1	0	1	1	3	0					1	0	**15**	**3**
MR-7	FA-115 (Slough 6A)	1	1	4	1			1	0					3	0	1	0					**10**	**2**
	FA-113 (Oxbow 1)	1	0	12	0			3	0					2	0							**18**	**0**
MR-8	FA-104 (Whiskers Slough)	1	0					10	1			5	0	3	0							**19**	**1**
	Total	**13**	**3**	**16**	**1**	**8**	**1**	**33**	**12**	**3**	**1**	**11**	**2**	**20**	**4**	**2**	**0**	**1**	**1**	**7**	**1**	**114**	**26**

Note:
1 Macrohabitat unit was not identified during the remote mapping process.

Table 5.1-1. Sum of length (m) surveyed, and composition by length of mesohabitats in Upper River and Middle River tributaries surveyed between August 3 and September 22, 2013.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Glide			Percolation Channel			Pool			Rapid			Riffle			Run			All Units[2]
			n	Length (m) & Percent		n	Length (m) & Percent		n	Length (m) & Percent		n	Length (m) & Percent		n	Length (m) & Percent		n	Length (m) & Percent		n	Length (m) & Percent		n	Length (m) & Percent		n	Length (m) & Percent		n	Length (m) & Percent		n	Total Length Surveyed (m)
Upper River																																	
Oshetna River	Oshetna-1	-							5	483	12				2	186	5							2	228	6	6	1,848	47	5	1,227	31	20	3,972
	Oshetna-2	-																						3	792	81	1	67	7	1	115	12	5	974
	Oshetna-3	-							5	616	16				2	196	5							2	590	15	8	921	23	13	1,614	41	30	3,936
Black River	Black-1	-							4	494	24				2	281	13				1	34	2				6	1,090	52	4	190	9	17	2,089
	Black-2	-							7	593	54													1	60	5	3	187	17	6	263	24	17	1,103
	Black-3	-							5	207	15													2	69	5	5	586	43	5	506	37	17	1,368
Goose Creek	Goose-1	-							7	1,056	75	1	58	4										5	164	12				5	129	9	18	1,407
	Goose-2	-							5	675	58	3	317	27																5	167	14	13	1,158
	Goose-3	-							5	247	41																1	118	19	6	243	40	12	609
Proposed reservoir full pool																																	
Jay Creek	Jay-1	-							4	435	89													1	37	7				1	20	4	6	492
	Jay-2	-							5	256	24													6	640	60	2	128	12	2	38	4	15	1,062
	Jay-3	-							4	236	75																			2	78	25	6	314
	Jay-4	-	1	7	1										5	187	37				5	102	20				5	187	37	1	21	4	17	503
Kosina Creek	Kosina-2	-																						5	428	100							5	428
Tsisi Creek	Tsisi-1	-							8	469	46				1	140	14							6	407	40							15	1,016
	Tsisi-2	-																									5	381	62	5	236	38	10	617
Unnamed Trib 206.3	UnnamedTrib206.3-1	-							5	75	30	6	119	47													1	40	16	1	18	7	13	253
	UnnamedTrib206.3-3	-										1	3	16													2	10	50	1	7	34	4	20
Watana Creek	Watana-1	-							1	98	15										2	113	17				4	357	53	2	100	15	9	668
	Watana-2	-							2	81	28										1	22	8	2	35	12	2	59	20	3	95	33	10	291
	Watana-3	-	2	29	3				13	470	50													3	59	6	3	122	13	7	269	28	28	948
Unnamed Watana Trib 1	Watana Trib-1	-							3	26	4				1	21	3	1	18	3	1	22	3	4	109	16	2	151	22	12	345	50	24	691
Unnamed Trib 194.8	UnnamedTrib194.8-3	-				1	37	6	2	20	3	2	22	3							10	366	55	3	39	6	1	5	1	6	178	27	25	667
	UnnamedTrib194.8-4	-																			6	71	44							4	89	56	10	159
Deadman Creek	Deadman-3	-							5	428	22	2	164	9							2	635	33	5	651	34				1	29	1	15	1,906
	Deadman-4	-							5	1,282	44				2	501	17				1	140	5	5	469	16				3	498	17	16	2,890
	Deadman-5								5	623	52													5	567	48							10	1,190
	Deadman-6	-													5	1,155	57										6	868	43				11	2,022
Total[1]			**3**	**36**	**0**	**1**	**37**	**0**	**105**	**8,869**	**27**	**15**	**683**	**2**	**20**	**2,666**	**8**	**1**	**18**	**0**	**29**	**1,504**	**5**	**60**	**5,343**	**16**	**63**	**7,124**	**22**	**101**	**6473**	**20**	**398**	**32,753**
Middle River																																	
Fog Creek	Fog-4	-							5	716	65													5	163	15	5	188	17	1	40	4	16	1,107
Unnamed Tributary 173.8	NA	FA-173 (Stephan Lake Complex)							3	867	80										4	21	2				4	191	18				11	1,079
Devils Canyon upper extent																																	
Chinook Creek	Chinook-1	-										5	185	33										5	341	60				2	39	7	12	564
	Chinook-2	-	1	5	1				1	45	9				1	6	1	1	36	7				5	352	71				5	50	10	14	494
Devils Canyon lower extent																																	
Indian River	NA	FA-141 (Indian River)	1	8	1										7	264	22				6	122	10				9	402	33	3	422	35	26	1,218
Gold Creek	NA	-													1	30	6							2	35	8	5	339	73	3	59	13	11	463
Unnamed Tributary 115.4	NA	FA-115 (Slough 6A)																			5	411	97				2	7	2	1	4	1	8	421
Chase Creek	NA	-													1	234	85				1	28	10				1	12	4				3	274
Whiskers Creek	NA	FA-104 (Whiskers Slough)	1	2	0										14	478	26				17	761	41				14	398	21	7	230	12	53	1,868
Total[1]			**3**	**15**	**0**	**0**	**0**	**0**	**9**	**1,629**	**22**	**5**	**185**	**2**	**24**	**1,012**	**14**	**1**	**36**	**0**	**33**	**1,342**	**18**	**17**	**891**	**12**	**40**	**1,537**	**21**	**22**	**842**	**11**	**154**	**7,488**

[1]Total number of measurements (n) and group mean (SD) for each mesohabitat type per River Segment.
[2]Total number of measurements (n) and group mean (SD) for each geomorphic reach.

Table 5.1-2. Mean (±SD) percent gradient of mesohabitats in Upper River and Middle River tributaries surveyed between August 3 and September 22, 2013.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Glide			Percolation Channel			Pool			Rapid			Riffle			Run			All Units[2]		
			n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																																		
Oshetna River	Oshetna-1	-							5	1.0	0.0				2	0.2	0.0							2	2.5	0.7	6	1.2	0.7	5	1.0	0.6	20	1.1	0.7
	Oshetna-2	-																						3	1.5	0.5	1	1.0	NA	1	1.0	NA	5	1.3	0.4
	Oshetna-3	-							5	0.4	0.1				2	0.3	0.4							1	2.0	NA	8	0.6	0.6	13	0.6	0.5	29	0.6	0.5
Black River	Black-1	-							4	2.5	1.2				2	0.5	0.0				1	0.0	NA				6	1.1	0.5	4	0.8	0.3	17	1.2	1.0
	Black-2	-							7	2.5	0.6													1	3.0		3	1.2	0.8	6	0.4	0.3	17	1.6	1.1
	Black-3	-							5	1.8	0.8													2	2.3	0.4	5	1.1	0.4	5	0.6	0.4	17	1.3	0.8
Goose Creek	Goose-1	-							7	2.9	1.2	1	4.0	NA										5	4.0	1.7				5	1.0	1.1	18	2.7	1.7
	Goose-2	-							5	1.8	0.6	3	12.0	15.6															5	0.4	0.4	13	3.6	8.0
	Goose-3	-							5	0.9	0.2																1	1.0	NA	6	0.4	0.2	12	0.6	0.3
Proposed reservoir full pool																																		
Jay Creek	Jay-1	-							4	3.3	0.6													1	5.0	NA				1	3.0	NA	6	3.5	0.9
	Jay-2	-							5	1.6	0.4													6	3.3	1.4	2	1.8	0.4	2	1.3	0.4	15	2.3	1.3
	Jay-3	-							4	2.3	0.6																			2	0.8	0.4	6	1.8	0.9
	Jay-4	-	1	0.0	NA										5	0.7	0.3				5	0.5	0.0				5	1.5	0.5	1	1.0	NA	17	0.9	0.6
Kosina Creek	Kosina-2	-																						5	3.3	1.0							5	3.3	1.0
Tsisi Creek	Tsisi-1	-							8	2.0	0.5				1	0.5	NA							6	2.3	0.9							15	2.0	0.8
	Tsisi-2	-																									5	1.0	0.6	5	0.4	0.2	10	0.7	0.5
Unnamed Trib 206.3	UnnamedTrib206.3-1	-							5	10.5	3.5	6	11.2	1.8													1	6.0	NA	1	8.0	NA	13	10.3	2.8
	UnnamedTrib206.3-3	-										1	20.0	NA													2	9.5	4.9	1	15.0	NA	4	13.5	5.8
Watana Creek	Watana-1	-							1	1.5	NA										2	0.3	0.4				4	1.5	0.4	2	1.0	0.0	9	1.1	0.6
	Watana-2	-							2	2.0	0.0										1	0.0	NA	2	3.5	2.1	2	1.5	0.0	3	0.8	0.3	10	1.7	1.4
	Watana-3	-	2	0.0	0.0				13	1.9	0.3													3	2.8	0.3	3	1.5	0.9	7	1.3	0.7	28	1.7	0.8
Unnamed Watana Trib 1	Watana Trib-1	-							3	2.7	0.3				1	1.0	NA	1	0.0	NA	1	0.0		4	2.6	0.5	2	1.8	0.4	12	1.2	0.6	24	1.5	0.9
Unnamed Trib 194.8	UnnamedTrib194.8-3	-				1	0.0	NA	2	5.0	0.0	2	4.5	0.7							10	0.0	0.0	3	4.7	1.2	1	2.5	NA	6	1.8	0.3	25	1.9	2.0
	UnnamedTrib194.8-4	-																			6	0.0	0.0							4	2.3	1.0	10	0.9	1.3
Deadman Creek	Deadman-3	-							6	1.9	1.0	2	2.0	0.0							2	1.0	0.0	5	2.5	0.5				1	0.5	NA	16	2.0	0.9
	Deadman-4	-							5	1.0	0.4				2	0.4	0.2				1	0.2	NA	5	2.0	0.4				3	0.3	0.2	16	1.1	0.8
	Deadman-5								5	1.8	0.4													5	1.9	1.0							10	1.9	0.7
	Deadman-6	-													4	0.1	0.1										6	0.3	0.2				10	0.2	0.2
	Total[1]		**3**	**0.0**	**NA**	**1**	**0.0**	**NA**	**106**	**2.4**	**0.6**	**15**	**8.9**	**4.5**	**19**	**0.5**	**0.2**	**1**	**0.0**	**NA**	**29**	**0.2**	**0.1**	**59**	**2.9**	**0.9**	**63**	**2.0**	**0.8**	**101**	**1.9**	**0.4**	**397**	**2.4**	**1.4**
Middle River																																		
Fog Creek	Fog-4	-							5	3.1	0.9													5	2.8	0.4	5	2.1	0.7	1	1.0	NA	16	2.6	0.9
Unnamed Tributary 173.8	NA	FA-173 (Stephan Lake Complex)							3	3.0	1.0										4	0.0	0.0				4	1.4	0.5				11	1.3	1.3
Devils Canyon upper extent																																		
Chinook Creek	Chinook-1	-										5	4.4	0.5										5	3.1	1.1				2	1.0	0.0	12	3.3	1.5
	Chinook-2	-	1	0.0	NA				1	2.0	NA				1	0.5	NA	1	1.5	NA				5	2.1	0.2				5	1.2	0.6	14	1.5	0.7
Devils Canyon lower extent																																		
Indian River	NA	FA-141 (Indian River)													7	0.7	0.8				5	0.2	0.4				10	2.0	1.5	3	0.7	0.6	25	1.1	1.3
Gold Creek	NA	-													1	1.0	NA							2	5.0	2.8	5	4.3	0.9	3	2.5	0.5	11	3.6	1.7
Unnamed Tributary 115.4	NA	FA-115 (Slough 6A)																			5	0.0	0.0				1	1.0	NA	1	0.0	NA	7	0.1	0.4
Chase Creek	NA	-													1	0.0	NA				1	0.0	NA				1	4.5	NA				3	1.5	2.6
Whiskers Creek	NA	FA-104 (Whiskers Slough)	1	0.0	NA										14	0.1	0.1				17	0.0	0.1				13	0.9	0.5	7	0.3	0.2	52	0.3	0.5
	Total[1]		**2**	**0.0**	**NA**	**0**	**NA**	**NA**	**9**	**2.7**	**0.9**	**5**	**4.4**	**0.5**	**24**	**0.5**	**0.4**	**1**	**1.5**	**NA**	**32**	**0.0**	**0.1**	**17**	**3.3**	**1.2**	**39**	**2.3**	**0.8**	**22**	**1.0**	**0.4**	**151**	**1.7**	**1.2**

[1]Total number of measurements (n) and group mean (SD) for each mesohabitat type per River Segment.

[2]Total number of measurements (n) and group mean (SD) for each geomorphic reach.

Table 5.1-3. Mean (±SD) bankfull width (m) of mesohabitats in Upper River and Middle River tributaries surveyed between August 3 and September 22, 2013.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Glide			Percolation Channel			Pool			Rapid			Riffle			Run			All Units[2]		
			n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																																		
Oshetna River	Oshetna-1	-							15	38	5				6	45	8							6	54	1	18	57	6	15	48	3	60	48	5
	Oshetna-2	-																						9	51	8	3	72	8	3	57	2	15	57	7
	Oshetna-3	-							15	34	5				6	18	3							6	60	6	24	28	3	39	39	3	90	35	3
Black River	Black-1	-							10	22	2				5	21	2				2	26	6				13	36	4	8	23	5	38	27	4
	Black-2	-							21	22	4													3	23	4	9	15	2	18	19	2	51	20	3
	Black-3	-							10	28	1													5	21	2	13	26	3	13	27	3	41	26	3
Goose Creek	Goose-1	-							20	18	3	3	19	2										9	14	1				13	15	1	45	16	2
	Goose-2	-							15	22	4	9	23	5																15	16	2	39	20	3
	Goose-3	-							15	14	2																3	17	3	18	13	3	36	14	2
Proposed reservoir full pool																																		
Jay Creek	Jay-1	-							11	10	2													1	9					2	9	0	14	9	2
	Jay-2	-							15	16	3													18	12	2	6	13	2	6	10	1	45	13	2
	Jay-3	-							10	11	1																			4	11	2	14	11	1
	Jay-4	-	1	1											10	6	1				10	6	1				10	8	1	2	8	0	33	6	1
Kosina Creek	Kosina-2	-																						15	35	7							15	35	7
Tsisi Creek	Tsisi-1	-							24	15	3				3	5	1							18	15	3							45	14	3
	Tsisi-2	-																									15	17	2	15	16	2	30	16	2
Unnamed Trib 206.3	UnnamedTrib206.3-1	-							12	5	1	18	4	1													3	4	0	3	5	1	36	5	1
	UnnamedTrib206.3-3	-										3	2	0													6	7	2	3	3	1	12	5	1
Watana Creek	Watana-1	-							3	19	3										6	35	3				12	36	6	6	24	1	27	31	4
	Watana-2	-							6	15	2										3	11	2	6	15	1	6	10	1	9	14	1	30	13	1
	Watana-3	-	6	2	0				39	13	1													9	10	1	9	16	2	21	10	2	84	11	1
Unnamed Watana Trib 1	Watana Trib-1	-							4	2	1				2	3	1	3	3	1	3	15	0	9	10	1	6	17	2	29	9	2	56	9	1
Unnamed Trib 194.8	UnnamedTrib194.8-3	-				3	7	2	6	5	1	6	7	1							34	6	1	9	5	1	2	7	1	18	6	1	78	6	1
	UnnamedTrib194.8-4	-																			18	4	1							12	4	1	30	4	1
Deadman Creek	Deadman-3	-							18	30	5	6	23	3							6	31	4	15	26	5				3	22	1	48	27	4
	Deadman-4	-							15	37	9				6	41	8				1	39		15	27	2				9	39	7	46	35	6
	Deadman-5								15	32	3													15	27	3							30	29	3
	Deadman-6	-													14	40	6										18	38	6				32	39	6
	Total[1]		**7**	**1**	**0**	**3**	**7**	**2**	**299**	**20**	**3**	**45**	**12**	**2**	**52**	**24**	**4**	**3**	**3**	**1**	**83**	**12**	**2**	**168**	**23**	**3**	**176**	**27**	**3**	**284**	**20**	**2**	**1,120**	**21**	**3**
Middle River																																		
Fog Creek	Fog-4	-							15	9	1													15	8	1	15	8	1	3	14	5	48	9	2
Unnamed Tributary 173.8	NA	FA-173 (Stephan Lake Complex)							9	8	2										12	5	1				9	5	2				30	6	2
Devils Canyon upper extent																																		
Chinook Creek	Chinook-1	-										6	10	1										9	9	1				2	8		17	9	1
	Chinook-2	-	3	3	0				3	5	1				1	3		3	3	1				10	8	1				9	8	1	29	7	1
Devils Canyon lower extent																																		
Indian River	NA	FA-141 (Indian River)													24	21	18				17	9	3				30	20	14	9	72	11	80	24	13
Gold Creek	NA	-													1	14								6	10	4	12	12	2	5	12	2	24	12	3
Unnamed Tributary 115.4	NA	FA-115 (Slough 6A)																			15	3	1				6	1	0	3	1	0	24	2	1
Chase Creek	NA	-													3	4	1				3	10	3										6	7	2
Whiskers Creek	NA	FA-104 (Whiskers Slough)	3	3	0										42	7	1				51	8	1				42	7	1	21	6	1	159	7	1
	Total[1]		**6**	**3**	**0**	**0**	**NA**	**NA**	**27**	**8**	**2**	**6**	**10**	**1**	**71**	**11**	**7**	**3**	**3**	**1**	**98**	**7**	**2**	**40**	**9**	**2**	**114**	**11**	**5**	**52**	**17**	**3**	**417**	**10**	**4**

[1]Total number of measurements (n) and group mean (SD) for each mesohabitat type per River Segment.
[2]Total number of measurements (n) and group mean (SD) for each geomorphic reach.

Table 5.1-4. Mean (±SD) wetted width (m) of mesohabitats in Upper River and Middle River tributaries surveyed between August 3 and September 22, 2013.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Glide			Percolation Channel			Pool			Rapid			Riffle			Run			All Units[2]		
			n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																																			
Oshetna River	Oshetna-1	-							15	34	3				6	43	7							6	38	3	18	53	7	15	39	3	60	42	5
	Oshetna-2	-																						9	47	10	3	66	1	3	39	3	15	49	7
	Oshetna-3	-							15	29	4				6	15	2							6	57	7	24	23	4	39	31	3	90	29	4
Black River	Black-1	-							10	22	2				5	16	1				2	18	4				13	34	5	8	20	7	38	25	4
	Black-2	-							21	20	5													3	18	2	9	14	2	18	17	2	51	18	3
	Black-3	-							10	27	1													5	19	4	13	26	4	13	25	2	41	25	3
Goose Creek	Goose-1	-							20	15	4	3	11	5										9	11	2				13	12	1	45	13	3
	Goose-2	-							15	18	2	9	19	5																15	14	2	39	17	3
	Goose-3	-							15	13	2																3	15	2	18	12	2	36	13	2
Proposed reservoir full pool																																			
Jay Creek	Jay-1	-							11	8	2													1	7					2	8	1	14	8	2
	Jay-2	-							15	12	2													18	10	1	6	12	1	6	9	1	45	11	2
	Jay-3	-							10	11	1																			4	9	2	14	10	1
	Jay-4	-	1	1											10	5	1				10	5	0				10	8	1	2	7	0	33	6	1
Kosina Creek	Kosina-2	-																						15	32	6							15	32	6
Tsisi Creek	Tsisi-1	-							24	14	3				3	5	1							18	14	3							45	14	3
	Tsisi-2	-																									15	16	2	15	14	2	30	15	2
Unnamed Trib 206.3	UnnamedTrib206.3-1	-							15	5	1	18	3	1													3	3	0	3	3	0	39	4	1
	UnnamedTrib206.3-3	-										3	1	0													6	1	0	3	1	0	12	1	0
Watana Creek	Watana-1	-							3	15	1										6	12	2				12	20	3	6	13	2	27	16	3
	Watana-2	-							6	11	2										3	7	1	6	10	3	6	9	1	9	10	1	30	10	2
	Watana-3	-	6	1	0				39	12	1													9	9	0	9	15	2	21	8	1	84	10	1
Unnamed Watana Trib 1	Watana Trib-1	-							4	2	1				2	2	1	3	1	0	3	9	1	9	4	1	6	14	2	29	8	2	56	6	1
Unnamed Trib 194.8	UnnamedTrib194.8-3	-				3	5	2	6	3	1	6	4	1							34	4	1	9	3	1	3	3	1	18	3	1	79	4	1
	UnnamedTrib194.8-4	-																			18	3	1							12	3	1	30	3	1
Deadman Creek	Deadman-3	-							18	28	5	6	19	5							6	29	5	15	25	6				3	18	2	48	25	5
	Deadman-4	-							15	36	10				6	39	9				1	39		15	25	1				9	38	7	46	34	6
	Deadman-5								15	30	3													15	25	2							30	27	3
	Deadman-6	-													15	43	9										18	37	6				33	40	8
Total[1]			**7**	**1**	**0**	**3**	**5**	**2**	**302**	**18**	**3**	**45**	**9**	**2**	**53**	**24**	**5**	**3**	**1**	**0**	**83**	**8**	**1**	**168**	**20**	**3**	**177**	**24**	**3**	**284**	**16**	**2**	**1,125**	**18**	**3**
Middle River																																			
Fog Creek	Fog-4	-							15	7	1													15	6	1	15	7	1	3	9	3	48	7	1
Unnamed Tributary 173.8	NA	FA-173 (Stephan Lake Complex)							9	4	1										12	3	1				12	5	2				33	4	1
Devils Canyon upper extent																																			
Chinook Creek	Chinook-1	-										6	8	1										9	8	1				2	7		17	8	1
	Chinook-2	-	3	2	0				3	4	1				1	2		3	2	0				10	7	1				9	4	0	29	5	1
Devils Canyon lower extent																																			
Indian River	NA	FA-141 (Indian River)	1	2											24	7	3				18	5	2				30	8	3	9	8	2	82	7	3
Gold Creek	NA	-													1	8								6	8	2	15	10	2	5	9	2	27	9	2
Unnamed Tributary 115.4	NA	FA-115 (Slough 6A)																			15	2	1				6	1	0	3	1	0	24	2	1
Chase Creek	NA	-													3	4	0				3	8	2				3	18	6				9	10	3
Whiskers Creek	NA	FA-104 (Whiskers Slough)	3	2	0										42	6	1				51	7	1				42	6	1	21	6	1	159	6	1
Total[1]			**7**	**2**	**0**	**0**	**NA**	**NA**	**27**	**6**	**1**	**6**	**8**	**1**	**71**	**6**	**1**	**3**	**2**	**0**	**99**	**5**	**1**	**40**	**7**	**1**	**123**	**7**	**2**	**52**	**6**	**1**	**428**	**6**	**1**

[1]Total number of measurements (n) and group mean (SD) for each mesohabitat type per River Segment.
[2]Total number of measurements (n) and group mean (SD) for each geomorphic reach.

Table 5.1-5. Mean (±SD) bankfull depth (m) of mesohabitats in Upper River and Middle River tributaries surveyed between August 3 and September 22, 2013.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Glide			Percolation Channel			Pool			Rapid			Riffle			Run			All Units[2]		
			n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																																		
Oshetna River	Oshetna-1	-							15	1.1	0.1				6	1.3	0.2										12	0.8	0.2	6	1.2	0.2	39	1.1	0.1
	Oshetna-2	-																																
	Oshetna-3	-							15	1.0	0.1				3	1.0	0.2										18	0.8	0.1	18	0.9	0.0	54	0.9	0.1
Black River	Black-1	-							10	0.5	0.0				5	0.8	0.2				2	2.1	0.4				13	0.5	0.1	8	0.7	0.1	38	0.7	0.1
	Black-2	-							21	0.7	0.1													3	0.7	0.1	9	0.7	0.1	18	0.9	0.1	51	0.7	0.1
	Black-3	-							10	0.6	0.0													5	0.8	0.1	13	0.7	0.1	13	0.7	0.0	41	0.7	0.1
Goose Creek	Goose-1	-							20	0.7	0.2	3	1.2	0.3										8	0.6	0.2				13	0.8	0.2	44	0.7	0.2
	Goose-2	-							15	0.8	0.1	9	0.6	0.1																15	0.9	0.1	39	0.8	0.1
	Goose-3	-							15	0.6	0.1																3	0.5	0.1	18	0.7	0.1	36	0.7	0.1
Proposed reservoir full pool																																		
Jay Creek	Jay-1	-							11	0.6	0.1													1	1.1					2	0.9	0.3	14	0.7	0.2
	Jay-2	-							15	0.7	0.1													18	0.8	0.1	6	0.6	0.1	6	0.8	0.1	45	0.7	0.1
	Jay-3	-							10	0.6	0.1																			4	0.7	0.2	14	0.6	0.1
	Jay-4	-	1	0.3											10	0.6	0.1				10	0.9	0.1				10	0.4	0.1	2	0.5	0.1	33	0.6	0.1
Kosina Creek	Kosina-2	-																						15	1.1	0.1							15	1.1	0.1
Tsisi Creek	Tsisi-1	-							24	0.7	0.1				3	0.9	0.1							18	0.8	0.1							45	0.7	0.1
	Tsisi-2	-																									15	0.6	0.0	15	0.7	0.1	30	0.7	0.0
Unnamed Trib 206.3	UnnamedTrib206.3-1	-							12	0.8	0.2	18	1.0	0.3													3	1.1	0.3	3	1.2	0.2	36	1.0	0.2
	UnnamedTrib206.3-3	-										3	1.0	0.1													6	1.0	0.1	3	1.2	0.1	12	1.1	0.1
Watana Creek	Watana-1	-							3	1.8	0.1										6	2.3	0.3				12	1.8	0.3	6	2.3	0.1	27	2.0	0.2
	Watana-2	-							6	1.3	0.3										3	1.3	0.3	6	1.5	0.2	6	0.7	0.3	9	1.4	0.3	30	1.3	0.3
	Watana-3	-	6	0.4	0.2				39	0.7	0.3													9	0.9	0.1	9	0.4	0.1	21	0.6	0.1	84	0.6	0.2
Unnamed Watana Trib 1	Watana Trib-1	-							4	0.7	0.0				2	0.5	0.1	3	0.8	0.3	3	1.3	0.2	9	1.0	0.1	6	1.0	0.3	28	0.9	0.1	55	0.9	0.1
Unnamed Trib 194.8	UnnamedTrib194.8-3	-				3	1.2	0.4	6	1.4	0.1	6	1.6	0.1							34	1.7	0.2	9	1.6	0.1	3	0.9	0.0	18	1.4	0.1	79	1.5	0.2
	UnnamedTrib194.8-4	-																			18	1.2	0.3							12	1.2	0.1	30	1.2	0.2
Deadman Creek	Deadman-3	-							18	1.0	0.1	6	1.2	0.2							6	1.0	0.2	15	1.1	0.1				3	1.2	0.2	48	1.1	0.1
	Deadman-4	-							15	0.9	0.1				6	1.2	0.3				1	0.8		15	1.0	0.1				9	0.9	0.1	46	1.0	0.1
	Deadman-5								15	0.9	0.1													15	1.0	0.1							30	0.9	0.1
	Deadman-6	-													15	0.9	0.1										18	0.8	0.3				33	0.9	0.2
Total[1]			**7**	**0.4**	**0.2**	**3**	**1.2**	**0.4**	**299**	**0.8**	**0.1**	**45**	**1.0**	**0.2**	**50**	**0.9**	**0.2**	**3**	**0.8**	**0.3**	**83**	**1.4**	**0.2**	**146**	**1.0**	**0.1**	**162**	**0.8**	**0.1**	**250**	**0.9**	**0.1**	**1,048**	**0.9**	**0.1**
Middle River																																		
Fog Creek	Fog-4	-							15	0.8	0.1													15	0.8	0.1	15	0.7	0.1	3	0.8	0.1	48	0.8	0.1
Unnamed Tributary 173.8	NA	FA-173 (Stephan Lake Complex)							9	0.7	0.1										12	0.9	0.2				9	0.6	0.1				30	0.7	0.1
Devils Canyon upper extent																																		
Chinook Creek	Chinook-1	-										6	0.7	0.1										9	0.6	0.1				2	0.8		17	0.7	0.1
	Chinook-2	-	3	0.4	0.1				3	0.3	0.1				1	0.3		3	0.3	0.1				10	0.6	0.1				9	0.5	0.0	29	0.5	0.1
Devils Canyon lower extent																																		
Indian River	NA	FA-141 (Indian River)													24	0.6	0.1				18	1.1	0.7				30	0.7	0.2	9	1.1	0.2	81	0.8	0.3
Gold Creek	NA	-													1	0.9								6	1.1	0.1	12	0.9	0.1	5	1.0	0.1	24	1.0	0.1
Unnamed Tributary 115.4	NA	FA-115 (Slough 6A)																			15	0.6	0.1				6	0.5	0.1	3	0.6	0.1	24	0.6	0.1
Chase Creek	NA	-													3	0.8	0.2				3	0.7	0.3										6	0.8	0.3
Whiskers Creek	NA	FA-104 (Whiskers Slough)	3	0.6	0.0										42	0.7	0.1				48	1.0	0.2				42	0.6	0.1	21	0.8	0.1	156	0.8	0.1
Total[1]			**6**	**0.5**	**0.0**	**0**	**NA**	**NA**	**27**	**0.7**	**0.1**	**6**	**0.7**	**0.1**	**71**	**0.7**	**0.1**	**3**	**0.3**	**0.1**	**96**	**0.9**	**0.3**	**40**	**0.7**	**0.1**	**114**	**0.7**	**0.1**	**52**	**0.8**	**0.1**	**415**	**0.7**	**0.1**

[1]Total number of measurements (n) and group mean (SD) for each mesohabitat type per River Segment.
[2]Total number of measurements (n) and group mean (SD) for each geomorphic reach.

Table 5.1-6. Mean (±SD) thalweg depth (m) of mesohabitats in Upper River and Middle River tributaries surveyed between August 3 and September 22, 2013.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Glide			Percolation Channel			Pool			Rapid			Riffle			Run			All Units[2]		
			n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																																			
Oshetna River	Oshetna-1	-							15	1.0	0.1				6	1.1	0.3										12	0.7	0.1	6	1.2	0.1	39	1.0	0.1
	Oshetna-2	-																																	
	Oshetna-3	-							15	0.9	0.1				3	0.8	0.1										18	0.6	0.1	18	0.7	0.1	54	0.7	0.1
Black River	Black-1	-							10	0.5	0.0				5	0.9	0.2				2	2.2	0.5				13	0.5	0.1	8	0.7	0.1	38	0.7	0.1
	Black-2	-							21	0.6	0.1													3	0.8	0.2	9	0.6	0.1	18	0.9	0.1	51	0.7	0.1
	Black-3	-							10	0.7	0.1													5	0.7	0.1	13	0.7	0.1	13	0.7	0.1	41	0.7	0.1
Goose Creek	Goose-1	-							20	0.6	0.2	3	0.6	0.2										8	0.6	0.1				13	0.8	0.2	44	0.7	0.2
	Goose-2	-							15	0.6	0.1	9	0.6	0.1																15	0.8	0.1	39	0.7	0.1
	Goose-3	-							15	0.6	0.1																3	0.5	0.1	18	0.7	0.1	36	0.6	0.1
Proposed Reservoir Full Pool																																			
Jay Creek	Jay-1	-							11	0.5	0.1													1	0.8					2	0.8	0.1	14	0.6	0.1
	Jay-2	-							15	0.6	0.0													18	0.6	0.1	6	0.5	0.1	6	0.7	0.1	45	0.6	0.1
	Jay-3	-							10	0.5	0.0																			4	0.7	0.1	14	0.6	0.1
	Jay-4	-	1	0.3											10	0.5	0.1				10	0.9	0.1				10	0.4	0.1	2	0.7	0.2	33	0.6	0.1
Kosina Creek	Kosina-2	-																						15	1.0	0.1							15	1.0	0.1
Tsisi Creek	Tsisi-1	-							24	0.5	0.1				3	0.7	0.2							18	0.7	0.1							45	0.6	0.1
	Tsisi-2	-																									15	0.5	0.1	15	0.7	0.1	30	0.6	0.1
Unnamed Trib 206.3	UnnamedTrib206.3-1	-							15	0.4	0.1	18	0.4	0.1													3	0.3	0.1	3	0.5	0.1	39	0.4	0.1
	UnnamedTrib206.3-3	-										3	0.3	0.2													6	0.2	0.1	3	0.4	0.1	12	0.3	0.1
Watana Creek	Watana-1	-							3	0.6	0.0										6	1.2	0.4				12	0.6	0.1	6	0.9	0.2	27	0.8	0.2
	Watana-2	-							6	0.6	0.1										3	0.9	0.4	6	0.6	0.1	6	0.5	0.2	9	0.6	0.1	30	0.6	0.1
	Watana-3	-	6	0.3	0.2				39	0.5	0.1													9	0.8	0.1	9	0.5	0.1	21	0.6	0.1	84	0.5	0.1
Unnamed Watana Trib 1	Watana Trib-1	-							4	0.6	0.0				2	0.4	0.1	3	0.2	0.1	3	0.9	0.2	9	0.5	0.1	6	0.5	0.1	29	0.7	0.1	56	0.6	0.1
Unnamed Trib 194.8	UnnamedTrib194.8-3	-				3	0.9	0.4	6	0.7	0.2	6	0.7	0.1							34	1.0	0.2	9	0.7	0.1	3	0.3	0.1	18	0.6	0.1	79	0.8	0.2
	UnnamedTrib194.8-4	-																			18	0.6	0.3							12	0.4	0.0	30	0.5	0.2
Deadman Creek	Deadman-3	-							18	1.0	0.1	6	1.0	0.2							6	0.7	0.1	15	0.9	0.2				3	1.4	0.4	48	0.9	0.1
	Deadman-4	-							15	0.8	0.1				6	0.9	0.2				1	1.0		15	0.9	0.1				9	1.0	0.1	46	0.9	0.1
	Deadman-5								15	0.7	0.1													15	0.9	0.1							30	0.8	0.1
	Deadman-6	-													15	1.2	0.1										18	1.1	0.4				33	1.2	0.3
	Total[1]		**7**	**0.3**	**0.2**	**3**	**0.9**	**0.4**	**302**	**0.6**	**0.1**	**45**	**0.6**	**0.1**	**50**	**0.9**	**0.1**	**3**	**0.2**	**0.1**	**83**	**0.9**	**0.2**	**146**	**0.7**	**0.1**	**162**	**0.6**	**0.1**	**251**	**0.7**	**0.1**	**1,052**	**0.7**	**0.1**
Middle River																																			
Fog Creek	Fog-4	-							15	0.6	0.1													15	0.6	0.1	15	0.6	0.1	3	0.6	0.1	48	0.6	0.1
Unnamed Tributary 173.8	NA	FA-173 (Stephan Lake Complex)							9	0.2	0.1										12	0.5	0.2				12	0.2	0.1				33	0.3	0.1
Devil's Canyon Upper Extent																																			
Chinook Creek	Chinook-1	-										6	0.7	0.1										9	0.6	0.1				2	0.7		17	0.6	0.1
	Chinook-2	-	3	0.2	0.0				3	0.2	0.0				1	0.3		3	0.1	0.1				10	0.6	0.1				9	0.4	0.0	29	0.4	0.1
Devil's Canyon Lower Extent																																			
Indian River	NA	FA-141 (Indian River)													24	0.3	0.1				18	0.7	0.5				30	0.3	0.1	9	0.5	0.3	81	0.4	0.2
Gold Creek	NA	-													1	0.7								6	0.7	0.1	15	0.6	0.1	5	0.7	0.1	27	0.7	0.1
Unnamed Tributary 115.4	NA	FA-115 (Slough 6A)																			15	0.3	0.1				6	0.1	0.0	3	0.2	0.0	24	0.2	0.1
Chase Creek	NA	-													3	0.5	0.2				3	0.8	0.6				3	0.2	0.1				9	0.5	0.3
Whiskers Creek	NA	FA-104 (Whiskers Slough)	3	0.3	0.1										42	0.4	0.1				51	0.8	0.3				42	0.2	0.1	21	0.4	0.1	159	0.5	0.2
	Total[1]		**6**	**0.2**	**0.0**	**0**	**NA**	**NA**	**27**	**0.4**	**0.1**	**6**	**0.7**	**0.1**	**71**	**0.4**	**0.1**	**3**	**0.1**	**0.1**	**99**	**0.7**	**0.3**	**40**	**0.6**	**0.1**	**123**	**0.3**	**0.1**	**52**	**0.5**	**0.1**	**427**	**0.5**	**0.1**

Notes:
1 Total number of measurements (n) and group mean (SD) for each mesohabitat type per River Segment.
2 Total number of measurements (n) and group mean (SD) for each geomorphic reach.

Table 5.1-7. Number of mesohabitats within macrohabitats measured for length, sum of length (m) surveyed, and composition by length in macrohabitats among geomorphic reaches and survey types in Upper River and Middle River mainstems surveyed between August 2 and September 17, 2013.

Geomorphic Reach	Focus Area	Main Channel			Split Main Channel			Multi Split Main Channel			Side Channel			Tributary Mouth			Side Slough			Upland Slough			Unconfirmed Macrohabitat[3]			All Measured Units[2]	
		n	Length (m) & Percent		n	Length (m) & Percent		n	Length (m) & Percent		n	Length (m) & Percent		n	Length (m) & Percent		n	Length (m) & Percent		n	Length (m) & Percent		n	Length (m) & Percent		n	Length
Upper River																											
UR-3	NA																1	58	100							1	58
UR-4	NA				1	555	14				2	1,142	28				2	755	18	3	1,641	40				8	4,093
UR-5	NA				1	287	100																			1	287
UR-6	NA							1	64	4	2	1,509	96													3	1,573
	Total[1]				**2**	**842**	**14**	**1**	**64**	**1**	**4**	**2,651**	**44**				**3**	**813**	**14**	**3**	**1,641**	**27**				**13**	**6,011**
Middle River																											
MR-5	NA				1	966	100																			1	966
MR-6	NA	1	1,113	20				4	1,173	21	1	202	4				4	1,295	23	3	1,750	31	1	156	3	14	5,690
MR-7	NA	2	235	12							1	741	37				3	892	45	2	127	6				8	1,995
MR-8	NA	1	608	29				3	1,217	58	2	287	14													6	2,112
	Total[1]	**4**	**1,956**	**18**	**1**	**966**	**9**	**7**	**2,390**	**22**	**4**	**1,230**	**11**				**7**	**2,187**	**20**	**5**	**1,877**	**17**	**1**	**156**	**1**	**29**	**10,762**
Focus Areas																											
MR-1	FA-184 (Watana Dam)										2	616	100													2	616
MR-2	FA-173 (Stephan Lake Complex)										4	1,448	43	1	162	5	4	1,788	53							9	3,398
MR-6	FA-144 (Slough 21)										1	2,504	61				3	1,176	28	1	159	4	1	292	7	6	4,132
	FA-141 (Indian River)	3	513	14				4	1,462	39	2	308	8	1	476	13				6	868	23	1	81	2	17	3,707
	FA-138 (Gold Creek)							1	17	0	2	1,092	25				1	1,812	41	2	321	7	7	1,190	27	13	4,432
	FA-128 (Slough 8A)										8	4,605	81	1	194	3	1	359	6	3	516	9				13	5,675
MR-7	FA-115 (Slough 6A)				4	921	24										1	341	9	4	1,951	50	2	681	17	11	3,894
	FA-113 (Oxbow 1)	1	56	2	6	1,308	40				1	76	2				4	1,430	43	2	322	10	1	106	3	15	3,298
MR-8	FA-104 (Whiskers Slough)	1	183	6							8	1,739	54				7	1,164	36	1	162	5				17	3,248
	Total[1]	**5**	**752**	**2**	**10**	**2,229**	**7**	**5**	**1,479**	**5**	**28**	**12,388**	**38**	**3**	**832**	**3**	**21**	**8,070**	**25**	**19**	**4,300**	**13**	**12**	**2,350**	**7**	**103**	**32,399**

Notes:
1 Total number of measurements (n), group sum, and group proportion for Focus Area and non-Focus Area macrohabitats per River Segment.
2 Total number of measurements (n), group sum, and group proportion for Focus Area and non-Focus Area macrohabitats per Geomorphic Reach.
3 Quality control of data ongoing; these ground-based calls considered preliminary at the time of this report.

Table 5.1-8. Sample size and mean (±SD) of percent gradient measurements made among geomorphic reaches and survey types by macrohabitat in Upper River and Middle River mainstem surveyed between August 2 and September 17, 2013.

Geomorphic Reach	Focus Area	Main Channel			Split Main Channel			Multi Split Channel			Side Channel			Tributary Mouth			Side Slough			Upland Slough			Unconfirmed Macrohabitat[3]			All Measured Units[2]		
		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																												
UR-3	NA																3	3.3	5.8							3	3.3	5.8
UR-4	NA	4	0.6	0.2	1	0.5	NA				1	0.8	NA				12	0.2	0.2	21	1.2	3.7				39	0.8	2.7
UR-5	NA				1	0.5	NA																			1	0.5	NA
UR-6	NA	1	0.5	NA				1	2.0	NA	4	0.3	0.3													6	0.6	0.7
	Total[1]	**5**	**0.6**	**0.1**	**2**	**0.5**	**0.0**	**1**	**2.0**	**NA**	**5**	**0.4**	**0.4**				**15**	**0.8**	**2.5**	**21**	**1.2**	**3.7**				**49**	**0.9**	**2.8**
Middle River																												
MR-2	NA	1	0.5	NA																						1	0.5	NA
MR-3	NA																											
MR-5	NA				1	0.5	NA																			1	0.5	NA
MR-6	NA	2	0.5	0.0				6	0.4	0.5	2	2.5	0.7				16	0.5	1.2	11	0.0	0.2	1	1.0	NA	38	0.5	1.0
MR-7	NA	2	0.3	0.4							4	0.4	0.3				13	0.1	0.3	3	0.0	0.0				22	0.2	0.3
MR-8	NA	1	0.5	NA	1	0.5	NA	18	0.7	0.6	5	0.4	0.6													25	0.6	0.6
	Total[1]	**6**	**0.4**	**0.2**	**2**	**0.5**	**0.0**	**24**	**0.6**	**0.6**	**11**	**0.8**	**1.0**				**29**	**0.3**	**0.9**	**14**	**0.0**	**0.1**	**1**	**1.0**	**NA**	**87**	**0.4**	**0.8**
Focus Areas																												
MR-1	FA-184 (Watana Dam)										3	0.7	0.3													3	0.7	0.3
MR-2	FA-173 (Stephan Lake Complex)										8	0.0	0.0	2	1.5	0.7	11	0.1	0.2							21	0.2	0.5
MR-6	FA-144 (Slough 21)	2	0.5	0.0				1	0.5	NA	9	1.0	0.9				8	0.1	0.2	3	0.0	0.0	2	0.0	0.0	25	0.5	0.7
	FA-141 (Indian River)	7	0.4	0.4				11	0.6	0.6	3	0.8	1.0	16	0.7	0.9				7	0.0	0.0	2	0.0	0.0	46	0.5	0.7
	FA-138 (Gold Creek)							2	1.5	2.1	14	0.5	0.5				14	0.4	0.6	9	1.4	2.9	9	0.7	0.8	48	0.7	1.4
	FA-128 (Slough 8A)										47	0.7	0.8	4	2.3	2.1				6	0.0	0.0	1	0.5	NA	58	0.7	1.0
MR-7	FA-115 (Slough 6A)				8	1.0	1.6										1	0.0	NA	22	0.2	0.5	7	0.5	0.9	38	0.4	0.9
	FA-113 (Oxbow 1)	1	0.0	NA	11	0.9	0.6				1	0.5	NA				11	0.8	2.4	17	0.1	0.2	1	0.0	NA	42	0.5	1.3
MR-8	FA-104 (Whiskers Slough)	2	0.0	0.0							14	0.5	0.7				42	0.8	1.6	4	1.3	2.5				62	0.7	1.5
	Total[1]	**12**	**0.3**	**0.3**	**19**	**0.9**	**1.1**	**14**	**0.7**	**0.8**	**99**	**0.6**	**0.7**	**22**	**1.0**	**1.3**	**87**	**0.6**	**1.4**	**68**	**0.4**	**1.3**	**22**	**0.5**	**0.7**	**343**	**0.6**	**1.1**

Notes:
1 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area macrohabitats per River Segment.
2 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area macrohabitats per Geomorphic Reach.
3 Quality control of data ongoing; these ground-based calls considered preliminary at the time of this report.

Table 5.1-9. Sample size and mean (±SD) of bankfull width measurements made among geomorphic reaches and survey types by macrohabitat in Upper River and Middle River mainstem surveyed between August 2 and September 17, 2013.

Geomorphic Reach	Focus Area	Main Channel			Split Main Channel			Multi Split Main Channel			Side Channel			Tributary Mouth			Side Slough			Upland Slough			Unconfirmed Macrohabitat[3]			All Units[2]		
		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																											
UR-3	NA	28	156	19													9	6	1							37	118	14
UR-4	NA	21	178	45	9	181	64				6	111	49				32	8	2	55	7	2				123	52	17
UR-5	NA				3	123	16																			3	123	16
UR-6	NA	11	272	82	6	147	51	3	111	48	18	103	56													38	143	59
	Total[1]	**60**	**177**	**37**	**18**	**160**	**52**	**3**	**111**	**48**	**24**	**105**	**54**				**41**	**8**	**2**	**55**	**7**	**2**				**201**	**80**	**24**
Middle River																											
MR-2	NA	3	127	4																						3	127	4
MR-3	NA	12	163	19	6	99	16																			18	131	18
MR-5	NA				3	115	11																			3	115	11
MR-6	NA	9	191	36				24	81	28	9	47	8				47	10	4	28	15	3	3	82	46	120	42	12
MR-7	NA	9	242	7	3	157	105				15	43	4				39	16	5	9	5	1				75	53	8
MR-8	NA	3	402	41	3	94	41	32	58	19	4	50	13													42	81	21
	Total[1]	**36**	**215**	**21**	**15**	**113**	**38**	**56**	**67**	**22**	**28**	**45**	**7**				**86**	**13**	**4**	**37**	**12**	**2**	**3**	**82**	**46**	**261**	**58**	**13**
Focus Areas																											
MR-1	FA-184 (Watana Dam)	6	164	35							9	64	7													15	89	14
MR-2	FA-173 (Stephan Lake Complex)	6	189	26							23	70	31	3	5	3	55	35	15							87	49	20
MR-6	FA-144 (Slough 21)	6	199	61				6	178	15	27	69	15				26	28	5	9	11	4	6	68	13	80	66	14
	FA-141 (Indian River)	14	196	22				24	101	32	9	30	11	53	18	15				18	14	5	2	6	1	120	56	17
	FA-138 (Gold Creek)	3	192	22	3	122	1	3	40	9	42	31	5				42	27	8	24	13	2	30	80	19	147	42	9
	FA-128 (Slough 8A)	3	228	105							137	45	10	9	9	1	12	21	8	17	9	2	3	95	22	181	42	10
MR-7	FA-115 (Slough 6A)				18	163	24										3	33	11	65	7	3	15	17	1	101	36	7
	FA-113 (Oxbow 1)	3	178	18	45	108	14				3	155	26				32	34	6	31	5	2	3	9	2	117	60	9
MR-8	FA-104 (Whiskers Slough)	3	27	6	3	187	29				45	53	8				123	11	2	9	14	3				183	25	4
	Total[1]	**44**	**181**	**34**	**69**	**126**	**17**	**33**	**109**	**27**	**295**	**50**	**11**	**65**	**16**	**13**	**293**	**23**	**6**	**173**	**9**	**3**	**59**	**57**	**13**	**1,031**	**45**	**10**

Notes:
1 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area macrohabitats per River Segment.
2 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area macrohabitats per Geomorphic Reach.
3 Quality control of data ongoing; these ground-based calls considered preliminary at the time of this report.

Table 5.1-10. Sample size and mean (±SD) of wetted width measurements made among geomorphic reaches and survey types by macrohabitats in Upper River and Middle River mainstem surveyed between August 2 and September 17, 2013.

Geomorphic Reach	Focus Area	Main Channel			Split Main Channel			Multi Split Main Channel			Side Channel			Tributary Mouth			Side Slough			Upland Slough			Unconfirmed Macrohabitat[3]			All Units[2]		
		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																												
UR-3	NA	19	151	19													6	3	1							25	110	14
UR-4	NA	14	151	27	6	100	28				4	63	20				20	8	2	37	6	2				81	41	9
UR-5	NA				2	109	3																			2	109	3
UR-6	NA	9	224	49	4	129	26	2	28	9	12	66	14													27	102	22
	Total[1]	**42**	**159**	**26**	**12**	**111**	**23**	**2**	**28**	**9**	**16**	**65**	**15**				**26**	**6**	**1**	**37**	**6**	**2**				**135**	**64**	**12**
Middle River																												
MR-2	NA	2	111	6																						2	111	6
MR-3	NA	10	145	11	4	88	16																			14	116	14
MR-5	NA				2	116	7																			2	116	7
MR-6	NA	6	185	35				16	53	15	6	36	6				26	5	3	19	6	2	2	39	26	75	33	9
MR-7	NA	6	162	5	2	78	13				10	32	4				22	8	3	6	3	1				46	36	4
MR-8	NA	2	350	57	2	84	5	36	30	9	10	24	4													50	44	10
	Total[1]	**26**	**179**	**20**	**10**	**91**	**11**	**52**	**37**	**11**	**26**	**30**	**5**				**48**	**6**	**3**	**25**	**5**	**1**	**2**	**39**	**26**	**189**	**42**	**8**
Focus Areas																												
MR-1	FA-184 (Watana Dam)	5	163	37							6	48	3													11	77	11
MR-2	FA-173 (Stephan Lake Complex)	5	188	24							19	10	3	6	6	3	37	11	2							67	16	3
MR-6	FA-144 (Slough 21)	4	215	66				4	150	11	18	27	9				16	9	3	4	8	3	4	30	5	50	45	11
	FA-141 (Indian River)	12	77	10				21	82	27	6	19	7	54	5	2				16	10	3	6	3	1	115	33	9
	FA-138 (Gold Creek)	2	191	26	2	117	1	2	23	6	28	17	2				28	13	3	16	5	1	20	48	13	98	26	5
	FA-128 (Slough 8A)	2	204	16							96	27	6	4	7	1	4	10	1	11	6	1	2	89	31	119	28	6
MR-7	FA-115 (Slough 6A)				16	106	9										2	27	9	42	5	2	10	9	2	70	29	4
	FA-113 (Oxbow 1)	4	96	19	30	82	10				2	19	1				19	16	5	28	6	2	2	7	4	85	40	6
MR-8	FA-104 (Whiskers Slough)	4	11	2	2	198	9				29	32	7				68	7	1	8	10	1				111	17	3
	Total[1]	**38**	**116**	**21**	**50**	**96**	**9**	**27**	**88**	**23**	**204**	**25**	**6**	**64**	**6**	**2**	**174**	**10**	**2**	**125**	**6**	**2**	**44**	**31**	**9**	**726**	**29**	**6**

Notes:
1 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area macrohabitats per River Segment.
2 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area macrohabitats per Geomorphic Reach.
3 Quality control of data ongoing; these ground-based calls considered preliminary at the time of this report.

Table 5.1-11. Sample size and mean (±SD) of bankfull depth measurements made among geomorphic reaches and survey types by macrohabitats in Upper River and Middle River mainstem surveyed between August 2 and September 17, 2013.

Geomorphic Reach	Focus Area	Main Channel			Split Main Channel			Multi Split Main Channel			Side Channel			Tributary Mouth			Side Slough			Upland Slough			Unconfirmed Macrohabitat[3]			All Units[2]		
		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																												
UR-3	NA	22	2.6	0.4													8	0.5	0.1							30	2.1	0.3
UR-4	NA	21	2.3	0.6	9	1.0	0.1				6	1.1	0.1				32	0.5	0.0	52	0.7	0.2				120	1.0	0.2
UR-5	NA				3	1.3	0.2																			3	1.3	0.2
UR-6	NA	11	1.8	0.6	6	1.6	0.5	3	1.0	0.2	18	1.0	0.2													38	1.3	0.3
	Total[1]	**54**	**2.4**	**0.5**	**18**	**1.3**	**0.2**	**3**	**1.0**	**0.2**	**24**	**1.0**	**0.2**				**40**	**0.5**	**0.1**	**52**	**0.7**	**0.2**				**191**	**1.2**	**0.2**
Middle River																												
MR-2	NA	3	3.4	0.2																						3	3.4	0.2
MR-3	NA	12	2.2	0.2	6	2.0	0.2																			18	2.1	0.2
MR-5	NA				3	3.0	0.3																			3	3.0	0.3
MR-6	NA	9	2.5	0.3				23	1.1	0.3	9	1.3	0.2				36	1.2	0.2	29	1.0	0.1	3	2.2	0.3	109	1.3	0.2
MR-7	NA	6	1.7	0.1	3	2.2	0.2				15	0.9	0.1				33	0.8	0.2	9	0.7	0.1				66	0.9	0.1
MR-8	NA	3	1.9	0.2	3	1.6	0.2	31	1.0	0.1	4	0.9	0.4													41	1.1	0.2
	Total[1]	**33**	**2.3**	**0.2**	**15**	**2.2**	**0.2**	**54**	**1.1**	**0.2**	**28**	**1.0**	**0.1**				**69**	**1.0**	**0.2**	**38**	**0.9**	**0.1**	**3**	**2.2**	**0.3**	**240**	**1.2**	**0.2**
Focus Areas																												
MR-1	FA-184 (Watana Dam)	6	2.3	0.5							8	1.5	0.3													14	1.7	0.4
MR-2	FA-173 (Stephan Lake Complex)	6	2.2	0.3							29	0.8	0.1	3	0.4	0.1	56	0.7	0.2							94	0.8	0.2
MR-6	FA-144 (Slough 21)	6	2.9	0.2				6	2.7	0.3	24	1.2	0.1				24	1.2	0.1	6	2.5	2.8	6	1.4	0.1	72	1.6	0.4
	FA-141 (Indian River)	8	1.8	0.1				12	1.7	0.1	9	0.7	0.2	54	0.7	0.3				17	1.1	0.2	3	0.7	0.1	103	1.0	0.2
	FA-138 (Gold Creek)	1	2.6		1	2.5		3	0.7	0.0	41	0.9	0.2				41	1.0	0.4	24	1.5	0.1	28	1.7	0.4	139	1.3	0.3
	FA-128 (Slough 8A)	3	2.1	0.5							129	1.3	0.2	6	0.7	0.0	6	0.8	0.1	18	0.8	0.1				162	1.2	0.2
MR-7	FA-115 (Slough 6A)				19	2.2	0.2										2	1.9	0.1	63	0.7	0.1	9	0.8	0.1	93	1.0	0.2
	FA-113 (Oxbow 1)	6	1.8	0.2	45	1.7	0.3				3	0.9	0.1				28	1.0	0.6	26	0.5	0.1	3	0.8	0.3	111	1.2	0.3
MR-8	FA-104 (Whiskers Slough)	3	0.8	0.1	3	2.2	0.1				39	1.3	0.1				99	0.7	0.1	9	1.2	0.3				153	0.9	0.1
	Total[1]	**39**	**2.0**	**0.2**	**68**	**1.9**	**0.2**	**21**	**1.8**	**0.2**	**282**	**1.2**	**0.2**	**63**	**0.6**	**0.2**	**256**	**0.8**	**0.2**	**163**	**0.9**	**0.2**	**49**	**1.4**	**0.3**	**941**	**1.1**	**0.2**

Notes:
1 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area macrohabitats per River Segment.
2 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area macrohabitats per Geomorphic Reach.
3 Quality control of data ongoing; these ground-based calls considered preliminary at the time of this report.

Table 5.1-12. Sample size and mean (±SD) of thalweg depth measurements made among geomorphic reaches and survey types by macrohabitats in Upper River and Middle River mainstem surveyed between August 2 and September 17, 2013.

Geomorphic Reach	Focus Area	Main Channel			Split Main Channel			Multi Split Main Channel			Side Channel			Tributary Mouth			Side Slough			Upland Slough			Unconfirmed Macrohabitat[3]			All Units[2]		
		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																												
UR-3	NA	22	3.1	0.6													9	0.3	0.1							31	2.4	0.4
UR-4	NA	20	4.0	1.0	3	1.3	0.3				3	0.9	0.0				32	0.4	0.1	56	0.6	0.2				114	1.1	0.3
UR-5	NA				3	1.9	0.3																			3	1.9	0.3
UR-6	NA	11	2.6	1.2	6	1.9	0.4	3	0.5	0.2	3	0.6	0.1													23	1.7	0.6
	Total[1]	**53**	**3.4**	**0.8**	**12**	**1.8**	**0.4**	**3**	**0.5**	**0.2**	**6**	**0.8**	**0.1**				**41**	**0.4**	**0.1**	**56**	**0.6**	**0.2**				**171**	**1.5**	**0.3**
Middle River																												
MR-2	NA	3	3.6	0.3																						3	3.6	0.3
MR-3	NA	12	2.7	0.2	6	2.3	0.1																			18	2.5	0.2
MR-5	NA				3	2.7	0.9																			3	2.7	0.9
MR-6	NA	9	2.4	0.3				18	1.8	0.2	9	0.8	0.1				32	0.3	0.1	20	0.4	0.1	3	1.0	0.5	91	0.9	0.1
MR-7	NA	9	1.7	0.4	3	1.7	0.4				15	0.5	0.1				33	0.3	0.1	9	0.3	0.1				69	0.6	0.2
MR-8	NA	3	3.2	0.2	3	1.1	0.6	54	0.5	0.1	15	0.5	0.2													75	0.6	0.2
	Total[1]	**36**	**2.5**	**0.3**	**15**	**2.0**	**0.4**	**72**	**0.8**	**0.1**	**39**	**0.6**	**0.1**				**65**	**0.3**	**0.1**	**29**	**0.4**	**0.1**	**3**	**1.0**	**0.5**	**259**	**0.9**	**0.2**
Focus Areas																												
MR-1	FA-184 (Watana Dam)	6	2.9	0.3							9	1.6	0.4													15	1.9	0.3
MR-2	FA-173 (Stephan Lake Complex)	6	2.8	0.5							29	0.3	0.1	6	0.2	0.1	56	0.7	0.3							97	0.6	0.3
MR-6	FA-144 (Slough 21)	6	2.4	0.2				6	2.2	0.2	24	0.6	0.1				24	0.4	0.1	6	0.7	0.2	6	0.6	0.1	72	0.8	0.1
	FA-141 (Indian River)	15	1.1	0.1				17	1.1	0.2	9	0.7	0.3	54	0.3	0.2				22	0.9	0.2	6	0.3	0.2	123	0.7	0.2
	FA-138 (Gold Creek)	1	2.8		1	2.0		6	0.5	0.1	41	0.4	0.1				42	0.5	0.3	24	0.3	0.1	30	0.8	0.2	145	0.5	0.2
	FA-128 (Slough 8A)	3	2.6	1.0							135	0.7	0.2	6	0.3	0.1	6	0.6	0.1	18	0.5	0.2				168	0.7	0.2
MR-7	FA-115 (Slough 6A)				24	1.6	0.3										2	1.1	0.1	63	0.5	0.2	15	0.3	0.1	104	0.8	0.2
	FA-113 (Oxbow 1)	6	1.4	0.5	45	1.3	0.2				3	0.6	0.1				27	0.3	0.2	41	0.3	0.1	3	0.4	0.3	125	0.7	0.2
MR-8	FA-104 (Whiskers Slough)	6	0.4	0.1	3	1.9	0.3				42	0.7	0.2				100	0.3	0.1	12	0.7	0.3				163	0.5	0.1
	Total[1]	**49**	**1.6**	**0.3**	**73**	**1.5**	**0.3**	**29**	**1.2**	**0.2**	**292**	**0.6**	**0.2**	**66**	**0.3**	**0.2**	**257**	**0.5**	**0.2**	**186**	**0.5**	**0.2**	**60**	**0.6**	**0.2**	**1,012**	**0.7**	**0.2**

Notes:
1 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area macrohabitats per River Segment.
2 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area macrohabitats per Geomorphic Reach.
3 Quality control of data ongoing; these ground-based calls considered preliminary at the time of this report.

Table 5.1-13. Number of mesohabitats measured for length, sum of length (m) surveyed, and composition by length of mesohabitats among geomorphic reaches and survey types in Upper River and Middle River mainstems surveyed between August 2 and September 17, 2013.

Geomorphic Reach	Focus Area	Pool			Riffle			Glide			Run			Backwater			Beaver Complex			Clearwater Plume			Dry Channel			No Mesohabitat Recorded			All Measured Units[2]	
		n	Length & Proportion		n	Length & Proportion		n	Length & Proportion		n	Length & Proportion		n	Length & Proportion		n	Length & Proportion		n	Length & Proportion		n	Length & Proportion		n	Length & Proportion		n	Length
Upper River																														
UR-3	NA	1	41	0.71	1	6	0.10	1	11	0.19																		3	58
UR-4	NA	13	1,150	0.28	9	1,554	0.38	10	549	0.13	2	581	0.14										3	258	0.06				37	4,093
UR-5	NA										1	287	1.00																1	287
UR-6	NA				2	155	0.10	2	808	0.51	3	610	0.39																7	1,573
	Total[1]	**14**	**1,191**	**0.20**	**12**	**1,715**	**0.29**	**13**	**1,368**	**0.23**	**6**	**1,478**	**0.25**										**3**	**258**	**0.04**				**48**	**6,011**
Middle River																														
MR-5	NA										1	966	1.00																1	966
MR-6	NA	10	877	0.15	8	500	0.09	3	408	0.07	4	1,624	0.29				8	1,435	0.25				5	539	0.09	3	308	0.05	41	5,690
MR-7	NA	1	7	0.00	4	251	0.13	6	942	0.47	1	210	0.11	3	206	0.10	5	139	0.07	1	25	0.01	2	215	0.11				23	1,995
MR-8	NA	5	99	0.05	6	325	0.15	7	875	0.41	4	813	0.38																22	2,112
	Total[1]	**16**	**983**	**0.09**	**18**	**1,075**	**0.10**	**16**	**2,225**	**0.21**	**10**	**3,613**	**0.34**	**3**	**206**	**0.02**	**13**	**1,574**	**0.15**	**1**	**25**	**0.00**	**7**	**754**	**0.07**	**3**	**308**	**0.03**	**87**	**10,762**
Focus Areas																														
MR-1	FA-184 (Watana Dam)				1	263	0.43	2	353	0.57																			3	616
MR-2	FA-173 (Stephan Lake Complex)	5	647	0.19	6	745	0.22	14	1,886	0.56													2	121	0.04				27	3,398
MR-6	FA-144 (Slough 21)	2	187	0.05	6	1,688	0.41	4	649	0.16	1	236	0.06	2	292	0.07	6	734	0.18				3	346	0.08				24	4,132
	FA-141 (Indian River)	12	728	0.20	9	891	0.24	7	264	0.07	5	873	0.24	1	58	0.02	3	442	0.12	5	452	0.12							42	3,707
	FA-138 (Gold Creek)	10	832	0.19	14	906	0.20	10	673	0.15	5	712	0.16	3	165	0.04	5	1,085	0.24				2	59	0.01				49	4,432
	FA-128 (Slough 8A)	18	1,654	0.29	16	1,204	0.21	8	1,015	0.18	8	1,382	0.24	1	66	0.01							4	262	0.05	2	93	0.02	57	5,675
MR-7	FA-115 (Slough 6A)	12	966	0.25	6	131	0.03	2	40	0.01	4	847	0.22	3	443	0.11	6	1,048	0.27				3	419	0.11				36	3,894
	FA-113 (Oxbow 1)	9	750	0.23	7	592	0.18	4	221	0.07	4	678	0.21	5	705	0.21							3	352	0.11				32	3,298
MR-8	FA-104 (Whiskers Slough)	23	1,365	0.42	11	783	0.24	2	490	0.15	1	89	0.03	2	75	0.02				2	77	0.02	8	370	0.11				49	3,248
	Total[1]	**91**	**7,128**	**0.22**	**76**	**7,202**	**0.22**	**53**	**5,590**	**0.17**	**28**	**4,817**	**0.15**	**17**	**1,803**	**0.06**	**20**	**3,309**	**0.10**	**7**	**529**	**0.02**	**25**	**1,929**	**0.06**	**2**	**93**	**0.00**	**319**	**32,399**

Notes:
1 Total number of measurements (n), group sum, and group proportion for Focus Area and non-Focus Area mesohabitats per River Segment.
2 Total number of measurements (n), group sum, and group proportion for Focus Area and non-Focus Area mesohabitats per Geomorphic Reach.

Table 5.1-14. Sample size and mean (±SD) of percent gradient measurements made among geomorphic reaches and survey types in mesohabitats in Upper River and Middle River mainstems surveyed between August 2 and September 17, 2013.

Geomorphic Reach	Focus Area	Pool			Riffle			Glide			Run			Backwater			Beaver Complex			Clearwater Plume			Dry Channel			No Mesohabitat Recorded			All Measured Units[2]		
		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																															
UR-3	NA	1	0.0	NA	1	10.0	NA	1	0.0	NA																		3	3.3	5.8
UR-4	NA	13	0.1	0.1	9	1.1	1.0	12	0.3	0.2	3	0.4	0.2										2	8.5	12.0				39	0.8	2.7
UR-5	NA										1	0.5	NA																1	0.5	NA
UR-6	NA				2	1.3	1.1	1	0.0	NA	3	0.3	0.3																6	0.6	0.7
	Total[1]	**14**	**0.1**	**0.1**	**12**	**1.8**	**2.7**	**14**	**0.2**	**0.2**	**7**	**0.4**	**0.2**										**2**	**8.5**	**12.0**				**49**	**0.9**	**2.8**
Middle River																															
MR-2	NA				1	0.5	NA																						1	0.5	NA
MR-3	NA																														
MR-5	NA										1	0.5	NA																1	0.5	NA
MR-6	NA	10	0.0	0.0	7	1.6	1.8	3	0.2	0.3	4	0.5	0.4				8	0.0	0.0				3	0.3	0.3	3.0	1.0	1.0	38	0.5	1.0
MR-7	NA	1	0.0	NA	4	0.5	0.4	5	0.1	0.2	1	0.0	NA	3	0.0	0.0	5	0.1	0.2	1	0.5	NA	2	0.0	0.0				22	0.2	0.3
MR-8	NA	5	0.0	0.0	6	1.3	0.6	8	0.4	0.4	6	0.8	0.3																25	0.6	0.6
	Total[1]	**16**	**0.0**	**0.0**	**18**	**1.2**	**1.2**	**16**	**0.2**	**0.3**	**12**	**0.6**	**0.4**	**3**	**0.0**	**0.0**	**13**	**0.0**	**0.1**	**1**	**0.5**	**NA**	**5**	**0.2**	**0.3**	**3.0**	**1.0**	**1.0**	**87**	**0.4**	**0.8**
Focus Areas																															
MR-1	FA-184 (Watana Dam)				1	1.0	NA	2	0.5	0.0																			3	0.7	0.3
MR-2	FA-173 (Stephan Lake Complex)	5	0.0	0.0	5	0.6	0.9	11	0.1	0.2																			21	0.2	0.5
MR-6	FA-144 (Slough 21)	2	0.0	0.0	8	1.2	0.7	4	0.1	0.3	2	0.8	0.4	2	0.0	0.0	6	0.0	0.0				1	0.0	NA				25	0.5	0.7
	FA-141 (Indian River)	11	0.0	0.0	11	1.0	1.0	7	0.7	0.8	9	0.6	0.2	1	0.0	NA	3	0.0	0.0	4	0.3	0.5							46	0.5	0.7
	FA-138 (Gold Creek)	11	0.0	0.0	13	1.3	0.6	10	0.5	0.7	5	0.5	0.4	3	0.0	0.1	5	0.0	0.0				1	9.0	NA				48	0.7	1.4
	FA-128 (Slough 8A)	18	0.0	0.0	17	1.6	1.0	9	0.4	1.0	9	0.6	0.7	1	0.0	NA							2	2.0	0.0	2.0	0.5	0.7	58	0.7	1.0
MR-7	FA-115 (Slough 6A)	12	0.0	0.0	7	1.4	1.7	3	0.0	0.0	4	0.4	0.3	3	0.0	0.0	6	0.2	0.3				3	1.3	0.8				38	0.4	0.9
	FA-113 (Oxbow 1)	12	0.7	2.3	7	1.1	0.6	8	0.2	0.2	6	0.4	0.2	5	0.0	0.0	1	0.0	NA				3	0.3	0.3				42	0.5	1.3
MR-8	FA-104 (Whiskers Slough)	32	0.0	0.0	13	1.9	1.4	4	0.1	0.3	1	0.5	NA	2	0.0	0.0				2	0.0	0.0	8	2.3	2.6				62	0.7	1.5
	Total[1]	**103**	**0.1**	**0.8**	**82**	**1.3**	**1.1**	**58**	**0.3**	**0.6**	**36**	**0.5**	**0.4**	**17**	**0.0**	**0.0**	**21**	**0.0**	**0.2**	**6**	**0.2**	**0.4**	**18**	**2.0**	**2.6**	**2.0**	**0.5**	**0.7**	**343**	**0.6**	**1.1**

Notes:
1 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area macrohabitats per River Segment.
2 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area macrohabitats per Geomorphic Reach.

Table 5.1-15. Sample size and mean (±SD) of bankfull width measurements made among geomorphic reaches and survey types in mesohabitats in Upper River and Middle River mainstems surveyed between August 2 and September 17, 2013.

Geomorphic Reach	Focus Area	Pool			Riffle			Glide			Run			Backwater			Beaver Complex			Clearwater Plume[4]			Dry Channel[3]			No Mesohabitat Recorded			All Measured Units[2]		
		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																															
UR-3	NA	3	8	0	20	142	20	3	9	2	11	138	13																37	118	14
UR-4	NA	35	8	2	39	95	30	34	36	10	12	113	35										3	2	1				123	52	17
UR-5	NA										3	123	16																3	123	16
UR-6	NA				6	104	36	12	164	94	20	141	40																38	143	59
	Total[1]	**38**	**8**	**2**	**65**	**109**	**28**	**49**	**64**	**30**	**46**	**131**	**30**										**3**	**2**	**1**				**201**	**80**	**24**
Middle River																															
MR-2	NA				3	127	4																						3	127	4
MR-3	NA				3	148	20				15	125	17																18	131	18
MR-5	NA										3	115	11																3	115	11
MR-6	NA	25	19	7	26	52	17	9	18	5	18	136	31				22	11	2				11	11	4	9	43	17	120	42	12
MR-7	NA	3	4	1	18	77	20	18	30	5	3	313	10	9	11	3	15	10	5	3	215	3	6	29	9				75	53	8
MR-8	NA	3	15	1	9	54	7	20	58	15	10	164	48																42	81	21
	Total[1]	**31**	**17**	**5**	**59**	**68**	**16**	**47**	**40**	**9**	**49**	**152**	**30**	**9**	**11**	**3**	**37**	**11**	**3**	**3**	**215**	**3**	**17**	**17**	**5**	**9**	**43**	**17**	**261**	**58**	**13**
Focus Areas																															
MR-1	FA-184 (Watana Dam)				3	47	3	6	73	10	6	164	35																15	89	14
MR-2	FA-173 (Stephan Lake Complex)	16	62	17	18	65	37	53	40	14																			87	49	20
MR-6	FA-144 (Slough 21)	6	17	4	24	86	14	12	65	16	9	184	45	6	68	13	18	13	4				5	18	3				80	66	14
	FA-141 (Indian River)	26	12	4	31	69	16	24	21	18	27	114	33				9	16	4	3	185	30							120	56	17
	FA-138 (Gold Creek)	30	22	5	42	36	6	30	46	14	21	94	11	9	26	6	15	34	9										147	42	9
	FA-128 (Slough 8A)	54	25	7	54	49	8	30	55	17	26	61	16	2	7	3							9	17	9	6	39	5	181	42	10
MR-7	FA-115 (Slough 6A)	27	12	3	18	53	5	9	72	9	12	114	23	9	16	5	17	9	4				9	14	2				101	36	7
	FA-113 (Oxbow 1)	26	22	4	27	86	13	19	96	14	21	81	10	15	26	4							9	17	5				117	60	9
MR-8	FA-104 (Whiskers Slough)	93	15	2	39	30	5	15	75	12	6	81	7	6	12	3							24	11	3				183	25	4
	Total[1]	**278**	**21**	**5**	**256**	**55**	**11**	**198**	**53**	**15**	**128**	**98**	**21**	**47**	**26**	**5**	**59**	**17**	**5**	**3**	**185**	**30**	**56**	**14**	**4**	**6**	**39**	**5**	**1,031**	**45**	**10**

Notes:
1 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area mesohabitats per River Segment.
2 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area mesohabitats per Geomorphic Reach.
3 Bankfull width in Dry channels indicates the mean bankfull width of intermittent or standing puddled water in the otherwise uncategorized mesohabitat unit.
4 Bankfull width of Cleawater Plume indicates the bankfull width of the mesohabitat into which the Clearwater Plume flows.

Table 5.1-16. Sample size and mean (±SD) of wetted width measurements made among geomorphic reaches and survey types in mesohabitats in Upper River and Middle River mainstems surveyed between August 2 and September 17, 2013.

Geomorphic Reach	Focus Area	Pool			Riffle			Glide			Run			Backwater			Beaver Complex			Clearwater Plume[3]			No Mesohabitat Recorded			All Measured Units[2]		
		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																												
UR-3	NA	2	5	2	14	137	20	2	1	1	7	127	12													25	110	14
UR-4	NA	22	8	2	28	64	18	23	28	5	8	88	6													81	41	9
UR-5	NA										2	109	3													2	109	3
UR-6	NA				4	66	11	8	103	20	15	117	29													27	102	22
	Total[1]	**24**	**8**	**2**	**46**	**84**	**18**	**33**	**44**	**8**	**32**	**110**	**16**													**135**	**64**	**12**
Middle River																												
MR-2	NA				2	111	6																			2	111	6
MR-3	NA				2	127	4				12	113	17													14	116	14
MR-5	NA										2	116	7													2	116	7
MR-6	NA	19	7	4	18	39	11	6	9	1	12	113	24				14	8	2				6	21	10	75	33	9
MR-7	NA	2	4	1	12	54	4	12	20	3	2	309	12	6	5	1	10	10	4	2	3	1				46	36	4
MR-8	NA	10	8	1	12	28	6	16	40	12	12	94	18													50	44	10
	Total[1]	**31**	**7**	**3**	**46**	**47**	**7**	**34**	**27**	**7**	**40**	**118**	**19**	**6**	**5**	**1**	**24**	**9**	**3**	**2**	**3**	**1**	**6**	**21**	**10**	**189**	**42**	**8**
Focus Areas																												
MR-1	FA-184 (Watana Dam)				2	38	4	4	54	2	5	163	37													11	77	11
MR-2	FA-173 (Stephan Lake Complex)	12	13	3	18	9	2	37	20	3																67	16	3
MR-6	FA-144 (Slough 21)	4	6	1	16	48	10	8	31	6	6	163	44	4	30	5	12	9	4							50	45	11
	FA-141 (Indian River)	27	22	4	25	22	5	24	7	3	19	113	31	4	2	0	6	13	1	10	3	1				115	33	9
	FA-138 (Gold Creek)	20	11	3	28	18	3	20	24	9	14	77	9	6	18	4	10	15	4							98	26	5
	FA-128 (Slough 8A)	40	14	3	36	29	6	20	43	9	18	46	12	1	3								4	19	1	119	28	6
MR-7	FA-115 (Slough 6A)	24	9	3	14	42	5	6	66	4	8	88	6	6	13	4	12	4	2							70	29	4
	FA-113 (Oxbow 1)	24	14	3	18	58	5	20	50	7	14	66	13	9	10	5										85	40	6
MR-8	FA-104 (Whiskers Slough)	62	9	1	25	16	4	12	56	5	4	69	13	4	7	2				4	3	0				111	17	3
	Total[1]	**213**	**12**	**3**	**182**	**28**	**5**	**151**	**33**	**6**	**88**	**85**	**18**	**34**	**13**	**4**	**40**	**9**	**3**	**14**	**3**	**1**	**4**	**19**	**1**	**726**	**29**	**6**

Notes:
1 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area mesohabitats per River Segment.
2 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area mesohabitats per Geomorphic Reach.
3 Wetted width of Cleawater Plume indicates the mean width of clear (non-turbid) water in the Clearwater Plume.

Table 5.1-17. Sample size and mean (±SD) of bankfull depth measurements made among geomorphic reaches and survey types in mesohabitats in Upper River and Middle River mainstems surveyed between August 2 and September 17, 2013.

Geomorphic Reach	Focus Area	Pool			Riffle			Glide			Run			Backwater			Beaver Complex			Clearwater Plume[3]			No Mesohabitat Recorded			All Measured Units[2]		
		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																												
UR-3	NA	3	1.1	0.3	18	1.9	0.3	2	0.4	0.1	7	3.0	0.4													30	2.1	0.3
UR-4	NA	35	0.9	0.2	39	1.2	0.2	34	0.5	0.1	12	1.5	0.6													120	1.0	0.2
UR-5	NA										3	1.3	0.2													3	1.3	0.2
UR-6	NA				6	1.0	0.2	12	1.4	0.4	20	1.2	0.3													38	1.3	0.3
	Total[1]	**38**	**1.0**	**0.2**	**63**	**1.4**	**0.2**	**48**	**0.7**	**0.2**	**42**	**1.8**	**0.4**													**191**	**1.2**	**0.2**
Middle River																												
MR-2	NA				3	3.4	0.2																			3	3.4	0.2
MR-3	NA				3	2.1	0.3				15	2.1	0.2													18	2.1	0.2
MR-5	NA										3	3.0	0.3													3	3.0	0.3
MR-6	NA	25	1.1	0.3	27	1.4	0.2	8	0.8	0.1	18	1.5	0.2				22	1.1	0.1				9	1.5	0.2	109	1.3	0.2
MR-7	NA	3	0.9	0.2	18	1.4	0.1	18	0.9	0.3				9	0.8	0.1	15	0.6	0.1	3	0.5	0.0				66	0.9	0.1
MR-8	NA	3	0.7	0.1	9	0.7	0.0	21	1.2	0.2	8	1.4	0.1													41	1.1	0.2
	Total[1]	**31**	**1.1**	**0.3**	**60**	**1.4**	**0.2**	**47**	**1.0**	**0.2**	**44**	**1.8**	**0.2**	**9**	**0.8**	**0.1**	**37**	**0.9**	**0.1**	**3**	**0.5**	**0.0**	**9**	**1.5**	**0.2**	**240**	**1.2**	**0.2**
Focus Areas																												
MR-1	FA-184 (Watana Dam)				2	1.0	0.1	6	1.7	0.5	6	2.3	0.5													14	1.7	0.4
MR-2	FA-173 (Stephan Lake Complex)	18	1.2	0.1	21	0.5	0.1	55	0.7	0.2																94	0.8	0.2
MR-6	FA-144 (Slough 21)	6	1.1	0.1	24	1.5	0.2	9	1.5	0.1	9	2.5	0.2	6	1.4	0.1	18	1.5	1.0							72	1.6	0.4
	FA-141 (Indian River)	26	0.9	0.4	28	0.8	0.1	24	0.6	0.1	13	1.9	0.1				9	1.3	0.3	3	0.8	0.1				103	1.0	0.2
	FA-138 (Gold Creek)	29	1.1	0.3	42	1.0	0.1	30	1.1	0.1	15	1.9	0.2	9	1.6	0.7	14	1.7	0.7							139	1.3	0.3
	FA-128 (Slough 8A)	53	1.2	0.3	48	0.9	0.1	27	1.2	0.2	25	1.6	0.3	3	0.8	0.2							6	1.7	0.3	162	1.2	0.2
MR-7	FA-115 (Slough 6A)	30	0.8	0.1	17	1.0	0.1	9	2.2	0.2	11	1.2	0.2	8	1.0	0.1	18	0.8	0.2							93	1.0	0.2
	FA-113 (Oxbow 1)	30	1.0	0.6	27	1.5	0.2	20	1.3	0.2	21	1.1	0.2	13	0.6	0.1										111	1.2	0.3
MR-8	FA-104 (Whiskers Slough)	91	0.8	0.1	38	0.9	0.1	15	1.3	0.1	6	1.3	0.1	3	0.8	0.0										153	0.9	0.1
	Total[1]	**283**	**0.964**	**0.238**	**247**	**0.992**	**0.136**	**195**	**1.085**	**0.183**	**106**	**1.662**	**0.21**	**42**	**1.023**	**0.231**	**59**	**1.3**	**0.6**	**3**	**0.8**	**0.1**	**6**	**1.7**	**0.3**	**941**	**1.1**	**0.2**

Notes:
1 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area mesohabitats per River Segment.
2 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area mesohabitats per Geomorphic Reach.
3 Bankfull depth of Cleawater Plume indicates the mean bankfull depth of clear (non-turbid) water in the Clearwater Plume as referenced by the bankfull width of the mesohabitat in which it flows.

Table 5.1-18. Sample size and mean (±SD) of thalweg depth measurements made among geomorphic reaches and survey types in mesohabitats in Upper River and Middle River mainstems surveyed between August 2 and September 17, 2013.

Geomorphic Reach	Focus Area	Pool			Riffle			Glide			Run			Backwater			Beaver Complex			Clearwater Plume[3]			No Mesohabitat Recorded			All Measured Units[2]		
		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)		n	Mean(SD)	
Upper River																												
UR-3	NA	3	0.8	0.3	18	2.7	0.6	3	0.1	0.0	7	2.9	0.3													31	2.4	0.4
UR-4	NA	35	0.8	0.2	33	1.6	0.4	35	0.6	0.1	11	2.7	0.7													114	1.1	0.3
UR-5	NA										3	1.9	0.3													3	1.9	0.3
UR-6	NA				3	0.5	0.2	6	2.1	1.1	14	1.8	0.4													23	1.7	0.6
	Total[1]	**38**	**0.8**	**0.2**	**54**	**1.9**	**0.4**	**44**	**0.7**	**0.3**	**35**	**2.5**	**0.5**													**171**	**1.5**	**0.3**
Middle River																												
MR-2	NA				3	3.6	0.3																			3	3.6	0.3
MR-3	NA				3	2.8	0.2				15	2.4	0.1													18	2.5	0.2
MR-5	NA										3	2.7	0.9													3	2.7	0.9
MR-6	NA	21	0.4	0.2	27	0.9	0.1	6	0.2	0.1	15	2.3	0.2				13	0.6	0.1				9	0.6	0.3	91	0.9	0.1
MR-7	NA	3	0.5	0.2	18	1.0	0.2	18	0.4	0.1	3	1.5	0.4	9	0.3	0.1	15	0.4	0.1	3	0.2	0.1				69	0.6	0.2
MR-8	NA	15	0.3	0.1	18	0.4	0.1	24	0.7	0.2	18	1.1	0.2													75	0.6	0.2
	Total[1]	**39**	**0.4**	**0.1**	**69**	**1.0**	**0.2**	**48**	**0.5**	**0.2**	**54**	**1.8**	**0.2**	**9**	**0.3**	**0.1**	**28**	**0.5**	**0.1**	**3**	**0.2**	**0.1**	**9**	**0.6**	**0.3**	**259**	**0.9**	**0.2**
Focus Areas																												
MR-1	FA-184 (Watana Dam)				3	1.2	0.2	6	1.8	0.4	6	2.9	0.3													15	1.9	0.3
MR-2	FA-173 (Stephan Lake Complex)	18	1.3	0.4	24	0.2	0.1	55	0.5	0.3																97	0.6	0.3
MR-6	FA-144 (Slough 21)	6	0.4	0.2	24	0.8	0.1	9	0.6	0.1	9	1.9	0.2	6	0.6	0.1	18	0.6	0.2							72	0.8	0.1
	FA-141 (Indian River)	32	0.5	0.3	28	0.5	0.1	24	0.3	0.1	13	1.6	0.3	5	0.6	0.3	9	1.4	0.3	12	0.3	0.1				123	0.7	0.2
	FA-138 (Gold Creek)	32	0.5	0.3	42	0.3	0.1	30	0.3	0.1	17	1.2	0.2	9	0.6	0.2	15	0.8	0.4							145	0.5	0.2
	FA-128 (Slough 8A)	60	0.6	0.2	48	0.3	0.1	27	0.8	0.3	25	1.6	0.4	3	0.6	0.3							5	0.3	0.1	168	0.7	0.2
MR-7	FA-115 (Slough 6A)	36	0.5	0.2	21	0.5	0.1	9	2.6	0.2	12	0.8	0.3	8	0.8	0.1	18	0.6	0.2							104	0.8	0.2
	FA-113 (Oxbow 1)	35	0.5	0.2	27	1.2	0.3	30	0.7	0.1	21	0.9	0.2	12	0.3	0.1										125	0.7	0.2
MR-8	FA-104 (Whiskers Slough)	91	0.4	0.2	36	0.5	0.1	18	0.7	0.2	6	0.9	0.2	6	0.5	0.0				6	0.2	0.0				163	0.5	0.1
	Total[1]	**310**	**0.5**	**0.2**	**253**	**0.5**	**0.1**	**208**	**0.7**	**0.2**	**109**	**1.3**	**0.3**	**49**	**0.5**	**0.2**	**60**	**0.8**	**0.3**	**18**	**0.2**	**0.1**	**5**	**0.3**	**0.1**	**1,012**	**0.7**	**0.2**

Notes:
1 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area mesohabitats per River Segment.
2 Total number of measurements (n), and group mean (SD) for Focus Area and non-Focus Area mesohabitats per Geomorphic Reach.
3 Bankfull depth of Cleawater Plume indicates the mean bankfull depth of clear (non-turbid) water in the Clearwater Plume as referenced by the bankfull width of the mesohabitat in which it flows.

10. FIGURES

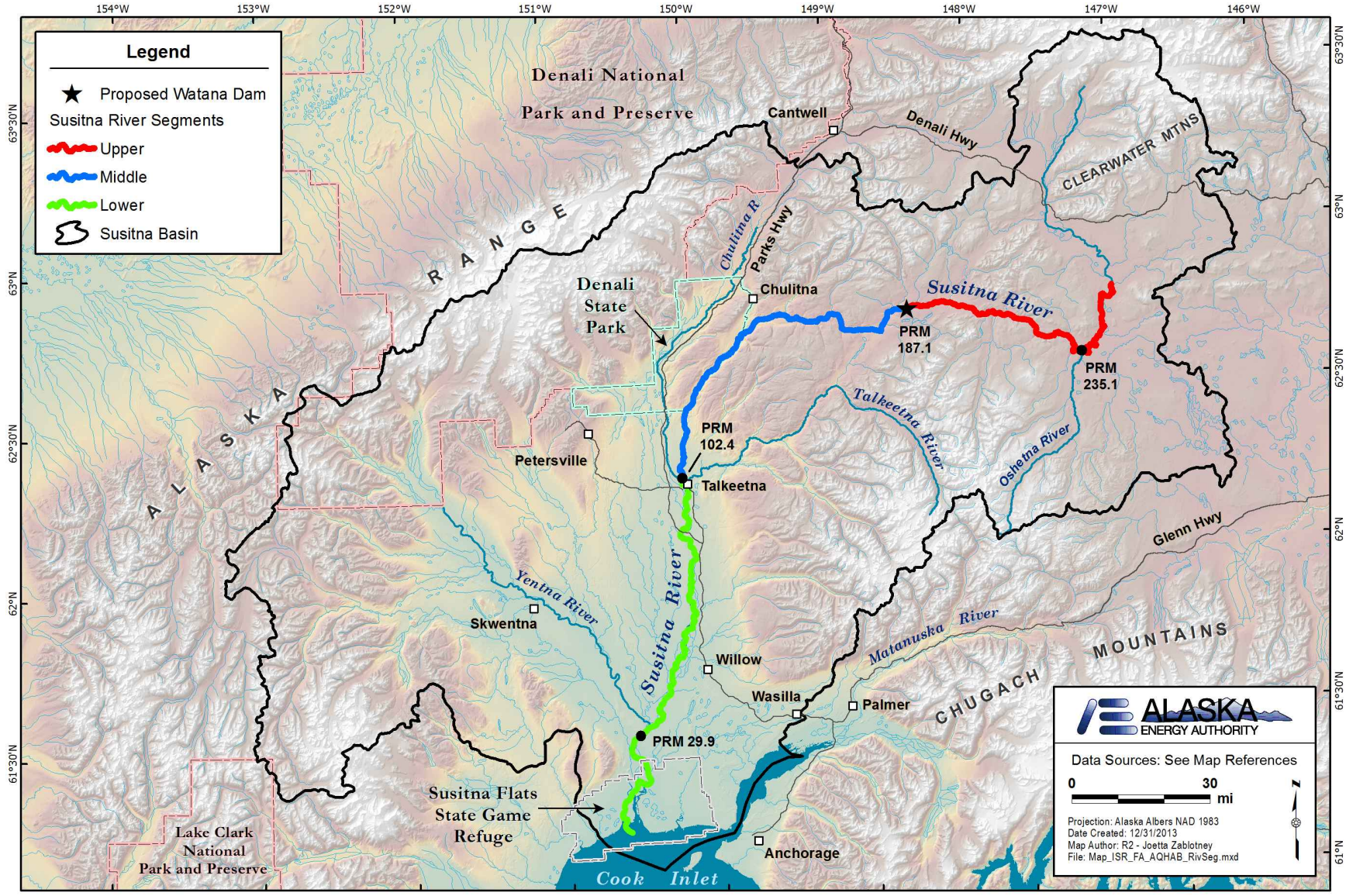

Figure 3-1. Aquatic habitat and mapping study area during 2013 field effort.

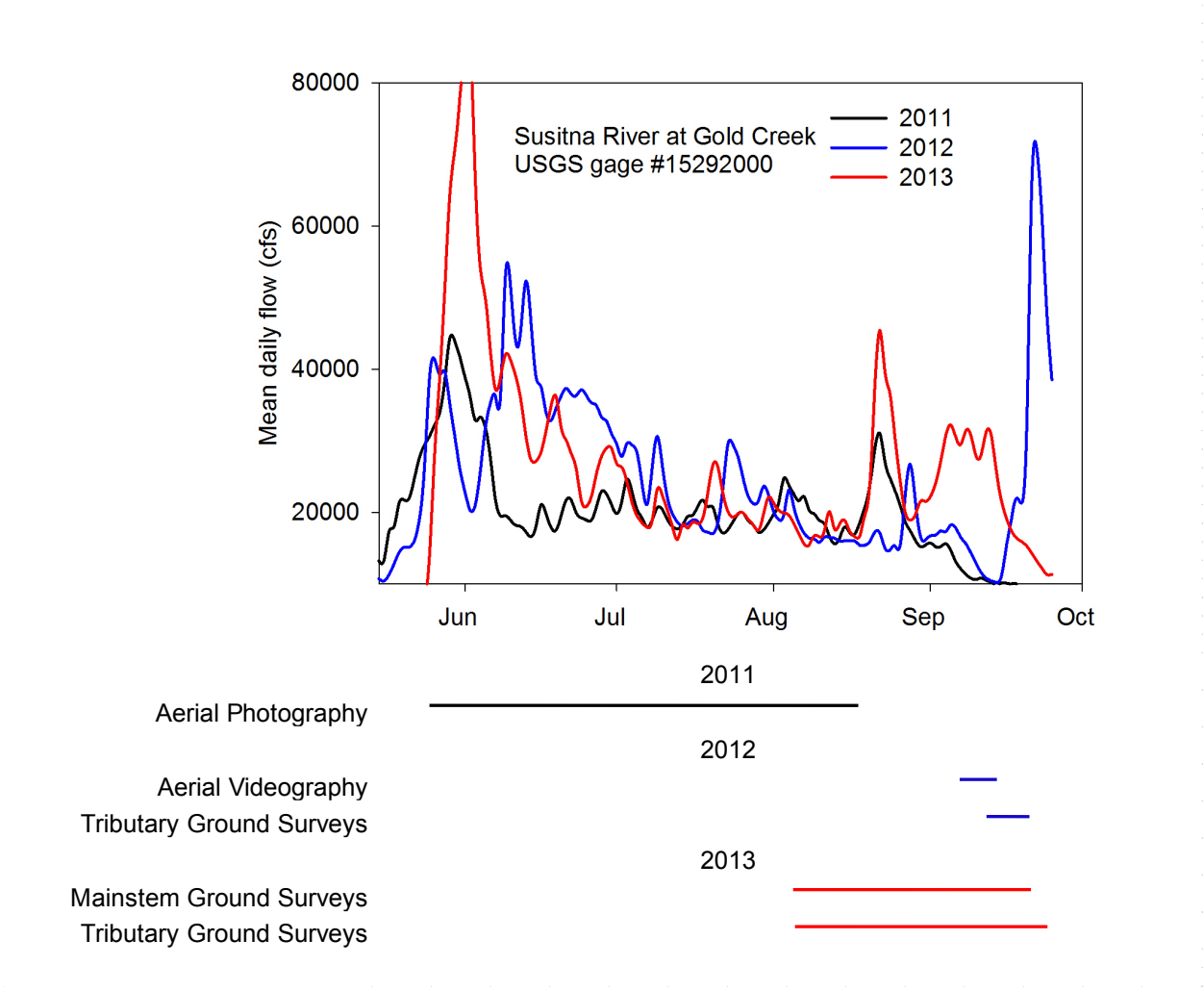

Figure 4.1-1 Flows during mainstem Susitna River in 2011, 2012 and 2013 with the timing of 2013 field surveys superimposed.

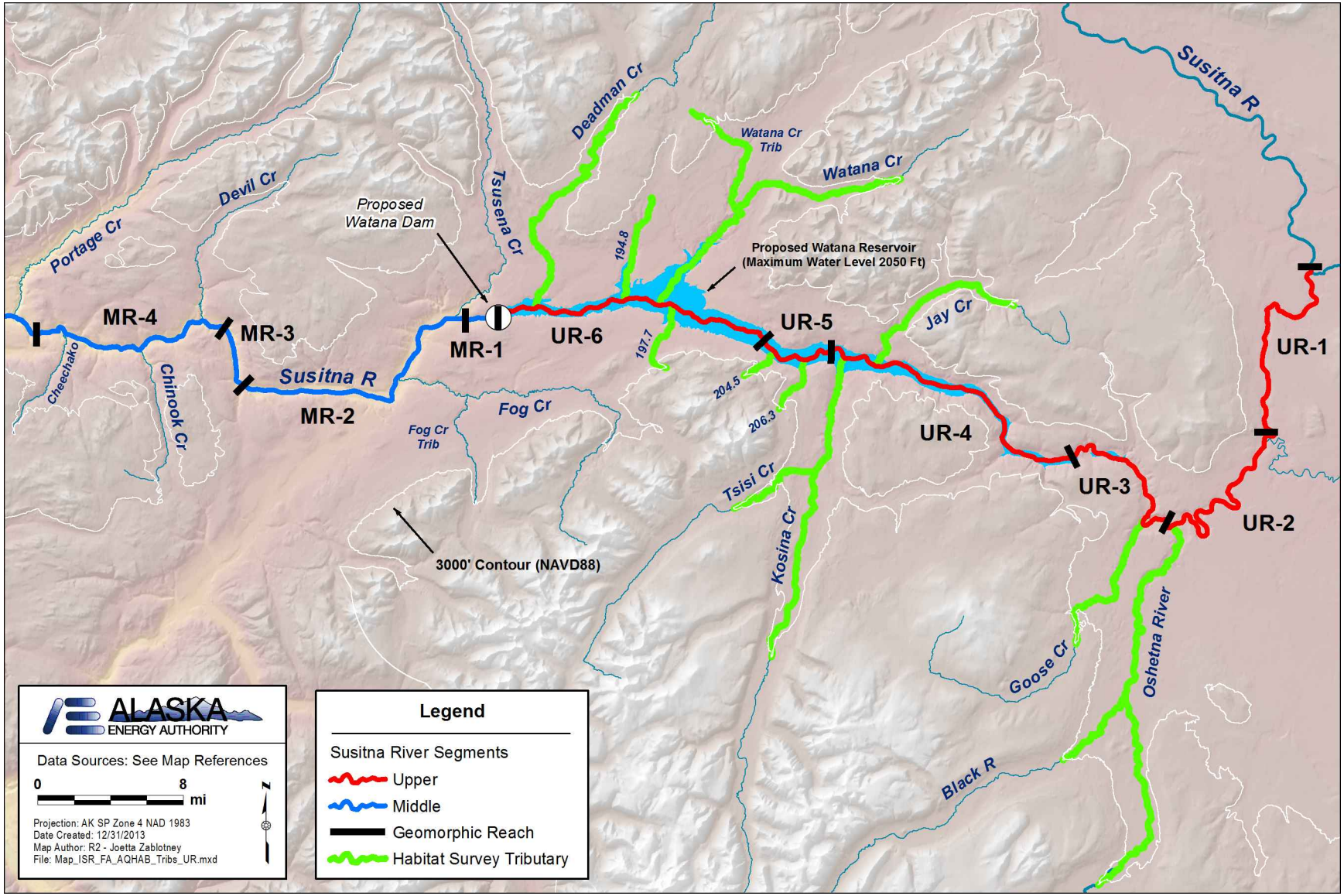

Figure 4.1-2. Map of Upper River tributaries with tributaries selected for field-surveys identified.

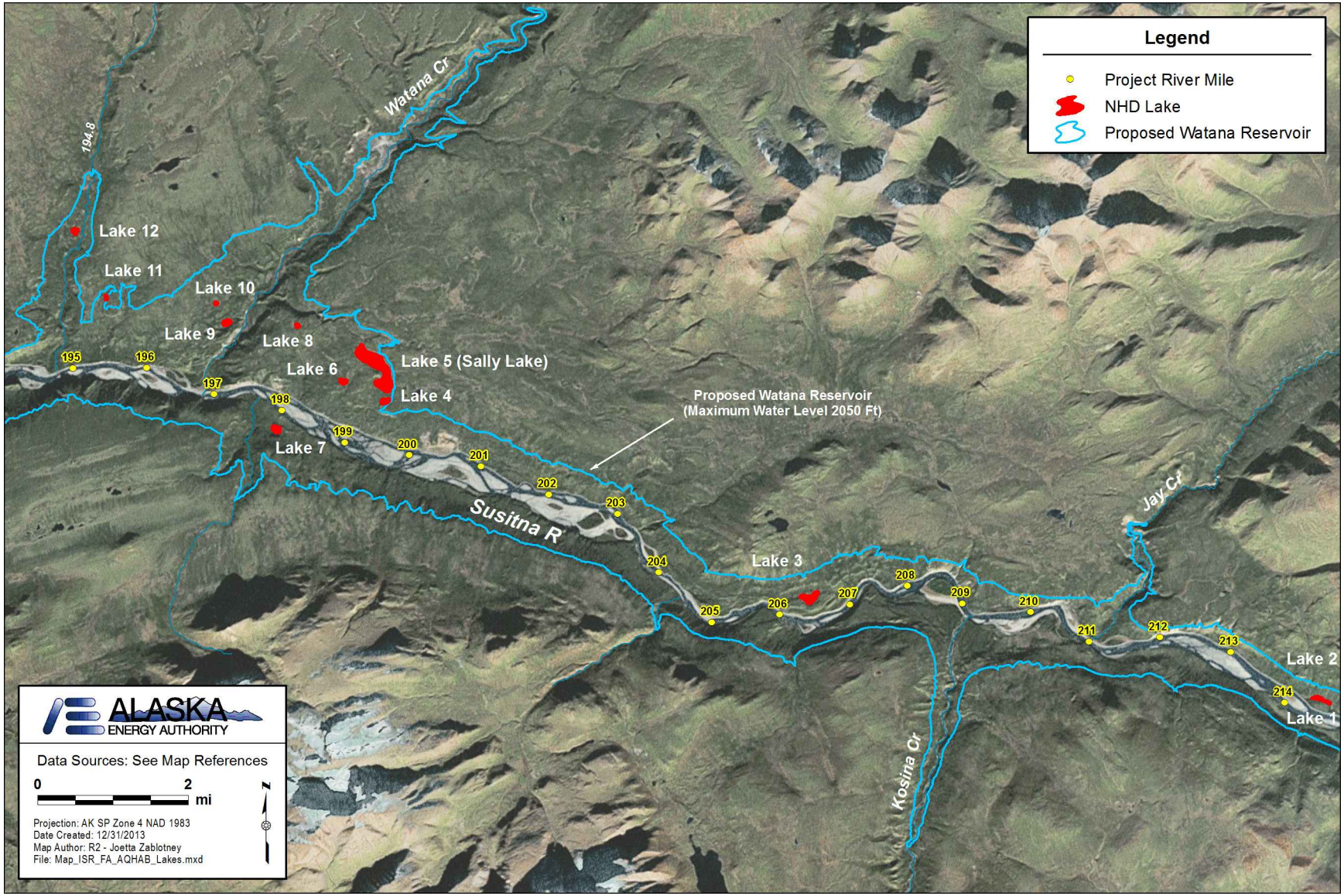

Figure 4.2-1 Map of Upper River basin lakes within the potential zone of reservoir inundation.

Figure 4.4-1 Aerial video capture of the Lower Susitna River mainstem showing highly complex braided channels characteristic of main channel habitats in this river section.

PART A - APPENDIX A: REMOTE LINE MAPPING, 2012

[See separate file for Appendix.]

Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Characterization and Mapping of Aquatic Habitats
Study 9.9

Part A - Appendix A: Remote Line Mapping, 2012
Initial Study Report

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

R2 Resource Consultants, Inc.

June 2014

INTRODUCTION

The maps contained in this map book were created using several sources of remote imagery in 2012. The habitat typing is consistent with the terminology that was current at that time, but has undergone refinement through 2013. In addition, an exercise to compare remote habitat typing with ground-based surveys conducted in 2013 is ongoing at the time of the publication of this ISR. Once this exercise is complete, final map books will be made that include both refinements of habitat definitions and typing.

PART A - APPENDIX B: UPPER SUSITNA RIVER SEGMENT REMOTE LINE HABITAT MAPPING TECHNICAL MEMORANDUM

[See separate file for Appendix.]

PART A - APPENDIX C: UPPER RIVER GROUND SURVEYS, 2013

[See separate file for Appendix.]

PART A - APPENDIX D: MIDDLE RIVER GROUND SURVEYS, 2013

[See separate file for Appendix.]