

2012 Survey Assessments and Analysis of Fish, Macroinvertebrates and Herpetofauna in the Otter Creek Coal Tracts Area of Powder River County

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Executive Summary

We summarize the second year of baseline surveys for the Assessment of Fish, Macroinvertebrates, and Herpetofauna in the Otter Creek coal tracts area. Project goals remain the same: 1) to continue standardized surveys and collecting baseline information on the aquatic communities prior to coal development, 2) to seasonally assess aquatic community integrity and condition with key indicators recorded at the sites and comparing these against biotic thresholds of reference condition standards. These 2012 data represent the second year of pre-coal development (i.e. pre-impact, BACI design) conditions at the local reach scale.

Habitat assessments, herpetofauna, macroinvertebrate and fish surveys were performed during seasonally similar dates at the same sites visited in 2011: four mainstem Otter Creek reaches (control, impact {2} and downstream) and three tributaries. In total, we performed 16 surveys for fish during the visits: 12 at four mainstem Otter Creek reaches and four surveys in the tributary streams. Thirteen macroinvertebrate samples were collected during the visits; neither survey was conducted at Threemile Creek in any season due to lack of surface water present. All stream reaches were visually surveyed for amphibians or reptiles during all visits. Biological community integrity was calculated for 16 fish surveys using Fish Integrated Biotic Indices (IBI's) and Observed/Expected Models (O/E), while the 13 macroinvertebrate samples were assessed with Montana DEQ's multi-metric indices (MT MMI).

Habitat Evaluations. Of the seven sampling reaches evaluated in the study area, we found three in Proper Functioning Condition (PFC) with a stable trend and four were Functional at Risk (FAR). Reasons that sites ranked FAR were likely due to anthropogenic habitat alteration by cattle (Home Creek {Otter_1A} and Threemile Creek {Otter_3m}) or stream manipulation (Otter Creek JT and Otter Creek #16). Highest site integrity scores using both the BLM Habitat and PFC Assessment methods were recorded at the Otter Creek sites #23 (Tenmile Creek) and #22 (control-Denson reach). Sites with lower habitat scores were structurally degraded by cattle use and had high associated CPI values (Home Creek, Threemile and Otter Creek #16-fall). Conductivity measurements recorded at all Otter Creek mainstem sites across most seasons were above the impairment threshold levels ($>500\mu\text{s}$, DEQ 2006), and the Home Creek site had visible signs of natural gas seepage from the sediments.

Macroinvertebrate Communities: Overall, 105 unique macroinvertebrate taxa were reported in 2012 from the 13 macroinvertebrate assessment samples. One mayfly species of concern (MTSOC), *Caenis youngi* was collected at the Otter Creek control site #22, which also reported the highest taxa richness (42 spp.) during the summer visit. Average macroinvertebrate richness per site was 29.8 taxa. The Montana DEQ multimetric index (MMI) ranked at least one sample of the five sites (9 of 13 samples) as non-impaired (good biological integrity), and scores were not significantly different than 2011 scores ($p > 0.4$). Three of the four samples that were ranked impaired were collected during the spring visit. Sites that maintained flowing water connectivity scored higher with the MMI than sites with interrupted pool areas. Overall, mainstem sites evaluated in the Otter Creek study scored significantly higher with MMI scores than those in the tributaries (ANOVA, $p < 0.01$). MMI's did not significantly differ between Otter Creek mainstem Pre-Impact Control, Impact or Downstream Sites (T-test, $p > 0.05$), despite fish communities reflecting a downstream decrease in biotic integrity.

Fish Communities. Overall, ten fish species (five native/five introduced) were identified from 19,440 individuals collected during 16 surveys. We added one introduced fish species, the golden shiner, in 2012. One potential species of concern (PSOC), the brassy minnow, was collected at five sites. Average total fish species per Otter Creek mainstem site across all seasons was 7.0 (\pm 0.5 SE), a slight increase from 2011 (6.5), while the tributary sites with water averaged 1.5 species. Brassy minnows had the highest site occupancy rate at 88% (14 of 16 visits) followed by fatheads, lake chubs and white suckers at 81% and 75% (13 and 12 of 16 visits), respectively. Fathead minnows continue to account for the highest proportion of total individuals collected at 34%. The most diverse fish sites in the study area were Otter Creek JT and Otter Creek #16 with nine species, while sites with the highest % of native species were Otter Creek #22 (four spp.) and Home Creek (two native spp.). Using Montana's Prairie Fish IBI, 10 of the 16 fish visits ranked non-impaired (good biological integrity), five were slightly-moderately impaired and one was ranked poor biotic integrity. As in 2011, fish biotic integrity decreased going downstream in the Otter Creek mainstem, and the Pre-Impact Control Site scored significantly higher than Downstream site (T-test, $p < 0.05$) but not the Impact sites ($p = 0.06$) this year. The O/E scores tracked the IBI ranks in most cases except in Otter impact site #2, where the O/E showed a slight impairment (0.73), but the IBI scores good integrity. Further evaluations into the relationship of the O/E to the IBI need to be addressed for non-natives.

Amphibian and Reptile Incidentals. All fish presence sites also reported at least one species of amphibian. Eight herpetofauna species were observed or collected in conjunction with the assessment surveys. Of the four amphibian species; the Northern Leopard Frog (*Rana pipiens*) had the highest site occupancy, occurring at five of seven sites, followed by the Woodhouse's Toad (*Bufo woodhousii*) which was detected most often in 2011, and Boreal Chorus Frog (*Pseudacris maculata*) recorded at four and three sites, respectively. The Boreal Chorus Frog was detected vocally calling at two sites during the spring visits with tadpoles at the Tenmile Creek site and two adult incidental sightings during summer visits. We also recorded four reptile species (in order of site occurrence): Painted Turtle (*Chrysemys picta*), Western Rattlesnake (*Crotalus viridis*), Snapping Turtle (*Chelydra serpentina*) (MT SOC) and Terrestrial Garter Snake (*Thamnophis elegans*). We observed the presence of juvenile snapping turtles during the spring site visit at Trussler's (Otter_JT) indicating successful overwintering of 2011 hatchlings.

Conclusions. Similar patterns of aquatic community species and biotic integrity were documented between the 2012 and 2011 surveys, despite significantly different flow regimes. Biotic integrity of mainstem Otter Creek (based on fish) in the upstream control reach remains higher and decreases as you proceed downstream with slight improvements in the IBI of the impact and downstream sites since 2011. Macroinvertebrates show no discernible pattern of integrity spatially, but temporally are showing higher integrity scores during the summer months. Fish communities have reassembled themselves since the 2011 high water with the addition of a new introduced species to three sites in 2012, likely from stock pond overflows, and sand shiners are no longer being collected at the Otter #2 impact site. The extraordinarily high density and large biomass of fish in the reach below Trussler's Ranch road crossing, essentially "stacking up" downstream of this barrier (20,000 fish per 300 m) has dispersed to other sections of Otter Creek and now averages about 3,000 fish per 300m with far fewer density dependent fish anomalies (lesions and parasites, i.e., yellow grub and anchorworm). The fish condition index at this site has improved tremendously since 2011.

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

Introduction

The Otter Creek basin in southeast Montana is currently undergoing exploration for a large, open-pit coal mine. Baseline data on the condition of the ecosystem prior to coal mine development (pre-impact) is essential to determine what effects the coal extraction might have on the fish and wildlife in, and downstream of, the effected extraction area (post-impact). The initial mining rights transfer determined that no Federally Listed species under the ESA would be affected in the coal tracts area (BLM 2002). But this EA did not take into account the presence of Montana Species of Concern (MT SOC) or other ecologically sensitive native species assemblages. Despite numerous projects undertaken to document and monitor biological communities in the Powder and Tongue River watersheds (Confluence Consulting Inc. 2003, 2004; Stagliano 2006; Davis et al. 2009; Maxell 2009; Petersen et al. 2009; Senecal 2009, Stagliano 2011), large gaps still exist in basic baseline surveys for riparian macroinvertebrate, fish, and herpetofauna in the Otter Creek basin. Fish communities have been documented to be seasonally variable in prairie streams (Bramblett and Fausch 1991), thus sampling across all seasons is a good strategy to document baseline community differences. Since 2011 was an extremely “wet” year in the historic record for Otter Creek, seasonal sampling in 2012 will compliment that high discharge period with a “normal” water year, even though 2012 was still almost 2 times higher than the 35 year average of 4.7 cfs (USGS 2012).. Many small prairie streams that constitute the Great Plains Intermittent Prairie Stream ecological system (Stagliano 2005) are highly variable, and may have downstream connectivity early in the season for potential fish spawning and nursery areas (Smith and Hubert 1989, Bramblett 2000) or no fish colonization at all in dry years. By summer this stream system type often becomes a string of isolated pools that are important breeding and rearing areas for amphibians (Stagliano 2011). Identifying spatial and temporal baseline communities and conditions in streams of the coal tracts area (i.e., presence of fish, macroinvertebrate, and herpetofauna) prior to coal development is essential to understanding and potentially mitigating impacts to habitats and species during and after coal extraction.

Methods

Study Sites

Pre-impact baseline sampling sites visited in 2012 were the same reaches designated in 2011 (Stagliano 2012). These sites are representative of the range of stream types found in the Otter Coal Tracts project area: Ephemeral, Intermittent and Perennial Prairie Streams. Four mainstem Otter Creek reaches (control, impact {2} and downstream) and three tributaries coinciding with established surface water quality stations were visited seasonally (May, July, October) (Table 1). Threemile Creek remained dry during all visits (see Site Photos). Seasonal site visits were timed

with 2011 dates, and we coordinated sampling with baseflow discharge levels, which was easily accomplished in 2012, because the spring pulse arrived early and declined quickly (Figure 1).

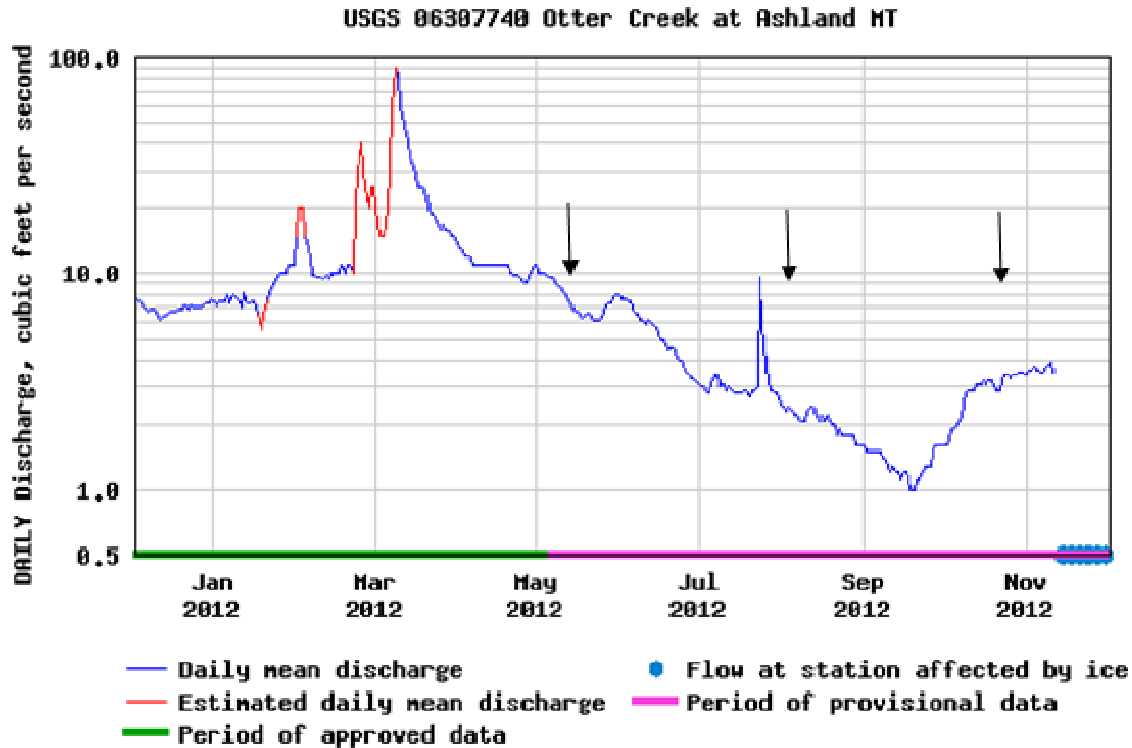
Table 1. Otter Creek Coal Study Site GPS Locations at the top (T) and bottom (B) of the assessment reach. Aquatic Ecological System (AES) code defined in text followed Stagiano (2005).

Site Code	Site Name	Type	AES code	Latitude	Longitude	Elev (m)	Comment
Otter_23	Tenmile Creek (T)	Control	D005/E005	45.43409	-106.13403	961	Small pools below road during spring survey. Dry during July, Oct. visits
Otter_23	Tenmile Creek (B)	Control	D005/E005	45.43465	-106.13253	958	
Otter_22	Otter Creek 22 (T)	Control	D005/C005	45.43035	-106.14428	951	Top of reach ~60m below Tenmile Creek road, proceeded 300m downstream
Otter_22	Otter Creek 22 (B)	Control	D005/C005	45.43274	-106.14366	948	
Otter_16	Otter Creek 16 (T)	Impact	C005	45.48514	-106.16487	938	Top of reach began ~60m above the stream crossing and went 240m below
Otter_16	Otter Creek 16 (B)	Impact	C005	45.48365	-106.16725	937	
Otter_3m	Threemile Creek (T)	Impact	E005	45.51054	-106.16288	933	Dry during all visits
Otter_3m	Threemile Creek (B)	Impact	E005	45.50955	-106.16960	928	
Otter_2	Otter Creek 2 (T)	Impact	C005	45.50475	-106.17493	929	Site surveyed for fish during all visits, downstream of road crossing
Otter_2	Otter Creek 2 (B)	Impact	C005	45.50561	-106.17561	928	
Otter_JT	Otter Creek JT (T)	Down	C005	45.55675	-106.21798	910	Top of reach began ~80m below the ranch road/impassable culvert, proceeded 300m down
Otter_JT	Otter Creek JT (B)	Down	C005	45.55782	-106.21770	909	
Otter_1A	Home Creek (B)	Down	D005/E005	45.54483	-106.18717	952	Bottom of reach began ~500m above the Otter Creek road crossing, proceeded 300m upstream
Otter_1A	Home Creek (T)	Down	D005/E005	45.54422	-106.18947	950	

Average yearly discharge for 2012 was 8.6 cfs versus 14.9 cfs in 2011 and 3.96 cfs in 2010, which is still significantly higher than the 35 year average of 4.7 cfs (USGS 2012). Discharge during the 2012 May visit (7 cfs) was roughly 3x less than in 2011 (Figure 1), while the summer and fall visits were closer to baseflow at 2.5 and 3 cfs, respectively. Habitat assessments, herpotofauna, macroinvertebrate and fish surveys were performed during the same site visit. In total, we surveyed 16 reaches for fish during the visits: four mainstem Otter Creek reaches (12 surveys) and two tributary streams (4 surveys). Thirteen macroinvertebrate samples were collected during the visits; neither aquatic survey was conducted at Threemile Creek in any season due to lack of surface water present. Spring and fall macroinvertebrate samples were collected outside the range of the MTDEQ recommend sampling time frame (June 1st-September 15th) (MTDEQ 2006), but this

time frame was largely derived for mountain streams, not the prairies. All stream reaches were visually and audibly surveyed for amphibians or reptiles during all visits.

Figure 1. Discharge reported at the USGS gage in Ashland, MT. Arrows indicate sampling visits.



Habitat Assessments

The stream assessment reach was divided into 10 equally spaced transects according to BLM and EMAP protocols (BLM 2008b; Lazorchak et al. 1998). The downstream transect 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 300m (designated the assessment area or “AA”) to the marked top of the reach. Parameters recorded at each transect were: wetted-width (WW), three channel depth measurements ($\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ ww distance), % large woody debris, substrate and riparian shading. 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 parameters (temperature, TDS, pH, conductivity) were recorded prior to biological sampling using a Horiba H-10 water monitor, calibrated for the higher conductivity range. The Livestock Use Index (“Cowpie” CPI) was assessed by walking a randomly chosen 75m transect on both sides of the stream channel in the riparian area within the assessment area and counting all the old and new cowpies (higher CPI equals high cow usage). 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 local reach-scale habitat.

Macroinvertebrate Communities

Macroinvertebrate communities were sampled semi-quantitatively from each of the 10 transects within the 300m assessment reach using the EMAP Reach-Wide protocol (Lazorchak et al. 1998). Sampling started at the downstream transect (A) or #10 in the BLM protocol, and proceeded upstream alternating sampling with the 500-micron D-frame net to the left, right or center of the stream channel, so a random sampling of all habitats is achieved (Figure 2). The ten multi-habitat kicks/jabs 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. 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 (2008a) and MTDEQ (2006). Macroinvertebrates were identified to the lowest taxonomic level (MTDEQ 2006), 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). Metric results were scored using the MTDEQ bioassessment criteria and each sample categorized as nonimpaired or impaired according to threshold values (Table 2). The macroinvertebrate MMI score is based

upon a series of metrics that measure attributes of benthic macroinvertebrate communities that are sensitive to condition changes in the stream (in the form of pollution or pollutants). 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

Table 2. Impairment determination thresholds from the MTDEQ MMI and O/E (RIVPACS) models.			
Ecoregion	RIVPACS	MMI	Impairment Determination
Mountain	≥ 0.8 or ≤ 1.2	≥ 63	Not impaired
	< 0.8 or > 1.2	< 63	Impaired
Low Valley	≥ 0.8 or ≤ 1.2	≥ 48	Not impaired
	< 0.8 or > 1.2	< 48	Impaired
Eastern Plains	≥ 0.8 or ≤ 1.2	≥ 37	Not impaired
	< 0.8 or > 1.2	< 37	Impaired

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 **37**

for the Eastern Plains Stream Index, thus any scores above this threshold are considered unimpaired.

Fish and Amphibian Surveys

Fish sampling within the 300m stream assessment reach was conducted with 6 and 9 meter straight seines in 25-30m increments seining in a downstream direction toward the block seine (Figure 3, protocols outlined in Bramblett et al. 2005). Fish captured in a blocked section were

Figure 3. Block seine set in Otter Creek JT Reach #2.



transferred to holding buckets until the reach was completed, unless the reach was broken up by riffles, impassable or dry sections; in this case, fish were processed and released within the section of capture. Fish holding in the buckets were identified to species (Holton and Johnson 2003), enumerated,

examined for external anomalies (e.g. deformities, eroded fins, lesions, and tumors), and then released. At least 10% of the individuals of a species were measured for total length in millimeters (TL mm) to obtain size structure data. Young-of-the-year fish less than 20 mm (TL) were noted on the field sheet (not included in the totals) and released. Voucher specimens were only taken in the case of uncertain field identifications, and were preserved in 10% buffered formalin. These will be deposited with the Montana State University Collections. Adult amphibians or reptiles encountered while seining or walking the designated stream reach were counted and recorded even if they were not captured in the seine.

Analysis of the sampled fish communities used Integrated Biotic Indices (IBI) designed for wadable prairie streams (Bramblett et. al 2005) and derived Observed/Expected (O/E) Fish Models (Stagliano 2011) to detect impairment in the biological integrity of the sites. The expected number of native fish species for a D005 classified reference stream is 2.5-3.75, while the expected number of fish for a C005 stream is 5.5-8.5 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) (Table 1). The IBI originally proposed by Karr (1981) involved

the calculation of a series of 12 metrics evaluating different attributes of the fish community (i.e. species richness, tolerance to pollutants, trophic status) (Table 3). The 10 metrics used for the prairie streams were adjusted for watershed area to calculate an overall score between 0 and 100. Bramblett et al. (2005) did not propose threshold criteria for good, fair, and poor biological integrity for these scores. Therefore, we applied percentiles above the null criteria (no fish present score) at >30% indicates good to excellent biological integrity, 10-30% fair/good biological integrity, 0-10% indicated poor to fair biological integrity and scores below the null are indicative of poor biological integrity or severely impaired.

Table 3. Fish metrics and classification of fishes captured during the Otter Creek Study (2012).

Species	Scientific Name	Trophic *	Feeding Habitat†	Repro Guild‡	General Tolerance **	Origin ††	Total Length 3 years
Catostomidae							
White sucker	<i>Catostomus commersoni</i>	OM	BE	LO	TOL	N	229
Cyprinidae							
Common Carp	<i>Cyprinus carpio</i>	OM	BE		TOL	I	381
Brassy minnow	<i>Hybognathus hankinsoni</i>	HB	BE		MOD	N	81
Fathead Minnow	<i>Pimephales promelas</i>	OM	GE	TOL§	TOL	N	76
Golden Shiner	<i>Notemigonus crysoleucas</i>	OM	WC		MOD	I	102
Lake Chub	<i>Couesius plumbeus</i>	OM	GE		MOD	N	140
Sand Shiner	<i>Notropis stramineus</i>	OM	GE	LO	MOD	N	61
Centrarchidae							
Green Sunfish	<i>Lepomis cyanellus</i>	IC	GE	TOL§	TOL	I	102
Pumpkinseed	<i>Lepomis gibbosus</i>	IC	GE	TOL§	MOD	I	89
Ictaluridae							
Black Bullhead	<i>Ameiurus melas</i>	IC	BE	TOL§	TOL	I	152

*HB = herbivore (> 90% plants or detritus); IC = invertivore/carnivore (>25% both invertebrates and vertebrates); IN = invertivore; OM = omnivore(25-90% plants or detritus)

† BE = benthic; GE = generalist; WC = water column: Brown (1971); Scott and Crossman (1973); Becker (1983)

‡ LO=Litho-obligate Reproductive Guild; Scott and Crossman (1973); Pflieger (1997); Barbour et al. (1999)

§ Tolerant reproductive strategists are not litho-obligates, use parental care at spawning site: Scott and Crossman (1973); Pflieger (1997)

** INT = intolerant; MOD = moderately tolerant; TOL = tolerant; Barbour et al. (1999);

†† N = native; I – introduced; Brown (1971); Holton and Johnson (2003)

Results

We evaluated seven stream reaches in the study area: four Otter Creek mainstem sites that were classified as Perennial Prairie Stream types (C005), and the three tributaries were Great Plains Intermittent Prairie Stream systems (D005, E005) (Table 1). Proper classification is important when

determining biological integrity (Hawkins and Norris 2000) and expected species richness. The Intermittent Prairie Stream (E005) in Montana is naturally fishless 80% of the time; therefore, absence of fish, in itself, should not be viewed as a biological impairment (e.g. Threemile and Tenmile Creek). Likewise, stream reaches of Otter Creek have become dry in previous years (Stagliano, personal observation. 2005-2008), thus placing certain stream sections within the D005 classification. We have identified and characterized reference condition indicator assemblages for these ecosystem types previously (Stagliano 2005), and were used here to compare to our site-specific observed species.

Habitat Evaluations. Of the seven sampling reaches evaluated within the study area, we found three in Proper Functioning Condition (PFC) with a stable trend and four were Functional at Risk (FAR) (Table 7). Reasons that sites ranked FAR were due to structural habitat alteration by cattle with associated high CPI values (Home Creek {Otter_1A}, Threemile Creek {Otter_3m} and Otter #16-fall) (Figure 4) or anthropogenic stream manipulation (Otter Creek JT-Trussler and Otter Creek

Figure 4. Structurally cattle damaged reach-Home Creek



#16). Highest site integrity scores using both the BLM Habitat and PFC Assessment methods were recorded at the Tenmile Creek (Otter_23) and Otter Creek #22 (control-Denson reach) (Table 7). Point conductivity measurements recorded at all Otter Creek mainstem sites and tributaries across all seasons were above the threshold for impairment levels ($>500\mu\text{s}$, DEQ 2006), and Home Creek site had visible signs of natural gas seepage from the sediments.

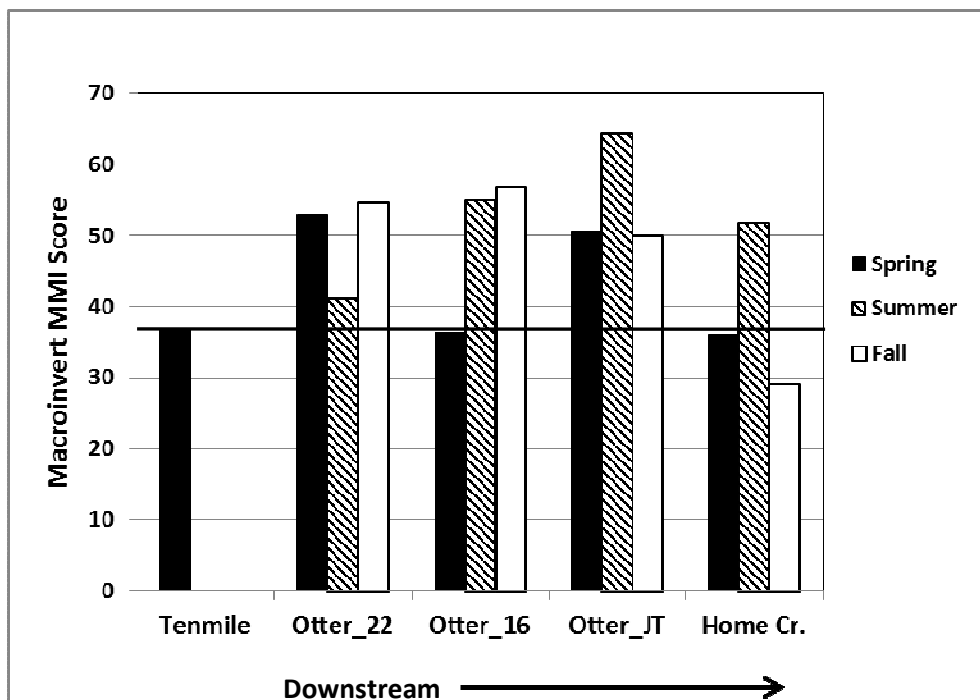
Macroinvertebrate Communities: Overall, 105 unique macroinvertebrate taxa were reported from the 13 macroinvertebrate assessment samples (Appendix B). One known MT species of concern (SOC), the mayfly, *Caenis youngi* was collected at the control site, Otter Creek #22. Stoneflies (P) were not present at any sites, so the EPT taxa per site usually consisted of two species of tolerant mayflies (E), and one or two species of caddisfly (T); the highest EPT richness at any site was five species at the Otter 16 site summer (Table 4, Appendix B). Average macroinvertebrate taxa richness per site was 29.8 and the highest taxa richness was 42 taxa reported at the Otter Creek 22

control site. Using the MTDEQ multimetric index (MMI), four of the five sites (9 of 13 samples) were ranked non-impaired (good to excellent biological integrity), while two samples from Home Creek and one each from Tenmile and Otter #16 were ranked impaired (Table 4, Figure 5).

Table 4. Macroinvertebrate sample characteristics and various metrics used for the DEQ MMI.

Site ID	CollDate	Total Ind. ID'd	Total Sample	Total Taxa	Plains MMI Index	EPT Tax	% EPT	HBI	% Non Insect
OTTER_23t	5/19/2012	405	810	12	36.4	0.0	0.0	7.8	6.9
OTTER_22t	5/19/2012	581	4,648	31	52.9	3.0	13.6	7.5	55.9
OTTER_22ts	7/31/2012	521	16,672	23	41.1	1.0	5.8	7.6	53.9
OTTER_22tf	10/16/2012	535	2,274	42	54.6	4.0	8.6	7.7	61.5
OTTER_16t	5/19/2012	511	1,022	33	36.3	4.0	19.2	7.0	19.4
OTTER_16ts	7/30/2012	594	1,931	31	55.0	3.0	17.3	7.3	35.0
OTTER_16tf	10/15/2012	554	1,108	33	56.8	5.0	23.5	6.9	21.3
OTTER_JTt	5/19/2012	481	1,924	31	50.6	3.0	1.5	7.0	25.4
OTTER_JTts	7/30/2012	573	2,292	33	64.4	2.0	3.3	7.3	8.9
OTTER_JTtf	10/15/2012	592	2,368	37	50.0	4.0	7.8	7.3	6.8
OTTER_1At	5/20/2012	558	3,488	24	35.9	1.0	0.2	7.0	9.1
OTTER_1Ats	7/30/2012	520	4,160	31	51.8	0.0	0.0	7.6	61.5
OTTER_1Atf	10/15/2012	517	3,231	26	29.0	1.0	0.2	7.5	38.7

Figure 5. DEQ MMI scores across sites and seasons. Line is the impairment threshold at 37.



Stream sites that maintained flowing, connected water scored higher with the MMI than sites with interrupted pools. Overall, Otter Creek mainstem sites received significantly higher macroinvertebrate MMI scores than those in the tributaries (ANOVA, $p < 0.01$) (Figure 5). Macroinvertebrate MMI's did not significantly differ between Otter Creek mainstem Pre-Impact Control, Impact or Downstream Sites or years (T-test, $p > 0.05$) (Figures 6 and 7), despite the fish communities reflecting a downstream decrease in biotic integrity. No site had consistently high MMI scores across all seasons though summer visits trended toward higher scores (Figure 5).

Figure 6. Average MMI scores by site type. (a) = no baseline differences between treatments.

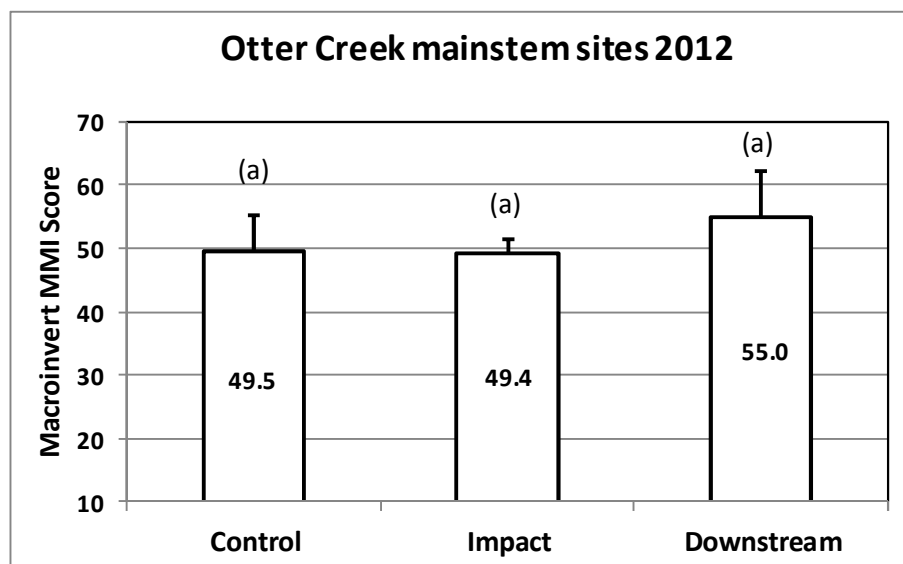
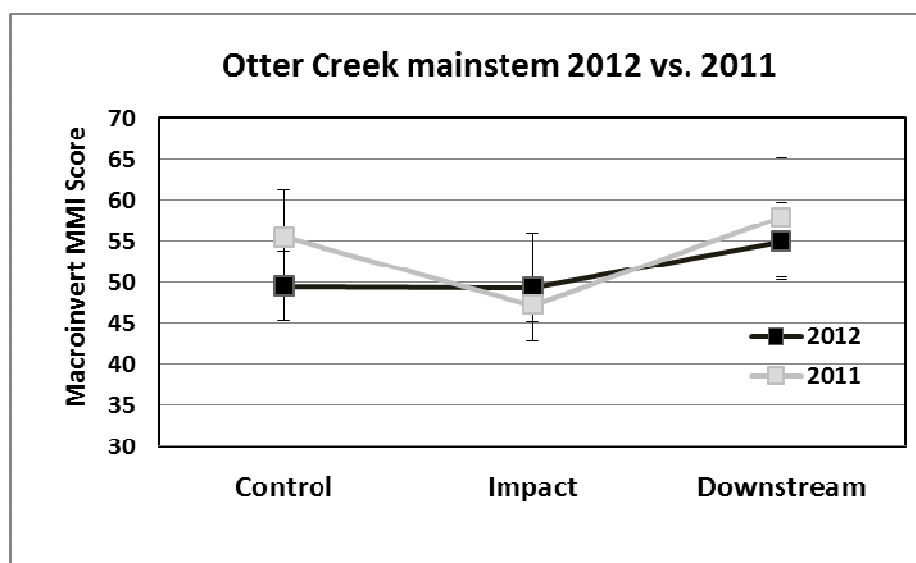


Figure 7. Average macroinvertebrate MMI scores by year. Error bars are standard error (SE).



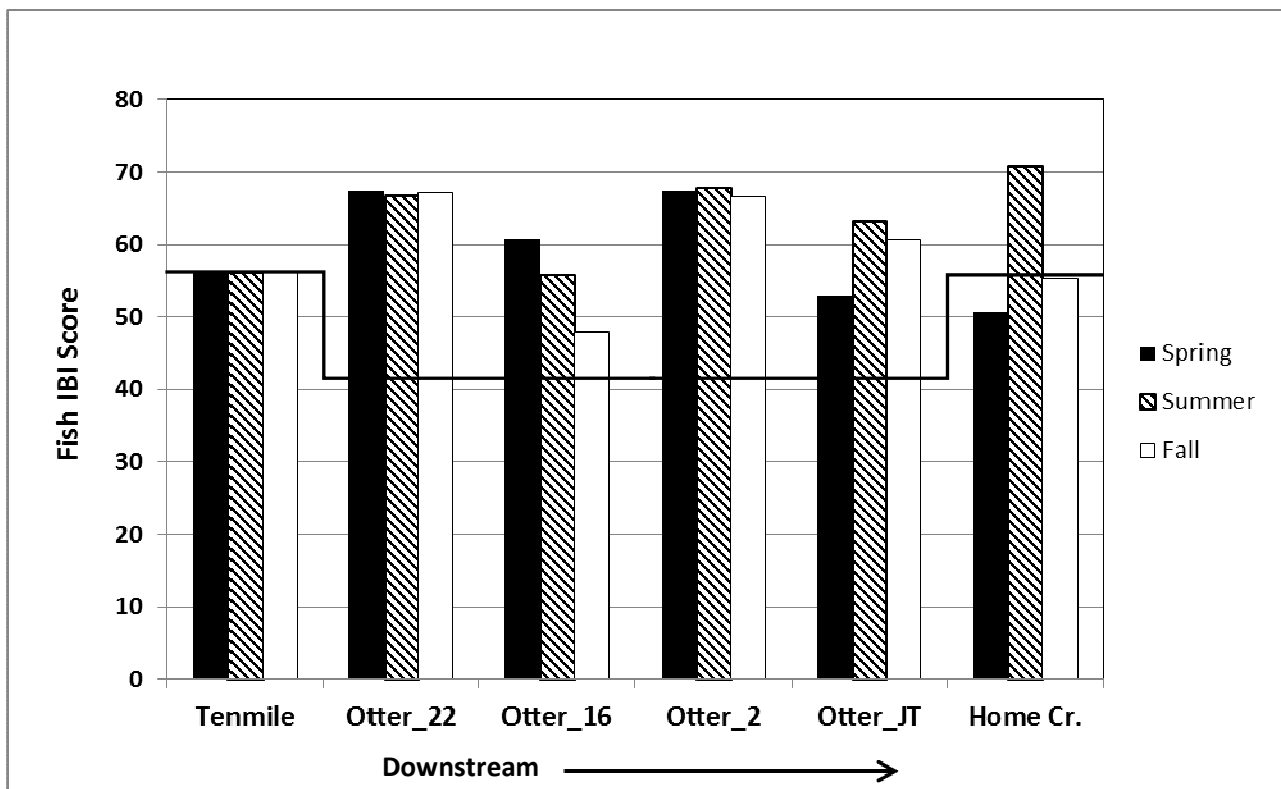
Fish Communities. Overall, ten fish species (five native/five introduced) were identified from 19,440 individuals collected during 16 surveys (Table 5). We added one introduced fish species, the golden shiner, to the Otter Creek species list in 2012. One potential species of concern (PSOC), the brassy minnow, was collected at five sites and in very high numbers at the control site, Otter 22 and during the spring visit at impact site Otter 16 (Table 5). Dominance by brassy minnows and lake chubs at the upstream sites shifts to a tolerant fathead minnow and sand shiner dominated community at the most downstream site, Otter JT (Table 5). Otter Creek site 16 was heavily infested by introduced species during the summer and fall visits representing 41% and 93% of the fish sampled, respectively. Average total fish species per Otter Creek mainstem site across all seasons was 7.0 (\pm 0.5 SE), a slight increase from 2011 (6.5), while the tributary sites with water averaged 1.5 species. Brassy minnows had the highest site occupancy rate at 88% (14 of 16 visits) followed by fatheads, lake chubs and white suckers at 81% and 75% (13 and 12 visits), respectively. Fathead minnows continue to be the highest proportion of total individuals collected at 34%. The most diverse fish sites in the study area were Otter Creek JT and Otter Creek 16 with nine species, while the sites with the highest % of native species were Otter Creek #22 (four spp.) and Home Creek (two native spp.). Fish communities have reassembled themselves since the 2011 high water with an addition of a new introduced species to three sites in 2012, likely from stock pond overflows, and sand shiners are no longer being collected at the Otter #2 impact site. The high density and large biomass of fish reported in the reach below Trusler's Ranch road crossing in fall of 2011, essentially "stacking up" downstream of this barrier (20,000 fish per 300 m) has dispersed to other sections of Otter Creek and now this reach averages about 3,000 fish per 300m with significantly fewer density dependent fish anomalies (lesions and parasites, i.e., yellow grub and anchorworm). The qualitative fish condition index at this site has improved tremendously since 2011.

Table 5. Fish abundance, IBI's and O/E results for the 6 sites that have reported fish. ns = not seined during visit (dry). Underlined values are fish communities that ranked biologically unimpaired. * = introduced species.

	OTTER_23			OTTER_22			OTTER_16			OTTER_2			OTTER_JT			OTTER_1A			
	May	Jul	Oct	May	Jul	Oct	May	Jul	Oct	May	Jul	Oct	May	Jul	Oct	May	Jul	Oct	Total
Black Bullhead*	0	ns	ns	0	5	20	16	27	123	7	21	0	8	0	3	0	0	0	230
Brassy Minnow	0	ns	ns	234	55	940	1604	90	3	98	49	154	10	15	5	2	0	5	3,264
Common Carp*	0	ns	ns	0	0	0	492	54	9	0	14	7	12	23	18	0	0	0	629
Fathead Minnow	0	ns	ns	0	0	0	620	189	45	35	63	7	3290	1085	1245	10	10	10	6,609
Lake Chub	0	ns	ns	870	300	1500	746	198	6	308	441	77	40	75	15	0	20	0	4,596
Green Sunfish*	0	ns	ns	0	5	75	44	9	42	0	0	0	14	0	3	0	0	0	192
Golden Shiner*	0	ns	ns	0	5	0	96	0	0	7	0	0	0	0	0	0	0	0	108
Pumpkinseed*	0	ns	ns	18	30	5	224	201	129	7	0	0	5	0	3	0	0	0	622
Sand Shiner	0	ns	ns	0	0	0	0	0	0	0	0	0	906	900	763	0	0	0	2,569
White Sucker	0	ns	ns	40	150	80	24	45	66	28	14	7	24	98	45	0	0	0	621
Total # species	0	0	0	4	7	6	9	8	8	7	6	5	9	6	9	2	2	2	10
Native Species	0	0	0	3	3	3	4	4	4	4	4	4	5	5	5	2	2	2	5
Total Individuals	0	0	0	1162	550	2620	3866	813	423	490	602	252	4309	2196	2100	12	30	15	19,440
IBI	56.1	56.1	56.1	<u>67.5</u>	<u>66.8</u>	<u>67.2</u>	<u>60.8</u>	55.8	47.9	<u>67.5</u>	<u>67.8</u>	<u>66.6</u>	52.9	<u>63.3</u>	<u>60.6</u>	51.7	<u>70.8</u>	55.4	
O/E	0	0	0	<u>0.80</u>	<u>0.80</u>	<u>0.80</u>	0.73	0.73	0.73	0.73	0.73	0.73	0.67	0.67	0.67	<u>0.82</u>	<u>0.82</u>	<u>0.82</u>	
O/E %	0	0	0	<u>80.0</u>	<u>80.0</u>	<u>80.0</u>	72.7	72.7	72.7	72.7	72.7	72.7	66.7	66.7	66.7	<u>81.6</u>	<u>81.6</u>	<u>81.6</u>	

Using the Prairie Fish IBI, 10 of the 16 fish sites were ranked non-impaired (good biological integrity), two were slightly impaired (moderate integrity), three were moderately impaired (poor biotic integrity) and the Home Creek spring survey was ranked severely impaired (Figure 8). Although, this Home Creek rank was due to low capture numbers, as the O/E has this site ranked as an almost intact community (Table 5, Figure 8). The O/E models tracked the IBI scores quite well in most cases (13 of 16), except where the O/E ranked the site as slightly impaired and the IBI ranked the sites as non-impaired (Figure 9).

Figure 8. Fish IBI scores across sites and seasons. Line is the null IBI threshold (fish absent).



Fish IBI's decreased going downstream on Otter Creek, and the Pre-Impact Control Site scored significantly higher than Downstream sites (T-test, $p < 0.05$), but not the Impact sites during this year (Figure 10). The O/E scores tracked the IBI ranks in most cases except in Otter impact site #2, where the O/E shows slight impairment (0.73), but the IBI scores good integrity. Further evaluations into the relationship of the O/E to the IBI need to be addressed for non-natives.

Figure 9. 2012 Fish IBI compared to O/E model (%) scores across sites and seasons.

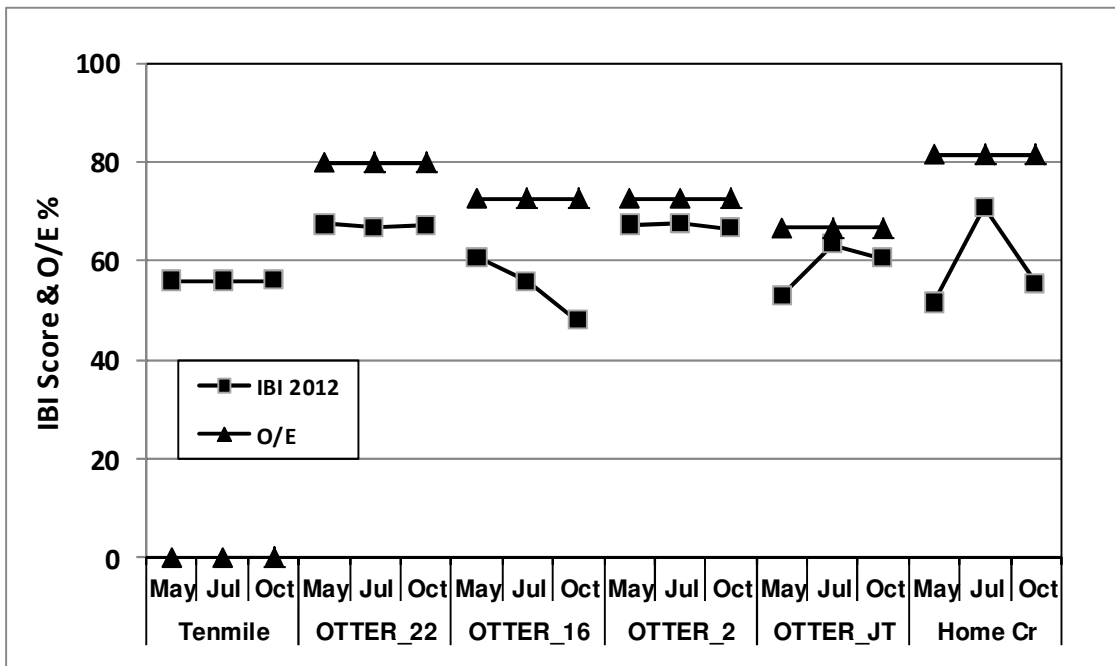
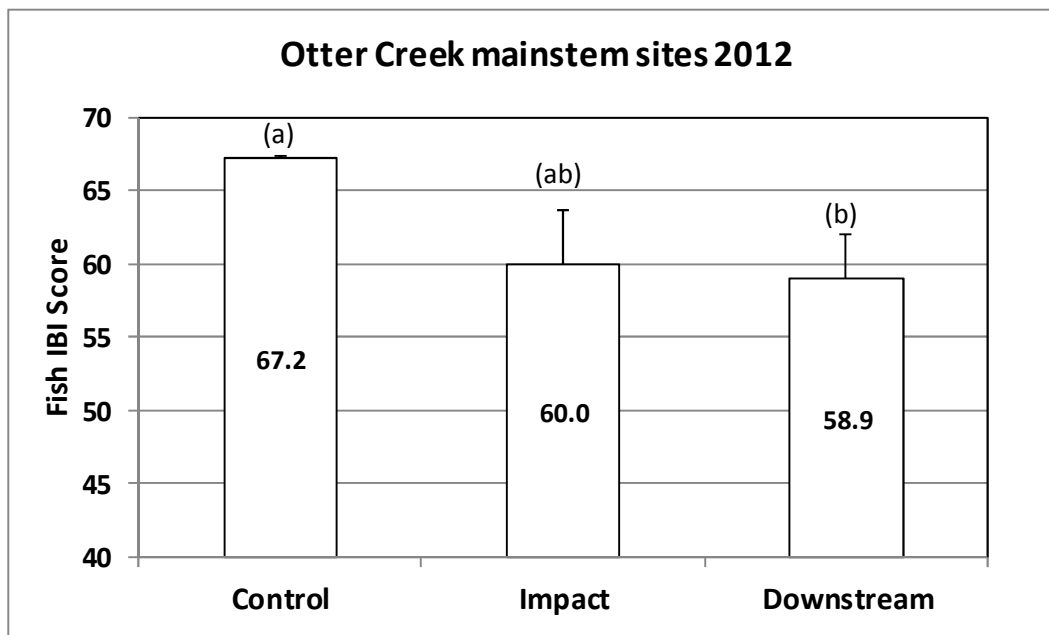


Figure 10. Average fish IBI scores by site type. (a) = no baseline differences between treatments.



Fish IBI scores in 2012 showed similar seasonal patterns as in 2011, except at the Otter JT site which reported a significantly higher IBI scores during all visits in 2012 (T-Test- $p < 0.01$) (Figure 11). Otter Creek site 16 exhibited decreasing seasonal trends in the Fish IBI during both years (Figure 11) and this was significantly correlated with the percentage of native fish individuals

collected during that visit (Figure 12). All mainstem Otter Creek sites reported introduced species present (Table 5), but native fish species still dominated the percentage of individuals of the communities except at site 16 (Figure 12).

Figure 11. Comparison of 2012 and 2011 Fish IBI scores across sites and seasons.

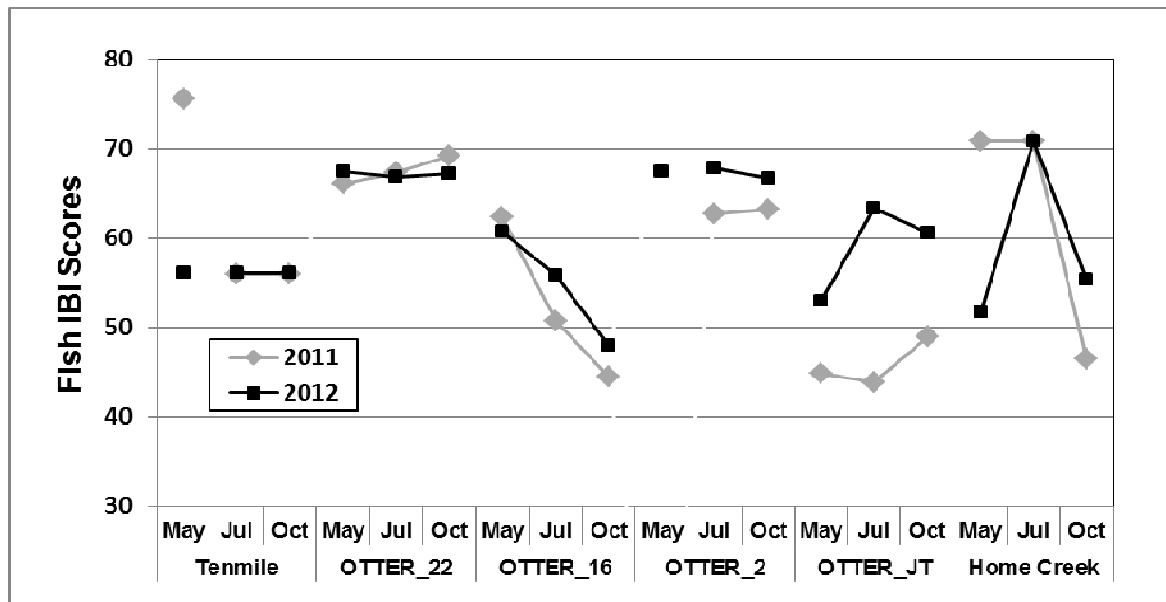
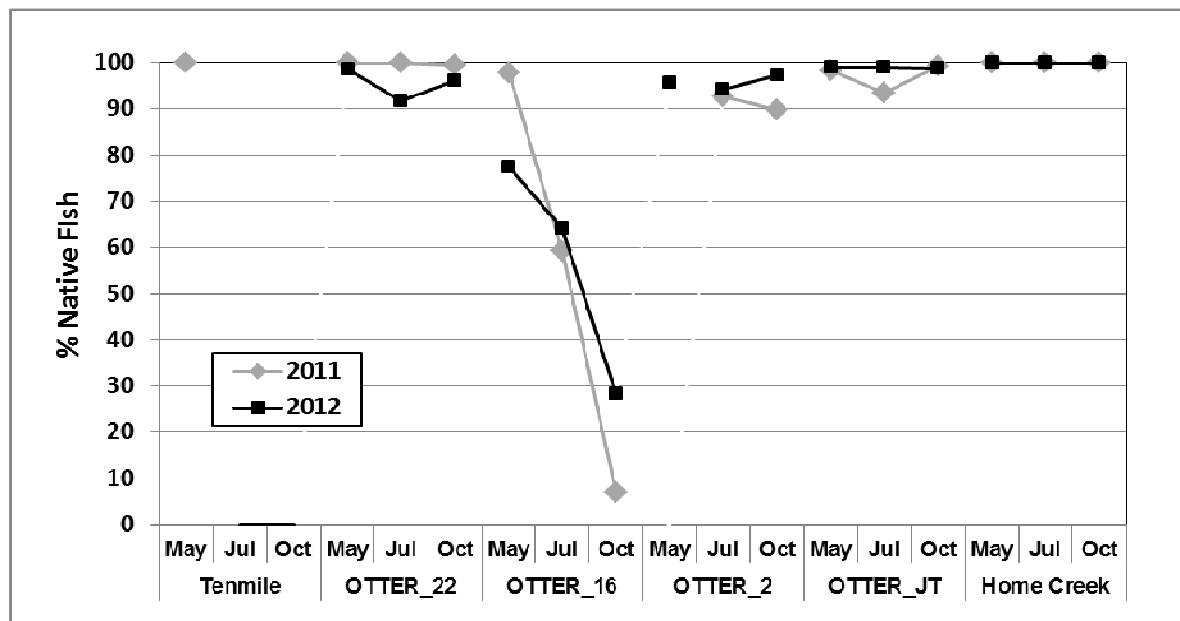


Figure 12. Comparison of 2012 and 2011 Native Fish Percentage (%) across sites and seasons.



Amphibian and Reptile Observations. Overall, eight herpetofauna species were observed, collected in dipnets/seines or incidentally recorded in conjunction with the 2012 surveys. Otter Creek #22 and #16 were the most diverse sites reporting five herpetofauna species cumulatively across all seasons. We reported four amphibian species, of which, Northern Leopard Frog (*Rana pipiens*) had the highest site detection, occurring at five of seven sites, followed by the Woodhouse's Toad (*Bufo woodhousii*), which was highest in 2011, and Boreal Chorus Frog (*Pseudacris maculata*) recorded at four and three sites, respectively (Table 6). The Woodhouse's Toad contributed the highest percent of individuals because of the pool of tadpoles (~100) detected at Tenmile Creek. The Boreal Chorus Frog was detected vocally calling at two sites during the spring visits with tadpoles detected during the same visit at Tenmile Creek and two incidental sightings during summer visits. We also recorded four reptile species (in order of site occurrence): Painted Turtle (*Chrysemys picta*) (Figure 10), Western Rattlesnake, (*Crotalus viridis*) and Snapping Turtle (*Chelydra serpentina*)(MT SOC) and Terrestrial Garter Snake, (*Thamnophis elegans*) (Table 6).

Table 6. Vertebrates (Species Code) recorded during the 2012 Otter Creek Surveys. Frequency of Occurrence (FO) was calculated from the # of site visits detected / # of visits capable for detection: Herps (n=21) and Fish (n=16). Proportion of individuals out of total. * = Introduced Species

Herpetofauna	Visits Det	FO	% of total ind.
Northern Leopard Frog (RAPI)	7	0.33	0.18
Woodhouse's Toad (BUWO)	6	0.29	0.42
Boreal Chorus Frog (PSMA)	4	0.19	0.30
Painted Turtle (CHPI)	4	0.19	0.04
Tiger Salamander (AMTI)	3	0.14	0.02
Western Rattlesnake (CRVI)	2	0.10	0.01
Snapping Turtle (CHSE)	2	0.10	0.02
Terrestrial Gartersnake (THEL)	2	0.10	0.01
Fish			
Brassy Minnow (BRMI)	14	0.88	0.17
Lake Chub (LACH)	13	0.81	0.24
Fathead Minnow (FAMI)	12	0.75	0.34
White Sucker (WHSU)	12	0.75	0.03
Black Bullhead* (BLBU)	9	0.56	0.01
Pumpkinseed* (PUMP)	9	0.56	0.03
Common Carp* (CARP)	8	0.50	0.03
Green Sunfish* (GRSU)	7	0.44	0.01
Golden Shiner*(GOSH)	3	0.19	0.01
Sand Shiner (SASH)	3	0.19	0.13

Figure 13. Snapping Turtle (yearling) (left) and Painted Turtle adult (right) from Otter Creek JT.



Conclusions

The 2012 aquatic community sampling baseline data represents some significant deviations from 2011 data. Seasonal baseflows this year were 2x lower than in 2012, but still were above the 35 year average. Spring 2012 visits to Tenmile Creek revealed small isolated pools, where in 2011, there were seineable pools with fish. Threemile Creek remained dry during all seasons and provided no biological data. Despite this being an unusually high water year for the region, stream communities that we sampled across the seasons encompassed the range of expected species to occur in these stream types, and fish and macroinvertebrate community assessment scores were similar to biological assessments performed in previous years (Table 7).

Biotic integrity of the upstream control reaches of Otter Creek remained higher than the lower Otter Creek reaches during this second year, but was not significantly different from the Impact Reaches. Otter Creek site #16 continued to exhibit decreasing seasonal trends in the Fish IBI during both years and increasing numbers of introduced fish in the community. A reason for this accumulation of introduced fish at site 16 and not at other sites may be related to the graveled road crossing acting as a barrier to fish movement during low water periods, but this is largely unexplained. The extraordinarily high density and large biomass of fish in the reach below Trusler's Ranch road crossing, essentially "stacking up" downstream of this barrier (20,000 fish per 300 m) has dispersed to other sections of Otter Creek and now averages about 3,000 fish per 300m with far fewer density dependent fish anomalies (lesions and parasites, i.e., yellow grub and anchorworm). The fish condition index at this site has improved tremendously since 2011.

Outside of coal extraction, manageable threats to this stream system include grazing and livestock use around the riparian areas. Moderate occurrences in these basins can have strong local effects resulting in sedimentation, stream widening at cattle crossings and loss of functional channel hydrology. Introductions of game (green sunfish, bullheads or pumpkinseeds) or forage fish (golden shiners) in stock ponds anywhere in the watershed can pose potential problems for native fish as these introduced fish become permanent residents, outcompete or prey upon the native fish and contribute to overall community degradation. Diverse aquatic communities with high biological integrity are usually correlated with good riparian condition and habitat quality (Allen et al. 1997). Thus, effective riparian zone management in cattle grazing would contribute

to intact vegetation buffers and less sediment in the aquatic environment (George et al. 2002). During both years of the study, macroinvertebrate communities assessed by the MMI ranked few sites as impaired, even those with an obvious impaired riparian condition and in-stream habitat limitations. The effectiveness of macroinvertebrate communities in assessing prairie stream impairment, especially for sediment, is still under debate in Montana. Community results from the habitat, fish and macroinvertebrate surveys combined to rank the following sites from highest biological integrity to lowest within their aquatic ecological classification codes:

Northwestern Great Plains Perennial Prairie Stream (AES code C005)-1) Otter Creek #22, 2) Otter Creek #2, 3) Otter Creek #16, 4) Otter Creek –J Trusler site

Site Photos

Otter Creek #22 (control) during spring 2012 visit: pools (left) and manipulated riffle (right)



Otter Creek #2 (impact): fall visit 2011 looking downstream to block net (left) and upstream summer 2012 (right).



Site Photos

Otter Creek #16 (impact) spring visit: pool (left) and shallow stream crossing (right).



Otter Creek #16 (impact) during summer visit: downstream pool (left) and drill trucks using the stream crossing (right).



Site Photos

Otter Creek JT (downstream): summer visit looking downstream (left) and upstream (right)



Northwestern Great Plains Intermittent Prairie Stream-(AES code D005)-1) Home Creek 1A, 2)
Tenmile Creek,

Home Creek (Otter 1A) during the Spring (left) and Summer (right) Visits



Site Photos

Tenmile Creek (Otter_23) in the Spring (left) and Summer (right)



Great Plains Intermittent Fishless Prairie Stream (AES code E005)-1) Threemile Creek

Site Photos: Threemile Creek (Otter 3m) during the spring 2011 (left) and 2012 (right) visits



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Appendix A. Raw data and IBI metric calculation from fish data collected from Otter Creek Coal Tract Sites

Spring 2012												
	Otter23	Otter22		Otter16		Otter2		OtterJT		Otter1A		
Black Bullhead	0.0		0.0	16.0		21.0		8.0		0.0		
Brassy Minnow	0.0		234.0	1604.0		49.0		10.0		2.0		
Common Carp	0.0		0.0	492.0		14.0		12.0		0.0		
Fathead Minnow	0.0		0.0	620.0		63.0		3290.0		10.0		
Lake Chub	0.0		870.0	746.0		441.0		40.0		0.0		
Green Sunfish	0.0		0.0	44.0		0.0		14.0		0.0		
Golden Shiner	0.0		0.0	96.0		0.0		0.0		0.0		
Pumpkinseed Sunfish	0.0		18.0	224.0		0.0		5.0		0.0		
Sand Shiner	0.0		0.0	0.0		0.0		906.0		0.0		
White Sucker	0.0		40.0	24.0		14.0		24.0		0.0		
Total # species	0.0		4.0	9.0		6.0		9.0		2.0		
Native Species	0.0		3.0	4.0		4.0		5.0		2.0		
Native Families	0.0		2.0	2.0		2.0		2.0		1.0		
Total Individuals	0.0		1162.0	3866.0		602.0		4309.0		12.0		
# Minnow Species Thrive	0.0		2.0	3.0		3.0		4.0		2.0		
Proportion of tolerant individuals	0.00		3.44	33.42		18.60		77.70		83.33		
# Sucker + Catfish Species	0.0		1.0	2.0		2.0		2.0		0.0		
% Insectivorous Minnows	0.0		74.9	19.3		73.3		22.0		0.0		
# Benthic Invertivore Species	0.0		0.0	1.0		1.0		1.0		0.0		
% Lithophilic Spawners	0.0		3.4	0.6		2.3		21.6		0.0		
% Parental Care	0.00		0.00	16.45		13.95		76.54		83.33		
% Native to Montana	0.0		98.5	77.4		94.2		99.1		100.0		
# Long Lived Species	0.0		4.0	5.0		1.0		4.0		2.0		
	Otter23		Otter22		Otter16		Otter2		OtterJT		Otter1A	
Metrics	Adjust Value	Score	Adjust Value	Score	Adjust Value	Score	Adjust Value	Score	Adjust Value	Score	Adjust Value	Score
Number of Native Fish Species to Montana	11.6	64.7	9.3	51.8	10.1	56.0	10.0	55.3	10.8	59.9	13.3	73.7
Number of Native Fish Families to Montana	2.1	39.5	3.2	58.7	3.1	57.8	3.1	57.4	3.1	56.8	3.1	56.7
Proportion of tolerant individuals	0.0	100.0	3.4	96.4	33.4	64.6	18.6	80.3	77.7	17.8	83.3	11.8
Number of Sucker and Catfish Species	7.1	77.1	4.9	53.3	5.8	62.6	5.7	61.8	5.6	60.7	6.9	74.7
Proportion out of the Total Number of Fish That Were Insect eating Minnows	0.0	0.0	74.9	102.8	19.3	26.5	73.3	100.6	22.0	30.2	0.0	0.0
Total Number of Species That Prefer to Eat Insects That Live on the Stream Bottom	5.5	93.1	3.0	51.3	4.9	83.3	4.8	82.4	4.8	81.0	5.3	90.2
Proportion of the Total Number of Fish That Require Rocks to Lay Eggs	0.0	0.0	3.4	4.2	0.6	0.7	2.3	2.8	21.6	26.0	0.0	0.0
Proportion of the Total Number of Individuals That Do Not Require Rocks, But Have Parental Care of Eggs	0.0	100.0	0.0	100.0	16.5	81.3	14.0	84.1	76.5	13.0	83.3	5.2
Proportion of the Total Number of Fish Sampled That Were Native to Montana	0.0	0.0	98.5	98.5	77.4	77.5	94.2	94.2	99.1	99.1	100.0	100.0
Number of Long-Lived Native Species	8.5	86.9	5.7	58.1	9.5	97.3	5.4	55.4	8.3	84.9	10.2	104.7
		561.4		675.1		607.6		674.5		529.4		517.3
IBI Score		56.14		67.51		60.76		67.45		52.94		51.73

Appendix A. Raw data and IBI metric calculation from fish data collected from Otter Creek Coal Tract Sites

Summer 2012												
	Otter23		Otter22		Otter16		Otter2		OtterJT		Otter1A	
Black Bullhead	0.0		5.0		27.0		21.0		0.0		0.0	
Brassy Minnow	0.0		55.0		90.0		49.0		15.0		0.0	
Common Carp	0.0		0.0		54.0		14.0		23.0		0.0	
Fathead Minnow	0.0		0.0		189.0		63.0		1085.0		10.0	
Lake Chub	0.0		300.0		198.0		441.0		75.0		20.0	
Green Sunfish	0.0		5.0		9.0		0.0		0.0		0.0	
Golden Shiner	0.0		5.0		0.0		0.0		0.0		0.0	
Pumpkinseed Sunfish	0.0		30.0		201.0		0.0		0.0		0.0	
Sand Shiner	0.0		0.0		0.0		0.0		900.0		0.0	
White Sucker	0.0		150.0		45.0		14.0		98.0		0.0	
Total # species	0.0		7.0		8.0		6.0		6.0		2.0	
Native Species	0.0		3.0		4.0		4.0		5.0		2.0	
Native Families	0.0		2.0		2.0		2.0		2.0		1.0	
Total Individuals	0.0		550.0		813.0		602.0		2196.0		30.0	
# Minnow Species Thrive	0.0		2.0		3.0		3.0		4.0		2.0	
Proportion of tolerant individuals	0.00		30.00		39.85		18.60		54.92		33.33	
# Sucker + Catfish Species	0.0		2.0		2.0		2.0		1.0		0.0	
% Insectivorous Minnows	0.0		54.5		24.4		73.3		44.4		66.7	
# Benthic Invertivore Species	0.0		1.0		1.0		1.0		0.0		0.0	
% Lithophilic Spawners	0.0		27.3		5.5		2.3		45.4		0.0	
% Parental Care	0.00		0.91		26.57		13.95		49.41		33.33	
% Native to Montana	0.0		91.8		64.2		94.2		99.0		100.0	
# Long Lived Species	0.0		1.0		2.0		1.0		4.0		1.0	
	Otter23		Otter22		Otter16		Otter2		OtterJT		Otter1A	
Metrics	Adjust Value		Adjust Value		Adjust Value		Adjust Value		Adjust Value		Adjust Value	Score
Number of Native Fish Species to Montana	11.6	64.7	9.3	51.8	10.1	56.0	10.1	56.0	10.8	59.9	13.3	73.7
Number of Native Fish Families to Montana	2.1	39.5	3.2	58.7	3.1	57.8	3.1	57.8	3.1	56.8	3.1	56.7
Proportion of tolerant individuals	0.0	100.0	30.0	68.3	39.9	57.8	18.6	80.3	54.9	41.9	33.3	64.7
Number of Sucker and Catfish Species	7.1	77.1	5.9	64.2	5.8	62.6	5.8	62.6	4.6	49.8	6.9	74.7
Proportion out of the Total Number of Fish That Were Insect eating Minnows	0.0	0.0	54.5	74.9	24.4	33.4	73.3	100.6	44.4	61.0	66.7	91.6
Total Number of Species That Prefer to Eat Insects That Live on the Stream Bottom	5.5	93.1	4.0	68.3	4.9	83.3	4.9	83.3	4.8	81.0	5.3	90.2
Proportion of the Total Number of Fish That Require Rocks to Lay Eggs	0.0	0.0	27.3	32.9	5.5	6.7	2.3	2.8	45.4	54.8	0.0	0.0
Proportion of the Total Number of Individuals That Do Not Require Rocks, But Have Parental Care of Eggs	0.0	100.0	0.9	99.0	26.6	69.8	14.0	84.1	49.4	43.8	33.3	62.1
Proportion of the Total Number of Fish Sampled That Were Native to Montana	0.0	0.0	91.8	91.9	64.2	64.2	94.2	94.2	99.0	99.0	100.0	100.0
Number of Long-Lived Native Species	8.5	86.9	5.7	58.1	6.5	66.5	5.5	56.3	8.3	84.9	9.2	94.5
		561.4		668.0		558.2		678.1		632.9		708.4
IBI Score		56.14		66.80		55.82		67.81		63.29		70.84

Appendix A. Raw data and IBI metric calculation from fish data collected from Otter Creek Coal Tract Sites

	Fall 2012											
	Otter23		Otter22		Otter16		Otter2		OtterJT		Otter1A	
Black Bullhead	0.0		20.0		123.0		0.0		3.0		0.0	
Brassy Minnow	0.0		940.0		3.0		154.0		5.0		5.0	
Common Carp	0.0		0.0		9.0		7.0		17.0		0.0	
Fathead Minnow	0.0		0.0		45.0		7.0		1245.0		10.0	
Lake Chub	0.0		1500.0		6.0		77.0		15.0		0.0	
Green Sunfish	0.0		75.0		42.0		0.0		3.0		0.0	
Golden Shiner	0.0		0.0		0.0		0.0		0.0		0.0	
Pumpkinseed Sunfish	0.0		5.0		129.0		0.0		3.0		0.0	
Sand Shiner	0.0		0.0		0.0		0.0		763.0		0.0	
White Sucker	0.0		80.0		66.0		7.0		45.0		0.0	
Total # species	0.0		6.0		8.0		5.0		9.0		2.0	
Native Species	0.0		3.0		4.0		4.0		5.0		2.0	
Native Families	0.0		2.0		2.0		2.0		2.0		1.0	
Total Individuals	0.0		2620.0		423.0		252.0		2099.0		15.0	
# Minnow Species Thrive	0.0		2.0		3.0		3.0		4.0		2.0	
Proportion of tolerant individuals	0.00		6.68		67.38		8.33		62.55		66.67	
# Sucker + Catfish Species	0.0		2.0		2.0		1.0		2.0		0.0	
% Insectivorous Minnows	0.0		57.3		1.4		30.6		37.1		0.0	
# Benthic Invertivore Species	0.0		1.0		1.0		0.0		1.0		0.0	
% Lithophilic Spawners	0.0		3.1		15.6		2.8		38.5		0.0	
% Parental Care	0.00		0.76		39.72		2.78		59.46		66.67	
% Native to Montana	0.0		96.2		28.4		97.2		98.8		100.0	
# Long Lived Species	0.0		4.0		4.0		4.0		4.0		2.0	
	Otter23		Otter22		Otter16		Otter2		OtterJT		Otter1A	
Metrics	Adjust Value		Adjust Value		Adjust Value		Adjust Value		Adjust Value		Adjust Value	Score
Number of Native Fish Species to Montana	11.6	64.7	9.3	51.8	10.1	56.0	10.1	56.0	10.8	59.9	13.3	73.7
Number of Native Fish Families to Montana	2.1	39.5	3.2	58.7	3.1	57.8	3.1	57.8	3.1	56.8	3.1	56.7
Proportion of tolerant individuals	0.0	100.0	6.7	92.9	67.4	28.7	8.3	91.2	62.6	33.8	66.7	29.5
Number of Sucker and Catfish Species	7.1	77.1	5.9	64.2	5.8	62.6	4.8	51.7	5.6	60.7	6.9	74.7
Proportion out of the Total Number of Fish That Were Insect eating Minnows	0.0	0.0	57.3	78.6	1.4	1.9	30.6	42.0	37.1	50.9	0.0	0.0
Total Number of Species That Prefer to Eat Insects That Live on the Stream Bottom	5.5	93.1	4.0	68.3	4.9	83.3	4.9	83.3	4.8	81.0	5.3	90.2
Proportion of the Total Number of Fish That Require Rocks to Lay Eggs	0.0	0.0	3.1	3.7	15.6	18.8	2.8	3.3	38.5	46.4	0.0	0.0
Proportion of the Total Number of Individuals That Do Not Require Rocks, But Have Parental Care of Eggs	0.0	100.0	0.8	99.1	39.7	54.8	2.8	96.8	59.5	32.4	66.7	24.2
Proportion of the Total Number of Fish Sampled That Were Native to Montana	0.0	0.0	96.2	96.2	28.4	28.4	97.2	97.3	98.8	98.8	100.0	100.0
Number of Long-Lived Native Species	8.5	86.9	5.7	58.1	8.5	87.0	8.5	87.0	8.3	84.9	10.2	104.7
		561.4		671.7		479.4		666.4		605.6		553.9
IBI Score		56.14		67.17		47.94		66.64		60.56		55.39

Appendix B

Macroinvertebrate taxa lists, abundance and metrics for the Otter
Creek collection sites

Montana Bioassessment Report

Waterbody Name: Otter Creek Site 16 for the Coal Tracts Study **Benthic Sample ID:** 17996
Station ID: OTTER_16t **Rep. Num** 0
Reference Status: **STORET Activity ID:** OTT16tM-MAC-R
Site Classification: **Collection Date:** 05/19/2012
Latitude: **Collection Method:** MAC-R-500
Longitude: **Total Number of Individuals in Sample:** 511

Sample Taxa List

<i>Order:</i>	<i>OTU name:</i>	<i>FinalID:</i>	<i>Individuals</i>	<i>Tol Val:</i>	<i>FFG:</i>	<i>Habit:</i>
		Callibaetis fluctuans	2			
		Gyraululus circumstriatus	8			
Amphipoda	Hyalella	Hyalella azteca	25	8	CG	SW/SP
Basommatop	Lymnaeidae	Stagnicola caperata	3	6	CG	CN
Basommatop	Physa_Physella	Physella acuta	45	8	CG	CN
Basommatop	Planorbidae	Gyraululus parvus	22	6	CG	CN
Coleoptera	Dubiraphia	Dubiraphia vittata	4	6	SC/CG	"CN/50%, BU/50%"
Coleoptera	Helophorus	Helophorus	1	5	SH	CM
Diptera	Ceratopogoninae	Bezzia	13	6	PR/CG	SP/BU/SW
Diptera	Chironominae	Chironomus	3	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Cladotanytarsus	7	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Dicrotendipes	15	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Glyptotendipes	6	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Microtendipes pedellus Gr.	1	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Tanytarsus	35	7	CG/CF/PR	BU/CN/SP
Diptera	Ephydriidae	Ephydra	2	6	CG	BU
Diptera	Hedriodiscus/Odon	Odontomyia	1		CG	SP
Diptera	Orthoclaadiinae	Cricotopus	40		CG/SC	SP/BU
Diptera	Orthoclaadiinae	Psectrocladius	5		CG/SC	SP/BU
Diptera	Simuliidae	Simulium	134	6	CF	CN
Diptera	Tanypodinae	Ablabesmyia	4		PR	SP/BU
Ephemeropte	Caenis	Caenis latipennis	90	8	CG	"SP/75%, CM/90%"
Haplotaxida	Oligochaeta	Tubificidae	1	8	CG	BU
Hemiptera	Corixidae	Corixidae	8	9	PH/PR	SW
Odonata	Coenagrionidae	Coenagrion	2	7	PR	CM
Odonata	Coenagrionidae	Enallagma	18	7	PR	CM
Odonata	Coenagrionidae	Ischnura	4	7	PR	CM
Odonata	Libellulidae	Sympetrum	1	9	PR	SP
Trichoptera	Cheumatopsyche	Cheumatopsyche	5	5	CF	CN
Trichoptera	Hydroptila	Hydroptila	2	6	PH	CN
Trichoptera	Limnephilus	Limnephilus	1	3	SH	CM/SP
Trombidiform	Acarina	Hydrodroma	1	5	PR	"SW/10%, CN/90%"
Trombidiform	Acarina	Limnochares	2	5	PR	"SW/10%, CN/90%"

Montana Bioassessment Report

Waterbody Name: Otter Creek Site 16 for the Coal Tracts Study **Benthic Sample ID:** 17997
Station ID: OTTER_16tf **Rep. Num** 0
Reference Status: **STORET Activity ID:** OT16tfM-MAC-R
Site Classification: **Collection Date:** 10/15/2012
Latitude: **Collection Method:** MAC-R-500
Longitude: **Total Number of Individuals in Sample:** 554

Sample Taxa List

<i>Order:</i>	<i>OTU name:</i>	<i>FinalID:</i>	<i>Individuals</i>	<i>Tol Val:</i>	<i>FFG:</i>	<i>Habit:</i>
		Gyraulus circumstriatus	20			
Amphipoda	Hyalella	Hyalella azteca	24	8	CG	SW/SP
Basommatop	Lymnaeidae	Pseudosuccinea columella	2	6	CG	CN
Basommatop	Lymnaeidae	Stagnicola caperata	20	6	CG	CN
Basommatop	Physa_Physella	Physella acuta	58	8	CG	CN
Basommatop	Planorbidae	Gyraulus parvus	6	6	CG	CN
Coleoptera	Dubiraphia	Dubiraphia vittata	60	6	SC/CG	"CN/50%, BU/50%"
Diptera	Ceratopogoninae	Culicoides	4	6	PR/CG	SP/BU/SW
Diptera	Ceratopogoninae	Probezzia	4	6	PR/CG	SP/BU/SW
Diptera	Chironominae	Chironomus	40	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Dicrotendipes	20	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Polypedilum	14	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Pseudochironomus	10	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Tanytarsus	20	7	CG/CF/PR	BU/CN/SP
Diptera	Dasyheleinae	Dasyhelea	4		CG	BU/SW
Diptera	Orthoclaadiinae	Cricotopus	20		CG/SC	SP/BU
Diptera	Orthoclaadiinae	Psectrocladius	10		CG/SC	SP/BU
Diptera	Simuliidae	Simulium	4	6	CF	CN
Diptera	Tanypodinae	Ablabesmyia	2		PR	SP/BU
Diptera	Tanypodinae	Procladius	28		PR	SP/BU
Ephemeropte	Caenis	Caenis latipennis	60	8	CG	"SP/75%, CM/90%"
Ephemeropte	Callibaetis	Callibaetis	2	9	CG	"SW/10%, CN/90%"
Haplotaxida	Oligochaeta	Tubificidae	6	8	CG	BU
Hemiptera	Corixidae	Corixidae	10	9	PH/PR	SW
Odonata	Coenagrionidae	Enallagma	14	7	PR	CM
Odonata	Coenagrionidae	Ischnura	10	7	PR	CM
Odonata	Lestes	Lestes dryas	4	9	PR	SW
Odonata	Libellulidae	Libellula forensis	6	9	PR	SP
Odonata	Libellulidae	Sympetrum	2	9	PR	SP
Trichoptera	Cheumatopsyche	Cheumatopsyche	60	5	CF	CN
Trichoptera	Chimarra	Chimarra	4	4	CF	CN
Trichoptera	Limnephilus	Limnephilus	4	3	SH	CM/SP
Trombidiform	Acarina	Hydrodroma	2	5	PR	"SW/10%, CN/90%"

Montana Bioassessment Report

Waterbody Name: Otter Creek Site 16 for the Coal Tracts Study **Benthic Sample ID:** 17998
Station ID: OTTER_16ts **Rep. Num** 0
Reference Status: **STORET Activity ID:** OT16tsM-MAC-R
Site Classification: **Collection Date:** 07/30/2012
Latitude: **Collection Method:** MAC-R-500
Longitude: **Total Number of Individuals in Sample:** 594

Sample Taxa List

<i>Order:</i>	<i>OTU name:</i>	<i>FinalID:</i>	<i>Individuals</i>	<i>Tol Val:</i>	<i>FFG:</i>	<i>Habit:</i>
		Enallagma anna	7			
		Gyraulus circumstriatus	50			
		Ischnura cervula	10			
		Ischnura perparva	2			
		Ischnura verticalis	2			
		Odonantra	2			
		Sympetrum internum	2			
		Sympetrum obtrusum	5			
Amphipoda	Hyalella	Hyalella azteca	12	8	CG	SW/SP
Basommatop	Lymnaeidae	Pseudosuccinea columella	2	6	CG	CN
Basommatop	Lymnaeidae	Stagnicola caperata	10	6	CG	CN
Basommatop	Physa_Physella	Physella acuta	120	8	CG	CN
Basommatop	Planorbidae	Gyraulus parvus	15	6	CG	CN
Diptera	Ceratopogoninae	Culicoides	2	6	PR/CG	SP/BU/SW
Diptera	Chironominae	Chironomus	5	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Cladotanytarsus	2	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Dicrotendipes	10	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Pseudochironomus	3	7	CG/CF/PR	BU/CN/SP
Diptera	Dasyheleinae	Dasyhelea	1		CG	BU/SW
Diptera	Orthoclaadiinae	Psectrocladius	5		CG/SC	SP/BU
Diptera	Simuliidae	Simulium	2	6	CF	CN
Diptera	Tanypodinae	Ablabesmyia	2		PR	SP/BU
Diptera	Tanypodinae	Procladius	2		PR	SP/BU
Ephemeropte	Caenis	Caenis amica	2	8	CG	"SP/75%, CM/90%"
Ephemeropte	Caenis	Caenis latipennis	98	8	CG	"SP/75%, CM/90%"
Ephemeropte	Callibaetis	Callibaetis	1	9	CG	"SW/10%, CN/90%"
Haplotaxida	Oligochaeta	Tubificidae	2	8	CG	BU
Hemiptera	Corixidae	Corixidae	5	9	PH/PR	SW
Odonata	Aeshna	Aeshna palmata	2		PR	CM
Odonata	Coenagrionidae	Enallagma	120	7	PR	CM
Odonata	Coenagrionidae	Enallagma annexum	30	7	PR	CM
Odonata	Coenagrionidae	Enallagma antennatum	2	7	PR	CM
Odonata	Coenagrionidae	Ischnura	5	7	PR	CM
Odonata	Lestes	Lestes dryas	2	9	PR	SW
Odonata	Libellulidae	Libellula pulchella	2	9	PR	SP

Montana Bioassessment Report

Waterbody Name: Otter Creek Site 16 for the Coal Tracts Study

Benthic Sample ID: 17998

Station ID: OTTER_16ts

Rep. Num 0

Reference Status:

STORET Activity ID: OT16tsM-MAC-R

Site Classification:

Collection Date: 07/30/2012

Latitude:

Collection Method: MAC-R-500

Longitude:

Total Number of Individuals in Sample: 594

Odonata	Libellulidae	Sympetrum	1	9	PR	SP
Trichoptera	Cheumatopsyche	Cheumatopsyche	1	5	CF	CN
Trichoptera	Limnephilus	Limnephilus	1	3	SH	CM/SP
Trombidiform	Acarina	Hydrodroma	2	5	PR	"SW/10%, CN/90%"
Trombidiform	Acarina	Limnochares	45	5	PR	"SW/10%, CN/90%"

Montana Bioassessment Report

Waterbody Name: Home Creek Site 1A for the Coal Tracts Study **Benthic Sample ID:** 17999
Station ID: OTTER_1At **Rep. Num** 0
Reference Status: **STORET Activity ID:** OTT1AtM-MAC-R
Site Classification: **Collection Date:** 05/20/2012
Latitude: **Collection Method:** MAC-R-500
Longitude: **Total Number of Individuals in Sample:** 558

Sample Taxa List

<i>Order:</i>	<i>OTU name:</i>	<i>FinalID:</i>	<i>Individuals</i>	<i>Tol Val:</i>	<i>FFG:</i>	<i>Habit:</i>
Amphipoda	Hyaella	Hyaella azteca	10	8	CG	SW/SP
Basommatop	Lymnaeidae	Stagnicola caperata	8	6	CG	CN
Basommatop	Lymnaeidae	Stagnicola elodes	3	6	CG	CN
Basommatop	Physa_Physella	Physella acuta	24	8	CG	CN
Coleoptera	Agabus	Agabus	4	5	PR	"CM(la), DI,SW(ad)"
Coleoptera	Haliphus	Haliphus	1	8	PH	:N,CM (la), SW,CM (ad
Coleoptera	Tropisternus	Tropisternis lateralis	1		PR	N,SP,CM(la), DI,SW(ac
Diptera	Ceratopogoninae	Bezzia	2	6	PR/CG	SP/BU/SW
Diptera	Ceratopogoninae	Culicoides	1	6	PR/CG	SP/BU/SW
Diptera	Ceratopogoninae	Probezzia	2	6	PR/CG	SP/BU/SW
Diptera	Chironominae	Chironomus	225	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Glyptotendipes	25	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Tanytarsus	105	7	CG/CF/PR	BU/CN/SP
Diptera	Ephydriidae	Ephydra	2	6	CG	BU
Diptera	Orthoclaadiinae	Acricotopus	10		CG/SC	SP/BU
Diptera	Orthoclaadiinae	Psectrocladius	110		CG/SC	SP/BU
Diptera	Tanypodinae	Procladius	4		PR	SP/BU
Diptera	Tanypodinae	Tanypus	3		PR	SP/BU
Haplotaxida	Oligochaeta	Tubificidae	1	8	CG	BU
Non-Insect ta	Ostracoda	Ostracoda	5		unk	SW
Odonata	Aeshna	Aeshna palmata	4		PR	CM
Odonata	Coenagrionidae	Enallagma	2	7	PR	CM
Odonata	Lestes	Lestes dryas	5	9	PR	SW
Trichoptera	Limnephilus	Limnephilus	1	3	SH	CM/SP

Montana Bioassessment Report

Waterbody Name: Home Creek Site 1A for the Coal Tracts Study **Benthic Sample ID:** 18000

Station ID: OTTER_1Atf

Rep. Num 0

Reference Status:

STORET Activity ID: OT1AtfM-MAC-R

Site Classification:

Collection Date: 10/15/2012

Latitude:

Collection Method: MAC-R-500

Longitude:

Total Number of Individuals in Sample: 517

Sample Taxa List

<i>Order:</i>	<i>OTU name:</i>	<i>FinalID:</i>	<i>Individuals</i>	<i>Tol Val:</i>	<i>FFG:</i>	<i>Habit:</i>
		Callibaetis fluctuans	1			
		Tropisternis	6			
Amphipoda	Hyalella	Hyalella azteca	150	8	CG	SW/SP
Basommatop	Lymnaeidae	Stagnicola caperata	8	6	CG	CN
Basommatop	Physa_Physella	Physella acuta	41	8	CG	CN
Coleoptera	Berosus	Berosus	1	5	PH	"CM(la), DI,SW(ad)"
Coleoptera	Coptotomus	Coptotomus longulus	1	5	PR	"CM (la), DI, SW (ad)"
Coleoptera	Haliphus	Haliphus	4	8	PH	:N,CM (la), SW,CM (ad
Diptera	Ceratopogoninae	Bezzia	1	6	PR/CG	SP/BU/SW
Diptera	Ceratopogoninae	Culicoides	4	6	PR/CG	SP/BU/SW
Diptera	Ceratopogoninae	Probezzia	1	6	PR/CG	SP/BU/SW
Diptera	Chironominae	Chironomus	31	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Glyptotendipes	13	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Tanytarsus	75	7	CG/CF/PR	BU/CN/SP
Diptera	Dasyheleinae	Dasyhelea	14		CG	BU/SW
Diptera	Ephydriidae	Ephydra	2	6	CG	BU
Diptera	Orthoclaadiinae	Corynoneura	17		CG/SC	SP/BU
Diptera	Orthoclaadiinae	Psectrocladius	102		CG/SC	SP/BU
Diptera	Orthoclaadiinae	Thienemanniella	2		CG/SC	SP/BU
Diptera	Pericoma/Telmatos	Pericoma	1	4	CG	BU
Diptera	Tanypodinae	Procladius	4		PR	SP/BU
Haplotaxida	Oligochaeta	Tubificidae	1	8	CG	BU
Hemiptera	Corixidae	Corixidae	6	9	PH/PR	SW
Odonata	Aeshna	Aeshna palmata	2		PR	CM
Odonata	Coenagrionidae	Enallagma	26	7	PR	CM
Odonata	Coenagrionidae	Ischnura	3	7	PR	CM

Montana Bioassessment Report

Waterbody Name: Home Creek Site 1A for the Coal Tracts Study **Benthic Sample ID:** 18001

Station ID: OTTER_1Ats

Rep. Num 0

Reference Status:

STORET Activity ID: OT1AtsM-MAC-R

Site Classification:

Collection Date: 07/30/2012

Latitude:

Collection Method: MAC-R-500

Longitude:

Total Number of Individuals in Sample: 520

Sample Taxa List

<i>Order:</i>	<i>OTU name:</i>	<i>FinalID:</i>	<i>Individuals</i>	<i>Tol Val:</i>	<i>FFG:</i>	<i>Habit:</i>
		Anacea	1			
		Desmopachria convexa	2			
		Tropisternis	6			
Amphipoda	Hyaella	Hyaella azteca	61	8	CG	SW/SP
Basommatop	Lymnaeidae	Fossaria humilis	5	6	CG	CN
Basommatop	Lymnaeidae	Pseudosuccinea columella	1	6	CG	CN
Basommatop	Lymnaeidae	Stagnicola caperata	15	6	CG	CN
Basommatop	Physa_Physella	Physella acuta	232	8	CG	CN
Basommatop	Planorbidae	Menetus opercularis	3	6	CG	CN
Coleoptera	Berosus	Berosus	2	5	PH	"CM(la), DI,SW(ad)"
Coleoptera	Coptotomus	Coptotomus longulus	1	5	PR	"CM (la), DI, SW (ad)"
Coleoptera	Enochrus	Enochrus	4	5	CG	unk
Coleoptera	Haliphus	Haliphus	12	8	PH	N,CM (la), SW,CM (ad)
Diptera	Chironominae	Chironomus	80	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Glyptotendipes	12	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Tanytarsus	21	7	CG/CF/PR	BU/CN/SP
Diptera	Ephydriidae	Ephydra	5	6	CG	BU
Diptera	Orthoclaadiinae	Psectrocladius	3		CG/SC	SP/BU
Diptera	Tabanidae	Tabanus	1	10	PR	SP
Diptera	Tanypodinae	Procladius	22		PR	SP/BU
Diptera	Tanypodinae	Tanypus	5		PR	SP/BU
Haplotaxida	Oligochaeta	Tubificidae	1	8	CG	BU
Hemiptera	Corixidae	Corisella	1	9	PH/PR	SW
Hemiptera	Corixidae	Corixidae	6	9	PH/PR	SW
Hemiptera	Notonectidae	Notonecta	2	7	PR	SW
Neotaenioglo	Hydrobiidae	Amnicola limosa	2		SC	CN
Odonata	Aeshna	Aeshna eremita	2		PR	CM
Odonata	Aeshna	Aeshna palmata	5		PR	CM
Odonata	Amphiagrion	Amphiagrion abbreviatum	2	7	PR	CM
Odonata	Coenagrionidae	Enallagma	4	7	PR	CM
Odonata	Coenagrionidae	Ischnura	1	7	PR	CM

Montana Bioassessment Report

Waterbody Name: Otter Creek Site 22 for the Coal Tracts Study **Benthic Sample ID:** 18002
Station ID: OTTER_22t **Rep. Num** 0
Reference Status: **STORET Activity ID:** OTT22tM-MAC-R
Site Classification: **Collection Date:** 05/19/2012
Latitude: **Collection Method:** MAC-R-500
Longitude: **Total Number of Individuals in Sample:** 581

Sample Taxa List

<i>Order:</i>	<i>OTU name:</i>	<i>FinalID:</i>	<i>Individuals</i>	<i>Tol Val:</i>	<i>FFG:</i>	<i>Habit:</i>
		Gyraulus circumstriatus	35			
		Helisoma trivolvis	3			
Amphipoda	Hyalella	Hyalella azteca	101	8	CG	SW/SP
Basommatop	Lymnaeidae	Pseudosuccinea columella	3	6	CG	CN
Basommatop	Physa_Physella	Physella acuta	150	8	CG	CN
Basommatop	Planorbidae	Gyraulus parvus	65	6	CG	CN
BASOMMAT	Planorbidae	HELISOMA ANCEPS	4	6	CG	CN
Coleoptera	Berosus	Berosus	1	5	PH	"CM(la), DI,SW(ad)"
COLEOPT	DINEUTUS	DINEUTUS	1	4	PR	
Coleoptera	Haliphus	Haliphus	10	8	PH	:N,CM (la), SW,CM (ad)
Coleoptera	Hydroporus	Hydroporus	1		PR	"CM (la), DI, SW (ad)"
Diptera	Ceratopogoninae	Bezzia	13	6	PR/CG	SP/BU/SW
Diptera	Ceratopogoninae	Culicoides	4	6	PR/CG	SP/BU/SW
Diptera	Chironominae	Chironomus	5	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Dicrotendipes	2	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Glyptotendipes	4	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Microtendipes pedellus Gr.	19	7	CG/CF/PR	BU/CN/SP
Diptera	Dasyheleinae	Dasyhelea	2		CG	BU/SW
Diptera	Orthoclaadiinae	Cricotopus	3		CG/SC	SP/BU
Diptera	Orthoclaadiinae	Psectrocladius	6		CG/SC	SP/BU
Diptera	Simuliidae	Simulium	11	6	CF	CN
Diptera	Tanypodinae	Procladius	26		PR	SP/BU
Diptera	Tanypodinae	Thienemannimyia Gr.	4		PR	SP/BU
Ephemeropte	Caenis	Caenis latipennis	74	8	CG	"SP/75%, CM/90%"
Haplotaxida	Oligochaeta	Tubificidae	2	8	CG	BU
Hemiptera	Corixidae	Corixidae	9	9	PH/PR	SW
Odonata	Coenagrionidae	Enallagma	15	7	PR	CM
Odonata	Libellulidae	Libellula pulchella	2	9	PR	SP
Odonata	Libellulidae	Sympetrum	1	9	PR	SP
Trichoptera	Hydroptila	Hydroptila	3	6	PH	CN
Trichoptera	Limnephilus	Limnephilus	2	3	SH	CM/SP

Montana Bioassessment Report

Waterbody Name: Otter Creek Site 22 for the Coal Tracts Study **Benthic Sample ID:** 18003
Station ID: OTTER_22tf **Rep. Num** 0
Reference Status: **STORET Activity ID:** OT22tfM-MAC-R
Site Classification: **Collection Date:** 10/16/2012
Latitude: **Collection Method:** MAC-R-500
Longitude: **Total Number of Individuals in Sample:** 535

Sample Taxa List

<i>Order:</i>	<i>OTU name:</i>	<i>FinalID:</i>	<i>Individuals</i>	<i>Tol Val:</i>	<i>FFG:</i>	<i>Habit:</i>
		Belstoma americana	1			
		Callibaetis fluctuans	4			
		Gyraulius circumstriatus	15			
		Helisoma trivolvis	2			
Amphipoda	Hyalella	Hyalella azteca	175	8	CG	SW/SP
Basommatop	Physa_Physella	Physella acuta	105	8	CG	CN
Basommatop	Planorbidae	Gyraulius parvus	40	6	CG	CN
Coleoptera	Berosus	Berosus	5	5	PH	"CM(la), DI,SW(ad)"
Coleoptera	Coptotomus	Coptotomus longulus	1	5	PR	"CM (la), DI, SW (ad)"
Coleoptera	Dubiraphia	Dubiraphia vittata	6	6	SC/CG	"CN/50%, BU/50%"
Coleoptera	Haliphus	Haliphus	2	8	PH	:N,CM (la), SW,CM (ad
Coleoptera	Peltodytes	Peltodytes	1	8	PH	:N,CM (la), SW,CM (ad
Diptera	Ceratopogoninae	Bezzia	1	6	PR/CG	SP/BU/SW
Diptera	Ceratopogoninae	Probezzia	2	6	PR/CG	SP/BU/SW
Diptera	Chironominae	Chironomus	3	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Cryptochironomus	1	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Dicrotendipes	10	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Paratanytarsus	4	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Polypedilum	5	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Pseudochironomus	2	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Tanytarsus	12	7	CG/CF/PR	BU/CN/SP
Diptera	Dasyheleinae	Dasyhelea	1		CG	BU/SW
Diptera	Dolichopodidae	Dolichopodidae	1	4	PR	SP
Diptera	Hemerodromia	Hemerodromia	1	6	PR	SP
Diptera	Orthoclaadiinae	Psectrocladius	5		CG/SC	SP/BU
Diptera	Simuliidae	Simulium	10	6	CF	CN
Diptera	Tabanidae	Chrysops	2	10	PR	SP
Diptera	Tabanidae	Tabanus	2	10	PR	SP
Diptera	Tanypodinae	Procladius	19		PR	SP/BU
Diptera	Tanypodinae	Radotanypus	2		PR	SP/BU
Ephemeropte	Caenis	Caenis latipennis	44	8	CG	"SP/75%, CM/90%"
Ephemeropte	Caenis	Caenis youngi	1	8	CG	"SP/75%, CM/90%"
Haplotaxida	Oligochaeta	Tubificidae	2	8	CG	BU
Hemiptera	Corixidae	Corixidae	22	9	PH/PR	SW
Non-Insect ta	Ostracoda	Ostracoda	7		unk	SW

Montana Bioassessment Report

Waterbody Name: Otter Creek Site 22 for the Coal Tracts Study

Benthic Sample ID: 18003

Station ID: OTTER_22tf

Rep. Num 0

Reference Status:

STORET Activity ID: OT22tfM-MAC-R

Site Classification:

Collection Date: 10/16/2012

Latitude:

Collection Method: MAC-R-500

Longitude:

Total Number of Individuals in Sample: 535

Odonata	Aeshna	Aeshna palmata	1		PR	CM
Odonata	Coenagrionidae	Enallagma	9	7	PR	CM
Odonata	Coenagrionidae	Ischnura	2	7	PR	CM
Odonata	Libellulidae	Libellula forensis	2	9	PR	SP
Odonata	Libellulidae	Libellula pulchella	3	9	PR	SP
Odonata	Libellulidae	Sympetrum	1	9	PR	SP
Trichoptera	Limnephilus	Limnephilus	1	3	SH	CM/SP

Montana Bioassessment Report

Waterbody Name: Otter Creek Site 22 for the Coal Tracts Study **Benthic Sample ID:** 18004
Station ID: OTTER_22ts **Rep. Num** 0
Reference Status: **STORET Activity ID:** OT22tsM-MAC-R
Site Classification: **Collection Date:** 07/30/2012
Latitude: **Collection Method:** MAC-R-500
Longitude: **Total Number of Individuals in Sample:** 521

Sample Taxa List

<i>Order:</i>	<i>OTU name:</i>	<i>FinalID:</i>	<i>Individuals</i>	<i>Tol Val:</i>	<i>FFG:</i>	<i>Habit:</i>
		Belstoma americana	1			
		Callibaetis fluctuans	4			
		Helisoma trivolvis	2			
		Leucorrhinia intacta	3			
Amphipoda	Hyalella	Hyalella azteca	246	8	CG	SW/SP
Basommatop	Planorbidae	Gyraulus parvus	35	6	CG	CN
Coleoptera	Berosus	Berosus	1	5	PH	"CM(la), DI,SW(ad)"
Coleoptera	Coptotomus	Coptotomus longulus	6	5	PR	"CM (la), DI, SW (ad)"
Coleoptera	Haliplus	Haliplus	10	8	PH	"N,CM (la), SW,CM (ad)"
Diptera	Orthoclaadiinae	Psectrocladius	25		CG/SC	SP/BU
Diptera	Tanypodinae	Procladius	9		PR	SP/BU
Ephemeropte	Caenis	Caenis latipennis	26	8	CG	"SP/75%, CM/90%"
Ephemeropte	Caenis	Caenis youngi	4	8	CG	"SP/75%, CM/90%"
Hemiptera	Corixidae	Corixidae	3	9	PH/PR	SW
Hemiptera	Notonectidae	Notonecta	2	7	PR	SW
Odonata	Aeshna	Aeshna palmata	12		PR	CM
Odonata	Amphiagrion	Amphiagrion abbreviatum	1	7	PR	CM
Odonata	Anax	Anax junius	3	5	PR	CM
Odonata	Coenagrionidae	Enallagma	60	7	PR	CM
Odonata	Coenagrionidae	Enallagma annexum	40	7	PR	CM
Odonata	Lestes	Lestes disjunctus	20	9	PR	SW
Odonata	Libellulidae	Libellula pulchella	7	9	PR	SP
Odonata	Libellulidae	Sympetrum	1	9	PR	SP

Montana Bioassessment Report

Waterbody Name: Otter Creek Site ASJT for the Coal Tracts Study **Benthic Sample ID:** 18005

Station ID: OTTER_JTt

Rep. Num 0

Reference Status:

STORET Activity ID: OTTJTtM-MAC-R

Site Classification:

Collection Date: 05/19/2012

Latitude:

Collection Method: MAC-R-500

Longitude:

Total Number of Individuals in Sample: 481

Sample Taxa List

<i>Order:</i>	<i>OTU name:</i>	<i>FinalID:</i>	<i>Individuals</i>	<i>Tol Val:</i>	<i>FFG:</i>	<i>Habit:</i>
		Gyraulus circumstriatus	1			
		Helisoma trivolvis	1			
		Leucorrhinia intacta	1			
Amphipoda	Hyalella	Hyalella azteca	44	8	CG	SW/SP
Basommatop	Lymnaeidae	Fossaria humilis	1	6	CG	CN
Basommatop	Physa_Physella	Physella acuta	72	8	CG	CN
Basommatop	Planorbidae	Gyraulus parvus	1	6	CG	CN
BASOMMAT	Planorbidae	HELISOMA ANCEPS	1	6	CG	CN
Coleoptera	Dubiraphia	Dubiraphia vittata	76	6	SC/CG	"CN/50%, BU/50%"
Coleoptera	Hydroporus	Hydroporus	4		PR	"CM (la), DI, SW (ad)"
Diptera	Ceratopogoninae	Bezzia	6	6	PR/CG	SP/BU/SW
Diptera	Ceratopogoninae	Probezzia	2	6	PR/CG	SP/BU/SW
Diptera	Chironominae	Chironomus	20	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Cryptochironomus	4	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Dicrotendipes	5	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Glyptotendipes	7	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Microtendipes pedellus Gr.	9	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Rheotanytarsus	5	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Tanytarsus	15	7	CG/CF/PR	BU/CN/SP
Diptera	Orthoclaadiinae	Cricotopus	12		CG/SC	SP/BU
Diptera	Orthoclaadiinae	Cricotopus bicinctus	9		CG/SC	SP/BU
Diptera	Orthoclaadiinae	Psectrocladius	45		CG/SC	SP/BU
Diptera	Simuliidae	Simulium	57	6	CF	CN
Diptera	Tanypodinae	Procladius	54		PR	SP/BU
Diptera	Tanypodinae	Tanypus	2		PR	SP/BU
Haplotaxida	Oligochaeta	Tubificidae	3	8	CG	BU
Hemiptera	Corixidae	Trichocorixa	17	9	PH/PR	SW
Trichoptera	Cheumatopsyche	Cheumatopsyche	7	5	CF	CN

Montana Bioassessment Report

Waterbody Name: Otter Creek Site ASJT for the Coal Tracts Study **Benthic Sample ID:** 18006

Station ID: OTTER_JTtf

Rep. Num 0

Reference Status:

STORET Activity ID: OTJTtfM-MAC-R

Site Classification:

Collection Date: 10/15/2012

Latitude:

Collection Method: MAC-R-500

Longitude:

Total Number of Individuals in Sample: 592

Sample Taxa List

<i>Order:</i>	<i>OTU name:</i>	<i>FinalID:</i>	<i>Individuals</i>	<i>Tol Val:</i>	<i>FFG:</i>	<i>Habit:</i>
		callibaetus	4			
		Gyraulus circumstriatus	3			
		Pisidium castertanum	2			
Amphipoda	Hyaella	Hyaella azteca	10	8	CG	SW/SP
Basommatop	Physa_Physella	Physella acuta	12	8	CG	CN
Basommatop	Planorbidae	Gyraulus parvus	9	6	CG	CN
BASOMMAT	Planorbidae	HELISOMA ANCEPS	1	6	CG	CN
Coleoptera	Berosus	Berosus	1	5	PH	"CM(la), DI,SW(ad)"
COLEOPT	DINEUTUS	DINEUTUS	1	4	PR	
Coleoptera	Dubiraphia	Dubiraphia vittata	70	6	SC/CG	"CN/50%, BU/50%"
Coleoptera	Haliphus	Haliphus	2	8	PH	:N,CM (la), SW,CM (ad
Diptera	Ceratopogoninae	Bezzia	1	6	PR/CG	SP/BU/SW
Diptera	Ceratopogoninae	Culicoides	1	6	PR/CG	SP/BU/SW
Diptera	Ceratopogoninae	Probezzia	2	6	PR/CG	SP/BU/SW
Diptera	Chironominae	Chironomus	55	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Cryptochironomus	5	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Dicrotendipes	10	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Glyptotendipes	60	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Microtendipes pedellus Gr.	2	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Polypedilum	4	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Tanytarsus	20	7	CG/CF/PR	BU/CN/SP
Diptera	Dasyheleinae	Dasyhelea	1		CG	BU/SW
Diptera	Orthoclaadiinae	Cricotopus	45		CG/SC	SP/BU
Diptera	Orthoclaadiinae	Cricotopus bicinctus	10		CG/SC	SP/BU
Diptera	Orthoclaadiinae	Psectrocladius	35		CG/SC	SP/BU
Diptera	Simuliidae	Simulium	23	6	CF	CN
Diptera	Tanypodinae	Ablabesmyia	1		PR	SP/BU
Diptera	Tanypodinae	Procladius	25		PR	SP/BU
Diptera	Tanypodinae	Radotanypus	2		PR	SP/BU
Ephemeropte	Caenis	Caenis latipennis	40	8	CG	"SP/75%, CM/90%"
Haplotaxida	Oligochaeta	Tubificidae	8	8	CG	BU
Hemiptera	Corixidae	Corixidae	108	9	PH/PR	SW
Megaloptera	Sialidae	Sialis velata	9	4	unk	"CN,CM,BU"
Odonata	Coenagrionidae	Enallagma	4	7	PR	CM
Trichoptera	Hydroptila	Hydroptila	2	6	PH	CN

Montana Bioassessment Report

Waterbody Name: Otter Creek Site ASJT for the Coal Tracts Study **Benthic Sample ID:** 18006

Station ID: OTTER_JTtf

Rep. Num 0

Reference Status:

STORET Activity ID: OTJTtfM-MAC-R

Site Classification:

Collection Date: 10/15/2012

Latitude:

Collection Method: MAC-R-500

Longitude:

Total Number of Individuals in Sample: 592

Trichoptera	Limnephilus	Limnephilus	2	3	SH	CM/SP
Trichoptera	Polycentropus	Polycentropus	2	6	PR	CN

Montana Bioassessment Report

Waterbody Name: Otter Creek Site ASJT for the Coal Tracts Study **Benthic Sample ID:** 18007

Station ID: OTTER_JTts

Rep. Num 0

Reference Status:

STORET Activity ID: OTJTtsM-MAC-R

Site Classification:

Collection Date: 07/30/2012

Latitude:

Collection Method: MAC-R-500

Longitude:

Total Number of Individuals in Sample: 573

Sample Taxa List

<i>Order:</i>	<i>OTU name:</i>	<i>FinalID:</i>	<i>Individuals</i>	<i>Tol Val:</i>	<i>FFG:</i>	<i>Habit:</i>
		Arigomphus cornutus	1			
		callibaetus	4			
		Enallagma clausum	5			
		Gyraulus circumstriatus	3			
		Helisoma trivolvis	1			
		Sympetrum internum	2			
Amphipoda	Hyalella	Hyalella azteca	11	8	CG	SW/SP
Basommatop	Physa_Physella	Physella acuta	25	8	CG	CN
Basommatop	Planorbidae	Gyraulus parvus	9	6	CG	CN
BASOMMAT	Planorbidae	HELISOMA ANCEPS	1	6	CG	CN
Coleoptera	Berosus	Berosus	1	5	PH	"CM(la), DI,SW(ad)"
Coleoptera	Dubiraphia	Dubiraphia vittata	63	6	SC/CG	"CN/50%, BU/50%"
Coleoptera	Haliphus	Haliphus	2	8	PH	"CN,CM (la), SW,CM (ad)"
Coleoptera	Stenelmis	Stenelmis	4	5	SC/CG	"CN/50%, BU/50%"
Diptera	Ceratopogoninae	Bezzia	10	6	PR/CG	SP/BU/SW
Diptera	Ceratopogoninae	Culicoides	1	6	PR/CG	SP/BU/SW
Diptera	Ceratopogoninae	Probezzia	3	6	PR/CG	SP/BU/SW
Diptera	Chironominae	Chironomus	20	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Cryptochironomus	12	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Glyptotendipes	25	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Microtendipes pedellus Gr.	4	7	CG/CF/PR	BU/CN/SP
Diptera	Chironominae	Tanytarsus	10	7	CG/CF/PR	BU/CN/SP
Diptera	Orthoclaadiinae	Cricotopus	10		CG/SC	SP/BU
Diptera	Orthoclaadiinae	Cricotopus bicinctus	35		CG/SC	SP/BU
Diptera	Orthoclaadiinae	Psectrocladius	45		CG/SC	SP/BU
Diptera	Simuliidae	Simulium	5	6	CF	CN
Diptera	Tanypodinae	Ablabesmyia	4		PR	SP/BU
Diptera	Tanypodinae	Procladius	90		PR	SP/BU
Diptera	Tanypodinae	Tanypus	2		PR	SP/BU
Ephemeropte	Caenis	Caenis latipennis	18	8	CG	"SP/75%, CM/90%"
Haplotaxida	Oligochaeta	Tubificidae	5	8	CG	BU
Hemiptera	Corixidae	Corixidae	90	9	PH/PR	SW
Megaloptera	Sialidae	Sialis velata	9	4	unk	"CN,CM,BU"
Odonata	Calopterygidae	Hetaerina	4	6	PR	CM
Odonata	Coenagrionidae	Enallagma	7	7	PR	CM

Montana Bioassessment Report

Waterbody Name: Otter Creek Site ASJT for the Coal Tracts Study **Benthic Sample ID:** 18007

Station ID: OTTER_JTts

Rep. Num 0

Reference Status:

STORET Activity ID: OTJTtsM-MAC-R

Site Classification:

Collection Date: 07/30/2012

Latitude:

Collection Method: MAC-R-500

Longitude:

Total Number of Individuals in Sample: 573

Odonata	Coenagrionidae	Enallagma annexum	25	7	PR	CM
Odonata	Libellulidae	Libellula forensis	2	9	PR	SP
Odonata	Libellulidae	Libellula pulchella	4	9	PR	SP
Trichoptera	Hydroptila	Hydroptila	1	6	PH	CN

Appendix C . Stream Habitat and Water Quality Parameters measured for the Otter Creek sites visited in 2012. na = not visited or sampled during this visit, dry.

2012	OTTER_23			OTTER_22			OTTER_16			OTTER_3m			OTTER_2			OTTER_JT			OTTER_1A		
	May	Jul	Oct	May	Jul	Oct	May	Jul	Oct	May	Jul	Oct	May	Jul	Oct	May	Jul	Oct	May	Jul	Oct
Water Temp ©	11.8	na	na	14	22.5	8.2	17.8	29.5	10.1	na	na	na	17.9	30.4	9.3	13.1	25	10.7	11.8	27.8	10.8
TDS (ppm)	>2,000	>2,000	na	1820	1824	1266	1970	>2,000	1456	na	na	na	2000	>2,000	1410	1860	1668	1750	>2,000	>2,000	1844
Conductivity (µs/cm)	>4,000	>4,000	na	3646	3658	2528	3915	>4,000	2741	na	na	na	3950	>4,000	2730	3760	3339	3540	>4,000	>4,000	3325
pH	7.8	8.4	na	8.3	8.4	8.4	8.5	8.5	8.5	na	na	na	8.44	8.6	8.6	8.1	8.4	8.1	8.05	8.5	8.2
PFC	FAR	FAR	FAR	PFC	PFC	PFC	PFC	PFC	FAR	FAR	FAR	FAR	FAR	FAR	FAR	PFC	PFC	PFC	FARd	FARd	FARd
BLM HBI	16	17	17	22	22	22	20	19	18	16	18	18	17	17	17	19	19	19	11	12	13
Avg wetted width (m)	0.4	0.2	0.0	7.0	6.2	5.7	10.3	10.3	9.5	0.0	na	na	1.8	1.5	1.2	5.0	4.7	4.6	2.2	2.1	2.0
Avg Left CHD (cm)	10	2	0	51	67	35	88	80	78	0	na	na	25	30	22	53	28	23	22	25	26
Avg Center CHD (cm)	12	3	0	52	97	47	107	100	96	0	na	na	35	42	30	54	44	28	30	27	35
Avg Right CHD (cm)	10	2	0	46	66	32	87	75	76	0	na	na	20	25	20	55	41	27	18	15	15
% Fines in Reach	90	100	100	95	84	92	90	91	88	100	100	100	30	50	60	70	67	63	99	99	100
% Gravel Reach	5	0	0	2	8	4	6	5	7	0	0	0	40	35	30	20	26	34	1	1	0
% Cobble Reach	5	0	0	3	9	5	4	4	5	0	0	0	30	15	10	11	8	3	0	0	0
Livestock Use (CPI)	63	11	60	30	36	13	90	7	46	30	44	24	5	12	5	18	22	19	36	30	44
Avg. Riparian Shade	0	5	0	0	10	0	5	10	10	20	40	20	10	10	10	10	20	10	10	30	20