APPENDIX G: Baseline Aquatic Survey and Assessment of Streams

Baseline Aquatic Survey and Assessment of Streams in the Tintina Black Butte Copper Project Area of Meagher County, MT

Prepared for:

TIntina Resources, Inc.
P.O. Box 431
White Sulphur Springs, Montana 59645

Sheep Creek AQ3 upstream of Little Sheep Creek

Prepared by:

David Stagliano, Aquatic Ecologist
Morrison Maierle, Inc.
Helena, Montana

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MORRISON MAIERLE, INC.
ENGINEERS · SURVEYORS · PLANNERS · SCIENTISTS

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All photos in the report were taken by MMI personnel, unless otherwise noted

Executive Summary

The first year of seasonal baseline surveys for the assessment of fish, mussels, macroinvertebrates, periphyton and habitat evaluation at sites in the Tintina Black Butte Copper Project and Sheep Creek drainage basin areas have been completed using Tenderfoot Creek as a reference reach. Project goals were: 1) to conduct standardized surveys and collect baseline information on the aquatic communities present at stream sites coincident with established surface water-quality monitoring sites prior to mine development, and 2) to assess aquatic community integrity with key indicators comparing these against biotic thresholds of reference condition standards. These 2014 and 2015 data represent the first year of multi-year, seasonal, reach-scale baseline conditions to be documented prior to proposed mine activity (i.e. pre-impact).

Habitat assessments, and macroinvertebrate, mussel, periphyton and fish surveys were performed on similar dates along the same stream reaches of Sheep, Little Sheep and Tenderfoot Creeks both in 2014 and 2015. Maps of baseline aquatic survey sampling sites are presented as Map 1 and Map 2 for the Sheep Creek and Tenderfoot drainages, respectively. These surveys used a Before, After, Control and Impact (BACI) sampling design with Before, After, and Control sample sites both at upstream and at off-site reference locations; and Impact sample sites both within and downstream of proposed mine activity. Coon Creek, another potential Impact site was sampled for fish in 2014 and macroinvertebrates in 2015. In total, nine stream reaches were sampled with 19 fish sampling events; and nine macroinvertebrate and eight periphyton samples were collected at established water quality sampling sites during the survey visits. All stream reaches were visually inspected for mussels and amphibians during the surveys. Biological community integrity was calculated for nine survey reaches and19 fish surveys using Fish Integrated Biotic Indices (IBI's) and Observed/Expected Models (O/E), while the nine macroinvertebrate and eight periphyton samples were assessed with Montana DEQ's (MTDEQ) multi-metric indices (MMI).

Habitat / Water Quality Evaluations. It is important to document existing water quality, baseline aquatic community surveys, and stream habitat conditions in the study area prior to any actual mine development. Water quality sampling has been conducted quarterly at four aquatic community (AQ) sites by Hydrometrics, Inc. over a four year period beginning in the spring of 2011. Stream habitat morphology is dominated by riffle and runs at all sites, with Sheep Creek averaging 85%, Coon Creek 100%, Little Sheep 73% and Tenderfoot Creek 75% of the total stream reaches. Of the nine sampling reaches evaluated in the study area, five were found in Proper Functioning Condition (PFC) with a stable trend, and four were deemed Functional at Risk (FAR). Sites were ranked FAR either because they had riparian habitat altered by cattle (Little Sheep AQ8, Sheep Creek AQ2, Tenderfoot AQ5) or by human stream manipulation (Sheep Creek AQ1 and AQ2). Highest site integrity scores using both the BLM Habitat and Proper Functioning Condition (PFC) Assessment methods were recorded at Sheep Creek upper (AQ3) and lower (AQ4) reaches and Tenderfoot Creek (AQ6). It is important to note that the riparian habitat of the lower reference reach on Tenderfoot Creek (AQ5) is moderately degraded.

Fish Communities. Overall, seven fish species and one hybrid (four native / four introduced) were identified from 3,862 individuals collected during 19 stream reach surveys. Average number of fish species per site across the study area was 3.6 with a standard error of ± 0.6, while the average number of native species averaged 1.5 with a standard error of ± 0.4. Rocky mountain sculpin comprised the highest proportion of total individuals collected at 72% and had 100% site occupancy (n=8), and at the other

extreme, Coon Creek, was determined to be fishless. Other native species, mountain whitefish, longnose dace and white sucker had site occupancy rates of 38%, 13% and 13%, respectively. The most diverse fish site in the study area was Sheep Creek (AQ3) with seven species, four (4) of them native. No fish species of concern (SOC) were identified during any of the surveys. Rainbow trout were collected at 7 of the 8 sites, while brook trout were reported at four sites (both Little Sheep Creek and Sheep Creek AQ2 and AQ3). Densities of rainbow trout reported during fall 2014 Sheep Creek (AQ1) (avg. 1,968 per mile) were most similar to the reference reach, Tenderfoot Creek (avg. 1,075 per mile). Seasonal salmonid densities at all sites varied significantly. Significant length/weight relationships and size-frequency tables were developed for sculpin, rainbow, brook and brown trout as baseline population indicators. Large resident brown trout (300-500mm) were prevalent in the Sheep Creek meadow reaches (AQ3 and AQ4), while smaller brown trout used the lower sections of Little Sheep Creek (AQ7).

Mussel Surveys. The western pearlshell mussel (WEPE), a Montana species of concern (SOC), has been documented in the Smith River basin, but no surveys had been performed specifically within the project area. Therefore, WEPE were searched for in all stream reaches (~1 man-hour per 300m reach) with aqua-scopes using a longitudinal transect survey technique covering all stream geomorphic units. No evidence of pearlshell mussel presence (live or dead shells) was reported during the surveys in Sheep, Little Sheep or Tenderfoot Creeks. In addition, no shell fragments were found which may have indicated earlier historical populations.

Macroinvertebrate Communities. Overall, 112 unique macroinvertebrate taxa were reported from the eight macroinvertebrate assessment samples collected in 2014 and the one sample collected in 2015. No Montana SOC invertebrates were collected, but the macroinvertebrate community at Sheep Creek AQ4 site had very high biological integrity that resembled the integrity of the reference Mountain Stream (Tenderfoot Creek). Sheep Creek AQ4 also reported the highest taxa richness (60 spp.) and the highest number of combined mayfly, caddisfly and stonefly taxa (EPT) at 19 species. The EPT Index uses these orders of aquatic insects because they are easily identified to species and commonly used as indicators of water quality. Tenderfoot Creek reported the highest integrity scores ranked by the DEQ multi-metric macroinvertebrate (MMI) protocols (avg. 70), while Sheep Creek sites averaged 61.4, which was significantly lower, and ranked slightly impaired by DEQ thresholds. Average macroinvertebrate richness across all sites was 44.7 taxa, while EPT taxa averaged 15 per site. Both Little Sheep Creek sites were ranked impaired by the MDEQ Mountain MMI with scores <63, but ranked unimpaired with the Low Valley MMI with scores >48. The MDEQ MMI ranked upstream and downstream reaches of the Sheep Creek treatment sites similarly.

Periphyton Communities. Overall, 146 unique diatom and algae taxa were reported from the eight periphyton assessment samples collected in 2014. No periphyton species are listed as SOC in the state. Diatoms were the most dominant taxa in six of eight study sites. Sheep Creek AQ3 reported the highest taxa richness (71 spp.), while the average richness per site was 57 taxa. Based on Teply's Diatom Index (TDI), lower site Sheep Creek AQ1 had the highest probability (61.4%) of impairment. Based on the TDI, other Sheep and Little Sheep Creek sites had less than a 33% chance of being impaired. Sites that the TDI ranked least likely to be impaired (<17%) were both of the Tenderfoot Creek reference sites.

Amphibian and Reptile Incidentals. One amphibian species, the Columbian Spotted Frog (*Rana columbiana*) was incidentally recorded at Sheep Creek AQ4. This was the only amphibian species, along with a terrestrial garter snake (*Thamnophis elegans*) observed or collected in conjunction with the aquatic assessment surveys. A MT SOC amphibian species, the western toad (*Anaxyrus boreas*), had been previously recorded near Sheep Creek AQ2 site, but was not observed during our surveys.

Conclusions. Aquatic communities surveyed in 2014 and 2015 were similar between Sheep Creek (impact and control) and the Tenderfoot Creek (reference) sites. Aquatic benthic communities at all sites are exhibiting signs of nutrient enrichment, likely due to cattle ranching, but these were less prevalent in the Tenderfoot Creek sites. Riparian habitat at four sites (AQ2, AQ5, AQ7 and AQ8) ranked degraded because of alterations by cattle, while Sheep Creek AQ1 is functional, but at risk, because of the county road effects on the hydrology. Fish species richness and diversity were higher in the Sheep Creek sites than the Tenderfoot reference reaches, and were similar between the upstream control reaches and the downstream impact reaches of the study, but the upstream Sheep Creek AQ2 site had lower fish numbers potentially due to public fishing access. Overall fish densities were highest in the Tenderfoot Creek reference reach, except for brook trout which reported highest average densities in Little Sheep Creek AQ7. In contrast to fish communities in Sheep Creek, initial baseline biotic integrity of macroinvertebrate and periphyton communities was significantly higher in the Tenderfoot Creek reaches.

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

The Black Butte / Sheep Creek basin located 16 miles north of White Sulphur Springs, Meagher County, Montana is currently undergoing exploration and permitting for a proposed underground copper mine. Baseline data on the condition of the aquatic ecosystems that could be potentially affected by the mine (pre-impact) are essential to determine what effects the mine might have on the fish and wildlife in, and downstream of, the affected area (post-impact). Environmental Assessments (EA) often address Threatened and Endangered species (there are no potential aquatic T&E species in the basin, USFWS 2104) and take into account the presence of Montana Species of Concern (MT SOC), but until these most recent on-the-ground surveys were completed, the presence of MT SOC or other ecologically sensitive native species assemblages might not be considered. Large gaps in basic baseline surveys for macroinvertebrate, fish, and mussels still exist both temporally and spatially in the Black Butte Copper Project basin. Sheep Creek within and upstream of the proposed mine area had only been sampled at intermittent times for fish between 1979 and 1992 (MFWP 2014). Recent fish movement studies performed by MT FWP have documented rainbow trout and whitefish from the Missouri and Smith Rivers using Sheep Creek in their spring spawning migrations (Grisak 2011, 2012, 2013). These studies did not report any tracked fish moving into the Sheep Creek Black Butte Project reach proper, but we will have a pit-tag reader on hand in 2016 to document any tagged fish in the project reach. Radio-tagged trout that used Sheep Creek in those studies were found to spawn ~11 miles upstream from the Smith River or moved into Moose Creek which is located ~3 miles from this study's lower site (AQ1). Identifying baseline aquatic communities and conditions in the streams of the project area (i.e., fish, macroinvertebrate, periphyton and mussels) prior to mine development is the objective of this study and is essential to understanding and potentially mitigating impacts to habitats and species during and after mine operation.

1.2 STUDY AREA DESCRIPTION

The entire Tintina Copper Project study area lies within the Middle Rockies Ecoregion (17q) (Woods et al. 2002), specifically the Little Belt Mountains. Sheep Creek is a 32 mile long tributary to the Smith River occurring in Hydrologic Unit 10030103 having a total watershed area of ~500 km^2 (194 sq. miles). The study area near the proposed mine area is approximately 17 miles upstream from the confluence (see Appendix B, Hydrometrics). The Sheep Creek watershed above the project area drains about 202 km^2 and is located approximately 16 miles north of White Sulphur Springs, Montana. Little Sheep Creek

is a Sheep Creek tributary within the project area and drains a watershed of approximately 30 km^2. Pre-impact baseline aquatic sampling reaches were established in 2014 in the Sheep, Little Sheep and Coon Creek basins upstream and downstream of the proposed mine activity drainage corridor and were sampled in both 2014 and 2015 (Map 1). Four aquatic sampling sites correspond to surface water quality monitoring stations established in 2011 (Hydrometrics 2015). Tenderfoot Creek, a 40 mile tributary to the Smith River has a total watershed area of 281 km^2 and was chosen as the off-site control reach; an estimated watershed area of 203 km^2 is drained above the reference reach (Map 2). Watershed areas upstream of the Sheep Creek lower site AQ1 and Tenderfoot Creek reference reaches are nearly identical. Tenderfoot Creek is being utilized as an off-site control site to be sampled pre- and post–impact similarly to the Sheep Creek site in a BACI design. We will be able to identify if changes detected to aquatic resources are occurring across watersheds (Tenderfoot and Sheep Creek) or because of mine operations (only Sheep Creek downstream of the proposed mine). These sites represent the range of Middle Rockies mountain stream types in the Black Butte project area: Mountain Streams, Small Mountain Streams and Headwater Foothills Rivers (Stagliano 2005). Six main-stem reaches in Sheep and Tenderfoot Creeks, and three tributary reaches in Little Sheep Creek (2 reaches) and Coon Creek (1 reach) were visited seasonally (Table 1). There are no current USGS stream flow gauges located on any streams in the area, and we relied on stream discharge data collected by Hydrometrics Inc. (2015). Discharge recorded for Sheep Creek (AQ1/SW1, AQ2/SW2), Little Sheep (AQ8/SW8) and Coon Creeks (AQ9/SW3) on or near our sampling dates are presented in Table 2. Stream gradients of individual reaches were estimated using the difference in the upper and lower GPS elevations and dividing by the reach length.

We performed initial macroinvertebrate, mussel and habitat surveys on August 14th and 15th, while the fish and periphyton sampling occurred approximately 2 weeks later on September 3rd-5th, 2014. During the spring visit of 2015 (May 4th), fish sampling in Sheep and Tenderfoot Creek was unable to be performed due to 10-day earlier than normal run-off (i.e. bankfull flows and unsafe shocking conditions); these run-off conditions persisted until mid-June, well past a “spring survey period” (see Hydrometrics 2015, Table 2). Therefore, only Little Sheep Creek reaches have spring fish samples. Flows recorded in Sheep Creek during the assigned spring sampling period (May) were bankfull at 100-124 cfs (Hydrometrics 2015, Appendix B), likewise with Tenderfoot Creek, which we estimated to be 150-180cfs based on a stream gauge relationship from USGS gauges on the Smith River with a Tenderfoot Creek gauge installed by Montana State University (Dave Ritter, personal comm. 2015). We performed summer fish surveys on July 8-10th, 2015.

Table 1. Aquatic Sampling Study Reach GPS locations at the downstream (D/S) and upstream (U/S) ends of the assessment reach**.**

Site Code	Site Name	Type	AES code	Latitude	Longitude	Elev. (m)	Comment
UM_SHEEPAQ1	Sheep Creek (D/S) Sheep Creek (U/S)	Impact	C003	46.795122 46.793362	-110.91037 -110.91094	1697	Downstream Canyon Reach on USFS land.
UM_SHEEPAQ2	Sheep Creek (D/S) Sheep Creek (U/S)	Control	C003	46.772124 46.771973	-110.85566 -110.85345	1743	Upstream of Castle Mtn Ranch off US 89
UM_SHEEPAQ3	Sheep Creek (D/S) Sheep Creek (U/S)	Control	C003	46.777247 46.777667	-110.89882 -110.89800	1718	Upper Hansen meadow Reach U/S of Little Sheep Creek
UM_SHEEPAQ4	Sheep Creek (D/S) Sheep Creek (U/S)	Impact	C003	46.785116 46.784465	-110.90883 -110.90650	1707	Lower Reach on the USFS boundary
UM_TENDAQ5	Tenderfoot Creek (D/S) Tenderfoot Creek (U/S)	Reference	C003	46.95049 46.95077	-111.14739 -111.14447	1435	Lower Reach at South Fork Tenderfoot confluence
UM_TENDAQ6	Tenderfoot Creek (D/S) Tenderfoot Creek (U/S)	Reference	C003	46.95018 46.95032	-111.14362 -111.14365	1438	Upper Reach above USFS boundary
UM_LSHEEPAQ7	Little Sheep Creek (D/S) Little Sheep Creek (U/S)	Impact	D001	46.775038 46.775897	-110.89779 -110.89849	1718	Mass wasting of some of the stream banks
UM_LSHEEPAQ8	Little Sheep Creek (D/S) Little Sheep Creek (U/S)	Control	D001	46.768352 46.769087	-110.87439 -110.87489	1738	Above Haul Road Mass wasting of stream banks
UM_COONAQ9	Coon Creek (D/S) Coon Creek (U/S)	Impact	D001	46.77871 46.77842	-110.90834 -110.90921	1708	Above County Road at SW3 site

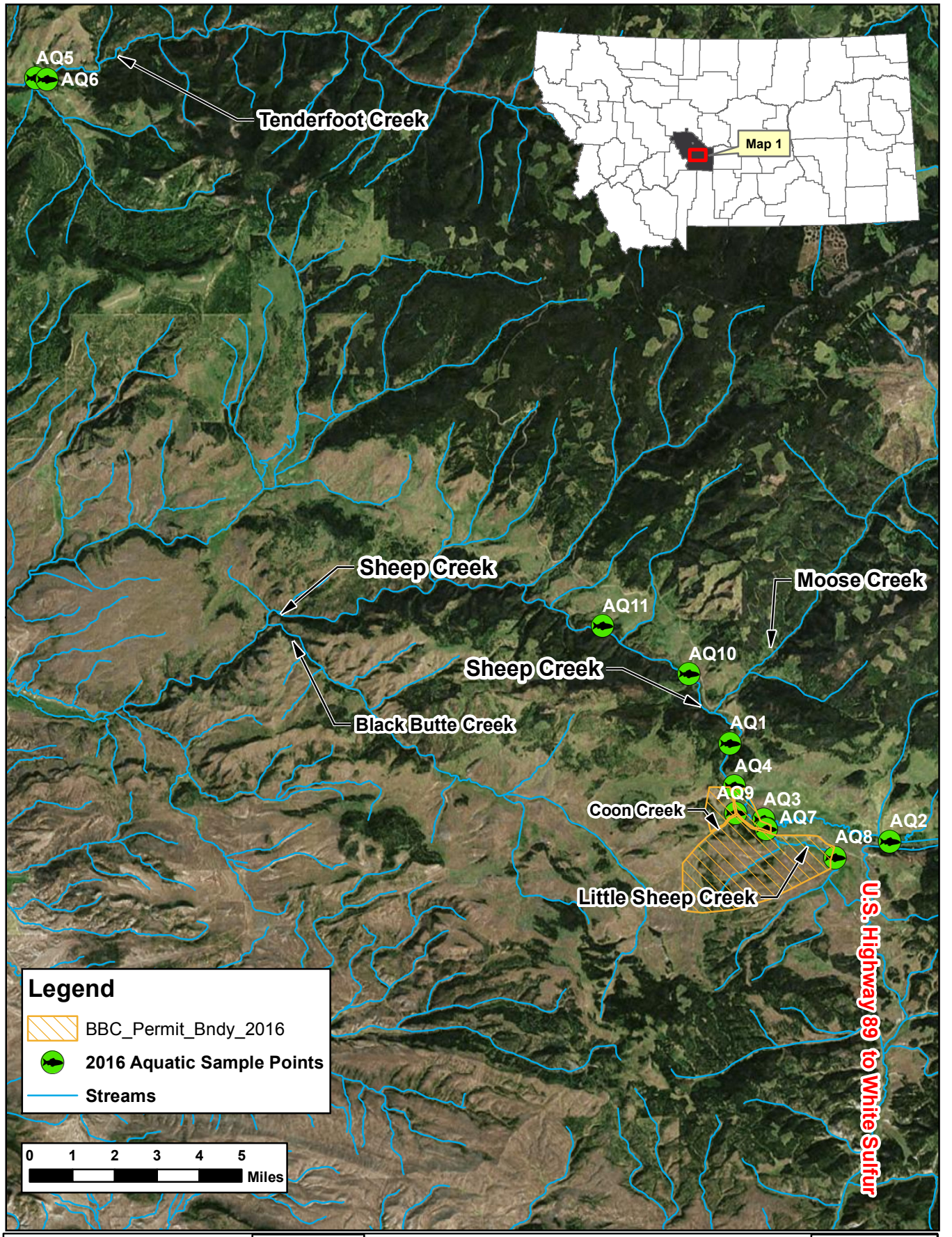
Aquatic Ecological System (AES) code defined in text followed Stagliano (2005).

Table 2. Seasonal stream discharge (cubic feet second) recorded nearest the sample dates for Aquatic sites.

Site	Stream	8/21/2014	4/29/2015	6/25/2015
AQ1/SW1	Sheep Creek Canyon	25	103	47
AQ2/SW2	Sheep Creek Control	19.3	82.2	30
AQ8/SW8	Little Sheep Impact	0.54	1	0.71
AQ9/SW3	Coon Creek Impact	0.08	0.1	0.07

2.0 METHODS

Habitat assessments and macroinvertebrate, mussel, periphyton and fish surveys were performed on similar dates along the same designated reaches of Sheep, Little Sheep and Tenderfoot Creeks in both 2014 and 2015. Maps of baseline aquatic survey sampling sites are presented as Map 1 and Map 2 for the Sheep Creek and Tenderfoot drainages, respectively. These surveys used a Before, After,



Montana Biological Survey	DRAWN BY: DS CHK'D BY: AK APPR. BY: AK DATE: April 2016	**Tintina Resources** Black Butte Copper Mine Project Meagher County MT	PROJECT NO. T01.2016
		Aquatic Sampling Sites Overview	FIGURE NUMBER **MAP 1**

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Control {upstream and off-site} and Impact {within and downstream} (BACI) sampling design with Before, After and Control sample sites both at upstream and at off-site reference locations; and Impact sample sites both within and downstream of proposed mine activity (Underwood 1994). Coon Creek, another potential impacted site, was sampled for fish in 2014 and macroinvertebrates in 2015. In total, we performed 19 fish surveys and collected nine macroinvertebrate and eight periphyton samples during the visits. Biological community integrity was calculated for 19 fish surveys using Observed/Expected Models (O/E), while the nine macroinvertebrate and eight periphyton samples were assessed with Montana DEQ (MDEQ) multimetric indicies (MMI) (Teply and Bahls 2006, MDEQ 2012). Summer macroinvertebrate samples were collected within the range of the MTDEQ recommend sampling time frame (June 21st-October 1st) (MTDEQ 2012). All stream reaches were visually surveyed for amphibians or reptiles during all visits.

2.1 LITERATURE/DATABASE SEARCHES

Information pertaining to aquatic animal species of concern that may potentially occur in the project corridor was downloaded from the Montana Natural Heritage Program (MNHP) database (MNHP 2014). Information pertaining to federally-listed threatened and endangered (T&E) aquatic species was obtained from U.S. Fish and Wildlife Service county list (USFWS October 2014). Information pertaining to prior fisheries investigations in the area was obtained from the MT Fish, Wildlife and Parks (MTFWP) Fisheries Information System Database (MFISH 2014) or the MTFWP Research Library (accessed in 2014 & 2015). Prior macroinvertebrate studies conducted in the area of the project were obtained from the Montana's Department of Environmental Quality (MDEQ) ecological data application database (Jessup 2006, EDAS 2014).

2.2 HABITAT / WATER QUALITY ASSESSMENTS

It is important to document existing water quality, baseline aquatic communities and stream habitat conditions in the study area prior to any actual mine development. Water quality sampling has been conducted at four of the aquatic community sampling sites by Hydrometrics quarterly over a four-year period beginning in the spring of 2011. The stream assessment reach was divided into 10 equally spaced transects according to BLM and EMAP protocols (BLM 2008; Lazorchak et al. 1998). The downstream transect (A, T10) was marked (GPS, flagging and photo point) as the bottom of the reach and all ecological assessment protocols started from this point and continued upstream for 20 times average bankfull width (BkfW) (n=4) or a minimum of 150 meters (designated the assessment area or "AA") to the marked top of the reach (K, T1). Parameters recorded at each transect were: wetted-width (ww), three channel depth measurements (¼, ½, ¾ ww), % large woody debris, substrate

composition and riparian shading. A stream map of the reach was sketched to scale, so that habitat features (riffle, run, pool) can be quantified (Appendix B). On-site habitat assessments were conducted using the rapid assessment protocol developed for the BLM by the National Aquatic Assessment Team (scores 0-24) (BLM 2008). The process for determining Proper Functioning Condition followed Pritchard et al. (1993). Basic water quality parameters (temperature, TDS, pH, conductivity) were recorded prior to biological sampling using a Horiba H-10 water meter, calibrated for the lower conductivity range. The goal of these evaluations is to characterize local reach geomorphology, riparian and in-stream habitat, and characteristics that influence aquatic community integrity. Sites ranking higher using these protocols are determined to have higher quality habitat at the local reach-scale.

2.3 FISH AND AMPHIBIAN COMMUNITY SURVEYS

We used a backpack-mounted, battery powered Smith-Root LR-24 electro-fishing unit to conduct seasonal, intensive two-pass, catch-per-unit effort (CPUE) fish population surveys to inventory fisheries in the project area. Four reaches of Sheep Creek and two reaches on Little Sheep Creek, representing upstream control, downstream and impact sites, as well as one "outside basin" control stream, Tenderfoot Creek (2 reaches), were surveyed following MT Fish, Wildlife, and Parks electrofishing protocols (MFWP 2002) (Table 1, Figure 1). Surveys typically started at the downstream riffle of the reach and proceeded upstream for 60 m (200 ft.), targeting all habitats and ending at an upstream pool/riffle break with a block seine. Fish collected during the first-pass were held in buckets or live-cars until the second, electrofishing pass was completed (Figure 1). All fish collected were sedated in batches with clove oil or MS-222 (tricane methansulfonate), identified to species (Holton and Johnson 2003), measured for total length (TL) (mm) and weighed (grams) on mass balance scales to determine densities and biomass per reach using standard fisheries techniques (Dunham et al. 2009) (Figure 1, Appendix A, Photos 15 & 18). Young-of-the-year fish less than 25 mm (TL) were field-identified to species, if possible, measured and released. All fish data were collected on standard Montana Fish, Wildlife & Parks (MFWP) electrofishing data sheets using MFWP species abbreviations. Fish anomalies (e.g. deformities, eroded fins, lesions, and tumors), and condition were also recorded during the surveys (Dunham et al. 2009). Fish were processed, revived in fresh water live cars and released within the section of capture. In order to establish reach variance, we surveyed a second 60 m (200 ft.) section upstream of the first and separated by a shallow riffle and the block seine (Figure 1). Fish numbers are reported as numbers per unit distance (per section or per stream mile) or per unit effort (CPUE-per minutes of shocking).

We used the Assemblage Tolerance Index (ATI) (Whittier et al. 2007) and derived Observed/Expected (O/E) Fish Models (Stagliano 2005) as an analysis of the sampled fish communities to detect impairment

in the biological integrity of the sites. The ATI assesses fish tolerance in the community; whereas, too many tolerant fish individuals or the lack of sensitive species can indicate impairment. The expected number of native fish species for a C003 classified reference stream is 2.6, while the expected number of species for a D001 stream is 1.6 depending on watershed area; dividing the observed number of native fish species at a site by the expected number derives a percentage compared to reference condition (>0.8 or 80% = unimpaired) (Hawkins and Norris 2002). Despite being non-native salmonids, brook and rainbow trout are considered sensitive according to the metrics (Mebane et al. 2002) (Table 3). Adult amphibians or reptiles encountered and identified while shocking, seining or walking the designated stream reach were counted and recorded, even if they were not captured.

Table 3. Metrics and classification of native (N) and introduced (I) fishes captured during the Tintina Black Butte Study. Tolerance: T=Tolerant, INT=Intermediate, S=Sensitive. Trophic = Omnivore, IN=Invertivore, C =Carnivore.

Species	Species code	Scientific Name	Trophic *	Feed Habit†	Repro Guild‡	General Tolerance	Origin	Total Length 3 years
Catostomidae								
White sucker	*WHSU*	*Catostomus commersoni*	OM	BE	LO	TOL	N	180
Cottidae								
Rocky Mountain Sculpin	*RMSC*	*Cottus bondii*	IN	BE	LO	INT	N	86
Cyprinidae								
Longnose Dace	*LODA*	*Rhinichthys cataractae*	IN	BE	LO	INT	I	71
Salmonidae								
Brook Trout	*EBT*	*Salvelinus fontinalis*	IN	GE	LO	S	I	264
Brown Trout	*LOLE*	*Salmo trutta*	IN/C	GE	LO	TOL	I	269
Rainbow Trout	*RBTR*	*Oncorhychus mykiss*	IN	GE	LO	S	I	240
Rainbow Trout x Westslope Cutthroat Hybrid	*CTxRBT*	*Oncorhychus mykiss x clarkia lewisi*	IN	GE	LO	S	I	266
Mountain Whitefish	*MOWF*	*Prosopium williamsoni*	IN	BE	LO	INT	N	190

† - BE=Benthic, GE=Generalist, ‡ - Reproductive Guild=Lithophilic Obligate (LO)

Figure 1. Macroinvertebrate and fish sampling procedures. Clockwise: 1) Backpack electrofishing Tenderfoot Creek (AQ5) staged, 2) macroinvertebrate sample washing, 3) fish measurement and processing (AQ7) with block seine and 4) 20.5 inch brown trout (AQ4).

2.4 FRESHWATER MUSSEL SURVEYS

The western pearlshell mussel (WEPE), a MT SOC and USFS sensitive species, has been reported in the Smith River basin, but no surveys had been performed within the project area (Stagliano 2010). Sheep Creek has channel reaches of preferred geomorphology and benthic habitat for the western pearlshell (Rosgen C3/C4) (Stagliano 2010). Therefore, we searched for this mussel in all reaches with an aquascope moving in an upstream direction, using a longitudinal transect survey technique (Young et al. 2001) (Appendix A, Photo 14). We devoted approximately one man-hour of search per reach, and this effort enabled us to effectively search all habitat and geomorphic units (riffle, glide and pool sequences).

2.5 MACROINVERTEBRATE COMMUNITY SURVEYS

Macroinvertebrate communities were sampled semi-quantitatively from each of the 10 transects within the 300 m assessment reach using the EMAP Reach-Wide protocol (BLM 2008, Lazorchak et al. 1998). We started sampling at the downstream transect (A) or T10 in the BLM protocol, and proceeded upstream alternating sampling with the 500-micron D-frame net to the right, left or center of the stream channel, so a random sampling of all habitats is achieved. The ten multi-habitat kicks (~1 square meter) were composited into a 20 liter bucket. All organisms and organic matter in the bucket were elutriated from the inorganic portion and washed onto a 500-micron sieve (Figure 1). The inorganic portion was washed and examined until no further organics or organisms were present and discarded. The organic portion on the sieve was transferred to one or two 1 liter Nalgene bottles (unless field sub-sampling was needed), labeled and preserved in 95% ethanol and brought to the MTNHP lab in Helena for processing (sorting, identification and data analysis) following protocols outlined by the BLM (2008) and MTDEQ (2012). Macroinvertebrates were identified to the lowest taxonomic level (MTDEQ 2012), counted, imported into EDAS (Jessup 2006), and biological metrics were calculated from the data using the Montana Department of Environmental Quality's newest multimetric macroinvertebrate (MMI) protocols (Jessup et al. 2005, Feldman 2006, MDEQ 2012). Metric results were scored using the MTDEQ bioassessment criteria and each sample categorized as nonimpaired or impaired according to threshold values. The index score represents the condition of the macroinvertebrate community at the time the sample was collected within that past year. If the index score is below the impairment threshold, the individual metrics can be used to provide insight as to why the communities are different from the reference condition (Barbour et. al 1999, Jessup et. al. 2005). The impairment threshold set by MTDEQ is 63 for the Mountain Stream Index, thus any scores above this threshold are considered unimpaired (MTDEQ 2012).

2.6 PERIPHYTON COMMUNITY SURVEYS

Periphyton communities were sampled semi-quantitatively from each of the ten transects within the assessment reach using the EMAP Reach-Wide protocol (Lazorchak et al. 1998), a.k.a. Modified Periphyton Field Protocols (MDEQ 2011). Sampling started at the downstream transect (A) or T10 in the protocol, and proceeded upstream alternating with the macroinvertebrate sampling to the left, right and center channel. Sampling periphyton for this study followed the standard methodology, preservation and quality assurance protocols specified in the MDEQ Periphyton SAP (MDEQ 2011). Rhithron Associates, Inc. (Missoula, MT) is the MDEQ approved contract lab that processed and identified the periphyton samples. Periphyton biointegrity metrics were generated and interpreted according to Teply and Bahls (2006).

3.0 AQUATIC ASSESSMENT RESULTS

We evaluated nine stream reaches in the study area: six mainstem Sheep and Tenderfoot Creek sites that were classified as Mountain Streams (C003), and three in tributaries, Little Sheep and Coon Creeks that are Headwater Stream systems (D001) (Stagliano 2005) (Table 1). Proper classification is important when determining biological integrity (Hawkins and Norris 2000) and the expected species richness.

3.1 AQUATIC SPECIES OF CONCERN

A search of the Montana Natural Heritage Program (MNHP) database (MNHP 2015) indicated the occurrence of the MT SOC amphibian species, western toad (*Anaxyrus boreas*) near Sheep Creek AQ2 site, but this species was not observed during our surveys. The western pearlshell (WEPE), *Margaritifera falcata*, a MT SOC and USFS sensitive species, has been reported in the Smith River basin, but no surveys had been performed within the project area (Stagliano 2010). The MT SOC, westslope cutthroat trout (*Oncorhychus clarkia lewisi*) is reported to occur in the project corridor of Sheep Creek, but there have been no documented occurrences, only professional opinion (MFWP 2014, MNHP 2015). Westslope cutthroat trout (90% pure) are documented to occur about 7 miles upstream of the Tenderfoot Creek reference reach and in the South Fork Tenderfoot Creek which enters the Tenderfoot near reach AQ5 (MFWP 2014), but we only collected Rainbow/Cutthroat Hybrids at this site. We did not find evidence of any Montana aquatic SOC within the project area during our seasonal, on-site surveys.

3.2 HABITAT EVALUATIONS

Of the nine sampling reaches evaluated in the study area, we found four in Proper Functioning Condition (PFC) with a stable trend and five were Functional at Risk (FAR) (Appendix E). Sites ranked FAR because they had riparian habitat altered recently or historically by cattle {Little Sheep AQ7 and AQ8, Sheep Creek AQ2, Tenderfoot Creek AQ5) (Figure 2) or because of human stream encroachment or manipulation (Sheep Creek AQ1 and AQ2) (Figure 2, Appendix E). Highest site integrity scores using both the BLM Habitat and PFC Assessment methods were recorded at the Sheep Creek upper (AQ3) and lower (AQ4) meadow reaches and the Tenderfoot Creek AQ6 site (Appendix E). Sites reporting lower habitat scores were structurally degraded by cattle use and had high associated livestock use indices (Little Sheep AQ8, Sheep Creek AQ2 and Tenderfoot AQ5) (Appendix E, See site photos, Appendix A). It is important to note that the riparian habitat of the lower reference reach on Tenderfoot Creek (AQ5) is moderately degraded, as well as the upstream Sheep Creek “control” reach AQ2 (Figure 2, Appendix E).

Figure 2. A structurally, cattle-damaged riparian section of Sheep Creek AQ2 (top) and a human manipulated section of AQ2 (bottom).

We mapped stream reach habitat features during the initial site set-up in 2014 following EMAP protocol (Appendix E). Stream gradient averaged 1.4% (0.6 - 2.2%) across all sites with the Sheep Creek AQ1 reach reporting the steepest drop and Coon Creek AQ9 the most gentle gradient. Based on reach gradient, stream geomorphology and bottom substrate characteristics, Sheep Creek and Tenderfoot can be classified broadly as Rosgen C3, while Little Sheep Creek has characteristics of E4-F4 classes, being moderately entrenched at the upper AQ8 and some sections of AQ7 (Rosgen 1996). Coon Creek has morphologic characters of an F4 stream (Rosgen 1996). Stream habitat morphology is dominated by riffle and runs at all sites; Sheep Creek averaged 85% riffle/run, Coon Creek 100%, Little Sheep 73% and Tenderfoot Creek 75% of the total stream reaches (Table 4).

Table 4. Aquatic Sampling Assessment Reach Measurements and average stream habitat percentages.

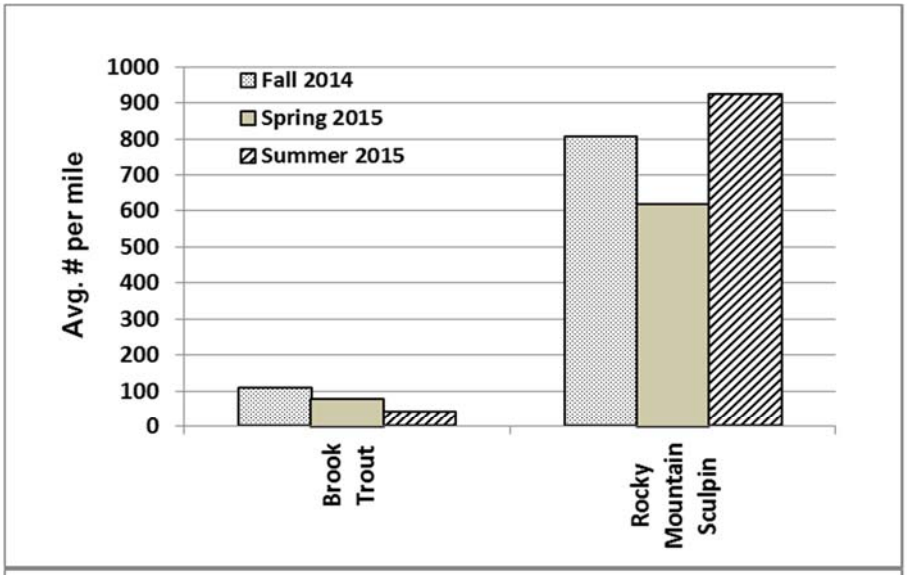
Site Code	Stream	Calculated EMAP Reach Length (m)	Actual Reach Length (m)	% Riffle	% Run	% Pool
AQ1	Sheep Creek	326	300	40	53	7
AQ2	Sheep Creek	158	200	60	20	20
AQ3	Sheep Creek	262	300	40	40	20
AQ4	Sheep Creek	273	300	50	37	13
			avg.	**47.5**	**37.5**	**15**
AQ5	Tenderfoot Creek	306	300	47	33	20
AQ6	Tenderfoot Creek	302	300	50	20	30
			avg.	**48.5**	**26.5**	**25**
AQ7	Little Sheep Creek	52	150	40	40	20
AQ8	Little Sheep Creek	34	150	40	25	35
			avg.	**40**	**32.5**	**27.5**
AQ9	Coon Creek	24	50	75	25	0

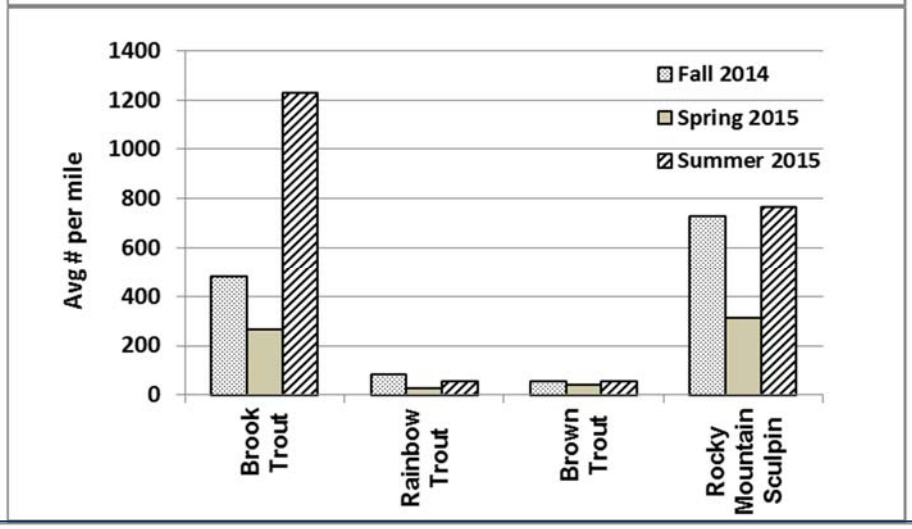
3.3 FISH COMMUNITIES

Overall, seven fish species and one hybrid (four native / four introduced) were identified from 3,862 individuals collected during 19 stream reach surveys. Average number of fish species per site across the project area was 3.6 (with a standard error of ± 0.6), while native species averaged 1.5 (with a standard error of ± 0.4). The rocky mountain sculpin comprised the highest proportion of total individuals collected (72%) and had 100% site occupancy (n=8), except at Coon Creek AQ9 which was documented to be fishless upstream of the county road. Tenderfoot Creek had the highest abundance and percentage of sculpin comprising the catch (80%). The other native species, mountain whitefish, longnose dace and white sucker had site occupancy rates of 38%, 13% and 13%, respectively (Appendix B). The most diverse fish site in the study area was Sheep Creek AQ3 with seven species and was also the site with the highest number of native species (n=4) (Appendix B). No fish species of concern (SOC) were documented during the surveys. Rainbow trout were collected at 7 of 8 sites, while brook trout were more prevalent in Little Sheep Creek, Sheep Creek sites AQ2 and AQ3 near its confluence with Little Sheep Creek.

Brown trout were not reported in the Tenderfoot Creek control/reference reach, and coincidently sculpin and smaller size-classes of rainbow trout were more abundant in this reach (Figure 5, Appendix B). Large resident brown trout (300-500mm) were prevalent in the Sheep Creek meadow reaches (AQ3 and AQ4), while smaller brown trout were observed in the lower sections of Little Sheep Creek (AQ7). Lowest trout densities were reported from Sheep Creek AQ2 (Table 3) where roadside fishing access may account for lower fish numbers (Figure 4). Seasonally, fall densities of rainbow trout reported at Sheep Creek AQ1 (avg. 1,968 per mile) were most similar to the reference reach, Tenderfoot Creek (avg. 1,075 per mile), but these higher densities showed a significant decrease at both sites by the summer 2015 sampling event (Figure 3 and 5). Rainbow trout size-frequency numbers indicate the presence of four size-classes (age classes) in most stream reaches, except those with brown trout where the 1st and 2nd year classes are missing (Appendix B) and is likely due to predation. Rainbow trout numbers in the Tenderfoot Creek reach (RM 9.1) (204 per 1000 ft.) are lower than reported in a 1988 survey (344 per 1000 ft., MFISH), but are very similar if Rainbow/Cutthroat Hybrid individuals are included (296 per 1000 ft.) (Appendix B). The length frequency distribution of the RBTR population in Sheep Creek is very similar to that of RBTR in the Tenderfoot Creek control reach (Appendix B). Using the O/E Index, Sheep Creek AQ3 was the only site that scored above the impairment threshold, while Sheep Creek AQ2 and AQ4 are on the threshold with scores of 0.8 (Figure 6). Fish condition was generally similar among stream reaches when compared to the calculated length-weight regressions (Appendix B).

Figure 3. Seasonal average fish abundance per mile for Little Sheep Creek AQ8 (top), Little Sheep AQ7 (Middle) and Sheep Creek AQ1 (bottom) for the Tintina survey sites.





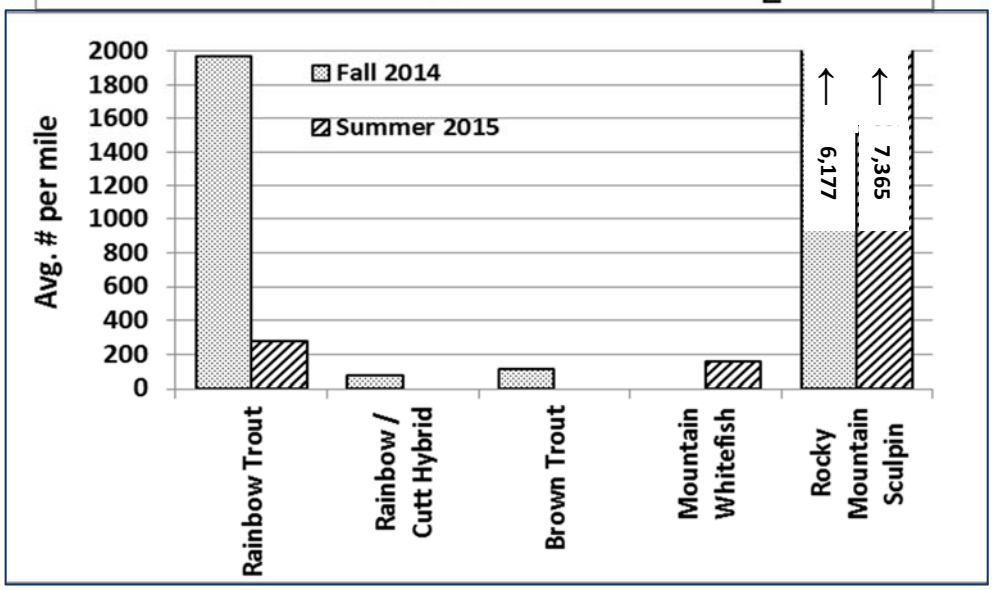


Figure 4. Seasonal average fish abundance per mile for Sheep Creek AQ2 (top), AQ 3 (middle) and AQ4 (bottom) for the Tintina Black Butte survey sites.

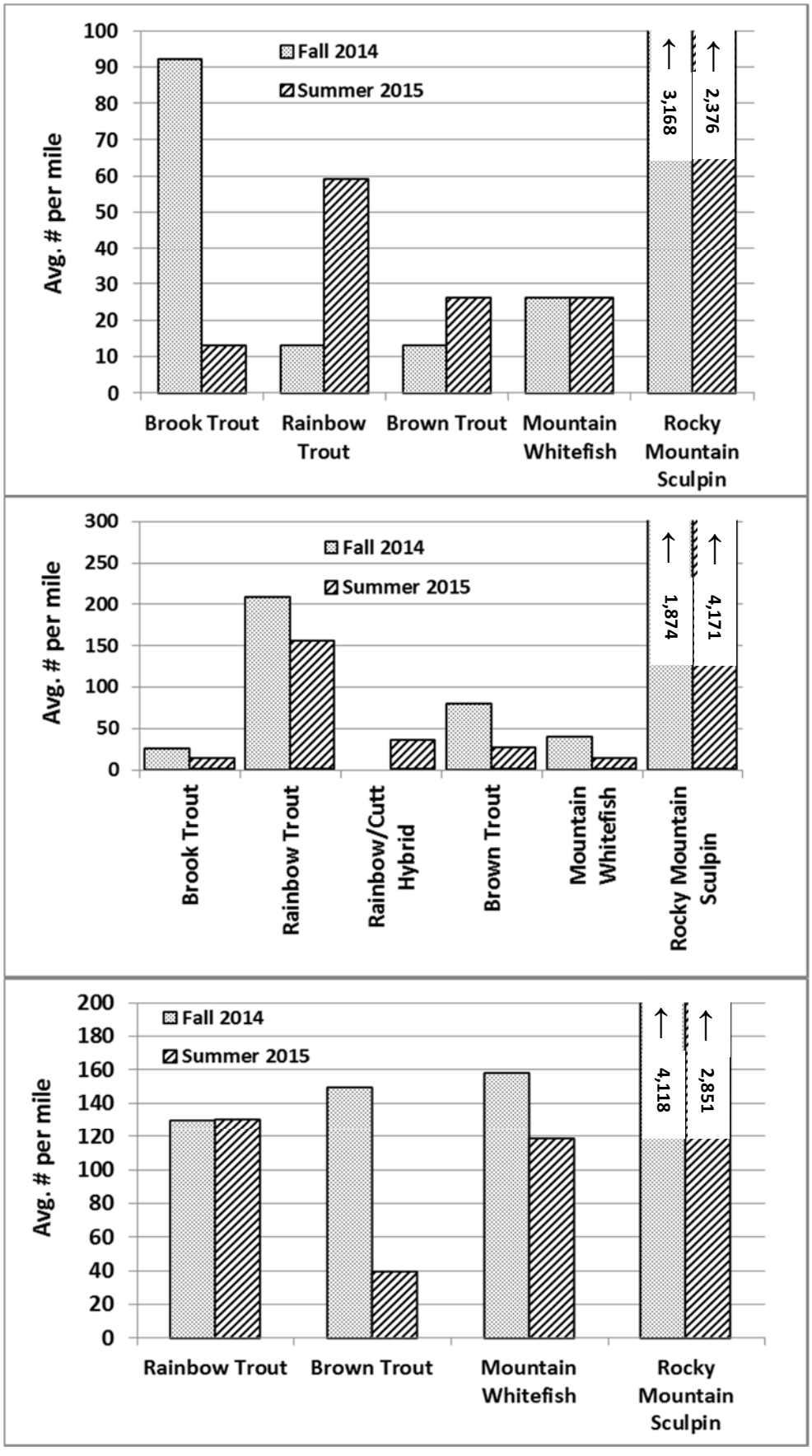


Figure 5. Seasonal average fish abundance per mile for Tenderfoot Creek AQ5 reference site.

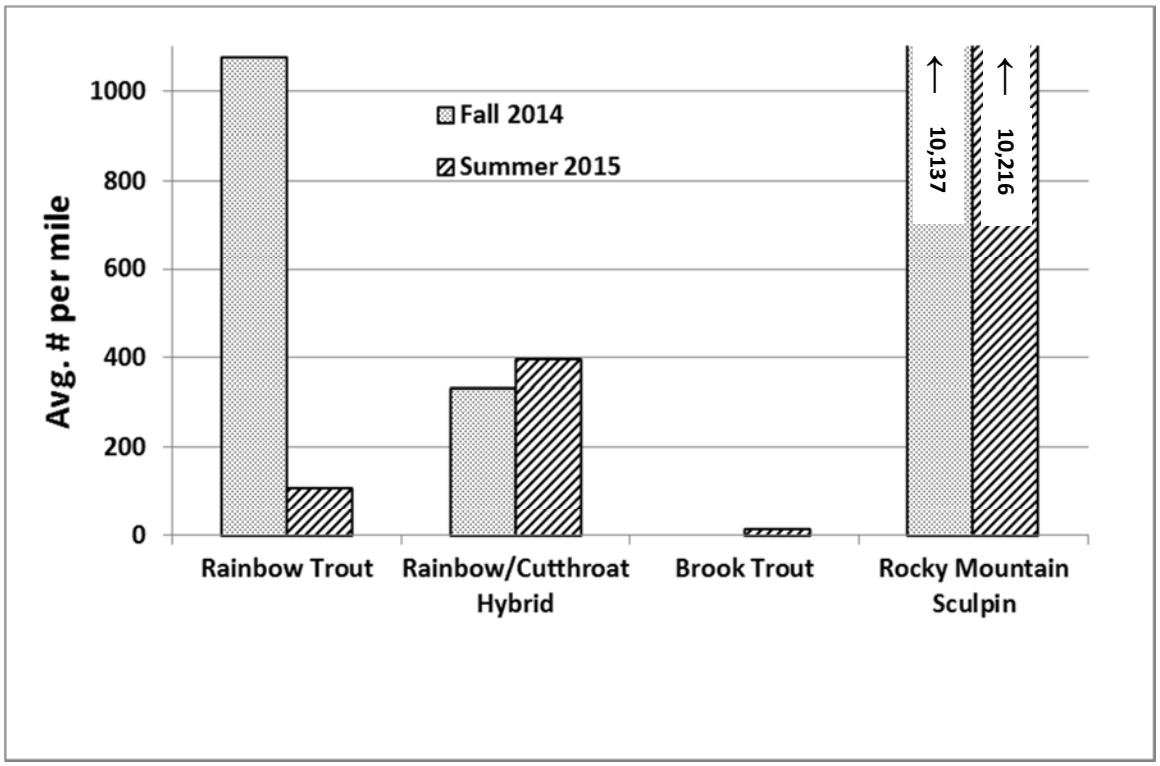
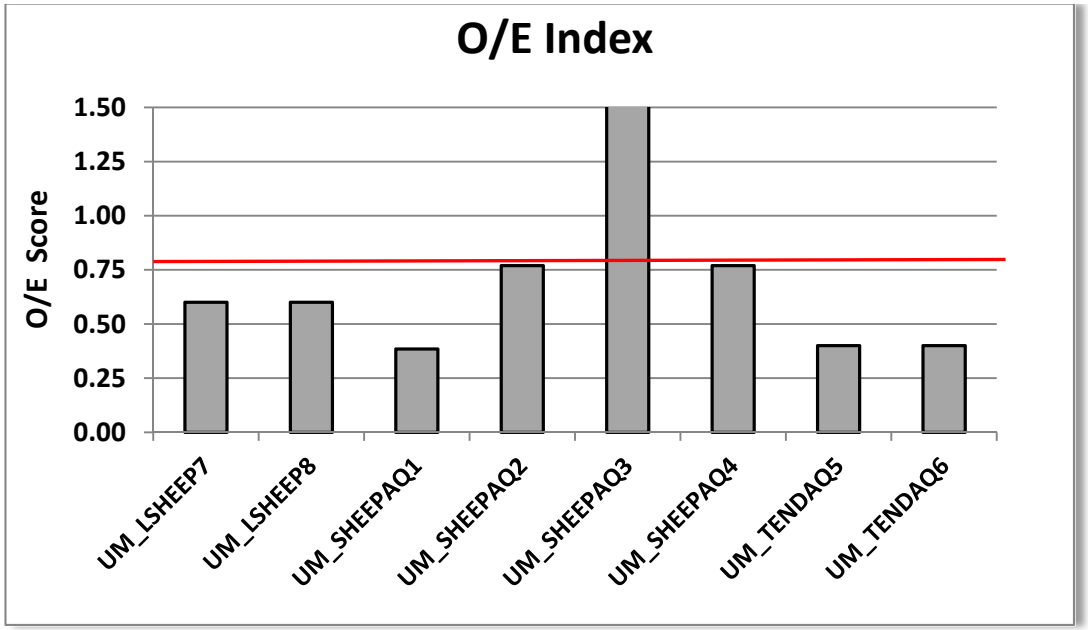


Figure 6. Fish community seasonal O/E scores across Tintina Study Sites. Red line represents the impairment threshold at 0.8.



We documented opercula erosion in some (<5%) of the brook trout and rainbow trout of Little Sheep Creek, but not in Sheep or Tenderfoot Creeks. This condition, bacterial gill disease (BGD), is an external infection caused by high-organic load, elevated bacterial activity. When the gills swell, the cover quickly erodes away. Typically, only one of the two gill covers is eroded (~20-40%). The gills on the reduced opercula side were otherwise in good condition with minimal bacterial activity in the gills (swelling, mucus etc.).

The Assemblage Tolerance Index (ATI) was dominated by percent intermediate taxa at all sites, except for Little Sheep Creek AQ7 which had a higher percentage of sensitive species, largely due to the relative abundance of brook trout compared to rocky mountain sculpin (Table 5). There is no significant difference in the initial average percent sensitive or percent tolerant fishes between the Sheep or Tenderfoot Creek or the Sheep Creek control versus impact reaches (Table 5).

Table 5. Assemblage Tolerance Indices (ATI) for the fish collected.

		% Tolerant	% Sensitive	% Intermediate
Sheep Creek AQ1	**Fall 2014**	0.01	0.25	0.74
	Spring 2015	na	na	na
	Summer 2015	0.00	0.04	0.96
	avg.	**0.01**	**0.14**	**0.85**
Sheep Creek AQ2	**Fall 2014**	0.00	0.03	0.96
	Spring 2015	na	na	na
	Summer 2015	0.01	0.03	0.96
	avg.	**0.01**	**0.03**	**0.96**
Sheep Creek AQ3	**Fall 2014**	0.05	0.10	0.85
	Spring 2015	na	na	na
	Summer 2015	0.01	0.05	0.95
	avg.	**0.03**	**0.07**	**0.90**
Sheep Creek AQ4	**Fall 2014**	0.03	0.03	0.94
	Spring 2015	na	na	na
	Summer 2015	0.01	0.04	0.95
	avg.	**0.02**	**0.04**	**0.94**
Tenderfoot Creek AQ5	**Fall 2014**	0.00	0.12	0.88
	Spring 2015	na	na	na
	Summer 2015	0.00	0.05	0.95
	avg.	**0.00**	**0.08**	**0.92**
Little Sheep Creek AQ7	**Fall 2014**	0.04	0.42	0.54
	Spring 2015	0.06	0.46	0.48
	Summer 2015	0.03	0.61	0.36
	avg.	**0.04**	**0.49**	**0.46**
Little Sheep Creek AQ8	**Fall 2014**	0.00	0.12	0.88
	Spring 2015	0.00	0.11	0.89
	Summer 2015	0.00	0.04	0.96
	avg.	**0.00**	**0.09**	**0.91**

**Underlined values were the highest average site score for the tolerance metric*

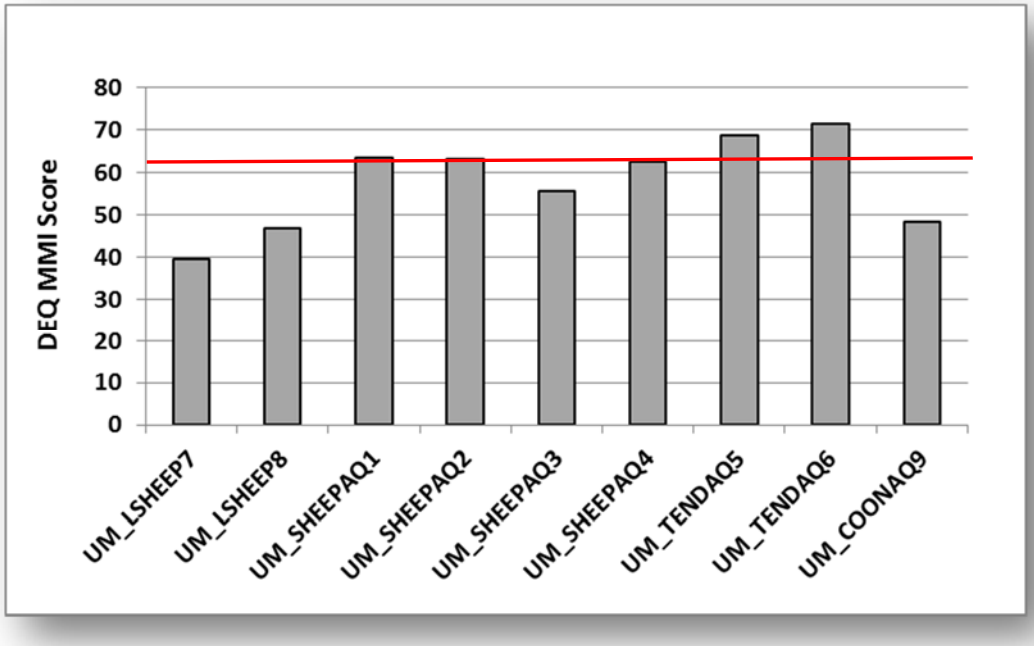
3.4 FRESHWATER MUSSEL SURVEYS

No evidence of western pearlshell mussel presence (live, dead, or as shell fragments indicative of a previous historical population) was reported during the surveys in Sheep, Little Sheep or Tenderfoot Creek reaches.

3.5 MACROINVERTEBRATE COMMUNITIES

Overall, 112 unique macroinvertebrate taxa were reported from the nine macroinvertebrate assessment samples collected in 2014 and 2015 (Appendix C). No Montana species of concern (MTSOC) were collected. The macroinvertebrate community at Sheep Creek AQ4 had very high benthic densities and resembled taxa of the reference condition mountain stream (Tenderfoot Creek) (Table 4). Sheep Creek AQ4 reported the highest taxa richness (60 spp.) and the highest number of combined mayfly, caddisfly and stonefly taxa (EPT) (19 species), but not the highest DEQ MMI Score (Table 4, Figure 7). Tenderfoot Creek reported the highest integrity scores ranked by the MDEQ MMI (avg. 70), while Sheep Creek sites averaged 61.4, which is significantly lower (ANOVA, p=0.02), and ranked slightly impaired by MDEQ thresholds. Control Sheep Creek sites (AQ2 and AQ3) had lower macroinvertebrate integrity than the treatment reaches (AQ1, AQ4), but this was not significantly different (ANOVA p=0.22). Initial macroinvertebrate densities are highest in Tenderfoot Creek and this is significantly higher than Sheep or Little Sheep Creek (one-way ANOVA, p=0.03 and 0.028, respectively) (Table 7). Average macroinvertebrate richness across all sites was 45 taxa, while EPT taxa averaged 15 per site (Table 6). EPT taxa and % EPT were not different between Sheep and Tenderfoot Creeks, but Little Sheep and Coon Creek had significantly lower values than both other sites (Table 7).

Figure 7. Macroinvertebrate DEQ MMI scores across Tintina Study Sites. Red line represents the impairment threshold (63).



Both Little Sheep Creek sites and Coon Creek were ranked impaired by the MDEQ MMI with scores <63 (Table 6), but ranked unimpaired with the Low Valley MMI. Hilsenhoff Biotic Index (HBI) scores averaged 4.1 across all sites; this is moderately impaired for mountain streams (>3), indicating probable nutrient or other organic impairment to all sites.

Table 6. Macroinvertebrate sample characteristics and various metrics used for the DEQ MMI. Bolded, underlined values are below the impairment threshold.

StationID	Coll Date	Ind m^{-2}	Mtn MMI Index	Total Taxa	EPT Taxa	% EPT	% CrusMol	% NonIns	HBI
UM_SHEEPAQ1	8/16/2014	2952	63.7	44	18.0	48.8	1.1	1.9	4.0
UM_SHEEPAQ2	8/15/2014	3260	63.3	47	13.6	60.0	2.6	3.4	3.4
UM_SHEEPAQ3	8/16/2014	3158	**55.8**	39	16.2	26.9	0.0	0.5	4.0
UM_SHEEPAQ4	8/16/2014	5872	**62.7**	60	18.8	47.0	0.1	3.1	3.8
	avg.	**3810.5**	**61.4**	**47.5**	**16.7**	**45.7**	**1.0**	**2.2**	**3.8**
UM_TENDAQ5	8/16/2014	6080	68.6	53	18.3	33.8	0.0	1.1	4.7
UM_TENDAQ6	8/16/2014	7424	71.4	43	18.4	48.4	0.0	0.0	3.6
	avg.	**6752.0**	**70.0**	**48.0**	**18.4**	**41.1**	**0.0**	**0.5**	**4.1**
UM_LSHEEP7	8/16/2014	3040	**39.7**	35	8.8	12.1	4.5	4.7	4.9
UM_LSHEEP8	8/15/2014	1132	**46.9**	37	10.4	24.7	8.5	14.8	4.7
	avg.	**2086.0**	**43.3**	**36.0**	**9.6**	**18.4**	**6.5**	**9.8**	**4.8**
UM_COONAQ9	7/8/2015	2520.0	**48.5**	36.0	14.0	35.4	2.4	19.4	3.4
	Overall Avg.	**4114.8**	**59.0**	**44.8**	**15.3**	**37.7**	**2.1**	**3.7**	**4.1**

Table 7. Macroinvertebrate Metric ANOVA statistical results by stream and treatment. Underlined and bolded values were significant at $p < 0.05$.

	Ind m^{-2}	Mtn MMI Index	Total Taxa	EPT Taxa	% EPT	HBI
Tenderfoot x Sheep	**0.03**	**0.02**	0.47	0.191	0.35	0.23
Sheep x L. Sheep	0.110	**0.004**	0.082	**0.009**	**0.034**	**0.004**
Tenderfoot x L. Sheep	**0.03**	**0.01**	**0.07**	**0.004**	**0.07**	0.16
Treatment X Control	0.248	0.219	0.210	0.064	0.407	0.294
Treatment X Reference	0.141	**0.022**	0.356	0.464	0.227	0.360
Control X Reference	**0.017**	0.060	0.258	0.060	0.455	0.285

3.6 PERIPHYTON COMMUNITIES

Overall, 146 unique diatom and algae taxa were reported from the eight periphyton assessment samples collected in 2014. No periphyton species are listed as SOC in the state. Diatoms were the most dominant taxa in 6 of 8 study sites (Table 8). Sheep Creek AQ3 reported the highest taxa richness (71 spp.), while the average periphyton richness per site was 57 taxa. Based on Teply's Diatom Index (TDI), the lower site, Sheep Creek AQ1 had the highest probability (61.4%) of impairment (Table 8). Based on the TDI, other Sheep and Little Sheep Creek sites had less than a 33% chance of being impaired. Sites that the TDI ranked least likely to be impaired (<17%) were both of the Tenderfoot Creek reference sites (Table 8). Tenderfoot Creek had significantly lower periphyton taxa richness than Sheep or Little Sheep Creeks (p=0.005 and p=0.03, respectively), but these were more sensitive taxa.

Table 8. Periphyton sample characteristics: total taxa in the sample, % relative abundance and the % probability of impairment ranked by TDI.

Site ID	Station Name	Total Taxa	% Rel Abun	% Prob Impairment	Dominant Taxa 1 & 2	
AQ1	Sheep Creek	62	19.3	61.4	Diatoms	*Cladophora*
AQ2	Sheep Creek	68	9.8	32.5	Diatoms	*Draparnaldia*
AQ3	Sheep Creek	71	6.9	25.2	*Cladophora*	*Tolypothrix*
AQ4	Sheep Creek	57	6.5	24.3	Diatoms	*Homeothrix*
AQ5	Tenderfoot Creek	44	3.3	17.5	Diatoms	*Zygnema*
AQ6	Tenderfoot Creek	42	2.0	14.7	Diatoms	*Zygnema*
AQ7	Little Sheep Creek	53	9.6	32.2	*Spirogyra*	Diatoms
AQ8	Little Sheep Creek	59	4.8	20.2	Diatoms	*Anabaena*

3.7 AMPHIBIAN AND REPTILE OBSERVATIONS

One amphibian species, the Columbia Spotted Frog (*Rana columbiana*) was incidentally recorded at Sheep Creek AQ4. One terrestrial garter snake (*Thamnophis elegans*) was observed at Tenderfoot Creek site AQ5. These were the only herpetofauna occurrences reported in conjunction with the seasonal aquatic survey visits. A MTSOC amphibian species, the western toad (*Anaxyrus boreas*), had been previously recorded within 1 km of Sheep Creek site AQ2, but was not observed during our surveys.

4.0 CONCLUSIONS

The 2014-2015 aquatic community sampling represents the first year of baseline data collected in Sheep Creek within and upstream of the proposed mine area since being sampled at intermittent times for fish between 1979 and 1992 (MFWP 2014). Despite "professional judgment" reports of westslope cutthroat trout occurring in the study area (MFWP 2014), none were collected, so no fish species of concern (SOC) have been documented during these initial surveys. Fish species richness and diversity were higher in the Sheep Creek sites than the Tenderfoot reference reaches, and were similar between the upstream control reaches and the downstream impact reaches of the study area. Overall fish densities were highest in the Tenderfoot Creek reference reach, except for brook trout which reported highest average densities in Little Sheep Creek AQ7, and brown trout which attained highest densities in the meadow reach of Sheep Creek AQ4. Fish community integrity ranked impaired with the O/E index (except Sheep Creek AQ3), largely because of the prevalence of non-native salmonids that have replaced the expected native cutthroat trout species. Assemblage tolerance indices (ATI) were dominated by large percentages of intermediate tolerant species, because of the abundant and ubiquitous rocky mountain sculpin populations.

Aquatic benthic communities at all sites are exhibiting signs of nutrient or organic enrichment based on the HBI index, likely due to cattle ranching, but this was less prevalent in the Tenderfoot Creek upper site AQ6. Riparian habitat at four sites (AQ2, AQ5, AQ7 and AQ8) ranked degraded because of alterations by cattle, while Sheep Creek AQ1 is functional, but at risk because of the county road effects on the hydrology. In contrast, initial baseline biotic integrity of macroinvertebrate and periphyton communities was significantly higher in the Tenderfoot Creek reaches. Diverse aquatic communities with high biological integrity are usually correlated with intact riparian conditions and diverse habitat quality (Allen et al. 1997); the streams of this study have a mixed relationship (Table 8). Tenderfoot Creek AQ6 and Sheep Creek AQ4 had both high aquatic diversity and habitat quality, while Tenderfoot AQ5 and Sheep Creek AQ2 had high biotic integrity, but lower habitat quality. During this initial year of the study, macroinvertebrate and periphyton communities indicated that many sites in Sheep and Little Sheep Creeks are slightly to moderately impaired, likely from nutrients, even those with high quality riparian and in-stream habitat condition. This is corroborated by the HBI scores being moderately elevated across all sites indicating probable nutrient or other organic impairment. The common cause of organic enrichment across all sub-basins of the study is cattle grazing and the macroinvertebrate and periphyton communities are exhibiting deleterious effects.

Community results from the habitat, fish, periphyton and macroinvertebrate surveys combined to rank the Tenderfoot Creek AQ6 site with the highest biological integrity and three sites (AQ5, AQ4, AQ3) tied for second highest overall integrity (Table 9).

Table 9. Community integrity rank within their aquatic ecological classification and treatment code.

Site ID	Type	AES code	Fish	Macros	Algae	Habitat	Overall Rank	Integrity Comment
Mountain Stream Reaches								
SHEEP CREEK AQ1	Impact	C003	**6**	**3**	**6**	**4**	**5**	Stream manipulation from roadside stabilization
SHEEP CREEK AQ2	Control	C003	**3**	**4**	**5**	**6**	**6**	Stream manipulation from road and cattle trampling
SHEEP CREEK AQ3	Control	C003	**1**	**5**	**4**	**3**	**3**	Upper reach affected by a partial beaver dam
SHEEP CREEK AQ4	Impact	C003	**2**	**6**	**3**	**2**	**3**	Lower Reach with some loss of riparian vegetation
TENDERFOOT AQ5	Reference	C003	**4**	**2**	**2**	**5**	**3**	Mass trampling of some stream banks by cattle
TENDERFOOT AQ6	Reference	C003	**5**	**1**	**1**	**1**	**1**	Upper Reach with no streambank impairment
Headwater Stream Reaches								
LITTLE SHEEP AQ7	Impact	D001	**1**	**3**	**2**	**3**	**3**	Mass wasting of some of the stream banks
LITTLE SHEEP AQ8	Control	D001	**2**	**2**	**1**	**2**	**2**	Mass wasting of some of the stream banks
COON CREEK AQ9	Impact	D001	**na**	**1**	**na**	**1**	**1**	Fenced, not grazed

**1 = highest integrity and 6 = lowest integrity.*

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Appendix A. Site Photographs

Photo 1. Sheep Creek Site AQ1, canyon reach lower.

Photo 2. Sheep Creek Site AQ1, canyon reach upper.

Photo 3. Sheep Creek Site AQ2, lower reach.

Photo 4. Sheep Creek Site AQ2, upper reach.

Photo 5. Sheep Creek Site AQ3, lower reach

Photo 6. Sheep Creek Site AQ3, upper reach (cover photo).

Photo 7. Sheep Creek Site AQ4, meadow reach lower.

Photo 8. Sheep Creek Site AQ4, meadow reach upper.

Photo 9. Tenderfoot Creek Site AQ5, lower reach.

Photo 10. Tenderfoot Creek Site AQ6, lower reach.

Photo 11. Little Sheep Creek Site AQ7, lower reach macroinvertebrate sample

Photo 12. Little Sheep Creek Site AQ8, lower reach

Photo 13. Rocky Mountain Sculpin from Sheep Creek (AQ1)

Photo 14. Sheep Creek (AQ2) mussel sampling with aquascope

Photo 15. Little Sheep Creek (AQ7) brook trout in fall 2014.

Photo 16. Backpack shocking Coon Creek (AQ9) (fishless).

Photo 17. Eroding bank Tenderfoot Creek (AQ5), looking downstream aspect.

Photo 18. Mountain whitefish from Sheep Creek (AQ3).

Appendix B. Average fish abundance, biomass and size-frequency data

Fall 2014	Species	Avg # per section	Avg biomass (g) per section	Avg # per 1000 ft	Avg biomass (g) per section	Avg # per mile	Avg biomass (kg) per mile
Sheep Creek (AQ1) Lower Canyon Reach	Rainbow Trout	74.6	4137.0	372.8	20,685.0	**1968.1**	**109.2**
	Rainbow/Cutthroat Hybrid	3.0	774.0	15.0	3870.0	**79.2**	**20.4**
	Brown Trout	4.5	1437.0	22.5	7,185.0	**118.8**	**37.9**
	Mountain Whitefish	0.0	0.0	0.0	0.0	**0.0**	**0.0**
	Rocky Mountain Sculpin	234.0	3,460.8	1,170.0	17,303.9	**6,177.6**	**91.4**
Sheep Creek (AQ2) Castle Mtn Upper	Brook Trout	3.5	360.0	17.5	1,800.0	**92.4**	**9.5**
	Rainbow Trout	0.5	25.0	2.5	125.0	**13.2**	**0.7**
	Brown Trout	0.5	236	2.5	1180	**13.2**	**6.2**
	Mountain Whitefish	1	145	5	725	**26.4**	**3.8**
	Rocky Mountain Sculpin	120.0	1,642.8	600.0	8,214.0	**3,168.0**	**43.4**
Sheep Creek (AQ3) Butte Meadow	Brook Trout	1.0	239.0	5.0	1,195.0	**26.4**	**6.3**
	Rainbow Trout	7.9	886.0	39.5	4,430.0	**208.6**	**23.4**
	Rainbow/Cutthroat Hybrid	0.0	0.0	0.0	0.0	**0.0**	**0.0**
	Brown Trout	3	850	15	4250	**79.2**	**22.4**
	Mountain Whitefish	1.5	316	7.5	175	**39.6**	**0.9**
	Rocky Mountain Sculpin	71.0	869.2	355.0	4,345.9	**1,874.4**	**22.9**
	Longnose Dace	1.0	2.0	5.0	10.0	**26.4**	**0.1**
	White Sucker	1.0	29.5	5.0	147.5	**26.4**	**0.8**
Sheep Creek (AQ4) Lower Meadow	Rainbow Trout	4.9	509.6	24.6	2548.1	**129.7**	**13.5**
	Brown Trout	5.7	2809.5	28.3	14047.5	**149.6**	**74.2**
	Mountain Whitefish	6	1423.5	30	7117.5	**158.4**	**37.6**
	Rocky Mountain Sculpin	156.0	2,089.3	780.0	10,446.4	**4,118.4**	**55.2**
	White Sucker	0	0	0	0	0	0

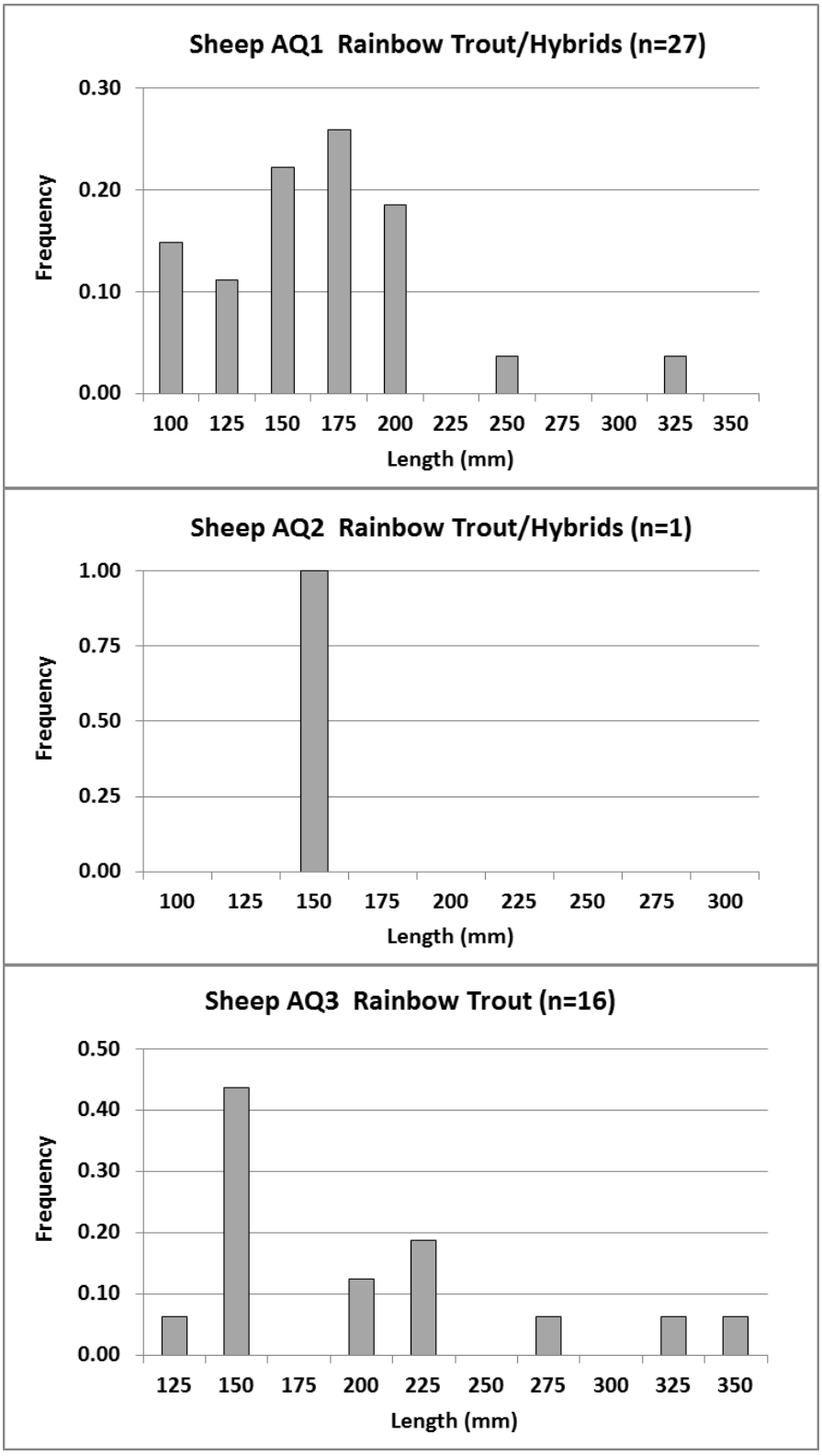
Tenderfoot Creek (AQ5)	Rainbow Trout	40.7	1,888.0	203.5	9,440.0	**1074.5**	**49.8**
	Rainbow/Cutthroat Hybrid	12.5	1,226.0	62.5	6,130.0	**330.0**	**32.4**
	Brook Trout	0.0	0.0	0.0	0.0	**0.0**	**0.0**
	Rocky Mountain Sculpin	384.0	5,260.6	1,920.0	26,302.9	**10,137.6**	**138.9**
Little Sheep Creek Lower (AQ7)	Brook Trout	18.1	1,370.0	90.5	6,850.0	**477.8**	**36.2**
	Rainbow Trout	3.0	222.5	15.0	1,112.5	**79.2**	**5.9**
	Brown Trout	2.0	111.0	10.0	555.0	**52.8**	**2.9**
	Rocky Mountain Sculpin	27.5	393.5	137.5	1,967.5	**726.0**	**10.4**
Little Sheep Creek Upper (AQ8)	Brook Trout	4.0	490.6	20.0	2,453.2	**105.6**	**13.0**
	Rocky Mountain Sculpin	30.5	198.7	152.5	993.3	**805.2**	**5.2**

Spring 2015	**Species**	**Avg # per section**	**Avg biomass (g) per section**	**Avg # per 1000 ft**	**Avg biomass (g) per section**	**Avg # per mile**	**Avg biomass (kg) per mile**
Little Sheep Creek Lower (AQ7)	Brook Trout	10.2	450.7	50.8	2,253.3	**268.0**	**11.9**
	Rainbow Trout	1.0	112.0	5.0	560.0	**26.4**	**3.0**
	Brown Trout	1.5	48.0	7.5	240.0	**39.6**	**1.3**
	Rocky Mountain Sculpin	11.8	115.1	58.8	575.6	**310.2**	**3.0**
Little Sheep Creek Upper (AQ8)	Brook Trout	3.0	255.5	15.0	1,277.5	**79.2**	**6.7**
	Rocky Mountain Sculpin	23.5	146.1	117.5	730.5	**620.4**	**3.9**

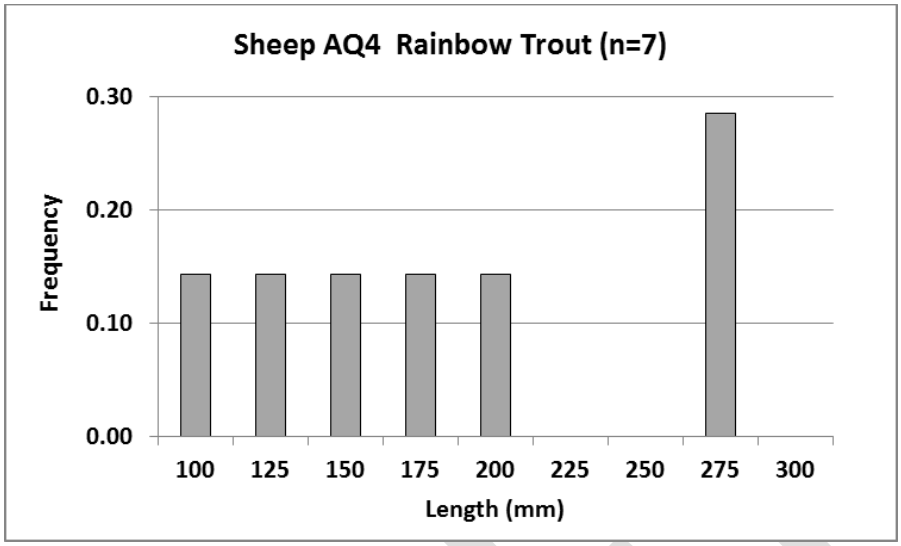
Summer 2015	Species	Avg # per section	Avg biomass (g) per section	Avg # per 1000 ft	Avg biomass (g) per section	Avg # per mile	Avg biomass (kg) per mile
Sheep Creek (AQ1) Lower Canyon Reach	Rainbow Trout	10.5	2517.0	52.5	12,585.0	**277.2**	**66.4**
	Rainbow/Cutthroat Hybrid	0.0	0.0	0.0	0.0	**0.0**	**0.0**
	Brown Trout	0.0	0.0	0.0	0.0	**0.0**	**0.0**
	Mountain Whitefish	6	1110	30	5550	**158.4**	**29.3**
	Rocky Mountain Sculpin	279.0	3,824.8	1,395.0	19,123.8	**7,365.6**	**101.0**
Sheep Creek (AQ2) Castle Mtn Upper	Brook Trout	0.5	36.5	2.5	182.5	**13.2**	**1.0**
	Rainbow Trout	2.3	17.0	11.3	85.0	**59.4**	**0.4**
	Brown Trout	1	215	5	1075	**26.4**	**5.7**
	Mountain Whitefish	1	204.5	5	1022.5	**26.4**	**5.4**
	Rocky Mountain Sculpin	90.0	802.8	450.0	4,013.9	**2,376.0**	**21.2**
Sheep Creek (AQ3) Butte Meadow	Brook Trout	0.5	21.0	2.5	105.0	**13.2**	**0.6**
	Rainbow Trout	5.9	485.0	29.5	2,425.0	**155.8**	**12.8**
	Rainbow/Cutthroat Hybrid	1.3	170.8	6.7	854.0	**35.2**	**4.5**
	Brown Trout	1	711	5	3555	**26.4**	**18.8**
	Mountain Whitefish	0.5	102.5	2.5	512.5	**13.2**	**2.7**
	Rocky Mountain Sculpin	158.0	1,166.0	790.0	5,829.8	**4,171.2**	**30.8**
	Longnose Dace	0.5	7.5	2.5	37.5	**13.2**	**0.2**
	White Sucker	0.0	0.0	0.0	0.0	**0.0**	**0.0**
Sheep Creek (AQ4) Lower Meadow	Rainbow Trout	4.9	509.6	24.6	2548.1	**129.7**	**13.5**
	Brown Trout	1.5	1045.5	7.5	5227.5	**39.6**	**27.6**
	Mountain Whitefish	6	1423.5	30	7117.5	**158.4**	**37.6**
	Rocky Mountain Sculpin	108.0	917.3	540.0	4,586.7	**2,851.2**	**24.2**
	White Sucker	0.5	1,250.0	2.5	6,250.0	**13.2**	**33.0**

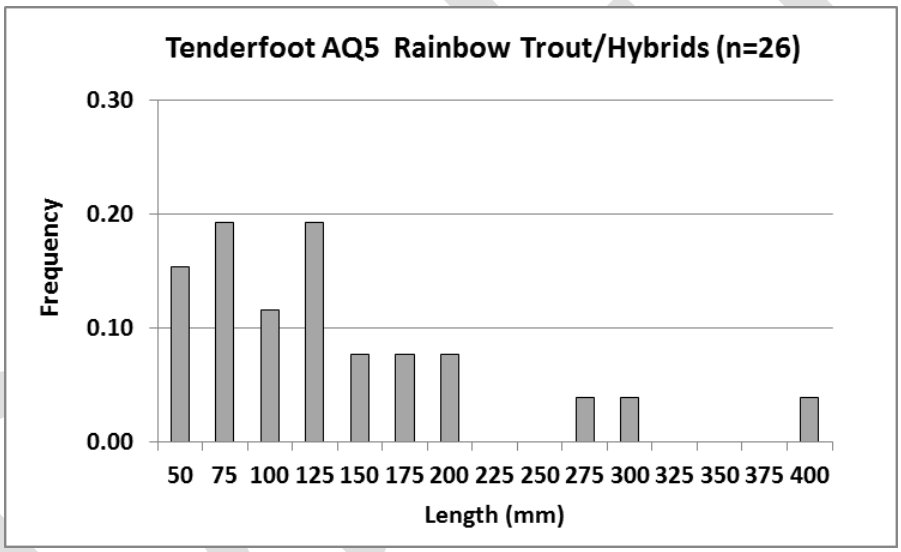
Tenderfoot Creek (AQ5)	Rainbow Trout	40.7	1,888.0	203.5	9,440.0	**1074.5**	**49.8**
	Rainbow/Cutthroat Hybrid	7.5	736.5	37.5	3,682.5	**198.0**	**19.4**
	Brook Trout	0.5	44.0	2.5	220.0	**13.2**	**1.2**
	Rocky Mountain Sculpin	387.0	4,854.5	1,935.0	24,272.3	**10,216.8**	**128.2**
Little Sheep Creek Lower (AQ7)	Brook Trout	46.5	790.5	232.5	3,952.7	**1227.6**	**20.9**
	Rainbow Trout	2.0	165.8	10.0	828.8	**52.8**	**4.4**
	Brown Trout	2.0	111.0	10.0	555.0	**52.8**	**2.9**
	Rocky Mountain Sculpin	29.0	313.7	145.0	1,568.6	**765.6**	**8.3**
Little Sheep Creek Upper (AQ8)	Brook Trout	1.5	43.5	7.5	217.5	**39.6**	**1.1**
	Rocky Mountain Sculpin	35.0	114.3	175.0	571.4	**924.0**	**3.0**

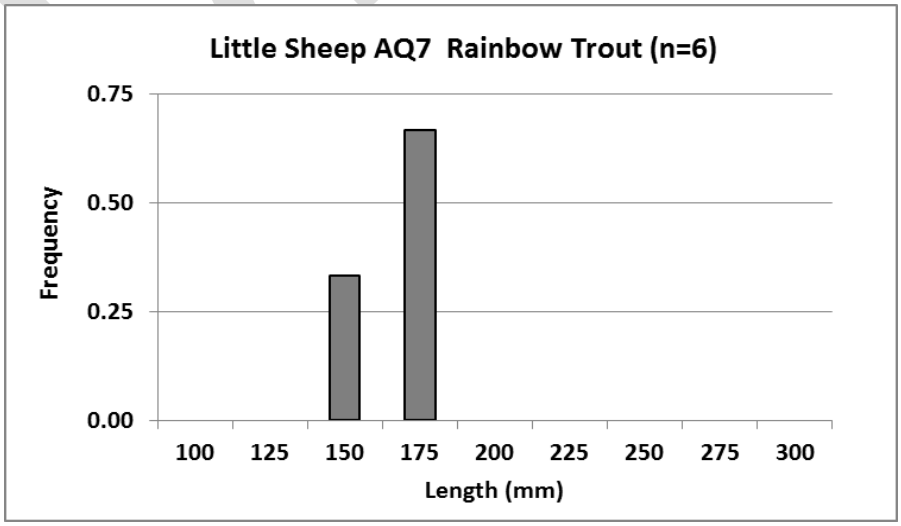
Size frequency collection data for Rainbow Trout and “Cutt-bows” collected at the Tintina Black Butte Mine Sites.



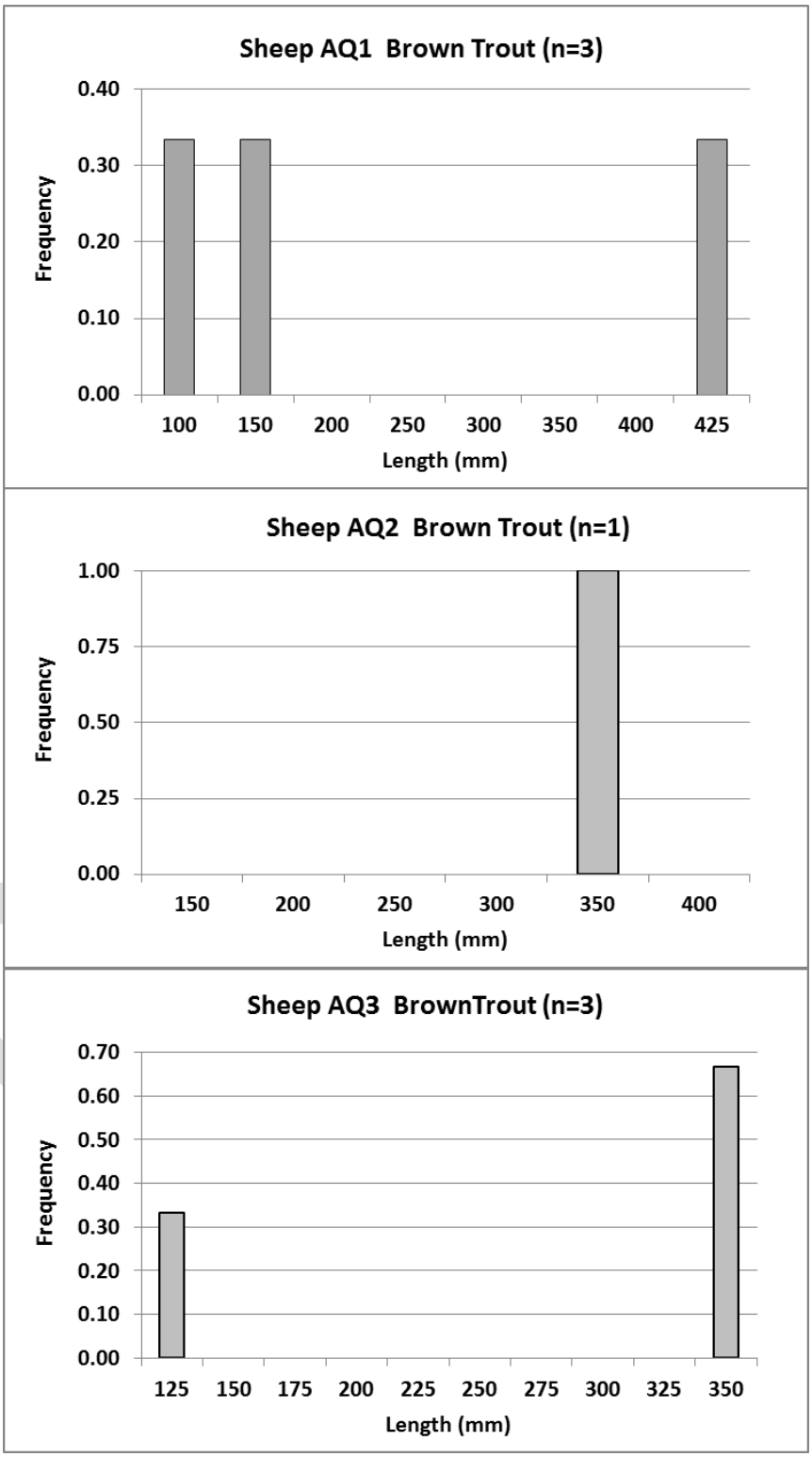
Size frequency collection data for Rainbow Trout and “Cutt-bows” collected at the Tintina Black Butte Mine Sites.



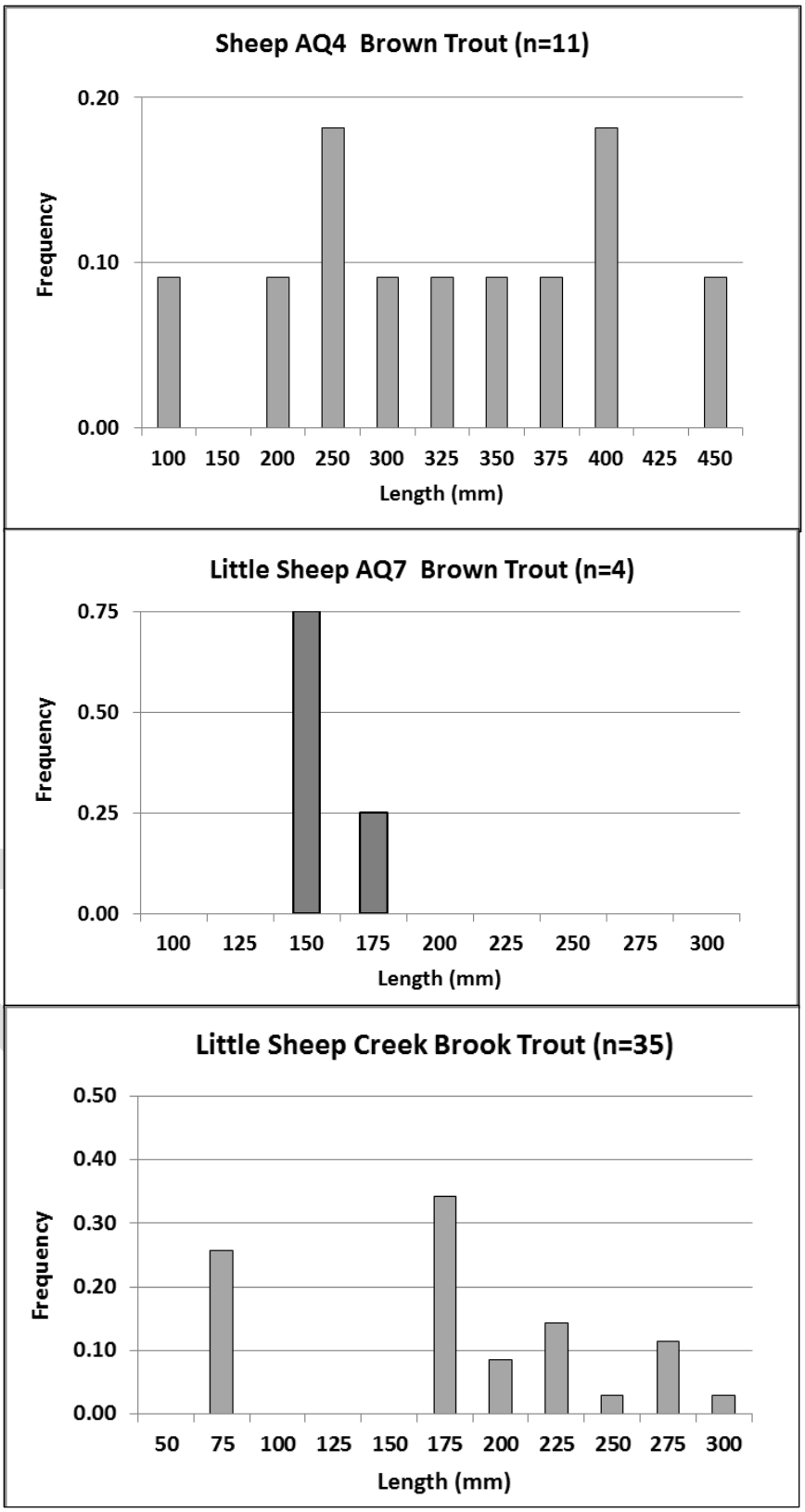




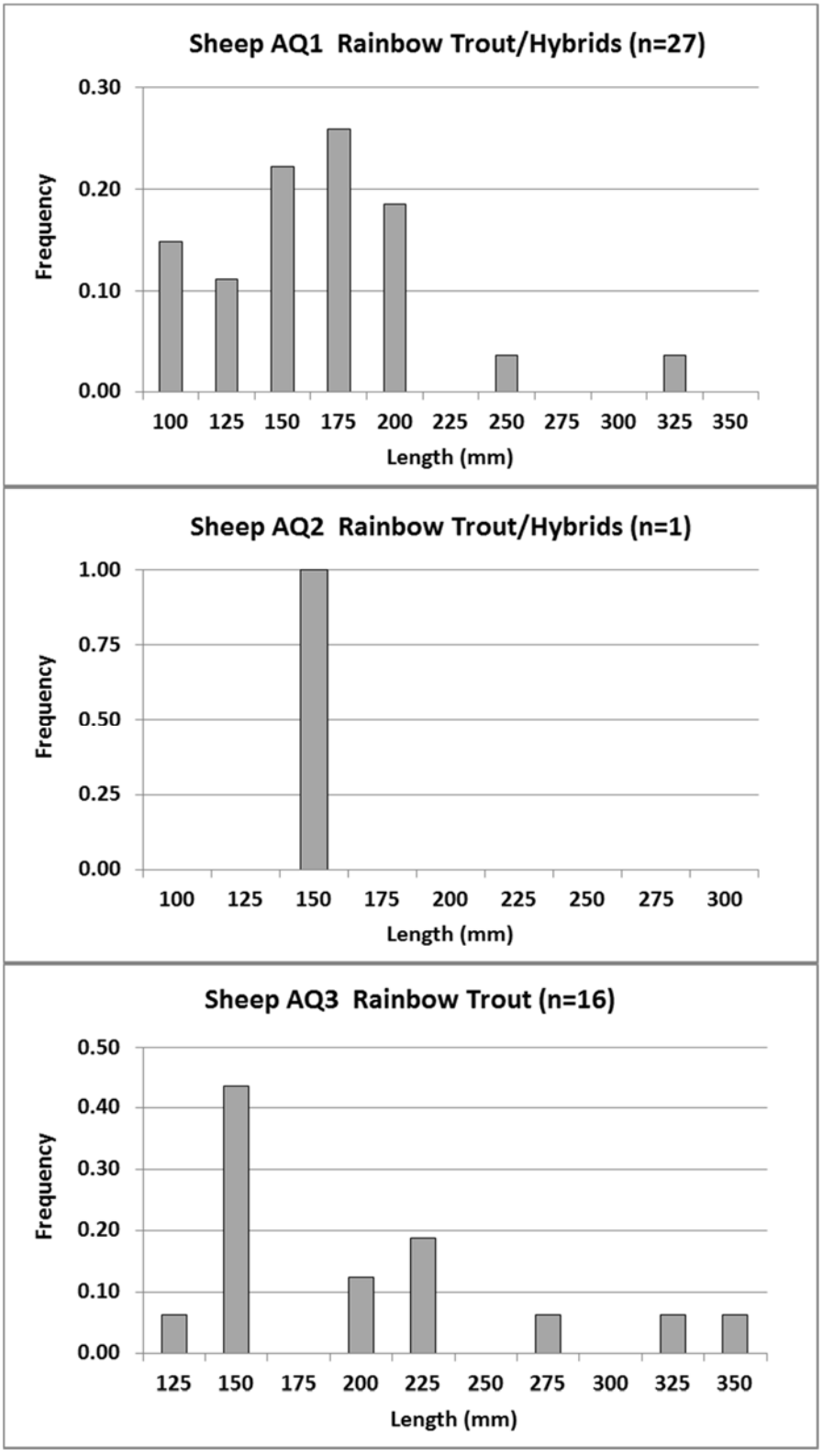
Size frequency collection data for Brown Trout collected at the Tintina Black Butte Mine Sites



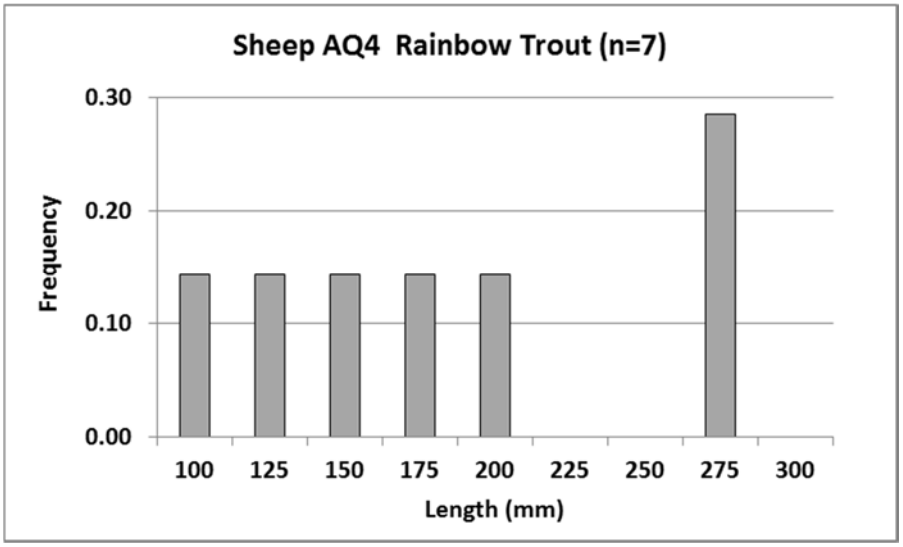
Size-frequency collection data for Brown Trout and Brook Trout collected at the Tintina Black Butte Mine Sites

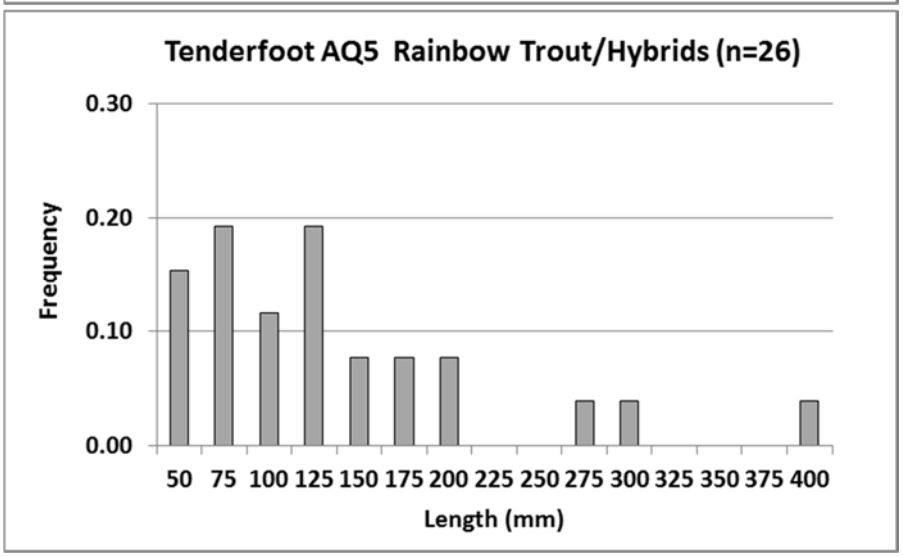


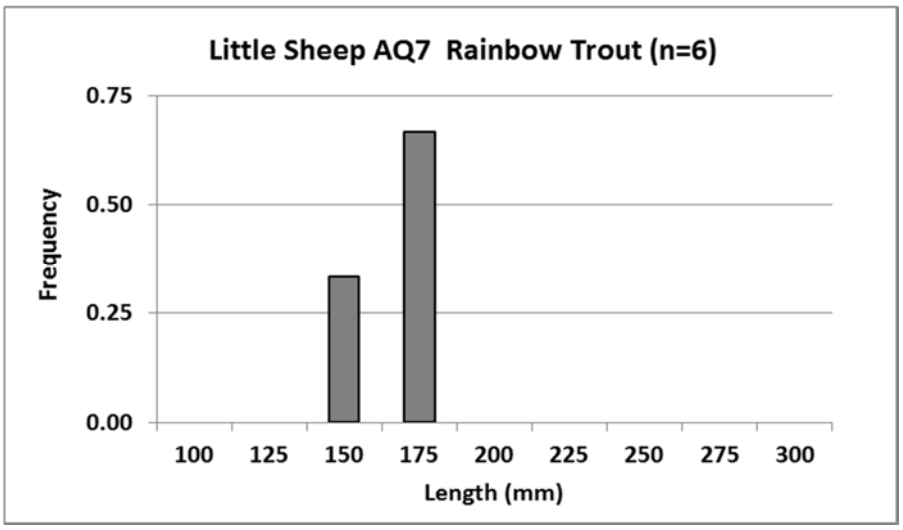
Size frequency collection data for Rainbow Trout and “Cutt-bows” collected during fall 2014 at the Tintina Black Butte Mine Sites.



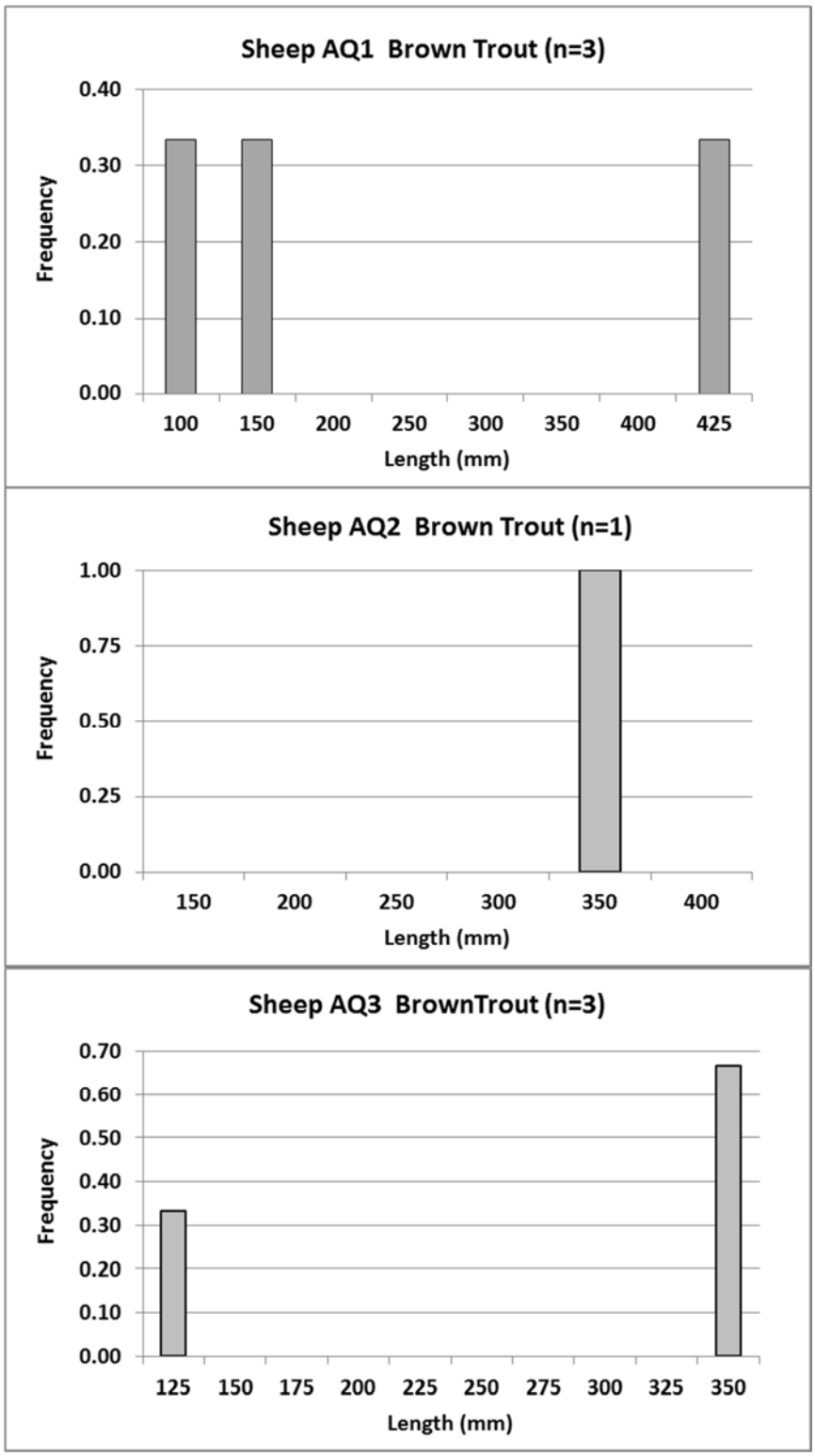
Size frequency collection data for Rainbow Trout and “Cutt-bows” collected during fall 2014 at the Tintina Black Butte Mine Sites.



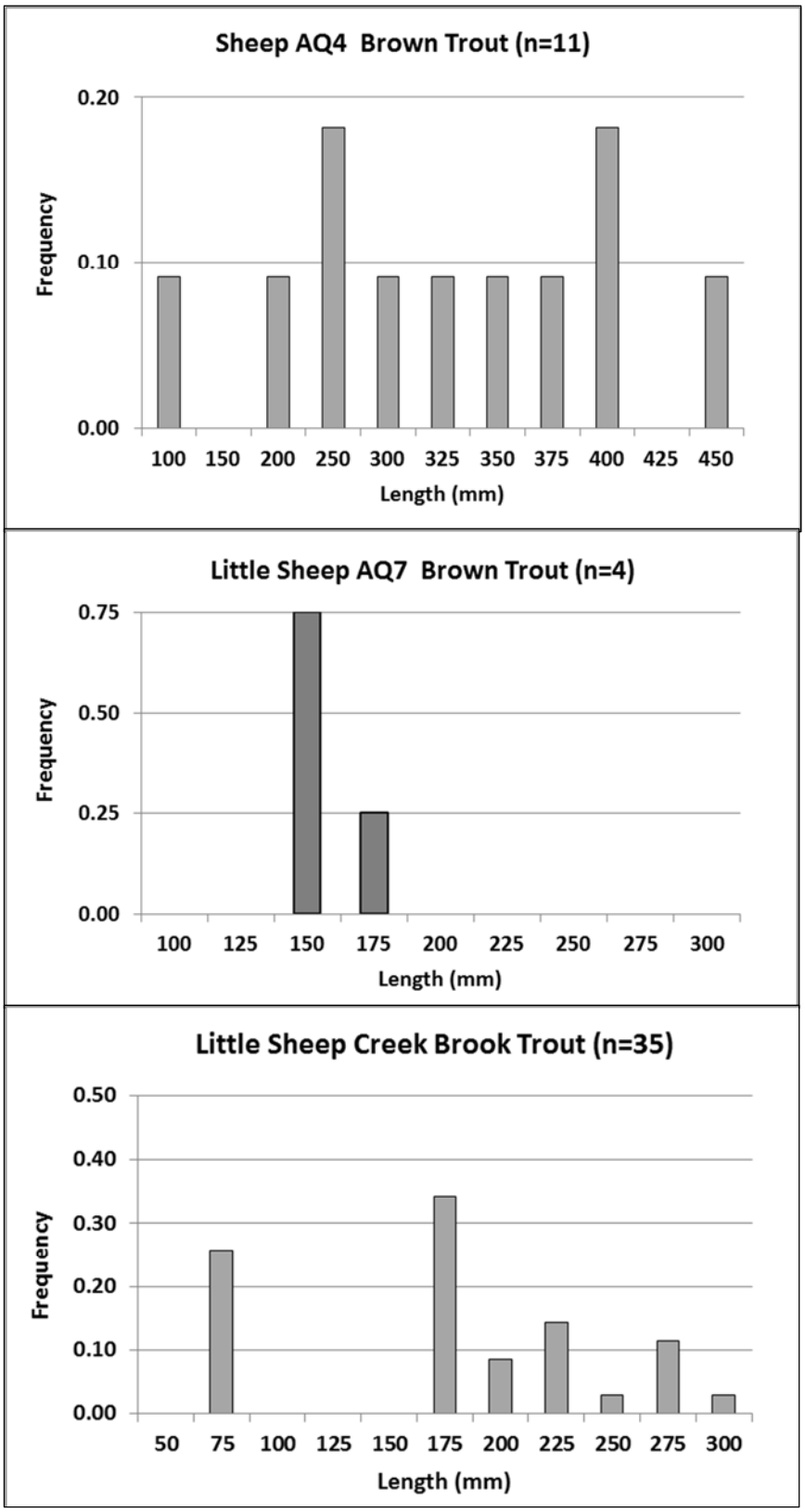




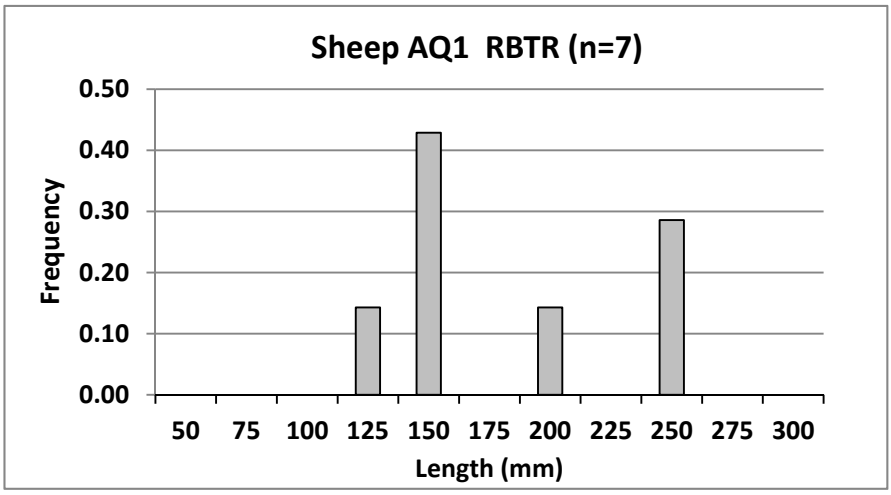
Size frequency collection data for Brown Trout collected during fall 2014 at the Tintina Black Butte Mine Sites

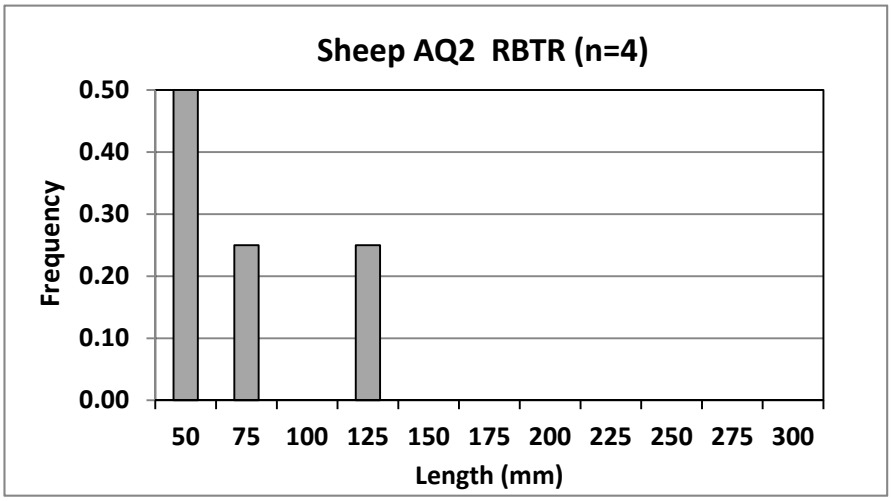


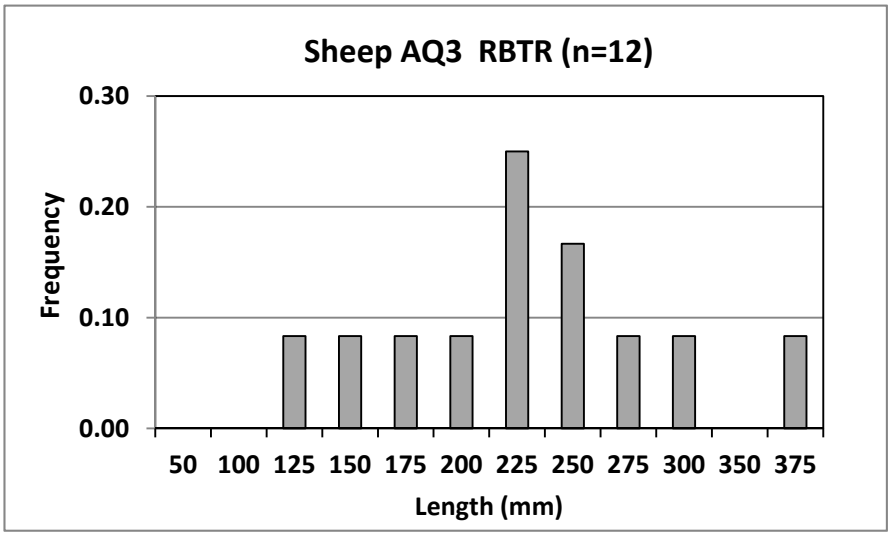
Size-frequency collection data for Brown Trout and Brook Trout collected during fall 2014 at the Tintina Black Butte Mine Sites



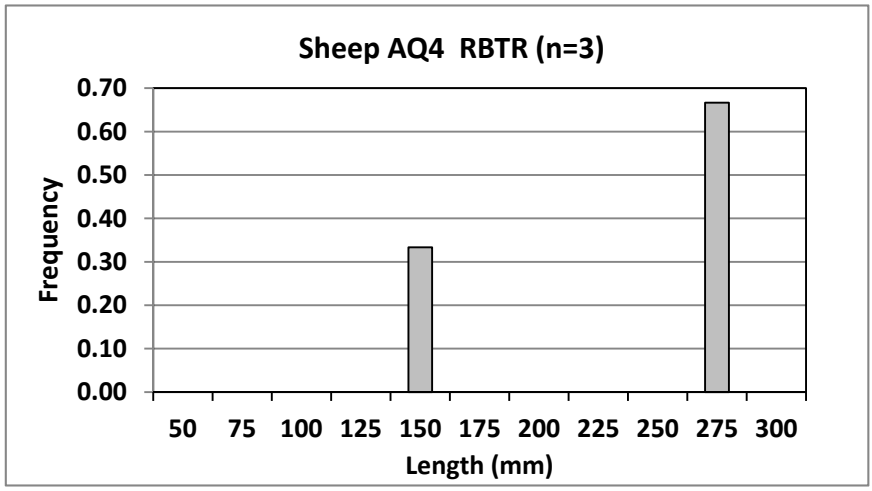
Size frequency collection data for Rainbow Trout collected during summer 2015 at the Tintina Black Butte Mine Sites

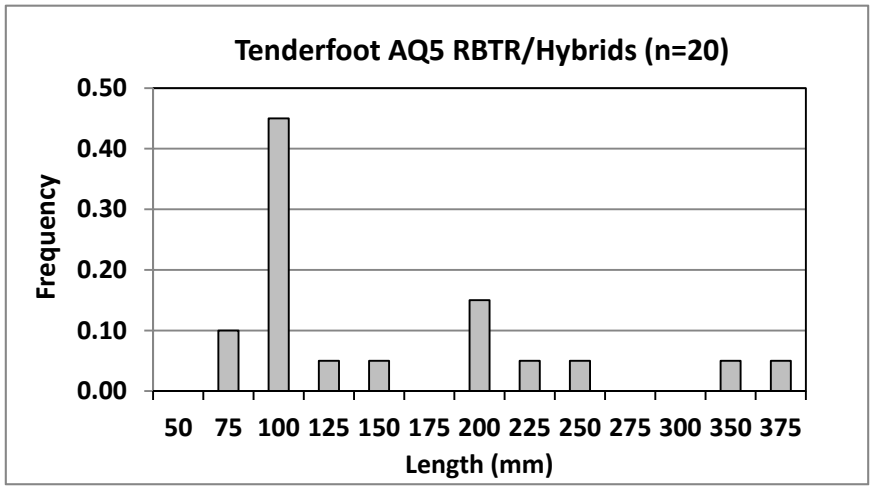


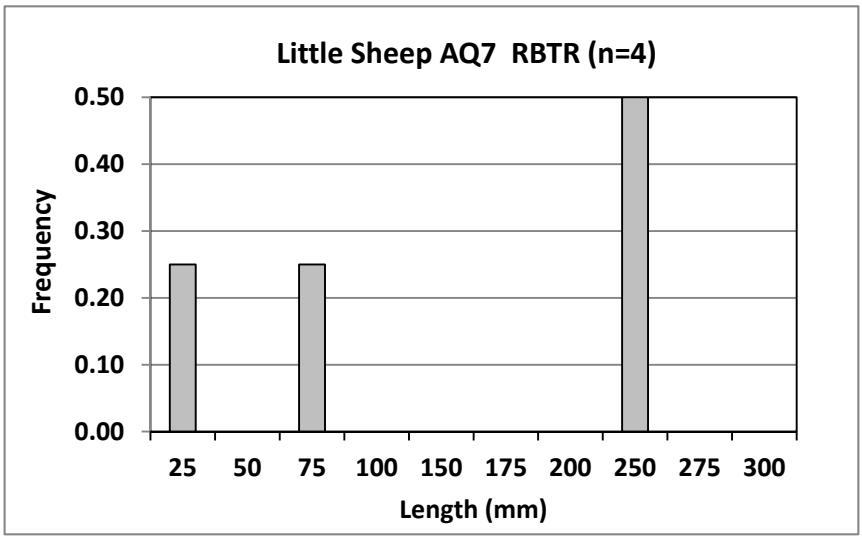




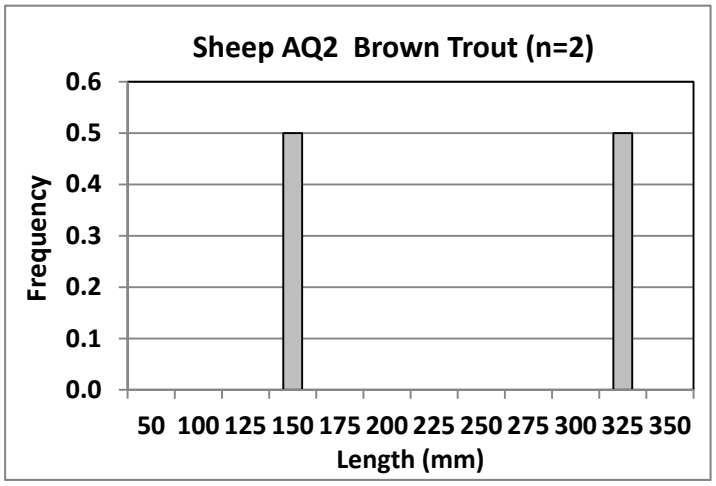
Size frequency collection data for Rainbow Trout and "Cutt-bows" collected during summer 2015 at the Tintina Black Butte Mine Sites

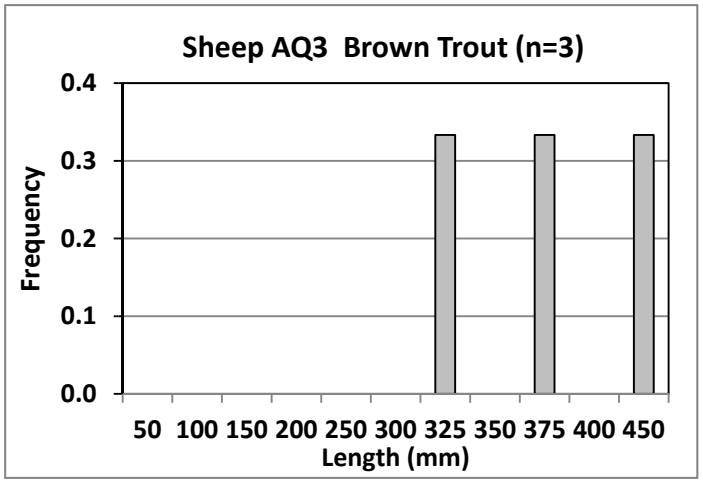


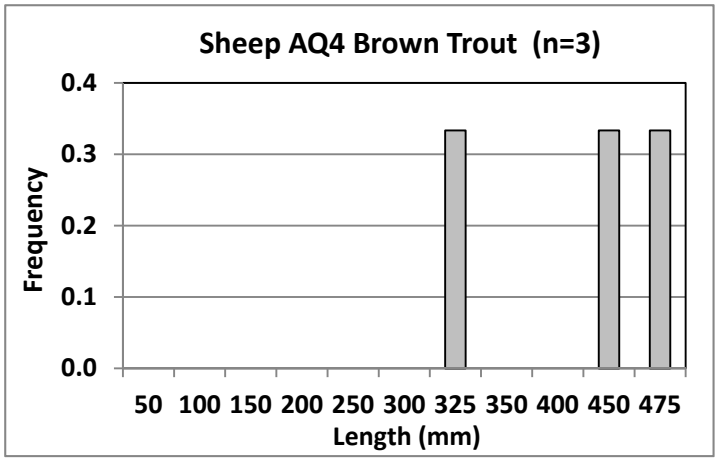


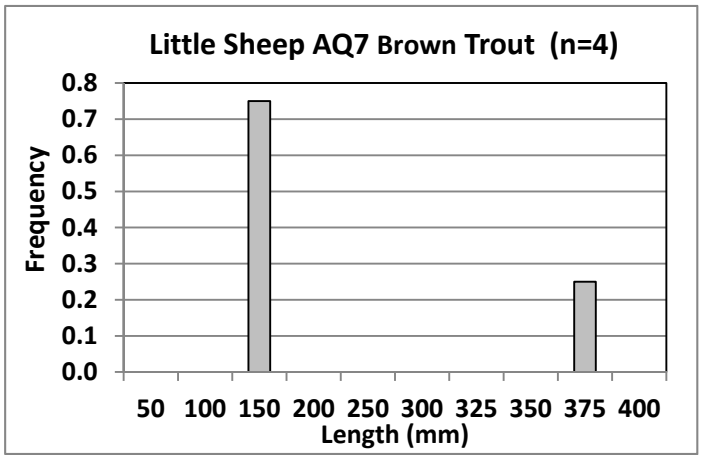


Size frequency collection data for Brown Trout collected during summer 2015 at the Tintina Black Butte Mine Sites

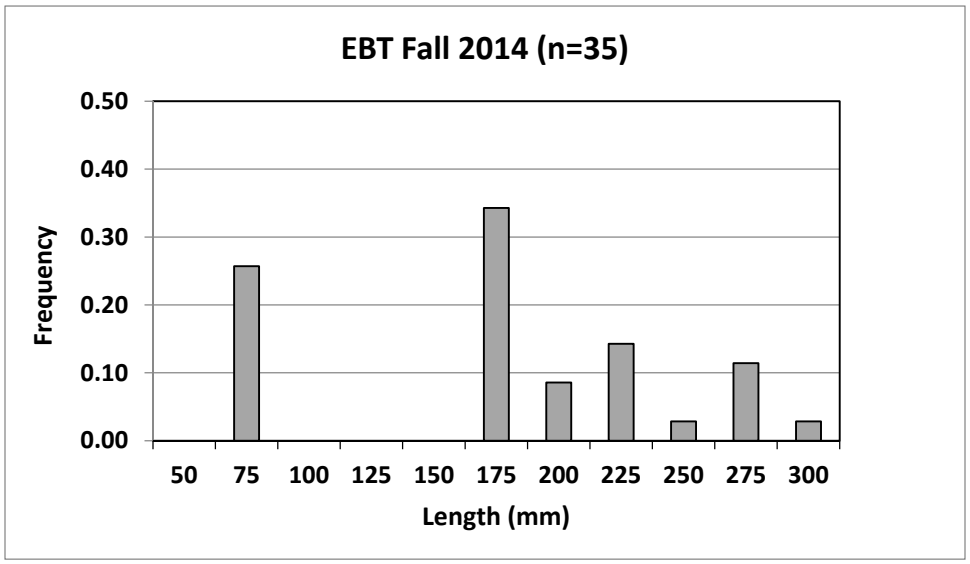


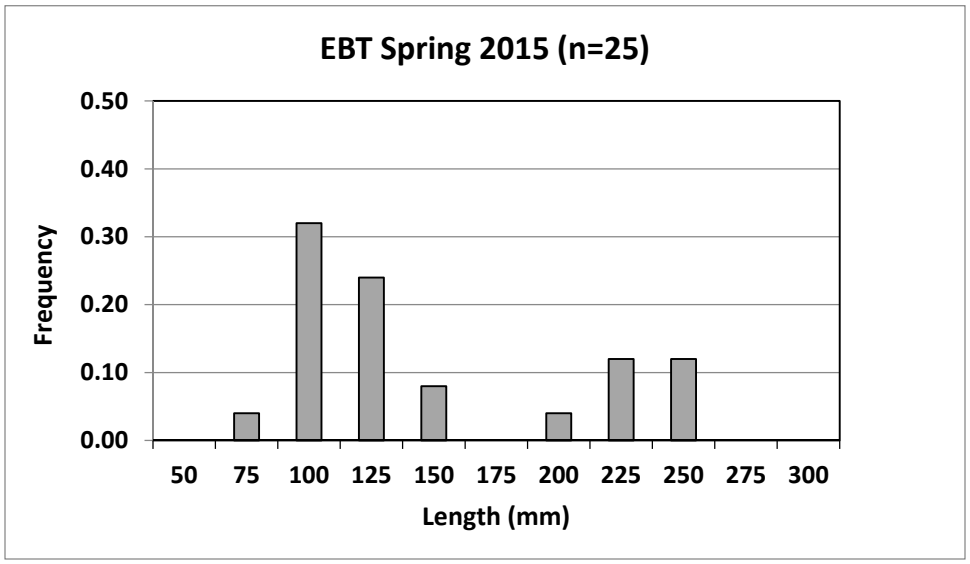


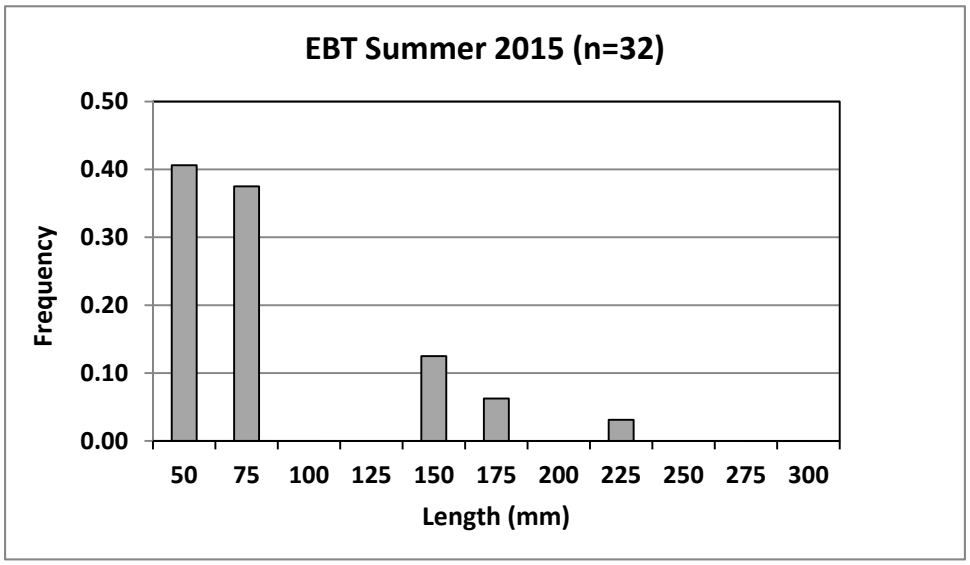




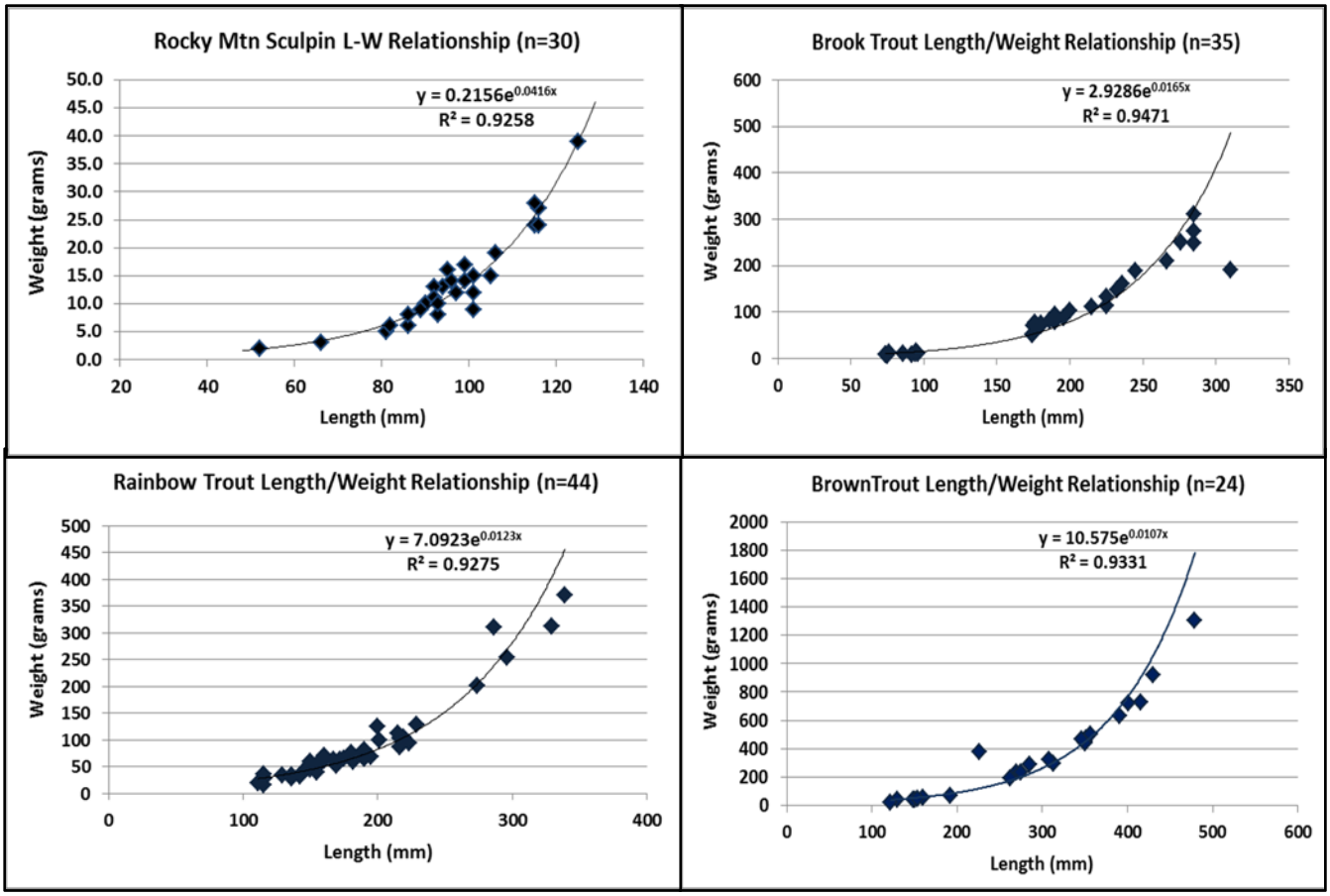
Little Sheep Creek seasonal Brook trout (EBT) size-frequency graphs







Appendix B. Length-weight relationships for Rocky Mountain Sculpin, Brook, Brown and Rainbow Trout at the Tintina Mine Sites.



Appendix C. Macroinvertebate taxa list, abundance and metrics

Montana Bioassessment Report

Waterbody Name: Little Sheep Creek AQ7 **Benthic Sample ID:** 19803

Station ID: UM_LSHEEP7 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E01-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 3040

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Thienimannimyia gr.	32			
Amphipoda	Gammarus	Gammarus lacustris	72	4	CG	"SW/50%, SP/50%"
Basommatop	Physa_Physella	Physella gyrina	24	8	CG	CN
Coleoptera	Cleptelmis	Cleptelmis addenda	8	4	CG	"CN/50%, BU/50%"
Coleoptera	Optioservus	Optioservus quadrimaculatus	352	5	SC	"CN/50%, BU/50%"
Diptera	Chironominae	Micropsectra	120	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Pagastia	360	4	CG	sp
Diptera	Hexatoma	Hexatoma	64	2	PR	BU
Diptera	Limnophila	Limnophila	8	3	PR	BU
Diptera	Orthocladiinae	Corynoneura	40		CG/SC	SP/BU
Diptera	Orthocladiinae	Cricotopus bicinctus	40		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	128		CG/SC	SP/BU
Diptera	Orthocladiinae	Lopescladius	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	80		CG/SC	SP/BU
Diptera	Orthocladiinae	Parametriocnemus	136		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	16		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	96		CG/SC	SP/BU
Diptera	Simuliidae	Simulium	960	6	CF	CN
Diptera	Tanypodinae	Radotanypus	24		PR	SP/BU
Diptera	Tipula	Tipula	56	4	SH	BU
Ephemeropte	Baetis	Baetis tricaudatus	120	5	CG	"SW/10%, CN/90%"
Ephemeropte	Diphetor	Diphetor hageni	8	5	CG	"SW/10%, CN/90%"
Ephemeropte	Leucrocuta	Leucrocuta	40	1	SC	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	16	1	CG	SW/CN/SP
Plecoptera	Isoperla	Isoperla	8	2	PR	CN
Plecoptera	Megarcys	Megarcys	16	1	PR	CN
Rhynchobdell	Glossiphoniidae	Helobdella stagnalis	8	9	PR	SW
Trichoptera	Agapetus	Agapetus montanus	8	0	SC	CN
Trichoptera	Arctopsyche	Arctopsyche grandis	8	2	CF	CN
Trichoptera	Brachycentrus	Brachycentrus americanus	88	1	CF	CN
Trichoptera	Brachycentrus	Brachycentrus occidentalis	24	1	CF	CN
Trichoptera	Glossosoma	Glossosoma	8	0	SC	CN
Trichoptera	Lepidostoma	Lepidostoma	16	1	SH	CM/SP
TRICHOPTE	Neophylax	NEOPHYLAX OCCIDENTIS	8	3	SC	CN
Veneroida	Pisidiidae	Pisidium	40	8	CF	BU

Montana Bioassessment Report

Waterbody Name: Little Sheep Creek AQ8 **Benthic Sample ID:** 19804

Station ID: UM_LSHEEP8 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E03-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 566

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
Basommatop	Planorbidae	Gyraulus parvus	3	6	CG	CN
Coleoptera	Haliplus	Haliplus	3	8	PH	:N,CM (la), SW,CM (ad
Coleoptera	Heterlimnius	Heterlimnius corpulentus	45	3	SC/CG	"CN/50%, BU/50%"
Coleoptera	Optioservus	Optioservus quadrimaculatus	10	5	SC	"CN/50%, BU/50%"
Diptera	Chironominae	Rheotanytarsus	13	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Pagastia	10	4	CG	sp
Diptera	Diamesinae	Potthastia	6	4	CG	sp
Diptera	Hedriodiscus/Odon	Odontomyia	3		CG	SP
Diptera	Limnophila	Limnophila	10	3	PR	BU
Diptera	Muscidae	Limnophora	6	9	PR	SP/BU
Diptera	Orthocladiinae	Cricotopus	10		CG/SC	SP/BU
Diptera	Orthocladiinae	Cricotopus bicinctus	13		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	6		CG/SC	SP/BU
Diptera	Orthocladiinae	Heterotrissocladius marcidus	35		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	6		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	10		CG/SC	SP/BU
Diptera	Orthocladiinae	Parametriocnemus	3		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia bavarica	6		CG/SC	SP/BU
Diptera	Simuliidae	Simulium	10	6	CF	CN
Diptera	Tabanidae	Chrysops	32	10	PR	SP
Diptera	Tipula	Tipula	102	4	SH	BU
Ephemeropte	Baetis	Baetis tricaudatus	3	5	CG	"SW/10%, CN/90%"
Ephemeropte	Nixe	Nixe	3	4	SC	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	3	1	CG	SW/CN/SP
Haplotaxida	Oligochaeta	Lumbricina	26	8	CG	BU
Haplotaxida	Oligochaeta	Tubificidae	10	8	CG	BU
Megaloptera	Sialidae	Sialis velata	3	4	unk	"CN,CM,BU"
Plecoptera	Amphinemura	Amphinemura	3	2	SH	CN
Plecoptera	Chloroperlidae	Suwallia	3	1	PR	CN
Plecoptera	Chloroperlidae	Sweltsa	26	1	PR	CN
Plecoptera	Megarcys	Megarcys	6	1	PR	CN
Plecoptera	Skwala	Skwala	10	3	PR	CN
Plecoptera	Taeniopterygidae	Taeniopterygidae	10	2	SH	CN
Trichoptera	Brachycentrus	Brachycentrus americanus	3	1	CF	CN
Trichoptera	Dicosmoecus	Dicosmoecus gilvipes	3	2	SC	SP

Montana Bioassessment Report

Waterbody Name: Little Sheep Creek AQ8 **Benthic Sample ID:** 19804

Station ID: UM_LSHEEP8 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E03-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 566

Trichoptera	Limnephilus	Limnephilus	67	3	SH	CM/SP
Veneroida	Pisidiidae	Pisidium	45	8	CF	BU

Montana Bioassessment Report

Waterbody Name: Sheep Creek AQ1 **Benthic Sample ID:** 19805

Station ID: UM_SHEEPAQ1 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E05-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 738

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Nostococladius	2			
		Stagnicola elodes	4			
		Thienimannimyia gr.	4			
Coleoptera	Cleptelmis	Cleptelmis addenda	8	4	CG	"CN/50%, BU/50%"
Coleoptera	Heterlimnius	Heterlimnius corpulentus	2	3	SC/CG	"CN/50%, BU/50%"
Coleoptera	Optioservus	Optioservus quadrimaculatus	234	5	SC	"CN/50%, BU/50%"
Coleoptera	Oreodytes	Oreodytes	2	5	PR	"CM (la), DI, SW (ad)"
Coleoptera	Zaitzevia	Zaitzevia parvula	10	5	SC/CG	"CN/50%, BU/50%"
Diptera	Antocha	Antocha saxicola	8	3	CG	CN
Diptera	Atherix	Atherix	22	5	PR	SP/BU
Diptera	Chelifera_Metachel	Chelifera	2	5	unk	SP
Diptera	Chironominae	Polypedilum	2	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Rheotanytarsus	30	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Stempellina	4	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Tanytarsus	10	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Pagastia	6	4	CG	sp
Diptera	Diamesinae	Potthastia	2	4	CG	sp
Diptera	Orthocladiinae	Eukiefferiella gracei	2		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	4		CG/SC	SP/BU
Diptera	Pelecorhynchidae	Glutops	2	1	PR	SP
Diptera	Simuliidae	Simulium	4	6	CF	CN
Ephemeropte	Attenella	Attenella margarita	12	3	CG	CN
Ephemeropte	Baetis	Baetis tricaudatus	88	5	CG	"SW/10%, CN/90%"
Ephemeropte	Drunella grandis	Drunella grandis	2	2	PR	"CN/75%, SP/25%"
Ephemeropte	Paraleptophlebia	Paraleptophlebia	2	1	CG	SW/CN/SP
Haplotaxida	Oligochaeta	Lumbricina	6	8	CG	BU
Plecoptera	Chloroperlidae	Suwallia	4	1	PR	CN
Plecoptera	Chloroperlidae	Sweltsa	20	1	PR	CN
Plecoptera	Hesperoperla	Hesperoperla pacifica	4	1	PR	CN
Plecoptera	Isoperla	Isoperla	2	2	PR	CN
Plecoptera	Megarcys	Megarcys	4	1	PR	CN
Plecoptera	Pteronarcys	Pteronarcys dorsata	6	2	SH	CN
Plecoptera	Skwala	Skwala	6	3	PR	CN
Plecoptera	Zapada	Zapada cinctipes	4	2	SH	CN
Trichoptera	Arctopsyche	Arctopsyche grandis	10	2	CF	CN

Montana Bioassessment Report

Waterbody Name: Sheep Creek AQ1 **Benthic Sample ID:** 19805

Station ID: UM_SHEEPAQ1 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E05-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 738

Trichoptera	Brachycentrus	Brachycentrus americanus	50	1	CF	CN
Trichoptera	Ceraclea	Ceraclea	6	3	CG	SP/CN
Trichoptera	Dicosmoecus	Dicosmoecus gilvipes	2	2	SC	SP
Trichoptera	Helicopsyche	Helicopsyche borealis	4	3	SC	CN
Trichoptera	Hydropsyche_Cera	Hydropsyche confusa	30	5	CF	CN
Trichoptera	Lepidostoma	Lepidostoma	80	1	SH	CM/SP
Trichoptera	Micrasema	Micrasema bactro	8	1	SH	CN
Trichoptera	Ochrotrichia	Ochrotrichia	16	4	CG	CN
Veneroida	Pisidiidae	Pisidium	8	8	CF	BU

Montana Bioassessment Report

Waterbody Name: Sheep Creek AQ2 **Benthic Sample ID:** 19806

Station ID: UM_SHEEPAQ2 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E04-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 615

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Nostococladius	3			
		Rhyachophila brunnea gr.	1			
		Stagnicola elodes	1			
		Thienimannimyia gr.	10			
Basommatop	Lymnaeidae	Fossaria humilis	1	6	CG	CN
Coleoptera	Cleptelmis	Cleptelmis addenda	4	4	CG	"CN/50%, BU/50%"
Coleoptera	Heterlimnius	Heterlimnius corpulentus	5	3	SC/CG	"CN/50%, BU/50%"
Coleoptera	Narpus	Narpus concolor	1	2	CG	"CN/50%, BU/50%"
Coleoptera	Optioservus	Optioservus quadrimaculatus	100	5	SC	"CN/50%, BU/50%"
Coleoptera	Oreodytes	Oreodytes	5	5	PR	"CM (la), DI, SW (ad)"
Coleoptera	Zaitzevia	Zaitzevia parvula	11	5	SC/CG	"CN/50%, BU/50%"
Diptera	Atherix	Atherix	5	5	PR	SP/BU
Diptera	Chironominae	Micropsectra	3	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Rheotanytarsus	28	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Stempellina	5	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Pagastia	7	4	CG	sp
Diptera	Diamesinae	Potthastia	2	4	CG	sp
Diptera	Hexatoma	Hexatoma	9	2	PR	BU
Diptera	Limnophila	Limnophila	3	3	PR	BU
Diptera	Orthocladiinae	Eukiefferiella	3		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	3		CG/SC	SP/BU
Diptera	Orthocladiinae	Parametriocnemus	2		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	3		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia bavarica	5		CG/SC	SP/BU
Diptera	Simuliidae	Simulium	6	6	CF	CN
Ephemeropte	Ameletus	Ameletus	2	0	SC	"SW/10%, CN/90%"
Ephemeropte	Ameletus	Ameletus validus	1	0	SC	"SW/10%, CN/90%"
Ephemeropte	Attenella	Attenella margarita	4	3	CG	CN
Ephemeropte	Baetis	Baetis flavistriga	2	5	CG	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	108	5	CG	"SW/10%, CN/90%"
Ephemeropte	Drunella grandis	Drunella grandis	7	2	PR	"CN/75%, SP/25%"
Ephemeropte	Paraleptophlebia	Paraleptophlebia	1	1	CG	SW/CN/SP
Ephemeropte	Serratella	Serratella tibialis	5	2	CG	CN
Haplotaxida	Oligochaeta	Tubificidae	3	8	CG	BU
Plecoptera	Chloroperlidae	Suwallia	5	1	PR	CN

Montana Bioassessment Report

Waterbody Name: Sheep Creek AQ2 **Benthic Sample ID:** 19806

Station ID: UM_SHEEPAQ2 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E04-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 615

Plecoptera	Chloroperlidae	Sweltsa	37	1	PR	CN
Plecoptera	Hesperoperla	Hesperoperla pacifica	5	1	PR	CN
Plecoptera	Skwala	Skwala	6	3	PR	CN
Plecoptera	Zapada	Zapada cinctipes	4	2	SH	CN
Trichoptera	Arctopsyche	Arctopsyche grandis	8	2	CF	CN
Trichoptera	Brachycentrus	Brachycentrus americanus	70	1	CF	CN
Trichoptera	Lepidostoma	Lepidostoma	71	1	SH	CM/SP
Trichoptera	Micrasema	Micrasema bactro	32	1	SH	CN
Trichoptera	Ochrotrichia	Ochrotrichia	1	4	CG	CN
Trombidiform	Acarina	Hydrovolzia	2	5	PR	"SW/10%, CN/90%"
Veneroida	Pisidiidae	Pisidium	5	8	CF	BU
Veneroida	Pisidiidae	Sphaerium	10	8	CF	BU

Montana Bioassessment Report

Waterbody Name: Sheep Creek AQ3 **Benthic Sample ID:** 19807

Station ID: UM_SHEEPAQ3 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E02-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 3152

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Thienimannimyia gr.	24			
Coleoptera	Lara	Lara avara	16	1	SH	"CN/50%, BU/50%"
Coleoptera	Optioservus	Optioservus quadrimaculatus	1792	5	SC	"CN/50%, BU/50%"
Coleoptera	Oreodytes	Oreodytes	40	5	PR	"CM (la), DI, SW (ad)"
Coleoptera	Zaitzevia	Zaitzevia parvula	24	5	SC/CG	"CN/50%, BU/50%"
Diptera	Antocha	Antocha	8	3	CG	CN
Diptera	Chironominae	Rheotanytarsus	40	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Tanytarsus	16	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Pagastia	88	4	CG	sp
Diptera	Hexatoma	Hexatoma	144	2	PR	BU
Diptera	Orthocladiinae	Corynoneura	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella devonica	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	16		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella pseudomontana	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	8		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	8		CG/SC	SP/BU
Diptera	Simuliidae	Simulium	32	6	CF	CN
Ephemeropte	Baetis	Baetis tricaudatus	96	5	CG	"SW/10%, CN/90%"
Ephemeropte	Drunella grandis	Drunella grandis	16	2	PR	"CN/75%, SP/25%"
Ephemeropte	Ephemera	Ephemera simulans	8	2	CG	BU
Ephemeropte	Paraleptophlebia	Paraleptophlebia	32	1	CG	SW/CN/SP
Ephemeropte	Rhithrogena	Rhithrogena	8	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	72	2	CG	CN
Ephemeropte	Timpanoga	Timpanoga hecuba	8	2	CG	CN/SP
Haplotaxida	Oligochaeta	Tubificidae	16	8	CG	BU
Plecoptera	Chloroperlidae	Sweltsa	32	1	PR	CN
Plecoptera	Hesperoperla	Hesperoperla pacifica	56	1	PR	CN
Plecoptera	Megarcys	Megarcys	24	1	PR	CN
Trichoptera	Agapetus	Agapetus montanus	8	0	SC	CN
Trichoptera	Arctopsyche	Arctopsyche grandis	24	2	CF	CN
Trichoptera	Brachycentrus	Brachycentrus americanus	336	1	CF	CN
Trichoptera	Ceraclea	Ceraclea	16	3	CG	SP/CN
Trichoptera	Dolophilodes	Dolophilodes	8	0	CF	CN
Trichoptera	Hydropsyche_Cera	Hydropsyche confusa	24	5	CF	CN

Montana Bioassessment Report

Waterbody Name: Sheep Creek AQ3 **Benthic Sample ID:** 19807

Station ID: UM_SHEEPAQ3 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E02-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 3152

Trichoptera	Hydroptila	Hydroptila	8	6	PH	CN
Trichoptera	Lepidostoma	Lepidostoma	16	1	SH	CM/SP
Trichoptera	Micrasema	Micrasema bactro	32	1	SH	CN
TRICHOPTE	Neophylax	NEOPHYLAX OCCIDENTIS	24	3	SC	CN

Montana Bioassessment Report

Waterbody Name: Sheep Creek AQ4 **Benthic Sample ID:** 19808

Station ID: UM_SHEEPAQ4 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E08-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 734

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Hetereotrissocladius	1			
		Nostococladius	1			
		Thienimannimyia gr.	4			
Basommatop	Planorbidae	Gyraulus parvus	1	6	CG	CN
Coleoptera	Cleptelmis	Cleptelmis addenda	1	4	CG	"CN/50%, BU/50%"
Coleoptera	Optioservus	Optioservus quadrimaculatus	220	5	SC	"CN/50%, BU/50%"
Coleoptera	Oreodytes	Oreodytes	2	5	PR	"CM (la), DI, SW (ad)"
Coleoptera	Zaitzevia	Zaitzevia parvula	17	5	SC/CG	"CN/50%, BU/50%"
Diptera	Antocha	Antocha monticola	7	3	CG	CN
Diptera	Atherix	Atherix pachypus	5	5	PR	SP/BU
Diptera	Chironominae	Phaenopsectra	1	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Rheotanytarsus	12	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Stempellina	7	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Tanytarsus	29	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Pagastia	11	4	CG	sp
Diptera	Diamesinae	Potthastia	2	4	CG	sp
Diptera	Hemerodromia	Hemerodromia	1	6	PR	SP
Diptera	Hexatoma	Hexatoma	14	2	PR	BU
Diptera	Orthocladiinae	Corynoneura	1		CG/SC	SP/BU
Diptera	Orthocladiinae	Cricotopus	3		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella devonica	1		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	2		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	1		CG/SC	SP/BU
Diptera	Orthocladiinae	Synorthocladius	2		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	10		CG/SC	SP/BU
Diptera	Pelecorhynchidae	Glutops	1	1	PR	SP
Diptera	Prodiamesinae	Odontomesa	2	5	CG	BU/SP
Diptera	Simuliidae	Simulium	4	6	CF	CN
Ephemeropte	Attenella	Attenella margarita	11	3	CG	CN
Ephemeropte	Baetis	Baetis tricaudatus	87	5	CG	"SW/10%, CN/90%"
Ephemeropte	Cinygmula	Cinygmula	1	0	SC	CN
Ephemeropte	Diphetor	Diphetor hageni	1	5	CG	"SW/10%, CN/90%"
Ephemeropte	Drunella grandis	Drunella grandis	6	2	PR	"CN/75%, SP/25%"
Ephemeropte	Ephemerella	Ephemerella excrucians	1	2	CG	CN/SW

Montana Bioassessment Report

Waterbody Name: Sheep Creek AQ4 **Benthic Sample ID:** 19808

Station ID: UM_SHEEPAQ4 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E08-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 734

Ephemeropte	Leucrocuta	Leucrocuta	1	1	SC	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	3	1	CG	SW/CN/SP
Ephemeropte	Rhithrogena	Rhithrogena	1	0	CG	CN
Ephemeropte	Serratella	Serratella tibialis	1	2	CG	CN
Haplotaxida	Oligochaeta	Lumbricina	1	8	CG	BU
Haplotaxida	Oligochaeta	Tubificidae	20	8	CG	BU
Lumbriculida	Oligochaeta	Lumbriculidae	1	8	CG	BU
Plecoptera	Chloroperlidae	Sweltsa	31	1	PR	CN
Plecoptera	Hesperoperla	Hesperoperla pacifica	5	1	PR	CN
Plecoptera	Megarcys	Megarcys	33	1	PR	CN
Trichoptera	Agapetus	Agapetus montanus	1	0	SC	CN
Trichoptera	Arctopsyche	Arctopsyche grandis	3	2	CF	CN
Trichoptera	Brachycentrus	Brachycentrus americanus	97	1	CF	CN
Trichoptera	Ceraclea	Ceraclea	2	3	CG	SP/CN
Trichoptera	Dicosmoecus	Dicosmoecus gilvipes	1	2	SC	SP
Trichoptera	Ecclisomyia	Ecclisomyia	1	4	CG	CN/SP/CM
Trichoptera	Glossosoma	Glossosoma	5	0	SC	CN
Trichoptera	Helicopsyche	Helicopsyche borealis	2	3	SC	CN
Trichoptera	Hydropsyche_Cera	Hydropsyche confusa	6	5	CF	CN
Trichoptera	Hydropsyche_Cera	Hydropsyche morosa gr.	8	5	CF	CN
Trichoptera	Lepidostoma	Lepidostoma	24	1	SH	CM/SP
Trichoptera	Micrasema	Micrasema bactro	9	1	SH	CN
TRICHOPTE	Neophylax	NEOPHYLAX OCCIDENTIS	1	3	SC	CN
Trichoptera	Ochrotrichia	Ochrotrichia	2	4	CG	CN
Trichoptera	Onocosmoecus	Onocosmoecus unicolor	1	3	SH	"SP/75%, CG/25%"

Montana Bioassessment Report

Waterbody Name: Tenderfoot Creek AQ5 **Benthic Sample ID:** 19809

Station ID: UM_TENDAQ5 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E07-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 464

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Rhyachophila brunnea gr.	6			
		Thienimannimyia gr.	7			
Coleoptera	Microcylloepus	Microcylloepus pusillus	2	5	CG	"CN/50%, BU/50%"
Coleoptera	Narpus	Narpus concolor	1	2	CG	"CN/50%, BU/50%"
Coleoptera	Optioservus	Optioservus quadrimaculatus	5	5	SC	"CN/50%, BU/50%"
Coleoptera	Oreodytes	Oreodytes	1	5	PR	"CM (la), DI, SW (ad)"
Coleoptera	Zaitzevia	Zaitzevia parvula	2	5	SC/CG	"CN/50%, BU/50%"
Diptera	Antocha	Antocha	7	3	CG	CN
Diptera	Ceratopogoninae	Probezzia	1	6	PR/CG	SP/BU/SW
Diptera	Chelifera_Metachel	Chelifera	1	5	unk	SP
Diptera	Chironominae	Rheotanytarsus	3	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Stempellina	19	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Tanytarsus	95	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Pagastia	28	4	CG	sp
Diptera	Diamesinae	Potthastia	2	4	CG	sp
Diptera	Hexatoma	Hexatoma	1	2	PR	BU
Diptera	Orthocladiinae	Corynoneura	2		CG/SC	SP/BU
Diptera	Orthocladiinae	Cricotopus bicinctus	19		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	1		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	20		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	15		CG/SC	SP/BU
Diptera	Orthocladiinae	Parametriocnemus	6		CG/SC	SP/BU
Diptera	Orthocladiinae	Paraphaenocladius	14		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	3		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia bavarica	19		CG/SC	SP/BU
Diptera	Pelecorhynchidae	Glutops	1	1	PR	SP
Diptera	Pericoma/Telmatos	Pericoma	8	4	CG	BU
Diptera	Simuliidae	Simulium	13	6	CF	CN
Ephemeropte	Attenella	Attenella margarita	8	3	CG	CN
Ephemeropte	Baetis	Baetis flavistriga	5	5	CG	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	48	5	CG	"SW/10%, CN/90%"
Ephemeropte	Drunella grandis	Drunella grandis	11	2	PR	"CN/75%, SP/25%"
Ephemeropte	Ephemerella	Ephemerella excrucians	1	2	CG	CN/SW
Ephemeropte	Paraleptophlebia	Paraleptophlebia	7	1	CG	SW/CN/SP
Ephemeropte	Serratella	Serratella tibialis	6	2	CG	CN

Montana Bioassessment Report

Waterbody Name: Tenderfoot Creek AQ5 **Benthic Sample ID:** 19809

Station ID: UM_TENDAQ5 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E07-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 464

Haplotaxida	Oligochaeta	Tubificidae	4	8	CG	BU
Plecoptera	Chloroperlidae	Suwallia	10	1	PR	CN
Plecoptera	Chloroperlidae	Sweltsa	12	1	PR	CN
Plecoptera	Hesperoperla	Hesperoperla pacifica	2	1	PR	CN
Plecoptera	Isoperla	Isoperla	1	2	PR	CN
Plecoptera	Megarcys	Megarcys	2	1	PR	CN
Plecoptera	Paraperla	Paraperla	2	1	unk	unk
Plecoptera	Zapada	Zapada cinctipes	3	2	SH	CN
Trichoptera	Arctopsyche	Arctopsyche grandis	5	2	CF	CN
Trichoptera	Brachycentrus	Brachycentrus americanus	13	1	CF	CN
Trichoptera	Ecclisomyia	Ecclisomyia	1	4	CG	CN/SP/CM
Trichoptera	Hydropsyche_Cera	Hydropsyche confusa	5	5	CF	CN
Trichoptera	Lepidostoma	Lepidostoma	2	1	SH	CM/SP
Trichoptera	Micrasema	Micrasema bactro	1	1	SH	CN
TRICHOPTE	Neophylax	NEOPHYLAX OCCIDENTIS	1	3	SC	CN
Trichoptera	Ochrotrichia	Ochrotrichia	10	4	CG	CN
Trichoptera	Psychoglypha	Psychoglypha	1	0	CG	SP
Trombidiform	Acarina	Testudacarus	1	5	PR	"SW/10%, CN/90%"

Montana Bioassessment Report

Waterbody Name: Tenderfoot Creek AQ6 **Benthic Sample ID:** 19810

Station ID: UM_TENDAQ6 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E06-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 760

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Rhyachophila brunnea gr.	12			
		Thienimannimyia gr.	12			
Coleoptera	Microcylloepus	Microcylloepus pusillus	2	5	CG	"CN/50%, BU/50%"
Coleoptera	Narpus	Narpus concolor	2	2	CG	"CN/50%, BU/50%"
Coleoptera	Optioservus	Optioservus quadrimaculatus	26	5	SC	"CN/50%, BU/50%"
Coleoptera	Oreodytes	Oreodytes	2	5	PR	"CM (la), DI, SW (ad)"
Coleoptera	Zaitzevia	Zaitzevia parvula	8	5	SC/CG	"CN/50%, BU/50%"
Diptera	Antocha	Antocha	32	3	CG	CN
Diptera	Chironominae	Rheotanytarsus	44	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Tanytarsus	60	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Pagastia	48	4	CG	sp
Diptera	Diamesinae	Potthastia	6	4	CG	sp
Diptera	Hexatoma	Hexatoma	8	2	PR	BU
Diptera	Orthocladiinae	Cricotopus bicinctus	24		CG/SC	SP/BU
Diptera	Orthocladiinae	Eukiefferiella gracei	2		CG/SC	SP/BU
Diptera	Orthocladiinae	Orthocladius	30		CG/SC	SP/BU
Diptera	Orthocladiinae	Parakiefferiella	4		CG/SC	SP/BU
Diptera	Orthocladiinae	Rheocricotopus	32		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia bavarica	32		CG/SC	SP/BU
Diptera	Pelecorhynchidae	Glutops	2	1	PR	SP
Diptera	Pericoma/Telmatos	Pericoma	4	4	CG	BU
Ephemeropte	Ameletus	Ameletus	8	0	SC	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis flavistriga	2	5	CG	"SW/10%, CN/90%"
Ephemeropte	Baetis	Baetis tricaudatus	96	5	CG	"SW/10%, CN/90%"
Ephemeropte	Drunella grandis	Drunella grandis	10	2	PR	"CN/75%, SP/25%"
Ephemeropte	Ephemerella	Ephemerella excrucians	10	2	CG	CN/SW
Ephemeropte	Nixe	Nixe	2	4	SC	CN
Ephemeropte	Paraleptophlebia	Paraleptophlebia	4	1	CG	SW/CN/SP
Ephemeropte	Serratella	Serratella tibialis	20	2	CG	CN
Plecoptera	Chloroperlidae	Suwallia	4	1	PR	CN
Plecoptera	Chloroperlidae	Sweltsa	60	1	PR	CN
Plecoptera	Hesperoperla	Hesperoperla pacifica	6	1	PR	CN
Plecoptera	Isoperla	Isoperla	2	2	PR	CN
Plecoptera	Skwala	Skwala	6	3	PR	CN
Plecoptera	Zapada	Zapada cinctipes	10	2	SH	CN

Montana Bioassessment Report

Waterbody Name: Tenderfoot Creek AQ6 **Benthic Sample ID:** 19810

Station ID: UM_TENDAQ6 **Rep. Num** 0

Reference Status: **STORET Activity ID:** E06-R500-M

Site Classification: **Collection Date:** 08/16/2014

Latitude: **Collection Method:** MAC-R-500

Longitude: **Total Number of Individuals in Sample:** 760

Trichoptera	Arctopsyche	Arctopsyche grandis	14	2	CF	CN
Trichoptera	Brachycentrus	Brachycentrus americanus	74	1	CF	CN
Trichoptera	Ecclisomyia	Ecclisomyia	4	4	CG	CN/SP/CM
Trichoptera	Hydropsyche_Cera	Hydropsyche confusa	14	5	CF	CN
Trichoptera	Lepidostoma	Lepidostoma	8	1	SH	CM/SP
Trichoptera	Micrasema	Micrasema bactro	6	1	SH	CN
Trichoptera	Ochrotrichia	Ochrotrichia	6	4	CG	CN
Trichoptera	Psychoglypha	Psychoglypha	2	0	CG	SP

Montana Bioassessment Report

Waterbody Name: Coon Creek u/s from county rd.
Benthic Sample ID: 18208
Station ID: UMCOONAQ9
Rep. Num 0
Reference Status:
STORET Activity ID: S09-R500-M
Site Classification:
Collection Date: 07/08/2015
Latitude:
Collection Method: WEMAP-RW
Longitude:
Total Number of Individuals in Sample: 504

Sample Taxa List

Order:	*OTU name:*	*FinalID:*	*Individuals*	*Tol Val:*	*FFG:*	*Habit:*
		Nostococladius	2			
		Thienimanniella	2			
.	Turbellaria	Polycelis coronata	8	4	CG/PR	SP
Basommatop	Lymnaeidae	Pseudosuccinea columella	6	6	CG	CN
Coleoptera	Heterlimnius	Heterlimnius corpulentus	40	3	SC/CG	"CN/50%, BU/50%"
Coleoptera	Hydrobius	Hydrobius	2			
Diptera	CALOPARYPHUS/	Caloparyphus	6	7	CG	SP
Diptera	Chironominae	Micropsectra	12	7	CG/CF/PR	BU/CN/SP
Diptera	Diamesinae	Pagastia	2	4	CG	sp
Diptera	Diamesinae	Pseudodiamesa	90	4	CG	sp
Diptera	Dicranota	Dicranota	26	0	PR	SP
Diptera	Limonia	Limonia	2		SH	BU
Diptera	Orthocladiinae	Cricotopus	10		CG/SC	SP/BU
Diptera	Orthocladiinae	HETEROTRISSOCLADIUS M	6		CG/SC	SP/BU
Diptera	Orthocladiinae	Tvetenia vitracies	8		CG/SC	SP/BU
Diptera	Prodiamesinae	Monodiamesa	2	5	CG	BU/SP
Diptera	Syrphidae	Syrphidae	2		CG	BU
Diptera	Tanypodinae	Paramerina	2		PR	SP/BU
Diptera	Tipula	Tipula	14	4	SH	BU
Ephemeropte	Baetis	Baetis tricaudatus	6	5	CG	"SW/10%, CN/90%"
Ephemeropte	Drunella coloraden	Drunella coloradensis	72	1	SC	"CN/75%, SP/25%"
Ephemeropte	Serratella	Serratella tibialis	2	2	CG	CN
Haplotaxida	Oligochaeta	Lumbricina	68	8	CG	BU
Haplotaxida	Oligochaeta	Tubificidae	10	8	CG	BU
Plecoptera	Chloroperlidae	Sweltsa	6	1	PR	CN
Plecoptera	Hesperoperla	Hesperoperla pacifica	6	1	PR	CN
Plecoptera	Paraperla	Paraperla	6	1	unk	unk
Plecoptera	Zapada	Zapada cinctipes	2	2	SH	CN
Trichoptera	Chyrandra	Chyranda centralis	2	2	SH	SP
Trichoptera	Neothremma	Neothremma alicia	20	1	SC	CN
Trichoptera	Ochrotrichia	Ochrotrichia	4	4	CG	CN
Trichoptera	Psychoglypha	Psychoglypha	16	0	CG	SP
Trichoptera	Pycnopsyche	Pycnopsyche	2		SH	SP
Trichoptera	Rhyacophila betten	Rhyacophila Betteni Gr.	2	1	PR	CN
Trichoptera	Rhyacophila brunn	Rhyacophila Brunnea Gr.	32	0	PR	CN

Montana Bioassessment Report

Waterbody Name: Coon Creek u/s from county rd.
Benthic Sample ID: 18208
Station ID: UMCOONAQ9
Rep. Num 0
Reference Status:
STORET Activity ID: S09-R500-M
Site Classification:
Collection Date: 07/08/2015
Latitude:
Collection Method: WEMAP-RW
Longitude:
Total Number of Individuals in Sample: 504

Veneroida	Pisidiidae	Pisidium	6	8	CF	BU

Montana Bioassessment Report

Waterbody Name: Little Sheep Creek AQ7
Benthic Sample ID: 19803
Station ID: UM_LSHEEP7
Rep. Num 0
Reference Status:
STORET Activity ID: E01-R500-M
Site Classification:
Collect. Date: 08/16/2014
Four Code HUC:
Collect Method: MAC-R-500
TMDL Plan. Area:
Total Indiv. in Sample: 3040

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI:

39.7

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**3**	***33.6***
Plecoptera Taxa:	**1**	***19.7***
EPT Percent:	**12.1**	***13.5***
Non-Insect Percent:	**4.7**	***83.1***
Predator Percent:	**8.2**	***20.9***
Burrower Taxa %:	**37.7**	***63.9***
HBI:	**4.91**	***43.2***

Predictive Model Results

O/E_p>0.5:

Model Test:

Total Individuals

Montana Bioassessment Report

Waterbody Name: Little Sheep Creek AQ8
Benthic Sample ID: 19804
Station ID: UM_LSHEEP8
Rep. Num 0
Reference Status:
STORET Activity ID: E03-R500-M
Site Classification:
Collect. Date: 08/16/2014
Four Code HUC:
Collect Method: MAC-R-500
TMDL Plan. Area:
Total Indiv. in Sample: 566

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI:

46.9

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**3**	***26.9***
Plecoptera Taxa:	**5**	***69.8***
EPT Percent:	**24.7**	***27.5***
Non-Insect Percent:	**14.8**	***47.0***
Predator Percent:	**18.7**	***48.0***
Burrower Taxa %:	**38.1**	***63.2***
HBI:	**4.74**	***46.1***

Predictive Model Results

O/E_p>0.5:

Model Test:

Total Individuals

Montana Bioassessment Report

Waterbody Name: Sheep Creek AQ1
Benthic Sample ID: 19805
Station ID: UM_SHEEPAQ1
Rep. Num 0
Reference Status:
STORET Activity ID: E05-R500-M
Site Classification:
Collect. Date: 08/16/2014
Four Code HUC:
Collect Method: MAC-R-500
TMDL Plan. Area:
Total Indiv. in Sample: 738

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI:

63.7

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**3**	***32.9***
Plecoptera Taxa:	**6**	***88.5***
EPT Percent:	**48.8**	***54.2***
Non-Insect Percent:	**1.9**	***93.2***
Predator Percent:	**15.4**	***39.6***
Burrower Taxa %:	**27.3**	***78.5***
HBI:	**3.97**	***58.8***

Predictive Model Results

O/E_p>0.5:

Model Test:

Total Individuals

Montana Bioassessment Report

Waterbody Name: Sheep Creek AQ2
Benthic Sample ID: 19806
Station ID: UM_SHEEPAQ2
Rep. Num 0
Reference Status:
STORET Activity ID: E04-R500-M
Site Classification:
Collect. Date: 08/16/2014
Four Code HUC:
Collect Method: MAC-R-500
TMDL Plan. Area:
Total Indiv. in Sample: 615

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI:

63.3

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**5**	***52.4***
Plecoptera Taxa:	**4**	***55.4***
EPT Percent:	**60.0**	***66.7***
Non-Insect Percent:	**3.4**	***87.8***
Predator Percent:	**19.5**	***50.0***
Burrower Taxa %:	**38.4**	***62.8***
HBI:	**3.43**	***67.9***

Predictive Model Results

O/E_p>0.5:

Model Test:

Total Individuals

Montana Bioassessment Report

Waterbody Name: Sheep Creek AQ3
Benthic Sample ID: 19807
Station ID: UM_SHEEPAQ3
Rep. Num 0
Reference Status:
STORET Activity ID: E02-R500-M
Site Classification:
Collect. Date: 08/16/2014
Four Code HUC:
Collect Method: MAC-R-500
TMDL Plan. Area:
Total Indiv. in Sample: 3152

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI:

55.8

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**5**	***54.1***
Plecoptera Taxa:	**3**	***41.0***
EPT Percent:	**26.9**	***29.9***
Non-Insect Percent:	**0.5**	***98.2***
Predator Percent:	**11.7**	***29.9***
Burrower Taxa %:	**26.9**	***79.0***
HBI:	**3.99**	***58.5***

Predictive Model Results

O/E_p>0.5:

Model Test:

Total Individuals

Montana Bioassessment Report

Waterbody Name: Sheep Creek AQ4
Benthic Sample ID: 19808
Station ID: UM_SHEEPAQ4
Rep. Num 0
Reference Status:
STORET Activity ID: E08-R500-M
Site Classification:
Collect. Date: 08/16/2014
Four Code HUC:
Collect Method: MAC-R-500
TMDL Plan. Area:
Total Indiv. in Sample: 734

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI:

62.7

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**6**	***62.0***
Plecoptera Taxa:	**3**	***41.8***
EPT Percent:	**47.0**	***52.2***
Non-Insect Percent:	**3.1**	***88.8***
Predator Percent:	**20.0**	***51.4***
Burrower Taxa %:	**25.3**	***81.3***
HBI:	**3.82**	***61.3***

Predictive Model Results

O/E_p>0.5:

Model Test:

Total Individuals

Montana Bioassessment Report

Waterbody Name: Tenderfoot Creek AQ5
Benthic Sample ID: 19809
Station ID: UM_TENDAQ5
Rep. Num 0
Reference Status:
STORET Activity ID: E07-R500-M
Site Classification:
Collect. Date: 08/16/2014
Four Code HUC:
Collect Method: MAC-R-500
TMDL Plan. Area:
Total Indiv. in Sample: 464

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI:

68.6

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**6**	***56.4***
Plecoptera Taxa:	**5**	***74.7***
EPT Percent:	**33.8**	***37.6***
Non-Insect Percent:	**1.1**	***96.2***
Predator Percent:	**34.5**	***88.4***
Burrower Taxa %:	**26.6**	***79.4***
HBI:	**4.66**	***47.4***

Predictive Model Results

O/E_p>0.5:

Model Test:

Total Individuals

Montana Bioassessment Report

Waterbody Name: Tenderfoot Creek AQ6
Benthic Sample ID: 19810
Station ID: UM_TENDAQ6
Rep. Num 0
Reference Status:
STORET Activity ID: E06-R500-M
Site Classification:
Collect. Date: 08/16/2014
Four Code HUC:
Collect Method: MAC-R-500
TMDL Plan. Area:
Total Indiv. in Sample: 760

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI:

71.4

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**6**	***64.7***
Plecoptera Taxa:	**5**	***64.7***
EPT Percent:	**48.4**	***53.8***
Non-Insect Percent:		***100.0***
Predator Percent:	**26.8**	***68.8***
Burrower Taxa %:	**24.7**	***82.1***
HBI:	**3.58**	***65.4***

Predictive Model Results

O/E_p>0.5:

Model Test:

Total Individuals

Montana Bioassessment Report

Waterbody Name: Coon Creek u/s from county rd.
Benthic Sample ID: 18208
Station ID: UMCOONAQ9
Rep. Num 0
Reference Status:
STORET Activity ID: S09-R500-M
Site Classification:
Collect. Date: 07/08/2015
Four Code HUC:
Collect Method: WEMAP-RW
TMDL Plan. Area:
Total Indiv. in Sample: 504

Latitude: GIS_LAT **Longitude:** GIS_LONG:

Mountain MMI:

48.4

Metric:	*Value*	*Score*
Ephemeroptera Taxa:	**3**	***28.3***
Plecoptera Taxa:	**4**	***54.6***
EPT Percent:	**35.3**	***39.2***
Non-Insect Percent:	**19.4**	***30.6***
Predator Percent:	**18.7**	***47.8***
Burrower Taxa %:	**33.0**	***70.4***
HBI:	**3.41**	***68.1***

Predictive Model Results

O/E_p>0.5:

Model Test:

Total Individuals

Appendix D. Periphyton taxa list, abundance and metrics

Non-diatom algae study: Black Butte Mine September 2014 Non-Diatom Algae Data					Determinations by Rhithron Associates, Inc.		
RAI Sample ID	**Client ID**	**Station Name**	**Sample Date**	**Taxon**	**Division**	**Relative Abundance**	**Biovolume Rank**
MM14BBM001	AQ1	Sheep Creek	9/4/2014	Diatoms	Bacillariophyta	A	1
MM14BBM001	AQ1	Sheep Creek	9/4/2014	*Cladophora*	Chlorophyta	C	2
MM14BBM001	AQ1	Sheep Creek	9/4/2014	*Phormidium*	Cyanophyta	C	3
MM14BBM001	AQ1	Sheep Creek	9/4/2014	*Homeothrix*	Cyanophyta	C	4
MM14BBM001	AQ1	Sheep Creek	9/4/2014	*Chamaesiphon*	Cyanophyta	C	5
MM14BBM001	AQ1	Sheep Creek	9/4/2014	*Heteroleibleinia*	Cyanophyta	C	6
MM14BBM001	AQ1	Sheep Creek	9/4/2014	*Closterium*	Chlorophyta	R	7
MM14BBM001	AQ1	Sheep Creek	9/4/2014	*Tolypothrix*	Cyanophyta	R	8
MM14BBM002	AQ2	Sheep Creek	9/3/2014	Diatoms	Bacillariophyta	VC	1
MM14BBM002	AQ2	Sheep Creek	9/3/2014	*Draparnaldia*	Chlorophyta	C	2
MM14BBM002	AQ2	Sheep Creek	9/3/2014	*Nostoc*	Cyanophyta	C	3
MM14BBM002	AQ2	Sheep Creek	9/3/2014	*Calothrix*	Cyanophyta	R	4
MM14BBM002	AQ2	Sheep Creek	9/3/2014	*Closterium*	Chlorophyta	R	5
MM14BBM003	AQ3	Sheep Creek	9/3/2014	*Cladophora*	Chlorophyta	C	1
MM14BBM003	AQ3	Sheep Creek	9/3/2014	*Tolypothrix*	Cyanophyta	C	2
MM14BBM003	AQ3	Sheep Creek	9/3/2014	Diatoms	Bacillariophyta	VC	3
MM14BBM003	AQ3	Sheep Creek	9/3/2014	*Microspora*	Chlorophyta	R	4
MM14BBM003	AQ3	Sheep Creek	9/3/2014	*Draparnaldia*	Chlorophyta	R	5
MM14BBM003	AQ3	Sheep Creek	9/3/2014	*Chamaesiphon*	Cyanophyta	C	6
MM14BBM003	AQ3	Sheep Creek	9/3/2014	*Heteroleibleinia*	Cyanophyta	C	7
MM14BBM003	AQ3	Sheep Creek	9/3/2014	*Closterium*	Chlorophyta	R	8
MM14BBM003	AQ3	Sheep Creek	9/3/2014	*Pseudanabaena*	Cyanophyta	R	9
MM14BBM004	AQ4	Sheep Creek	9/4/2014	Diatoms	Bacillariophyta	A	1
MM14BBM004	AQ4	Sheep Creek	9/4/2014	*Homeothrix*	Cyanophyta	VC	2
MM14BBM004	AQ4	Sheep Creek	9/4/2014	*Phormidium*	Cyanophyta	C	3
MM14BBM004	AQ4	Sheep Creek	9/4/2014	*Closterium*	Chlorophyta	R	4
MM14BBM004	AQ4	Sheep Creek	9/4/2014	*Stigeoclonium*	Chlorophyta	R	5
MM14BBM005	AQ5	Tenderfoot Creek	9/4/2014	Diatoms	Bacillariophyta	A	1
MM14BBM005	AQ5	Tenderfoot Creek	9/4/2014	*Zygnema*	Chlorophyta	C	2
MM14BBM005	AQ5	Tenderfoot Creek	9/4/2014	*Closterium*	Chlorophyta	R	3
MM14BBM005	AQ5	Tenderfoot Creek	9/4/2014	*Microspora*	Chlorophyta	R	4
MM14BBM006	AQ6	Tenderfoot Creek	9/4/2014	Diatoms	Bacillariophyta	A	1
MM14BBM006	AQ6	Tenderfoot Creek	9/4/2014	*Zygnema*	Chlorophyta	C	2
MM14BBM006	AQ6	Tenderfoot Creek	9/4/2014	*Tribonema*	Chrysophyta	C	3
MM14BBM006	AQ6	Tenderfoot Creek	9/4/2014	*Hydrurus*	Chrysophyta	R	4

MM14BBM006	AQ6	Tenderfoot Creek	9/4/2014	*Closterium*	Chlorophyta	R	5
MM14BBM007	AQ7	Little Sheep Creek	9/3/2014	*Spirogyra*	Chlorophyta	VC	1
MM14BBM007	AQ7	Little Sheep Creek	9/3/2014	Diatoms	Bacillariophyta	A	2
MM14BBM007	AQ7	Little Sheep Creek	9/3/2014	*Cladophora*	Chlorophyta	C	3
MM14BBM007	AQ7	Little Sheep Creek	9/3/2014	*Rhizoclonium*	Chlorophyta	C	4
MM14BBM007	AQ7	Little Sheep Creek	9/3/2014	*Phormidium*	Cyanophyta	C	5
MM14BBM007	AQ7	Little Sheep Creek	9/3/2014	*Stigeoclonium*	Chlorophyta	C	6
MM14BBM007	AQ7	Little Sheep Creek	9/3/2014	*Microspora*	Chlorophyta	C	7
MM14BBM007	AQ7	Little Sheep Creek	9/3/2014	*Closterium*	Chlorophyta	R	8
MM14BBM007	AQ7	Little Sheep Creek	9/3/2014	*Cosmarium*	Chlorophyta	R	9
MM14BBM008	AQ8 SW8	Little Sheep Creek	9/3/2014	Diatoms	Bacillariophyta	VA	1
MM14BBM008	AQ8 SW8	Little Sheep Creek	9/3/2014	*Anabaena*	Cyanophyta	C	2
MM14BBM008	AQ8 SW8	Little Sheep Creek	9/3/2014	*Microspora*	Chlorophyta	C	3
MM14BBM008	AQ8 SW8	Little Sheep Creek	9/3/2014	*Heteroleibleinia*	Cyanophyta	C	4
MM14BBM008	AQ8 SW8	Little Sheep Creek	9/3/2014	Unknown Green Spherical	Chlorophyta	R	5
MM14BBM008	AQ8 SW8	Little Sheep Creek	9/3/2014	Unknown Coccoid	Chlorophyta	R	6
MM14BBM008	AQ8 SW8	Little Sheep Creek	9/3/2014	*Cosmarium*	Chlorophyta	R	7

#Activity_ ID	Taxonomic_Name	Biological_Unidentified_Sp	Result_Value	Result_Value
AQ1 SW1	Achnanthes conspicua	Platessa conspicua	2	COUNT
AQ1 SW1	Achnanthidium deflexum		2	COUNT
AQ1 SW1	Achnanthidium minutissimum		53	COUNT
AQ1 SW1	Adlafia minuscula		1	COUNT
AQ1 SW1	Amphipleura pellucida		2	COUNT
AQ1 SW1	Amphora inariensis		8	COUNT
AQ1 SW1	Amphora ovalis		8	COUNT
AQ1 SW1	Amphora ovalis var. pediculus		23	COUNT
AQ1 SW1	Caloneis bacillum		3	COUNT
AQ1 SW1	Cocconeis pediculus		52	COUNT
AQ1 SW1	Cocconeis placentula		11	COUNT
AQ1 SW1	Cocconeis placentula var. lineata		23	COUNT

AQ1 SW1	Cyclotella meneghiniana		2	COUNT
AQ1 SW1	Cymbella affinis		15	COUNT
AQ1 SW1	Diatoma moniliformis		105	COUNT
AQ1 SW1	Encyonema minutum		15	COUNT
AQ1 SW1	Encyonema reichardtii		3	COUNT
AQ1 SW1	Encyonema silesiacum		33	COUNT
AQ1 SW1	Encyonopsis subminuta		1	COUNT
AQ1 SW1	Eolimna minima		13	COUNT
AQ1 SW1	Epithemia adnata		2	COUNT
AQ1 SW1	Fragilaria		2	COUNT
AQ1 SW1	Fragilaria capucina		1	COUNT
AQ1 SW1	Fragilaria vaucheriae		1	COUNT
AQ1 SW1	Geissleria acceptata		2	COUNT
AQ1 SW1	Gomphonema		11	COUNT
AQ1 SW1	Gomphonema angustatum		2	COUNT
AQ1 SW1	Gomphonema minutum		14	COUNT
AQ1 SW1	Gomphonema olivaceum		2	COUNT
AQ1 SW1	Gomphonema parvulum		2	COUNT
AQ1 SW1	Mayamaea atomus		2	COUNT
AQ1 SW1	Meridion circulare		7	COUNT
AQ1 SW1	Navicula antonii		3	COUNT
AQ1 SW1	Navicula capitatoradiata		20	COUNT
AQ1 SW1	Navicula caterva		27	COUNT
AQ1 SW1	Navicula cryptotenella		27	COUNT
AQ1 SW1	Navicula pseudoventralis		11	COUNT
AQ1 SW1	Navicula tripunctata		30	COUNT
AQ1 SW1	Nitzschia		10	COUNT
AQ1 SW1	Nitzschia acicularis		7	COUNT
AQ1 SW1	Nitzschia acidoclinata		6	COUNT
AQ1 SW1	Nitzschia archibaldii		58	COUNT
AQ1 SW1	Nitzschia dissipata		47	COUNT
AQ1 SW1	Nitzschia inconspicua		2	COUNT
AQ1 SW1	Nitzschia lacuum		6	COUNT
AQ1 SW1	Nitzschia palea		2	COUNT
AQ1 SW1	Nitzschia paleacea		2	COUNT
AQ1 SW1	Nitzschia pusilla		2	COUNT
AQ1 SW1	Nitzschia subacicularis		4	COUNT
AQ1 SW1	Planothidium frequentissimum		19	COUNT
AQ1 SW1	Planothidium lanceolatum		4	COUNT
AQ1 SW1	Pseudostaurosira	Pseudostaurosira parasitica	1	COUNT
AQ1 SW1	Reimeria sinuata		7	COUNT
AQ1 SW1	Reimeria uniseriata		4	COUNT
AQ1 SW1	Rhoicosphenia abbreviata		2	COUNT
AQ1 SW1	Staurosira construens		16	COUNT
AQ1 SW1	Staurosira construens var. venter		28	COUNT

AQ1 SW1	Staurosirella leptostauron		12	COUNT
AQ1 SW1	Staurosirella pinnata		15	COUNT
AQ1 SW1	Surirella angusta		2	COUNT
AQ1 SW1	Surirella brebissonii		1	COUNT
AQ1 SW1	Synedra ulna		2	COUNT
AQ2 SW2	Achnanthidium	Achnanthidium thienemannii	4	COUNT
AQ2 SW2	Achnanthidium deflexum		3	COUNT
AQ2 SW2	Achnanthidium minutissimum		112	COUNT
AQ2 SW2	Adlafia minuscula		8	COUNT
AQ2 SW2	Amphipleura pellucida		11	COUNT
AQ2 SW2	Amphora ovalis		2	COUNT
AQ2 SW2	Amphora ovalis var. pediculus		3	COUNT
AQ2 SW2	Caloneis bacillum		11	COUNT
AQ2 SW2	Cocconeis pediculus		8	COUNT
AQ2 SW2	Cocconeis placentula		6	COUNT
AQ2 SW2	Cocconeis placentula var. lineata		20	COUNT
AQ2 SW2	Cyclotella meneghiniana		1	COUNT
AQ2 SW2	Cymbella affinis		11	COUNT
AQ2 SW2	Diatoma mesodon		3	COUNT
AQ2 SW2	Diatoma moniliformis		117	COUNT
AQ2 SW2	Encyonema minutum		18	COUNT
AQ2 SW2	Encyonema obscurum		1	COUNT
AQ2 SW2	Encyonema reichardtii		12	COUNT
AQ2 SW2	Encyonema silesiacum		38	COUNT
AQ2 SW2	Encyonopsis	Encyonopsis microcephala	8	COUNT
AQ2 SW2	Encyonopsis subminuta		1	COUNT
AQ2 SW2	Eolimna minima		29	COUNT
AQ2 SW2	Epithemia adnata		2	COUNT
AQ2 SW2	Epithemia sorex		2	COUNT
AQ2 SW2	Fragilaria capucina		2	COUNT
AQ2 SW2	Frustulia rhomboides		2	COUNT
AQ2 SW2	Gomphoneis	Gomphoneis minuta	2	COUNT
AQ2 SW2	Gomphonema		6	COUNT
AQ2 SW2	Gomphonema olivaceum		6	COUNT
AQ2 SW2	Mayamaea atomus		1	COUNT
AQ2 SW2	Navicula antonii		2	COUNT
AQ2 SW2	Navicula capitatoradiata		18	COUNT
AQ2 SW2	Navicula caterva		17	COUNT
AQ2 SW2	Navicula cryptocephala		11	COUNT
AQ2 SW2	Navicula cryptotenella		13	COUNT
AQ2 SW2	Navicula disjuncta		2	COUNT

AQ2 SW2	Navicula radiosa		2	COUNT
AQ2 SW2	Navicula reichardtiana		9	COUNT
AQ2 SW2	Navicula tripunctata		10	COUNT
AQ2 SW2	Nitzschia		8	COUNT
AQ2 SW2	Nitzschia acicularis		2	COUNT
AQ2 SW2	Nitzschia archibaldii		41	COUNT
AQ2 SW2	Nitzschia dissipata		47	COUNT
AQ2 SW2	Nitzschia fonticola		2	COUNT
AQ2 SW2	Nitzschia heufleriana		2	COUNT
AQ2 SW2	Nitzschia inconspicua		6	COUNT
AQ2 SW2	Nitzschia lacuum		14	COUNT
AQ2 SW2	Nitzschia linearis		4	COUNT
AQ2 SW2	Nitzschia paleacea		11	COUNT
AQ2 SW2	Nitzschia pura		2	COUNT
AQ2 SW2	Nitzschia recta		3	COUNT
AQ2 SW2	Nitzschia sociabilis		12	COUNT
AQ2 SW2	Planothidium dubium		5	COUNT
AQ2 SW2	Planothidium frequentissimum		8	COUNT
AQ2 SW2	Planothidium lanceolatum		3	COUNT
AQ2 SW2	Reimeria sinuata		11	COUNT
AQ2 SW2	Reimeria uniseriata		2	COUNT
AQ2 SW2	Rhoicosphenia abbreviata		4	COUNT
AQ2 SW2	Sellaphora pupula		2	COUNT
AQ2 SW2	Simonsenia delognei		1	COUNT
AQ2 SW2	Stauroneis anceps		2	COUNT
AQ2 SW2	Staurosira construens		19	COUNT
AQ2 SW2	Staurosira construens var. venter		26	COUNT
AQ2 SW2	Staurosirella leptostauron		4	COUNT
AQ2 SW2	Staurosirella pinnata		21	COUNT
AQ2 SW2	Surirella		1	COUNT
AQ2 SW2	Synedra ulna		3	COUNT
AQ3	Achnanthes conspicua	Platessa conspicua	2	COUNT
AQ3	Achnanthidium	Achnanthidium rivulare	2	COUNT
AQ3	Achnanthidium deflexum		2	COUNT
AQ3	Achnanthidium minutissimum		36	COUNT
AQ3	Adlafia minuscula		5	COUNT
AQ3	Amphipleura pellucida		5	COUNT
AQ3	Amphora ovalis		2	COUNT
AQ3	Amphora ovalis var. pediculus		13	COUNT
AQ3	Caloneis bacillum		6	COUNT
AQ3	Cocconeis pediculus		5	COUNT
AQ3	Cocconeis placentula		16	COUNT

AQ3	Cocconeis placentula var. lineata		12	COUNT
AQ3	Cyclotella meneghiniana		1	COUNT
AQ3	Cymbella affiniformis		2	COUNT
AQ3	Cymbella affinis		26	COUNT
AQ3	Diatoma moniliformis		157	COUNT
AQ3	Encyonema minutum		4	COUNT
AQ3	Encyonema prostratum		2	COUNT
AQ3	Encyonema reichardtii		5	COUNT
AQ3	Encyonema silesiacum		12	COUNT
AQ3	Encyonopsis subminuta		8	COUNT
AQ3	Eolimna minima		12	COUNT
AQ3	Epithemia adnata		4	COUNT
AQ3	Epithemia sorex		1	COUNT
AQ3	Epithemia turgida		6	COUNT
AQ3	Fragilaria vaucheriae		1	COUNT
AQ3	Gomphoneis	Gomphoneis minuta	2	COUNT
AQ3	Gomphonema		3	COUNT
AQ3	Gomphonema olivaceum		1	COUNT
AQ3	Gyrosigma attenuatum		1	COUNT
AQ3	Mayamaea atomus		7	COUNT
AQ3	Navicula		8	COUNT
AQ3	Navicula antonii		1	COUNT
AQ3	Navicula capitatoradiata		12	COUNT
AQ3	Navicula caterva		18	COUNT
AQ3	Navicula cryptocephala		4	COUNT
AQ3	Navicula cryptotenella		10	COUNT
AQ3	Navicula densilineolata		2	COUNT
AQ3	Navicula menisculus		1	COUNT
AQ3	Navicula pseudoventralis		2	COUNT
AQ3	Navicula reichardtiana		21	COUNT
AQ3	Navicula schmassmannii		2	COUNT
AQ3	Navicula tridentula		6	COUNT
AQ3	Navicula tripunctata		10	COUNT
AQ3	Neidium binodeforme		3	COUNT
AQ3	Nitzschia		16	COUNT
AQ3	Nitzschia acicularis		6	COUNT
AQ3	Nitzschia aequorea		4	COUNT
AQ3	Nitzschia archibaldii		91	COUNT
AQ3	Nitzschia dissipata		74	COUNT
AQ3	Nitzschia fonticola		4	COUNT
AQ3	Nitzschia inconspicua		2	COUNT
AQ3	Nitzschia lacuum		9	COUNT
AQ3	Nitzschia palea		1	COUNT
AQ3	Nitzschia paleacea		17	COUNT
AQ3	Nitzschia reversa		2	COUNT

AQ3	Nitzschia sociabilis		8	COUNT
AQ3	Nitzschia subacicularis		6	COUNT
AQ3	Nitzschia sublinearis		2	COUNT
AQ3	Planothidium dubium		3	COUNT
AQ3	Planothidium frequentissimum		13	COUNT
AQ3	Planothidium rostratum		4	COUNT
AQ3	Reimeria sinuata		13	COUNT
AQ3	Rhopalodia gibba		3	COUNT
AQ3	Sellaphora pupula		1	COUNT
AQ3	Staurosira construens		3	COUNT
AQ3	Staurosira construens var. venter		44	COUNT
AQ3	Staurosirella leptostauron		1	COUNT
AQ3	Staurosirella pinnata		9	COUNT
AQ3	Surirella angusta		2	COUNT
AQ3	Synedra ulna		1	COUNT
AQ4	Achnanthidium deflexum		1	COUNT
AQ4	Achnanthidium minutissimum		45	COUNT
AQ4	Adlafia minuscula		5	COUNT
AQ4	Amphipleura pellucida		5	COUNT
AQ4	Amphora ovalis var. pediculus		4	COUNT
AQ4	Amphora veneta		2	COUNT
AQ4	Cocconeis pediculus		1	COUNT
AQ4	Cocconeis placentula		7	COUNT
AQ4	Cocconeis placentula var. lineata		18	COUNT
AQ4	Cyclotella meneghiniana		4	COUNT
AQ4	Cymbella	Cymbella compacta	7	COUNT
AQ4	Cymbella affinis		66	COUNT
AQ4	Diatoma moniliformis		74	COUNT
AQ4	Diploneis ovalis		1	COUNT
AQ4	Encyonema minutum		6	COUNT
AQ4	Encyonema reichardtii		8	COUNT
AQ4	Encyonema silesiacum		21	COUNT
AQ4	Encyonopsis subminuta		4	COUNT
AQ4	Eolimna minima		6	COUNT
AQ4	Epithemia adnata		1	COUNT
AQ4	Gomphonema		3	COUNT
AQ4	Gomphonema minutum		4	COUNT
AQ4	Gomphonema olivaceum		4	COUNT
AQ4	Navicula antonii		2	COUNT
AQ4	Navicula capitatoradiata		19	COUNT
AQ4	Navicula caterva		20	COUNT

AQ4	Navicula cryptotenella		16	COUNT
AQ4	Navicula lenzii		1	COUNT
AQ4	Navicula menisculus		2	COUNT
AQ4	Navicula reichardtiana		19	COUNT
AQ4	Navicula tripunctata		13	COUNT
AQ4	Navicula viridula		2	COUNT
AQ4	Nitzschia		4	COUNT
AQ4	Nitzschia acicularis		8	COUNT
AQ4	Nitzschia agnita		1	COUNT
AQ4	Nitzschia archibaldii		141	COUNT
AQ4	Nitzschia dissipata		111	COUNT
AQ4	Nitzschia gracilis		2	COUNT
AQ4	Nitzschia heufleriana		4	COUNT
AQ4	Nitzschia inconspicua		4	COUNT
AQ4	Nitzschia linearis		2	COUNT
AQ4	Nitzschia palea		1	COUNT
AQ4	Nitzschia paleacea		6	COUNT
AQ4	Nitzschia recta		3	COUNT
AQ4	Nitzschia sociabilis		9	COUNT
AQ4	Planothidium dubium		1	COUNT
AQ4	Planothidium frequentissimum		8	COUNT
AQ4	Planothidium lanceolatum		1	COUNT
AQ4	Reimeria sinuata		18	COUNT
AQ4	Staurosira construens		18	COUNT
AQ4	Staurosira construens var. venter		47	COUNT
AQ4	Staurosirella leptostauron		2	COUNT
AQ4	Staurosirella pinnata		4	COUNT
AQ4	Surirella		4	COUNT
AQ4	Surirella angusta		1	COUNT
AQ4	Surirella brebissonii		8	COUNT
AQ4	Synedra ulna		1	COUNT
AQ5	Achnanthidium minutissimum		155	COUNT
AQ5	Aulacoseira subarctica		4	COUNT
AQ5	Cocconeis pediculus		1	COUNT
AQ5	Cocconeis placentula		11	COUNT
AQ5	Cocconeis placentula var. lineata		20	COUNT
AQ5	Diatoma moniliformis		4	COUNT
AQ5	Encyonema cespitosum		4	COUNT
AQ5	Encyonema minutum		255	COUNT
AQ5	Encyonema prostratum		2	COUNT
AQ5	Encyonema silesiacum		33	COUNT
AQ5	Eolimna minima		4	COUNT

AQ5	Epithemia sorex		2	COUNT
AQ5	Epithemia turgida		2	COUNT
AQ5	Fragilaria vaucheriae		23	COUNT
AQ5	Gomphonema		2	COUNT
AQ5	Gomphonema micropus		2	COUNT
AQ5	Gomphonema rhombicum		6	COUNT
AQ5	Gomphosphenia	Gomphosphenia sp. 1 Idaho DW ANSP	11	COUNT
AQ5	Karayevia clevei		2	COUNT
AQ5	Mayamaea atomus		9	COUNT
AQ5	Navicula	Navicula cryptotenelloides	19	COUNT
AQ5	Navicula antonii		2	COUNT
AQ5	Navicula capitatoradiata		6	COUNT
AQ5	Navicula caterva		12	COUNT
AQ5	Navicula cryptotenella		26	COUNT
AQ5	Navicula recens		1	COUNT
AQ5	Navicula reichardtiana		18	COUNT
AQ5	Navicula tripunctata		2	COUNT
AQ5	Nitzschia archibaldii		11	COUNT
AQ5	Nitzschia dissipata		1	COUNT
AQ5	Nitzschia fonticola		39	COUNT
AQ5	Nitzschia frustulum		27	COUNT
AQ5	Nitzschia inconspicua		20	COUNT
AQ5	Nitzschia linearis		2	COUNT
AQ5	Nitzschia paleacea		16	COUNT
AQ5	Nitzschia sociabilis		2	COUNT
AQ5	Planothidium frequentissimum		15	COUNT
AQ5	Planothidium lanceolatum		2	COUNT
AQ5	Reimeria sinuata		2	COUNT
AQ5	Rhoicosphenia abbreviata		1	COUNT
AQ5	Staurosira construens		6	COUNT
AQ5	Staurosira construens var. venter		8	COUNT
AQ5	Synedra mazamaensis		3	COUNT
AQ5	Synedra ulna		7	COUNT
AQ6	Achnanthidium minutissimum		123	COUNT
AQ6	Cocconeis pediculus		1	COUNT
AQ6	Cocconeis placentula		7	COUNT
AQ6	Cocconeis placentula var. lineata		20	COUNT
AQ6	Diatoma moniliformis		7	COUNT
AQ6	Didymosphenia geminata		1	COUNT

AQ6	Encyonema minutum		289	COUNT
AQ6	Encyonema silesiacum		35	COUNT
AQ6	Eolimna minima		2	COUNT
AQ6	Epithemia sorex		7	COUNT
AQ6	Epithemia turgida		4	COUNT
AQ6	Fragilaria vaucheriae		33	COUNT
AQ6	Gomphoneis eriense		1	COUNT
AQ6	Gomphonema		6	COUNT
AQ6	Gomphonema minutum		3	COUNT
AQ6	Gomphonema rhombicum		1	COUNT
AQ6	Gomphosphenia	Gomphosphenia sp. 1 Idaho DW ANSP	4	COUNT
AQ6	Karayevia laterostrata		1	COUNT
AQ6	Mayamaea		1	COUNT
AQ6	Mayamaea atomus		2	COUNT
AQ6	Melosira varians		5	COUNT
AQ6	Meridion circulare		1	COUNT
AQ6	Navicula	Navicula cryptotenelloides (20)	26	COUNT
AQ6	Navicula capitatoradiata		10	COUNT
AQ6	Navicula caterva		35	COUNT
AQ6	Navicula cryptotenella		21	COUNT
AQ6	Navicula difficillima		2	COUNT
AQ6	Navicula reichardtiana		14	COUNT
AQ6	Navicula tripunctata		2	COUNT
AQ6	Nitzschia		8	COUNT
AQ6	Nitzschia archibaldii		15	COUNT
AQ6	Nitzschia dissipata		2	COUNT
AQ6	Nitzschia fonticola		27	COUNT
AQ6	Nitzschia frustulum		32	COUNT
AQ6	Nitzschia inconspicua		17	COUNT
AQ6	Nitzschia paleacea		9	COUNT
AQ6	Planothidium dubium		3	COUNT
AQ6	Planothidium frequentissimum		7	COUNT
AQ6	Planothidium lanceolatum		1	COUNT
AQ6	Rhoicosphenia abbreviata		2	COUNT
AQ6	Staurosirella leptostauron		2	COUNT
AQ6	Synedra ulna		11	COUNT
AQ7	Achnanthidium deflexum		7	COUNT
AQ7	Achnanthidium minutissimum		108	COUNT
AQ7	Adlafia minuscula		1	COUNT
AQ7	Cocconeis pediculus		4	COUNT
AQ7	Cocconeis placentula		16	COUNT

AQ7	Cocconeis placentula var. lineata		24	COUNT
AQ7	Cyclotella meneghiniana		2	COUNT
AQ7	Cymbella affiniformis		1	COUNT
AQ7	Cymbella affinis		16	COUNT
AQ7	Diatoma mesodon		2	COUNT
AQ7	Diatoma moniliformis		34	COUNT
AQ7	Encyonema reichardtii		1	COUNT
AQ7	Encyonema silesiacum		18	COUNT
AQ7	Eolimna minima		4	COUNT
AQ7	Fragilaria capucina		6	COUNT
AQ7	Fragilaria vaucheriae		8	COUNT
AQ7	Gomphonema	Gomphonema kobayasii (1)	12	COUNT
AQ7	Gomphonema angustatum		2	COUNT
AQ7	Gomphonema exilissimum		2	COUNT
AQ7	Gomphonema micropus		2	COUNT
AQ7	Gomphonema minutum		33	COUNT
AQ7	Gomphosphenia	Gomphosphenia sp. 1 Idaho DW ANSP	1	COUNT
AQ7	Mayamaea agrestis		1	COUNT
AQ7	Mayamaea atomus		1	COUNT
AQ7	Meridion circulare		11	COUNT
AQ7	Navicula capitatoradiata		4	COUNT
AQ7	Navicula caterva		12	COUNT
AQ7	Navicula cryptotenella		5	COUNT
AQ7	Navicula reichardtiana		2	COUNT
AQ7	Navicula tripunctata		4	COUNT
AQ7	Nitzschia		8	COUNT
AQ7	Nitzschia acicularis		2	COUNT
AQ7	Nitzschia archibaldii		5	COUNT
AQ7	Nitzschia dissipata		32	COUNT
AQ7	Nitzschia frustulum		2	COUNT
AQ7	Nitzschia inconspicua		4	COUNT
AQ7	Nitzschia linearis		6	COUNT
AQ7	Nitzschia palea		2	COUNT
AQ7	Nitzschia perminuta		2	COUNT
AQ7	Nitzschia recta		2	COUNT
AQ7	Nitzschia sublinearis		2	COUNT
AQ7	Planothidium dubium		2	COUNT
AQ7	Planothidium frequentissimum		2	COUNT
AQ7	Reimeria sinuata		2	COUNT
AQ7	Sellaphora pupula		2	COUNT
AQ7	Staurosira construens		56	COUNT

AQ7	Staurosira construens var. venter		147	COUNT
AQ7	Staurosirella leptostauron		46	COUNT
AQ7	Staurosirella pinnata		108	COUNT
AQ7	Surirella angusta		7	COUNT
AQ7	Surirella brebissonii var. kuetzingii		12	COUNT
AQ7	Synedra rumpens		4	COUNT
AQ7	Synedra ulna		1	COUNT
AQ8 SW8	Achnanthidium minutissimum		12	COUNT
AQ8 SW8	Adlafia minuscula		2	COUNT
AQ8 SW8	Amphipleura pellucida		6	COUNT
AQ8 SW8	Amphora ovalis var. pediculus		26	COUNT
AQ8 SW8	Caloneis bacillum		4	COUNT
AQ8 SW8	Cocconeis placentula		54	COUNT
AQ8 SW8	Cocconeis placentula var. lineata		81	COUNT
AQ8 SW8	Craticula molestiformis		2	COUNT
AQ8 SW8	Cyclotella meneghiniana		3	COUNT
AQ8 SW8	Cymbella	Cymbella compacta	2	COUNT
AQ8 SW8	Cymbella affinis		2	COUNT
AQ8 SW8	Diatoma moniliformis		27	COUNT
AQ8 SW8	Encyonema minutum		2	COUNT
AQ8 SW8	Encyonema prostratum		8	COUNT
AQ8 SW8	Encyonema silesiacum		14	COUNT
AQ8 SW8	Eolimna minima		18	COUNT
AQ8 SW8	Epithemia adnata		2	COUNT
AQ8 SW8	Fragilaria		10	COUNT
AQ8 SW8	Fragilaria capucina		4	COUNT
AQ8 SW8	Fragilaria capucina var. gracilis		5	COUNT
AQ8 SW8	Fragilaria vaucheriae		17	COUNT
AQ8 SW8	Geissleria acceptata		3	COUNT
AQ8 SW8	Gomphonema		4	COUNT
AQ8 SW8	Gomphonema minutum		10	COUNT
AQ8 SW8	Gomphonema olivaceum		6	COUNT
AQ8 SW8	Mayamaea atomus		18	COUNT
AQ8 SW8	Navicula		5	COUNT
AQ8 SW8	Navicula capitatoradiata		25	COUNT
AQ8 SW8	Navicula caterva		81	COUNT
AQ8 SW8	Navicula cryptocephala		8	COUNT
AQ8 SW8	Navicula cryptotenella		6	COUNT
AQ8 SW8	Navicula menisculus		1	COUNT
AQ8 SW8	Navicula recens		1	COUNT

AQ8 SW8	Navicula reichardtiana		38	COUNT
AQ8 SW8	Navicula tripunctata		4	COUNT
AQ8 SW8	Navicula veneta		1	COUNT
AQ8 SW8	Nitzschia		6	COUNT
AQ8 SW8	Nitzschia acicularis		12	COUNT
AQ8 SW8	Nitzschia archibaldii		64	COUNT
AQ8 SW8	Nitzschia dissipata		57	COUNT
AQ8 SW8	Nitzschia dissipata var. media		2	COUNT
AQ8 SW8	Nitzschia fonticola		4	COUNT
AQ8 SW8	Nitzschia linearis		8	COUNT
AQ8 SW8	Nitzschia palea		34	COUNT
AQ8 SW8	Nitzschia paleacea		6	COUNT
AQ8 SW8	Nitzschia pusilla		3	COUNT
AQ8 SW8	Nitzschia recta		6	COUNT
AQ8 SW8	Nitzschia reversa		1	COUNT
AQ8 SW8	Nitzschia sociabilis		6	COUNT
AQ8 SW8	Nitzschia sublinearis		6	COUNT
AQ8 SW8	Planothidium dubium		8	COUNT
AQ8 SW8	Planothidium frequentissimum		2	COUNT
AQ8 SW8	Reimeria sinuata		5	COUNT
AQ8 SW8	Rhoicosphenia abbreviata		2	COUNT
AQ8 SW8	Staurosira construens var. venter		1	COUNT
AQ8 SW8	Surirella angusta		3	COUNT
AQ8 SW8	Surirella brebissonii var. kuetzingii		28	COUNT
AQ8 SW8	Synedra rumpens		3	COUNT
AQ8 SW8	Synedra ulna		21	COUNT

Appendix E. Reach Maps, Site Habitat and Physical Conditions

Appendix E. Habitat and Water Quality Parameters measured for the Black Butte Project sites visited. na = not visited or sampled during this visit. Proper Functioning Condition = PFC, Functional-At-Risk=FAR, Non-Functioning=NF.

2014/2015	Sheep AQ1				Sheep AQ2				Sheep AQ3				Sheep AQ4				Tenderfoot AQ5			
	2014		2015		2014		2015		2014		2015		2014		2015		2014		2015	
	Aug	Sept	May	July	Aug	Sept	May	July	Aug	Sept	May	July	Aug	Sept	May	Jul	Aug	Sept	May	July
Water Temp °C	13.4	10.1	9.5	19.1	17.1	10.5	7.8	13.5	12.9	12.3	9.4	15.5	13.8	11.4	14.5	17.1	13.9	8.5	na	11.3
Conductivity (µs/cm)	268	205	210	277	241	195	178	261	225	204	199	260	240	212	170	273	122	98	na	115
TDS (ppm)	132	112	122	138	121	102	91	134	112	108	100	131	128	110	98	171	65	58	na	70
pH	8.2	8.2	8.2	8.2	8	8	7.9	7.9	8.3	8	7.8	7.8	8.2	8.3	7.8	7.8	8	8	na	7.9
PFC Rating	FAR	FAR	FAR	FAR	FAR	FAR	FAR	FAR	PFC	PFC	PFC	PFC	PFC	PFC	PFC	PFC	FAR	FAR	na	FAR
BLM HBI (24 max)	18	17	17	18	17	17	17	17	19	19	20	21	20	21	22	21	17	18	na	17
Avg. wetted width (m)	15.6	16.4	na	17.5	7.9	8.2	na	10.5	8.6	11.2	na	12.1	11.1	11.6	na	12.1	9.0	10.2	na	10.4
Avg. Left CHD (cm)	24	25	na	25	19	25	na	28	29	37	na	37	39	40	na	44	28	33	na	20
Avg. Center CHD (cm)	40	37	na	45	23	32	na	33	39	45	na	45	38	41	na	45	30	38	na	37
Avg. Right CHD (cm)	28	30	na	33	24	38	na	40	32	50	na	50	40	44	na	48	24	27	na	26
% Boulder	40	40	na	45	3	3	na	3	5	5	na	5	4	4	na	4	10	10	na	10
% Cobble Reach	30	40	na	35	47	45	na	45	57	57	na	50	52	52	na	47	50	50	na	60
% Pebble Reach	20	10	na	15	22	20	na	20	21	21	na	25	20	20	na	23	20	20	na	17
% Gravel Reach	5	5	na	5	18	20	na	20	10	10	na	12	15	15	na	18	13	13	na	8
% Sand Reach	0	0	na	0	5	5	na	5	4	4	na	3	4	4	na	4	3	3	na	0
% Fines in Reach	5	5	na	0	7	8	na	8	5	5	na	5	4	4	na	4	5	5	na	5
Livestock Use (CPI)	0	0	0	0	20	18	na	5	0	0	0	0	0	0	0	0	8	15	na	12
Avg. Riparian Shade	33	30	20	30	25	25	20	25	10	10	10	10	20	20	20	25	20	20	na	20

Appendix E. cont. Habitat and Water Quality Parameters. na = not visited or sampled during this visit.
Proper Functioning Condition= PFC, Functional-At-Risk=FAR, Non-Functioning=NF.

2014/2015	Tenderfoot AQ6				L. Sheep AQ7				L. Sheep AQ8				Coon Creek AQ9			
	2014		2015		2014		2015		2014		2015		2014		2015	
	Aug	Sept	May	July	Aug	Sept	May	July	Aug	Sept	May	Jul	Aug	Sept	May	Jul
Water Temp °C	13.9	8.5	na	11.3	11.5	12.1	10.1	18.3	16.4	11.2	6.5	11.7	na	9.5	na	13.6
Conductivity (µs/cm)	117	97	na	116	311	315	272	313	373	333	220	306	na	288	na	304
TDS (ppm)	66	58	na	72	156	170	136	157	186	176	119	153	na	145	na	153
pH	8	8	na	7.9	8.1	8.2	8.2	8	8.2	8.1	8.1	7.9	na	7.6	na	7.5
PFC Rating	PFC	PFC	na	PFC	FAR	FAR	FAR	FAR	FAR	FAR	FAR	FAR	na	PFC	na	PFC
BLM HBI (24 max)	20	19	na	19	17	16	16	16	16	16	16	16	na	19	na	19
Avg. wetted width (m)	8.8	10.9	na	10.4	2.2	2.2	2.3	2.1	1.5	1.6	1.5	1.3	na	0.4	na	0.4
Avg. Left CHD (cm)	28	33	na	26	15	15	16	14	16	15	16	14	na	5	na	6
Avg. Center CHD (cm)	35	38	na	40	20	18	22	17	16	18	16	14	na	10	na	11
Avg. Right CHD (cm)	24	27	na	25	13	13	14	12	12	12	12	11	na	5	na	6
% Boulder	8	9	na	10	1	1	1	2	1	1	1	2	na	0	na	0
% Cobble in Reach	56	55	na	65	8	8	9	9	5	5	5	6	na	15	na	15
% Pebble in Reach	15	15	na	15	28	27	24	25	5	5	5	4.5	na	45	na	45
% Gravel in Reach	12	12	na	5	39	40	40	40	33	33	33	32.5	na	35	na	35
% Sand in Reach	4	4	na	0	8	7	8	7	35	35	35	30	na	0	na	0
% Fines in Reach	5	5	na	5	18	17	18	17	23	23	23	25	na	5	na	5
Livestock Use (CPI)	0	0	na	5	0	0	5	10	0	0	0	0	na	0	na	0
Avg. Riparian Shade	10	10	na	20	30	30	20	30	20	20	15	20	na	30	na	30

Place Site Visit Label Here

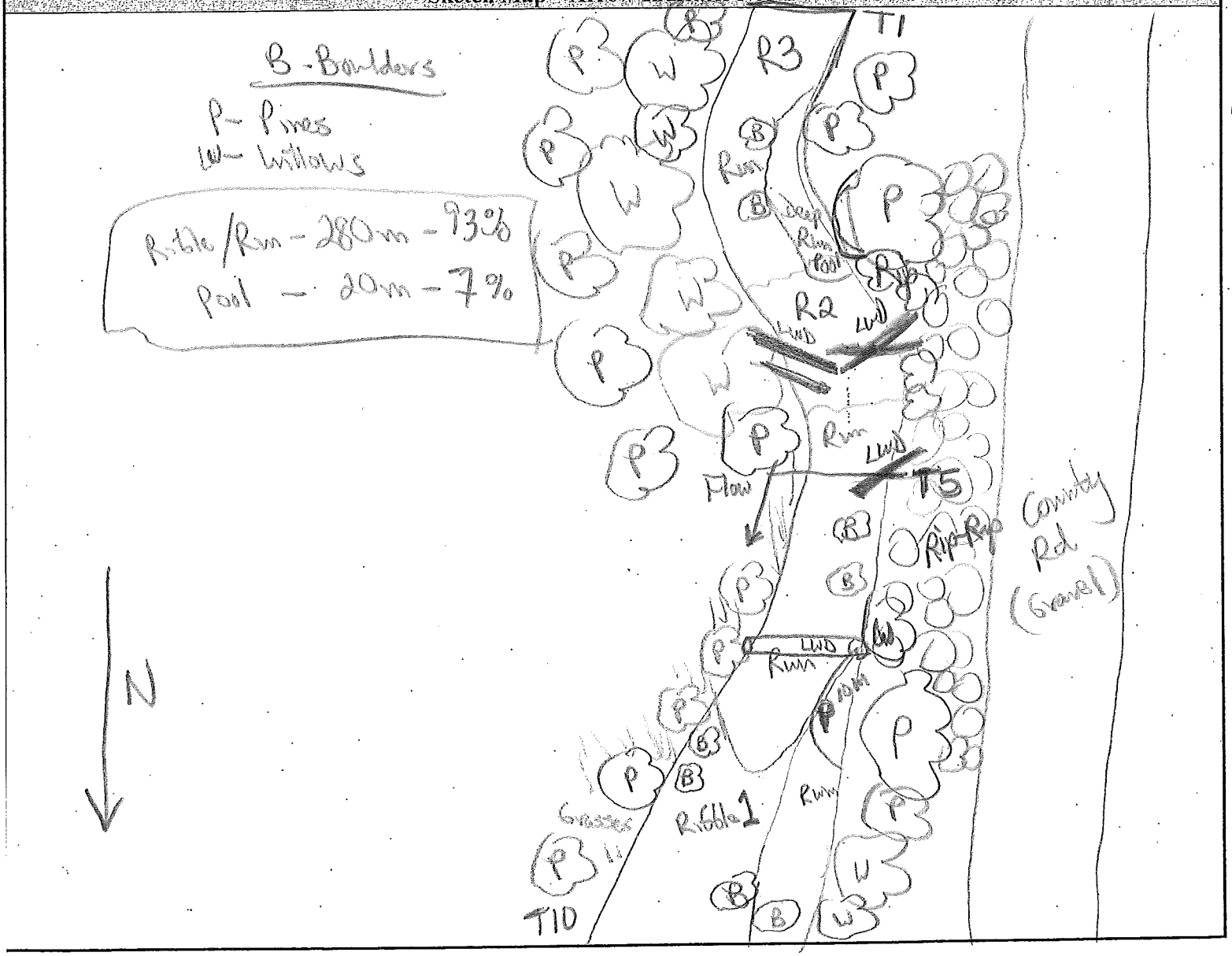
Sediment Assessment
Site Location and Map Form

Date: 6/14/2024 Personnel: DMB, TH

Waterbody: Sheep Creek Station ID: AQ1/SW1

Stream/River Site Determination					
Latitude (NAD 83)	Longitude (NAD 83)	Bkf Measures (m)	Mean Bkf Width (m)	Calculated Site Length (m)	Actual Site Length (m)
At Downstream End of Site		18 m 16.5 15.8 15.0	16.3 m	326 m	300 m
46.795122	-110.910367				
At Upstream End of Site					
46.793362	-110.910938				

Sketch Map – Arrow Indicates North



Comments

Entire reach on USFS lands / heavily riprapped left-bank lining D/S along county rd.

Place Site Visit Label Here

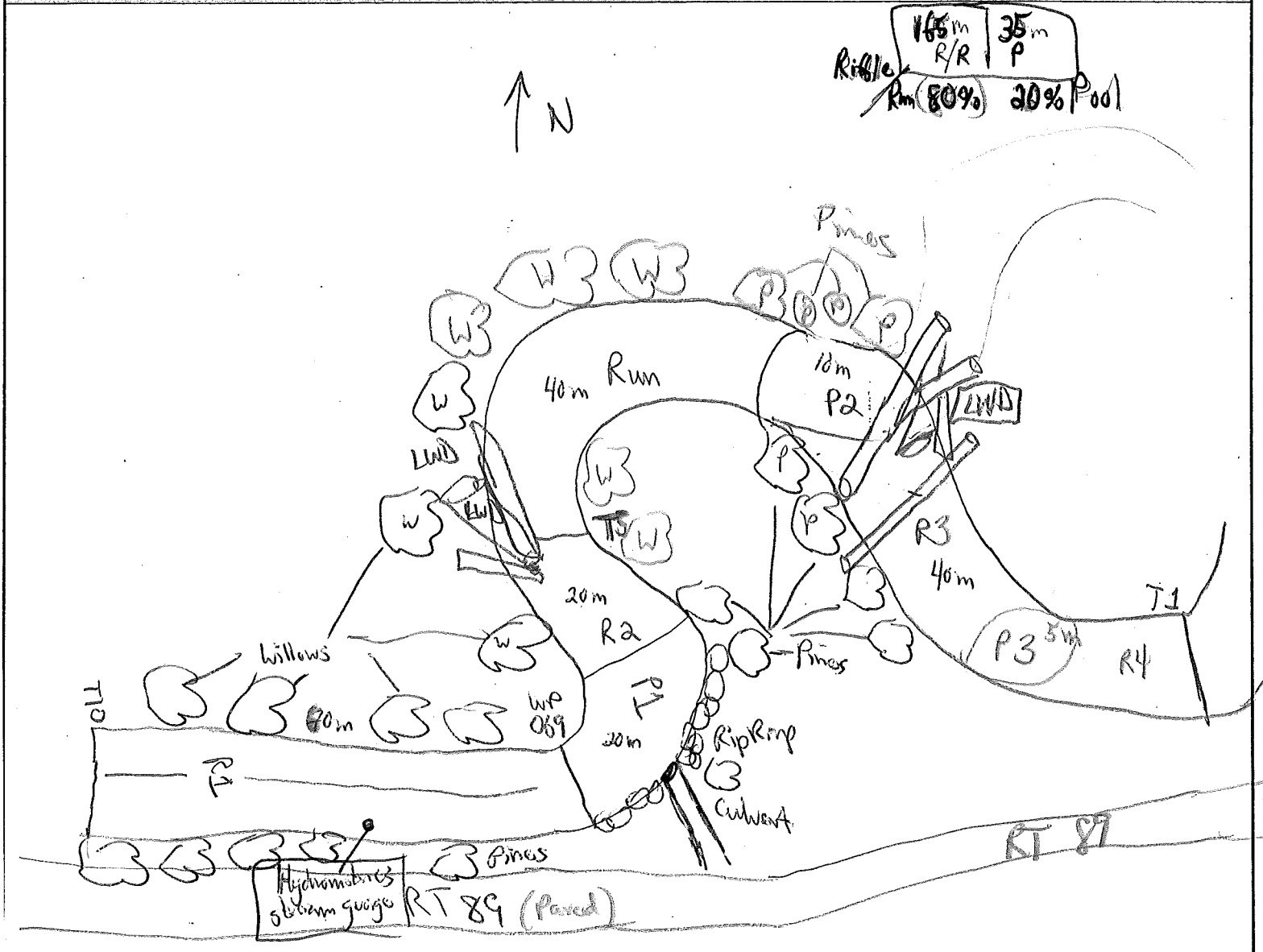
Sediment Assessment
Site Location and Map Form

Date: 8/15/2014 Personnel: DMS, FGH

Waterbody: Sheep Creek Upper Station ID: AQ2/SW2

Stream/River Site Determination					
Latitude (NAD 83)	Longitude (NAD 83)	Bkf Measures (m)	Mean Bkf Width (m)	Calculated Site Length (m)	Actual Site Length (m)
At Downstream End of Site		7.0 7.5 8.0 7.8	7.9	158m	200m
46.77213	-110.85361				
At Upstream End of Site					
46.77197	-110.85345				

Sketch Map – Arrow Indicates North



Comments

Culvert coming into pool 1

Place Site Visit Label Here

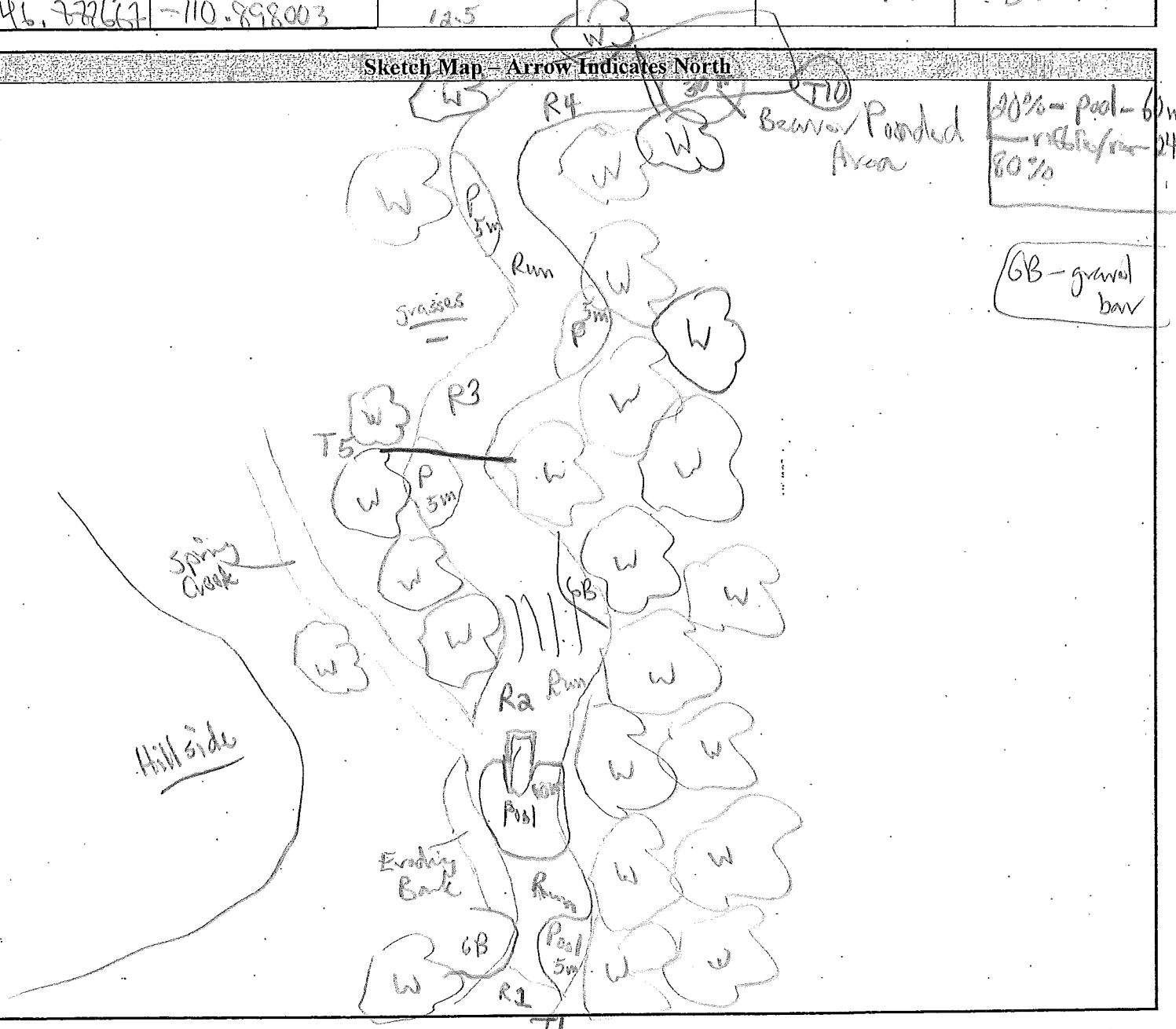
Sediment Assessment
Site Location and Map Form

Date: 8/15/2015 Personnel: JMS, PH Tmtn in Black Butte Project

Waterbody: Sheep Creek Station ID: HQ 3

Stream/River Site Determination					
Latitude (NAD 83)	Longitude (NAD 83)	Bkf Measures (m)	Mean Bkf Width (m)	Calculated Site Length (m)	Actual Site Length (m)
At Downstream End of Site		13.6 12.8 13.4 12.5	13.1m	262m	300m
46.772145	-110.998618				
At Upstream End of Site					
46.772667	-110.898003				

Sketch Map – Arrow Indicates North



Comments

Large silt pocket where spring creek enters Sheep creek / Beaver Activity at the top of reach

Willow dominated riparian

>2m deep pool formed

Place Site Visit Label Here

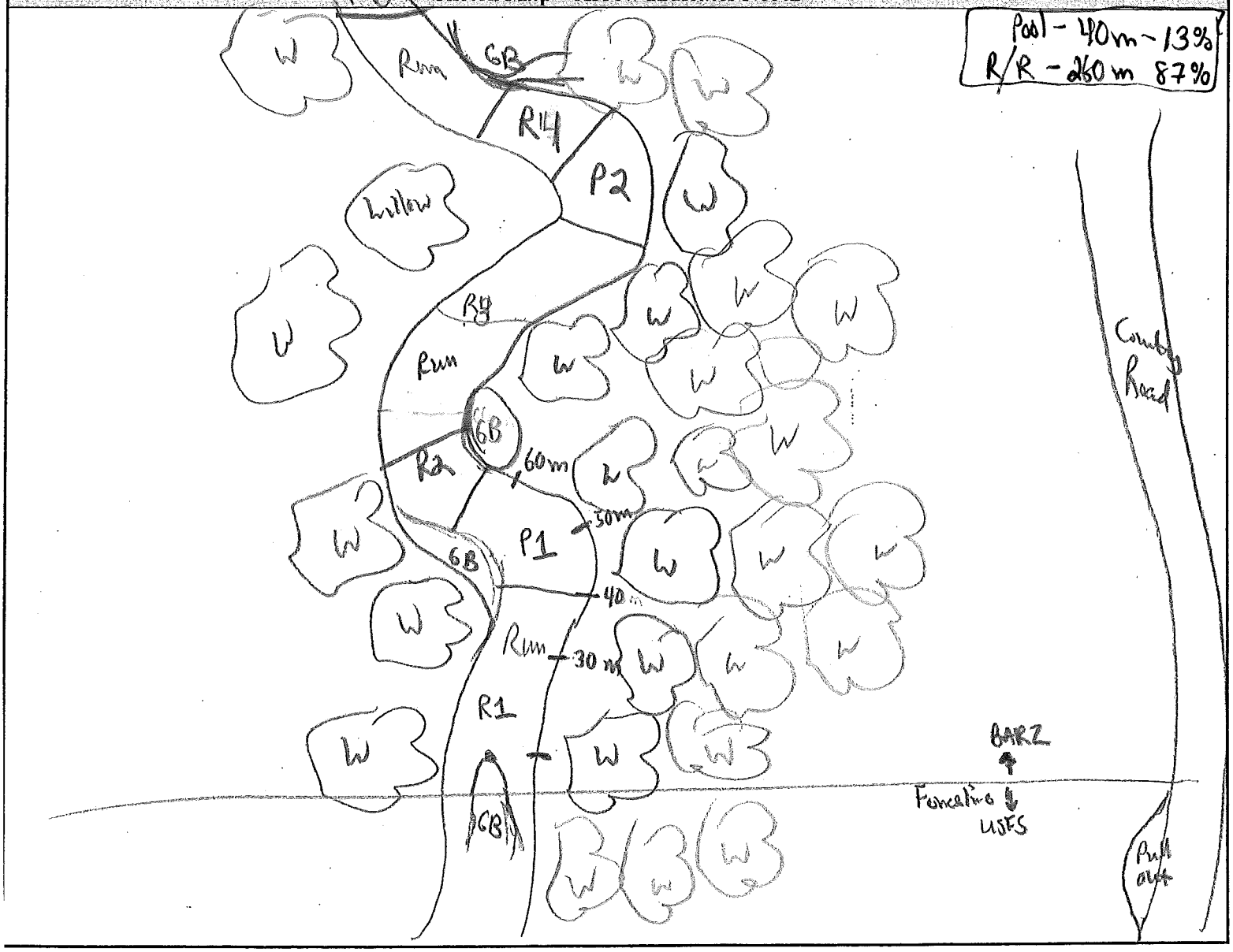
Sediment Assessment
Site Location and Map Form

Date: 8/15/2014 Personnel: DMS, FH Timbira Copper Project

Waterbody: Sheep Creek Station ID: ASQ 4

Stream/River Site Determination					
Latitude (NAD 83)	Longitude (NAD 83)	Bkf Measures (m)	Mean Bkf Width (m)	Calculated Site Length (m)	Actual Site Length (m)
At Downstream End of Site		12.6 15.1 13.6 13.2	13.6	272.5	300 m
56.785114	-110.908826				
At Upstream End of Site					
56.784965	-110.906504				

Sketch Map – Arrow Indicates North



Comments

Bottom of Reach starts on a gravel bar above the forcaline

Place Site Visit Label Here

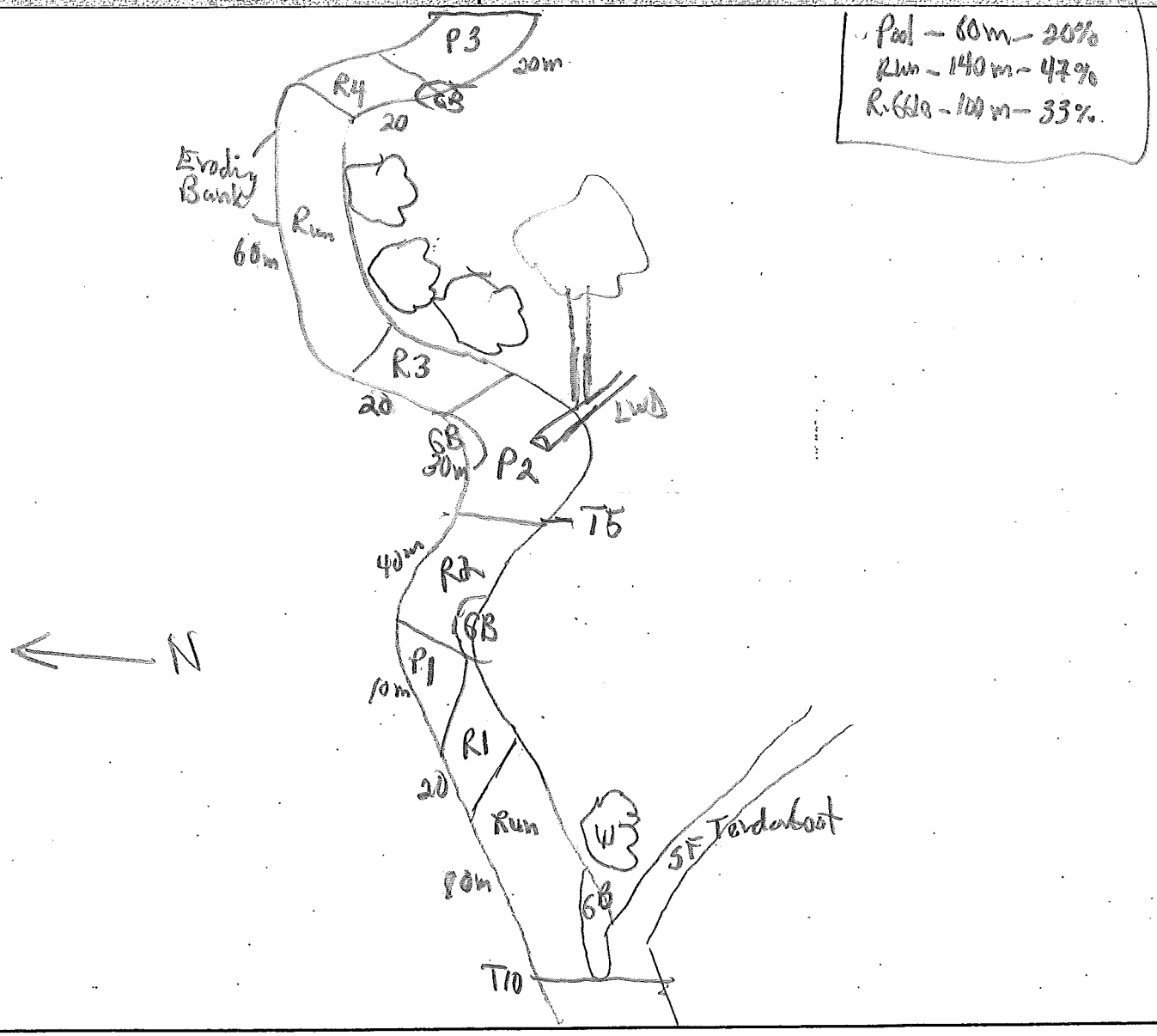
Sediment Assessment
Site Location and Map Form

Date: 8/12/2014 Personnel: DMS, FH

Waterbody: Tenderfoot Creek Station ID: AQ5

Stream/River Site Determination					
Latitude (NAD 83)	Longitude (NAD 83)	Bkf Measures (m)	Mean Bkf Width (m)	Calculated Site Length (m)	Actual Site Length (m)
At Downstream End of Site		15.2 16.3 15.0 14.6	15.3 m	305.5	300 m
46.95093	-111.147397				
At Upstream End of Site					
46.95077	-111.144479				

Sketch Map – Arrow Indicates North



Comments

Lower end of site is at the confluence of SF Tenderfoot
GBs = gravel bar

Place Site Visit Label Here

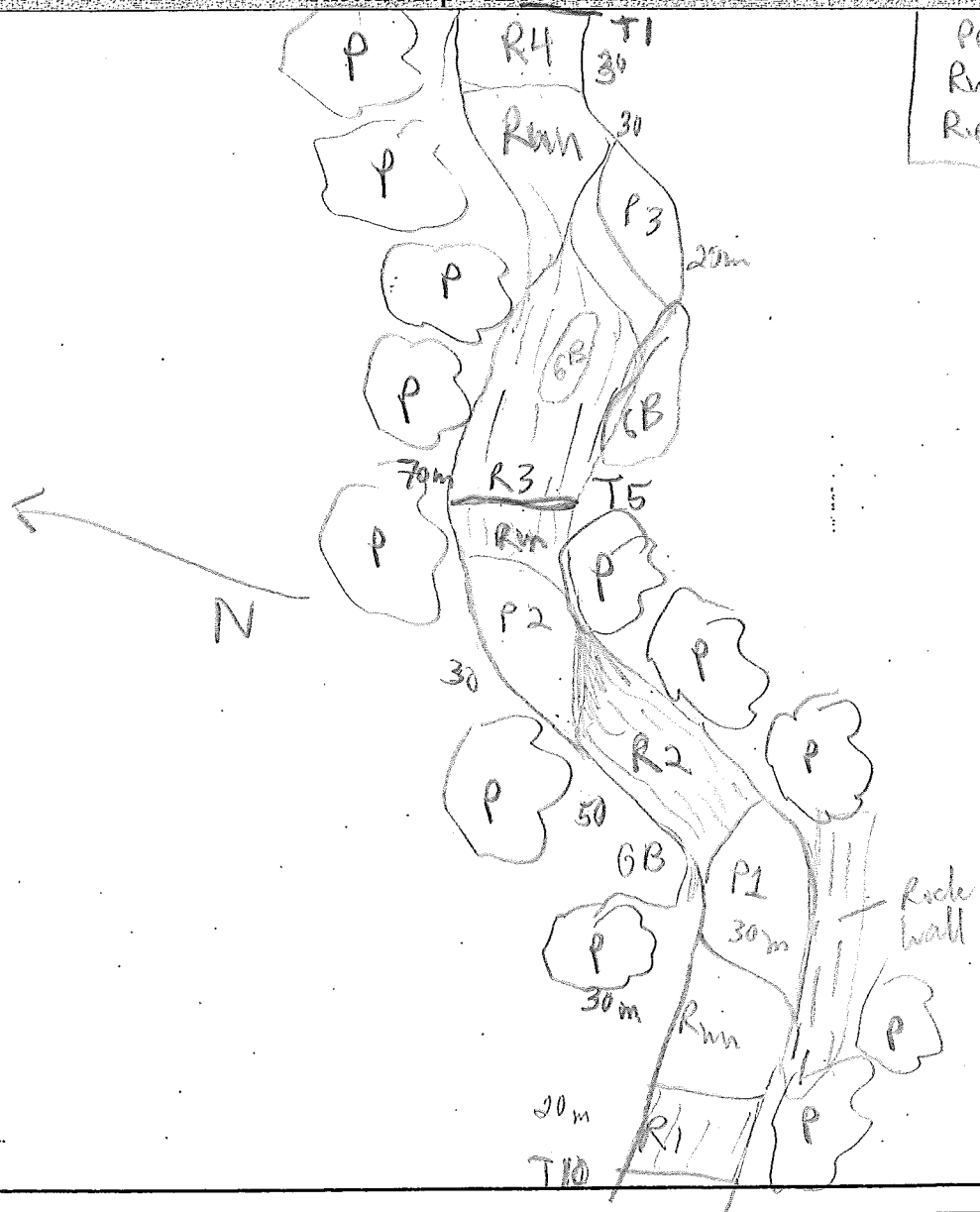
Sediment Assessment
Site Location and Map Form

Date: 8/15/2014 Personnel: DMS, FH

Waterbody: Tenderfoot Creek Station ID: AQ6

Stream/River Site Determination					
Latitude (NAD 83)	Longitude (NAD 83)	Bkf Measures (m)	Mean Bkf Width (m)	Calculated Site Length (m)	Actual Site Length (m)
At Downstream End of Site		16.0 15.5 14.7 14.0	15.1 m	302 m	300m
46.95018	-110.14362				
At Upstream End of Site					
46.95032	-111.14365				

Sketch Map – Arrow Indicates North



Comments

Some cattle crossing at Gravel Bar (GB) near Riffle #3 (R3)

Place Site Visit Label Here

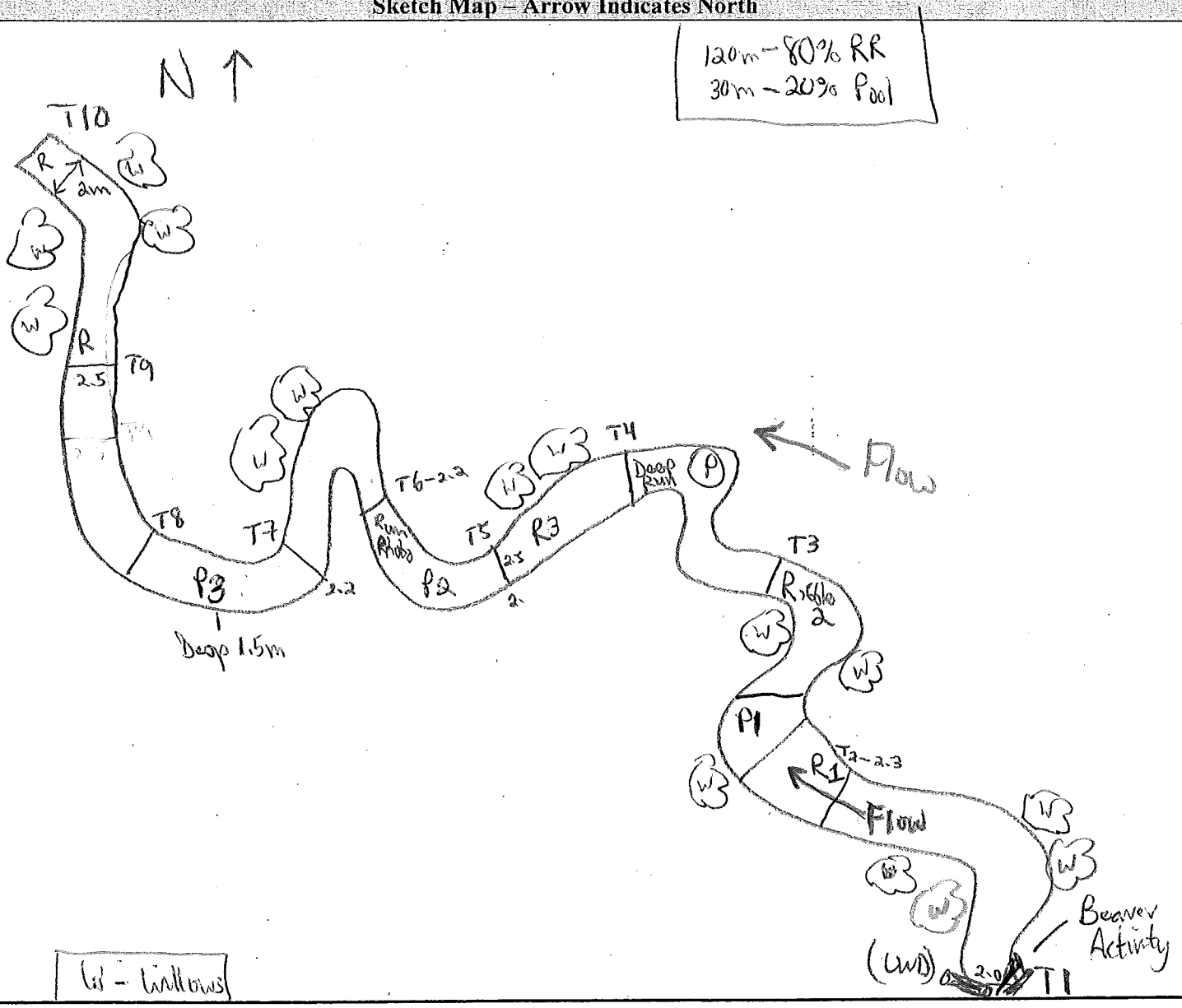
Sediment Assessment
Site Location and Map Form

Date: 8/16/2014 Personnel: NMS, FCH

Waterbody: Little Sheep Creek Station ID: SW7

Stream/River Site Determination					
Latitude (NAD 83)	Longitude (NAD 83)	Bkf Measures (m)	Mean Bkf Width (m)	Calculated Site Length (m)	Actual Site Length (m)
At Downstream End of Site		2.5 2.8 2.5 2.75	2.6m	52m	150m
46.77590	-110.89850				
At Upstream End of Site					
46.77504	-110.89779				

Sketch Map – Arrow Indicates North



Comments

More channel migration, nibbles + cobbles than upper sites

Place Site Visit Label Here

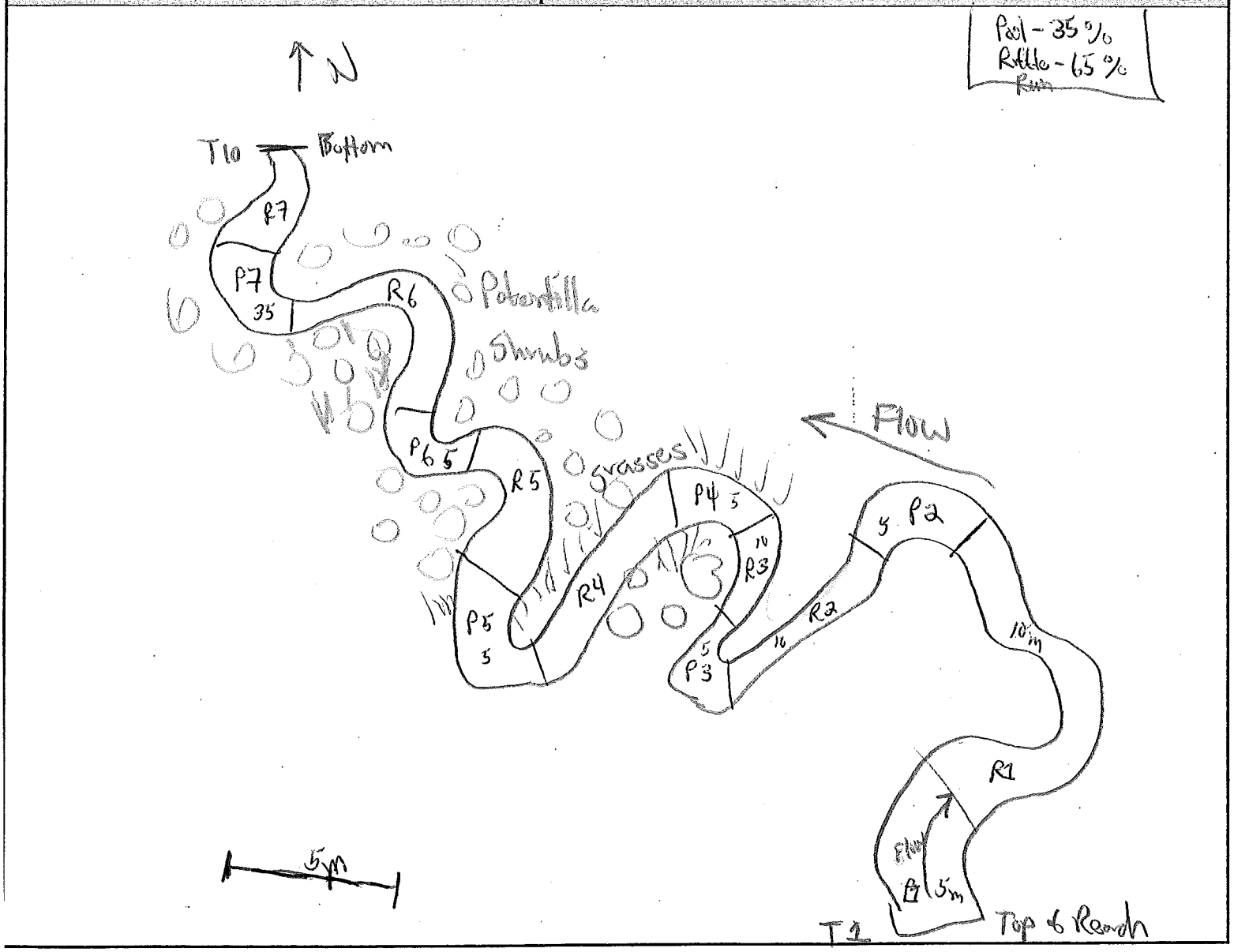
Sediment Assessment
Site Location and Map Form

Date: 8/15/2014 Personnel: DMS, FGH

Waterbody: Little Sheep Creek Station ID: SW8 / AQ8

Stream/River Site Determination					
Latitude (NAD 83)	Longitude (NAD 83)	Bkf Measures (m)	Mean Bkf Width (m)	Calculated Site Length (m)	Actual Site Length (m)
At Downstream End of Site		1.8 m 2.0 m 1.5 m 1.5 m	1.7	34 m	100 m
46.76909	-110.87490				
At Upstream End of Site					
46.76835	-110.87440				

Sketch Map – Arrow Indicates North



Comments

T10 at ~~A~~bout 70 m upstream of ~~H~~ard Road Bridge