Calibration of a Multimetric Benthic Invertebrate Index of Biological Integrity for the Upper Bulkley River Watershed

A Tool for Assessing & Monitoring Stream Condition

Bio Logic Consulting Terrace, BC

595.7/R996 2000

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April, 2000

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Executive Summary

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Degradation of fisheries resources and water quality are a top concern in Northwestern British Columbia. Many government and non-government programs have been initiated in the last ten years to inventory, assess and rehabilitate habitat for salmonids. Although hundreds of thousands of dollars have been spent on restoration of salmonid habitat, few of the restoration programs have a monitoring program in place to evaluate the short-term or long-term effectiveness of the project. In cases where monitoring programs may be in place, they often emphasize measuring physical habitat parameters (*e.g.* amount of large woody debris) or chemical water quality parameters (*e.g.* toxic substances or alkalinity) to estimate the capacity of the habitat to support salmonids. As there are many factors which can affect fish survival, some of which may not even be known yet, clearly there is a need for a monitoring tool which directly measures the condition of the aquatic life in a stream.

There are many factors to consider when choosing a biological monitoring tool. It must be inexpensive, easy to use, verifiable, and sensitive to changes in environmental conditions (Yoder, 1995). Decreasing financial and government human resources available for monitoring and assessment programs dictate that the monitoring program must be one which community members and volunteers have the ability to implement.

For years, benthic invertebrates have been used for monitoring and assessment of river ecosystems. Over the last twenty years, benthic invertebrate multimetric indices have gained recognition as sensitive and effective indicators of stream condition. A multimetric approach is one where a number of single community metrics (or attributes) are combined into a final index. Benthic invertebrates are ubiquitous, relatively sedentary, and can be easily sampled by community groups, making them a good choice for bio-monitoring. There have been many multimetric approaches to assessing stream condition using invertebrates, including the Alaska Stream Condition Index (Major et al., 1998), the Coast Plain Macroinvertebrate Index (Maxted et al., 1999), a biotic index for the southeastern USA (Lenat, 1993), the Invertebrate Community Index (DeShon, 1995) and the Index of Biological Integrity (Karr, 1981). The Index of Biological Integrity (IBI) is arguably the most widely used and effective multimetric index of stream condition (Simon and Lyons, 1995).

The purpose of this project was to calibrate the IBI, which has already been proven effective, for the upper Bulkley River watershed. The IBI was calibrated by testing the response of the individual metrics across a gradient of human influence, from uninfluenced to heavily influenced, and by establishing expectations for local streams based on reference (uninfluenced) streams.

Nine metrics which clearly distinguished lightly influenced from heavily influenced streams were chosen for incorporation into the multimetric index and included:

- Taxa richness,
- Ephemeroptera taxa richness,
- Plecoptera taxa richness,
- Trichoptera taxa richness,
- Long-lived taxa richness,
- Intolerant taxa richness,
- % Predators,
- Clinger taxa richness, and
- % Dominance (3 taxa).

Each stream which was sampled was given a score for each metric. The values for each metric were then summed to provide one final number or index. The index was compared against other local sites which were already scored, and the relative condition of the stream was determined.

This report provides a summary of the procedures and methods used to calibrate the IBI for the upper Bulkley River basin. Calibrating the IBI should be an iterative process, where metrics are re-evaluated as more data becomes available.

Acknowledgements

This project was completed through a partnership between the Community Futures Development Corporation (CFDC) of Nadina, the Office of the Wet'suwet'en Hereditary Chiefs, the Upper Bulkley River Roundtable, and the BC Environment Skeena Region Pollution Prevention Program. Funding was provided through Fisheries Renewal BC and BC Environment.

Many thanks to Scott Mackay, CFDC Nadina Watershed Stewardship Coordinator, Al McCracken, Upper Bulkley River Roundtable Representative, and Andy Witt, Morice Forest District Forest Ecosystem Specialist for assisting with stream selection. Thanks to the BC Environment Skeena Region Pollution Prevention Program for funding a portion of the benthic invertebrate taxonomy and enumeration. Thanks to Walter Joseph and Stefan Schug, of the Office of the Wet'suwet'en Hereditary Chiefs for providing the project with two talented and knowledgeable interns, Annette Fuchs and Ingrid Gilly. Thanks to the Gitxsan Fisheries Council for contributing the invaluable services of Charlie Weget to the project. Thank you to Annette Fuchs, Charlie Weget, Ian Sharpe, Ingrid Gilly, Lisa Westenhofer and Tanya Dykens for persevering joyfully through bad weather and long field days to complete the field work.

Most of all, thank you to James Karr, for reviewing the proposal, and for invaluable help, advice and encouragement throughout the project.

2

Table of Contents

1	Intro	oduction	. 1
2	Met	hods	. 1
	2.1	Site Selection	
	2.2	Field Methods	.2
	2.3	Metric Definitions & Calculations	
3	Sele	ction of Metrics for Incorporation into the Index	
	3.1	Human Influence	
	3.2	Metric Testing	. 8
	3.3	Core Metric Scoring	
4	Results		
5	Discussion		
6			
7	Literature Cited		

List of Figures

Figure 1: Location of stream sites within study area (not to scale). Streams and lakes not sampled were no included on map. Assessment sites are marked with red circles.	
Figure 2: ASCI in-stream and riparian condition value (Major and Barbour, 1997) plotted against landscape scale human influence classification.	7
Figure 3: Benthic invertebrate metrics across a gradient of human influence. <i>Plus signs</i> represent lightly influenced sites. <i>Open boxes</i> represent the most severely degraded sites. <i>Solid circles</i> represent moderately influenced sites. 1	
Figure 4: Cutoff scoring values for each metric based on rank distribution of scores for upper Bulkley River watershed streams	

List of Tables

Table 1: List of stream sites and locations within the upper Bulkley River basin	2
Table 2: List of stream sites used for metric testing, location and level of human influence within the	
upstream catchment basin of the watershed.	7
Table 3: Candidate metrics and their expected direction of metric response (from Karr & Chu, 1999)	9
Table 4: Nine metrics and scoring cutoff points chosen for inclusion in the upper Bulkley River water	shed
multimetric index	14
Table 5: Nine metric upper Bulkley - calibrated IBI scores and associated stream condition	14
Table 6: Stream sites and condition within the upper Bulkley River watershed	15

List of Appendices

Appendix A:	Benthic Invertebrate Data	A-1
Appendix B:	Habitat Assessment Forms	B- 1
Appendix C:	Benthic Invertebrate Taxa & Classifications	C-1
	Summary of Metrics Calculated from Raw Data	
	Field Notes and Site Assessment Form	
Appendix F:	Site Photos	F-1
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1 Introduction

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Degradation of fisheries resources and water quality are a top concern in Northwestern British Columbia. Many government and non-government programs have been initiated in the last ten years to inventory, assess and rehabilitate habitat for salmonids. Although hundreds of thousands of dollars have been spent on restoration of salmonid habitat, few of the restoration programs have a monitoring program in place to evaluate the short-term or long-term effectiveness of the project. In cases where monitoring programs may be in place, they often emphasize measuring physical habitat parameters (*e.g.* amount of large woody debris) or chemical water quality parameters (*e.g.* toxic substances or alkalinity) to estimate the capacity of the habitat to support salmonids. As there are many factors which can affect fish survival, some of which may not even be known yet, clearly there is a need for a monitoring tool which directly measures the condition of the aquatic life in a stream.

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For years, benthic invertebrates have been used for monitoring and assessment of river ecosystems. Over the last twenty years, benthic invertebrate multimetric indices have gained recognition as sensitive and effective indicators of stream condition. A multimetric approach is one where a number of single community metrics (or attributes) are combined into a final index. Benthic invertebrates are ubiquitous, relatively sedentary, and can be easily sampled by community groups, making them a good choice for bio-monitoring. There have been many multimetric approaches to assessing stream condition using invertebrates, including the Alaska Stream Condition Index (Major et al., 1998), the Coast Plain Macroinvertebrate Index (Maxted et al., 1999), a biotic index for the southeastern USA (Lenat, 1993), the Invertebrate Community Index (DeShon, 1995) and the Index of Biological Integrity (Karr, 1981). The Index of Biological Integrity (IBI) is arguably the most widely used and effective multimetric index of stream condition (Simon and Lyons, 1995).

The purpose of this project was to calibrate the IBI for the upper Bulkley River watershed. The IBI was calibrated by testing the response of the individual metrics across a gradient of human influence, from uninfluenced to heavily influenced, and by establishing expectations for local streams based on reference (uninfluenced) streams.

This report provides a summary of the procedures and methods used to calibrate the IBI for the upper Bulkley River basin. Calibrating the IBI should be an iterative process, where metrics are reevaluated as more data becomes available.

2 Methods

Methods adopted for this project, and also for an IBI calibration project in the Kispiox River watershed (Rysavy, 2000), were kept as consistent as possible with work completed by James Karr (Karr and Chu, 1999).

2.1 Site Selection

The goal of site selection was to choose a set of streams within the Upper Bulkley River watershed with similar broad ecological and natural attributes including stream order, elevation, and gradient. Scott Mackay and Al McCraken of CFDC Nadina, Ian Sharpe of BC Environment, and a number of community members were consulted during the stream selection process to ensure the best local knowledge of streams was used. Local knowledge, combined with the results of completed assessments and past work (particularly Mackay *et al.*, 1998) were used to identify a group of streams with a diverse range of human influence, from little or no influence to highly influenced. The intention was to include the best and worst available streams within the upper Bulkley River watershed in the data set. All of the streams selected were non-glacial (clear) streams.

Selected streams were 2nd order or greater, 1950 to 3200 feet in elevation (determined from 1:50,000 NTS maps), relatively low gradient, and within the Sub-Boreal Spruce (SBS) biogeoclimatic zone (Banner *et al.*, 1993). Twenty-three potential assessment sites were chosen based on the easiest access. Three sites on the Bulkley River were assessed as well, although IBI calibration was not intended for this larger stream size. Assessment sites and locations are presented in Figure 1 and listed in Table 1.

Stream Site	Location
Ailport Creek	Upstream of the Highway 16 crossing
Barren Creek	Upstream of the Highway 16 crossing
Bob Creek	Upstream of the confluence with Buck Creek
Buck Creek @ 12 km	Upstream of the 12km bridge crossing
Buck Creek @ Bulkley Conf.	Upstream of the confluence with the Bulkley River
Buck Creek @ Mall	Adjacent to the Houston Shopping Mall
Bulkley River @ Craker	Upstream of the old Craker Rd. bridge
Bulkley River @ Knockholt	Downstream of the Knockholt bridge
Bulkley River @ Morice Confl.	Upstream of the Highway 16 bridge crossing
Byman Creek Downstream	Upstream of the Highway 16 crossing
Byman Creek Ref. or Upstream	Upstream of the North Road crossing
Cesford Creek Downstream	Upstream of the Highway 16 crossing
Cesford Creek Reference	Upstream of the transformer station, below the old bridge
Cesford Creek Upstream	Upstream of the Granisle Highway crossing
Crow Creek	Upstream of the Maxan Creek FSR Crossing
Foxy Creek @ Maxan	Upstream of the confluence with Maxan Creek
Foxy Creek below mine	Downstream of the mine, below confluence with Berzelius Creek
Johnny David Creek	Upstream of the Highway 16 crossing
McQuarrie Creek Downstream	Upstream of the Highway 16 crossing
McQuarrie Creek Ref. or Upstream	Upstream of the North Road crossing
Richfield Creek @ CN	Upstream of the CN Rail crossing
Richfield Creek Downstream	Upstream of the Highway 16 crossing
Richfield Creek Upstream	Upstream of the Granisle Highway crossing

Table 1:	List of stream	sites and locations	within the upper	Bulkley River basin.
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In early August, potential assessment sites were visited to assess access and wadability. Those sites which were too large to wade, too low gradient, or too difficult to access were removed from the list.

2.2 Field Methods

Benthic invertebrate communities generally vary greatly from season to season and Karr and Chu (1999) recommend calibrating the IBI for one period in the year. Late summer, early fall was chosen as the sampling period for the Bulkley IBI which is consistent with the period used in the Pacific Northwestern United States (Karr and Chu, 1999). As flows are usually lower at the end of summer, and stream temperatures are high, this is an ideal period for impact assessment, and in terms of safety and stream wadability. Following a one day training workshop which provided participants with an introduction to sampling and habitat assessment techniques, sites were sampled during a five day period which began August 23rd, 1999. Each site was assessed and sampled by a team consisting of a biologist and a trainee or assistant biologist. Biologists for the project included Shauna Rysavy, Tanya Dykens, Lisa Westenhofer and Ian Sharpe. Assistant biologists included Charlie Weget, Annette Fuchs and Ingrid Gilly. It was intended to complete the sampling during a dry period, but a rainstorm occurred on the second day of sampling. Rainfall was not great enough to cause a noticeable increase in flows, and sampling was continued. To minimize year to year variability, sampling in future years should occur over a dry period between August 15th and September 15th. If weather allows, the last week of August should be ideal in terms of meeting requirements for low flow and avoiding spawning fish.

Field methods were adopted to meet Provincial sampling standards (Cavanagh *et al.*, 1997) and were consistent with methods used by Karr and Chu (1999). Three samples were collected in the best natural riffle at each site, starting at the downstream end of the riffle and moving upstream. All samples were collected in the main stream flow at depths between 10 and 25 cm. An exception to this rule was for samples collected from the Bulkley River, where depths were too great in the main flow, and sample collection was mainly from the edges of riffles. A modified 250 micron Surber sampler with a Dolphin Adaptor cod end was used for sampling (900 cm² sample area). Large rocks on top of the smaller substrate within the sampling area were gently removed and set aside in a wash basin. Invertebrates were carefully picked off the large rocks and added to the appropriate sample jar. Substrate within the sample area was disturbed to a 10 cm depth with a screwdriver for one minute. The sample was carefully transferred from the cod end to a labeled sample jar and 10% buffered formalin was added as a preservative. The three samples collected at each site were kept separate for identification and enumeration.

After benthic invertebrates were collected and preserved, in-stream and riparian conditions were assessed at each site. Four field forms were filled out at each site and are included in Appendix B. The first two forms summarized chosen key <u>Fish Habitat Assessment Procedure</u> parameters (Johnston and Slaney, 1996). The second two forms were copied from the <u>Standard Operating Procedures for the Alaska Stream Condition Index</u> (Major and Barbour, 1997). Photographs were taken of the stream, riparian area, substrate size and any potential or actual land use impacts. A selection of site photos are included in Appendix F.

Benthic invertebrate samples were shipped to Fraser Environmental Services in Surrey, BC where invertebrates were identified to genus where possible, and enumerated by taxonomists Linda Curry and Jim Donkersly. Whole samples were analyzed and counted and electronic data was archived in the BC Environment EMS database. Raw benthic invertebrate data is included in Appendix A.

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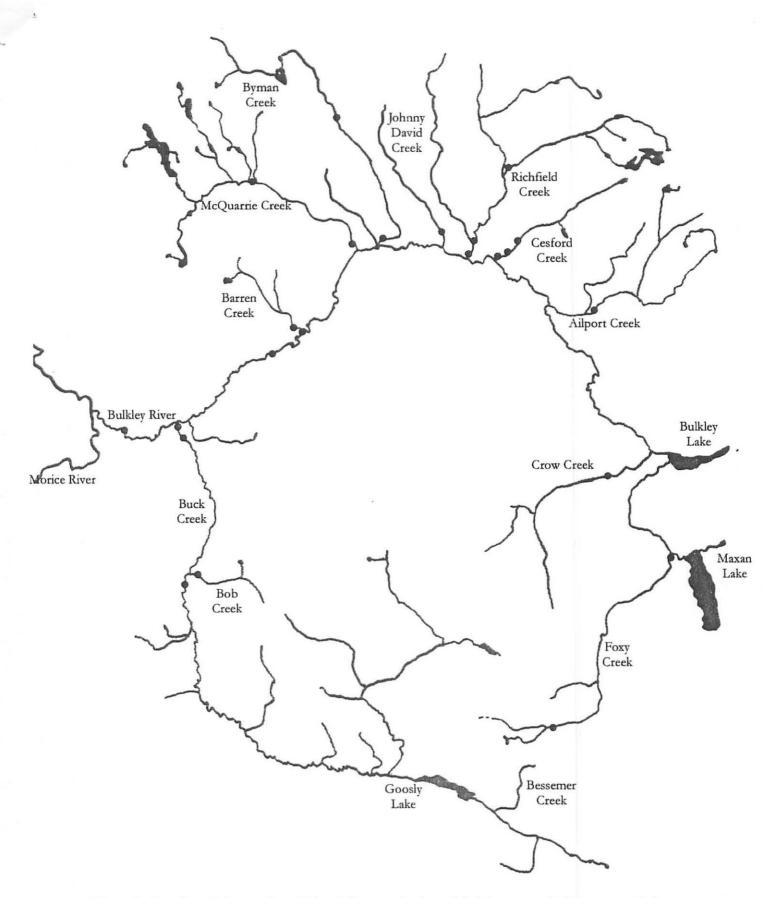


Figure 1: Location of stream sites within study area (not to scale). Streams and lakes not sampled were not included on map. Assessment sites are marked with red circles.

2.3 Metric Definitions & Calculations

Twelve metrics were chosen for testing based on Karr's B-IBI (Karr & Chu, 1999). Included were total taxa richness, Ephemeroptera taxa richness, Plecoptera taxa richness, Trichoptera taxa richness, long-lived taxa richness, intolerant taxa richness, percent tolerant individuals, clinger taxa richness, percent predator individuals, relative abundance of Oligochaetes, relative abundance of Chironomids and percent dominance. Metrics were calculated and defined as described on the <u>Salmonweb</u> internet site which hosts the <u>Northwest Taxa Database</u> (www.salmonweb.org). A brief summary of these definitions and calculations follows.

Total taxa richness was the total number of distinct taxa (groups of like organisms) identified in each replicate sample. For one stream site, where three replicate samples were collected, there would be three counts for this metric. The three replicates were then averaged to give one number for total taxa richness.

Ephemeroptera taxa richness was the total number of distinct taxa in the Order Ephemeroptera, identified in each replicate sample. The three replicates were then averaged to give one number for total Ephemeroptera taxa richness. Plecoptera and Trichoptera taxa richness were calculated in the same way as Ephemeroptera taxa richness, counting the number of taxa in the Order Plecoptera and Order Trichoptera respectively.

The number of long-lived taxa has been defined as the number of taxa living at least two to three years in the immature state (Karr and Chu, 1999; <u>www.salmonweb.org</u>). The best available information was used for this metric, summarized from the Northwest Taxa Database (<u>www.salmonweb.org</u>) and Merritt and Cummins (1996), and was not specific to this region. As there are very few taxa which are long-lived in each replicate, the cumulative number of unique long-lived taxa in all three replicates were counted (and not averaged over the three samples).

The number of intolerant taxa was calculated in the same way as the number of long-lived taxa. There are very few taxa which are intolerant, so the cumulative number of unique taxa in all three replicates were counted (and not averaged over the three samples). Intolerance refers to organic pollution and information on which taxa are intolerant was retrieved from the <u>Northwest Taxa Database</u> on the Salmonweb.

Percent tolerant individuals refers to the total number of tolerant individuals counted in each replicate, divided by the total number of individuals counted in that replicate, multiplied by 100. Both intolerant and tolerant taxa metrics refer to the response of benthic invertebrates to organic pollution and this information was retrieved from the <u>Northwest Taxa Database</u>.

The number of clinger taxa refers to the primary behavior exhibited by an invertebrate as documented by Merritt and Cummins (1996). The total number of clinger taxa were counted for each of three replicates, and then averaged to give one final metric score for the site.

Percent predator individuals is the total number of individuals in a replicate belonging to the predator functional feeding group, divided by the total number of individuals in that replicate and multiplied by 100. The percent predator individuals for each of the three replicates was then averaged to give one final metric score.

Relative abundance of Oligochaete individuals was calculated per replicate, as the total number of Oligochaete individuals divided by the total number of individuals, and multiplied by 100. The percent Oligochaete individuals for each of the three replicates was then averaged to give one final metric score. Relative abundance of Chironomids was calculated using the same method.

Percent dominance is the sum of individuals in the three most abundant taxa in that replicate, divided by the total number of individuals in that replicate and multiplied by 100. The percent dominance for each of the three replicates was then averaged to give one final metric score for the site.

A list of taxa, assigned functional feeding group, life history, and tolerance designations has been included in Appendix C. Sample calculations have been posted by the Salmonweb organization on their

internet website. Metric scores for streams sampled in the upper Bulkley River watershed are summarized in Appendix D.

3 Selection of Metrics for Incorporation into the Index

3.1 Human Influence

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Similar to Fore *et al.* (1996), sites were subjectively classified into three categories: little or no human influence, moderately influenced, or heavily influenced. Types of influence included residential development, agricultural land use, forest harvest (including road density), and range land use. Recreational land use and accessibility were also considered. Classification was based primarily on air photo interpretation, forest development plan interpretation, field notes on assessment of the local area surrounding the sampling site and in-stream condition, and local knowledge.

Only twelve of the twenty-three sites sampled were used for testing the responses of metrics over a gradient of human influence. The twelve sites were chosen based on a greater confidence that the level of human influence could be easily estimated within the watershed using maps and air photos, and that the stream was accurately classified. In some watersheds, there was local knowledge of potential impacts, where the magnitude of the impact was unknown or the source of the potential impact could not be confirmed. A buried mine concentrate discovered near Richfield Creek and an old garbage dump and / or forest fire tower battery dump thought to be within the upper Cesford Creek watershed are two examples of watersheds harbouring potential (unconfirmed in the case of Cesford Creek) impact sources with unknown magnitude. Sites on these streams were excluded from metric testing as it was too difficult to accurately assign a human influence classification to them.

Two uninfluenced sites were identified. The sites were not pristine, but had a greater percentage of forested area and less human influence in the watershed upstream of the site. Foxy Creek at the Maxan Creek confluence and Ailport Creek had the lowest relative human influence within the upstream catchment basin. Although a closed silver mine exists which was a source of acid drainage affecting Foxy Creek in the early 1980s, benthic invertebrate and periphyton monitoring in 1998 found diverse and abundant benthic invertebrate communities at two sites on downstream Foxy Creek, when compared with an upstream reference site (Perrin, 1999). Originally, based on forest development plan map interpretation, McQuarrie Creek upstream of North Road and Byman Creek upstream of North Road were classified as lightly influenced. However, field inspection found indicators of riparian and channel impacts, and the sites were re-classified as moderately influenced.

Moderately influenced sites included those with low to moderate land use within the upstream catchment basin. The majority of streams, except for a few which were identified as having low human influence or high human influence within the watershed, were placed in this category.

Heavily influenced sites included those with moderate to high recreation, agriculture, forest harvesting and / or residential land use within the watershed. McQuarrie Creek downstream, Byman Creek downstream, Buck Creek at the mall and at the Bulkley River Confluence were classified as heavily influenced.

In-stream state and riparian condition were assessed at the time of sampling using key <u>Fish Habitat</u> <u>Assessment Procedure</u> parameters (Johnston and Slaney, 1996) and assessment forms excerpted from the <u>Standard Operating Procedures for the Alaska Stream Condition Index (ASCI)</u> (Major and Barbour, 1997). Competed field forms for each site are in Appendix E. The ASCI in-stream and riparian condition values were calculated for each stream and values for the twelve streams ranged from 116 to 170, where the minimum possible score was 0 and the maximum possible score was 200. These values were plotted against the landscape-scale human influence category assigned to each stream site as shown in Figure 2, in an effort to identify any streams which may have been misclassified. Generally, the average ASCI value decreased with increasing human influence at the landscape scale. One exception was Ailport Creek. Ailport Creek scored a low ASCI value due to poor in-stream and riparian conditions at the assessment site. However, the majority of the watershed upstream of the site is forested, and overall the watershed was thought to have a low human influence.

In summary, stream sites were classified as either high, moderate or low human influence using air photos and forest development plan maps. Following this rough classification, streams were moved up or down a category based on field assessment of instream and riparian condition, and on local knowledge. Stream sites and associated human influence classifications are listed in Table 2.

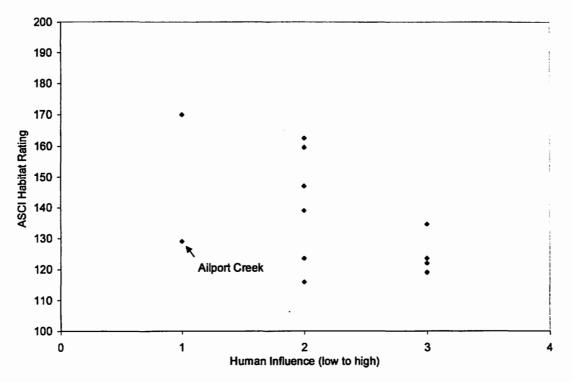


Figure 2: ASCI in-stream and riparian condition value (Major and Barbour, 1997) plotted against landscape scale human influence classification.

Table 2: List of stream sites used for metric testing, location and level of human inf	luence within the
upstream catchment basin of the watershed.	

Stream	Site Location	Human Influence Classification
Foxy Creek @ Maxan	Foxy Creek above confluence with Maxan Creek	Low
Ailport Creek	Ailport Creek above Highway 16	Low
Crow Creek	Crow Creek upstream of FSR	Moderate
Barren Creek	Barren Creek upstream of Highway 16	Moderate
Byman Creek Upstream	Byman Creek upstream of North Road	Moderate
McQuarrie Creek Upstream	McQuarrie Creek upstream of North Road	Moderate
Buck Creek @ 12 km	Buck Creek upstream of 12km bridge	Moderate
Johnny David Creek	Johnny David Creek upstream of Highway 16	Moderate
Buck Creek @ Bulkley Confluence	Buck Creek upstream of confluence with Bulkley River	High
McQuarrie Creek Downstream	McQuarrie Creek upstream of Highway 16	High
Buck Creek @ Mall	Buck Creek adjacent to Houston Shopping Mall	High
Byman Creek Downstream	Byman Creek upstream of Highway 16	High

3.2 Metric Testing

A metric is one attribute of a sampled benthic invertebrate community (Karr, 1981). A multimetric index combines a number of individual metrics into one score or value, easing comparison of multiple sites. Examples of commonly presented metrics include, but are not limited to, abundance (*e.g.* mean number of individuals per sample or standard measurement unit), functional feeding group metrics (*e.g.* relative abundance of shredders) and richness indices.

The benthic index of biological integrity (B-IBI) is a multimetric index of stream condition developed by James Karr (1981). The index of biological integrity is the sum of scores for a set of core metrics that are known to respond in a predictable way across a gradient of human influence. Each metric is assigned a set of unitless values across the range of results, which indicate whether the results were similar to those expected of an uninfluenced stream, a moderately influenced stream or a highly influenced stream (Karr and Chu, 1999).

Twelve metrics were considered for inclusion in the multimetric index. Candidate metrics and their expected response to increased human influence within the watershed are included in Table 3. The twelve metrics considered have been successfully included in multi-metric IBI's for the Tennessee Valley, southwest Oregon, north coast Oregon, Puget Sound, Japan and northwest Wyoming (Karr & Chu, 1999). Each metric was tested to determine whether the metric varied uniformly across a gradient of human influence in the upper Bulkley Watershed, using simple graphical analysis. A multivariate approach was not employed to test for statistically significant differences between sites. Simple graphical analyses are recommended over complex multivariate statistics as the "inherent statistical complexity of multivariate analyses distracts biologists from making clear, testable statements to each other and to non-scientists about how the biota responds to human influence" (Fore et al., 1996). Using simple graphical analyses promotes interpretation and comprehension of monitoring results by community members, volunteers, or other interested stakeholders.

Figure 3 illustrates each metric graphed as a function of human influence within the watershed sampled. Human influence was rated as either 1, 2 or 3 where 1 is uninfluenced, 2 is moderately influenced and 3 is highly influenced. Metrics which successfully differentiated between uninfluenced and highly influenced sites, included total number of taxa, number of Ephemeroptera taxa, number of Plecoptera taxa, number of Trichoptera taxa, number of long lived taxa, number of intolerant taxa, number of clinger taxa and dominance (3 taxa). Although a decreasing trend was discernable, uninfluenced sites were not clearly distinguished from heavily influenced sites using relative abundance of predator individuals. There was no clear pattern across a gradient of human influence for relative abundance of tolerant individuals, relative abundance of Oligochaetes, and relative abundance of Chironomids.

Total taxa richness (number of taxa) clearly declined across a gradient of human influence which was consistent with the expected response. Taxa richness is thought to be a good indicator for most types of pollution with the exception of organic pollution. In streams where organic pollution is present, alien taxa may artificially increase taxa richness at a site (Karr and Chu, 1999). Alien taxa are defined as those which were not originally present in the stream, but were introduced through human activities and land use.

Ephemeroptera taxa richness and Plecoptera taxa richness clearly distinguished uninfluenced sites from heavily influenced sites. Trichoptera taxa richness also distinguished uninfluenced from heavily influenced sites, but the difference was much smaller. Karr and Chu (1999) suggest that decreased taxa richness of these three orders occur due to different types of disturbance within the watershed. Ephemeroptera are generally sensitive to toxic chemical pollutants such as mine wastes, while Plecoptera are thought to be sensitive to sedimentation impacts and removal of riparian vegetation (Karr and Chu, 1999). Figure 3 illustrates that in the upper Bulkley River watershed, Plecoptera taxa richness was the most sensitive to human influence. Moderately and highly influenced streams have similarly low Plecoptera taxa richness scores. The Plecoptera taxa richness result is consistent with other research which has found the metric to be the most sensitive of the three (Karr and Chu, 1999). A similar calibration project conducted in the Kispiox River watershed which focused mainly on forest harvesting impacts, found that Plecoptera taxa richness and Trichoptera taxa richness were sensitive indicators of sedimentation impacts (Rysavy, 2000).

Category	Metric	Definition	Expected Response to Increasing Human Influence within the Watershed
Taxa Richness & Composition	No. of Taxa	Total number of different taxa	Decrease
	No. of Ephemeroptera Taxa	Total number of different Ephemeroptera taxa	Decrease
	No. of Plecoptera Taxa	Total number of different Plecoptera taxa	Decrease
	No. of Trichoptera Taxa	Total number of different Trichoptera taxa	Decrease
<u> </u>	No. of Long-lived Taxa	Total number of long-lived taxa	Decrease
	% Oligochaetes	Relative abundance of Oligochaetes	Increase
	% Chironomids	Relative Abundance of Chironomids	Increase
Tolerants / Intolerants	No. of Intolerant Taxa	Total number of intolerant taxa	Decrease
	% Tolerants	Relative abundance of tolerant individuals	Increase
Feeding / Habit Metrics	% Predators	Relative abundance of predators	Decrease
	No. of Clinger Taxa	Total number of clinger taxa	Decrease
Populations Attributes	% Dominance (3 taxa)	Measures the relative abundance of the three most abundant taxa	Increase

Table 3:	Candidate metrics and their expected direction of metric response (from Karr & Chu,
1 999)	

The number of long lived taxa and number of intolerant taxa (organic pollution) clearly distinguished between uninfluenced and heavily influenced sites although the range was not large for either metric. Presence of long-lived and intolerant taxa, even in small numbers, are strong indicators of good biological condition (Karr and Chu, 1999).

Relative abundance of tolerant individuals did not clearly discriminate uninfluenced sites from heavily influenced sites. All sites were found to have less than 3.5% tolerant individuals, which was lower than expected for heavily influenced sites. In Puget sound lowland streams and in the Clackamas River basin in Oregon, this metric was included in an IBI as a successful indicator of human influence (J. Karr, pers. comm., March 17, 2000). The expectation for sites with good biological condition in those regions, is for less than 27% tolerant individuals, with expectations of higher values at more degraded sites. This suggests that the metric has low sensitivity, as it has not responded to levels of human influence present in the upper Bulkley River basin streams. However, based on the success of this metric in other areas, it may become more useful if stream conditions decline in the upper Bulkley River basin. This metric should be re-evaluated after further data has been collected in the upper Bulkley River basin streams.

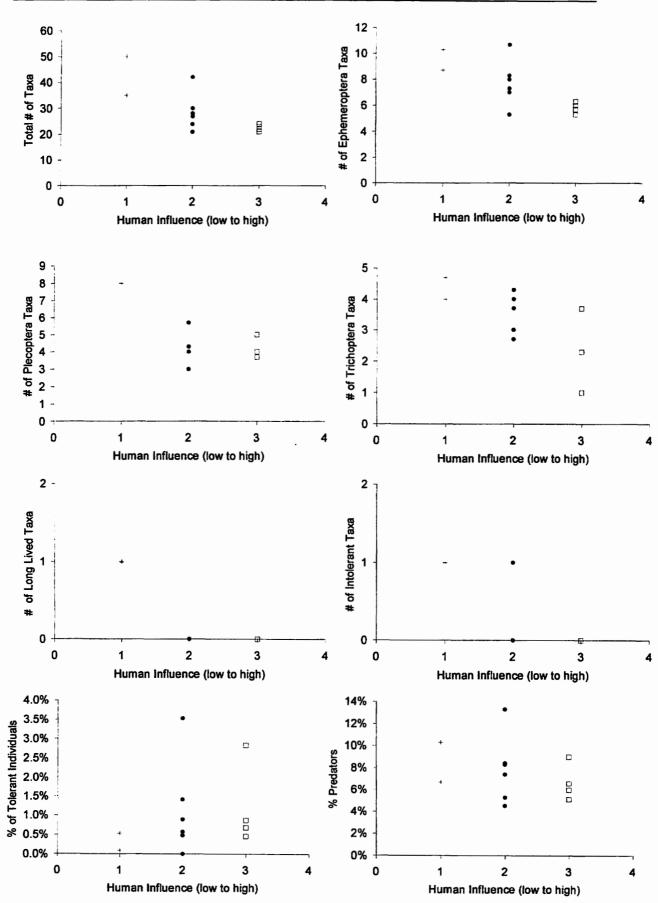
Two feeding and behavior metrics were included for testing: relative abundance of predators and the number of clinger taxa. Declining clinger taxa richness (and relative abundance of clingers) has been found to be an effective indicator of stream degradation and has been included in several benthic invertebrate multimetric indices (Karr and Chu, 1999; Maxted *et al.*, 1999). Clinger taxa richness clearly differentiated between uninfluenced and heavily influenced sites within the upper Bulkley River basin. The results for the heavily influenced streams were clumped together, suggesting high sensitivity to human influence and low variability. As predicted, relative abundance of predators decreased across the gradient of human influence. Although the metric did not clearly separate all uninfluenced sites from heavily influenced sites, it was included in the IBI based on past performance (Karr and Chu, 1999) as a successful indicator of biological integrity in the Tennessee Valley, Northcoast Oregon, and northwest Wyoming. When additional data has been collected, this metric should be re-evaluated.

Feeding and behavior information for each taxon was found in Merritt and Cummins (1996). Other feeding metrics include relative abundance of scrapers, shredders, filter feeders, gatherers, and omnivores, and the number of taxa within a specific feeding group. Scrapers and other specialized feeders are thought to be sensitive to human influence and more abundant in uninfluenced streams (Major et al., 1998). However, many of these other metrics have been found to vary unpredictably with increasing human influence within a watershed, or to vary unpredictably year to year (Fore *et al.*, 1996).

Dominance of three taxa increased over the gradient of human influence and distinguished uninfluenced sites from heavily influenced sites.

Neither relative abundance of Chironomids nor relative abundance of Oligochaetes differentiated between uninfluenced and heavily influenced sites. Neither metric was included in the upper Bulkley IBI.

10



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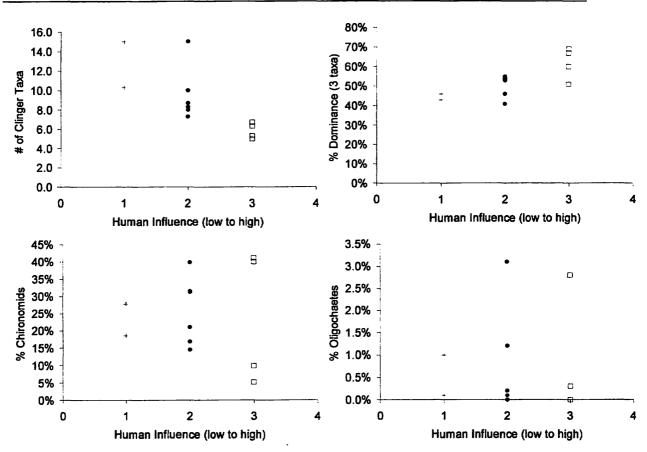


Figure 3: Benthic invertebrate metrics across a gradient of human influence. *Plus signs* represent lightly influenced sites. *Open boxes* represent the most severely degraded sites. *Solid circles* represent moderately influenced sites.

3.3 Core Metric Scoring

Nine out of twelve metrics were chosen for incorporation into the multimetric index based on the ability to clearly differentiate uninfluenced from heavily influenced sites. Pair-wise correlations between each of the metrics have found them to be non-redundant (Kerans & Karr, 1994), suggesting that each metric contributes different and valuable information to the end product. Data results from all twenty-three streams sampled in the upper Bulkley River watershed were ranked by metric value and graphed as illustrated in Figure 4.

Graphs were studied closely for natural breaks or patterns, and compared with cutoffs used in the Puget Sound lowland streams and Clackamas River basin streams in Oregon (J. Karr, pers. comm., March 17, 2000). Cutoff points were selected and metrics were scored 5 points if values were similar to uninfluenced streams, 3 points if values were similar to moderately influenced streams, and 1 point if values were similar to heavily influenced streams (Karr and Chu, 1999). All selected metrics and scoring cutoff points are summarized in Table 4.

Some other multimetric index projects have taken a more standardized approach by trisecting or quadrisecting the ranked metric values, depending on the number of human influence classifications (Maxted *et al.*, 1999; Major *et al.*, 1998). However, as there were lower numbers of uninfluenced streams sampled for this project compared with the number of moderately influenced and highly influenced streams sampled, an equal trisection of the data would have resulted in artificially low cutoff points for the uninfluenced condition, leading to higher overall stream condition scores for some moderately influenced streams.

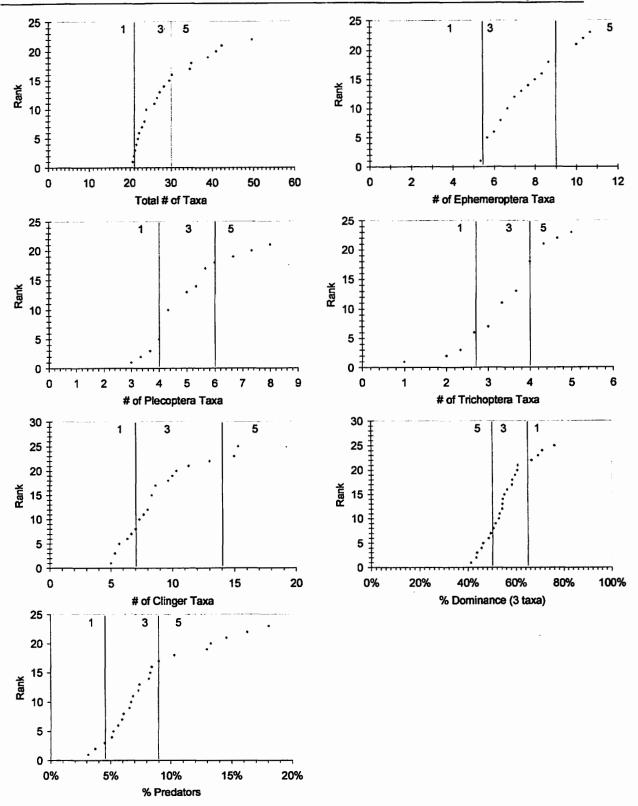


Figure 4: Cutoff scoring values for each metric based on rank distribution of scores for upper Bulkley River watershed streams.

Graphs for scoring intolerant taxa richness and long-lived taxa richness are not shown as there were only two or three possible results for these metrics. In these cases, the maximum value was scored as a 5, the minimum value was scored as a 1 and if there was an intermediate value, it was scored as a 3.

When more data is collected for similar streams in this region, all metrics and their associated scores should be re-evaluated to ensure that the maximum range of possible values have been included.

Metric	Metric Score		
	1	3	5
Total number of taxa	< 22	22 - 30	> 30
Number of Ephemeroptera taxa	< 5.5	5.5 - 9	> 9
Number of Plecoptera taxa	< 4	4.1 - 6	> 6
Number of Trichoptera taxa	< 2.7	2.7 - 3.9	≥4
Number of long-lived taxa	0	1	≥2
Number of intolerant taxa	0		≥1
Number of clinger taxa	< 7	7-13.9	≥ 14
% Predators	< 4.5	4.5 - 9	> 9
% Dominance (3 taxa)	≥ 65	50 - 64	< 50

Table 4: Nine metrics and scoring cutoff points chosen for inclusion in the upper Bulkle	y River
watershed multimetric index.	

4 Results

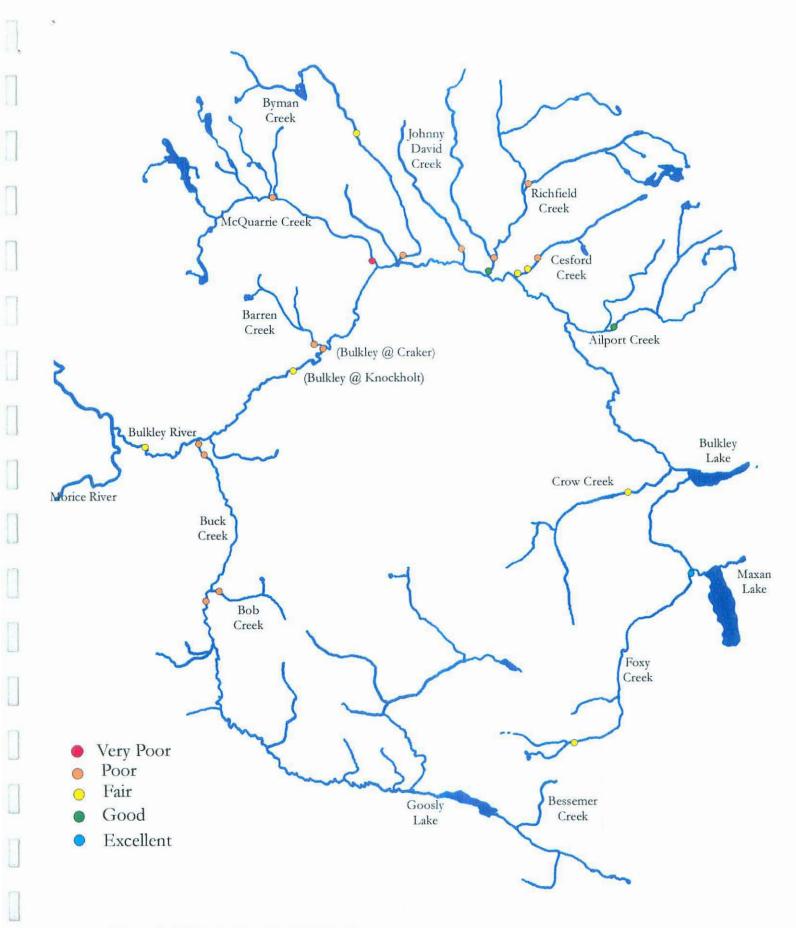
Benthic invertebrate metrics for all streams sampled within the upper Bulkley River watershed were summarized and scored using cutoff points identified in Table 4. The final score was converted to stream condition as shown in Table 5, using 10-metric IBI score cut-off points from the Salmonweb internet site (<u>www.salmonweb.org</u>) which were adjusted to reflect the 9-metric IBI calibrated for the upper Bulkley River watershed. Metric scores for each site were added up to provide one final index score, as presented in Table 6. There were nine metrics included in the index, each of which had a maximum possible score of 5 and a minimum possible score of 1. Therefore, the maximum possible index score was 45 and the minimum possible index score was 9. The actual maximum score for streams sampled was 41 for Foxy Creek at the Maxan Creek confluence, and the minimum score was 15 for McQuarrie Creek above the Highway 16 crossing. Many of the streams sampled were in poor or fair condition as illustrated in Figure 5. Very poor sites are marked in red, while poor sites were orange, fair sites were yellow, good sites were green and excellent sites were blue.

9 Metric Kispiox-Calibrated IBI Score	Stream Condition
41 - 45	Excellent
34-40	Good
25-33	Fair
16-24	Poor
9 - 15	Very Poor

Stream Site	Index of Biological Integrity Score	Stream Condition
McQuarrie downstream	15	Very Poor
Buck @ Confluence	17	Poor
Byman downstream	17	Poor
Buck @ Mall	19	Poor
Bulkley @ Craker Road	19	Poor
Richfield upstream	19	Poor
Bob Creek	21	Роог
Buck Creek above 12km bridge	21	Poor
Cesford upstream	21	Poor
Barren Creek	23	Poor
Johnny David	23	Poor
McQuarrie Upstream	23	Poor
Richfield above Hwy 16	23	Poor
Cesford above Topley	25	Fair
Bulkley @ Morice Confluence	25	Fair
Byman Upstream	29	Fair
Bulkley @ Knockholt bridge	31	Fair
Crow Creek	31	Fair
Cesford @ Topley	33	Fair
Foxy Creek below mine	33	Fair
Ailport Creek	37	Good
Richfield Creek @ CN bridge	39	Good
Foxy Creek @ Maxan	. 41	Excellent

Table 6: Stream sites and condition within the upper Bulkley River watershed.

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5 Discussion

Assessment of twenty-three stream sites within the upper Bulkley River basin has provided a baseline for trend monitoring at those sites over time. For comparison of a number of sites on the same stream, we need to know what level of variability would be expected between two sites on the same stream with similar levels of human influence. Deshon (1995) has investigated this question for the Invertebrate Community Index (ICI), and found that an ICI difference of 4 points or less (out of a total of 60 for a 10 metric index) should be considered a significant departure. If we assume a similar 7% difference to be significant within the upper Bulkley River basin, this would work out to be a difference of 3 points or more. This definition of 'significant' difference between two sites on the same stream, combined with the condition rating (e.g. very poor to excellent), will aid in interpretation of results.

As expected, a decrease in biological integrity between the upstream and downstream sites was found at both Byman and McQuarrie Creeks. In both cases the difference in IBI scores between the upstream and downstream sites was 8 points or more. This suggests that land use increases in the lower watershed, which agrees with air photo analysis. Further analysis of differences between the upstream and downstream sites on these two creeks might allow identification of specific indicator metrics for forest harvesting impacts versus combined land use impacts, as forest harvesting was the main influence in the upper watersheds of both streams.

Concerns regarding the state of Cesford Creek and possible contamination from an old garbage dump, an old transformer station and a rumoured battery dump near the Cesford hill forestry look-out tower lead to three sampling stations on this creek. Two downstream sites, one within Topley and one just upstream of the Granisle Highway were found to be in fair condition. A site further upstream was rated as poor. The site furthest upstream was above the old transformer station, upstream of an old bridge and adjacent to old logging. Whether the poor condition rating was due to an old garbage dump or battery dump influence was not clear. It seems likely that if an old battery dump was affecting the upstream reference site, it would have had some impact on the site upstream of the Granisle Highway as well, which was not the case. In any case, the IBI scores for the three Cesford Creek sites provide a starting point for long term trend monitoring of stream condition.

Ailport Creek had one of the most highly influenced local sampling areas. Samples were collected in an area which was an obvious livestock trail. Despite this, the final IBI score for this stream was relatively high compared with other streams in the upper Bulkley watershed. However, although the instream and riparian condition was poor, the majority of the Ailport Creek watershed was forested with low human influence. This suggests that watershed influences play a larger role than local instream and riparian condition in predicting biological integrity of a stream site. Similar results were found for the Kispiox River IBI calibration project (Rysavy, 2000). During a study of landscape scale influences and stream buffers on stream habitats and biota, Richards et al, (1996) found that whole catchment variables were more predictive of biotic condition than local stream buffer data, even though riparian buffers had a modifying influence on sediment delivery from the catchment basin and reach-scale erosional processes.

One metric which is used as part of the ICI, is relative abundance of Tribe Tanytarsini midges. Tanytarsini midges are intermediate in pollution tolerance and often disappear or decline under moderate human influence (DeShon, 1995). Although this metric was not tested formally for this project, a review of the data found that Tanytarsini midges were found at all sites rated with the IBI as excellent or good condition, and at roughly half of the sites rated as fair condition. Tanytarsini midges were not present at any of the sites rated as poor or very poor condition by the upper Bulkley River calibrated IBI. Based on these preliminary findings, further study and sampling of streams within the upper Bulkley River watershed should include evaluation of this metric. Even without inclusion of the metric in the Bulkley River IBI, it has potential benefit as a tool for assessing stream condition.

Larger river sites, such as the upper Bulkley River, were expected to have slightly lower taxa richness and decreased diversity compared with mid-sized streams due to changes in organic inputs and substrate types (DeShon, 1995). Although samples were collected at three sites in each of Buck Creek and the Bulkley River, these aquatic ecosystems are much larger than the other streams sampled, and as such, should mainly be compared with other sites on the same stream. Although expectations may differ making

comparison of a large stream with a small stream impractical, comparison of a number of sites on one stream or comparison of a single site to itself over time still allows monitoring of changes in biological condition. Concerns were raised by a community member at the start of the Bulkley IBI project regarding the immediate and long-term potential impacts of a garbage dump adjacent to the Bulkley River. Three sites on the Bulkley River were sampled, and results of assessment have created a baseline for comparison of future monitoring results.

Overall, the 9 metric benthic invertebrate Index of Biological Integrity appears to be an effective tool for assessing and monitoring streams within the upper Bulkley River watershed. The applications and expected benefits of this tool are many, and include:

- serving as a stream monitoring and assessment tool for LRMP or other strategic level plan,
- serving as an effectiveness monitoring tool for watershed restoration and stream rehabilitation projects,
- serving as an assessment tool for prioritizing streams for rehabilitation and/ or restoration,
- tracking stream recovery or degradation over the long term, and
- aiding in defensible resource management and planning decisions.

6 Recommendations

To successfully use the IBI for the applications as mentioned above, the following recommendations are made for implementation and further study:

- Sampling of additional reference sites within the upper Bulkley River watershed or from a similar biogeoclimatic zone would serve to strengthen the uninfluenced data range and metric scores.
- The calibrated IBI should be tested and validated with an independent data set.
- Data could be collected for different biogeoclimatic zones around the upper Bulkley. If scoring cutoffs for metrics were similar between ecoregions, perhaps the IBI could be applied over a broader area, without additional work to calibrate it for each region.
- A search for comparable historical benthic invertebrate data would allow calculation of IBI scores for streams in past years, and ultimately provide a historical trend of stream condition for those sites. For example, historical data for both the Bulkley River at the Morice confluence site, and the Foxy Creek at the Maxan confluence site are available, and although sampling techniques were slightly different, the period of collection (late August, early September) was the same (Remington et al., 1993, Remington, 1991 and Perrin, 1999).
- Local calibration of the IBI should be an iterative process. Any additional data collected should be used to re-check the metric trends over a gradient of human influence, and re-affirm the metric scoring cut-off points. Use of relative abundance of predators and Tanytarsini midges as metrics should be re-evaluated.

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Appendix A: Benthic Invertebrate Data

EMS Number		400296	400296	400296	E238800	E238800	E238800
FES Sample Number Site Name		990524 Bulkley @ Morice	990525 Bulkley @ Morice	990526 Bulkley @ Morice	990527 Butkley @ Craker	990528 Bulkley @ Craker	990529 Bulkley @ Craker
Replicate #		1	2	3	1	2	3
units	stage						
Phylum : Nematomorpha Class : Oligochaeta		3			5		
Family : Lumbricidae		3			5		
Family: Naididae							
Nais sp.							
Order : Ephemeroptera	adult						
Order : Ephemeroptera	nymph	17	20	13	21	7	26
Family : Ameletidae	nymph						
Ameletus sp.	nymph	20	7	1	5		
Family : Ephemerellidae	nymph	32	25	21	Π	14	40
Drunella doddsi	nymph						
<u>Drunella grandis</u>	nymph	•					
<u>Drunella sp.</u> Drunella ?	nymph	2		1	4	15	26
Ephemerella	nymph Iarvae						
Serratella sp.	nymph						
Family : Heptageniidae	nymph	3	16	17		16	49
Cinygmula sp.	nymph	-					
Epeorus sp.	nymph						
Rhithrogena sp.	nymph			2	3	16	20
Stenonema	larvae						
<u>1st instar</u>	larvae						
Family : Baetidae	nymph		1	2		1	
Baetis sp.	nymph						3
Baetis ?	nymph						
Family : Leptophlebiidae	nymph	3	2	3		1	1
Paraleptophlebia sp.	nymph				3		
Order : Plecoptera	juvenile	5	28	07			
Order : Plecoptera Family : Capniidae	nymph juvenile		20	27	3	13	14
Family : Capniidae	nymph						
Family : Chloroperiidae	juvenile						
Family : Chloroperlidae	nymph	10	15	4	12	1	21
Kathroperla sp.						-	
Alloperta	larvae						
<u>Paraporta</u>	larvae						
Suwallia sp.	nymph						
Sweltsa sp.	nymph						
Sweltsa complex	nymph						
Sweltsa complex ?	nymph						
Family : Taeniopterygidae	juvenile						
Family : Taeniopterygidae Family : Nemouridae	nymph	4 1	6	2			
Amphinemura sp.	nymph nymph		0	2			
<u>Visoka</u>	larvae						
Nemoura	larvae						
Zapada sp.	nymph						
Zapada ?	nymph						
Family : Periodidae	nymph	6			2	3	3
Megarcys sp.	nymph						-
Megarcys?	nymph						
Isoperla	larvae						
Acrynopteryx	larvae						
<u>1st instar</u>	larvae						
<u>Skwala ?</u> Skwala so	nymph			-			
<u>Skwala sp.</u> Family : Pteronarcyidae	nymph		12	9			
Pteronarcella sp.	nymph nymph	2	4	4	3		45
Pteronarcys sp.	nymph	-	-	4	3	11	15
Family : Perlidae	nymph						
Doroneuria sp.	nymph						
Hesperoperta sp.	nymph						
Family : Leuchridae / Capniidae	nymph						
Phylum : Coelenterata							
<u>Hydra sp.</u>							
Order : Lepidoptera							

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EMS Number FES Sample Number Site Name		400296 990524 Buikley @ Morice	400296 990525 Bulkley @ Morice	4002 96 990526 Bulkley @ Morice	E238800 990527 Buikley @ Craker	E238800 990528 Bulkley @ Craker	E238800 990529 Bulkley @ Craker
Replicate #		1	2	3	1	2	3
units Order: Thysanoptera	stage						
Order: Hymenoptera	adult						
Order : Hemiptera						<u> </u>	······································
Family : Aphididae							
Sub-order : Homoptera	adult						
Sub-order : Homoptera Order : Trichoptera	<u>rrymph</u> iarvae	12	23	7	15		
Order : Trichoptera	juvenile		20	,	15	••	
Order : Trichoptera	pupae						
Family : Glossosomatidae	larvae						
<u>Glossosoma sp.</u>	larvae						
Family : Rhyacophilidae Family : Rhyacophilidae	pupae Iarvae						
Rhyacophila sp.	larvae						
Rhyacophila ?	larvae						
Family : Hydropsychidae	juvenile						
Family : Hydropsychidae	larvae	7					6
Arctopsyche sp.	larvae						
Hydropsyche sp. Hydropsyche 2	larvae Iarvae						
<u>Hydropsyche ?</u> Ceratopsyche ?	larvae larvae	3	34	52		9	4
Parapsyche sp.	larvae	•	•••			U U	-
Family : Brachycentridae	larvae	7	3	2			
Brachycentrus sp.	larvae						
Family : Hydroptilidae	juvenile						
Family : Hydroptiidae ?	pupae						
Family : Hydroptilidae Family : Hydroptilidae ?	larvae larvae		1		1	1	1
Family : Limnephilidae	juvenile						
Family : Limnephilidae	larvae						
Dicosmoecus sp.	larvae		<u> </u>				
Order : Diptera	adult		6	. 10			1
Order : Diptera	pupae	9	7	5	2	3	5
Order : Diptera Family : Dixidae	larvae larvae						
Family : Chironomidae	adult						
Family : Chironomidae	pupae						
Family : Chironomidae	larvae	230	165	127	49	84	188
Sub-family : Orthocladlinae	larvae	8	44	14	Present	11	28
<u>Crictopus_spp.</u>	larvae						
<u>Crictopus / Orthocladius sp.</u> Orthocladius sp.	larvae larvae						
Corynoneura sp.	larvae						
Eukiafferiella sp.	larvae						
<u>Eukiefferiella sp. ?</u>	larvae						
Rheocricotopus sp.	larvae						
<u>Thienemanniella sp.</u> Suporthoologuio ap	larvae						
<u>Synorthocladuis sp.</u> Sub-family : Prodiamesinae	larvae Iarvae						
Sub-family : Diamesinae	larvae						
Boreoheptgyia sp.	larvae						
<u>Diamesa sp.</u>	iarvae						
<u>Diamesa ?</u>	larvae						
<u>Pagastia sp.</u> Potthastia sp.	larvae						
Potthastia sp. Sub-family : Tanypodinae	larvae Iarvae	16	Present				
Thienemannimyla group	larvae						
Sub-family : Tanytarsini	larvae						
Tribe : Tanytarsini	pupae						
Tribe : Tanytarsini	larvae	40					
Sub-family : Chironominae Micropsectna sp.	larvae larvae	16					
Family : Empididae	larvae						
<u>Chelifera sp.</u>	larvae						
Oreogeton sp.	larvae						
Family : Ceratopogonidae	larvae						
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EMS Number FES Sample Number		400296 990524	400296 990525	400296 990526	E238800 990527	E238800 990528	E238800 990529
Site Name			Bulkley @ Morice		Bulkley @ Craker	Bulkley @ Craker	Buikley @ Craker
Replicate #		1	2	3	1	2	3
units	stage						
Bezzia / Probezzia sp.	larvae	2	2		_		1
Family : Tipulidae	larvae	4	5	1	3		6
Tipula abdominalis	larvae						
Dicranota sp.	larvae						
<u>Hexatoma sp.</u>	larvae						
Rhabdomastix sp.	larvae						
Antocha sp.	larvae						
Family : Athericidae	larvae						_
<u>Atherix sp.</u>	larvae			-	4	6	5
Family : Simuliidae	larvae		1	2			
Family : Simuliidae	pupae						
<u>Cnephia sp.</u>	larvae						
<u>Simulium sp.</u>	pupae						
<u>Simulium sp.</u>	larvae						
<u>Simulium ?</u>	larvae						
Family : Stratiomyidae	larvae						
Family : Tanyderidae	larvae						
Protoplasa fitchii	larvae						
Family : Psychodidae	larvae						
Pericoma sp.	larvae		11		- <u> </u>	· · · · · · · · · · · · · · · · · · ·	
Order : Coleoptera	adult	1	1				
Family : Elmidae	adult						•
Family : Elmidae	larvae		2	1	2	3	3
<u>Lara sp.</u>	larvae						
Narpus ?	larvae						
Optioservus sp.	larvae						
Family : Ourculionidae ? Family : Dytiscidae	larvae						
Family : Gyrinidae ?	iarvae						
Order : Collembola	101100						
Family : Sminthuridae							
Sub-Class : Ostracoda							
Sub-class : Copepoda				•			
Order : Cyclopoida							
Order : Harpacticoida							
Phylum : Nematoda		3	2	1			
Class: Arachnoida		~		<u> </u>			
Group : Hydracarina		8	12	3	33	23	60
Family : Protziidae		-		-			••
Wandesia sp.							
Division : Oribatei							
Phylum : Mollusca							
Class : Gastropoda							
Family : Planorbidae							
Order : Pelecypoda							1
Phylum : Platyhelminthes							
Class : Turbeilaria							
Polycelis coronata							
Total		404	445	004			
Total # of Taxa		434	445	331	247	249	538
# of Ephemeroptera		27	27	24	20	20	24
# of Plecoptera # of Plecoptera		6	6	8	6	7	7
# of Tricoptera		6 4	5 4	5 3	4	4	4
# of Long- Lived Taxa (sv?)		-	4	3	2	3	4
# of Long- Lived Taxa (sv?) # of intolerant Taxa		1			1		
# of Individuals in Tol. Taxa		0	0.000	0.000	0		
% of Predator Individuals		0.69% 7.83%	0.22% 6.52%	0.00%	4.05%	2.81%	1.12%
# of Clinger taxa		7.83%	6.52%	3.93% 8	7.29%	4.02%	5.58%
% dominance (3 taxa)		65%	55%	62%	4 64%	6	7
% Oligochaetes		0.7%	0.0%	0.0%		49%	55%
% Chironomids		62.2%	47.0%	42.6%	2.0%	0.0%	0.0%
		02.476	-1.V76		19.8%	38.2%	40.1%

EMS Number FES Sample Number Site Name		E238643 990335 Buikley Knockholt	E238643 990336 Bulkley Knockholt	E238643 990337 Buikley Knockholt	E238636 990320 Foxy Maxan	E238636 990321 Foxy Maxan	E238636 990322 Foxy Maxan
Replicate #		1	2	3	1	2	3
units	stage						
Phylum : Nematomorpha						1	4
Class : Oligochaeta Family : Lumbricidae						•	-
Family: Naididae							
Nels sp.							
Order : Ephemeroptera	adult						
Order : Ephemeroptera	nymph	13	14	16		4	60
Family : Ameletidae	nymph						
Ameletus sp.	nymph			2	2	2	17
Family : Ephemerellidae	nymph		3	17	8	22	34
<u>Drunella doddsi</u>	nymph			4	66	48	98
<u>Drunella grandis</u> <u>Drunella sp.</u>	nymph nymph			-	5	6	15
Druneila ?	nymph				5	Ū	10
<u>Ephemerella</u>	larvae						
Serratella sp.	nymph					2	4
Family : Heptageniidae	nymph		39	92	2	11	48
Cinygmula sp.	nymph				4	9	9
Epeorus sp.	nymph		1	1	6	9	13
Rhithrogena sp.	nymph	81	79	128	6	26	14
Stenonema	larvae						
<u>1st instar</u>	larvae						
Family : Baetidae	nymph		35	30	78	181	96
<u>Baetis sp.</u> Baetis ?	nymph nymph		35	30	76	101	90
Family : Leptophlebiidae	nymph						
Paraleptophlebia sp.	nymph		8	46			
Order : Plecoptera	juvenile		1	6	2	7	5
Order : Plecoptera	nymph						
Family : Capniidae	juvenile	•					
Family : Capniidae	nymph		3	1	5	1	3
Family : Chloroperlidae	juvenile			•			
Family : Chloroperlidae	nymph	24	13	23	5	2	29
Kathroperla sp.	1						
<u>Alloperta</u> Paraperta	larvae larvae						
Suwallia sp.	nymph						
Sweltsa sp.	nymph						
Sweltsa complex	nymph	23	32	24	6	40	20
Sweltsa complex ?	nymph						
Family : Taeniopterygidae	juvenile						
Family : Taeniopterygidae	nymph				2	1	
Family : Nemounidae	nymph						
Amphinemura sp.	nymph	1					
Visoka	larvae						
<u>Nemoura</u> Zapada sp.	larvae		1	2	22	34	42
Zapada <u>?</u>	nymph nymph		•	2		34	42
Family : Periodidae	nymph		2	3	2		5
Megarcys sp.	nymph		_	2	_		·
Megarcys?	nymph						
Isoperta	larvae						
Acrynopteryx	larvae						
<u>1st instar</u>	larvae						
Skwala ?	nymph						
Skwela sp.	nymph		1	7		1	
Family : Pteronarcyidae <u>Pteronarcella sp.</u>	nymph		7	13			
Pteronarcella sp. Pteronarcys sp.	nymph nymph		/	13		1	2
Family : Perlidae	nymph				2		2 5
Doroneuria sp.	nymph				2		5
Hesperoperta sp.	nymph						
Family : Leuctridae / Capnildae	nymph						
Phylum : Coelenterata							
<u>Hydra sp.</u>			<u> </u>			1	1
Order : Lepidoptera							

Bio Logic Consulting

EMS Number FES Sample Number		E238643 990335 Buikley Knockholt	E238643 990336 Bulkley Knockholt	E238843 990337 Bulkley Knockhott	E238836 990320 Foxy Maxan	E238636 990321 Foxy Maxan	E238636 990322 Foxy Maxan
sibe Name Replicate #			2	3	1	2	3
inits	stage	•	_				
Order: Thysanoptera	aduit		1		1		
Order: Hymenoptera							22
Order : Hemiptera							
amily : Aphididae							
Sub-order : Homoptera	adult						
Sub-order : Homoptera	nymph		11	1	2	1	2
Order : Trichoptera	larvae						
Order : Trichoptera	juvenile	3	3	1	2	8	110
Order : Trichoptera	pupae						1
amily : Glossosomatidae	larvae						
Glossosoma sp.	larvae				1	2	3
amily : Rhyacophilidae	pupae						
amily : Rhyacophilidae	larvae						
Rhyacophila sp.	larvae				6	6	13
Rhyacophila ?	larvae						
amily : Hydropsychidae	juvenile	3	23	30			4
amily: Hydropsychidae	larvae	· · ·				2	
	larvae					_	
Arctopsyche sp.			5	2			
Hydropsyche sp.	larvae		5	2			
Hydropsyche ?	larvae						
Ceratopsyche ?	larvae						
Parepsyche sp.	larvae						
Family : Brachycentridae	larvae						
Brachycentrus sp.	larvae						
Family : Hydroptilidae	juvenile	e 1		2			
Family : Hydroptilidae ?	pupae						
Family : Hydroptilidae	larvae						
Family : Hydroptilidae ?	larvae						
Family : Limnephilidae	juvenile	•			3	2	5
Family : Limnephilidae	larvae						
Dicosmoecus sp.	larvae	1					
Order : Diptera	adult					4	4
Order : Diptera	pupae						
Order : Diptera	larvae						2
Family : Dbidae	larvae						
	adult		1		3	1	1
Family : Chironomidae		2	4	5	2	3	4
Family : Chironomidae	pupae		15	13	23	•	260
Family : Chironomidae	larvae		42	52	28	95	158
Sub-family : Orthodadiinae	larvae					_	
Crictopus spp.	larvae		17	29	10	8 2	
Crictopus / Orthocladius sp.	larvae					2	
Orthocladius sp.	larvae						
Corynoneura sp.	larvae		1			1	1
<u>Eukiefferiella sp.</u>	larvae	3	6	11			
Eukiefferiella sp. ?	larvae						
Rheocricotopus sp.	larvae						
Thienemanniella sp.	larvae	10	4	5	2	5	
Synorthocladuis sp.	larvae						
Sub-family : Prodiamesinae	larvae						
Sub-family : Diamesinae	larvae						19
Borecheptgvia sp.	larvae				1		
Diamesa sp.	larvae						
<u>Diamesa ?</u> Respectio se	larvae						
<u>Pagastia sp.</u>	larvae				8	6	
Potthastia sp.	larvae				8 1	6 1	1
Sub-family : Tanypodinae	larvae		1		1	1	1
Thienemannimyia group	larvae						
Sub-family : Tanytarsini	larvae						
Tribe : Tanytarsini	pupae						
Tribe : Tanytarsini	larvae	2		5	11	43	58
Sub-family : Chironominae	larvae	•			1		
Micropsectra sp.	larvae	2					
Family : Empididae	larvae	•					
Chelifera sp.	larvae					1	
Oreogeton sp.	larvae						

Balder for ochant Balder for ochant Four Mann	EMS Number FES Sample Number		E238643 990335	E238643 990336	E238843 990337	E238636 990320	E238636 990321	E238636 990322
International and a stage Import Products and a strategy of the stage of the strategy	Site Name		Bulkley Knockholt	Bulkley Knockholt	Bulkley Knockholt	Foxy Maxan	Foxy Maxan	•
Bergie / Character and Bergie / Character and Bergi / Character and Bergie / Character and Bergie / Character and	Replicate #		1	2	3	1	2	3
Damp: Transform Longe 1 1 1 Diagram Longe 1 1 1 Diagram Longe 1 1 1 Diagram Longe 1 2 6 1 5 Diagram Longe 1 2 6 1 5 Diagram Longe 1 2 6 1 6 Particity Structure Longe 2 41 23 1 6 2 Particity Structure Longe 2 41 23 1 6 2 Particity Structure Longe 2 41 23 1 6 2 Particity Structure Longe 2 3 7 6 1 7 Particity Structure Longe 2 3 7 6 1	units	stage						
Tangi aboannangi Bandionnangi Bandi Bandionangi Bandionnangi Bandionnangi Bandionnangi Bandionnangi						1	3	5
Dampatia urve 1 Backbandla Ja. urve 2 6 1 5 Backbandla Ja. urve 2 6 1 5 Backbandla Ja. urve 2 1 8 2 Family : Simulitize urve 2 41 23 1 8 2 Family : Simulitize urve 2 41 23 1 8 2 Simulatina Ja. urve 2 41 23 1 8 2 Simulatina Ja. urve 3 1 <td>Family : Tipulidae</td> <td></td> <td>1</td> <td>1</td> <td>1</td> <td></td> <td></td> <td></td>	Family : Tipulidae		1	1	1			
Image and any and any and any and any	<u>Tipula abdominalis</u>					1		1
Backbonski zm. Luvae Faruhy / Ehrotkike Luvae Straktike / Ehrote 2 Straktike / Ehrote 3 Straktike / Ehrote 1 <	Dicranota sp.		1		-			_
Anderson Larvae Attends Sa Larvae 1 2 Attends Sa Larvae 1 2 Kannity - Simulicitie Durvae 2 41 23 1 8 2 Kannity - Simulicitie Durvae 2 41 23 1 8 2 Kannity - Simulicitie Durvae 2 41 23 1 8 2 Simuliani an Durvae 1 - <td><u>Hexatoma sp.</u></td> <td>larvae</td> <td></td> <td>2</td> <td>6</td> <td>1</td> <td></td> <td>5</td>	<u>Hexatoma sp.</u>	larvae		2	6	1		5
Family : Enclose Enclose <thenclose< th=""> Enclose <thenclose< th=""></thenclose<></thenclose<>	Rhabdomastix sp.	larvae						
Jamma Annone Invoice 1 2 Family Simulitate puppe 2 41 23 1 6 2 Family Simulitate puppe 3 1 6 2 Simulitata A. puppe 3 1 6 2 Simulatina A. puppe 3 1 1 Simulatina A. puppe 3 1 1 Simulatina A. puppe 3 7 6 Simulatina A. puppe 3 7 6 <tr< td=""><td>Antocha sp.</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>	Antocha sp.							
Earthy: Simulicable Invole Simulicable Invole I	Family : Athenicidae	larvae						
Carding San Property Simulation San <td><u>Atherix sp.</u></td> <td>larvae</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	<u>Atherix sp.</u>	larvae						
Conceptie So. Larvate Strauturn 30. Larvate Strauturn 30. Larvate Strauturn 30. Larvate Strauturn 21. Larvate Strauturn12. Larvate <td< td=""><td>Family : Simuliidae</td><td>larvae</td><td>2</td><td>41</td><td>23</td><td>1</td><td>8</td><td>2</td></td<>	Family : Simuliidae	larvae	2	41	23	1	8	2
Simulation a. puppe Simulation a. karve Simulation a. karve Simulation 2. karve Simulation 2. karve Simulation 2. karve Simulation 2. S Simulation 2. S <t< td=""><td>Family : Simuliidae</td><td>pupae</td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	Family : Simuliidae	pupae						
Simulan AL Simulan Z Iarvae Simulan Z Iarvae Simulan Z Iarvae Samuly : Strationydoe Iarvae Samuly : Strationydoe Iarvae Samuly : Strationydoe Iarvae Samuly : Strationydoe Iarvae Samuly : Employee 2 Samuly : Employee 3 7 Samuly : Employee 2 3 7 Samuly : Employee 1 2 2 Samuly : Employee 1 1 6 Samuly : Samul	<u>Cnephia sp.</u>	larvae						
Simular 2 larvae 3 1 Family : StrationyXdae larvae 1 1 1 Protochasz Michi larvae 1	<u>Simulium sp.</u>	pupae						
Family : Chardyderidae Iarvae 3 1 Family : Taryderidae Iarvae 1 1 1 Family : Taryderidae Iarvae 35 62 98 Family : Endose adult 2 1 2 1 Family : Endose adult 2 1 2 1 Family : Endose adult 2 3 7 8 Family : Endose Iarvae 3 7 8 1 Family : Endose Iarvae 3 7 8 1	<u>Simullum sp.</u>	larvae						
Tanah : Tanah Kabu karwa in the serve in the	Simulium ?	larvae						
Darbage Mitheline Janvae Ramity : Reychoodidae Jarvae 35 62 68 Ramity : Reychoodidae Jarvae 35 62 68 Order : Cokepotera adult 2 1 2 Famity : Emidee Jarvae 3 7 8 Jarra BL Jarvae 3 7 8 Jarra BL Jarvae 3 7 8 Jarra BL Jarvae 2 2 3 7 8 Jarra BL Jarvae 1 1 4 6 1 1 6 1 1 1 6 1	Family : Stratiomyldae	larvae				3		1
Famble Flagshouldage Jarobe 35 92 98 Particerans an, Cherri Colleption adult 2 1 2 Famble, Elmidae adult 2 3 7 8 Famble, Elmidae adure 2 2 2 2 Carlassourse an, Famble, Elmidae I 1 4 6 7 8 Carlassourse an, Famble, Elmidae 1 1 1 6 6 6 8 8 8 8 8 8 8 8 8 8 6 7 1 </td <td>Family : Tanyderidae</td> <td>larvae</td> <td></td> <td>1</td> <td></td> <td></td> <td></td> <td></td>	Family : Tanyderidae	larvae		1				
Partonne sn. Jarvae 35 92 98 Order : Colexptera adut 2 1 2 Samthy : Emitoke alvae 3 7 8 Samthy : Emitoke alvae 3 7 8 Manue : T alvae 3 7 8 Manue : T alvae 2 2 Optionnum : Son lavae 2 2 Sondors : Sondors : Sondors : Sondors : Concolonidae ? 1 1 1 Famithy : Ourcalonidae ? 1 1 1 6 Sub-Case : Concolonida : Lavae 4 1 4 6 Sond-Case : Concolonida : Lavae 1 1 2 0 Sub-Case : Concolonida : Concolonida : Lavae 1 2 3 2 Order : Harpacktockiche 1 2 3 2 3 3 Sub-Case : Conconda : Conconda : Lavae 1 1 3 3 3 3 Sub-Case : Conconda : Lavae 1	Protoplasa fitchii	larvae						
Order : Colepters adult 2 Family : Emiliate aburd 3 7 8 Family : Emiliate farvace 3 7 8 family : Emiliate farvace 3 7 8 family : Emiliate farvace 2 2 2 Different : Collectoriate : 2 farvace 1 1 1 Family : Controlide ? farvace 1 1 6 Collectoriate : Collectoriate : 2 farvace 1 1 6 Collectoriate : C	Family : Psychodidae	larvae						
Family : Bindale adult Family : Bindale knows 2 3 7 8 Family : Control on the serve 2 3 7 8 Manues 7 larvae 2 2 Manues 7 larvae 1 1 Family : Optications as larvae 1 1 1 Family : Optications as larvae 1 4 8 Family : Optications as larvae 1 1 4 8 Family : Optications as larvae 1 1 1 6 Sub-Class : Obstroads 1 1 2 3 7 8 Sub-Class : Obstroads 1 1 1 2 3	Pericoma sp.	larvae				35	92	98
Family : Emitabe karvase 2 3 7 8 Lanz B. larvase larvase 2 2 Lanz B. larvase 2 2 Defision Vision larvase 1 1 Family : Curculandate ? larvase 1 1 Family : Curculandate ? larvase 1 1 6 Stand B.S. Stand B.S. 1 1 1 6 Stand Standse ? larvase 1 1 1 6 Stand Standse ? larvase 1 1 1 1 1 Stand Standse ? 1	Order : Coleoptera	adult	2	1		2		
Jama Bab. Jarvale 2 Manus Z Jarvale 2 Manus Z Jarvale 1 Family : Controlication 7 Jarvale 1 Family : Controlication 7 Jarvale 1 Family : Controlication 7 Jarvale 1 Criter : Coloritobal 4 1 4 Sub-Class : Operacoda 1 2 3 Corder : Schopolda 1 2 3 Order : Coloritobal 1 2 3 Corder : Coloritobal 1 1 1 Corder : Coloritobal 1 1 1 Corder : Coloritobal 1 1 1 2 Corder : Coloritobal 1 1 1 1 1 Class : Corporda 1 1 1 1 3 3 Class : Corporda 1 1 1 1 3 3 3 3 3 3 3 3 3 3 3 <td>Family : Elmidae</td> <td>adult</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Family : Elmidae	adult						
Manual 2 larvae 2 Outlinearius au. larvae 1 Carting : Curcifondae ? 1 1 Family : Dydiskde larvae 1 Family : Dydiskde ? larvae 1 Coter : Collembola 4 1 4 Order : Collembola 1 1 1 Coter : Collembola 1 1 2 Sth-Class : Costrancia 1 2 3 Coter : Harpacticokia 1 1 1 1 Creas: Aractinokia 8 5 20 1 4 39 Family : Protzikiae 1 1 1 1 1 1 Greus : Hydroxatria 8 5 20 1 4 39 Family : Protzikiae 1 1 3 3 3 3 Order : Harpactiokias 2 1 1 6 3 Order : Harpactiokia 2 1 1 3 3	Family : Elmidae	larvae	2			3	7	8
Dataservirs sp. larvae 1 Family : Discolar 1 1 1 Family : Discolar 1 1 4 6 Family : Discolar 1 1 1 6 Family : Sinchards ? Invae 1 1 1 6 Sub-Class : Ostracoda 1 1 1 2 7 Sub-Class : Ostracoda 1 2 3 7 4 30 Order : Olytopoida 1 2 3 3 3 3 3 3 Order : Olytopoida 1 2 3	Lara sp.	larvae						
Tamily : Curculandade ? Inverse 1 Family : Cyridioda 1 I anvae 1 1 6 Stindae 7 Invae 1 1 6 Stindae 7 Invae 4 1 1 6 Stindae 7 Invae 4 1 1 6 Stindaes : Copeoda 1 1 2 0 4 Stindaes : Copeoda 1 2 3 2 1	Narpus ?	larvae						2
Family : Dytiszdae larvae 1 Family : Cyrinidae ? larvae 1 4 6 Family : Sminthunidae 1 1 1 6 Sub-Case : Ostracoda 1 1 1 6 Sub-Case : Costracoda 1 2 7 4 Sub-Case : Costracoda 1 2 3 2 Order : Clyclopoida 1 2 3 3 3 Order : Clyclopoida 1 2 3	Optioservus sp.	larvae						1
Tamp: 2 Grinde ? larvee Criter : Collembola 4 1 4 6 Sub-Class : Ostracoda 1 1 1 6 Sub-Class : Costracoda 1 2 4 Sub-Class : Costracoda 1 2 3 Order : Cyclopoida 1 2 3 Order : Harpacticoida 1 1 1 1 Gass: Arachnoka 1 1 1 3 Gass: Arachnoka 1 3 3 3 3 Division : Oribatei 2 1 1 6 7 Phylum : Natykeiteminthes 2 1 1 6 7 Phylum : Platykeiteminthes - - - - - Cass : Gastropoda - - - - - Phylum : Platykeiteminthes - - - - - Cass : Gastropoda - - - - - - <tr< td=""><td>Family : Curculionidae ?</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>	Family : Curculionidae ?							
Order : Collembola 4 1 4 6 Family : Sintriburidae 1 1 1 6 Sub-Class : Ostraooda 4 4 6 Sub-Class : Ostraooda 4 4 6 Sub-class : Ostraooda 1 2 3 Order : Harpacticoida 1 2 3 Order : Harpacticoida 1 2 3 Class: Arachnolda 1 1 1 1 Group : Hydracarina 8 5 20 1 4 39 Tamity : Proteitidae 1 3 30 30 30 30 Wandesits st. 1 3 3 30 30 30 30 Otision : Oribatei 2 1 1 6 30 5 Phyturn : Nolusca 3 3 36 35 44 49 66 Class : Castropoda - - 1 1 1 1 1	Family : Dytiscidae							1
Name 1 1 1 1 6 Sub-Class : Costracoda		larvae		·				
Sub-Class : Ostracoda 4 Sub-Class : Copeoda 1 2 Order : Cyclopokia 1 2 Phytein : Nematoda 1 2 Class: Arachnokia 1 1 Group : Mydrazrina 8 5 20 Torup : Mydrazrina 8 5 20 1 4 Group : Mydrazrina 8 5 20 1 3 Verkissi as, Drubision : Oribatei 2 1 1 6 Phytum : Mollusca - - 6 Class : Castropoda - - - Framily : Pinorbidae - - - Order : Pelocypoda - - - Phytem : Natyhelminthes - - - Class : Turbellaria - - - - Paycelis coronata - - - - Order : Pelocypoda - - - - Phytein : Nebeotota - - - - Order : Pelocypoda - - - - Phytein : Nebeotota 33 36 35 44 49 66 # of Taxa 33 36	Order : Collembola						4	-
Sub-dass : Copepada Order : Cyclopokla	Family : Sminthuridae			1	1	1		
Order : Cyclopoida 1 2 Order : Harpacticokia 2 Phylum : Nematoda 1 2 Dass: Anachnoida 1 1 Group : Hydracarina 8 5 20 1 4 39 Family : Protziidae 1 3 30 30 30 Wandesia sp. 1 3 3 30 30 30 Division : Oribatei 2 1 1 6 6 6 6 6 6 8 6 6 6 8 8 8 8 8 8 8 8 6	Sub-Class : Ostracoda							4
Order : Karpacticokia 2 Phytum : Nematoda 1 2 3 Class: Arachnoida 1 1 1 1 Cass: Arachnoida 1 1 1 1 3 Class: Group : Hydracarina 8 5 20 1 4 39 Family : Protziklae 1 3 3 6 6 7 1 6 7 7 1 6 7 1 6 7 7 9 9 11 1 6 7 1 1 6 7 7 9 9 1 3 7 1	Sub-class : Copepoda							
Phytum : Nematoda 1 2 3 Class: Arachnokia 1 1 1 1 Group : Hydracarina 8 5 20 1 4 39 Family : Protzikdae - Mandesia sp. 1 3 Dhiston : Oribatei 2 1 1 6 Phytum : Moliusca - - - - Class : Gastropoda - - - - Samily : Flanortikide - - - - - Order : Peleoppoda - - - - - - Phytum : Riskyhelmithes - <	Order : Cyclopoida						1	
Class: Arachnokia 1 1 1 Group: Hydracarina 8 5 20 1 4 39 Family : Protziidae 7 1 3 3 Wandesia sp. 1 3 3 Division : Oribatei 2 1 1 6 Phytum : Moliusca - - - - Class : Gastropoda - - - - Samily : Planorbidae - - - - Order : Pelecypoda - - - - - Phytum : Platyhelminthes - <td>Order : Harpacticoida</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Order : Harpacticoida							
Group : Hydracarina 8 5 20 1 4 39 Family : Protzikkae 1 3 1 3 Division : Oribatei 2 1 1 3 Division : Oribatei 2 1 1 6 Phytum : Molusca - - - - Class : Gastropoda - - - - Family : Planorbidae - - - - Order : Pelecypoda - - - - Phytum : Platyhelminthes - - - - Coss : Turbelaria 347 421 625 379 724 1369 # of Taxa 33 36 35 44 49 66 # of Flaceptora 6 8 8 8 8 8 # of Clong- Lived Taxa (sv?) 1 1 # 5 6 # of Individuats In Tol. Taxa 0.58% 1.19% 0.96% 0.79%	Phylum : Nematoda					1		
Family : Protzikace 1 3 Wandesia sp. 2 1 6 Phylum : Mollusca - - 6 Class : Gastropoda - - - Samily : Planotbidae - - - Order : Pelecypoda - - - Phylum : Platyhelminthes - - - Class : Turbeliaria - - - Polycelis coronata - 1 - Total 347 421 625 379 724 1369 # of Taxa 33 36 35 44 49 56 # of Taxa 33 36 35 44 49 56 # of Plocoptora 6 8 8 8 8 8 8 # of Intooptora 4 3 4 4 5 5 # of Intolerant Taxa 0 1 - 1 - % of Individuals In Tol. Taxa 0.68% 1.19% 0.96% 0.79% 0.28% 0.51%	Class: Arachnoida							
Wandesia sp. 1 3 Dhiston : Oribatei 2 1 6 Phylum : Mollusca - - - Class : Gastropoda - - - Smily : Planorbidae - - - Order : Pelecypoda - - - Phylum : Platyhelminthes - - - Class : Turbellaria - - 1 - Polycells coronata - - - 1 - Total 347 421 625 379 724 1369 # of Taxa 33 36 35 44 49 56 # of Ephemoroptora 10 7 9 9 11 11 # of Tricoptora 4 3 4 4 5 5 # of Intolorant Taxa 0 1 - 1 - # of Individuals In Tol. Taxa 0.65% 1.19% 0.28% 0.51% 6 <	Group: Hydracarina		8	5	20	1	4	39
Division : Oribatei 2 1 6 Phytum : Mollusca -	Family : Protziidae							
Phylum : Mollusca - Glass : Gastropoda - Family : Planorbidae - Order : Pelecypoda - Phylum : Platyhelminthes - Class : Turbellaria - Polvcelis coronata 1 Total 347 421 625 379 724 1369 # of Taxa 33 36 35 44 49 66 # of Ephemeroptera 10 7 9 9 11 11 # of Plecoptera 6 8 8 8 8 8 # of Incoptera 1 1 1 1 1 1 # of Incoptera 6 8 8 8 8 8 # of Individuals In Tol. Taxa 0.58% 1.19% 0.96% 0.79% 0.28% 0.51% % of Individuals 16.43% 12.11% 10.40% 6.33% 7.60% 6.21% % of Olinger taxa 10 9 10 13 15 17 % of Olinger taxa 10% 9	<u>Wandesia sp.</u>						1	3
Class : Gastropoda	Division : Oribatei			2	1		1	6
Family : Planorbidae Order : Pelecypoda Phytum : Platyhelminthes Class : Turbellaria Polycells coronata 1 Total 347 421 625 379 724 1369 # of Taxa 33 36 35 44 49 66 # of Taxa 10 7 9 9 11 11 # of Placoptera 6 8 8 8 8 8 # of Plocoptera 6 8 8 8 8 8 8 # of Incoptera 1 </td <td>Phytum : Mollusca</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Phytum : Mollusca							
Order : Pelecypoda Phytum : Platyhelminthes Class : Turbellaria Polycel/ls coronata Total 347 421 625 379 724 1369 # of Taxa 33 36 35 444 49 66 # of Taxa 10 7 9 9 11 11 # of Plocoptera 6 8 8 8 8 8 # of Tricoptera 6 8 8 8 8 8 8 # of Tricoptera 1	Class : Gastropoda				-			
Phylum : Platyhelminthes Class : Turbellaria Polycells coronata Total 347 421 625 379 724 1369 # of Taxa 33 36 35 44 49 66 # of Taxa 33 36 35 44 49 66 # of Ephameroptera 10 7 9 9 11 11 # of Plecoptera 6 8 8 8 8 8 8 # of Incolerant Taxa 0 1 1 1 1 1 # of Individuals in Tol. Taxa 0.56% 1.19% 0.96% 0.79% 0.28% 0.61% % of Predator Individuals 16.43% 12.11% 10.40% 6.33% 7.60% 6.21% % of Clinger taxa 10 9 10 13 15 17 % dominance (3 taxa) 49% 38% 44% 47% 51% 39% % Oilgochaetes 0.0% 0.0% 0.0% 0.0% 0.3% 0.3%	Family : Planorbidae							
Class : Turbellaria 1 Polycells coronata 1 Total 347 421 625 379 724 1369 # of Taxa 33 36 35 44 49 56 # of Taxa 10 7 9 9 11 11 # of Plecoptera 6 8 8 8 8 8 # of Plecoptera 6 8 8 8 8 8 8 # of Intolerant Taxa 0 7 9 9 11 11 # of Intolerant Taxa 0.58% 1.19% 0.96% 0.79% 0.28% 0.51% % of Individuals In Tol. Taxa 0.58% 1.19% 0.96% 0.79% 0.28% 0.51% % of Clinger taxa 10 9 10 13 15 17 % dominance (3 taxa) 49% 38% 44% 47% 51% 39% % Oilgochaetes 0.0% 0.0% 0.0% 0.0% 0.3% 0.3%	Order : Pelecypoda							
Polycelis coronata 1 Total 347 421 625 379 724 1369 # of Taxa 33 36 35 44 49 56 # of Taxa 10 7 9 9 11 11 # of Plecoptera 6 8 8 8 8 8 # of Plecoptera 6 8 1 4 5 5 # of Intolerant Taxa 0 1 1 1 1 # of Intolerant Taxa 0.58% 1.19% 0.96% 0.79% 0.28% 0.51% % of Individuals in Tol. Taxa 0.58% 1.19% 0.96% 0.79% 0.28% 0.51% % of Predator Individuals 16.43% 12.11% 10.40% 6.33% 7.60% 6.21% # of Clinger taxa 10 9 10 13 15 17 % dominance (3 taxa) 49% 38% 44% 47% 51% 39% % Oiligoc	Phytum : Platyhelminthes				_			
Total 347 421 625 379 724 1369 # of Taxa 33 36 35 44 49 56 # of Ephemeroptera 10 7 9 9 11 11 # of Plecoptera 6 8 8 8 8 8 # of Plecoptera 6 8 8 8 8 8 8 # of Intolerant Taxa 4 3 4 4 5 5 # of Intolerant Taxa 0 1 1 1 1 % of Individuals in Tol. Taxa 0.58% 1.19% 0.96% 0.79% 0.28% 0.51% % of Predator Individuals 16.43% 12.11% 10.40% 6.33% 7.60% 6.21% % of Clinger taxa 10 9 10 13 15 17 % dominance (3 taxa) 49% 38% 44% 47% 51% 39% % Oilgochaetes 0.0% 0.0% 0.0	Class : Turbellaria							
# of Taxa 33 36 35 44 49 56 # of Ephemeroptera 10 7 9 9 11 11 # of Plecoptera 6 8 8 8 8 8 8 # of Plecoptera 6 8 8 8 8 8 8 8 8 8 8 9 9 11	Polycells coronata							1
# of Taxa 33 36 35 44 49 56 # of Ephemeroptera 10 7 9 9 11 11 # of Plecoptera 6 8 8 8 8 8 8 # of Plecoptera 6 8 8 8 8 8 8 8 8 8 8 9 9 11								
# of Ephameroptera 10 7 9 9 11 11 # of Piecoptera 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 9 11 11 14 6 9 9 11 11 8 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 6 6 5 6 5	Total		347	421	625	379	724	1369
# of Plecoptera 6 8 8 8 8 8 8 8 9 9 9 1 9 1 <th1< th=""> 1 1</th1<>	# of Taxa		33	36	35	44	49	56
# of Plecoptera 6 8 8 8 8 8 8 # of Tricoptera 4 3 4 4 5 5 # of Tricoptera 4 3 4 4 5 5 # of Intolerant Taxa 0 1 1 1 1 % of Individuals in Tol. Taxa 0.58% 1.19% 0.96% 0.79% 0.28% 0.51% % of Predator Individuals 16.43% 12.11% 10.40% 6.33% 7.60% 6.21% # of Clinger taxa 10 9 10 13 15 17 % dominance (3 taxa) 49% 38% 44% 47% 51% 39% % Oilgochaetes 0.0% 0.0% 0.0% 0.1% 0.3%	# of Ephemeroptera		10	7	9	9	11	11
# of Tricoptera 4 3 4 4 5 5 # of Long-Lived Taxa (sv?) 1	# of Plecoptera		6	8	8	8		
# of Long-Lived Taxa (sv?) 1 1 # of Intolerant Taxa 0 1 % of Individuals in Tol. Taxa 0.58% 1.19% 0.96% 0.79% 0.28% 0.51% % of Predator Individuals 16.43% 12.11% 10.40% 6.33% 7.80% 6.21% % of Clinger taxa 10 9 10 13 15 17 % dominance (3 taxa) 49% 38% 44% 47% 51% 39% % Oilgochaetes 0.0% 0.0% 0.0% 0.0% 0.1% 0.3%	# of Tricoptera		4	3	4	4		
% of Individuals in Tol. Taxa 0.58% 1.19% 0.96% 0.79% 0.28% 0.51% % of Predator Individuals 16.43% 12.11% 10.40% 6.33% 7.60% 6.21% # of Clinger taxa 10 9 10 13 15 17 % dominance (3 taxa) 49% 38% 44% 47% 51% 39% % Oligochaetes 0.0% 0.0% 0.0% 0.1% 0.3%	# of Long- Lived Taxa (sv?)		1			1		
% of Individuals in Tol. Taxa 0.58% 1.19% 0.96% 0.79% 0.28% 0.51% % of Predator Individuals 16.43% 12.11% 10.40% 6.33% 7.60% 6.21% # of Clinger taxa 10 9 10 13 15 17 % dominance (3 taxa) 49% 38% 44% 47% 51% 39% % Oligochaetes 0.0% 0.0% 0.0% 0.0% 0.1% 0.3%	# of Intolerant Taxa		0			1		
% of Predator Individuals 16.43% 12.11% 10.40% 6.33% 7.60% 6.21% # of Clinger taxa 10 9 10 13 15 17 % dominance (3 taxa) 49% 38% 44% 47% 51% 39% % Oilgochaetes 0.0% 0.0% 0.0% 0.0% 0.1% 0.3%	% of Individuals in Tol. Taxa			1.19%	0.96%	0.79%	0.28%	0.51%
# of Clinger taxa 10 9 10 13 15 17 % dominance (3 taxa) 49% 38% 44% 47% 51% 39% % Oligochaetes 0.0% 0.0% 0.0% 0.0% 0.1% 0.3%	% of Predator Individuals							
% dominance (3 taxa) 49% 38% 44% 47% 51% 39% % Oilgochaetes 0.0% 0.0% 0.0% 0.1% 0.3%	# of Clinger taxa							
% Oilgochaetes 0.0% 0.0% 0.0% 0.1% 0.3%	% dominance (3 taxa)							
-	% Oligochaetes							
	% Chironomids		28.2%	21.6%	19.2%	23.7%	22.9%	36.7%

EMS Number ES Sample Number itte Name		E238622 990278 Buck 12km	E238622 990279 Buck 12km	E238622 990280 Buck 12km		E238624 990285 Buck Mail	E238624 990286 Buck Mail		E238625 990288 Buck Conf.	
Replicate #		1	2	3	1	2	3	1	2	3
inits	stage									
hylum : Nematomorpha	_									
lass : Oligochaeta				1						
amily : Lumbricidae										
amily: Naididae										
lais sp.										
Order : Ephemeroptera	adult			~	60		10	80	39	48
Order : Ephemeroptera	nymph	40		22	60		10	80	39	40
amily : Ameletidae	nymph								6	3
Ameletus sp.	nymph	1						•	5	3
amily : Ephemerellidae	nymph	10	3					2	2	
Drunella doddsi	nymph									
Drunella grandis	nymph				-					•
Drunella sp.	nymph	19	2	8	3			1		3
Drunolla ?	nymph									
Ephemerella	larvae									
Serratella sp.	nymph						_			-
amily : Heptageniidae	nymph	27	21		10		6		15	8
Cinyamula sp.	nymph									
poorus sp.	nymph				2					
Rhithrogena sp.	nymph	5	41	8	27	28	30	19	11	6
Stenonema	larvae									
Ist instar	larvae									
Family : Baetidae	nymph			4		20		3	1	2
Baetis sp.	nymph	30	9		17	3	8			
Baetis ?	nymph									
amily : Leptophiebiidae	nymph				1	3	1	2		
Paraleptophiebia sp.	nymph									
Order : Plecoptera	juvenile									
Order : Plecoptera	nymph	40		6	32	10	13	10	23	8
amily : Capniidae	juvenile									
amily : Capnidae	nymph									
amily : Chloroperlidae	juvenile									
Family : Chloroperlidae	nymph		6		3	2				
Kathroperla sp.										
Alloperta	larvae									
Paraperta	larvae									
Suwallia sp.	nymph									
Swellsa sp.	nymph									
Sweltsa complex	nymph	14	12	7	4	4	12	20	10	5
		14		•	•	•				•
<u>Sweltsa complex ?</u> Eamily : Taoplontoninidae	nymph juvenile				3					
Family : Taeniopterygidae Family : Taeniopterygidae	nymph									
						6		3		1
Family : Nemouridae	nymph					0		3		
<u>Amphinemura sp.</u> Viseko	nymph									
<u>Visoka</u>	larvae									
<u>Nemoura</u>	larvae									
<u>Zapada sp.</u>	nymph									
Zapada ?	nymph		-		-					
Family : Periodidae	nymph	10	3		2					
Megarcys sp.	nymph									
Megarcys?	nymph									
soperta	larvae									
Acrynopteryx	larvae									
<u>Ist instar</u>	larvae									
Skwala ?	nymph			8						2
Skwala_sp.	nymph					3	4	9	5	
Family : Pteronarcyidae	nymph				1	2				
Pteronarcella sp.	nymph									
Pteronarcys sp.	nymph									
Family : Perlidae	nymph									
Doroneuria sp.	nymph									
Hesperoperta sp.	nymph									
Family : Leuchidae / Capniidae	nymph									
Phylum : Coelenterata										

Bio Logic Consulting

EMS Number FES Sample Number Site Name	•	E238622 990278 Buck 12km	E238622 990279 Buck 12km	E238822 990260 Buck 12km	E238624 990284 Buck Mail	E238624 990285 Buck Mail	E238624 990286 Buck Mall	E238625 990287 Buck Conf.	E238625 990268 Buck Conf.	E238625 990289 Buck Conf
Replicate #		1	2	3	1	2	3	1	2	3
units	stage									
Order: Thysanoptera	adult									
Order: Hymenoptera										
Order : Hemiptera						_				
Family : Aphididae					3	6	1		1	
Sub-order : Homoptera	adult									
Sub-order : Homoptera	nymph	72	9		95	109	33	213	132	128
Order : Trichoptera	larvae juvenile	12			55	105		215	1.52	120
Order : Trichoptera Order : Trichoptera	pupae	1				1				
Family : Glossosomatidae	iarvae	•				•				
Glossosoma sp.	larvae	1	1					1		1
Family : Rhyacophilidae	pupae									
Family : Rhyacophilidae	larvae									
Rhyacophila sp.	larvae	1	1							
Rhyscophila ?	larvae									
Family : Hydropsychidae	juvenile									
Family : Hydropsychidae	larvae		8	3	43		15			
Arctopsyche sp.	larvae					33	7	26	18	11
Hydropsyche sp.	larvae									
Hydropsyche ?	larvae	19								
Ceratopsyche ?	larvae									
Parapsycho sp.	larvae									
Family : Brachycentridae	larvae							7		
Brachycentrus sp.	larvae juvenile							,		
Family : Hydroptilidae Family : Hydroptilidae ?	pupae									
Family : Hydroptilidae	larvae							4		2
Family : Hydroptilidae ?	larvae							-		-
Family : Limnephilidae	juvenile									
Family : Limnephilidae	larvae									
Dicosmoecus sp.	larvae									
Order : Diptera	adult		2	1.	3	5	3	5	2	2
Order : Diptera	pupae	3	4	2	3	4	6	. 1	3	10
Order : Diptera	larvae									
Family : Dbddae	larvae									
Family : Chironomidae	adult									
Family : Chironomidae	pupae									
Family : Chironomidae	larvae	288	51	45	140	160	168	228	240	160
Sub-family : Orthodadiinae	larvae									
Crictopus spp.	larvae	-			•		•			
Crictopus / Orthocladius sp.	larvae	72		20	8	60	24	40	50	30
Orthocladius sp.	larvae									
<u>Corynoneura sp.</u> Eukiefferlella sp.	larvae larvae			Present					Present	Present
Euklefferiella sp. ?	larvae			Fleben	24		6		ricacht	rresent
<u>Rheocricotopus sp.</u>	larvae				24		0			
Thienemannielia sp.	larvae									
Synorthocladuis sp.	larvae									
Sub-family : Prodiamesinae	larvae									
Sub-family : Diamesinae	larvae									
Boreoheptovia sp.	larvae									
Diamesa sp.	larvae									
Diamesa ?	iarvae									
Pagastia sp.	larvae									
Potthastia sp.	larvae									
Sub-family : Tanypodinae	larvae									
Thienemannimyia group	larvae									
Sub-family : Tanytarsini	larvae									
Tribe : Tanytarsini	pupae									
Tribe : Tanytarsini Sub-family : Chimnomiaaa	larvae									
Sub-family : Chironominae Micropsectra sp.	larvae Iarvae				8	present				
	larvae				0	prosent		6		
Family : Empididae Chelifera sp.										
Chelifera sp. Orsogeton sp.	larvae larvae									

EMS Number FES Sample Number Site Name		E238622 990278 Buck 12km	E238622 990279 Buck 12km	E238622 990260 Buck 12km	E238824 990284 Buck Mali	E238624 990285 Buck Mail	E238624 990286 Buck Mail	E238625 990287 Buck Conf.	E238625 990268 Buck Conf.	E238625 990289 Buck Con
Site Name Replicate #		BUCK 12Km	2	BUCK 12Km	DUCK Mail	2 2	BUCK MEEL	1	2	3
units	stage	•	-	•	•	-	•	•	-	•
Bezzia / Probezzia sp.	larvae	4	4	3		1			1	
Family : Tipulidae	larvae	2	5	4	6		9	4	1	2
Tipula abdominalis	larvae									
Dicranota sp.	larvae									
Hexatoma sp.	larvae									
Rhabdomastix sp.	tarvae									
Antocha sp.	larvae									
Family : Atherkidae	larvae									
Atherix sp.	larvae									
Family : Simuliidae	larvae									
Family : Simuliidae	pupae									
Cnephia sp.	larvae									
Simulium sp.	pupae									
Simulium sp.	larvae	3		1	3	6	4		3	1
Simulium ?	larvae	•		•	•	•			•	
Family : Stratiomyldae	larvae									
Family : Tanyderidae	tarvae									
Protoplasa fitchii	iarvae									
Family: Psychodidae	larvae									
	larvae	2								1
<u>Pericoma sp.</u>	adutt		1			2	3	1	1	1
Order : Coleoptera	adust					2	3		1	,
Family : Elmidae				1		1	7	2	1	3
Family : Elmidae	larvae			'		•	'	2	1	3
Lara sp.	larvae									
<u>Narpus ?</u> Ontingon un on	larvae									
<u>Optioservus sp.</u>	larvae									
Family : Curculionidae ?	larvae									
Family : Dytiscidae Family : Cyrinidae 2	larvae									
Family : Gyrinidae ?	ICT VOC									
Order : Collembola										
Family : Sminthuridae								1		
Sub-Class : Ostracoda				•				•		
Sub-class : Copepoda										
Order : Cyclopoida										
Order : Harpacticoida	<u> </u>									
Phylum : Nematoda		2	1		2			1		
Class: Arachnoida							-	_		
Group : Hydracarina		49	16	12	93	44	51	57	44	48
Family : Protzildae										
Wandesia sp.										
Division : Oribatei										
Phylum : Mollusca										
Class : Gastropoda										
Family : Planorbidae										
Order : Pelecypoda		1								
Phylum : Platyhelminthes										
Class : Turbellaria							1			
Polycelis coronata										
Total		716	200	167	596	513	422	746	608	488
# of Taxa		24	19	19	25	22	22	25	22	25
# of Ephemeroptera		7	5	4	7	4	5	5	6	6
# of Plecoptera		3	3	3	6	6	3	4	3	4
# of Tricoptera		4	4	2	2	2	3	5	2	4
# of Long- Lived Taxa (sv?)		0	-	-	0	-	•	0	-	•
# of Intolerant Taxa		1			ŏ			0		
% of individuals in Tol. Taxa		3.07%	0.00%	1.20%	0.50%	1.17%	0.95%	0.54%	0.49%	1.02%
% of Predator Individuals		4.05%	13.00%	10.78%	1.51%	8.38%	0.95% 5.45%	0.04% 8.18%	0.49% 5.59%	4.10%
							6	0.10% 7	5.59% 6	4.10%
# of Clinner taxe		•								
-		9	9	5	8	5				
% dominance (3 taxa)		60%	57%	62%	55%	64%	60%	70%	69%	69%
# of Clinger taxa % dominance (3 taxa) % Oligochaetes % Chironomids										

EMS Number ES Sample Number		E238623 990281	E238623 990282 Bob	E238623 990283 Bob	E238839 990326	E238639 990327 Burgan Ref	E238639 990328 Byman Ref.	E238629 990299 Byman	E238629 990300 Byman	E238629 990301 Byman
ite Name Leplicate #		Bob 1	BOD 2	3	byman r.e 1	2	3	1	2	3
nits	stage									
hylum : Nematomorpha					7	8	11	2	14	10
Jass : Oligochaeta					1	0	11	2	14	10
amily: Lumbricidae										
iamily: Naididae										
<u>lais sp.</u>)rder : Ephemeroptera	adult									·
)rder : Ephemeroptera	nymph	45	74	16		33	33	13	10	52
amily : Ameletidae	nymph		-							
umeletus sp.	nymph		13	17	2	2	3	4	3	6
amily : Ephemerellidae	nymph	5		26	з	1	2		4	
Druneila doddsi	nymph				6	29	7			
Drunella grandis	nymph									
Drunella sp.	nymph		16						4	3
Drunella ?	nymph			15						
phemerella	larvae									
Serratella sp.	nymph					-		•	65	52
amily : Heptageniidae	nymph	35	65	85	9	5	12	3	65	53
Cinygmula sp.	nymph		.=	•			3			
poorus sp.	nymph	23	17	9	1 17	22	21	1	2	21
Rhithrogena sp.	nymph	13	24	26	17	22	21	I	2	21
Stenonema	larvae									
i <u>st instar</u> Family : Baetida e	larvae nymph									
	nymph	26	44	22	10	31	8		1	2
Baetis sp. Baetis ?	nymph			-			•			
amily : Leptophiebiidae	nymph			2				1		
Paraleptophlebia sp.	nymph			-	3	12	8			
order : Plecoptera	juvenile				6	11	18			
Order : Plecoptera	nymph		82	54				2	7	17
amily : Capniidae	juvenile						2			
amily : Capniidae	nymph									
amily : Chloroperlidae	juvenile									
amily : Chloropertidae	nymph	2			3	12	1			
Kathroperta sp.										
Alloperta	larvae									
Paraperla	larvae									
Suwallia sp.	nymph									
Sweltsa sp.	nymph				-				•	
Sweltsa complex	nymph		25	14	3	18	12	10	21	25
Sweltsa complex ?	nymph									
amily : Taeniopterygidae	juvenile									
amily : Taeniopterygidae	nymph						1		13	5
Family : Nemouridae	nymph								13	5
<u>Amphinemura sp.</u> Visoka	nymph Iarvae									
visoka Nemoura	iarvae									
<u>tapada sp.</u>	nymph				14	11	1			
Zapada sp. Zapada ?	nymph						•			
Family : Periodidae	nymph		2					3	2	
Wegarcys sp.	nymph		-					-	_	
Megarcys?	nymph									
soperla	larvae									
Acrynopteryx	larvae									
Ist instar	larvae									
Skwala ?	nymph									
Skwala sp.	nymph									
family : Pteronarcyidae	nymph									
Pteronarcella sp.	nymph									
Pteronarcys sp.	nymph									
Family : Perlidae	nymph				1					
Doroneuria sp.	nymph				1					
<u>Hesperoperia sp.</u>	nymph		-						•	
Family : Leuctridae / Capniidae	nymph		2	13				1	2	
hylum : Coelenterata					1					
tydra sp.										

EMS Number FES Sample Number Site Name		E238823 990281 Bob	E238623 990282 Bob	E238623 990283 Bob	E238839 990326 Byman Ref.	E238639 990327 Byman Ref.	E238639 990328 Byman Ref.	E238629 990299 Byman	E238629 990300 Byman	E238629 990301 Byman
Replicate #		1	2	3	1	2	3	1	2	3
units	stage									
Order: Thysanoptera	adult				1					
Order: Hymenoptera	_				1					
Order : Hemiptera										
Family : Aphididae				1						
Sub-order : Homoptera	adult					•				
Sub-order : Homoptera Order : Trichoptera	nymph Iarvae	3	2	1		2			52	42
Order : Trichoptera	juvenile		2	•	16	3	1	10	52	42
Order : Trichoptera	pupae	1	1	1	10	5	•	1		
Family : Glossosomatidae	larvae	•	•	•				•		
Giossosoma sp.	larvae				1	3				
Family : Rhyacophilidae	pupae									
Family : Rhyacophilidae	larvae									
<u>Rhyacophila sp.</u>	larvae	22	20	11						
<u>Rhyacophila ?</u>	larvae									
Family: Hydropsychidae	juvenile				1					
Family : Hydropsychidae	larvae							1	1	2
Arctopsyche sp.	larvae				1					
Hydropsyche sp.	larvae									
Hydropsyche ?	larvae									
<u>Ceratopsyche ?</u> Parapsyche sp.	larvae									
<u>Parapsyone sp.</u> Family : Brachycentridae	larvae larvae									
Brachycentrus sp.	larvae									2
Family : Hydroptilidae	juvenile									2
Family : Hydroptilidae ?	pupae									
Family : Hydroptilidae	larvae				1					
Family : Hydroptilidae ?	larvae									
Family : Limnephilidae	juvenile									
Family : Limnephilidae	larvae						1			
Dicosmoecus sp.	larvae		_							
Order : Diptera	adult	17	8	4	•			5	1	6
Order : Diptera	pupae	9	2	6				1	1	2
Order : Diptera	larvae									
Family : Dixidae	larvae	1			1			1		
Family : Chironomidae	adult				1	1	1			
Family : Chironomidae	pupae		004	500	54	4	1			
Family : Chironomidae Sub-family : Orthocladiinae	larvae larvae	94	264	588 52	54 27	57 25	16 22	9	37	41
<u>Crictopus_spp.</u>	larvae			JZ	21	20	22			
Crictopus / Orthocladius sp.	larvae		30							
Orthocladius sp.	larvae									
Corynoneura sp.	larvae									
Eukiefferiella sp.	larvae									
Eukiefferiella sp. ?	larvae	17								
Rheocricatopus sp.	larvae									
Thienemanniella sp.	larvae									
Synorthocladuis sp.	larvae									
Sub-family : Prodiamesinae	larvae									
Sub-family : Diamesinae	larvae									
Borecheptgyia sp.	larvae									
<u>Diamesa sp.</u>	larvae									
<u>Diamesa ?</u>	larvae									
Pagastia sp. Potthastia sp.	larvae									
<u>Potthastia sp.</u> Sub-family : Tammodinao	larvae					-	-			
Sub-family : Tanypodinae <u>Thienemannimyia group</u>	larvae				1	3	3			
Sub-family: Tanytarsini	larvae tarvae									
Tribe : Tanytarsini	pupae									
Tribe : Tanytarsini	larvae				18	48	56			
Sub-family : Chironominae	larvae						~			
Micropsectra sp.	larvae									
Family : Empldidae	larvae					2				
<u>Chelifera sp.</u>	iarvae									
Oreogeton sp.	larvae				2					
Family : Ceratopogonidae	larvae									

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EMS Number FES Sample Number Site Name		E238623 990281 Bob	E238623 990282 Bob	E238623 990283 Bob	•	E238639 990327 Byman Ref.		E238629 990299 Byman	E238629 990300 Byman	E238629 990301 Byman
Replicate #	-	1	2	3	1	2	3	1	2	3
units	stage larvae	1				3		2	2	3
<u>Bezzia / Probezzia sp.</u> Family : Tipulidae	larvae	•				•		1	1	2
Tipula abdominalis	larvae									
Dicranota sp.	larvae									
Hexatoma sp.	larvae				1					
Rhabdomastix sp.	larvae									
Antocha sp.	larvae									
Family : Athenicidae	larvae									
Athenix sp.	iarvae									
Family : Simuliidae	larvae				2	1	1			
Family : Simuliidae	pupae				-					
•	larvae									
<u>Cnephia sp.</u> Simulium sp.	pupae									
	larvae	1								
<u>Simulium sp.</u>		•								
<u>Simulium ?</u> Family : Strationadae	larvae larvae									
Family : Stratiomyidae	iarvae larvae									
Family : Tanyderidae Amtoplasa fitabil										
<u>Protoplasa fitchii</u> Family I. Dausbodidaa	larvae									
Family : Psychodidae	larvae			1		1		9	16	14
Pericoma sp.	larvae				1	1				
Order : Coleoptera	adult				I	,			1	1
Family : Elmidae	adult	44	1	5	2					
Family : Elmidae	larvae	11	1	5	2					
Lara sp.	larvae				1					
Narpus ?	larvae				•		1			
<u>Optioservus sp.</u> Familie a Cumulianidae 3	larvae						•			
Family : CurcutionIdae ? Family : Dytiscidae	larvae									
Family : Gyrinidae ?	larvae									
Order : Collembola	101100	1		3	1	2	1	2		
Family : Sminthuridae		•								
Sub-Class : Ostracoda		_		3			1			
Sub-class : Copepoda				•	•					
Order : Cyclopoida										
Order : Harpacticoida										
Phylum : Nematoda			1		1					
Class: Arachnoida										
Group: Hydracarina		9	6	11	16	22	8	35	79	54
Family : Protziklae		5	Ū				•			•
Wandesia sp.										
							1			
Division : Oribatei	·						<u>'</u>		· · · · · ·	
Phylum : Mollusca Class : Castropoda					_					
Class : Gastropoda Family : Planorbidae					-					
Order : Pelecypoda	-									
Phylum : Platyhelminthes				,						
Class : Turbellaria		14	5	4						
Polycelis coronata										
Total		428	704	990	238	373	257	125	339	363
fora		420		990 24	230 37	373 27	25/ 27	20	22	365 20
			20 7					20 5	7	20 6
# of Ephemeroptera		7	7	9	8	8	9	-		-
# of Plecoptera		3	4	3	6	4	6	4	5	3
# of Tricoptera		2	2	2	5	2	2	2	2	3
# of Long- Lived Taxa (sv?)		0			0			0		
# of Intolerant Taxa		0			1			0		
% of Individuals in Tol. Taxa		0.23%	0.00%	0.00%	3.78%	2.14%	4.67%	1.60%	4.13%	2.75%
% of Predator Individuals		11.45%	6.68%	2.53%	5.88%	10.19%	6.23%	12.00%	7.37%	7.71%
# of Clinger taxa		8	6	7	12	8	10	4	6	6
% dominance (3 taxa)		42%	60%	73%	42%	38%	43%	53%	58%	44%
% Oligochaetes		0.0%	0.0%	0.0%	2.9%	2.1%	4.3%	1.6%	4.1%	2.8%
% Chironomids		25.9%	41.8%	64.6%	43.3%	37.5%	38.5%	7.2%	10.9%	11.3%

EMS Number FES Sample Number Site Name		E638640 990329 Ailport	E638640 990330 Ailport	E638640 990331 Ailport		E238631 990306 Richfield d/s			E238632 990309 Richfield u/s	
Replicate #		1	2	3	1	2	3	1	2	3
units	stage									
Phytum : Nematomorpha		2			3					
Class : Oligochaeta		2			3					
Family : Lumbricidae Family: Naididae										
Nais sp.										
Order : Ephemeroptera	adult									
Order : Ephemeroptera	nymph	11	37	4	10	25		10	9	
Family : Ameletidae	nymph		•.	•					· ·	
Ameletus sp.	nymph	20			2			11	18	16
Family : Ephemerellidae	nymph	4	9	2	-		1	••	10	
Drunella doddsi	nymph	8	14	2						
Drunella grandis	nymph	•		-						
Drunella sp.	nymph	1			17	17	9			9
Drunella ?	nymph	•					-			•
Ephemerella	larvae									
Serratella sp.	nymph									
Family : Heptagenlidae	nymph	32	24	16	17		13			
Cinygmula sp.	nymph	2								
Epeorus sp.	nymph	-	2	1		2	4		5	
Rhithrogena sp.	nymph	64	100	47	22	44	39	20	34	23
Stenonema	larvae								•	~-
1st instar	larvae									
Family : Baetidae	nymph									
Baetis sp.	nymph	60	210	118	7	12	24	83	23	79
Baetis ?	nymph		210		•				2.0	
Family : Leptophlebiidae	nymph					1		9		
Paraleptophiebia sp.	nymph	23	27	15		•		Ū	9	4
Order : Plecoptera	juvenile		85	20						
Order : Plecoptera	nymph			20	28	2	6	26	11	22
Family : Capnidae	juvenile						-			
Family : Capniidae	nymph	4	10	1						
Family : Chloroperlidae	juvenile									
Family : Chloroperlidae	nymph	3	8		1					
Kathroperta sp.		-	•							
Alloperta	larvae									
Paraperla	larvae									
Suwallia sp.	nymph									
Sweltsa sp.	nymph									
Sweltsa complex	nymph	52	84	52	21	29	13	6	5	9
Sweltsa complex ?	nymph		•••					•	•	•
Family : Taeniopterygidae	juvenile									
Family : Taeniopterygidae	nymph	3	6							
Family : Nemouridae	nymph	-	-		7		1			
Amphinemura sp.	nymph									
Visoka	larvae									
Nemoura	larvae									
Zepada sp.	nymph	67	101	23				29	16	49
Zapada ?	nymph			20				23	10	
Family : Periodidae	nymph	1	5				1	1		4
Megarcys sp.	nymph		•							4
Megarcys?	nymph									
Isoperta	larvae									
Acrynopteryx	larvae									
1st instar	larvae									
Skwala ?	nymph									
Skwala sp.	nymph									
Family : Pteronarcyldae	nymph		1							
Pteronarcella sp.	nymph	1	1							
Pteronarcys sp.	nymph		•							
Family : Perlidae	nymph	2	3			1	2			2
Doroneuria sp.	nymph	-	•				-		2	4
<u>Hesperoperla sp.</u>	nymph			1					4	
Family : Leuctridae / Capniidae	nymph				1					
Phylum : Coelenterata										
Hydra sp.										

EMS Number FES Sample Number Site Name		E638840 990329 Ailport	E638640 990330 Ailport	E638640 990331 Ailport	E238631 990305 Richfield d/s	E238631 990306 Richfield d/s	E238631 990307 Richfield d/s	E238632 990308 Richfield u/s	E238632 990309 Richfield u/s	E238632 990310 Richfield w
Replicate #		1	2	3	1	2	3	1	2	3
units	stage									
Order: Thysanoptera	adult									
Order: Hymenoptera		1								
Order : Hemiptera										
Family : Aphldidae					1	9	4	1		
Sub-order : Homoptera	adult									
Sub-order : Homoptera	nymph	3								
Order : Trichoptera	larvae					18	11	28		11
Order : Trichoptera	juvenile	65	81	22						
Order : Trichoptera	pupae							1		
Family : Glossosomatidae	larvae									
Glossosoma sp.	larvae		1	2						
Family : Rhyacophilidae	pupae									
Family : Rhyacophilidae	larvae						-			•
Rhyacophila sp.	larvae	1	1			1	5	1		2
Rhyacophila ?	larvae	67		•						
Family : Hydropsychidae	juvenile	37	206	8		37		•	3	1
Family : Hydropsychidae	larvae		•			3/	~	2	1	1
Arctopsyche sp.	larvae		2				20			
Hydropsyche sp.	larvae									
Hydropsyche ?	larvae									
<u>Ceratopsyche ?</u>	larvae									
Parapsyche sp.	larvae									
Family : Brachycentridae	larvae									
Brachycentrus sp.	larvae									
Family : Hydroptilidae	juvenile									
Family : Hydroptilidae ?	pupae					2		-	5	46
Family : Hydroptilidae	larvae					2		.7	5	16 43
Family : Hydroptilidae ?	larvae	7								43
Family : Limnephilidae	juvenile	'								
Family : Limnephilidae	larvae									
Dicosmoecus sp.	larvae adult				. 4	7		2	3	7
Order : Diptera Order : Diptera	pupae				. 4	2		2 8	9	26
Order : Diptera	larvae				5	2		0	3	20
Family : Dixidae	larvae									
Family : Chironomidae	adult	1	1	2						
Family : Chironomidae	pupae	13	14	3						
Family : Chironomidae	iarvae	14	46	3	160	125	120	136	46	200
Sub-family : Orthodadiinae	larvae	115	131	34		120	120	100	-10	200
Crictopus_spp.	larvae		.01							
Crictopus / Orthocladius sp.	larvae				10	Present	70	53	240	
Orthocladius sp.	larvae				10	riesen	10	35	240	
Corynoneura sp.	larvae	6		1						
Euklefferleila sp.		0		•			30	36	23	
Eukiefferiella sp. ?	larvae Iarvae						30	30	23	
<u>Rheocricotopus sp.</u>	larvae									
<u>Rheochcollopus sp.</u> Thienemanniella sp.	larvae									
Synorthocladuis sp.	larvae							Present		
Sub-family: Prodiamesinae	larvae							riesent		
Sub-family : Diamesinae	larvae						Present			
Boreoheptovia sp.	larvae						- idociti			
Diamesa sp.	larvae									
Diamesa <u>?</u>	larvae									
Pagastia sp.	larvae									
Potthastia_sp.	larvae									
Sub-family : Tanypodinae	larvae	3	4							
Thienemannimyia group	larvae	5	4							
Sub-family : Tanytarsini	larvae									
Tribe : Tanytarsini	pupae									
Tribe : Tanytarsini	larvae	28	49	5						
Sub-family : Chironominae	larvae	20		0						
Micropsectra sp.	larvae				6	Present				
Family : Empididae	larvae		2		Ũ	, reacht				
			-							
Chetifera sp	lange									
<u>Cheiifera sp.</u> Oreogeton sp.	larvae Iarvae									

EMS Number FES Sample Number		E638840 990329 Ailport	E638840 990330 Ailport	E638840 990331 Ailport	E238631 990305 Richfield d/s	E238631 990306 Richfield d/s	E238631 990307 Richfield d/s	E238632 990308 Richfield u/s	E238632 990309 Richfield u/s	E238632 990310 Richfield u/s
Site Name Replicate #		1 1	2	3	1	2	3	1	2	3
units	stage									
Bezzia / Probezzia sp.	larvae		5	1	4	1		7		6
Family : Tiputidae	larvae		1			1		1		1
Tipula abdominalis	larvae									
Dicranota sp.	larvae									
Hexatoma sp.	larvae									
Rhabdomastix sp.	larvae									
Antocha sp.	larvae									
amily : Athericidae	larvae									3
<u>Atherix sp.</u>	larvae larvae		36							1
Family : Simuliidae Family : Simuliidae	pupae						6			
Cnephia <u>sp.</u>	larvae						-			
Simulium sp.	pupae									
Simulium sp.	larvae				1	13				
Simulium ?	larvae						67			
Family : Stratiomyidae	larvae									
Family : Tanyderidae	larvae									
Protoplasa fitchii	larvae									
Family : Psychodidae	larvae						1			
Pericoma sp.	larvae	2	9	1	6	5		4	1	12
Order : Coleoptera	adust									
Family : Elmidae	adult				2					
Family : Elmidae	larvae				1					
Lara sp.	larvae									
Narpus ?	larvae									
Optioservus sp.	larvae									
Family : Curculionidae ?			1	1						
Family : Dytiscidae	larvae									
Family : Gyrinidae ?	larvae									
Order : Collembola		2			3	3				
Family : Sminthuridae										
Sub-Class : Ostracoda		1	2							1
Sub-class : Copepoda		•	•							
Order : Cyclopoida		3	2	1						
Order : Harpacticoida		1	1		1			1		3
Phylum : Nematoda		1	1							
Class: Arachnoida		16	15	3	51	1	7	11	1	12
Group : Hydracarina Family : Protziidae		10	15	5	51	•			•	
Wandesia sp.		2	22	5						
Division : Oribatei		~	1	Ĵ						
Phylum : Mollusca										
Class : Gastropoda										
Family : Planorbidae										
Order : Pelecypoda										
Phylum : Platyheiminthes								_		
Class : Turbellaria		1	1							
Polycelis coronata		1								
Total		703	1361	394	391	358	454	494	464	562
# of Taxa		39	40	26	24	24	23	24	19	24
# of Ephemeroptera		10	8	8	6	6	6	5	6	5
# of Plecoptera		9	10	5	5	3	5	4	4	5
# of Tricoptera		4	5	3	0	4	3	4	3	5
# of Long- Lived Taxa (sv?)		1			0			0		
# of Intolerant Taxa		1			0			0		
% of Individuals in Tol. Taxa		0.28%	0.00%	0.00%	1.02%	4.19%	14.76%	1.42%	1.08%	11.03%
% of Predator Individuals		8.82%	8.38%	13.71%	6.65%	8.94%	9.03%	3.04%	1.72%	4.63%
# of Clinger taxa		11	12	8	6	7	10	4	5	6
% dominance (3 taxa)		35%	40%	55%	61%	58%	57%	55%	69%	58%
% Oligochaetes		0.3%	0.0%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%
% Chironomids		25.6%	18.1%	12.2%	45.0%	34.9%	48.5%	45.5%	66.6%	35.6%

EMS Number FES Sample Number Site Name		E238645 990338 Richfeld CN	E238645 990339 Richfield CN	E238645 990340 Richfield CN	E238627 990293	E238627 990294 McQuarrie d/s	E238627 990295 McQuarrie d/s	E238628 990296	E238628 990297 McQuarrie ref.	E238628 990298 McQuarrie ref.
Replicate #		1	2	3	1	2	3	1	2	3
units	stage									
Phylum : Nematomorpha										
Class : Oligochaeta		2	1	31		1	2	1	15	3
Family : Lumbricidae Family: Naididae										
Nais sp.										
Order : Ephemeroptera	adult									
Order : Ephemeroptera	nymph	68	21	14		10	1	15	24	40
Family : Ameletidae	nymph									
Ameletus sp.	nymph	3			3	1	6			8
Family : Ephemerellidae	nymph	6	7	11		1				
<u>Drunella doddsi</u>	nymph	16	16	17						
<u>Drunella grandis</u> <u>Drunella sp.</u>	nymph	4	9	6 3	5		5	27	42	33
Drunella ?	nymph nymph			3	5		5	21	42	35
Ephemerella	larvae									
Serratella sp.	nymph	3	1	1						
Family : Heptageniidae	nymph	65	13	19	60	48	99	7	23	17
Cinvamula sp.	nymph									
Epeonus sp.	nymph		11	10				12	22	1
Rhithrogena sp.	nymph	106	73	76	23	15	15	38	48	47
<u>Stenonema</u>	larvae									
<u>1st instar</u>	larvae									
Family : Baetidae <u>Baetis sp.</u>	nymph	10	63	62	17	5	0	40	~	•
Baetis ?	nymph nymph	10	65	02	17	5	6	46	92	9
Family : Leptophlebildae	nymph				1		2	6	11	
Paraleptophiebia sp.	nymph	4	4		•		-	Ũ		19
Order : Piecoptera	juvenile		19	19						
Order : Plecoptera	nymph				11				16	5
Family : Capnildae	juvenile									
Family : Capnildae	nymph	6	1							
Family : Chloroperlidae	juvenile									
Family : Chloroperlidae	nymph	3	1	3						
<u>Kethroperla sp.</u> <u>Alloperla</u>	larvae									
Paraperta	larvae									
Suwaltia sp.	nymph									
Sweltsa sp.	nymph									
Sweltsa complex	nymph	117	40	47	25	18	17	19	29	12
Sweltsa complex ?	nymph									
Family : Taeniopterygidae	juvenile									
Family : Taeniopterygidae	nymph									
Family : Nemounidae	nymph						1	3	11	
<u>Amphinemura sp.</u> <u>Visoka</u>	nymph Iarvae									
Nemoura	larvae									
Zapada sp.	nymph	19	19	40	10					
Zapada ?	nymph									
Family : Periodidae	nymph				1	1	1			1
Megarcys sp.	nymph									·
Megarcys?	nymph									
Isoperte	larvae									
Acrynopteryx 1st instar	larvae									
<u>1st instar</u> Skwala ?	larvae									
Skwala r	nymph nymph			7						
Family : Pteronarcyidae	nymph			,						
Ptercnarcella sp.	nymph	2	2							
Pteronarcys sp.	nymph		_							
Family : Perlidae	nymph	3	4	4						
Doroneuria sp.	nymph									
Hesperoperta sp.	nymph									
Family : Leuctridae / Capniidae	nymph				6		3	1		
Phytum : Coelenterata <u>Hydra sp.</u>										
Order : Lepidoptera										
and a september										

EMS Number FES Sample Number Site Name		E238645 990338 Richfield CN	E238645 990339 Richfield CN	E238645 990340 Richfield CN	E238627 990293 McCularria d/a	E238627 990294 McQuarrie d/s	E238627 990295 McQuarrie d/s	E238628 990296 McQuarrie ref.	E238628 990297 McQuarrie ref.	E238628 990298 McQuarrie ref.
Replicate #		1	2	3	1	2	3	1	2	3
units	stage	1			<u> </u>					
Order: Thysanoptera Order: Hymenoptera	adult	3	<u> </u>	2						
Order : Hemiptera										
Family : Aphididae					6	9	1			
Sub-order : Homoptera	adult			_						
Sub-order : Homoptera	nymph	1	12	8	4		5	10	50	42
Order : Trichoptera Order : Trichoptera	larvae juvenile	58	61	10	-		5	10	30	72
Order : Trichoptera	pupae		•••							
Family : Glossosomatidae	larvae									
Glossosoma sp.	larvae							6		
Family : Rhyacophilidae	pupae									
Family : Rhyacophilidae <u>Rhyacophila sp.</u>	larvae larvae	1	2	3				1	2	
<u>Rhyacophila ?</u>	larvae	•	-	5					-	
Family : Hydropsychidae	juvenile	37	181	201						
Family : Hydropsychidae	larvae							24		1
Arctopsyche sp.	larvae		2	4	2				41	
Hydropsyche sp.	larvae		69	51						
Hydropsyche ?	larvae									
<u>Ceratopsyche ?</u> Parapsyche sp.	larvae larvae									
Family : Brachycentridae	larvae									
Brachycentrus sp.	larvae							1	1	
Family : Hydroptilidae	juvenile	1								
Family : Hydroptilidae ?	pupae									
Family : Hydroptilidae	larvae									
Family : Hydroptilidae ?	larvae	56	10							
Family : Limnephilidae Family : Limnephilidae	juvenile Iarvae	90	10							
Dicosmoecus sp.	larvae									
Order : Diptera	adult		4	6.	19	32	5	2	1	1
Order : Diptera	pupae		2	2		2	1			4
Order : Diptera	larvae		1							
Family : Doddae	larvae	2	-	1	1		1			
Family : Chironomidae Family : Chironomidae	adult pupae	3 11	7 10	16 20						
Family : Chironomidae	larvae	22	113	31	18	24	13	20	95	198
Sub-family : Orthocladiinae	larvae	187	338	318						
Crictopus spp.	larvae	7	5	5						
Crictopus / Orthocladius sp.	larvae									
Orthocladius sp.	larvae		2							
<u>Corynoneura sp. Eukiefferiella sp.</u>	larvae larvae	1 6	1 4	4						
Euklefferiella sp. ?	larvae	Ū	-							
Rheocricotopus sp.	larvae									
Thienemanniella sp.	larvae	2	1	3						
Synorthocladuis sp.	larvae									
Sub-family : Prodiamesinae	larvae									
Sub-family : Diamesinae Borecheptgyia sp.	iarvae Iarvae									
Diamesa sp.	larvae									
Diamesa ?	larvae									
Pagastia sp.	larvae									
Potthastia sp.	larvae									
Sub-family : Tanypodinae	larvae									
<u>Thienemannimyia group</u> Sub-family : Tanytarsini	larvae larvae	47	9	34						
Tribe : Tanytarsini	pupae	47	9	34						
Tribe : Tanytarsini	larvae									
Sub-family : Chironominae	larvae									
Micropsectra sp.	larvae									
Family : Empididae	larvae	1						1		
<u>Cheilfera sp.</u> <u>Oreogeton sp.</u>	larvae									
Family : Ceratopogonidae	larvae larvae									
	AL TOP									

EMS Number FES Sample Number		E238645 990338 Richfield CN	E238845 990339 Richfield CN	E238645 990340 Richfield CN	E238627 990293 McQuarrie d/s	E238627 990294 McQuarrie d/s	E238627 990295 McQuarrie d/s	E238628 990296 McQuamie ref.	E238628 990297 McQuarrie ref.	E238628 990298 McQuarrie re
Site Name Replicate #		1	2	3	1	2	3	1	2	3
inits	stage						3	1	3	6
Bezzia / Probezzia sp.	larvae	3	3 3	4 2	5	2	3	1	3	2
amily : Tipulidae	larvae	2	3	2			•	•		-
lipula abdominalis	larvae			1						
Dicranota sp.	larvae	1 9	1 2	3						
lexatoma sp.	larvae	Э	2	3						
Rhabdomastix sp.	larvae									
Antocha sp.	larvae larvae									
amily : Athenicidae	larvae	2								
<u>Atherix sp.</u> Family : Simuliidae	larvae	5	652	127						
amily : Simuliidae	pupae	1	6	12						
Cnephia <u>sp.</u>	larvae	•	•							
Simulium sp.	pupae									
Simulium sp.	larvae				1		1		4	
Simulium ?	larvae									
amily : Stratiomyidae	larvae									
amily : Tanyderidae	larvae									
Protoplasa fitchii	larvae									
Family : Psychodidae	larvae									
Pericoma sp.	larvae		1	3	21	6	_14	6	22	22
Order : Coleoptera	adult	21		2		1			3	1
Family : Elmidae	adult									
Family : Elmidae	larvae		1	3	7		4	2	8	12
Lara sp.	larvae	3	4	4						
Narpus ?	larvae									
Optioservus sp.	larvae	1								
Family : Curculionidae ?										
Family : Dytiscidae	larvae									
Family : Gyrinidae ?	larvae									
Order : Collembola		2	8	17	7	24				
Family : Sminthundae		1								
Sub-Class : Ostracoda		1	6	13						
Sub-class : Copepoda										
Order : Cyclopoida			1	1						
Order : Harpacticoida										
Phylum : Nematoda				2			<u></u>	11		1
Class: Arachnoida				54	~	~	455	40	40	20
Group : Hydracarina		59	18	51	234	92	155	12	18	28
Family : Protziidae		•	•	•						
Wandesia sp.		3 6	3 7	2 3						
Division : Oribatei		0	/	3						
Phylum : Mollusca					1		1			
Class : Gastropoda Eamily : Planothidae				-						
Family : Planorbidae Order : Peleomoda										
Order : Pelecypoda Phylum : Platyhelminthes										
Phytum : Platyneminnes Class : Turbellaria										
Class : Turbellana <u>Polycelis coronata</u>		2	1	1						
around continuita										
Total		1048	1858	1340	488	292	363	263	581	513
# of Taxa		49	61	49	24	17	24	25	23	23
# of Ephemeroptera		10	10	10	6	6	7	7	7	8
# of Plecoptera		7	7	6	5	2	4	3	3	3
# of Tricoptera		4	6	5	2	0	1	5	4	2
# of Long- Lived Taxa (sv?)		2			0	•		ō	•	-
# of Intolerant Taxa		- 1			0			o		
% of Individuals in Tol. Taxa		0.48%	3.77%	6.12%	0.20%	0.34%	0.83%	0.38%	3.27%	0.58%
% of Predator Individuals		13.38%	2.96%	5.67%	6.76%	7.19%	5.79%	8.37%	12.91%	3.70%
# of Clinger taxa		14	16	16	6	4	5	9	9	6
% dominance (3 taxa)		39%	63%	49%	65%	60%	75%	42%	41%	56%
% Oligochaetes		0.2%	0.1%	2.3%	0.0%	0.3%	0.6%	0.4%	2.6%	0.6%
-			28.4%	32.2%	3.7%	8.2%	3.6%	8.0%	16.4%	38.6%

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EMS Number ES Sample Number itte Name		E238633 990311 Cestord Ref	E238633 990312 Cestord Ref	E238633 990313 Cesford Ref	E238834 990314 Cestord u/s	E238634 990315 Cesford u/s	E238634 990316 Cesford u/s	E238635 990317 Cesford d/s	E238635 990318 Cestord d/s	E238638 990319 Cestord d/
Replicate #		1	2	3	1	2	3	1	2	3
inits	stage									
hylum : Nematomorpha								·		
lass : Oligochaeta		5	15	3		1	3	3	7	10
amily: Lumbricidae										
amily: Naididae										
<u>Vais sp.</u> Order : Ephemeroptera	adult	93	72							
)rder : Ephemeroptera	nymph	~	12			95	303	60		
amily : Ameletidae	nymph									
Ameletus sp.	nymph		23	12	2		10	2	31	
amily : Ephemerellidae	nymph								5	11
Drunella doddsi	nymph								2	16
Drunella grandis	nymph									
Drunella sp.	nymph	23	26	46	39	22	12	20		
Druneila ?	nymph									
phomerolia	larvae									
Serratella sp.	nymph									2
amily : Heptageniidae	nymph	5	15	42	34	24	33	44	24	26
Cinygmula sp.	nymph								18	6
peonus sp.	nymph	1		<u>.</u>	15	5	19	17		10
Rhithrogena sp.	nymph	1		4	8	13	7	3	1	8
Stenonema	larvae									
I <u>st instar</u>	larvae									
amily : Baetidae	nymph	10	11	16	14	36	16	22	17	1 30
Baetis sp.	nymph	10		10	14	30	10	4	.,	30
<u>Baetis ?</u> Family : Leptophlebiidae	nymph nymph								13	22
Paraleptophlebia sp.	nymph								10	-
Order : Plecoptera	juvenile								35	48
Order : Piecoptera	nymph	81	91	44	42	109	315	12		
amily : Capniidae	juvenile									
amily : Capniidae	nymph									
amily : Chloroperfidae	juvenile									
amily : Chloroperlidae	nymph					55	59	60	31	31
Kathroperta sp.										
Woperia	larvae									
Paraperta	larvae									
Suwallia sp.	nymph									
Sweltsa sp.	nymph									
Sweltsa complex	nymph	34	40	34	56	41	164	87	105	39
Sweltsa complex ?	nymph									
amily : Taenlopterygidae	juvenile									
amily : Taeniopterygidae	nymph		2			•	-			30
amily : Nemouridae	nymph		2	4		2	7			
Amphinemura sp. Visoka	nymph									
<u>/isoka</u> Verncura	larvae Iarvae									
<u>tenipura</u> Zapada sp.	nymph	22					5		9	34
Zapada ?	nymph						5	29		34
amily : Periodidae	nymph	4		5	1		2	20		1
Megarcys sp.	nymph	-		2			-		1	1
Megarcys?	nymph							2	·	•
soperta	larvae							_		
Acrynopteryx	larvae									
Ist instar	larvae									
Skwala ?	nymph									
Skwala sp.	nymph								2	
amily : Pteronarcyidae	nymph									
<u>Pteronarcella sp.</u>	nymph									
<u>Pleronarcys sp.</u>	nymph									
amily : Perlidae	nymph									
<u>Doroneuria sp.</u> Jespempeda sp.	nymph									
<u>tesperoperta sp.</u> ^z amily : Leuctridae / Capniidae	nymph nymph	3	3		1	5	7			
			-1		1					

EMS Number FES Sample Number Site Name		E238633 990311 Cestord Ref	E238633 990312 Cesford Ref	E238633 990313 Cesford Ref	E238634 990314 Cesford u/s	E238634 990315 Cestord u/s	E238634 990316 Cesford u/s	E238635 990317 Cesford d/s	E238635 990318 Cesford d/s	E238635 990319 Cesford d/s
Replicate #		1	2	3	1	2	3	1	2	3
units	stage									
Order: Thysanoptera	adult									
Order: Hymenoptera Order: Hemiptera			1						2	2
Family : Aphicidae					3		3	40		
Sub-order : Homoptera	adult				3		3	16		
Sub-order : Homoptera	nymph								9	1
Order : Trichoptera	larvae	4	7	13	5	2	7	1	9	
Order : Trichoptera	juvenile				•	-	'	•	16	1
Order : Trichoptera	pupae	7	5		2	1	4	1		•
Family : Glossosomatidae	larvae				_			•		
Glossosoma sp.	larvae	6	1		8	4	5	2	4	2
Family : Rhyacophilidae	pupae									_
Family : Rhyacophilidae	larvae									
Rhyacophila sp.	larvae	21	35	18		25	27	14	10	5
Rhyacophila ?	larvae				14					
Family : Hydropsychidae	juvenile									
Family : Hydropsychidae	larvae									
Arctopsyche sp.	larvae									
Hydropsyche sp.	larvae									
Hydropsyche ?	larvae									
Ceratopsyche ?	larvae									
Parapsyche sp.	larvae									
Family : Brachycentridae	larvae									
Brachycentrus sp.	larvae									
Family : Hydroptilidae	juvenile									
Family : Hydroptilidae ?	pupae									
Family : Hydroptilidae	larvae									
Family : Hydroptilidae ?	larvae									
Family : Limnephilidae	juvenile									
Family : Limnephilidae	larvae	63	34	25					2	
Dicosmoecus sp.	larvae									
Order : Diptera	adult	5	1	2.	1	20	5	27	2	
Order : Diptera	pupae	13	8	4	2	8	13	39		
Order : Diptera	larvae		1		112					
Family : Dixidae Family : Chironomidae	larvae adult	1			1			1	1	1
Family : Chironomidae									5	20
Family : Chironomidae	pupae Iarvae	1200	1248	1040		400	0.40		53	29
Sub-family : Orthodadiinae	larvae	140	1240	59		120	240	420	307	85
<u>Crictopus spp.</u>	larvae	140	12	55			10	40	57	52
Crictopus / Orthocladius sp.	larvae								15	15
Orthocladius sp.	larvae								145	
Corynoneura sp.	larvae								9	•
Eukiefferiella sp.	larvae								9	6
Eukiefferiella sp. ?	larvae									
Rheocricotopus sp.	larvae								9	4
Thienemanniella sp.	larvae		24						9 25	4 8
Synorthocladuis sp.	larvae								25	0
Sub-family : Prodiamesinae	larvae									
Sub-family : Diamesinae	larvae									
Boreoheptgvia sp.	larvae									
Diamesa sp.	larvae		60	89			17			
Diamesa ?	larvae	140		-						
Pagastia sp.	larvae									
Potthastia sp.	tarvae								1	1
Sub-family : Tanypodinae	larvae									
Thienemannimyia group	larvae								36	12
Sub-family : Tanytarsini	larvae									
Tribe : Tanytarsini	pupae									
Tribe : Tanytarsini	larvae								196	25
Sub-family : Chironominae	larvae									
Micronsectra sp.	larvae		12	Present			20	61		
Family : Empididae	larvae									
<u>Chelifera sp.</u>	larvae								1	
Oreogeton sp.	larvae									
Family : Ceratopogonidae	larvae									

EMS Number FES Sample Number Site Name		E238633 990311 Cestord Ref 1	E238633 990312 Cesford Ref 2	E238633 990313 Cesford Ref 3	E238634 990314 Cesford u/s 1	E238634 990315 Cesford u/s 2	E238634 990316 Cestord u/s 3	E238635 990317 Cesford d/s 1	E238635 990318 Cesford d/s 2	E238635 990319 Cestord d/s 3
Replicate # units	stage	1	4	•	•	-	•	•	-	-
Bezzia / Probezzia sp.	larvae	4	10		1		2	6	6	1
Family : Tipulidae	larvae	1	4	3		1	3	1		
Tipula abdominalis	larvae								2	1
Dicranota sp.	iarvae								1	
Hexatoma sp.	larvae									
<u>Rhabdomastix sp.</u>	larvae									
Antocha sp.	larvae									
Family : Athenicidae	larvae									
Athentx sp.	larvae								1	5
Family : Simulidae	larvae							32	•	5
Family : Simuliidae	pupae			1				32		
<u>Cnephia sp.</u>	larvae									
<u>Simulium sp.</u>	pupae Iarvae	4	2	4	1		7	132		
<u>Simulium sp.</u> Simulium ?	larvae	-	-	•			-			
Family : Stratiomyidae	larvae									
Family : Tanyderidae	larvae									
Protoplasa fitchil	larvae									
Family : Psychodidae	larvae									
Pericoma sp.	larvae		1				1	8	12	4
Order : Coleoptera	adult			2			6	3		1
Family : Elmidae	adult									
Family : Elmidae	larvae	2	1	2	16	20	16	11	9	4
Lara sp.	tarvae									
Narpus ?	larvae								3	
Optioservus sp.	larvae									
Family : Curculionidae ?									1	1
Family : Dytisciclae	larvae								I	'
Family : Gyrinidae ? Order : Collembola	larvae			1		3	1	8	6	2
Family : Sminthuridae				•		Ũ	•	•	•	1
Sub-Class : Ostracoda		2	4	2	2	1	2			
Sub-class : Copepoda		-	-		-		-			
Order : Cyclopoida										
Order : Harpacticoida										
Phylum : Nematoda			2	1	2	2	2		2	
Class: Arachnoida		2						2	1	1
Group : Hydracarina		87	151	87	10	29	96	18	22	5
Family : Protzildae										
Wandesia sp.										
Division : Oribatei										
Phylum : Mollusca										
Class : Gastropoda			4	2						
Family : Planorbidae										
Order : Pelecypoda										
Phylum : Platyhelminthes		~	3	2	3	9	1	16		
Class : Turbellaria		23	3	2	3	9		10		
Polycelis coronata										
Total		2007	1929	1567	395	653	1450	1220	1272	621
# of Taxa		200.	31	29	23	24	35	33	48	44
# of Ephemeroptera		6	5	5	6	6	7	7	8	10
# of Plecoptera		5	4	4	4	5	7	5	6	7
# of Tricoptera		4	4	3	3	3	3	3	4	3
# of Long- Lived Taxa (sv?)		0	·	-	0	-	-	0		
# of Intolerant Taxa		1			0			1		
% of Individuals in Tol. Taxa		0.45%	0.88%	0.45%	0.25%	0.15%	0.69%	11.07%	0.55%	1.61%
% of Predator Individuals		3.14%	4.41%	3.64%	18.23%	18.53%	17.52%	13.85%	16.25%	14.65%
# of Clinger taxa		9	7	8	8	8	9	10	12	12
% dominance (3 taxa)		74%	77%	78%	54%	50%	59%	52%	58%	38%
% Oligochaetes		0.2%	0.8%	0.2%	0.0%	0.2%	0.2%	0.2%	0.6%	1.6%
% Chironomids		73.7%	70 .3%	75.8%	0.0%	18.4%	19.8%	42.7%	67.5%	41.4%

EMS Number FES Sample Number Site Name		E238626 990290 Barren	E238626 990291 Barren	990292	990302	E238630 990303 Johnny David	E238630 990304 Johnny David	E238636 990323 Crow	E238636 990324 Crow	E238636 990325 Crow	400764 990533 Foxy b/m	400764 990534 Foxy b/m	40076- 990534 Foxy b/
Replicate #		1	2	3	1	2	3	1	2	3	1	2	3
units	stage												
Phylum : Nematomorpha													
Class : Oligochaeta Esmiliu u lumbricidae					2			3		1			
Family : Lumbricidae Family: Naididae													
Nais sp.												1	1
Order : Ephemeroptera	aduit											1	<u> </u>
Order : Ephemeroptera	nymph	20		32	40	8	133	79	78	19		•	
Family : Ameletidae	nymph												
Ameletus sp.	nymph	12		2	7		8	2	3		1		
Family : Ephemerellidae	nymph	4	4	6				6	9		31	13	27
Drunella doddsi	nymph							69	30	52	7	32	14
<u>Drunella grandis</u>	nymph	•			_	-							
Drunella sp. Drunella ?	nymph	2	1	8	7	9	22	1		1			
Ephemerella	nymph Iarvae												
Serratella sp.	nymph							2	1	2			
Family : Heptageniidae	nymph	17	10	30	60	18	53	2 52	14	12	26	10	12
Cinyamula sp.	nymph							3	2		1	2	16
Epeonis sp.	nymph		24	24	2	1	8	32	9	38	21	34	18
Rhithrogena sp.	nymph	6	12	11	1	1		40	29	36	2	4	1
Stenonema	larvae										_		•
<u>1st instar</u>	larvae												
Family : Baetidae	nymph												
Baetis sp.	nymph	19	39	46	20	26	76	304	97	370	192	333	81
Baetis ?	nymph			-			-						
^r amily : Leptophiebiidae Romiostoshiobio on	nymph	2	1	2	1		3					46	4
<u>Paralaptophlebia sp.</u> Drder : Plecoptera	nymph							4	1	2	67		
Dider : Plecoptera	juvenile nymph	169	174	49	92	42	184	24	17	14	20	40	11
amily : Capniidae	juvenile	105	1/4	40	52	42	104						
amily : Capniidae	nymph							8	5	5	15	28	2
amily : Chloroperlidae	juvenile							Ũ	J		15	25 16	2
amily : Chloroperlidae	nymph		2					4	3	2	12	10	з
Kathroperla sp.									•	-			Ũ
Monería	larvae												
Paraperla	larvae												
Suwattia sp.	nymph												
weltsa sp.	nymph												
Sweitsa complex	nymph	60	27	72	23	8	51	23	16	15	21	19	2
Weitsa complex ?	nymph												
amily : Taeniopterygidae amily : Taeniopterygidae	juvenile			405									
amily: Nemouridae	nymph nymph			165	1	e							
amay : Nemourode Amphinemura sp.	nymph nymph				1	6							
Alsoka	larvae												
lemoura	larvae												
lapada sp.	nymph							50	13	34	13	25	9
apada ?	nymph	18		57			84				10	20	
amily : Periodidae	nymph	3		3				4		2	48	17	21
legarcys sp.	nymph												
Aegarcys?	nymph												
soperla	larvae												
crynopteryx	larvae												
<u>st instar</u> Skupla 2	larvae				_								
<u>ìkwala ?</u> ìkwala sp.	nymph				5	-							
amily : Pteronarcyidae	nymph nymph					2	4				1		
teronarcella sp.	nymph												
teronarcys sp.	nymph												
amily : Periidae	nymph										2	25	
oroneuria sp.	nymph										2	20	14
esperoperta sp.	nymph											1	
amily : Leuctridae / Capnildae	nymph												
hylum : Coelenterata													
rdra sp.													

order thouse the second of the s	EMS Number FES Sample Number Site Name		E238626 990290 Barren	E238626 990291 Barren	E238626 990292 Barren	E238630 990302 Johnny David	E238630 990303 Johnny David	E238630 990304 Johnny David	E238636 990323 Crow	E238636 990324 Crow	990325 Crow	400764 990533 Foxy b/m	400764 990534 Foxy b/m	
Date: Promotypes 1	Replicate #		1	2	3	1	2	3	1	2	3	1	2	3
Date: Image: Image: <thimage:< th=""> Image: <thimage:< th=""> <thimage:< th=""> Image:</thimage:<></thimage:<></thimage:<>	units													
Date: Junce J		adun												
name: name: <th< td=""><td></td><td></td><td></td><td></td><td>_</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td></th<>					_								2	
Bakender: Homogen reput 1 1 Dried:: Information Jacobic Structure 1 2 Dried:: Jacobic Structure Jacobic Structure 1 3 Dried:: Jacobic Structure Jacobic Structure 1 3 Dried:: Jacobic Structure Jacobic Structure Jacobic Structure Dried:: Jacobic Structure Jacobic Structure Jacobic Structure <td>•</td> <td></td> <td>1</td> <td></td> <td></td> <td>3</td> <td>1</td> <td>1</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	•		1			3	1	1						
Date: Tendentian jurve 1 3 2 16 39 1 2 1 2 Driet: Tringparts puppe 1 2 1 2 1 2 Driet: Tringparts puppe 1 2 1 3 1 1 2 1 3 Tringparts puppe 3 1 1 2 1 3 1 1 2 1 3 1 1 2 1 3 1 1 2 1 3 1 1 1 3 1 <t< td=""><td>Sub-order : Homoptera</td><td>adult</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	Sub-order : Homoptera	adult												
Date 1 Date 1 2 1 2 1 2 Start 11200000000000000000000000000000000000	Sub-order : Homoptera	nymph	·						1					
Date: Torongene Torongene <thtororongene< th=""> <thtorongene< th=""> <thtor< td=""><td>Order : Trichoptera</td><td></td><td>14</td><td>13</td><td>33</td><td>23</td><td>16</td><td>39</td><td>_</td><td></td><td></td><td></td><td></td><td></td></thtor<></thtorongene<></thtororongene<>	Order : Trichoptera		14	13	33	23	16	39	_					
Same 1 Same 1<		•		-					3	2		1	•	
Biogeogeneration Name 1 2 2 1 3 1 1 2 2 1 3 1 1 2 1 3 1 1 2 1 3 1 1 2 1 3 1 1 2 1 3 1 1 2 1 3 1 1 3 1			1	2							1		2	
Tamber Proponentiale Parame	•		1			3	1	1	2	2	1		3	
Same of Same o			•			•	•	•	-	-	•	1	Ū	
Physeconding Burves Burves B 6 6 1 2 14 6 6 25 16 8 Brandy Hydopsychidae Javenia Javenia 2 6 2 1 37 1 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>														
name: functionage/initiale juence/initiale initiale initi	Rhyacophila sp.		6	6	6		1	2	14	6	6	25	16	8
Tamby : Independence Iannee 1 2 6 2 1 databasedo al. Catabasedo al. Diference al. Sately-catabasedo 2. lannee 1 3 5 1 1 databasedo al. Diference al. Stately-catabasedo 2. lannee 1 1 1 1 Ranaezo al. Diference al. Stately-catabasedo 2. lannee 1 1 1 1 Ranaezo al. Stately-catabasedo 2. lannee 1 1 1 1 1 Ranaezo al. Stately-catabasedo 2. lannee 1 <td>Rhyacophila ?</td> <td>larvae</td> <td></td>	Rhyacophila ?	larvae												
andipage/particular and bardingsauzubar and interessional and	Family : Hydropsychidae	juvenile							20	1	37			
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Oregonation sp. larvae 1	Family : Empididae													
	<u>Chelifera sp.</u>	iarvae											1	1
Family : Ceratopogonidae larvae	Oreogeton sp.	larvae												1
	Family : Ceratopogonidae	larvae												

EMS Number FES Sample Number Site Name		E238626 990290 Barren	E238626 990291 Barren	E238626 990292 Barren	990302	E238630 990303 Johnny David	E238630 990304 Johnny David	E238636 990323 Crow	E238636 990324 Crow	E238636 990325 Crow	400764 990533 Faxy b/m	400764 990534 Foxy b/m	400764 990535 Foxy b/n
Replicate #		1	2	3	1	2	3	1	2	3	1	2	3
nits	stage								<u> </u>				
Bezzia / Probezzia sp.	larvae	3	1	2	4	1	3	3	1	1	5	•	
amily : Tipulidae	larvae		3	1		2	6	_	1	1		2	
Tipula abdominalis	larvae							1		1			
Dicranota sp.	larvae								1	-			1
Hexetome sp.	larvae							1		5			
Rhabdomastix sp.	larvae									1			
Antocha sp.	larvae												
amily : Athencidae	larvae												
Athentx sp.	larvae							_					
Family : Simuliidae	larvae			1				7		359		•	
Family : Simuliidae	pupae									11		3	
<u>Cnephia sp.</u>	larvae									1			
<u>Simulium sp.</u>	pupae												-
Simullum sp.	larvae					1	4				1	27	2
Simulium ?	larvae												
amily : Stratiomyidae	larvae												
Family : Tanyderidae	larvae												
Protoplasa fitchii	larvae												
Family : Psychodidae	larvae												
Pericoma sp.	larvae	31	9	18	40	13	44	11	19	16	· · · _		
Order : Coleoptera	adult	3						5	6	2	1	1	
Family : Elmidae	adust												
Family : Elmidae	larvae	8	13	32	1	1	5	17	6	5	11	7	
ara sp.	larvae												
<u>Varpus ?</u>	larvae							11	1	4	4	3	13
Optioservus sp.	larvae							7		2			
Family : Curculionidae ?													
Family : Dytiscidae	larvae										1		
Family : Gyrinidae ?	larvae							-					
Order : Collembola					1	1		2	4		4	1	2
Family : Sminthuridae												•	
Sub-Class : Ostracoda		1	2	6	22 .		28				5	3	
Sub-class : Copepoda												3	
Order : Cyclopoida									1				
Order : Harpacticoida					<u>. – – –</u>								
Phylum : Nematoda				2	1		1	4	2		1	2	
Class: Arachnoida										1			1
Group : Hydracarina		9	4	8	4	3	5	16	3	9	3	8	1
Family : Protziidae													
<u>Wandesia sp.</u>								2				4	
Division : Ortbatei								2	2	5			1
Phylum : Mollusca													
Class : Gastropoda		1		1	-								
Family : Planorbidae													
Order : Pelecypoda													
Phylum : Platyhelminthes													
Class : Turbellaria					1								
Polycelis coronata								2	1		2	2	2
Total		550	416	698	574	268	1086	995	526	1185	584	832	296
f of Taxa		27	24	29	29	27	29	45	39	43	39	47	31
# of Ephemeroptera		8	7	9	8	6	7	12	11	9	9	9	8
f of Plecoptera		4	3	5	4	4	4	6	5	6	9	8	7
# of Tricoptera		3	3	3	3	5	5	4	4	4	3	6	1
# of Long- Lived Taxa (sv?)		0			0			0			1		
# of Intolerant Taxa		0			0			0			0		
% of Individuals in Tol. Taxa		0.00%	0.00%	0.00%	0.35%	1.49%	0.83%	1.01%	0.19%	0.25%	0.17%	3.25%	0.687
% of Predator Individuals		13.09%	12.50%	14.33%	5.57%	4.48%	5.71%	5.13%	5.70%	2.70%	20.03%	11.66%	17.23
		7	9	9	7	10	9	16	13	16	12	16	11
# of Clinger taxa													
# of Clinger taxa % dominance (3 taxa)													444
# of Clinger taxa % dominance (3 taxa) % Oligochaetes		63% 0.0%	58% 0.0%	42% 0.0%	56% 0.3%	59% 0.0%	51% 0.0%	45% 0.3%	45% 0.0%	68% 0.1%	53% 0.0%	52% 0.1%	44% 0.3%

4

Appendix B: Habitat Assessment Forms

Stream Name:	Site No.:	EMS:
Site Description:		
Date:	Time:	Field Crew:
Comments:		
Air Temp: °C	Water Temp: °C	
Weather Conditions: Now: storm (heavy rain) rain (steady rain) showers (intermittent) overcast clear/ sunny Has there been a heavy rain in the p	☐ rain (☐ show ☐ overc ☐ clear/	(heavy rain) steady rain) ers (intermittent) ast ' sunny
	diagram of the site and indicate th	e areas sampled, and estimate the
length of channel assessed)		
Record Time of Collection for each Sample 1: Sample 2		
Disturbance Indicators: Check off Bed Characteristics	the following disturbance indicators	present at the site
Extensive areas of scour	Extensive areas of (un	vegetated) bar
Large extensive sediment wedg	es Elevated mid-channel	bars
Extensive riffle zones	Limited pool frequence	y and extent
Channel Pattern Multiple channels (braiding)		
Banks		
Eroding banks	Isolated sidechannels	or backchannels
Large Woody Debris	Recently formed LWD) jams

4

Riparian Vegetation	
Check off the dominant vegetation type:	
Unvegetated (much bare mineral soil is visible)	Shrub / Herb
Conjerous Forest Deciduous Forest	Mixed Conifer - Deciduous Forest
	_
Record the dominant species present:	
Record the dominant species present.	
Record the Structural Stage of the dominant vegetat	ion in the Rinarian Area
Non-vegetated or initial stage following disturba	
shrub / herb stage, less than 10% tree cover	
pole-sapling stage, with trees overtopping the sh	rub layer, usually less than 15-20 years old
young forest (30- 80 years) - forest canopy is diff	
mature forest - well developed understory	
	the stream covered by the projecting riparian canopy)
$\square 0 - 20\% \text{ covered} \qquad \square 20 - 40\% \text{ covered} \\ \square 70 - 20\% \text{ covered} \qquad \square 200\% \text{ covered} $	40 - 70% covered
70 - 90% covered >90% covered	
Stream Characterization	Gradient
	Steep
	☐ Moderate ☐ Low
Stained	Low
Other	
Predominant Surrounding Land Use	ricultural
	ricultural Residential
Logging Mining Con Local Watershed Erosion	Local Watershed NPS Pollution
Heavy	Obvious sources Comments:
☐ Moderate	Some potential Sources
□ None	No evidence
Stream Parameters (Record 3 measurements)	
Stream Wetted Width: m m m	Stream Bankfull Width: m m m
Stream Wetted Depth:mmm	Stream Bankfull Depth:mmm
Primary Habitat Units Present (check any habita	ats that occupy more than 50% of the wetted width
of the main channel)	
Pools Glides Riffles	Cascades Other
Sediment / Substrate	
<u>Odors</u>	
Sewage Petroleum Anaerobic	Chemical None Other
	Durafina
Absent Slight Moderate	Profuse
Bed Material	
Substrate Type Diameter	% composition in reach (=100%)
Sands, Silts, Clays & fine < 2mm	76 composition in reach (=100%)
Organic materials	
Gravels 2 - 64 mm	· · · · · ·
Cobbles 64 - 256 mm	······································
Boulder > 256 mm	
Bedrock > 4000 mm	
Cover = %	

<u>Cover =</u>

(% cover is the percent of the wetted surface area that is covered by woody debris, boulders, cutbanks, deep pools, overhanging vegetation (within 1 m of water surface) or instream vegetation)

Alaska Stream Condition Index (ASCI) Habitat Assessment Field Data Sheet

Major, E.B. and M.T. Barbour. 1997. Standard Operating Procedures for the Alaska Stream Condition Index: A Modification of the U.S. EPA Rapid Bioassessment Protocols. Prepared for Alaska Department of Environmental Conservation, Anchorage, Alaska.

Site Name:	Date/Time:
Sampling Team:	Comments:

Habitat Parameter		Categ	jory				
	Optimal	Suboptimal	Marginal	Poor			
1. Epifaunal Substrate / Available Cover	Greater than 70% of substrate favorable for epifaunal colonization, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (ie, logs/snags that are not new fall and not transient	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale)	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.				
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0			
2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides substantial niche space.	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are			
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0			
3. Velocity-Depth Combinations	All four velocity-depth combinations present (slow-deep, slow- shallow, fast-deep, fast- shallow)	Only 3 of the 4 combinations present (if fast-shallow is missing, score lower than if missing other combinations)	Only 2 of the 4 habitat combinations present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity-depth combination (usually slow-deep).			
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0			
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20- 50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low- gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.			
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0			
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	available channel; or ate is substrate is exposed. Available channel, and/or rifle substrates are mostly exposed. are mostly exposed. are mostly exposed.					
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0			

Habitat Parameter		Categor	ry				
	Optimal	Suboptimal	Marginal	Poor			
6. Channel	Channelization or dredging	Some channelization	Channelization may	Banks shored with			
Alteration	absent or minimal; stream with normal pattern.	present, usually in areas of bridge abutments; evidence of past channelization, ie, dredging, (greater than past 20 yr) may be present, but recent channelization is not	be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	gabion or cement; over 80% of stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.			
		present.					
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0			
7. Channel Sinuousity	Occurrence of riffles (or bends) relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important. All 4 velocity-depth patterns present.	Occurrence of riffles (or bends) infrequent; distance between riffles divided by the width of the stream is between 7 to 15. Only 3 of 4 velocity-depth patterns present (ie, slow-deep, slow-shallow, fast-deep, fast- shallow).	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles (or bends) divided by the width of the stream is between 15 to 25. Only 2 velocity-depth patterns present; usually lacking deep areas.	Generally all flat water or shallow riffles (or bends); poor habitat; distance between riffles divided by the width of the stream is a ratio of >25. Dominated by one velocity-depth pattern.			
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0			
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion, mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60 – 100% of bank has erosional scars.			
SCORE (LB)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0			
SCORE (RB)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0			
9. Bank Vegetative Protection (score each bank)	More than 90% of the streambank & immediate riparian zone surfaces covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream- bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.			
SCORE (LB)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0			
SCORE (RB)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0			
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (ie parking, roadbeds, clearcuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.			
SCORE (LB)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0			
SCORE (RB)	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0			

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Appendix C: Benthic Invertebrate Taxa & Classifications

FES Sample Number	LL	FFG	LH	CLINGER		SED	TOL	SENS	COLD	COMMENTS
Phylum : Nematomorpha										
Class : Oligochaeta		cg	uv		ST		Т			
Family : Lumbricidae										
Family: Naididae										
Nais sp.										
Order : Ephemeroptera		un	uv							
Family : Ameletidae										
Ameletus sp.		cg	uv							
Family : Ephemerellidae		cg	uv	d						
Drunella doddsi		сg	uv	cl				yes	yes	
Drunella grandis		cg	uv	cl						
Drunella sp.		cg	SV	cl						
Serratella sp.		cg	uv	cl						
Ephemerella sp.		cg		cl			1			
Family : Heptageniidae		SC	uv	cl						
Cinygmula sp.		SC	uv	cl						
Epeorus sp.		SC	uv	cl		-				
Rhithrogena sp.		SC	uv	cl						
Family : Baetidae		cg	mv							
Baetis sp.		cg	mv							
Family : Leptophlebiidae		cg	uv							
Paraleptophlebia sp.		cg	uv							
Order : Plecoptera		un	uv					[
Family : Capniidae		sh	uv							sens. family
Family : Chloroperlidae		pr	uv	cl						
Isoperta sp. ?		pr	uv	cl						common
Kathroperla sp.		pr	uv	cł				yes		
Kathroperla / Paraperla sp.		pr	uv	cl			1	yes		
Neaviperla sp.?								<u> </u>		
Suwallia sp.		pr	uv	cl				ļ		
Sweltsa sp.		pr	uv	cl						
Sweltsa complex		pr	uv	cl						
Family : Taeniopterygidae		om	uv					yes		
Taenionema sp.		SC	uv					yes		
Family : Nemouridae		sh	uv			1				
Amphinemura sp.		sh	uv	1			-			
Zapada sp.		sh	uv					t		
Family : Perlodidae		pr	uv	1						
Cultus ?		<u> </u>				1				
Megarcys sp.		pr	uv					yes	yes	cold adapted, intolerant
Skwala sp.		pr	uv				<u> </u>	<u> </u>		*
Family : Pteronarcyidae		om	sv							
Pteronarcella sp.	LL	om	sv	1						
Pteronarcys sp.		om	sv							

FES Sample Number	LL	FFG	LH	CLINGER	,	SED INTOL	TOL	SENS	COLD	COMMENTS
Family : Perlidae		pr	SV							
Doroneuria sp.		pr	SV					yes	yes	
Hesperoperla sp.		pr	SV							
Family : Leuctridae	_	sh	uv				_	yes	yes	sens. family
Family : Leuctridae / Capniidae	;	sh	uv					yes	yes	sens. family
Order : Lepidoptera		un	uv							
Order: Thysanoptera										
Order: Hymenoptera										
Order : Hemiptera		un	uv							
Family : Aphididae										
Sub-order : Homoptera						-				
Order : Trichoptera		un	uv							
Family : Glossosomatidae		SC	uv						<u> </u>	
Glossosoma sp.		SC	uv	cl		SIT				
Family : Rhyacophilidae		pr	sv	cl					<u> </u>	
Rhyacophila sp.		pr	sv	cl					<u> </u>	
Family : Hydropsychidae		cf	mv	cl						
Arctopsyche sp.		pr	sv	cl		SIT			<u> </u> +	cold, swift water
Hydropsyche sp.		cf	uv	cl			T		+	ubiquitous
Ceratopsyche ?			<u> </u>	d?					<u> </u>	· · · · · · · · · · · · · · · · · · ·
Cheumatopsyche sp.										
Parapsyche sp.	LL	pr	sv	. cl		SIT				
Family : Brachycentridae		om	uv	cl				<u> </u>		
Micrasema sp.		om	uv	cl			<u> </u>			
Brachycentrus sp.		om	sv	cl						
Family : Hydroptilidae		ph	mv				T	<u> </u>		
Family : Limnephilidae		un	uv	cl?	-		1?	<u> </u>		some sp. Intolerant
Dicosmoecus sp.		om	uv						+	
Ecclisiomyia ?				<u> </u>						
Order : Diptera		un	uv	+			-		<u> </u> -	······
Family : Dixidae		cg	uv					}		
Family : Chironomidae		un	mv							
Sub-family : Orthocladiinae		cg	mv							
Crictopus spp.		cg	mv				-			
							-	-	<u>├──</u> +	
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		1 3								
Crictopus / Orthocladius sp. Orthocladius sp. Corynoneura sp. Eukiefferiella sp. Rheocricotopus sp. Thienemanniella sp. Synorthocladuis sp. Sub-family : Prodiamesinae Sub-family : Diamesinae Boreoheptgyia sp. Diamesa sp. Pagastia sp.		Cg om om Cg Cg Cg Cg Cg Cg Cg	mv mv mv mv mv mv mv mv					yes		

FES Sample Number	LL	FFG	LH	CLINGER		SED INTOL	TOL	SENS	COLD	COMMENTS
Potthastia gaedii type		cg	mν					yes		
Potthastia sp.		cg	mv					yes		
Sub-family : Tanypodinae		pr	mv							
Thienemannimyia group		pr	mν							
Sub-family : Tanytarsini		cg	mv							
Tribe : Tanytarsini		cg	mv							
Sub-family : Chironominae		cg	mv							
<u>Tanytarsus sp.</u>										
Micropsectra sp.		cg	mv							
Family : Empididae		pr	uv							
<u>Chelifera sp.</u>		pr	uv							
<u>Hemerodromia sp.</u>										
Oreogeton sp.		pr	uv					yes	yes	
Family : Ceratopogonidae		pr	uv				t	l		
<u>Bezzia / Probezzia sp.</u>		pr	uv							
Family : Tipulidae		sh	uv		ST					
<u>Tipula abdominalis</u>		sh	uv		ST					
<u>Dicranota sp.</u>		pr	uv		ST					
<u>Ormosia sp.</u>		pr	sv		ST	_				
<u>Hexatoma sp.</u>		pr	uv		ST					
Rhabdomastix sp.		pr	sv					yes		
Antocha sp.		cg	uv	cl	ST					
Family : Athericidae		pr					yes			
<u>Atherix sp.</u>		pr	uv				yes			
Family: Dixidae										
Family : Simuliidae		cf	uv	cl						
<u>Cnephia sp.</u>		cf		cl						
<u>Simulium sp.</u>		cf	uv	cl			T			
Family : Stratiomyidae		cg	uv				yes			
Family : Tanyderidae										
Protoplasa fitchii										
Family : Psychodidae		cg	uv							
<u>Pericoma sp.</u>		cg	uv							
Family: Tabanidae		pr	uv				Т			
<u>Tabanus sp.</u>		pr					T			
Order : Coleoptera		un	uv							
Family : Carabidae ?										
Family : Elmidae		cg	sv							
Lara sp.	LL	sh	sv	cl						
Narpus ?		SC	sv	cl						
<u>Optioservus sp.</u>		SC	sv	cl			Т			
Zautaevia sp.		cg	sv				yes			
Family: Haliptidae		sh					yes			
<u>Haliplus sp.</u>		sh					yes			
Family : Curculionidae ?										

FES Sample Number	LL	FFG	LH	CLINGER		SED INTOL	TOL	SENS	COLD	COMMENTS
Family : Dytiscidae		pr	SV				yes			
Family : Gyrinidae ?		pr	SV							
Order : Collembola		cg								
Family : Sminthuridae										
Class: Crustacea										
Sub-Class : Ostracoda										
Sub-class : Copepoda										
Order : Cyclopoida										
Order : Harpacticoida										
Order : Cladocera										
Bosmina sp.										
Phylum : Nematoda		om								
Class: Arachnoida										
Group : Hydracarina		pa	mv							
Family : Protziidae										
Wandesia sp.										
Division : Oribatei										
Phylum : Mollusca										
Class : Gastropoda		SC	uv		st					
Family : Planorbidae		SC	uv		yes		yes			
Order : Pelecypoda		cg	sv							
Family : Sphaeriidae				•						
Phylum : Platyhelminthes										
Class : Turbellaria										
Polycelis coronata										
Phylum : Coelenterata										
Hydra sp.		pr	mv				yes			

	Abbreviation	Classes
Long Lived	LL	
Functional Feeding	FFG	un = unknown
Group		cg = collector - gatherer
-		sc = scraper
		pr = predator
		sh = shredder
		om = osmosis
		cf = collector - filterer
		pa = parasite
Life History	LH	uv = univoltine
-		sv = semi-voltine
		mv = multiivoltine
Clinger	CL	Clinger behaviour
Sediment Tolerant	Sed Tol	
Sediment Intolerant	Sed Intol	
Sensitive	Sens.	
Cold water taxon	Cold	

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Appendix D: Summary of Metrics Calculated from Raw Data

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Stream	Team	ASCI Habitat Rating	Total # of taxa	Ephemeroptera	Plecoptera	Trichoptera	Long Lived	Intolerant	% Tolerants	% Predators	# Clinger Taxa	% dominance (3 taxa)	IBI Score
				Taxa	Taxa	Taxa	Taxa	Taxa					
Allport	2	129	35	8.7	8.0	4.0	1	1	0.09%	10.30%	10.3	43%	37
Barren	3	123.5	27	8.0	4.0	3.0	0	0	0.00%	13.31%	8.3	54%	23
Bob	3	154	22	7.7	3.3	2.0	0	0	0.08%	6.88%	7.0	58%	21
Buck @ 12 km	3	159.5	21	5.3	4.0	2.7	0	1	0.57%	8.43%	7.3	55%	21
Buck @ Buikley Conf.	3	134.5	24	5.7	3.7	3.7	0	0	0.68%	5.96%	6.7	69%	17
Buck @ Mall	3	123.5	23	5.3	5.0	2.3	0	0	0.87%	5.11%	6.3	60%	19
Bulkley @ Craker	1	131.5	21	6.7	4.0	3.0	1	0	2.66%	5.63%	5.7	56%	19
Buikley @ Knockholt	1	157	35	8.7	7.3	3.7	1	0	0.91%	12.98%	9.7	44%	31
Bulkley @ Morice Confl.	1	141.5	26	6.7	5.3	3.7	1	0	0.31%	6.09%	7.0	61%	25
Byman	3	122	21	6.0	4.0	2.3	0	0	2.83%	9.03%	5.3	51%	17
Byman Reference	2	162.5	30	8.3	5.3	3.0	0	1	3.53%	7.43%	10.0	41%	29
Cesford @ Topley	2	111	41	8.3	6.0	3.3	0	1	4.41%	14.59%	11.3	49%	33
Cesford Reference	2	169	30	5.3	4.3	3.7	0	1	0.59%	3.73%	8.0	76%	21
Cesford above Topley	2	130	27	6.3	5.3	3.0	0	0	0.37%	18.09%	8.3	54%	25
Crow	1	139	42	10.7	5.7	4.0	0	0	0.48%	4.51%	15.0	53%	31
Foxy below mine	1	181	39	8.7	8.0	3.3	1	0	1.36%	16.31%	13.0	49%	33
Foxy @ Maxan	1	170	50	10.3	8.0	4.7	1	1	0.53%	6.71%	15.0	46%	41
Johnny David	3	116	28	7.0	4.0	4.3	0	0	0.89%	5.25%	8.7	55%	23
McQuarrie	3	119	22	6.3	3.7	1.0	0	0	0.46%	6.58%	5.0	67%	15
McQuarrie Reference	2	147	24	7.3	3.0	3.7	0	0	1.41%	8.33%	8.0	46%	23
Richfield @ CN	1	144.5	50	10.0	6.7	5.0	2	1	3.45%	7.33%	15.3	51%	39
Richfield @ hwy 16	2	131	24	6.0	4.3	2.3	0	0	6.66%	8.21%	7.7	58%	23
Richfield Upstream	2	154	22	5.3	4.3	4.0	0	0	4.51%	3.13%	5.0	61%	19

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