Hydro-sedimentological Monitoring and Analysis for Material Sites on the Sagavanirktok River

2015–2016 Data Report

H. Toniolo, T. Tschetter, K.D. Tape, J. Cristobal, E.K. Youcha,
W.E. Schnabel, D. Vas, and J. Keech

Prepared for the
Alaska Department of Transportation and Public Facilities

Water and Environmental Research Center
University of Alaska Fairbanks
Fairbanks, AK 99775

Report INE/WERC 16.02

April 2016

Hydro-sedimentological Monitoring and Analysis for Material Sites on the Sagavanirktok River

2015–2016 Data Report

H. Toniolo, T. Tschetter, K.D. Tape, J. Cristobal, E.K. Youcha, W.E. Schnabel, D. Vas, and J. Keech

Prepared for the
Alaska Department of Transportation and Public Facilities

Water and Environmental Research Center
University of Alaska Fairbanks
Fairbanks, AK 99775

Report INE/WERC 16.02

April 2016

Front cover photo:

Excavation of trench at DSS2 Sagavanirktok River below Ivishak River on September 10, 2015

Recommended citation:

H. Toniolo, T. Tschetter, K.D. Tape, J. Cristobal, E.K. Youcha, W.E. Schnabel, D. Vas, and J. Keech (2016). Hydro-sedimentological Monitoring and Analysis for Material Sites on the Sagavanirktok River: 2015–2016 Data Report. University of Alaska Fairbanks, Water and Environmental Research Center, Report INE/WERC 16.02, Fairbanks, Alaska.

For additional information, write to:

Publications
Water and Environmental Research Center
University of Alaska Fairbanks
Fairbanks, AK99775
http://ine.uaf.edu/werc/

ABSTRACT

Researchers from the Water and Environmental Research Center at the Institute of Northern Engineering, University of Alaska Fairbanks, are conducting a research project related to sediment transport conditions along the Sagavanirktok River. This report presents tasks conducted from summer 2015 to early winter 2016.

Four hydrometeorological stations were installed in early July 2015 on the west bank of the river. The stations are spread out over a reach of approximately 90 miles along the Dalton Highway (from MP 405, the northernmost location, to MP 318, the southernmost location). These stations are equipped with pressure transducers and with air temperature, relative humidity, wind speed, wind direction, barometric pressure, and turbidity sensors. Cameras were installed at each station, and automatic water samplers were deployed during the open-water season. The stations have a telemetry system that allows for transmitting data in near-real time.

Discharge measurements were performed three times: twice in July (early and late in the month), and once in mid-September. Measured discharges were in the order of 100 m^3/s, indicating that measurements were performed during low flows. Suspended sediment concentrations ranged from 2 mg/l (nearly clear water) to 625 mg/l. The average grain size for suspended sediment from selected samples was 47.8 μm, which corresponds to silt. Vegetation was characterized at 27 plots near the stations. Measurements of basic water quality parameters, performed during winter, indicated no potential issues at the sampled locations.

Dry and wet pits were excavated in the vicinity of each station. These trenches will be used to estimate average bedload sediment transport during spring breakup 2016.

A change detection analysis of the period 1985–2007 along the area of interest revealed that during the present study period, the river was relatively stable.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

The authors would like to thank Ken Irving and Joel Bailey, who assisted in field data collection efforts; Troy Hicks at ADOT&PF, who collected and processed much of the GPS survey data; and Benjamin Ritter, who assisted in quantifying the substrate.

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the accuracy of the data presented herein. This research was funded by the Alaska Department of Transportation and Public Facilities (ADOT&PF).The contents of the report do not necessarily reflect the views or policies of the ADOT&PF or any other project sponsor. This work does not constitute a standard, specification, or regulation.

The use of trade and firm names in this document is for the purpose of identification only and does not imply endorsement by the University of Alaska Fairbanks, ADOT&PF, or any other sponsor.

CONVERSION FACTORS, UNITS, WATER QUALITY UNITS, VERTICAL AND HORIZONTAL DATUM, ABBREVIATIONS, AND SYMBOLS

Conversion Factors

Multiply	By	To obtain
	Length	
inch (in.)	25.4	millimeter (mm)
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	43560.0	square feet (ft^2)
acre	0.405	hectare (ha)
square foot (ft^2)	3.587e-8	square mile (mi^2)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
gallon (gal)	3785.412	milliliter (mL)
cubic foot (ft^3)	28.317	liter (L)
acre-ft	1233.482	cubic meter (m^3)
acre-ft	325851.43	gallon(gal)
gallon(gal)	0.1337	cubic feet (ft^3)
	Velocity and Discharge	
foot per day (ft/d)	0.3048	meter per day (m/d)
square foot per day (ft^2/d)	0.0929	square meter per day (m^2/d)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/sec)
	Water Density	
kilograms per cubic meter (kg/m^3)	1/1000	grams per cubic centimeter (g/cm^3)
grams per cubic centimeter (g/cm^3)	1.94	slugs per cubic foot (slugs/ft^3

Units

In this report, both metric (SI) and English units were employed. The choice of "primary" units employed depended on common reporting standards for a particular property or parameter measured. The approximate value in the "secondary" units may also be provided in parentheses.

Thus, for instance, runoff was reported in cubic meters per second (m^3/s) followed by the cubic feet per second (ft^3/s) value in parentheses.

Physical and Chemical Water-Quality Units:

Temperature

Water and air temperatures are given in degrees Celsius (°C) and in degrees Fahrenheit (°F). Degrees Celsius can be converted to degrees Fahrenheit by use of the following equation:

$$°F = 1.8(°C) + 32$$

Milligrams per liter (mg/L) or micrograms per liter (μg/L)

Milligrams per liter is a unit of measurement indicating the concentration of chemical constituents in solution as weight (milligrams) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter. For concentrations less than 7000 mg/L, the numerical value is the same as for concentrations in parts per million (ppm).

Horizontal datum

The horizontal datum for all locations in this report is the North America Datum of 1983 (NAD83).

Vertical datum

"Sea level" in the following report refers to the North American Vertical Datum of 1988 (NAVD88) (GEOID12AK) datum for all water level elevations.

ABBREVIATIONS, ACRONYMS, AND SYMBOLS

ADCP	acoustic Doppler current profiler
ADOT&PF	Alaska Department of Transportation and Public Facilities
C	Celsius (°C)
cfs	cubic feet per second
cm	centimeter
cms	cubic meters per second
d	day
DGS	digital grain size
F	Fahrenheit (°F)
ft	feet
GIS	Geographic Information System
GPS	Global Positioning System
in.	inch
INE	Institute of Northern Engineering
km	kilometer
m	meter
mg/L	milligrams per liter, equivalent to ppm
mi	mile
mm	millimeter
NAVD	North American Vertical Datum
NMS	Non-metric Multidimensional Scaling
RTK	real-time kinematic
s	second
SBAS	satellite based augmentation system
SSC	suspended sediment concentration
UAF	University of Alaska Fairbanks
USGS	U.S. Geological Survey
WAAS	Wide Area Augmentation System
WERC	Water and Environmental Research Center

1 INTRODUCTION AND STUDY AREA

To improve road safety and reduce maintenance costs, the Alaska Department of Transportation and Public Facilities (ADOT&PF) is reconstructing two segments of the Dalton Highway from the north side of the Brooks Range to Prudhoe Bay—MP 362–414 and MP 305–335. This multiyear effort, which began at Deadhorse, may require more than two million cubic yards of gravel. The roadway, which follows a south–north direction, often parallels the Sagavanirktok River. The river's deposits constitute a natural material source for road construction. Given the expected quantity of gravel required to accomplish these tasks, ADOT&PF had the following questions of interest:

- What are the short- and long-term impacts from future gravel mining in the Sagavanirktok?
- What is the potential area of influence from gravel mining operations in the Sagavanirktok?
- What will be the channel-restoring period after the river has been mined?

Researchers from the Water and Environmental Research Center (WERC) at the Institute of Northern Engineering (INE), University of Alaska Fairbanks (UAF), are working with ADOT&PF to study sediment transport conditions along the Sagavanirktok River. Funding was provided by ADOT&PF for a one-year study, which covered fieldwork activities and data collection for summer 2015 and early winter 2016. This report presents the data collected by WERC. Subsequent study phases will provide data to answer, at least partially, the original questions.

The Sagavanirktok River (Figure 1) originates in the Brooks Range and flows north to the Beaufort Sea near Deadhorse. The upper part of the Sagavanirktok basin contains the Ivishak River and the Upper Sagavanirktok River. The basin is at least 250 km long, and the stream is over 300 km long. The basin has a low hydraulic gradient (Coastal Plain) near the Arctic Ocean and a high hydraulic gradient (Brooks Range) in the headwaters to the south. The basin area is approximately 13,500 km^2, most of which lies in the Brooks Range (>50%). Less than 20% of the basin area is located on the Coastal Plain. The river is fed primarily by snowmelt, rain, and several small glaciers. The floodplain varies in width, from narrow at the river's source, to approximately 1 mile wide at its midpoint, to 2 miles wide below the confluence with the Ivishak River, to several miles wide where the river discharges into the Arctic Ocean. The reaches adjacent to the Dalton Highway and the Trans Alaska Pipeline System (TAPS) are characterized by extensive channel braiding, with some bars vegetated by shrubs and others not. This vegetation reduces erosion and stabilizes the floodplain. River discharge has been continuously measured on the Sagavanirktok River since 1983 by the United States Geological Survey (USGS) at a station located near Pump Station 3 (MP 312), where the river presents a single channel (USGS station No.15908000). Records demonstrate the influence of different water sources on the annual hydrograph. Approximately 5 miles downstream of the station, the river begins a braided pattern that is maintained to its mouth. Even though the Ivishak River is an important stream, no discharge record is available for it. In addition, as with many arctic rivers, there is a lack of geomorphological studies along the entire Sagavanirktok River.

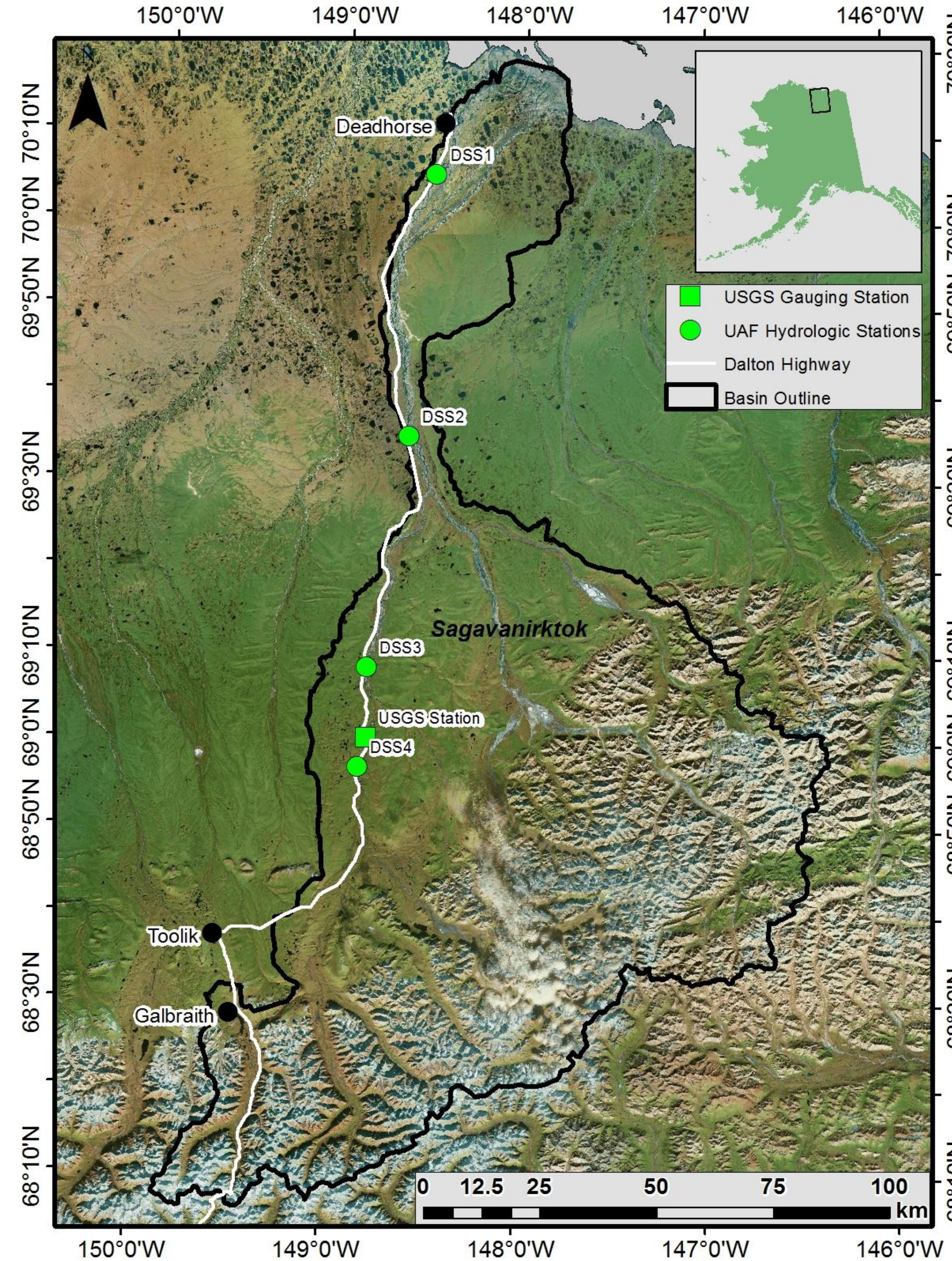

Figure 1. Sagavanirktok River basin and the hydro-sediment observation network. The white line indicates the location of the Dalton Highway; the black line indicates the Sagavanirktok watershed boundary.

Table 1 summarizes the Sagavanirktok River basin characteristics. The basin area above the USGS gauge site near Pump Station 3 is approximately 4100 km^2, and runoff is measured in the Sagavanirktok River before the confluence with the Ivishak River (Ivishak basin area ~5200 km^2). Upstream of the USGS gauge site, most of the basin lies in the Mountain region and a smaller percentage is within the Foothills region. The hypsometric curve for the Sagavanirktok River basin is shown in Figure 2. Over 50% of the basin is above 750 m (2460 ft). The Sagavanirktok River area has an arctic climate, is underlain by continuous permafrost (Kane et al., 2012), and is vegetated with grasses, sedges, and shrubs (Homer et al., 2007). Some areas are barren (in the Mountain region) (Homer et al., 2007), and the region is mostly treeless except for some areas along the major drainages (Kane et al., 2012).

Table 1. Characteristics of the Sagavanirktok River basin (from Toniolo et al., 2015).

Basin Area (km^2)	**13,500**
Aspect	north
Minimum Elevation (m)	0
Maximum Elevation (m)	2477
Mean Elevation (m)	784
Basin Area above 500 m (%)	70
Basin Area above 1000 m (%)	35
Basin Length (km)	250
Shrub (%)	43
Barren (%)	37
Sedge (%)	14
Other (%)	6

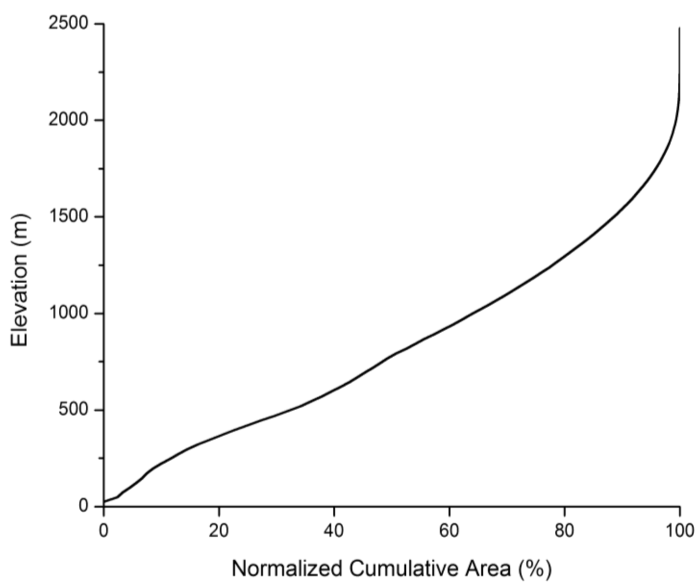

Figure 2. Hypsometric curve for the Sagavanirktok River basin.

Gravel mining in rivers is a common practice in the western part of the United States, carried out under the assumption that the river will replace the extracted gravel with sediment of similar characteristics (ASCE, 2008). However, gravel extraction without appropriate constraints can cause excessive riverbed degradation downstream (Galay, 1983) and have adverse effects on riparian habitat (Kondolf et al., 2002). The approach used in this study was to develop a hydro-sedimentological monitoring and analysis network focused on past, current (summer 2015), and potential gravel sites along the Sagavanirktok River. Specifically, sediment transport conditions need to be characterized in four areas (Table 2 and Figure 3 through Figure 6):

- DSS1 Sagavanirktok River near Deadhorse MP 405 Site 042 (MS 65-9-042-2)
- DSS2 Sagavanirktok River below Ivishak River
- DSS3 Sagavanirktok River at Happy Valley Site 055 (MS 65-9-005-2)
- DSS4 Sagavanirktok River near MP 318 Site 066 (MS 65-9-066-2)

Figure 3 through Figure 6 show the four Sagavanirktok River study areas. Locations DSS3 and DSS4 are in the middle Sagavanirktok River basin, above the confluence with the Ivishak River. Location DSS2 is located in the Sagavanirktok River approximately 7 miles below the Ivishak confluence. Location DSS1 is in the west channel of the lower Sagavanirktok River approximately 8 miles south of Deadhorse.

Table 2. Station locations established on the Sagavanirktok in 2015.

Site ID	Site Name	Latitude (WGS84)	Longitude (WGS84)	Elevation (m) (NAVD88)	Data Type*
DSS1	Sagavanirktok River near Deadhorse MP 405 Site 042	70.099117	-148.508917	26	AT, RH, WS, WD, WL, Q, SS, TU
DSS2	Sagavanirktok River below Ivishak River	69.59580	-148.626000	137	AT, RH, WS, WD, WL, Q, SS, TU
DSS3	Sagavanirktok River at Happy Valley Site 055	69.15065	-148.823233	291	AT, RH, WS, WD, WL, Q, SS, TU
DSS4	Sagavanirktok River near MP 318 Site 066	68.958350	-148.859967	371	AT, RH, WS, WD, WL, Q, SS, TU

* AT = air temperature; RH = relative humidity; WS = wind speed; WD = wind direction; WL = water levels; Q = discharge; SS = suspended sediment; TU = turbidity

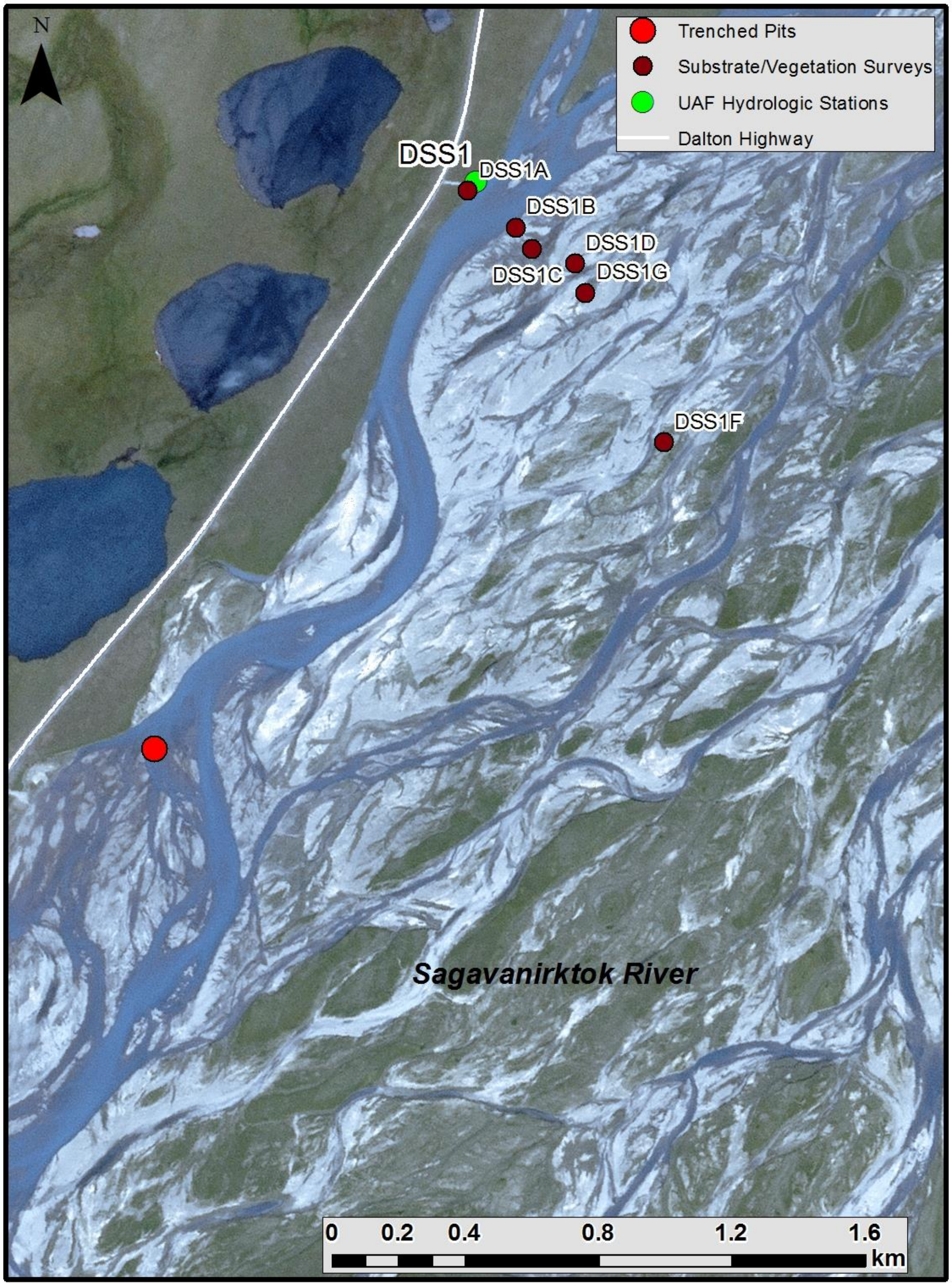

Figure 3. Study area DSS1, Sagavanirktok River Site 042, near Deadhorse and Dalton Highway MP 405. Flow direction is from bottom to top.

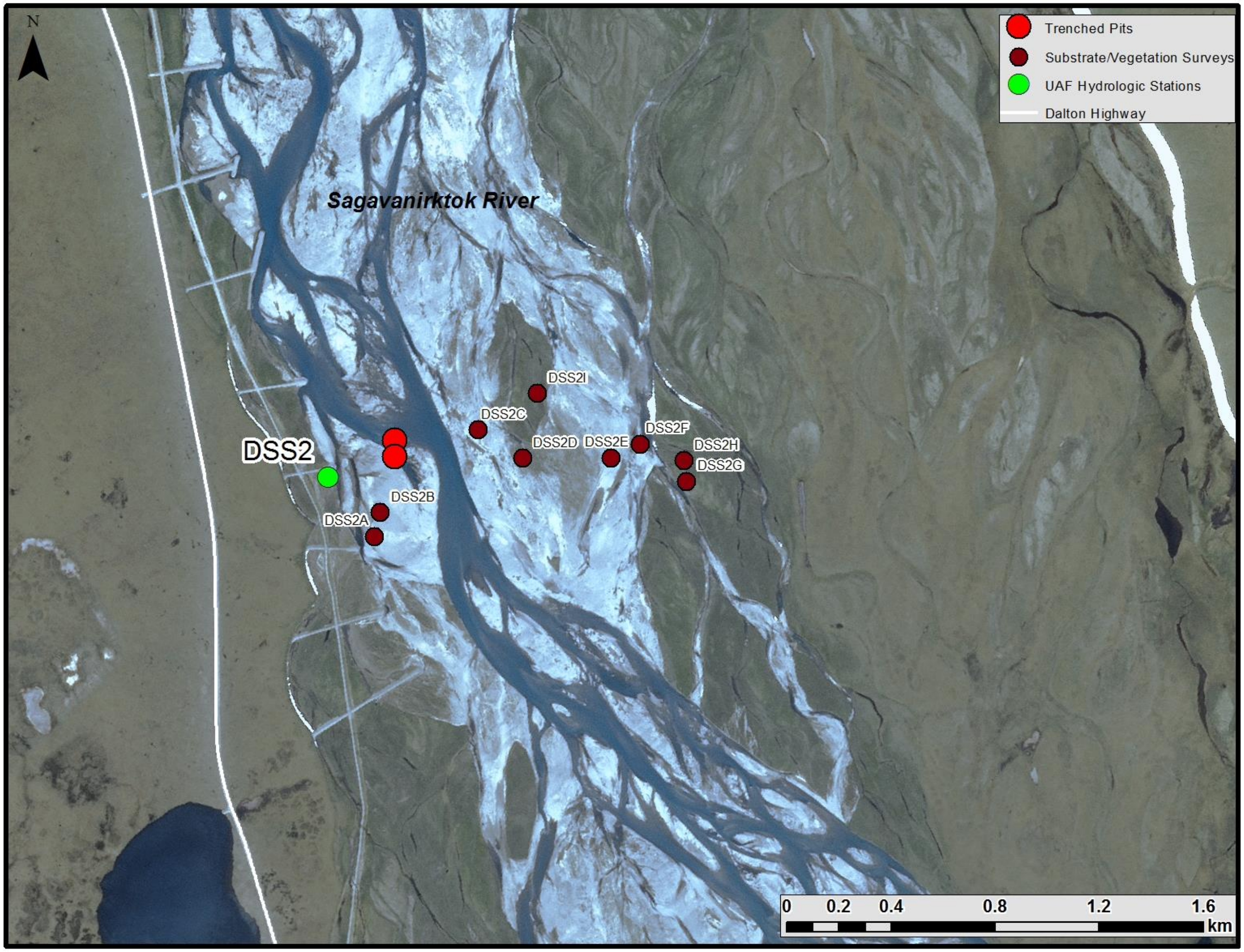

Figure 4. Study area DSS2, Sagavanirktok River below the Ivishak confluence. Flow direction is from bottom to top.

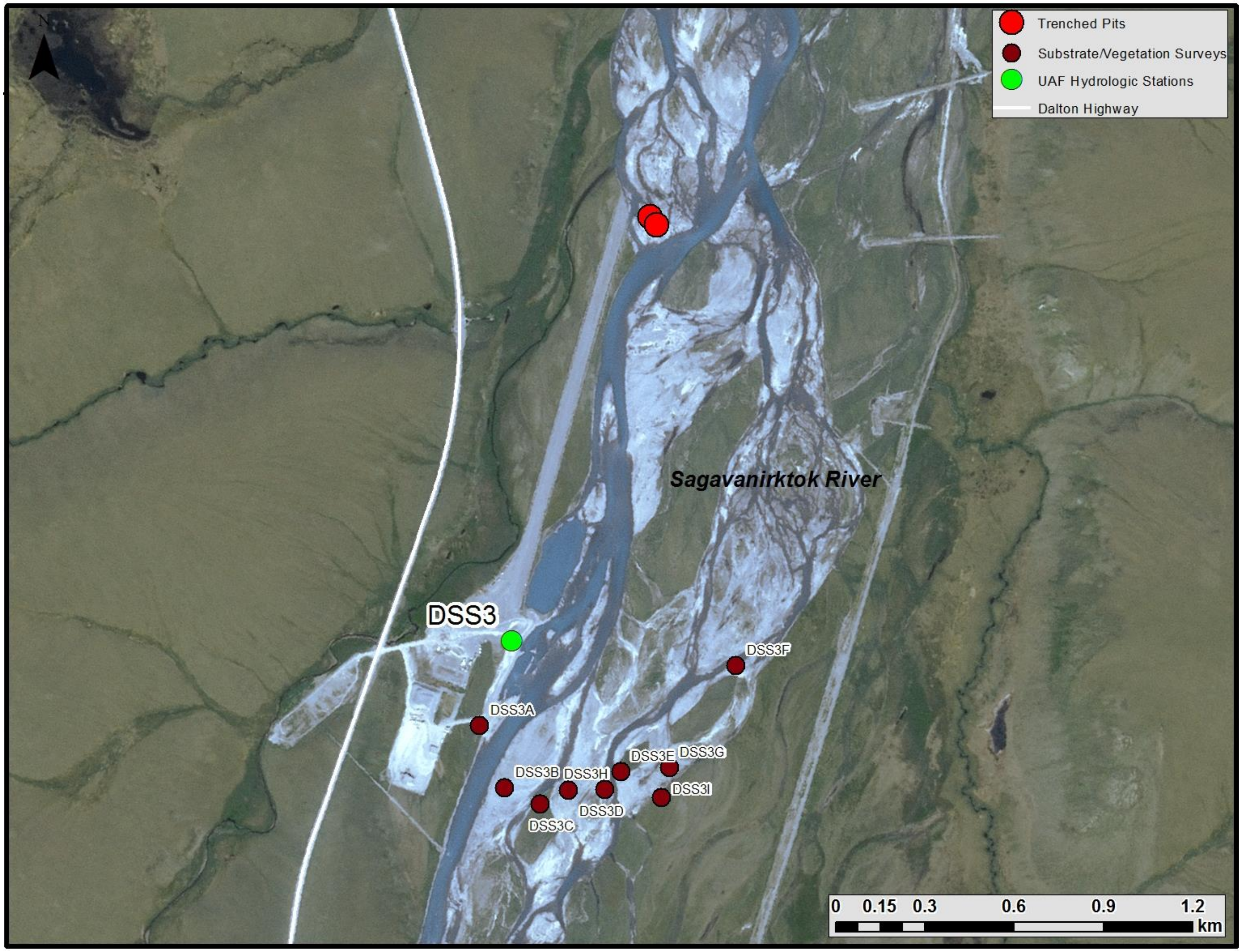

Figure 5. Study area DSS3, Sagavanirktok River at Site 055 (Happy Valley). Flow direction is from bottom to top.

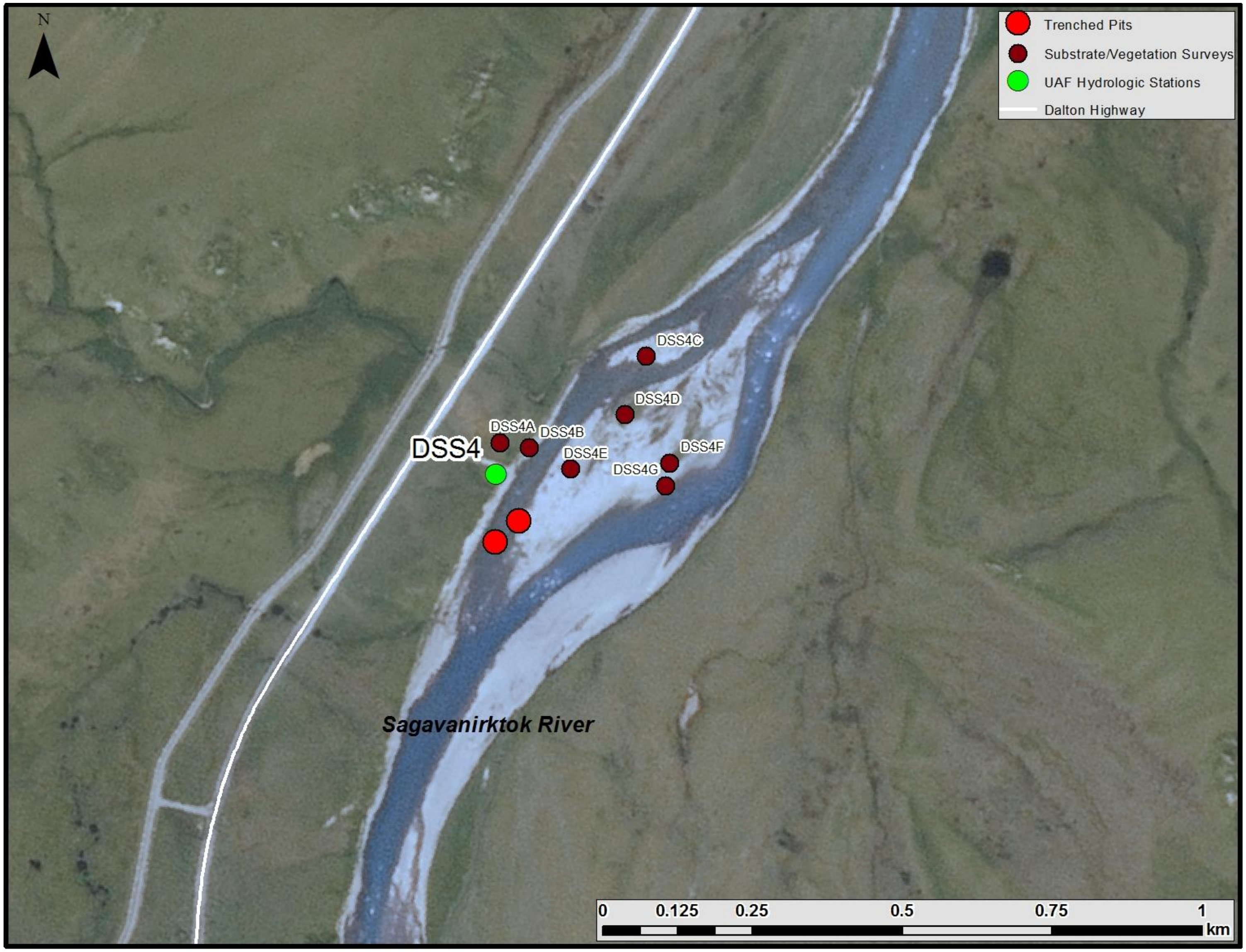

Figure 6. Study area DSS4, Sagavanirktok River at Site 066, near Dalton Highway MP 318. Flow direction is from bottom to top.

In September 2015, ADOT&PF dredged mini-trenches in the river channel at each site to use for calculating the average bed-sediment transport rates. These bed-sediment transport rates can be obtained by comparing successive bathymetric surveys of the trenches over time.

Observations at the four locations included basic weather variables (air temperature, relative humidity, wind speed, and wind direction), bathymetric surveys, discharge measurements, and specific measurements to quantify bed and suspended sediment loads (see Table 2). In addition, water quality data were collected at each site (water temperature, conductivity, dissolved oxygen, organic/inorganic carbon). Existing satellite data (Landsat imagery) were examined to study the temporal stability of the channel at each site. Bathymetric surveys were performed to establish baseline conditions after the trenches were dredged. A survey of the floodplain vegetation and soil properties was conducted in summer 2015. Discharge and sediment loads can be used to establish, in subsequent study phases, sediment rating curves for each site. Bed-sediment rating curves can provide valuable information for estimating the required time to refill a material site.

2 METHODOLOGY AND EQUIPMENT

The goal of the monitoring program was to establish hydrologic/sediment observation stations at each of the four trenching locations on the Sagavanirktok River. Stations were installed in July 2015, and trenching occurred in September 2015. At each station, we recorded 15-minute water levels and turbidity, daily suspended sediment, hourly air temperature, wind speed, and wind direction. Data are transmitted via telemetry and downloaded to the project website in "near real time": http://ine.uaf.edu/werc/projects/sagdot/data.aspx

Individual measurements of stream discharge were made at each station in July and September 2015. In 2016, frequent measurements will be made during the spring runoff period. A stream stage–discharge relationship has not yet been developed because measurements in 2015 at varying stages were minimal. A floodplain vegetation and substrate survey was performed at each of the four study reaches in summer 2015. Bathymetry was mapped at the trenches in September 2015, immediately after the trenches were dredged by ADOT&PF. Water quality measurements were made during winter to develop a water quality baseline at the sites.

Table 3 summarizes the equipment installed at each station. This chapter further describes the methods of data collection and sensor specifications.

Table 3. Details of equipment used on the Sagavanirktok River study.

Category	Item	Model	Accuracy	Remarks
Met	Wind Direction	RM Young 05103	± 3 degrees	
Met	Wind Speed	RM Young 05103	± 0.3 m/s	
Met	Air Temperature	HMP45C	± 0.5°C at −40°C	
Met	Air Relative Humidity	HMP45C	± 3% at 20°C	
Met	Barometric Pressure	CS106	± 1.5 mb @ −40 to +60°C	
Hydro	Water Level	INW AquiStar SDI-12	± 0.5 cm (5 psi), ± 1.6 cm (15 psi)	vented to atmosphere
Hydro	Water Level	HOBO U20	± 0.6 cm	absolute pressure, barometric corrections required
Hydro	Turbidity	OBS500, OBS501	± 2% of reading or 0.5 NTU	
Hydro	Suspended Sediment	ISCO 3700 Auto Sampler		
Hydro	Suspended Sediment	DH76 Depth Integrated Sampler		
Hydro	ADCP, shallow	RDI StreamPro		

Category	Item	Model	Accuracy	Remarks
Hydro	ADCP Software	WinRiver II		
Hydro	ADCP GPS Reference	Novatel Smart- V1-2US-L1RTK/WAAS		
Hydro	ADCP Manned Boat	Inflatable kayak for low flow		
Hydro	Computer	Panasonic Toughbook CF19		
Station	Datalogger	CR1000		
Station	Camera	CC640, CC5MPX,or PlantCam		
Station	Radio	FreeWave FGR or DGR or AT&T cellular modem		
Station	Solar Panel	Sharp 85 W, typical		
Station	Batteries	Concorde 104 AH		3 batteries
Station	Charge Controller	SunSaver 10 or 12		
Station	Tripod	CM110		

2.1 Pit Trenches

Seven sediment traps (trenches) were excavated in the river channel and active floodplain of the Sagavanirktok River at four locations. The trenches were excavated by ADOT&PF during the week of September 8, 2015, with a Komatsu PC270LC excavator. A “wet” trench and a “dry” trench were excavated at each station, except for DSS1, which has only a wet trench. The wet trenches were excavated in shallow water near the edge of the channel, whereas the dry trenches were excavated from the gravel bar at a higher elevation than the wet trench. The wet versus dry terminology is somewhat misleading, since after excavation, all dry trenches fill with water from the permeable gravel. The two trenches were positioned this way to reduce the probability of both trenches filling completely with sediment during one high water event. A dry trench was not installed at DSS1 because the excavator could not access the dry gravel bars from the highway.

Following excavation of the trenches, the sites were surveyed using a real-time kinematic (RTK) GPS, and bathymetry was recorded using an acoustic Doppler current profiler (ADCP).The survey data were collected using a Leica Viva GS14 survey grade differential GPS (Leica, 2015). This system achieves horizontal and vertical accuracies of ±0.008 m and ±0.015 m, respectively. At least four hours of static GPS data were collected at each station to obtain an OPUS solution for the position of the local temporary benchmark (TBM). The RTK GPS data were then referenced to the OPUS solution position in post-processing.

Bathymetry was surveyed using a TDRI StreamPro ADCP and a RTK GPS system. The kayak-mounted StreamPro ADCP was integrated with a Novatel Smart V1-2US-L1GPS receiver, which received RTK corrections via Bluetooth from a base station (another Novatel receiver). The Novatel SMART V1-2US-L1 (Novatel, 2011) is a single-frequency (L1) receiver with reported horizontal accuracy (RMS) of 0.7m. The base station was programmed to transmit RTK corrections following a 6-minute fast static position lock, which established an arbitrary local datum for the survey. Muirhead and Annable (2014) noted the accuracy of an ADCP bathymetry survey was dependent on the accuracy of the arbitrary local datum defined by the base station. To improve the accuracy of the survey, the position of the base station was surveyed with the survey-grade GPS. In post-processing, all points in the ADCP bathymetry dataset were adjusted to account for the true base station position.

2.2 Meteorology

Air temperature was measured hourly with a Campbell Scientific model H2CS3 air temperature and relative humidity probe housed in a radiation shield. The sensor is installed at 2 m height above ground surface. The sensor specifications are listed in Table 3.

Wind speed and direction were measured using an RM Young 05103 anemometer, mounted at a height of 3 m. The sensor specifications are listed in Table 3. A common problem pertaining to the measurement of wind speed and direction is the accumulation of rime ice or freezing precipitation that affects the aerodynamics of the sensor. This accumulation commonly occurs in fall, winter, and spring and is often reported in the dataset as prolonged periods of calm (zero wind speed), which are rare.

2.3 Water Level Measurements

Water levels (or stage) were measured every 15 minutes with both vented and non-vented pressure transducers at each of the four stations. Accuracy information for each water level sensor is listed in Table 4. Errors associated with the pressure transducer itself are typically under 1 cm. Additional errors may occur if the sensor does not have a secure installation and moves due to high flows or during ice conditions. Point measurements of stage were collected with traditional surveying equipment. Temporary benchmarks at each station were established by ADOT&PF surveyors using GPS techniques; the vertical datum is NAVD88 (GEOID12A).

Additionally, cameras took an hourly photograph of the river at each site. These images may be used to qualitatively evaluate the river stage, corroborate pressure transducer data, and observe ice conditions.

Table 4. Specifications of the pressure transducers.

Sensor	Full Scale Range	Accuracy (typical)	Accuracy (typical)	Water Level Range
AquiStar	0–15 PSI Gauge	0.06% Full Scale	0.009 PSIG, 0.6 cm	0–10 m
AquiStar	0–5 PSI Gauge	0.06% Full Scale	0.003 PSIG, 0.2 cm	0–3.5 m
HOBO	0–21 PSI Absolute	0.075% Full Scale	0.016 PSIA, 0.3 cm	0–4 m

The two largest errors that result from manually measuring water levels are associated with (1) surveying and (2) vertical datum related to the control point. Survey levels may be read incorrectly, but also rod levels may be difficult to read because of wave action, which can yield an error in water level of plus or minus several centimeters. Differential GPS survey techniques were used to establish the temporary benchmarks for level loop surveys.

2.4 Runoff

Acoustic Doppler current profiler (ADCP) techniques were used to measure runoff at each site. A RDI StreamPro was used on the project. Both ADCP bottom tracking and GPS options were used as the reference to measure river velocity. The GPS model used during measurements was the Novatel Smart V1-2US-L1. Typically, a base station is set up and a RTK GPS is used, but satellite-based augmentation system (SBAS or WAAS) differential correction can also be used and is considered acceptable (Wagner and Mueller, 2011). The horizontal position accuracy of the RTK is 0.2 m and 1.2 m when using SBAS/WAAS with the Novatel units. Kane et al. (2012) discuss the methods and challenges associated with making discharge measurements using an ADCP.

To calculate river discharge and determine any directional bias, multiple transects are made from both the left-to-right-bank and the right-to-left-bank directions when possible. Each manual measurement is given a rating of good, fair, or poor, based on variability of the transects, the accuracy and percentage of unmeasured areas, and the quality of the boat navigation reference (Mueller, 2012) .

A rating curve (the relationship between individual measurements of stage and discharge) could be developed at each station after sufficient discharge measurements are made. This rating curve could be applied to continuous readings of water levels to estimate continuous streamflow. The individual measurements of discharge could be used to develop a suspended-sediment rating curve at each station to predict continuous suspended sediment concentration.

2.5 Suspended Sediment

Automated ISCO 3700 Portable Autosamplers were deployed at all four Sagavanirktok River stations to monitor suspended sediment concentration (SSC) through the summer. Samples were collected at least once per 24 hours from early July 2015 until early September 2015. The SSC of each water sample was determined at the Water and Environmental Research Center (WERC), Following ASTM Standard 3977-97, the samples were vacuum filtered through Whatman GF/C glass microfiber filters with a particle retention size of 1.2 μm. The percentage of organic matter in each sample was then determined using ASTM Standard 2974 (Test Method C), in which samples are placed in a muffle furnace at 440°C for 12 hours. For this study, only the inorganic solids, referred to as SSC, were considered.

Additionally, water samples with elevated SSC were selected for sediment grain-size analysis. The samples were sent to Particle Tech Labs in Downers Grove, Illinois, for testing with an AccuSizer 770 optical sensor.

2.6 Turbidity

Campbell Scientific 500 or 501 turbidity sensors were also installed at each site; they have both backscatter and sidescatter capabilities. The backscatter sensor performs better at higher turbidity, and the sidescatter sensor performs better at low turbidity. Operating at wavelengths of 850 nanometers (±5 nm), these sensors are capable of measuring turbidity levels from 0 to 4000 NTUs (nephelometric turbidity units). Turbidity readings have an accuracy of 2% of the reading or 0.5 NTU, whichever is greater. Installation involved mounting the sensor on rebar driven into the streambed, with the optics facing the middle of the channel and 180° away from the rebar. The sensor was installed roughly 15 cm above the channel bed on all three rivers and in proximity to the ISCO sampler intake. Each turbidity sensor was electronically connected to the surface-water observation station datalogger at each river to record readings at 15-minute intervals.

2.7 Substrate and Floodplain Vegetation Survey

The goal of the floodplain vegetation and substrate survey was to use vegetation and substrate properties to determine the stability of the floodplain. Due to a general lack of fire in the Arctic, vegetation community composition is commonly linked to substrate properties and climate (Tape et al., 2012; Walker et al., 2005).By characterizing substrate and vegetation under similar climate regimes (sites in proximity), we can assess the recent history and stability of the sites. Certain types of vegetation and soil indicate frequent hydrologic disturbance, whereas other types indicate long-term stability and inactivity (Walker, 1985; Walker, 1987; Bockheim et al., 1998). Ordination analysis relates certain vegetation communities with substrate types identified in the field. Diagnostic vegetation and soil characteristics identified using these analyses allow floodplain mapping in terms of both substrate and vegetation.

2.7.1 Site selection

Multiple circular plots (7–9) were sampled near each of the four locations where gravel was dredged (Figure 3 through Figure 6) to create a conceptual cross section of the vegetation and substrate in the floodplain. A non-motorized inflatable boat was used to cross the river channels and access all parts of the floodplain. Sites were selected that represent the variety of vegetation and substrate in the area, from stable upland tundra to highly active floodplain sites, many devoid of vegetation and dominated by rocks or sediment. Once a site was identified, the position was recorded using a GPS.

2.7.2 Quantifying substrate

At sites where little to no vegetation was present, the substrate was characterized by particle size. To quantify particle size, we took vertical photographs (3 per site) of the substrate from a height of 1.8 m; a 1-meter ruler was included in the images. The average particle size of sediments in the photographs was analyzed using the MATLAB-based automated software, Digital Grain Size (Buscombe, 2013). The scale of each photograph was calibrated to the 1-meter ruler in the photograph. Default settings were used for filtering and flattening.

Additional photographs were analyzed with the automated software to compare with results from a manual technique described as follows: One hundred grains from each photograph were selected by overlaying a 10 by 10 grid and using the grid intersections to select particles (Figure 7). Large grains located under more than one grid intersect were measured only once, and then labeled as repeats for subsequent intersects. The outer gridline intersects were used to select the number of grains needed to reach the target of 100 measurements per photograph. The *b*-axis of all the particles was measured in pixels and then converted to millimeters based on the scaling of each photograph, calculated using the 1-meter ruler reference. Grain-size measurements were converted into phi values and used to plot a cumulative frequency curve for each sampled site. Values for standard diameter particles (D_{16}, D_{50}, and D_{84}) were drawn from these curves. These manually measured values were compared with those derived using the automated grain-size detection software. Resulting correction equations will allow the use of the automated software in future work.

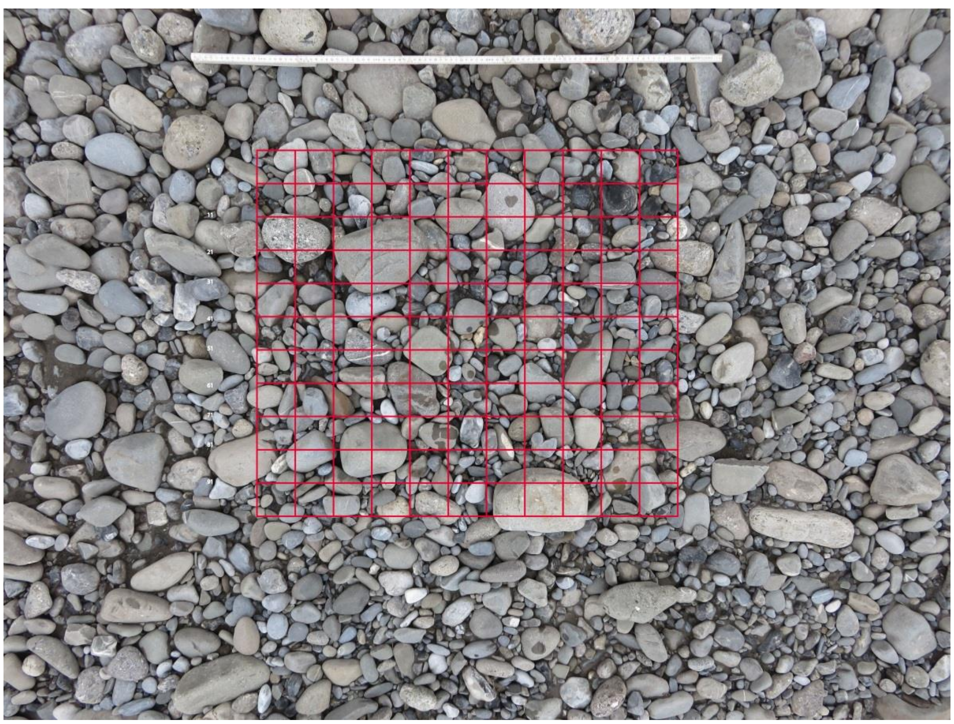

Figure 7. Example grid and 1-meter ruler used to measure grain size.

2.7.3 Characterizing vegetation

Where vegetation was present, plant species cover and plant functional cover were quantified. Plant species cover was sampled within a 10-meter-diameter circular plot, and the data were quantified using the Braun-Blanquet cover scale (Westhoff and Van Der Maarel, 1978), where *R* is 1 occurrence, *t* is <1%, *1* is 1–5%, *2* is 6–25%, *3* is 26–50%, *4* is 51–75%, and *5* is 76–100%. Plant functional cover was quantified within the plot by ocular method using a percentile scale. Less than 10% was quantified to the nearest 1%, and any value greater than 10% was quantified to the nearest 5%.Ordination statistical analysis was performed using PC-Ord statistical software, Version 6.Non-metric multidimensional scaling (NMS) was the ordination technique applied to the data.

3 RESULTS

In this chapter, hydrologic, sedimentological, and meteorological data collected in 2015, as well as water quality data collected in 2016, are described; selected raw data are in Appendices A and B.

3.1 Pit Trench Configuration

The results of the bathymetry survey at each trench are shown in Table 5 and Figure 8 through Figure 11. The volume of material extracted from each trench varied from 98 m^3 to 468 m^3. Pictures were taken at each trench, and selected photographs are shown in Figure 12 through Figure 18.

Table 5. Trench locations at each site.

Site Name	Latitude (WGS84)	Long (WGS84)	Volume of Material Extracted (m^3)
DSS1 Wet Pit	70.08367	-148.533	288.4
DSS2 Wet Pit	69.59713	-148.619	156.4
DSS2 Dry Pit	69.59658	-148.619	468.6
DSS3 Dry Pit	69.16355	-148.813	116.3
DSS3 Wet Pit	69.1633	-148.812	143.2
DSS4 Dry Pit	68.95767	-148.859	98.1
DSS4 Wet Pit	68.95733	-148.86	122.0

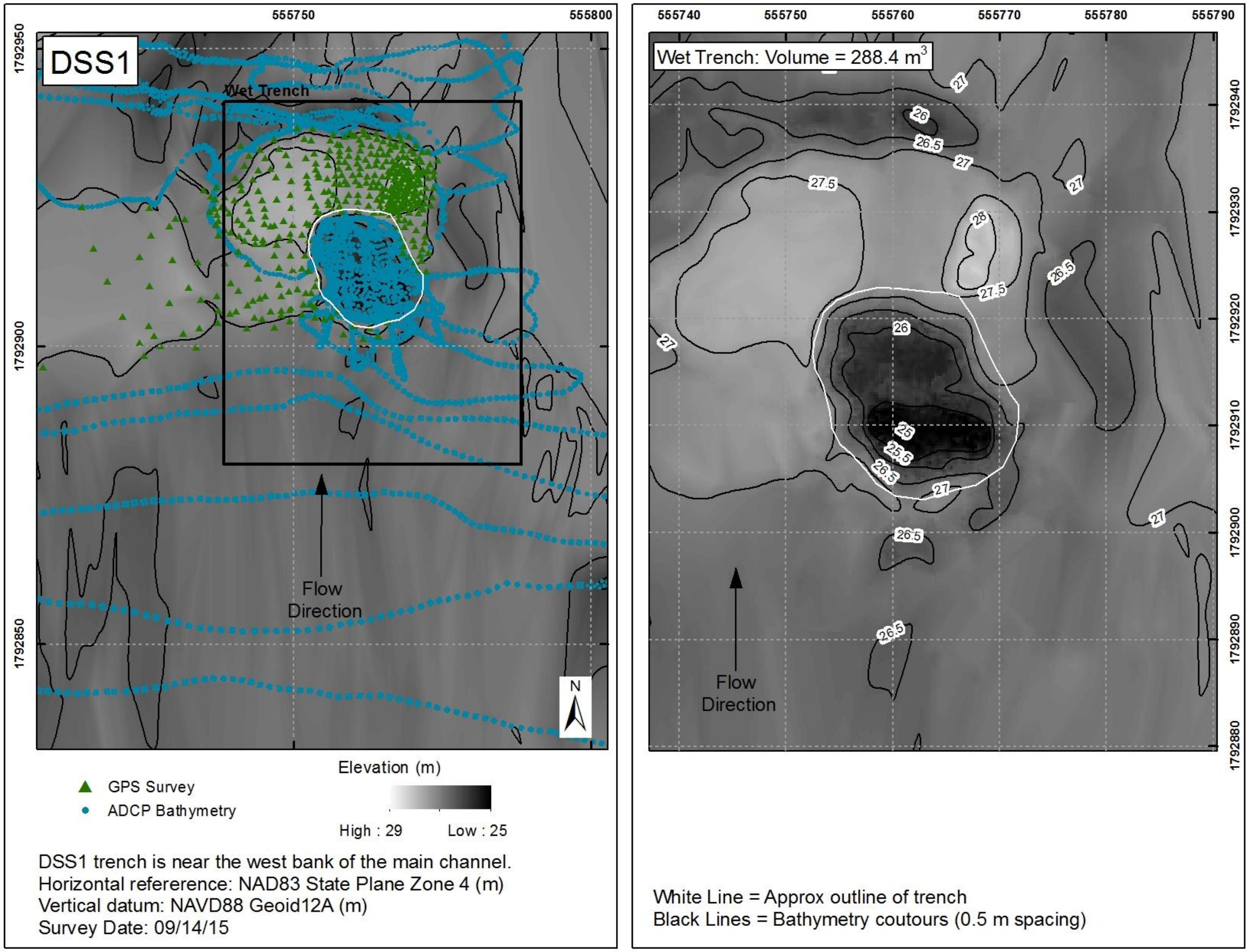

Figure 8. Trench at Sagavanirktok River near MP 405 Site 042 (DSS1). Site consists of one wet trench.

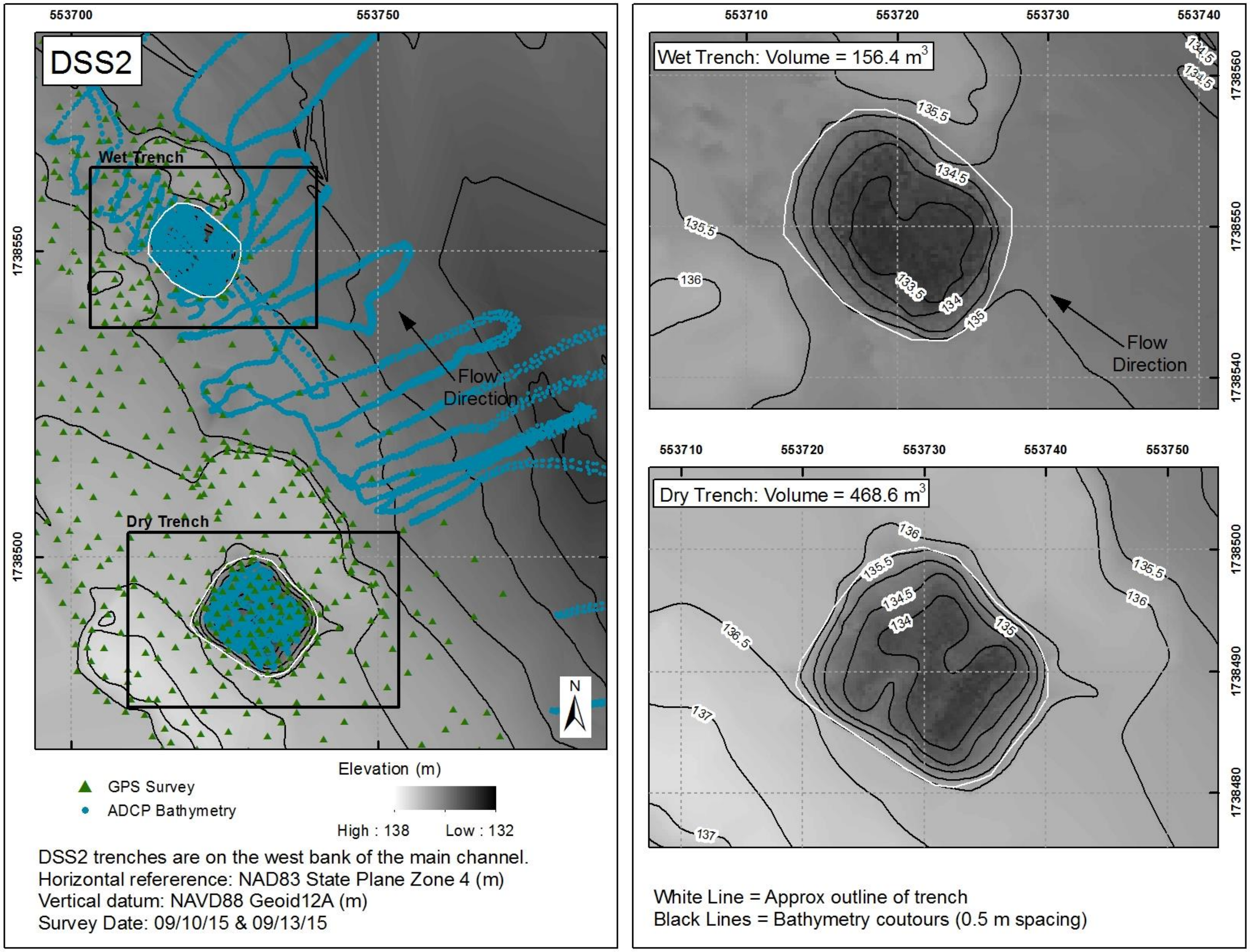

Figure 9. Trench at Sagavanirktok River below Ivishak River (DSS2). Site consists of a wet trench (flowing water) and a dry trench (gravel bar).

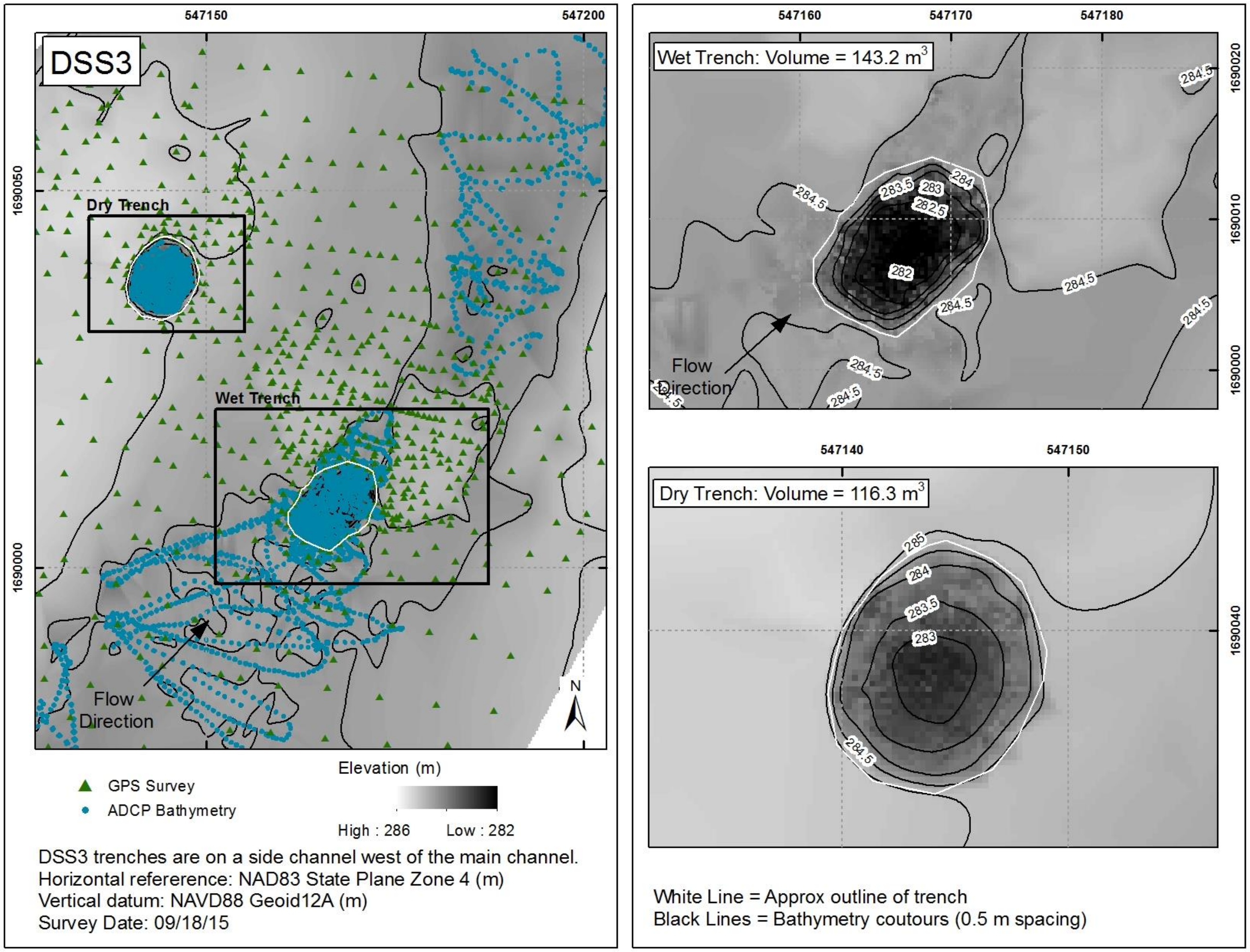

Figure 10. Trench at Sagavanirktok River at Happy Valley (DSS3). Site consists of a wet trench (flowing water) and a dry trench (gravel bar).

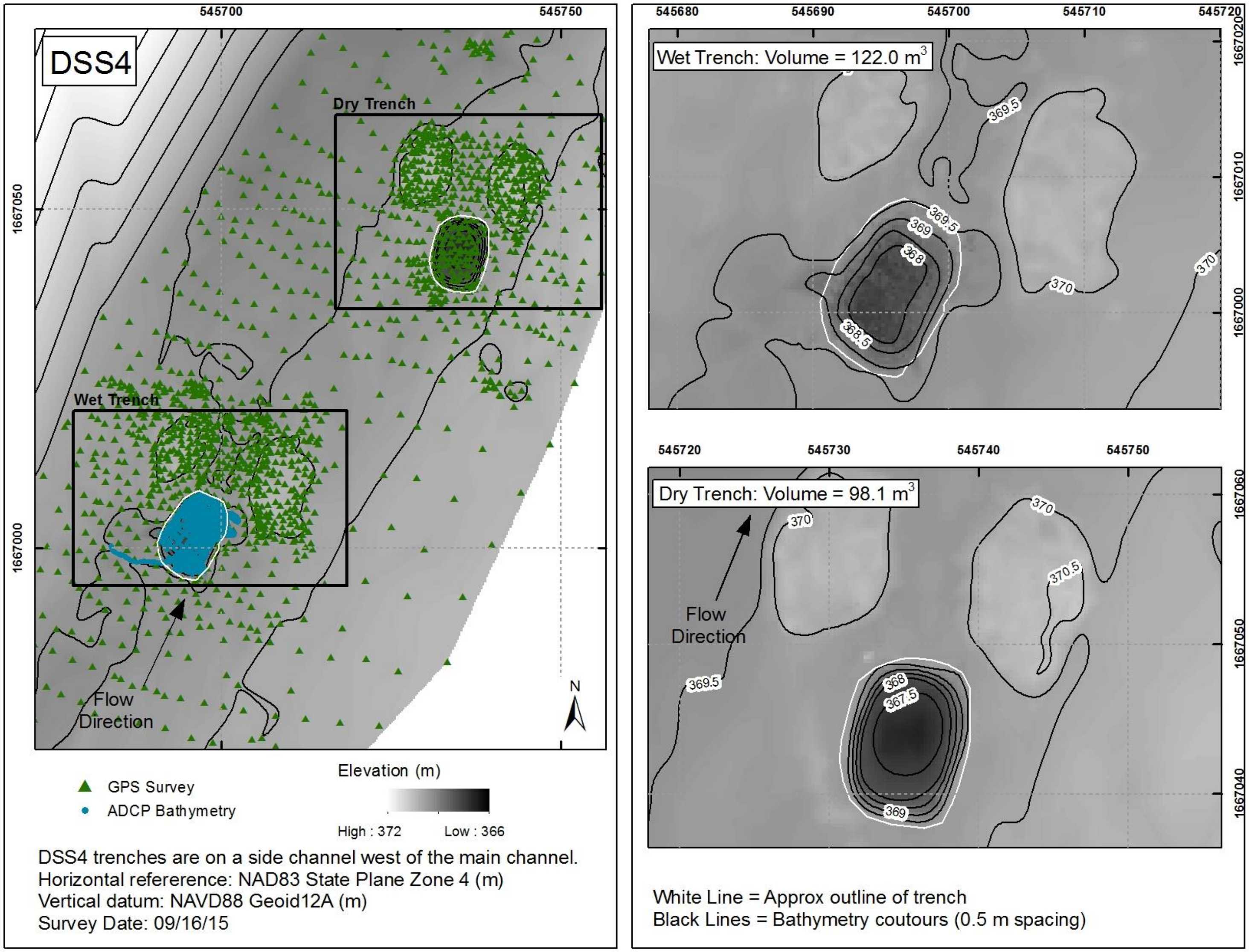

Figure 11. Trench at Sagavanirktok River at MP 318 (DSS4). Site consists of a wet trench (flowing water) and a dry trench (gravel bar).

Figure 12. Digging the wet trench at DSS1 on September 9, 2015.

Figure 13. Digging the dry trench at DSS2 on September 10, 2015.

Figure 14. Dry trench at DSS2 on September 13, 2015, a few days after excavation.

Figure 15. Dry trench at DSS3 on September 18, 2015.

Figure 16. Digging the wet trench at DSS4 on September 15, 2015.

Figure 17. Dry trench at DSS4 on September 15, 2015.

Figure 18. Dry trench at DSS4 on September 18, 2015.

3.2 Meteorology

Air temperature was collected at all four hydro-meteorological stations. Air temperature is reported for the summer months in Figure 19, and wind speed is plotted in Figure 20. The warmest part of the study area is in the Foothills region (Kane et al., 2014). During the study period, DSS3 (Happy Valley) reported the warmest summer temperatures, DSS1 (located near Deadhorse) had the highest wind speeds, DSS3 and DSS4 had the lowest wind speeds, and DSS3 had the most variable wind speeds.

3.3 Water Level Observations

Continuous water levels (or river stage) are presented in Figure 21. Pressure transducers were installed at each station (DSS1–DSS4) in summer 2015. Water levels were relatively low in the early part of summer. In mid-August, rainfall caused water levels to increase. Water levels declined through September going into winter. The annual peak stage for the year likely occurred during spring breakup; however, stations were not installed until after breakup. The peak summer stage for 2015 occurred on August 26 (DSS4), August 27 (DSS3), August 28 (DSS2), and August 28 (DSS1).

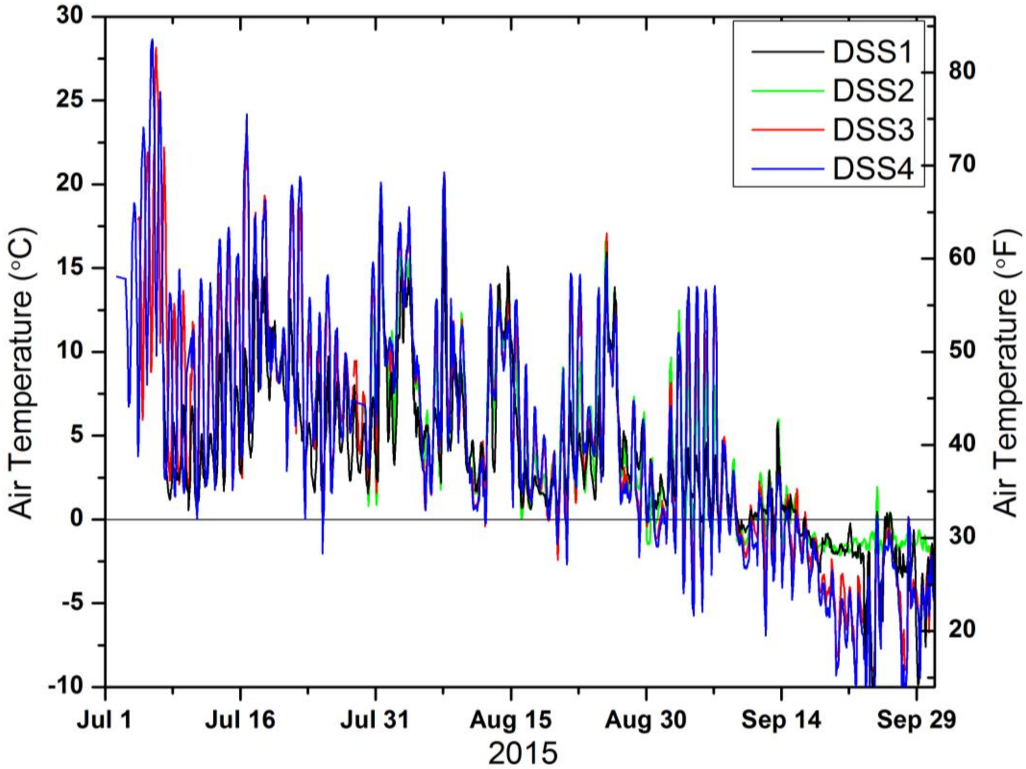

Figure 19. Air temperature at the four trench locations along the Sagavanirktok River in summer/fall 2015.

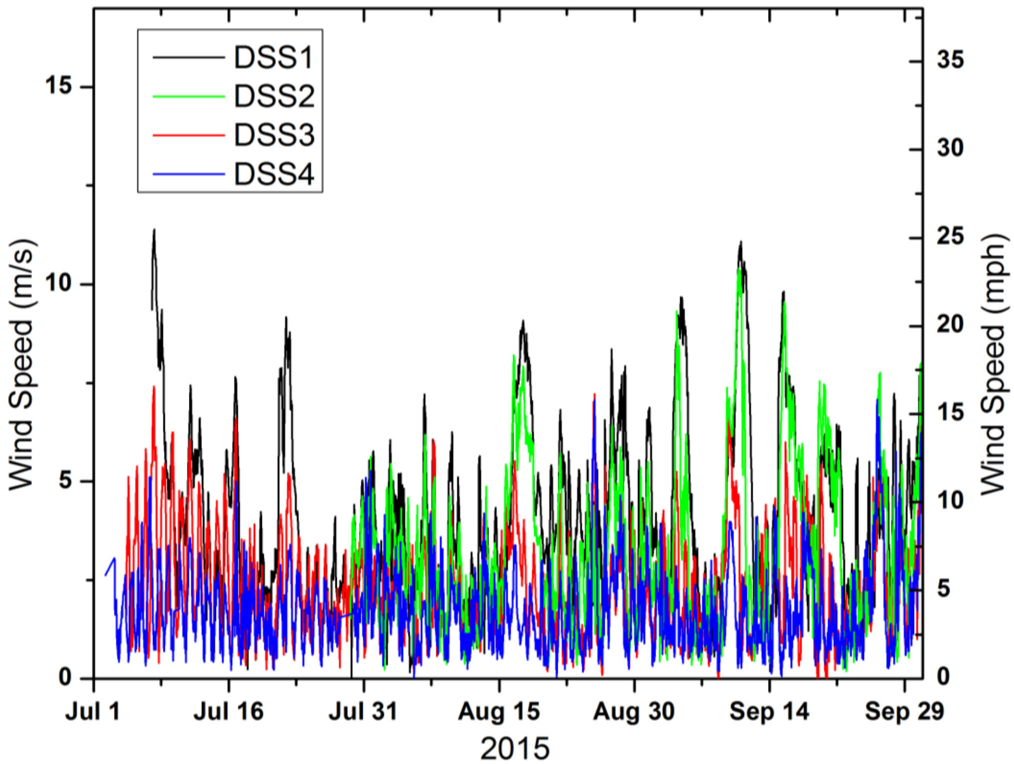

Figure 20. Wind speed at the four trench locations along the Sagavanirktok River in summer/fall 2015.

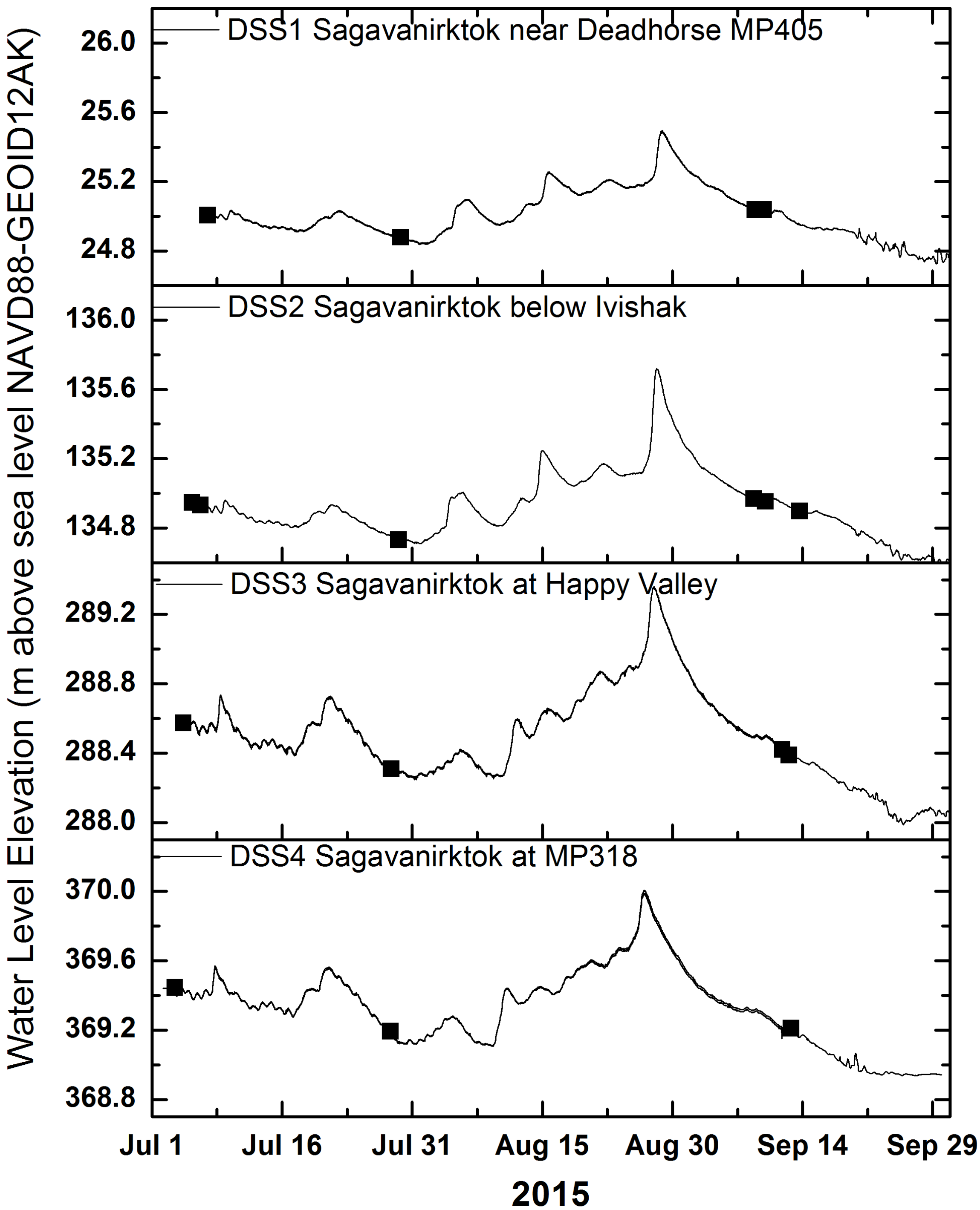

Figure 21. Continuous (solid line) and discrete (black square) water level elevations at the four Sagavanirktok River trenching locations.

3.4 Runoff

Individual measurements of runoff are presented in Table 6 and Appendix A. All the measurements were made during periods of lower flow. A rating curve (river stage vs. manual discharge measurements) to estimate continuous discharge can be developed once additional measurements are collected at varying river stages.

Table 6. ADCP discharge measurements at each station (DSS1–DSS4) on the Sagavanirktok River.

Date AST	Station	Msmt. #	Discharge (m^3/s)	Discharge (ft^3/s)	Coefficient of Variation	Msmt. Rating	Reference	Notes
7/7/2015 9:41	DSS1	1	60	2119	8	fair	RTK/VTG	20+ mph, 2' waves
7/29/2015 15:56	DSS1	2	40	1413	5	good	RTK/VTG	
9/9/2015 9:41	DSS1	3	82	2896	10	fair	RTK/VTG	
7/6/2015 12:34	DSS2	1	161	5686	2	good	RTK/VTG	
7/29/2015 12:04	DSS2	2	101	3567	1	good	RTK/VTG	
9/13/2015 12:27	DSS2	3	152	5368	6	fair	RTK/VTG	
7/4/2015 13:38	DSS3	1	90	3178	2	good	RTK/VTG	
7/28/2015 14:40	DSS3	2	53	1872	4	good	RTK/VTG	
9/11/2015 9:34	DSS3	3	76	2684	4	good	RTK/VTG	
7/3/2015 13:59	DSS4	1	94	3320	1	good	RTK/VTG	
7/28/2015 11:11	DSS4	2	52	1836	8	fair	RTK/VTG	
9/12/2015 13:30	DSS4	3	58	2048	5	good	RTK/VTG	

3.4.1 Additional runoff observations

Figure 22 presents runoff on the Upper Sagavanirktok River for summer 2015 (USGS, 2016). Above the gauge site, most of the basin lies in the Mountain region; a smaller percentage of the basin area is within the Foothills region. Similar to the river stage recorded at UAF stations DSS1–DSS4, the months of July and early August were relatively dry with lower flows. Late August produced some slightly higher flows due to rainfall events. The summer peak flow occurred on August 27.

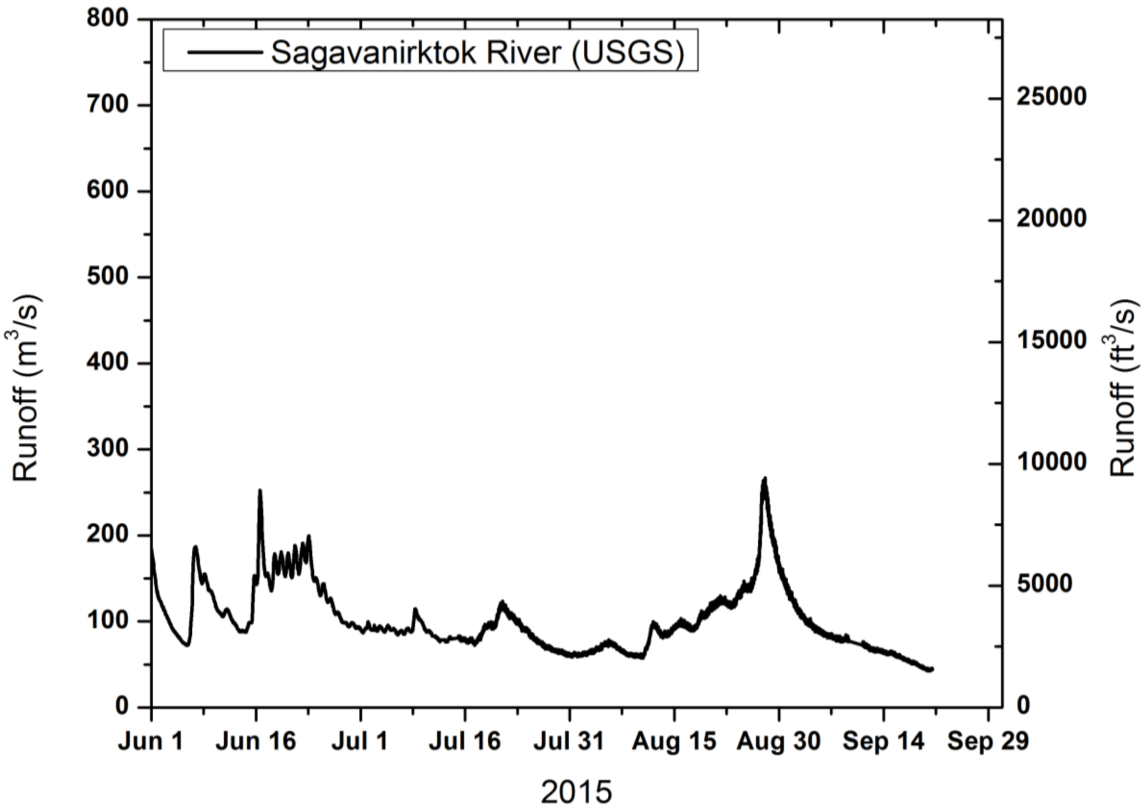

Figure 22. Upper Sagavanirktok River runoff for summer2015 (USGS, 2016).

3.5 Suspended Sediment

During the period of record, suspended sediment concentration (SSC) was generally low (3–20 mg/L) except for during two distinct flow events that occurred on 7–10 July 2015 and 27–30 August 2015 (Figure 23). The maximum SSC recorded during the summer was 624.9 mg/L at DSS3 on August 28, 2015. For this higher runoff event, the maximum SSC at the other sites was 133.1 mg/L, 104.2 mg/L, and 208.7 mg/L for DSS4, DSS2, and DSS1, respectively. No clear trend of increasing or decreasing peak SSC magnitude along the Sagavanirktok River was indicated during either of the two summer higher flow events.

A smaller SSC peak was recorded at DSS1 during August 15–16, 2015, but was not observed at any other stations upstream. This sediment transport event is attributed to the breaching of a temporary levy at the active MP 405 material site, which is approximately 1 mile upstream of DSS1.

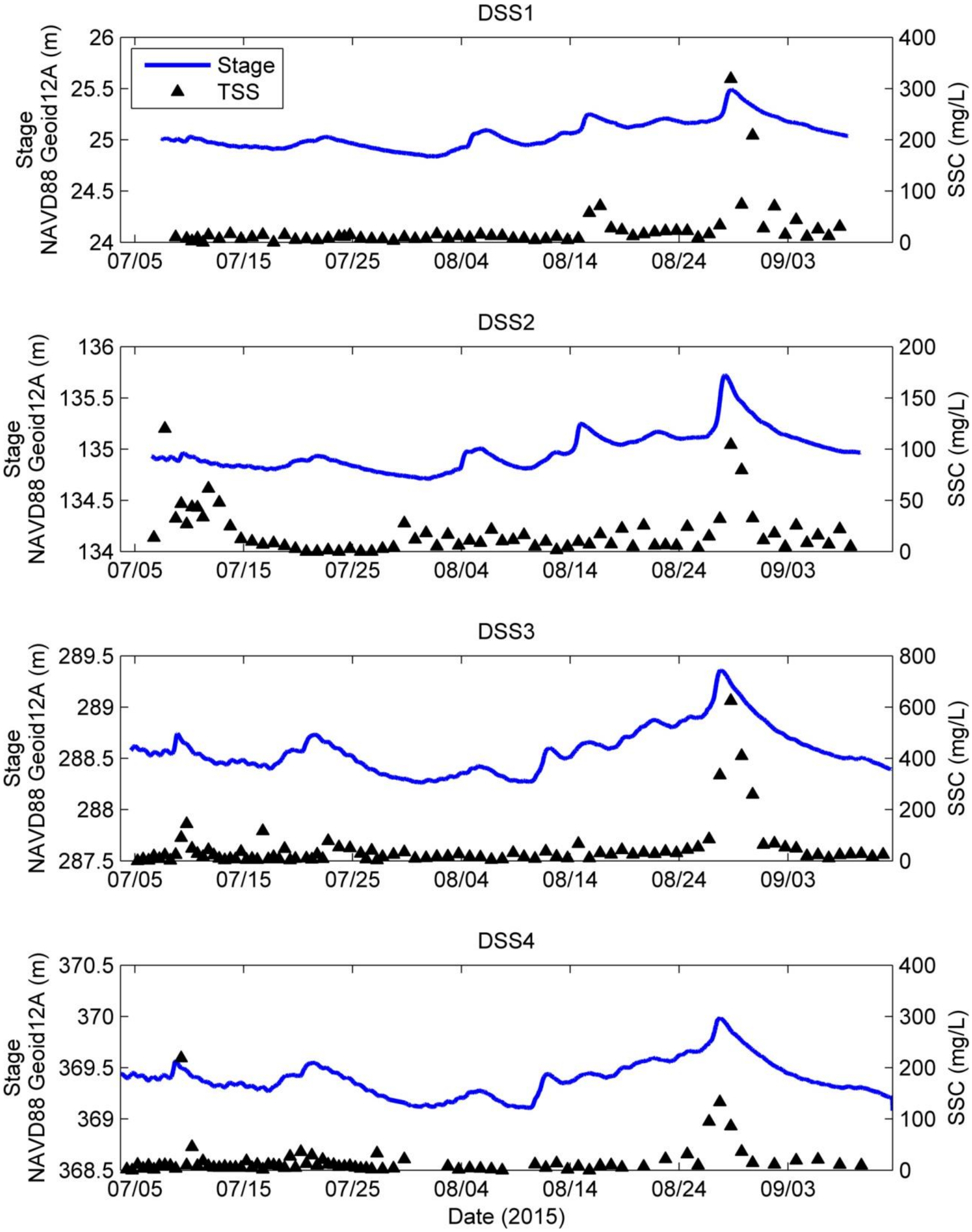

Figure 23. Suspended sediment concentration and river stage at stations (DSS1–DSS4) on the Sagavanirktok River.

3.6 Suspended Sediment Grain-Size Distribution

Twenty-four water samples with elevated suspended sediment concentration were selected for sediment grain-size analysis (Table 7). Figure 24 shows the grain-size distribution. The mean D_{50} for all samples was 47.8 μm, which corresponds to silt. Several samples also contained fine- to medium-sized sand.

Table 7. Sample location, time, SSC, and measured D_{50}.

Station	Date & Time	SSC (mg/L)	D_{50} (μm)
DSS1	7/10/15 6:00	2.4	29.2
DSS1	7/10/15 18:00	8.2	81.3
DSS2	7/10/15 6:00	43.4	20.0
DSS3	7/9/15 6:00	90.4	11.0
DSS3	7/9/15 18:00	144.1	40.3
DSS3	7/10/15 6:00	48.0	52.8
DSS3	7/10/15 18:00	27.8	22.3
DSS1	8/28/15 18:00	318.8	24.8
DSS1	8/29/15 18:00	74.0	44.9
DSS1	8/30/15 18:00	208.7	29.2
DSS1	8/31/15 18:00	27.4	38.2
DSS2	8/27/15 18:00	32.0	40.3
DSS2	8/28/15 18:00	104.2	22.3
DSS2	8/29/15 18:00	79.6	44.9
DSS2	8/30/15 18:00	32.6	47.4
DSS3	8/26/15 18:00	84.4	46.2
DSS3	8/27/15 18:00	334.1	25.5
DSS3	8/28/15 18:00	624.9	115.5
DSS3	8/29/15 18:00	409.6	20.5
DSS3	8/30/15 18:00	259.1	43.7
DSS4	8/26/15 18:00	95.0	54.3
DSS4	8/27/15 18:00	133.1	187.8
DSS4	8/28/15 18:00	85.9	28.4
DSS4	8/29/15 18:00	36.2	79.2

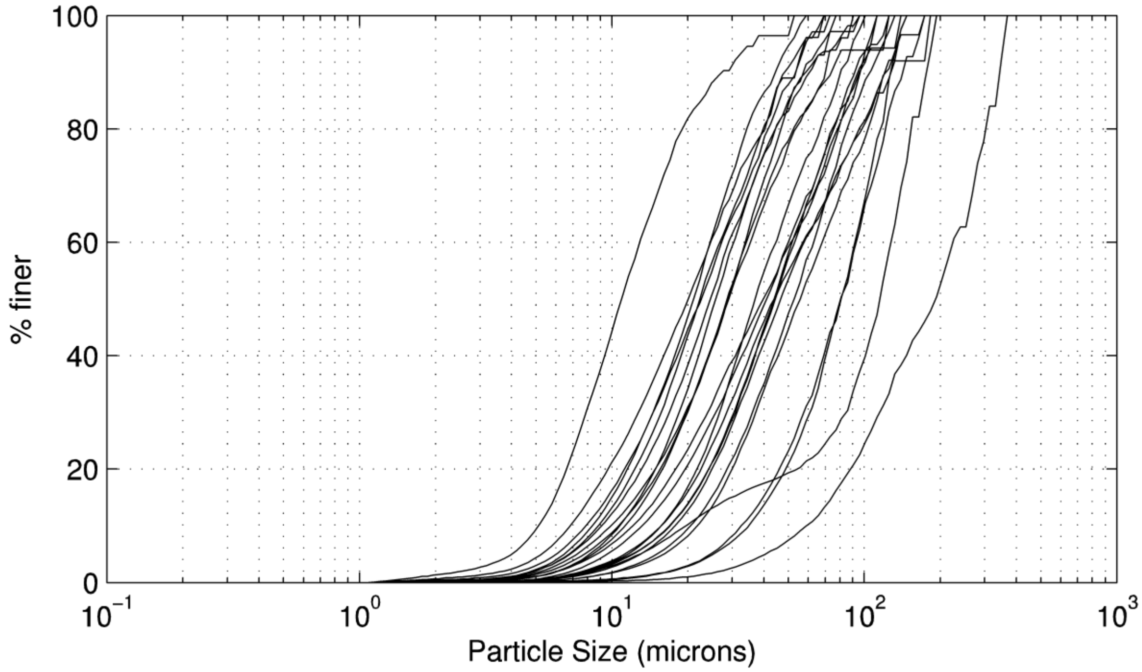

Figure 24. Grain-size distributions of 24 samples collected during summer 2015 on the Sagavanirktok River.

3.7 Turbidity

Turbidimeters were deployed at all four stations on the Sagavanirktok River from early July 2015 to early September 2015. The turbidimeter at DSS1 failed shortly after installation; it was replaced on July 25, 2015. The new turbidimeter recorded data until it was retrieved on September 8, 2015. The turbidimeters at DSS2 and DSS3 recorded during the entire deployment from early July to early September. The turbidimeter at DSS4 malfunctioned on July 29, 2015; it was retrieved on September 10, 2015. Anomalous peaks appear in the data in late August at DSS1 and in early August at DSS3. These peaks may result from fouling of the optical sensor, which is a known problem with turbidimeters. The measured turbidity peaked during the same higher discharge events that resulted in elevated SSC (Figure 25).

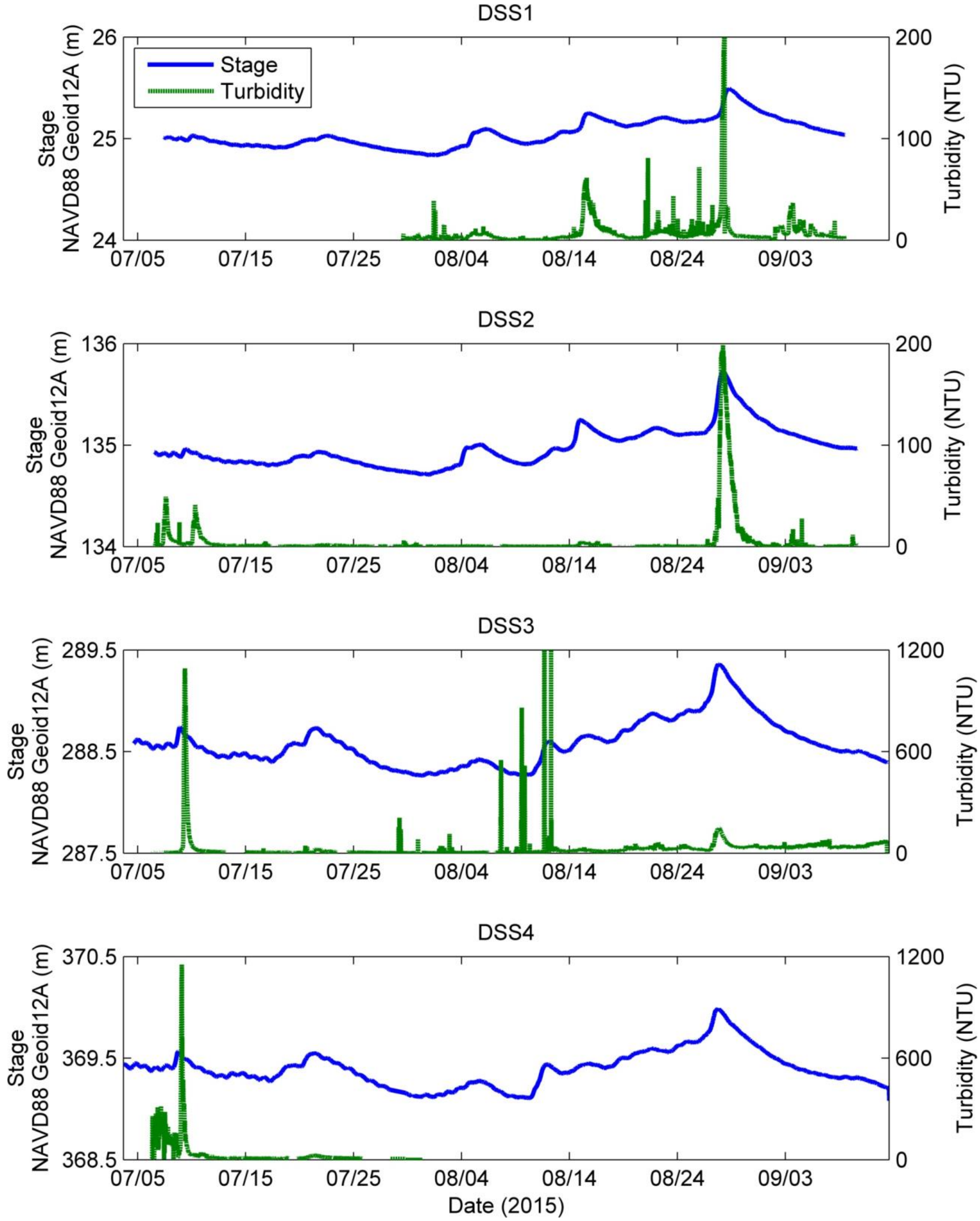

Figure 25. Turbidity and river stage at stations DSS1–DSS4 on the Sagavanirktok River.

3.8 Water Quality

Water quality sampling of the Sagavanirktok River was conducted on January 27 and 28, 2016. Samples were collected from two sites: DSS1 (Sagavanirktok River near MP 405) and DSS3 (Sagavanirktok River at Happy Valley Site 055, MP 335). Temperature, dissolved oxygen, and conductivity were measured using a YSI 556 multimeter. Total organic carbon (TOC) and total inorganic carbon (TIC) were measured in the laboratory with an OI Analytical TOC combustion instrument.

On January 27, a water sample was collected approximately 1.3 miles south of station DSS1 from beneath the Sagavanirktok River aufeis (channel adjacent to the Dalton Highway near MP 405). This location is where the trench was dug in fall 2015. Three holes were bored with an ice auger; only one hole yielded water. In the water-bearing hole, subsurface pressures caused the water to continuously bubble up out of the hole until the hole refroze.

On January 28, holes were bored beneath the ice to locate water from various apparent river channels adjacent to the Dalton Highway MP 394.5 and Franklin Bluffs (approximately 1.6 miles east of the Dalton Highway near UAF's East Bank hydrologic station). However, the river was frozen completely to the channel bottom at all locations.

Water quality measurements were collected from two locations in the Sagavanirktok River at Happy Valley Site 055 (DSS3) on January 28. The Old Gravel Pit location was adjacent to the camp road, approximately 15 feet from the riverbank near station DSS3. This location was a previous ADOT&PF gravel mine (summer 2008), but has since become an actively flowing channel. Although the sample was collected from a hole bored in the ice, open water was observed close to the location of the hole. The second sample was located approximately 1 mile downstream from the DSS3 station from within the dry trench excavated in September 2015 by ADOT&PF specifically for this project. While the resulting hole did contain water, a sample for TOC and/or TIC analysis could not be obtained because of low water elevation. Thus, for this hole, only the water quality measurements made with the YSI 556 probe are available. The results of each water quality sample are presented in Table 8.

Table 8. Water quality sampling results for the Sagavanirktok River on January 27 and 28, 2016.

	Sagavanirktok River near DSS1 trench dug in 2015	**DSS3 Sagavanirktok River at Happy Valley Site 055 (old DOT gravel pit)**	**DSS3 Sagavanirktok River at Happy Valley Site 055 (dry trench dug in 2015)**
Latitude/Longitude (WGS84)	70.0836667, -148.5331667	69.15083333, -148.823000	69.1636667, -148.8121667
Ice Thickness (cm)	175	45	105
Depth of Water Under Ice (cm)	60	55	80
Water Temperature (°C)	-0.3	-0.3	-0.3
Dissolved Oxygen (mg/L)	14.4	15.3	15.2
Conductivity (µS/cm)	264	193	437
Total Organic Carbon (mg/L)	1.23	1.24	--
Total Inorganic Carbon (mg/L)	41.0	34.0	--

The water was saturated with dissolved oxygen at all three locations tested. The TOC was extremely low, indicating a low oxygen demand in the water. Thus, the dissolved oxygen was not expected to decrease. The conductivity was low, indicating low dissolved solids (primarily salts), and the water was observed to be extremely clear. In sum, the samples did not yield any evidence of degraded water quality in the areas where the trenches were established, but this does not rule out the possibility that gravel excavation at the river has had a measurable impact on under-ice water quality.

4 ANALYSIS

This section presents the results of two analyses that were completed to better understand the hydro-sedimentological processes along the Sagavanirktok River channel. The first analysis is of the floodplain substrate and vegetation survey and associated ordination (Appendix B1–B6). The second analysis is of the Sagavanirktok River's channel stability.

4.1 Substrate and Vegetation

The substrate (particle size) and vegetation near the four hydro-sedimentological observation stations located in the Sagavanirktok River floodplain were quantified. Future work could include the use of these site attributes to create a map of the floodplain's vegetation and particle size from DSS4 to Deadhorse. The map could be generated from the data presented in this section and by using high-resolution floodplain imagery.

4.1.1 Substrate

The automated technique (described in Section 2.7.2) was used to estimate particle-size distribution in 142 images. Both manual and automated techniques were used to analyze an additional 53 images for particle size (Figure 26).

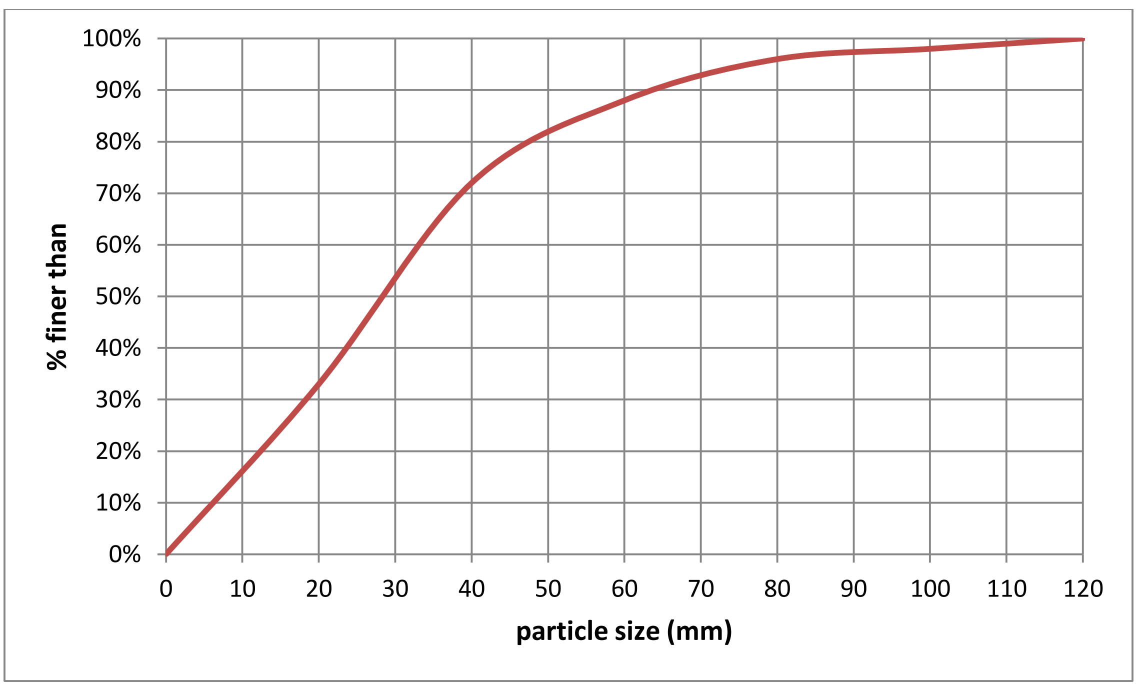

Figure 26. Example particle-size distribution plotted from grain size measurements of one substrate photos (*n* = 53 photos).

The automated and manual measurements were compared to determine the relationship between the automated measurements and the actual particle size. We found the strongest relationship for larger particle sizes, with decreasing correlation coefficients at smaller grain sizes. These correlations could be used as correction equations to permit the confident use of the automated technique in future work (Figure 27).

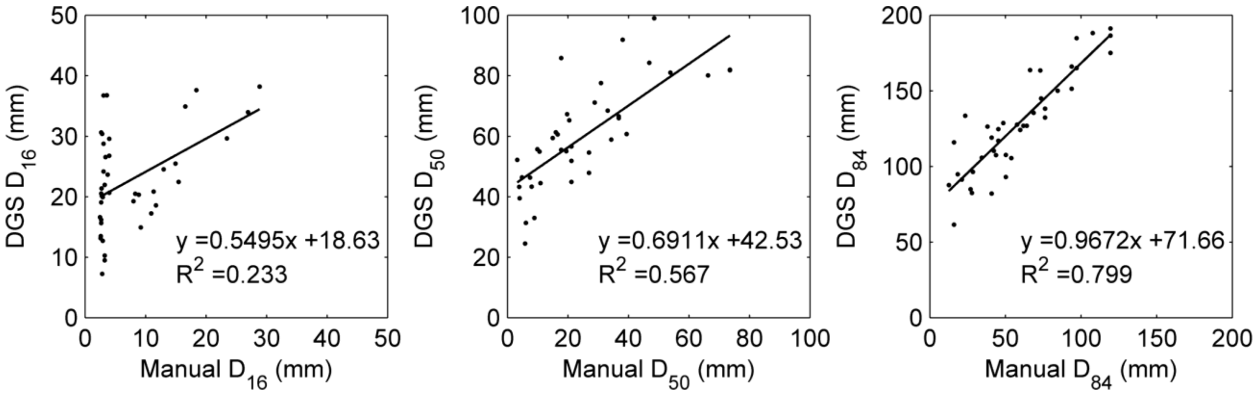

Figure 27. Correlation between automated (DGS, digital grain size) and manual particle size measurements.

4.1.2 Vegetation

Vegetation was characterized at 27 plots located along the 4 floodplain cross-sections. There were 137 species total (Appendix B), which includes unidentified mosses. Species that occurred once were excluded from the ordination analysis, leaving 43 species to calculate floristic differences between floodplain vegetation communities. The ordination plot (Figure 28) shows differences between vegetation at each site. Sites that are close together have similar plant communities, whereas sites that are far apart have different plant communities. The statistical technique of ordination allows us to examine the characteristics that describe ordination space, represented in the figure by red axes. The bounding box does not represent axes in the traditional sense. Floristic differences emerged between sites with high versus low flood frequency; sites with greater shrub, moss, and plant cover were assumed to have low flood frequency (Figure 28 and Figure 29). Many sites on the left one-third of the ordination space have higher fractions of bare substrate, as would be expected at high flood frequency locations.

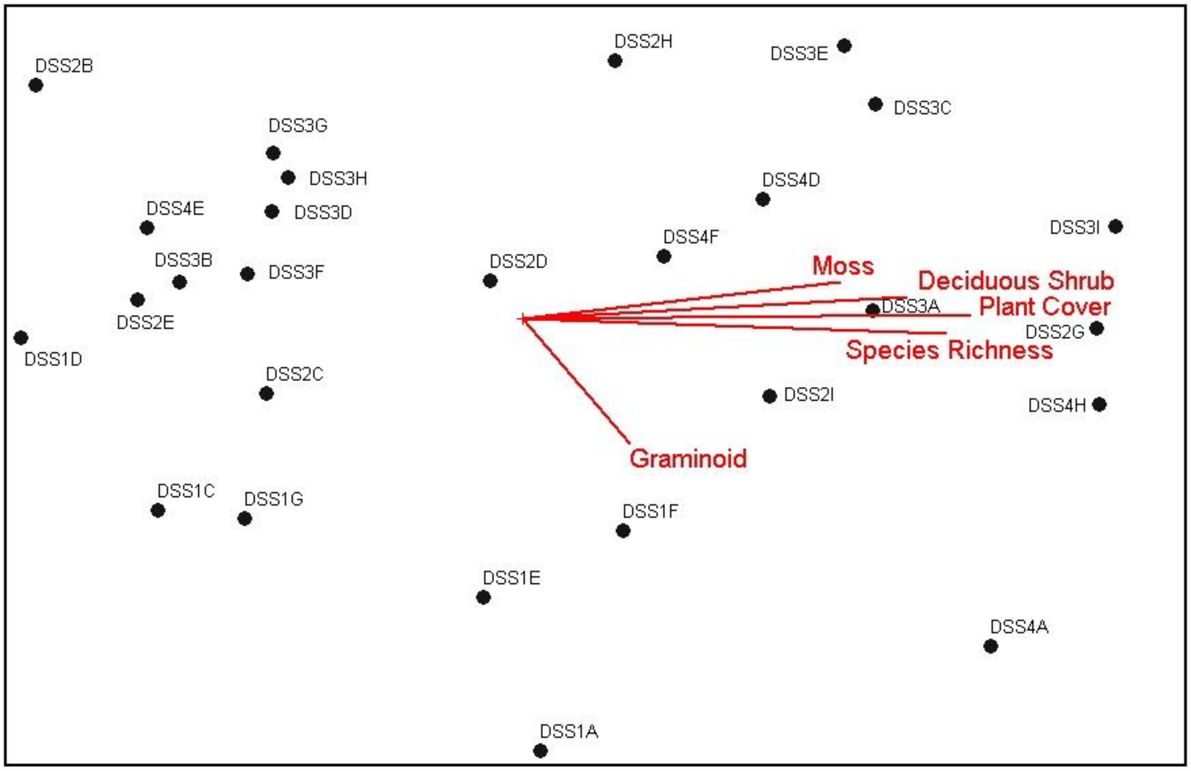

Figure 28. Non-metric multidimensional scaling plot ordination, where dots denote floristics at individual sites, and distance is proportional to floristic difference. Red lines are axes that describe the ordination space and thus explain vegetation differences among sites, where the length and direction of the axis indicates correlation. Vegetation differences are apparent between sites with high vegetation cover and low flood frequency (right two-thirds), and sites with low vegetation cover and high flood frequency (left one-third).

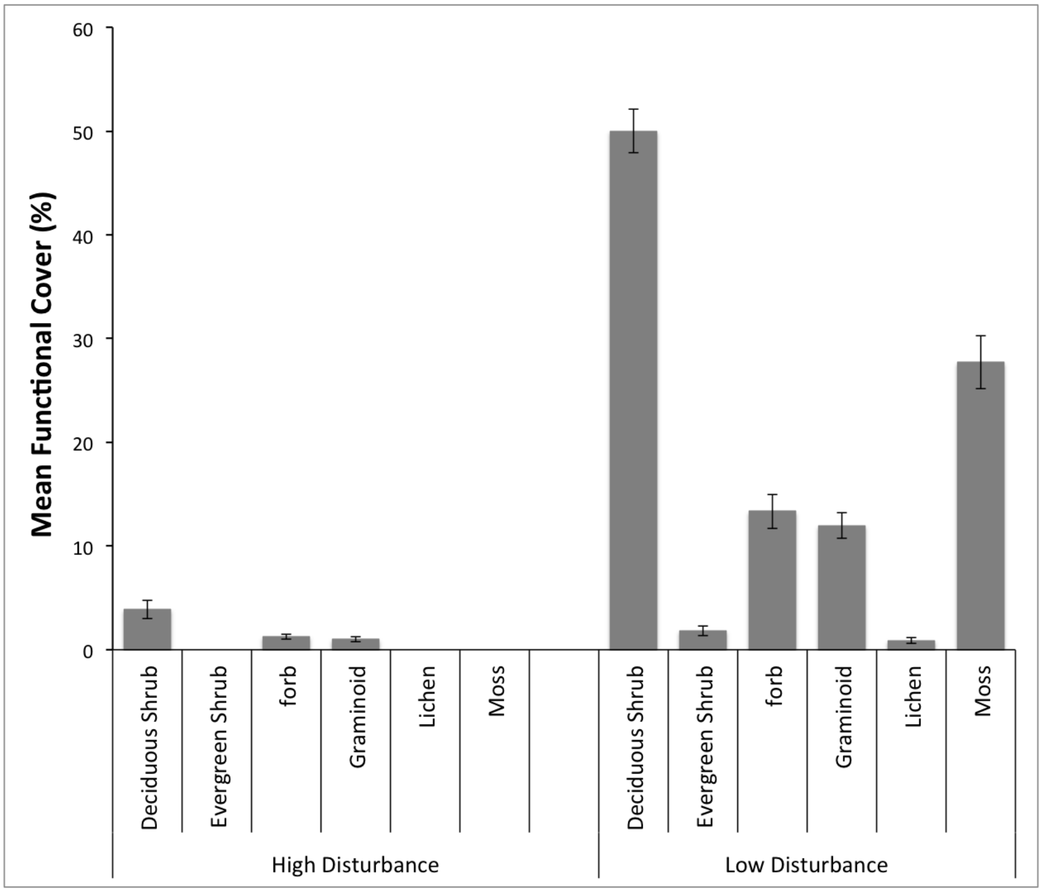

Figure 29. Mean cover of plant functional type as related to disturbance (flooding) regime. There are 15 plots in the low disturbance category and 19 plots in the high disturbance category. Low disturbance sites (infrequent flooding) had higher plant cover; this was true across all floodplain transects (DSS1–DSS4).

4.2 River Channel Stability

Changes in the Sagavanirktok River channel configuration from 1985 to 2007 were analyzed using GIS and Landsat imagery. To detect channel changes in the Sagavanirktok River and its floodplain, we selected three cloud-free Landsat-4 and Landsat-5 TM scenes from the same month for the period 1985–2007: August 4, 1985, August 3, 1999, and August 24, 2007 (paths 73–74, row 11).

These images were downloaded from the USGS-GLOVIS web portal (http://glovis.usgs.gov/). We carried out a radiometric correction of Landsat optical imagery following the methodology proposed by Pons et al. (2014). This method allowed us to compare the three Landsat images by reducing the number of undesired artifacts caused by the effects of the atmosphere or differential illumination which is, in turn, due to the time of day, the location on Earth, and the relief (some zones are more illuminated than others, cast shadows, etc.). Once the Landsat optical imagery was radiometrically corrected, we checked the imagery for specific metadata, making sure it would follow international standards in data models and interoperability, to ensure easy data access, management, and updates.

To detect the active river channel, we used several water indices proposed by Rokni et al. (2014). This methodology was originally designed to detect water; in this work, it was used to detect the active river channel. Six water indices were computed following this methodology (Table 9). To select those pixels belonging to the active river channel, we implemented a set of threshold values for each index. These threshold values were then iteratively modified to fit the Sagavanirktok River conditions. This process was accomplished by visually inspecting each index in each Landsat scene, determining that the Normalized Difference Water Index (NDWI) was best at identifying areas that appeared to be water (an example can be found in Figure 30A). Pixels with a value greater than 0 in the NDWI were selected as an active river category for each one of the Landsat scenes (see Figure 30B).

Once the pixels were selected, a coarse river channel morphology layer was used to mask the final image (see Figure 30C). This layer was previously photo-interpreted and digitized using the same Landsat scenes (an example can be found in Figure 31). Finally, to analyze the change in the active river channel, we combined the different layers by means of map algebra, allowing us to quantify the rate of change of the riverbed at various intervals from 1985 to 2007 (see Figure 32 through Figure 37 and Table 10). Figure 32 is a description of the study area showing the changes in the active river channel from 1985 to 2007. Figure 33 to Figure 37 are inset maps of the five rectangles in Figure 32 showing the temporal dynamics of the changes in the active river channel in the three periods: 1985–1999, 1999–2007, and 1985–2007. Figure 38 through Figure 40 show these changes at each trench site. The information provided in the figures seems to indicate that the active river channel was relatively stable during the three study periods for the entire area of interest.

Although Landsat-5 TM scenes were selected from the same month, ensuring image comparability, river discharges were not the same. Daily discharges at Pump Station 3 reported by USGS for August 4, 1985, August 3, 1999, and August 24, 2007, were 2620 ft^3/s, 2510 ft^3/s

and 1910ft^3/s, respectively. In 1985 and 1999, river discharges were similar, but not in 2007, meaning that changes in the active river channel between 1999 and 2007 might have been even larger than the changes reported in this work. Unfortunately, cloud-free images from previous months were not available, so further comparison cannot be made.

Table 9. Water indices used to retrieve the active river channel (from Rokni et al., 2014).

Index	Equation
Normalized Difference Water Index (NDWI)	NDWI = (Green – NIR)/(Green + NIR)
Normalized Difference Moisture Index (NDMI)	NDMI = (NIR – MIR)/(NIR + MIR)
Modified Normalized Difference Water Index (MNDWI)	MNDWI = (Green – MIR)/(Green + MIR)
Water Ratio Index (WRI)	WRI = (Green + Red)/NIR + MIR)
Normalized Difference Vegetation Index (NDVI)	NDVI = (NIR – Red)/(NIR + Red)
Automated Water Extraction Index (AWEI)	AWEI = 4 × (Green – MIR) – (0.25 × NIR + 2.75 × SWIR)

Table 10. Active river channel change analysis results for the whole study area in m^2 and percentage relative to the coarse river channel morphology layer.

Units: m^2					
Period	**Not active**	**Active in 1985**	**Active in 1999**	**Active in 2007**	**Active both years**
1985–1999	95040900	24655500	4079700		178516800
1999–2007	110692800		5809500	9003600	17678700
1985–2007	91580400	24921900		7540200	178250400
Units: %					
Period	**Not active**	**Active in 1985**	**Active in 1999**	**Active in 2007**	**Active both years**
1985–1999	31.4	8.2	1.3		59.1
1999–2007	36.6		1.9	3.0	58.5
1985–2007	30.3	8.2		2.5	59.0

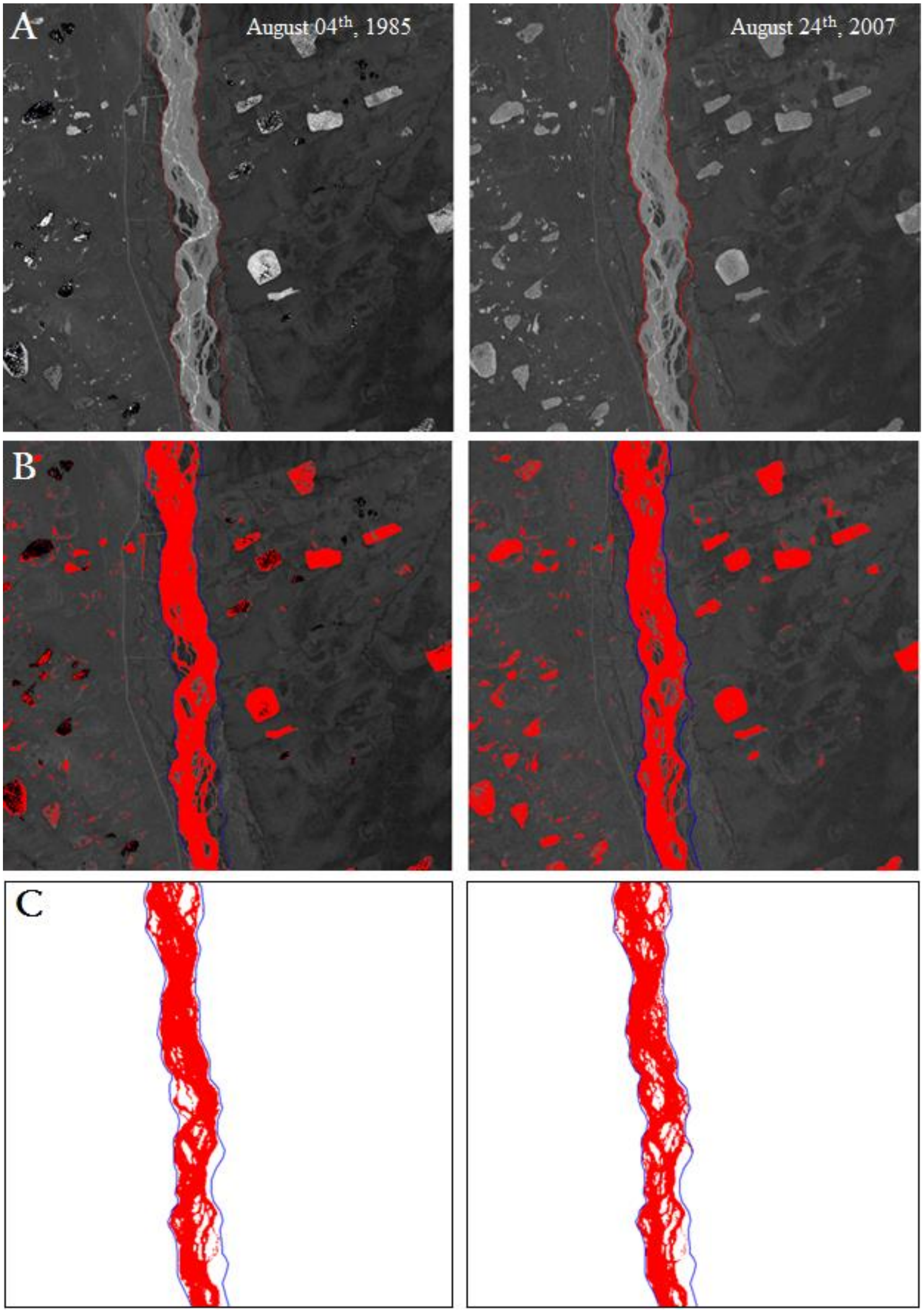

Figure 30. Active river channel detection flow chart. (A): NDWI computation. (B): NDWI threshold selection, pixels with a value greater than 0 in red. (C): active river channel extraction.

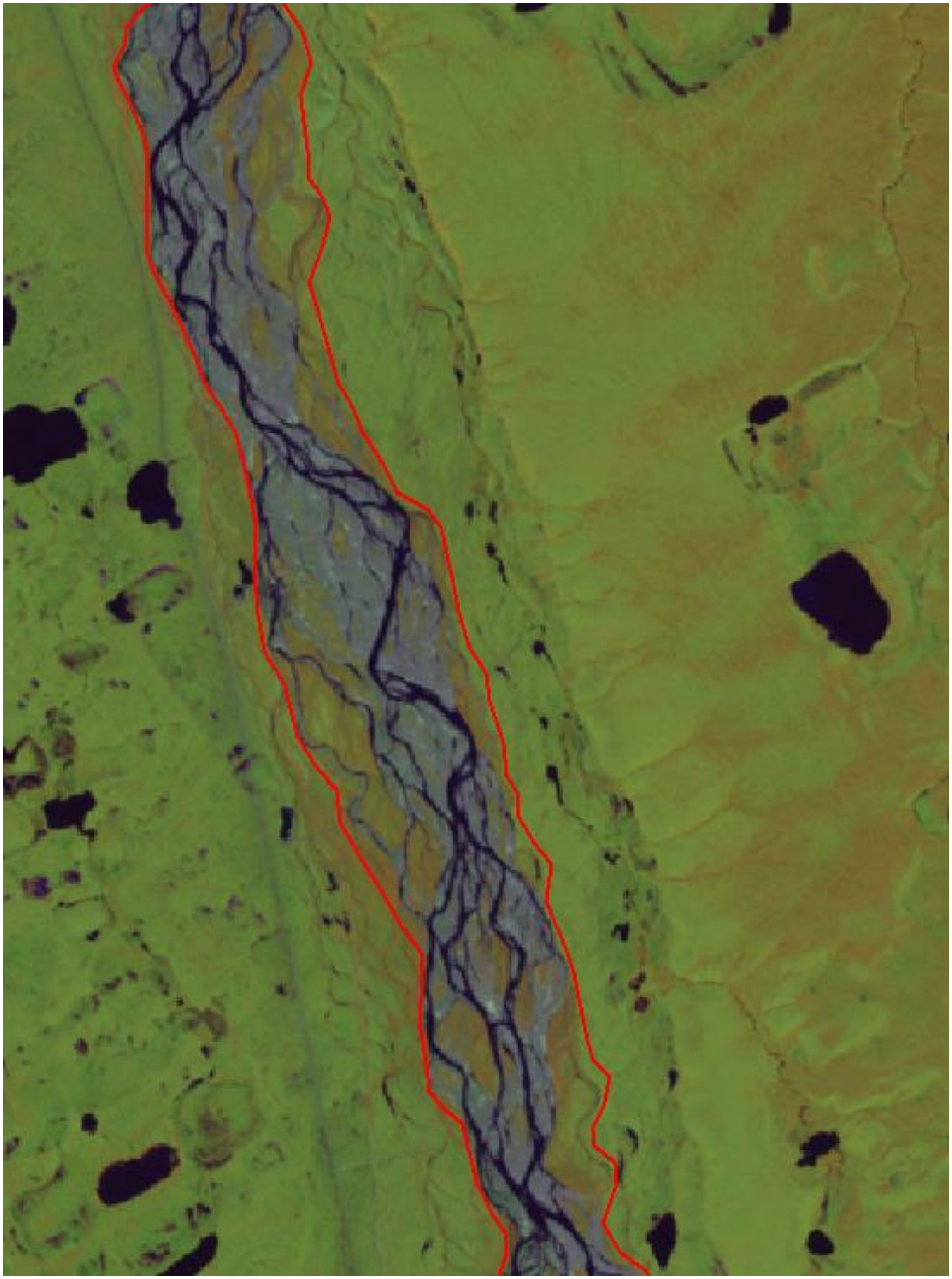

Figure 31. Example of the coarse river channel morphology layer. Background image is a 4+5+3 Landsat-5 TM combination of an August 24, 2007, scene.

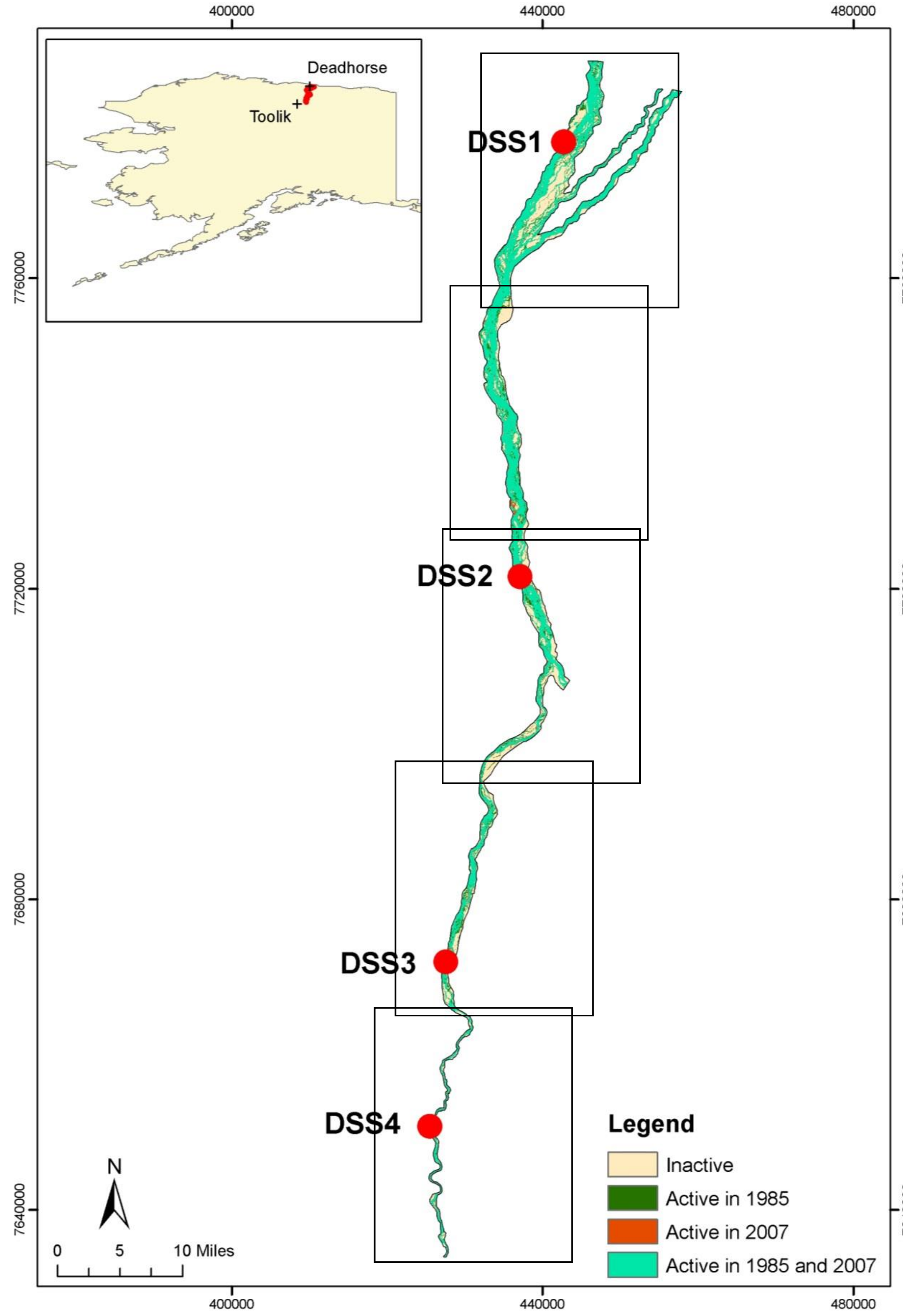

Figure 32. Active river channel change from 1985 to 2007 for the whole study area. The red dot is the station location. Coordinates in UTM-6N, datum WGS-84.

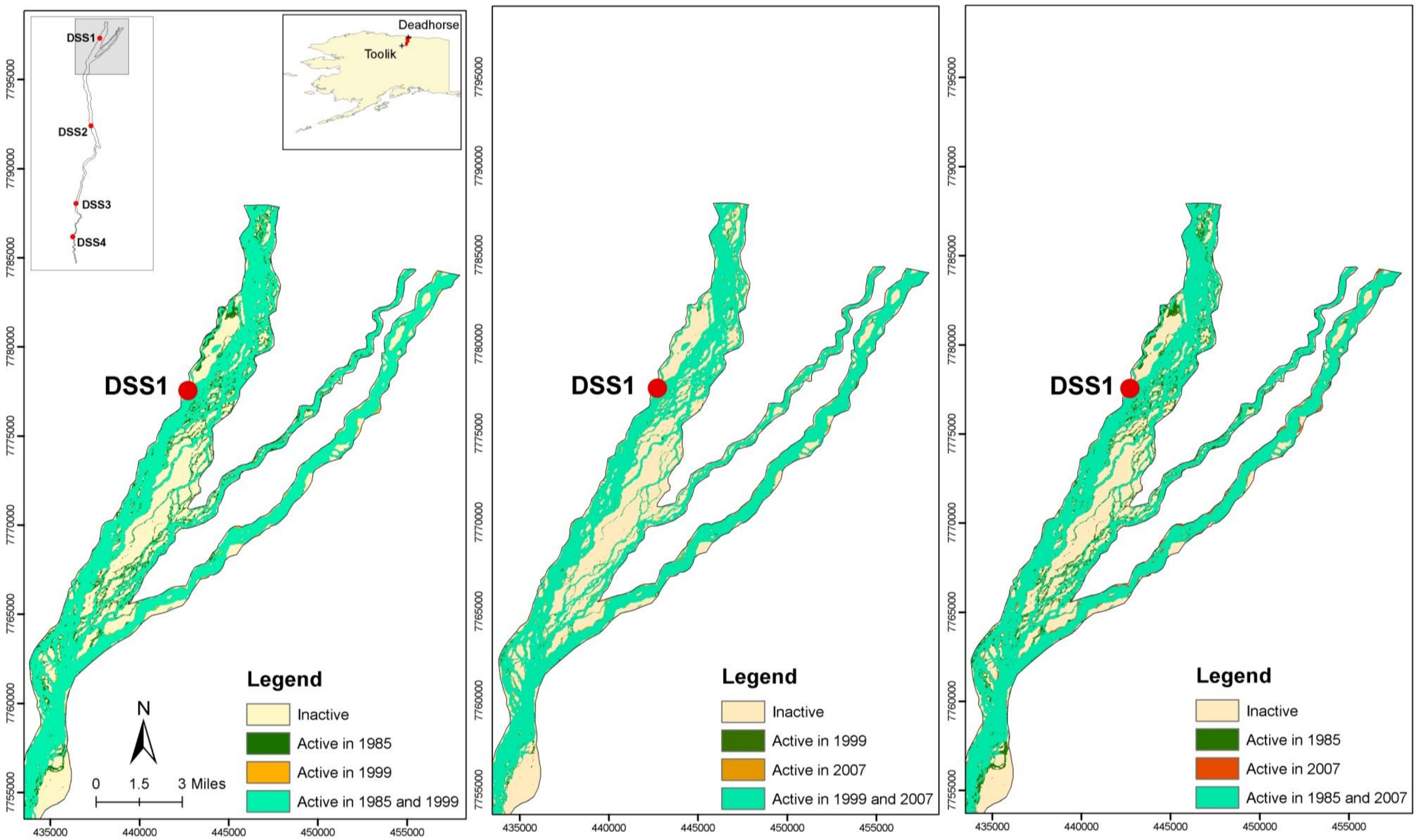

Figure 33. Active river channel changes inlet map from 1985 to 2007 in the vicinity of DSS1. The red dot is the station location. Coordinates in UTM-6N, datum WGS-84.

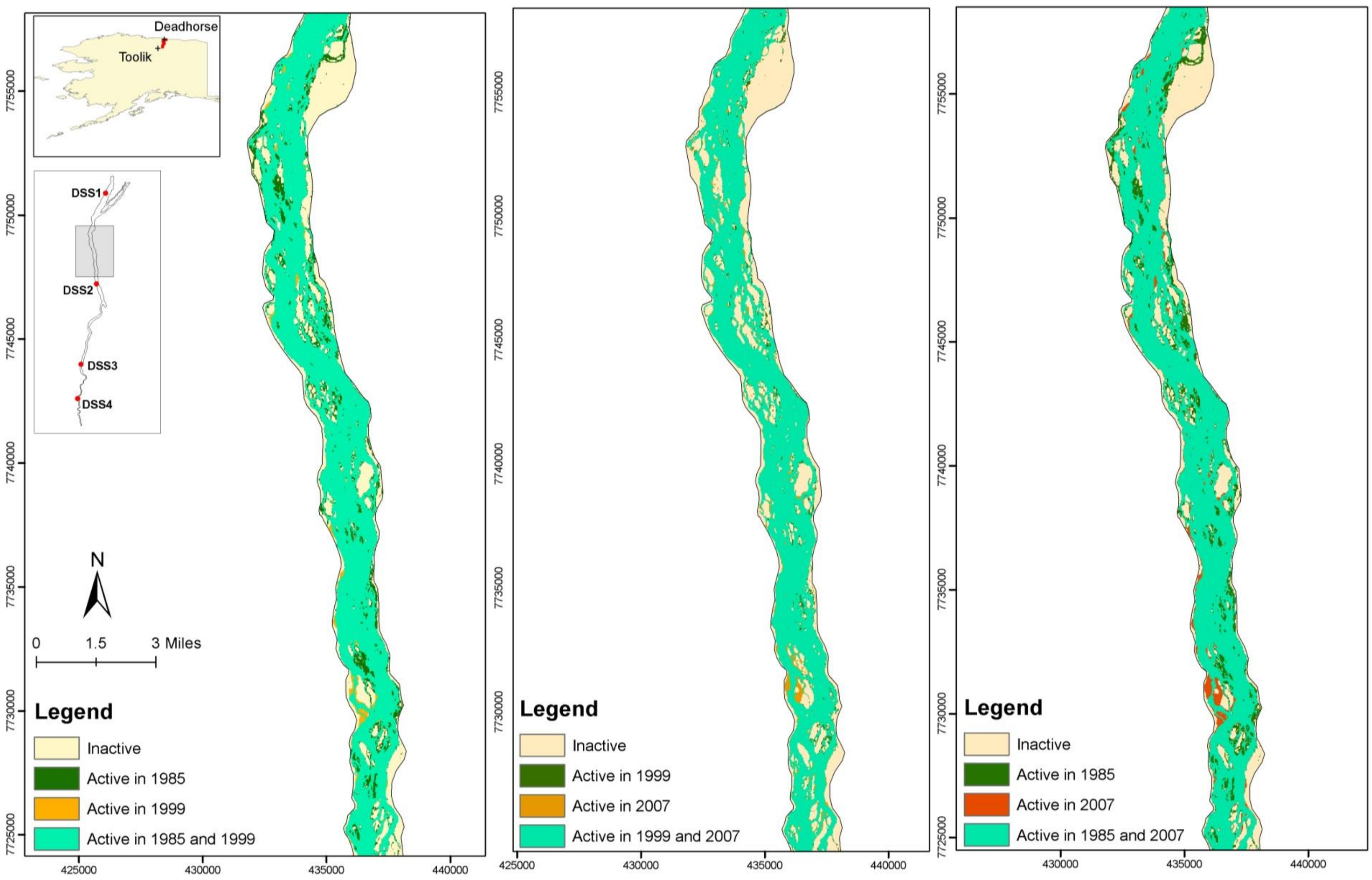

Figure 34. Active river channel changes inlet map from 1985 to 2007 between DSS1 and DSS2. Coordinates in UTM-6N, datum WGS-84.

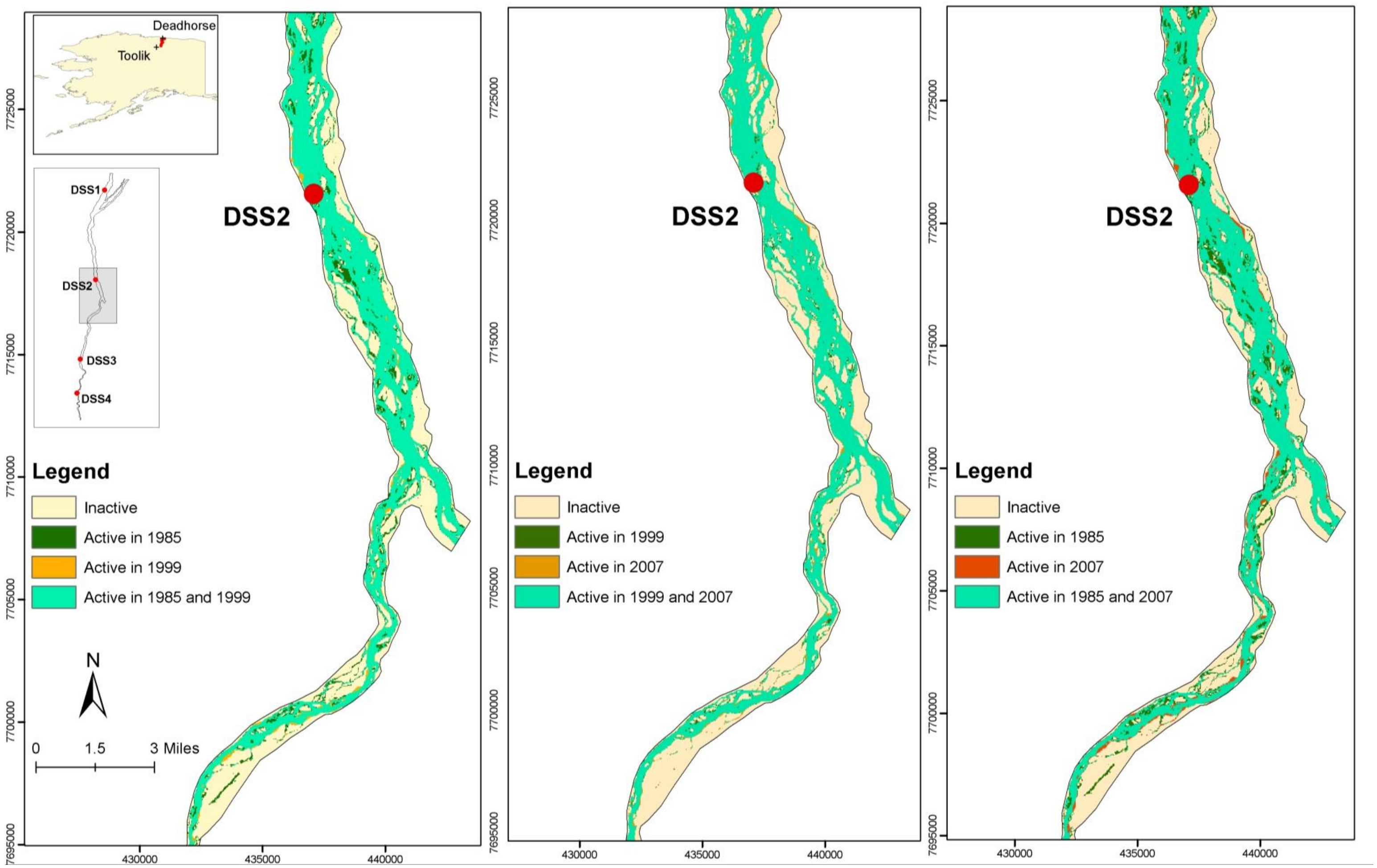

Figure 35. Active river channel changes inlet map from 1985 to 2007 at DSS2. The red dot is the station location. Coordinates in UTM-6N, datum WGS-84.

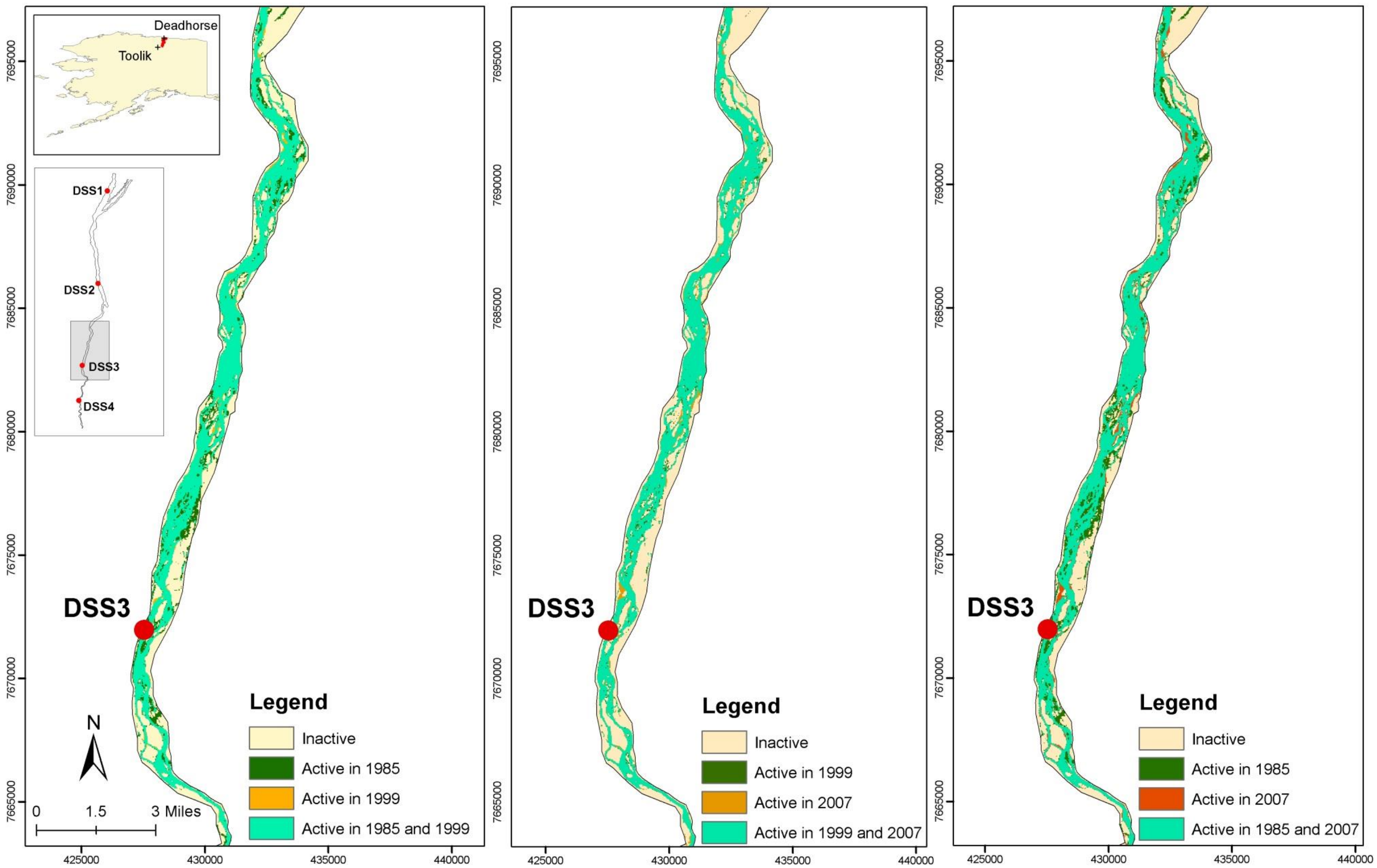

Figure 36. Active river channel changes inlet map from 1985 to 2007 at DSS3. The red dot is the station location. Coordinates in UTM-6N, datum WGS-84.

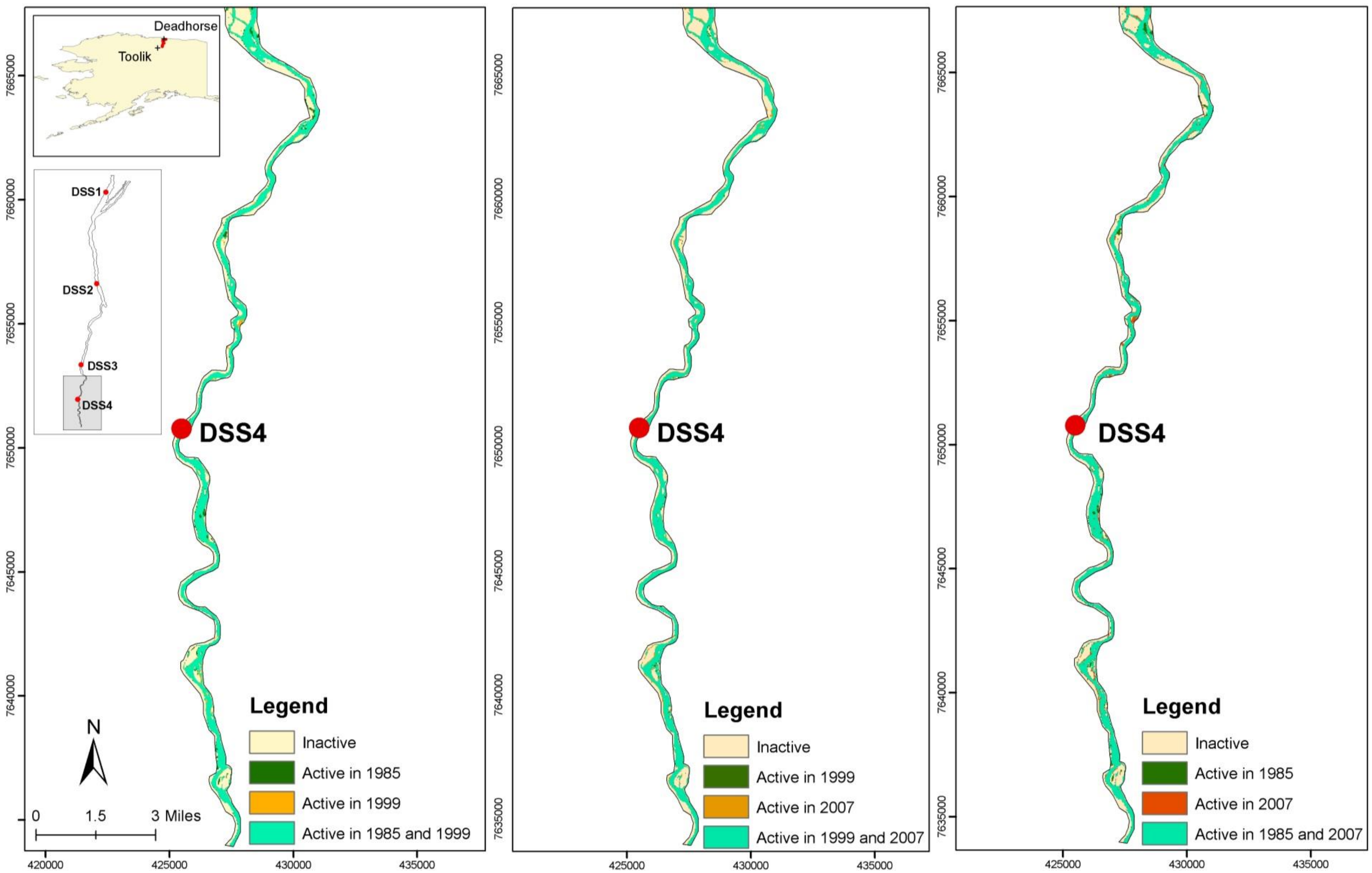

Figure 37. Active river channel changes inlet map from 1985 to 2007 at DSS4. The red dot is the station location. Coordinates in UTM-6N, datum WGS-84.

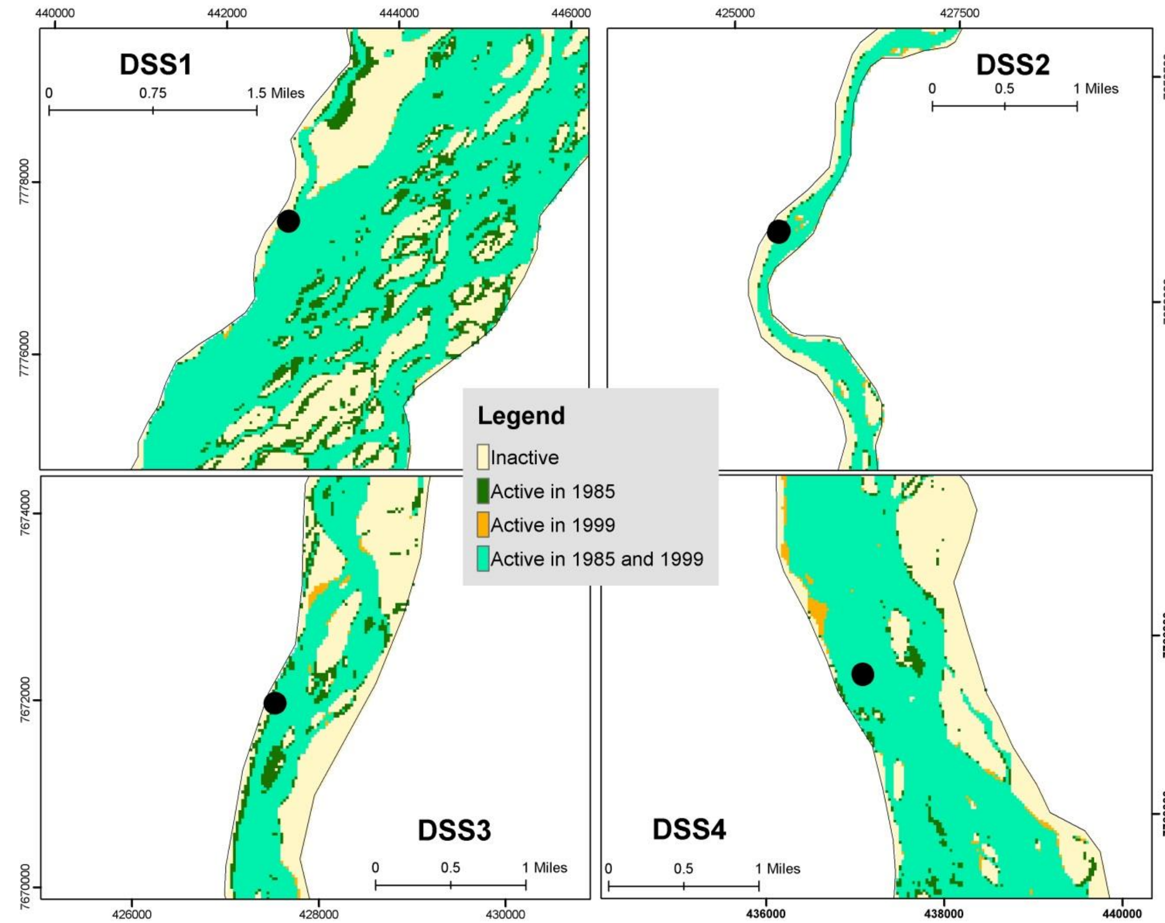

Figure 38. Active river channel change from 1985 to 1999 in the four trench areas. The black dot is the station location. Coordinates in UTM-6N, datum WGS-84.

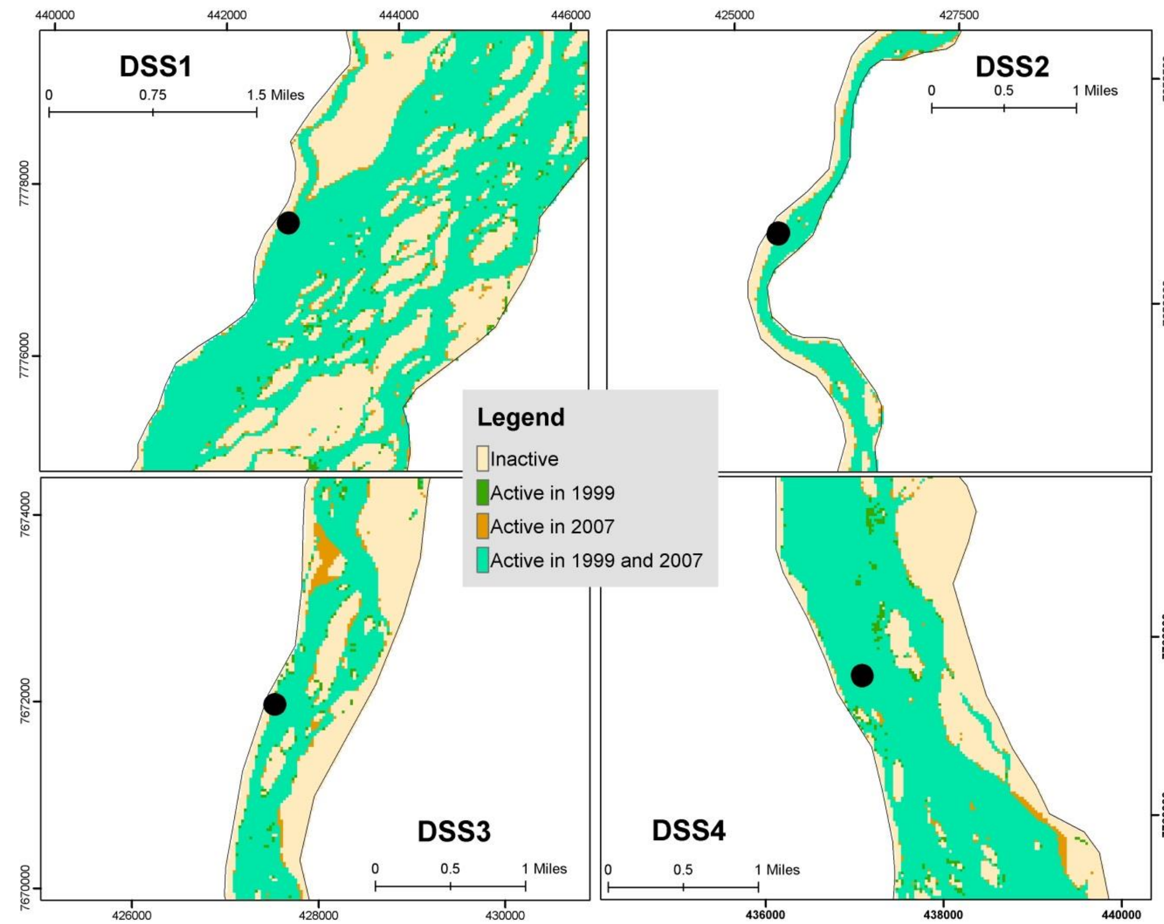

Figure 39. Active river channel change from 1999 to 2007 in the four trench areas. The black dot is the station location. Coordinates in UTM-6N, datum WGS-84.

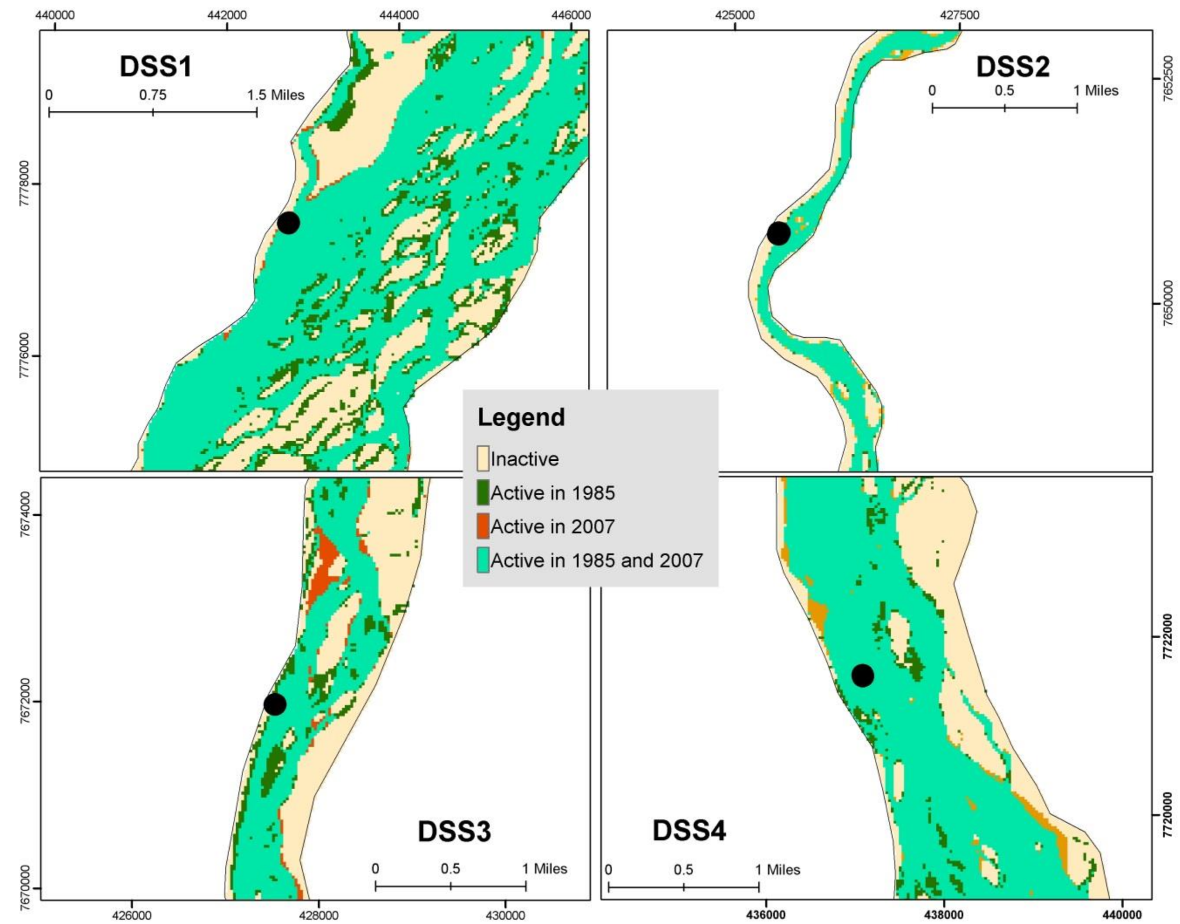

Figure 40. Active river channel change from 1985 to 2007 in the four trench areas. The black dot is the station location. Coordinates in UTM-6N, datum WGS-84.

5 CONCLUSIONS

Last year, the Alaska Department of Transportation and Public Facilities funded a research project focused on establishing baseline data related to sediment transport conditions along the Sagavanirktok River in northern Alaska. Initial fieldwork included the installation of four hydrometeorological stations, discharge measurements, excavation of trenches, vegetation characterization, and measurements of basic water quality parameters. Additionally, a change detection analysis was performed using Landsat-5 TM scenes from the period 1985–2007.

The hydrometeorological stations, which were installed in early July 2015, are identified as (1) DSS1 (near the Dalton Highway MP 405), (2) DSS2 (below Ivishak River), (3) DSS3 (Happy Valley), and (4) DSS4 (near MP 318). Due to accessibility limitations, all the stations are located on the west bank of the river. Basic meteorological parameters such as air temperature, relative humidity, wind speed, wind direction, and barometric pressure are measured in the stations. Additionally, water level changes are recorded by pressure transducers. Automatic water samplers and turbidity sensors were deployed during the open-water season. Cameras were installed at each station to report weather conditions visually. The stations have a telemetry system that allows for transmitting data in near-real time. Data collected by the stations can be found at http://ine.uaf.edu/werc/projects/sagdot/data.aspx. These data are being used by the National Oceanic and Atmospheric Administration (NOAA) to feed their models. Alyeska is also benefiting from the information collected from the stations. Thus, this research is of value to public and private organizations.

Discharge measurements were performed using an ADCP and a GPS system capable of providing RTK correction. Two measurements were done in July (early and late in the month), and one was done in mid-September. Flows were low in all the measurements, most of them in the order of 100 m^3/s. Available data indicate that suspended sediment concentration follows, in general, the variation of water levels in the stream. Suspended sediment concentrations ranged from 2 mg/l (nearly clear water) to 625 mg/l. Average grainsize for suspended sediment, from selected samples, was 47.8 μm, which corresponds to silt. This value is higher than the average value reported by Toniolo et al. (2015) during breakup, which indicates a lack of available sediment during the initial period of open water. During summer, the vegetation was characterized at twenty-seven 10-meter circular plots near the stations, and an ordination analysis was performed.

In early September, dry and wet pits were excavated in the vicinity of each station with a Komatsu PC270LC excavator, property of ADOT&PF. The volume of each trench ranged from 98 to 469 m^3.These trenches will be surveyed again after breakup, and the change in volume will be used to estimate average bedload sediment transport during that period.

Measurements of basic water quality parameters, such as dissolved oxygen, conductivity, total organic carbon, and total inorganic carbon, were done during winter. The results from these measurements did not indicate potential issues related to water quality.

The change detection analysis consisted of three sets of scenes: August 4, 1985; August 3, 1999; and August 24, 2007. The comparison between consecutive as well as first and last periods along the area of interest showed that the river was relatively stable during the study period.

6 REFERENCES

ASCE (2008). Sedimentation engineering: Processes, measurements, modeling and practice. Manual 110, M. Garcia (Ed.), Reston, VA.

Bockheim, J., Walker, D., Everett, L., Nelson, F., and Shiklomanov, N. (1998). Soils and cryoturbation in moist nonacidic and acidic tundra in the Kuparuk River basin, Arctic Alaska, USA. *Arctic and Alpine Research*, 30: 166–174.

Buscombe D. (2013). Transferable wavelet method for grain-size distribution from images of sediment surfaces and thin sections, and other natural granular patterns. *Sedimentology*, 60: 1709–1732.

Galay, V. (1983). Causes of river bed degradation. *Water Resources Research*, 19: 1057–1090.

Homer, C., Dewitz, J., Fry, J., Coan, M., Hossain, N., Larson, C., Herold, N., McKerrow, A., VanDriel, J.N., and Wickham, J. (2007). Completion of the 2001 National Land Cover Database for the Conterminous United States. *Photogrammetric Engineering and Remote Sensing*, 73(4): 337–341.

Kane, D.L., Youcha, E.K., Stuefer, S., Toniolo, H., Schnabel, W., Gieck, R., Myerchin-Tape, G., Homan, J., Lamb, E., and Tape, K. (2012). Meteorological and Hydrological Data and Analysis Report for Foothills/Umiat Corridor and Bullen Projects: 2006–2011. University of Alaska Fairbanks, Water and Environmental Research Center, Report INE/WERC 12.01, Fairbanks, AK, 260 pp. + Appendices.

Kane, D.L., Youcha, E.K., Stuefer, S.L., Myerchin-Tape, G., Lamb, E., Homan, J.W., Gieck, R.E., Schnabel, W.E., and Toniolo, H. (2014). Hydrology and Meteorology of the Central Alaskan Arctic: Data Collection and Analysis, Final Report. University of Alaska Fairbanks, Water and Environmental Research Center, Report INE/WERC 14.05, Fairbanks, AK, 168 pp.

Kondolf, G., Smeltzer, M., and Kimball, L. (2002).Freshwater Gravel Mining and Dredging Issues. Center for Environmental Design Research, University of California Berkeley, 130 pp.

Leica Geosystems AG (Leica). (2015). Leica Viva GS14 Data Sheet, Leica Geosystems AG, Heerbrugg, Switzerland.

Mueller, D.S. (2012). Review and Rating of Moving-Boat ADCP Q Measurements. Hydroacoustics Webinar, Sept., https://hydroacoustics.usgs.gov/training/webinars.shtml.

Muirhead, J.W., and Annable, W.K. (2014). Limitations in extraction of survey data from real-time kinematic GPS ADCP systems. *Journal of Hydraulic Engineering*, 140(8), 06014012.

Novatel Inc. (Novatel) (2011). *Smart V1/V1G Product Sheet*, Novatel Inc., Calgary, Alberta, Canada.

Pons, X., Pesquer, L., Cristóbal, J., and González-Guerrero, O. (2014). An automatic and improved radiometric correction procedure for Landsat imagery through MODIS surface reflectance products. *International Journal of Applied Earth Observation,* 33: 243–254.

Rokni, K., Ahmad, A., Selamat, A., and Hazini, S. (2014). Water feature extraction and change detection using multitemporal Landsat imagery. *Remote Sensing,* 6(5): 4173–4189.

Tape, K., Hallinger, M., Welker, J., and Ruess, R. (2012).Landscape heterogeneity of shrub expansion in Arctic Alaska. *Ecosystems,* 15: 711–724.

Toniolo, H., Youcha, E.K., Gieck, R.E., Tschetter, T., Engram, M., and Keech, J. (2015). Sagavanirktok River Spring Breakup 2015: Final Report. University of Alaska Fairbanks, Water and Environmental Research Center, Report INE/WERC 15.10, Fairbanks, AK.

USGS (U.S. Geological Survey) (2016). Water-resources data for the United States. Retrieved August 2015 from http://waterdata.usgs.gov/nwis/.

Wagner, C.R., and Mueller, D.S. (2011). Comparison of bottom-track to global positioning system referenced discharges measured using an acoustic Doppler current profiler. *Journal of Hydrology,* 401: 250–258.

Walker, D. (1985).Vegetation and environmental gradients of the Prudhoe Bay region, Alaska. *In:* CRREL Report 85-14. Hanover, NH: U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, 237 pp.

Walker, D. (1987).Height and growth rings of *Salix lanata* ssp *richardsonii* along the coastal temperature gradient of northern Alaska. *Canadian Journal of Botany*, 65: 988–993.

Walker, D., Raynolds, M., and Daniels, F. (2005).The circumpolar Arctic vegetation map. *Journal of Vegetation Science,* 16: 267–282.

Westhoff, V., and Van Der Maarel, E. (1978). *The Braun-Blanquet Approach*, Springer.

7 APPENDICES

Appendix A – Discharge Measurement Summaries

Appendix B – Floodplain Vegetation and Substrate Survey

Appendix B1 –Grain Size Analysis

Appendix B2 – Vegetation Species and Abundance

Appendix B3 – Vegetation Cover by Functional Group

Appendix B4 – Surface Cover

Appendix B5 – Total Species List

Appendix B6 – Location of Substrate Sites

APPENDIX A

Discharge Measurement Summaries

Station Number: DSS1
Station Name: Sag DSS1

Meas. No: 1
Date: 07/07/2015

Party: DAV/JK
Boat/Motor: kayak
Gage Height: 0.000 m

Width: 67.2 m
Area: 79.4 m²
G.H.Change: 0.000 m

Processed by: DAV
Mean Velocity: 0.758 m/s
Discharge: 60.1 m³/s

Area Method: Avg. Course
Nav. Method: DGPS
MagVar Method: None (19.2°)
Depth: Bottom Track

ADCP Depth: 0.080 m
Shore Ens.:10
Bottom Est: Power (0.1667)
Top Est: Power (0.1667)

Index Vel.: 0.00 m/s
Adj.Mean Vel: 0.00 m/s
Rated Area: 0.000 m²
Control1: Unspecified
Control2: Unspecified
Control3: Unspecified

Rating No.: 1
Qm Rating: U
Diff.: 0.000%

Screening Thresholds:
BT 3-Beam Solution: YES
WT 3-Beam Solution: YES
BT Error Vel.: 0.10 m/s
WT Error Vel.: 0.35 m/s
BT Up Vel.: 0.30 m/s
WT Up Vel.: 2.00 m/s
Use Weighted Mean Depth: YES

Max. Vel.: 2.20 m/s
Max. Depth: 1.82 m
Mean Depth: 1.18 m
% Meas.: 72.74
Water Temp.: None
ADCP Temp.: 12.0 °C

ADCP:
Type/Freq.: StreamPro / 2000 kHz
Serial #: 1180 Firmware: 31.12
Bin Size: 7 cm Blank: 3 cm
BT Mode: 10 BT Pings: 2
WT Mode: 12 WT Pings: 6

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location: at gage

Project Name: sagdss1_07072015q60.1cms.m
Software: 2.15

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
005	L	1.00	10.0	106	8.39	44.9	6.58	0.143	0.923	61.0	70.7	83.9	10:41	10:43	0.53	0.73	0	2
006	*R*	*1.00*	*10.0*	*67*	*8.56*	*48.2*	*6.88*	*0.530*	*1.21*	*65.4*	*64.0*	*78.9*	*10:43*	*10:45*	*0.69*	*0.83*	*0*	*1*
007	*L*	*1.00*	*10.0*	*84*	*8.13*	*39.8*	*6.24*	*0.041*	*0.994*	*55.2*	*69.9*	*78.1*	*10:45*	*10:47*	*0.63*	*0.71*	*0*	*2*
008	*R*	*1.00*	*10.0*	*61*	*7.99*	*40.2*	*6.33*	*0.489*	*0.931*	*56.0*	*68.0*	*77.8*	*10:47*	*10:48*	*0.82*	*0.72*	*0*	*1*
009	*L*	*1.00*	*10.0*	*84*	*7.69*	*41.2*	*6.58*	*0.197*	*1.32*	*57.0*	*67.0*	*80.3*	*10:49*	*10:51*	*0.61*	*0.71*	*0*	*1*
010	*R*	*1.00*	*10.0*	*69*	*8.89*	*48.1*	*7.23*	*0.508*	*1.59*	*66.3*	*63.2*	*77.4*	*10:51*	*10:52*	*0.68*	*0.86*	*0*	*1*
Mean		1.00	10.0	78	8.27	43.7	6.64	0.318	1.16	60.1	67.2	79.4	**Total**	00:11	0.66	0.76	0	1
SDev		0.00	0.00	16	0.430	3.84	0.365	0.216	0.265	4.84	3.0	2.4			0.10	0.07		
SD/M		0.00	0.00	0.21	0.05	0.09	0.05	0.68	0.23	0.08	0.05	0.03			0.15	0.09		

Remarks: Q with StreamPro 60.1cms using VTG with 8% error and 0 bad ens, 62.2cms using BT with 3% error and 7 bad ens. Wind 20+ mph, 2 foot standing waves

Discharge for transects in *italics* have a total Q more than 5% from the mean

Station Number: DSS1
Station Name: Sag DSS1

Meas. No: 2
Date: 07/29/2015

Party: JK/TT
Boat/Motor: kayak
Gage Height: 0.000 m

Width: 76.2 m
Area: 70.0 m²
G.H.Change: 0.000 m

Processed by: DAV
Mean Velocity: 0.578 m/s
Discharge: 40.3 m³/s

Area Method: Avg. Course
Nav. Method: DGPS
MagVar Method: None (19.0°)
Depth: Composite

ADCP Depth: 0.140 m
Shore Ens.:10
Bottom Est: Power (0.1667)
Top Est: Power (0.1667)

Index Vel.: 0.00 m/s
Adj.Mean Vel: 0.00 m/s
Rated Area: 0.000 m²
Control1: 4-Clear
Control2: Unspecified
Control3: Unspecified

Rating No.: 1
Qm Rating: U
Diff.: 0.000%

Screening Thresholds:
BT 3-Beam Solution: YES
WT 3-Beam Solution: YES
BT Error Vel.: 0.10 m/s
WT Error Vel.: 0.38 m/s*
BT Up Vel.: 0.30 m/s*
WT Up Vel.: 1.10 m/s*
Use Weighted Mean Depth: YES

Max. Vel.: 1.38 m/s
Max. Depth: 1.68 m
Mean Depth: 0.919 m
% Meas.: 68.90
Water Temp.: None
ADCP Temp.: 9.2 °C

ADCP:
Type/Freq.: StreamPro / 2000 kHz
Serial #: 1180 Firmware: 31.12
Bin Size: 5 cm* Blank: 3 cm
BT Mode: 10 BT Pings: 2
WT Mode: 12 WT Pings: 6

Performed Diag. Test: YES
Performed Moving Bed Test: NO
Performed Compass Calibration: YES Evaluation: YES
Meas. Location: 20m US of gage

Project Name: DSS-01-7-29-15_0.mmt
Software: 2.15

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
000	L	1.00	20.0	186	8.51	26.9	2.43	0.025	1.99	39.9	72.9	66.5	15:56	15:59	0.25	0.60	1	2
002	*R*	*1.00*	*22.0*	*155*	*8.90*	*29.1*	*1.75*	*0.043*	*3.09*	*42.8*	*74.1*	*67.1*	*16:02*	*16:05*	*0.31*	*0.64*	*1*	*1*
003	*L*	*1.00*	*21.0*	*261*	*8.01*	*26.1*	*1.87*	*0.026*	*1.64*	*37.6*	*79.9*	*71.9*	*16:06*	*16:11*	*0.23*	*0.52*	*9*	*1*
004	R	*1.00*	*21.0*	*165*	*8.28*	*29.1*	*2.02*	*0.128*	*1.46*	*41.0*	*77.8*	*74.6*	*16:11*	*16:15*	*0.32*	*0.55*	*8*	*2*
Mean		1.00	21.0	191	8.42	27.8	2.02	0.056	2.05	40.3	76.2	70.0	**Total**	00:19	0.28	0.58	5	2
SDev		0.00	0.82	48	0.375	1.55	0.297	0.049	0.727	2.19	3.2	3.9			0.04	0.05		
SD/M		0.00	0.04	0.25	0.04	0.06	0.15	0.88	0.36	0.05	0.04	0.06			0.16	0.09		

Remarks: Q with StreamPro 40cms using VTG with 5% error and 1 bad ens., 41cms using BT with 1% error and 1 bad ens.
cool,cloundy, moderate(to light) wind

* - value not consistent for all transects
Discharge for transects in *italics* have a total Q more than 5% from the mean

Station Number: DSS1 | Meas. No: 3

Station Name: Sag DSS1 | Date: 09/09/2015

Party: JK/TT
Boat/Motor: kayak
Gage Height: 0.000 m

Width: 90.0 m
Area: 94.4 m²
G.H.Change: 0.000 m

Processed by: DAV
Mean Velocity: 0.862 m/s
Discharge: 81.5 m³/s

Area Method: Avg. Course
Nav. Method: DGPS
MagVar Method: None (19.0°)
Depth: Composite

ADCP Depth: 0.140 m
Shore Ens.:10
Bottom Est: Power (0.1667)
Top Est: Power (0.1667)

Index Vel.: 0.00 m/s
Adj.Mean Vel: 0.00 m/s
Rated Area: 0.000 m²
Control1: Unspecified
Control2: Unspecified
Control3: Unspecified

Rating No.: 1
Qm Rating: U
Diff.: 0.000%

Screening Thresholds:
BT 3-Beam Solution: YES
WT 3-Beam Solution: YES
BT Error Vel.: 0.10 m/s
WT Error Vel.: 0.35 m/s*
BT Up Vel.: 0.30 m/s
WT Up Vel.: 1.50 m/s*
Use Weighted Mean Depth: YES

Max. Vel.: 1.82 m/s
Max. Depth: 1.83 m
Mean Depth: 1.05 m
% Meas.: 60.20
Water Temp.: None
ADCP Temp.: 3.1 °C

ADCP:
Type/Freq.: StreamPro / 2000 kHz
Serial #: 1180 | Firmware: 31.12
Bin Size: 6 cm* | Blank: 3 cm
BT Mode: 10 | BT Pings: 2
WT Mode: 12 | WT Pings: 6

Performed Diag. Test: YES
Performed Moving Bed Test: NO
Performed Compass Calibration: YES Evaluation: YES
Meas. Location: not sure

Project Name: dss-01-090915_0--.mmt
Software: 2.15

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
000	*L*	*3.00*	*35.0*	*174*	*12.7*	*42.4*	*9.53*	*0.442*	*6.17*	*71.2*	*87.4*	*86.3*	*09:41*	*09:45*	*0.36*	*0.82*	*3*	*0*
001	R	3.00	35.0	196	13.4	52.0	9.58	0.565	8.87	84.4	89.0	94.2	09:46	09:50	0.29	0.90	1	1
002	*L*	*3.00*	*37.0*	*185*	*13.7*	*54.2*	*10.7*	*0.472*	*10.6*	*89.6*	*94.2*	*102.1*	*09:51*	*09:55*	*0.33*	*0.88*	*0*	*1*
003	R	3.00	37.0	155	12.4	47.7	9.21	0.713	10.8	80.9	89.4	95.0	09:55	09:58	0.34	0.85	0	2
Mean		3.00	36.0	177	13.0	49.1	9.74	0.548	9.11	81.5	90.0	94.4	**Total**	00:17	0.33	0.86	1	1
SDev		0.00	1.15	17	0.616	5.21	0.628	0.122	2.15	7.75	3.0	6.4			0.03	0.03		
SD/M		0.00	0.03	0.10	0.05	0.11	0.06	0.22	0.24	0.10	0.03	0.07			0.08	0.04		

Remarks: Q with StreamPro 81.5cms using VTG with 10% error and 0 bad ens., 86cms using BT with 2% error and 0 bad ens.

* - value not consistent for all transects
Discharge for transects in *italics* have a total Q more than 5% from the mean

Station Number: DSS2
Station Name: Sag DSS2

Meas. No: 1
Date: 07/06/2015

Party: DAV/JK
Boat/Motor: kakya
Gage Height: 0.000 m

Width: 102.8 m
Area: 160.1 m²
G.H.Change: 0.000 m

Processed by: DAV
Mean Velocity: 1.02 m/s
Discharge: 161 m³/s

Area Method: Avg. Course
Nav. Method: DGPS
MagVar Method: None (19.1°)
Depth: Bottom Track

ADCP Depth: 0.080 m
Shore Ens.:10
Bottom Est: Power (0.1667)
Top Est: Power (0.1667)

Index Vel.: 0.00 m/s
Adj.Mean Vel: 0.00 m/s
Rated Area: 0.000 m²
Control1: Unspecified
Control2: Unspecified
Control3: Unspecified

Rating No.: 1
Qm Rating: U
Diff.: 0.000%

Screening Thresholds:
BT 3-Beam Solution: YES
WT 3-Beam Solution: YES
BT Error Vel.: 0.10 m/s
WT Error Vel.: 0.30 m/s
BT Up Vel.: 0.30 m/s
WT Up Vel.: 3.00 m/s
Use Weighted Mean Depth: YES

Max. Vel.: 3.05 m/s
Max. Depth: 2.90 m
Mean Depth: 1.56 m
% Meas.: 77.85
Water Temp.: None
ADCP Temp.: 16.6 °C

ADCP:
Type/Freq.: StreamPro / 2000 kHz
Serial #: 1180
Firmware: 31.12
Bin Size: 10 cm
Blank: 3 cm
BT Mode: 10
BT Pings: 2
WT Mode: 12
WT Pings: 6

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: NO   Evaluation: NO
Meas. Location: 300 us of gage

Project Name: sag ivishak.mmt
Software: 2.15

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
000	L	8.00	10.0	133	14.2	126	20.2	0.272	-0.217	160	105.8	184.0	13:34	13:37	0.68	0.87	14	3
001	R	8.00	12.0	106	15.6	129	20.4	1.83	-0.134	167	106.1	154.0	13:38	13:40	0.70	1.09	19	3
002	L	7.00	12.0	125	14.5	125	19.9	0.078	-0.154	160	99.8	167.8	13:43	13:45	0.68	0.95	8	3
003	R	8.00	12.0	100	14.9	122	20.0	1.51	-0.062	158	99.4	134.7	13:46	13:48	0.76	1.17	13	5
Mean		7.75	11.5	116	14.8	126	20.1	0.921	-0.142	161	102.8	160.1	**Total**	00:14	0.70	1.02	14	3
SDev		0.50	1.00	16	0.600	3.17	0.229	0.874	0.064	4.02	3.6	20.9			0.04	0.14		
SD/M		0.06	0.09	0.13	0.04	0.03	0.01	0.95	0.45	0.02	0.04	0.13			0.05	0.13		

Remarks: Q with StreamPro 161.3cms using VTG with 2% error and 13 bad ens., 110.6cms using BT with 40% error and 20 bad ens.

Station Number: DSS2 | Meas. No: 2
Station Name: Sag DSS2 | Date: 07/29/2015

Party: JK/TT
Boat/Motor: kayak
Gage Height: 0.000 m

Width: 90.5 m
Area: 127.1 m²
G.H.Change: 0.000 m

Processed by: DAV
Mean Velocity: 0.803 m/s
Discharge: 101 m³/s

Area Method: Avg. Course
Nav. Method: DGPS
MagVar Method: None (19.0°)
Depth: Composite

ADCP Depth: 0.140 m
Shore Ens.:10
Bottom Est: Power (0.1667)
Top Est: Power (0.1667)

Index Vel.: 0.00 m/s
Adj.Mean Vel: 0.00 m/s
Rated Area: 0.000 m²
Control1: 4-Clear
Control2: Unspecified
Control3: Unspecified

Rating No.: 1
Qm Rating: U
Diff.: 0.000%

Screening Thresholds:
BT 3-Beam Solution: YES
WT 3-Beam Solution: YES
BT Error Vel.: 0.10 m/s
WT Error Vel.: 0.30 m/s
BT Up Vel.: 0.30 m/s
WT Up Vel.: 2.25 m/s*
Use Weighted Mean Depth: YES

Max. Vel.: 2.60 m/s
Max. Depth: 2.49 m
Mean Depth: 1.41 m
% Meas.: 77.73
Water Temp.: None
ADCP Temp.: 9.7 °C

ADCP:
Type/Freq.: StreamPro / 2000 kHz
Serial #: 1180 | Firmware: 31.12
Bin Size: 8 cm | Blank: 3 cm
BT Mode: 10 | BT Pings: 2
WT Mode: 12 | WT Pings: 6

Performed Diag. Test: YES
Performed Moving Bed Test: NO
Performed Compass Calibration: YES Evaluation: YES
Meas. Location: 200m US of gage

Project Name: DSS-02-7-29-15_0.mmt
Software: 2.15

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
000	L	8.00	15.0	163	13.3	80.5	6.52	0.439	-0.381	100	95.2	130.1	12:04	12:08	0.47	0.77	25	4
001	R	10.0	15.0	154	13.3	81.8	6.64	1.20	0.147	103	81.8	113.2	12:10	12:13	0.49	0.91	5	5
003	R	9.00	19.0	118	11.4	72.7	6.35	11.1	-0.386	101	86.0	124.7	12:20	12:23	0.55	0.81	0	7
004	L	10.0	18.0	148	13.5	80.2	6.17	0.777	0.200	101	99.0	140.5	12:33	12:36	0.52	0.72	10	6
Mean		9.25	16.8	145	12.9	78.8	6.42	3.38	-0.105	101	90.5	127.1	**Total**	00:31	0.51	0.80	10	5
SDev		0.96	2.06	20	0.962	4.14	0.205	5.16	0.322	1.22	8.0	11.4			0.04	0.08		
SD/M		0.10	0.12	0.13	0.07	0.05	0.03	1.53	3.07	0.01	0.09	0.09			0.07	0.10		

Remarks: Q with StreamPro 101.3cms using VTG with 1% error and 12 bad ens., 103.7cms using BT with 2% error and 13 bad ens.
cool, 40, cloudy, light wind

* - value not consistent for all transects

Station Number: DSS2
Station Name: Sag DSS2

Meas. No: 3
Date: 09/13/2015

Party: JK/TT	Width: 116.7 m	Processed by: DAV
Boat/Motor: kayak	Area: 187.1 m²	Mean Velocity: 0.813 m/s
Gage Height: 0.000 m	G.H.Change: 0.000 m	Discharge: 152 m³/s

Area Method: Avg. Course	ADCP Depth: 0.140 m	Index Vel.: 0.00 m/s	Rating No.: 1
Nav. Method: DGPS	Shore Ens.:10	Adj.Mean Vel: 0.00 m/s	Qm Rating: U
MagVar Method: None (19.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 m²	Diff.: 0.000%
Depth: Composite	Top Est: Power (0.1667)	Control1: Unspecified	
		Control2: Unspecified	
		Control3: Unspecified	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: YES	Max. Vel.: 2.60 m/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: YES	Max. Depth: 2.90 m	Serial #: 1180	Firmware: 31.12
BT Error Vel.: 0.10 m/s	Mean Depth: 1.60 m	Bin Size: 8 cm	Blank: 3 cm
WT Error Vel.: 0.30 m/s	% Meas.: 77.34	BT Mode: 10	BT Pings: 2
BT Up Vel.: 0.30 m/s*	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 2.25 m/s	ADCP Temp.: 3.6 °C		
Use Weighted Mean Depth: YES			

Performed Diag. Test: YES
Performed Moving Bed Test: NO
Performed Compass Calibration: YES   Evaluation: YES
Meas. Location: not sure

Project Name: dss-02-ivishak-091315_0__.mm
Software: 2.15

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
000	L	10.0	15.0	113	18.0	116	9.61	0.150	1.71	145	112.8	168.2	12:27	12:29	0.69	0.86	13	3
001	*R*	*10.0*	*15.0*	*125*	*21.1*	*133*	*13.4*	*0.115*	*0.335*	*168*	*117.4*	*187.3*	*12:32*	*12:35*	*0.64*	*0.90*	*9*	*5*
002	L	12.0	15.0	128	17.9	114	17.1	0.237	1.22	150	118.7	192.2	12:46	12:49	0.68	0.78	0	4
003	R	10.0	15.0	115	17.3	116	17.2	0.424	0.376	152	113.6	190.9	12:50	12:53	0.72	0.79	0	3
004	*L*	*12.0*	*15.0*	*122*	*17.1*	*107*	*16.5*	*0.508*	*1.43*	*143*	*119.9*	*194.3*	*12:58*	*13:00*	*0.68*	*0.73*	*0*	*5*
005	R	10.0	15.0	154	19.3	119	14.2	0.244	1.21	154	117.9	189.9	13:01	13:05	0.59	0.81	0	4
Mean		10.7	15.0	126	18.4	117	14.7	0.280	1.05	152	116.7	187.1	**Total**	00:37	0.67	0.81	4	4
SDev		1.03	0.00	15	1.52	8.47	2.95	0.155	0.566	8.77	2.9	9.6			0.04	0.06		
SD/M		0.10	0.00	0.12	0.08	0.07	0.20	0.55	0.54	0.06	0.02	0.05			0.07	0.07		

Remarks: Q with StreamPro 152cms using VTG with 6% error and 0 bad ens., 161cms using BT with 5% error and 0 bad ens.

* - value not consistent for all transects
Discharge for transects in *italics* have a total Q more than 5% from the mean

Station Number: DSS3
Station Name: Sag DSS3

Meas. No: 1
Date: 07/04/2015

Party: DAV/JK
Boat/Motor: kayak
Gage Height: 0.000 m

Width: 88.5 m
Area: 90.5 m²
G.H.Change: 0.000 m

Processed by: DAV
Mean Velocity: 1.00 m/s
Discharge: 90.0 m³/s

Area Method: Avg. Course
Nav. Method: DGPS
MagVar Method: None (19.3°)
Depth: Bottom Track

ADCP Depth: 0.080 m
Shore Ens.:10
Bottom Est: Power (0.1667)
Top Est: Power (0.1667)

Index Vel.: 0.00 m/s
Adj.Mean Vel: 0.00 m/s
Rated Area: 0.000 m²
Control1: Unspecified
Control2: Unspecified
Control3: Unspecified

Rating No.: 1
Qm Rating: U
Diff.: 0.000%

Screening Thresholds:
BT 3-Beam Solution: YES
WT 3-Beam Solution: YES
BT Error Vel.: 0.10 m/s
WT Error Vel.: 0.32 m/s
BT Up Vel.: 0.30 m/s
WT Up Vel.: 2.00 m/s
Use Weighted Mean Depth: YES

Max. Vel.: 2.64 m/s
Max. Depth: 1.90 m
Mean Depth: 1.03 m
% Meas.: 68.44
Water Temp.: None
ADCP Temp.: 16.6 °C

ADCP:
Type/Freq.: StreamPro / 2000 kHz
Serial #: 1180 Firmware: 31.12
Bin Size: 10 cm Blank: 3 cm
BT Mode: 10 BT Pings: 2
WT Mode: 12 WT Pings: 6

Performed Diag. Test: YES
Performed Moving Bed Test: NO
Performed Compass Calibration: NO Evaluation: NO
Meas. Location: 100m us of gage

Project Name: sagdss3_07042015q90cms.mm
Software: 2.15

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
000	L	10.0	7.00	120	15.6	61.5	13.0	0.260	0.625	90.9	92.6	82.4	14:38	14:41	0.60	1.10	13	4
001	R	7.00	3.00	119	13.5	63.2	13.7	0.301	0.123	90.8	84.2	96.2	14:43	14:45	0.64	0.94	4	6
002	L	7.00	7.00	148	14.9	59.1	13.1	0.188	0.481	87.8	86.9	83.3	14:46	14:49	0.54	1.05	2	7
003	R	8.00	3.00	126	13.6	62.6	13.7	0.434	0.157	90.6	90.2	100.3	14:51	14:53	0.62	0.90	2	7
Mean		8.00	5.00	128	14.4	61.6	13.4	0.296	0.347	90.0	88.5	90.5	**Total**	00:15	0.60	1.00	5	6
SDev		1.41	2.31	14	1.00	1.82	0.377	0.103	0.246	1.50	3.7	9.1			0.04	0.09		
SD/M		0.18	0.46	0.11	0.07	0.03	0.03	0.35	0.71	0.02	0.04	0.10			0.07	0.09		

Remarks: Q with StreamPro 90cms using VTG with 2% error and 3 bad ens., 93cms using BT with 2% error and 12 bad ens.

Station Number: DSS3
Station Name: Sag DSS3

Meas. No: 2
Date: 07/28/2015

Party: JK/TT
Boat/Motor: kayak
Gage Height: 0.000 m

Width: 78.7 m
Area: 62.5 m²
G.H.Change: 0.000 m

Processed by: DAV
Mean Velocity: 0.847 m/s
Discharge: 52.9 m³/s

Area Method: Avg. Course
Nav. Method: DGPS
MagVar Method: None (19.0°)
Depth: Composite

ADCP Depth: 0.140 m
Shore Ens.:10
Bottom Est: Power (0.1667)
Top Est: Power (0.1667)

Index Vel.: 0.00 m/s
Adj.Mean Vel: 0.00 m/s
Rated Area: 0.000 m²
Control1: 4-Clear
Control2: Unspecified
Control3: Unspecified

Rating No.: 1
Qm Rating: U
Diff.: 0.000%

Screening Thresholds:
BT 3-Beam Solution: YES
WT 3-Beam Solution: YES
BT Error Vel.: 0.10 m/s
WT Error Vel.: 0.38 m/s*
BT Up Vel.: 0.30 m/s
WT Up Vel.: 1.50 m/s*
Use Weighted Mean Depth: YES

Max. Vel.: 1.95 m/s
Max. Depth: 1.38 m
Mean Depth: 0.796 m
% Meas.: 63.83
Water Temp.: None
ADCP Temp.: 11.0 °C

ADCP:
Type/Freq.: StreamPro / 2000 kHz
Serial #: 1180 Firmware: 31.12
Bin Size: 5 cm* Blank: 3 cm
BT Mode: 10 BT Pings: 2
WT Mode: 12 WT Pings: 6

Performed Diag. Test: YES
Performed Moving Bed Test: NO
Performed Compass Calibration: YES Evaluation: YES
Meas. Location: 200m UP of gage

Project Name: dss-03_0-reprocess.mmt
Software: 2.15

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
001	R	10.0	10.0	97	12.4	33.2	3.51	0.789	1.68	51.6	75.5	63.6	14:40	14:42	0.52	0.81	35	2
002	L	15.0	10.0	90	13.9	33.6	3.76	1.20	1.77	54.2	81.0	60.5	14:44	14:46	0.59	0.89	40	2
003	R	15.0	10.0	106	12.1	33.4	2.93	1.44	1.88	51.7	77.7	63.7	14:46	14:48	0.50	0.81	38	2
004	L	17.0	10.0	96	14.3	34.5	3.03	1.79	1.90	55.5	84.2	61.6	14:53	14:55	0.58	0.90	29	2
005	R	10.0	10.0	109	12.4	34.1	2.39	0.671	1.76	51.4	75.3	63.2	14:56	14:58	0.46	0.81	31	3
Mean		13.4	10.0	99	13.0	33.8	3.12	1.18	1.80	52.9	78.7	62.5	**Total**	00:18	0.53	0.85	35	2
SDev		3.21	0.00	8	1.01	0.524	0.534	0.462	0.090	1.86	3.8	1.4			0.05	0.05		
SD/M		0.24	0.00	0.08	0.08	0.02	0.17	0.39	0.05	0.04	0.05	0.02			0.10	0.06		

Remarks: Q with StreamPro 53cms using VTG with 4% error and 34 bad ens., 57cms using BT with 2% error and 34 bad ens. 50,CLOUDY, LIGHT WIND

* - value not consistent for all transects

Station Number: DSS3 | Meas. No: 3
Station Name: Sag DSS3 | Date: 09/11/2015

Party: JK/TT
Boat/Motor: kayak
Gage Height: 0.000 m

Width: 84.8 m
Area: 76.6 m²
G.H.Change: 0.000 m

Processed by: DAV
Mean Velocity: 0.987 m/s
Discharge: 75.6 m³/s

Area Method: Avg. Course
Nav. Method: DGPS
MagVar Method: None (19.0°)
Depth: Composite

ADCP Depth: 0.140 m
Shore Ens.:10
Bottom Est: Power (0.1667)
Top Est: Power (0.1667)

Index Vel.: 0.00 m/s
Adj.Mean Vel: 0.00 m/s
Rated Area: 0.000 m²
Control1: Unspecified
Control2: Unspecified
Control3: Unspecified

Rating No.: 1
Qm Rating: U
Diff.: 0.000%

Screening Thresholds:
BT 3-Beam Solution: YES
WT 3-Beam Solution: YES
BT Error Vel.: 0.10 m/s
WT Error Vel.: 0.35 m/s
BT Up Vel.: 0.30 m/s*
WT Up Vel.: 2.00 m/s
Use Weighted Mean Depth: YES

Max. Vel.: 2.24 m/s
Max. Depth: 1.53 m
Mean Depth: 0.904 m
% Meas.: 68.36
Water Temp.: None
ADCP Temp.: 3.3 °C

ADCP:
Type/Freq.: StreamPro / 2000 kHz
Serial #: 1180 | Firmware: 31.12
Bin Size: 6 cm | Blank: 3 cm
BT Mode: 10 | BT Pings: 2
WT Mode: 12 | WT Pings: 6

Performed Diag. Test: YES
Performed Moving Bed Test: NO
Performed Compass Calibration: YES   Evaluation: YES
Meas. Location: not sure

Project Name: dss-03-091115_0.mmt
Software: 2.15

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
001	L	10.0	14.0	225	18.0	53.1	4.15	0.556	1.78	77.6	89.0	76.4	09:34	09:38	0.33	1.01	24	3
002	R	7.00	10.0	97	16.8	51.7	3.77	0.545	2.12	75.0	82.6	77.3	09:40	09:42	0.60	0.97	16	2
003	*L*	*7.00*	*11.0*	*222*	*16.6*	*47.9*	*5.05*	*0.413*	*1.30*	*71.2*	*82.2*	*73.0*	*09:42*	*09:47*	*0.36*	*0.97*	*21*	*3*
004	R	*10.0*	*11.0*	*94*	*17.0*	*54.1*	*3.72*	*0.796*	*2.97*	*78.6*	*85.3*	*79.7*	*09:49*	*09:51*	*0.67*	*0.99*	*24*	*4*
Mean		8.50	11.5	159	17.1	51.7	4.17	0.578	2.05	75.6	84.8	76.6	**Total**	00:17	0.49	0.99	21	3
SDev		1.73	1.73	74	0.626	2.73	0.616	0.160	0.705	3.30	3.1	2.8			0.17	0.02		
SD/M		0.20	0.15	0.46	0.04	0.05	0.15	0.28	0.34	0.04	0.04	0.04			0.35	0.02		

Remarks: Q with StreamPro 75.6cms using Vtg with 4% error and 23 bad ens., 78cms using BT with 4% error and 25 bad ens.

* - value not consistent for all transects
Discharge for transects in *italics* have a total Q more than 5% from the mean

Station Number: DSS4
Station Name: Sag DSS4

Meas. No: 1
Date: 07/03/2015

Party: DAV/JK	Width: 94.6 m	Processed by: DAV
Boat/Motor: kayak	Area: 106.8 m²	Mean Velocity: 0.882 m/s
Gage Height: 0.000 m	G.H.Change: 0.000 m	Discharge: 94.1 m³/s

Area Method: Avg. Course	ADCP Depth: 0.080 m	Index Vel.: 0.00 m/s	Rating No.: 1
Nav. Method: DGPS	Shore Ens.:10	Adj.Mean Vel: 0.00 m/s	Qm Rating: U
MagVar Method: None (19.0°)	Bottom Est: Power (0.1667)	Rated Area: 0.000 m²	Diff.: 0.000%
Depth: Bottom Track	Top Est: Power (0.1667)	Control1: Unspecified	
		Control2: Unspecified	
		Control3: Unspecified	

Screening Thresholds:		ADCP:	
BT 3-Beam Solution: YES	Max. Vel.: 2.03 m/s	Type/Freq.: StreamPro / 2000 kHz	
WT 3-Beam Solution: YES	Max. Depth: 1.80 m	Serial #: 1180	Firmware: 31.12
BT Error Vel.: 0.10 m/s	Mean Depth: 1.13 m	Bin Size: 7 cm	Blank: 3 cm
WT Error Vel.: 0.32 m/s	% Meas.: 71.84	BT Mode: 10	BT Pings: 2
BT Up Vel.: 0.30 m/s	Water Temp.: None	WT Mode: 12	WT Pings: 6
WT Up Vel.: 2.50 m/s	ADCP Temp.: 13.2 °C		
Use Weighted Mean Depth: YES			

Performed Diag. Test: NO
Performed Moving Bed Test: NO
Performed Compass Calibration: YES   Evaluation: YES
Meas. Location: 350m US of gage

Project Name: sag near toolik.mmt
Software: 2.15

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
000	L	3.00	7.00	161	14.2	67.6	12.1	0.147	0.701	94.7	92.0	103.9	14:59	15:03	0.45	0.91	0	3
001	R	3.00	5.00	221	13.0	68.0	11.8	0.014	0.062	92.9	90.6	109.3	15:04	15:09	0.37	0.85	2	3
002	L	3.00	7.00	145	14.2	68.8	12.3	-0.032	0.413	95.7	93.1	105.5	15:09	15:12	0.51	0.91	1	2
003	R	3.00	7.00	222	14.4	66.1	12.1	0.163	0.458	93.3	102.6	108.3	15:13	15:18	0.37	0.86	10	2
Mean		3.00	6.50	187	14.0	67.6	12.1	0.073	0.409	94.1	94.6	106.8	**Total**	00:18	0.42	0.88	3	3
SDev		0.00	1.00	40	0.639	1.12	0.206	0.097	0.263	1.31	5.5	2.5			0.07	0.03		
SD/M		0.00	0.15	0.21	0.05	0.02	0.02	1.33	0.64	0.01	0.06	0.02			0.16	0.04		

Remarks: Q with StreamPro 94.1cms using VTG with 1% error and 23 bad ens., 94cms using BT with 1% error and 23 bad ens.

Station Number: DSS4 Meas. No: 2
Station Name: Sag DSS4 Date: 07/28/2015

Party: JK/TT
Boat/Motor: kayak
Gage Height: 0.000 m

Width: 82.2 m
Area: 65.1 m²
G.H.Change: 0.000 m

Processed by: DAV
Mean Velocity: 0.796 m/s
Discharge: 51.7 m³/s

Area Method: Avg. Course
Nav. Method: DGPS
MagVar Method: None (19.0°)
Depth: Composite

ADCP Depth: 0.140 m
Shore Ens.:10
Bottom Est: Power (0.1667)
Top Est: Power (0.1667)

Index Vel.: 0.00 m/s
Adj.Mean Vel: 0.00 m/s
Rated Area: 0.000 m²
Control1: 4-Clear
Control2: Unspecified
Control3: Unspecified

Rating No.: 1
Qm Rating: U
Diff.: 0.000%

Screening Thresholds:
BT 3-Beam Solution: YES
WT 3-Beam Solution: YES
BT Error Vel.: 0.10 m/s
WT Error Vel.: 0.38 m/s*
BT Up Vel.: 0.30 m/s
WT Up Vel.: 2.00 m/s
Use Weighted Mean Depth: YES

Max. Vel.: 1.79 m/s
Max. Depth: 1.24 m
Mean Depth: 0.793 m
% Meas.: 63.23
Water Temp.: None
ADCP Temp.: 10.2 °C

ADCP:
Type/Freq.: StreamPro / 2000 kHz
Serial #: 1180 Firmware: 31.12
Bin Size: 5 cm* Blank: 3 cm
BT Mode: 10 BT Pings: 2
WT Mode: 12 WT Pings: 6

Performed Diag. Test: YES
Performed Moving Bed Test: NO
Performed Compass Calibration: YES Evaluation: YES
Meas. Location: US of gage

Project Name: dss-04_0.mmt
Software: 2.15

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
003	*L*	*4.00*	*8.00*	*131*	*13.5*	*30.0*	*2.70*	*0.602*	*1.21*	*48.0*	*81.8*	*66.2*	*11:11*	*11:13*	*0.53*	*0.73*	*38*	*3*
004	R	*4.00*	*6.00*	*134*	*15.9*	*34.8*	*2.40*	*0.568*	*0.600*	*54.3*	*79.2*	*63.1*	*11:16*	*11:18*	*0.48*	*0.86*	*25*	*2*
005	*L*	*4.00*	*10.0*	*116*	*13.7*	*30.3*	*2.36*	*0.412*	*1.44*	*48.3*	*86.0*	*66.6*	*11:20*	*11:22*	*0.61*	*0.72*	*18*	*2*
006	*R*	*4.00*	*7.00*	*153*	*16.3*	*35.7*	*3.03*	*0.589*	*0.757*	*56.4*	*81.7*	*64.5*	*11:24*	*11:27*	*0.42*	*0.87*	*26*	*2*
Mean		4.00	7.75	133	14.9	32.7	2.62	0.543	1.00	51.7	82.2	65.1	**Total**	00:16	0.51	0.80	27	2
SDev		0.00	1.71	15	1.43	2.97	0.312	0.088	0.392	4.22	2.8	1.6			0.08	0.08		
SD/M		0.00	0.22	0.11	0.10	0.09	0.12	0.16	0.39	0.08	0.03	0.03			0.16	0.10		

Remarks: Q with StreamPro 51.7cms using VTG with 8% error and 40 bad ens., 53.5cms using BT with 4% error and 40 bad ens.
overcast, no wind

* - value not consistent for all transects
Discharge for transects in *italics* have a total Q more than 5% from the mean

Station Number: DSS4 Meas. No: 3
Station Name: Sag DSS4 Date: 09/12/2015

Party: JK/TT
Boat/Motor: kayak
Gage Height: 0.000 m

Width: 89.1 m
Area: 71.5 m²
G.H.Change: 0.000 m

Processed by: DAV
Mean Velocity: 0.810 m/s
Discharge: 57.9 m³/s

Area Method: Avg. Course
Nav. Method: DGPS
MagVar Method: None (19.0°)
Depth: Composite

ADCP Depth: 0.140 m
Shore Ens.:10
Bottom Est: Power (0.1667)
Top Est: Power (0.1667)

Index Vel.: 0.00 m/s
Adj.Mean Vel: 0.00 m/s
Rated Area: 0.000 m²
Control1: Unspecified
Control2: Unspecified
Control3: Unspecified

Rating No.: 1
Qm Rating: U
Diff.: 0.000%

Screening Thresholds:
BT 3-Beam Solution: YES
WT 3-Beam Solution: YES
BT Error Vel.: 0.10 m/s
WT Error Vel.: 0.38 m/s
BT Up Vel.: 0.30 m/s
WT Up Vel.: 2.00 m/s
Use Weighted Mean Depth: YES

Max. Vel.: 2.00 m/s
Max. Depth: 1.41 m
Mean Depth: 0.804 m
% Meas.: 64.10
Water Temp.: None
ADCP Temp.: 3.4 °C

ADCP:
Type/Freq.: StreamPro / 2000 kHz
Serial #: 1180 Firmware: 31.12
Bin Size: 5 cm Blank: 3 cm
BT Mode: 10 BT Pings: 2
WT Mode: 12 WT Pings: 6

Performed Diag. Test: YES
Performed Moving Bed Test: NO
Performed Compass Calibration: YES Evaluation: YES
Meas. Location: not sure

Project Name: dss-04-091215_0.mmt
Software: 2.15

Tr.#		Edge Distance		#Ens.	Discharge						Width	Area	Time		Mean Vel.		% Bad	
		L	R		Top	Middle	Bottom	Left	Right	Total			Start	End	Boat	Water	Ens.	Bins
001	*L*	*5.00*	*17.0*	*116*	*14.0*	*33.2*	*2.93*	*0.581*	*3.02*	*53.7*	*94.2*	*75.1*	*13:30*	*13:32*	*0.59*	*0.71*	*22*	*4*
002	R	5.00	8.00	132	16.0	37.3	3.02	0.717	0.716	57.7	84.9	69.7	13:34	13:37	0.51	0.83	18	2
003	L	5.00	10.0	144	16.0	37.2	2.59	0.712	1.48	57.9	86.5	69.2	13:37	13:40	0.48	0.84	19	2
004	*R*	*5.00*	*10.0*	*137*	*17.1*	*41.1*	*3.45*	*0.669*	*0.457*	*62.7*	*92.6*	*75.7*	*13:42*	*13:45*	*0.51*	*0.83*	*15*	*2*
005	L	5.00	12.0	126	15.9	35.7	2.82	0.501	1.77	56.7	91.4	70.3	13:52	13:54	0.53	0.81	22	2
006	R	5.00	7.00	130	16.4	38.1	2.89	0.722	0.304	58.4	84.9	69.3	13:56	13:58	0.54	0.84	21	2
Mean		5.00	10.7	130	15.9	37.1	2.95	0.650	1.29	57.9	89.1	71.5	**Total**	00:28	0.53	0.81	20	2
SDev		0.00	3.56	10	1.04	2.61	0.286	0.090	1.02	2.93	4.1	3.0			0.04	0.05		
SD/M		0.00	0.33	0.07	0.07	0.07	0.10	0.14	0.79	0.05	0.05	0.04			0.07	0.06		

Remarks: Q with StreamPro 57.9cms using VTG with 5% error and 27 bad ens., 59.7cms using BT with 4% error and 28 bad ens.

Discharge for transects in *italics* have a total Q more than 5% from the mean

APPENDIX B

Floodplain Vegetation and Substrate Survey

Appendix B1: Grain Size Analysis

Table 1. Grain size measurements from 142 sites, determined using the automated technique.

ID	D_{16} (mm)	D_{50} (mm)	D_{84} (mm)	Mean Size (mm)
DSS1-01	15.07	43.92	94.61	63.28
DSS1-02	17.42	48.61	110.50	69.28
DSS1-03	15.52	42.80	100.52	63.28
DSS1-04	17.87	43.70	95.83	63.28
DSS1-05	12.94	43.79	91.78	61.82
DSS1-06	15.78	44.14	104.80	66.69
DSS1-07	12.20	33.46	84.89	54.87
DSS1-08	12.82	35.93	78.53	53.97
DSS1-09	13.62	36.39	84.41	55.79
DSS1-10	16.85	44.41	97.80	63.07
DSS1-11	16.43	45.96	97.31	63.86
DSS1-12	11.98	38.68	90.52	59.30
DSS1-13	15.93	49.86	116.15	71.28
DSS1-14	17.27	51.73	113.74	72.33
DSS1-15	16.20	49.12	113.02	68.96
DSS1-16	18.17	47.83	102.88	66.06
DSS1-17	18.18	45.43	95.74	63.28
DSS1-18	9.83	36.40	86.98	56.43
DSS1-19	16.41	45.43	108.20	68.18
DSS1-20	17.54	47.45	96.38	64.64
DSS1-21	20.61	48.89	101.79	68.62
DSS1-22	15.40	39.96	92.02	60.51
DSS1-23	13.40	36.69	89.13	58.80
DSS1-24	10.89	34.14	87.78	57.44
DSS1-25	12.80	38.88	91.82	60.49
DSS1-26	15.47	46.05	104.89	68.32
DSS1-27	14.70	41.27	95.22	64.43
DSS1-28	13.04	39.30	95.71	61.46
DSS1-29	15.51	44.77	98.08	65.51
DSS1-30	9.93	30.86	72.61	51.25
DSS1-31	10.54	31.15	79.46	52.98
DSS1-32	11.19	34.65	84.84	57.04
DSS1-33	12.29	36.07	91.42	58.44
DSS1-34	15.32	44.77	96.85	66.30
DSS2-01	25.05	83.44	170.06	105.73
DSS2-02	15.93	67.73	161.12	97.05
DSS2-03	34.24	82.33	184.52	114.31

Appendix B1: Grain Size Analysis

ID	D_{16} (mm)	D_{50} (mm)	D_{84} (mm)	Mean Size (mm)
DSS2-04	23.69	75.03	149.55	96.33
DSS2-05	17.05	58.17	130.16	84.88
DSS2-06	21.01	79.42	186.73	111.21
DSS2-07	28.19	79.72	174.61	107.19
DSS2-08	11.65	34.87	92.11	60.72
DSS2-09	11.70	37.14	97.24	62.92
DSS2-10	9.72	32.43	76.20	53.59
DSS2-11	14.37	42.03	98.76	65.27
DSS2-12	11.54	38.72	82.55	58.79
DSS2-13	13.21	41.66	99.99	66.96
DSS2-14	11.31	35.38	85.81	58.78
DSS2-15	15.86	45.70	96.03	65.93
DSS2-16	17.67	47.25	109.91	71.43
DSS2-17	16.19	50.49	118.48	76.21
DSS2-18	7.95	26.41	67.21	46.74
DSS2-19	21.50	67.34	149.10	94.59
DSS2-20	16.70	48.01	121.04	76.94
DSS2-21	10.27	30.14	73.20	51.38
DSS2-22	23.13	83.54	198.69	117.79
DSS2-23	16.83	46.37	102.73	70.56
DSS2-24	25.54	70.29	161.61	98.50
DSS2-25	18.28	51.34	114.15	76.24
DSS2-26	19.28	46.98	108.21	71.97
DSS2-27	8.86	29.09	70.53	49.51
DSS2-28	34.75	100.80	191.33	123.22
DSS2-29	27.33	76.15	159.91	104.38
DSS2-30	11.22	34.98	107.45	66.98
DSS2-31	8.72	30.85	88.21	57.02
DSS2-32	13.82	44.88	105.45	70.94
DSS2-33	31.83	93.02	183.33	117.15
DSS2-34	31.44	88.26	179.84	112.23
DSS2-35	34.15	81.42	170.49	111.56
DSS3-01	28.81	74.96	170.23	104.50
DSS3-02	22.99	55.57	119.74	80.07
DSS3-03	21.26	63.18	129.47	85.46
DSS3-04	23.41	63.83	139.58	87.81
DSS3-05	23.17	60.27	134.87	87.67
DSS3-06	23.46	61.01	141.90	88.92
DSS3-07	28.60	69.60	140.32	94.04

Appendix B1: Grain Size Analysis

ID	D_{16} (mm)	D_{50} (mm)	D_{84} (mm)	Mean Size (mm)
DSS3-08	33.62	74.78	158.47	103.08
DSS3-09	18.14	51.11	128.10	80.78
DSS3-10	27.18	73.59	150.24	96.78
DSS3-11	27.94	67.83	134.89	90.72
DSS3-12	28.03	71.02	150.31	97.24
DSS3-13	29.42	77.70	163.64	102.77
DSS3-14	32.21	83.82	152.07	103.61
DSS3-15	25.22	80.54	155.11	101.55
DSS3-16	34.00	81.34	157.33	104.57
DSS3-17	26.63	66.51	150.19	94.78
DSS3-18	30.67	80.67	159.07	107.22
DSS3-19	28.59	76.55	165.62	101.52
DSS3-20	29.28	86.88	167.57	107.96
DSS3-21	31.95	89.04	164.65	110.25
DSS3-22	34.84	97.10	185.36	118.32
DSS3-23	38.61	103.49	196.06	125.76
DSS3-24	33.60	82.87	170.31	109.47
DSS3-25	31.43	71.18	182.40	106.24
DSS3-26	28.69	80.52	181.44	110.29
DSS3-27	23.34	60.94	132.45	86.54
DSS3-28	34.22	80.54	160.01	104.29
DSS4-01	29.54	65.25	154.47	97.78
DSS4-02	30.36	76.41	182.07	112.80
DSS4-03	27.62	70.33	143.30	94.53
DSS4-04	34.69	83.43	151.21	103.57
DSS4-05	28.82	74.38	146.88	98.37
DSS4-06	29.90	79.43	176.19	106.88
DSS4-07	29.80	72.42	150.28	98.10
DSS4-08	31.61	74.36	175.01	105.06
DSS4-09	38.24	93.31	166.51	113.81
DSS4-10	33.87	81.78	185.29	110.56
DSS4-11	37.18	83.25	167.84	108.92
DSS4-12	27.09	69.61	130.93	89.42
DSS4-13	20.54	52.09	119.07	77.61
DSS4-14	26.70	72.53	136.90	92.74
DSS4-15	25.95	66.15	142.29	93.66
DSS4-16	35.01	82.27	176.45	110.38
DSS4-17	30.50	79.34	157.21	103.52
DSS4-18	16.37	47.38	110.71	71.78

Appendix B1: Grain Size Analysis

ID	D_{16} (mm)	D_{50} (mm)	D_{84} (mm)	Mean Size (mm)
DSS4-19	24.10	69.26	149.81	94.69
DSS4-20	25.30	71.76	146.74	93.48
DSS4-21	24.67	60.36	124.25	84.50
DSS4-22	27.52	69.26	139.48	91.12
DSS4-23	23.60	63.36	137.33	87.93
DSS4-24	24.74	62.00	143.44	89.52
DSS4-25	25.67	65.39	139.99	90.00
DSS4-26	24.80	63.35	136.00	88.83
DSS4-27	24.71	68.78	141.75	94.15
DSS4-28	31.93	73.43	149.28	96.72
DSS4-29	23.89	67.29	155.66	95.31
DSS4-30	24.92	64.99	143.65	92.21
DSS4-31	23.82	65.12	133.95	86.85
DSS4-32	29.99	73.07	162.60	101.25
DSS4-33	39.97	95.78	174.95	116.13
DSS4-34	38.69	97.21	185.04	118.37
DSS4-35	30.39	77.24	157.79	102.65
DSS4-36	28.03	74.17	153.78	100.17
DSS4-37	27.39	73.05	157.35	100.99
DSS4-38	28.79	82.76	165.20	106.65
DSS4-39	33.54	75.45	163.49	104.49
DSS4-40	25.45	72.59	138.15	93.86
DSS4-41	25.95	64.68	159.30	96.29
DSS4-42	25.24	64.48	140.75	90.92
DSS4-43	34.91	82.99	168.63	106.99
DSS4-44	28.32	74.91	166.55	103.51
DSS4-45	32.44	84.38	189.66	113.69

Appendix B1: Grain Size Analysis

Table 2. Grain size measurements manually calculated from photos. D_{16}, D_{50}, and D_{84} values derived from cumulative frequency curves (e.g., Figure 26).

Site ID	Number of Particles	D_{16} (mm)	D_{50} (mm)	D_{84} (mm)	Mean Size (mm)
DSS4B1	92	119.43	73.52	18.38	48.37
DSS4B2	88	119.43	73.52	3.61	43.68
DSS4B3	59	97.01	17.75	2.64	18.04
DSS4C1	100	84.45	36.76	14.93	33.91
DSS4C2	100	57.68	26.91	11.31	25.14
DSS4C3	100	64.00	36.76	13.00	30.03
DSS4E1	100	68.59	39.40	15.45	34.90
DSS4E2	100	73.01	28.84	3.03	22.28
DSS4E3	100	76.11	34.30	4.00	24.57
DSS4G1	100	73.52	33.13	4.00	27.71
DSS4G2	100	66.26	30.91	4.00	26.10
DSS4G3	100	107.63	38.05	3.03	25.93
DSS3B1	100	76.11	20.39	3.03	18.94
DSS3B2	100	38.05	14.93	2.73	10.89
DSS3B3	100	59.71	9.85	2.64	12.48
DSS3D1	100	53.82	26.91	10.93	24.45
DSS3D2	100	23.43	10.56	2.93	10.45
DSS3D3	100	43.71	21.11	9.19	20.13
DSS3F1	100	119.43	66.26	23.43	55.18
DSS3F2	100	115.36	55.72	19.03	47.98
DSS3F3	100	84.45	28.84	13.00	30.63
DSS3G1	100	33.13	14.93	3.61	13.23
DSS3G2	100	32.00	12.55	2.73	10.98
DSS3G3	100	22.63	4.44	2.64	8.22
DSS3H1	100	42.22	3.61	2.51	9.58
DSS3H3	100	32.00	3.61	2.46	8.47
DSS2A1	100	93.70	53.82	26.91	49.12
DSS2A2	100	97.01	48.50	28.84	45.81
DSS2A3	100	93.70	46.85	16.56	41.09
DSS2B1	100	48.50	16.00	3.73	16.55
DSS2B2	100	61.82	19.70	3.36	18.20
DSS2B3	100	45.25	17.75	3.25	16.20
DSS2C1	100	40.79	10.93	2.64	11.80
DSS2C2	100	50.21	16.56	2.83	15.69
DSS2C3	100	66.26	28.84	3.73	22.82
DSS2E1	100	55.72	25.63	10.93	24.85
DSS2E2	100	45.25	21.86	8.88	19.59
DSS2E3	100	42.22	21.11	8.88	19.72

Appendix B1: Grain Size Analysis

Site ID	Number of Particles	D_{16} (mm)	D_{50} (mm)	D_{84} (mm)	Mean Size (mm)
DSS2F1	100	50.21	26.91	11.71	24.04
DSS2F2	100	40.79	21.11	8.28	19.05
DSS2F3	100	45.25	19.43	8.00	18.51
DSS1B1	100	28.44	8.00	2.93	9.78
DSS1B2	100	34.30	7.46	2.64	9.54
DSS1B3	100	26.91	4.76	2.64	8.94
DSS1C1	100	21.11	3.86	2.55	7.83
DSS1C2	100	16.00	3.25	2.45	6.45
DSS1C3(fines)	100	3.97	3.97	3.97	3.97
DSS1D1	100	18.77	3.61	2.50	7.13
DSS1D2	100	17.75	3.61	2.50	6.65
DSS1D3	100	27.86	4.00	2.58	8.72
DSS1H1	100	12.55	6.06	3.25	6.80
DSS1H2	100	16.00	5.86	2.83	7.03
DSS1H3	100	18.38	8.88	3.25	9.27

Appendix B2: Vegetation Species and Abundance

Date	Functional Type 1	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)	Genus	Species
8/4/2015	Deciduous Shrub	DSS4A	salric	1	1-5	Salix	richardsonii
8/4/2015	Deciduous Shrub	DSS4A	salfus	3	26-50	Salix	fuscescens
8/4/2015	Evergreen Shrub	DSS4A	dryint	2	6-25	Dryas	integrifolia
8/4/2015	Graminoid	DSS4A	eriang	2	6-25	Eriophorum	angustifolium
8/4/2015	Graminoid	DSS4A	carcap	0.5	<1	Carex	capallaris
8/4/2015	Forb	DSS4A	equarv	0.5	<1	Equisetum	arvense
8/4/2015	Graminoid	DSS4A	carsax	0.5	<1	Carex	saxatalis
8/4/2015	Graminoid	DSS4A	carmem	0.5	<1	Carex	membranacea
8/4/2015	Evergreen Shrub	DSS4A	rholap	0.5	<1	Rhododendron	lapponicum
8/4/2015	Evergreen Shrub	DSS4A	andpol	0.5	<1	Andromeda	polifolia
8/4/2015	Forb	DSS4A	pedsud	0.5	<1	Pedicularis	sudetica
8/4/2015	Forb	DSS4A	equvar	0.5	<1	Equisetum	variegatum
8/4/2015	Evergreen Shrub	DSS4A	empnig	0.5	<1	Empetrum	nigrum
8/4/2015	Forb	DSS4A	tofpus	0.5	<1	Tofieldia	pusilla
8/4/2015	Graminoid	DSS4A	caratr	0.5	<1	Carex	atrofusca
8/4/2015	Forb	DSS4A	rubarc	0.5	<1	Rubus	arcticus
8/4/2015		DSS4A	litter	3	26-50	Litter	
8/4/2015		DSS4A	Bare Soil	0	0	Bare Soil	
8/4/2015		DSS4A	Standing Dead	3	26-50	Standing Dead	
8/4/2015		DSS4A	Surface Rock	0	0	Surface Rock	
8/4/2015		DSS4A	Standing Water	0.5	<1	Standing Water	
8/4/2015	Moss	DSS4A	tomnit	1	1-5	Tomenthypnum	nitens
8/4/2015	Moss	DSS4A	scorp	1	1-5	Scorpidium	sp.
8/4/2015	Moss	DSS4A	camste	1	1-5	Campylium	stellatum
8/4/2015	Moss	DSS4A	sanunc	1	1-5	Sanionia	uncinata
8/4/2015	Moss	DSS4A	ditfle	0.5	<1	Ditrichum	flexicaule
8/4/2015	Forb	DSS4A	polviv	0.5	<1	Polygonum	viviparum
8/4/2015		DSS4B	No veg	0	0	No Vegetation	
8/4/2015		DSS4C	No veg	0	0	No Vegetation	
8/4/2015	Deciduous Shrub	DSS4D	salric	0.5	<1	Salix	richardsonii
8/4/2015	Deciduous Shrub	DSS4D	salala	0.5	<1	Salix	alaxensis
8/4/2015	Deciduous Shrub	DSS4D	arcrub	2	6-25	Arctous	rubra
8/4/2015	Deciduous Shrub	DSS4D	salgla	3	26-50	Salix	glauca
8/4/2015	Evergreen Shrub	DSS4D	dryint	0.5	<1	Dryas	integrifolia
8/4/2015	Forb	DSS4D	equvar	0.5	<1	Equisetum	variegatum
8/4/2015	Forb	DSS4D	zygele	0.5	<1	Zigadenus	elegans
8/4/2015	Graminoid	DSS4D	leymol	2	6-25	Leymus	mollis
8/4/2015	Forb	DSS4D	hedalp	0.5	<1	Hedysarum	alpinum
8/4/2015	Forb	DSS4D	astragalus	0.5	<1	Astragalus	sp.
8/4/2015	Forb	DSS4D	eursib	0.5	<1	Eurybia	sibirica
8/4/2015	Forb	DSS4D	parpal	0.5	<1	Parnassia	palustris
8/4/2015	Forb	DSS4D	anepar	0.5	<1	Anemone	parviflora
8/4/2015	Forb	DSS4D	genpro	0.01	<1	Gentianella	propinqua
8/4/2015	Graminoid	DSS4D	fesrub	1	1-5	Festuca	rubra
8/4/2015	Graminoid	DSS4D	Bropum	0.5	<1	Bromus	pumellianus
8/4/2015	Forb	DSS4D	senlug	0.5	<1	Senecio	lugens
8/4/2015	Moss	DSS4D	discap	2	6-25	Distichium	capillaceum
8/4/2015	Moss	DSS4D	unkmoss1	0.5	<1	Unknown Moss 1	
8/4/2015	Moss	DSS4D	tomnit	0.5	<1	Tomenthypnum	nitens
8/4/2015	Moss	DSS4D	camste	1	1-5	Campylium	stellatum

Date	Functional Type 1	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)	Genus	Species
8/4/2015	Moss	DSS4D	plesch	0.5	<1	Pleurozium	schreberi
8/4/2015		DSS4D	Bare Soil	2	6-25	Bare Soil	
8/4/2015		DSS4D	Standing Water	0	0	Standing Water	
8/4/2015		DSS4D	litter	3	26-50	Litter	
8/4/2015		DSS4D	Standing Dead	0	0	Standing Dead	
8/4/2015		DSS4D	Surface Rock	0.5	<1	Surface Rock	
8/4/2015	Forb	DSS4E	chalat	0.5	<1	Chamerion	latifolium
8/4/2015	Forb	DSS4E	hedalp	0.5	<1	Hedysarum	alpinum
8/4/2015	Deciduous Shrub	DSS4E	salala	1	1-5	Salix	alaxensis
8/4/2015	Forb	DSS4E	astalp	0.5	<1	Astragalus	alpinus
8/4/2015	Graminoid	DSS4E	fesrub	0.5	<1	Festuca	rubra
8/4/2015		DSS4E	litter	1	1-5	Litter	
8/4/2015		DSS4E	Standing Dead	1	1-5	Standing Dead	
8/4/2015		DSS4E	Bare Soil	2	6-25	Bare Soil	
8/4/2015		DSS4E	Standing Water	0	0	Standing Water	
8/4/2015		DSS4E	Surface Rock	4	51-75	Surface Rock	
8/4/2015	Deciduous Shrub	DSS4F	shecan	0.5	<1	Sheperdia	canadensis
8/4/2015	Deciduous Shrub	DSS4F	salgla	3	26-50	Salix	glauca
8/4/2015	Deciduous Shrub	DSS4F	salala	1	1-5	Salix	alaxensis
8/4/2015	Forb	DSS4F	rubarc	2	6-25	Rubus	arcticus
8/4/2015	Graminoid	DSS4F	elyvio	0.5	<1	Elymus	violaceus
8/4/2015	Graminoid	DSS4F	leymol	1	1-5	Leymus	mollis
8/4/2015	Graminoid	DSS4F	Bropum	0.5	<1	Bromus	pumellianus
8/4/2015	Graminoid	DSS4F	calstr	1	1-5	Calamagrostis	stricta
8/4/2015	Graminoid	DSS4F	fesrub	1	1-5	Festuca	rubra
8/4/2015	Forb	DSS4F	zygele	0.5	<1	Zigadenus	elegans
8/4/2015	Forb	DSS4F	pyrasa	0.5	<1	Pyrola	asarifolia
8/4/2015	Forb	DSS4F	genpro	0.5	<1	Gentianella	propinqua
8/4/2015	Forb	DSS4F	oxycam	0.5	<1	Oxytropis	campestris
8/4/2015	Forb	DSS4F	senlug	0.5	<1	Senecio	lugens
8/4/2015	Forb	DSS4F	eursib	0.5	<1	Eurybia	sibirica
8/4/2015	Graminoid	DSS4F	carcon	0.5	<1	Carex	concinna
8/4/2015	Forb	DSS4F	anepar	0.5	<1	Anemone	parviflora
8/4/2015	Graminoid	DSS4F	carcap	0.5	<1	Carex	capallaris
8/4/2015	Forb	DSS4F	equvar	0.5	<1	Equisetum	variegatum
8/4/2015	Forb	DSS4F	cascau	0.5	<1	Castilleja	caudata
8/4/2015	Forb	DSS4F	parpal	0.5	<1	Parnassia	palustris
8/4/2015	Moss	DSS4F	unkmoss	0.5	<1	Unknown Moss	
8/4/2015	Moss	DSS4F	camste	0.5	<1	Campylium	stellatum
8/4/2015	Moss	DSS4F	abiabi	2	6-25	Abietinella	abietina
8/4/2015	Moss	DSS4F	discap	1	1-5	Distichium	capillaceum
8/4/2015	Moss	DSS4F	scorp	0.5	<1	Scorpidium	sp.
8/4/2015		DSS4F	Litter	3	26-50	Litter	
8/4/2015		DSS4F	Standing Dead	2	6-25	Standing Dead	
8/4/2015		DSS4F	Bare Soil	2	6-25	Bare Soil	
8/4/2015		DSS4F	Standing Water	0	0	Standing Water	
8/4/2015		DSS4F	Surface Rock	0.5	<1	Surface Rock	
8/4/2015	Forb	DSS4F	oxyarc	0.5	<1	Oxytropis	arctica
8/4/2015		DSS4G	No veg	0	0	No Vegetation	
8/4/2015	Evergreen Shrub	DSS4H	rholap	0.5	<1	Rhododendron	lapponicum

Date	Functional Type 1	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)	Genus	Species
8/4/2015	Deciduous Shrub	DSS4H	arcrub	3	26-50	Arctous	rubra
8/4/2015	Evergreen Shrub	DSS4H	dryint	4	51-75	Dryas	integrifolia
8/4/2015	Deciduous Shrub	DSS4H	salret	0.5	<1	Salix	reticulata
8/4/2015	Deciduous Shrub	DSS4H	salric	2	6-25	Salix	richardsonii
8/4/2015	Deciduous Shrub	DSS4H	potfru	0.5	<1	Dasiphora	fruticosa
8/4/2015	Evergreen Shrub	DSS4H	andpol	0.5	<1	Andromeda	polifolia
8/4/2015	Deciduous Shrub	DSS4H	vaculi	0.5	<1	Vaccinium	uliginosum
8/4/2015	Forb	DSS4H	pedcap	0.5	<1	Pedicularis	capitata
8/4/2015	Forb	DSS4H	equarv	1	1-5	Equisetum	arvense
8/4/2015	Forb	DSS4H	anepar	0.5	<1	Anemone	parviflora
8/4/2015	Forb	DSS4H	genpro	0.5	<1	Gentianella	propinqua
8/4/2015	Forb	DSS4H	astumb	0.5	<1	Astragalus	umbellatus
8/4/2015	Graminoid	DSS4H	fesalt	1	1-5	Festuca	altaica
8/4/2015	Evergreen Shrub	DSS4H	empnig	0.5	<1	Empetrum	nigrum
8/4/2015	Forb	DSS4H	senlug	0.5	<1	Senecio	lugens
8/4/2015	Forb	DSS4H	pedkan	0.01	<1	Pedicularis	kanei
8/4/2015	Forb	DSS4H	tofpus	0.01	<1	Tofieldia	pusilla
8/4/2015	Evergreen Shrub	DSS4H	castet	0.5	<1	Cassiope	tetragona
8/4/2015	Graminoid	DSS4H	leymol	1	1-5	Leymus	mollis
8/4/2015	Forb	DSS4H	luparc	1	1-5	Lupinus	arcticus
8/4/2015	Moss	DSS4H	calliergon	0.5	<1	Calliergon	sp.
8/4/2015	Moss	DSS4H	hylspl	1	1-5	Hylocomnium	splendens
8/4/2015	Moss	DSS4H	tomnit	3	26-50	Tomenthypnum	nitens
8/4/2015	Moss	DSS4H	rhyrug	1	1-5	Rhytidium	rugosum
8/4/2015	Moss	DSS4H	abiabi	3	26-50	Abietinella	abietina
8/4/2015	Moss	DSS4H	ditfle	0.5	<1	Ditrichum	flexicaule
8/4/2015	Lichen	DSS4H	flacuc	0.5	<1	Flavocetraria	cucullata
8/4/2015	Lichen	DSS4H	Stereocaulon sp.	0.5	<1	Stereocaulon	sp.
8/4/2015	Lichen	DSS4H	thaver	0.5	<1	Thamnolia	vermicularis
8/4/2015	Lichen	DSS4H	pelleu	0.5	<1	Peltigera	leucophlebia
8/4/2015	Deciduous Shrub	DSS4H	betgla	0.5	<1	Betula	glandulosa
8/4/2015		DSS4H	litter	2	6-25	Litter	
8/4/2015		DSS4H	Standing Dead	0.5	<1	Standing Dead	
8/4/2015		DSS4H	Standing Water	0	0	Standing Water	
8/4/2015		DSS4H	Bare Soil	0	0	Bare Soil	
8/4/2015		DSS4H	Surface Rock	0	0	Surface Rock	
8/5/2015	Deciduous Shrub	DSS3A	Salhas	1	1-5	Salix	hastata
8/5/2015	Deciduous Shrub	DSS3A	salric	4	51-75	Salix	richardsonii
8/5/2015	Deciduous Shrub	DSS3A	salgla	0.5	<1	Salix	glauca
8/5/2015	Deciduous Shrub	DSS3A	arcrub	2	6-25	Arctous	rubra
8/5/2015	Deciduous Shrub	DSS3A	shecan	1	1-5	Sheperdia	canadensis
8/5/2015	Deciduous Shrub	DSS3A	salpul	0.5	<1	Salix	pulchra
8/5/2015	Graminoid	DSS3A	fesrub	0.5	<1	Festuca	rubra
8/5/2015	Graminoid	DSS3A	calstr	0.5	<1	Calamagrostis	stricta
8/5/2015	Graminoid	DSS3A	elyvio	0.5	<1	Elymus	violaceus
8/5/2015	Forb	DSS3A	equarv	1	1-5	Equisetum	arvense
8/5/2015	Forb	DSS3A	equvar	0.5	<1	Equisetum	variegatum
8/5/2015	Forb	DSS3A	senlug	0.5	<1	Senecio	lugens
8/5/2015	Forb	DSS3A	hedalp	0.5	<1	Hedysarum	alpinum
8/5/2015	Forb	DSS3A	anepar	0.5	<1	Anemone	parviflora

Date	Functional Type 1	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)	Genus	Species
8/5/2015	Forb	DSS3A	tofpus	0.5	<1	Tofieldia	pusilla
8/5/2015	Graminoid	DSS3A	fesalt	0.5	<1	Festuca	altaica
8/5/2015	Deciduous Shrub	DSS3A	vaculi	0.5	<1	Vaccinium	uliginosum
8/5/2015	Deciduous Shrub	DSS3A	salret	0.5	<1	Salix	reticulata
8/5/2015	Forb	DSS3A	parpal	0.5	<1	Parnassia	palustris
8/5/2015	Forb	DSS3A	polviv	0.5	<1	Polygonum	viviparum
8/5/2015	Graminoid	DSS3A	trispi	0.5	<1	Trisetum	spicatum
8/5/2015	Graminoid	DSS3A	carcon	0.5	<1	Carex	concinna
8/5/2015	Moss	DSS3A	abiabi	3	26-50	Abietinella	abietina
8/5/2015	Moss	DSS3A	tomnit	1	1-5	Tomenthypnum	nitens
8/5/2015	Moss	DSS3A	drepa	0.5	<1	Drepanocladus	sp.
8/5/2015		DSS3A	litter	2	6-25	Litter	
8/5/2015		DSS3A	Standing Dead	0.5	<1	Standing Dead	
8/5/2015		DSS3A	Standing Water	0	0	Standing Water	
8/5/2015		DSS3A	Bare Soil	0	0	Bare Soil	
8/5/2015		DSS3A	Surface Rock	0	0	Surface Rock	
8/5/2015	Forb	DSS3B	hedalp	0.5	<1	Hedysarum	alpinum
8/5/2015	Forb	DSS3B	chalat	0.5	<1	Chamerion	latifolium
8/5/2015	Forb	DSS3B	eursib	0.5	<1	Eurybia	sibirica
8/5/2015	Graminoid	DSS3B	elyvio	0.5	<1	Elymus	violaceus
8/5/2015	Graminoid	DSS3B	fesrub	0.5	<1	Festuca	rubra
8/5/2015	Deciduous Shrub	DSS3B	salala	0.5	<1	Salix	alaxensis
8/5/2015	Forb	DSS3B	astalp	0.5	<1	Astragalus	alpinus
8/5/2015	Forb	DSS3B	crenan	0.5	<1	Crepis	nana
8/5/2015		DSS3B	Standing Dead	0.5	<1	Standing Dead	
8/5/2015		DSS3B	Bare Soil	3	26-50	Bare Soil	
8/5/2015		DSS3B	Standing Water	0	0	Standing Water	
8/5/2015		DSS3B	Litter	0.5	<1	Litter	
8/5/2015		DSS3B	Surface Rock	2	6-25	Surface Rock	
8/5/2015	Deciduous Shrub	DSS3C	salhas	1	1-5	Salix	hastata
8/5/2015	Deciduous Shrub	DSS3C	salala	2	6-25	Salix	alaxensis
8/5/2015	Deciduous Shrub	DSS3C	salgla	3	26-50	Salix	glauca
8/5/2015	Deciduous Shrub	DSS3C	arcrub	2	6-25	Arctous	rubra
8/5/2015	Deciduous Shrub	DSS3C	shecan	0.5	<1	Sheperdia	canadensis
8/5/2015	Evergreen Shrub	DSS3C	dryint	0.5	<1	Dryas	integrifolia
8/5/2015	Graminoid	DSS3C	leymol	2	6-25	Leymus	mollis
8/5/2015	Forb	DSS3C	hedalp	1	1-5	Hedysarum	alpinum
8/5/2015	Graminoid	DSS3C	fesalt	0.5	<1	Festuca	altaica
8/5/2015	Forb	DSS3C	zygele	0.5	<1	Zigadenus	elegans
8/5/2015	Forb	DSS3C	parpal	0.5	<1	Parnassia	palustris
8/5/2015	Forb	DSS3C	senlug	0.5	<1	Senecio	lugens
8/5/2015	Graminoid	DSS3C	carcon	0.5	<1	Carex	concinna
8/5/2015	Forb	DSS3C	anepar	0.5	<1	Anemone	parviflora
8/5/2015	Graminoid	DSS3C	carcap	0.5	<1	Carex	capallaris
8/5/2015	Forb	DSS3C	pedver	0.5	<1	Pedicularis	verticillata
8/5/2015	Forb	DSS3C	pedcap	0.5	<1	Pedicularis	capitata
8/5/2015	Forb	DSS3C	tofpus		0	Tofieldia	pusilla
8/5/2015	Forb	DSS3C	polviv	0.5	<1	Polygonum	viviparum
8/5/2015	Moss	DSS3C	abiabi	2	6-25	Abietinella	abietina
8/5/2015	Moss	DSS3C	hylspl	4	51-75	Hylocomnium	splendens

Date	Functional Type 1	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)	Genus	Species
8/5/2015	Moss	DSS3C	rhyrug	0.5	<1	Rhytidium	rugosum
8/5/2015	Moss	DSS3C	sanunc	0.5	<1	Sanionia	uncinata
8/5/2015	Moss	DSS3C	paludella	0.5	<1	Paludella	sp.
8/5/2015	Lichen	DSS3C	cetisl	0.5	<1	Cetraria	islandica
8/5/2015	Lichen	DSS3C	flacuc	0.5	<1	Flavocetraria	cucullata
8/5/2015	Moss	DSS3C	tomnit	1	1-5	Tomenthypnum	nitens
8/5/2015	Moss	DSS3C	discap	0.5	<1	Distichium	capillaceum
8/5/2015	Moss	DSS3C	calliergon	0.5	<1	Calliergon	sp.
8/5/2015	Moss	DSS3C	unkliverwort	0.5	<1	Unknown Liverwort	
8/5/2015	Lichen	DSS3C	flaniv	0.01	<1	Flavocetraria	nivalis
8/5/2015		DSS3C	Standing Dead	2	6-25	Standing Dead	
8/5/2015		DSS3C	Litter	1	1-5	Litter	
8/5/2015		DSS3C	Standing Water	0	0	Standing Water	
8/5/2015		DSS3C	Bare Soil	0	0	Bare Soil	
8/5/2015		DSS3C	Surface Rock	0	0	Surface Rock	
8/5/2015	Graminoid	DSS3D	fesrub	0.5	<1	Festuca	rubra
8/5/2015	Deciduous Shrub	DSS3D	salala	2	6-25	Salix	alaxensis
8/5/2015	Deciduous Shrub	DSS3D	shecan	0.5	<1	Sheperdia	canadensis
8/5/2015	Forb	DSS3D	hedalp	0.5	<1	Hedysarum	alpinum
8/5/2015	Forb	DSS3D	eursib	0.5	<1	Eurybia	sibirica
8/5/2015	Forb	DSS3D	chalat	0.5	<1	Chamerion	latifolium
8/5/2015	Forb	DSS3D	chaang	0.5	<1	Chamerion	angustifolium
8/5/2015	Graminoid	DSS3D	fesrub	0.5	<1	Festuca	rubra
8/5/2015	Graminoid	DSS3D	Callap	0.5	<1	Calamagrostis	lapponica
8/5/2015	Graminoid	DSS3D	elyvio	0.5	<1	Elymus	violaceus
8/5/2015	Forb	DSS3D	astalp	0.5	<1	Astragalus	alpinus
8/5/2015		DSS3D	Standing Dead	1	1-5	Standing Dead	
8/5/2015		DSS3D	Litter	1	1-5	Litter	
8/5/2015		DSS3D	Bare Soil	1	1-5	Bare Soil	
8/5/2015		DSS3D	Surface Rock	5	76-100	Surface Rock	
8/5/2015		DSS3D	Standing Water	0	0	Standing Water	
8/5/2015	Deciduous Shrub	DSS3E	salhas	0.5	<1	Salix	hastata
8/5/2015	Deciduous Shrub	DSS3E	shecan	2	6-25	Sheperdia	canadensis
8/5/2015	Deciduous Shrub	DSS3E	salala	2	6-25	Salix	alaxensis
8/5/2015	Deciduous Shrub	DSS3E	salgla	2	6-25	Salix	glauca
8/5/2015	Deciduous Shrub	DSS3E	salric	1	1-5	Salix	richardsonii
8/5/2015	Deciduous Shrub	DSS3E	vaculi	0.5	<1	Vaccinium	uliginosum
8/5/2015	Deciduous Shrub	DSS3E	potfru	0.5	<1	Dasiphora	fruticosa
8/5/2015	Deciduous Shrub	DSS3E	salret	0.5	<1	Salix	reticulata
8/5/2015	Forb	DSS3E	zygele	0.5	<1	Zigadenus	elegans
8/5/2015	Forb	DSS3E	senlug	0.5	<1	Senecio	lugens
8/5/2015	Graminoid	DSS3E	leymol	2	6-25	Leymus	mollis
8/5/2015	Forb	DSS3E	hedalp	0.5	<1	Hedysarum	alpinum
8/5/2015	Graminoid	DSS3E	fesalt	0.5	<1	Festuca	altaica
8/5/2015	Deciduous Shrub	DSS3E	arcrub	1	1-5	Arctous	rubra
8/5/2015	Forb	DSS3E	anepar	0.5	<1	Anemone	parviflora
8/5/2015	Forb	DSS3E	parpal	0.5	<1	Parnassia	palustris
8/5/2015	Forb	DSS3E	tofpus	0.5	<1	Tofieldia	pusilla
8/5/2015	Graminoid	DSS3E	carcon	0.5	<1	Carex	concinna
8/5/2015	Moss	DSS3E	hylspl	4	51-75	Hylocomnium	splendens

Date	Functional Type 1	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)	Genus	Species
8/5/2015	Moss	DSS3E	tomnit	0.5	<1	Tomenthypnum	nitens
8/5/2015	Moss	DSS3E	abiabi	1	1-5	Abietinella	abietina
8/5/2015	Lichen	DSS3E	pelmal	0.5	<1	Peltigera	malacea
8/5/2015	Moss	DSS3E	rhyrug	0.5	<1	Rhytidium	rugosum
8/5/2015	Lichen	DSS3E	cladonia	0.5	<1	Cladonia	sp.
8/5/2015	Moss	DSS3E	unkliverwort	0.5	<1	Unknown Liverwort	
8/5/2015	Lichen	DSS3E	dacarc	0.5	<1	Dactylina	arctica
8/5/2015	Moss	DSS3E	sanunc	0.5	<1	Sanionia	uncinata
8/5/2015		DSS3E	Standing Dead	2	6-25	Standing Dead	
8/5/2015		DSS3E	Standing Water	0	0	Standing Water	
8/5/2015		DSS3E	Bare Soil	0	0	Bare Soil	
8/5/2015		DSS3E	Surface Rock	0	0	Surface Rock	
8/5/2015		DSS3E	Litter	2	6-25	Litter	
8/5/2015	Deciduous Shrub	DSS3F	salala	1	1-5	Salix	alaxensis
8/5/2015	Forb	DSS3F	hedalp	0.5	<1	Hedysarum	alpinum
8/5/2015	Forb	DSS3F	chalat	0.5	<1	Chamerion	latifolium
8/5/2015	Forb	DSS3F	eursib	0.5	<1	Eurybia	sibirica
8/5/2015	Graminoid	DSS3F	fesrub	0.5	<1	Festuca	rubra
8/5/2015	Graminoid	DSS3F	elyvio	0.5	<1	Elymus	violaceus
8/5/2015	Graminoid	DSS3F	leymol	0.5	<1	Leymus	mollis
8/5/2015	Graminoid	DSS3F	trispi	0.5	<1	Trisetum	spicatum
8/5/2015		DSS3F	Standing Dead	0.5	<1	Standing Dead	
8/5/2015		DSS3F	Bare Soil	0.5	<1	Bare Soil	
8/5/2015		DSS3F	Surface Rock	5	76-100	Surface Rock	
8/5/2015		DSS3F	Standing Water	0	0	Standing Water	
8/5/2015		DSS3F	Litter	0.5	<1	Litter	
8/5/2015	Deciduous Shrub	DSS3G	salala	3	26-50	Salix	alaxensis
8/5/2015	Forb	DSS3G	hedalp	0.5	<1	Hedysarum	alpinum
8/5/2015	Graminoid	DSS3G	fesrub	0.5	<1	Festuca	rubra
8/5/2015	Forb	DSS3G	chalat	0.5	<1	Chamerion	latifolium
8/5/2015	Graminoid	DSS3G	leymol	0.5	<1	Leymus	mollis
8/5/2015	Forb	DSS3G	eursib	0.5	<1	Eurybia	sibirica
8/5/2015		DSS3G	Bare Soil	3	26-50	Bare Soil	
8/5/2015		DSS3G	Standing Water	0	0	Standing Water	
8/5/2015		DSS3G	Standing Dead	0.5	<1	Standing Dead	
8/5/2015		DSS3G	Litter	2	6-25	Litter	
8/5/2015		DSS3G	Surface Rock	3	26-50	Surface Rock	
8/5/2015	Deciduous Shrub	DSS3H	salala	2	6-25	Salix	alaxensis
8/5/2015	Forb	DSS3H	hedalp	0.5	<1	Hedysarum	alpinum
8/5/2015	Graminoid	DSS3H	leymol	0.5	<1	Leymus	mollis
8/5/2015	Graminoid	DSS3H	elyvio	0.5	<1	Elymus	violaceus
8/5/2015	Graminoid	DSS3H	fesrub	0.5	<1	Festuca	rubra
8/5/2015	Forb	DSS3H	eursib	0.5	<1	Eurybia	sibirica
8/5/2015	Graminoid	DSS3H	Calamagrostis	0.5	<1	Calamagrostis	sp.
8/5/2015		DSS3H	Bare Soil	4	51-75	Bare Soil	
8/5/2015		DSS3H	Standing Dead	0.5	<1	Standing Dead	
8/5/2015		DSS3H	Standing Water	0	0	Standing Water	
8/5/2015		DSS3H	Litter	1	1-5	Litter	
8/5/2015		DSS3H	Surface Rock	1	1-5	Surface Rock	
8/5/2015	Deciduous Shrub	DSS3I	salgla	1	1-5	Salix	glauca

Date	Functional Type 1	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)	Genus	Species
8/5/2015	Deciduous Shrub	DSS3I	salric	1	1-5	Salix	richardsonii
8/5/2015	Evergreen Shrub	DSS3I	rholap	1	1-5	Rhododendron	lapponicum
8/5/2015	Evergreen Shrub	DSS3I	dryint	3	26-50	Dryas	integrifolia
8/5/2015	Deciduous Shrub	DSS3I	salret	0.5	<1	Salix	reticulata
8/5/2015	Deciduous Shrub	DSS3I	arcrub	2	6-25	Arctous	rubra
8/5/2015	Forb	DSS3I	tofpus	0.5	<1	Tofieldia	pusilla
8/5/2015	Graminoid	DSS3I	carsci	2	6-25	Carex	scirpoidea
8/5/2015	Forb	DSS3I	pedcap	0.5	<1	Pedicularis	capitata
8/5/2015	Forb	DSS3I	pedkan	0.5	<1	Pedicularis	kanei
8/5/2015	Graminoid	DSS3I	fesalt	0.5	<1	Festuca	altaica
8/5/2015	Forb	DSS3I	oxycam	1	1-5	Oxytropis	campestris
8/5/2015	Forb	DSS3I	hedalp	1	1-5	Hedysarum	alpinum
8/5/2015	Forb	DSS3I	saxfla	0.01	<1	Saxifraga	flagellaris
8/5/2015	Forb	DSS3I	polviv	0.5	<1	Polygonum	viviparum
8/5/2015	Forb	DSS3I	carhyp	0.01	<1	Cardamine	hyperborea
8/5/2015	Forb	DSS3I	pedsud	0.01	<1	Pedicularis	sudetica
8/5/2015	Deciduous Shrub	DSS3I	vaculi	2	6-25	Vaccinium	uliginosum
8/5/2015	Deciduous Shrub	DSS3I	salpul	0.5	<1	Salix	pulchra
8/5/2015	Lichen	DSS3I	dacarc	0.5	<1	Dactylina	arctica
8/5/2015	Moss	DSS3I	aulacu	0.5	<1	Aulacomnium	acuminatum
8/5/2015	Lichen	DSS3I	masric	0.5	<1	Masonhalea	richardsonii
8/5/2015	Lichen	DSS3I	flacuc	0.5	<1	Flavocetraria	cucullata
8/5/2015	Lichen	DSS3I	flaniv	0.5	<1	Flavocetraria	nivalis
8/5/2015	Moss	DSS3I	rhyrug	1	1-5	Rhytidium	rugosum
8/5/2015	Moss	DSS3I	hylspl	3	26-50	Hylocomnium	splendens
8/5/2015	Moss	DSS3I	tomnit	2	6-25	Tomenthypnum	nitens
8/5/2015	Moss	DSS3I	ditfle	0.5	<1	Ditrichum	flexicaule
8/5/2015	Lichen	DSS3I	clagra	0.5	<1	Cladonia	gracilis
8/5/2015	Lichen	DSS3I	thaver	0.5	<1	Thamnolia	vermicularis
8/5/2015	Lichen	DSS3I	cetisl	0.5	<1	Cetraria	islandica
8/5/2015		DSS3I	Standing Dead	2	6-25	Standing Dead	
8/5/2015		DSS3I	Litter	2	6-25	Litter	
8/5/2015		DSS3I	Bare Soil	0	0	Bare Soil	
8/5/2015		DSS3I	Surface Rock	0	0	Surface Rock	
8/5/2015		DSS3I	Standing Water	0	0	Standing Water	
8/5/2015	Moss	DSS3I	discap	0.5	<1	Distichium	capillaceum
8/6/2015		DSS2A	No veg	0	0	No Vegetation	
8/6/2015	Deciduous Shrub	DSS2B	salala	1	1-5	Salix	alaxensis
8/6/2015	Forb	DSS2B	chalat	1	1-5	Chamerion	latifolium
8/6/2015		DSS2B	Standing Dead	0.5	<1	Standing Dead	
8/6/2015		DSS2B	Bare Soil	2	6-25	Bare Soil	
8/6/2015		DSS2B	Surface Rock	4	51-75	Surface Rock	
8/6/2015		DSS2B	Standing Water	0	0	Standing Water	
8/6/2015		DSS2B	Litter	0.5	<1	Litter	
8/6/2015	Deciduous Shrub	DSS2C	salala	1	1-5	Salix	alaxensis
8/6/2015	Forb	DSS2C	equarv	1	1-5	Equisetum	arvense
8/6/2015	Forb	DSS2C	chalat	0.5	<1	Chamerion	latifolium
8/6/2015	Forb	DSS2C	eursib	0.5	<1	Eurybia	sibirica
8/6/2015	Graminoid	DSS2C	arclat	0.5	<1	Arctagrostis	latifolia
8/6/2015	Graminoid	DSS2C	fesrub	0.5	<1	Festuca	rubra

Date	Functional Type 1	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)	Genus	Species
8/6/2015		DSS2C	Standing Dead	0.5	<1	Standing Dead	
8/6/2015		DSS2C	Litter	0.5	<1	Litter	
8/6/2015		DSS2C	Standing Water	0	0	Standing Water	
8/6/2015		DSS2C	Bare Soil	5	76-100	Bare Soil	
8/6/2015		DSS2C	Surface Rock	3	26-50	Surface Rock	
8/6/2015	Deciduous Shrub	DSS2D	salala	4	51-75	Salix	alaxensis
8/6/2015	Deciduous Shrub	DSS2D	salhas	0.5	<1	Salix	hastata
8/6/2015	Deciduous Shrub	DSS2D	salric	0.5	<1	Salix	richardsonii
8/6/2015	Graminoid	DSS2D	elyvio	0.5	<1	Elymus	violaceus
8/6/2015	Graminoid	DSS2D	fesrub	1	1-5	Festuca	rubra
8/6/2015	Graminoid	DSS2D	poapra	0.5	<1	Poa	pratensis
8/6/2015	Forb	DSS2D	eursib	1	1-5	Eurybia	sibirica
8/6/2015	Forb	DSS2D	parpal	0.5	<1	Parnassia	palustris
8/6/2015	Forb	DSS2D	equvar	3	26-50	Equisetum	variegatum
8/6/2015	Forb	DSS2D	hedalp	0.5	<1	Hedysarum	alpinum
8/6/2015	Forb	DSS2D	equarv	0.5	<1	Equisetum	arvense
8/6/2015	Deciduous Shrub	DSS2D	Salix sp	0.5	<1	Salix	sp.
8/6/2015	Forb	DSS2D	parkot	0.5	<1	Parnassia	kotzebuei
8/6/2015	Graminoid	DSS2D	poa	0.5	<1	Poa	sp.
8/6/2015	Forb	DSS2D	polviv	0.5	<1	Polygonum	viviparum
8/6/2015	Moss	DSS2D	unkmoss	0.5	<1	Unknown Moss	
8/6/2015		DSS2D	Standing Dead	0.5	<1	Standing Dead	
8/6/2015		DSS2D	Litter	2	6-25	Litter	
8/6/2015		DSS2D	Bare Soil	5	76-100	Bare Soil	
8/6/2015		DSS2D	Surface Rock	0	0	Surface Rock	
8/6/2015		DSS2D	Standing Water	0	0	Standing Water	
8/6/2015	Deciduous Shrub	DSS2E	salala	1	1-5	Salix	alaxensis
8/6/2015	Forb	DSS2E	chalat	0.5	<1	Chamerion	latifolium
8/6/2015	Forb	DSS2E	artarc	1	1-5	Artemisia	arctica
8/6/2015	Forb	DSS2E	hedmac	0.5	<1	Hedysarum	mackensii
8/6/2015	Forb	DSS2E	oxycam	0.5	<1	Oxytropis	campestris
8/6/2015	Forb	DSS2E	hedalp	0.5	<1	Hedysarum	alpinum
8/6/2015	Graminoid	DSS2E	elyvio	0.5	<1	Elymus	violaceus
8/6/2015	Graminoid	DSS2E	fesrub	0.5	<1	Festuca	rubra
8/6/2015		DSS2E	Standing Dead	0.5	<1	Standing Dead	
8/6/2015		DSS2E	Standing Water	0	0	Standing Water	
8/6/2015		DSS2E	Surface Rock	5	76-100	Surface Rock	
8/6/2015		DSS2E	Litter	0.5	<1	Litter	
8/6/2015		DSS2E	Bare Soil	0.5	<1	Bare Soil	
8/6/2015		DSS2F	No veg	0	0	No Vegetation	
8/6/2015	Evergreen Shrub	DSS2G	dryint	5	76-100	Dryas	integrifolia
8/6/2015	Deciduous Shrub	DSS2G	arcrub	2	6-25	Arctous	rubra
8/6/2015	Deciduous Shrub	DSS2G	salhas	0.5	<1	Salix	hastata
8/6/2015	Deciduous Shrub	DSS2G	salret	0.5	<1	Salix	reticulata
8/6/2015	Deciduous Shrub	DSS2G	salpul	0.5	<1	Salix	pulchra
8/6/2015	Graminoid	DSS2G	leymol	1	1-5	Leymus	mollis
8/6/2015	Graminoid	DSS2G	carcap	0.5	<1	Carex	capallaris
8/6/2015	Deciduous Shrub	DSS2G	salgla	1	1-5	Salix	glauca
8/6/2015	Forb	DSS2G	hedmac	1	1-5	Hedysarum	mackensii
8/6/2015	Forb	DSS2G	pedcap	0.5	<1	Pedicularis	capitata

Appendix B2: Vegetation Species and Abundance

Date	Functional Type 1	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)	Genus	Species
8/6/2015	Forb	DSS2G	oxytropis	0.5	<1	Oxytropis	sp.
8/6/2015	Forb	DSS2G	pedver	0.5	<1	Pedicularis	verticillata
8/6/2015	Forb	DSS2G	tofpus	0.5	<1	Tofieldia	pusilla
8/6/2015	Forb	DSS2G	oxyvis	0.5	<1	Oxytropis	viscida
8/6/2015	Moss	DSS2G	discap	1	1-5	Distichium	capillaceum
8/6/2015	Moss	DSS2G	unkmoss	0.5	<1	Unknown Moss	
8/6/2015	Moss	DSS2G	tomnit	0.5	<1	Tomenthypnum	nitens
8/6/2015	Moss	DSS2G	brachy	0.5	<1	Brachythecium	sp.
8/6/2015	Moss	DSS2G	camste	1	1-5	Campylium	stellatum
8/6/2015	Moss	DSS2G	Bryum	0.5	<1	Bryum	sp.
8/6/2015	Moss	DSS2G	calliergon	0.5	<1	Calliergon	sp.
8/6/2015	Moss	DSS2G	rhyrug	0.5	<1	Rhytidium	rugosum
8/6/2015	Moss	DSS2G	abiabi	1	1-5	Abietinella	abietina
8/6/2015		DSS2G	Standing Dead	1	1-5	Standing Dead	
8/6/2015		DSS2G	Litter	3	26-50	Litter	
8/6/2015		DSS2G	Bare Soil	3	26-50	Bare Soil	
8/6/2015		DSS2G	Surface Rock	0.5	<1	Surface Rock	
8/6/2015		DSS2G	Standing Water	0	0	Standing Water	
8/6/2015	Deciduous Shrub	DSS2H	arcrub	1	1-5	Arctous	rubra
8/6/2015	Deciduous Shrub	DSS2H	salric	0.5	<1	Salix	richardsonii
8/6/2015	Deciduous Shrub	DSS2H	salhas	3	26-50	Salix	hastata
8/6/2015	Deciduous Shrub	DSS2H	salala	3	26-50	Salix	alaxensis
8/6/2015	Deciduous Shrub	DSS2H	salret	0.5	<1	Salix	reticulata
8/6/2015	Forb	DSS2H	eursib	0.5	<1	Eurybia	sibirica
8/6/2015	Forb	DSS2H	parpal	0.5	<1	Parnassia	palustris
8/6/2015	Forb	DSS2H	equarv	3	26-50	Equisetum	arvense
8/6/2015	Forb	DSS2H	equvar	3	26-50	Equisetum	variegatum
8/6/2015	Forb	DSS2H	hedalp	0.5	<1	Hedysarum	alpinum
8/6/2015	Graminoid	DSS2H	trispi	0.5	<1	Trisetum	spicatum
8/6/2015	Graminoid	DSS2H	fesrub	0.5	<1	Festuca	rubra
8/6/2015	Moss	DSS2H	Hypnum	0.5	<1	Hypnum	sp.
8/6/2015	Moss	DSS2H	camste	3	26-50	Campylium	stellatum
8/6/2015	Moss	DSS2H	philonitis	1	1-5	Philonitis	sp.
8/6/2015	Moss	DSS2H	brachy	0.5	<1	Brachythecium	sp.
8/6/2015	Moss	DSS2H	unkmoss	0.5	<1	Unknown Moss	
8/6/2015	Moss	DSS2H	tomnit	0.5	<1	Tomenthypnum	nitens
8/6/2015	Moss	DSS2H	redstem	0.5	<1	Unknown Moss	
8/6/2015		DSS2H	Standing Dead	1	1-5	Standing Dead	
8/6/2015		DSS2H	Litter	4	51-75	Litter	
8/6/2015		DSS2H	Bare Soil	2	6-25	Bare Soil	
8/6/2015		DSS2H	Standing Water	0	0	Standing Water	
8/6/2015		DSS2H	Surface Rock	0	0	Surface Rock	
8/6/2015	Deciduous Shrub	DSS2I	salric	4	51-75	Salix	richardsonii
8/6/2015	Deciduous Shrub	DSS2I	salhas	2	6-25	Salix	hastata
8/6/2015	Deciduous Shrub	DSS2I	arcrub	1	1-5	Arctous	rubra
8/6/2015	Deciduous Shrub	DSS2I	salala	0.5	<1	Salix	alaxensis
8/6/2015	Deciduous Shrub	DSS2I	salgla	0.5	<1	Salix	glauca
8/6/2015	Graminoid	DSS2I	leymol	0.5	<1	Leymus	mollis
8/6/2015	Graminoid	DSS2I	fesrub	0.5	<1	Festuca	rubra
8/6/2015	Graminoid	DSS2I	carcon	0.5	<1	Carex	concinna

Date	Functional Type 1	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)	Genus	Species
8/6/2015	Forb	DSS2I	anepar	0.5	<1	Anemone	parviflora
8/6/2015	Forb	DSS2I	equarv	3	26-50	Equisetum	arvense
8/6/2015	Forb	DSS2I	equvar	1	1-5	Equisetum	variegatum
8/6/2015	Forb	DSS2I	parpal	0.5	<1	Parnassia	palustris
8/6/2015	Forb	DSS2I	senlug	0.01	<1	Senecio	lugens
8/6/2015	Forb	DSS2I	eursib	0.5	<1	Eurybia	sibirica
8/6/2015	Moss	DSS2I	camste	1	1-5	Campylium	stellatum
8/6/2015	Moss	DSS2I	redstem	0.5	<1	Unknown Moss	
8/6/2015	Moss	DSS2I	Bryum	0.5	<1	Bryum	sp.
8/6/2015	Moss	DSS2I	brachy	2	6-25	Brachythecium	sp.
8/6/2015	Moss	DSS2I	discap	0.5	<1	Distichium	capillaceum
8/6/2015		DSS2I	Standing Dead	2	6-25	Standing Dead	
8/6/2015		DSS2I	Litter	2	6-25	Litter	
8/6/2015		DSS2I	Bare Soil	5	76-100	Bare Soil	
8/6/2015		DSS2I	Surface Rock	0	0	Surface Rock	
8/6/2015		DSS2I	Standing Water	0	0	Standing Water	
8/7/2015	Deciduous Shrub	DSS1A	salric	2	6-25	Salix	richardsonii
8/7/2015	Deciduous Shrub	DSS1A	salarc	2	6-25	Salix	arctica
8/7/2015	Deciduous Shrub	DSS1A	salova	1	1-5	Salix	ovalifolia
8/7/2015	Graminoid	DSS1A	descae	2	6-25	Deschampsia	cespitosa
8/7/2015	Graminoid	DSS1A	caratr	0.5	<1	Carex	atrofusca
8/7/2015	Graminoid	DSS1A	eriang	0.5	<1	Eriophorum	angustifolium
8/7/2015	Graminoid	DSS1A	carcap	1	1-5	Carex	capallaris
8/7/2015	Graminoid	DSS1A	eriang	0.5	<1	Eriophorum	angustifolium
8/7/2015	Graminoid	DSS1A	arclat	0.5	<1	Arctagrostis	latifolia
8/7/2015	Forb	DSS1A	polviv	0.5	<1	Polygonum	viviparum
8/7/2015	Forb	DSS1A	pedsud	0.5	<1	Pedicularis	sudetica
8/7/2015	Forb	DSS1A	eursib	0.01	<1	Eurybia	sibirica
8/7/2015	Forb	DSS1A	saxopp	0.5	<1	Saxifraga	oppositifolia
8/7/2015	Graminoid	DSS1A	poaviv	0.5	<1	Poa	vivipara
8/7/2015	Graminoid	DSS1A	trispi	0.01	<1	Trisetum	spicatum
8/7/2015	Graminoid	DSS1A	fesrub	0.5	<1	Festuca	rubra
8/7/2015	Forb	DSS1A	artarc	0.01	<1	Artemisia	arctica
8/7/2015	Deciduous Shrub	DSS1A	salala	0.5	<1	Salix	alaxensis
8/7/2015	Deciduous Shrub	DSS1A	salret	0.5	<1	Salix	reticulata
8/7/2015		DSS1A	Standing Dead	1	1-5	Standing Dead	
8/7/2015		DSS1A	Standing Water	0	0	Standing Water	
8/7/2015		DSS1A	Bare Soil	5	76-100	Bare Soil	
8/7/2015		DSS1A	Litter	0.5	<1	Litter	
8/7/2015		DSS1A	Surface Rock	0	0	Surface Rock	
8/7/2015		DSS1B	No veg	0	0	No Vegetation	
8/7/2015	Deciduous Shrub	DSS1C	salala	0.5	<1	Salix	alaxensis
8/7/2015	Forb	DSS1C	artemisia	0.01	<1	sp.	
8/7/2015	Forb	DSS1C	chalat	2	6-25	Chamerion	latifolium
8/7/2015	Graminoid	DSS1C	arclat	0.5	<1	Arctagrostis	latifolia
8/7/2015	Forb	DSS1C	eursib	0.5	<1	Eurybia	sibirica
8/7/2015	Graminoid	DSS1C	descae	0.5	<1	Deschampsia	cespitosa
8/7/2015	Graminoid	DSS1C	fesrub	0.5	<1	Festuca	rubra
8/7/2015	Graminoid	DSS1C	elyvio	0.5	<1	Elymus	violaceus
8/7/2015	Graminoid	DSS1C	bropum	0.5	<1	Bromus	pumellianus

Date	Functional Type 1	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)	Genus	Species
8/7/2015	Forb	DSS1C	artarc	0.5	<1	Artemisia	arctica
8/7/2015	Forb	DSS1C	hedmac	0.5	<1	Hedysarum	mackensii
8/7/2015		DSS1C	Standing Dead	0.5	<1	Standing Dead	
8/7/2015		DSS1C	Litter	1	1-5	Litter	
8/7/2015		DSS1C	Bare Soil	5	76-100	Bare Soil	
8/7/2015		DSS1C	Standing Water	0	0	Standing Water	
8/7/2015		DSS1C	Surface Rock	1	1-5	Surface Rock	
8/7/2015	Forb	DSS1D	artbor	0.5	<1	Artemisia	borealis
8/7/2015	Forb	DSS1D	chalat	0.5	<1	Chamerion	latifolium
8/7/2015	Forb	DSS1D	artarc	0.5	<1	Artemisia	arctica
8/7/2015	Graminoid	DSS1D	elyvio	0.5	<1	Elymus	violaceus
8/7/2015	Graminoid	DSS1D	fesrub	0.5	<1	Festuca	rubra
8/7/2015	Forb	DSS1D	hedalp	0.5	<1	Hedysarum	alpinum
8/7/2015		DSS1D	Standing dead	0.5	<1	Standing Dead	
8/7/2015		DSS1D	Litter	0.5	<1	Litter	
8/7/2015		DSS1D	Standing Water	0	0	Standing Water	
8/7/2015		DSS1D	Bare Soil	4	51-75	Bare Soil	
8/7/2015		DSS1D	Surface Rock	4	51-75	Surface Rock	
8/7/2015	Deciduous Shrub	DSS1E	salala	1	1-5	Salix	alaxensis
8/7/2015	Deciduous Shrub	DSS1E	salova	2	6-25	Salix	ovalifolia
8/7/2015	Evergreen Shrub	DSS1E	dryint	0.5	<1	Dryas	integrifolia
8/7/2015	Graminoid	DSS1E	descae	0.5	<1	Deschampsia	cespitosa
8/7/2015	Graminoid	DSS1E	Calamagrostis	0.5	<1	Calamagrostis	sp.
8/7/2015	Graminoid	DSS1E	trispi	0.5	<1	Trisetum	spicatum
8/7/2015	Graminoid	DSS1E	arclat	0.5	<1	Arctagrostis	latifolia
8/7/2015	Graminoid	DSS1E	Bropum	1	1-5	Bromus	pumellianus
8/7/2015	Graminoid	DSS1E	fesrub	0.5	<1	Festuca	rubra
8/7/2015	Graminoid	DSS1E	kobmyo	0.5	<1	Kobresia	myosuroides
8/7/2015	Forb	DSS1E	polviv	0.5	<1	Polygonum	viviparum
8/7/2015	Forb	DSS1E	eursib	0.5	<1	Eurybia	sibirica
8/7/2015	Forb	DSS1E	equarv	0.5	<1	Equisetum	arvense
8/7/2015	Forb	DSS1E	equvar	1	1-5	Equisetum	variegatum
8/7/2015	Forb	DSS1E	oxyvis	2	6-25	Oxytropis	viscida
8/7/2015	Forb	DSS1E	genpro	0.5	<1	Gentianella	propinqua
8/7/2015	Forb	DSS1E	astalp	2	6-25	Astragalus	alpinus
8/7/2015	Forb	DSS1E	saxfla	0.5	<1	Saxifraga	flagellaris
8/7/2015	Forb	DSS1E	cascau	0.5	<1	Castilleja	caudata
8/7/2015	Forb	DSS1E	oxydef	0.01	<1	Oxytropis	deflecta
8/7/2015	Forb	DSS1E	hedmac	0.5	<1	Hedysarum	mackensii
8/7/2015	Forb	DSS1E	pedcap	0.5	<1	Pedicularis	capitata
8/7/2015	Graminoid	DSS1E	carcap	0.5	<1	Carex	capallaris
8/7/2015	Moss	DSS1E	unkmoss1	1	1-5	Unknown Moss 1	
8/7/2015	Moss	DSS1E	unkmoss2	1	1-5	Unknown Moss 2	
8/7/2015	Moss	DSS1E	redmoss	0.5	<1	Unknown Moss	
8/7/2015		DSS1E	Standing Dead	1	1-5	Standing Dead	
8/7/2015		DSS1E	Standing Water	0	0	Standing Water	
8/7/2015		DSS1E	Surface Rock	0.5	<1	Surface Rock	
8/7/2015		DSS1E	Litter	2	6-25	Litter	
8/7/2015		DSS1E	Bare Soil	3	26-50	Bare Soil	
8/7/2015	Deciduous Shrub	DSS1F	arcrub	0.5	<1	Arctous	rubra

Date	Functional Type 1	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)	Genus	Species
8/7/2015	Deciduous Shrub	DSS1F	salala	1	1-5	Salix	alaxensis
8/7/2015	Evergreen Shrub	DSS1F	dryint	2	6-25	Dryas	integrifolia
8/7/2015	Deciduous Shrub	DSS1F	salova	2	6-25	Salix	ovalifolia
8/7/2015	Graminoid	DSS1F	arclat	1	1-5	Arctagrostis	latifolia
8/7/2015	Graminoid	DSS1F	leymol	1	1-5	Leymus	mollis
8/7/2015	Graminoid	DSS1F	Bropum	1	1-5	Bromus	pumellianus
8/7/2015	Graminoid	DSS1F	kobmyo	0.5	<1	Kobresia	myosuroides
8/7/2015	Graminoid	DSS1F	fesrub	1	1-5	Festuca	rubra
8/7/2015	Forb	DSS1F	polviv	0.5	<1	Polygonum	viviparum
8/7/2015	Forb	DSS1F	eursib	0.5	<1	Eurybia	sibirica
8/7/2015	Forb	DSS1F	oxyvis	1	1-5	Oxytropis	viscida
8/7/2015	Forb	DSS1F	astalp	0.5	<1	Astragalus	alpinus
8/7/2015	Forb	DSS1F	saxfla	0.5	<1	Saxifraga	flagellaris
8/7/2015	Forb	DSS1F	hedmac	1	1-5	Hedysarum	mackensii
8/7/2015	Forb	DSS1F	equarv	0.5	<1	Equisetum	arvense
8/7/2015	Forb	DSS1F	equvar	0.5	<1	Equisetum	variegatum
8/7/2015	Forb	DSS1F	genpro	0.5	<1	Gentianella	propinqua
8/7/2015	Forb	DSS1F	oxydef	0.01	<1	Oxytropis	deflecta
8/7/2015	Forb	DSS1F	stelae	0.01	<1	Stellaria	laeta
8/7/2015	Forb	DSS1F	anepar	0.5	<1	Anemone	parviflora
8/7/2015	Graminoid	DSS1F	calstr	0.5	<1	Calamagrostis	stricta
8/7/2015	Moss	DSS1F	discap	1	1-5	Distichium	capillaceum
8/7/2015	Moss	DSS1F	Bryum	0.5	<1	Bryum	sp.
8/7/2015	Moss	DSS1F	unkmoss	0.5	<1	Unknown Moss	
8/7/2015	Forb	DSS1F	pedcap	0.5	<1	Pedicularis	capitata
8/7/2015	Graminoid	DSS1F	carmem	0.01	<1	Carex	membranacea
8/7/2015	Graminoid	DSS1F	trispi	0.5	<1	Trisetum	spicatum
8/7/2015	Graminoid	DSS1F	carcap	0.5	<1	Carex	capallaris
8/7/2015	Forb	DSS1F	aremar	0.5	<1	Armeria	maritima
8/7/2015		DSS1F	Standing Dead	2	6-25	Standing Dead	
8/7/2015		DSS1F	Standing Water	0	0	Standing Water	
8/7/2015		DSS1F	Bare Soil	3	26-50	Bare Soil	
8/7/2015		DSS1F	Surface Rock	0.5	<1	Surface Rock	
8/7/2015		DSS1F	Litter	2	6-25	Litter	
8/7/2015	Deciduous Shrub	DSS1G	salala	0.5	<1	Salix	alaxensis
8/7/2015	Deciduous Shrub	DSS1G	salova	0.5	<1	Salix	ovalifolia
8/7/2015	Graminoid	DSS1G	trispi	0.5	<1	Trisetum	spicatum
8/7/2015	Graminoid	DSS1G	arclat	0.5	<1	Arctagrostis	latifolia
8/7/2015	Graminoid	DSS1G	descae	1	1-5	Deschampsia	cespitosa
8/7/2015	Graminoid	DSS1G	fesrub	1	1-5	Festuca	rubra
8/7/2015	Graminoid	DSS1G	junarc	2	6-25	Juncus	arcticus
8/7/2015	Forb	DSS1G	chalat	0.5	<1	Chamerion	latifolium
8/7/2015	Forb	DSS1G	aremar	0.5	<1	Armeria	maritima
8/7/2015	Forb	DSS1G	artarc	0.5	<1	Artemisia	arctica
8/7/2015	Forb	DSS1G	eursib	0.5	<1	Eurybia	sibirica
8/7/2015	Graminoid	DSS1G	elyvio	0.5	<1	Elymus	violaceus
8/7/2015	Forb	DSS1G	artbor	0.5	<1	Artemisia	borealis
8/7/2015	Forb	DSS1G	parkot	0.01	<1	Parnassia	kotzebuei
8/7/2015	Forb	DSS1G	genpro	0.01	<1	Gentianella	propinqua
8/7/2015	Forb	DSS1G	equarv	0.5	<1	Equisetum	arvense

Date	Functional Type 1	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)	Genus	Species
8/7/2015		DSS1G	Standing dead	1	1-5	Standing Dead	
8/7/2015		DSS1G	litter	0.5	<1	Litter	
8/7/2015		DSS1G	Bare Soil	5	76-100	Bare Soil	
8/7/2015		DSS1G	Surface Rock	0	0	Surface Rock	
8/7/2015		DSS1G	Standing Water	0	0	Standing Water	
8/7/2015		DSS1H	No veg	0	0	No Vegetation	

Appendix B3: Vegation Cover by Functional Group

Date	Site	Disturbance	Funtional Type	Percent Cover Scale
8/4/2015	DSS4A	Low Disturbance	Moss	25
8/4/2015	DSS4A	Low Disturbance	Lichen	0
8/4/2015	DSS4A	Low Disturbance	Deciduous Shrub	30
8/4/2015	DSS4A	Low Disturbance	Evergreen Shrub	15
8/4/2015	DSS4A	Low Disturbance	Graminoid	35
8/4/2015	DSS4A	Low Disturbance	forb	1
8/4/2015	DSS4B	High Disturbance	Moss	0
8/4/2015	DSS4B	High Disturbance	Lichen	0
8/4/2015	DSS4B	High Disturbance	Evergreen Shrub	0
8/4/2015	DSS4B	High Disturbance	Deciduous Shrub	0
8/4/2015	DSS4B	High Disturbance	Graminoid	0
8/4/2015	DSS4B	High Disturbance	Forb	0
8/4/2015	DSS4C	High Disturbance	Moss	0
8/4/2015	DSS4C	High Disturbance	Lichen	0
8/4/2015	DSS4C	High Disturbance	Evergreen Shrub	0
8/4/2015	DSS4C	High Disturbance	Deciduous Shrub	0
8/4/2015	DSS4C	High Disturbance	Graminoid	0
8/4/2015	DSS4C	High Disturbance	Forb	0
8/4/2015	DSS4D	Low Disturbance	Moss	5
8/4/2015	DSS4D	Low Disturbance	Lichen	0
8/4/2015	DSS4D	Low Disturbance	Evergreen Shrub	0
8/4/2015	DSS4D	Low Disturbance	Deciduous Shrub	45
8/4/2015	DSS4D	Low Disturbance	Graminoid	15
8/4/2015	DSS4D	Low Disturbance	Forb	0.5
8/4/2015	DSS4E	High Disturbance	Moss	0
8/4/2015	DSS4E	High Disturbance	Lichen	0
8/4/2015	DSS4E	High Disturbance	Evergreen Shrub	0
8/4/2015	DSS4E	High Disturbance	Deciduous Shrub	5
8/4/2015	DSS4E	High Disturbance	Graminoid	0
8/4/2015	DSS4E	High Disturbance	Forb	0.5
8/4/2015	DSS4F	Low Disturbance	Lichen	0
8/4/2015	DSS4F	Low Disturbance	Moss	20
8/4/2015	DSS4F	Low Disturbance	Graminoid	25
8/4/2015	DSS4F	Low Disturbance	Deciduous Shrub	40
8/4/2015	DSS4F	Low Disturbance	Evergreen Shrub	0
8/4/2015	DSS4F	Low Disturbance	Forb	0.5
8/4/2015	DSS4G	High Disturbance	Moss	0
8/4/2015	DSS4G	High Disturbance	Lichen	0
8/4/2015	DSS4G	High Disturbance	Evergreen Shrub	0
8/4/2015	DSS4G	High Disturbance	Deciduous Shrub	0
8/4/2015	DSS4G	High Disturbance	Graminoid	0

Appendix B3: Vegation Cover by Functional Group

Date	Site	Disturbance	Funtional Type	Percent Cover Scale
8/4/2015	DSS4G	High Disturbance	Forb	0
8/4/2015	DSS4H	Low Disturbance	Moss	70
8/4/2015	DSS4H	Low Disturbance	Lichen	10
8/4/2015	DSS4H	Low Disturbance	Evergreen Shrub	10
8/4/2015	DSS4H	Low Disturbance	Deciduous Shrub	45
8/4/2015	DSS4H	Low Disturbance	Graminoid	5
8/4/2015	DSS4H	Low Disturbance	Forb	5
8/5/2015	DSS3A	Low Disturbance	Moss	30
8/5/2015	DSS3A	Low Disturbance	Graminoid	2
8/5/2015	DSS3A	Low Disturbance	Deciduous Shrub	80
8/5/2015	DSS3A	Low Disturbance	Evergreen Shrub	0
8/5/2015	DSS3A	Low Disturbance	Forb	15
8/5/2015	DSS3A	Low Disturbance	Lichen	0
8/5/2015	DSS3B	High Disturbance	Moss	0
8/5/2015	DSS3B	High Disturbance	Graminoid	0.5
8/5/2015	DSS3B	High Disturbance	Deciduous Shrub	0.5
8/5/2015	DSS3B	High Disturbance	Evergreen Shrub	0
8/5/2015	DSS3B	High Disturbance	Forb	1
8/5/2015	DSS3B	High Disturbance	Lichen	0
8/5/2015	DSS3C	Low Disturbance	Moss	65
8/5/2015	DSS3C	Low Disturbance	Lichen	0.5
8/5/2015	DSS3C	Low Disturbance	Evergreen Shrub	0
8/5/2015	DSS3C	Low Disturbance	Deciduous Shrub	70
8/5/2015	DSS3C	Low Disturbance	Graminoid	10
8/5/2015	DSS3C	Low Disturbance	Forb	3
8/5/2015	DSS3D	High Disturbance	Moss	0
8/5/2015	DSS3D	High Disturbance	Lichen	0
8/5/2015	DSS3D	High Disturbance	Evergreen Shrub	0
8/5/2015	DSS3D	High Disturbance	Deciduous Shrub	0
8/5/2015	DSS3D	High Disturbance	Graminoid	2
8/5/2015	DSS3D	High Disturbance	Forb	1
8/5/2015	DSS3E	Low Disturbance	Moss	65
8/5/2015	DSS3E	Low Disturbance	Lichen	0.5
8/5/2015	DSS3E	Low Disturbance	Evergreen Shrub	0
8/5/2015	DSS3E	Low Disturbance	Deciduous Shrub	55
8/5/2015	DSS3E	Low Disturbance	Graminoid	15
8/5/2015	DSS3E	Low Disturbance	Forb	2
8/5/2015	DSS3F	High Disturbance	Moss	0
8/5/2015	DSS3F	High Disturbance	Lichen	0
8/5/2015	DSS3F	High Disturbance	Evergreen Shrub	0
8/5/2015	DSS3F	High Disturbance	Deciduous Shrub	1

Appendix B3: Vegation Cover by Functional Group

Date	Site	Disturbance	Funtional Type	Percent Cover Scale
8/5/2015	DSS3F	High Disturbance	Graminoid	1
8/5/2015	DSS3F	High Disturbance	Forb	1
8/5/2015	DSS3G	High Disturbance	Moss	0
8/5/2015	DSS3G	High Disturbance	Lichen	0
8/5/2015	DSS3G	High Disturbance	Evergreen Shrub	0
8/5/2015	DSS3G	High Disturbance	Deciduous Shrub	30
8/5/2015	DSS3G	High Disturbance	Graminoid	1
8/5/2015	DSS3G	High Disturbance	Forb	1
8/5/2015	DSS3H	High Disturbance	Moss	0
8/5/2015	DSS3H	High Disturbance	Lichen	0
8/5/2015	DSS3H	High Disturbance	Evergreen Shrub	0
8/5/2015	DSS3H	High Disturbance	Deciduous Shrub	25
8/5/2015	DSS3H	High Disturbance	Graminoid	1
8/5/2015	DSS3H	High Disturbance	Forb	1
8/5/2015	DSS3I	Low Disturbance	Moss	50
8/5/2015	DSS3I	Low Disturbance	Lichen	2
8/5/2015	DSS3I	Low Disturbance	Evergreen Shrub	2
8/5/2015	DSS3I	Low Disturbance	Deciduous Shrub	60
8/5/2015	DSS3I	Low Disturbance	Graminoid	10
8/5/2015	DSS3I	Low Disturbance	Forb	2
8/6/2015	DSS2A	High Disturbance	Moss	0
8/6/2015	DSS2A	High Disturbance	Lichen	0
8/6/2015	DSS2A	High Disturbance	Evergreen Shrub	0
8/6/2015	DSS2A	High Disturbance	Deciduous Shrub	0
8/6/2015	DSS2A	High Disturbance	Graminoid	0
8/6/2015	DSS2A	High Disturbance	Forb	0
8/6/2015	DSS2B	High Disturbance	Moss	0
8/6/2015	DSS2B	High Disturbance	Lichen	0
8/6/2015	DSS2B	High Disturbance	Evergreen Shrub	0
8/6/2015	DSS2B	High Disturbance	Deciduous Shrub	5
8/6/2015	DSS2B	High Disturbance	Graminoid	0
8/6/2015	DSS2B	High Disturbance	Forb	1
8/6/2015	DSS2C	High Disturbance	Moss	0
8/6/2015	DSS2C	High Disturbance	Lichen	0
8/6/2015	DSS2C	High Disturbance	Evergreen Shrub	0
8/6/2015	DSS2C	High Disturbance	Deciduous Shrub	5
8/6/2015	DSS2C	High Disturbance	Graminoid	0.5
8/6/2015	DSS2C	High Disturbance	Forb	3
8/6/2015	DSS2D	Low Disturbance	Moss	0.5
8/6/2015	DSS2D	Low Disturbance	Lichen	0
8/6/2015	DSS2D	Low Disturbance	Evergreen Shrub	0

Appendix B3: Vegation Cover by Functional Group

Date	Site	Disturbance	Funtional Type	Percent Cover Scale
8/6/2015	DSS2D	Low Disturbance	Deciduous Shrub	50
8/6/2015	DSS2D	Low Disturbance	Graminoid	1
8/6/2015	DSS2D	Low Disturbance	Forb	30
8/6/2015	DSS2E	High Disturbance	Moss	0
8/6/2015	DSS2E	High Disturbance	Lichen	0
8/6/2015	DSS2E	High Disturbance	Evergreen Shrub	0
8/6/2015	DSS2E	High Disturbance	Deciduous Shrub	1
8/6/2015	DSS2E	High Disturbance	Graminoid	0.5
8/6/2015	DSS2E	High Disturbance	Forb	3
8/6/2015	DSS2F	High Disturbance	Moss	0
8/6/2015	DSS2F	High Disturbance	Lichen	0
8/6/2015	DSS2F	High Disturbance	Evergreen Shrub	0
8/6/2015	DSS2F	High Disturbance	Deciduous Shrub	0
8/6/2015	DSS2F	High Disturbance	Graminoid	0
8/6/2015	DSS2F	High Disturbance	Forb	0
8/6/2015	DSS2G	Low Disturbance	Moss	15
8/6/2015	DSS2G	Low Disturbance	Lichen	0
8/6/2015	DSS2G	Low Disturbance	Evergreen Shrub	0
8/6/2015	DSS2G	Low Disturbance	Deciduous Shrub	75
8/6/2015	DSS2G	Low Disturbance	Graminoid	5
8/6/2015	DSS2G	Low Disturbance	Forb	5
8/6/2015	DSS2H	Low Disturbance	Moss	35
8/6/2015	DSS2H	Low Disturbance	Lichen	0
8/6/2015	DSS2H	Low Disturbance	Evergreen Shrub	0
8/6/2015	DSS2H	Low Disturbance	Deciduous Shrub	60
8/6/2015	DSS2H	Low Disturbance	Graminoid	0.5
8/6/2015	DSS2H	Low Disturbance	Forb	45
8/6/2015	DSS2I	Low Disturbance	Moss	20
8/6/2015	DSS2I	Low Disturbance	Lichen	0
8/6/2015	DSS2I	Low Disturbance	Evergreen Shrub	0
8/6/2015	DSS2I	Low Disturbance	Deciduous Shrub	65
8/6/2015	DSS2I	Low Disturbance	Graminoid	1
8/6/2015	DSS2I	Low Disturbance	Forb	40
8/7/2015	DSS1A	Low Disturbance	Moss	0
8/7/2015	DSS1A	Low Disturbance	Lichen	0
8/7/2015	DSS1A	Low Disturbance	Evergreen Shrub	0.5
8/7/2015	DSS1A	Low Disturbance	Deciduous Shrub	45
8/7/2015	DSS1A	Low Disturbance	Graminoid	35
8/7/2015	DSS1A	Low Disturbance	Forb	1
8/7/2015	DSS1B	High Disturbance	Moss	0
8/7/2015	DSS1B	High Disturbance	Lichen	0

Appendix B3: Vegation Cover by Functional Group

Date	Site	Disturbance	Funtional Type	Percent Cover Scale
8/7/2015	DSS1B	High Disturbance	Evergreen Shrub	0
8/7/2015	DSS1B	High Disturbance	Deciduous Shrub	0
8/7/2015	DSS1B	High Disturbance	Graminoid	0
8/7/2015	DSS1B	High Disturbance	Forb	0
8/7/2015	DSS1C	High Disturbance	Moss	0
8/7/2015	DSS1C	High Disturbance	Lichen	0
8/7/2015	DSS1C	High Disturbance	Evergreen Shrub	0
8/7/2015	DSS1C	High Disturbance	Deciduous Shrub	0.5
8/7/2015	DSS1C	High Disturbance	Graminoid	2
8/7/2015	DSS1C	High Disturbance	Forb	10
8/7/2015	DSS1D	High Disturbance	Moss	0
8/7/2015	DSS1D	High Disturbance	Lichen	0
8/7/2015	DSS1D	High Disturbance	Evergreen Shrub	0
8/7/2015	DSS1D	High Disturbance	Deciduous Shrub	0
8/7/2015	DSS1D	High Disturbance	Graminoid	0.5
8/7/2015	DSS1D	High Disturbance	Forb	1
8/7/2015	DSS1E	Low Disturbance	Moss	10
8/7/2015	DSS1E	Low Disturbance	Lichen	0
8/7/2015	DSS1E	Low Disturbance	Evergreen Shrub	0
8/7/2015	DSS1E	Low Disturbance	Deciduous Shrub	10
8/7/2015	DSS1E	Low Disturbance	Graminoid	5
8/7/2015	DSS1E	Low Disturbance	Forb	25
8/7/2015	DSS1F	Low Disturbance	Moss	5
8/7/2015	DSS1F	Low Disturbance	Lichen	0
8/7/2015	DSS1F	Low Disturbance	Evergreen Shrub	0
8/7/2015	DSS1F	Low Disturbance	Deciduous Shrub	20
8/7/2015	DSS1F	Low Disturbance	Graminoid	15
8/7/2015	DSS1F	Low Disturbance	Forb	25
8/7/2015	DSS1G	High Disturbance	Moss	0
8/7/2015	DSS1G	High Disturbance	Lichen	0
8/7/2015	DSS1G	High Disturbance	Evergreen Shrub	0
8/7/2015	DSS1G	High Disturbance	Deciduous Shrub	1
8/7/2015	DSS1G	High Disturbance	Graminoid	10
8/7/2015	DSS1G	High Disturbance	Forb	0.5
8/7/2015	DSS1H	High Disturbance	Moss	0
8/7/2015	DSS1H	High Disturbance	Lichen	0
8/7/2015	DSS1H	High Disturbance	Evergreen Shrub	0
8/7/2015	DSS1H	High Disturbance	Deciduous Shrub	0
8/7/2015	DSS1H	High Disturbance	Graminoid	0
8/7/2015	DSS1H	High Disturbance	Forb	0

Appendix B4: Surface Cover

Date	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)
8/4/2015	DSS4A	litter	3	26-50
8/4/2015	DSS4A	Bare Soil	0	0
8/4/2015	DSS4A	Standing Dead	3	26-50
8/4/2015	DSS4A	Standing Water	0.5	<1
8/4/2015	DSS4B	No veg	0	0
8/4/2015	DSS4C	No veg	0	0
8/4/2015	DSS4D	Bare Soil	2	6-25
8/4/2015	DSS4D	Standing Water	0	0
8/4/2015	DSS4D	litter	3	26-50
8/4/2015	DSS4D	Surface Rock	0.5	<1
8/4/2015	DSS4E	litter	1	1-5
8/4/2015	DSS4E	Standing Dead		0
8/4/2015	DSS4E	Bare Soil	2	6-25
8/4/2015	DSS4E	Surface Rock	4	51-75
8/4/2015	DSS4F	Litter	3	26-50
8/4/2015	DSS4F	Standing Dead	2	6-25
8/4/2015	DSS4F	Bare Soil	2	6-25
8/4/2015	DSS4F	Standing Water	0	0
8/4/2015	DSS4F	Surface Rock	0.5	<1
8/4/2015	DSS4G	No veg	0	0
8/4/2015	DSS4H	litter	2	6-25
8/4/2015	DSS4H	Standing Dead	0.5	<1
8/4/2015	DSS4H	Standing Water	0	0
8/4/2015	DSS4H	Bare Soil	0	0
8/4/2015	DSS4H	Surface Rock	0	0
8/5/2015	DSS3A	litter	2	6-25
8/5/2015	DSS3A	Standing Dead	0.5	<1
8/5/2015	DSS3A	Standing Water	0	0
8/5/2015	DSS3A	Bare Soil	0	0
8/5/2015	DSS3A	Surface Rock	0	0
8/5/2015	DSS3B	Standing Dead	0.5	<1
8/5/2015	DSS3B	Bare Soil	3	26-50
8/5/2015	DSS3B	Standing Water	0	0
8/5/2015	DSS3B	Litter	0.5	<1
8/5/2015	DSS3B	Surface Rock	2	6-25
8/5/2015	DSS3C	Standing Dead	2	6-25
8/5/2015	DSS3C	Litter	1	1-5
8/5/2015	DSS3C	Standing Water	0	0
8/5/2015	DSS3C	Bare Soil	0	0
8/5/2015	DSS3C	Surface Rock	0	0
8/5/2015	DSS3D	Standing Dead	1	1-5

Appendix B4: Surface Cover

Date	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)
8/5/2015	DSS3D	Litter	1	1-5
8/5/2015	DSS3D	Bare Soil	1	1-5
8/5/2015	DSS3D	Surface Rock	5	76-100
8/5/2015	DSS3D	Standing Water	0	0
8/5/2015	DSS3E	Standing Dead	2	6-25
8/5/2015	DSS3E	Standing Water	0	0
8/5/2015	DSS3E	Bare Soil	0	0
8/5/2015	DSS3E	Surface Rock	0	0
8/5/2015	DSS3E	Litter	2	6-25
8/5/2015	DSS3F	Standing Dead	0.5	<1
8/5/2015	DSS3F	Bare Soil	0.5	<1
8/5/2015	DSS3F	Surface Rock	5	76-100
8/5/2015	DSS3F	Standing Water	0	0
8/5/2015	DSS3F	Litter	0.5	<1
8/5/2015	DSS3G	Bare Soil	3	26-50
8/5/2015	DSS3G	Standing Water	0	0
8/5/2015	DSS3G	Standing Dead	0.5	<1
8/5/2015	DSS3G	Litter	2	6-25
8/5/2015	DSS3G	Surface Rock	3	26-50
8/5/2015	DSS3H	Bare Soil	4	51-75
8/5/2015	DSS3H	Standing Dead	0.5	<1
8/5/2015	DSS3H	Standing Water	0	0
8/5/2015	DSS3H	Litter	1	1-5
8/5/2015	DSS3H	Surface Rock	1	1-5
8/5/2015	DSS3I	Standing Dead	2	6-25
8/5/2015	DSS3I	Litter	2	6-25
8/5/2015	DSS3I	Bare Soil	0	0
8/5/2015	DSS3I	Surface Rock	0	0
8/5/2015	DSS3I	Standing Water	0	0
8/6/2015	DSS2A	No veg	0	0
8/6/2015	DSS2B	Standing Dead	0.5	<1
8/6/2015	DSS2B	Bare Soil	2	6-25
8/6/2015	DSS2B	Surface Rock	4	51-75
8/6/2015	DSS2B	Litter	0.5	<1
8/6/2015	DSS2C	Standing Dead	0.5	<1
8/6/2015	DSS2C	Litter	0.5	<1
8/6/2015	DSS2C	Standing Water	0	0
8/6/2015	DSS2C	Bare Soil	5	76-100
8/6/2015	DSS2C	Surface Rock	3	26-50
8/6/2015	DSS2D	Standing Dead	0.5	<1
8/6/2015	DSS2D	Litter	2	6-25

Appendix B4: Surface Cover

Date	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)
8/6/2015	DSS2D	Bare Soil	5	76-100
8/6/2015	DSS2D	Surface Rock	0	0
8/6/2015	DSS2D	Standing Water	0	0
8/6/2015	DSS2E	Standing Dead	0.5	<1
8/6/2015	DSS2E	Standing Water	0	0
8/6/2015	DSS2E	Surface Rock	5	76-100
8/6/2015	DSS2E	Litter	0.5	<1
8/6/2015	DSS2E	Bare Soil	0.5	<1
8/6/2015	DSS2F	No veg	0	0
8/6/2015	DSS2G	Standing Dead	1	1-5
8/6/2015	DSS2G	Litter	3	26-50
8/6/2015	DSS2G	Bare Soil	3	26-50
8/6/2015	DSS2G	Surface Rock	0.5	<1
8/6/2015	DSS2G	Standing Water	0	0
8/6/2015	DSS2H	Standing Dead	1	1-5
8/6/2015	DSS2H	Litter	4	51-75
8/6/2015	DSS2H	Bare Soil	2	6-25
8/6/2015	DSS2H	Standing Water	0	0
8/6/2015	DSS2H	Surface Rock	0	0
8/6/2015	DSS2I	Standing Dead	2	6-25
8/6/2015	DSS2I	Litter	2	6-25
8/6/2015	DSS2I	Bare Soil	5	76-100
8/6/2015	DSS2I	Surface Rock	0	0
8/6/2015	DSS2I	Standing Water	0	0
8/7/2015	DSS1A	Standing Dead	1	1-5
8/7/2015	DSS1A	Standing Water	0	0
8/7/2015	DSS1A	Bare Soil	5	76-100
8/7/2015	DSS1A	Litter	0.5	<1
8/7/2015	DSS1A	Surface Rock	0	0
8/7/2015	DSS1B	No veg	0	0
8/7/2015	DSS1C	Standing Dead	0.5	<1
8/7/2015	DSS1C	Litter	1	1-5
8/7/2015	DSS1C	Bare Soil	5	76-100
8/7/2015	DSS1C	Standing Water	0	0
8/7/2015	DSS1C	Surface Rock	1	1-5
8/7/2015	DSS1D	Standing dead	0.5	<1
8/7/2015	DSS1D	Litter	0.5	<1
8/7/2015	DSS1D	Standing Water	0	0
8/7/2015	DSS1D	Bare Soil	4	51-75
8/7/2015	DSS1D	Surface Rock	4	51-75
8/7/2015	DSS1E	Standing Dead	1	1-5

Appendix B4: Surface Cover

Date	Unique Name	Species	Cover (Cover Class 1-5)	Percent Cover (%)
8/7/2015	DSS1E	Standing Water	0	0
8/7/2015	DSS1E	Surface Rock	0.5	<1
8/7/2015	DSS1E	Litter	2	6-25
8/7/2015	DSS1E	Bare Soil	3	26-50
8/7/2015	DSS1F	Standing Dead	2	6-25
8/7/2015	DSS1F	Standing Water	0	0
8/7/2015	DSS1F	Bare Soil	3	26-50
8/7/2015	DSS1F	Surface Rock	0.5	<1
8/7/2015	DSS1F	Litter	2	6-25
8/7/2015	DSS1G	Standing dead	1	1-5
8/7/2015	DSS1G	litter	0.5	<1
8/7/2015	DSS1G	Bare Soil	5	76-100
8/7/2015	DSS1G	Surface Rock	0	0
8/7/2015	DSS1G	Standing Water	0	0
8/7/2015	DSS1H	No veg	0	0

Appendix B5: Total Species List

	Species	No. of Occurences
High Disturbance	*Arctagrostis latifolia ?*	3
	Armeria maritima	1
	Artemisia arctica	4
	Artemisia borealis	2
	Astragalus alpinus	1
	Calamagrostis lapponica	1
	Calamagrostis sp.	1
	Chamerion angustifolium	1
	Chamerion latifolium	11
	Crepis nana	1
	Deschampsia cespitosa	2
	Elymus violaceus	8
	Equisetum arvense	2
	Eurybia sibirica	8
	Festuca rubra sl	1
	Festuca rubra ssp. arctica	9
	Festuca rubra ssp. aucta cf	2
	Gentianella propinqua	1
	Hedysarum alpinum	8
	Hedysarum mackensii	2
	Juncus arcticus	1
	Leymus mollis	3
	Oxytropis campestris	1
	Parnassia kotzebuei	1
	Salix alaxensis	11
	Salix ovalifolia	1
	Sheperdia canadensis	1
	Trisetum spicatum	2

Low Disturbance	*Abietinella abietina*	6
	Andromeda polifolia	2
	Anemone parviflora	8
	Arctagrostis latifolia ?	3
	Arctous rubra	10
	Armeria maritima	1
	Artemisia arctica	1
	Astragalus sp.	1

Astragalus umbellatus	1
Aulacomnium acuminatum	1
Betula glandulosa	1
Bromus pumellianus ssp. pumpellianus	1
Bryum sp.	3
Calamagrostis sp.	1
Calamagrostis stricta ssp. stricta	3
Calliergon sp.	3
Campylium stellatum	6
Cardamine hyperborea	1
Carex atrofusca	2
Carex capallaris	7
Carex concinna	5
Carex saxatalis	1
Carex scirpoidea	1
Carex membranacea	2
Cassiope tetragona	1
Castilleja caudata	2
Cetraria islandica	2
Cladonia gracilis	1
Cladonia sp.	1
Dactylina arctica	2
Dasiphora fruticosa	2
Deschampsia cespitosa	2
Distichium capillaceum	7
Ditrichum flexicaule	3
Drepanocladus sp.	1
Dryas integrifolia	8
Elymus violaceus	3
Empetrum nigrum	2
Equisetum arvense	8
Equisetum variegatum	9
Eriophorum angustifolium	3
Eurybia sibirica	8
Festuca altaica	5
Festuca rubra sl	2
Festuca rubra ssp. arctica	7
Flavocetraria cucullata	3
Flavocetraria nivalis	2
Gentianella propinqua	5

Hedysarum alpinum	7
Hedysarum mackensii	3
Hylocomnium splendens	4
Hypnum sp.	1
Kobresia myosuroides	2
Leymus mollis	8
Lupinus arcticus	1
Masonhalea richardsonii	1
Oxytropis arctica	1
Oxytropis campestris	1
Oxytropis deflecta	2
Oxytropis sp.	1
Oxytropis viscida	1
Oxytropis campestris	1
Paludella sp.	1
Parnassia kotzebuei	1
Parnassia palustris	8
Pedicularis capitata	6
Pedicularis kanei	2
Pedicularis sudetica	3
Pedicularis verticillata	2
Peltigera leucophlebia	1
Peltigera malacea	1
Philonitis sp.	1
Pleurozium schreberi	1
Poa sp.	1
Poa vivipara	1
Poa pratensis ssp. alpigena	1
Polygonum viviparum	8
Pyrola asarifolia	1
Rhododendron lapponicum	3
Rhytidium rugosum	5
Rubus arcticus	2
Salix alaxensis	10
Salix fuscescens	1
Salix glauca	8
Salix hastata	7
Salix pulchra	3
Salix reticulata	2
Salix richardsonii	10

Salix sp.	1
Salix arctica	1
Salix ovalifolia	3
Salix reticulata	5
Sanionia uncinata	3
Saxifraga flagellaris	3
Saxifraga oppositifolia	1
Scorpidium sp.	2
Senecio lugens	7
Sheperdia canadensis	4
Stellaria laeta	1
Stereocaulon sp.	1
Thamnolia vermicularis	2
Tofieldia pusilla	7
Tomenthypnum nitens	9
Trisetum spicatum	5
Unknown Liverwort	2
Unknown Moss	8
Unknown Moss 1	2
Unknown Moss 2	1
Vaccinium uliginosum	4
Zigadenus elegans	4

Appendix B6: Location of Substrate/Vegetation Sites

Site	Latitude	Longitude	GPS elevation (m, WGS84)
DSS4A	68.95882398	-148.859835	379.3
DSS4B	68.95876103	-148.858633	376.8
DSS4C	68.96018403	-148.853857	373.1
DSS4D	68.95930401	-148.854684	374.4
DSS4E	68.95846599	-148.856863	372.0
DSS4F	68.958597	-148.852744	372.7
DSS4G	68.95825602	-148.852901	370.7
DSS3A	69.14807302	-148.825791	295.3
DSS3B	69.146215	-148.82348	299.8
DSS3C	69.145754	-148.820481	291.7
DSS3D	69.14621098	-148.818063	294.2
DSS3E	69.14680601	-148.8137	294.3
DSS3F	69.15010404	-148.804197	292.5
DSS3G	69.14696602	-148.809617	294.0
DSS3H	69.14625297	-148.815016	294.5
DSS3I	69.14606304	-148.810198	293.6
DSS2A	69.59380402	-148.621226	135.7
DSS2B	69.59462604	-148.620756	134.8
DSS2C	69.59757303	-148.611289	134.4
DSS2D	69.59663803	-148.606829	136.0
DSS2E	69.59672403	-148.598069	134.2
DSS2F	69.59722702	-148.595238	143.7
DSS2G	69.59598097	-148.590556	137.3
DSS2H	69.59669704	-148.590845	134.9
DSS2I	69.59888496	-148.605524	139.8
DSS1A	70.09887001	-148.509551	22.3
DSS1B	70.09791397	-148.5057	25.7
DSS1C	70.09734903	-148.504349	23.0
DSS1D	70.09698903	-148.500925	21.1
DSS1F	70.09224898	-148.493605	23.3
DSS1G	70.09621203	-148.500073	28.1

UAF
UNIVERSITY OF
ALASKA
FAIRBANKS