Susitna-Watana Hydroelectric Project Document
ARLIS Uniform Cover Page

Title: Characterization and mapping of aquatic habitats, Study plan Section 9.9, Study Completion Report	**SuWa 289**
Author(s) – Personal:	
Author(s) – Corporate: R2 Resource Consultants, Inc.	
AEA-identified category, if specified: November 2015; Study Completion and 2014/2015 Implementation Reports	
AEA-identified series, if specified:	
Series (ARLIS-assigned report number): Susitna-Watana Hydroelectric Project document number 289	**Existing numbers on document:**
Published by: [Anchorage : Alaska Energy Authority, 2015]	**Date published:** October 2015
Published for: Alaska Energy Authority	**Date or date range of report:**
Volume and/or Part numbers: Study plan Section 9.9	**Final or Draft status, as indicated:**
Document type: text with 103 maps	**Pagination:** vii, 99, 55, 55 pages
Related works(s):	**Pages added/changed by ARLIS:**
Notes: *Contents:* • [Main report] • Appendix A. Remote line mapping, 2012-2014 • Appendix B. Upper and middle river mainstem surveys, 2013-2014	

All reports in the Susitna-Watana Hydroelectric Project Document series include an ARLIS-produced cover page and an ARLIS-assigned number for uniformity and citability. All reports are posted online at http://www.arlis.org/resources/susitna-watana/

ARLIS
Alaska Resources Library & Information Services

SUSITNA-WATANA HYDRO

Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Characterization and Mapping of Aquatic Habitats
Study Plan Section 9.9

Study Completion Report

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

R2 Resource Consultants, Inc.

October 2015

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

LIST OF ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

Abbreviation	Definition
AEA	Alaska Energy Authority
ARRC	Alaska Railroad Corporation
BFD	measured bankfull depth
BFW	measured or estimated bankfull width
ºC	degrees Celsius
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIRWG	Cook Inlet Region Working Group
DO	dissolved oxygen
FA	Focus Area
FDA	Fish Distribution and Abundance Studies (Studies in RSP Sections 9.5 and 9.6)
FERC	Federal Energy Regulatory Commission
ft	Feet
GIS	Geographic Information System
GPS	Global Positioning System
IFSAR	Interferometric Synthetic Aperture Radar
ILP	Integrated Licensing Process
ISR	Initial Study Report
LB	left bank – looking downstream
Level 3	mainstem and tributary macrohabitat
Level 4	mainstem and tributary mesohabitat
LiDAR	Light Detection and Ranging. An optical remote sensing technology.
LWD	large woody debris
m	meter(s)
mg/L	milligrams per liter
mi	mile(s)
MSB	Matanuska-Susitna Borough
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
SD	standard deviation
SPD	Study Plan Determination
TWG	Technical Workgroup
USFS	United States Forest Service
USGS	United States Geological Survey
yd	yard
ZHI	zone of hydrologic influence

1. INTRODUCTION

This Characterization and Mapping of Aquatic Habitats, Section 9.9 of the Revised Study Plan (RSP) approved by the Federal Energy Regulatory Commission (FERC or Commission) for the Susitna-Watana Hydroelectric Project, FERC Project No. 14241, focuses on describing the aquatic habitats of the Susitna River using a specific hierarchical and nested classification system based on historic and current data.

A summary of the development of this study, together with the Alaska Energy Authority's (AEA) implementation of it through the 2013 study season, appears in Part A, Section 1 of the Initial Study Report (ISR) filed with FERC in June 2014. As required under FERC's regulations for the Integrated Licensing Process (ILP), the ISR describes AEA's "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)).

Since filing the ISR in June 2014, AEA has continued to implement the FERC-approved plan for the Characterization and Mapping of Aquatic Habitats. For example:

- AEA completed ground-truthing surveys in mainstem habitats of the Upper River and Middle River including 100 percent coverage of mesohabitat mapping within Focus Areas.
- AEA completed ground surveys of selected Upper and Middle River tributaries.
- AEA collected habitat information for the 12 lakes identified within the potential reservoir inundation zone.
- On September 17, 2014, AEA filed the 2013 and 2014 Aquatic Habitat Mapping Field Season Completion Progress Technical Memorandum.
- On October 15, 2014, AEA held an ISR meeting for the Characterization and Mapping of Aquatic Habitats.
- On November 14, 2014, AEA filed errata to Initial Study Report Part A - Appendix A, Remote Line Mapping, 2012. This map book replaced the version published on June 3, 2014 with the Study 9.9 Initial Study Report.

In furtherance of the next round of ISR meetings and FERC's SPD expected in 2016, this report contains a comprehensive discussion of results of the Characterization and Mapping of Aquatic Habitats from the beginning of AEA's study program in 2012, through the end of calendar year 2014. It describes the methods and results of the Characterization and Mapping of Aquatic Habitats, and explains how all Study Objectives set forth in the Commission-approved Study Plan have been met. Accordingly, with this report, AEA has now completed all field work, data collection, data analysis, and reporting for this study.

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 zone.
- **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]

[1] The Study Plan (RSP Section 9.9.4) provided that AEA would consider the study area for the Lower River segment to extend downstream to the upper extent of tidal influence. AEA adjusted the study area for the Lower River segment to extend downstream to PRM 3.3. Mapping and characterization in the Lower River segment has been completed (see Section 4.4) using

4. METHODS

This section provides an updated description of the methods relied upon to meet the Study Plan objectives. These methods are cumulative for 2012 through 2014 and include methods reported in the ISR Section 4. 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

Habitat mapping methods were consistent during study activities in 2013 and 2014. This overview is largely unchanged from ISR Section 4.1 with the exception of Section 4.1.2.4, which has been updated to describe the flow conditions during 2014 field surveys.

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 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 among 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 4.1-1) developed during the 2012 study design and planning process and modified by FERC's April 2013 SPD recommendations as well as standard protocols outlined in the USFS Aquatic Habitat Surveys Protocol (USFS 2001). When flow levels were too low to evaluate mesohabitat type, mesohabitat units were characterized by the flow levels described in Section 4.1.2.2 (i.e. dry, puddled).

---

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.

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. The remote line mapping effort used high resolution elevation data and aerial imagery for 3,680 square miles of the Matanuska-Susitna Borough (MSB) collected as part of the MSB LiDAR and Imagery Project. Aerial imagery was obtained over five days between May 25, 2011 and August 16, 2011. Flows for the majority of these flights - as measured at the Gold Creek USGS gage (PRM 140) – ranged between 16,700 and 18,300 cfs with one day occurring at a high flow of 30,600 cfs; videography was collected from September 7-11, 2012. During the video collection, mean daily discharge from Gold Creek steadily declined from 16,500 cfs on September 7 to 10,800 cfs on September 11, 2012. The methods for video surveys are comprehensively described in RSP Section 9.9.5.4 and technical memoranda (HDR Alaska, Inc. 2013b; R2 Resource Consultants, Inc. 2013b). 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 (Table 4.1-1). The habitat classification hierarchy was composed of four levels representing: (1) major hydrologic segment; (2) geomorphic reach (RSP Section 6.5.4.1.2.2 and RSP Table 6.5-1); (3) macrohabitat type (Table 4.1-1); and (4) mesohabitat type (Mainstem, Table 4.1-1; Tributary, Table 4.1-2).

For remote line mapping in the mainstem of the river, all main channel habitats were identified to Level 4 mesohabitat type (riffle, pool, run, etc.). 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. During the 2013 and 2014 field efforts, off-channel habitats were specifically targeted to characterize a subsample of these habitats to the level of mesohabitat (Sections 4.2.2 and 4.3.2). 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 and ground surveyed 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.

The methods used to compare remote (2012) and field mapping data (2013 and 2014) are presented in sections 4.2.2.1 and 4.3.2.1 and the results of that verification of aerial imagery and video typing are presented in sections 5.2.2.1 and 5.3.2.1.

A mapbook presenting the 2012 remote line mapping effort was included as Appendix A to Part A of the ISR. During the ISR meeting, it was identified that the data query used to build the maps inadvertently did not include side slough habitat in the reaches between MR-1 and UR-5 and side sloughs were not depicted on Appendix A maps 1 through 21. On November 14, 2014, AEA filed errata with an updated mapbook that was corrected by using the same GIS files to produce maps with all layers turned on; thus including side sloughs throughout the study area.

4.1.1.1. *GIS Habitat Mapping*

As described in ISR Section 4.1.1.1, in 2012 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. 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 4.1-1). 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 where possible. 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 or within small secondary or tertiary 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 4.1.1). 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, ISR 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, ISR 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 typically 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 and carried less than 10 percent of the main channel flow. 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 permanent 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. 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. 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. 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.

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 extent of vegetation on 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 this criteria was used to aid in separating the main channel line segment into a main channel segment containing the dominant portion of flow and a side channel segment containing less than ten percent of flow 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; ISR Appendix B).

4.1.1.2. *Aerial Video Data Collection and Analysis*

As described in ISR Section 4.1.1.2, low altitude aerial video was collected in 2012 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 4.1-3 and 4.1-4).

Because habitat delineation within tributaries was not always possible from remote imagery, a mesohabitat frequency analysis was completed for a subset of habitat in 16 videotaped tributaries (Table 4.1-3) 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 in Devils Canyon upstream of Impediment 3, 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 4.1-5). These primary mesohabitats were then used to set sampling targets for the 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 entitled 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

Ground mapping survey protocols were consistently applied in 2013 and 3014. As described in ISR Section 4.1.2, 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 4.1-1 and 4.1-2). 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.

The methods used to compare remote (2012) and ground mapping data (2013 and 2014) are presented in sections 4.2.2.1 and 4.3.2.1 and the results of that verification of aerial imagery and video typing are presented in sections 5.2.2.1 and 5.3.2.1.

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) constraints; 3) confinement (approximate extent of floodplain, off-channel features); 4) gradient; and 5) bed materials. Details of geomorphic reach delineation are provided in the Geomorphic Reach Delineation and Characterization, Upper, Middle, and Lower Susitna River Segments 2015 Updated Technical Memorandum (TetraTech 2015)

4.1.2.1.2. Tributaries

As described in ISR Section 4.1.2.1.2, tributaries were segmented into geomorphic reaches using desktop tools including IFSAR topographic contour data, U.S. Geological Survey (USGS) topographic maps, aerial video, and information from reconnaissance flights. Reach breaks were identified in 2013 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*

Field methods described in ISR Section 4.1.2.2 were implemented during surveys in both 2013 and 2014. 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 4.1.1 and 4.1.2)
- 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). 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). 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 4.1-3). 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 4.1-3) where permanent impassable barriers were encountered these were documented and barrier measurements were taken and the survey continued. If no Chinook presence was documented, surveys ended at the upper extent of the zone of hydrologic influence (ZHI) of potential project operations. For tributary surveys in the Middle River below Devils Canyon, surveys were conducted within the length of stream within the ZHI (Table 4.1-4).

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.

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*

In the RSP, 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 but were subsequently re-assigned as Level 4 mesohabitats (following the directive in the April 1, 2013 SPD). Accordingly, backwaters, beaver complexes and clearwater plumes were also treated as special habitat features and along with the features described above (Section 4.1.2.2), were specifically noted and characterized when encountered in the course of general field survey efforts in 2013 and 2014. 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). When a barrier was encountered, 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*

AEA implemented the methods as described in the Study Plan with the exception of the variances described in ISR Part A Sections 4.2.4.3 and 4.3.3.3 and below in Sections 4.2.4.2 and 4.3.3.2. 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 and 2014 were conducted in a roughly downstream to upstream manner throughout the field season. During 2013, 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). Flows occurring during 2014 field surveys were less variable than during the previous year, ranging from 17,930 to 23,800 cfs over the majority of the survey period (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 ISR Part A Section 4.2.4 and below 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 in both 2013 and 2014 (Section 4.1.2). Due to the vast extent of the Upper River, sub-sampling during ground-truthing was required. Ground surveys were planned for a total of 42 randomly selected mainstem macrohabitat units (a target of 7 of each macrohabitat type), 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 2013 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 and 2014 field seasons 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 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 field surveys were presented in 2012 Upper Susitna River Fish Distribution and Habitat Study – Habitat Report (HDR Alaska, Inc. 2013b). Select reaches of 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 and 2014 field efforts (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). In tributaries that had not previously been surveyed by videography, primary mesohabitats were determined by first surveying a complete 20-channel width segment and assessing the relative dominance of each mesohabitat type within that survey segment. The 20-channel-width section within each tributary geomorphic reach was selected based on accessibility and the presence of 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 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.

During the 2013 and 2014 field seasons, all of the previously selected large and primary tributaries were 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 initially selected for ground-surveys in response to the FERC April 2013 SPD and consultation with the TWG (Table 4.1-3). 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 mainstem field surveys were conducted 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. 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 17 available mesohabitats within single main channels and 35 macrohabitat units of other types (Table 4.2-1).

Within single main channel macrohabitat, all targeted and existing mesohabitats were mapped (8 riffles, 9 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 were only located within the Upper River in a single reach at two sites. Among habitats that were both targeted and available, field crews surveyed 7 split main channel units and 7 side channels, however, two side channels were reclassified in the field and confirmed as split main channel habitat (see Section 5.1.3) and a multi-split main channel resulting in a final count of macrohabitat surveys of 8 split main channel and 5 side channel segments. Field crews surveyed all 6 known upland sloughs in the

Upper River as well as 7 tributary mouths (Table 4.2-1). A total of 8 side sloughs were surveyed in the Upper River due to the inclusion of a backwater habitat (formerly considered a macrohabitat class) that was reclassified as a side slough with backwater mesohabitat following the April 1, 2013 SPD recommendations.

The special mesohabitat features backwaters, beaver complexes and clearwater plumes, were scarce in the Upper River, although clearwater plume habitat was present in UR-3 and UR-4 (ISR Part A Appendix B). These mesohabitat units did not occur within single main channel habitat and, thus, were not targeted during the random selection procedure. Field crews identified and mapped these special features as they encountered them and although clearwater plumes and beaver complexes were not encountered, a total of 5 backwater habitats were identified and mapped during Upper River field surveys.

4.2.2.1 Comparisons between remote and field habitat characterizations in the Upper River

Determining whether ground-truthing at the range of flows encountered during field surveys was adequate to meet the study objectives is dependent on the degree and magnitude of difference in the resulting habitat classifications between remote and field habitat characterizations. This is of particular concern since target flows were not universally achieved during ground surveys (Section 4.2.4 and Table 4.2-2).

Remote line mapping was completed in 2012, using aerial imagery collected during 2011. Some of that imagery was obtained outside the optimal flow range. Particularly during the 2013 field season, survey teams encountered some unavoidably high flow conditions; every effort was made to avoid these flows or to survey only the least flow-sensitive habitats, however these flow variations were considered a factor in the assessment of field calls that differed from the remote line mapping designation. Additional aerial imagery from 2013 is available that was flown over a range of flows between approximately 12,000 and 16,000 cfs – this imagery was referred to as supplementary information to aid in the evaluation of habitat classification differences that co-occurred with high flows during either the remote line mapping or the field assessment.

Over the 2013 and 2014 field seasons, survey crews classified mesohabitats in a total of 35 macrohabitat segments in the Upper River and for 16 mesohabitat segments of single main channel habitat (Table 4.2-1). Field habitat classifications for these segments were subsequently compared with the classifications made during the remote line mapping exercise to identify possible variations. An initial desktop assessment was made using a simple text-based comparison in the database between the macrohabitat classification from the 2012 remote line mapping and the macrohabitat classification made by field survey crews. Differences that resulted from either typographical variation (differences in naming conventions) or which arose due to changes to macrohabitat categories were excluded. For example, backwater habitats, beaver complex and clearwater plume habitat were considered Level 3 macrohabitats in the RSP but were re-assigned to Level 4 mesohabitat following FERC's Study Plan Determination. All remaining discrepancies were flagged for subsequent visual review within the GIS environment. Senior staff determined whether a difference in categorization arose from the documentation of a new feature, a difference based on stream channel geometry or change or a difference generated by different flow levels during observation.

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 4.2-3); 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 4.2-3.

The 12 lakes in the proposed reservoir inundation zone were surveyed during July and August, 2014 (Figure 4.2-2). The lakes ranged in elevation between 1,750 and 2,042 ft. msl. The lakes were numbered from 1 to 12, from the upstream-most location near PRM 214, downstream to near PRM 195. Only Lake 5 (Sally Lake) was a named lake in the National Hydrography Database (NHD) database (Table 4.2-3). The 2014 survey intent was to gather basic limnology information including water depths, water quality (temperature, dissolved oxygen, pH, and conductivity), and light penetration data at multiple locations throughout the lakes. A two-person field crew with the aid of an inflatable kayak performed measurements along perpendicular and longitudinal transects in each lake. Distances from the shoreline starting point for each transect were calculated from the GPS track line as validated with data from a laser range finder where horizontal distances were measured at each of the water quality stations described below. The lakes varied in size ranging between 0.16 ha to 23.0 ha (0.40 – 56.8 acres) and shape (simple to complex). The number of transects used to provide representative data similarly varied by the size and shape of each lake.

Depths were collected using hand-held sonar (Hawkeye Model H22PX) at routine distances along both perpendicular and longitudinal transects to generate sufficient soundings to construct a bathymetric contour map of the lakes. Hand-held sonar depths were validated frequently using a metered lead line or in shallow water, a meter stick. Water quality measurements were taken at select intervals along each perpendicular transects at stations representing 25, 50, and 75 percent of the horizontal distance across the lake. Water quality measurements were collected with an YSI Model 556MPS, with the exception of Lakes 1-3 where an YSI ProPlus Model was used. Calibration for both YSI models followed manufacturer's specifications. At each station, water temperature (^{o}C) and dissolved oxygen concentrations (mg/L) were recorded at the surface and at every 0.5 m depth for lakes with a maximum depth of less than < 5 m and at every 1.0 m depth for lakes with a maximum depth of greater than or equal to ≥ 5 m. Bottom samples at each station were collected typically 0.1 m to 0.5 m above the lake bottom to avoid the influence of bottom sediments on YSI readings. Sampling in this manner allowed the generation of vertical temperature and DO profiles to document summer stratification conditions. Hydrogen Ion Activity (pH units) and conductivity (µs/cm) were recorded at the lake surface and bottom at each water quality station. The depth of light penetration (water transparency) was collected using a standard 20 cm black and white Secchi disk. The maximum disappearing and subsequent reappearing depths were recorded at each water quality station along the perpendicular transects. The Secchi depth was calculated as the average of these two readings. Notes of visual observations regarding the occurrence of aquatic vegetation (macrophytes and algae) and other organic matter, the relative tannic color of the water, observations of potential groundwater influx and fish use were made in each lake where appropriate.

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 provided that AEA would characterize and map a selection of smaller and secondary tributaries as discussed in the July 2013 technical memo Characterization and Mapping of Aquatic Habitats (HDR 2013c). A subset of these tributaries are on Cook Inlet Regional Working Group (CIRWG) lands that could not be accessed in 2013 (ISR Section 4.2.4.1.2); these tributaries were surveyed in 2014. Uncontrollable access limitations due to high velocity water, rapids, canyons or other physical barriers, resulted in minimal surveys for two small Upper River tributaries, both within geomorphic reach UR-3 (tributary ID: H230.8-22H and H226.2-22H, see Table 4.1-1). Instead, these tributaries were briefly surveyed by helicopter to estimate dominant habitat types and metrics such as geomorphic reach length and gradient.

4.2.4.2. *Ground Survey Flow Conditions*

The Study Plan (RSP sections 9.9.5.3.2 and 9.9.5.4.1) provided that ground mapping for Upper River tributaries would be done at low to moderate flows similar to those which occurred during aerial videography and mapping of Upper River mainstem habitats would be done at flows near the range of the reference imagery 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 and 2014 field mapping seasons 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 within the short time window where Susitna River flows were within the targeted range (Figure 4.1-1). 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 field efforts in 2013 and 2014, 75 percent of Upper River side sloughs were mapped at flows less than 25,000 cfs –2 side sloughs were mapped at flows greater than 25,000 cfs (Table 4.2-3). A total of 83 percent of Upper River upland slough habitats were mapped at flows less than 25,000 cfs with just 1 upland slough mapped at flows greater than 25,000 cfs (Table 4.2-3). . This prioritization strategy was effective and resulted in very few differences in habitat classifications between ground surveys and remote line mapping despite variable flow conditions (Section 5.1.3).

4.3. Middle River Habitat Mapping

AEA implemented the methods as described in the Study Plan with the exception of the variances described in ISR Part A Section 4.3.3 and below 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 and 2014, field surveys were conducted in selected tributaries (Table 4.1-4) of the Middle River segment and in randomly selected mainstem habitat units (Table 4.2-1) following the same selection procedure described for the Upper River (Section 4.2.2).

4.3.1. Tributaries in the Middle River

Matanuska-Susitna Borough LiDAR and aerial 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. At 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 4.1-4).

A total of six tributaries outside of Focus Areas within and upstream of Devils Canyon in the Middle River were selected for ground mapping (Tsusena Creek, Unnamed 184.0, Fog Creek, Devil Creek, Chinook Creek, and 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 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. Habitat classifications within these tributaries were ground-truthed according to the same methods described for Upper River tributaries (Section 4.2.1). Devil Creek and one of the tributaries in the Stephan Lake Complex (Unnamed 174.3) were not fully surveyed due to safety constraints associated with access.

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; 9 occurred within Focus Areas and 11 were outside of Focus Areas. In 2013 and 2014, reaches that were within the zone of hydrologic influence in these tributaries were ground mapped following field protocols described in Section 4.2.1. However, Lower McKenzie Creek joins the mainstem Susitna in off-channel habitat, so the surveys of the confluence of Lower Mckenzie Creek with the main channel are included in mainstem habitat results.

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 and 2014 in accordance with the methods outlined in Section 4.1.2. 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 16 mesohabitat segments within single main channels and 57 units of other macrohabitat types. In addition, private lands limited AEA

access to some targeted habitat units during 2013 (ISR Section 4.3.3.1); these habitats were subsequently surveyed during the 2014 field season. Habitat units ground-mapped in the Middle River mainstem during the 2013 and 2014 field season are presented in Table 4.2-1.

In the April 2013 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. A total of 26 backwaters were identified and mapped within Middle River Focus Areas. An additional 13 backwaters were identified and mapped during random survey segments outside of Focus Areas in the Middle River. Nine clearwater plumes and 10 beaver complexes were identified along random survey segments with a further 28 beaver complexes and 3 clearwater plumes located within Focus Areas; these were mapped in the same manner as in the Upper River (Sections 4.1.2.3 and 4.2.2).

4.3.2.1. *Comparisons between remote and field habitat characterizations in the Middle River*

As for the Upper River, flow variations were considered a factor in the assessment of field classifications that differed from the remote line mapping designation. Over the 2013 and 2014 field seasons, survey crews classified habitats in a total of 222 macrohabitat segments in the Middle River and for 39 mesohabitat segments of single main channel habitat (Table 4.2-3). Inside Focus Areas, survey crews classified habitats in 97 macrohabitat segments with 19 mesohabitat segments of single main channel habitat. (Table 4.2-1). As described for the Upper River (Section 4.2.4.2), field habitat calls for these segments were subsequently compared with the classifications made during the remote line mapping.

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). This was not completed in a single year (2013) due to limited private land access. However, after land access was permitted, additional field surveys occurred in 2014 and all targeted habitats were surveyed. All mainstem habitat features identified for survey were successfully mapped during the 2013 and 2014 field mapping efforts. Uncontrollable access limitations due to high velocity water, rapids, canyons or other physical barriers, resulted in minimal surveys for two Middle River tributaries (Devil Creek and Unnamed 174.3, see Table 4.1-4). Instead of foot surveys, these tributaries were surveyed by helicopter to estimate dominant habitat types and metrics such as geomorphic reach length and gradient.

4.3.3.2. *Ground Survey Flow Conditions*

The Study Plan (RSP Section 9.9.5.3.2) provided that ground mapping in the Middle River 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 and 2014 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 within the targeted range (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 field effort, 11 side sloughs were mapped at flows meeting this criteria with a further 14 side sloughs mapped at flows less than approximately 25,000 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 12.9 percent of habitats mapped at flows above this target (Table 4.2-2). 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 39) upland sloughs in the Middle River mapped above 30,000 cfs (Table 4.2-2).

4.4. Lower River Habitat Mapping

AEA implemented the methods as described in the Study Plan with no variances. The Geomorphology study team (Study 6.5, see RSP section 6.5.4.4.2.2 and ISR Part A Section 4.4.2.4) used existing LiDAR and aerial imagery from the Matanuska-Susitna Borough LiDAR and Imagery Project to map the Lower River. The September 2014 technical memorandum *Mapping of Geomorphic Features and Turnover within the Middle and Lower Susitna River Segments from 1950s, 1980s, and Current Aerials* (Tetra Tech, Inc. 2014) was used to delineate different geomorphic features in the mainstem Lower Susitna River. As part of that study, aerial photographs from the 1950s, 1980s and 2012 were reviewed to delineate all geomorphic features within the Lower River floodplain. For the Lower Susitna River Segment, geomorphic feature mapping classifications were adapted and modified from the habitat types in Ashton and Trihey (1985). These included: vegetated areas, exposed substrate, and aquatic macrohabitat types (main channel, side channels, side sloughs, tributaries, and upland sloughs). Features such as the side channel complex (SCC), bar island complex (BIC), bar/attached bar (BAB), tributary delta, and additional open water were added to the set of geomorphic features.

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 provides a detailed description of the cumulative results of the Study Plan 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. These results are cumulative and supersede the preliminary results of 2013 surveys presented in the ISR Part A Section 5.

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 as well as the presentation of mean values for habitat metrics within each mesohabitat unit type and are grouped by both macrohabitat designation and geomorphic reach.

5.1.1. Tributaries in the Upper River

The results presented for tributaries in the Upper River include information previously summarized in technical memoranda for remote line mapping (HDR 2013a, R2 Resource Consultants, Inc. 2013b, ISR 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 and 2014.

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

Tributary geomorphic reach classes were established using aerial video and contour maps. The primary product of video mapping was a mesohabitat frequency estimate for the selected tributaries. Preliminary results of the habitat frequency analysis from videography for selected Upper River tributaries were presented in Appendix 2 of the *Fish Distribution and Abundance Implementation Plan* (R2 Resource Consultants, Inc. 2013b). Those results were presented by study area tributary and included mesohabitat frequency analysis, distribution of mesohabitat types by river mile and tributary geomorphic reach; and photographs that provide a visual reference for some of the more prominent habitat types and the general character of each tributary (R2 Resource Consultants, Inc. 2013b). An updated frequency analysis of mesohabitats by tributary geomorphic reach is presented in Figure 5.1-1.

5.1.1.2. *Tributary 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).

During the 2013 and 2014 ground survey efforts, a total of 28 tributaries in the Upper River were ground mapped including 11 that had been mesohabitat mapped using videography (Section 4.1.1.2, Table 4.1-1). One small tributary in the UR that had been identified for ground mapping – Unnamed 230.8 – was not surveyed because safe access via either helicopter or jetboat could not be located. The total length surveyed within these Upper River tributaries was 50, 189 m (31.2 mi) with an average survey length of 965 m (0.60 mi) within each tributary geomorphic reach (Table 5.1-1).

Mesohabitats in these tributaries were largely composed of run/glide, riffle, and, boulder riffle mesohabitats representing 31 percent, 27 percent, and 19 percent of the total length of tributary habitat surveyed respectively (Table 5.1-1). The mesohabitat composition estimated using the ground survey protocol was similar to the estimates made from the videographic analysis (Figures 5.1-1 and 5.1-2). In general, the ground surveys estimated a higher proportion of "fast-water" habitat types than the video analysis, although the videography documented rare off-channel habitats that were not captured by the ground survey subsampling (e.g. the beaver pond in Geomorphic Reach 2 of the Oshetna). This apparent discrepancy is likely related to the size of the Oshetna River prohibiting full access by wading crews while the wide channel and open canopy provides excellent coverage of the full channel in the remotes imagery.

Descriptive summary statistics for all habitat metrics by mesohabitat within Upper River tributaries surveyed during the 2012, 2013, and 2014 field efforts are presented in Tables 5.1-2 through 5.1-18. Average habitat characteristics included mean gradients (outside of alcoves, which had a mean gradient of 0 percent) ranging from 0.3 percent in pools to 10.4 percent in cascades. Overall mean bankfull width in all mesohabitats surveyed was 19 m (21 yd) with a range from 1.4 m (1.5 yd) in alcoves to 22.7 m (24.8 yd) in riffles; overall mean wetted width was 16.1 m (17.6 yd) and ranged from 1.1 m (1 yd) in alcoves and percolation channels to 19.6 m (21.4 yd) in riffle mesohabitats. Overall mean bankfull depth was 0.8 m (0.9 yd) and ranged from 0.4 m (1.3 ft) in alcoves to 1.2 m (1.3 yd) in pool and beaver dam mesohabitats; overall mean thalweg depth was 0.5 m (0.5 ft) and ranged from 0.2 m (0.7 ft) in chute mesohabitats to 0.6 m in run/glides, boulder riffles, beaver ponds and rapids .

Additional habitat characteristics not reported in the ISR include average maximum pool depth which ranged from 1.3 m (4.3 ft) in beaver ponds to 1.1 m (1.2 yd) in pool mesohabitats; average pool crest depth of all pool mesohabitats surveyed was 0.4 m (1.3 ft). The overall mean percent bank erosion was 7.1 percent and ranged from 0 percent in alcoves and falls to 56.3 percent in chute mesohabitats; overall mean percent undercut bank was 4.7 percent and ranged from 0 percent in alcoves and chutes to 17.1 percent in pool mesohabitats. The total count of large woody debris (LWD) observed was 1,229 pieces, with 0 pieces observed in chutes and percolation channels and 359 pieces observed in run/glide mesohabitats. The most common riparian vegetation surveyed was nonforested shrub willow, observed along 49 percent (24,262 m (15.1 mi)) of the surveyed stream length, while the least common riparian vegetation was broadleaf forest closed, observed along only 0.66 percent (332 m (0.2 mi)) of stream margins. Only 1.3 percent (646 m (706 yd) of the habitats surveyed were nonvegetated.

Substrate types were classified into six categories: bedrock, boulders, cobble, gravel, sand/silt, and organic material. Boulder was the dominant substrate type observed followed by cobble. The overall mean bedrock percentage was 0.5 percent and ranged from 0 percent in alcoves, beaver ponds, and percolation channels to 10 percent in chute mesohabitats; overall mean boulder cover was 32.9 percent and ranged from 0 percent in beaver ponds to 100 percent in falls; overall mean cobble cover was 32.2 percent and ranged from 0 percent in beaver ponds to 39.7 percent in riffle mesohabitats; overall mean gravel cover was 22.2 percent and ranged from 3.3 percent in alcoves to 30.1 percent in pool mesohabitats; overall mean sand/silt cover was 9.9 percent and ranged from 2.5 percent in rapids to 76.7 percent in alcove mesohabitats; and overall mean organics cover was 2.2 percent and ranged from 0 percent in alcoves to 33.3 percent in beaver pond 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, ISR 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 and 2014.

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 (ISR 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* (ISR Appendix B).

5.1.2.2. *Habitat Distribution from Ground Surveys*

The total length of habitat ground surveyed within the Upper River mainstem was 34,429 m (21.2 mi) composed of 17,168 m of main channel, 5,793 m of (3.6 mi) of split main channel, 2,7739 m (1.7 mi) of multi-split main channel, 1842 m (1.1 mi) of side channel, 3,344 m (2.1 mi) of side slough, 2,878 m (1.8 mi) of upland slough and 320 m (0.2 mi) of tributary mouth habitat (Table 4.2-1). The most common Upper River mainstem habitat was single main channel which represented 50 percent of the total measured habitat by length (Table 5.1-19).

Descriptive statistics for select mesohabitat metrics summarized by macrohabitat within Upper River mainstem habitat units surveyed are presented in Tables 5.1-19 through 5.1-29. Gradient was lowest in main channel macrohabitats with a mean gradient of 0.4 percent and was highest in tributary mouths where the mean gradient was 3 percent. Bankfull width ranged from 10.7 m (11.7 yd) in upland sloughs to 198.1 m (216.6 yd) in single main channels; wetted widths ranged from 6.4 m (7.0 yd) in upland sloughs to 169.2 m (185 yd) in single main channel. Average thalweg depth ranged from 0.3 m (1 ft) in tributary mouths to 2.9 m (9.5 ft) in single main

channel; bankfull depth averaged 0.9 m (3 ft) in upland and side sloughs to 2.7 m (8.9 ft) in single main channel macrohabitats.

Mesohabitats in the Upper River mainstem were dominated by run/glide and riffle habitats which formed 0 percent of the total length of habitat surveyed (Table 5.1-19). Beaver complexes were not encountered during mainstem surveys in the Upper River. A total of 5 backwaters – 428.9 m (0.27 mi) of habitat – were surveyed in the Upper River, all were located at the downstream confluence of side sloughs with mainstem habitats.

5.1.3. Comparisons between remote and field habitat characterizations in the Upper River

Discrepancies between remote-line mapping and ground-survey habitat calls were infrequent. Of 52 macrohabitat comparisons (including 17 mesohabitat segments within single main channel habitat) there were two instances where the field-based habitat classifications were judged more valid than the original line mapping classification. In both cases, the segments were identified as a side channel during remote line mapping while survey data classified one as a split main channel and one as a multi-split main channel. A desktop review of this variation concluded that the field survey assessment was made closer to target flows than occurred with the imagery underlying the original line mapping macrohabitat classification. Additional variations occurred either because of changes to the classification system (backwaters, beaver complexes and clearwater plumes categorized as Level 3 macrohabitats at the time of 2012 remote line mapping prior to FERC's SPD change in the hierarchy) or because new segments or features were identified and mapped during field surveys.

Single main channel habitats were selected separately from other mainstem macrohabitat types to adjust for indeterminacy of practical survey start and end points in these habitats. Discrepancies between 2012 remote line mapping mesohabitat classifications and those made by field crews were almost exclusively an artifact of field crews using finer scale habitat divisions resulting in the identification of sequences of riffles and runs within segments where remote line mapping had identified a single mesohabitat or where a glide and a riffle were determined by field crews to be a riffle and a glide, respectively. AEA judged this kind of habitat difference between remote line mapping and field calls to be due to the inherent subjectivity of distinctions between these mesohabitat types in combination with flow variation. Thus, no revisions to line mapping were needed.

Ground truthing surveys, even at slightly higher flows, resulted in very few habitat classification changes. Upper River macrohabitat classifications were not sensitive to the range of flows during survey conditions. The infrequency of classification differences despite greater than planned for disparities between mapping flows allowed AEA to successfully complete the ground-truthing of remote-line mapping habitat and fully meet Objectives 1 -3 in the Upper River.

5.1.4. 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). The maximum depth of lakes ranged from 1.1 to 10.1 m while average depths ranged between 0.6 m and 4.6 m. Average transparency in these lakes was determined by the mean secchi depth and ranged between 0.7 and 3.5 m. Surface and bottom pH was 5.8-7.8 while conductivity varied between surface and bottom on the order of 8.6 μs/cm^2 to 247 μs/cm^2 – details of these characteristics for each surveyed lake are summarized in Table 4.2-2. Temperature and dissolved oxygen depth profiles for each lake surveyed are presented in Figures 5.1-3 and 5.1-4.

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 as well as the presentation of mean values for habitat metrics within each mesohabitat unit type and are grouped by both macrohabitat type and geomorphic reach.

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.

5.2.1.1. *Tributary 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. *Tributary Habitat Distribution from Ground Surveys*

During the 2012, 2013, and 2014 field efforts, habitat surveys were conducted in twenty-five Middle River tributaries as described in Section 4.3.1. A total of 13,772m (8.6 mi) were surveyed (Table 5.1-1). Overall mesohabitats in these 25 Middle River tributaries were largely composed of fast water habitats. The total length of all tributaries combined, by type was 24 percent riffle, 21 percent boulder riffle, and 18 percent run/glide (Table 5.2-1). Descriptive summary statistics for all habitat metrics by mesohabitat within Middle River tributaries surveyed during the 2012, 2013, and 2014 field efforts are presented in Tables 5.2-2 through 5.2-18.

Average habitat characteristics included mean gradients ranging from 0 percent in beaver ponds to 10 percent in chute mesohabitats; the overall mean gradient in these tributaries was 1.9

percent. Overall mean bankfull width in all mesohabitats surveyed was 10.8 m (11.8 yd) with a range from 2.7 m (3 yd) in alcove mesohabitats to 18.5 m (20.3 yd) in beaver pond mesohabitats. Overall mean wetted width was 8.1 m (8.9 yd) and ranged from 1.6 m (1.7 yd) in a percolation channel mesohabitat to 13.5 m (14.8 yd) in boulder riffle mesohabitats. The overall mean bankfull depth was 0.8 m (2.6 ft) and ranged from 0.3 m (1 ft) in run/glides to 1.3 m (1.4 yd) in chute mesohabitats; overall mean thalweg depth was 0.6 m (2 ft) and ranged from 0.2 m (0.7 ft) in alcoves to 1.1 m (1.1 yd) in a chute mesohabitat.

Additional summary of habitat characteristics not found in the ISR includes average maximum pool depth which ranged from 1.2 m (1.3 yd) in pools to 1.0 m (1.1 yd) in beaver pond mesohabitats; average pool crest depth of all pool mesohabitats surveyed was 0.3 m (1 ft). The overall mean percent erosion was 7 percent and ranged from 0 percent in alcoves, beaver ponds, chutes, and percolation channels to 12.8 percent in pool mesohabitats; overall mean percent undercut was 5.7 percent and ranged from 0 percent in chutes, and percolation channels to 14.2 percent in pool mesohabitats. The total amount of large woody debris (LWD) observed was 1,229 pieces, with 0 pieces observed in percolation channels and chutes and 359 pieces observed in run/glide mesohabitats. The most common riparian vegetation surveyed was nonforested shrub Alder, covering 22 percent (2,985 m [1.9 mi]) of stream, while the least common riparian vegetation was closed canopy broadleaf forest, covering 3 percent (386 m [0.2 mi]) of the total stream length surveyed. Only 0.7 percent (99 m [108 yd]) of the total survey length was nonvegetated.

Substrate types were classified into six types including bed rock, boulders, cobble, gravel, sand/silt, or organic material. The overall mean bed rock cover was 1 percent and ranged from 0 percent in alcoves, beaver ponds, dry habitats, percolation channels, and riffles to 40 percent in chute mesohabitats; overall mean boulder cover was 25.4 percent and ranged from 0 percent in beaver ponds to 57.3 percent in the cascade mesohabitats. Overall mean cobble cover was 24.5 percent and ranged from 0 percent in alcoves and beaver ponds to 38.1 percent in run/glide mesohabitats; overall mean gravel cover was 28 percent and ranged from 0 percent in alcoves and beaver pounds to 37.2 percent in riffle mesohabitats. Overall mean sand/silt cover was 12.9 percent and ranged from 0 percent in cascades, chutes, and dry habitats to 100 percent in beaver pond mesohabitats. Overall mean organics cover was 2.2 percent and ranged from 0 percent in alcoves to 33 percent in beaver pond 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 2013and 2014.

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 run/glide habitat. 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 both inside and outside Focus Areas (FAs) was 141,474 m (87.9 mi). This was composed of 51,682 m (32.1 mi) of single main channels, 17,693 m (11 mi) of split main channel, 13,180 m (8.2 mi) of multiple split main channels, 20,258 m (12.6 mi) of side channels, 18,842 m (11.7 mi) of upland sloughs, and 1,261 m (0.8 mi) of tributary mouth habitat.

Descriptive statistics for mesohabitat metrics summarized by macrohabitat within all Middle River mainstem habitat units surveyed are presented in Tables 5.1-19 through 5.1-29. Gradient was lowest in main channels where the mean gradient was 0.4 percent whereas gradient was highest in tributary mouth macrohabitats where the mean gradient was 3.0 percent. Bankfull widths ranged from 10.7 m (11.7 yd) in upland sloughs to 198.1 m (216.6 yd) in single main channels. Wetted widths ranged from 6.4 m (7 yd) in upland slough macrohabitats to 169.2 m (184.8 yd) in single main channels. The average thalweg depth ranged from 0.3 m (1 ft) in side sloughs to 2.9 m (3.2 yd) in single main channels; average bankfull depths ranged from 0.4 m (1.3 ft) in upland slough macrohabitats to 2.7 m (3 ft) in single main channel macrohabitats.

Habitat metrics collected in Focus Areas were generally similar to those in the Middle River outside of Focus Areas. Ground-surveyed macrohabitats consisted primarily of main channel habitats which formed 28 percent and 41 percent by length respectively of the total length of habitat surveyed within and outside of Focus Areas. Upland sloughs, tributary mouths, and split main channel macrohabitats were also surveyed in similar proportions. Multi-split main channel habitats were a higher proportion of surveyed area outside Focus Areas (17 percent versus 9 percent) whereas longer surveys of side channels and side sloughs were completed within Focus Areas.

5.2.3. Comparisons between remote and field habitat characterizations in the Middle River

Discrepancies between remote-line mapping or videoed habitat classifications and ground-survey habitat classifications were infrequent. Of 192 macrohabitat comparisons in the Middle River

(including 41 mesohabitats within single main channel segments), there were 6 survey lines where field crew habitat classifications were judged more valid than the original line mapping. All of these differences were side channels that field crews assessed as side sloughs. A desktop review of these variations concluded that these represented instances where the field survey assessment was made closer to target flows than occurred with the imagery underlying the original line mapping macrohabitat classifications. Thus, 6 variations out of 192 macrohabitat classifications represent the current misclassification rate associated with the comprehensive remote line mapping in the Middle River. Additional variations occurred either because of changes to the classification system (backwaters, beaver complexes and clearwater plumes categorized as Level 3 macrohabitats at the time of 2012 remote line mapping) or because new segments or features were identified and mapped during field surveys.

Single main channel habitats were selected separately from other mainstem macrohabitat types to adjust for indeterminacy of practical survey start and end points in these habitats. Discrepancies between 2012 remote line mapping mesohabitat classifications and those made by field crews were almost exclusively an artifact of field crews using finer scale habitat divisions resulting in the identification of sequences of riffles and runs within segments where remote line mapping had identified a single mesohabitat. In some instances, a glide and a riffle were determined by field crews to be a riffle and a glide, respectively. AEA judged this kind of habitat difference between remote line mapping and field classifications to be due to the inherent subjectivity of distinctions between these mesohabitat types in combination with flow variation. Thus, no revisions to line mapping were needed.

Ground truthing surveys, even at slightly higher flows, resulted in very few habitat classification changes. Middle River macrohabitat classifications were not sensitive to the range of flows during survey conditions. The infrequency of these differences despite greater than planned for disparity in mapping flows supports AEA's contention that the objective of ground-truthing remote-line mapping habitat classifications has been met.

5.3. Lower River

The September 2014 technical memorandum *Mapping of Geomorphic Features and Turnover within the Middle and Lower Susitna River Segments from 1950s, 1980s, and Current Aerials* (Tetra Tech, Inc. 2014) summarizes geomorphic features in the mainstem Lower Susitna River in Section 5.1.1 with corresponding maps in Appendix H.

6. DISCUSSION

The objectives of this study were twofold: to establish a baseline against which to evaluate potential habitat loss or gain caused by Project operations and to provide a habitat template for the design of coordinated aquatic studies. The specifics of baseline data objectives varied by river segment to reflect the nature of potential Project effects on aquatic habitats and included mainstem, tributary and lake habitat data. Remote line mapping results were combined with 2013- 2014 ground-truthing to developed accurate and detailed maps of the baseline habitat condition with the Upper and Middle River segments. Geomorphic assessments in the Lower

River (Study 6.5) provided a baseline of macrohabitat mapping that has also supported coordinated study efforts and will be adequate for any future impact analysis.

The 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. In tributaries, the comparison of habitat frequencies estimated by 2012 videography and 2013-2014 ground surveys revealed that the analysis of still images from the videography tended to underestimate water velocities and thus pool habitats were estimated to be more frequent whereas ground surveys characterized the same habitats as run/glides. Nonetheless, videography provided a tool that allowed informed decisions and planning for representing the Susitna basin for instream flow (Study 8.5) and fish distribution studies (Studies 9.5 and 9.6) during 2013 and a basis for developing a survey protocol for field confirmation of habitat calls. The interpretation of videography represented only a small portion of habitat mapping study activity. Significant on-the-ground activity was conducted in 2013 and 2014 that expanded the resolution and working knowledge of available habitat in the Susitna River and surrounding tributaries. Future analysis of habitats in tributaries should use the more comprehensive and accurate ground survey data.

Ground truthing of the remote line mapping effort revealed relatively few inconsistencies between ground surveys and the remote line mapping. The robust nature of the comprehensive line mapping product supports its use as a baseline for future analyses. Ground surveys provided more detailed attributes of macrohabitat types, particularly in off-channel and tributary habitats where visibility from the air was limited.

6.1. Study Coordination and Updates

Multiple studies used the Aquatic Habitat Study data to inform their efforts including: Instream Flow (Study 8.5), Fish Distribution and Abundance in the Upper Susitna River (Study 9.5), Fish Distribution and Abundance in the Middle and Lower Susitna River (Study 9.6), River Productivity (Study 9.8). This data will also be considered within the Future Watana Reservoir Fish Community and Risk of Entrainment (Study 9.10).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. CONCLUSION

From 2012 to 2014, AEA completed remote line mapping, videography and ground surveys to map and characterize aquatic habitats in the Upper and Middle Susitna River. Geomorphological mapping provides baseline data for the Lower River (Study 6.5). The field work, data collection, data analysis, and reporting for this Characterization and Mapping of Aquatic Habitats Study successfully met all study objectives in the FERC-approved Study Plan. The results of this

Characterization and Mapping of Aquatic Habitats Study are reported herein and earlier by AEA (2014). With this report, AEA has now completed the Characterization and Mapping of Aquatic Habitats Study.

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

AEA. 2014. Initial Study Report: Susitna-Watana Hydroelectric Project FERC Project No. 14241. June 2014.

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 Alaska, Inc. 2013a. Middle Susitna River Segment Remote Line Habitat Mapping Memorandum: Susitna-Watana Hydroelectric Project FERC Project No. 14241. January 2013. http://www.susitna-watanahydro.org/wp-content/uploads/2013/02/Att-B-Habitat-Mapping-Report.pdf

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

HDR Alaska, Inc. 2013c. 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

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

Tetra Tech. 2014. Mapping of Geomorphic Features and Turnover within the Middle and Lower Susitna River Segments from 1950s, 1980s, and Current Aerials. Technical Memorandum. September 26, 2014. Susitna-Watana Hydroelectric Project. Prepared for the Alaska Energy Authority. Anchorage, Alaska.

Tetra Tech. 2015. Study Implementation Report Attachment 1. Geomorphic Reach Delineation and Characterization, Upper, Middle, and Lower Susitna River Segments Updated Technical Memorandum: Susitna-Watana Hydroelectric Project FERC Project No. 14241. October 2015.

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).

Wetzel, R.G. 1983. Limnology. 2nd Edition. Published by Harcourt Brace College Publishers. ISBN 10: 0030579139; ISBN 13: 978003057134,

9. TABLES

Table 4.1.1. 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

Level	Unit	Grouping	Mesohabitat	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.
			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.
			Run/Glide	A habitat area with minimal surface turbulence with generally uniform depth that is greater than the maximum substrate size. 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.
		Slow Water	Pool	Slow water habitat with minimal turbulence and deeper due to a strong hydraulic control.
			Pool subtypes	Straight Scour Pool: Formed by mid-channel scour. Generally with a broad scour hole and symmetrical cross-section.
				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.
				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.
				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.
				Isolated Pool: Areas of puddled or stranded water
		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 4.1.2

Table 4.1.2. Nested and tiered habitat mapping units and hydraulic categories used for tributary mesohabitats.

Macrohabitat (# of channels)	Grouping	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.
		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.
		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. 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. 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.
	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. For pool subtypes, refer to Table 4.1-1.
		Beaver Pond	Water impounded by the creation of a beaver dam. Equivalent to a Beaver Complex.
		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.
	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, and survey status.

Mainstem Geomorphic Reach	Tributary Name	Selection Category	Tributary Category [2]	Tributary Geomorphic Reach / Site ID	Project River Mile	End of Survey Elev. (ft)	Approx. Drainage Area (km^2)	Approx. Length (km)	Total Grad. (%)	Ground survey
UR-2	Oshetna River[1]	Above Inundation Zone	1	Oshetna-1	235.1	3000	885.1	89.48		2013
				Oshetna-2						2013
				Oshetna-3[3]						2013
UR-2	Black River[1]	Above Inundation Zone	2	Black-1	12.6 (LB)	3000	NI	NI		2013
				Black-2						2013
				Black-3[3]						2013
UR-3	Goose Creek[1]	Above Inundation Zone	1	Goose-1	232.8	3000	167.2	40.56		2013
				Goose-2						2013
				Goose-3[3]						2013
Proposed reservoir full pool (2050' NAVD88)										
UR-3	Unnamed 230.8	small primary*	1	H230.8-22H	230.8	2200	1	2.19	11	2014
UR-3	Unnamed 230.2	small primary	1	H230.2-22H	230.2	2200	0.4	0.72	19	2014
UR-3	Unnamed 230.1	small primary	1	H230.1-22H	230.1	2200	4.3	5.39	7	2014
UR-3	Unnamed 228.5	small primary	1	H228.5-22H	228.5	2200	75.1	25.39	5	2014
UR-3	Unnamed 226.2	small primary	1	H226.2-22H	226.2	2200	5.9	4.50	10	2014
UR-4	Unnamed 219.6	small primary	1	H219.6-22H	219.6	2200	8.4	7.28	8	2014
UR-4	Unnamed 214.4	small primary	1	H214.4-22H	214.4	2200	1.7	2.44	23	2014
UR-4	Jay Creek[1]	Inundation Zone	1	Jay-1	211.0	3000	99.5	31.54		2012, 2013
				Jay-2						2012, 2013
				Jay-3						2012, 2013
				Jay-4[3]						2013
UR-4	Kosina Creek[1]	Inundation Zone	1	Kosina-1	209.1	3000	644.1	63.57		2012
				Kosina-2						2012, 2013
				Kosina-3						2012
UR-4	Tsisi Creek[1]	Inundation Zone	2	Tsisi-1[3]	7.2 (LB)	3000	NI	NI		2013
				Tsisi-2[3]						2013
UR-4	Unnamed 208.6	small primary	1	H208.6-22H	208.6	2200	5.0	7.52	8	2014
UR-5	Unnamed 207.4	small primary	1	H207.4-HW1	207.4	HW	1.1	2.50	14	2014
UR-5	Unnamed 207.4 RB-1	small primary	2	H207.4-HW2	207.4	HW		NI		2014
UR-5	Unnamed 206.3	Inundation Zone	1	206.3-1	206.3	3000	49.9	11.96		2013
				206.3-3						2013
UR-5	Unnamed 204.5	Inundation Zone	1	204.5-1	204.5	3000	49.9	9.98		2014
				204.5-2						2014
UR-6	Unnamed 198.9	small primary	1	H198.9-22H	198.9	2200	1.2	3.36	13	2014
UR-6	Unnamed 198.4 LB -1	small primary*	2	H198.4-HW	198.4	HW		NI		2014
UR-6	Unnamed 197.7	Inundation Zone	1	197.7-1	197.7	3000	49.9	8.69		2014
				197.7-2						2014
				197.7-3						2014
UR-6	Unnamed 197.7 RB-1	small primary*	2	H197.7-22T	197.7	2200		NI		2014
UR-6	Watana Creek[1]	Inundation Zone	1	Watana-1	196.9	3000	281.3	43.29		2012, 2013
				Watana-2						2012, 2013
				Watana-3[3]						2013
UR-6	Watana RB-1	small primary*	2	H196.9-HW1	196.9	HW		NI		2014
UR-6	Watana LB-1.1.1	small primary*	4	H196.9-HW2	196.9	HW		NI		2014
UR-6	Watana Tributary[1]	Inundation Zone	2	Watana Trib-1[3]	8.7 (RB)	3000	NI	NI		2013
				Watana Trib-2[3]						2013
UR-6	Unnamed 194.8	Inundation Zone	1	194.8-1	194.8	HW	199.6	11.43		2014
				194.8-3						2013
				194.8-4						2013
UR-6	Deadman Creek[1]	Inundation Zone	1	Deadman-1	189.4	3000	281.8	67.43		2014
				Deadman-3						2013, 2014
				Deadman-4						2013
				Deadman-5						2013
				Deadman-6						2013

[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

Table 4.1-2. Middle River tributary geomorphic reaches selected for ground survey, gradient, basin area, and survey year(s).

Mainstem Geomorphic Reach	Tributary Name (ID)	Tributary Category[2]	Tributary Geomorphic Reach or SiteID	Project River Mile	End of Survey Elev. (ft)	Approx. Drainage Area (km²)	Approx. Length (km)	Focus Area	Ground survey
MR-2	Tsusena Creek[1]	1	Tsusena-1	184.6	upper extent of ZHI	145.3	49.41	NA	2014
			Tsusena-2					NA	Outside of study bounds (ZHI)
MR-2	Unnamed 184.0[1]	1	184.0-1	184.0	upper extent of ZHI	<31	16.74	NA	2014
			184.0-2					NA	Outside of study bounds (ZHI)
MR-2	Fog Creek[1]	1	Fog-1	179.3	3000	147.2	44.74	NA	2014
			Fog-2					NA	2014
			Fog-3					NA	2014
			Fog-4[3]					NA	2013, 2014
MR-2	Unnamed 174.3	1	H174.3-ZHI	174.3	upper extent of ZHI	NI	NI	FA-173 (Stephan Lake Complex)	ns
MR-2	Unnamed 173.8	1	H173.8-ZHI	173.8	upper extent of ZHI	NI	NI	FA-173 (Stephan Lake Complex)	2013
Devils Canyon upper extent									
MR-4	Devil Creek[1]	1	Devil-1	164.8	upper extent of ZHI	74.8	25.43	NA	2014
MR-4	Chinook Creek[1]	1	Chinook-1	160.5	3000	24.7	17.06	NA	2013
			Chinook-2[3]					NA	2013
MR-4	Cheechako Creek[1]	1	Cheechako-1	155.9	barrier	36.4	17.22	NA	2014
Devils Canyon lower extent									
MR-5	Portage Creek	1	H152.3-ZHI	152.3	upper extent of ZHI	178.6	0.31	FA-151 (Portage Cr)	2014
MR-6	Jack Long Creek	1	H148.3-ZHI	148.3	upper extent of ZHI	NI	0.05	NA	2014
MR-6	Unnamed 144.6	1	H144.6-ZHI	144.6	upper extent of ZHI	NI	0.02	FA-144 (Slough 21)	2014
MR-6	Indian River	1	H142.1-ZHI	142.1	upper extent of ZHI	86.2	0.23	FA-141 (Indian River)	2013
MR-6	Gold Creek	**1**	H140.1-ZHI	140.1	upper extent of ZHI	23.7	0.24	NA	2013
MR-6	Fourth of July Creek	1	H134.3-ZHI	134.3	upper extent of ZHI	NI	0.19	NA	2014
MR-6	Sherman Creek	1	H134.1-ZHI	134.1	upper extent of ZHI	NI	0.03	NA	2014
MR-6	Skull Creek	1	H128.1-ZHI	128.1	upper extent of ZHI	NI	0.06	FA-128 (Slough 8A)	2014
MR-6	Fifth of July Creek	1	H127.3-ZHI	127.3	upper extent of ZHI	NI	0.02	NA	2014
MR-6	Deadhorse Creek	1	H124.4-ZHI	124.4	upper extent of ZHI	6.5	0.29	NA	2014
MR-7	Little Portage Creek	1	H121.4-ZHI	121.4	upper extent of ZHI	2.4	0.19	NA	2012, 2014
MR-7	McKenzie Creek	1	H120.2-ZHI	120.2	upper extent of ZHI	2.3	0.03	NA	2014
MR-7	Lower McKenzie Creek	1	H119.7-ZHI	119.7	upper extent of ZHI	NI	0.26	NA	2012, 2014
MR-7	Lane Creek	1	H117.2-ZHI	117.2	upper extent of ZHI	10.4	0.18	NA	2014
MR-7	Unnamed 115.4	1	H115.4-ZHI	115.4	upper extent of ZHI	NI	0.19	FA-115 (Slough 6A)	2013
MR-7	Gash Creek	1	H115.0-ZHI	115.0	upper extent of ZHI	NI	0.02	FA-113 (Oxbow 1)	2012, 2014
MR-7	Slash Creek	1	H114.9-ZHI	114.9	upper extent of ZHI	NI	0.03	FA-113 (Oxbow 1)	2012, 2014
MR-7	Unnamed 113.7	1	H113.7-ZHI	113.7	upper extent of ZHI	NI	NI	FA-113 (Oxbow 1)	2014
MR-7	Chase Creek	1	H110.5-ZHI	110.5	upper extent of ZHI	NI	0.27	NA	2013
MR-8	Whiskers Creek	1	H105.1-ZHI	105.1	upper extent of ZHI	17.2	0.53	FA-104 (Whiskers Slough)	2013

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	Not Surveyed																										
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	Not Surveyed																										
	206.3-2	Not Surveyed																										
	206.3-3	Not Surveyed																										
Unnamed 204.3	204.3-1	Not Surveyed																										
	204.3-2	Not Surveyed																										
Unnamed 197.7	197.7-1	Not Surveyed																										
	197.7-2	Not Surveyed																										
	197.7-3	Not Surveyed																										
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	Not Surveyed																										
	194.8-2	Not Surveyed																										
	194.8-3	Not Surveyed																										
	194.8-4	Not Surveyed																										
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. Number of randomly selected Upper and Middle River mainstem macrohabitats survyed and total number of Focus Area mainstem macrohabtiats surveyed during 100 percent ground survey coverage.

		Main Channel[1]								Special Habitat Features		
	Geomorphic Reach	Run/ Glide	Riffle	Pool	Multi-Split Main Channel	Split Main Channel	Side Channel	Side Slough	Upland Slough	Tributary Mouth	Backwater	Beaver Complex[2]	Clearwater Plume
Upper River	UR-3	4	5					1		3			
	UR-4	2	3			5	2	5	5	1	4		
	UR-5					1	1			2			
	UR-6	2			1	2	2	2	1	1	1		
	Upper River Total	8	8		1	8	5	8	6	7	5		
Middle River	MR-2	1	1					1	1	2	1		2
	MR-3	1	1			1	2			2			1
	MR-4*												
	MR-5					1							
	MR-6	3	1		4	4	3	7	7	2	6	6	4
	MR-7	5	1			2	1	3	3	1	2	4	2
	MR-8	2			6	1	1		1		4		
	Middle River Total	12	4		10	9	7	11	12	7	13	10	9
Focus Area Surveys	MR-1	1					2						
	MR-2	1					3	6	3	1	1	4	
	MR-5	1								1	1		1
	MR-6	6	3	1	12		21	6	16	2	16	16	
	MR-7	1				16	1	4	8	2	4	7	
	MR-8	1					12	7	3		4	2	2
	Focus Area Total	11	3	1	12	16	39	23	30	6	26	28	3

Notes:

1 Main Channel macrohabitats were selected and surveyed by available mesohabitats, see section 4.2-2 for discussion.

2 As requested by FERC (SPD 2013) Beaver Complex is a mesohabitat designation that represents a single pool or pond formed by beaver activity – thus this count may represent multiple ponds within a single Macrohabitat feature

* All habitat units in Middle River geomorphic reach 4 are within or near Devils Canyon, were deemed unsafe and were not 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 or measured in the field.

Lake ID	Perimeter (m)	Elevation (ft)	Area (ha)	Surface water connection	Littoral area %	Avg. depth (m)	Max depth (m)	Secchi depth (m)	% of max depth	pH		Conductivity (µs/cm2)	
										Surface	Bottom	Surface	Bottom
Lake 1	260	1752	0.23	Yes	55.6	0.9	1.8	1.0	54.2	7.0	na	247.0	na
Lake 2	543	1750	0.68	Yes	55.9	1.0	2.0	1.0	50.0	7.0	na	116.0	na
Lake 3	1001	1796	3.37	Yes	53.1	4.1	8.3	3.4	41.1	7.6	na	311.0	na
Lake 4	441	2042	1.15	No	62.5	2.6	4.2	2.0	47.1	6.0	5.8	8.6	9.3
Lake 5	3009	2034	22.99	Yes	46.4	3.0	8.0	2.7	34.3	7.8	7.5	110.4	108.8
Lake 6	399	2008	0.89	No	53.6	4.6	10.1	3.5	34.9	7.6	7.5	98.9	110.4
Lake 7	467	1598	1.48	Indeterminate	57.7	3.1	6.4	1.5	22.7	7.0	6.6	51.9	68.4
Lake 8	211	2030	0.3	No	43.8	2.0	3.1	1.6	52.8	6.8	6.3	49.8	55.7
Lake 9	419	1782	1.15	Yes	59.1	0.6	1.4	0.7	49.2	6.9	6.8	93.1	106.4
Lake 10	144	1958	0.16	No	57.1	0.8	1.4	1.1	79.6	6.7	6.7	53.2	52.8
Lake 11	198	2038	0.2	No	62.5	0.6	1.1	0.9	78.8	6.2	6.2	29.8	29.7
Lake 12	391	2008	0.72	No	62.5	1.0	2.5	1.5	60.8	6.6	6.7	43.9	42.1

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

Table 4.2-3. Range of mean daily flows at the USGS 15292000 Susitna River at Gold Creek real time streamflow gage during ground surveys.

River Segment	Macrohabitat Type	Susitna River at Gold Creek Discharge				Grand Total
		< 18,000 cfs	18,000 to 25,000 cfs	25,000 to 30,000 cfs	> 30,000 cfs	
Upper River	Single Main Channel		1	2	11	14
	Multi-Split Main Channel			2		2
	Side Channel		3	1	2	6
	Split Main Channel		1	3	4	8
	Tributary Mouth		5	2		7
	Side Slough		4	2	2	8
	Upland Slough		2	3	1	6
	Upper River Subtotal		*16*	*16*	*20*	*51*
Middle River	Single Main Channel	10	20	7	2	39
	Multi-Split Main Channel	1	21			22
	Side Channel	19	24	1	2	46
	Split Main Channel	20	3	2		25
	Tributary Mouth	2	7	4		13
	Side Slough	16	14	2	2	34
	Upland Slough	11	24	8		43
	Middle River Subtotal	*79*	*6*	*113*	*24*	*222*
	Grand Total	*79*	*26*	*129*	*39*	*273*

Notes:

[1]No date or flow information available from field data.

[*]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 as measured at the Susitna River at Gold Creek gage.

Table 5.1-1. Sum of length (m) surveyed, and composition by length of mesohabitats in Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	Length (m) & Percent		n	Length
Oshetna River	Oshetna-3							5	616	16%																2	590	15%	8	921	23%	15	1,809	46%	30	3,936
	Oshetna-2																									3	792	73%	2	171	16%	1	115	11%	6	1,078
	Oshetna-1							5	483	12%																2	228	6%	5	1,744	45%	5	1,413	37%	17	3,868
Black River	Black-3							5	207	15%																2	69	5%	5	586	43%	5	506	37%	17	1,368
	Black-2							7	593	54%																1	60	5%	3	187	17%	6	263	24%	17	1,103
	Black-1							4	494	24%													1	34	2%				5	1,105	53%	5	456	22%	15	2,089
Goose Creek	Goose-3							5	247	41%																			1	118	19%	6	243	40%	12	609
	Goose-2							5	675	58%	3	317	27%																			5	167	14%	13	1,158
	Goose-1							7	1,056	75%	1	58	4%													5	164	12%				5	129	9%	18	1,407
Proposed reservoir full pool																																				
Unnamed 230.2	NA										1	54	100%																					1	54
Unnamed 230.1	NA										3	115	75%										3	17	11%	1	22	14%							7	154
Unnamed 228.5	NA										3	143	30%													5	252	52%	1	27	6%	3	63	13%	12	485
Unnamed 226.2	NA										1	50	100%																					1	50
Unnamed 219.6	NA																												4	193	100%				4	193
Unnamed 214.4	NA										1	224	100%																					1	224
Jay Creek	Jay-4	1	7	1%																			5	102	20%				5	187	37%	6	208	41%	17	503
	Jay-3							5	300	28%													3	39	4%				2	35	3%	7	691	65%	17	1,065
	Jay-2							5	302	17%																6	640	37%	4	183	11%	5	607	35%	20	1,732
	Jay-1							3	325	30%	1	9	1%							1	10	1%	2	22	2%	1	37	3%	11	343	32%	15	331	31%	34	1,077
Tsisi Creek	Tsisi-2																												5	381	62%	5	236	38%	10	617
	Tsisi-1							8	469	46%																6	407	40%				1	140	14%	15	1,016
Kosina Creek	Kosina-3																			2	-	-	2	-	-				4	395	17%	26	1,909	83%	34	2,304
	Kosina-2										1	81	2%							2	134	3%	1	26	1%	5	428	10%	17	2,452	60%	16	970	24%	42	4,091
	Kosina-1																						2	37	3%				14	858	59%	13	566	39%	29	1,461
Unnamed 208.6	NA										1	61	100%																					1	61
Unnamed 207.4 RB-1	207.4 RB-1																1	80	100%															1	80
Unnamed 207.4	NA										6	128	100%																					6	128
Unnamed 206.3	206.3-3										1	3	16%																2	10	50%	1	7	34%	4	20
	206.3-1							4	69	28%	6	119	48%																1	40	16%	1	18	7%	12	246
Unnamed 204.5	204.5-2										1	146	100%																					1	146
	204.5-1							3	93	22%	7	315	74%																1	7	2%	1	9	2%	12	423
Unnamed 198.9	NA										1	63	100%																					1	63
Unnamed 198.4 LB-1	NA													1	46	100%																			1	46
Unnamed 197.7	197.7-3										2	27	35%																			2	49	65%	4	76
	197.7-2										3	120	90%																1	14	10%				4	134
	197.7-1							2	54	12%	3	75	17%										2	19	4%	3	236	53%	1	43	10%	1	17	4%	12	443
Unnamed 197.7 RB-1	NA										3	286	93%													1	21	7%							4	307
Watana Creek Trib	Watana Trib-2							3	26	18%																2	44	31%				5	72	51%	10	142
	Watana Trib-1																			1	18	3%	1	22	4%	2	65	12%	2	151	27%	8	293	53%	14	549
Watana Cr. LB-1.1.1	NA																						1	141	41%				2	96	28%	2	108	31%	5	345
Watana Creek RB-1	NA										3	38	20%				1	31	16%				1	23	12%				4	46	24%	4	50	26%	13	188
Watana Creek	Watana-3	2	29	3%				13	470	48%																3	59	6%	4	143	15%	7	269	28%	29	969
	Watana-2							2	81	7%										2	128	11%	1	22	2%	2	35	3%	6	586	48%	5	368	30%	18	1,219
	Watana-1				1	47	2%	1	98	4%										2	46	2%	6	201	7%				17	1,659	60%	12	731	26%	39	2,782
Unnamed 194.8	194.8-4																						6	71	44%							4	89	56%	10	159
	194.8-3				2	148	22%	2	20	3%	2	22	3%										9	255	38%	3	39	6%	1	5	1%	6	178	27%	25	667
	194.8-1							2	365	96%													1	17	4%										3	382
Deadman Creek	Deadman-6																												6	868	43%	5	1,155	57%	11	2,022
	Deadman-5							5	623	52%																5	567	48%							10	1,190
	Deadman-4							5	1,282	44%																5	469	16%				5	1,139	39%	15	2,890
	Deadman-3							6	428	18%	5	1,090	46%	1	39	2%										6	755	32%				2	58	2%	20	2,368
	Deadman-1										1	124	25%										1	28	6%	1	352	70%							3	504
Total[1]		**3**	**36**	**0.07%**	**3**	**195**	**0.39%**	**112**	**9,375**	**19%**	**60**	**3,667**	**7%**	**2**	**85**	**0.17%**	**2**	**111**	**0.22%**	**10**	**336**	**1%**	**48**	**1,074**	**2%**	**72**	**6,329**	**13%**	**144**	**13,551**	**27%**	**221**	**15,431**	**31%**	**677**	**50,189**

Table 5.1-2. Mean (±SD) percent gradient of mesohabitats in Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Oshetna River	Oshetna-3							5	0.4	0.1																1	2.0	-	8	0.6	0.6	15	0.6	0.5	29	0.6	0.5
	Oshetna-2																									3	1.5	0.5	2	1.5	0.7	1	1.0	-	6	1.4	0.5
	Oshetna-1							5	1.0	0.0																2	2.5	0.7	5	1.0	0.6	5	0.9	0.7	17	1.2	0.7
Black River	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
	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-1							4	2.5	1.2													1	0.0	-				5	0.9	0.4	5	0.7	0.3	15	1.2	1.0
Goose Creek	Goose-3							5	0.9	0.2																			1	1.0	-	6	0.4	0.2	12	0.6	0.3
	Goose-2							5	1.8	0.6	2	17.0	18.4																			5	0.4	0.4	12	3.7	8.4
	Goose-1							7	2.9	1.2	1	4.0	-													5	4.0	1.7				5	1.0	1.1	18	2.7	1.7
Proposed reservoir full pool																																					
Unnamed 230.2	NA										1	27.0	-																					1	27.0	-
Unnamed 230.1	NA										2	24.3	7.4										1	0.0	-	1	6.0	-							4	13.6	13.2
Unnamed 228.5	NA										3	6.2	1.8													5	5.4	0.9	1	4.0	-	3	1.3	0.8	12	4.5	2.2
Unnamed 226.2	NA																																				
Unnamed 219.6	NA																												1	5.5	-				1	5.5	-
Unnamed 214.4	NA										1	15.0	-																					1	15.0	-
Jay Creek	Jay-4																						5	0.5	0.0				5	1.5	0.5	6	0.8	0.3	16	0.9	0.5
	Jay-3							5	2.2	0.6													2	-	-				2	1.5	0.7	7	1.2	0.6	16	1.6	0.7
	Jay-2							5	1.7	0.6																6	3.3	1.4	4	1.4	0.5	5	1.7	0.4	20	2.1	1.2
	Jay-1							3	3.5	0.5										1	-	-	1	-	-	1	5.0	-	9	1.0	0.0	11	1.7	1.2	26	2.5	1.5
Tsisi Creek	Tsisi-2																												5	1.0	0.6	5	0.4	0.2	10	0.7	0.5
	Tsisi-1							8	2.0	0.5																6	2.3	0.9				1	0.5	-	15	2.0	0.8
Kosina Creek	Kosina-3																												3	1.3	0.6	14	1.0	0.0	17	1.1	0.3
	Kosina-2										1	5.0	-							2	1.0	-	1	1.0	-	5	3.3	1.0	15	1.0	0.0	15	1.0	0.0	39	1.4	1.1
	Kosina-1																						2	1.0	0.0				14	1.0	0.0	13	1.0	0.0	29	1.0	0.0
Unnamed 208.6	NA										1	27.5	-																					1	27.5	-
Unnamed 207.4 RB-1	207.4 RB-1																																				
Unnamed 207.4	NA										3	19.6	1.3																					3	19.6	1.3
Unnamed 206.3	206.3-3																																				
	206.3-1							2	6.8	0.4	6	11.2	1.8																1	6.0	-				9	9.6	2.7
Unnamed 204.5	204.5-2										1	10.0	-																					1	10.0	-
	204.5-1										6	8.4	2.2																					6	8.4	2.2
Unnamed 198.9	NA										1	12.0	-																					1	12.0	-
Unnamed 198.4 LB-1	NA													1	12.0	-																			1	12.0	-
Unnamed 197.7	197.7-3										2	3.5	0.7																				2	1.5	0.7	4	2.5	1.3
	197.7-2										3	4.1	0.9																1	4.0	-				4	4.1	0.7
	197.7-1							2	3.5	0.7	3	5.7	0.6										1	0.0	-	3	4.0	0.0	1	3.0	-	1	0.0	-	11	3.5	2.0
Unnamed 197.7 RB-1	NA										3	4.7	2.1													1	3.0	-							4	4.3	1.9
Watana Creek Trib	Watana Trib-2							1	2.5	-																2	3.0	0.0				2	1.3	0.4	5	2.2	0.9
	Watana Trib-1																			1	0.0	-	1	0.0	-	2	2.3	0.4	2	1.8	0.4	8	0.9	0.5	14	1.1	0.8
Watana Cr. LB-1.1.1	NA																						1	0.5	-				2	2.0	0.0	1	2.0	-	4	1.6	0.8
Watana Cr. RB-1	NA										2	19.0	8.5				1	50.0	-				1	1.0	-				1	2.5	-	1	1.0	-	6	15.4	19.4
Watana Creek	Watana-3	1	0	-				12	1.9	0.3																3	2.8	0.3	4	1.5	0.7	6	1.3	0.8	26	1.7	0.8
	Watana-2							2	2.0	0.0										2	1.0	0.0	1	0.0	-	2	3.5	2.1	6	1.1	0.2	5	0.9	0.3	18	1.4	1.1
	Watana-1				1	1	-	1	1.5	-										2	1.0	0.0	5	0.7	0.4				17	1.1	0.3	12	1.0	0.0	38	1.0	0.3
Unnamed 194.8	194.8-4																						4	0.0	0.0							3	1.8	0.8	7	0.8	1.1
	194.8-3				2	0	0	2	5.0	0.0	1	4.0	-										9	0.0	0.0	2	4.0	0.0				6	1.8	0.3	22	1.5	1.8
	194.8-1							2	3.3	1.1													1	1.0	-										3	2.5	1.5
Deadman Creek	Deadman-6																												6	0.3	0.2	4	0.1	0.1	10	0.2	0.2
	Deadman-5							5	1.8	0.4																5	1.9	1.0							10	1.9	0.7
	Deadman-4							5	1.0	0.4																5	2.0	0.4				5	0.3	0.2	15	1.1	0.8
	Deadman-3							6	1.9	1.0	3	4.4	0.9	1	4.0	-										6	2.6	0.5				2	0.3	0.4	18	2.5	1.4
	Deadman-1										1	3.5	-										1	0.5	-	1	2.4	-							3	2.1	1.5
Total[1]		**1**	**0**	**-**	**3**	**0.33**	**0.58**	**104**	**2.1**	**1.2**	**47**	**10.4**	**7.7**	**2**	**8.0**	**5.7**	**1**	**50.0**	**-**	**8**	**0.8**	**0.4**	**38**	**0.3**	**0.4**	**70**	**3.1**	**1.3**	**129**	**1.2**	**0.9**	**191**	**0.9**	**0.6**	**594**	**2.3**	**4.0**

Table 5.1-3. Mean (±SD) bankfull width (m) of mesohabitats in Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Oshetna River	Oshetna-3							5	33.7	9.6																2	60.2	0.3	8	27.7	10.4	15	36.0	20.8	30	35.0	17.5
	Oshetna-2																									3	51.4	2.8	2	66.4	7.6	1	56.9	-	6	57.3	8.3
	Oshetna-1							5	37.8	4.5																2	54.1	6.8	5	55.9	4.6	5	49.0	6.1	17	48.3	8.9
Black River	Black-3							5	28.0	1.3																2	20.9	2.2	5	26.4	5.1	5	26.6	3.3	17	26.3	3.8
	Black-2							7	22.4	6.8																1	23.1	-	3	15.4	9.2	6	18.8	5.4	17	19.9	6.7
	Black-1							4	21.6	7.0													1	25.6	-				5	36.7	35.1	5	23.7	7.8	15	27.6	20.6
Goose Creek	Goose-3							5	13.8	3.7																			1	16.7	-	6	13.4	5.0	12	13.9	4.1
	Goose-2							5	22.2	4.1	3	23.1	8.5																			5	16.4	1.5	13	20.2	5.3
	Goose-1							7	18.0	2.9	1	18.6	-													5	14.3	3.5				5	14.9	3.0	18	16.1	3.3
Proposed reservoir full pool																																					
Unnamed 230.2	NA										1	1.3	-																					1	1.3	-
Unnamed 230.1	NA										3	4.6	0.8										3	4.2	1.2	1	3.7	-							7	4.3	0.9
Unnamed 228.5	NA										3	11.5	0.3													5	11.2	1.0	1	11.6	-	3	8.0	1.8	12	10.5	1.8
Unnamed 226.2	NA																																				
Unnamed 219.6	NA																												4	6.2	1.9				4	6.2	1.9
Unnamed 214.4	NA										1	9.4	-																					1	9.4	-
Jay Creek	Jay-4	1	0.9	-																			5	6.3	0.8				5	8.1	1.5	6	6.1	1.9	17	6.4	2.2
	Jay-3							5	12.1	2.9													3	6.0	6.1				2	6.5	6.4	7	8.8	5.6	17	9.0	5.1
	Jay-2							5	14.3	6.3																6	12.1	3.6	4	13.0	0.9	5	12.7	2.8	20	13.0	3.8
	Jay-1							3	9.7	4.8	1	11.0	-							1	5.0	-	2	8.5	0.7	1	9.0	-	11	10.3	3.1	15	11.1	3.4	34	10.3	3.3
Tsisi Creek	Tsisi-2																												5	16.9	3.2	5	16.1	2.4	10	16.5	2.7
	Tsisi-1							8	14.7	6.2																6	15.4	4.3				1	5.2	-	15	14.3	5.7
Kosina Creek	Kosina-3																												3	62.0	53.1	14	69.0	40.0	17	67.8	40.7
	Kosina-2										1	56.0	-							2	3.3	1.1	1	16.0	-	5	34.7	9.3	17	34.2	16.5	16	25.4	15.7	42	29.5	16.7
	Kosina-1																						2	16.0	1.4				14	24.0	13.5	13	20.5	9.8	29	21.9	11.4
Unnamed 208.6	NA										1	2.7	-																					1	2.7	-
Unnamed 207.4 RB-1	207.4 RB-1																																				
Unnamed 207.4	NA										6	1.9	1.2																					6	1.9	1.2
Unnamed 206.3	206.3-3										1	2.3	-																2	7.1	1.1	1	2.9	-	4	4.8	2.7
	206.3-1							4	5.1	0.3	6	4.5	1.1																1	4.0	-	1	4.7	-	12	4.6	0.9
Unnamed 204.5	204.5-2										1	6.6	-																					1	6.6	-
	204.5-1							3	5.1	1.2	7	5.5	2.3																1	1.6	-	1	3.2	-	12	4.9	2.2
Unnamed 198.9	NA										1	2.0	-																					1	2.0	-
Unnamed 198.4 LB-1	NA													1	2.1	-																			1	2.1	-
Unnamed 197.7	197.7-3										2	3.4	0.9																				2	3.1	0.1	4	3.2	0.5
	197.7-2										3	4.5	0.8																1	4.2	-				4	4.4	0.7
	197.7-1							2	8.8	0.6	3	8.4	1.7										2	4.9	4.0	3	9.6	4.4	1	8.9	-	1	4.9	-	12	7.9	3.0
Unnamed 197.7 RB-1	NA										3	4.9	1.7													1	6.7	-							4	5.3	1.6
Watana Creek Trib	Watana Trib-2							3	2.2	0.5																2	2.4	0.2				5	2.4	0.5	10	2.3	0.4
	Watana Trib-1																			1	2.8	-	1	15.4	-	2	18.0	1.9	2	16.5	3.9	8	12.4	2.0	14	13.3	4.2
Watana Creek LB-1.1.1	NA																						1	5.2	-				2	1.3	0.2	2	1.6	1.0	5	2.2	1.7
Watana Creek RB-1	NA										3	1.8	1.0										1	5.9	-				4	1.8	0.3	4	2.3	1.0	12	2.3	1.4
Watana Creek	Watana-3	2	1.7	0.2				13	12.8	5.6																3	9.9	0.9	4	13.7	6.0	7	10.2	3.8	29	11.2	5.4
	Watana-2							2	14.6	0.7										2	2.8	0.4	1	10.5	-	2	14.9	4.3	6	10.2	4.1	5	14.9	1.8	18	11.7	4.7
	Watana-1				1	16.0	-	1	19.3	-										2	1.6	0.3	6	16.0	16.2				17	21.4	11.9	12	17.4	7.1	39	18.1	11.3
Unnamed 194.8	194.8-4																						6	4.3	1.1							4	4.4	1.1	10	4.3	1.1
	194.8-3				2	7.5	0.7	2	4.8	1.6	2	6.8	0.7										9	6.1	1.0	3	4.6	0.7	1	7.5	-	6	5.7	1.2	25	6.0	1.2
	194.8-1							2	8.7	0.4													1	8.6	-										3	8.7	0.3
Deadman Creek	Deadman-6																												6	37.5	9.8	5	42.8	17.1	11	39.9	13.1
	Deadman-5							5	31.5	3.0																5	27.2	1.5							10	29.4	3.2
	Deadman-4							5	37.3	9.4																5	27.4	2.9				5	38.6	4.1	15	34.4	7.7
	Deadman-3							6	29.6	4.6	5	26.8	4.7	1	24.3	-										6	24.9	3.8				2	22.2	0.9	20	26.5	4.5
	Deadman-1										1	22.6	-										1	27.3	-	1	26.9	-							3	25.6	2.6
Total[1]		**3**	**1.4**	**0.5**	**3**	**10.3**	**5.0**	**112**	**19.2**	**11.0**	**59**	**9.2**	**10.3**	**2**	**13.2**	**15.7**				**8**	**2.9**	**1.2**	**46**	**9.0**	**8.1**	**72**	**21.2**	**14.4**	**143**	**22.7**	**19.1**	**209**	**21.6**	**21.4**	**657**	**19.0**	**17.6**

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

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

Table 5.1-4. Mean (±SD) wetted width (m) of mesohabitats in Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Oshetna River	Oshetna-3							5	29.0	7.3															2	57.1	2.1	8	23.0	11.5	15	28.9	17.8	30	29.3	16.0
	Oshetna-2																								3	47.1	2.3	2	63.4	3.5	1	39.4	-	6	51.2	10.1
	Oshetna-1							5	34.0	5.3															2	38.4	16.5	5	51.6	3.9	5	41.9	3.4	17	42.0	9.0
Black River	Black-3							5	26.6	2.1															2	19.1	0.8	5	26.3	5.0	5	25.5	3.3	17	25.3	4.0
	Black-2							7	20.4	7.9															1	18.3	-	3	14.2	8.5	6	17.0	4.8	17	18.0	6.7
	Black-1							4	21.5	7.0													1	17.9	-				5	33.6	35.3	5	18.8	4.0	15	24.4	20.4
Goose Creek	Goose-3							5	13.2	3.7																		1	14.9	-	6	12.2	3.5	12	12.8	3.3
	Goose-2							5	17.6	2.7	3	19.0	5.2																	5	14.3	1.3	13	16.7	3.4
	Goose-1							7	14.9	2.9	1	11.2	-												5	11.4	1.9				5	11.9	2.4	18	12.9	2.8
Proposed reservoir full pool																																					
Unnamed 230.2	NA										1	1.1	-																					1	1.1	-
Unnamed 230.1	NA										3	2.7	0.5										3	2.2	0.5	1	2.6	-						7	2.5	0.5
Unnamed 228.5	NA										3	9.2	1.2													5	8.0	0.5	1	9.9	-	3	6.4	0.9	12	8.0	1.4
Unnamed 226.2	NA										1	2.5	-																					1	2.5	-
Unnamed 219.6	NA																											4	3.1	0.9				4	3.1	0.9
Unnamed 214.4	NA										1	1.8	-																					1	1.8	-
Jay Creek	Jay-4	1	0.9	-																			5	5.2	0.5				5	7.9	1.7	6	5.3	1.8	17	5.8	2.2
	Jay-3							5	10.8	1.0													3	3.8	2.8				2	5.9	5.8	7	6.4	3.8	17	7.2	3.9
	Jay-2							5	11.4	1.9																6	10.1	1.2	4	11.6	0.9	5	10.2	1.6	20	10.7	1.5
	Jay-1							3	8.0	4.4	1	5.0	-							1	1.0	-	2	4.0	1.4	1	7.2	-	11	8.5	2.8	15	7.4	3.2	34	7.3	3.3
Tsisi Creek	Tsisi-2																											5	16.1	3.1	5	14.1	2.7	10	15.1	3.0
	Tsisi-1							8	14.1	6.4															6	14.4	4.1				1	4.7	-	15	13.6	5.7
Kosina Creek	Kosina-3																			2	1.4	0.1	1	3.0	-				3	57.7	53.1	19	47.6	40.6	25	43.3	41.5
	Kosina-2										1	34.0	-							2	1.7	0.4	1	11.0	-	5	32.3	9.3	17	28.6	12.3	16	21.0	13.9	42	24.6	13.8
	Kosina-1																						2	11.5	3.5				14	20.8	13.6	13	16.9	8.6	29	18.4	11.2
Unnamed 208.6	NA										1	2.0	-																					1	2.0	-
Unnamed 207.4 RB-1	207.4 RB-1																																				
Unnamed 207.4	NA										6	0.8	0.4																					6	0.8	0.4
Unnamed 206.3	206.3-3										1	1.2	-															2	1.4	0.6	1	1.2	-	4	1.3	0.4
	206.3-1							4	3.5	0.2	6	3.3	1.1															1	2.5	-	1	2.5	-	12	3.2	0.8
Unnamed 204.5	204.5-2										1	5.2	-																					1	5.2	-
	204.5-1							3	2.9	1.4	7	4.5	2.0															1	0.6	-	1	1.3	-	12	3.5	2.1
Unnamed 198.9	NA										1	2.0	-																					1	2.0	-
Unnamed 198.4 LB-1	NA													1	2.1	-																		1	2.1	-
Unnamed 197.7	197.7-3										2	3.4	0.9																				2	3.1	0.1	4	3.2	0.5
	197.7-2										3	4.1	0.9															1	2.6	-				4	3.7	1.0
	197.7-1							2	7.2	1.6	3	6.6	0.8										2	3.5	2.9	3	6.9	0.6	1	6.0	-	1	4.8	-	12	6.0	1.8
Unnamed 197.7 RB-1	NA										3	3.6	2.0													1	4.8	-							4	3.9	1.8
Watana Creek Trib	Watana Trib-2							3	2.1	0.5																2	2.2	0.1				5	2.3	0.4	10	2.2	0.4
	Watana Trib-1																			1	0.8	-	1	9.1	-	2	5.0	1.0	2	14.2	5.0	8	10.6	2.1	14	9.5	4.2
Watana Creek LB-1.1.1	NA																						1	4.7	-				2	1.0	0.1	2	1.2	0.6	5	1.8	1.6
Watana Creek RB-1	NA										2	1.2	0.8										1	0.9	-				4	0.9	0.3	4	0.9	0.4	11	0.9	0.4
Watana Creek	Watana-3	2	1.2	0.2				13	11.6	5.9															3	8.5	1.6	4	12.8	5.8	7	7.8	2.5	29	9.8	5.4
	Watana-2							2	11.4	0.7										2	1.3	0.4	1	7.1	-	2	10.2	1.1	6	6.6	4.5	5	10.4	1.3	18	8.0	4.0
	Watana-1				1	14.0	-	1	14.7	-										2	1.4	0.2	6	7.7	3.6				17	16.2	7.1	12	12.7	5.1	39	13.0	6.8
Unnamed 194.8	194.8-4																						6	3.1	0.9							4	2.6	0.5	10	2.9	0.8
	194.8-3				2	5.1	0.5	2	3.2	0.8	2	3.6	0.2										9	3.9	0.8	3	2.6	0.5	1	2.6	-	6	3.2	0.7	25	3.5	0.9
	194.8-1							2	5.9	0.2													1	7.4	-										3	6.4	0.9
Deadman Creek	Deadman-6																											6	36.9	9.5	5	42.6	17.4	11	39.5	13.2
	Deadman-5							5	29.7	3.2															5	24.6	2.8							10	27.1	3.9
	Deadman-4							5	36.3	9.1															5	25.4	2.4				5	37.9	3.6	15	33.2	7.9
	Deadman-3							6	28.0	4.6	5	23.3	5.0	1	18.3	-										6	24.0	4.2				2	18.2	1.0	20	24.2	5.1
	Deadman-1										1	18.0	-										1	15.7	-	1	21.0	-							3	18.3	2.7
Total[1]		**3**	**1.1**	**0.2**	**3**	**8.1**	**5.1**	**112**	**17.2**	**10.6**	**59**	**6.9**	**7.9**	**2**	**10.2**	**11.4**				**10**	**1.3**	**0.3**	**47**	**5.5**	**3.8**	**72**	**18.2**	**13.6**	**143**	**19.6**	**18.0**	**214**	**18.0**	**19.5**	**665**	**16.0**	**16.1**

Table 5.1-5. Mean (±SD) bankfull depth (m) of mesohabitats in Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Oshetna River	Oshetna-3							5	0.9	0.2																		6	0.7	0.2	7	0.9	0.3	18	0.9	0.2
	Oshetna-2																																				
	Oshetna-1							5	0.7	0.4																		4	0.6	0.2	2	1.1	0.5	11	0.8	0.3
Black River	Black-3							5	0.7	0.4															2	0.8	0.2	5	0.8	0.1	5	0.7	0.2	17	0.7	0.2
	Black-2							7	0.7	0.2															1	0.2	-	3	0.6	0.2	6	1.0	0.4	17	0.8	0.4
	Black-1							4	0.5	0.2													1	2.1	-				5	1.0	0.5	5	1.0	0.3	15	1.0	0.5
Goose Creek	Goose-3							5	1.0	0.4																		1	0.5	-	6	0.7	0.1	12	0.8	0.3
	Goose-2							5	0.6	0.3	3	0.7	0.1																	5	1.0	0.1	13	0.7	0.3
	Goose-1							7	1.0	0.4	1	1.3	-												5	0.6	0.1				5	0.8	0.4	18	0.8	0.4
Proposed reservoir full pool																																					
Unnamed 230.2	NA										1	0.5	-																				1	0.5	-
Unnamed 230.1	NA										3	0.7	0.1										3	0.5	0.1	1	0.5	-					7	0.6	0.1
Unnamed 228.5	NA										3	0.8	0.2													5	0.8	0.4	1	1.3	-	3	0.6	0.4	12	0.8	0.4
Unnamed 226.2	NA																																				
Unnamed 219.6	NA																											4	0.7	0.2				4	0.7	0.2
Unnamed 214.4	NA										1	0.9	-																				1	0.9	-
Jay Creek	Jay-4	1	0.3	-																			5	0.9	0.2				5	0.7	0.4	6	0.7	0.2	17	0.7	0.3
	Jay-3							5	0.6	0.2																					2	0.9	0.4	7	0.7	0.3
	Jay-2							5	0.7	0.2															6	0.6	0.3	2	0.6	0.1	2	0.5	0.1	15	0.6	0.2
	Jay-1							3	1.0	0.2															1	1.0	-				1	0.5	-	5	0.9	0.2
Tsisi Creek	Tsisi-2																											5	0.8	0.3	5	0.7	0.1	10	0.8	0.2
	Tsisi-1							8	0.7	0.3															6	0.6	0.1				1	0.6	-	15	0.6	0.2
Kosina Creek	Kosina-3																																				
	Kosina-2																						1	0.7	-	5	0.6	0.2					6	0.6	0.2
	Kosina-1																						2	1.0	0.4								2	1.0	0.4
Unnamed 208.6	NA										1	0.6	-																				1	0.6	-
Unnamed 207.4 RB-1	207.4 RB-1																																				
Unnamed 207.4	NA										6	0.4	0.1																				6	0.4	0.1
Unnamed 206.3	206.3-3										1	1.0	-															2	1.0	0.2	1	1.2	-	4	1.1	0.1
	206.3-1							4	0.8	0.1	6	1.0	0.2															1	0.8	-	1	1.2	-	12	0.9	0.2
Unnamed 204.5	204.5-2										1	1.0	-																				1	1.0	-
	204.5-1							3	0.6	0.0	7	1.2	1.0															1	0.3	-	1	0.4	-	12	0.9	0.8
Unnamed 198.9	NA										1	0.4	-																				1	0.4	-
Unnamed 198.4 LB-1	NA													1	0.3	-																		1	0.3	-
Unnamed 197.7	197.7-3										2	0.9	0.4																		2	0.6	0.1	4	0.8	0.3
	197.7-2										3	2.2	1.4															1	0.6	-				4	1.8	1.4
	197.7-1							2	1.1	0.4	3	1.2	0.4										2	0.7	0.3	3	0.7	0.1	1	0.4	-	1	1.2	-	12	0.9	0.4
Unnamed 197.7 RB-1	NA										3	0.8	0.2													1	0.6	-							4	0.8	0.2
Watana Creek Trib	Watana Trib-2							3	0.8	0.1																2	0.5	0.0				5	0.6	0.2	10	0.6	0.2
	Watana Trib-1																			1	0.8	-	1	1.3	-	2	0.5	0.4	2	0.4	0.3	8	0.9	0.3	14	0.8	0.4
Watana Cr. LB-1.1.1	NA																						1	1.0	-				2	0.6	0.2	2	0.6	0.0	5	0.7	0.2
Watana Cr. RB-1	NA										2	0.3	0.0										1	0.3	-				4	0.2	0.1	4	0.3	0.2	11	0.3	0.1
Watana Creek	Watana-3	2	0.4	0.2				13	0.6	0.2															3	0.7	0.1	4	0.5	0.1	7	0.6	0.3	29	0.6	0.2
	Watana-2							2	0.8	0.1													1	1.3	-	2	0.8	0.7	1	0.6	-	3	1.3	0.5	9	1.0	0.5
	Watana-1				1	0.8	-	1	0.6	-													5	1.3	1.1				4	0.9	0.3	2	1.0	0.3	13	1.0	0.7
Unnamed 194.8	194.8-4																						6	1.2	0.2							4	0.8	0.5	10	1.1	0.4
	194.8-3				2	1.4	0.2	2	0.9	0.2	2	1.7	0.0										9	1.7	0.2	3	1.5	0.3	1	0.9	-	6	0.7	0.3	25	1.3	0.5
	194.8-1							2	0.9	0.2													1	1.0	-										3	0.9	0.1
Deadman Creek	Deadman-6																												6	0.8	0.4	5	0.9	0.1	11	0.9	0.3
	Deadman-5							5	0.5	0.2																5	0.9	0.3							10	0.7	0.3
	Deadman-4							5	0.7	0.3																5	0.6	0.1				5	1.0	0.1	15	0.8	0.2
	Deadman-3							6	0.7	0.3	5	1.0	0.2	1	0.9	-										6	0.8	0.2				2	2.6	1.9	20	1.0	0.7
	Deadman-1										1	0.8	-										1	3.6	-	1	0.7	-							3	1.7	1.7
Total[1]		**3**	**0.4**	**0.1**	**3**	**1.2**	**0.4**	**112**	**0.7**	**0.3**	**56**	**0.9**	**0.6**	**2**	**0.6**	**0.4**				**1**	**0.8**	**-**	**40**	**1.2**	**0.7**	**65**	**0.7**	**0.3**	**71**	**0.7**	**0.3**	**120**	**0.8**	**0.4**	**473**	**0.8**	**0.4**

Table 5.1-6. Mean (±SD) thalweg depth (m) of mesohabitats in Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Oshetna River	Oshetna-3							5	0.6	0.3																		6	0.5	0.3	7	0.7	0.2	18	0.6	0.2
	Oshetna-2																																				
	Oshetna-1							5	0.5	0.3																		4	0.5	0.3	2	0.5	0.1	11	0.5	0.3
Black River	Black-3							5	0.6	0.3															2	0.8	0.2	5	0.6	0.2	5	0.7	0.3	17	0.7	0.2
	Black-2							7	0.7	0.2															1	0.2	-	3	0.6	0.3	6	0.6	0.3	17	0.6	0.3
	Black-1							4	0.5	0.1													1	0.3	-				5	0.7	0.2	5	0.9	0.2	15	0.6	0.3
Goose Creek	Goose-3							5	0.6	0.3																		1	0.2	-	6	0.5	0.2	12	0.5	0.3
	Goose-2							5	0.5	0.2	3	0.5	0.1																	5	0.7	0.3	13	0.6	0.2
	Goose-1							7	0.7	0.4	1	0.7	-												5	0.5	0.2				5	0.5	0.3	18	0.6	0.3
Proposed reservoir full pool																																					
Unnamed 230.2	NA										1	0.1	-																				1	0.1	-
Unnamed 230.1	NA										3	0.3	0.0										3	0.3	0.0	1	0.2	-				7	0.3	0.1
Unnamed 228.5	NA										3	0.5	0.0													5	0.5	0.2	1	1.3	-	3	0.5	0.4	12	0.6	0.3
Unnamed 226.2	NA																																				
Unnamed 219.6	NA																											4	0.4	0.3				4	0.4	0.3
Unnamed 214.4	NA										1	0.2	-																				1	0.2	-
Jay Creek	Jay-4	1	0.3	-																			5	0.9	0.3				5	0.4	0.2	6	0.5	0.4	17	0.6	0.4
	Jay-3							5	0.6	0.2													3	0.5	0.4							2	0.4	0.0	10	0.5	0.2
	Jay-2							5	0.5	0.3																6	0.5	0.3	2	0.4	0.3	2	0.4	0.3	15	0.5	0.3
	Jay-1							3	0.9	0.2													2	0.5	0.2	1	0.7	-				1	0.5	-	7	0.7	0.2
Tsisi Creek	Tsisi-2																											5	0.7	0.3	5	0.6	0.2	10	0.6	0.2
	Tsisi-1							8	0.7	0.3																6	0.6	0.2				1	0.4	-	15	0.6	0.2
Kosina Creek	Kosina-3																						2	0.7	0.2										2	0.7	0.2
	Kosina-2																						1	0.3	-	5	0.5	0.2							6	0.4	0.2
	Kosina-1																						2	0.7	0.4										2	0.7	0.4
Unnamed 208.6	NA										1	0.2	-																				1	0.2	-
Unnamed 207.4 RB-1	207.4 RB-1																																				
Unnamed 207.4	NA										6	0.1	0.0																				6	0.1	0.0
Unnamed 206.3	206.3-3										1	0.3	-															2	0.4	0.5	1	0.5	-	4	0.4	0.3
	206.3-1							4	0.4	0.1	6	0.4	0.2															1	0.2	-	1	0.5	-	12	0.4	0.2
Unnamed 204.5	204.5-2										1	0.6	-																				1	0.6	-
	204.5-1							3	0.3	0.2	7	0.7	0.6															1	0.3	-	1	0.4	-	12	0.5	0.5
Unnamed 198.9	NA										1	0.3	-																				1	0.3	-
Unnamed 198.4 LB-1	NA													1	0.2	-																		1	0.2	-
Unnamed 197.7	197.7-3										2	0.7	0.1																		2	0.6	0.1	4	0.7	0.1
	197.7-2										3	1.0	0.6															1	0.6	-				4	0.9	0.5
	197.7-1							2	0.7	0.1	3	0.5	0.2										2	0.3	0.1	3	0.4	0.2	1	0.4	-	1	0.3	-	12	0.5	0.2
Unnamed 197.7 RB-1	NA										3	0.6	0.1													1	0.6	-							4	0.6	0.1
Watana Creek Trib	Watana Trib-2							3	0.6	0.4																2	0.5	0.0				5	0.4	0.2	10	0.5	0.3
	Watana Trib-1																			1	0.4	-	1	0.4	-	2	0.5	0.4	2	0.3	0.4	8	0.6	0.3	14	0.5	0.3
Watana Cr. LB-1.1.1	NA																						1	0.3	-				2	0.6	0.2	2	0.5	0.2	5	0.5	0.2
Watana Cr. RB-1	NA										2	0.2	0.0										1	0.1	-				4	0.2	0.1	4	0.2	0.1	11	0.2	0.1
Watana Creek	Watana-3	2	0.3	0.1				13	0.5	0.2																3	0.7	0.1	4	0.5	0.2	7	0.6	0.3	29	0.5	0.2
	Watana-2							2	0.8	0.1													1	0.6	-	2	0.4	0.2	1	0.4	-	3	0.6	0.2	9	0.6	0.2
	Watana-1				1	0.8	-	1	0.5	-													6	0.6	0.3				4	0.9	0.3	2	0.7	0.0	14	0.7	0.3
Unnamed 194.8	194.8-4																						6	0.4	0.2							4	0.5	0.3	10	0.5	0.3
	194.8-3				2	0.5	0.5	2	0.6	0.0	2	0.9	0.1										9	0.6	0.4	3	0.6	0.1	1	0.3	-	6	0.6	0.3	25	0.6	0.3
	194.8-1							2	0.7	0.4													1	0.2	-										3	0.5	0.4
Deadman Creek	Deadman-6																											6	0.5	0.2	5	0.6	0.3	11	0.6	0.3
	Deadman-5							5	0.5	0.2																5	0.8	0.3							10	0.7	0.3
	Deadman-4							5	0.6	0.2																5	0.6	0.1				5	0.8	0.2	15	0.7	0.2
	Deadman-3							6	0.5	0.1	5	0.7	0.3	1	0.2	-										6	0.8	0.2				2	0.5	0.1	20	0.6	0.2
	Deadman-1										1	0.3	-										1	0.2	-	1	0.7	-							3	0.4	0.3
Total[1]		**3**	**0.3**	**0.1**	**3**	**0.6**	**0.4**	**112**	**0.6**	**0.3**	**56**	**0.5**	**0.4**	**2**	**0.2**	**0.0**				**1**	**0.4**	**-**	**48**	**0.5**	**0.3**	**65**	**0.6**	**0.2**	**71**	**0.5**	**0.3**	**120**	**0.6**	**0.3**	**481**	**0.5**	**0.3**

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. Mean (±SD) max pool and crest depths (m) of Beaver Pond and Pool mesohabitats in Upper River tributaries.

Tributary Name	Geomorphic Reach	Average Max Pool Depth									Average Pool Crest Depth					
		Beaver Pond			Pool			All Units2			Pool			All Units[2]		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Oshetna River	Oshetna-3															
Oshetna River	Oshetna-2															
Oshetna River	Oshetna-1															
Black River	Black-3															
Black River	Black-2															
Black River	Black-1				1	2.5	-	1	2.5	-	1	0.5	-	1	0.5	-
Goose Creek	Goose-3															
Goose Creek	Goose-2															
Goose Creek	Goose-1															
Proposed reservoir full pool																
Unnamed 230.2	NA															
Unnamed 230.1	NA				3	0.6	0.2	3	0.6	0.2	3	0.2	0.0	3	0.2	0.0
Unnamed 228.5	NA															
Unnamed 226.2	NA															
Unnamed 219.6	NA															
Unnamed 214.4	NA															
Jay Creek	Jay-4				5	1.0	0.2	5	1.0	0.2	5	0.2	0.1	5	0.2	0.1
Jay Creek	Jay-3				3	0.8	0.4	3	0.8	0.4	2	0.3	0.2	2	0.3	0.2
Jay Creek	Jay-2															
Jay Creek	Jay-1				2	0.6	0.1	2	0.6	0.1	1	0.3	-	1	0.3	-
Tsisi Creek	Tsisi-2															
Tsisi Creek	Tsisi-1															
Kosina Creek	Kosina-3				2	0.7	0.2	2	0.7	0.2	2	0.3	0.1	2	0.3	0.1
Kosina Creek	Kosina-2				1	2.0	-	1	2.0	-						
Kosina Creek	Kosina-1				2	0.7	0.0	2	0.7	0.0	2	0.3	0.0	2	0.3	0.0
Unnamed 208.6	NA															
Unnamed 207.4 RB-1	207.4 RB-1															
Unnamed 207.4	NA															
Unnamed 206.3	206.3-3															
Unnamed 206.3	206.3-1															
Unnamed 204.5	204.5-2															
Unnamed 204.5	204.5-1															
Unnamed 198.9	NA															
Unnamed 198.4 LB-1	NA															
Unnamed 197.7	197.7-3															
Unnamed 197.7	197.7-2															
Unnamed 197.7	197.7-1				2	0.7	0.4	2	0.7	0.4	2	0.2	0.1	2	0.2	0.1
Unnamed 197.7 RB-1	NA															
Watana Creek Trib	Watana Trib-2															
Watana Creek Trib	Watana Trib-1				1	1.1	-	1	1.1	-	1	0.6	-	1	0.6	-
Watana Creek LB-1.1.1	NA				1	1.4	-	1	1.4	-	1	0.4	-	1	0.4	-
Watana Creek RB-1	NA				1	0.6	-	1	0.6	-	1	0.2	-	1	0.2	-
Watana Creek	Watana-3															
Watana Creek	Watana-2				1	1.3	-	1	1.3	-	1	0.5	-	1	0.5	-
Watana Creek	Watana-1	1	0.7	-	6	0.9	0.5	7	0.9	0.5	5	0.3	0.2	5	0.3	0.2
Unnamed 194.8	194.8-4				6	0.8	0.1	6	0.8	0.1	5	0.2	0.1	5	0.2	0.1
Unnamed 194.8	194.8-3	1	1.8	-	9	1.2	0.1	10	1.3	0.2	9	0.6	0.2	9	0.6	0.2
Unnamed 194.8	194.8-1				1	1.0	-	1	1.0	-	1	0.4	-	1	0.4	-
Deadman Creek	Deadman-6															
Deadman Creek	Deadman-5															
Deadman Creek	Deadman-4							1	1.0	-				1	1.0	-
Deadman Creek	Deadman-3													1	1.2	-
Deadman Creek	Deadman-1				1	6.0	-	1	6.0	-	1	1.2	-	1	1.2	-
Total[1]		**2**	**1.3**	**0.8**	**48**	**1.1**	**0.8**	**51**	**1.1**	**0.8**	**43**	**0.4**	**0.2**	**45**	**0.4**	**0.3**

Table 5.1-8. Mean (±SD) percent erosion along mesohabitat units in Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Oshetna River	Oshetna-3							5	1.0	2.2																2	32.5	24.7	8	9.4	15.2	15	13.0	13.6	30	11.3	14.8
	Oshetna-2																									3	15.0	10.0	1	0.0	-	1	0.0	-	5	9.0	10.8
	Oshetna-1							5	13.0	16.4																2	5.0	7.1	5	2.0	2.7	5	15.8	9.3	17	9.6	11.4
Black River	Black-3							5	0.0	0.0																2	0.0	0.0	5	0.0	0.0	5	1.0	2.2	17	0.3	1.2
	Black-2							7	0.0	0.0																1	0.0	-	3	0.0	0.0	6	0.0	0.0	17	0.0	0.0
	Black-1							4	0.0	0.0													1	0.0	-				5	0.0	0.0	5	0.0	0.0	15	0.0	0.0
Goose Creek	Goose-3							5	0.0	0.0																			1	0.0	-	6	0.0	0.0	12	0.0	0.0
	Goose-2							5	0.0	0.0	3	0.0	0.0																			5	0.0	0.0	13	0.0	0.0
	Goose-1							7	8.6	11.1	1	0.0	-													5	14.0	20.7				5	23.0	20.2	18	13.6	17.0
Proposed reservoir full pool																																					
Unnamed 230.2	NA										1	25.0	-																					1	25.0	-
Unnamed 230.1	NA										3	0.0	0.0										3	0.0	0.0	1	0.0	-						7	0.0	0.0
Unnamed 228.5	NA										3	16.7	28.9													5	0.0	0.0	1	0.0	-	3	0.0	0.0	12	4.2	14.4
Unnamed 226.2	NA																																				
Unnamed 219.6	NA																												4	13.8	9.5				4	13.8	9.5
Unnamed 214.4	NA										1	0.0	-																					1	0.0	-
Jay Creek	Jay-4	1	0.0	-																			5	0.0	0.0				5	1.0	2.2	6	0.0	0.0	17	0.3	1.2
	Jay-3							5	0.0	0.0													3	8.3	14.4				2	0.0	0.0	7	7.1	7.6	17	4.4	7.9
	Jay-2							5	3.0	6.7																6	1.7	4.1	4	5.0	4.1	5	14.0	15.2	20	5.8	9.5
	Jay-1							3	1.7	2.9	1	0.0	-							1	50.0	-	2	0.0	0.0	1	0.0	-	11	7.3	11.0	15	0.8	2.6	34	4.3	10.7
Tsisi Creek	Tsisi-2																												5	0.0	0.0	5	0.0	0.0	10	0.0	0.0
	Tsisi-1							8	0.0	0.0																6	0.0	0.0				1	0.0	-	15	0.0	0.0
Kosina Creek	Kosina-3																			2	7.5	10.6	2	15.0	14.1				4	0.0	0.0	26	4.4	9.9	34	4.7	9.7
	Kosina-2										1	5.0	-							2	0.0	0.0	1	0.0	-	5	12.0	16.8	17	1.8	3.5	16	1.6	3.0	42	2.9	6.9
	Kosina-1																						2	0.0	0.0				14	0.0	0.0	13	0.8	2.8	29	0.3	1.9
Unnamed 208.6	NA										1	50.0	-																					1	50.0	-
Unnamed 207.4 RB-1	207.4 RB-1																																				
Unnamed 207.4	NA										6	11.7	13.9																					6	11.7	13.9
Unnamed 206.3	206.3-3										1	0.0	-																2	0.0	0.0	1	0.0	-	4	0.0	0.0
	206.3-1							4	0.0	0.0	6	0.0	0.0																1	0.0	-	1	0.0	-	12	0.0	0.0
Unnamed 204.5	204.5-2										1	0.0	-																					1	0.0	-
	204.5-1							3	0.0	0.0	7	4.3	5.5																1	0.0	-	1	0.0	-	12	2.5	4.6
Unnamed 198.9	NA										1	0.0	-																					1	0.0	-
Unnamed 198.4 LB-1	NA													1	12.5	-																			1	12.5	-
Unnamed 197.7	197.7-3										2	0.0	0.0																			2	0.0	0.0	4	0.0	0.0
	197.7-2										3	6.7	2.9																1	0.0	-				4	5.0	4.1
	197.7-1							2	25.0	7.1	3	6.7	2.9										2	15.0	0.0	3	11.7	7.6	1	12.5	-	1	15.0	-	12	13.5	7.4
Unnamed 197.7 RB-1	NA										3	13.3	15.3													1	10.0	-							4	12.5	12.6
Watana Creek Trib	Watana Trib-2							3	0.0	0.0																2	0.0	0.0				5	0.0	0.0	10	0.0	0.0
	Watana Trib-1																			1	0.0	-	1	40.0	-	2	15.0	21.2	2	18.8	26.5	8	6.9	13.9	14	11.6	17.0
Watana Cr. LB-1.1.1	NA																						1	15.0	-				2	0.0	0.0	2	5.0	7.1	5	5.0	7.1
Watana Cr. RB-1	NA										3	20.0	20.0										1	0.0	-				4	17.5	23.6	4	22.5	45.0	12	18.3	28.6
Watana Creek	Watana-3	2	0.0	0.0				13	0.0	0.0																3	0.0	0.0	4	0.0	0.0	7	2.9	7.6	29	0.7	3.7
	Watana-2							2	0.0	0.0										2	0.0	0.0	1	50.0	-	2	27.5	38.9	6	1.7	4.1	5	9.5	19.9	18	9.0	19.1
	Watana-1				1	2.5	-	1	65.0	-										2	0.0	0.0	6	20.8	40.1				17	21.8	31.9	12	16.3	23.7	39	19.4	29.8
Unnamed 194.8	194.8-4																						6	72.5	35.9							4	63.8	20.6	10	69.0	29.6
	194.8-3				2	25.0	21.2	2	85.0	14.1	2	0.0	0.0										9	21.7	43.0	3	0.0	0.0	1	0.0	-	6	0.0	0.0	25	16.6	34.5
	194.8-1							2	2.5	3.5													1	5.0	-										3	3.3	2.9
Deadman Creek	Deadman-6																												6	0.0	0.0	5	0.0	0.0	11	0.0	0.0
	Deadman-5							5	1.0	2.2																5	10.0	10.0							10	5.5	8.3
	Deadman-4							5	0.0	0.0																5	0.0	0.0				4	8.1	14.7	14	2.3	8.0
	Deadman-3							6	0.0	0.0	5	5.0	7.1	1	100.0	-										6	15.0	32.1				2	7.5	10.6	20	11.5	27.5
	Deadman-1										1	0.0	-													1	0.0	-							3	0.0	0.0
Total[1]		**3**	**0.0**	**0.0**	**3**	**17.5**	**19.8**	**112**	**4.0**	**14.0**	**59**	**6.7**	**12.3**	**2**	**56.3**	**61.9**				**10**	**6.5**	**16.0**	**48**	**19.8**	**34.2**	**72**	**7.4**	**15.2**	**143**	**5.4**	**14.6**	**220**	**6.4**	**14.9**	**672**	**7.0**	**17.4**

Table 5.1-9. Mean (±SD) percent undercut banks along mesohabitat units in Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Oshetna River	Oshetna-3							5	1.0	2.2																2	5.0	7.1	8	1.9	3.7	15	1.0	2.8	30	1.5	3.3
	Oshetna-2																									3	0.0	0.0	1	10.0	-	1	15.0	-	5	5.0	7.1
	Oshetna-1							5	0.0	0.0																2	0.0	0.0	5	1.0	2.2	5	4.4	8.8	17	1.6	4.9
Black River	Black-3							5	0.0	0.0																2	0.0	0.0	5	0.0	0.0	5	0.0	0.0	17	0.0	0.0
	Black-2							7	0.0	0.0																1	0.0	-	3	0.0	0.0	6	0.0	0.0	17	0.0	0.0
	Black-1							4	0.0	0.0													1	0.0	-				5	0.0	0.0	5	0.0	0.0	15	0.0	0.0
Goose Creek	Goose-3							5	0.0	0.0																			1	0.0	-	6	1.7	4.1	12	0.8	2.9
	Goose-2							5	0.0	0.0	3	13.3	23.1																			5	0.0	0.0	13	3.1	11.1
	Goose-1							7	0.0	0.0	1	0.0	-													5	0.0	0.0				5	0.0	0.0	18	0.0	0.0
Proposed reservoir full pool																																					
Unnamed 230.2	NA										1	25.0	-																					1	25.0	-
Unnamed 230.1	NA										3	0.0	0.0										3	0.0	0.0	1	0.0	-						7	0.0	0.0
Unnamed 228.5	NA										3	0.0	0.0													5	0.0	0.0	1	0.0	-	3	0.0	0.0	12	0.0	0.0
Unnamed 226.2	NA																																				
Unnamed 219.6	NA																												4	7.5	6.5				4	7.5	6.5
Unnamed 214.4	NA										1	0.0	-																					1	0.0	-
Jay Creek	Jay-4	1	0.0	-																			5	3.0	6.7				5	0.0	0.0	6	0.0	0.0	17	0.9	3.6
	Jay-3							5	0.0	0.0													3	6.7	7.6				2	0.0	0.0	7	5.0	9.6	17	3.2	7.1
	Jay-2							5	0.0	0.0																6	0.0	0.0	4	1.3	2.5	5	2.0	4.5	20	0.8	2.4
	Jay-1							3	0.0	0.0	1	0.0	-							1	0.0	-	2	37.5	3.5	1	0.0	-	11	4.5	9.1	15	3.8	10.4	34	5.4	11.8
Tsisi Creek	Tsisi-2																												5	0.0	0.0	5	0.0	0.0	10	0.0	0.0
	Tsisi-1							8	0.0	0.0																6	0.0	0.0				1	0.0	-	15	0.0	0.0
Kosina Creek	Kosina-3																			2	5.0	7.1	2	7.5	10.6				4	6.3	6.3	26	10.3	20.9	34	9.3	18.5
	Kosina-2										1	0.0	-							2	0.0	0.0	1	0.0	-	5	1.0	2.2	17	1.5	3.4	16	5.0	9.5	42	2.6	6.5
	Kosina-1																						2	0.0	0.0				14	0.7	1.9	13	0.4	0.9	29	0.5	1.4
Unnamed 208.6	NA										1	0.0	-																					1	0.0	-
Unnamed 207.4 RB-1	207.4 RB-1																																				
Unnamed 207.4	NA										6	0.0	0.0																					6	0.0	0.0
Unnamed 206.3	206.3-3										1	10.0	-																2	0.0	0.0	1	0.0	-	4	2.5	5.0
	206.3-1							4	28.8	16.5	6	41.7	30.8																1	40.0	-	1	55.0	-	12	38.3	23.9
Unnamed 204.5	204.5-2										1	0.0	-																					1	0.0	-
	204.5-1							3	0.0	0.0	7	12.5	22.9																1	0.0	-	1	0.0	-	12	7.3	18.1
Unnamed 198.9	NA										1	0.0	-																					1	0.0	-
Unnamed 198.4 LB-1	NA													1	0.0	-																			1	0.0	-
Unnamed 197.7	197.7-3										2	0.0	0.0																			2	0.0	0.0	4	0.0	0.0
	197.7-2										3	1.7	2.9																1	0.0	-				4	1.3	2.5
	197.7-1							2	13.8	1.8	3	5.0	0.0										2	17.5	10.6	3	6.7	5.8	1	12.5	-	1	25.0	-	12	11.3	7.7
Unnamed 197.7 RB-1	NA										3	10.0	10.0													1	0.0	-							4	7.5	9.6
Watana Creek Trib	Watana Trib-2							3	0.0	0.0																2	0.0	0.0				5	0.0	0.0	10	0.0	0.0
	Watana Trib-1																			1	0.0	-	1	0.0	-	2	5.0	7.1	2	2.5	3.5	8	3.1	7.0	14	2.9	5.8
Watana Cr. LB-1.1.1	NA																						1	25.0	-				2	0.0	0.0	2	0.0	0.0	5	5.0	11.2
Watana Cr. RB-1	NA										3	0.0	0.0										1	0.0	-				4	0.0	0.0	4	0.0	0.0	12	0.0	0.0
Watana Creek	Watana-3	2	0.0	0.0				13	1.9	3.8																3	0.0	0.0	4	0.0	0.0	7	4.3	6.1	29	1.9	4.1
	Watana-2							2	0.0	0.0										2	0.0	0.0	1	45.0	-	2	5.0	7.1	6	0.0	0.0	5	2.0	4.5	18	3.6	10.8
	Watana-1				1	0.0	-	1	0.0	-										2	2.5	3.5	6	1.7	4.1				17	2.8	6.8	12	2.3	4.9	39	2.3	5.5
Unnamed 194.8	194.8-4																						6	19.2	28.4							4	13.8	14.4	10	17.0	22.9
	194.8-3				2	15.0	7.1	2	47.5	17.7	2	30.0	28.3										9	51.1	29.7	3	63.3	20.8	1	25.0	-	6	28.3	24.8	25	41.2	27.0
	194.8-1							2	6.3	1.8													1	0.0	-										3	4.2	3.8
Deadman Creek	Deadman-6																												6	0.0	0.0	5	0.0	0.0	11	0.0	0.0
	Deadman-5							5	0.0	0.0																5	0.0	0.0							10	0.0	0.0
	Deadman-4							5	0.0	0.0																5	0.0	0.0				4	0.0	0.0	14	0.0	0.0
	Deadman-3							6	0.0	0.0	5	1.0	2.2	1	0.0	-										6	0.0	0.0				2	0.0	0.0	20	0.3	1.1
	Deadman-1										1	0.0	-										1	5.0	-	1	0.0	-							3	1.7	2.9
Total[1]		**3**	**0.0**	**0.0**	**3**	**10.0**	**10.0**	**112**	**2.5**	**9.0**	**59**	**8.9**	**18.7**	**2**	**0.0**	**0.0**				**10**	**1.5**	**3.4**	**48**	**17.1**	**25.2**	**72**	**3.4**	**13.3**	**143**	**2.1**	**5.9**	**220**	**4.2**	**11.5**	**672**	**4.7**	**13.2**

Table 5.1-10. Mean (±SD) LWD count in mesohabitat units of Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove		Beaver Pond		Boulder Riffle		Cascade		Chute		Dry		Percolation Channel		Pool		Rapid		Riffle		Run/Glide		All Units[2]	
		n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD
Oshetna River	Oshetna-3					5	0											2	12	8	3	15	7	30	22
	Oshetna-2																	3	6	1	0	1	0	5	6
	Oshetna-1					5	9											2	2	5	3	5	8	17	22
Black River	Black-3					5	0											2	0	5	0	5	0	17	0
	Black-2					7	0											1	0	3	0	6	2	17	2
	Black-1					4	0									1	0			5	18	5	0	15	18
Goose Creek	Goose-3					5	0													1	0	6	0	12	0
	Goose-2					5	1	3	0													5	1	13	2
	Goose-1					7	6	1	0									5	4			5	7	18	17
Proposed reservoir full pool																									
Unnamed 230.2	NA							1	13															1	13
Unnamed 230.1	NA							3	16							3	1	1	1					7	18
Unnamed 228.5	NA							3	10									5	18	1	1	3	16	12	45
Unnamed 226.2	NA																								
Unnamed 219.6	NA																			4	41			4	41
Unnamed 214.4	NA							1	17															1	17
Jay Creek	Jay-4	1	0													5	0			5	0	6	0	17	0
	Jay-3					5	0									3	0			2	0	7	2	17	2
	Jay-2					5	10											6	5	4	8	5	0	20	23
	Jay-1					3	2	1	0					1	0	2	0	1	0	11	0	15	0	34	2
Tsisi Creek	Tsisi-2																			5	0	5	0	10	0
	Tsisi-1					8	0											6	0			1	0	15	0
Kosina Creek	Kosina-3													2	0	2	0			4	0	26	0	34	0
	Kosina-2							1	0					2	0	1	0	5	1	17	0	16	0	42	1
	Kosina-1															2	0			14	0	13	0	29	0
Unnamed 208.6	NA							1	11															1	11
Unnamed 207.4 RB-1	207.4 RB-1																								
Unnamed 207.4	NA							6	37															6	37
Unnamed 206.3	206.3-3							1	1											2	5	1	0	4	6
	206.3-1					4	9	6	37											1	13	1	4	12	63
Unnamed 204.5	204.5-2							1	11															1	11
	204.5-1					3	27	7	59											1	1	1	2	12	89
Unnamed 198.9	NA							1	0															1	0
Unnamed 198.4 LB-1	NA									1	5													1	5
Unnamed 197.7	197.7-3							2	0													2	0	4	0
	197.7-2							3	27											1	7			4	34
	197.7-1					2	6	3	32							2	1	3	48	1	3	1	6	12	96
Unnamed 197.7 RB-1	NA							3	39									1	0					4	39
Watana Creek Trib	Watana Trib-2					3	0											2	0			5	0	10	0
	Watana Trib-1													1	0	1	0	2	5	2	0	8	5	14	10
Watana Cr. LB-1.1.1	NA															1	19			2	0	2	0	5	19
Watana Cr. RB-1	NA							3	1							1	0			4	2	4	1	12	4
Watana Creek	Watana-3	2	0			13	3											3	1	4	1	7	0	29	5
	Watana-2					2	7							2	0	1	1	2	2	6	2	5	5	18	17
	Watana-1			1	0	1	5							2	0	6	76			17	143	12	14	39	238
Unnamed 194.8	194.8-4															5	7					3	0	8	7
	194.8-3			2	13	2	0	2	0							9	22	3	4	1	0	6	10	25	49
	194.8-1					2	28									1	16							3	44
Deadman Creek	Deadman-6																			6	0	5	0	11	0
	Deadman-5					5	2											5	0					10	2
	Deadman-4					5	1											5	0			5	23	15	24
	Deadman-3					6	0	5	26	1	1							6	3			2	3	20	33
	Deadman-1							1	1							1	0	1	29					3	30
Total[1]		**3**	**0**	**3**	**13**	**112**	**116**	**59**	**338**	**2**	**6**			**10**	**0**	**47**	**143**	**72**	**141**	**143**	**251**	**220**	**116**	**671**	**1,124**

Table 5.1-11. Mean (±SD) percent bedrock substrate in mesohabitat units of Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Oshetna River	Oshetna-3							5	0.0	0.0																		6	0.0	0.0	7	0.0	0.0	18	0.0	0.0
	Oshetna-2																																				
	Oshetna-1							5	0.0	0.0																		4	0.0	0.0	2	0.0	0.0	11	0.0	0.0
Black River	Black-3							5	0.0	0.0															2	0.0	0.0	5	0.0	0.0	5	0.0	0.0	17	0.0	0.0
	Black-2							7	0.0	0.0															1	0.0	-	3	0.0	0.0	6	0.0	0.0	17	0.0	0.0
	Black-1							4	0.0	0.0													1	0.0	-				5	0.0	0.0	5	0.0	0.0	15	0.0	0.0
Goose Creek	Goose-3							5	0.0	0.0																		1	0.0	-	6	0.0	0.0	12	0.0	0.0
	Goose-2							5	0.0	0.0	3	0.0	0.0																	5	0.0	0.0	13	0.0	0.0
	Goose-1							7	0.0	0.0	1	0.0	-												4	0.0	0.0				5	0.0	0.0	17	0.0	0.0
Proposed reservoir full pool																																					
Unnamed 230.2	NA										1	0.0	-																				1	0.0	-
Unnamed 230.1	NA										3	0.0	0.0										3	0.0	0.0	1	0.0	-					7	0.0	0.0
Unnamed 228.5	NA										3	0.0	0.0													5	0.0	0.0	1	0.0	-	3	0.0	0.0	12	0.0	0.0
Unnamed 226.2	NA																																				
Unnamed 219.6	NA																											4	0.0	0.0				4	0.0	0.0
Unnamed 214.4	NA										1	0.0	-																				1	0.0	-
Jay Creek	Jay-4	1	0.0	-																			5	0.0	0.0				5	0.0	0.0	6	0.0	0.0	17	0.0	0.0
	Jay-3							5	0.0	0.0													3	0.0	0.0				2	0.0	0.0	7	0.0	0.0	17	0.0	0.0
	Jay-2							5	0.0	0.0															6	0.0	0.0	4	0.0	0.0	5	0.0	0.0	20	0.0	0.0
	Jay-1							3	0.0	0.0	1	0.0	-							1	0.0	-	2	0.0	0.0	1	0.0	-	11	0.0	0.0	15	0.0	0.0	34	0.0	0.0
Tsisi Creek	Tsisi-2																											5	0.0	0.0	5	0.0	0.0	10	0.0	0.0
	Tsisi-1							8	0.0	0.0															6	0.0	0.0				1	0.0	-	15	0.0	0.0
Kosina Creek	Kosina-3																			2	0.0	0.0	2	0.0	0.0				4	0.0	0.0	26	0.0	0.0	34	0.0	0.0
	Kosina-2										1	0.0	-							2	0.0	0.0	1	0.0	-	5	0.0	0.0	17	0.6	2.4	16	5.0	8.9	42	2.1	6.1
	Kosina-1																						2	0.0	0.0				14	0.0	0.0	13	0.0	0.0	29	0.0	0.0
Unnamed 208.6	NA										1	0.0	-																				1	0.0	-
Unnamed 207.4 RB-1	207.4 RB-1																																				
Unnamed 207.4	NA										6	0.0	0.0																				6	0.0	0.0
Unnamed 206.3	206.3-3										1	0.0	-															2	0.0	0.0	1	0.0	-	4	0.0	0.0
	206.3-1							4	0.0	0.0	6	0.0	0.0															1	0.0	-	1	0.0	-	12	0.0	0.0
Unnamed 204.5	204.5-2										1	5.0	-																				1	5.0	-
	204.5-1							3	0.0	0.0	7	0.0	0.0															1	0.0	-	1	0.0	-	12	0.0	0.0
Unnamed 198.9	NA										1	0.0	-																				1	0.0	-
Unnamed 198.4 LB-1	NA													1	0.0	-																	1	0.0	-
Unnamed 197.7	197.7-3										2	0.0	0.0																	2	0.0	0.0	4	0.0	0.0
	197.7-2										3	0.0	0.0															1	0.0	-				4	0.0	0.0
	197.7-1							2	0.0	0.0	3	0.0	0.0										2	0.0	0.0	3	0.0	0.0	1	0.0	-	1	0.0	-	12	0.0	0.0
Unnamed 197.7 RB-1	NA										3	0.0	0.0													1	0.0	-							4	0.0	0.0
Watana Creek Trib	Watana Trib-2							3	0.0	0.0																		2	0.0	0.0				5	0.0	0.0	10	0.0	0.0
	Watana Trib-1																			1	0.0	-	1	20.0	-	2	0.0	0.0	2	0.0	0.0	8	1.3	3.5	14	2.1	5.8
Watana Cr. LB-1.1.1	NA																						1	0.0	-				2	0.0	0.0	2	0.0	0.0	5	0.0	0.0
Watana Cr. RB-1	NA										3	0.0	0.0										1	0.0	-				4	0.0	0.0	4	0.0	0.0	12	0.0	0.0
Watana Creek	Watana-3	2	0.0	0.0				13	0.0	0.0															3	0.0	0.0	4	0.0	0.0	7	0.0	0.0	29	0.0	0.0
	Watana-2							2	5.0	7.1										2	0.0	0.0	1	10.0	-	2	25.0	21.2	6	0.0	0.0	5	2.0	4.5	18	4.4	9.8
	Watana-1				1	0.0	-	1	0.0	-										2	0.0	0.0	6	3.3	8.2				17	0.0	0.0	12	0.8	2.9	39	0.8	3.5
Unnamed 194.8	194.8-4																						6	0.0	0.0							4	0.0	0.0	10	0.0	0.0
	194.8-3				2	0.0	0.0	2	0.0	0.0	2	0.0	0.0										9	0.0	0.0	3	0.0	0.0	1	0.0	-	6	0.0	0.0	25	0.0	0.0
	194.8-1							2	0.0	0.0													1	0.0	-										3	0.0	0.0
Deadman Creek	Deadman-6																											6	0.0	0.0	5	0.0	0.0	11	0.0	0.0
	Deadman-5							5	0.0	0.0															5	0.0	0.0							10	0.0	0.0
	Deadman-4							5	0.0	0.0															5	0.0	0.0				4	0.0	0.0	14	0.0	0.0
	Deadman-3							6	0.0	0.0	5	0.0	0.0	1	20.0	-									6	1.7	4.1				2	5.0	7.1	20	2.0	5.2
	Deadman-1										1	10.0	-										1	20.0	-	1	0.0	-							3	10.0	10.0
Total[1]		**3**	**0.0**	**0.0**	**3**	**0.0**	**0.0**	**112**	**0.1**	**0.9**	**59**	**0.3**	**1.4**	**2**	**10.0**	**14.1**				**10**	**0.0**	**0.0**	**48**	**1.5**	**5.0**	**64**	**0.9**	**5.3**	**139**	**0.1**	**0.8**	**208**	**0.6**	**3.1**	**648**	**0.5**	**3.0**

Table 5.1-12. Mean (±SD) percent boulder substrate in mesohabitat units of Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Oshetna River	Oshetna-3							5	54.0	13.4																		6	20.0	27.6	7	12.9	16.0	18	26.7	25.9
	Oshetna-2																																			
	Oshetna-1							5	72.0	8.4																		4	27.5	22.2	2	46.8	18.7	11	51.2	25.6
Black River	Black-3							5	46.0	15.2															2	45.0	21.2	5	34.0	11.4	5	50.0	7.1	17	43.5	13.2
	Black-2							7	58.6	10.7															1	50.0	-	3	30.0	20.0	6	26.7	12.1	17	41.8	19.4
	Black-1							4	57.5	15.0													1	30.0	-				5	35.8	18.5	5	34.0	18.2	15	40.6	18.8
Goose Creek	Goose-3							5	20.0	7.1																		1	0.0	-	6	11.7	7.5	12	14.2	9.0
	Goose-2							5	54.0	5.5	3	70.0	10.0																	5	48.0	14.8	13	55.4	13.3
	Goose-1							7	54.3	9.8	1	80.0	-												4	57.5	25.0				5	34.0	24.1	17	50.6	21.4
Proposed reservoir full pool																																				
Unnamed 230.2	NA										1	35.0	-																				1	35.0	-
Unnamed 230.1	NA										3	90.0	10.0										3	29.1	5.2	1	70.0	-						7	61.1	31.4
Unnamed 228.5	NA										3	31.7	15.3													5	22.0	5.7	1	5.0	-	3	6.7	2.9	12	19.2	12.8
Unnamed 226.2	NA																																			
Unnamed 219.6	NA																											4	27.2	24.2				4	27.2	24.2
Unnamed 214.4	NA										1	0.0	-																				1	0.0	-
Jay Creek	Jay-4	1	10.0	-																			5	10.0	17.3				5	12.0	11.0	6	6.7	10.3	17	9.4	12.0
	Jay-3							5	44.0	15.2													3	3.3	5.8				2	10.0	14.1	7	12.9	13.8	17	20.0	20.3
	Jay-2							5	36.0	8.9																6	35.0	10.5	4	27.5	9.6	5	30.0	18.7	20	32.5	12.1
	Jay-1							3	23.3	5.8	1	40.0	-										1	0.0	-	2	30.0	14.1	1	40.0	-	11	27.3	20.0	15	28.0	17.8	34	27.4	17.3
Tsisi Creek	Tsisi-2																											5	22.0	8.4	5	20.0	7.1	10	21.0	7.4
	Tsisi-1							8	45.0	9.3																6	50.0	8.9				1	20.0	-	15	45.3	11.3
Kosina Creek	Kosina-3																			2	0.0	0.0	2	0.0	0.0				4	45.0	12.9	26	33.8	18.6	34	31.2	20.6
	Kosina-2										1	50.0	-							2	25.0	21.2	1	70.0	-	5	72.0	11.0	17	48.2	13.3	16	50.0	10.3	42	51.2	15.2
	Kosina-1																						2	45.0	21.2				14	42.1	11.9	13	47.7	14.8	29	44.8	13.5
Unnamed 208.6	NA										1	10.0	-																				1	10.0	-
Unnamed 207.4 RB-1	207.4 RB-1																																			
Unnamed 207.4	NA										6	22.5	24.0																				6	22.5	24.0
Unnamed 206.3	206.3-3										1	80.0	-															2	5.0	7.1	1	10.0	-	4	25.0	37.0
	206.3-1							4	22.5	5.0	6	28.3	7.5															1	20.0	-	1	20.0	-	12	25.0	6.7
Unnamed 204.5	204.5-2										1	65.0	-																				1	65.0	-
	204.5-1							3	26.7	5.8	7	58.6	29.5															1	0.0	-	1	0.0	-	12	40.8	32.3
Unnamed 198.9	NA										1	65.0	-																				1	65.0	-
Unnamed 198.4 LB-1	NA													1	10.0	-																		1	10.0	-
Unnamed 197.7	197.7-3										2	95.0	7.1																	2	85.0	0.0	4	90.0	7.1
	197.7-2										3	70.0	26.5															1	0.0	-				4	52.5	41.1
	197.7-1							2	25.0	7.1	3	25.0	8.7										2	2.5	3.5	3	53.3	25.2	1	5.0	-	1	10.0	-	12	25.4	22.4
Unnamed 197.7 RB-1	NA										3	36.7	32.1													1	40.0	-							4	37.5	26.3
Watana Creek Trib	Watana Trib-2							3	50.0	26.5																2	30.0	42.4				5	10.0	7.1	10	26.0	26.7
	Watana Trib-1																			1	0.0	-	1	30.0	-	2	40.0	14.1	2	35.0	7.1	8	16.3	11.9	14	22.1	15.3
Watana Cr. LB-1.1.1	NA																						1	40.0	-				2	47.4	67.0	2	17.5	17.7	5	33.9	37.9
Watana Cr. RB-1	NA										3	0.0	0.0										1	0.0	-				4	0.0	0.0	4	0.0	0.0	12	0.0	0.0
Watana Creek	Watana-3	2	10.0	0.0				13	45.4	9.7																3	50.0	0.0	4	25.0	5.8	7	17.1	16.0	29	33.8	17.6
	Watana-2							2	50.0	0.0										2	5.0	7.1	1	10.0	-	2	45.0	7.1	6	11.7	13.3	5	20.0	7.1	18	21.1	17.5
	Watana-1				1	0.0	-	1	50.0	-										2	0.0	0.0	6	6.7	8.2				17	7.1	9.2	12	15.0	11.7	39	10.0	12.1
Unnamed 194.8	194.8-4																						6	8.3	7.5							4	20.0	11.5	10	13.0	10.6
	194.8-3				2	5.0	7.1	2	75.0	7.1	2	70.0	14.1										9	18.9	20.9	3	46.7	35.1	1	0.0	-	6	16.7	16.3	25	28.4	28.8
	194.8-1							2	15.0	0.0													1	5.0	-										3	11.7	5.8
Deadman Creek	Deadman-6																												6	25.0	23.5	5	8.0	8.4	11	17.3	19.5
	Deadman-5							5	52.0	8.4																5	56.0	5.5							10	54.0	7.0
	Deadman-4							5	44.0	5.5																5	54.0	15.2				4	16.1	12.5	14	39.6	19.3
	Deadman-3							6	53.3	10.3	5	77.0	12.0	1	70.0	-										6	60.0	6.3				2	60.0	14.1	20	62.8	12.9
	Deadman-1										1	90.0	-										1	40.0	-	1	85.0	-							3	71.7	27.5
Total[1]		**3**	**10.0**	**0.0**	**3**	**3.3**	**5.8**	**112**	**46.2**	**16.4**	**59**	**49.4**	**31.2**	**2**	**40.0**	**42.4**				**10**	**6.0**	**12.6**	**48**	**16.4**	**18.5**	**64**	**49.6**	**19.0**	**139**	**26.0**	**21.1**	**208**	**27.0**	**20.5**	**648**	**33.1**	**23.9**

Table 5.1-13. Mean (±SD) percent cobble substrate in mesohabitat units of Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Oshetna River	Oshetna-3							5	34.0	11.4																		6	58.3	19.4	7	47.1	18.0	18	47.2	18.7
	Oshetna-2																																				
	Oshetna-1							5	22.0	4.5																		4	60.0	14.1	2	47.2	10.2	11	40.4	20.3
Black River	Black-3							5	40.0	12.2															2	45.0	21.2	5	48.0	8.4	5	38.0	8.4	17	42.4	10.9
	Black-2							7	34.3	12.7															1	40.0	-	3	56.7	15.3	6	50.0	16.7	17	44.1	16.2
	Black-1							4	30.0	14.1													1	10.0	-				5	39.3	17.8	5	48.0	19.2	15	37.8	18.7
Goose Creek	Goose-3							5	28.0	17.9																		1	20.0	-	6	30.0	16.7	12	28.3	15.9
	Goose-2							5	30.0	7.1	3	23.3	5.8																	5	34.0	11.4	13	30.0	9.1
	Goose-1							7	27.1	4.9	1	20.0	-												4	35.0	17.3				5	26.0	5.5	17	28.2	9.5
Proposed reservoir full pool																																					
Unnamed 230.2	NA										1	45.0	-																					1	45.0	-
Unnamed 230.1	NA										3	5.0	5.0										3	4.2	5.2	1	10.0	-						7	5.4	4.6
Unnamed 228.5	NA										3	45.0	8.7													5	58.0	16.0	1	50.0	-	3	65.0	18.0	12	55.8	15.1
Unnamed 226.2	NA																																				
Unnamed 219.6	NA																											4	36.5	5.0				4	36.5	5.0
Unnamed 214.4	NA										1	70.0	-																				1	70.0	-
Jay Creek	Jay-4	1	0.0	-																			5	34.0	13.4				5	50.0	17.3	6	46.7	27.3	17	41.2	22.6
	Jay-3							5	28.0	8.4													3	33.3	11.5				2	55.0	21.2	7	34.3	12.7	17	34.7	13.7
	Jay-2							5	32.0	4.5															6	31.7	7.5	4	37.5	5.0	5	28.0	4.5	20	32.0	6.2
	Jay-1							3	53.3	11.5	1	60.0	-							1	40.0	-	2	10.0	0.0	1	40.0	-	11	40.9	15.1	15	44.0	14.5	34	42.1	15.9
Tsisi Creek	Tsisi-2																											5	50.0	7.1	5	46.0	5.5	10	48.0	6.3
	Tsisi-1							8	36.3	5.2																6	41.7	4.1				1	20.0	-	15	37.3	7.0
Kosina Creek	Kosina-3																			2	5.0	7.1	2	0.0	0.0				4	25.0	5.8	26	28.5	7.8	34	25.0	11.1
	Kosina-2										1	30.0	-							2	20.0	0.0	1	30.0	-	5	22.0	4.5	17	30.6	4.3	16	27.5	10.0	42	27.9	7.5
	Kosina-1																						2	30.0	14.1				14	40.0	9.6	13	36.2	7.7	29	37.6	9.1
Unnamed 208.6	NA										1	60.0	-																				1	60.0	-
Unnamed 207.4 RB-1	207.4 RB-1																																				
Unnamed 207.4	NA										6	17.5	5.2																					6	17.5	5.2
Unnamed 206.3	206.3-3										1	10.0	-															2	15.0	21.2	1	80.0	-	4	30.0	35.6
	206.3-1							4	45.0	5.8	6	30.0	12.6															1	30.0	-	1	50.0	-	12	36.7	12.3
Unnamed 204.5	204.5-2										1	0.0	-																				1	0.0	-
	204.5-1							3	20.0	10.0	7	20.7	19.0															1	0.0	-	1	5.0	-	12	17.5	16.3
Unnamed 198.9	NA										1	20.0	-																				1	20.0	-
Unnamed 198.4 LB-1	NA													1	40.0	-																		1	40.0	-
Unnamed 197.7	197.7-3										2	5.0	7.1																		2	15.0	0.0	4	10.0	7.1
	197.7-2										3	8.3	7.6															1	5.0	-				4	7.5	6.5
	197.7-1							2	45.0	0.0	3	66.7	5.8										2	37.5	10.6	3	36.7	20.8	1	70.0	-	1	40.0	-	12	48.8	17.2
Unnamed 197.7 RB-1	NA										3	21.7	2.9													1	45.0	-						4	27.5	11.9
Watana Creek Trib	Watana Trib-2							3	33.3	15.3																2	30.0	28.3				5	26.0	16.7	10	29.0	16.6
	Watana Trib-1																			1	10.0	-	1	30.0	-	2	40.0	14.1	2	40.0	0.0	8	43.8	10.6	14	39.3	12.7
Watana Cr. LB-1.1.1	NA																						1	0.0	-				2	5.0	7.1	2	17.5	24.7	5	9.0	15.2
Watana Cr. RB-1	NA										3	0.0	0.0										1	0.0	-				4	2.8	3.3	4	2.5	2.9	12	1.8	2.6
Watana Creek	Watana-3	2	15.0	21.2				13	26.9	6.0																3	30.0	0.0	4	42.5	5.0	7	32.9	22.1	29	30.0	13.6
	Watana-2							2	25.0	7.1										2	20.0	0.0	1	30.0	-	2	25.0	7.1	6	36.7	15.1	5	38.0	4.5	18	32.2	11.1
	Watana-1				1	0.0	-	1	30.0	-										2	0.0	0.0	6	28.3	22.3				17	52.4	20.8	12	48.3	19.9	39	42.8	24.4
Unnamed 194.8	194.8-4																						6	6.7	12.1							4	5.0	5.8	10	6.0	9.7
	194.8-3				2	0.0	0.0	2	5.0	7.1	2	15.0	7.1										9	7.8	9.7	3	30.0	10.0	1	0.0	-	6	26.7	23.4	25	14.4	16.6
	194.8-1							2	45.0	21.2													1	30.0	-										3	40.0	17.3
Deadman Creek	Deadman-6																												6	33.3	17.5	5	8.0	8.4	11	21.8	18.9
	Deadman-5							5	36.0	5.5																5	36.0	5.5							10	36.0	5.2
	Deadman-4							5	36.0	8.9																5	36.0	8.9				4	28.9	13.2	14	34.0	10.0
	Deadman-3							6	26.7	10.3	5	13.0	7.6	1	5.0	-										6	29.2	8.0				2	10.0	14.1	20	21.3	11.9
	Deadman-1										1	0.0	-										1	10.0	-	1	10.0	-							3	6.7	5.8
Total[1]		**3**	**10.0**	**17.3**	**3**	**0.0**	**0.0**	**112**	**31.7**	**11.5**	**59**	**23.1**	**19.8**	**2**	**22.5**	**24.7**				**10**	**14.0**	**12.6**	**48**	**17.9**	**16.9**	**64**	**34.8**	**13.7**	**139**	**39.7**	**18.5**	**208**	**34.3**	**17.9**	**648**	**32.2**	**18.1**

Table 5.1-14. Mean (±SD) percent gravel substrate in mesohabitat units of Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Oshetna River	Oshetna-3							5	12.0	4.5																		6	21.7	11.7	7	38.6	23.4	18	25.6	19.2
	Oshetna-2																																				
	Oshetna-1							5	6.0	5.5																		4	12.5	12.6	2	6.0	8.5	11	8.4	8.8
Black River	Black-3							5	10.0	7.1															2	10.0	0.0	5	16.0	8.9	5	8.0	4.5	17	11.2	7.0
	Black-2							7	7.1	4.9															1	10.0	-	3	10.0	0.0	6	13.3	8.2	17	10.0	6.1
	Black-1							4	10.0	0.0													1	50.0	-				5	17.0	18.6	5	16.0	19.5	15	17.0	17.3
Goose Creek	Goose-3							5	34.0	16.7																		1	70.0	-	6	33.3	22.5	12	36.7	21.0
	Goose-2							5	12.0	4.5	3	6.7	5.8																	5	10.0	7.1	13	10.0	5.8
	Goose-1							7	15.7	9.8	1	0.0	-												4	7.5	9.6				5	36.0	27.0	17	18.8	19.6
Proposed reservoir full pool																																					
Unnamed 230.2	NA										1	15.0	-																					1	15.0	-
Unnamed 230.1	NA										3	5.0	5.0										3	51.6	17.5	1	20.0	-						7	27.1	25.8
Unnamed 228.5	NA										3	21.7	15.3													5	20.0	14.1	1	45.0	-	3	28.3	15.3	12	24.6	14.5
Unnamed 226.2	NA																																				
Unnamed 219.6	NA																											4	20.5	8.9				4	20.5	8.9
Unnamed 214.4	NA										1	30.0	-																				1	30.0	-
Jay Creek	Jay-4	1	0.0	-																			5	40.0	15.8				5	36.0	16.7	6	43.3	30.8	17	37.6	23.1
	Jay-3							5	22.0	8.4													3	33.3	11.5				2	35.0	7.1	7	35.7	16.2	17	31.2	13.2
	Jay-2							5	18.0	8.4																6	23.3	5.2	4	27.5	5.0	5	38.0	11.0	20	26.5	10.4
	Jay-1							3	16.7	11.5	1	0.0	-							1	0.0	-	2	0.0	0.0	1	20.0	-	11	28.2	14.7	15	23.3	11.1	34	21.5	14.2
Tsisi Creek	Tsisi-2																											5	22.0	8.4	5	20.0	0.0	10	21.0	5.7
	Tsisi-1							8	15.0	9.3																6	8.3	9.8				1	20.0	-	15	12.7	9.6
Kosina Creek	Kosina-3																			2	25.0	21.2	2	50.0	0.0				4	17.5	9.6	26	21.2	11.4	34	22.6	13.1
	Kosina-2										1	20.0	-							2	30.0	14.1	1	0.0	-	5	6.0	8.9	17	17.1	8.5	16	12.5	10.0	42	14.3	10.4
	Kosina-1																						2	20.0	0.0				14	17.9	8.0	13	16.2	9.6	29	17.2	8.4
Unnamed 208.6	NA										1	30.0	-																				1	30.0	-
Unnamed 207.4 RB-1	207.4 RB-1																																				
Unnamed 207.4	NA										6	40.0	18.2																					6	40.0	18.2
Unnamed 206.3	206.3-3										1	10.0	-															2	50.0	0.0	1	10.0	-	4	30.0	23.1
	206.3-1							4	20.0	0.0	6	21.7	7.5															1	30.0	-	1	20.0	-	12	21.7	5.8
Unnamed 204.5	204.5-2										1	15.0	-																				1	15.0	-
	204.5-1							3	31.7	7.6	7	12.9	8.1															1	65.0	-	1	15.0	-	12	22.1	17.2
Unnamed 198.9	NA										1	15.0	-																				1	15.0	-
Unnamed 198.4 LB-1	NA													1	30.0	-																		1	30.0	-
Unnamed 197.7	197.7-3										2	0.0	0.0																				2	0.0	0.0	4	0.0	0.0
	197.7-2										3	21.7	24.7															1	90.0	-				4	38.8	39.7
	197.7-1							2	25.0	7.1	3	8.3	7.6										2	35.0	7.1	3	8.3	10.4	1	25.0	-	1	40.0	-	12	19.6	14.1
Unnamed 197.7 RB-1	NA										3	35.0	31.2													1	10.0	-							4	28.8	28.4
Watana Creek Trib	Watana Trib-2							3	16.7	11.5																2	25.0	7.1				5	52.0	13.0	10	36.0	20.1
	Watana Trib-1																			1	0.0	-	1	20.0	-	2	20.0	0.0	2	25.0	7.1	8	30.0	14.1	14	25.0	13.4
Watana Cr. LB-1.1.1	NA																						1	0.0	-				2	20.0	28.3	2	0.0	0.0	5	8.0	17.9
Watana Cr. RB-1	NA										3	5.0	5.0										1	20.0	-				4	28.1	35.6	4	27.5	36.6	12	21.5	28.6
Watana Creek	Watana-3	2	5.0	7.1				13	27.7	7.0																3	20.0	0.0	4	32.5	5.0	7	47.1	25.6	29	30.7	17.3
	Watana-2							2	20.0	0.0										2	30.0	14.1	1	40.0	-	2	5.0	7.1	6	41.7	16.0	5	34.0	11.4	18	31.7	16.2
	Watana-1				1	0.0	-	1	20.0	-										2	20.0	28.3	6	40.0	17.9				17	34.7	15.9	12	29.2	19.3	39	31.8	18.2
Unnamed 194.8	194.8-4																						6	20.0	11.0							4	40.0	14.1	10	28.0	15.5
	194.8-3				2	35.0	7.1	2	5.0	7.1	2	10.0	14.1										9	22.2	22.8	3	16.7	15.3	1	90.0	-	6	33.3	24.2	25	25.6	24.3
	194.8-1							2	40.0	21.2													1	60.0	-										3	46.7	18.9
Deadman Creek	Deadman-6																												6	30.0	17.9	5	24.0	33.6	11	27.3	24.9
	Deadman-5							5	10.0	0.0																5	8.0	4.5							10	9.0	3.2
	Deadman-4							5	14.0	13.4																5	4.0	5.5				4	26.1	7.3	14	13.9	12.7
	Deadman-3							6	8.3	4.1	5	7.0	2.7	1	0.0	-										6	5.8	4.9				2	5.0	7.1	20	6.5	4.3
	Deadman-1										1	0.0	-										1	30.0	-	1	5.0	-							3	11.7	16.1
Total[1]		**3**	**3.3**	**5.8**	**3**	**23.3**	**20.8**	**112**	**16.9**	**11.3**	**59**	**16.3**	**16.0**	**2**	**15.0**	**21.2**				**10**	**21.0**	**17.9**	**48**	**30.1**	**19.7**	**64**	**12.0**	**9.9**	**139**	**26.7**	**17.6**	**208**	**25.3**	**19.2**	**648**	**22.2**	**17.5**

Table 5.1-15. Mean (±SD) percent and and silt substrate in mesohabitat units of Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Oshetna River	Oshetna-3							5	0.0	0.0																		6	0.0	0.0	7	1.4	3.8	18	0.6	2.4
	Oshetna-2																																				
	Oshetna-1							5	0.0	0.0																		4	0.0	0.0	2	0.0	0.0	11	0.0	0.0
Black River	Black-3							5	0.0	0.0															2	0.0	0.0	5	0.0	0.0	5	0.0	0.0	17	0.0	0.0
	Black-2							7	0.0	0.0															1	0.0	-	3	3.3	5.8	6	8.3	11.7	17	3.5	7.9
	Black-1							4	0.0	0.0													1	10.0	-				5	4.0	5.5	5	0.0	0.0	15	2.0	4.1
Goose Creek	Goose-3							5	12.0	8.4																		1	10.0	-	6	21.7	7.5	12	16.7	8.9
	Goose-2							5	4.0	5.5	3	0.0	0.0																5	4.0	5.5	13	3.1	4.8
	Goose-1							7	2.9	4.9	1	0.0	-												4	0.0	0.0				5	4.0	5.5	17	2.4	4.4
Proposed reservoir full pool																																					
Unnamed 230.2	NA										1	5.0	-																					1	5.0	-
Unnamed 230.1	NA										3	0.0	0.0										3	15.0	15.0	1	0.0	-					7	6.4	11.8
Unnamed 228.5	NA										3	1.7	2.9													5	0.0	0.0	1	0.0	-	3	0.0	0.0	12	0.4	1.4
Unnamed 226.2	NA																																				
Unnamed 219.6	NA																											4	15.9	16.6				4	15.9	16.6
Unnamed 214.4	NA										1	0.0	-																					1	0.0	-
Jay Creek	Jay-4	1	90.0	-																			5	14.0	16.7				5	2.0	4.5	6	3.3	5.2	17	11.2	22.9
	Jay-3							5	4.0	5.5													3	20.0	10.0				2	0.0	0.0	7	11.4	13.5	17	9.4	11.4
	Jay-2							5	14.0	5.5																6	8.3	4.1	4	7.5	5.0	5	4.0	5.5	20	8.5	5.9
	Jay-1							3	6.7	5.8	1	0.0	-							1	60.0	-	2	60.0	14.1	1	0.0	-	11	3.6	6.7	15	4.7	6.4	34	9.1	17.3
Tsisi Creek	Tsisi-2																											5	2.0	4.5	5	6.0	5.5	10	4.0	5.2
	Tsisi-1							8	1.3	3.5																6	0.0	0.0				1	30.0	-	15	2.7	8.0
Kosina Creek	Kosina-3																			2	45.0	35.4	2	50.0	0.0				4	12.5	5.0	26	16.5	12.6	34	19.7	16.4
	Kosina-2										1	0.0	-							2	20.0	14.1	1	0.0	-	5	0.0	0.0	17	3.5	7.9	16	5.0	8.2	42	4.3	8.3
	Kosina-1																						2	5.0	7.1				14	0.0	0.0	13	0.0	0.0	29	0.3	1.9
Unnamed 208.6	NA										1	0.0	-																					1	0.0	-
Unnamed 207.4 RB-1	207.4 RB-1																																				
Unnamed 207.4	NA										6	20.0	13.8																					6	20.0	13.8
Unnamed 206.3	206.3-3										1	0.0	-															2	30.0	14.1	1	0.0	-	4	15.0	19.1
	206.3-1							4	10.0	0.0	6	18.3	11.7															1	20.0	-	1	10.0	-	12	15.0	9.0
Unnamed 204.5	204.5-2										1	15.0	-																					1	15.0	-
	204.5-1							3	21.7	7.6	7	7.9	7.0															1	25.0	-	1	80.0	-	12	18.8	21.4
Unnamed 198.9	NA										1	0.0	-																					1	0.0	-
Unnamed 198.4 LB-1	NA													1	10.0	-																			1	10.0	-
Unnamed 197.7	197.7-3										2	0.0	0.0																				2	0.0	0.0	4	0.0	0.0
	197.7-2										3	0.0	0.0															1	5.0	-					4	1.3	2.5
	197.7-1							2	5.0	0.0	3	0.0	0.0										2	25.0	7.1	3	1.7	2.9	1	0.0	-	1	10.0	-	12	6.3	9.6
Unnamed 197.7 RB-1	NA										3	6.7	2.9													1	5.0	-							4	6.3	2.5
Watana Creek Trib	Watana Trib-2							3	0.0	0.0																2	15.0	7.1				5	12.0	4.5	10	9.0	7.4
	Watana Trib-1																			1	90.0	-	1	0.0	-	2	0.0	0.0	2	0.0	0.0	8	8.8	6.4	14	11.4	23.5
Watana Cr. LB-1.1.1	NA																						1	60.0	-				2	15.1	14.0	2	52.5	53.0	5	39.1	35.2
Watana Cr. RB-1	NA										3	40.0	13.2										1	80.0	-				4	44.1	27.9	4	52.5	33.0	12	48.9	25.8
Watana Creek	Watana-3	2	70.0	28.3				13	0.0	0.0																3	0.0	0.0	4	0.0	0.0	7	2.9	4.9	29	5.5	18.8
	Watana-2							2	0.0	0.0										2	30.0	14.1	1	10.0	-	2	0.0	0.0	6	10.0	12.6	5	6.0	5.5	18	8.9	11.8
	Watana-1				1	50.0	-	1	0.0	-										2	55.0	7.1	6	21.7	9.8				17	5.9	11.8	12	6.7	7.8	39	12.1	16.4
Unnamed 194.8	194.8-4																						6	35.0	17.6							4	22.5	5.0	10	30.0	14.9
	194.8-3				2	35.0	7.1	2	15.0	7.1	2	5.0	7.1										9	35.6	8.8	3	6.7	11.5	1	10.0	-	6	23.3	10.3	25	24.0	14.4
	194.8-1							2	0.0	0.0													1	5.0	-										3	1.7	2.9
Deadman Creek	Deadman-6																												6	11.7	4.1	5	60.0	33.9	11	33.6	33.2
	Deadman-5							5	2.0	4.5																5	0.0	0.0							10	1.0	3.2
	Deadman-4							5	6.0	5.5																5	6.0	5.5				4	28.9	30.0	14	12.5	18.5
	Deadman-3							6	11.7	7.5	5	3.0	4.5	1	5.0	-										6	3.3	5.2				2	20.0	0.0	20	7.5	7.7
	Deadman-1										1	0.0	-										1	0.0	-	1	0.0	-							3	0.0	0.0
Total[1]		**3**	**76.7**	**23.1**	**3**	**40.0**	**10.0**	**112**	**4.2**	**6.7**	**59**	**8.1**	**12.3**	**2**	**7.5**	**3.5**				**10**	**45.0**	**25.5**	**48**	**26.7**	**20.0**	**64**	**2.5**	**5.0**	**139**	**6.2**	**11.7**	**208**	**11.3**	**17.5**	**648**	**9.9**	**16.4**

Table 5.1-16. Mean (±SD) percent organic substrate in mesohabitat units of Upper River tributaries.

Tributary Name	Geomorphic Reach	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Oshetna River	Oshetna-3							5	0.0	0.0																		6	0.0	0.0	7	0.0	0.0	18	0.0	0.0
	Oshetna-2																																				
	Oshetna-1							5	0.0	0.0																		4	0.0	0.0	2	0.0	0.0	11	0.0	0.0
Black River	Black-3							5	4.0	5.5															2	0.0	0.0	5	2.0	4.5	5	4.0	5.5	17	2.9	4.7
	Black-2							7	0.0	0.0															1	0.0	-	3	0.0	0.0	6	1.7	4.1	17	0.6	2.4
	Black-1							4	2.5	5.0													1	0.0	-				5	4.0	5.5	5	2.0	4.5	15	2.7	4.6
Goose Creek	Goose-3							5	6.0	5.5																		1	0.0	-	6	3.3	5.2	12	4.2	5.1
	Goose-2							5	0.0	0.0	3	0.0	0.0																	5	4.0	5.5	13	1.5	3.8
	Goose-1							7	0.0	0.0	1	0.0	-												4	0.0	0.0				5	0.0	0.0	17	0.0	0.0
Proposed reservoir full pool																																					
Unnamed 230.2	NA										1	0.0	-																				1	0.0	-
Unnamed 230.1	NA										3	0.0	0.0										3	0.0	0.0	1	0.0	-				7	0.0	0.0
Unnamed 228.5	NA										3	0.0	0.0													5	0.0	0.0	1	0.0	-	3	0.0	0.0	12	0.0	0.0
Unnamed 226.2	NA																																				
Unnamed 219.6	NA																											4	0.0	0.0				4	0.0	0.0
Unnamed 214.4	NA										1	0.0	-																				1	0.0	-
Jay Creek	Jay-4	1	0.0	-																			5	2.0	4.5				5	0.0	0.0	6	0.0	0.0	17	0.6	2.4
	Jay-3							5	2.0	4.5													3	10.0	17.3				2	0.0	0.0	7	5.7	15.1	17	4.7	11.8
	Jay-2							5	0.0	0.0																6	1.7	4.1	4	0.0	0.0	5	0.0	0.0	20	0.5	2.2
	Jay-1							3	0.0	0.0	1	0.0	-										1	0.0	-	2	0.0	0.0	1	0.0	-	11	0.0	0.0	15	0.0	0.0	34	0.0	0.0
Tsisi Creek	Tsisi-2																											5	4.0	5.5	5	8.0	4.5	10	6.0	5.2
	Tsisi-1							8	2.5	4.6																6	0.0	0.0				1	10.0	-	15	2.0	4.1
Kosina Creek	Kosina-3																			2	25.0	21.2	2	0.0	0.0				4	0.0	0.0	26	0.0	0.0	34	1.5	7.0
	Kosina-2										1	0.0	-							2	5.0	7.1	1	0.0	-	5	0.0	0.0	17	0.0	0.0	16	0.0	0.0	42	0.2	1.5
	Kosina-1																						2	0.0	0.0				14	0.0	0.0	13	0.0	0.0	29	0.0	0.0
Unnamed 208.6	NA										1	0.0	-																				1	0.0	-
Unnamed 207.4 RB-1	207.4 RB-1																																				
Unnamed 207.4	NA										6	0.0	0.0																				6	0.0	0.0
Unnamed 206.3	206.3-3										1	0.0	-															2	0.0	0.0	1	0.0	-	4	0.0	0.0
	206.3-1							4	2.5	5.0	6	1.7	4.1															1	0.0	-	1	0.0	-	12	1.7	3.9
Unnamed 204.5	204.5-2										1	0.0	-																				1	0.0	-
	204.5-1							3	0.0	0.0	7	0.0	0.0															1	10.0	-	1	0.0	-	12	0.8	2.9
Unnamed 198.9	NA										1	0.0	-																				1	0.0	-
Unnamed 198.4 LB-1	NA													1	10.0	-																		1	10.0	-
Unnamed 197.7	197.7-3										2	0.0	0.0																	2	0.0	0.0	4	0.0	0.0
	197.7-2										3	0.0	0.0															1	0.0	-				4	0.0	0.0
	197.7-1							2	0.0	0.0	3	0.0	0.0										2	0.0	0.0	3	0.0	0.0	1	0.0	-	1	0.0	-	12	0.0	0.0
Unnamed 197.7 RB-1	NA										3	0.0	0.0													1	0.0	-							4	0.0	0.0
Watana Creek Trib	Watana Trib-2							3	0.0	0.0																2	0.0	0.0				5	0.0	0.0	10	0.0	0.0
	Watana Trib-1																			1	0.0	-	1	0.0	-	2	0.0	0.0	2	0.0	0.0	8	0.0	0.0	14	0.0	0.0
Watana Cr. LB-1.1.1	NA																						1	0.0	-				2	12.5	17.7	2	12.5	10.6	5	10.0	11.7
Watana Cr. RB-1	NA										3	55.0	13.2										1	0.0	-				4	25.0	20.8	4	17.5	35.0	12	27.9	28.2
Watana Creek	Watana-3	2	0.0	0.0				13	0.0	0.0																3	0.0	0.0	4	0.0	0.0	7	0.0	0.0	29	0.0	0.0
	Watana-2							2	0.0	0.0										2	15.0	21.2	1	0.0	-	2	0.0	0.0	6	0.0	0.0	5	0.0	0.0	18	1.7	7.1
	Watana-1				1	50.0	-	1	0.0	-										2	25.0	35.4	6	0.0	0.0				17	0.0	0.0	12	0.0	0.0	39	2.6	11.2
Unnamed 194.8	194.8-4																						6	30.0	30.3							4	12.5	5.0	10	23.0	24.5
	194.8-3				2	25.0	7.1	2	0.0	0.0	2	0.0	0.0										9	15.6	14.2	3	0.0	0.0	1	0.0	-	6	0.0	0.0	25	7.6	12.3
	194.8-1							2	0.0	0.0													1	0.0	-										3	0.0	0.0
Deadman Creek	Deadman-6																												6	0.0	0.0	5	0.0	0.0	11	0.0	0.0
	Deadman-5							5	0.0	0.0																5	0.0	0.0							10	0.0	0.0
	Deadman-4							5	0.0	0.0																5	0.0	0.0				4	0.0	0.0	14	0.0	0.0
	Deadman-3							6	0.0	0.0	5	0.0	0.0	1	0.0	-										6	0.0	0.0				2	0.0	0.0	20	0.0	0.0
	Deadman-1										1	0.0	-										1	0.0	-	1	0.0	-							3	0.0	0.0
Total[1]		**3**	**0.0**	**0.0**	**3**	**33.3**	**15.3**	**112**	**0.9**	**2.9**	**59**	**3.0**	**12.5**	**2**	**5.0**	**7.1**				**10**	**14.0**	**19.0**	**48**	**7.5**	**16.0**	**64**	**0.2**	**1.3**	**139**	**1.3**	**5.9**	**208**	**1.5**	**6.4**	**648**	**2.2**	**8.4**

Table 5.1-17. Mean (±SD) percent instream cover in mesohabitat units of Upper River tributaries.

Tributary Name	Geomorphic Reach	Aquatic Vegetation			Boulder			Cobble			Depth			Insufficient Cover			Overhanging Vegetation			Undercut Bank			Woody Debris			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
Oshetna River	Oshetna-3				4	45.0	23.8	3	33.3	20.8	3	33.3	25.2	7	0.0	0.0	1	10.0	-				1	10.0	-	19	21.1	24.0
	Oshetna-2													6	0.0	0.0										6	0.0	0.0
	Oshetna-1				4	57.5	12.6	1	0.0	-				6	0.0	0.0										11	20.9	29.8
Black River	Black-3				10	16.0	7.0							7	0.0	0.0										17	9.4	9.7
	Black-2				15	32.0	9.4							1	0.0	-	1	10.0	-							17	28.8	12.7
	Black-1				7	16.4	7.5				2	40.0	28.3	6	0.0	0.0										15	13.0	16.2
Goose Creek	Goose-3				5	24.0	11.4										6	10.0	0.0	1	10.0	-				12	15.8	10.0
	Goose-2				13	44.6	12.7																			13	44.6	12.7
	Goose-1				14	32.1	12.5				1	10.0	-	1	0.0	-	2	15.0	7.1							18	27.2	14.9
Unnamed 230.2	NA													1	0.0	-										1	0.0	-
Unnamed 230.1	NA				4	72.8	24.2							2	0.0	0.0	1	100.0	-							7	55.9	43.0
Unnamed 228.5	NA				8	52.5	13.6	1	70.0	-													3	46.7	37.9	12	52.5	20.4
Unnamed 226.2	NA				2	15.0	7.1	1	20.0	-				1	0.0	-										4	12.5	9.6
Unnamed 219.6	NA							1	50.0	-																1	50.0	-
Unnamed 214.4	Jay-4										5	32.0	4.5	9	0.0	0.0	3	13.3	5.8							17	11.8	14.7
Jay Creek	Jay-3				5	42.0	13.0							1	0.0	-							1	10.0	-	7	31.4	21.2
	Jay-2				9	31.1	7.8							2	0.0	0.0	1	10.0	-				2	20.0	0.0	14	23.6	13.4
	Jay-1				5	16.0	5.5							4	0.0	0.0										9	8.9	9.3
	Tsisi-2				9	17.8	8.3										1	10.0	-							10	17.0	8.2
Tsisi Creek	Tsisi-1				14	49.3	8.3										1	10.0	-							15	46.7	12.9
	Kosina-3				7	23.6	14.9							5	0.0	0.0	8	11.9	5.3	1	10.0	-				21	12.9	12.6
Kosina Creek	Kosina-2				14	38.9	20.0										2	22.5	24.7							16	36.9	20.5
	NA													1	0.0	-										1	0.0	-
	NA				2	10.0	0.0	1	10.0	-				3	0.0	0.0										6	5.0	5.5
Unnamed 208.6	206.3-3																3	30.0	10.0				1	20.0	-	4	27.5	9.6
Unnamed 207.4 RB-1	206.3-1				7	21.4	6.9							2	0.0	0.0				3	26.7	5.8				12	19.2	10.8
Unnamed 207.4	204.5-2				1	20.0	-																			1	20.0	-
Unnamed 206.3	204.5-1				9	23.9	11.9							3	0.0	0.0										12	17.9	14.8
	NA				1	45.0	-																			1	45.0	-
Unnamed 204.5	NA																1	70.0	-							1	70.0	-
	197.7-3																4	100.0	0.0							4	100.0	0.0
Unnamed 198.9	197.7-2				3	26.7	5.8										1	10.0	-							4	22.5	9.6
Unnamed 198.4 LB-1	197.7-1				3	18.3	2.9	1	20.0	-	3	46.7	23.1				3	25.0	13.2				1	30.0	-	11	29.1	16.9
Unnamed 197.7	NA				3	31.7	2.9							1	0.0	-										4	23.8	16.0
	Watana Trib-2																10	84.0	16.5							10	84.0	16.5
	Watana Trib-1				3	10.0	0.0	1	40.0	-	2	15.0	7.1				7	25.7	16.2				1	30.0	-	14	22.1	14.2
Unnamed 197.7 RB-1	NA	1	10.0	-	3	48.3	27.5										1	60.0	-							5	43.0	27.3
Watana Creek Trib	NA													4	0.0	0.0	6	7.5	6.1				2	15.0	7.1	12	6.3	7.1
	Watana-3				14	15.0	6.5							4	0.0	0.0	11	24.5	28.1							29	16.6	19.1
Watana Cr. LB-1.1.1	Watana-2				7	12.9	4.9				1	30.0	-	4	0.0	0.0	4	48.8	39.2	1	20.0	-				17	19.7	25.2
Watana Cr. RB-1	Watana-1	1	40.0	-	3	13.3	5.8							8	0.0	0.0	1	5.0	-							13	6.5	11.8
Watana Creek	194.8-4				5	20.0	12.2							3	0.0	0.0				2	25.0	21.2				10	15.0	15.1
	194.8-3				4	42.5	20.6							1	0.0	-	8	20.0	10.7	11	18.2	7.5	1	20.0	-	25	22.0	14.4
	194.8-1				2	20.0	0.0																1	30.0	-	3	23.3	5.8
Unnamed 194.8	Deadman-6				3	33.3	23.1	2	25.0	7.1	1	70.0	-	4	0.0	0.0										10	22.0	25.3
	Deadman-5				10	42.0	7.9																			10	42.0	7.9
	Deadman-4				12	36.7	16.1	1	34.5	-	1	30.0	-													14	36.0	15.0
Deadman Creek	Deadman-3				18	38.3	14.3				1	80.0	-													19	40.5	16.9
	Deadman-1				2	80.0	0.0				1	70.0	-													3	76.7	5.8
	Total[1]	**2**	**25.0**	**21.2**	**264**	**32.2**	**18.0**	**13**	**30.3**	**19.6**	**21**	**38.1**	**21.8**	**97**	**0.0**	**0.0**	**87**	**32.4**	**32.3**	**19**	**19.5**	**9.1**	**14**	**25.7**	**19.9**	**517**	**25.7**	**23.3**

Table 5.1-18. Sum of length (m) surveyed and composition by length of riparian cover types along Upper River tributaries.

Tributary Name	Geomorphic Reach	Broadleaf Forest Closed			Broadleaf Forest Open			Conifer Forest Closed			Conifer Forest Open			None			Nonforest Herbaceous Other			Nonforest Shrub Alder			Nonforest Shrub Other			Nonforest Shrub Willow			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
Oshetna River	Oshetna-3													1	93	2%	16	2,182	56%	1	258	7%	7	1,032	27%	4	314	8%	29	3,879
	Oshetna-2																						6	1,078	100%				6	1,078
	Oshetna-1																9	1,960	51%	2	999	26%	4	714	18%	2	195	5%	17	3,868
Black River	Black-3																3	174	13%							14	1,194	87%	17	1,368
	Black-2																7	359	33%							10	744	67%	17	1,103
	Black-1																5	757	36%				1	31	1%	9	1,301	62%	15	2,089
Goose Creek	Goose-3																1	51	8%							11	558	92%	12	609
	Goose-2																4	427	37%				4	405	35%	5	327	28%	13	1,158
	Goose-1													5	163	12%	4	344	24%	2	218	16%				7	682	48%	18	1,407
Proposed reservoir full pool																														
Unnamed 230.2	NA																			1	54	100%							1	54
Unnamed 230.1	NA																			7	154	100%							7	154
Unnamed 228.5	NA	1	59	12%				3	84	17%	8	343	71%																12	485
Unnamed 226.2	NA	1	50	100%																									1	50
Unnamed 219.6	NA																			4	193	100%							4	193
Unnamed 214.4	NA																			1	224	100%							1	224
Jay Creek	Jay-4																5	192	38%							12	312	62%	17	503
	Jay-3							1	21	2%	1	40	4%				1	56	5%							14	948	89%	17	1,065
	Jay-2	2	162	9%													1	50	3%	4	498	29%				13	1,022	59%	20	1,732
	Jay-1				3	19	2%							1	21	2%				2	43	4%				28	994	92%	34	1,077
Tsisi Creek	Tsisi-2																									10	617	100%	10	617
	Tsisi-1																2	181	18%							13	835	82%	15	1,016
Kosina Creek	Kosina-3																5	-	-	1	-	-	2	135	6%	26	2,169	94%	34	2,304
	Kosina-2				1	262	6%				2	47	1%							8	514	13%				31	3,268	80%	42	4,091
	Kosina-1				10	433	30%				4	106	7%							7	537	37%				8	385	26%	29	1,461
Unnamed 208.6	NA	1	61	100%																									1	61
Unnamed 207.4	NA																			6	128	100%							6	128
Unnamed 206.3	206.3-3																									4	20	100%	4	20
	206.3-1							1	22	9%	1	40	16%							10	184	75%							12	246
Unnamed 204.5	204.5-2																			1	146	100%							1	146
	204.5-1																			12	423	100%							12	423
Unnamed 198.9	NA										1	63	100%																1	63
Unnamed 198.4 LB-1	NA																									1	46	100%	1	46
Unnamed 197.7	197.7-3																									4	76	100%	4	76
	197.7-2																			4	134	100%							4	134
	197.7-1										8	337	76%							3	102	23%				1	5	1%	12	443
Unnamed 197.7 RB-1	NA																			2	276	90%				2	31	10%	4	307
Watana Creek Trib	Watana Trib-2																									10	142	100%	10	142
	Watana Trib-1																3	96	17%							11	453	83%	14	549
Watana Cr. LB-1.1.1	NA																5	345	100%										5	345
Watana Creek RB-1	NA				2	28	18%													6	48	31%				4	81	52%	12	157
Watana Creek	Watana-3																						1	26	3%	27	932	97%	28	958
	Watana-2																			4	102	8%				14	1,117	92%	18	1,219
	Watana-1				1	11	0.40%	2	234	9%	1	47	2%	4	306	11%	4	316	12%	8	426	16%				18	1,396	51%	38	2,737
Unnamed 194.8	194.8-4													3	62	39%	6	91	57%							1	6	4%	10	159
	194.8-3																16	483	72%							9	185	28%	25	667
	194.8-1										3	382	100%																3	382
Deadman Creek	Deadman-6																10	1,892	94%							1	130	6%	11	2,022
	Deadman-5																									10	1,190	100%	10	1,190
	Deadman-4																4	999	36%	2	183	7%				8	1,568	57%	14	2,750
	Deadman-3																			9	1,347	57%				11	1,021	43%	20	2,368
	Deadman-1				3	504	100%																						3	504
Total[1]		**5**	**332**	**1%**	**20**	**1,257**	**3%**	**7**	**361**	**1%**	**29**	**1,404**	**3%**	**14**	**646**	**1%**	**111**	**10,953**	**22%**	**107**	**7,190**	**14%**	**25**	**3,421**	**7%**	**353**	**24,262**	**49%**	**671**	**49,825**

Table 5.1-19. Sample sizes and mean and standard deviation (sd) of mesohabitat length measurements in meters made among geomorphic reaches by macrohabitat in mainstem habitats surveyed.

Geo-morphic Reach	Focus Area	Macrohabitat	Backwater			Beaver Complex			Boulder Riffle			Cascade			Clearwater Plume			Dry			Unspecified			Pool			Puddled			Rapid			Riffle			Run/Glide			All Measured Units		
			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		n	Mean	SD	n	Mean	SD
UR-3	NA	Main Channel																													5	775	184	4	488	346	9	647	291
	NA	Side Slough																						1	41	-					1	6	-	1	11	-	3	19	19
	NA	Tributary Mouth										1	2	-															1	25	-	3	29	22				5	23	20
UR-4	NA	Main Channel																													3	988	688	2	577	386	5	824	570
	NA	Split Main Channel																													2	827	24	3	583	229	5	680	211
	NA	Side Channel																													2	571	55				2	571	55
	NA	Side Slough	4	86	86													2	100	57				3	54	21					6	51	25	8	212	254	23	118	164
	NA	Upland Slough																5	49	46				10	115	95	2	105	30		5	60	29	11	67	64	33	80	70
	NA	Tributary Mouth																1	43	-				1	5	-				1	34	-	4	19	21	1	7	-	8	21	19
UR-5	NA	Split Main Channel																																1	287	-	1	287	-
	NA	Side Channel													1	38	-														1	157	-	1	272	-	3	156	117
	NA	Tributary Mouth							1	6	-	1	12	-																							2	9	4
UR-6	NA	Main Channel																																2	3,611	4,366	2	3,611	4,366
	NA	Multi-Split Main Channel																													1	91	-	4	662	559	5	548	547
	NA	Split Main Channel																																2	1,053	60	2	1,053	60
	NA	Side Channel																													1	64	-	1	169	-	2	116	74
	NA	Side Slough	1	83	-													1	32	-				2	119	147	1	38	-					4	48	31	9	64	65
	NA	Upland Slough																						1	115	-					1	5	-	3	39	30	5	48	46
	NA	Tributary Mouth																													1	21	-				1	21	-
MR-2	NA	Main Channel													2	461	429														1	363	-	1	765	-	4	512	303
	NA	Side Slough	1	88	-																																1	88	-
	NA	Upland Slough																2	117	138				1	57	-											3	97	103
	NA	Tributary Mouth																												1	30	-	2	25	6				3	26	5
MR-3	NA	Main Channel																													1	410	-	1	3,676	-	2	2,043	2,309
	NA	Split Main Channel																																1	574	-	1	574	-
	NA	Side Channel													1	20	-																	1	485	-	2	252	329
	NA	Tributary Mouth																												1	25	-	1	9	-				2	17	11
MR-5	NA	Split Main Channel																																1	966	-	1	966	-
MR-6	NA	Main Channel													3	144	110														1	322	-	2	791	456	6	389	384
	NA	Multi-Split Main Channel	1	259	-																			1	125	-					2	71	44	3	395	335	7	244	248
	NA	Split Main Channel																			1	156	-								1	136	-	2	300	-	4	223	89
	NA	Side Channel													1	42	-				1	80	-								1	122	-	1	216	-	4	115	75
	NA	Side Slough	1	41	-													6	159	113				4	37	30	2	39	3				3	16	19	4	63	19	20	76	83
	NA	Upland Slough	4	152	57	6	321	271										2	223	290	2	215	218	1	64	-							2	33	25	4	100	62	21	188	191
	NA	Tributary Mouth																													2	29	33	1	74	-	3	44	35
MR-7	NA	Main Channel													1	25	-														1	495	-	5	562	366	7	476	360
	NA	Split Main Channel													1	198	-														2	348	55	1	502	-	4	349	128
	NA	Side Channel																													2	107	71	3	176	86	5	148	80
	NA	Side Slough				2	336	446										1	65	-	1	153	-	1	47	-	1	201	-				2	19	1	3	104	67	11	135	183
	NA	Upland Slough	2	61	34	2	122	78																2	36	25								4	50	13	10	64	44
	NA	Tributary Mouth																													1	12	-				1	12	-
MR-8	NA	Main Channel																																2	1,239	892	2	1,239	892
	NA	Multi-Split Main Channel	3	22	4																			1	11	-					4	72	36	9	441	671	17	255	517
	NA	Split Main Channel																																1	681	-	1	681	-
	NA	Side Channel																																1	114	-	1	114	-
	NA	Upland Slough	1	14	-																			1	99	-	1	7	-							1	9	-	4	32	44
Total			18	90	77	10	284	266	1	6	-	2	7	7	10	168	225	20	111	115	5	164	122	30	78	73	7	76	67	4	29	4	65	219	331	100	427	819	272	254	546

Table 5.1-20. Sample sizes and mean and standard deviation (sd) of mesohabitat length measurements in meters made among geomorphic reaches by macrohabitat in Middle River Focus Area mainstem habitats surveyed.

Geo-morphic Reach	Focus Area	Macrohabitat	Backwater			Beaver Complex			Boulder Riffle			Cascade			Clearwater Plume			Dry			Unspecified			Pool			Puddled			Rapid			Riffle			Run/Glide			All Measured Units		
			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	n	Mean	SD	n	Mean	SD
MR-1	FA-184	Main Channel																																	1	1,678	-	1	1,678	-
		Side Channel																															1	263	-	2	177	30	3	205	54
MR-2	FA-173	Main Channel																																	1	3,366	-	1	3,366	-
		Side Channel																2	306	114							1	359	-				1	328	-	1	67	-	5	273	130
		Side Slough	1	76	-													2	94	-				2	51	57	2	42	30				3	93	51	7	267	203	17	153	162
		Upland Slough				4	97	19										6	80	83				2	180	211	2	45	23							9	90	75	23	92	81
		Tributary Mouth																						1	3	-							4	23	15	1	33	-	6	21	15
MR-5	FA-151	Main Channel													1	549	-																		1	3,000	-	2	1,775	1,733
		Tributary Mouth	1	25	-																									1	90	-	2	29	20	1	37	-	5	42	29
MR-6	FA-144	Main Channel																															2	443	39	2	815	184	4	629	241
		Side Channel																1	112	-				2	93	98							5	320	347	3	246	10	11	240	242
		Side Slough	1	134	-	4	146	68										2	169	27				1	158	-							1	86	-	2	73	54	11	131	55
		Upland Slough				3	74	27										1	8	-																			4	58	40
	FA-141	Main Channel																						1	120	-							1	393	-	3	434	395	5	363	311
		Multi-Split Main Channel	2	22	5																												3	218	20	5	527	320	10	333	304
		Side Channel																						1	85	-							1	115	-	1	108	-	3	103	16
		Upland Slough	3	109	108	4	260	118													1	99	-															8	184	127
		Tributary Mouth	3	31	13																															2	33	27	5	32	16
	FA-138	Main Channel																																	1	1,697	-	1	1,697	-
		Multi-Split Main Channel	1	35	-																												1	122	-	3	301	117	5	212	151
		Side Channel																						1	125	-							3	63	45	3	142	103	7	106	76
		Side Slough	3	105	76	3	345	271										2	83	45	1	72	-	6	96	33							7	71	28	6	72	8	28	111	115
		Upland Slough	2	68	76	1	51	-										6	7	4				12	30	18							5	14	4	7	32	13	33	27	24
	FA-128	Main Channel																																	1	2,458	-	1	2,458	-
		Side Channel	1	111	-													2	107	35	1	68	-	10	123	97	1	88	-				17	74	52	16	249	345	48	145	216
		Side Slough				1	361	-										1	43	-				1	49	-							5	63	38	7	127	75	15	110	94
		Upland Slough																4	78	92				6	86	120													10	83	104
		Tributary Mouth																1	24	-				1	46	-							1	100	-				3	57	39
MR-7	FA-115	Main Channel																																	1	332	-	1	332	-
		Split Main Channel																						3	78	60							2	153	66	5	524	355	10	316	326
		Side Channel																						2	15	3	2	196	116							1	58	-	5	96	110
		Upland Slough	1	341	-	6	231	370																4	102	133	1	27	-				3	15	7	3	29	15	18	127	233
		Tributary Mouth																															1	9	-				1	9	-
	FA-113	Main Channel	1	56	-																														1	1,031	-	2	544	690
		Split Main Channel																1	80	-				1	170	-							5	428	709	5	368	560	12	352	556
		Side Slough	2	170	90													1	113	-				3	139	32	1	120	-							3	111	67	10	132	52
		Upland Slough				1	104	-										1	159	-				5	27	26	1	206	-				1	5	-	7	103	117	16	83	93
		Tributary Mouth																															1	6	-				1	6	-
MR-8	FA-104	Main Channel																																	1	1,734	-	1	1,734	-
		Side Channel	1	23	-										2	38	45	1	113	-				3	107	79	1	125	-				5	151	118	3	695	712	16	219	360
		Side Slough	3	51	54													8	22	17				13	71	102	6	54	29				6	37	25	2	66	47	38	51	65
		Upland Slough				2	416	402																4	60	63							3	24	5	5	133	190	14	129	203
Total				26	85	83	29	207	222							3	209	296	42	76	82	3	80	17	85	80	83	18	101	93	1	90	-	90	121	212	123	329	559	420	172

Table 5.1-21. Sample sizes and mean and standard deviation (sd) of mesohabitat percent gradient measurements made among geomorphic reaches by macrohabitat in Upper River and Middle River mainstem habitats surveyed.

Geomorphic Reach	Focus Area	Main Channel			Multi-Split Main Channel			Split Main Channel			Side Channel			Side Slough			Upland Slough			Tributary Mouth			All Measured Units		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Non-Focus Areas																									
UR-3	NA													2	-	-				4	4.8	6.2	6	3.2	5.4
UR-4	NA	2	0.5	-				3	0.6	0.2	1	0.8	-	22	0.5	0.6	31	1.2	3.1	6	4.5	3.0	65	1.2	2.6
UR-5	NA							1	0.5	-	3	1.1	0.4							2	15.0	4.2	6	5.6	7.5
UR-6	NA	2	0.7	0.4	5	0.1	0.3	2	1.0	1.4	2	1.3	1.1	9	0.6	0.8	5	0.7	0.4	1	1.0	-	26	0.7	0.7
MR-2	NA	4	0.6	0.5										1	-	-	3	0.5	0.5	3	2.7	1.2	11	1.1	1.2
MR-3	NA										1	-	-							1	4.0	-	2	2.0	2.8
MR-5	NA							1	0.5	-													1	0.5	-
MR-6	NA	5	0.4	0.4	6	0.2	0.3	3	0.8	0.3	3	1.7	1.5	18	0.4	0.6	18	0.1	0.2	3	1.0	0.9	56	0.4	0.6
MR-7	NA	3	0.5	0.5				1	0.5	-	4	0.4	0.3	11	0.1	0.3	9	-	-	1	3.0	-	29	0.3	0.6
MR-8	NA	1	0.5	-	17	0.5	0.6	1	0.5	-	1	0.4	-				4	-	-				24	0.4	0.5
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)													11	0.1	0.3	23	0.6	0.5	5	1.3	0.8	39	0.6	0.6
MR-5	FA-151 (Portage Creek)	2	-	-																5	1.4	0.8	7	1.0	1.0
MR-6	FA-144 (Slough 21)	3	0.5	-							11	0.9	0.9	9	0.1	0.2	4	-	-				27	0.4	0.7
	FA-141 (Indian River)	5	0.5	0.4	10	0.7	0.6				3	0.8	1.0				8	-	-	5	0.1	0.2	31	0.4	0.5
	FA-138 (Gold Creek)				4	1.0	0.7				6	0.7	0.3	27	0.3	0.6	30	0.5	1.7				67	0.5	1.2
	FA-128 (Slough 8A)										42	0.8	0.8	15	0.8	0.8	10	-	-	3	2.3	2.5	70	0.8	1.0
MR-7	FA-115 (Slough 6A)	1	-	-				8	0.3	0.3	5	0.7	1.0				18	0.2	0.5				32	0.3	0.6
	FA-113 (Oxbow 1)	2	-	-				11	0.7	0.5				9	0.1	0.2	15	0.1	0.2				37	0.3	0.4
MR-8	FA-104 (Whiskers Slough)										15	0.4	0.7	38	0.8	1.6	14	0.8	1.4				67	0.7	1.4
	Total[1]	30	0.4	0.4	42	0.5	0.6	31	0.6	0.5	100	0.7	0.8	172	0.5	1.0	192	0.5	1.5	39	3.0	4.0	606	0.7	1.6

Table 5.1-22. Sample sizes (*n*) and mean and standard deviation (sd) of mesohabitat Bankfull Width in meters made among geomorphic reaches by macrohabitat in Upper River and Middle River mainstem habitats surveyed.

Geomorphic Reach	Focus Area	Main Channel			Multi-Split Main Channel			Split Main Channel			Side Channel			Side Slough			Upland Slough			Tributary Mouth			All Measured Units		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Non-Focus Areas																									
UR-3	NA	9	155.6	50.6										3	6.4	3.5				4	47.6	36.9	16	100.6	77.3
UR-4	NA	5	181.3	9.5				5	181.5	79.0	2	111.0	76.3	21	69.3	74.3	29	10.8	13.3	4	8.7	6.4	66	58.2	76.6
UR-5	NA							1	122.7	-	3	40.9	30.3										4	61.3	47.8
UR-6	NA	2	396.8	137.9	5	111.6	25.0	2	178.9	44.5	2	67.7	61.8	8	33.1	62.8	5	6.7	2.5	1	19.6	-	25	85.4	119.1
MR-2	NA	4	158.8	23.0										1	192.0	-	3	3.6	1.0	3	42.9	33.0	11	87.9	78.8
MR-3	NA	2	163.0	21.7				1	123.0	-	2	70.1	6.5							2	17.3	3.5	7	89.1	62.8
MR-5	NA							1	114.7	-													1	114.7	-
MR-6	NA	6	179.0	56.0	7	62.7	37.8	3	142.2	55.3	4	91.7	91.2	19	8.6	3.0	18	12.9	8.5	3	15.9	7.6	60	45.8	65.1
MR-7	NA	7	231.2	40.7				4	139.0	38.9	5	42.6	10.4	11	18.2	19.6	9	16.7	13.8				36	76.0	89.3
MR-8	NA	2	299.7	144.2	13	54.0	42.4	1	94.2	-	1	44.7	-				4	20.0	10.4				21	72.4	90.2
Focus Areas																									
MR-1	FA-184 (Watana Dam)	1	164.2	-							3	64.3	27.2										4	89.3	54.6
MR-2	FA-173 (Stephan Lake Complex)	1	189.2	-							2	103.6	103.4	15	44.7	62.9	23	12.3	8.2	5	3.8	3.3	46	29.7	51.1
MR-5	FA-151 (Portage Creek)	2	148.4	2.1																5	72.6	20.8	7	94.3	40.7
MR-6	FA-144 (Slough 21)	4	188.4	59.2							10	62.8	36.5	10	37.3	27.4	4	12.6	1.6				28	64.5	63.5
	FA-141 (Indian River)	4	243.4	78.4	8	100.9	49.4				3	30.2	13.5				7	12.7	4.4	5	44.3	35.6	27	80.8	87.0
	FA-138 (Gold Creek)	1	192.0	-	4	112.3	31.1				7	43.9	11.4	27	27.1	12.5	30	9.0	5.9				69	28.3	33.6
	FA-128 (Slough 8A)	1	227.7	-							45	42.5	30.2	15	23.3	6.5	10	9.4	3.9	3	8.9	2.4	74	36.8	35.8
MR-7	FA-115 (Slough 6A)	1	211.7	-				7	141.9	41.3	5	17.2	6.5				18	7.4	8.8				31	45.9	67.0
	FA-113 (Oxbow 1)	1	147.9	-				12	88.0	55.0				10	26.3	10.0	10	7.9	9.5				33	46.9	51.5
MR-8	FA-104 (Whiskers Slough)	1	186.7	-							13	46.1	28.2	37	11.5	7.5	13	10.6	6.2				64	21.1	28.8
	Total[1]	54	198.1	71.6	37	79.0	46.2	37	128.4	58.6	107	49.3	37.1	177	28.9	41.3	183	10.7	9.1	35	31.0	31.0	630	50.7	66.7

Table 5.1-23. Sample sizes (n) and mean and standard deviation (sd) of mesohabitat wetted width in meters made among geomorphic reaches by macrohabitat in Upper River and Middle River mainstem habitats surveyed.

Geomorphic Reach	Focus Area	Main Channel			Multi-Split Main Channel			Split Main Channel			Side Channel			Side Slough			Upland Slough			Tributary Mouth			All Measured Units		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Non-Focus Areas																									
UR-3	NA	9	149.1	47.4										3	2.6	2.1				4	9.9	5.2	16	86.8	80.8
UR-4	NA	5	163.4	19.2				5	127.6	54.5	2	70.7	22.1	22	15.3	15.6	27	5.9	5.6	7	5.2	5.3	68	31.3	52.5
UR-5	NA							1	118.4	-	3	35.2	29.2							2	7.3	4.4	6	39.8	44.9
UR-6	NA	2	356.8	166.8	5	80.1	18.3	2	140.8	16.7	2	23.8	4.3	8	3.9	2.3	5	3.0	2.6	1	8.5	-	25	59.1	107.7
MR-2	NA	4	138.2	25.3										1	19.3	-	1	1.5	-	3	12.5	10.2	9	67.9	68.8
MR-3	NA	2	152.2	19.2				1	107.0	-	2	56.0	6.2							2	7.6	0.5	7	76.9	62.1
MR-5	NA							1	110.7	-													1	110.7	-
MR-6	NA	6	138.4	83.4	7	42.5	43.6	4	108.8	43.2	4	63.6	54.3	14	2.7	1.6	18	9.7	11.2	3	11.1	5.6	56	36.8	57.2
MR-7	NA	7	187.6	92.9				4	100.2	48.8	5	31.4	4.5	10	11.6	20.9	10	10.6	7.8	1	8.6	-	37	56.8	81.3
MR-8	NA	2	276.7	139.9	17	30.5	33.3	1	70.5	-	1	33.3	-				4	11.8	14.8				25	48.9	80.0
Focus Areas																									
MR-1	FA-184 (Watana Dam)	1	160.3	-							3	50.2	20.8										4	77.8	57.6
MR-2	FA-173 (Stephan Lake Complex)	1	181.8	-							2	5.6	1.3	15	12.4	14.0	17	6.4	4.6	6	3.5	3.3	41	12.4	28.7
MR-5	FA-151 (Portage Creek)	2	131.8	3.8																5	10.5	8.2	7	45.2	59.6
MR-6	FA-144 (Slough 21)	4	168.0	50.1							11	25.7	25.9	9	15.5	13.0	3	6.6	1.6				27	41.3	59.5
	FA-141 (Indian River)	5	165.2	142.1	10	83.6	47.7				3	21.4	16.1				8	9.7	4.3	5	7.8	8.6	31	59.4	82.0
	FA-138 (Gold Creek)	1	184.0	-	4	78.8	27.7				7	20.1	6.3	26	15.5	9.0	29	4.0	2.7				67	17.3	28.3
	FA-128 (Slough 8A)	1	175.5	-							45	26.0	22.6	14	13.8	4.9	10	3.9	3.9	2	6.8	4.6	72	22.1	27.1
MR-7	FA-115 (Slough 6A)	1	206.7	-				10	92.9	64.0	3	7.0	5.2				17	5.7	7.0	1	2.7	-	32	39.3	61.7
	FA-113 (Oxbow 1)	2	98.6	89.9				11	62.8	49.0				9	14.6	7.5	11	5.7	5.3	1	3.5	-	34	31.9	43.8
MR-8	FA-104 (Whiskers Slough)	1	181.7	-							14	26.1	22.6	31	6.8	5.8	14	6.7	4.8				60	14.2	26.2
	Total[1]	56	169.2	82.8	43	54.5	43.4	40	94.6	52.9	107	28.6	24.6	162	11.2	11.3	174	6.4	6.5	43	7.6	6.1	625	35.0	58.0

Table 5.1-24. Sample sizes (*n*) and mean and standard deviation (sd) of mesohabitat Bankfull Depth in meters made among geomorphic reaches by macrohabitat in Upper River and Middle River mainstem habitats surveyed.

Geomorphic Reach	Focus Area	Main Channel			Multi-Split Main Channel			Split Main Channel			Side Channel			Side Slough			Upland Slough			Tributary Mouth			All Measured Units		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Non-Focus Areas																									
UR-3	NA	9	2.6	1.2										3	0.5	0.5				4	1.4	0.6	16	1.9	1.2
UR-4	NA	5	2.8	1.0				5	1.1	0.1	2	1.1	0.0	21	0.9	0.6	26	0.7	0.3	4	0.7	0.2	64	1.0	0.7
UR-5	NA							1	1.3	-	3	1.4	0.2										4	1.4	0.2
UR-6	NA	2	2.1	0.3	5	1.1	0.3	2	2.1	0.6	2	0.9	0.1	8	0.9	0.1	5	0.9	0.4	1	1.1	-	25	1.1	0.5
MR-2	NA	4	3.2	0.9										1	1.5	-	1	0.7	-	3	1.0	0.4	9	2.0	1.3
MR-3	NA	2	2.2	0.1				1	2.2	-	2	2.4	0.8							1	0.6	-	6	2.0	0.8
MR-5	NA							1	3.0	-													1	3.0	-
MR-6	NA	6	4.1	3.2	7	1.2	0.7	3	2.0	1.7	4	1.7	0.9	17	1.2	0.4	17	0.9	0.3	3	1.4	0.6	57	1.5	1.4
MR-7	NA	4	2.2	1.3				4	2.7	0.6	5	0.9	0.1	10	0.9	0.3	10	0.8	0.3	1	0.3	-	34	1.2	0.9
MR-8	NA	2	2.9	1.4	12	0.9	0.6	1	1.6	-	1	0.8	-				4	0.9	0.3				20	1.1	0.8
Focus Areas																									
MR-1	FA-184 (Watana Dam)	1	2.3	-							3	1.5	0.9										4	1.7	0.8
MR-2	FA-173 (Stephan Lake Complex)	1	2.2	-							2	0.4	0.1	14	0.9	0.6	17	0.7	0.1	5	0.4	0.1	39	0.8	0.5
MR-5	FA-151 (Portage Creek)	2	1.9	0.2																5	1.7	0.3	7	1.8	0.3
MR-6	FA-144 (Slough 21)	4	2.8	0.2							9	1.2	0.3	9	1.2	0.4	4	1.7	1.7				26	1.5	0.9
	FA-141 (Indian River)	3	2.2	1.2	8	1.7	0.4				3	0.7	0.1				7	1.0	0.3	5	1.3	0.6	26	1.3	0.7
	FA-138 (Gold Creek)	1	2.6	-	4	1.7	0.7				7	1.1	0.6	27	1.0	0.4	28	1.1	0.4				67	1.1	0.5
	FA-128 (Slough 8A)	1	2.1	-							41	1.2	0.5	14	1.3	0.2	10	0.8	0.1	2	0.7	0.2	68	1.2	0.4
MR-7	FA-115 (Slough 6A)	1	5.8	-				8	1.8	0.6	5	0.7	0.2				18	0.7	0.4				32	1.1	1.1
	FA-113 (Oxbow 1)	2	1.7	1.5				12	1.2	0.7				10	1.0	0.8	9	0.5	0.2	1	0.2	-	34	0.9	0.7
MR-8	FA-104 (Whiskers Slough)	1	2.2	-							12	1.2	1.2	35	0.6	0.2	13	1.4	0.6				61	0.9	0.7
	Total[1]	51	2.7	1.5	36	1.3	0.6	38	1.6	0.9	101	1.2	0.6	169	0.9	0.5	169	0.9	0.5	35	1.0	0.6	600	1.2	0.9

Table 5.1-25. Sample sizes (n) and mean and standard deviation (sd) of mesohabitat thalweg depth in meters made among geomorphic reaches by macrohabitat in Upper River and Middle River mainstem habitats surveyed.

Geomorphic Reach	Focus Area	Main Channel			Multi-Split Main Channel			Split Main Channel			Side Channel			Side Slough			Upland Slough			Tributary Mouth			All Measured Units		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Non-Focus Areas																									
UR-3	NA	8	3.2	1.2										3	0.3	0.4				4	0.5	0.3	15	1.9	1.6
UR-4	NA	4	4.5	1.8				3	1.5	0.2	1	0.9	-	22	0.4	0.4	27	0.5	0.4	7	0.2	0.1	65	0.7	1.1
UR-5	NA							1	1.9	-	3	0.8	0.5							2	0.3	0.0	6	0.8	0.7
UR-6	NA	2	2.2	0.7	2	-	-	2	2.1	0.3	2	0.6	0.1	8	0.3	0.2	5	0.4	0.4	1	0.5	-	22	0.7	0.8
MR-2	NA	4	2.9	0.6										1	0.8	-	1	0.4	-	2	0.5	0.2	8	1.7	1.3
MR-3	NA	2	2.7	0.3				1	2.8	-	2	1.8	-							2	0.3	0.2	7	1.8	1.1
MR-5	NA							1	2.7	-													1	2.7	-
MR-6	NA	6	3.9	4.5	6	0.8	0.8	4	3.0	2.1	4	1.1	0.7	13	0.3	0.2	15	0.5	0.4	3	0.5	0.3	51	1.1	2.0
MR-7	NA	4	1.9	1.4				4	2.3	1.5	5	0.5	0.1	9	0.4	0.3	10	0.7	0.4	1	0.3	-	33	0.9	1.0
MR-8	NA	2	3.2	0.1	17	0.5	0.4	1	1.1	-	1	0.6	-				3	0.4	0.3				24	0.8	0.8
Focus Areas																									
MR-1	FA-184 (Watana Dam)	1	2.9	-							3	1.6	0.8										4	1.9	0.9
MR-2	FA-173 (Stephan Lake Complex)	1	2.8	-							2	0.1	0.0	15	0.8	1.4	17	0.4	0.2	6	0.2	0.1	41	0.5	1.0
MR-5	FA-151 (Portage Creek)	1	2.9	-																4	0.4	0.3	5	0.9	1.1
MR-6	FA-144 (Slough 21)	4	2.3	0.2							10	0.5	0.4	9	0.5	0.2	3	0.7	0.3				26	0.8	0.7
	FA-141 (Indian River)	3	1.6	1.3	4	0.7	0.3				3	0.7	0.5				8	0.8	0.4	4	0.5	0.2	22	0.8	0.6
	FA-138 (Gold Creek)				3	0.8	0.2				7	0.5	0.2	25	0.4	0.2	29	0.4	0.3				64	0.4	0.3
	FA-128 (Slough 8A)	1	2.6	-							43	0.7	0.8	14	0.4	0.3	10	0.3	0.3	2	0.3	0.2	70	0.6	0.7
MR-7	FA-115 (Slough 6A)	1	7.3	-				10	1.0	0.7	3	0.3	0.0				16	0.5	0.3	1	0.1	-	31	0.8	1.3
	FA-113 (Oxbow 1)	2	1.3	0.9				11	0.9	1.0				7	0.4	0.3	11	0.3	0.2	1	0.3	-	32	0.6	0.7
MR-8	FA-104 (Whiskers Slough)	1	1.9	-							14	0.6	0.9	29	0.3	0.2	14	0.7	0.6				58	0.5	0.6
	Total[1]	47	2.9	2.0	32	0.6	0.5	38	1.5	1.2	103	0.7	0.7	155	0.4	0.5	169	0.5	0.4	40	0.3	0.2	585	0.8	1.1

Table 5.1-26. Sample sizes (n) and mean and standard deviation (sd) of maximum pool depth in meters among geomorphic reaches by macrohabitat in Upper River and Middle River mainstem habitats surveyed.

Geomorphic Reach	Focus Area	Main Channel			Multi-Split Main Channel			Split Main Channel			Side Channel			Side Slough			Upland Slough			Tributary Mouth			All Measured Units		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Non-Focus Areas																									
UR-3	NA	8		1.2										3	1.3	0.4				4		0.3	15	1.3	1.6
UR-4	NA	4		1.8				3		0.2	1		-	22	0.9	0.4	27	1.2	0.4	7	0.8	0.1	64	1.1	1.1
UR-5	NA							1		-	3		0.5							2		0.0	6		0.7
UR-6	NA	2		0.7	2	-	-	2		0.3	2		0.1	8	0.6	0.2	5	1.5	0.4	1		-	22	0.8	0.8
MR-2	NA	4		0.6										1		-	1	0.7	-	2		0.2	8	0.7	1.3
MR-3	NA	2		0.3				1		-	2		-							2		0.2	7		1.1
MR-5	NA							1		-													1		-
MR-6	NA	6		4.5	6	1.4	0.8	4		2.1	4		0.7	13	0.6	0.2	15	0.9	0.4	3		0.3	51	0.8	2.0
MR-7	NA	4		1.4				4		1.5	5		0.1	9	1.2	0.3	10	0.8	0.4	1		-	33	1.0	1.0
MR-8	NA	2		0.1	17	0.5	0.4	1		-	1		-				3	0.4	0.3				24	0.4	0.8
Focus Areas																									
MR-1	FA-184 (Watana Dam)	1		-							3		0.8										4		0.9
MR-2	FA-173 (Stephan Lake Complex)	1		-							2		0.0	15	0.5	1.4	17	0.7	0.2	6	0.3	0.1	41	0.6	1.0
MR-5	FA-151 (Portage Creek)	1		-																4	0.9	0.3	5	0.9	1.1
MR-6	FA-144 (Slough 21)	4		0.2							10	0.5	0.4	9	1.0	0.2	3	1.0	0.3				26	0.9	0.7
	FA-141 (Indian River)	3	0.5	1.3	4	0.9	0.3				3	1.1	0.5				8	0.6	0.4	4	0.8	0.2	22	0.8	0.6
	FA-138 (Gold Creek)				3	0.9	0.2				7	1.3	0.2	25	0.9	0.2	29	0.7	0.3				64	0.8	0.3
	FA-128 (Slough 8A)	1		-							43	1.1	0.8	14	0.9	0.3	10	0.7	0.3	2	0.6	0.2	70	1.0	0.7
MR-7	FA-115 (Slough 6A)	1		-				10	0.9	0.7	3	0.5	0.0				16	0.9	0.3	1		-	31	0.8	1.3
	FA-113 (Oxbow 1)	2	1.0	0.9				11	0.7	1.0				7	0.7	0.3	11	0.5	0.2	1		-	32	0.7	0.7
MR-8	FA-104 (Whiskers Slough)	1		-							14	0.6	0.9	29	0.5	0.2	14	1.6	0.6				58	0.7	0.6
	Total[1]	47	0.8	2.0	32	0.7	0.5	38	0.9	1.2	103	0.9	0.7	155	0.7	0.5	169	0.9	0.4	40	0.7	0.2	584	0.8	1.1

Table 5.1-27. Sample sizes (n) and mean and standard deviation (sd) of percent erosion along mesohabitat units in Upper River and Middle River mainstem habitats surveyed by macrohabitat.

Geomorphic Reach	Focus Area	Main Channel			Multi-Split Main Channel			Split Main Channel			Side Channel			Side Slough			Upland Slough			Tributary Mouth			All Measured Units		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Non-Focus Areas																									
UR-3	NA	8	6.7	1.2										3	-	0.4				4	24.4	0.3	15	9.8	1.6
UR-4	NA	4	14.0	1.8				3	6.0	0.2	1	25.0	-	22	-	0.4	27	-	0.4	7	8.8	0.1	64	3.1	1.1
UR-5	NA							1	-	-	3	-	0.5							2	-	0.0	6	-	0.7
UR-6	NA	2	1.3	0.7	2	15.2	-	2	22.0	0.3	2	25.0	0.1	8	-	0.2	5	-	0.4	1	-	-	22	6.6	0.8
MR-2	NA	4	8.8	0.6										1	-	-	1	-	-	2	-	0.2	8	3.2	1.3
MR-3	NA	2	17.5	0.3				1	-	-	2	13.8	-							2	-	0.2	7	8.9	1.1
MR-5	NA							1	-	-													1	-	-
MR-6	NA	6	2.1	4.5	6	5.7	0.8	4	1.3	2.1	4	10.0	0.7	13	1.8	0.2	15	-	0.4	3	5.0	0.3	51	2.4	2.0
MR-7	NA	4	11.1	1.4				4	5.0	1.5	5	6.0	0.1	9	2.2	0.3	10	-	0.4	1	-	-	33	4.0	1.0
MR-8	NA	2	7.5	0.1	17	5.1	0.4	1	5.0	-	1	10.0	-				3	-	0.3				24	4.7	0.8
Focus Areas																									
MR-1	FA-184 (Watana Dam)	1	10.0	-							3	23.3	0.8										4	20.0	0.9
MR-2	FA-173 (Stephan Lake Complex)	1	15.0	-							2	-	0.0	15	-	1.4	17	-	0.2	6	-	0.1	41	0.3	1.0
MR-5	FA-151 (Portage Creek)	1	1.3	-																4	-	0.3	5	0.4	1.1
MR-6	FA-144 (Slough 21)	4	38.8	0.2							10	3.0	0.4	9	22.5	0.2	3	2.5	0.3				26	15.0	0.7
	FA-141 (Indian River)	3	7.0	1.3	4	7.8	0.3				3	16.7	0.5				8	-	0.4	4	11.0	0.2	22	7.0	0.6
	FA-138 (Gold Creek)		30.0		3	14.0	0.2				7	24.3	0.2	25	1.3	0.2	29	4.4	0.3				64	6.3	0.3
	FA-128 (Slough 8A)	1	-	-							43	26.9	0.8	14	1.8	0.3	10	-	0.3	2	85.0	0.2	70	21.3	0.7
MR-7	FA-115 (Slough 6A)	1	5.0	-				10	4.5	0.7	3	7.0	0.0				16	0.3	0.3	1		-	31	2.6	1.3
	FA-113 (Oxbow 1)	2	-	0.9				11	10.3	1.0				7	4.0	0.3	11	-	0.2	1	-	-	32	4.2	0.7
MR-8	FA-104 (Whiskers Slough)	1	55	-							14	4.5	0.9	29	1.5	0.2	14	3.2	0.6				58	3.3	0.6
	Total[1]	47	11.0	2.0	32	7.8	0.5	38	6.6	1.2	103	17.2	0.7	155	2.5	0.5	169	1.0	0.4	40	11.2	0.2	584	6.4	1.1

Table 5.1-28. Sample sizes (n) and mean and standard deviation (sd) of percent undercut banks along mesohabitat units in Upper River and Middle River mainstem habitats surveyed by macrohabitat.

Geomorphic Reach	Focus Area	Main Channel			Multi-Split Main Channel			Split Main Channel			Side Channel			Side Slough			Upland Slough			Tributary Mouth			All Measured Units		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Non-Focus Areas																									
UR-3	NA	8	0.6	1.2										3	-	0.4				4	-	0.3	15	0.3	1.6
UR-4	NA	4	-	1.8				3	-	0.2	1	-	-	22	0.5	0.4	27	-	0.4	7	3.8	0.1	65	0.6	1.1
UR-5	NA							1	-	-	3	-	0.5							2	-	0.0	6	-	0.7
UR-6	NA	2	-	0.7	2	-	-	2	-	0.3	2	-	0.1	8	0.3	0.2	5	-	0.4	1	-	-	22	0.1	0.8
MR-2	NA	4	-	0.6										1	-	-	1	-	-	2	-	0.2	8	-	1.3
MR-3	NA	2	7.5	0.3				1	-	-	2	-	-							2	-	0.2	7	2.1	1.1
MR-5	NA							1	-	-													1	-	-
MR-6	NA	6	-	4.5	6	0.7	0.8	4	-	2.1	4	-	0.7	13	-	0.2	15	6.7	0.4	3	6.7	0.3	51	2.4	2.0
MR-7	NA	4	-	1.4				4	-	1.5	5	-	0.1	9	-	0.3	10	-	0.4	1	-	-	33	-	1.0
MR-8	NA	2	-	0.1	17	0.3	0.4	1	-	-	1	-	-				3	-	0.3				24	0.2	0.8
Focus Areas																									
MR-1	FA-184 (Watana Dam)	1	-	-							3	-	0.8										4	-	0.9
MR-2	FA-173 (Stephan Lake Complex)	1	-	-							2	-	0.0	15	0.1	1.4	17	0.4	0.2	6	10.4	0.1	41	1.6	1.0
MR-5	FA-151 (Portage Creek)	1	-	-																4	-	0.3	5	-	1.1
MR-6	FA-144 (Slough 21)	4	-	0.2							10	1.7	0.4	9	8.0	0.2	3	-	0.3				26	3.5	0.7
	FA-141 (Indian River)	3	9.0	1.3	4	2.5	0.3				3	-	0.5				8	2.5	0.4	4	4.0	0.2	22	3.6	0.6
	FA-138 (Gold Creek)		15.0		3	11.0	0.2				7	9.2	0.2	25	3.9	0.2	29	1.8	0.3				64	4.2	0.3
	FA-128 (Slough 8A)	1	-	-							43	5.9	0.8	14	-	0.3	10	2.5	0.3	2	-	0.2	70	4.0	0.7
MR-7	FA-115 (Slough 6A)	1	-	-				10	2.5	0.7	3	1.0	0.0				16	-	0.3	1		-	31	0.9	1.3
	FA-113 (Oxbow 1)	2	-	0.9				11	1.3	1.0				7	0.5	0.3	11	-	0.2	1	-	-	32	0.5	0.7
MR-8	FA-104 (Whiskers Slough)	1	0	-							14	0.0	0.9	29	0.5	0.2	14	0.0	0.6				58	0.3	0.6
	Total[1]	47	1.4	2.0	32	2.1	0.5	38	1.0	1.2	103	3.3	0.7	155	1.2	0.5	169	1.1	0.4	40	3.0	0.2	585	1.7	1.1

Table 5.1-29. Sample sizes (n) and mean and standard deviation (sd) of large woody debris counts within mesohabitat units in mainstem habitats.

Geomorphic Reach	Focus Area	Main Channel			Multi-Split Main Channel			Split Main Channel			Side Channel			Side Slough			Upland Slough			Tributary Mouth			All Measured Units		
		n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Non-Focus Areas																									
UR-3	NA	4	2.3	0.6										1	2.0	-	1	5.0	-	2	0.3	0.2	8	2.5	1.3
UR-4	NA	2	20.5	0.3				1	9.0	-	2	2.5	-							2	-	0.2	7	7.9	1.1
UR-5	NA							1	10.0	-													1	10.0	-
UR-6	NA	6	23.2	4.5	6	6.7	0.8	4	2.8	2.1	4	6.8	0.7	13	1.3	0.2	15	16.3	0.4	3	-	0.3	51	8.6	2.0
MR-2	NA	4	13.1	1.4				4	9.3	1.5	5	12.8	0.1	9	10.6	0.3	10	15.4	0.4	1	-	-	33	12.2	1.0
MR-3	NA	2	66.5	0.1	17	6.1	0.4	1	17.0	-	1	57.0	-				3	6.3	0.3				24	13.4	0.8
MR-5	NA	8	4.7	1.2										3	0.7	0.4				4	0.5	0.3	15	2.9	1.6
MR-6	NA	4	3.2	1.8				3	2.8	0.2	1	2.0	-	22	0.2	0.4	27	1.9	0.4	7	0.9	0.1	64	1.4	1.1
MR-7	NA							1	4.0	-	3	1.3	0.5							2	2.5	0.0	6	2.2	0.7
MR-8	NA	2	28.0	0.7	2	25.8	-	2	17.0	0.3	2	-	0.1	8	1.9	0.2	5	4.2	0.4	1	1.0	-	22	9.6	0.8
Focus Areas																									
MR-1	FA-184 (Watana Dam)	1	-	-							3	0.3	0.8										4	0.3	0.9
MR-2	FA-173 (Stephan Lake Complex)	1	20.0	-							2	-	0.0	15	2.7	1.4	17	5.7	0.2	6	0.7	0.1	41	4.3	1.0
MR-5	FA-151 (Portage Creek)	1	-	-																4	0.6	0.3	5	0.4	1.1
MR-6	FA-144 (Slough 21)	4	84.3	0.2							10	11.7	0.4	9	9.3	0.2	3	30.0	0.3				26	21.6	0.7
	FA-141 (Indian River)	3	8.4	1.3	4	16.8	0.3				3	5.0	0.5				8	17.8	0.4	4	3.4	0.2	22	11.9	0.6
	FA-138 (Gold Creek)		35.0		3	2.2	0.2				7	18.0	0.2	25	4.9	0.2	29	4.8	0.3				64	6.2	0.3
	FA-128 (Slough 8A)	1	70.0	-							43	7.7	0.8	14	3.2	0.3	10	6.0	0.3	2	-	0.2	70	7.2	0.7
MR-7	FA-115 (Slough 6A)	1	2.0	-				10	5.8	0.7	3	1.0	0.0				16	4.0	0.3	1	-	-	31	3.9	1.3
	FA-113 (Oxbow 1)	2	18.5	0.9				11	6.3	1.0				7	8.0	0.3	11	6.0	0.2	1	3.0	-	32	7.2	0.7
MR-8	FA-104 (Whiskers Slough)	1	60	-							14	8.1	0.9	29	2.6	0.2	14	27.2	0.6				58	9.9	0.6
	Total[1]	47	19.0	2.0	32	9.9	0.5	38	6.6	1.2	103	8.2	0.7	155	3.7	0.5	169	8.7	0.4	40	1.0	0.2	584	7.6	1.1

Table 5.2-1. Sum of length (m) surveyed, and composition by length of mesohabitats in Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	Length (m) & Percent		n	Length
Tsusena Creek	Tsusena-1	-							2	212	32%													1	28	4%	1	87	13%	2	84	13%	2	260	39%	8	671
Unnamed 184.0	184.0-1	-							1	16	100%																								1	16
Fog Creek	Fog-4	-							5	716	55%																7	263	20%	6	238	18%	2	79	6%	20	1,297
Fog Creek	Fog-3	-							5	292	15%	1	28	1%													6	750	40%	7	663	35%	4	156	8%	23	1,889
Fog Creek	Fog-2	-							4	410	59%													3	122	18%	2	136	20%	1	24	4%				10	692
Fog Creek	Fog-1	-							3	342	24%	1	35	2%										2	39	3%	3	338	24%	10	559	39%	3	108	8%	22	1,422
Unnamed 173.8	NA	FA-173							3	867	84%													3	17	2%				3	153	15%				9	1,037
Devils Canyon upper extent																																					
Chinook Creek	Chinook-2	-	1	5	1%				1	45	9%										1	36	7%				5	352	71%				6	56	11%	14	494
Chinook Creek	Chinook-1	-										5	185	33%													5	341	60%				2	39	7%	12	564
Cheechako Creek	Cheechako-1	-							1	40	6%	4	385	57%	1	23	3%							4	80	12%	3	144	21%							13	673
Devils Canyon lower extent																																					
Portage Creek	NA	FA-151																									1	97	33%	1	135	46%	1	62	21%	3	295
Unnamed 144.6	NA	FA-144																1	84	100%																1	84
Indian River	NA	FA-141	2	8	1%	1	26	3%																3	78	9%				8	363	42%	7	395	45%	21	870
Gold Creek	NA	-																									2	35	8%	5	339	73%	4	89	19%	11	463
Fourth of July Creek	NA	-																						2	32	21%	1	47	31%	2	42	28%	2	30	20%	7	151
Sherman Creek	NA	-										1	14	28%																2	23	44%	1	14	28%	4	52
Skull Creek	NA	FA-128																						1	23	34%				1	23	35%	1	20	31%	3	66
Fifth of July Creek	NA	-										1	27	100%																						1	27
Deadhorse Creek	NA	-							1	9	63%																						1	5	37%	2	14
Little Portage Creek	NA	-																									1	24	100%							1	24
McKenzie Creek	NA	-																1	21	55%										1	17	45%				2	37
Lane Creek	NA	-																												1	70	100%				1	70
Unnamed 115.4	NA	FA-115																						2	255	54%				4	55	12%	3	159	34%	9	469
Gash Creek	NA	FA-113																												1	26	100%				1	26
Slash Creek	NA	FA-113										1	5	3%										3	56	31%				3	34	19%	3	83	47%	10	178
Unnamed 113.7	NA	FA-113										1	17	100%																						1	17
Chase Creek	NA	-																						1	28	10%				1	12	4%	1	234	85%	3	274
Whiskers Creek	NA	FA-104	1	2	0.11%																			16	761	41%				14	398	21%	18	708	38%	49	1,868
Total[1]			**4**	**15**	**0.11%**	**1**	**26**	**0%**	**26**	**2,949**	**21%**	**15**	**696**	**5%**	**1**	**23**	**0.17%**	**2**	**105**	**1%**	**1**	**36**	**0.26%**	**41**	**1,518**	**11%**	**37**	**2,614**	**19%**	**73**	**3,258**	**24%**	**61**	**2,497**	**18%**	**262**	**13,738**

Table 5.2-2. Mean (±SD) percent gradient of mesohabitats in Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Tsusena Creek	Tsusena-1	-							2	1.5	0.7													1	0.0	-	1	3.0	-	2	1.0	0.0	2	1.0	0.0	8	1.3	0.9
Unnamed 184.0	184.0-1	-							1	1.0	-																								1	1.0	-
Fog Creek	Fog-4	-							5	3.1	0.9																7	2.7	0.5	6	2.1	0.7	2	1.0	0.0	20	2.5	0.9
Fog Creek	Fog-3	-							5	3.2	0.3	1	4.0	-													6	3.5	0.8	7	1.9	0.6	4	1.3	0.3	23	2.6	1.1
Fog Creek	Fog-2	-							4	2.8	1.5													3	0.2	0.3	2	3.3	0.4	1	2.0	-				10	2.0	1.6
Fog Creek	Fog-1	-							3	2.0	1.0	1	3.0	-										2	0.0	0.0	2	2.5	0.7	9	2.0	0.4	3	0.3	0.6	20	1.7	1.0
Unnamed 173.8	NA	FA-173							3	3.0	1.0																			2	1.5	0.7				5	2.4	1.1
Devils Canyon upper extent																																						
Chinook Creek	Chinook-2	-							1	2.0	-										1	1.5	-				5	2.1	0.2				3	1.3	0.6	10	1.8	0.5
Chinook Creek	Chinook-1	-										5	4.4	0.5													5	3.1	1.1				2	1.0	0.0	12	3.3	1.5
Cheechako Creek	Cheechako-1	-							1	3.0	-	4	7.4	0.5	1	10.0	-							4	0.8	0.6	3	4.3	0.6							13	4.5	3.2
Devils Canyon lower extent																																						
Portage Creek	NA	FA-151																									1	1.0	-	1	1.0	-	1	0.0	-	3	0.7	0.6
Unnamed 144.6	NA	FA-144																1	4.8	-																1	4.8	-
Indian River	NA	FA-141				1	0	-																2	0.3	0.5				8	1.9	1.6	6	0.5	0.5	17	1.1	1.4
Gold Creek	NA	-																									2	5.0	2.8	4	4.0	0.7	4	2.1	0.9	10	3.5	1.7
Fourth of July Creek	NA	-																						2	0.5	0.7	1	2.0	-	1	2.0	-	2	1.0	0.0	6	1.2	0.8
Sherman Creek	NA	-										1	10.0	-																1	0.0	-	1	0.5	-	3	3.5	5.6
Skull Creek	NA	FA-128																						1	0.0	-				1	2.0	-	1	1.0	-	3	1.0	1.0
Fifth of July Creek	NA	-										1	4.9	-																						1	4.9	-
Deadhorse Creek	NA	-																																		0		
Little Portage Creek	NA	-																									1	4.0	-							1	4.0	-
McKenzie Creek	NA	-																1	6.5	-										1	1.5	-				2	4.0	3.5
Lane Creek	NA	-																												1	2.5	-				1	2.5	-
Unnamed 115.4	NA	FA-115																						1	0.0	-				2	2.0	1.4	1	0.0	-	4	1.0	1.4
Gash Creek	NA	FA-113																												1	3.0	-				1	3.0	-
Slash Creek	NA	FA-113																						1	0.0	-				1	2.0	-	3	0.5	0.5	5	0.7	0.8
Unnamed 113.7	NA	FA-113										1	7.0	-																						1	7.0	-
Chase Creek	NA	-																						1	0.0	-							1	0.0	-	2	0.0	0.0
Whiskers Creek	NA	FA-104																						15	0.0	0.1				12	0.9	0.5	18	0.1	0.2	45	0.3	0.5
Total[1]						**1**	**0**	**-**	**25**	**2.7**	**1.0**	**14**	**5.7**	**2.0**	**1**	**10.0**	**-**	**2**	**5.7**	**1.2**	**1**	**1.5**	**-**	**33**	**0.2**	**0.4**	**36**	**3.1**	**1.1**	**61**	**1.8**	**1.1**	**54**	**0.6**	**0.7**	**228**	**1.9**	**1.8**

Table 5.2-3. Mean (±SD) bankfull width (m) of mesohabitats in Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Tsusena Creek	Tsusena-1	-		\					2	22.6	5.1												1	6.7	-	1	28.7	-	2	7.4	7.2	2	11.6	8.2	8	14.8	9.7
Unnamed 184.0	184.0-1	-							1	33.4	-																							1	33.4	-
Fog Creek	Fog-4	-							5	9.4	1.8															7	8.9	2.1	6	8.1	2.1	2	12.8	2.3	20	9.2	2.3
Fog Creek	Fog-3	-							5	18.1	4.1	1	14.6	-												6	15.7	6.4	7	18.4	5.5	4	14.9	2.2	23	16.9	4.9
Fog Creek	Fog-2	-							4	20.4	5.6												3	15.1	2.8	2	17.8	3.6	1	14.7	-				10	17.7	4.5
Fog Creek	Fog-1	-							3	28.8	16.5	1	18.5	-									2	11.2	6.5	2	22.9	0.3	9	13.6	8.6	3	16.1	7.4	20	17.2	10.1
Unnamed 173.8	NA	FA-173							3	7.7	1.7												3	4.5	1.8				3	5.3	0.6				9	5.8	1.9
Devils Canyon upper extent																																						
Chinook Creek	Chinook-2	-	1	2.6	-				1	5.1	-										1	3.4	-				5	8.3	1.2				6	6.7	3.8	14	6.6	3.1
Chinook Creek	Chinook-1	-										5	9.6	3.7												5	9.2	1.3				2	8.3	0.4	12	9.2	2.4
Cheechako Creek	Cheechako-1	-							1	13.9	-	4	14.8	3.4	1	6.9	-							4	13.0	2.2	3	14.6	3.1							13	13.5	3.2
Devils Canyon lower extent																																						
Portage Creek	NA	FA-151																								1	30.4	-	1	33.2	-	1	34.8	-	3	32.8	2.2
Unnamed 144.6	NA	FA-144																1	19.4	-															1	19.4	-
Indian River	NA	FA-141				1	5.2	-																3	8.3	7.7				8	13.2	7.2	7	15.9	13.2	19	13.0	9.8
Gold Creek	NA	-																								2	9.7	1.2	4	11.8	1.0	4	12.2	2.4	10	11.5	1.9
Fourth of July Creek	NA	-																						2	6.6	0.8	1	5.6	-	2	8.5	1.8	2	6.9	1.7	7	7.1	1.5
Sherman Creek	NA	-										1	7.3	-															2	6.0	2.8	1	8.0	-	4	6.8	1.9
Skull Creek	NA	FA-128																						1	12.4	-				1	7.9	-	1	11.8	-	3	10.7	2.4
Fifth of July Creek	NA	-										1	20.1	-																				1	20.1	-
Deadhorse Creek	NA	-																																				
Little Portage Creek	NA	-																								1	3.8	-							1	3.8	-
McKenzie Creek	NA	-																1	7.5	-									1	5.5	-				2	6.5	1.4
Lane Creek	NA	-																											1	8.0	-				1	8.0	-
Unnamed 115.4	NA	FA-115																						2	3.1	2.7				4	1.1	0.3	3	1.7	0.9	9	1.7	1.3
Gash Creek	NA	FA-113																											1	4.4	-				1	4.4	-
Slash Creek	NA	FA-113										1	2.0	-										3	4.0	1.4				3	4.3	2.1	3	4.6	2.7	10	4.1	1.9
Unnamed 113.7	NA	FA-113										1	7.5	-																				1	7.5	-
Chase Creek	NA	-																						1	9.7	-							1	4.3	-	2	7.0	3.8
Whiskers Creek	NA	FA-104	1	2.8	-																			16	8.0	3.1				14	6.9	1.5	18	6.8	1.8	49	7.1	2.3
Total[1]			**2**	**2.7**	**0.2**	**1**	**5.2**	**-**	**25**	**17.0**	**9.7**	**15**	**11.8**	**5.4**	**1**	**6.9**	**-**	**2**	**13.5**	**8.4**	**1**	**3.4**	**-**	**41**	**8.4**	**4.4**	**36**	**12.7**	**6.7**	**70**	**10.0**	**6.9**	**60**	**9.8**	**7.3**	**254**	**10.8**	**7.2**

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

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

Table 5.2-4. Mean (±SD) wetted width (m) of mesohabitats in Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Tsusena Creek	Tsusena-1	-							2	18.6	6.8												1	2.7	-	1	23.2	-	2	5.5	6.8	2	8.7	9.7	8	11.4	9.1
Unnamed 184.0	184.0-1	-							1	29.8	-																							1	29.8	-
Fog Creek	Fog-4	-							5	7.3	1.3															7	6.8	1.5	6	7.0	1.4	2	9.4	0.6	20	7.3	1.5
Fog Creek	Fog-3	-							5	16.5	4.3	1	12.6	-												6	13.7	5.9	7	16.2	5.6	4	11.6	1.6	23	14.6	4.9
Fog Creek	Fog-2	-							4	16.7	6.4												3	12.4	3.2	2	15.1	4.0	1	12.4	-				10	14.7	4.7
Fog Creek	Fog-1	-							3	21.2	10.5	1	13.9	-									2	5.7	1.5	2	21.2	1.4	9	9.7	6.5	3	13.9	8.4	20	13.0	8.1
Unnamed 173.8	NA	FA-173							3	4.3	1.0												3	3.0	1.1				3	4.0	0.7				9	3.8	1.1
Devils Canyon upper extent																																						
Chinook Creek	Chinook-2	-	1	1.8	-				1	4.2	-										1.0	1.6	-				5	7.4	1.1				6	4.0	2.3	14	4.9	2.6
Chinook Creek	Chinook-1	-										5	8.5	3.1												5	8.0	1.0				2	7.0	0.0	12	8.0	2.1
Cheechako Creek	Cheechako-1	-							1	11.3	-	4	10.7	2.0	1	5.1	-							4	9.8	2.2	3	10.8	1.9							13	10.1	2.3
Devils Canyon lower extent																																						
Portage Creek	NA	FA-151																								1	19.3	-	1	27.2	-	1	24.1	-	3	23.5	4.0
Unnamed 144.6	NA	FA-144																1	0.0	-															1	0.0	-
Indian River	NA	FA-141	1	2.0	-	1	4.5	-															3	4.6	3.6				8	8.3	6.5	7	6.5	5.3	20	6.6	5.4
Gold Creek	NA	-																								2	8.1	0.1	5	9.5	1.5	4	8.7	1.4	11	8.9	1.3
Fourth of July Creek	NA	-																					2	4.6	0.5	1	4.8	-	2	6.1	1.7	2	4.3	0.4	7	5.0	1.1
Sherman Creek	NA	-										1	4.0	-															2	2.7	1.1	1	1.5	-	4	2.7	1.2
Skull Creek	NA	FA-128																					1	10.3	-				1	3.3	-	1	7.6	-	3	7.1	3.5
Fifth of July Creek	NA	-										1	5.5	-																				1	5.5	-
Deadhorse Creek	NA	-							1	6.6	-																					1	4.5	-	2	5.6	1.5
Little Portage Creek	NA	-																								1	2.1	-							1	2.1	-
McKenzie Creek	NA	-																											1	1.4	-				1	1.4	-
Lane Creek	NA	-																											1	4.6	-				1	4.6	-
Unnamed 115.4	NA	FA-115																					2	2.4	2.2				4	0.8	0.1	3	1.1	0.4	9	1.3	1.0
Gash Creek	NA	FA-113																											1	2.4	-				1	2.4	-
Slash Creek	NA	FA-113										1	1.3	-									3	2.8	1.1				3	1.8	0.3	3	1.6	0.3	10	2.0	0.8
Unnamed 113.7	NA	FA-113										1	3.1	-																				1	3.1	-
Chase Creek	NA	-																					1	7.7	-				1	17.7	-	1	3.7	-	3	9.7	7.2
Whiskers Creek	NA	FA-104	1	1.8	-																		16	6.9	3.1				14	5.7	1.6	18	6.1	1.9	49	6.2	2.4
Total[1]			**3**	**1.9**	**0.1**	**1**	**4.5**	**-**	**26**	**13.5**	**8.1**	**15**	**8.4**	**4.0**	**1**	**5.1**	**-**	**1**	**0.0**	**-**	**1.0**	**1.6**	**-**	**41**	**6.5**	**3.7**	**36**	**10.5**	**5.5**	**72**	**7.7**	**6.0**	**61**	**6.7**	**4.8**	**258**	**8.1**	**5.9**

Table 5.2-5. Mean (±SD) bankfull depth (m) of mesohabitats in Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Tsusena Creek	Tsusena-1	-							2	0.8	0.4													1	0.8	-	1	0.6	-	2	0.6	0.1	2	0.8	0.2	8	0.7	0.2
Unnamed 184.0	184.0-1	-							1	0.4	-																								1	0.4	-
Fog Creek	Fog-4	-							5	0.8	0.5																7	0.7	0.2	6	0.7	0.1	2	0.9	0.1	20	0.8	0.3
Fog Creek	Fog-3	-							5	0.7	0.2	1	1.7	-													6	0.8	0.2	7	0.8	0.3	4	0.7	0.1	23	0.8	0.3
Fog Creek	Fog-2	-							4	1.1	0.7													3	1.8	0.3	2	0.7	0.1	1	1.0	-				10	1.2	0.6
Fog Creek	Fog-1	-							3	0.6	0.1	1	0.7	-										2	1.2	0.2	2	0.8	0.2	9	0.5	0.2	3	1.0	0.3	20	0.7	0.3
Unnamed 173.8	NA	FA-173							3	0.5	0.2													3	0.8	0.1				3	0.7	0.3				9	0.7	0.2
Devils Canyon upper extent																																						
Chinook Creek	Chinook-2	-	1	0.4	-				1	0.5	-										1.0	0.7	-				5	0.6	0.2				6	0.7	0.4	14	0.6	0.3
Chinook Creek	Chinook-1	-										5	1.0	0.5													5	0.6	0.4				2	0.7	0.1	12	0.8	0.4
Cheechako Creek	Cheechako-1	-							1	0.7	-	4	1.1	0.1	1	1.3	-							4	1.1	0.4	3	1.3	0.3							13	1.1	0.3
Devils Canyon lower extent																																						
Portage Creek	NA	FA-151																									1	0.9	-	1	3.5	-	1	1.4	-	3	1.9	1.4
Unnamed 144.6	NA	FA-144																1	0.8	-																1	0.8	-
Indian River	NA	FA-141				1	1.0	-																3	1.2	0.6				8	0.9	0.7	7	0.8	0.4	19	0.9	0.6
Gold Creek	NA	-																									2	0.7	0.6	4	0.9	0.2	4	1.1	0.4	10	0.9	0.4
Fourth of July Creek	NA	-																						2	0.7	0.1	1	0.5	-	2	0.5	0.2	2	0.8	0.2	7	0.6	0.2
Sherman Creek	NA	-										1	1.1	-																2	0.7	0.2	1	0.8	-	4	0.8	0.2
Skull Creek	NA	FA-128																						1	1.1	-				1	0.9	-	1	0.4	-	3	0.8	0.3
Fifth of July Creek	NA	-										1	2.1	-																						1	2.1	-
Deadhorse Creek	NA	-							1	0.4	-																						1	0.4	-	2	0.4	0.0
Little Portage Creek	NA	-																									1	1.7	-							1	1.7	-
McKenzie Creek	NA	-																1	0.7	-										1	0.6	-				2	0.7	0.1
Lane Creek	NA	-																												1	1.0	-				1	1.0	-
Unnamed 115.4	NA	FA-115																						2	0.6	0.1				4	0.6	0.1	3	0.5	0.1	9	0.6	0.1
Gash Creek	NA	FA-113																												1	0.5	-				1	0.5	-
Slash Creek	NA	FA-113										1	0.6	-										3	0.8	0.1				3	0.5	0.2	3	0.6	0.1	10	0.6	0.1
Unnamed 113.7	NA	FA-113										1	0.9	-																						1	0.9	-
Chase Creek	NA	-																						1	0.7	-							1	0.8	-	2	0.8	0.0
Whiskers Creek	NA	FA-104	1	0.6	-																			15	1.0	0.2				14	0.7	0.3	18	0.7	0.2	48	0.8	0.3
Total[1]			**2**	**0.5**	**0.1**	**1**	**1.0**	**-**	**26**	**0.7**	**0.4**	**15**	**1.1**	**0.4**	**1**	**1.3**	**-**	**2**	**0.7**	**0.0**	**1.0**	**0.7**	**-**	**40**	**1.0**	**0.4**	**36**	**0.8**	**0.3**	**70**	**0.8**	**0.5**	**61**	**0.8**	**0.3**	**255**	**0.8**	**0.4**

Table 5.2-6. Mean (±SD) thalweg depth (m) of mesohabitats in Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Tsusena Creek	Tsusena-1	-							2	0.8	0.4													1	0.5	-	1	0.6	-	2	0.4	0.0	2	0.5	0.2	8	0.6	0.2
Unnamed 184.0	184.0-1	-							1	0.2	-																								1	0.2	-
Fog Creek	Fog-4	-							5	0.5	0.3																7	0.7	0.2	6	0.7	0.1	2	0.6	0.0	20	0.7	0.2
Fog Creek	Fog-3	-							5	0.6	0.1	1	1.2	-													6	0.6	0.3	7	0.7	0.3	4	0.5	0.1	23	0.6	0.3
Fog Creek	Fog-2	-							4	0.9	0.3													3	1.1	1.0	2	0.5	0.4	1	1.0	-				10	0.9	0.6
Fog Creek	Fog-1	-							3	0.5	0.2	1	0.7	-										2	0.5	0.2	2	0.7	0.1	9	0.4	0.2	3	0.8	0.2	20	0.5	0.2
Unnamed 173.8	NA	FA-173							3	0.5	0.2													3	0.4	0.0				3	0.4	0.2				9	0.4	0.1
Devils Canyon upper extent																																						
Chinook Creek	Chinook-2	-	1	0.2	-				1	0.5	-										1.0	0.7	-				5	0.6	0.2				6	0.5	0.2	14	0.5	0.2
Chinook Creek	Chinook-1	-										5	0.6	0.3													5	0.5	0.3				2	0.3	0.1	12	0.5	0.3
Cheechako Creek	Cheechako-1	-							1	0.7	-	4	0.9	0.1	1	1.1	-							4	0.6	0.3	3	0.7	0.2							13	0.8	0.2
Devils Canyon lower extent																																						
Portage Creek	NA	FA-151																									1	0.8	-	1	3.4	-	1	0.4	-	3	1.6	1.6
Unnamed 144.6	NA	FA-144																1	0.0	-																1	0.0	-
Indian River	NA	FA-141				1	0.3	-																3	0.5	0.3				8	0.7	0.4	7	0.5	0.3	19	0.5	0.3
Gold Creek	NA	-																									2	0.5	0.3	5	0.5	0.3	4	0.9	0.5	11	0.6	0.4
Fourth of July Creek	NA	-																						2	0.4	0.2	1	0.5	-	2	0.4	0.1	2	0.5	0.0	7	0.5	0.1
Sherman Creek	NA	-										1	0.3	-																2	0.3	0.2	1	0.8	-	4	0.4	0.3
Skull Creek	NA	FA-128																						1	0.5	-				1	0.9	-	1	0.2	-	3	0.5	0.3
Fifth of July Creek	NA	-										1	0.9	-																						1	0.9	-
Deadhorse Creek	NA	-							1	0.2	-																						1	0.4	-	2	0.3	0.1
Little Portage Creek	NA	-																									1	0.9	-							1	0.9	-
McKenzie Creek	NA	-																												1	0.6	-				1	0.6	-
Lane Creek	NA	-																												1	1.0	-				1	1.0	-
Unnamed 115.4	NA	FA-115																						2	0.3	0.2				4	0.2	0.2	3	0.2	0.1	9	0.3	0.2
Gash Creek	NA	FA-113																												1	0.5	-				1	0.5	-
Slash Creek	NA	FA-113										1	0.1	-										3	0.4	0.1				3	0.3	0.2	3	0.4	0.2	10	0.4	0.2
Unnamed 113.7	NA	FA-113										1	0.2	-																						1	0.2	-
Chase Creek	NA	-																						1	0.2	-				1	0.2	-	1	0.8	-	3	0.4	0.3
Whiskers Creek	NA	FA-104	1	0.3	-																			16	0.6	0.3				14	0.5	0.3	18	0.5	0.2	49	0.5	0.3
Total[1]			**2**	**0.2**	**0.0**	**1**	**0.3**	**-**	**26**	**0.6**	**0.3**	**15**	**0.7**	**0.3**	**1**	**1.1**	**-**	**1**	**0.0**	**-**	**1.0**	**0.7**	**-**	**41**	**0.5**	**0.4**	**36**	**0.6**	**0.2**	**72**	**0.6**	**0.4**	**61**	**0.5**	**0.3**	**257**	**0.6**	**0.3**

Table 5.2-7. Mean (±SD) max pool and crest depths (m) of Beaver Pond and Pool mesohabitats in Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Average Max Pool Depth									Average Pool Crest Depth					
			Beaver Pond			Pool			All Units2			Pool			All Units[2]		
			n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Tsusena Creek	Tsusena-1	-				1	0.5	-	1	0.5	-	1	0.0	-	1	0.0	-
Unnamed 184.0	184.0-1	-															
Fog Creek	Fog-4	-															
Fog Creek	Fog-3	-															
Fog Creek	Fog-2	-				3	2.6	0.7	3	2.6	0.7	3	0.7	0.2	3	0.7	0.2
Fog Creek	Fog-1	-				2	0.9	0.0	2	0.9	0.0	2	0.4	0.0	2	0.4	0.0
Unnamed 173.8	NA	FA-173				3	0.6	0.1	3	0.6	0.1	3	0.2	0.0	3	0.2	0.0
Devils Canyon upper extent																	
Chinook Creek	Chinook-2	-															
Chinook Creek	Chinook-1	-															
Cheechako Creek	Cheechako-1	-				4	1.7	0.3	4	1.7	0.3	4	0.5	0.1	4	0.5	0.1
Devils Canyon lower extent																	
Portage Creek	NA	FA-151															
Unnamed 144.6	NA	FA-144															
Indian River	NA	FA-141	1	1.0	-	3	1.5	0.3	4	1.4	0.4	3	0.2	0.2	4	0.2	0.1
Gold Creek	NA	-															
Fourth of July Creek	NA	-				2	1.0	0.0	2	1.0	0.0	2	0.3	0.0	2	0.3	0.0
Sherman Creek	NA	-															
Skull Creek	NA	FA-128				1	0.7	-	1	0.7	-	1	0.1	-	1	0.1	-
Fifth of July Creek	NA	-															
Deadhorse Creek	NA	-															
Little Portage Creek	NA	-															
McKenzie Creek	NA	-															
Lane Creek	NA	-															
Unnamed 115.4	NA	FA-115				2	0.6	0.5	4	0.4	0.4	2	0.1	0.1	4	0.1	0.1
Gash Creek	NA	FA-113															
Slash Creek	NA	FA-113				3	0.7	0.2	3	0.7	0.2	3	0.1	0.0	3	0.1	0.0
Unnamed 113.7	NA	FA-113															
Chase Creek	NA	-				1	1.5	-	1	1.5	-	1	0.1	-	1	0.1	-
Whiskers Creek	NA	FA-104				15	1.3	0.7	15	1.3	0.7	14	0.3	0.2	14	0.3	0.2
Total[1]			**1**	**1.0**	**-**	**40**	**1.2**	**0.7**	**43**	**1.2**	**0.7**	**39**	**0.3**	**0.2**	**42**	**0.3**	**0.2**

Table 5.2-8. Mean (±SD) percent erosion along mesohabitat units in Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Tsusena Creek	Tsusena-1	-							2	0.0	0.0												1	0.0	-	1.0	0.0	-	2	0.0	0.0	2	0.0	0.0	8	0.0	0.0
Unnamed 184.0	184.0-1	-							1	0.0	-																							1	0.0	-
Fog Creek	Fog-4	-							5	0.0	0.0															7.0	0.0	0.0	6	0.0	0.0	2	0.0	0.0	20	0.0	0.0
Fog Creek	Fog-3	-							5	0.5	1.1	1	0.0	-												6.0	8.8	20.2	7	0.4	0.9	4	1.3	2.5	23	2.7	10.4
Fog Creek	Fog-2	-							4	5.0	10.0												3	18.3	16.1	2.0	20.0	14.1	1	80.0	-				10	19.5	24.8
Fog Creek	Fog-1	-							3	11.7	12.6	1	0.0	-									2	0.0	0.0	2.0	15.0	7.1	8	0.0	0.0	3	5.8	6.3	19	4.3	7.6
Unnamed 173.8	NA	FA-173							3	31.7	30.6												3	66.7	28.9				3	35.0	56.3				9	44.4	38.9
Devils Canyon upper extent																																						
Chinook Creek	Chinook-2	-	1	0.0	-				1	0.0	-										1.0	0.0	-				5.0	0.0	0.0				6	3.3	8.2	14	1.4	5.3
Chinook Creek	Chinook-1	-										5	0.0	0.0													5.0	0.0	0.0				2	0.0	0.0	12	0.0	0.0
Cheechako Creek	Cheechako-1	-							1	0.0	-	4	0.0	0.0	1	0.0	-							4	0.6	1.3	3.0	0.0	0.0							13	0.2	0.7
Devils Canyon lower extent																																						
Portage Creek	NA	FA-151																								1.0	0.0	-	1	0.0	-	1	0.0	-	3	0.0	0.0
Unnamed 144.6	NA	FA-144																1	0.0	-															1	0.0	-
Indian River	NA	FA-141				1	0.0	-																3	0.0	0.0				8	0.0	0.0	7	0.5	1.2	19	0.2	0.8
Gold Creek	NA	-																									2.0	0.0	0.0	5	0.0	0.0	4	0.0	0.0	11	0.0	0.0
Fourth of July Cr.	NA	-																						2	2.5	3.5	1.0	0.0	-	2	7.5	7.1	2	33.8	23.0	7	12.5	17.8
Sherman Cr.	NA	-										1	25.0	-															2	5.0	7.1	1	0.0	-	4	8.8	11.8
Skull Cr.	NA	FA-128																						1	100.0	-				1	100.0	-	1	100.0	-	3	100.0	0.0
Fifth of July Cr.	NA	-										1	0.0	-																					1	0.0	-
Deadhorse Creek	NA	-							1	0.0	-																					1	0.0	-	2	0.0	0.0
Little Portage Cr.	NA	-																									1.0	0.0	-							1	0.0	-
McKenzie Creek	NA	-																1	2.5	-										1	50.0	-				2	26.3	33.6
Lane Creek	NA	-																												1	0.0	-				1	0.0	-
Unnamed 115.4	NA	FA-115																						2	42.5	60.1				4	40.0	46.2	3	50.0	47.7	9	43.9	42.9
Gash Creek	NA	FA-113																												1	0.0	-				1	0.0	-
Slash Creek	NA	FA-113										1	0.0	-										3	0.0	0.0				3	0.0	0.0	3	0.0	0.0	10	0.0	0.0
Unnamed 113.7	NA	FA-113										1	0.0	-																					1	0.0	-
Chase Creek	NA	-																						1	0.0	-				1	0.0	-	1	0.0	-	3	0.0	0.0
Whiskers Creek	NA	FA-104	1	0.0	-																			16	4.9	7.7				14	1.8	4.6	18	3.0	4.6	49	3.2	5.8
Total[1]			**2**	**0.0**	**0.0**	**1**	**0.0**	**-**	**26**	**5.9**	**14.3**	**15**	**1.7**	**6.5**	**1**	**0.0**	**-**	**2**	**1.3**	**1.8**	**1.0**	**0.0**	**-**	**41**	**12.8**	**26.6**	**36.0**	**3.4**	**10.1**	**71**	**7.7**	**23.3**	**61**	**6.8**	**19.6**	**257**	**7.0**	**19.9**

Table 5.2-9. Mean (±SD) percent undercut banks along mesohabitat units in Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Tsusena Creek	Tsusena-1	-							2	0.0	0.0												1.0	0.0	-	1.0	0.0	-	2	0.0	0.0	2	0.0	0.0	8	0.0	0.0
Unnamed 184.0	184.0-1	-							1	5.0	-																								1	5.0	-
Fog Creek	Fog-4	-							5	0.0	0.0															7.0	0.4	0.9	6	0.0	0.0	2	17.5	24.7	20	1.9	7.8
Fog Creek	Fog-3	-							5	0.0	0.0	1	0.0	-												6.0	0.8	2.0	7	0.0	0.0	4	0.0	0.0	23	0.2	1.0
Fog Creek	Fog-2	-							4	0.0	0.0												3.0	18.3	16.1	2.0	5.0	0.0	1	5.0	-				10	7.0	11.1
Fog Creek	Fog-1	-							3	3.3	3.8	1	50.0	-									2.0	2.5	3.5	2.0	18.8	23.0	8	0.6	1.8	3	1.7	2.9	19	5.9	13.3
Unnamed 173.8	NA	FA-173							3	1.7	2.9												3.0	8.3	14.4				3	0.3	0.6				9	3.4	8.2
Devils Canyon upper extent																																						
Chinook Creek	Chinook-2	-	1	0.0	-				1	0.0	-										1.0	0.0	-				5.0	1.0	2.2				6	0.0	0.0	14	0.4	1.3
Chinook Creek	Chinook-1	-										5	0.0	0.0												5.0	0.0	0.0				2	0.0	0.0	12	0.0	0.0
Cheechako Creek	Cheechako-1	-							1	0.0	-	4	0.0	0.0	1	0.0	-							4.0	0.0	0.0	3.0	0.0	0.0							13	0.0	0.0
Devils Canyon lower extent																																						
Portage Creek	NA	FA-151																								1.0	0.0	-	1	0.0	-	1	0.0	-	3	0.0	0.0
Unnamed 144.6	NA	FA-144																1	0.0	-															1	0.0	-
Indian River	NA	FA-141				1	40.0	-																3.0	10.0	10.0				8	1.3	3.5	7	1.1	1.8	19	4.6	10.1
Gold Creek	NA	-																								2.0	0.0	0.0	5	0.0	0.0	4	0.0	0.0	11	0.0	0.0
Fourth of July Cr.	NA	-																						2.0	22.5	31.8	1.0	5.0	-	2	0.0	0.0	2	20.0	28.3	7	12.9	20.4
Sherman Cr.	NA	-										1	12.5	-															2	8.7	1.8	1	0.0	-	4	7.5	5.4
Skull Cr.	NA	FA-128																						1.0	0.0	-				1	0.0	-	1	0.0	-	3	0.0	0.0
Fifth of July Cr.	NA	-										1	0.0	-																					1	0.0	-
Deadhorse Creek	NA	-							1	0.0	-																					1	0.0	-	2	0.0	0.0
Little Portage Cr.	NA	-																								1.0	0.0	-							1	0.0	-
McKenzie Creek	NA	-																1	10.0	-									1	0.0	-				2	5.0	7.1
Lane Creek	NA	-																											1	0.0	-				1	0.0	-
Unnamed 115.4	NA	FA-115																						2.0	0.0	0.0				4	5.0	10.0	3	0.0	0.0	9	2.2	6.7
Gash Creek	NA	FA-113																											1	0.0	-				1	0.0	-
Slash Creek	NA	FA-113										1	0.0	-										3.0	0.0	0.0				3	8.3	14.4	3	0.0	0.0	10	2.5	7.9
Unnamed 113.7	NA	FA-113										1	0.0	-																					1	0.0	-
Chase Creek	NA	-																						1.0	0.0	-				1	0.0	-	1	0.0	-	3	0.0	0.0
Whiskers Creek	NA	FA-104	1	25.0	-																			16.0	26.4	30.3				14	10.0	14.9	18	18.7	19.1	49	18.9	22.8
Total[1]			**2**	**12.5**	**17.7**	**1**	**40.0**	**-**	**26**	**0.8**	**2.0**	**15**	**4.2**	**13.1**	**1**	**0.0**	**-**	**2**	**5.0**	**7.1**	**1.0**	**0.0**	**-**	**41.0**	**14.2**	**23.1**	**36.0**	**1.8**	**6.0**	**71**	**3.1**	**8.4**	**61**	**7.0**	**14.4**	**257**	**5.7**	**13.8**

Table 5.2-10. Mean (±SD) LWD count in mesohabitat units of Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove		Beaver Pond		Boulder Riffle		Cascade		Chute		Dry		Percolation Channel		Pool		Rapid		Riffle		Run/Glide		All Units[2]	
			n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD	n	Sum of LWD
Tsusena Creek	Tsusena-1	-					2	7									1	0	1	2	2	2	2	4	8	15
Unnamed 184.0	184.0-1	-					1	1																	1	1
Fog Creek	Fog-4	-					5	0											7	1	6	0	2	2	20	3
Fog Creek	Fog-3	-					5	2	1	0									6	7	7	2	4	1	23	12
Fog Creek	Fog-2	-					4	7									3	0	2	1	1	2			10	10
Fog Creek	Fog-1	-					3	20	1	5							2	13	2	13	8	39	3	6	19	96
Unnamed 173.8	NA	FA-173					3	83									3	9			3	27			9	119
Devils Canyon upper extent																										
Chinook Creek	Chinook-2	-	1	0			1	0							1	0			5	1			6	0	14	1
Chinook Creek	Chinook-1	-							5	1									5	0			2	0	12	1
Cheechako Creek	Cheechako-1	-					1	3	4	16	1	0					4	8	3	3					13	30
Devils Canyon lower extent																										
Portage Creek	NA	FA-151																	1	2	1	2	1	0	3	4
Unnamed 144.6	NA	FA-144											1	19											1	19
Indian River	NA	FA-141	1	12	1	15											3	47			7	44	7	108	19	226
Gold Creek	NA	-																	2	11	5	21	4	3	11	35
Fourth of July Cr.	NA	-															2	7	1	7	2	6	2	3	7	23
Sherman Cr.	NA	-							1	1											2	6	1	1	4	8
Skull Cr.	NA	FA-128															1	0			1	0	1	0	3	0
Fifth of July Cr.	NA	-							1	0															1	0
Deadhorse Creek	NA	-					1	0															1	0	2	0
Little Portage Cr.	NA	-																	1	0					1	0
McKenzie Creek	NA	-											1	4							1	3			2	7
Lane Creek	NA	-																			1	1			1	1
Unnamed 115.4	NA	FA-115															2	53			4	18	3	40	9	111
Gash Creek	NA	FA-113																			1	5			1	5
Slash Creek	NA	FA-113							1	0							3	38			3	19	3	9	10	66
Unnamed 113.7	NA	FA-113							1	1															1	1
Chase Creek	NA	-															1	4			1	0	1	15	3	19
Whiskers Creek	NA	FA-104	1	0													16	151			14	98	18	167	49	416
Total[1]			**3**	**12**	**1**	**15**	**26**	**123**	**15**	**24**	**1**	**0**	**2**	**23**	**1**	**0**	**41**	**330**	**36**	**48**	**70**	**295**	**61**	**359**	**257**	**1,229**

Table 5.2-11. Mean (±SD) percent bedrock substrate in mesohabitat units of Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Tsusena Creek	Tsusena-1	-							2	0.0	0.0												1	0.0	-	1	0.0	-	2	0.0	0.0	2	0.0	0.0	8	0.0	0.0
Unnamed 184.0	184.0-1	-							1	0.0	-																							1	0.0	-
Fog Creek	Fog-4	-							5	0.0	0.0															7	0.0	0.0	6	0.0	0.0	2	0.0	0.0	20	0.0	0.0
Fog Creek	Fog-3	-							5	0.0	0.0	1	20.0	-												4	5.6	6.5	7	0.0	0.0	4	11.3	13.1	21	4.2	8.1
Fog Creek	Fog-2	-							4	0.0	0.0												3	13.3	11.5	2	5.0	7.1	1	0.0	-				10	5.0	8.5
Fog Creek	Fog-1	-							3	0.0	0.0	1	0.0	-									2	0.0	0.0	2	0.0	0.0	9	0.0	0.0	3	0.0	0.0	20	0.0	0.0
Unnamed 173.8	NA	FA-173							3	0.0	0.0												3	0.0	0.0				3	0.0	0.0				9	0.0	0.0
Devils Canyon upper extent																																						
Chinook Creek	Chinook-2	-	1	0.0	-				1	0.0	-										1	0.0	-				5	0.0	0.0				6	0.0	0.0	14	0.0	0.0
Chinook Creek	Chinook-1	-										5	0.0	0.0												5	0.0	0.0				2	0.0	0.0	12	0.0	0.0
Cheechako Creek	Cheechako-1	-							1	0.0	-	4	1.3	2.5	1	40.0	-							4	10.0	20.0	3	8.3	14.4							13	8.5	15.6
Devils Canyon lower extent																																						
Portage Creek	NA	FA-151																								1	5.0	-	1	0.0	-	1	0.0	-	3	1.7	2.9
Unnamed 144.6	NA	FA-144																1	0.0	-															1	0.0	-
Indian River	NA	FA-141				1	0.0	-																3	0.0	0.0				8	0.0	0.0	7	0.0	0.0	19	0.0	0.0
Gold Creek	NA	-																								2	0.0	0.0	5	0.0	0.0	4	0.0	0.0	11	0.0	0.0
Fourth of July Cr.	NA	-																						2	0.0	0.0	1	0.0	-	2	0.0	0.0	2	0.0	0.0	7	0.0	0.0
Sherman Cr.	NA	-										1	0.0	-															2	0.0	0.0	1	0.0	-	4	0.0	0.0
Skull Cr.	NA	FA-128																						1	0.0	-				1	0.0	-	1	0.0	-	3	0.0	0.0
Fifth of July Cr.	NA	-										1	0.0	-																				1	0.0	-
Deadhorse Creek	NA	-							1	0.0	-																					1	0.0	-	2	0.0	0.0
Little Portage Cr.	NA	-																								1	0.0	-							1	0.0	-
McKenzie Creek	NA	-																1	0.0	-									1	0.0	-				2	0.0	0.0
Lane Creek	NA	-																											1	0.0	-				1	0.0	-
Unnamed 115.4	NA	FA-115																						2	0.0	0.0				4	0.0	0.0	3	0.0	0.0	9	0.0	0.0
Gash Creek	NA	FA-113																											1	0.0	-				1	0.0	-
Slash Creek	NA	FA-113										1	0.0	-										3	0.0	0.0				3	0.0	0.0	3	0.0	0.0	10	0.0	0.0
Unnamed 113.7	NA	FA-113										1	0.0	-																					1	0.0	-
Chase Creek	NA	-																						1	0.0	-				1	0.0	-	1	0.0	-	3	0.0	0.0
Whiskers Creek	NA	FA-104	1	0.0	-																			16	0.0	0.0				13	0.0	0.0	18	0.0	0.0	48	0.0	0.0
Total[1]			**2**	**0.0**	**0.0**	**1**	**0.0**	**-**	**26**	**0.0**	**0.0**	**15**	**1.7**	**5.2**	**1**	**40.0**	**-**	**2**	**0.0**	**0.0**	**1.0**	**0.0**	**-**	**41**	**2.0**	**7.5**	**34**	**1.8**	**5.2**	**71**	**0.0**	**0.0**	**61**	**0.7**	**4.1**	**255**	**1.0**	**4.9**

Table 5.2-12. Mean (±SD) percent boulder substrate in mesohabitat units of Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Tsusena Creek	Tsusena-1	-							2	72.5	10.6												1	0.0	-	1	80.0	-	2	2.5	3.5	2	25.0	35.4	8	35.0	37.3
Unnamed 184.0	184.0-1	-							1	40.0	-																								1	40.0	-
Fog Creek	Fog-4	-							5	34.0	5.5															7	25.7	17.2	6	11.7	4.1	2	2.5	3.5	20	21.3	14.9
Fog Creek	Fog-3	-							5	50.3	24.1	1	60.0	-												4	46.4	22.0	7	22.1	16.5	4	7.5	8.7	21	32.5	24.5
Fog Creek	Fog-2	-							4	65.0	10.0												3	31.7	10.4	2	35.0	21.2	1	5.0	-				10	43.0	23.2
Fog Creek	Fog-1	-							3	65.0	5.0	1	5.0	-									2	5.0	7.1	2	67.5	3.5	9	8.9	13.2	3	16.7	28.9	20	23.8	28.4
Unnamed 173.8	NA	FA-173							3	33.3	5.8												3	23.3	20.8				3	23.9	10.5				9	26.9	13.0
Devils Canyon upper extent																																						
Chinook Creek	Chinook-2	-	1	10.0	-				1	30.0	-										1	10.0	-				5	34.0	16.7				6	13.3	8.2	14	21.4	15.1
Chinook Creek	Chinook-1	-										5	68.0	16.4												5	64.0	8.9				2	35.0	7.1	12	60.8	16.8
Cheechako Creek	Cheechako-1	-							1	70.0	-	4	77.5	15.0	1	25.0	-							4	51.3	36.1	3	66.7	5.8							13	62.3	25.1
Devils Canyon lower extent																																						
Portage Creek	NA	FA-151																								1	40.0	-	1	20.0	-	1	30.0	-	3	30.0	10.0
Unnamed 144.6	NA	FA-144																1	11.1	-															1	11.1	-
Indian River	NA	FA-141				1	0.0	-																3	4.4	7.6				8	2.5	4.6	7	1.4	3.8	19	2.3	4.6
Gold Creek	NA	-																								2	10.0	0.0	5	10.0	7.1	4	5.0	5.8	11	8.2	6.0
Fourth of July Cr.	NA	-																						2	5.0	7.1	1	10.0	-	2	0.0	0.0	2	0.0	0.0	7	2.9	4.9
Sherman Cr.	NA	-										1	80.0	-															2	20.8	27.1	1	0.0	-	4	30.4	37.9
Skull Cr.	NA	FA-128																						1	0.0	-				1	0.0	-	1	0.0	-	3	0.0	0.0
Fifth of July Cr.	NA	-										1	55.6	-																					1	55.6	-
Deadhorse Creek	NA	-							1	20.0	-																					1	30.0	-	2	25.0	7.1
Little Portage Cr.	NA	-																								1	0.0	-							1	0.0	-
McKenzie Creek	NA	-																1	20.0	-									1	5.0	-				2	12.5	10.6
Lane Creek	NA	-																											1	0.0	-				1	0.0	-
Unnamed 115.4	NA	FA-115																						2	4.1	5.8				4	12.5	25.0	3	0.0	0.0	9	6.5	16.5
Gash Creek	NA	FA-113																											1	0.0	-				1	0.0	-
Slash Creek	NA	FA-113										1	0.0	-										3	0.0	0.0				3	0.0	0.0	3	0.0	0.0	10	0.0	0.0
Unnamed 113.7	NA	FA-113										1	15.0	-																					1	15.0	-
Chase Creek	NA	-																						1	50.0	-				1	30.0	-	1	40.0	-	3	40.0	10.0
Whiskers Creek	NA	FA-104	1	0.0	-																			16	0.0	0.0				13	0.0	0.0	18	0.0	0.0	48	0.0	0.0
Total[1]			**2**	**5.0**	**7.1**	**1**	**0.0**	**-**	**26**	**49.3**	**19.4**	**15**	**57.7**	**29.6**	**1**	**25.0**	**-**	**2**	**15.6**	**6.3**	**1**	**10.0**	**-**	**41**	**11.3**	**21.2**	**34**	**41.5**	**24.2**	**71**	**8.5**	**12.7**	**61**	**6.8**	**13.1**	**255**	**20.1**	**25.4**

Table 5.2-13. Mean (±SD) percent cobble substrate in mesohabitat units of Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Tsusena Creek	Tsusena-1	-							2	20.0	7.1												1	40.0	-	1	15.0	-	2	40.0	42.4	2	45.0	7.1	8	33.1	20.7
Unnamed 184.0	184.0-1	-							1	50.0	-																								1	50.0	-
Fog Creek	Fog-4	-							5	44.0	5.5															7	50.7	20.5	6	44.2	20.6	2	65.0	21.2	20	48.5	17.8
Fog Creek	Fog-3	-							5	43.7	20.5	1	20.0	-												4	41.8	18.1	7	57.9	9.9	4	60.0	21.6	21	50.0	18.5
Fog Creek	Fog-2	-							4	25.0	10.0												3	36.7	11.5	2	40.0	14.1	1	40.0	-				10	33.0	11.6
Fog Creek	Fog-1	-							3	28.3	7.6	1	35.0	-									2	47.5	10.6	2	30.0	0.0	9	68.3	14.1	3	43.3	23.1	20	51.0	21.1
Unnamed 173.8	NA	FA-173							3	33.3	5.8												3	36.7	11.5				3	39.8	9.7				9	36.6	8.5
Devils Canyon upper extent																																						
Chinook Creek	Chinook-2	-	1	0.0	-				1	30.0	-										1	10.0	-				5	52.0	16.4				6	46.7	12.1	14	41.4	20.3
Chinook Creek	Chinook-1	-										5	20.0	12.2												5	22.0	4.5				2	55.0	7.1	12	26.7	15.6
Cheechako Creek	Cheechako-1	-							1	20.0	-	4	13.8	4.8	1	25.0	-							4	17.5	9.6	3	15.0	8.7							13	16.5	7.2
Devils Canyon lower extent																																						
Portage Creek	NA	FA-151																								1	50.0	-	1	75.0	-	1	60.0	-	3	61.7	12.6
Unnamed 144.6	NA	FA-144																1	77.8	-															1	77.8	-
Indian River	NA	FA-141				1	0.0	-																3	38.9	25.3				8	66.3	27.7	7	42.8	26.7	19	49.8	30.1
Gold Creek	NA	-																								2	50.0	14.1	5	56.0	15.2	4	50.0	25.8	11	52.7	17.9
Fourth of July Cr.	NA	-																						2	40.0	28.3	1	80.0	-	2	80.0	0.0	2	70.0	14.1	7	65.7	22.3
Sherman Cr.	NA	-										1	15.0	-															2	35.8	27.1	1	85.0	-	4	42.9	33.6
Skull Cr.	NA	FA-128																						1	10.0	-				1	55.0	-	1	20.0	-	3	28.3	23.6
Fifth of July Cr.	NA	-										1	43.4	-																					1	43.4	-
Deadhorse Creek	NA	-							1	60.0	-																					1	60.0	-	2	60.0	0.0
Little Portage Cr.	NA	-																								1	40.0	-							1	40.0	-
McKenzie Creek	NA	-																1	50.0	-									1	70.0	-				2	60.0	14.1
Lane Creek	NA	-																											1	30.0	-				1	30.0	-
Unnamed 115.4	NA	FA-115																						2	0.0	0.0				4	0.0	0.0	3	0.0	0.0	9	0.0	0.0
Gash Creek	NA	FA-113																											1	40.0	-				1	40.0	-
Slash Creek	NA	FA-113										1	0.0	-										3	0.0	0.0				3	8.3	14.4	3	3.3	2.9	10	3.5	7.8
Unnamed 113.7	NA	FA-113										1	10.0	-																					1	10.0	-
Chase Creek	NA	-																						1	40.0	-				1	60.0	-	1	40.0	-	3	46.7	11.5
Whiskers Creek	NA	FA-104	1	0.0	-																			16	16.8	15.4				13	21.5	19.1	18	24.0	21.1	48	20.4	18.6
Total[1]			**2**	**0.0**	**0**	**1**	**0.0**	**-**	**26**	**35.5**	**14.4**	**15**	**18.6**	**12.2**	**1**	**25.0**	**-**	**2**	**63.9**	**19.6**	**1**	**10.0**	**-**	**41**	**22.9**	**18.9**	**34**	**40.1**	**19.8**	**71**	**45.1**	**27.4**	**61**	**38.1**	**25.9**	**255**	**36.1**	**24.5**

Table 5.2-14. Mean (±SD) percent gravel substrate in mesohabitat units of Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Tsusena Creek	Tsusena-1	-							2	5.0	0.0												1	40.0	-	1	5.0	-	2	55.0	49.5	2	17.5	17.7	8	25.0	29.5
Unnamed 184.0	184.0-1	-							1	10.0	-																							1	10.0	-
Fog Creek	Fog-4	-							5	18.0	8.4															7	19.3	14.8	6	34.2	15.6	2	22.5	10.6	20	23.8	14.3
Fog Creek	Fog-3	-							5	6.0	4.2	1	0.0	-												4	6.3	4.8	7	20.0	8.7	4	21.3	14.9	21	13.3	11.1
Fog Creek	Fog-2	-							4	10.0	0.0												3	11.7	2.9	2	20.0	14.1	1	55.0	-				10	17.0	14.8
Fog Creek	Fog-1	-							3	6.7	5.8	1	60.0	-									2	32.5	38.9	2	2.5	3.5	9	22.8	18.0	3	33.3	23.1	20	22.8	21.5
Unnamed 173.8	NA	FA-173							3	33.3	5.8												3	36.7	15.3				3	33.0	6.0				9	34.3	8.9
Devils Canyon upper extent																																						
Chinook Creek	Chinook-2	-	1	0.0	-				1	20.0	-										1.0	10.0	-			5	14.0	5.5				6	30.0	17.9	14	20.0	15.2
Chinook Creek	Chinook-1	-										5	12.0	4.5												5	14.0	8.9				2	10.0	0.0	12	12.5	6.2
Cheechako Creek	Cheechako-1	-							1	10.0	-	4	7.5	9.6	1	10.0	-							4	20.0	14.7	3	10.0	10.0							13	12.3	11.1
Devils Canyon lower extent																																						
Portage Creek	NA	FA-151																								1	5.0	-	1	5.0	-	1	10.0	-	3	6.7	2.9
Unnamed 144.6	NA	FA-144																1	11.1	-															1	11.1	-
Indian River	NA	FA-141				1	0.0	-																3	31.1	8.4				8	30.0	26.2	7	39.4	20.9	19	32.0	22.4
Gold Creek	NA	-																								2	35.0	7.1	5	30.0	12.2	4	40.0	24.5	11	34.5	16.3
Fourth of July Cr.	NA	-																						2	35.0	35.4	1	10.0	-	2	10.0	0.0	2	17.5	10.6	7	19.3	18.8
Sherman Cr.	NA	-										1	5.0	-															2	40.2	49.7	1	15.0	-	4	25.1	33.8
Skull Cr.	NA	FA-128																						1	20.0	-				1	45.0	-	1	70.0	-	3	45.0	25.0
Fifth of July Cr.	NA	-										1	0.9	-																					1	0.9	-
Deadhorse Creek	NA	-							1	20.0	-																					1	10.0	-	2	15.0	7.1
Little Portage Cr.	NA	-																								1	60.0	-							1	60.0	-
McKenzie Creek	NA	-																1	30.0	-									1	20.0	-				2	25.0	7.1
Lane Creek	NA	-																											1	60.0	-				1	60.0	-
Unnamed 115.4	NA	FA-115																						2	0.0	0.0				4	7.5	15.0	3	0.0	0.0	9	3.3	10.0
Gash Creek	NA	FA-113																											1	45.0	-				1	45.0	-
Slash Creek	NA	FA-113										1	70.0	-										3	65.0	5.0				3	70.0	10.0	3	36.7	32.5	10	58.5	22.2
Unnamed 113.7	NA	FA-113										1	75.0	-																					1	75.0	-
Chase Creek	NA	-																						1	10.0	-				1	10.0	-	1	20.0	-	3	13.3	5.8
Whiskers Creek	NA	FA-104	1	0.0	-																			16	26.9	23.6				13.0	70.0	20.0	18	53.0	27.5	48	47.8	30.0
Total[1]			**2**	**0.0**	**0.0**	**1**	**0.0**	**-**	**26**	**13.5**	**10.0**	**15**	**20.1**	**25.9**	**1**	**10.0**	**-**	**2**	**20.6**	**13.4**	**1**	**10.0**	**-**	**41**	**28.0**	**22.4**	**34**	**15.4**	**13.7**	**71**	**37.2**	**27.0**	**61**	**34.8**	**25.7**	**255**	**28.0**	**24.5**

Table 5.2-15. Mean (±SD) percent and and silt substrate in mesohabitat units of Middle r River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Tsusena Creek	Tsusena-1	-							2	2.5	3.5													1	20.0	-	1	0.0	-	2	2.5	3.5	2	12.5	10.6	8	6.9	8.4
Unnamed 184.0	184.0-1	-							1	0.0	-																								1	0.0	-
Fog Creek	Fog-4	-							5	4.0	5.5															7	4.3	5.3	6	10.0	6.3	2	10.0	14.1	20	6.5	6.7
Fog Creek	Fog-3	-							5	0.0	0.0	1	0.0	-												4	0.0	0.0	7	0.0	0.0	4	0.0	0.0	21	0.0	0.0
Fog Creek	Fog-2	-							4	0.0	0.0													3	6.7	11.5	2	0.0	0.0	1	0.0	-				10	2.0	6.3
Fog Creek	Fog-1	-							3	0.0	0.0	1	0.0	-										2	15.0	21.2	2	0.0	0.0	9	0.0	0.0	3	6.7	5.8	20	2.5	7.2
Unnamed 173.8	NA	FA-173							3	0.0	0.0													3	3.3	5.8				3	3.2	5.6				9	2.2	4.3
Devils Canyon upper extent																																						
Chinook Creek	Chinook-2	-	1	90.0	-				1	20.0	-										1.0	70.0	-				5	0.0	0.0				6	10.0	15.5	14	17.1	29.2
Chinook Creek	Chinook-1	-										5	0.0	0.0													5	0.0	0.0				2	0.0	0.0	12	0.0	0.0
Cheechako Creek	Cheechako-1	-							1	0.0	-	4	0.0	0.0	1	0.0	-							4	1.3	2.5	3	0.0	0.0							13	0.4	1.4
Devils Canyon lower extent																																						
Portage Creek	NA	FA-151																									1	0.0	-	1	0.0	-	1	0.0	-	3	0.0	0.0
Unnamed 144.6	NA	FA-144																1	0.0	-																1	0.0	-
Indian River	NA	FA-141				1	100.0	-																3	25.6	29.8				8	1.3	3.5	7	16.4	13.7	19	15.9	25.9
Gold Creek	NA	-																									2	5.0	7.1	5	4.0	5.5	4	5.0	5.8	11	4.5	5.2
Fourth of July Cr.	NA	-																						2	20.0	0.0	1	0.0	-	2	10.0	0.0	2	12.5	3.5	7	12.1	7.0
Sherman Cr.	NA	-										1	0.0	-																2	2.4	3.4	1	0.0	-	4	1.2	2.4
Skull Cr.	NA	FA-128																						1	60.0	-				1	0.0	-	1	10.0	-	3	23.3	32.1
Fifth of July Cr.	NA	-										1	0.0	-																						1	0.0	-
Deadhorse Creek	NA	-							1	0.0	-																						1	0.0	-	2	0.0	0.0
Little Portage Cr.	NA	-																									1	0.0	-							1	0.0	-
McKenzie Creek	NA	-																1	0.0	-										1	5.0	-				2	2.5	3.5
Lane Creek	NA	-																												1	10.0	-				1	10.0	-
Unnamed 115.4	NA	FA-115																						2	77.6	3.4				4	57.5	9.6	3	80.0	26.5	9	69.5	18.5
Gash Creek	NA	FA-113																												1	15.0	-				1	15.0	-
Slash Creek	NA	FA-113										1	0.0	-										3	20.0	17.3				3	20.0	10.0	3	51.7	37.5	10	27.5	26.8
Unnamed 113.7	NA	FA-113										1	0.0	-																						1	0.0	-
Chase Creek	NA	-																						1	0.0	-				1	0.0	-	1	0.0	-	3	0.0	0.0
Whiskers Creek	NA	FA-104	1	90.0	-																			16	45.7	26.3				13	8.5	8.0	18	21.9	22.6	48	27.6	27.0
Total[1]			**2**	**90.0**	**0.0**	**1**	**100.0**	**-**	**26**	**1.7**	**4.7**	**15**	**0.0**	**0.0**	**1**	**0.0**	**-**	**2**	**0.0**	**0.0**	**1.0**	**70.0**	**-**	**41**	**29.5**	**28.3**	**34**	**1.2**	**3.3**	**71**	**7.9**	**14.1**	**61**	**17.8**	**24.5**	**255**	**12.9**	**22.7**

Table 5.2-16. Mean (±SD) percent organic substrate in mesohabitat units of Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Alcove			Beaver Pond			Boulder Riffle			Cascade			Chute			Dry			Percolation Channel			Pool			Rapid			Riffle			Run/Glide			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	n	Mean	SD
Tsusena Creek	Tsusena-1	-							2	0.0	0.0												1	0.0	-	1	0.0	-	2	0.0	0.0	2	0.0	0.0	8	0.0	0.0
Unnamed 184.0	184.0-1	-							1	0.0	-																								1	0.0	-
Fog Creek	Fog-4	-							5	0.0	0.0															7	0.0	0.0	6	0.0	0.0	2	0.0	0.0	20	0.0	0.0
Fog Creek	Fog-3	-							5	0.0	0.0	1	0.0	-												4	0.0	0.0	7	0.0	0.0	4	0.0	0.0	21	0.0	0.0
Fog Creek	Fog-2	-							4	0.0	0.0												3	0.0	0.0	2	0.0	0.0	1	0.0	-				10	0.0	0.0
Fog Creek	Fog-1	-							3	0.0	0.0	1	0.0	-									2	0.0	0.0	2	0.0	0.0	9	0.0	0.0	3	0.0	0.0	20	0.0	0.0
Unnamed 173.8	NA	FA-173							3	0.0	0.0												3	0.0	0.0				3	0.0	0.0				9	0.0	0.0
Devils Canyon upper extent																																						
Chinook Creek	Chinook-2	-	1	0.0	-				1	0.0	-										1.0	0.0	-			5	0.0	0.0				6	0.0	0.0	14	0.0	0.0
Chinook Creek	Chinook-1	-										5	0.0	0.0												5	0.0	0.0				2	0.0	0.0	12	0.0	0.0
Cheechako Creek	Cheechako-1	-							1	0.0	-	4	0.0	0.0	1	0.0	-							4	0.0	0.0	3	0.0	0.0							13	0.0	0.0
Devils Canyon lower extent																																						
Portage Creek	NA	FA-151																								1	0.0	-	1	0.0	-	1	0.0	-	3	0.0	0.0
Unnamed 144.6	NA	FA-144																1	0.0	-															1	0.0	-
Indian River	NA	FA-141				1	0.0	-																3	0.0	0.0				8	0.0	0.0	7	0.0	0.0	19	0.0	0.0
Gold Creek	NA	-																								2	0.0	0.0	5	0.0	0.0	4	0.0	0.0	11	0.0	0.0
Fourth of July Cr.	NA	-																						2	0.0	0.0	1	0.0	-	2	0.0	0.0	2	0.0	0.0	7	0.0	0.0
Sherman Cr.	NA	-										1	0.0	-															2	0.8	1.2	1	0.0	-	4	0.4	0.8
Skull Cr.	NA	FA-128																						1	10.0	-				1	0.0	-	1	0.0	-	3	3.3	5.8
Fifth of July Cr.	NA	-										1	0.0	-																					1	0.0	-
Deadhorse Creek	NA	-							1	0.0	-																						1	0.0	-	2	0.0	0.0
Little Portage Cr.	NA	-																								1	0.0	-							1	0.0	-
McKenzie Creek	NA	-																1	0.0	-									1	0.0	-				2	0.0	0.0
Lane Creek	NA	-																											1	0.0	-				1	0.0	-
Unnamed 115.4	NA	FA-115																						2	18.3	2.5				4	22.5	26.3	3	20.0	26.5	9	20.7	20.9
Gash Creek	NA	FA-113																											1	0.0	-				1	0.0	-
Slash Creek	NA	FA-113										1	30.0	-										3	15.0	13.2				3	1.7	2.9	3	8.3	7.6	10	10.5	11.4
Unnamed 113.7	NA	FA-113										1	0.0	-																					1	0.0	-
Chase Creek	NA	-																						1	0.0	-				1	0.0	-	1	0.0	-	3	0.0	0.0
Whiskers Creek	NA	FA-104	1	10.0	-																			16	10.6	17.7				13	0.0	0.0	18	1.1	3.2	48	4.2	11.3
Total[1]			**2**	**5.0**	**7.1**	**1**	**0.0**	**-**	**26**	**0.0**	**0.0**	**15**	**2.0**	**7.7**	**1**	**0.0**	**-**	**2**	**0.0**	**0.0**	**1.0**	**0.0**	**-**	**41**	**6.4**	**12.9**	**34**	**0.0**	**0.0**	**71**	**1.4**	**7.6**	**61**	**1.7**	**7.0**	**255**	**2.0**	**7.8**

Table 5.2-17. Mean (±SD) percent instream cover in mesohabitat units of Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Aquatic Vegetation			Bedrock			Boulder			Cobble			Depth			Insufficient Cover			Overhanging Vegetation			Undercut Bank			Woody Debris			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
Tsusena Creek	Tsusena-1	-							3	23.3	10.4							1	0.0	-	3	31.7	17.6				1	70.0	-	8	29.4	22.3
Unnamed 184.0	184.0-1	-							1	60.0	-																		1	60.0	-
Fog Creek	Fog-4	-							16	21.3	7.4	2	30.0	0.0							1	10.0	-	1	35.0	-				20	22.3	8.2
Fog Creek	Fog-3	-				1	30.0	-	17	13.9	11.1	3	10.0	5.0	1	10.0	-													22	13.9	10.6
Fog Creek	Fog-2	-							5	27.0	24.4				4	40.0	14.1				1	10.0	-							10	30.5	20.6
Fog Creek	Fog-1	-							6	27.5	19.9	1	30.0	-	1	50.0	-	3	0.0	0.0	7	20.0	20.4							18	21.4	20.3
Unnamed 173.8	NA	FA-173																1	0.0	-	3	33.3	25.2				5	36.0	20.7	9	31.1	22.6
Devils Canyon upper extent																																
Chinook Creek	Chinook-2	-							4	25.0	5.8	1	40.0	-				3	0.0	0.0	5	26.0	30.5				1	10.0	-	14	20.0	21.1
Chinook Creek	Chinook-1	-							6	43.3	10.3										6	33.3	5.2							12	38.3	9.4
Cheechako Creek	Cheechako-1	-							9	44.4	8.8				4	53.8	22.1													13	47.3	13.9
Devils Canyon lower extent																																
Portage Creek	NA	FA-151				2	2.5	3.5	1	5.0	-																		3	3.3	2.9
Indian River	NA	FA-141																			10	21.4	16.4	3	18.9	2.0	5	16.8	6.4	18	19.7	12.5
Gold Creek	NA	-							1	20.0	-	1	30.0	-				3	0.0	0.0							6	26.7	19.7	11	19.1	18.7
Fourth of July Cr.	NA	-																			4	30.0	4.1	1	20.0	-	2	12.5	10.6	7	23.6	9.9
Sherman Cr.	NA	-							2	42.5	10.6							1	0.0	-	1	41.7	-							4	31.7	22.0
Skull Cr.	NA	FA-128																3	0.0	0.0										3	0.0	0.0
Fifth of July Cr.	NA	-							1	25.6	-																			1	25.6	-
Deadhorse Creek	NA	-							1	30.0	-	1	60.0	-																2	45.0	21.2
Little Portage Cr.	NA	-																			1	20.0	-							1	20.0	-
McKenzie Creek	NA	-																			1	70.0	-							1	70.0	-
Lane Creek	NA	-							1	10.0	-																			1	10.0	-
Unnamed 115.4	NA	FA-115	3	87.7	10.8				1	30.0	-										5	72.0	33.5							9	72.6	30.0
Gash Creek	NA	FA-113										1	15.0	-																1	15.0	-
Slash Creek	NA	FA-113																2	0.0	0.0	4	97.5	5.0	1	50.0	-	3	35.0	27.8	10	54.5	42.3
Unnamed 113.7	NA	FA-113							1	15.0	-																			1	15.0	-
Chase Creek	NA	-	1	80.0	-										1	80.0	-	1	0.0	-										3	53.3	46.2
Whiskers Creek	NA	FA-104	12	52.5	32.8							3	36.7	15.3	3	73.3	5.8	3	0.0	0.0	17	18.4	8.5	7	44.3	34.1	4	25.0	12.9	49	34.3	28.3
Total[1]			**16**	**60.8**	**32.1**	**3**	**11.7**	**16.1**	**76**	**26.1**	**16.0**	**13**	**28.8**	**16.0**	**14**	**52.5**	**22.6**	**21**	**0.0**	**0.0**	**69**	**32.1**	**27.0**	**13**	**36.3**	**27.1**	**27**	**27.2**	**19.3**	**252**	**29.9**	**25.0**

Table 5.2-18. Sum of length (m) surveyed and composition by length of riparian cover types along Middle River tributaries.

Tributary Name	Geomorphic Reach	Focus Area	Broadleaf Forest Closed			Broadleaf Forest Open			Conifer Forest Closed			Conifer Forest Open			None			Nonforest Herbaceous Other			Nonforest Shrub Alder			Nonforest Shrub Other			Nonforest Shrub Willow			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
Tsusena Creek	Tsusena-1	-				2	163	24%				3	227	34%							1	28	4%				2	253	38%	8	671
Unnamed 184.0	184.0-1	-										1	16	100%																1	16
Fog Creek	Fog-4	-				4	190	15%										1	25	2%	14	625	48%				1	457	35%	20	1,297
Fog Creek	Fog-3	-				6	421	22%	6	743	39%	11	726	38%																23	1,889
Fog Creek	Fog-2	-																			9	440	64%				1	252	36%	10	692
Fog Creek	Fog-1	-				1	19	1%				4	549	43%							13	646	50%				1	73	6%	19	1,287
Unnamed 173.8	NA	FA-173																						9	1,037	100%				9	1,037
Devils Canyon upper extent																															
Chinook Creek	Chinook-2	-																3	151	31%	3	249	50%				8	94	19%	14	494
Chinook Creek	Chinook-1	-																			7	228	40%				5	336	60%	12	564
Cheechako Creek	Cheechako-1	-	6	320	48%	7	353	52%																						13	673
Devils Canyon lower extent																															
Portage Creek	NA	FA-151				3	295	100%																						3	295
Unnamed 144.6	NA	FA-144																			1	84	100%							1	84
Indian River	NA	FA-141																			14	609	71%				5	253	29%	19	862
Gold Creek	NA	-													4	99	21%	2	35	8%				2	212	46%	3	117	25%	11	463
Fourth of July Creek	NA	-	1	34	23%	5	100	66%													1	17	11%							7	151
Sherman Creek	NA	-																			3	37	72%				1	14	28%	4	52
Skull Creek	NA	FA-128				1	23	35%																			2	43	65%	3	66
Fifth of July Creek	NA	-																									1	27	100%	1	27
Deadhorse Creek	NA	-																									2	14	100%	2	14
Little Portage Creek	NA	-																									1	24	100%	1	24
McKenzie Creek	NA	-																			1	21	55%				1	17	45%	2	37
Lane Creek	NA	-				1	70	100%																						1	70
Unnamed 115.4	NA	FA-115																6	460	98%							3	10	2%	9	469
Gash Creek	NA	FA-113				1	26	100%																						1	26
Slash Creek	NA	FA-113	4	32	18%	1	17	9%																			5	129	73%	10	178
Unnamed 113.7	NA	FA-113																									1	17	100%	1	17
Chase Creek	NA	-																3	274	100%										3	274
Whiskers Creek	NA	FA-104																48	1,866	100%	1	2	0.11%							49	1,868
Total[1]			**11**	**386**	**3%**	**32**	**1,677**	**12%**	**6**	**743**	**5%**	**19**	**1,517**	**11%**	**4**	**99**	**1%**	**63**	**2,811**	**21%**	**68**	**2,985**	**22%**	**11**	**1,249**	**9%**	**43**	**2,130**	**16%**	**257**	**13,596**

10. FIGURES

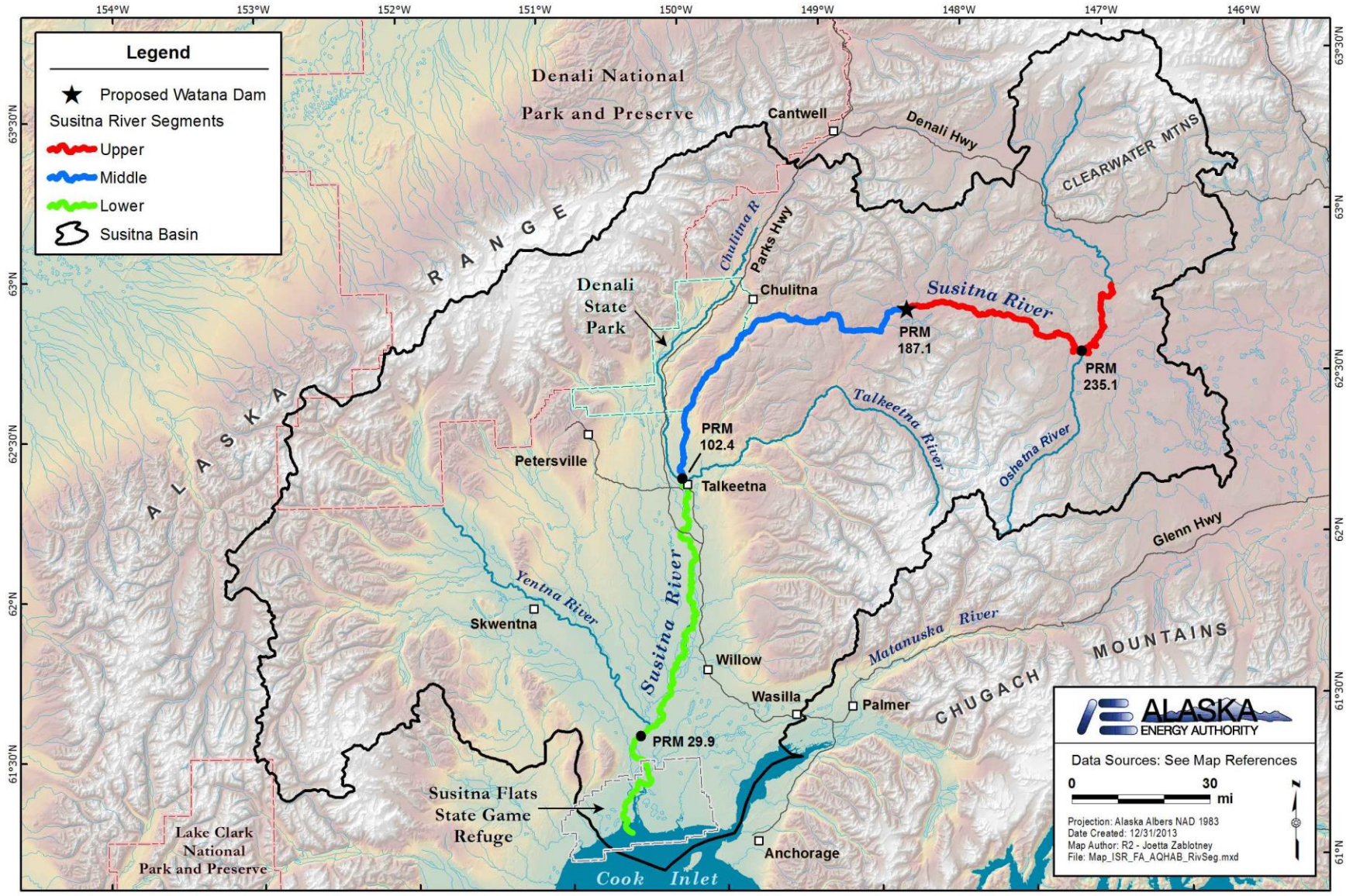

Figure 3-1. Aquatic habitat characterization and mapping study area.

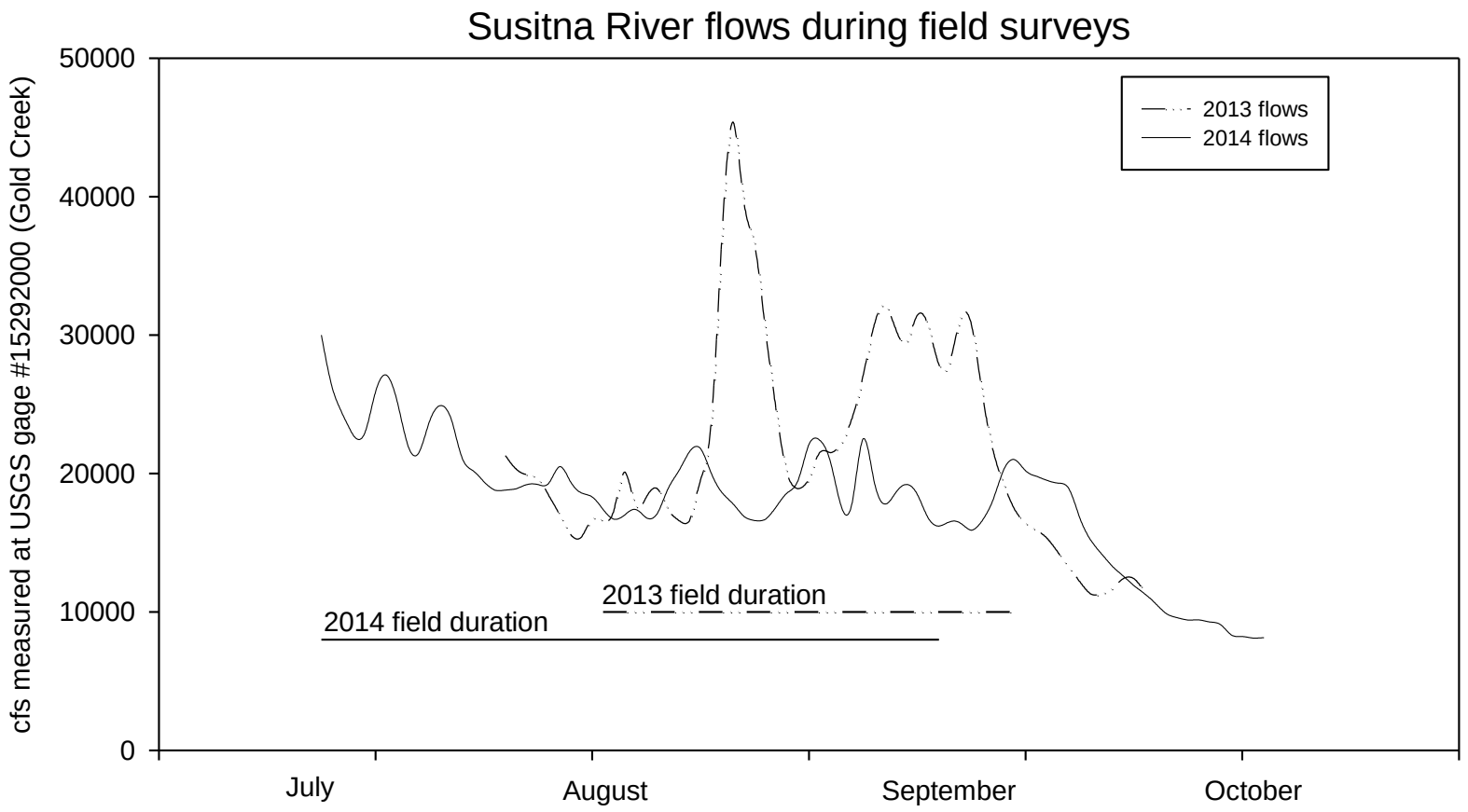

Figure 4.1-1 Susitna River flows in 2013 and 2014 with the timing of field surveys superimposed.

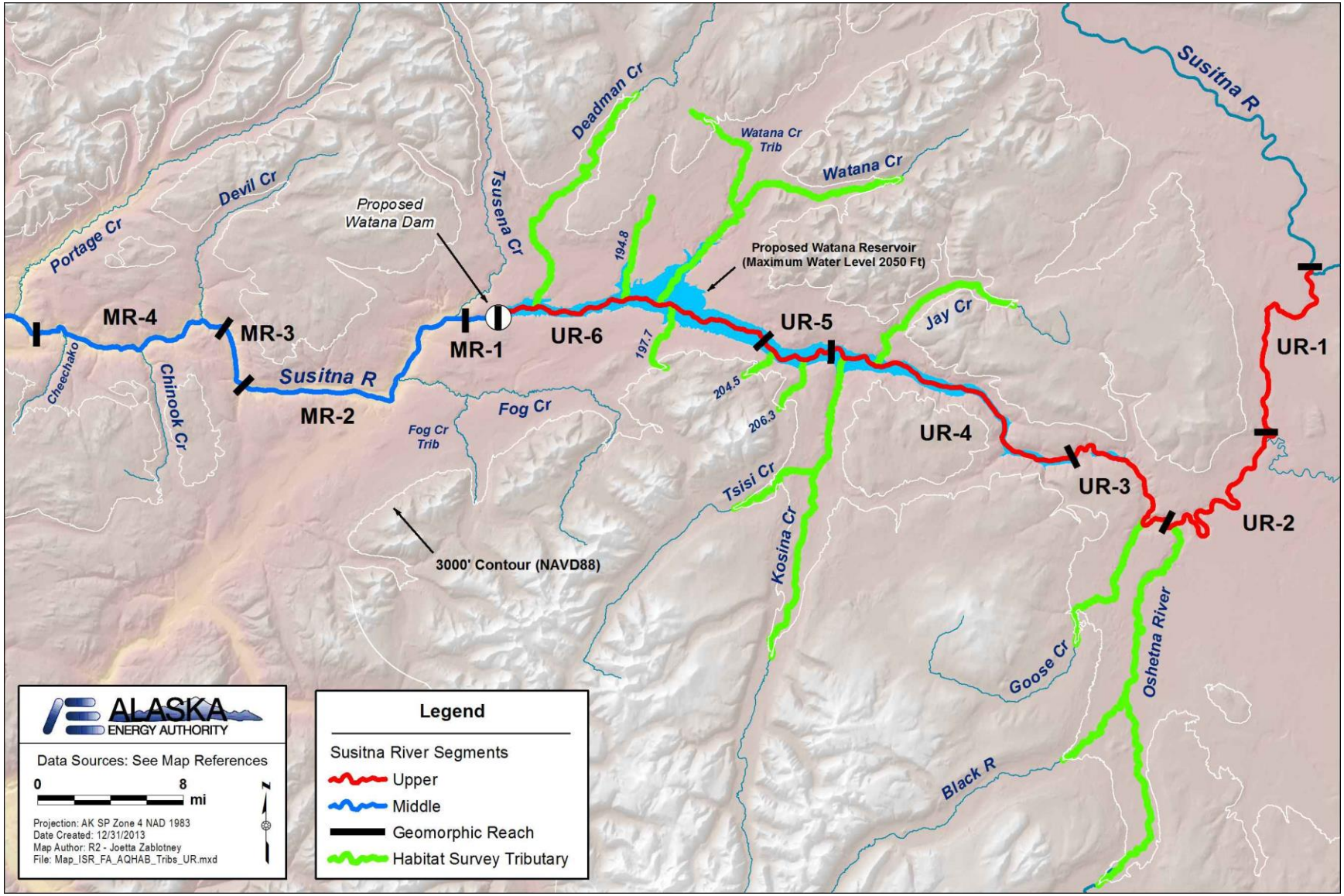

Figure 4.1-2. Map of Upper River tributaries with tributaries selected for field-surveys identified.

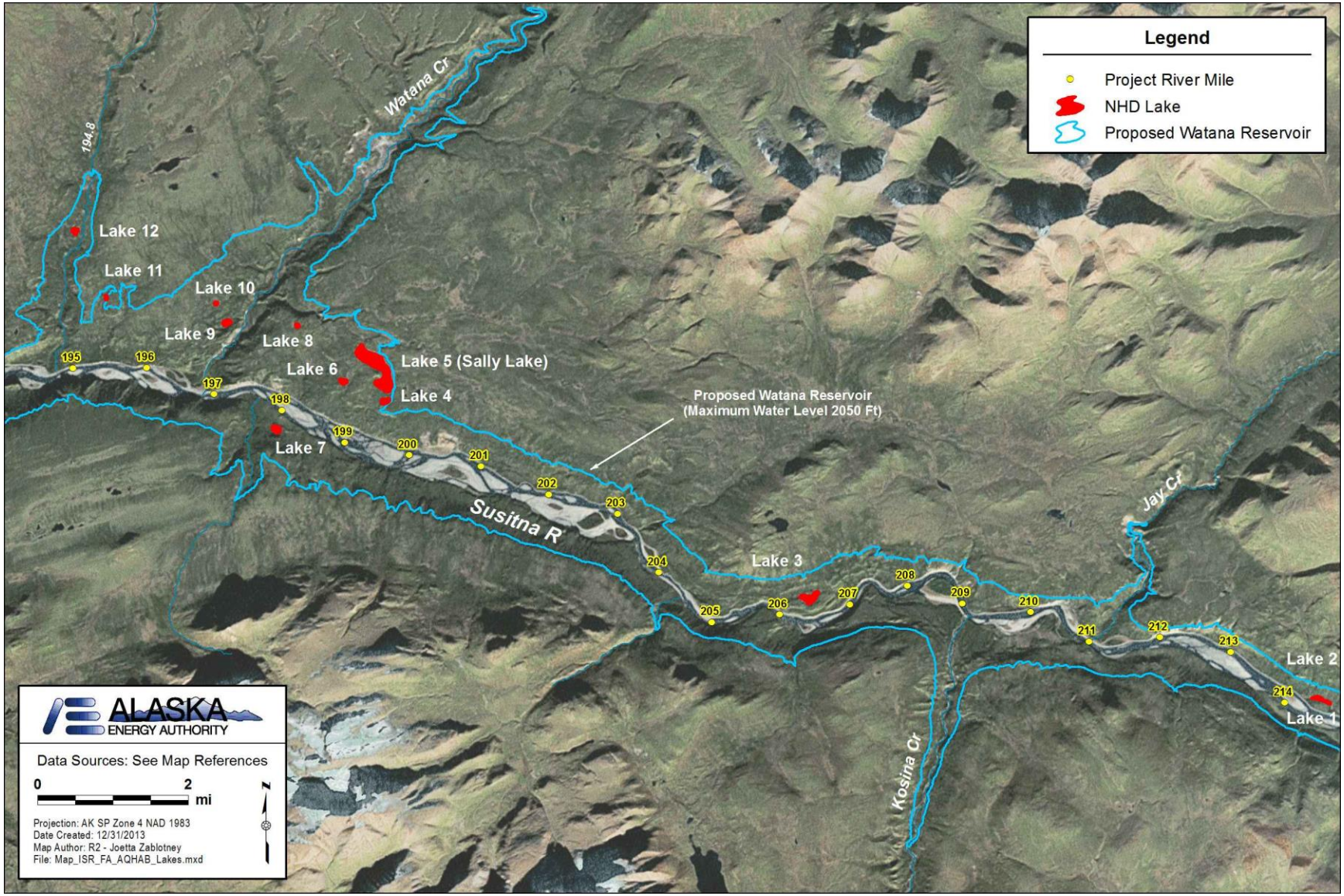

Figure 4.2-1 Map of Upper River lakes within the potential zone of reservoir inundation.

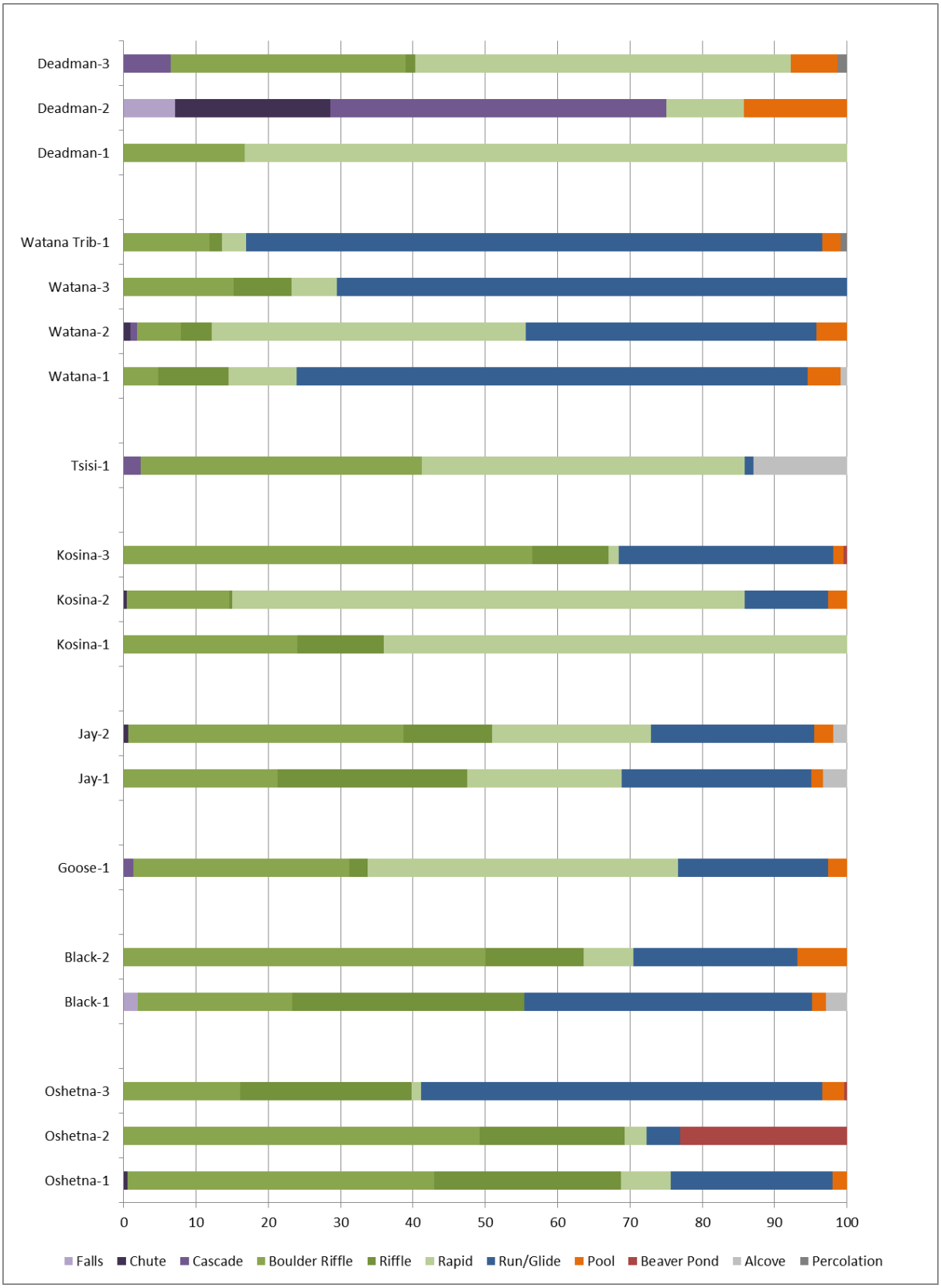

Figure 5.1-1. Upper River tributary mesohabitat frequencies from 2012 videographic surveys.

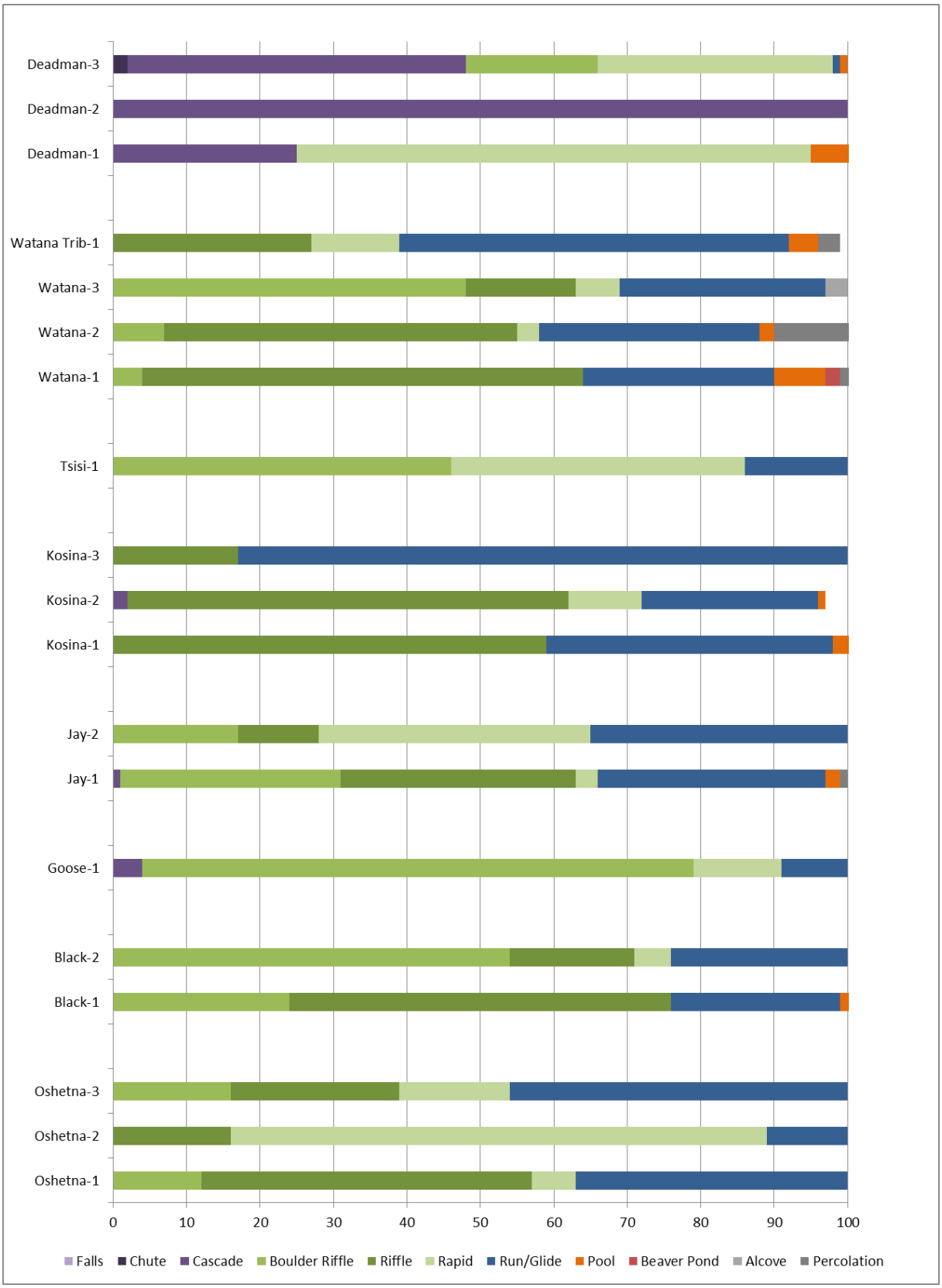

Figure 5.1-2. Upper River tributary mesohabitat frequencies from 2013-2014 ground surveys.

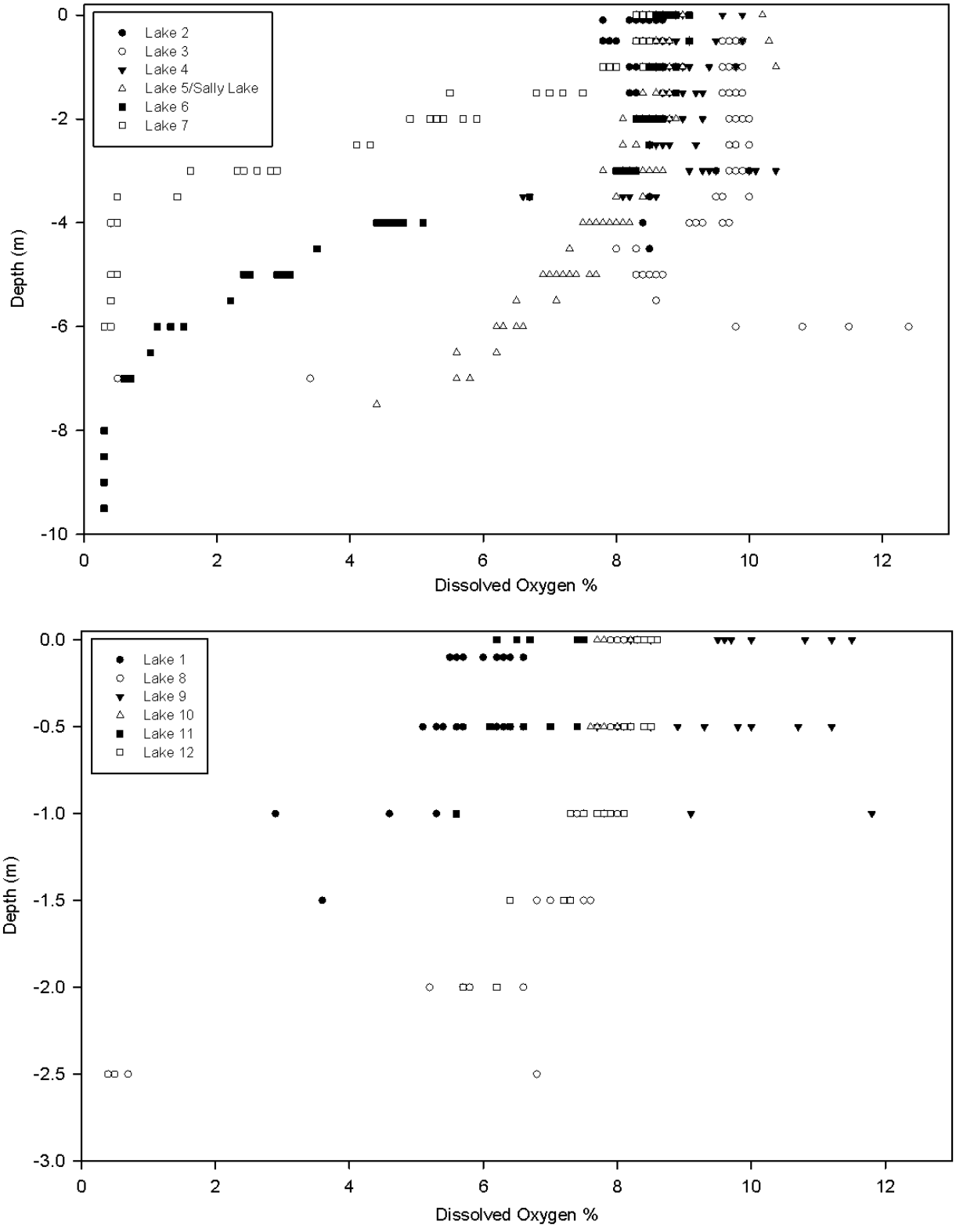

Figure 5.1-3. 2014 dissolved oxygen profiles in Lakes 1-12.

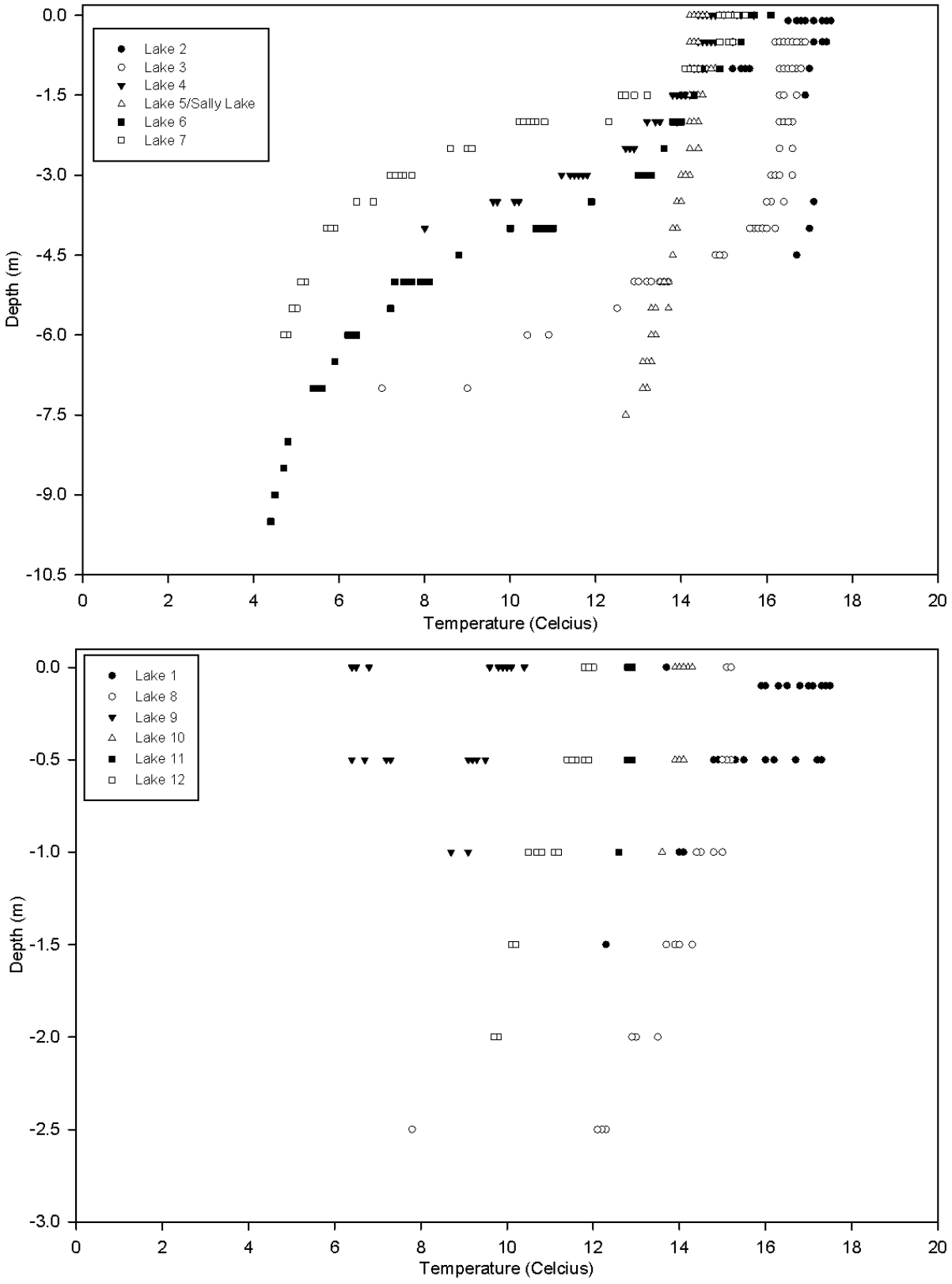

Figure 5.1-4. 2014 temperature profiles in Lakes 1-12.

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.

APPENDIX A: REMOTE LINE MAPPING 2012-2014

[See separate file for Appendix.]

APPENDIX B: GROUND SURVEYS, 2013-2014

[See separate file for Appendix.]