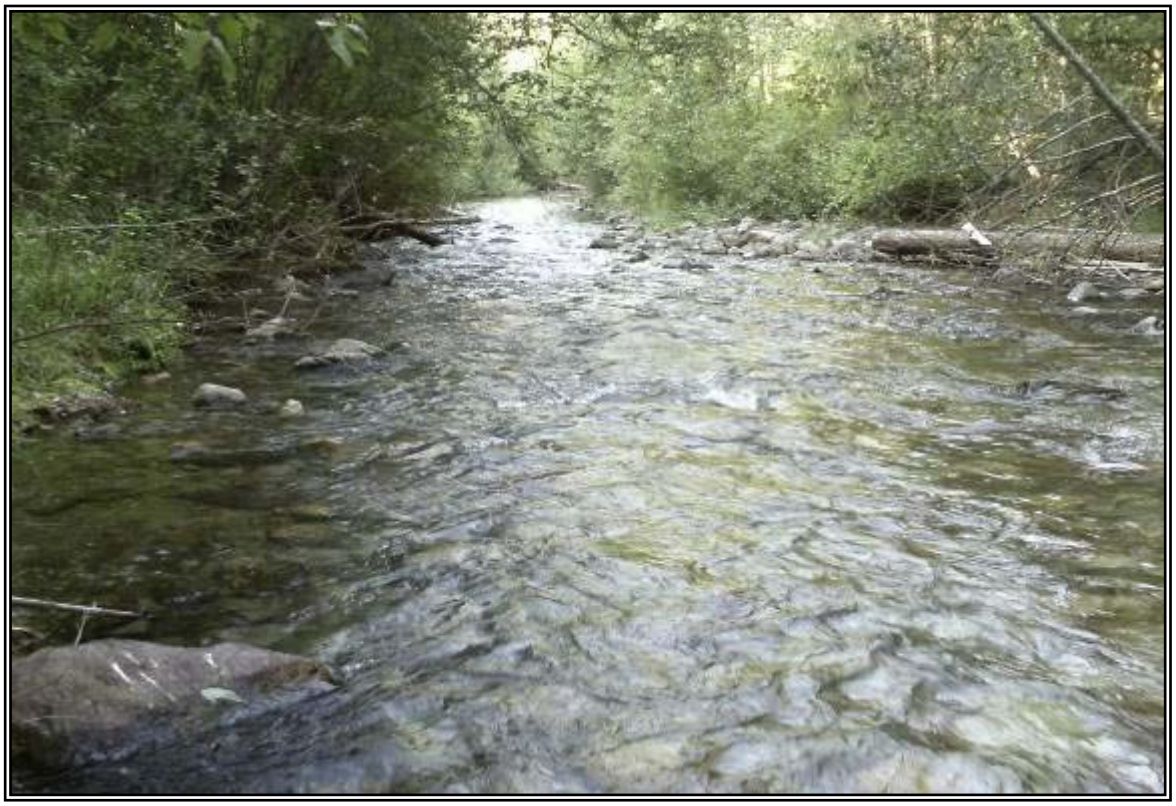
FISHER and KOOTENAI TPA BIOLOGICAL SAMPLING 2011:

MACROINVERTEBRATE AND PERIPHYTON RESULTS



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1.0 Study Objective and Area

This report summarizes results of 2011 biological sampling and analysis conducted in two stream reaches of the Fisher TMDL Planning Area (TPA) and nine reaches in the Kootenai TPA. Analysis of the resulting data serves to support the Montana Department of Environmental Quality (MTDEQ) Total Maximum Daily Load (TMDL) program by documenting the aquatic macroinvertebrate and periphyton taxa present in each project reach. The taxa present are used as supporting information for TMDL development.

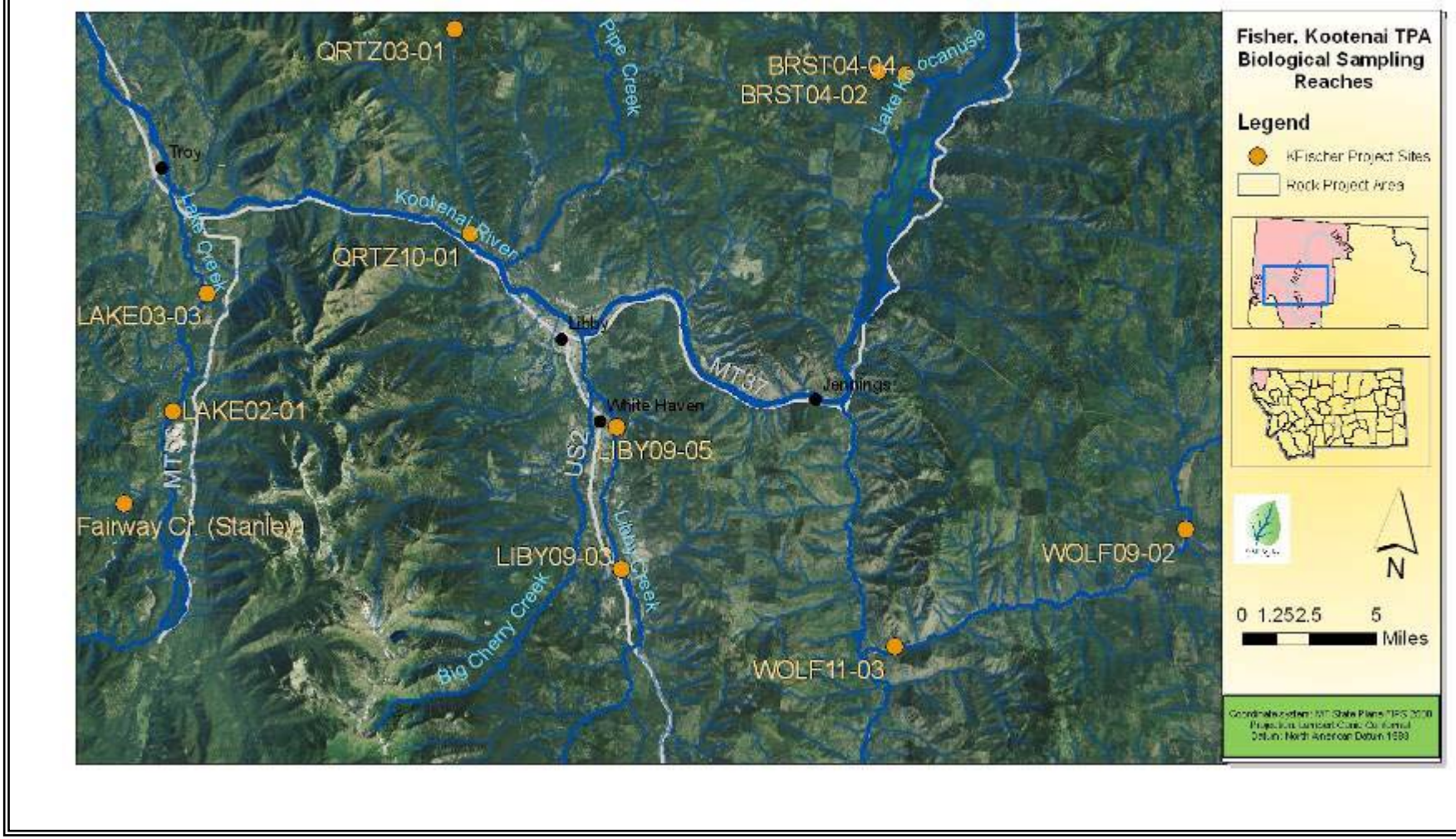
Following MTDEQ Standard Operating Procedures (SOP) for both periphyton and macroinvertebrates, a qualified team collected samples and other field data between September 5th and 9th, 2011. Field crew, consisting of the Project Manager and a field technician, followed the EMAP protocol for macroinvertebrate sampling and the Peri-1*mod* method for periphyton. Additional data collected included aquatic vegetation composition, amount, color and condition, water chemistry indicators such as dissolved oxygen (DO), pH, specific conductivity (SC), and air and water temperature, as well as digital photos upstream, downstream and across each reach. All samples were delivered to Rithron Associates of Missoula, a qualified taxonomy laboratory, for analysis. All samples were analyzed for the taxa present and reports provided to DEQ.

Project reaches are listed in **Table 1** and locations are shown in **Figure 1**.

Table 1. Fisher and Kootenai TPA Reaches

Reach ID	Stream Name	Date Sampled	F transect Latitude	F transect Longitude
Fisher TPA				
RAVN06-01	Raven Creek	9/05	48.0451	-115.2879
RAVN07-01	Raven Creek	9/05	48.0439	-115.2871
Kootenai TPA				
BRST04-02	Bristow Creek	9/08	48.5444	-115.3139
BRST04-04	Bristow Creek	9/08	48.5441	-115.2912
LAKE02-01	Lake Creek	9/07	48.3319	-115.8629
LAKE03-03	Lake Creek	9/07	48.3971	-115.8432
LIBY09-03	Libby Creek	9/06	48.2666	-115.4914
LIBY09-05	Libby Creek	9/06	48.3425	-115.5039
Fairway Creek	Fairway Creek	9/07	48.2806	-115.8961
WOLF09-02	Wolf Creek	9/06	48.3101	-115.0384
WOLF11-03	Wolf Creek	9/05	48.2359	-115.2660
QRTZ10-01	Quartz Creek	9/08	48.4403	-115.6337
QRTZ03-01	Quartz Creek	9/08	48.5498	-115.6595

Figure 1. Kootenai and Fisher TPAs Sampled Reaches



2.0 Methods

Sample sites for this study were selected by DEQ personnel as part of a larger TMDL planning effort for the Kootenai and Fisher TPAs. Simultaneous sediment/habitat TMDL assessments occurring in the Kootenai and Fisher TPAs provided site access information, including coordinates for the upstream and downstream ends of each reach to be sampled. Two sites on Stanley Creek were not sampled as they were dry. An additional site, Fairway Creek was sampled as it was adjacent to the downstream Stanley site. Changes in the sampling plan were confirmed by the DEQ project officer.

The Kootenai and Fisher project areas were visited between September 5th and 9th for sample collection. No inclement weather was observed during the sampling period. Both reaches of the same stream were visited the same day, beginning with the downstream site. Following protocol outlined in SOP's for macroinvertebrate (DEQ 2006)[1] and periphyton (DEQ, 2011)[2] sampling, our team identified a suitable F transect point within the given stream reach where water chemistry data were collected: pH, DO, SC and temperatures. F transects were chosen based on their representation of overall stream conditions. In cases where a reach showed different characteristics between their upstream and downstream portions, the F transect was chosen so that both stream characteristics would be included in the total sampled area. Reach lengths represented 40 times the average wetted width at the F transect.

Macroinvertebrate composite samples were collected using a 500 micron kick net across 11 transects (A-K) and preserved in 99% ethanol, provided by the taxonomy contractor. The 50mL periphyton samples were sub-sampled from a composite of 11 transects and preserved with formalin. Samples were delivered to the qualified taxonomy laboratory upon completion of the field visit. More details of the sample collection procedure followed can be found in the SOPs (DEQ 2006, 2011).

Laboratory results were provided first to DEQ personnel to be processed and entered into the appropriate data bases. For each reach DEQ personnel used the O/E model to calculate the ratio of the number of taxa observed (O) in the collected sample to the number expected (E) in that site type. O/E scores relate to stream impairment as shown in Table 2. The macroinvertebrate metric is a general impairment indicator which can be affected by both pollutants and non-pollutants.

Table 2. RIVPACS Impairment classes

O/E Score	Impairment Class
0.80 - 1.20	Unimpaired
0.44 - 0.79	Moderate
<0.44	Severe

[1] DEQ, 2006. Sample Collection, Sorting, and Taxonomic Identification of Benthic Macroinvertebrates: Standard Operation Procedure WQPBWQM-009. Water Quality Planning Bureau. Helena, MT

[2] DEQ, 2011. Periphyton: Standard Operating Procedure WQPBWQM-010. Water Quality Planning Bureau, Helena, MT.

Periphyton results were reported with an impairment probability percentage. Scores greater than 51% are considered impaired for sediment. These results, along with observations for each reach are provided below.

2.1 Fish Cover/Other

Using the Fish Cover/Other form provided by DEQ, field observations of aquatic vegetation were made between each transect. A total of 11 sub-reaches were documented, which included an inter-transect distance upstream of the upstream K transect. Data collected included a presence score for microalgae, filamentous algae, macrophytes and moss, as well as their color, condition, and thickness.

The habitat type (Riffle, Run/Glide, Pool) for periphyton sample locations were not documented in the field for this assessment. Using field notes and photographs the relative distribution of habitat types was estimated for all field sites and reflect our best estimate of periphyton habitat types sampled, expressed as a percent.

Presence scores for each of the periphyton types were averaged and then rounded to the nearest whole number score. These scores are represented in our findings by their percent (e.g. sites averaging a 1 for microalgae are presented as <10%). A similar averaging approach was used to determine an overall color, condition and length for each periphyton type. In cases where equal numbers were found for two different qualities (for example 5 green and 5 light green color microalgae), the 11th data point, field notes and photographs were used to make a final determination.

Microalgae: Color photographs provided in the periphyton SOP (DEQ 2011) were the primary guidance used to determine cover scores. The photographs clearly show that as scores approach 4 stream substrates increasingly become covered in mats of material, appearing to "clog". Scores of 0 or 1, by contrast, indicate "clean" substrate. Often in western Montana streams, substrate can appear "clean" but will be slippery, which would indicate the presence of microalgae. Slippery but "clean" substrate was generally scored as 1.

Moss: Generally moss in streams appears dark, and is often noted in the Fish Cover/Other form as DBB. This notation does not necessarily indicate a decadent vegetative state, but visual appearance. Most often dark-looking moss had bright green new growth.

3.0 Results

Results of this sampling project are presented by reach in the following subsections. DEQ personnel have run macroinvertebrate and periphyton results through their data entry protocol and have run biometric models, resulting in impairment probability scores (periphyton) and observed/expected ratios (macroinvertebrates) for each stream reach. Those results are presented here along with a summary of site visit information and a short discussion of each reach based on field notes. General water quality conditions and site visit information are provided in **Table 3**.

Table 3. Kootenai and Fisher TPAs Site Visit Summary Data

Reach ID	Sample Date	Reach Length (ft)	Water temp (°C)	pH	SC (us/cm)	DO (mg/L)
Fisher TPA						
RAVN06-01	9/05	180	9	8.10	118.7	16.0
RAVN07-01	9/05	150	8	8.18	197.3	16.3
Kootenai TPA						
BRST04-02	9/08	560	12	7.00	208.0	13.9
BRST04-04*	9/08	480	11	6.90	404.0	12.4
LAKE02-01	9/07	2400	12	7.60	65.0	15.9
LAKE03-03	9/07	2600	10	7.10	46.0	17.2
LIBY09-03	9/06	1120	16	7.90	134.4	14.0
LIBY09-05	9/06	1600	16	8.10	163.4	13.8
Fairway Creek	9/07	1200	8	7.70	65.5	17.5
WOLF09-02	9/06	500	13	7.40	173.9	14.5
WOLF11-03	9/05	1280	14	8.30	203.2	14.8
QRTZ03-01*	9/08	400	8	7.60	74.8	16.0
QRTZ10-01	9/08	1000	8	6.90	59.4	16.4
***Results apply to both original and replicate samples**						

3.1 FISHER TPA

3.1.1 RAVN06-01

This alder-dominated riparian had several weed species present. The reach showed signs of being in a state of natural recovery following surrounding land use impacts. Patches of reed canary grass were dense and tall in places. Dense thickets of alder break up weeds. Macrophytes were observed in more abundance where larger canopy openings were observed. The reach was found impaired for periphyton. An impairment summary is provided in **Table 4** and summary results of the Fish Cover/Other form are presented in **Table 5.**

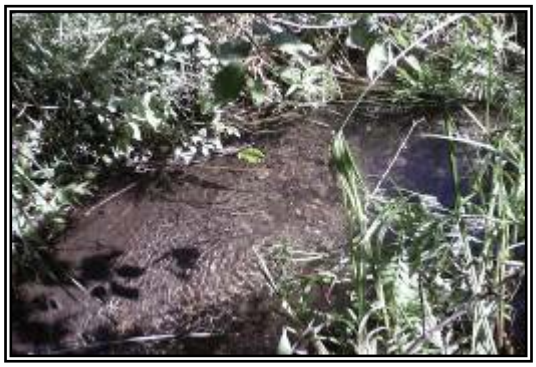
Table 4. RAVN06-01, Periphyton and Macroinvertebrate Impairment Class Summary

Reach ID	Periphyton		Macroinvertebrate	
	Impairment Probability	Impairment Class	O/E Score	Impairment Class
RAVN06-01	60.78%	Impaired	0.99	Unimpaired

Table 5. RAVN06-01, Periphyton Cover and Sample Habitat Summary

Characteristic	Periphyton Cover				Sample Habitat (%)		
	Microalgae	Filamentous Algae	Macrophytes	Moss	Riffle	Run/Glide	Pool
Presence	Absent	Absent	<10%	<10%	9%	82%	9%
Color	----	----	Green	Green			
Condition	----	----	Growing	Growing			
Thickness/ Length	----	----					

3.1.2 RAVN07-01



This reach showed a relatively healthy riparian surrounded by weeds. The stream had easy accesses to its floodplain, where vegetation varied between alder and hawthorne to aspen and canary reed grass. This reach was found impaired for periphyton. An impairment summary is provided in **Table 6** and summary results of the Fish Cover/Other form are presented in **Table 7.**

Table 6. RAVN07-01, Periphyton and Macroinvertebrate Impairment Class Summary

Reach ID	Periphyton		Macroinvertebrate	
	Impairment Probability	Impairment Class	O/E Score	Impairment Class
RAVN07-01	57.49%	Impaired	0.87	Unimpaired

Table 7. RAVN07-01, Periphyton Cover and Sample Habitat Summary

Characteristic	Periphyton Cover				Sample Habitat (%)		
	Microalgae	Filamentous Algae	Macrophytes	Moss	Riffle	Run/Glide	Pool
Presence	Absent	Absent	Absent	<10%	0%	100%	0%
Color	----	----	----	Green			
Condition	----	----	----	Growing			
Thickness/ Length	----	----					

3.2 Kootenai TPA

3.2.1 BRST04-02

Moss dominates the stream bottom in this cedar forest. The channel is slightly entrenched with pools and side channels common. Periphyton was found to be unimpaired in this reach, while results for macroinvertebrates were found to be beyond the scope of the O/E model. This means the reach is either a reference reach or nutrient impaired and would require field evaluation by DEQ personnel. An impairment summary is provided in **Table 8** and summary results of the Fish Cover/Other form are presented in **Table 9.**

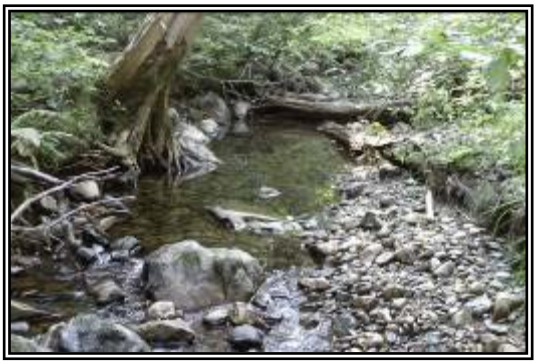
Table 8. BRST04-02, Periphyton and Macroinvertebrate Impairment Class Summary

Reach ID	Periphyton		Macroinvertebrate	
	Impairment Probability	Impairment Class	O/E Score	Impairment Class
BRST04-02	30.00%	Unimpaired	1.25	Outside scope of O/E

Table 9. BRST04-02, Periphyton Cover and Sample Habitat Summary

Characteristic	Periphyton Cover				Sample Habitat (%)		
	Microalgae	Filamentous Algae	Macrophytes	Moss	Riffle	Run/Glide	Pool
Presence	<10%	<10%	Absent	<10%	64%	0%	36%
Color	Green/ Light Brown	Green	------	Green			
Condition	Mature	Growing	------	Growing			
Thickness/ Length	Thin	Long					

3.2.2 BRST04-04



This stream lies in a Cedar-dominated alluvial fan system, which sub-surfaces and braids often. The narrow and shallow stream made macrophyte sampling tricky, as most areas deep enough for a net were in "pocket water" almost trapped among large cobbles. Replicate samples were taken here. Both periphyton sample results showed unimpaired and both macroinvertebrate samples scores outside the scope of the O/E model. Further evaluation will be needed to determine if these scores mean the stream is in reference condition or show excess nutrients. An impairment summary is provided in **Table 10** and summary results of the Fish Cover/Other form are presented in **Table 11.**

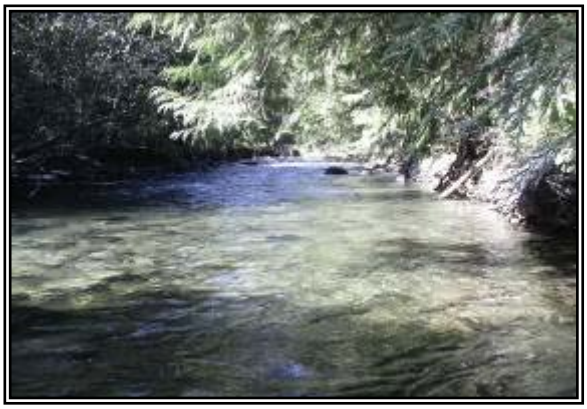
Table 10. BRST04-04, Periphyton and Macroinvertebrate Impairment Class Summary

Reach ID	Periphyton		Macroinvertebrate	
	Impairment Probability	Impairment Class	O/E Score	Impairment Class
BRST04-04	30.00%	Unimpaired	1.25	Outside scope of O/E
BRST 04-04 Rep	38.02%	Unimpaired	1.41	Outside scope of O/E

Table 11. BRST04-04, Periphyton Cover and Sample Habitat Summary

Characteristic	Periphyton Cover				Sample Habitat (%)		
	Microalgae	Filamentous Algae	Macrophytes	Moss	Riffle	Run/Glide	Pool
Presence	<10%	<10%	Absent	10 - 40%	64%	0%	36%
Color	Green/ Light Brown	Light Brown	------	Green			
Condition	Growing	Decaying	------	Growing			
Thickness/ Length	Thin	Long					

3. 1.3 LAKE 02-01



This stream reach is confined in a steep valley with cedar and alder riparian vegetation in a natural setting. Light brown filamentous algae was seen on many rocks. Microalgae was rare and some moss was seen on the sides of the channel. Periphyton readings showed unimpaired while macroinvertebrate scores were outside the scope of the model. Additional assessment by DEQ personnel will be needed to determine whether this means if the reach has a nutrient impairment or is a reference reach. An impairment summary is provided in **Table 12** and summary results of the Fish Cover/Other form are presented in **Table 13.**

Table 12. LAKE02-01, Periphyton and Macroinvertebrate Impairment Class Summary

Reach ID	Periphyton		Macroinvertebrate	
	Impairment Probability	Impairment Class	O/E Score	Impairment Class
LAKE02-01	20.00%	Unimpaired	1.37	Outside scope of O/E

Table 13. LAKE02-01, Periphyton Cover and Sample Habitat Summary

Characteristic	Periphyton Cover				Sample Habitat (%)		
	Microalgae	Filamentous Algae	Macrophytes	Moss	Riffle	Run/Glide	Pool
Presence	<10%	10-40%	<10%	10-40%	45%	55%	0%
Color	Green	Light Brown	Green	Green			
Condition	Growing	Mature	Growing	Growing			
Thickness/ Length	Thin	Short					

3. 1.4 LAKE03-03

Rocks on the stream bottom here are not slick and have minimal microalgae, concentrated mostly on the sides of streams in more slack water, and in side channels. The stream is entrenched on one side from the road. The stream appears over-widened and is heavily rip-rapped on outside bends. Periphyton concentrations varied dramatically depending on width and flow. A large island at F created small side channels coated in light brown filamentous algae. Results showed unimpaired for both periphyton and macroinvertebrates. An impairment summary is provided in **Table 14** and summary results of the Fish Cover/Other form are presented in **Table 15.**

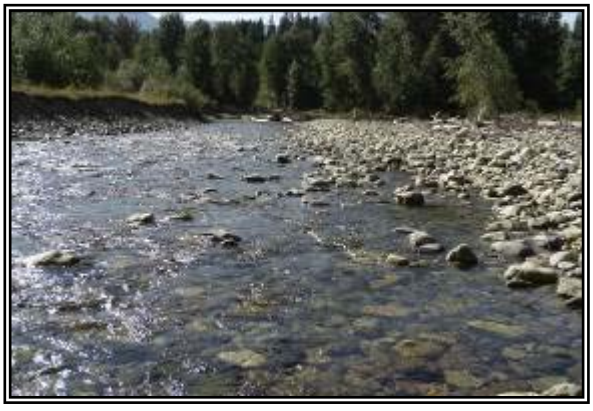
Table 14. LAKE03-03, Periphyton and Macroinvertebrate Impairment Class Summary

Reach ID	Periphyton		Macroinvertebrate	
	Impairment Probability	Impairment Class	O/E Score	Impairment Class
LAKE03-03	29.09%	Unimpaired	1.14	Unimpaired

Table 15. LAKE03-03, Periphyton Cover and Sample Habitat Summary

Characteristic	Periphyton Cover				Sample Habitat (%)		
	Microalgae	Filamentous Algae	Macrophytes	Moss	Riffle	Run/Glide	Pool
Presence	<10%	10-40%	<10%	Absent	45%	45%	9%
Color	Light Brown	Light Brown	Green	------			
Condition	Mature	Mature	Growing	------			
Thickness/ Length	Thin	Short					

3. 1.5 LIBY09-03



This reach is on a cobble streambed with very slick rocks. Many were green in appearance but no algae could be scraped from them. Algae was rated a 1 throughout according to explanations in the methods section. The stream is mostly shallow and riffle dominated. Macroinvertebrate impairment was determined to be moderate while periphyton appeared unimpaired. An impairment summary is provided in **Table 16** and summary results of the Fish Cover/Other form are presented in **Table 17.**

Table 16. LIBY09-03, Periphyton and Macroinvertebrate Impairment Class Summary

Reach ID	Periphyton		Macroinvertebrate	
	Impairment Probability	Impairment Class	O/E Score	Impairment Class
LIBY09-03	18.19%	Unimpaired	0.74	Moderate

Table 17. LIBY09-03, Periphyton Cover and Sample Habitat Summary

Characteristic	Periphyton Cover				Sample Habitat (%)		
	Microalgae	Filamentous Algae	Macrophytes	Moss	Riffle	Run/Glide	Pool
Presence	<10%	<10%	Absent	Absent	55%	36%	9%
Color	Green	Green	------	------			
Condition	Growing	Growing	------	------			
Thickness/ Length	Thin	Short					

3. *1.***6** *LIBY09-05*

This site is similar to the upstream site except the slickness of rocks is less here. No microalgae were seen but rocks remain slippery. Several side channels and braids were formed. There were minimal signs of microalgae or filamentous algae. In several reaches filamentous algae were only seen is side channels and slack water. An impairment summary is provided in **Table 18** and summary results of the Fish Cover/Other form are presented in **Table 19.**

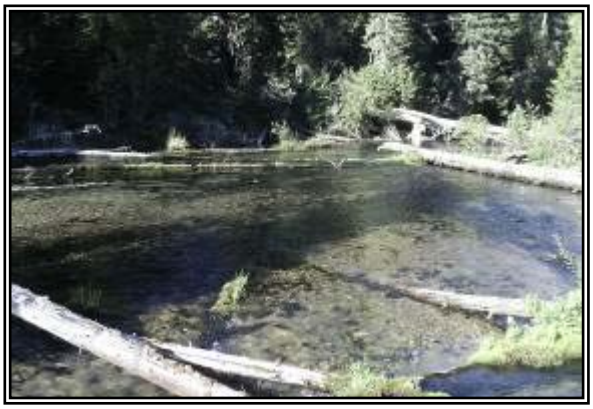
Table 18. LIBY09-05, Periphyton and Macroinvertebrate Impairment Class Summary

Reach ID	Periphyton		Macroinvertebrate	
	Impairment Probability	Impairment Class	O/E Score	Impairment Class
LIBY09-05	17.44%	Unimpaired	0.76	Moderate

Table 19. LIBY09-05, Periphyton Cover and Sample Habitat Summary

Characteristic	Periphyton Cover				Sample Habitat (%)		
	Microalgae	Filamentous Algae	Macrophytes	Moss	Riffle	Run/ Glide	Pool
Presence	Absent	<10%	Absent	Absent	10%	90%	0%
Color	------	Green	------	------			
Condition	------	Growing	------	------			
Thickness/ Length	------	Short					

3.2.7 Fairway Creek



This stream is in a cedar-bottomed alluvial fan, unconfined and with multiple braids. There was much downed wood in the cold stream with moss abundant. Both periphyton and macroinvertebrates were shown to be unimpaired. An impairment summary is provided in **Table 20** and summary results of the Fish Cover/Other form are presented in **Table 21.**

Table 20. N/A (nutrient site), Periphyton and Macroinvertebrate Impairment Class Summary

Reach ID	Periphyton		Macroinvertebrate	
	Impairment Probability	Impairment Class	O/E Score	Impairment Class
N/A (nutrient site)	26.68%	Unimpaired	0.98	Unimpaired

Table 21. N/A (nutrient site), Periphyton Cover and Sample Habitat Summary

Characteristic	Periphyton Cover				Sample Habitat (%)		
	Microalgae	Filamentous Algae	Macrophytes	Moss	Riffle	Run/ Glide	Pool
Presence	<10%	<10%	<10%	10 - 40%	55%	27%	18%
Color	Green	Green	Green	Green			
Condition	Growing	Growing	Growing	Growing			
Thickness/ Length	Thin	Long					

3.2.8 WOLF09-02

The stream reach chosen for this study is further downstream than the coordinates given by the sediment/habitat assessment contractor. The stream is heavily beaver-influenced and sampling protocol had to change slightly. A 500m reach was used to get all 11 transects between two beaver ponds. Based on stream width, the real reach should have been 800 feet. The system is a slow-moving run system. Almost all rocks were covered in mature microalgae and filamentous algae. Macrophytes were seen along stream edges. The channel was deeply incised due to beaver activity. The reach was unimpaired for both macroinvertebrates and periphyton. An impairment summary is provided in **Table 22** and summary results of the Fish Cover/Other form are presented in **Table 23.**

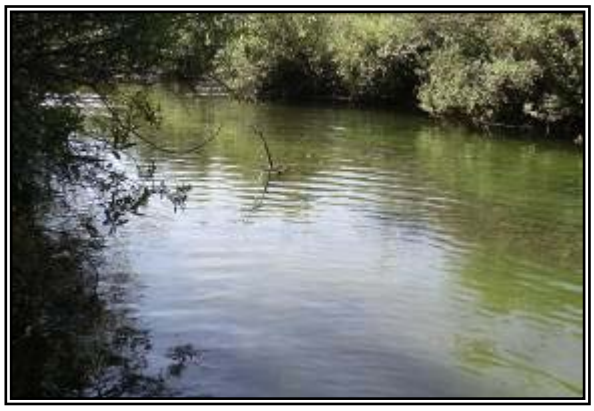
Table 22. WOLF09-02, Periphyton and Macroinvertebrate Impairment Class Summary

Reach ID	Periphyton		Macroinvertebrate	
	Impairment Probability	Impairment Class	O/E Score	Impairment Class
WOLF09-02	21.42%	Unimpaired	0.90	Unimpaired

Table 23. WOLF09-02, Periphyton Cover and Sample Habitat Summary

Characteristic	Periphyton Cover				Sample Habitat (%)		
	Microalgae	Filamentous Algae	Macrophytes	Moss	Riffle	Run/ Glide	Pool
Presence	>75%	40 – 74%	<10%	<10%	18%	45%	36%
Color	Light Brown	Green/ Light Brown	Green/ Light Brown	Green			
Condition	Mature	Mature	Mature	Growing			
Thickness/ Length	Medium	Long					

3.2.9 WOLF11-03



The downstream half of this reach is in a confined, straight reach parallel to and constrained by the road. The upstream end meanders away from the road and heavy rip-rap near F. Micro and filamentous algae coat most rocks leaving the stream with a brownish/green appearance. The dominant algae in the stream is mature or decaying. Some green algae and moss were seen but small numbers in comparison to more decadent periphyton. Algae cover was noticeably different as the stream approaches the road and straightens at G. Coverage became less thick on rocks as flows increased, but only in this G reach. Both macroinvertebrates and periphyton were unimpaired from results of analysis. An impairment summary is provided in **Table 24** and summary results of the Fish Cover/Other form are presented in **Table 25**.

Table 24. WOLF11-03, Periphyton and Macroinvertebrate Impairment Class Summary

Reach ID	Periphyton		Macroinvertebrate	
	Impairment Probability	Impairment Class	O/E Score	Impairment Class
WOLF11-03	20.21%	Unimpaired	1.20	Unimpaired

Table 25. WOLF11-03, Periphyton Cover and Sample Habitat Summary

Characteristic	Periphyton Cover				Sample Habitat (%)		
	Microalgae	Filamentous Algae	Macrophytes	Moss	Riffle	Run/ Glide	Pool
Presence	>75%	10% - 40%	Absent	10% - 40%	10%	90%	0%
Color	Brown	Light Brown	------	Light Brown			
Condition	Mature	Mature	------	Mature			
Thickness/ Length	Medium	Long					

QUTZ 10-01

This reach is constrained on one side by hillslopes. Channel substrate and periphyton communities appeared consistent throughout the reach. No impairment was found for periphyton, while macroinvertebrates were found to be moderately impaired. An impairment summary is provided in **Table 26** and summary results of the Fish Cover/Other form are presented in **Table 27.**

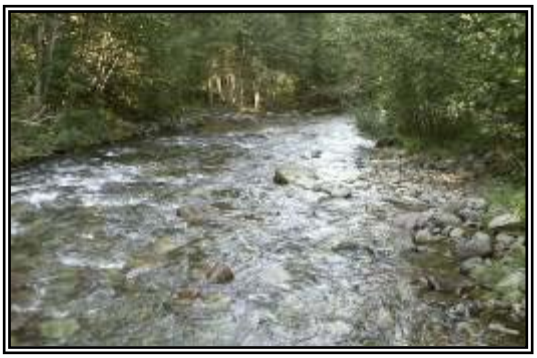


Table 26. QRTZ 10-01, Periphyton and Macroinvertebrate Impairment Class Summary

Reach ID	Periphyton		Macroinvertebrate	
	Impairment Probability	Impairment Class	O/E Score	Impairment Class
QRTZ 10-01	22.38%	Unimpaired	0.74	Moderate

Table 27. QRTZ 10-01, Periphyton Cover and Sample Habitat Summary

Characteristic	Periphyton Cover				Sample Habitat (%)		
	Microalgae	Filamentous Algae	Macrophytes	Moss	Riffle	Run/ Glide	Pool
Presence	<10%	<10%	Absent	<10%	91%	9%	0%
Color	Green	Green	------	Green			
Condition	Growing	Growing	------	Growing			
Thickness/ Length	Thin	Long					

QRTZ 03-01

This reach is in a tight valley. The channel is confined but in a healthy condition in a cedar bottom. Small amount of filamentous algae noted in each transect. Moss was common. Replicate samples were taken here. Both samples for periphyton were unimpaired. The original sample for macroinvertebrates was determined to be beyond the scope of the O/E model. The replicate sample showed no impairment. An impairment summary is provided in **Table 28** and summary results of the Fish Cover/Other form are presented in **Table 29.**

Table 28. QRTZ 03-01, Periphyton and Macroinvertebrate Impairment Class Summary

Reach ID	Periphyton		Macroinvertebrate	
	Impairment Probability	Impairment Class	O/E Score	Impairment Class
QRTZ 03-01	37.31%	Unimpaired	1.23	Outside scope of O/E
QRTZ 03-01 Rep	50.56%	Unimpaired	1.00	Unimpaired

Table 29. QRTZ 03-01, Periphyton Cover and Sample Habitat Summary

Characteristic	Periphyton Cover				Sample Habitat (%)		
	Microalgae	Filamentous Algae	Macrophytes	Moss	Riffle	Run/ Glide	Pool
Presence	<10%	<10%	Absent	<10%	45%	55%	0%
Color	Green/ Light Brown	Green	------	Green			
Condition	Mature	Growing	------	Growing			
Thickness/ Length	Thin	Long					

4.0 Summary

All stream reaches within the Kootenai TPA showed that periphyton were unimpaired, while both reaches of Raven Creek in the Fisher TPA were impaired for periphyton. In regards to macroinvertebrate sampling both Fisher sites were unimpaired while 3 sites in the Kootenai TPA were impaired for macroinvertebrates. In the Kootenai TPA, five macroinvertebrate samples were outside the scope of the O/E model and further assessment may be necessary to determine if they are reference reaches or have nutrient impairments. A summary table of impairment is provided in **Table 30** below.

Table 30. Stream Reach Impairment Summary

Reach ID	Periphyton	Macroinvertebrate
Fisher TPA		
RAVN06-01	Impaired	Unimpaired
RAVN07-01	Impaired	Unimpaired
Kootenai TPA		
BRST04-02	Unimpaired	Outside scope of O/E
BRST04-04	Unimpaired	Outside scope of O/E
BRST04-04 Rep	Unimpaired	Outside scope of O/E
LAKE02-01	Unimpaired	Outside scope of O/E
LAKE03-03	Unimpaired	Unimpaired
LIBY09-03	Unimpaired	Moderate
LIBY09-05	Unimpaired	Moderate
Fairway Creek	Unimpaired	Unimpaired
WOLF09-02	Unimpaired	Unimpaired
WOLF11-03	Unimpaired	Unimpaired
QRTZ10-01	Unimpaired	Moderate
QRTZ03-01	Unimpaired	Outside scope of O/E
QRTZ03-01 Rep	Unimpaired	Unimpaired