FINAL

A BIOLOGICAL ASSESSMENT OF THE BENTHIC MACROINVERTEBRATES IN THE SILVER CREEK WATERSHED, BLAINE COUNTY, IDAHO

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AUTHORIZATION TO SUBMIT

THESIS

This thesis of Nicholas M. Whitaker, submitted for the degree of Master of Science with a Major in Environmental Science and titled "A Biological Assessment of the Benthic Macroinvertebrate in the Silver Creek Watershed, Blaine County, Idaho," has been reviewed in final form. Permission, as indicated by the signatures and dates given below, is now granted to submit final copies to the College of Graduate Studies for approval.

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Abstract

The federal Clean Water Act (CWA) requires that states monitor the biological components of streams. In 1993, the Beneficial Use Reconnaissance Project (BURP) was developed in Idaho to meet the CWA criteria of monitoring the chemical and biological aspects with the integration of the physical attributes to assess the quality of the states' streams. Bioassessment using benthic macroinvertebrates as an indicator of stream health is the most efficient method in analyzing water quality because: (1) the cost of sampling water is modest, (2) this technique produces rapid bio-assessments, and (3) macroinvertebrates are sensitive to many types of environmental changes. In order to understand the water conditions of Silver Creek, in south central Idaho, a biological assessment of the benthic macroinvertebrates was conducted in 2005 and 2006. Macroinvertebrates were collected with a modified Hess sampler at ten sampling locations in the Silver Creek watershed and identified to the lowest possible taxonomic level. Analyses of the results were based on the Idaho's Department of Environmental Quality Stream Macroinvertebrate Index (ISMI) and a modified index (MSMI) to better evaluate spring-fed streams. Based on the calculated MSMI scores, an overall average ecological health rating of good was achieved by the watershed in both 2005 and 2006. Many of the differences noted in the macroinvertebrate assemblages between 2005 and 2006, were probably related to the major flooding event in April 2006 (100 year flood). The data will provide The Nature Conservancy and other managers interested in Silver Creek with a more thorough understanding of the ecological health of this ecosystem and the adjacent riparian area. The sampling sites that only achieved ecological health ratings of "FAIR", should undergo a change in management to improve ecological health in

designated stream segment. Based on comparisons made on Sites #8 (restoration 2002), #9 (restoration 2004), and #10 (no restoration) on Upper Grove Creek, there appears to be improvements to the water quality. Additional improvements could be made to Upper Grove creek by the planting of more woody riparian vegetation and also future rehabilitation work on Site #10, where banks are trampled and un-restored. All of the ten sampling sites will provide a solid baseline to compare with improvements or degradations that will occur on the Silver Creek watershed in the future.

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Introduction

Streams are a dynamic part of watersheds. Any alteration of the water body by humans will affect the ecology of the aquatic ecosystem (Hynes, 1975). As a result, how we choose to treat watersheds has the potential to impact many physical, chemical, and biological characteristics of the surrounding streams. Even the slightest human-induced change can lead to multiple indirect effects that could alter community and physical structures of aquatic ecosystems (Strauss, 1991). For example, poor farming practices, can result in soil and nutrients being washed into waters resulting in increased biomass of plants growing in slow moving and stagnant water bodies (eutrophication). As these plants die they fall to stream beds and resulting decomposition reduces available dissolved oxygen (DO) in the water. These conditions create hypoxic environments (diminished oxygen), which may lead to the demise of fish and other benthic organisms (Kalff, 2002).

Alterations to streams and their surrounding environment by humans have occurred for thousands of years. As early as 3200 BC, irrigation ditches were used in Egypt and even today the remains of great aqueducts created by the Romans still exist (Petts, 1989). Whether changes to watersheds have been from older civilizations or modern present day societies, all have impacted water bodies. Changes to watersheds can lead to undesirable outcomes such as that observed along the Snake River, in southern Idaho. Here during the late 19th and early 20th century settlers viewed the river as an endless supply of water for their crops (Fiege, 1999). But by 1910, the Snake River had dried up at least 35 different times (Lovin, 1981).

Human modifications of surface waters can minimize or destroy niches of already threatened and endangered species of plants and animals. Each species plays a unique

role in the ecosystem (Grinnell, 1914), and removal of just one seemingly insignificant species can cause a cascading effect that will adversely alter the aquatic food web and will ultimately compromise the biologic integrity of a stream (Strong, 1992). Not only can stream biota be adversely impacted, but humans may lose clean water and experience a decline in the game and fish harvest.

A more recent devastating impact can be seen from the water diversions on rivers draining into the Aral Sea. In 1960, the sea had a surface area of 66,900 km^2 but by the year 2000 it had shrunk to 24,200 km^2 (Kalff, 2002). Not only has the commercial fishing been destroyed due to increased salt concentrations, but the people living near the sea, have seen their life expectancy reduced due to higher cancer rates and poorer nutrition. These undesirable changes are linked to the diversions of fresh water from incoming rivers for irrigation and the large amounts of pesticides being used to produce crops (Kalff, 2002; The Ecologist, 2006). People in the region have finally seen the need to change management and The World Bank has put $87 million dollars into trying to improve the Aral Sea. To date, some improvements have been observed (New Scientist, 2006).

Both the Snake River system and Aral Sea show some of the undesirable outcomes that may occur if watersheds are not treated properly. Many of our nation's water bodies have been degraded and polluted from similar actions. This type of impact is not uncommon because humans have many needs for water and consequently watersheds themselves will be impacted from both a water quality and water quantity standpoint. Some pollution and changes on the landscape are unavoidable, because of the food and fiber needs of 300,000,000 people in the USA. Problems occur when humans become over zealous or perhaps greedy in their prospects of wealth and in the process

compromise the watershed and stream health conditions. These compromises can pose threats to human health and the surrounding biota. To try and mitigate the impacts of human modifications of aquatic ecosystems, Congress enacted the Federal Water Pollution Control Act Amendments of 1972.

The Act was later amended and became known as the Clean Water Act (CWA), which was originally written to regulate point source (PS) pollution, defined as pollutants discharged into a water body from a specific source such as effluent discharging from a wastewater treatment plant. Point source pollutants are relatively easy to monitor and regulate because of a specific outlet of the pollutant that can be sampled and measured. In 1987 the CWA was amended to include the regulation of non-point source pollution (NPS) (USEPA, 2006). Non-point source pollution is far more difficult to measure and regulate because its input is more diverse and more diffuse, e.g. fertilizers and pesticides applied to agricultural fields. The applied products will make their way into the local water body by runoff or seepage through a large area of soils and/or geologic materials rather than a specific point source. The CWA requires states to have programs that control non-point source pollutants (Sullivan et al., 2005).

The CWA is not designed to eliminate all pollutants, but rather it is intended to limit the amount of pollution. The elimination of pollution is not feasible given the needs of 300,000,000 Americans. In order to regulate pollutants, a standardized system was established and is known as the Total Maximum Daily Load (TMDL). This program essentially sets the limit on the amounts of regulated contaminants that are acceptable in water bodies. If the TMDL for a particular category of pollutant is exceeded a plan must be developed to reduce the pollutants so that acceptable water quality standards are achieved (Sullivan et al., 2005). Sediments, heavy metals, nutrients, pH, temperature,

and toxic organics are examples of water quality parameters that are regulated under the TMDL program because of their potential to adversely impact aquatic biota. All of these pollutants can originate as non-point source pollutants (USEPA, 2001). This fact can complicate watershed plans developed by managers to decrease levels of pollution because non-point sources are not easy to identify.

Restoring Streams

Many of our nation's streams have been negatively impacted by human activities. These anthropogenic practices which often degraded the physical habitat have reduced water quality and resulted in billions of dollars spent on restoration projects in the USA (Moerke and Lamberti, 2004). In order to improve these degraded ecological systems, modifications must be made to the streams' habitat (Bond and Lake, 2003). Shields et al. (2003 pp.141-142) defined "restoration" as, the "return[ing] of a degraded ecosystem to a close approximation of its remaining natural potential." Such is the hope behind stream rehabilitation programs that have focused on improving aquatic habitats in the USA since the early 1960's (Moerke and Lamberti, 2004).

Some of the benefits derived from stream restoration include cleaner water and the reestablishment and reinvigoration of native flora and fauna. Cleaner water is achieved by the stabilization of stream banks and improvements of riparian zones, which results in reduced runoff of sediments and pesticides into the water systems. Many different techniques have been applied to produce such results in degraded streams. The differing successful restoration techniques applied are dependent on the specific local problem (Frissell and Ralph, 1998). For example, if a stream lacks pools or cover for fish, then pools can be formed by dredging and emplacing logs to help create a habitat

where fish can rest and hide from predators. In returning streams to pre-disturbance conditions, the surrounding native animals and plant species will have conditions that are more likely to enhance their existence.

Such successful restoration efforts have been made on Silver Creek, in southern Idaho. Historically the Silver Creek Drainage has been extensively used for grazing and growing crops since the first settlers came to the area in the late 1800's (Clark and Glasscock, 1997). Because of the intensive grazing in the riparian zones many of the stream banks of the local creeks were trampled and consequently the native riparian vegetation disappeared resulting in serious stream bank erosion (Moore, 2002). This resulted in widened stream channels, which allowed for shallower streams which had increased water temperatures in the summer (Illustration 1). In addition, plant growth in the middle of the creeks allowed for sediments to be deposited in the interstitial spaces. These conditions reduced the stream suitability for fish that require the clean gravels for spawning and also for several other native taxa in the area (Grunder, 1985). Restoration efforts at Silver Creek have been carried out by groups such as Sawtooth Environmental Consulting, Conservation Inc; and The Nature Conservancy. These efforts are supported by the government and private landowners. Under incentives contained in the 2002 Farm Bill, private landowners pay for 25% of the restoration efforts and the government will pay for the remaining 75% (Moore, 2002). Most of the restoration efforts on Silver Creek have used Biologs to create pool-riffle habitats. Biologs are made out of coconut fiber, which are then manufactured into the shape of a log (Illustration 2). The coconut fiber is a preferred medium because they successfully stabilize banks, they have interstitial spaces for aquatic macroinvertebrates to live, and they allow for riparian vegetation to grow. The sediment that is dug out of the channels is placed behind these

Illustration 1. Grazing practices not mindful of the local streams resulted in trampled banks and widened stream channels, such as on Upper Grove Creek shown in the above illustration (Site #10).

Illustration 2. Restoration efforts on Upper Grove Creek, occurred in 2002 and 2004 with the use of Biologs to narrow stream channels.

Biologs to create stabilized banks and the gravel that is removed from deeper pools is then placed in the riffle areas in an effort to improve spawning areas for the fish. Reports indicate that in areas where previously no fish were found in the tributaries due to the intensive grazing, just a year after restoration, fish are holding in pools and spawning on these tributaries (Bonnivier, 2005).

The outcomes from the restoration efforts on Silver Creek are not known. Many costly restoration efforts have proven ineffective over the long-term (Frissell and Ralph, 1998). In order to have an efficient system of emplacing structures to enhance a streams ecosystem, there is a need to evaluate the direct water quality impacts resulting from these remediation changes (Moerke and Lamberti, 2004). Also, with hundreds of millions of tax payers dollars being spent each year, monitoring of restoration outcomes is essential to determine long-term values. Thus an intensive water quality monitoring effort is needed to be associated with all restoration efforts.

Chemical Monitoring

The traditional method for monitoring water quality has been through chemical analysis conducted under laboratory conditions. This method is still used because it can be very accurate and precise in detecting the amounts of chemicals found in a water body. However, this method has many weaknesses (Karr, 1987). One of the primary weaknesses is the cost of analyzing all the different chemical constituents, which can amount to tens of thousands dollars. These chemicals that are detected come from normal human everyday activities including the: (1) manufacture of products, (2) agricultural practices, (3) mining, (4) motor vehicle emissions, and (5) many other sources. To completely eliminate these impacts on our water bodies would be

impossible; however, we can regulate and enforce standards that can be acceptable from an economic standpoint and for the water body and human health. Many chemicals still remain unregulated though, because of the lack of research and knowledge about the impact they have on humans. For example, there is a list of hundreds of chemicals that are suspected of causing cancer or reproductive toxicity, yet most remain unregulated because lack of scientific proof (Sullivan et al., 2005). This problem becomes apparent when it is realized that there are more than 72,000 chemicals produced in the USA and for most of these we know very little about potential impacts on human exposure (NRC 1999). This lack of regulation is primarily because the government does not appropriate the money to produce the research to understand the full impacts of these chemicals on human health. Even if there are human health advisories caused by a chemical, the inefficiencies of federal bureaucracy (such as the EPA that regulates these chemicals) do not allow for monitoring and regulation in a timely manner. Some examples of unregulated pollutants found in our drinking water include Acetone, Benzene (methyl propyl), Diazinon, and 2,4,5-Trichlorophenol (Sullivan et al. 2005).

Another problem with conventional chemical analysis is that samples are taken in the field at one point in time. In other words, a grab sample of water is taken from the field to the laboratory where the results are measured. These results indicate the conditions for only the specific time when the sample was taken. This can be a problem because the chemical concentrations in water are known to fluctuate throughout the day and year. Consequently, peak periods of chemical outputs may be missed and an accurate assessment of water chemistry cannot be made unless multiple samples are collected over a longer period of time. In addition, the concentrations of a pollutant may vary throughout the stream due to the hydrologic complexities in heterogeneous habitats

found in streams. With all the temporal and spatial variation, it is very hard for chemical procedures to accurately assess non-point source pollution. These pollutants seeping or draining into the stream also diffuse from a large area making it hard to determine the amount of pollution coming from NPS and the impacts that land uses are making on the entire watershed.

Currently, the technology exists (data loggers) to measure chemistry parameters include dissolved oxygen (DO), pH, temperature, BOD, COD, conductivity, and turbidity over a longer period of time. However, the ability to collect information about many chemicals is insufficient. There is a lot of research currently being conducted in this area. For instance a project at Washington State University is evaluating sensors to detect heavy metal concentrations in water at many intervals over a 30-day period before the data needs to be downloaded (Reik, 2006). The technology of commonly using data loggers is promising, but it will be sometime in the future before this technology improves the measurements of chemical parameters over time.

Biological Monitoring

Throughout the 1990's to the present, biological monitoring has become more accepted than chemical monitoring and in fact is often the preferred monitoring method as an indicator of water quality. Currently in use in almost every state, organisms are being used as bio-indicators of water quality (USEPA, 2002). The significance of organisms is nothing new since historic observations of rivers and lakes have noted the biological importance of different species (Cairns and Pratt, 1992). The biota of a stream have been shown to respond to peak and cumulative pollution as well as habitat alterations. Because of this, organisms are useful indicators of water quality conditions

(Jessup and Gerritsen, 2002). This biological importance is also referred to as "biological integrity", defined by the EPA (2002) as "the capacity of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region." Aquatic organisms in particular show an overall ecological integrity, which includes the chemical, biological, and physical aspects of a stream.

The Europeans developed the first measurement of this biointegrity in 1907, called the Saprobrien System. This system simply used indicator organisms as measures of conditions in water bodies. Changes to this early system came in 1948, when the focus was switched to community composition rather than individual species (Huels, 2002). The River Continuum Concept (RCC) developed by Vannote et al. (1980) mirrored parts of the earlier methodology using community composition, but also included how the local hydrology and geology of the watershed shaped the aquatic community. The RCC is based on general trends seen in lotic aquatic communities. For example, more allochthonous inputs (leaves and riparian inputs) will often be found in the headwaters, so more shredder and collector organisms will be present compared to higher ordered stream, which should have more scraper organisms in the streams because the food base is primary autochthonous like algae on rocks and macrophytes. Such trends in the biological community can also be seen from responses to environmental changes caused by humans (Vannote et al., 1980).

Based on the above trends, statistical measures of biotic responses to environmental changes were developed, called metrics (Cairns and Pratt, 1992). A metric is simply a predictable response, of a characteristic of community, to an increase in human disturbance to the environment (Karr et al., 1986). There are many different

metrics that have been developed over the years and some are widely used by water managers (Shannon and Weaver, 1949; and Simpson, 1949). Barbour et al. (1996) stated the need to use a multimetric approach, which encompasses many different attributes of the ecological community. Each of the metrics has its own purpose in what it measures and there needs to be an ecologically sound reason for using each one (Karr et al., 1986). It is also important that individual metrics are not redundant and therefore will not bias the ecological rating (Barbour et al., 1992). This multimetric approach is an advantage especially when measuring NPS (the major source of pollution), because it combines the biological, physical, and chemical characteristics of a watershed that are not as easily detected with traditional chemical analysis (Barbour et al., 1996; Grafe, 2002). These metrics combine to form multimetric indices, which result in a number that can be easily compared to assess the water quality conditions of the sample taken. There are arrays of organisms that have been used in bioassessments including: algae, fish, and benthic macroinvertebrates (Grafe, 2002). Each of these organism groups has strengths and weakness as a measure of water health in streams.

Algae as water quality indicators

Periphyton (algae) can be used effectively to monitor stream conditions, although its usage is not as common as fish and macroinvertebrates. Algae, is simply the broad term given to all the organisms that contain chlorophyll a (Biggs and Kilroy 2000). Though it may seem that algae would not be important in assessing water conditions, periphyton are important bioindicators. Strengths of using algae for bioassessments include (Biggs and Kilroy, 2000; Barbour et al., 1999; Hill et al., 2001):

- Algae have short lifecycles and reproduce rapidly making them valuable indicators of short-term impacts.
- At the base of the food web, algae are directly affected by many chemical and physical disturbances in a watershed.
- Algae are very sensitive to pollution; changes in the environment can be seen in the taxonomy and the biomass of algae. This includes sensitivity to herbicides and some other chemicals that fish and macroinvertebrates are not sensitive to.
- Algae flourish in low flow conditions, conditions with high nutrient inputs, and where a flood has not occurred for awhile.
- Algae sampling is generally easy, cheap, and has minimal impact on the resident biota.

Though there are many practical uses of periphyton some key weakness have limited their usage by managers. Some of the more important problems associated with algae as bioindicators are:

- Public acceptance of algae is low because people do not perceive them as good indicators of stream conditions (Rosen, 1995).
- Since periphyton respond rapidly to environmental changes; they are "snapshots" of conditions and do not represent the environmental conditions for the entire season or longer periods of time (Barbour et al., 1999).
- Few states have implemented periphyton monitoring programs (Hill et al., 2001).
- Algae may be sparse in heavily shaded streams and high flows may wipe them away (Barbour et al., 1999).
- Most scientists lack taxonomic expertise for periphyton identification (Hill et al., 2001).

Fish as Water Quality Indicators

Fish were used in 21 states to help gauge water-quality criteria in 2001 (Hill et al., 2001). Fish were also used in the first successful application of the multimetric system. This system was developed by Karr (1981) and was called the Index of Biological Integrity (IBI). Thus, the roots of bioassessments of water bodies in the USA started with the fish. There are a variety of reasons for their continual usage in bioassessment of streams including:

- Because of their longevity and mobility, fish represent long-term environmental impacts and the overall watershed conditions.
- Fish are at the top of the food chain and are important because we eat them.
- The public perception of fish is good as they are well liked because of their recreational aspects in fishing.
- Taxonomy of fish species is relatively simple and easy enough to do identification in the field.
- The environmental requirements of most fish species are well known.

Despite the positive aspects of fish being excellent indicators of watershed conditions there are a variety of reasons for them not being universally used by state monitoring programs (Barbour et al. 1999). Some of the weaknesses associated with using fish for bioassessments include:

- There are only a few fish species in some regions, including the Northwest, making it hard to get an accurate assessment.
- Stocking of water bodies with fish has blurred the true environmental impact on fish communities.
- Fish are mobile; it is hard to reference local water quality conditions.

- The efficiency of collecting a good representative fish sample is difficult.
- There is a risk of injury or death to the fish that may be threatened or endangered during collection.

Macroinvertebrates as Water Quality Indicators

Macroinvertebrates have been the basis for the most widely used monitoring protocol in state water quality agencies since Plafkin et al. (1989) developed the benthic Rapid Bioassessment Protocols (RBP). This protocol for macroinvertebrates has been continually growing in acceptance by the public and regulators as the understanding of the ecological significance of macroinvertebrate communities has increased. Macroinvertebrates have become the main monitoring tool as 44 of the 47 states that have bioassessment programs of the states use benthic invertebrates as indicators (Davis et al., 1996). The reasons for using macroinvertebrates as the primary indicators of water quality monitoring are:

- Macroinvertebrates are ubiquitous; they are found in all water bodies from the most pristine to the most degraded streams (Rosenberg and Resh, 1993).
- Macroinvertebrates are relatively sedentary; managers can get site specific information, about local disturbances or pollution input (Barbour et al., 1999).
- There are many different species, all having a wide range of tolerances and responses to environmental conditions (Rosenberg and Resh, 1993).
- Sampling protocols are well defined (Karr and Chu, 1999).
- Life stages are a year or more for many insects and the sensitive instars will respond rapidly, while the overall community structure will change gradually to the environmental disturbances (Barbour et al., 1999).

- Taxonomy of many groups is well developed and the taxonomic keys are available (Rosenberg and Resh, 1993).
- Sampling is relatively easy and inexpensive (Barbour et al., 1999). Biomonitoring is also cheaper and quicker than chemical analysis (Cummins, 1994).
- Research has recorded the responses of many macroinvertebrates to different types of pollution (Rosenberg and Resh, 1993).
- Most state water agencies have background information on macroinvertebrates. There is also more staff with expertise about insects than fish or periphyton (Barbour et al., 1999).
- There are many well established methods for data analysis of the macroinvertebrates communities (Rosenberg and Resh, 1993).

Because of numerous benefits in using macroinvertebrates as bioindicators, it is easy to understand their wide acceptance by water quality managers. There are however, the following difficulties to consider (Rosenberg and Resh, 1993; Barbour et al., 1999):

- The taxonomic literature is not well developed for a few groups including the Chironomidae.
- The insect seasonal and habitat distribution in a stream varies considerably throughout the year; this can be offset by using standard time sampling protocols.
- Macroinvertebrates are not sensitive to certain perturbations such as herbicides.
- Quantitative sampling requires very large number of samples. Due to this problem, monitors often concentrate instead on qualitative sampling.

Overall, the benefits of using benthic macroinvertebrates for many water managers are far more advantageous than other means of assessing water quality.

Idaho's Beneficial Use Reconnaissance Program (BURP)

The federal Clean Water Act (CWA) requires that states monitor the biological components of streams. In 1993, the Beneficial Use Reconnaissance Project (BURP) was developed in Idaho to meet the CWA criteria of monitoring the chemical and biological aspects with the integration of the physical attributes to assess the quality of the states' streams (McIntyre, 1993). By 1994, the project became a program that was used statewide and continues to grow to this day (McIntyre, 1994). Idaho's BURP is based on the Rapid Bioassessment Protocol (RBP) developed by the EPA (Plafkin et al., 1989; Barbour et al., 1999). Essentially the RBP was designed to collect field data and then analyze the results with relative ease. Decision makers can then address the needs and changes that need to be implemented in the watersheds in a timely manner. Recently the Idaho Department of Environmental Quality (IDEQ) and Idaho State University made some modifications to this protocol (BURP Tech. Ad. Comm., 2004). This program has become so widely used that by the end of 2003 over 5,182 streams had been monitored. This makes Idaho a national leader in bioassessment monitoring (DEQ, 2005). The BURP considers periphyton, fish, and macroinvertebrates in assessing water quality, but the preferred method of analysis continues to be the use of benthic macroinvertebrates (Jolly, 2004).

Objectives

The specific goals and objectives of this thesis are:

1. Develop and carry out a biological assessment of Silver Creek and its tributaries using the Idaho Department Environmental Quality (IDEQ) protocols.
2. Determine the ecological health of The Nature Conservancy's transects currently being monitored and other selected sites in the Silver Creek watershed.
3. Establish baseline macroinvertebrate data as a basis to assess future improvements or degradation.
4. Determine the impact that stream restoration has had on the ecological health of selected stream segments in the Silver Creek watershed.
5. Evaluate the assessment's results and provide suggestions to The Nature Conservancy, landowners, government agencies, and policy makers for further improvements of the watershed.

Justification

Once an established monitoring program is put into place for the Silver Creek watershed, the Nature Conservancy, local landowners, policy makers, and the IDEQ will be able evaluate the current and future conditions present. These scientific results will give guidance for appropriate strategies and consequent implementation of what managers need to do to maintain and/or improve sections of the Silver Creek watershed. Any changes in land practices need to be monitored to determine the impact on the local ecological health of stream macroinvertebrates. Bioassessments are an important tool that can rapidly assess the water quality conditions of sites and allow managers to rapidly interpret and evaluate any adjustments being made to the surrounding watershed.

Materials and Methods

Silver Creek

Silver Creek is situated in south-central Idaho, approximately 50 km south of Sun Valley. The stream winds it way through 32 km of Blaine County and terminates at its convergence with the Little Wood River (Figure 1). The flow of Silver Creek is the result of groundwater seepage from the nearby Big Wood River. This subterranean flow is transported within glacial till until it surfaces 15 km to the east, as a result of the impermeable sedimentary and volcanic substrate (Moreland, 1977). This system is responsible for the formation of numerous springs throughout the region, as well as at least three creeks including Grove, Stalker, and Loving. The confluence of Grove and Stalker creeks is the beginning of Silver Creek. Loving Creek joins Silver Creek 1 km downstream (Clark and Glassock 1996).

The Silver Creek watershed is classified as part of the Basin Bioregion (Grafe, 2002). Because Silver Creek borders the Southern Rocky Mountains Bioregion, it is a transitional region that is difficult to analyze from a biological standpoint. The climatic conditions are generally cool and semi-arid, with an average annual precipitation of 35 cm (Grunder, 1985).

The stream substrate consists primarily of fine sediments formed from eroded landscapes and decayed aquatic plants that line the stream bottom. The aquatic plants provide shelter and food for macroinvertebrates where, outside of these refuge mats their numbers drop dramatically. *Chara sp.* (stonewort), makes up over 90% of the macrophytes found within the stream (Illustration 3). Commonly found aquatic plants include: Sago pondweed (*Potamogeton pectinatus* L.), horned pondweed (*Zannichellia palustris* L.), and watercress (*Rorippa spp.*) (Grunder, 1985; Clark and Glassock, 1996).

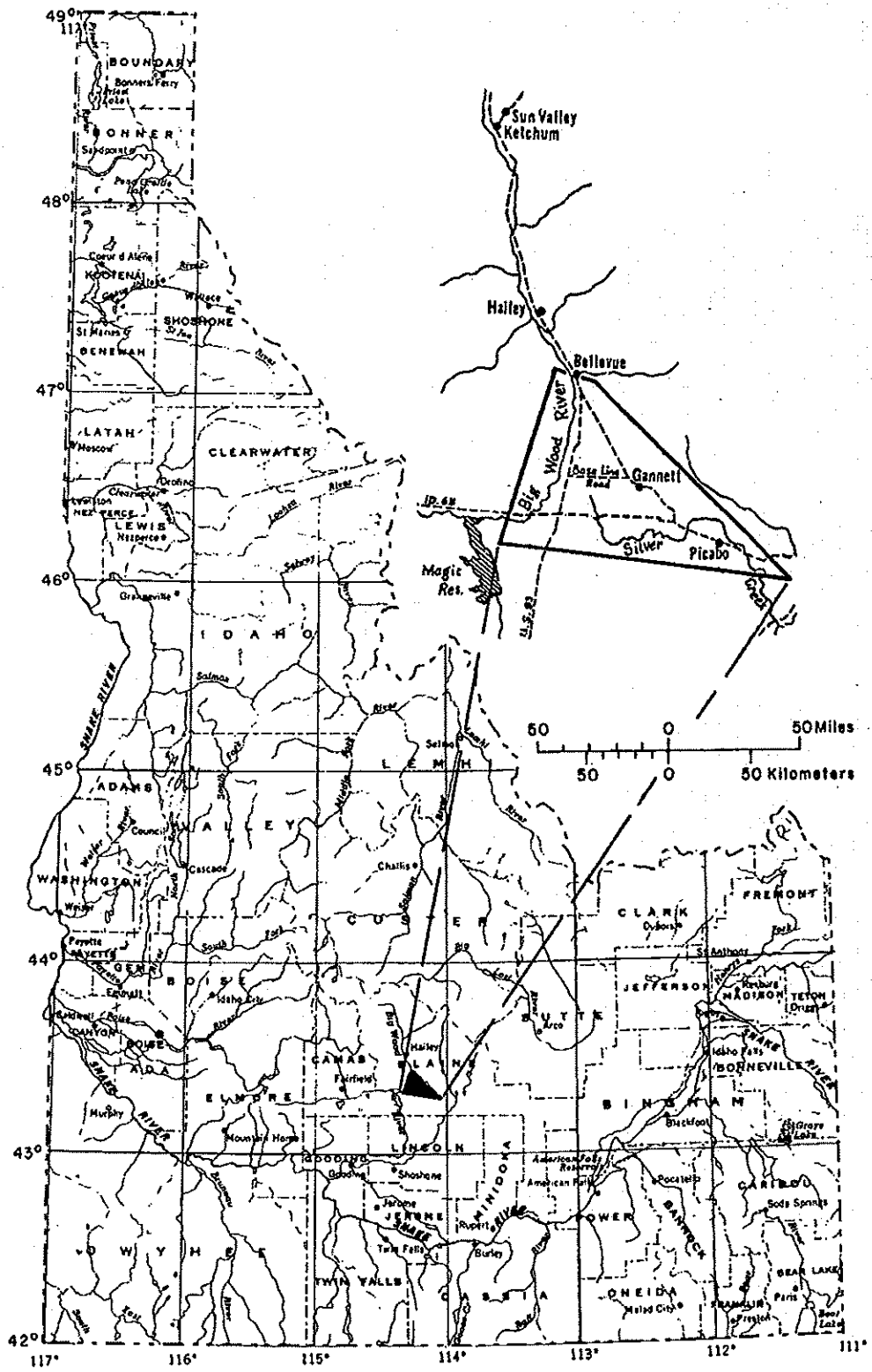

Figure 1. Silver Creek is located in South Central Idaho about 50 km south of Sun Valley (Moreland, 1977).

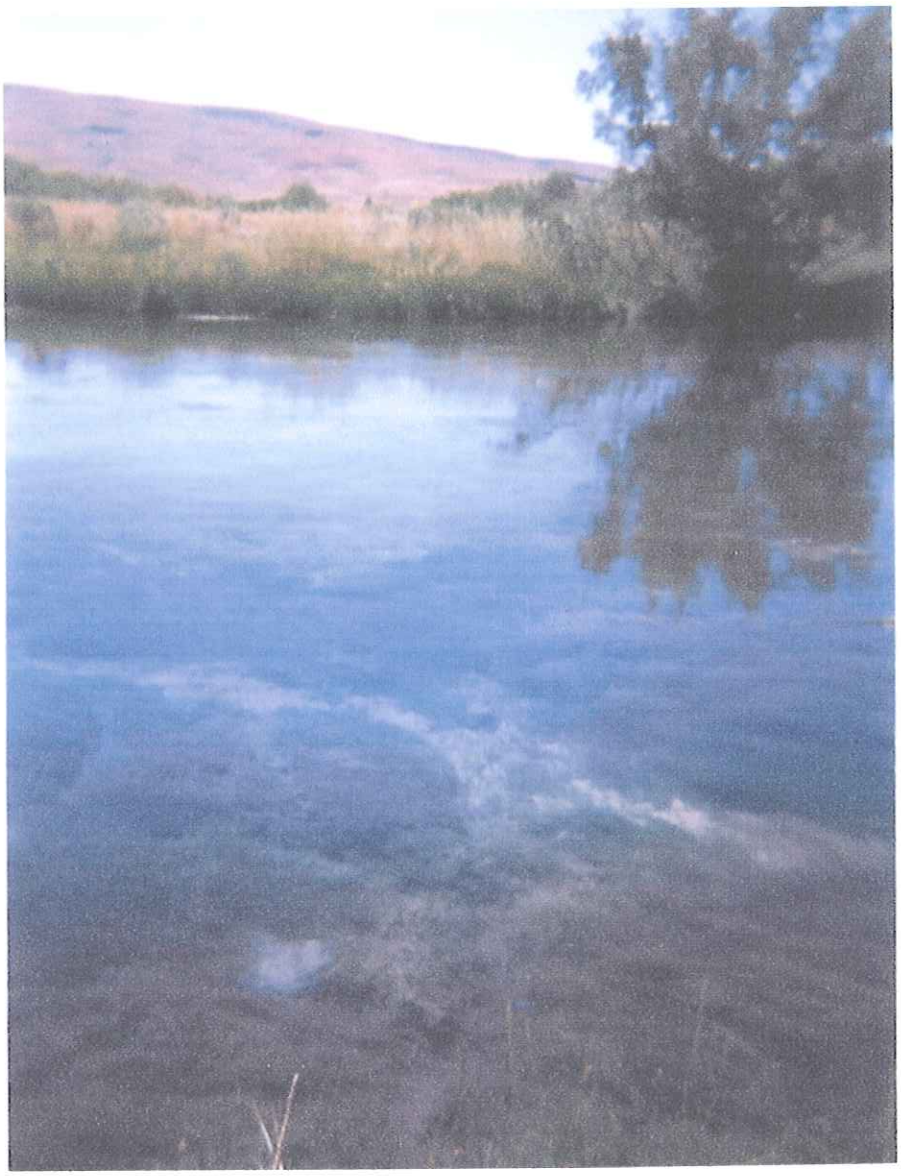

Illustration 3. Aquatic plants cover much of the streambed and provide habitat for the aquatic insects.

The RBP protocols call for sampling of single habitats with the highest macroinvertebrates diversity. These high diversity habitats would typically be in riffle areas with cobble substrate, but since Silver Creek is a spring-fed system, significant riffles and cobble substrate are lacking. The optimum habitat in Silver Creek is found in the riffles that resemble more of a run and the preferred substrate is in the *Chara* mats (Barbour et al., 1999). Three sections on the Silver Creek Preserve were noted to have gravel beds present in the faster segments of the stream.

In April of 2006, major flooding occurred on Silver Creek drainage washing out large amounts of sediments, forming gravel beds and riffles on some segments. It was estimated to be a 100-year flooding event. Flooding does not occur on an annual basis on Silver Creek because its surrounding drainage is not large enough to yield sufficient amounts of runoff, because it is sourced from groundwater. The reason for flooding in 2006 was large amounts of snow that fell on the Silver Creek drainage, which was later melted by warm rains in April (Illustration 4). Thus, large amounts of water were flushed into Silver Creek in a short period of time flooding the surrounding drainage (Illustration 5). Dayna Gross, Silver Creek Preserve Manager, noted dramatic changes in the stream composition because of the flood, with heavy sediment deposits in some areas and cleaned gravel beds in others.

As a consequence of habitat restoration and conservation easements established by The Nature Conservancy, the current riparian vegetation generally consists of a healthy assemblage of plants along most of Silver Creek. This habitat has greatly improved over the past several years compared to the past, when traditional grazing and agriculture practices resulted in degraded riparian areas in this habitat. Some of the current woody riparian vegetation found within the Silver Creek watershed includes:

Illustration 4. The flooding in April of 2006, originated from the snow pack from the surrounding area that rapidly melted when warm rains came.

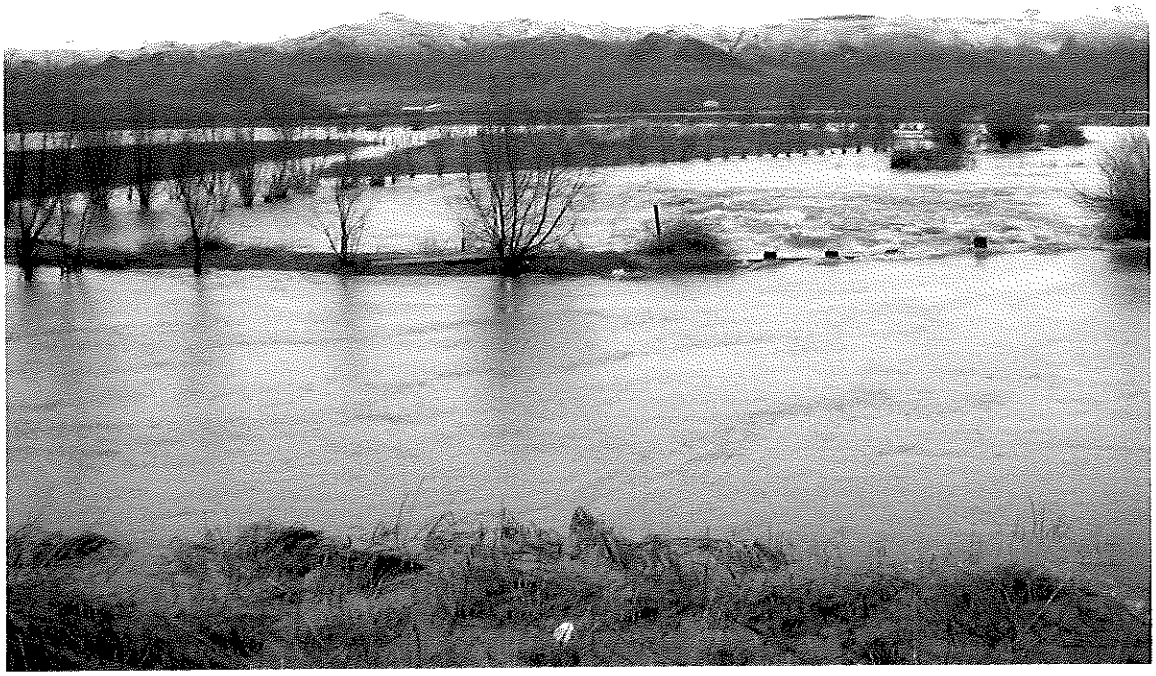

Illustration 5. The 2006 flooding flushed large amounts of water down Silver Creek.

Booth willow (*Salix boothii* Dorn), Yellow willow (*Salix lutea* Nutt.), Coyote willow (*Salix exigua* Nutt.), Drummonds willow (*Salix drummondiana* Barratt ex. Hook), red-stem dogwood (*Cornus stolonifera* Michx), and water birch (*Betula* sp.). The herbaceous plants commonly found include: grasses (*Poa spp.*), wildroses (*Rosa spp.*), sedges (*Carex spp.*), Reed canarygrass (*Phalaris arundinacea* L.), and Kentucky bluegrass (*Poa pratensis* L.) (Davidson et al., 2007). The Silver Creek Preserve is densely covered by these plants. There is also a large aspen grove (*Populus sp.*) dispersed across the Preserve near Sullivan Lake. Farther away from the stream valley, the surrounding vegetation changes to sage brush (*Artemisia spp.*). This transition is due to the semi-arid climatic conditions (Clark and Glassock 1996).

Landuse in the watershed valley is dominated by agriculture including grazing. In attempts to improve conditions in and around Silver Creek, The Nature Conservancy has partnered with landowners to protect 3,850 ha using conservation easements (TNC, 2006a). These easements have ensured that development will not occur on critical properties and that practices on the land are protecting conservation values of Silver Creek (TNC, 2006b). The Nature Conservancy has invested into Silver Creek because of its rich biodiversity and the uniqueness of its system. Significant attention has also been focused on Silver Creek because of its superb fly fishing, bird watching, and hunting opportunities. Consequently, recreational endeavors also impact land use on Silver Creek, and infuse millions of dollars into the region each year. This constant flow of income has invigorated efforts by locals and people all over the world to ensure the future of the Silver Creek watershed.

Site Selection

In July 2005 meetings were conducted with local Silver Creek professionals employed by The Nature Conservancy (Dayna Gross and Trish Klahr) about research needs in the Silver Creek watershed. Guy Bonnivier was also involved in meetings because of his association with stream restoration work in the Silver Creek watershed. These conversations helped produce an outline of appropriate sites to be selected for a detailed assessment of macroinvertebrates on Silver Creek. The study was designed in cooperation with The Nature Conservancy to conduct an assessment that would be helpful to their management and understanding of the ecological health of Silver Creek. In past years, chemical analysis has been carried out by The Nature Conservancy on five transects on the Silver Creek Preserve. Each proposed macroinvertebrate study site was then visited and evaluated for a feasible sampling location based on ease of access and sampling potential. The sampling of the benthic macroinvertebrates was scheduled for August of 2005 and July of 2006. These sampling dates follow the RBP procedures (Plaftkin et al. 1989). A total of ten sampling sites were selected for this project (Figure 2). Four of the sampling sites were located on established Nature Conservancy transects (Site #2, #3, #4, and #7). The fifth Nature Conservancy transect site, on Stalker Creek, could not be sampled due to excessive water depth. Consequently a sampling site was established farther up stream from this location (Site #6). These five sites were located by Dayna Gross and The Nature Conservancy's interns. The other sampling sites were chosen by observation while canoeing on Silver Creek. One site was selected because of its unique riffles, located just below the confluence of Grove and Stalker Creek (Site #5). Another site was selected near Fisherman's Access point, off Highway 20, where the United States Geological Survey (USGS) has done past macroinvertebrates sampling

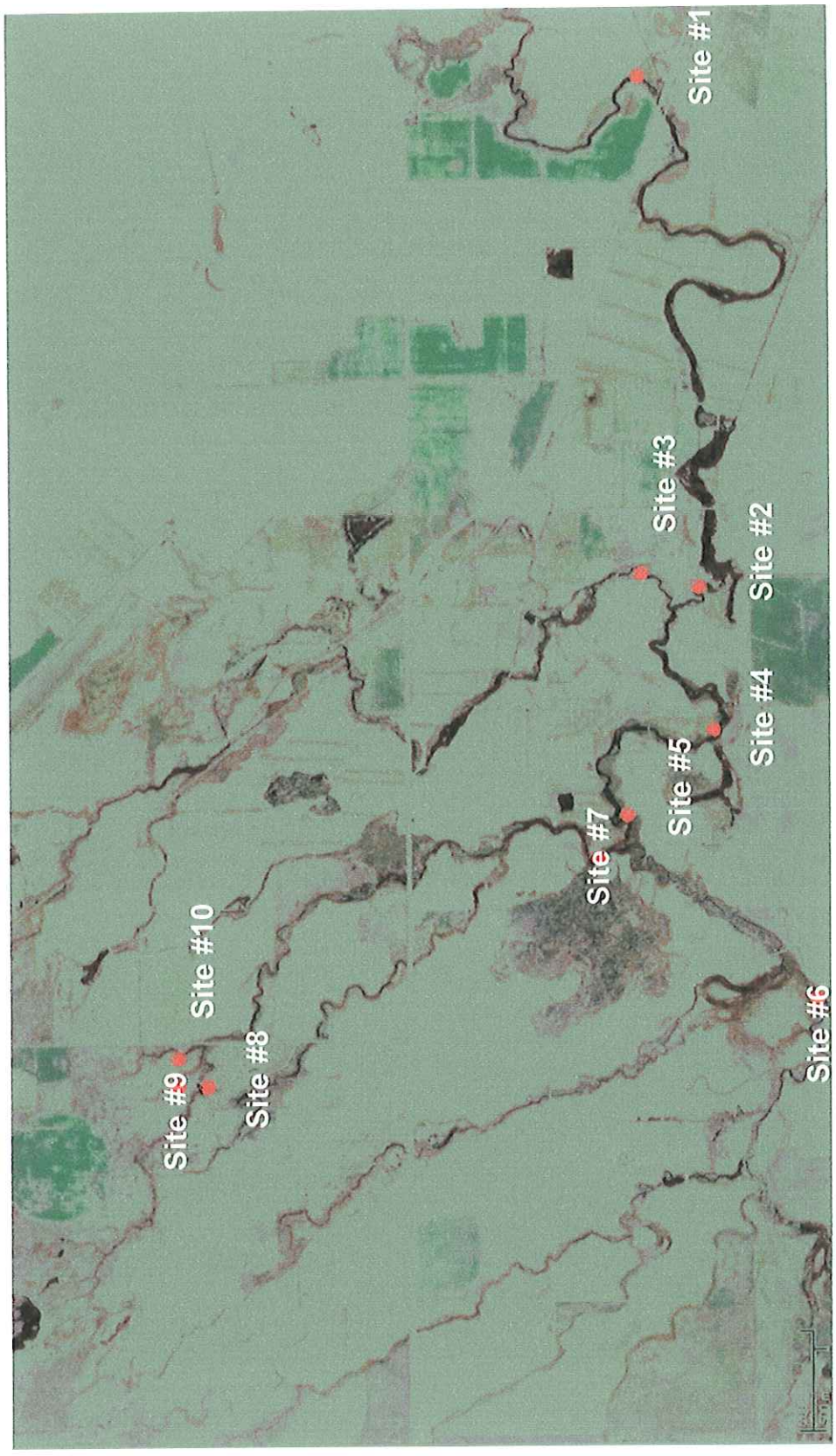

Figure 2. Aerial image and the locations of the ten sites that were sampled on Silver Creek headwaters.

using RBP's. The remaining three sites were located on branches of Grove Creek, where some degree of stream restoration has taken place in the last eight years. Guy Bonnivier, former executive director of The Nature Conservancy in Idaho and now owner of Conservation Inc., led past stream rehabilitation projects on Grove Creek and suggested the last three sampling points. One site was a branch of Grove that had stream restoration work completed in 2004 (Site #9), another was restored in 2002 (Site #8), and the other was on a tributary that has not been restored (Site #10). These sites were selected based on their similar hydrologic and habitat conditions so that a comparative analysis could be made on how stream restoration had affected the macroinvertebrate community and ecological health.

Data Collection

For each of the ten sampling sites, the elevation and location were recorded using a Magellan Meridian Color/Global Positioning System (GPS) (50 m confidence). At each sampling site a 100m distance was measured and divided into four 25m sub-sampling sections. Four sub-samples were collected at each of the ten sampling sites, totaling 40 collected samples for each sampling year. At each sampling site two thermometers were placed in the middle of the current of the creek and left for a minimum of 15 min and the two readings were averaged to determine the water temperature (Illustration 6). Starting at the tail of the reach one random macroinvertbrate sample was taken with a modified Hess sampler (0.1 m^2) in each of the four sub-sections at each site. A diagram of the procedure is shown in Figure 3. This technique follows the guidelines established by Clark and Maret (1993). Because of the unique spring-fed conditions at Silver Creek the great majority of the aquatic insects at the sampled sites are

Illustration 6. Temperature readings were averaged from two thermometers that were placed in the middle of stream currents.

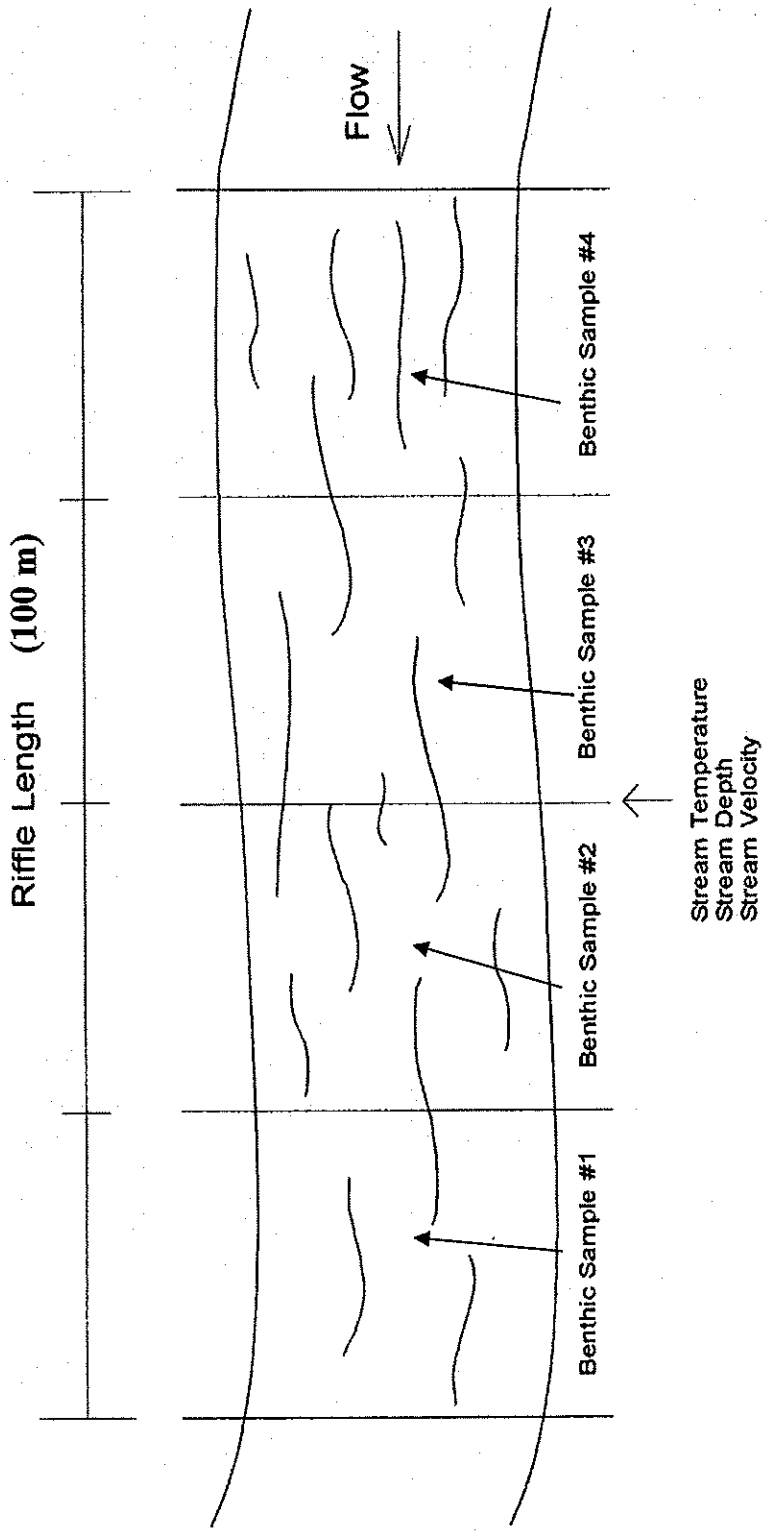

Figure 3. A schematic of how each sampling site (reach) was divided into four sub-sections and sampled.

found on the aquatic plants. When sites where selected, preference in sampling location was based on the presence of aquatic plants and faster currents. Due to the depth of Silver Creek, further adjustments had to be made to the traditionally used Hess sampler to prevent water from flowing over the top of the sampling instrument, which might have allowed aquatic insects to escape. An extension to the Hess sampler was crafted to meet this need. This extension sealed the area around the Hess sampler so that it could be effectively used in the deeper waters of Silver Creek. This extension with the fork scraper used to scoop up the substrate and plants to be scrubbed within arms length is shown in Illustration 7. The substrate collected in the Hess sampler was scrubbed for a minimum of two minutes to dislodge and collect the macroinvertebrates. In addition, the plant materials were thoroughly scrubbed, broken up, washed and then visually inspected to be sure the organisms had been collected (Illustration 8). The substratum was then stirred to a depth of 10 to 15 cm. The collected material in the catch bucket was then placed in a one-quart mason jar filled with 95% ethanol. All jars were labeled with the date, site name, stream identification number, and sample number (e.g. 08/09/05, Loving Creek Site #3 3/4).

After the four Hess sub-samples were collected at each sampling site, the physical variables of the surrounding riparian vegetation, stream substrate, macrophytes, and bank conditions were qualitatively evaluated through visual inspection and recorded. Visual observations were recorded with digital and 35mm photographs at each of the sample sites. The wetted width of the stream was measured and then divided into at least ten equal sections. Each section was measured for the depth and stream velocity at six tenths depth by using a Marsh McBirney electromagnetic flow meter and wading rod (Figure 4). The stream flow rates were determined by summing the discharge values from each

Illustration 7. The extension Hess sampler device and fork was used to sample in deeper water that was not suitable using a normal Hess sampler.

Illustration 8. A modified Hess sampler was used to collect benthic macroinvertebrates. All plant material and substrate were scrubbed and cleared of any insects.

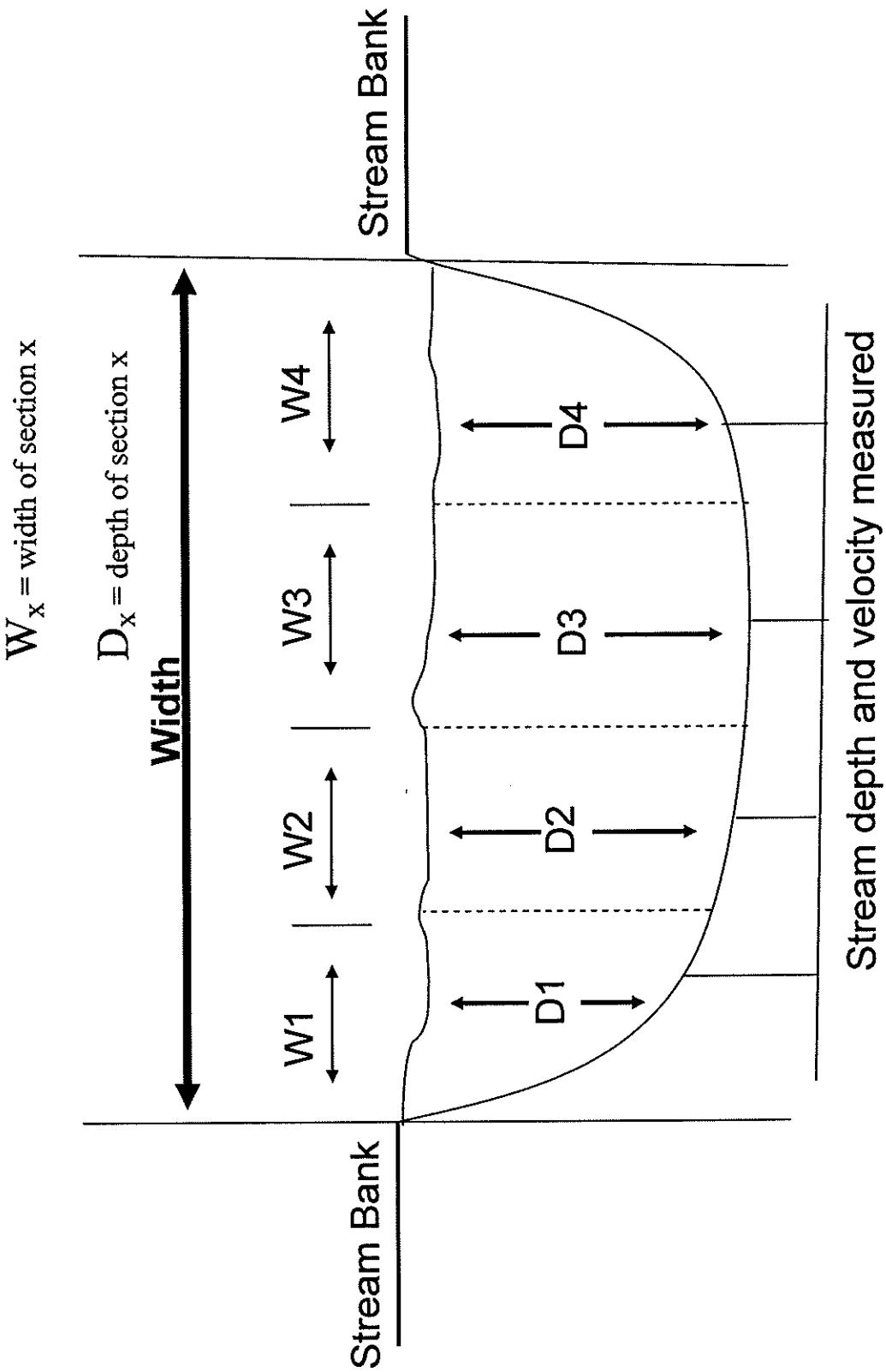

Figure 4. A cross sectional view of how each sampling site was measured for stream velocity and depth. This data was used to determine estimated stream discharge at the time of sampling

section. During the second year of sampling the Marsh McBirney meter malfunctioned in the field and was inoperable. The Nature Conservancy, however, helped to collect flow readings on the sites. The GPS coordinates, average stream velocity, and stream temperatures can be found in Appendix A.

Taxonomic Identification

All of the benthic macroinvertebrate samples were washed and sorted to separate the insects from any organic or inorganic debris that were in the collected samples in the laboratory. The separation process used was based on the technique outlined by Clark and Maret (1993) and Barbour et al. (1999). The organic material along with most of the insects, were separated by using a pan washing technique, which included agitation and skimming of the samples. The organic material was then washed and drained using a 500-micron sieve or mesh net to remove the fine sediments. The inorganic material was then visually inspected for larval cases (e.g. Trichoptera cases). The scuds (Amphipoda) and leeches (Hirundinea) were counted at this stage during the sorting process. However, the large numbers of scuds and leeches observed at certain sites and time constraints did not allow further taxonomic identification. All the aquatic insects were sorted out by visual inspection and stored in 8-dram vials, filled with 70% ethanol, until identification was conducted.

All aquatic macroinvertebrates were identified to the lowest practical taxonomic level (usually genus level), using the keys of Merritt and Cummins (1996) and Johnson and Biggam (2005) with the aid of a dissecting scope (Illustration 9). The Chironomidae larvae, Corixidae, some Coleoptera, and some early instars were only identified to the family level due to the difficulty with these taxonomic evaluations. All the

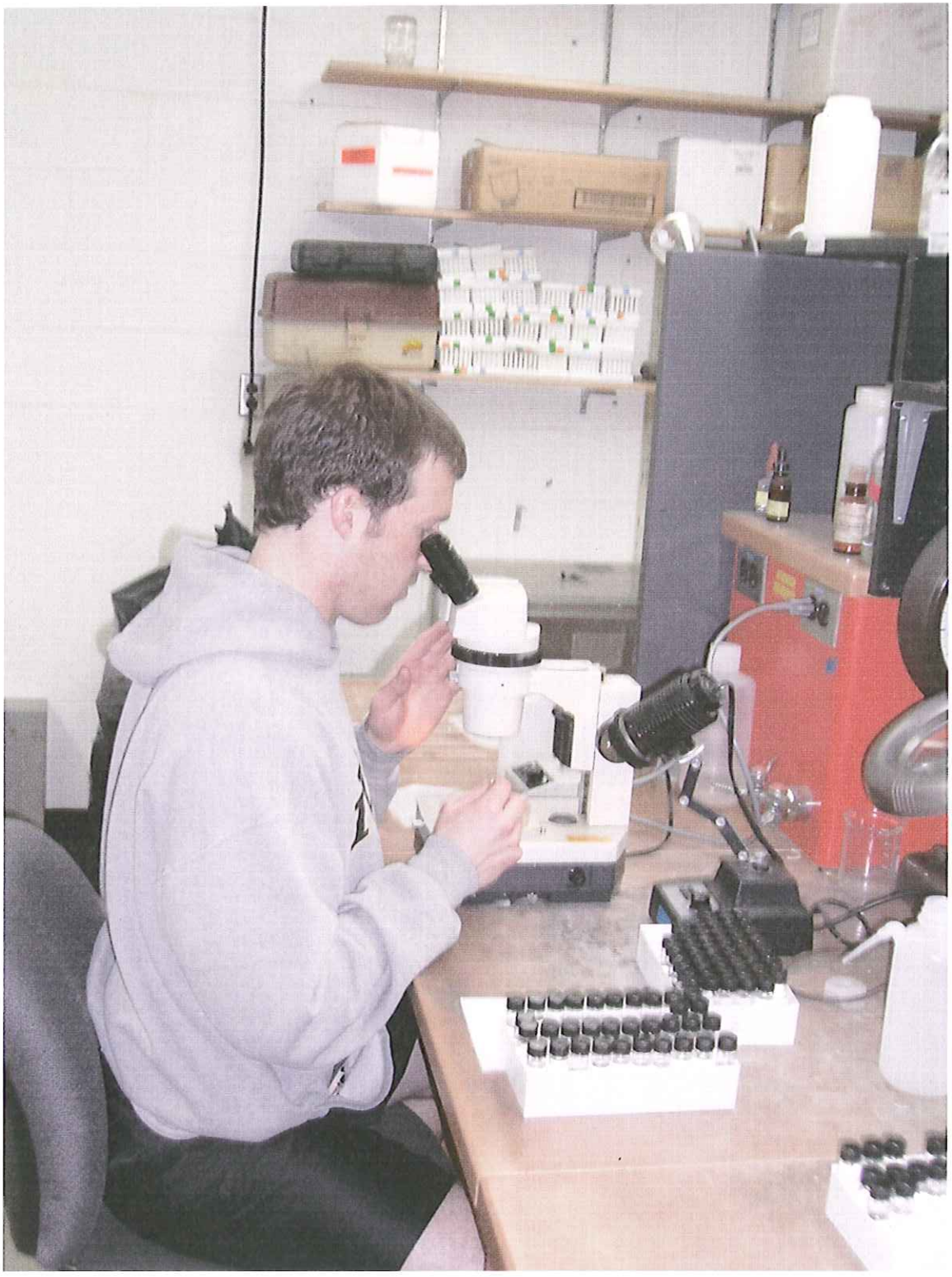

Illustration 9. All collected macroinvertebrates were identified to the lowest possible taxonomic level.

macroinvertebrates in the 80 collected samples (2 years x 10 sites x 4 samples) were determined by presence and abundance and recorded in a laboratory notebook, which was later transferred into an Excel spreadsheet. A total of 103,884 macroinvertebrates were identified in this study. The identifications were spot confirmed and occasionally corrected when required by EcoAnalysts Inc., an independent consulting firm that specializes in aquatic macroinvertebrate taxonomy located in Moscow, Idaho. The identified macroinvertebrates for each of the ten sites and their corresponding four sub-samples for 2005 and 2006 are recorded in Appendix B.

Data Analysis

Data recorded in the Excel spread sheet were statistically analyzed by EcoAnalysts Inc. of Moscow, Idaho using a software package that calculated 97 different metrics for each of the samples collected in this study (Appendix C). Each metric is a different measure of the aquatic insect's community health. Further statistical analysis was carried out using software programmed into Excel to evaluate the metric scores and the related sites ecological health at each sampling site.

In order to accurately assess stream conditions, the collected samples must be compared to reference sites of pristine streams in similar ecosystems. James Omernik (1987) developed a map of ecoregions, which are simply regions that have similar climatic, geology, soils, hydrology, topography, and natural vegetation. Ecoregions set a baseline for environmental managers to compare the aquatic resources within regions and to understand regional patterns. Currently, there are nine different recognized ecoregions in Idaho (Omernik, 1987). Within each ecoregion, streams can be compared to reference conditions. The relationship between metrics and reference conditions for healthy stream

systems based on specific ecoregions were developed in Florida (Barbour et al., 1996). Through similar research, using Idaho's nine ecoregions and three bioregions this relationship has also been developed and used in Idaho. The three bioregions recognized in Idaho are the Northern Mountain, South and Central Mountains, and the Basins (Figure 5). The Idaho studies compared pristine and degraded streams using different metrics to make evaluations. Stream health ratings ranged from very good (pristine) to very poor (degraded) for each of the three bioregions. Out of the 97 metrics initially evaluated, nine metrics were used to assess the biological health of the sites on Silver Creek (Appendix B). These nine metrics are based on the Idaho Department of Environmental Quality (IDEQ) Idaho Stream Macroinvertebrate Index (ISMI) protocols found in *Idaho's Small Stream Ecological Assessment Framework: An Integrated Approach* (Grafe, 2002).

These nine metrics used by the IDEQ to calculate a SMI score that measures the biological health of a water body using macroinvertebrate communities includes measures of community richness, community composition, pollution tolerance, diversity, feeding group, and habitat (Table 1). The nine metrics used were calculated using the formulas shown in Table 2, which are based on the reference conditions for the Basins Bioregion. The total taxa metric is used to measure the overall diversity of the streams macroinvertebrate assemblage. A high diversity within each of these groups indicates that there are a variety habitat conditions or niches and consequently, the presence of a healthy composition of aquatic organisms. The Ephemeroptera, Plecoptera, and Trichoptera metrics are important because the taxa are especially sensitive to pollution and perturbation. Ephemeroptera are measured because they are known to be sensitive to

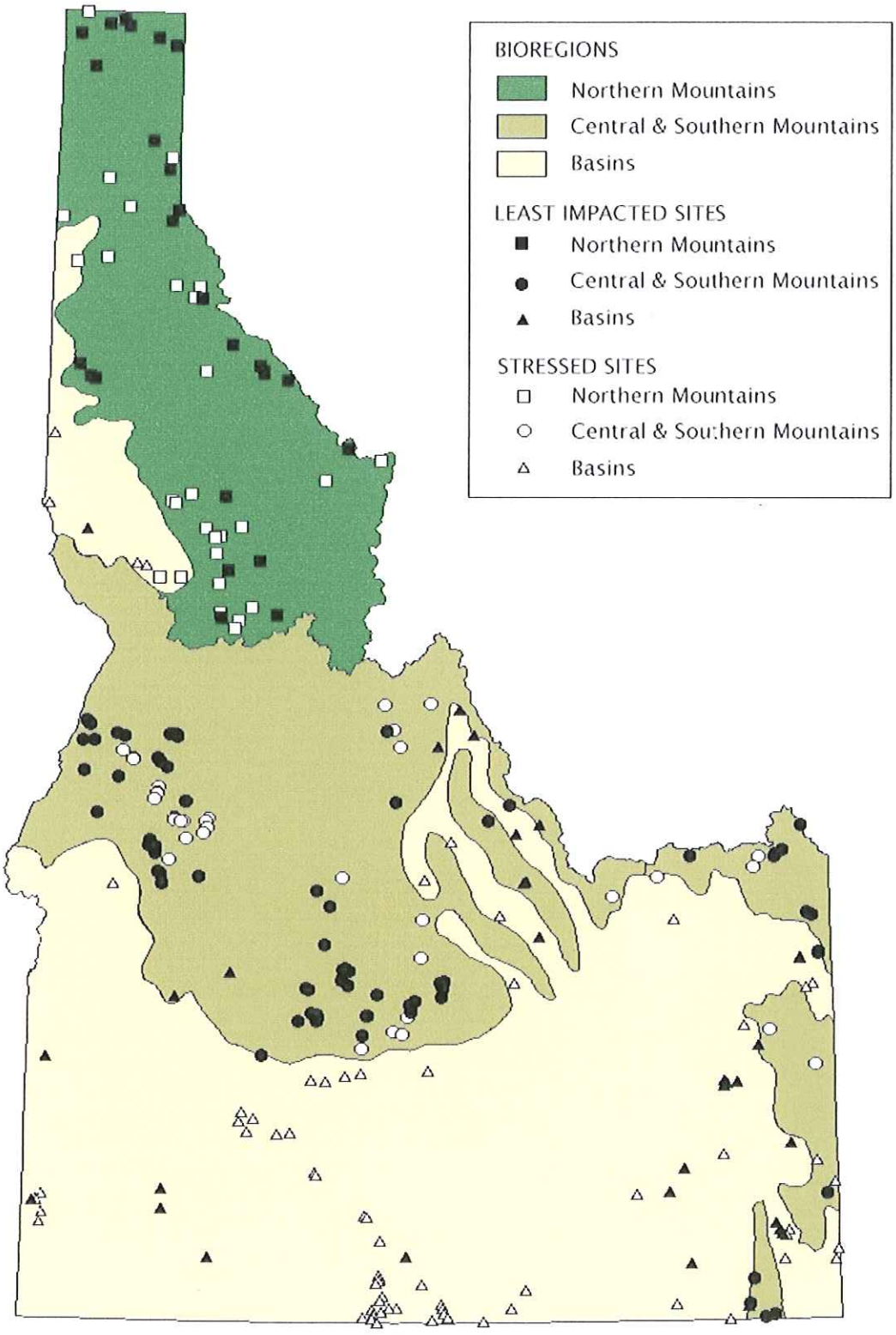

Figure 5. The three bioregions of Idaho based on work by Grafe (2002).

Table 1. The nine index metrics used by the Idaho Department of Environmental Quality (IDEQ) to determine the Idaho Stream Macroinvertebrate Index (ISMI).

Metric	**Type of Measure**	**Definition**	**Predicted Response to Increasing Perturbation**
Total taxa	Richness	The number of distinct macroinvertebrate taxa	Decrease
Ephemeroptera taxa	Richness	Number of mayfly taxa	Decrease
Plecoptera taxa*	Richness	Number of stonefly taxa	Decrease
Trichoptera taxa	Richness	Number of caddisfly taxa	Decrease
Percent Plecoptera*	Composition	The percentage of the sample that is composed of stoneflies	Decrease
Hilsenhoff Biotic Index (HBI)	Pollution tolerance	Abundance-weighted measure of the avg. pollution tolerance of organisms	Increase
Percent five dominant taxa	Diversity	The percentage of the five most abundant taxa	Increase
Scraper taxa	Functional Feeding Group	Measure of amount of taxa that scrape algae from substrate	Decrease
Clinger taxa	Habitat	The number of taxa that have fixed retreats or capabilities to survive in flowing waters	Decrease

Table 2. The metric scoring formulas used for Basins Bioregion based on established protocols were used in the Silver Creek watershed study (Grafe,2002). The denominator of the formula is the reference for that metric.

Metric	**Metric Scoring Formula**
Total Taxa	100 x Total Taxa / 34
Ephemeroptera Taxa	100 x Ephemeroptera Taxa / 9
Plecoptera Taxa	100 x Plecoptera Taxa / 6
Trichoptera Taxa	100 x Trichoptera Taxa / 7
Percent Plecoptera	100 x Percent Plecoptera/ 20
Hilsenhoff Biotic Index (HBI)	100 x (10 – HBI) / 7.3
Percent Five Dominant Taxa	100 x (100-5% Dominant Taxa) / 36
Scraper Taxa	100 x Scraper Taxa / 8
Clinger Taxa	100 x Clinger Taxa / 17

* The Modified SMI scoring (MSMI) excludes both the Plecoptera Taxa and the Percent Plecoptera metrics in its calculations.

heavy metals while the Trichoptera are very sensitive to sedimentation. The Plecoptera percentage metric is used because these taxa require cold, clean, and well oxygenated water. When found on streams Plecoptera show positive signs of clean water because they will not usually survive in polluted or disturbed streams. By specifically evaluating each of these groups, different pollutants can be monitored because of different sensitivities of each taxon (Grafe, 2002).

The Hilsenhoff Biotic Index (HBI) was originally used to detect organic pollution, but it has now been modified to measure the average tolerance values of the overall aquatic organisms. The HBI is a weighted average of the tolerance values:

$$HBI = \Sigma \frac{n_i \times tv_i}{N}$$

Where n_i is the number of the macroinvertebrates of the i^{th} taxa, the tv_i is the tolerance value of the i^{th} taxa and N is the total number of individuals in the sample that have known tolerance values (Grafe, 2002). The percent five dominant taxa metric measures the degree that conditions favor the support for a few species relative to a diverse assemblage of organisms. If a water body has only a few dominant species, it is usually a sign that it is a heavily disturbed habitat because only a few tolerant species can proliferate. The feeding measure is determined by the scraper taxa metric. Scraper taxa tend to be more sensitive organisms because they require low pollution levels and specific periphyton, which grows on substrate like aquatic plants for food. The clinger taxa metric measures the condition of the stream channel. Clingers are sensitive to habitat disturbances that increase sedimentation and respond to hydrologic fluxes and the taxa demand stable substrates to grasp (Grafe, 2002).

Once these nine metrics are calculated in Idaho, an SMI score is calculated by averaging each of these nine metrics, based on the IDEQ method (Grafe, 2002).

Henceforth in this thesis the stream macroinvertebrate index used by the Idaho Department of Environmental Quality will be referred to as ISMI. An overall ISMI score is determined for each of the ten site locations in the Silver Creek watershed that yields the ecological health of the transect sampled. The ISMI values can range from 0 to 100 and have the following subdivisions: very good, good, fair, poor, and very poor. The established ecological health ratings for the Basin Bioregion are shown in Table 3.

The Current ISMI Limitations and Solutions

The ISMI scores calculated may be misleading because the current IDEQ scoring system is not appropriate for spring-fed systems, like Silver Creek. The reason for the ISMI's inaccuracy is because in spring-fed systems Plecoptera taxa are absent or low in abundance under the most pristine conditions. The ISMI uses reference conditions based off stream systems that have cobble substrate and riffles that usually originate in mountain systems. These conditions are favorable to the Plecoptera. Spring-fed systems on the other hand, usually originate in flatter basins that have slower moving currents. Thus, they usually lack cobble substrate and often have a sediment substrate and aquatic plants lining significant parts of the streambed and are not favorable to Plecoptera.

A goal of this thesis project was to find a more appropriate method to evaluate spring-fed systems, such as Silver Creek. Various ecological experts and managers for water monitoring programs such as the Idaho's Beneficial Use Reconnaissance Program (BURP) were contacted. They were asked for their professional advice on assessing the macroinvertebrate ecological health on spring-fed systems. The general consensus from the interviews and conversations was that there was no present system to adequately

Table 3. The Ecological Health Rating categories for the Basins Bioregion based on 25th percentile of least impacted sites (Grafe, 2002)

Ecological Health Rating	ISMI Score
VERY GOOD (midpoint between 25th percentile and maximum index score to maximum score)	76-100
GOOD (25th percentile to midpoint between 25th percentile and maximum score)	51-75
FAIR (upper trisect of minimum score to 25th percentile)	34-50
POOR (middle trisect of minimum score to 25th percentile)	17-33
VERY POOR (lower trisect of minimum score to 25th percentile)	0-16

monitor spring-fed systems. The problem is the associated reference streams are dissimilar to spring-fed systems. The macroinvertebrate assemblage of the typical reference streams used by the IDEQ will not match pristine conditions of spring-fed because of the aquatic habitat differences, which support these organisms.

A solution to this problem of using macroinvertebrates on spring-fed streams is to have reference conditions based on the sampling of spring-fed streams that have not been extensively negatively impacted by anthropogenic changes. Managers and scientist have tried this as a solution; however, there are few if any spring-fed systems that are relatively pristine to serve as a reference. Some managers have suggested that Silver Creek be used as a reference site for other systems because of its robust and healthy fishery, while others have suggested that it is nowhere close to pristine because of the recreational use and past associated agriculture practices. Reference spring-fed streams could be potentially found in Yellowstone National Park or in the Henry's Fork basin, but there is not a current assessment system established for spring streams. Consequently, appropriate modifications should be made to the current ISMI scorings to accurately access the Silver Creek watershed. Such modifications were done in this study, by using what many ecological experts would deem as appropriate by excluding the Plecoptera Taxa and Percent Plecoptera metrics, forming the Modified SMI score. This score will be referred to as MSMI henceforth in this thesis.

proposed in the discussion portion of this section to help improve the current SMI scoring for spring-fed systems and also to alleviate some of the current water quality problems existing on the studied sites.

Sample Site #1: USGS

Sample Site #1 is located about 200 m from Highway 20, right below a small irrigation dam on Silver Creek. The site was accessible via a path used frequently by fishermen. This sampling site was the lowest elevation sampling point on the Silver Creek Watershed in this study. This site was chosen because the United States Geological Survey (USGS) has sampled macroinvertebrates in the past for The Nature Conservancy (TNC) and because of the presence of riffle-like habitat (Illustration 10).

The riparian vegetation at this site was thick and consisted of grasses, dogwoods, and willows, creating stable stream banks with minimal human or animal impact (Illustration 11). The surrounding land is currently being used for agriculture and pastures. There is bridge that crosses about 50 meters upstream of Site #1. The streambed is primarily gravels and small rocks, with mats of aquatic plants consisting mostly of *Chara* with some grasses (Illustration 12). There were no apparent changes to the riparian vegetation from the flooding that occurred earlier in April of 2006, but some scouring did occur on the stream bed with aquatic mats being displaced.

In 2005, Sample Site #1 received an average ISMI score of 39.49 and a MSMI score of 50.77 (Table 4). The individual scores for each of the four sub-samples are shown in the Table 4. The score of 39.49 is in the "FAIR" category and the MSMI of 50.77 falls into the "GOOD" category. Sample Site #1 in 2006 received an average ISMI of 48.39 and a MSMI of 62.22 (Table 5). The individual scores for each of the four sub

Illustration 10. Sample Site #1 has the presence of riffle like habitat. Sampling conditions here were suitable to use the Hess sampler without an extension tube.

Illustration 11. Sample Site #1 has stable bank conditions due to the thick riparian brush and grasses

Illustration 12. Sample Site #1 has the presence of riffles with gravels and aquatic vegetation.

Table 4. The raw data and calculated SMI scores for the biological assessment of Sample Site #1 (USGS) conducted in August 2005.

Metric	Reference Value*	USGS Sample 1	USGS Sample 2	USGS Sample 3	USGS Sample 4	USGS Average (2005)	Watershed** Avg. 2005
Species Taxa	34.00	19.00	17.00	19.00	19.00	18.50	19.65
Metric Score	100.00	55.88	50.00	55.88	55.88	54.41	57.79
Ephemeroptera Taxa	9.00	7.00	6.00	6.00	4.00	5.75	5.10
Metric Score	100.00	77.78	66.67	66.67	44.44	63.89	56.67
Plecoptera Taxa	6.00	0.00	0.00	0.00	0.00	0.00	0.90
Metric Score	100.00	0.00	0.00	0.00	0.00	0.00	15.00
Trichoptera Taxa	7.00	3.00	2.00	2.00	5.00	3.00	3.93
Metric Score	100.00	42.86	28.57	28.57	71.43	42.86	56.07
Percent Plecoptera	20.00	0.00	0.00	0.00	0.00	0.00	1.70
Metric Score	100.00	0.00	0.00	0.00	0.00	0.00	8.52
Hilsenhoff Biotic Index	2.70	4.10	4.83	4.74	4.90	4.64	4.59
Metric Score	100.00	80.82	70.82	72.05	69.86	73.39	74.09
Percent Five Dominant Taxa	64.00	84.42	89.57	85.50	82.46	85.49	85.48
Metric Score	100.00	43.28	28.97	40.28	48.72	40.31	40.34
Scraper Taxa	8.00	2.00	1.00	1.00	2.00	1.50	1.50
Metric Score	100.00	25.00	12.50	12.50	25.00	18.75	18.75
Clinger Taxa	17.00	12.00	10.00	10.00	10.00	10.50	10.50
Metric Score	100.00	70.59	58.82	58.82	58.82	61.76	61.76
Idaho SMI Score	100.00	44.02	35.15	37.20	41.57	39.49	42.73
Ecological Health Rating	VERY GOOD	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR
*Modified SMI Score****	*100.00*	*55.60*	*45.19*	*47.83*	*53.45*	*50.77*	*51.58*
Ecological Health Rating	*VERY GOOD*	*GOOD*	*FAIR*	*FAIR*	*GOOD*	*GOOD*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2005

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics).

Table 5. The raw data and calculated SMI scores for the biological assessment of Sample Site #1 (USGS) conducted in July 2006.

Metric	Reference Value*	USGS Sample 1	USGS Sample 2	USGS Sample 3	USGS Sample 4	USGS Average (2006)	Watershed** Avg. 2006
Species Taxa	34.00	21.00	20.00	21.00	21.00	20.75	20.57
Metric Score	100.00	61.76	58.82	61.76	61.76	61.03	60.49
Ephemeroptera Taxa	9.00	6.00	6.00	7.00	7.00	6.50	4.78
Metric Score	100.00	66.67	66.67	77.78	77.78	72.22	53.15
Plecoptera Taxa	6.00	0.00	0.00	0.00	0.00	0.00	1.10
Metric Score	100.00	0.00	0.00	0.00	0.00	0.00	18.33
Trichoptera Taxa	7.00	4.00	5.00	4.00	5.00	4.50	4.93
Metric Score	100.00	57.14	71.43	57.14	71.43	64.29	70.36
Percent Plecoptera	20.00	0.00	0.00	0.00	0.00	0.00	0.67
Metric Score	100.00	0.00	0.00	0.00	0.00	0.00	3.36
Hilsenhoff Biotic Index	2.70	4.73	4.90	4.49	4.86	4.75	4.46
Metric Score	100.00	72.19	69.86	75.48	70.41	71.99	75.90
Percent Five Dominant Taxa	64.00	65.64	77.68	73.01	64.51	70.21	88.12
Metric Score	100.00	95.44	62.00	74.97	98.58	82.75	33.01
Scraper Taxa	8.00	2.00	1.00	1.00	1.00	1.25	1.51
Metric Score	100.00	25.00	12.50	12.50	12.50	15.63	18.85
Clinger Taxa	17.00	11.00	10.00	12.00	13.00	11.50	10.90
Metric Score	100.00	64.71	58.82	70.59	76.47	67.65	64.12
Idaho SMI Score	100.00	49.21	44.46	47.80	52.10	48.39	43.71
Ecological Health Rating	VERY GOOD	FAIR	FAIR	FAIR	GOOD	FAIR	FAIR
*Spring SMI Score****	*100.00*	*63.27*	*57.16*	*61.46*	*66.99*	*62.22*	*53.11*
Ecological Health Rating	*VERY GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2006

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics).

samples are shown Table 5. The score of 48.39 is in the "FAIR" category and the MSMI of 62.22 falls in to the "GOOD" category.

Total Taxa: The total taxa score is based on the number of distinct species found at a site. This is a measure of richness of the macroinvertebrate assemblage. A high diversity indicates better ecological health. Generally, as disturbance increases there will be a lower overall diversity of taxa because a few pollution tolerant species will dominant in these conditions. The disturbed conditions will exclude sensitive species that are found only in optimal environments. More taxa are also closely associated to there being supplementary niches, food sources, and habitats that are able to support a variety of the demands that each species requires (Barbour et al., 1999). The reference condition for the Basins Bioregion is 34 taxa resulting in a perfect metric score of 100.

Sample Site #1 (USGS site) had an average of 18.50 distinct taxa, and a metric score of 54.41 in 2005 (Table 4). This compares to the watershed averages of 19.65 taxa with a metric score of 57.79. The Sample Site #1 species taxa metric for 2005 was similar to the watershed average.

In 2006, the number of distinct taxa at Sample Site #1 was 20.75 with an ecological health rating of 61.03. This value is an increase from the previous year; however, entire watershed averages were higher in 2006. The watershed average was 20.57 with an ecological health rating of a 60.49. Again, as in 2005, the 2006 species numbers for Sample Site #1 were similar to the watershed average.

Ephemeroptera Taxa: Ephemeroptera taxa indicate the total number of distinct mayfly species present in the sample. The number of mayfly species decrease in the presence of disturbance because they are not tolerant to pollution. A higher diversity of mayfly taxa indicates an environment that is cleaner and healthier. The reference

condition for Ephemeroptera taxa in the Basins Bioregion is nine taxa resulting in a perfect metric score of 100. In 2005, the four sub-samples at site #1 averaged 5.75 taxa resulting in a metric score of 63.89 (Table 4). The watershed average of Ephemeroptera distinct taxa was 5.10 and a metric score of 56.67.

The collection in 2006 showed an increase in Ephemeroptera richness with an average of 6.50 taxa and a metric score of 72.22 at Site #1. The watershed average for 2006 was lower with only 4.78 taxa and a metric score of 53.15. When looking at the results from both years the number of Ephemeroptera taxa present at the USGS site was higher than the watershed average.

Plecoptera Taxa: The Plecoptera are the total number of distinct stonefly taxa present in the sample. When present, stoneflies indicate clean, cold, and well oxygenated water (Grafe, 2002). If disturbance occurs stonefly numbers will likely decrease. Because Silver Creek is a spring-fed system it doesn't have the riffles and cobbles that typically support stoneflies as indicated by the typical reference conditions for Idaho. The reference condition for the Plecoptera taxa in the Basins Bioregion is six taxa with a corresponding metric score of 100. Aquatic ecologists have shown that stoneflies are not commonly present in spring-fed systems even in the healthiest of systems like Silver Creek because of the lack of sufficient riffles. Due to this problem the Plecoptera Taxa metric was excluded in the MSMI score to provide a more accurate ecological health rating for spring-fed systems.

The Site #1 average for 2005 and 2006 was 0.00 taxa and a corresponding metric score of 0.00. The Plecoptera watershed average for 2005 and 2006 was 0.90 and 1.10 for number of taxa, respectively. This resulted in metric scores of 15.00 (2005) and

18.33 (2006) (Tables 4 and 5). It is likely that no stoneflies were collected at Site #1 because there was an absence of riffles with cobble substrate.

Trichoptera Taxa: The Trichoptera metric is used to indicate the total number of distinct caddisfly taxa present in the sample. Trichoptera are also considered key indicator species because of their sensitivities to pollution. Sedimentation is a particular pollutant that can harm these case-bearing insects. The number of taxa is predicted to decrease with disturbances. The reference conditions for Trichoptera taxa in the Basins Bioregion is seven, which results in a perfect metric score of 100.

Sample Site #1 had an average 3.00 taxa from the four samples collected 2005 with an average metric score of 42.86 (Table 4). The watershed average in 2005 was 3.93 taxa and a score of 56.07. In 2006, Sample Site #1 averaged 4.50 Trichoptera and an overall metric score of 64.29 (Table 4). The watershed average for the same year was 4.93 taxa and a metric score of 70.36. The Trichoptera metric score at study site #1 had lower values than the watershed average in both 2005 and 2006.

Percent Plecoptera: Percent Plecoptera is a composition metric used in the standard Idaho Department of Environmental Quality Macroinvertebrate protocol. This composition metric is used to determine the percent of the aquatic assemblage that is composed of the stoneflies. Stoneflies are very important in metric scoring because of their extreme sensitivity to disturbance and pollutants. The stream reference condition for the Basins Bioregion is 20% giving a perfect metric score of 100. The MSMI excluded this metric from its ratings because of the lack of Plecoptera presence in pristine spring-fed systems like Silver Creek. Consequently, the inclusion of this metric could greatly bias the true conditions on the sample site.

There were no stoneflies present at Sampling Site #1, resulting in a metric score of 0.00 for both years (Tables 4 and 5). The watershed average in 2005 was 1.70% with a rating of 8.52. The following year's average was 0.67% and a score of 3.36. Normally, the lack of presence of stoneflies would be a bad sign; however, the lack of natural riffles in the spring-fed Silver Creek system probably makes the lack of stoneflies meaningless.

Hilsenhoff Biotic Index (HBI): The HBI metric is used to calculate the tolerance of the aquatic assemblage to organic and toxic pollutants (Barbour et al., 1999). Although this index is expected to increase with increasing stream disturbance, the HBI metric score is formulated so that it decreases with an increase in disturbance. The reference condition for the HBI in the Basins Bioregion is 2.7 resulting in a perfect score of 100.

The sample site #1 HBI average in 2005 for the four sub-samples was 4.64, which a corresponded to metric score of 73.39 (Table 4). The watershed average was a HBI of 4.59 with a metric score of 74.09. The HBI score increased slightly in 2006 to 4.75 with a metric score of 71.99 (Table 5). The 2006 watershed average was 4.46 with a metric score of 75.90. Both years show relatively high metric scores, which would indicate that the overall assemblage of insects represents good water quality conditions.

Percent Five Dominant Taxa: The percent five dominant taxa is a measure of the five most abundant species on the site. This metric is a measure of the diversity in the site and indicates the amount of habitat that is occupied by the most common species. The species more sensitive to pollution tend to decrease with decreases in water quality. These sensitive species also decrease in numbers because of habitat modifications and food limitations of their normal niches and/or they are being out competed by the presence of exotic species (Grafe, 2002). It is predicted that the five dominant taxa will

increase as a percentage of fauna when poor water quality conditions or disturbances are present. The Basins Bioregion reference condition for the percent five dominant taxa is 64% with a corresponding metric score of 100.

Sample Site #1 had an average of 85.49% of the five dominant taxa and a metric score of 40.31 in 2005 (Table 4). The watershed average in 2005 was almost identical with an 85.48% dominance of the top five taxa and a metric rating of 40.34. In 2006 the five dominant taxa decreased to an average of 70.21% and a corresponding metric score of 82.75 (Table 5). The watershed average however, was higher in 2006 with 88.12% dominance and a metric score of 33.01. Sampling Site #1 in 2006 had the highest average metric score of 82.75 for the five dominant taxa metric out of all the ten sites sampled. Reasons for the decrease in dominance of the taxa in 2006 may be because of the timing of sampling (July 2006 vs. August 2005) and the potential change in habitat conditions during the intense flooding period in the spring of 2006.

Scraper Taxa: Scraper taxa are a measure of the number of species that consume algae from substrate. This is a measure of the functional feeding groups and is important because they are known to be sensitive organisms to changes in their food and the substrate that holds the food (Grafe, 2002). The abundance of taxa is expected to decrease with an increase in disturbance especially sedimentation. The reference condition for the scraper taxa in the Basins Bioregion is 8.00 taxa, corresponding to a perfect metric score of 100.00.

There was an average of 1.50 scraper taxa in 2005 and a metric score of 18.75 at Sample Site #1 (Table 4). The watershed average for the same year was also 1.50 scraper taxa and a corresponding metric score of 18.75. For 2006, the Sample Site #1 average was 1.25 taxa with a metric score of 15.63 (Table 5). The watershed average was almost

identical to the previous year's watershed average with 1.51 taxa and a metric score of 18.85. Basically, the scraper taxa data from both 2005 and 2006 were similar.

Clinger Taxa: Clinger taxa are a measure of the habitat in which the number of unique taxa that are able to cope with hydraulic conditions and/or settle into fixed retreats. These species have adapted to specialize at living in such unique habitats and will indicate the quality of the stream channel and flow rate. They are sensitive to hydrologic perturbation, pollution, and habitat change (Grafe, 2002). The number of unique clinger taxa is predicted to decrease when there is an increase in disturbance to the stream channel. The reference condition for the Basins Bioregion for clinger taxa is 17.00 which results in a perfect metric score of 100.00.

The number of unique clinger taxa in 2005 was 10.50 which resulted in a metric score of 61.76 at Sample Site #1 (Table 4). The entire watershed average in 2005 was identical to Sample Site #1 with 10.50 taxa and a score of 61.76. The results of 2006 showed an average of 11.50 taxa from the four samples collected and a score of 67.65 (Table 5). The watershed average was slightly higher than the previous year's average with 10.90 clinger taxa and a metric score of 64.12. The data for both years were similar and the site had clinger taxa numbers similar to the watershed average.

Community Similarity Percentage: The community similarity percentage is used to estimate the degree that the aquatic macroinvertebrates assemblage is similar between two sites. The Wittaker-Fairbanks Percent Similarity method was used to measure the degree of differences at the same sampling locations between 2005 and 2006. Wittaker-Fairbanks makes the comparison of two sites using a correlation value of 1.00 as a perfect association and the lowest correlation having a value of 0.00. Sample Site #1 had a similarity value of 49.9% when comparing 2005 and 2006 (Appendix D).

This correlation value indicates some association between the two years. However, there also appears to be some distinct difference between the two years. The extreme flooding that occurred in April 2006 and/or the timing of sampling (July 2006 vs. August 2005) are likely reasons for this change in the aquatic macroinvertebrate community structure between the sampling years. Larger changes are probably associated to the shifts in the dominant species, which will cause community structure to change because of their dominance in collected samples.

Sample Site #1 Evaluation Discussion: The USGS site received an ecological health rating of "FAIR" rating for both years based on Idaho Department of Environmental Quality (IDEQ) standards. The ISMI score was slightly below the watershed average in 2005, but was higher than the watershed average in 2006. The ratings show that conditions are only satisfactory, with a need for habitat improvements. This rating may be misleading because of the absence of stoneflies in a spring-fed system, which directly affects the SMI score. Historical collection of macroinvertebrates at this site has been carried out by the USGS for The Nature Conservancy in the past. These reports did not show ecological health ratings, but did quantify macroinvertebrates. In order for appropriate comparisons to be made with the USGS data, this USGS data would need to be statistically analyzed and then scored with metrics to get the associated ISMI score. This study completed in 2005 and 2006 can be used as a baseline for future managers to make comparisons and see if any shifts have occurred in the macroinvertebrates ecological health in the future from any changes in land use practices.

The Modified SMI (MSMI) excluded the Plecoptera in the water quality measurement due to their absence in even the most pristine spring fed systems. The exclusion resulted in a higher ecological health rating of "GOOD" for both 2005 and

2006. The watershed average was also "GOOD" for both years. The overall MSMI for 2006 was slightly higher than 2005. The flooding event of 2006 seemed to have little effect on the scoring. The "GOOD" rating is a positive sign of stable conditions, but this does not imply that improvements do not need to be made.

Overall, Silver Creek has been known to be a healthy aquatic ecosystem by many ecological experts. The strong fishery is stable mainly due to its high bio-density of aquatic insects. Due to the lack of research about spring-fed systems in assessing water conditions the ISMI scoring systems are not appropriate. This ISMI gave a "FAIR" rating to site #1 whereas as the MSMI resulted in a "GOOD" ecological rating. Conditions on Silver Creek are considered by local experts to be good, and based on this and the macroinvertebrate identifications it would be more appropriate to use the MSMI on the Silver Creek system.

Based on the ecological health ratings and SMI score it appears that the two sampling years at the USGS resulted in similar results. This is interesting because the Wittaker-Fairbanks Percent Similarity was only 0.499 which is not a close similarity. This could imply that even in natural disturbances like the flooding in April of 2006 the community structure will shift, but the ecological health of Sample Site #1 remained consistent (GOOD).

The riparian zone at Sample Site #1 was stable and well vegetated, but the land use upstream of the USGS site, outside of the Silver Creek Preserve, could be improved. There is ranching and farming near the stream banks that could be pushed farther away from the channel to increase the size of the riparian buffer zone. This riparian buffer zone could be improved through riparian restoration work similar to that conducted by The Nature Conservancy on other properties in the area. The enhancement and

expansion of the riparian zone will help to reduce stream water temperatures and will decrease the quantity of sediment or pesticides sourced from the land use agriculture practices. The Nature Conservancy has made extensive efforts to work with local land managers in changing land practices that are more supportive to surrounding ecological health of the watershed. In order to improve the habitat of Silver Creek, The Nature Conservancy has used conservation easements and promoted the usage of Best Management Practices to achieve this goal.

Sample Site #2: Float Tube Access

Sample Site #2 is located at the float tube access point just above the well known S-turns on Silver Creek. The S-turns are well known because of the large fish found in this portion of Silver Creek and is the primary reason why many fly fishermen choose to float this segment. The site was accessible using foot paths frequented by fishermen. The riparian zone is composed mainly of stable grasses and small amounts of brush with minimal erosion (Illustration 13). There were no riffles present at this sampling site. Only slow moving deep runs holding small amounts of aquatic vegetation relative to rest of the stream were visible (Illustrations 14 and 15). Due to the depths of the stream at this site an extension tube for the Hess sampler was used to collect samples. While the riparian zone seemed to be unchanged by the flooding of 2006, Sample Site #2 appeared to have significant amounts of aquatic plants wiped away from the streambed and heavy sediment deposits.

Sample Site #2 is in the Silver Creek Preserve with the primary direct land use impact being caused by recreational users. This impact is the disturbance of the streambed frequently used by fly fishermen at the float tube access point. Currently the

Illustration 13. The riparian zone at Sample Site #2 is mainly composed of thick grasses and some brush with minimal erosion on the banks

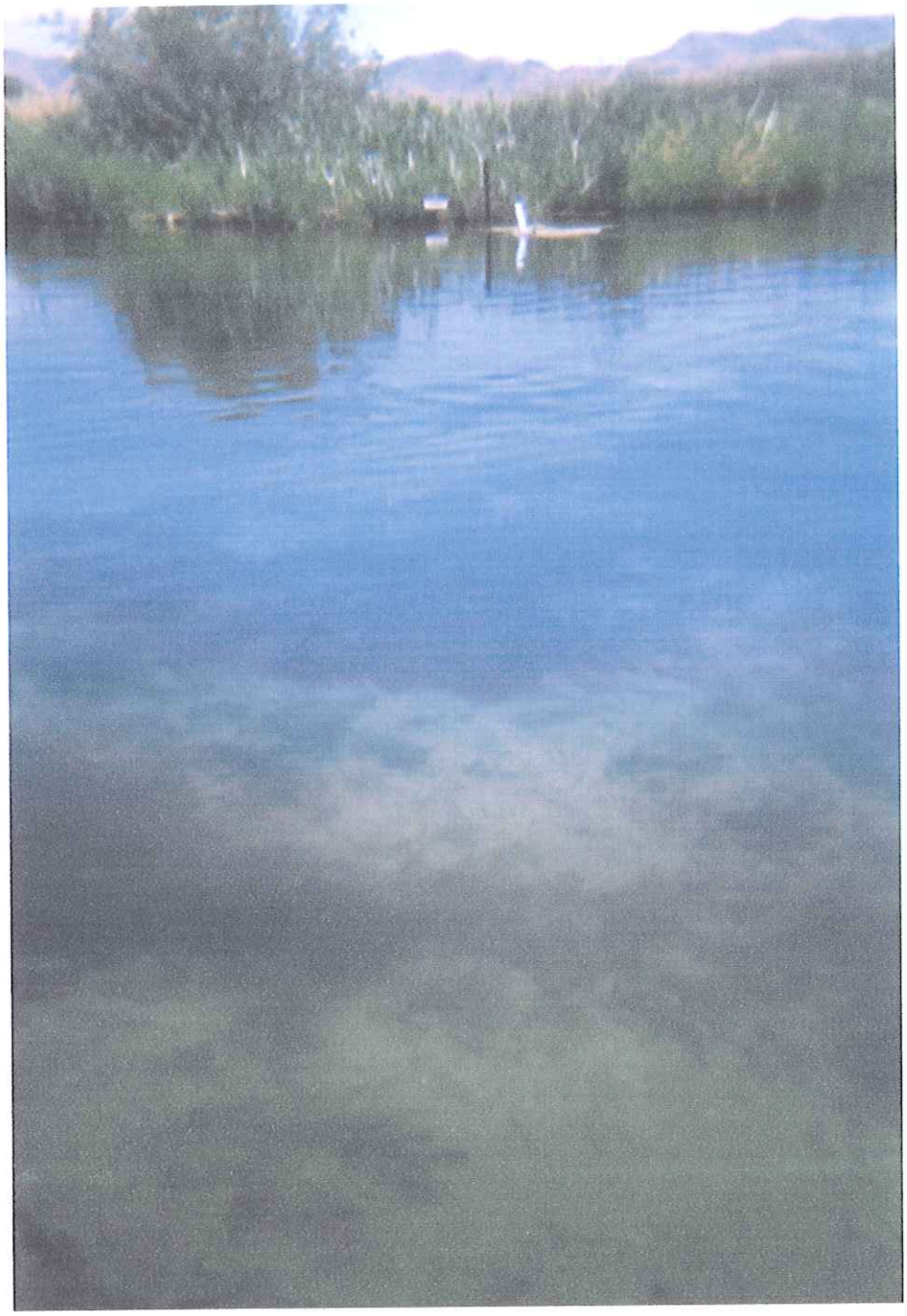

Illustration 14. The primary substrate found on the streambed of Sampling Site #2 is silt and sediment.

Illustration 15. Sample Site #2 (Float tube Access Point) has minimal amounts of aquatic vegetation present, when compared to other the stream segments. This sampling site also contains slow moving pools of waters.

site is being monitored by The Nature Conservancy for water quality parameters including (1) temperature, (2) dissolved oxygen (DO), (3) turbidity, (4) conductance, and (5) total dissolved solids (TDS). Results from the Sample Site #2 macroinvertebrate sampling will be used by The Nature Conservancy to look at trends by comparing the data with past sampling.

The average ISMI (2005) for the four sub-samples on Sample Site #2 was 35.99, while a MSMI score of 46.27 was calculated (Table 6). Both scores correspond to an ecological health rating of "FAIR". In 2006, the scores fell to ISMI and MSMI values of 27.45 and 35.30, respectively (Table 7). The 2006 ISMI of 27.45 resulted in a "POOR" rating while the 2006 MSMI resulted in a "FAIR" rating. The overall SMI score for individual metrics are discussed below.

Total Taxa: Sampling Site #2 averaged 17.25 taxa (2005), which resulted in a species taxa metric score of 50.74 (Table 6). The 2005 watershed average for the number of species was 19.65, with a corresponding metric score of 57.79. In 2006, the number of species at Site #2 dropped to 15.00 taxa resulting in a metric score of 44.12 (Table 7). The watershed average in 2006 was 20.57 taxa and a metric score of 60.49. This decrease in the number of species at Site #2 in 2006 could be due stream alterations caused by the major flood event of 2006.

Ephemeroptera taxa: There were 5.50 mayfly taxa in 2005 resulting in a metric score of 61.11 in 2005 (Table 6). The watershed average was slightly lower at 5.10 with a metric score of 56.67. In 2006, Sample Site #2 averaged 5.00 taxa and a metric score of 55.56 (Table 7). The 2006 watershed average was 4.78 mayfly taxa resulting in a metric score of 53.15. Based on the data the Ephemeroptera data was consistent over the two-year sampling period.

Table 6. The raw data and calculated SMI scores for the biological assessment of Sample Site #2 (Float) conducted in August 2005.

Metric	Reference Value*	Float Sample 1	Float Sample 2	Float Sample 3	Float Sample 4	Float Average	Watershed Avg. 2005
Species Taxa	34.00	14.00	14.00	22.00	19.00	17.25	19.65
Metric Score	100.00	41.18	41.18	64.71	55.88	50.74	57.79
Ephemeroptera Taxa	9.00	5.00	5.00	7.00	5.00	5.50	5.10
Metric Score	100.00	55.56	55.56	77.78	55.56	61.11	56.67
Plecoptera Taxa	6.00	0.00	0.00	0.00	0.00	0.00	0.90
Metric Score	100.00	0.00	0.00	0.00	0.00	0.00	15.00
Trichoptera Taxa	7.00	2.00	2.00	3.00	3.00	2.50	3.93
Metric Score	100.00	28.57	28.57	42.86	42.86	35.71	56.07
Percent Plecoptera	20.00	0.00	0.00	0.00	0.00	0.00	1.70
Metric Score	100.00	0.00	0.00	0.00	0.00	0.00	8.52
Hilsenhoff Biotic Index	2.70	4.25	5.00	4.54	4.55	4.59	4.59
Metric Score	100.00	78.77	68.49	74.79	74.66	74.09	74.09
Percent Five Dominant Taxa	64.00	86.55	81.34	81.89	86.73	84.13	85.48
Metric Score	100.00	37.36	51.83	50.31	36.86	44.09	40.34
Scraper Taxa	8.00	1.00	1.00	1.00	1.00	1.00	1.50
Metric Score	100.00	12.50	12.50	12.50	12.50	12.50	18.75
Clinger Taxa	17.00	6.00	7.00	10.00	8.00	7.75	10.50
Metric Score	100.00	35.29	41.18	58.82	47.06	45.59	59.12
Idaho SMI Score	100.00	32.14	33.26	42.42	36.15	35.99	42.73
Ecological Health Rating	VERY GOOD	POOR	FAIR	FAIR	FAIR	FAIR	FAIR
*Modified SMI Score****	*100.00*	*41.32*	*42.76*	*54.54*	*46.48*	*46.27*	*51.58*
Ecological Health Rating	*VERY GOOD*	*FAIR*	*FAIR*	*GOOD*	*FAIR*	*FAIR*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2005

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics).

Table 7. The raw data and calculated SMI scores for the biological assessment of Sample Site #2 (Float tube access, TNC transect 2) conducted in July 2006.

Metric	Reference Value*	Float Sample 1	Float Sample 2	Float Sample 3	Float Sample 4	Float Average	Watershed** Avg. 2006
Species Taxa	34.00	15.00	15.00	15.00	15.00	15.00	20.57
Metric Score	100.00	44.12	44.12	44.12	44.12	44.12	60.49
Ephemeroptera Taxa	9.00	5.00	6.00	4.00	5.00	5.00	4.78
Metric Score	100.00	55.56	66.67	44.44	55.56	55.56	53.15
Plecoptera Taxa	6.00	0.00	0.00	0.00	0.00	0.00	1.10
Metric Score	100.00	0.00	0.00	0.00	0.00	0.00	18.33
Trichoptera Taxa	7.00	3.00	1.00	2.00	2.00	2.00	4.93
Metric Score	100.00	42.86	14.29	28.57	28.57	28.57	70.36
Percent Plecoptera	20.00	0.00	0.00	0.00	0.00	0.00	0.67
Metric Score	100.00	0.00	0.00	0.00	0.00	0.00	3.36
Hilsenhoff Biotic Index	2.70	5.80	5.75	5.61	6.26	5.86	4.46
Metric Score	100.00	57.53	58.22	60.14	51.23	56.78	75.90
Percent Five Dominant Taxa	64.00	95.00	92.41	90.78	94.39	93.15	88.12
Metric Score	100.00	13.89	21.08	25.61	15.58	19.04	33.01
Scraper Taxa	8.00	1.00	1.00	0.00	0.00	0.50	1.51
Metric Score	100.00	12.50	12.50	0.00	0.00	6.25	18.85
Clinger Taxa	17.00	6.00	7.00	7.00	5.00	6.25	10.90
Metric Score	100.00	35.29	41.18	41.18	29.41	36.76	64.12
Idaho SMI Score	100.00	29.08	28.67	27.12	24.94	27.45	43.71
Ecological Health Rating	VERY GOOD	POOR	POOR	POOR	POOR	POOR	FAIR
*Modified SMI Score****	*100.00*	*37.39*	*36.86*	*34.87*	*32.07*	*35.30*	*53.11*
Ecological Health Rating	*VERY GOOD*	*FAIR*	*FAIR*	*FAIR*	*POOR*	*FAIR*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2006

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics).

Plecoptera Taxa: No stoneflies were found at Site #2 in either sampling year. This lack of stoneflies resulted in metric scores of 0.00 (Tables 6 and 7). The watershed average for the number of stonefly taxa in 2005 and 2006 were 0.90 and 1.10, respectively. This resulted in watershed scores of 15.00 (2005) and 18.33 (2006). The absence of stoneflies is due to the lack of riffle habitat at Sampling Site #2.

Trichoptera Taxa: The number of caddisfly species at Sample Site #2 was low in both 2005 and 2006 at 2.50 and 2.00 taxa, respectively (Tables 6 and 7). The resulting metric scores were 35.71 (2005) and 28.57 (2006). The ten-site taxa average was higher than the Site #2 average in both 2005 and 2006 with 3.93 and 4.93 taxa, corresponding to metric scores of 56.07 and 70.36. Sample site #2 had the lowest diversity of caddisfly species of the ten sites sampled in both years.

Percent Plecoptera: Again no stoneflies were present at Site #2 resulting in metric scores of 0.00 for both 2005 and 2006 (Tables 6 and 7). The watershed averages were low with 1.70% (2005) and 0.67% (2006) stonefly dominance in the overall assemblage and metric scores of 8.52 and 3.36, respectively.

Hilsenhoff Biotic Index (HBI): The average HBI score at Sample Site #2 in 2005 was 4.59, which resulted in a metric score of 74.18. The lower HBI correlates to higher metric scores. The ten-site average was the same at 4.59. In 2006, the HBI average on site #2 increased to 5.86, resulting in a metric score of 56.78 (Tables 6 and 7). The watershed average in 2006 was 4.46, resulting in a metric score of 75.90.

Percent Five Dominant Taxa: The five dominant taxa found at Site #2 made up 84.13% of all the macroinvertebrates in 2005, resulting in a metric score of 44.09. The ten-site average was slightly higher at 85.48% with a corresponding metric score of 40.34. During 2006, the five dominant taxa composed 93.15% of the taxa, resulting in a

metric score of 19.04 for Sample Site #2. The watershed average was at 88.12% and metric score of 33.01 in 2006 (Tables 6 and 7).

Scraper Taxa: The average number of scraper species was 1.00 in 2005 and only 0.50 taxa in 2006 (Tables 6 and 7). The resulting metric scores were 12.50 (2005) and 6.25 (2006). The watershed average was higher with 1.50 (2005) and 1.51 (2006) taxa, resulting in metric scores of 18.75 and 18.85, respectively. The average number of scraper taxa at Site #2 was the lowest for the entire watershed.

Clinger Taxa: The clinger taxa average at Sample Site #2 was 7.75, resulting in a metric score of 45.59 in 2005. The 2005 watershed average was 10.50 with a corresponding metric score of 59.12. Clinger diversity dropped in 2006 to 6.25 taxa, resulting in a metric score of 36.76. The ten-site average for 2006 was 10.90 with a metric score at 64.12. Consequently, Sample Site #2 had fewer clinger taxa than most of the other sampled sites in both 2005 and 2006.

Community Similarity Index: The similarity between samples collected in 2005 and 2006 at Site #2 using the Wittaker-Fairbanks Percent Similarity method was 22.9% (Appendix D). This is a very low correlation, indicating the aquatic macroinvertebrate community was quite different in 2005 and 2006. The change between the two sampling years can be visually observed by looking at streambed differences due to the 2006 flooding.

Sample Site #2 (Float Tube Access) Evaluation Discussion: The float tube access site received an ecological health rating as "FAIR" (2005) and "POOR" (2006) based on the current Idaho Department of Environmental Quality (IDEQ) standards. Both years the ISMI at Sample Site #2 was lower than the watershed average. It appears from the ratings, that conditions are not good, resulting in a need to improve the habitat.

The ISMI scores in Sample Site #2 are lower both years when compared to the overall watershed averages. Lower scores are likely associated with the absence of riffles. These ISMI scores may be misleading because of the absence of stoneflies at the site.

The MSMI takes into account that stoneflies are absent on even the more pristine spring-fed systems in Idaho. The resulting MSMI value was higher than the ISMI in both 2005 and 2006, but still resulted in ecological health ratings of "FAIR" both years. The conditions at site #2 appear to be suitable enough to support a fairly healthy assemblage of macroinvertebrates, but improvements need to be made to the habitat. Upon visual inspection this site had the poorest streambed conditions and consequently received the lowest SMI scores of the ten sites evaluated in 2006.

Based on the SMI scores for the two years there was a small decrease in the SMI score in 2006. The Wittaker-Fairbanks Percent Similarity was 22.9%, illustrating a very low correlation between the two sampling years in 2005 and 2006. The MSMI ecological health rating was "FAIR" for both years despite the 2006 flooding event and consequent changes in the aquatic community.

The riparian vegetation was stable on site #2, but some areas lacked the trees and shrubbery commonly found throughout the Silver Creek Preserve. The surrounding landscape is in good condition due to the preservation and restoration work of The Nature Conservancy. Lower ratings earned by this stream section may be due in part to heavy streambed usage by fly fishermen that access this site virtually everyday. However, adverse impact by the fly fishermen is probably minimal on the ecological health rating. Site #2 is very different from a riffle habitat and the lower SMI scores can be more likely associated with these slow moving waters and lack of suitable streambed substrate to support a diverse macroinvertebrate community.

The Nature Conservancy (TNC) has been monitoring this site for several years and has not found obvious indications of poor water quality. The fishing around the site is also very good as some of the largest fish in the preserve are found here. The main quality problem are due: (1) to heavy amounts of silt on the streambed, (2) small amount of aquatic plants, and (3) the pool resembling habitat found on Site #2.

Sampling Site #3: Loving Creek

Sample Site #3 is located at the Silver Creek Preserve boundary just right above a foot bridge that was washed out by the flooding in 2006. Loving Creek is considered pollution impaired for high temperature conditions based on the Total Maximum Daily Load (TMDL) standard established by the IDEQ. Loving Creek is the only tributary labeled as impaired in the Silver Creek Watershed. The IDEQ reported that Loving Creek could be removed from the impaired list, if upon reassessment; the water temperature values decreased (Claire, 2005).

A qualitative analysis of Site #3 would rate this stream segment as in good condition based on excellent trout fishing and healthy insect hatches. The riparian vegetation at the site consisted of thick brush and grasses, resulting in stable stream bank conditions (Illustration 16). The streambed contains both gravel patches and *Chara* mats. There are some riffle-like habitats present, but they lack cobble substrate.

Loving Creek is managed by The Nature Conservancy and human use is limited to bird watching and sport fishing. Based on trail use this section of the stream is not visited by anglers as frequently as the other sections of the Silver Creek Preserve. On the other hand, there is a privately owned pasture directly above this site. During sampling cattle were observed grazing on this pasture near the stream. This land use has resulted

in well-worn banks and poor riparian vegetation above Site #3 (Illustration 17). Two and a half km above Site #3 is the Hayspur Fish Hatchery. The impacts of the hatchery on the ecology of Site #3 are not fully known. The hatchery however, has made improvements over the years on trying to minimize environmental impacts on Loving Creek.

In 2005, Sample Site #3 received low scores with the IMI being 26.42 and the MSMI at 33.97 (Table 8). The individual score for each of the four sub-samples collected at Site #3 are shown in Table 8. The corresponding ecological health ratings are in the "POOR" (ISMI) and "FAIR" (MSMI). In 2006, one of the four collected sub-samples was compromised and had to be excluded from the study. The three 2006 samples were substantially higher at 37.80 for the ISMI and 48.60 for the MSMI. The corresponding 2006 ecological health ratings are "FAIR" for both SMI scoring values. The scores for each of the nine evaluated metrics are discussed below.

Total Taxa: The average number of species found at Sample Site #3 in 2005 was 13.50 resulting in a rating of 39.71 (Table 8). Site #3 had the lowest diversity of species collected in the entire watershed. The average number of species for the ten sites in 2005 was 19.65 taxa resulting in a corresponding rating of 57.79. In 2006 the average number of species at Site #3 increased to 18.67 taxa producing a score of 54.90 (Table 9). The watershed average for 2006 was 20.57 species and a metric score 60.49. The flooding in 2006 may have flushed the dominant taxa out of the system, cooled water temperatures, and/or swept out sediments out of the system, allowing for an increase in the number of species at this site.

Ephemeroptera Taxa: The number of mayflies collected at Site #3 in 2005 averaged 3.25 taxa with a metric score of 36.11 (Table 8). The watershed average was

Illustration 16. Sampling Site #3 (Loving Creek) has stable bank conditions because the riparian zone is thick with vegetation with little disturbance, which results in very little erosion.

Illustration 17. Above Sampling Site #3, Loving Creek, there is a pasture with cattle grazing. It appears that the cattle graze near the stream banks which have minimal vegetation. Also pictured, is the foot bridge wiped out by flooding in 2006.

Table 8. The raw data and calculated SMI scores for the biological assessment of Sample Site #3 (Loving Creek) conducted in August 2005.

Metric	Reference Value*	Loving Sample 1	Loving Sample 2	Loving Sample 3	Loving Sample 4	Loving Average	Watershed avg. 2005
Species Taxa	34.00	14.00	11.00	13.00	16.00	13.50	19.65
Metric Score	100.00	41.18	32.35	38.24	47.06	39.71	57.79
Ephemeroptera Taxa	9.00	4.00	2.00	3.00	4.00	3.25	5.10
Metric Score	100.00	44.44	22.22	33.33	44.44	36.11	56.67
Plecoptera Taxa	6.00	0.00	0.00	0.00	0.00	0.00	0.90
Metric Score	100.00	0.00	0.00	0.00	0.00	0.00	15.00
Trichoptera Taxa	7.00	2.00	1.00	2.00	3.00	2.00	3.93
Metric Score	100.00	28.57	14.29	28.57	42.86	28.57	56.07
Percent Plecoptera	20.00	0.00	0.00	0.00	0.00	0.00	1.70
Metric Score	100.00	0.00	0.00	0.00	0.00	0.00	8.52
Hilsenhoff Biotic Index	2.70	6.09	4.26	4.46	4.53	4.84	4.59
Metric Score	100.00	53.56	78.63	75.89	74.93	70.75	74.09
Percent Five Dominant Taxa	64.00	84.84	98.84	96.29	96.51	94.12	85.48
Metric Score	100.00	42.11	3.22	10.31	9.69	16.33	40.34
Scraper Taxa	8.00	1.00	0.00	2.00	1.00	1.00	1.50
Metric Score	100.00	12.50	0.00	25.00	12.50	12.50	18.75
Clinger Taxa	17.00	7.00	3.00	6.00	7.00	5.75	10.50
Metric Score	100.00	41.18	17.65	35.29	41.18	33.82	59.12
Idaho SMI Score	100.00	29.28	18.71	27.40	30.30	26.42	42.73
Ecological Health Rating	VERY GOOD	POOR	POOR	POOR	POOR	POOR	FAIR
*Modified SMI Score****	*100.00*	*37.65*	*24.05*	*35.23*	*38.95*	*33.97*	*51.58*
Ecological Health Rating	*VERY GOOD*	*FAIR*	*POOR*	*FAIR*	*FAIR*	*FAIR*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2005

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics).

Table 9. The raw data and calculated SMI scores for the biological assessment of Sample Site #3 (Loving Creek) conducted in July 2006.

Metric	Reference Value*	Loving Sample1	Loving Sample2	Loving Sample3	Loving Sample 4 (incomplete)	Loving Average	Watershed** Avg. 2006
Species Taxa	34.00	19.00	20.00	17.00	X	18.67	20.57
Metric Score	100.00	55.88	58.82	50.00		54.90	60.49
Ephemeroptera Taxa	9.00	7.00	5.00	7.00	X	6.33	4.78
Metric Score	100.00	77.78	55.56	77.78		70.37	53.15
Plecoptera Taxa	6.00	0.00	0.00	0.00	X	0.00	1.10
Metric Score	100.00	0.00	0.00	0.00		0.00	18.33
Trichoptera Taxa	7.00	4.00	5.00	3.00	X	4.00	4.93
Metric Score	100.00	57.14	71.43	42.86		57.14	70.36
Percent Plecoptera	20.00	0.00	0.00	0.00	X	0.00	0.67
Metric Score	100.00	0.00	0.00	0.00		0.00	3.36
Hilsenhoff Biotic Index	2.70	4.50	5.39	4.33	X	4.74	4.46
Metric Score	100.00	75.34	63.15	77.67		72.05	75.90
Percent Five Dominant Taxa	64.00	92.03	96.59	93.99	X	94.20	88.12
Metric Score	100.00	22.14	9.47	16.69		16.10	33.01
Scraper Taxa	8.00	0.00	2.00	2.00	X	1.33	1.51
Metric Score	100.00	0.00	25.00	25.00		16.67	18.85
Clinger Taxa	17.00	8.00	10.00	9.00	X	9.00	10.90
Metric Score	100.00	47.06	58.82	52.94		52.94	64.12
Idaho SMI Score	100.00	37.26	38.03	38.10	X	37.80	43.71
Ecological Health Rating	VERY GOOD	FAIR	FAIR	FAIR	X	FAIR	FAIR
*Modified SMI Score****	*100.00*	*47.91*	*48.89*	*48.99*	*X*	*48.60*	*53.11*
Ecological Health Rating	*VERY GOOD*	*FAIR*	*FAIR*	*FAIR*	*X*	*FAIR*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2006

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics).

5.10 taxa, resulting in a metric score of 56.67. In 2006 the mayfly average nearly doubled to 6.33 taxa with a metric score of 70.37 (Table 9). An average of 4.78 species of mayfly per site was found in the entire watershed in 2006, which resulted in a metric score of 53.15.

Plecoptera Taxa: There were no Plecoptera taxa found at Sample Site #3 in 2005 or 2006, which resulted in metric scores of 0.00 (Tables 8 and 9). The absence of stoneflies is due to the lack of riffle habitat with cobble substrate. The watershed averages were only 0.90 (2005) and 1.10 (2006) taxa with corresponding metric scores of 15.00 and 18.33, respectively.

Trichoptera Taxa: The number of caddisflies observed at Loving Creek was 2.00 in 2005 and 4.00 taxa in 2006 (Tables 8 and 9). The corresponding metric scores were 28.57 and 57.14 in 2005 and 2006, respectively. The watershed caddisfly average was 3.93 taxa in 2005 and 4.93 taxa in 2006, with average metric scores of 70.36 and 56.07 respectively. The flooding in 2006 may have created habitat more suitable, e.g. with less deposited sediment, or flushed out competing species to increase the diversity of caddisflies at Sample Site #3.

Percent Plecoptera: The absence of stoneflies in both 2005 and 2006 resulted in metric scores of 0.00 for the Percent Plecoptera (Tables 8 and 9). The watershed average was higher in 2005 at 1.70% and at 0.67% stonefly dominance in 2006. The related metric scores were 8.52 and 3.36.

Hilsenhoff Biotic Index (HBI): The average HBI for Site #3 was very similar for 2005 and 2006 with scores of 4.84 and 4.74, respectively. The metric scores were 70.75 (2005) and 72.05 (2006). This metric indicates that the species present are sensitive to pollution and perturbations. The HBI watershed averages were 4.59 (2005) and 4.46

(2006) with associated metric scores of 74.09 and 75.90. Site #3 had HBI scores similar to the watershed averages.

Percent Five Dominant Taxa: The Five dominant taxa value at Site #3 were high in both sampling years as a 94.12% dominance was observed in 2005 and 94.20% dominance in 2006 (Tables 8 and 9). Consequently, associated metric scores were very low with values of 16.33 (2005) and 16.10 (2006). The ten-site averages were 85.48% in 2005 and 88.12% dominance in 2006, resulting in higher metric scores of 40.34 and 33.01, respectively. The macroinvertebrate diversity at Site #3 (Loving Creek) was lower than the other nine sampled sites and is likely the major factor contributing to the low overall ISMI and MSMI scores at this site.

Scraper Taxa: There was an average of 1.00 scraper taxa at Site #3 in 2005 with a metric score of 12.50 (Table 8). The 2005 watershed average was 1.50 taxa, with a metric score of 18.75. In 2006, the average scraper taxa number was 1.33 species resulting in metric score of 16.67 (Table 9). The watershed average in 2006 for scraper taxa was 1.51 taxa, resulting in a metric score of 18.85.

Clinger Taxa: The samples collected at Loving Creek contained an average of 5.75 clinger taxa. This resulted in an average metric score of 33.82 in 2005 (Table 8). The average number of clinger taxa in 2006 increased to 9.00 with a metric score of 52.94 (Table 9). The ten-site average was 10.50 (2005) and 10.90 (2006) taxa, with corresponding metric scores of 59.12 and 64.12.

Community Similarity Percentage: The two sampling years of 2005 and 2006 had a 44.6% community similarity, based on the Wittaker-Fairbanks Percent Similarity method. There are some distinct differences between the two years, however, the similarity indicates some consistency between the two sampling years (Appendix D).

Site #3 Evaluation Discussion: Loving Creek received an ecological health rating of "POOR" in 2005 and "FAIR" in 2006, based on the IDEQ standards, and was the lowest rated sampling site of the ten evaluated. The watershed average SMI scores were higher in both years with resulting in ecological health ratings of "FAIR" in 2005 and 2006. Though fishing is adequate to maintain anglers' interest, on Loving Creek, the ecological health appears to be less than satisfactory based on the traditional ISMI scoring used by IDEQ. Again, these ratings may be misleading because the ISMI assumes the presence of Plecoptera in pristine systems, but spring-fed systems will not always have stoneflies present.

The MSMI is a more appropriate evaluation of Loving Creek because stoneflies are removed from the rating system. The averages for 2005 and 2006 MSMI ecological health ratings were both "FAIR". These ratings are lower than the watershed average of "GOOD". The flooding in April of 2006 appears to have positively affected the aquatic community because the MSMI scores increased in 2006, while the Wittaker-Fairbanks Percent Similarity is only 44.6%. Yet, even with larger changes in the macroinvertebrate assemblage the ecological health remained consistent for both years based on MSMI ratings (changes could be associated with the global climatic changes).

These findings will help The Nature Conservancy with their understanding of Loving Creek and in doing comparative analysis with their on-going water quality monitoring program. In addition this data can serve as a baseline to measure the impact of changes in land use upstream of Site #3 on the ecological health of this stream of this stream segment.

A rating of "FAIR" indicates conditions are suitable, but improvements should be made to improve the biological health of this stream segment. Plausible explanations for

the lower ratings on Loving Creek include the pasture upstream and discharge from the fish hatchery. The pasture seen in Illustration 10 shows that cattle graze close to stream banks. This practice often removes significant amounts of riparian vegetation. The negative impacts associated with such grazing practices to the stream include the direct waste deposits produced by the cattle, increased water temperatures due to the removed riparian vegetation provides less shade to the stream, and increases in erosion of soils and of the stream bank. Improvements should be made by using Best Management Practices including creating buffer strips near the stream bank that minimize the impact of grazing cattle. This would serve as a buffer against erosion and waste inputs, and would provide more shade to decrease the water temperature because of the riparian vegetation.

The Hayspur Fish Hatchery has likely been a contributor of dissolved and particulate organic matter to Loving Creek. This could result in an excessive amount of nutrients present. Stream temperatures may also be affected by the hatchery's effluent. These potential problems could be mitigated by using a simple treatment system prior to release into the creek.

Sampling Site #4: Visitor Center

Sample Site #4 is located just below The Nature Conservancy Silver Creek Visitor Center and is accessed by a maintained path leading to the site. This site was chosen because The Nature Conservancy has done past water quality monitoring at this location. Geographically Sample Site #4 is located near the center of the Silver Creek Preserve.

The stream bank vegetation consists of grasses, shrubs, and small trees (Illustrations 18 and 19). The banks are stable with only minimal disturbance, probably

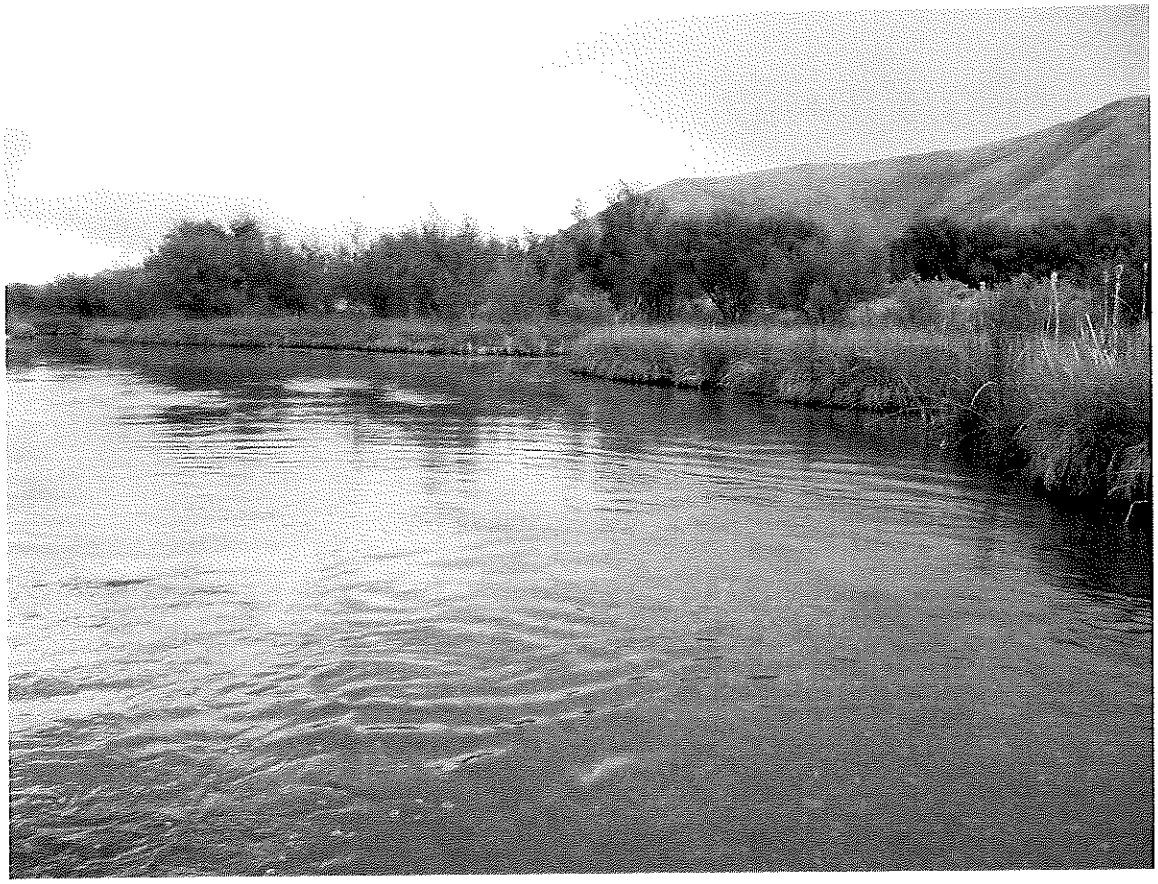

Illustration 18. Sample Site #4 located near the Visitor Center, has a healthy array of grasses, brush, and small trees making up the riparian zone.

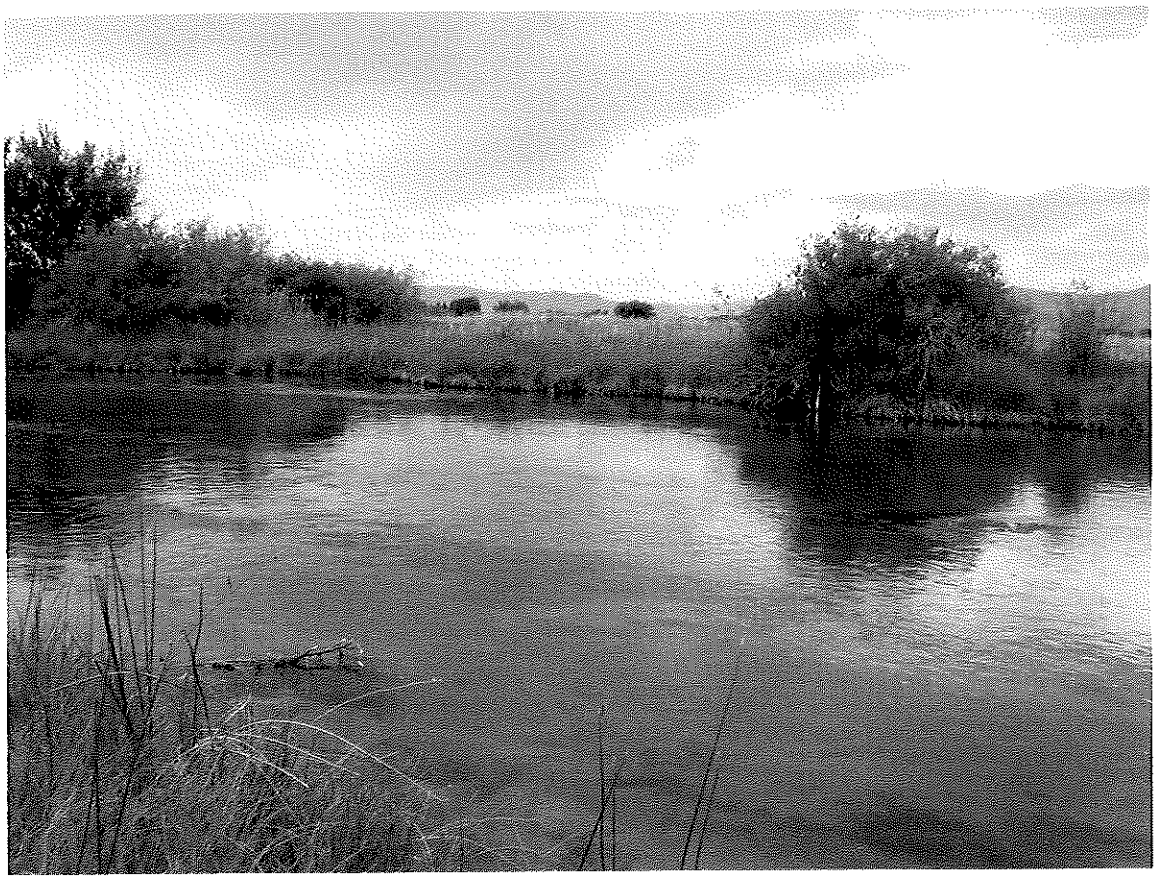

Illustration 19. Sampling Site #4 has streambeds that consist of gravels with strips of Chara.

primarily from recreationists. The stream current is swifter in this segment of Silver Creek as runs are apparent (Illustration 18). Upon visual assessment, the streambed consists primarily of gravels and patches of *Chara*, though this aquatic vegetation is much less abundant on this reach than at other sampling locations in the Silver Creek Watershed.

In 2005, the ISMI average value was 34.48 and the MSMI was 43.05. The scores of both SMI techniques resulted in ecological health rating category of "FAIR". The individual scores for each of the four sub-samples are shown in Table 10. The Visitor Center average SMI scores increased in value in 2006 to 41.80 ISMI and to 51.25 MSMI (Table 11). The score of 41.80 is in the "FAIR" category and the Modified SMI falls into the "GOOD" category. Past sampling of macroinvertebrates has been conducted in this area, however records do not indicate sampling coordinates and this previous sampling was not as complete as reported in this study. The overall SMI scores for individual metrics are evaluated below.

Total Taxa: The number of the unique species at Sample Site #4 average was 15.75 taxa, with a metric score of 46.32 in 2005 (Table 10). Conversely, the ten-site average was 19.65 taxa, with a metric score of 57.79 in 2005. The total taxa average increased to 17.75 distinct species in 2006 resulting in a metric score of 52.21. The watershed average in 2006 was 20.57 species, which resulted in a metric score of 60.49 (Table 11). The average number of taxa calculated is probably lower because of the absence of aquatic plants in some samples on Site #4, which is the primary substrate that macroinvertebrates occupy on Silver Creek.

Ephemeroptera Taxa: Sample Site #4 averaged 5.75 Ephemeroptera taxa resulting in a metric score of 63.89 in 2005 (Table 10). The average number of distinct

Table 10. The raw data and calculated SMI scores for the biological assessment of Sample Site #4 (Visitor Center) conducted in August 2005.

Metric	Reference Value*	Visitor Sample 1	Visitor Sample 2	Visitor Sample 3	Visitor Sample 4	Visitor Average	Watershed ** avg. 2005
Species Taxa	34.00	14.00	13.00	18.00	18.00	15.75	19.65
Metric Score	100.00	41.14	38.24	52.94	52.94	46.32	57.79
Ephemeroptera Taxa	9.00	4.00	5.00	7.00	7.00	5.75	5.10
Metric Score	100.00	44.44	55.56	77.78	77.78	63.89	56.67
Plecoptera Taxa	6.00	0.00	1.00	0.00	1.00	0.50	0.90
Metric Score	100.00	0.00	16.67	0.00	16.67	8.33	15.00
Trichoptera Taxa	7.00	2.00	2.00	2.00	2.00	2.00	3.93
Metric Score	100.00	28.57	28.57	28.57	28.57	28.57	56.07
Percent Plecoptera	20.00	0.00	0.32	0.00	0.19	0.13	1.70
Metric Score	100.00	0.00	1.60	0.00	0.95	0.64	8.52
Hilsenhoff Biotic Index	2.70	4.47	4.28	4.37	4.23	4.34	4.59
Metric Score	100.00	75.75	78.36	77.12	79.04	77.57	74.09
Percent Five Dominant Taxa	64.00	94.27	92.43	94.62	93.40	93.68	85.48
Metric Score	100.00	15.92	21.03	14.94	18.33	17.56	40.34
Scraper Taxa	8.00	2.00	1.00	2.00	2.00	1.75	1.50
Metric Score	100.00	25.00	12.50	25.00	25.00	21.88	18.75
Clinger Taxa	17.00	7.00	6.00	9.00	9.00	7.75	10.50
Metric Score	100.00	41.18	35.29	52.94	52.94	45.59	59.12
Idaho SMI Score	100.00	30.23	31.98	36.59	39.14	34.48	42.73
Ecological Health Rating	VERY GOOD	POOR	POOR	FAIR	FAIR	FAIR	FAIR
*Modified SMI Score****	*100.00*	*38.86*	*38.51*	*47.04*	*47.80*	*43.05*	*51.58*
Ecological Health Rating	*VERY GOOD*	*FAIR*	*FAIR*	*FAIR*	*FAIR*	*FAIR*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2005

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics)

Table 11. The raw data and calculated SMI scores for the biological assessment of Sample Site #4 (Visitor Center) conducted in July 2006.

Metric	Reference Value*	Visitor Sample 1	Visitor Sample 2	Visitor Sample 3	Visitor Sample 4	Visitor Average	Watershed** Avg. 2006
Species Taxa	34.00	21.00	16.00	15.00	19.00	17.75	20.57
Metric Score	100.00	61.76	47.06	44.12	55.88	52.21	60.49
Ephemeroptera Taxa	9.00	6.00	4.00	4.00	6.00	5.00	4.78
Metric Score	100.00	66.67	44.44	44.44	66.67	55.56	53.15
Plecoptera Taxa	6.00	2.00	1.00	0.00	1.00	1.00	1.10
Metric Score	100.00	33.33	16.67	0.00	16.67	16.67	18.33
Trichoptera Taxa	7.00	4.00	3.00	3.00	4.00	3.50	4.93
Metric Score	100.00	57.14	42.86	42.86	57.14	50.00	70.36
Percent Plecoptera	20.00	0.15	0.43	0.00	0.09	0.17	0.67
Metric Score	100.00	0.75	2.15	0.00	0.45	0.84	3.36
Hilsenhoff Biotic Index	2.70	3.89	3.37	3.47	3.37	3.53	4.46
Metric Score	100.00	83.70	90.82	89.45	90.82	88.70	75.90
Percent Five Dominant Taxa	64.00	86.49	89.04	91.33	87.41	88.57	88.12
Metric Score	100.00	37.53	30.44	24.08	34.97	31.76	33.01
Scraper Taxa	8.00	2.00	1.00	1.00	2.00	1.50	1.51
Metric Score	100.00	25.00	12.50	12.50	25.00	18.75	18.85
Clinger Taxa	17.00	13.00	9.00	8.00	12.00	10.50	10.90
Metric Score	100.00	76.47	52.94	47.06	70.59	61.76	64.12
Idaho SMI Score	100.00	49.15	37.76	33.83	46.47	41.80	43.71
Ecological Health Rating	VERY GOOD	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR
*Modified SMI Score****	*100.00*	*58.32*	*45.87*	*43.50*	*57.30*	*51.25*	*53.11*
Ecological Health Rating	*VERY GOOD*	*GOOD*	*FAIR*	*FAIR*	*GOOD*	*GOOD*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2006

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics)

taxa within the entire watershed was 5.10 in 2005, resulting in a metric score of 56.67. The average number of mayflies in 2006 decreased to 5.00 taxa, which resulted in a metric score of 55.56 (Table 11). The watershed average was 4.78 taxa resulting in a metric score of 53.15. The average number of Ephemeroptera taxa at Sampling Site #4 exceeded the watershed average in both years.

Plecoptera Taxa: Plecoptera were found both years at Sample Site #4. An average of 0.50 distinct taxa were found in 2005 and 1.00 taxa were found in 2006 (Tables 10 and 11). The associated metric scores were 8.33 and 16.66, respectively. The watershed averages of Plecoptera taxa were 0.90 (2005) and 1.10 (2006), resulting in metric scores of 15.00 and 18.33. Stoneflies were probably found here because the site had a riffle-like habitat. This habitat was not common at the other sampling sites in the watershed.

Trichoptera Taxa: In 2005, the number of distinct Trichoptera taxa collected on Site #4 was 2.00, which resulted in a metric score of 28.57 (Table 10). The watershed average was nearly double Site #4 with 3.93 distinct taxa and a metric score of 56.07. In 2006, the average increased to 3.50 Trichoptera taxa, resulting in a metric score of 50.00 (Table 11). The watershed average was also higher in 2006 with 4.93 taxa and a metric score of 70.36.

Percent Plecoptera Taxa: The average Percent Plecoptera collected on Sample Site #4 was very low both years with 0.13% in 2005 and 0.17% in 2006, resulting in metric scores of 0.64 and 0.84 respectively (Tables 10 and 11). The watershed averages were 1.70% in 2005 and 0.67% in 2006. The resulting metric score was 8.52 (2005) and 3.36 (2006). Such a low percentage of presence Plecoptera taxa indicate the lack of stonefly habitat present at Sample Site #4.

Hilsenhoff Biotic Index (HBI): The average HBI for Sample Site #4 was 4.34 in 2005 and 3.53 in 2006 (Tables 10 and 11). The resulting metric scores were 77.57 (2005) and 88.70 (2006). The watershed averages were 4.59 in 2005 and 4.46 in 2006, with corresponding metric scores of 74.09 and 75.90. Sample Site #4 analysis indicates that species sensitive to pollution inputs were present and this indicates relatively good water quality conditions.

Percent Five Dominant Taxa: The average Percent Five Dominant Taxa collected at Sample Site #4 was 93.68% in 2005 with a metric score of 17.56 (Table 10). Again, a higher percent dominance correlates to a lower metric score. The ten-site average was significantly lower at 85.48% resulting in a higher metric score of 40.34. In 2006, the dominance percentage decreased to 88.57%, which resulted in a metric score of 31.76 (Table 11). The watershed average in 2006 was similar at 88.12% dominance with a metric score of 33.01. The timing of sampling and the flooding in 2006 are possible reasons for the decrease in the dominant species percentage of the overall assemblage compared to the 2005 data.

Scraper Taxa: The number of scraper taxa at Sample Site #4 were 1.75 (2005) and 1.50 (2006), resulting in metric scores of 21.88 and 18.75, respectively (Tables 10 and 11). The corresponding watershed averages were 1.50 taxa, and 1.51 taxa in 2005 and 2006. The resulting metric scores were 18.75 and 18.85. Based on this data the Sample Sites #4 Scraper taxa data was similar to the ten-site average.

Clinger Taxa: The average total clinger taxa collected at Sample Site #4 was 7.75 (2005) with a metric score of 45.59 (Table 10). The watershed average was higher at 10.50 total clinger taxa with a resulting metric score of 59.12. The average number of clinger taxa increased to 10.50 at Sample Site #4 in 2006 with a metric score of 61.76.

The 2006 watershed average was slightly higher at 10.90 taxa and a resulting metric score of 64.12.

Community Similarity Percentage: Sample Site #4 had a 34.7% assemblage similarity when the 2005 and 2006 data were compared, based on the Wittaker-Fairbanks Percent Similarity method. This value is low and may be due to the 2006 flooding event which may have shifted the community structure. Another potential reason for this shift is that in 2005 sampling was conducted in August while the sampling in 2006 took place in July.

Sample Site #4 Evaluation Discussion: Sample Site #4 received an ecological health rating of "FAIR" for both years based on the IDEQ standards. These ISMI scores at site #4 were below the watershed average. The ratings indicate that the conditions are acceptable, but improvements should be made. These ratings include the calculations of the Plecoptera metrics and do not properly evaluate the site for its true ecological conditions (spring-fed systems). Even though there were some stoneflies present at Sample Site #4 their numbers and diversity were very low and they consequently lowered the ISMI score significantly.

The MSMI value which excludes the Plecoptera metrics from the calculation raised the scores and ecological health ratings. The MSMI resulted in Site #4 receiving a "FAIR" in 2005 rating and a "GOOD" rating in 2006. For both years, the SMI scores were below the watershed average, which corresponded to ecological health ratings of "GOOD". The Wittaker-Fairbanks Percent Similarity method showed only a 34.7% similarity of the macroinvertebrate community sampled between 2005 and 2006. The flooding of 2006 appears to have changed the community structure and may have even enhanced the ecological health rating at this site.

The landscape surrounding Sample Site #4, near the Visitor Center, is well managed and protected from practices which degrade the riparian area. This site is one of the five transects that The Nature Conservancy is currently monitoring for water quality conditions. This report will help the Conservancy assess the current water quality and health conditions at the Visitor Center.

Sample Site #5: Silver Creek Riffle

Sample Site #5 is located just below the confluence of Grove and Stalker creeks. This site was chosen based on the presence of abundant riffle-like habitat and because of its locations at the confluence of the two important tributaries. Sample Site #5 marks the beginning of Silver Creek and has relatively shallow, fast-flowing waters (Illustrations 20 and 21). Access to this location required a short hike on a Nature Conservancy trail.

The stream banks at this sampling location were stable with minimal human impact. The riparian vegetation was composed primarily of grasses and brush. This site is in the Silver Creek Preserve, but just upstream on Grove Creek the property is privately owned. The streambed is composed mostly of gravels and small rocks, with mats of *Chara*. The flooding in 2006 washed out a lot of the sediments on Sample Site #5 and created swifter channels with small islands of flood deposits (Illustration 22).

In 2005, the average ISMI and MSMI scores were 47.30 and 58.33, respectively (Table 12). The individual scores for each of the four sub-samples are shown in the Table 12. The ISMI score of 47.30 is in the "FAIR" category, while the MSMI is in the "GOOD" category. The scores dropped slightly in 2006 to 43.22 for the ISMI and to 53.06 for the MSMI (Table 13). The corresponding ecological ratings in 2006 were

Illustration 20. The Sampling Site #5 has swifter currents and substrate consisting of small rocks and gravels.

Illustration 21. Sample Site #5 is located just below the confluence of Grove and Stalker creeks. The presence of riffles can be seen in the above image.

Illustration 22. Due to flooding in 2006, significant sediment was cleared from channels and new gravel bars were formed.

Table 12. The raw data and calculated SMI scores for the biological assessment of Sample Site #5 (Silver Creek Riffle) conducted in August 2005.

Metric	Reference Value*	Riffle Sample 1	Riffle Sample2	Riffle Sample3	Riffle Sample 4	Riffle Average	Watershed** avg. 2005
Species Taxa	34.00	20.00	20.00	21.00	21.00	20.50	19.65
Metric Score	100.00	58.82	58.82	61.76	61.76	60.29	57.79
Ephemeroptera Taxa	9.00	6.00	7.00	6.00	6.00	6.25	5.10
Metric Score	100.00	66.67	77.78	66.67	66.67	69.44	56.67
Plecoptera Taxa	6.00	1.00	0.00	2.00	1.00	1.00	0.90
Metric Score	100.00	16.67	0.00	33.33	16.67	16.67	15.00
Trichoptera Taxa	7.00	5.00	3.00	2.00	4.00	3.50	3.93
Metric Score	100.00	71.43	42.86	28.57	57.14	50.00	56.07
Percent Plecoptera	20.00	0.38	0.00	0.13	0.06	0.14	1.70
Metric Score	100.00	1.90	0.00	0.65	0.30	0.71	8.52
Hilsenhoff Biotic Index	2.70	4.34	4.12	4.41	4.49	4.34	4.59
Metric Score	100.00	77.53	80.55	76.58	75.48	77.53	74.09
Percent Five Dominant Taxa	64.00	81.27	78.25	87.03	69.35	78.98	85.48
Metric Score	100.00	52.03	60.42	36.03	85.14	58.40	40.34
Scraper Taxa	8.00	2.00	2.00	2.00	2.00	2.00	1.50
Metric Score	100.00	25.00	25.00	25.00	25.00	25.00	18.75
Clinger Taxa	17.00	11.00	9.00	13.00	13.00	11.50	10.50
Metric Score	100.00	64.71	52.94	76.47	76.47	67.65	59.12
Idaho SMI Score	100.00	48.31	44.26	45.01	51.63	47.30	42.73
Ecological Health Rating	VERY GOOD	FAIR	FAIR	FAIR	GOOD	FAIR	FAIR
*Modified SMI Score****	*100.00*	*59.46*	*56.91*	*53.01*	*63.95*	*58.33*	*51.58*
Ecological Health Rating	*VERY GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2005

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics).

Table 13. The raw data and calculated SMI scores for the biological assessment of Sample Site #5 (Silver Creek Riffle) conducted in July 2006.

Metric	Reference Value*	Riffle Sample 1	Riffle Sample 2	Riffle Sample 3	Riffle Sample 4	Riffle Average	Watershed** Avg. 2006
Species Taxa	34.00	25.00	14.00	20.00	20.00	19.75	20.57
Metric Score	100.00	73.53	41.18	58.82	58.82	58.09	60.49
Ephemeroptera Taxa	9.00	6.00	4.00	3.00	3.00	4.00	4.78
Metric Score	100.00	66.67	44.44	33.33	33.33	44.44	53.15
Plecoptera Taxa	6.00	0.00	1.00	1.00	2.00	1.00	1.10
Metric Score	100.00	0.00	16.67	16.67	33.33	16.67	18.33
Trichoptera Taxa	7.00	7.00	3.00	6.00	4.00	5.00	4.93
Metric Score	100.00	100.00	42.86	85.71	57.14	71.43	70.36
Percent Plecoptera	20.00	0.00	0.21	0.13	0.38	0.18	0.67
Metric Score	100.00	0.00	1.05	0.65	1.90	0.90	3.36
Hilsenhoff Biotic Index	2.70	3.08	5.24	3.73	3.44	3.87	4.46
Metric Score	100.00	94.79	65.21	85.89	89.86	83.94	75.90
Percent Five Dominant Taxa	64.00	86.64	97.76	93.08	90.31	91.95	88.12
Metric Score	100.00	37.11	6.22	19.22	26.92	22.37	33.01
Scraper Taxa	8.00	3.00	1.00	2.00	2.00	2.00	1.51
Metric Score	100.00	37.50	12.50	25.00	25.00	25.00	18.85
Clinger Taxa	17.00	15.00	7.00	12.00	11.00	11.25	10.90
Metric Score	100.00	88.24	41.18	70.59	64.71	66.18	64.12
Idaho SMI Score	100.00	55.32	30.14	43.99	43.45	43.22	43.71
Ecological Health Rating	VERY GOOD	GOOD	POOR	FAIR	FAIR	FAIR	FAIR
*Modified SMI Score****	*100.00*	*71.12*	*36.23*	*54.08*	*50.83*	*53.06*	*53.11*
Ecological Health Rating	*VERY GOOD*	*GOOD*	*FAIR*	*GOOD*	*GOOD*	*GOOD*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2006

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics).

"FAIR" for the ISMI and "GOOD" for MSMI. The overall SMI scores for the metrics at Sampling Site #5 are interpreted below.

Total Taxa: The average number of species collected a Sample Site #5 in 2005 was 20.50, which resulted in a metric score of 60.29 (Table 12). This is slightly above the watershed average of 19.65 species with an overall metric score of 57.79. In 2006, the average number of species was 19.75, resulting in a metric score of 58.09 (Table 13). The watershed average was 20.57 taxa with a metric score of 60.49 in 2006. The number of species present indicated that there is a relatively healthy community of insects present at this location.

Ephemeroptera Taxa: The average numbers of mayfly taxa were 6.25 in 2005 and 4.00 in 2006. The corresponding metric scores were 69.44 (2005) and 44.44 (2006). The watershed average in 2005 was 5.10 taxa and 4.78 taxa in 2006. The watershed average metric values were 56.67 (2005) and 53.15 (2006).

Plecoptera Taxa: The average number of Plecoptera taxa on Sample Site #5 for both years was 1.00, resulting in metric scores of 16.67 (Tables 12 and 13). The watershed averages were 0.90 taxa in 2005 and 1.10 taxa in 2006, with metric scores 15.00 and 18.33, respectively. Stoneflies were present at Sample Site #5, but the low diversity is likely related to the lack of cobbles in the riffles.

Trichoptera Taxa: In 2005, the Trichoptera diversity at Sample Site #5 was 3.50 taxa, but it increased to 5.00 taxa in 2006. This resulted in metric scores of 50.00 (2005) and 71.43 (2006) (Tables 12 and 13). The ten-site average in 2005 was 3.93 taxa with a metric score of 56.07. The watershed average in 2006 was 4.93 taxa with a resulting metric score of 70.36.

Percent Plecoptera: The average percent Plecoptera collected at Sampling Site #5 was 0.14% in 2005 and 0.18% in 2006, resulting in metric scores of 0.71 and 0.90 (Tables 12 and 13). The watershed averages were higher with 1.70% (2005) and 0.67% Plecoptera dominance. The watershed average metric scores were 8.52 (2005) and 3.36 (2006). Even though there were relatively swift currents at Sample Site #5, there was an absence of cobble substrate to support healthy levels of stoneflies.

Hilsenhoff Biotic Index (HBI): The average HBI value was 4.34 in 2005 with a metric score of 77.53 (Table 12). The HBI watershed average in 2005 was 4.59, with a resulting metric score of 74.09. The HBI score in 2006 decreased to 3.87, resulting in a metric score of 83.94. The watershed average for 2006 was 4.46 with a metric score of 75.90.

Percent Five Dominant Taxa: The five dominant taxa compromised 78.98% of the sample at Site #5 resulting in a metric score of 40.31 in 2005 (Table 12). The dominance rose to 91.95% in 2006 with a metric score decreasing to 22.37 (Table 13). The ten-site averages were 85.48% in 2005 and 88.12% in 2006, resulting in metric scores of 40.34 and 33.01 respectively. The increase in the in the five dominant species at Sample Site #5 shows a negative shift in the benthic community that may have been caused by the flooding that altered the streambed.

Scraper Taxa: The number of distinct scraper taxa at Sample Site #5 for both years averaged 2.00, resulting in metric scores of 25.00 in 2005 and 2006 (Tables 12 and 13). The watershed averages were 1.50 (2005) and 1.51 taxa (2006) with metric scores of 18.75 and 18.85, respectively. There appears to be no change in the scraper taxa due to the flooding and seasonal differences.

Clinger Taxa: The average number of distinct clinger taxa in 2005 at Sample Site #5 was 11.50 resulting in a metric score of 67.65 (Table 12). The watershed average in 2005 was 10.50 taxa with a metric score of 59.12. The Sample Site #5 average decreased to 11.25 taxa in 2006 with a metric score of 66.18 (Table 13). The ten-site average was 10.90 taxa with a metrics core of 64.12. Again there was little change in clinger taxa diversity between 2005 and 2006 at Sample Site #5.

Community Similarity Percentage: Based on the Wittaker-Fairbanks Percent Similarity technique there was a similarity of 50.5% between the data from 2005 and 2006 at Sample Site #5 (Appendix D). The distinct difference could have been caused by the flood event earlier in 2006 or the seasonal differences (August vs. July) in sampling. The flooding can change the ecological community because large disturbances are known to impact the local macroinvertebrate communities. Seasonal differences in sampling are the result of the varying lifecycles of insects, which vary in their seasonal hatches.

Sample Site #5 Evaluation Discussion: Sample Site #5 received an ecological health rating of "FAIR" for both years based on the IDEQ standards. The ISMI score for 2005 was higher than the watershed average, but was slightly lower than the watershed average in 2006. The ratings indicate that the site needs habitat improvement. This rating may be misleading because this index includes Plecoptera metrics. Unfortunately The Nature Conservancy has not monitored this site so there are no historical records at this site to evaluate long-term trends.

The MSMI ratings for 2005 and 2006 were "GOOD." The watershed average was "GOOD" as well, for both years. The overall MSMI score was higher in 2006 than the 2005 average. Improvements could be made to the riparian zone by the addition of more woody species.

The Wittaker-Fairbanks evaluation indicated a similarity of 50.5% between the two sampling years at Sample Site #5. Even though this is not a high similarity the ecological health was "GOOD" in both years, indicating that a healthy benthic macroinvertebrate community remained stable even with community structure shifts due to disturbance (flood) or sampling (July vs. August).

Stalker Creek, which is upstream of Sample Site #5 is managed by the Nature Conservancy and appears to currently be in good ecological health. Grove Creek on the other hand, which is located right above Site #5, does not appear to be as healthy, in part because it has less desirable stream widths and the stream segment also runs through pastures.

Sample Site #6: Stalker Creek

Sampling Site #6 was selected because of previous sampling done on Stalker Creek by The Nature Conservancy. This site is located about a half of a km upstream from the Conservancy's transect. It was not sampled at the same location because of sampling limitations (e.g. depth of water). The choice of sampling location was based on the presence of riffles and cobble substrate. Sample Site #6 doesn't represent the typical spring fed-system on the Silver Creek system, but more of a freestone system (Illustration 23). The existence of the cobbles and riffles is due to the presence of a culvert and a small footbridge suspended over Stalker Creek (Illustration 25). The cobble substrate is not natural, but is actually composed of concrete chunks (Illustration 26).

The riparian vegetation at this sampling site is dominated by grasses with only a limited amount of brush (Illustration 27). All of the surrounding land is managed by The Nature Conservancy, with some nearby agriculture fields under conservation easements.

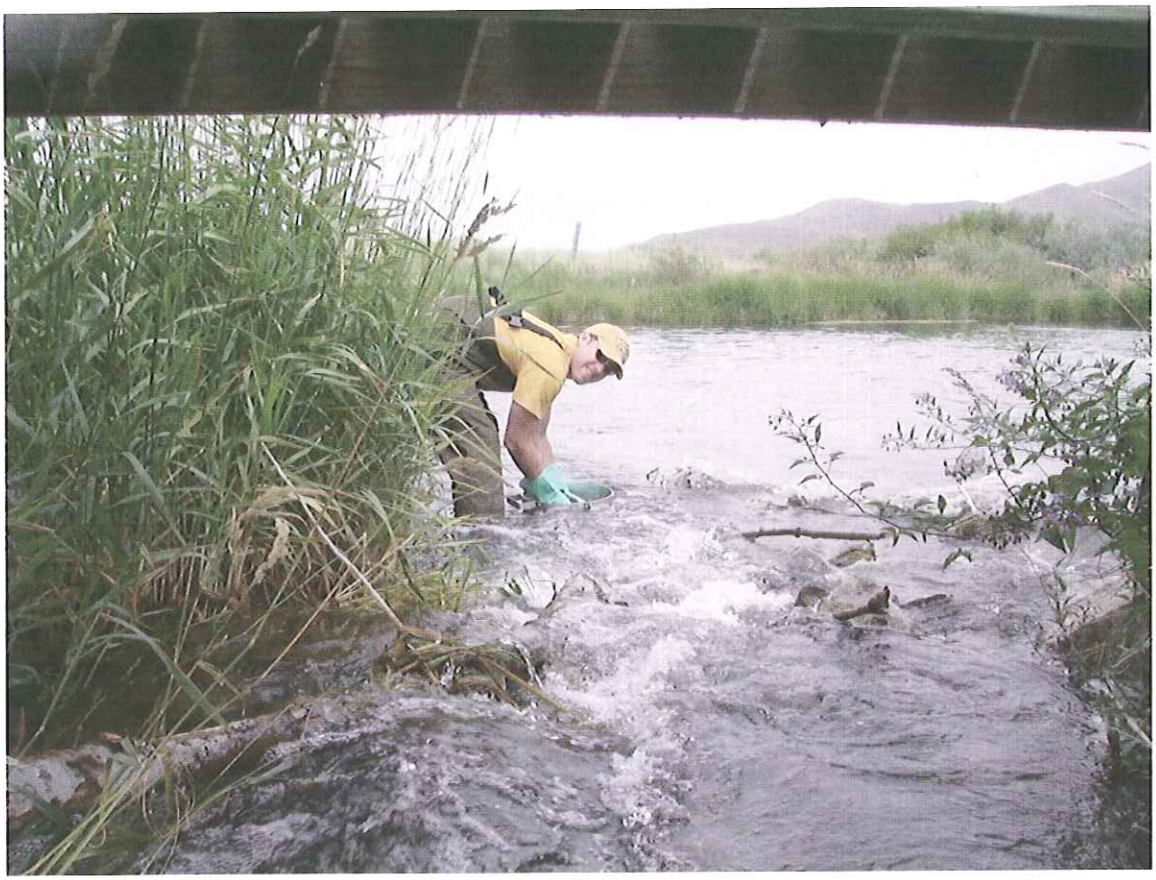

Illustration 23. Site #6 is located below a culvert that creates riffle-resembling conditions.

This site has limited access and consequently, few visitors. The April 2006 flood did not appear to affect this site. Aquatic plants in the streambed included *Chara* with the presence of grasses.

In 2005 Sample Site #6 received an average ISMI of 52.57 and a MSMI score of 65.78 (Table 14). Both of the SMI scores resulted in an ecological health rating of "GOOD". The scores in 2006 dropped slightly to 50.10 for the ISMI and 64.42 for the MSMI. The ecological health rating dropped to "FAIR" for the ISMI but remained "GOOD" for the MSMI (Table 15). The overall SMI scores and the metrics are interpreted below.

Total Taxa: Sample Site #6 had an average of 29.25 unique species in 2005 resulting in a metric score of 86.03 (Table 14). The watershed average in 2005 was substantially lower at 19.65 taxa and a resulting metric score of 57.79. The 2006 average was a slightly lower with an average of 28.50 species providing a metric score of 83.82 (Table 15). The ten-site average for 2006 was 20.57 taxa with a metric score of 60.49. Sample Site #6 had the highest average number of unique species out of the ten sites sampled in both 2005 and 2006. Explanations for this high diversity may be due to the presence of the riffles and the cobble that are considered ideal habitat for benthic macroinvertebrates.

Ephemeroptera Taxa: Sample Site #6 averaged 6.25 Ephemeroptera species in 2005 and 6.00 species in 2006, with metric scores of 69.44 and 66.67, respectively (Tables 14 and 15). The ten-site average for 2005 was 5.10 taxa with a consequent metric score of 56.67. In 2006, the watershed average was 4.93 taxa and a metric score of 53.15. The Ephemeroptera scores on Sample Site #6 indicated a healthy diversity of mayflies.

Illustration 24. The Stalker Creek Site, Site #6 is located below a culvert and foot bridge.

Illustration 25. The substrate at Sample Site #6 is made primarily of concrete chunks that resembled cobblestone.

Illustration 26. The typical riparian vegetation along this section of Sample Site #6 is primarily grasses

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Table 14. The raw data and calculated SMI scores for the biological assessment of Sample Site #6 (Stalker Creek) conducted in August 2005.

Metric	Reference Value*	Stalker Sample 1	Stalker Sample 2	Stalker Sample 3	Stalker Sample 4	Stalker Average	Watershed** Avg. 2005
Species Taxa	34.00	33.00	32.00	30.00	22.00	29.25	19.65
Metric Score	100.00	97.06	94.12	88.24	64.71	86.03	57.79
Ephemeroptera Taxa	9.00	5.00	*8.00*	6.00	6.00	6.25	5.10
Metric Score	100.00	55.56	*88.89*	66.67	66.67	69.44	56.67
Plecoptera Taxa	6.00	0.00	2.00	1.00	0.00	0.75	0.90
Metric Score	100.00	0.00	33.33	16.67	0.00	12.50	15.00
Trichoptera Taxa	7.00	7.00	6.00	6.00	4.00	5.75	3.93
Metric Score	100.00	100.00	85.71	85.71	57.14	82.14	56.07
Percent Plecoptera	20.00	0.00	0.09	0.04	0.00	0.03	1.70
Metric Score	100.00	0.00	0.45	0.20	0.00	0.16	8.52
Hilsenhoff Biotic Index	2.70	4.59	4.38	4.88	4.97	4.71	4.59
Metric Score	100.00	74.11	76.99	70.14	68.90	72.53	74.09
Percent Five Dominant Taxa	64.00	87.57	80.02	77.44	82.23	81.82	85.48
Metric Score	100.00	34.53	55.50	62.67	49.36	50.51	40.34
Scraper Taxa	8.00	2.00	2.00	1.00	2.00	1.75	1.50
Metric Score	100.00	25.00	25.00	12.50	25.00	21.88	18.75
Clinger Taxa	17.00	13.00	15.00	13.00	12.00	13.25	10.50
Metric Score	100.00	76.47	88.24	76.47	70.59	77.94	59.12
Idaho SMI Score	100.00	51.41	60.91	53.25	44.71	52.57	42.73
Ecological Health Rating	VERY GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	FAIR
*Modified SMI Score****	*100.00*	*66.10*	*73.49*	*66.06*	*57.48*	*65.78*	*51.58*
Ecological Health Rating	*VERY GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2005

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics).

Table 15. The raw data and calculated SMI scores for the biological assessment of Sample Site #6 (Stalker Creek) conducted in July 2006.

Metric	Reference Value*	Stalker Sample 1	Stalker Sample 2	Stalker Sample 3	Stalker Sample 4	Stalker Average	Watershed** Avg. 2006
Species Taxa	34.00	37.00	27.00	23.00	27.00	28.50	20.57
Metric Score	100.00	100.00	79.41	67.65	79.41	83.82	60.49
Ephemeroptera Taxa	9.00	5.00	9.00	4.00	6.00	6.00	4.78
Metric Score	100.00	55.56	100.00	44.44	66.67	66.67	53.15
Plecoptera Taxa	6.00	0.00	0.00	0.00	0.00	0.00	1.10
Metric Score	100.00	0.00	0.00	0.00	0.00	0.00	18.33
Trichoptera Taxa	7.00	11.00	7.00	5.00	6.00	7.25	4.93
Metric Score	100.00	100.00	100.00	71.43	85.71	100.00	70.36
Percent Plecoptera	20.00	0.00	0.00	0.00	0.00	0.00	0.67
Metric Score	100.00	0.00	0.00	0.00	0.00	0.00	3.36
Hilsenhoff Biotic Index	2.70	5.04	5.80	4.87	5.01	5.18	4.46
Metric Score	100.00	67.95	57.53	70.27	68.36	66.03	75.90
Percent Five Dominant Taxa	64.00	75.21	95.82	70.50	85.54	81.77	88.12
Metric Score	100.00	68.86	11.61	81.94	40.17	50.65	33.01
Scraper Taxa	8.00	2.00	1.00	2.00	1.00	1.50	1.51
Metric Score	100.00	25.00	12.50	25.00	12.50	18.75	18.85
Clinger Taxa	17.00	16.00	12.00	12.00	13.00	13.25	10.90
Metric Score	100.00	94.12	70.59	70.59	76.47	77.94	64.12
Idaho SMI Score	100.00	56.83	47.96	47.93	47.70	50.10	43.71
Ecological Health Rating	VERY GOOD	GOOD	FAIR	FAIR	FAIR	FAIR	FAIR
*Modified SMI Score****	*100.00*	*73.07*	*61.66*	*61.62*	*61.33*	*64.42*	*53.11*
Ecological Health Rating	*VERY GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2006

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics).

Plecoptera Taxa: There was an average of 0.75 Plecoptera taxa on Sample Site #6 in 2005, with a metric score of 12.50 (Table 14). The watershed average was close to the Site #6 value at 0.90 taxa and a metric score of 15.00. There were no Plecoptera collected in 2006 resulting in a metric score of 0.00 (Table 15). The ten-site average in 2006 was 1.10 taxa, resulting in a metric score of 18.33. The lack of stoneflies present cannot be blamed on the lack of riffles with cobble substrate because this habitat was present. The lack maybe due to other stream conditions that are more suitable for other species because of the food sources present in spring-fed systems.

Trichoptera Taxa: The average number of Trichoptera taxa was 5.75 in 2005 and 7.25 in 2006 (Tables 15 and 16). The resulting metric scores were 82.14 (2005) and 100.00 (2006). The watershed averages were lower at 3.93 taxa in 2005 and 4.93 taxa in 2006, with metric scores of 56.07 and 70.36 respectively. Sample site #6 had the second highest number of Trichoptera taxa present.

Percent Plecoptera Taxa: The Percent Plecoptera present at Sample Site #6 in 2005 was only 0.03%, with no stoneflies present in 2006 (Tables 14 and 15). The metric scores were 0.16 (20050 and 0.00 (2006). The watershed average in 2005 was 1.70% and 0.67% in 2006, resulting in metric scores of 8.52 and 3.36 respectively. Overall, there is a lack of Plecoptera at Sample Site #6. Speculation for this finding may be related to the water not being clean enough for, or the unnatural concrete cobble is not suitable for stoneflies. Concrete has a different surface texture than typical cobble substrate and surface textures have been shown to influence macroinvertebrate distributions (Way et al., 1995). This unnatural surface texture could partly account for the lower number of stoneflies.

Hilsenhoff Biotic Index (HBI): The average HBI for Sample Site #6 was 4.97 in 2005 and 5.01 in 2006. The watershed averages were 4.71 (2005) and 5.18 (2006) (Tables 14 and 15). The metric scores were 72.53 and 66.03, with the watershed average at 74.09 and 75.90, respectively.

Percent Five Dominant Taxa: The average percentage of the five dominant taxa was similar both years at 81.82% in 2005 and 81.77% in 2006. This resulted in metric scores of 50.51 (2005) and 50.65 (2006) (Tables 14 and 15). The watershed average was 85.48% (2005) and 88.12% (2006), with resulting metric score of 40.34 and 33.01, respectively. The five species were not as dominant at Sample Site #6 when compared to the entire watershed.

Scraper Taxa: The average number of scraper taxa in 2005 was 1.75 and 1.50 in 2006, resulting in metric scores of 21.88 and 18.75 (Tables 14 and 15). The watershed average for 2005 was 1.51 taxa and 1.50 taxa in 2006, resulting in metric scores of 18.85 and 18.75, respectively.

Clinger Taxa: The clinger taxa averaged at 13.25 in 2005, with a metric score of 77.94 (Table 14). The watershed average was 10.90 taxa with a metric score of 64.12. The average number of clinger taxa dropped to 9.25 in 2006 with a metric score of 54.41 (Table 15). The ten-site average in 2006 was 10.50 taxa and a metric score of 59.12. The drop in the number of distinct clinger taxa may be associated with either the sampling dates (July vs. August) or the flooding in 2006.

Community Similarity Percentage: The similarity based on the Wittaker-Fairbanks Percent Similarity in the macroinvertebrate community was 56.6% between 2005 and 2006 on Sample Site #6 (Appendix D). The there appears to be an association between the two sampling years. This is more so when compared to the other sampling

sites already discussed. Flooding appeared to have little effect on the Site #6 and the difference in community structure is probably more closely associated with the time of sampling (August 2005 vs. July 2006).

Sample Site #6 Evaluation Discussion: Sampling Site #6 received an ecological health rating of "GOOD" (2005) and "FAIR" (2006) based on the IDEQ standards. The ISMI at Sampling Site #6 was substantially higher than the watershed average for both years. Based on the IDEQ standards the stream conditions at Site #6 appear to be in relatively good shape. The scores are unexpected considering the lack of the Plecoptera presence and their consequence in two of the nine metrics used for the ISMI evaluations.

The MSMI accounted for the absence of Plecoptera and resulted in significantly higher scores than the ISMI. This translated into ecological health ratings of "GOOD" for both 2005 and 2006. The watershed averages had lower MSMI scores, but also received ecological health ratings of "GOOD". Even with the "GOOD" rating on Sampling Site #6, Stalker Creek has need for some restoration work, especially where the channel is wide and the stream is shallow. The Nature Conservancy has been working on stream rehabilitation over the past several years and has placed coconut fiber logs in the reach to help restructure the stream channel.

The scoring SMI difference between 2005 and 2006 was not significant and indicated little change in the health rating of Sampling Site #6. The Community Similarity Percentage was moderate at 56.6% between the two years. Even with a lower correlation in the insect community, the macroinvertebrate ecological health rated as "GOOD".

Improvements that could be made to this stream segment include the addition of more riparian vegetation, consisting of trees and bushes. In addition, the stream could be

narrowed were the banks are wide and the water depth is shallow. Both of theses changes would decrease water temperatures and possibly increase fish productivity. The Nature Conservancy has previously noted these needs and has been making an effort at stream and riparian rehabilitation.

Sample Site #7: Lower Grove Creek

Sample Site #7 is located at the mouth of Grove Creek, above its confluence with Stalker Creek. The site was accessible through the use of trails created by The Nature Conservancy and then wading upstream from the Preserve boundary to reach Sample Site #7. The land along Grove Creek is managed and owned by multiple landowners. There are no available historical records of macroinvertebrate sampling at Sampling Site #7, but it is on sampling transect currently being monitored by The Nature Conservancy.

The banks of Lower Grove Creek are stable with the riparian vegetation consisting of grasses, trees, and shrubbery (Illustrations 27 and 28). Sampling Site #7 is a wide, but shallow section. The water is shallow enough that aquatic plants can be seen above the water surface (Illustration 27 and 28). Upstream of Sample Site #7 the land use is dominated by agriculture including pastures that are grazed. The streambed has deposits of silt and fine organic debris, and mats of *Chara*. The flood of 2006 may have removed some of the aquatic vegetation and silt deposits that were observed in 2005.

Sample Site #7 received an average ISMI score of 41.20 and an MSMI score of 52.98 in 2005(Table 16). The resultant ecological health ratings were "FAIR" using the ISMI and "GOOD" using the MSMI. In 2006, Sample Site #7 received an average ISMI of 42.37 and 50.56 for the MSMI (Table 17). The 42.37 is in the "FAIR" category and

Illustration 27. The riparian vegetation at Sample Site #7 consists of grasses, brush, and trees along the banks.

Illustration 28. The stream width is wide, while the depth is shallow at Sampling Site #7.

Table 16. The raw data and calculated SMI scores for the biological assessment of Sample Site #7 (Lower Grove Creek) conducted in August 2005.

Metric	Reference Value*	L. Grove Sample 1	L. Grove Sample 2	L. Grove Sample 3	L. Grove Sample 4	L. Grove Average	Watershed** avg. 2005
Species Taxa	34.00	16.00	15.00	20.00	16.00	16.75	19.65
Metric Score	100.00	47.06	44.12	58.82	47.06	49.26	57.79
Ephemeroptera Taxa	9.00	7.00	7.00	8.00	7.00	7.25	5.10
Metric Score	100.00	77.78	77.78	88.89	77.78	80.56	56.67
Plecoptera Taxa	6.00	0.00	0.00	0.00	0.00	0.00	0.90
Metric Score	100.00	0.00	0.00	0.00	0.00	0.00	15.00
Trichoptera Taxa	7.00	3.00	2.00	4.00	2.00	2.75	3.93
Metric Score	100.00	42.86	28.57	57.14	28.57	39.29	56.07
Percent Plecoptera	20.00	0.00	0.00	0.00	0.00	0.00	1.70
Metric Score	100.00	0.00	0.00	0.00	0.00	0.00	8.52
Hilsenhoff Biotic Index	2.70	4.46	3.72	4.35	4.11	4.16	4.59
Metric Score	100.00	75.89	86.03	77.40	80.68	80.00	74.09
Percent Five Dominant Taxa	64.00	82.27	84.39	80.85	87.05	83.64	85.48
Metric Score	100.00	49.25	43.36	53.19	35.97	45.44	40.34
Scraper Taxa	8.00	2.00	1.00	2.00	2.00	1.75	1.50
Metric Score	100.00	25.00	12.50	25.00	25.00	21.88	18.75
Clinger Taxa	17.00	9.00	8.00	12.00	8.00	9.25	10.50
Metric Score	100.00	52.94	47.06	70.59	47.06	54.41	59.12
Idaho SMI Score	100.00	41.20	37.71	47.89	38.01	41.20	42.73
Ecological Health Rating	VERY GOOD	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR
*Modified SMI Score****	*100.00*	*52.97*	*48.49*	*61.58*	*48.87*	*52.98*	*51.58*
Ecological Health Rating	*VERY GOOD*	*GOOD*	*FAIR*	*GOOD*	*FAIR*	*GOOD*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2005

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics).

the 50.56 is in the "GOOD" category. The individual scores for each sub-sample are shown in Tables 16 and 17. The overall SMI scores are evaluated in the section below.

Total Taxa: Sample Site #7 had an average of 16.75 distinct taxa in 2005 and 17.25 taxa in 2006, with resulting metric scores of 49.26 and 50.74, respectively (Tables 16 and 17). The Silver Creek ten-site average in 2005 was 20.57 taxa and in 2006 19.65 taxa. The resultant metric scores were 60.49 and 57.79, respectively. Site #7 had lower diversity in distinct taxa than the ten-site average. This can partly be blamed on the heavy silt deposits found on the streambed and the widened stream channels. The flowrates on Lower Grove Creek (38.7 cfs in 2005 and 22.5 cfs in 2006) are very low in comparison to Silver Creek (nearing100 cfs both years) with nearly the same stream width (Appendix A).

Ephemeroptera Taxa: In 2005 the four sub-samples collected at Site #7 had an average of 7.25 distinct species of Ephemeroptera taxa. This resulted in a metric score of 80.56 (Table 16). The watershed average was 5.10 taxa with a metric score 56.67. In 2006, the Ephemeroptera taxa average at Site #7 dropped to 3.75 taxa with a metric score of 41.67 (Table 17). The 2006 watershed average was 4.78 taxa with a metric score of 53.15. The dramatic decrease in the number of mayflies in 2006 may be caused by the flooding in 2006, which scoured the river bottom in the vicinity of Sample Site #7, taking away some of the taxa habitat or just removing the insects.

Plecoptera Taxa: Plecoptera were not identified at Sampling Site #7 in 2005, but there was an average of 1.50 taxa found in 2006 (Tables 16 and 17). The resulting metric scores were 0.00 (2005) and 25.00 (2006). The watershed averages are 0.90 taxa in 2005 and 1.10 taxa in 2006, with metric scores of 15.00 and 18.33, respectively.

Table 17. The raw data and calculated SMI scores for the biological assessment of Sample Site #7 (Lower Grove Creek) conducted in July 2006.

Metric	Reference Value*	L. Grove Sample 1	L. Grove Sample 2	L. Grove Sample 3	L. Grove Sample 4	L. Grove Average	Watershed** Avg. 2006
Species Taxa	34.00	17.00	15.00	17.00	20.00	17.25	20.57
Metric Score	100.00	50.00	44.12	50.00	58.82	50.74	60.49
Ephemeroptera Taxa	9.00	4.00	3.00	4.00	4.00	3.75	4.78
Metric Score	100.00	44.44	33.33	44.44	44.44	41.67	53.15
Plecoptera Taxa	6.00	2.00	1.00	1.00	2.00	1.50	1.10
Metric Score	100.00	33.33	16.67	16.67	33.33	25.00	18.33
Trichoptera Taxa	7.00	5.00	5.00	5.00	6.00	5.25	4.93
Metric Score	100.00	71.43	71.43	71.43	85.71	75.00	70.36
Percent Plecoptera	20.00	0.26	0.07	0.10	1.48	0.48	0.67
Metric Score	100.00	1.30	0.35	0.50	7.40	2.39	3.36
Hilsenhoff Biotic Index	2.70	2.98	3.70	3.57	3.66	3.48	4.46
Metric Score	100.00	96.16	86.30	88.08	86.85	89.35	75.90
Percent Five Dominant Taxa	64.00	94.93	95.53	94.62	86.47	92.89	88.12
Metric Score	100.00	14.08	12.42	14.92	37.58	19.76	33.01
Scraper Taxa	8.00	1.00	1.00	2.00	1.00	1.25	1.51
Metric Score	100.00	12.50	12.50	25.00	12.50	15.63	18.85
Clinger Taxa	17.00	9.00	10.00	12.00	11.00	10.50	10.90
Metric Score	100.00	52.94	58.82	70.59	64.71	61.76	64.12
Idaho SMI Score	100.00	41.80	37.33	42.41	47.93	42.37	43.71
Ecological Health Rating	VERY GOOD	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR
*Modified SMI Score****	*100.00*	*48.79*	*45.56*	*52.07*	*55.80*	*50.56*	*53.11*
Ecological Health Rating	*VERY GOOD*	*FAIR*	*FAIR*	*GOOD*	*GOOD*	*GOOD*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2006

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics).

Trichoptera Taxa: Sampling Site #7 averaged 2.75 distinct Trichoptera taxa in 2005, with the number increasing to 5.25 taxa in 2006 (Tables 16 and 17). The corresponding metric scores were 39.29 and 75.00 in 2005 and 2006, respectively. The watershed averages were 3.93 taxa 4.93 taxa, which resulted in metric scores of 56.07 and 70.36, respectively. The flooding in 2006 may be responsible for the increased species diversity in 2006. A shift in community structure was observed as the Trichoptera increased while the number of distinct Ephemeroptera taxa decreased in 2006.

Percent Plecoptera: No stonefly taxa were collected in 2005, but there was an average presence of 0.48% stoneflies at Sampling Site #7 in 2006 (Tables 16 and 17). The resulting metric scores for 2005 and 2006 were 0.00 and 2.39, respectively. The ten-site averages were 1.70% Plecoptera dominance in 2005 and 0.67% dominance in 2006. The resulting metric scores were 8.52 in 2005 and 3.36 in 2006. The reason for a lack of the stonefly's presence on Site #7 is probably related to the absence of cobble substrate, large deposits of sediments, and warm temperatures.

Hilsenhoff Biotic Index (HBI): The average HBI for Sample Site #7 was 4.16 in 2005 and 3.48 in 2006, which resulted in metric scores of 80.00 and 89.35, respectively (Tables 16 and 17). The HBI watershed averages were 4.59 in 2005 and 4.46 in 2006. The corresponding metric scores are 74.09 (2005) and 75.90 (2006). Site #7 had the lowest HBI of the ten sites sampled.

Percent Five Dominant Taxa: The five dominant taxa found at Site #7 constituted 83.64% of the community in 2005 and 92.89% in 2006 (Tables 16 and 17). The resulting metric scores were 45.44 (2005) and 19.76 (2006). The watershed averages were 85.48% in 2005 and 88.12% in 2006, with the metrics scores of 40.34 and 33.01

respectively. The flooding and seasonal sampling variations are a probable cause for the increasing community control by the five dominant species.

Scraper Taxa: The average number of distinct scraper taxa was 1.75 in 2005 and 1.25 in 2006, which resulted in metric scores of 21.88 and 15.63, respectively (Tables 16 and 17). The Silver Creek watershed averages were 1.50 taxa in 2005 and 1.51 in 2006, with corresponding metric scores of 18.75 and 18.85. The number of distinct scraper appears to be similar between the two sampling years

Clinger Taxa: The number of distinct clinger taxa in 2005 was 9.25, resulting in a metric score of 54.41 (Table 16). The Silver Creek watershed average was slightly higher at 10.50 distinct taxa and a resulting metric score of 59.12. In 2006, the clinger taxa increased to an average of 10.50 taxa with a metric score of 61.76 (Table 17). The watershed average was 10.90 taxa and a corresponding metric score of 64.12. Sample Site #7 was slightly below the watershed average in both sampling years.

Community Similarity Percentage: The Wittaker-Fairbanks Percent Similarity method measured a relationship of 53.0% between sampling years 2005 and 2006 (Appendix D). This correlation shows that there are both similarities and differences in both community structure and the macroinvertebrate assemblage. Flooding and/or the time of sampling (July vs. August) may have caused the shift.

Site #7 Evaluation Discussion: Sample Site #7 received an ecological health rating of "FAIR" based on IDEQ standards. In both years the ISMI score was slightly below the watershed average (Tables 16 and 17). The conditions at Site #7 are satisfactory, but improvements are needed to reach the good or very good designations for the stream habitat.

The Modified rating increased both SMI scores in 2005 and 2006 on Site #7 to an ecological health rating of "GOOD". The ratings and MSMI scores for Lower Grove Creek are similar to the watershed average, which also achieved a rating in the "GOOD" category. Overall, Sample Site #7 had metric values that were similar to the ten-site average.

The macroinvertebrate community structure shows some differences between 2005 and 2006, with a Wittaker-Fairbanks Percent Similarity of only 53.0%. Tables 16 and 17 show that there are changes in the number of distinct Ephemeroptera taxa and Trichoptera taxa between 2005 and 2006 at Site #7. There is also a large variation in the percentage of the five dominant species between the two years. Even with this community structure shift on Lower Grove Creek the SMI scores and ecological health ratings remained consistent from 2005 and 2006. This stream segment appears to be satisfactorily healthy, although the ecological health rating could still be raised.

Macroinvertebrate health could be improved at this site through stream restoration efforts. Restoration should emphasize the narrowing of the stream width and increasing the stream depth. This work should be similar to some of the projects currently ongoing at Stalker Creek. Upstream restoration efforts should also be considered because of the many surrounding pastures on Grove Creek upstream. The Nature Conservancy is currently doing further analysis on correlations between the ecological health of Site #7 and the historical water quality data collected for Lower Grove Creek.

Sample Site #8: Upper Grove Tributary (Stream Restoration in 2002)

Sample Site #8 is located on the property of Tom O'Gara, and is accessed via a dirt road leading to Upper Grove Creek. The site was chosen based on having a comparative

analysis of evaluating how stream restoration has affected the macroinvertebrate community and the ecological health. Site #8 is a tributary that has had stream rehabilitation work in 2002. Such restoration efforts were done because previous grazing practices seriously degraded the riparian zone. Prior to restoration in 2002, the stream banks were trampled and resulted in wide channels and shallow depths (Illustration 29). These conditions are unsuitable for a stable fishery as they result in a loss of critical spawning beds for both the rainbow trout (*Oncorhynchus mykiss* Gilberti) and brown trout (*Salmo trutta* L.).

The landowner tried to restore the stream segment by creating a pool-riffle habitat, which is more suitable for the native stream biota (Illustration 30). In 2002 the stream channels were narrowed by using habitat logs, made from coconut palm fibers. These logs are used because they stabilize the banks, allow interstitial space for organisms to crawl, and will eventually decompose. Prior to 2005 there were no previous records of sampling for macroinvertebrates on Upper Grove Creek.

The riparian vegetation at Sample Site #8 is composed mainly of grasses, with some younger trees such as willows, which were planted during the 2002 rehabilitation. The streambed is composed of smaller rocks and gravels. Aquatic plants dominated by grasses, cover the stream bottom (Illustration 31). The nearby surrounding landscape is private property that is not used intensively. This parcel of land is being conserved to help establish a preserve for the surrounding native plants and wildlife. Access to Sight #8 is very limited and given only upon approval by the owner and/or manager of the land.

Sample Site #8 received an average ISMI of 53.79 and a MSMI score of 65.63 in 2005 (Table 18). The individual scores for each of the four sub- samples are shown in the Table 18. The scores for both the ISMI and MSMI values are in the "GOOD

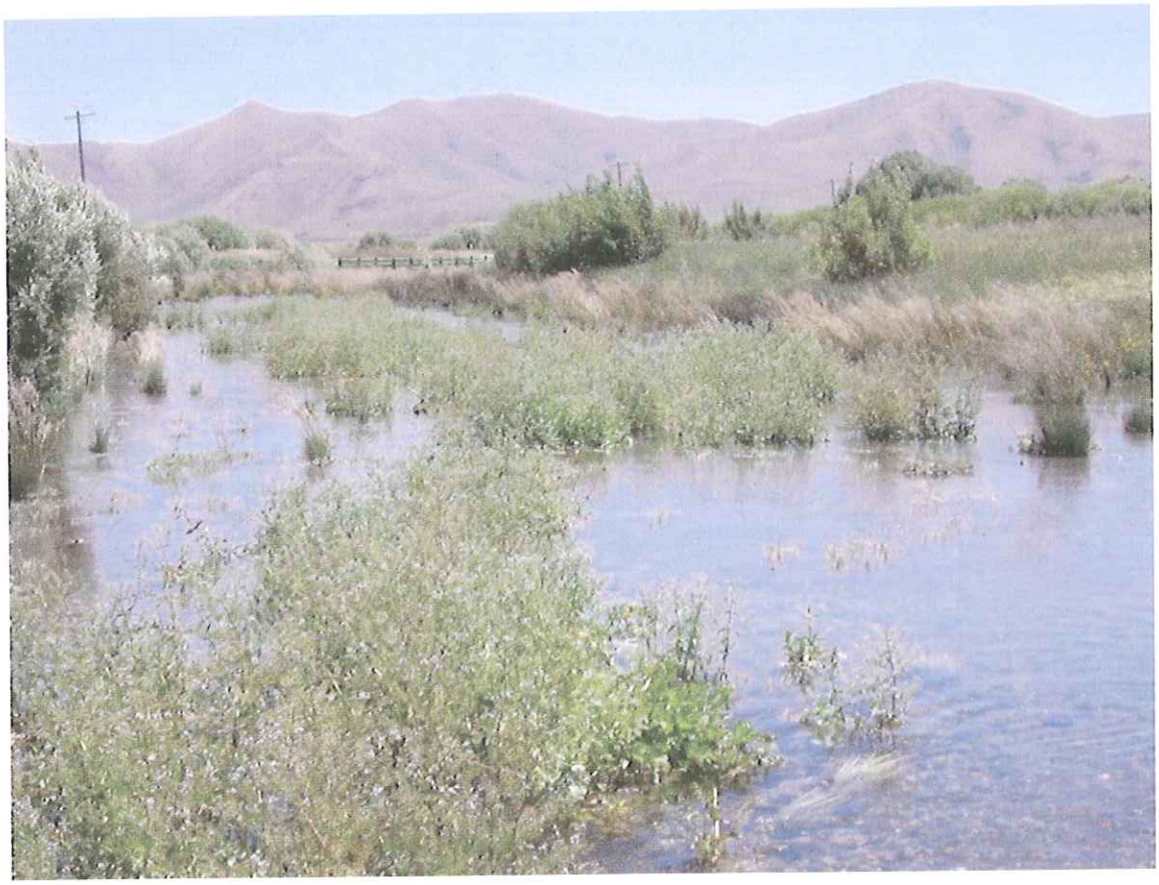

Illustration 29. The stream bank conditions at Site #8 prior to stream restoration in 2002, were wide with shallow depths similar to the characteristics of Sampling Site#10 (shown above).

Illustration 30. Sampling Site #8 was partially restored in 2002 by narrowing the stream channel to create a pool-riffle habitat.

Illustration 31. Sampling Site #8 has small riffles with a streambed composed of gravels, small cobbles, and aquatic plants. Most of the riparian vegetation is composed of grasses, with a few small trees that were planted in 2002.

Table 18. The raw data and calculated SMI scores for the biological assessment of Sample Site #8 (Upper Grove Creek, restoration in 2002) conducted in August 2005.

Metric	Reference Value*	U. Grove Sample 1	U. Grove Sample 2	U. Grove Sample 3	U. Grove Sample 4	U. Grove Average	Watershed** avg. 2005
Species Taxa	34.00	23.00	28.00	24.00	23.00	24.50	19.65
Metric Score	100.00	67.65	82.35	70.59	67.65	72.06	57.79
Ephemeroptera Taxa	9.00	5.00	5.00	3.00	4.00	4.25	5.10
Metric Score	100.00	55.56	55.56	33.33	44.44	47.22	56.67
Plecoptera Taxa	6.00	1.00	0.00	2.00	2.00	1.25	0.90
Metric Score	100.00	16.67	0.00	33.33	33.33	20.83	15.00
Trichoptera Taxa	7.00	6.00	9.00	9.00	8.00	8.00	3.93
Metric Score	100.00	85.71	100.00	100.00	100.00	100.00	56.07
Percent Plecoptera	20.00	2.16	0.00	0.60	0.32	0.77	1.70
Metric Score	100.00	10.80	0.00	3.00	1.60	3.85	8.52
Hilsenhoff Biotic Index	2.70	4.83	4.93	4.80	5.35	4.98	4.59
Metric Score	100.00	70.82	69.45	71.23	63.70	68.80	74.09
Percent Five Dominant Taxa	64.00	70.44	83.28	78.89	79.10	77.93	85.48
Metric Score	100.00	82.11	46.44	58.64	58.06	61.31	40.34
Scraper Taxa	8.00	2.00	3.00	3.00	2.00	2.50	1.50
Metric Score	100.00	25.00	37.50	37.50	25.00	31.25	18.75
Clinger Taxa	17.00	13.00	15.00	14.00	14.00	14.00	10.50
Metric Score	100.00	76.47	88.24	82.35	82.35	82.35	59.12
Idaho SMI Score	100.00	54.53	53.28	54.44	52.90	53.79	42.73
Ecological Health Rating	VERY GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	FAIR
*Modified SMI Score****	*100.00*	*66.19*	*68.51*	*64.81*	*63.03*	*65.63*	*51.58*
Ecological Health Rating	*VERY GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2005

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics)

category of the ecological health ratings. The scoring in 2006 was similar to 2005 with an ISMI of 52.63 and a MSMI of 63.52 were observed. Both scores resulted in ecological health ratings of "GOOD". The overall SMI scores for the metrics are interpreted in the following section.

Total Taxa: Sample Site #8 had an average of 24.50 distinct taxa present in 2005, resulting in a metric score of 72.06 (Table 18). The overall watershed average was lower with 19.65 species, resulting in a metric score of 57.79. In 2006, the Site #8 average number of taxa increased to 25.75 distinct species, with a metric score of 75.74 (Table 19). The 2006 ten-site average was 20.57 taxa providing a metric score of 60.49. Sample Site #8 had the second highest number of distinct taxa of the ten sampling sites on Silver Creek.

Ephemeroptera Taxa: The average number of Ephemeroptera taxa collected at Site #8 was consistent across the two year sampling with 4.25 taxa in 2005 and 4.75 taxa in 2006 (Tables 18 and 19). The resulting metric scores were 47.22 (2005) and 52.78 (2006). The watershed average was slightly higher with 5.10 taxa in 2005 and 4.78 in 2006, resulting in metric scores of 56.67 and 53.15, respectively.

Plecoptera Taxa: The total of Plecoptera taxa was 1.25 in 2005 and 1.50 in 2006. This resulted in metric scores of 20.83 (2005) and 25.00 (2006) (Tables 18 and 19). The watershed averages were 0.90 (2005) and 1.10 (2006), which resulted in metric scores of 15.00 and 18.33, respectively. The average number of distinct Plecoptera taxa at the site was higher than the overall watershed average in Silver Creek, probably because there was some riffle-cobble habitat present.

Trichoptera Taxa: The average number of Trichoptera species collected at Site #8 in 2005 was 8.00 and 7.75 taxa in 2006, both resulting in metric scores of 100.00

Table 19. The raw data and calculated SMI scores for the biological assessment of Sample Site #8 (Upper Grove Creek, restoration in 2002) conducted in July 2006.

Metric	Reference Value*	U. Grove Sample 1	U. Grove Sample 2	U. Grove Sample 3	U. Grove Sample 4	U. Grove Average	Watershed** Avg. 2006
Species Taxa	34.00	27.00	30.00	26.00	20.00	25.75	20.57
Metric Score	100.00	79.41	88.24	76.47	58.82	75.74	60.49
Ephemeroptera Taxa	9.00	5.00	5.00	4.00	5.00	4.75	4.78
Metric Score	100.00	55.56	55.56	44.44	55.56	52.78	53.15
Plecoptera Taxa	6.00	1.00	1.00	2.00	2.00	1.50	1.10
Metric Score	100.00	16.67	16.67	33.33	33.33	25.00	18.33
Trichoptera Taxa	7.00	8.00	9.00	11.00	3.00	7.75	4.93
Metric Score	100.00	100.00	100.00	100.00	42.86	100.00	70.36
Percent Plecoptera	20.00	0.95	0.26	0.40	1.64	0.81	0.67
Metric Score	100.00	4.75	1.30	2.00	8.20	4.06	3.36
Hilsenhoff Biotic Index	2.70	4.81	5.15	5.28	4.52	4.94	4.46
Metric Score	100.00	71.10	66.44	64.66	75.07	69.32	75.90
Percent Five Dominant Taxa	64.00	68.19	89.98	88.09	91.99	84.56	88.12
Metric Score	100.00	88.36	27.83	33.08	22.25	42.88	33.01
Scraper Taxa	8.00	3.00	3.00	3.00	2.00	2.75	1.51
Metric Score	100.00	37.50	37.50	37.50	25.00	34.38	18.85
Clinger Taxa	17.00	14.00	17.00	14.00	12.00	14.25	10.90
Metric Score	100.00	82.35	100.00	82.35	70.59	83.82	64.12
Idaho SMI Score	100.00	59.52	54.84	52.65	43.52	52.63	43.71
Ecological Health Rating	VERY GOOD	GOOD	GOOD	GOOD	FAIR	GOOD	FAIR
*Modified SMI Score****	*100.00*	*73.47*	*67.94*	*62.64*	*50.02*	*63.52*	*53.11*
Ecological Health Rating	*VERY GOOD*	*GOOD*	*GOOD*	*GOOD*	*FAIR*	*GOOD*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2006

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics).

(Tables 18 and 19). The watershed averages were significantly lower with 3.93 (2005) and 4.93 taxa (2006), with resulting metric scores of 56.07 and 70.36, respectively. The abundance of caddisflies maybe attributed to the stream restoration done in 2002, which made the habitat more suitable for this sensitive order of macroinvertebrates.

Percent Plecoptera: The average percentage of Plecoptera taxa present in 2005 was 0.77%, which resulted in a metric score of 3.85 (Table 18). The average percentage in 2006 was similar with 0.81% Plecoptera taxa (Table 19). The ten-site averages were 1.70% (2005) and 0.67% (2006), with resulting metric scores of 8.52 and 3.36 respectively. The lack the dominance by the stoneflies at Site #8 could be due to the recent restoration work. More time may be needed before this very sensitive order can re-establish itself as a higher percentage of the macroinvertebrate community, but spring-fed stream characteristics could also limit Plecoptera establishment.

Hilsenhoff Biotic Index (HBI): The average HBI scores for Sample Site #8 in 2005 and 2006 were both slightly above the watershed average with values of 4.98 and 4.94, respectively (Tables 18 and 19). The resulting metric scores were 68.80 (2005) and 69.32 (2006), compared to the watershed average of 74.09 (2005) and 75.90 (2006).

Percent Five Dominant Taxa: The average Percent Five Dominant Taxa collected at Site #8 was 77.93% in 2005, with a resulting metric score of 61.31 (Table 18). The average percentage of the five dominant taxa rose to 84.56% in 2006, with a resulting metric score being lowered to 42.88 (Table 19). The watershed averages were slightly higher with 85.48% (2005) and 88.12% (2006), which resulted in corresponding lower metric scores of 40.34 and 33.01, respectively.

Scraper Taxa: The average number of distinct scraper taxa at Site #8 in 2005 was 2.50 and 2.75 in 2006, with resulting metric scores of 31.25 and 34.38, respectively

(Tables 18 and 19). The overall watershed average was lower at 1.50 taxa (2005) and 1.51 (2006), with corresponding metric scores of 18.75 and 18.85. Site #8 had the highest average number of distinct scraper taxa present of the ten sites sampled on Silver Creek. The higher diversity of scraper taxa may be associated with the recent restoration work allowing for algae growth, which would allow for scrapers to return.

Clinger Taxa: The average total clinger taxa present at Site #8 was 14.00 in 2005 and 14.25 in 2006 (Tables 18 and 19). The corresponding metric scores were 82.35 (2005) and 83.82 (2006). The watershed averages were significantly lower with 10.50 taxa (2005) and 10.90 taxa (2006), which resulted in lower metric scores of 59.12 and 64.12, respectively. Sample Site #8 had the highest average number of clinger taxa of the ten sites sampled in the Silver Creek drainage. The high numbers of clinger taxa could indicate that the rehabilitation has helped improve stream flow rates, because clinger taxa are sensitive to hydraulic conditions. Both the scraper and clinger taxa have a higher diversity and indicate positive stream conditions.

Community Similarity Percentage: Sample Site #8 had a community similarity of 61.8% between 2005 and 2006, based on IDEQ methodology (Appendix D). The 61.8% similarity is the second highest correlation of the ten sites sampled in the Silver Creek watershed. This value indicates that the community structure shift was relatively slight between years (2005 vs. 2006) when compared to the other sites sampled in the Silver Creek drainage.

Sample Site #8 Evaluation Discussion: Sample Site #8 received an ecological health rating of "GOOD" for both years, based on the IDEQ standards, and received the highest ISMI score of the ten sites evaluated in this study. The watershed averages were lower than in Site #8 both years, with resulting ecological health ratings of "FAIR".

Even with the inclusion of the Plecoptera metrics the ISMI was still relatively high at Sample Site #8 because of the presence of stoneflies and due to higher values of several of the other metrics, which were a part of the ISMI calculation.

The MSMI, calculated with the removal of stoneflies from the rating system, resulted in higher scores of 65.63 (2005) and 63.52 (2006). This resulted in ecological health ratings of "GOOD" both years. The overall watershed averages also rated as "GOOD" using this method. However, the MSMI scores of 51.58 (2005) and 53.11 (2006) of the entire watershed where lower. Site #8 received the highest MSMI scores out of the ten sites sampled in Silver Creek. The stream restoration that occurred in 2002 proved to be beneficial based on enhanced ecological health of the macroinvertebrate community.

The stream restoration at Sample Site #8, led by Guy Bonnivier, helped establish a healthy system of pool-riffle habitats. These conditions are more suitable for fish communities. Many rainbow and brown trout were observed holding in these areas during sampling in both 2005 and 2006. Another benefit of the restoration efforts is the presence of segments beneficial for spawning trout. This restored section of Upper Grove Creek is a vital section that will ensure healthy trout regeneration in the future for the Silver Creek watershed.

Even with all the positive impacts of the restoration effort in this stream segment, more riparian vegetation is needed to stabilize the stream conditions. The riparian vegetation will provide more shade to cool stream temperatures and allochthonous inputs will provide nutrients for the stream biota. Additional plantings of brush/tree species, such as willows and alders are recommended.

Sampling Site #9: Upper Grove Creek Tributary (Stream restoration in 2004)

Sample Site #9 is located 300 meters north-east of Sample Site #8 on the property of Tom O'Gara. This site was chosen to evaluate the impact of restoration on the ecological health of this stream segment. Similar to Site #8, cattle grazing practices degraded the stream habitat by resulting in wide, shallow channels. Stream rehabilitation was done in 2004 to return stream conditions to a more suitable habitat for the native stream biota. This site was chosen to compare to Site #8 and Site #10.

The vegetation surrounding the stream consists of grasses, with young brush and trees planted during the restoration efforts in 2004 (Illustration 32). At restoration, the channels were narrowed so that a riffle habitat would form. Small rocks and gravels cover most of the streambed, however many aquatic plants are also present.

The Idaho SMI (ISMI) average in 2005 was 43.40, while the Modified SMI (MSMI) was 44.08 (Table 20). Both scores resulted in ecological health category of "FAIR". The tributary's average SMI scores increased to 46.77 (ISMI) and 50.48 (MSMI) in 2006 (Table 21). Both of these results placed the site in the "FAIR" category. Previous sampling of macroinvertebrates has not been conducted in the vicinity of Sampling Site #9 The overall SMI scores for the individual metrics are evaluated in the section below.

Total Taxa: The number of unique species at Sample Site #9 averaged 18.00 taxa in 2005 resulting in a metric score of 52.94 (Table 20). Conversely, the ten-site average was 19.65 taxa, with a metric score of 57.79. By 2006, the average number of species identified increased to 20.75 taxa, which resulted in a metric score of 61.03 (Table 21). The watershed average was slightly lower at 20.57 taxa resulting in a metric score of 60.49. The increase in the average number of distinct species identified in 2006

Illustration 32. Sample Site #9 underwent stream restoration in 2004. At this time, the riparian zone was planted with native grasses, young trees, and brush.

Table 20. The raw data and calculated SMI scores for the biological assessment of Sample Site #9 (Upper Grove Tributary, Restored in 2004) conducted in August 2005.

Metric	Reference Value*	Grove 04 Sample 1	Grove 04 Sample 2	Grove 04 Sample 3	Grove 04 Sample 4	Grove 04 Average	Watershed** avg. 2005
Species Taxa	34.00	22.00	15.00	17.00	18.00	18.00	19.65
Metric Score	100.00	64.71	44.12	50.00	52.94	52.94	57.79
Ephemeroptera Taxa	9.00	3.00	3.00	3.00	2.00	2.75	5.10
Metric Score	100.00	33.33	33.33	33.33	22.22	30.56	56.67
Plecoptera Taxa	6.00	3.00	2.00	3.00	3.00	2.75	0.90
Metric Score	100.00	50.00	33.33	50.00	50.00	45.83	15.00
Trichoptera Taxa	7.00	6.00	2.00	5.00	5.00	4.50	3.93
Metric Score	100.00	85.71	28.57	71.43	71.43	64.29	56.07
Percent Plecoptera	20.00	8.79	15.52	1.72	2.92	7.24	1.70
Metric Score	100.00	43.95	77.60	8.60	14.60	36.19	8.52
Hilsenhoff Biotic Index	2.70	4.64	4.21	5.13	4.50	4.62	4.59
Metric Score	100.00	73.42	79.32	66.71	75.34	73.70	74.09
Percent Five Dominant Taxa	64.00	87.12	86.37	96.55	91.95	90.50	85.48
Metric Score	100.00	35.78	37.86	9.58	22.36	26.40	40.34
Scraper Taxa	8.00	2.00	0.00	0.00	0.00	0.50	1.50
Metric Score	100.00	25.00	0.00	0.00	0.00	6.25	18.75
Clinger Taxa	17.00	12.00	7.00	9.00	9.00	9.25	10.50
Metric Score	100.00	70.59	41.18	52.94	52.94	54.41	59.12
Idaho SMI Score	100.00	53.61	41.70	38.07	40.20	43.40	42.73
Ecological Health Rating	VERY GOOD	GOOD	FAIR	FAIR	FAIR	FAIR	FAIR
*Modified SMI Score****	*100.00*	*55.51*	*37.77*	*40.57*	*42.46*	*44.08*	*51.58*
Ecological Health Rating	*VERY GOOD*	*GOOD*	*FAIR*	*FAIR*	*FAIR*	*FAIR*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2005

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics)

Table 21. The raw data and calculated SMI scores for the biological assessment of Sample Site #9 (Upper Grove Tributary, Restored in 2004) conducted in July 2006.

Metric	Reference Value*	Grove 04 Sample 1	Grove 04 Sample 2	Grove 04 Sample 3	Grove 04 Sample 4	Grove 04 Average	Watershed** Avg. 2006
Species Taxa	34.00	22.00	21.00	20.00	20.00	20.75	20.57
Metric Score	100.00	64.71	61.76	58.82	58.82	61.03	60.49
Ephemeroptera Taxa	9.00	2.00	3.00	5.00	2.00	3.00	4.78
Metric Score	100.00	22.22	33.33	55.56	22.22	33.33	53.15
Plecoptera Taxa	6.00	3.00	3.00	3.00	3.00	3.00	1.10
Metric Score	100.00	50.00	50.00	50.00	50.00	50.00	18.33
Trichoptera Taxa	7.00	6.00	5.00	3.00	6.00	5.00	4.93
Metric Score	100.00	85.71	71.43	42.86	85.71	71.43	70.36
Percent Plecoptera	20.00	3.78	5.10	3.35	1.83	3.52	0.67
Metric Score	100.00	18.90	25.50	16.75	9.15	17.58	3.36
Hilsenhoff Biotic Index	2.70	3.89	4.41	4.69	2.70	3.92	4.46
Metric Score	100.00	83.70	76.58	72.74	100.00	83.25	75.90
Percent Five Dominant Taxa	64.00	91.40	91.12	91.36	93.66	91.89	88.12
Metric Score	100.00	23.89	24.67	24.00	17.61	22.54	33.01
Scraper Taxa	8.00	1.00	2.00	2.00	0.00	1.25	1.51
Metric Score	100.00	12.50	25.00	25.00	0.00	15.63	18.85
Clinger Taxa	17.00	12.00	11.00	13.00	9.00	11.25	10.90
Metric Score	100.00	70.59	64.71	76.47	52.94	66.15	64.12
Idaho SMI Score	100.00	48.02	48.11	46.91	44.05	46.77	43.71
Ecological Health Rating	VERY GOOD	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR
*Modified SMI Score****	*100.00*	*51.90*	*51.07*	*50.78*	*48.19*	*50.48*	*53.11*
Ecological Health Rating	*VERY GOOD*	*GOOD*	*GOOD*	*GOOD*	*FAIR*	*FAIR*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2006

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics)

at Site #9, maybe related to the macroinvertebrate community being more established. A more established community could have formed because the stream restoration in 2004 caused disturbance to the stream conditions. It takes time for the aquatic community to re-establish itself after disturbance (e.g. restoration) in a system.

Ephemeroptera Taxa: Sample Site #9 averaged 2.75 Ephemeroptera taxa in 2005 and 3.00 taxa in 2006 (Tables 20 and 21). The resulting metric scores were 30.56 and 33.33, respectively. The overall watershed averages were significantly higher with 5.10 taxa in 2005 and 4.78 taxa in 2006, which translated into metric scores of 56.67 and 53.15, respectively. Sample Site #9 had the lowest average number of distinct mayfly taxa of the ten sites sampled in the Silver Creek watershed.

Plecoptera Taxa: The average number of Plecoptera taxa present at Site #9 in 2005 was 2.75 taxa and 3.00 in 2006 (Tables 20 and 21). The resulting metric scores were 45.83 (2005) and 50.00 (2006). The overall watershed average in 2005 was 0.90 taxa and 1.10 in 2006, with resulting metric scores of 15.00 and 18.33, respectively. Sample Site #9 tied with Site #10 for having the highest average number of stoneflies out of the ten sampled sites in the Silver Creek watershed. Higher numbers of stonefly taxa appear to be present, but the overall taxa diversity is lower than the watershed average. A possible reason for this is that the site conditions are suitable for more sensitive species like stoneflies, but is limiting to the overall community because Site #9 was the smallest transect (smallest width, lowest flow rates) of the ten sites sampled (Appendix A).

Trichoptera Taxa: In 2005 the average number of Trichoptera taxa collected was 4.50, resulting in a metric score of 64.29 (Table 20). The watershed average of 3.93 in 2005 resulted in metric score of 56.07. The 2006 average increased to 5.00 distinct

caddisfly taxa, with a resulting metric score of 71.43 (Table 21). The watershed average was 4.93 taxa and a metric score of 70.36 in 2006.

Percent Plecoptera: The average Percent Plecoptera collected at Site #9 was 7.24% in 2005 and 3.52% in 2006 (Tables 20 and 21). The corresponding metric scores were 36.19 and 17.58. The watershed average was significantly lower compared to Sample Site #9 with only a 1.70% (2005) and 0.67% (2006) Plecoptera dominance, which resulted in metric scores of 8.52 and 3.36, respectively. Sample Site #9 had the second highest metric score for Percent Plecoptera of the ten sampled sites in the Silver Creek watershed.

Hilsenhoff Biotic Index (HBI): The average HBI for Sample Site #9 was 4.62 in 2005 and 3.92 in 2006, with resulting metric scores of 73.70 and 83.25, respectively (Tables 20 and 21). The watershed metric average in 2005 was slightly higher with a score of 74.09. However, the watershed average was lower in 2006 with a metric score of 75.90. The analysis of Sample Site #9 data indicates the presence of pollution sensitive species, which is a positive indication of good water quality.

Percent Five Dominant Taxa: The five dominant taxa percentage at Sample Site #9 was 91.89% in 2005, with a resulting metric score of 22.54 (Table 20). The watershed average was slightly lower with an average of 88.12% of five dominant taxa present, with a higher metric score of 33.01 (Table 21). The average dominance dropped to 84.51% in 2006, and resulted in an increased metric score of 43.03. The watershed average was slightly higher with a dominance of 85.48% and a resulting metric score of 40.34. The metric scores increase in 2006 for the Percent Five Dominant Taxa could be attributed to improved community structure as the ecosystem is recovering from the restoration in 2004, which resulted in a decrease in dominance by five taxa in 2005.

Scraper Taxa: The average number of distinct scraper taxa in 2005 was 0.50 and increased to 1.25 taxa in 2006 (Tables 20 and 21). The corresponding metric scores were 6.25 (2005) and 15.63 (2006). The watershed average was 1.50 in 2005 and 1.51 in 2006, with resulting metric scores of 18.75 and 18.85, respectively. Sample Site #9 tied with Site #2 for the lowest number of distinct Scraper taxa out of the ten sites sampled. Low scores may be because the restoration was too recent.

Clinger Taxa: The average number of distinct clinger taxa was 9.25 in 2005 and 11.25 in 2006, with resulting metric scores of 54.41 and 66.15, respectively. The entire watershed average was higher in 2005 with 10.50 distinct taxa and lower in 2006 with 10.90 taxa. The corresponding metric scores were 59.12 (2005) and 64.12 (2006).

Community Similarity Percentage: Sample Site #9 had a 76.3% assemblage similarity when the 2005 and 2006 data were compared, based on the Wittaker-Fairbanks Percent Similarity method (Appendix D). This is the highest similarity of the ten sites sampled on the Silver Creek watershed. Such a high correlation between the years indicated that few changes occurred on this tributary due to the flood event in 2006. Smaller changes may be associated with the drainage area on Site # 9 being much smaller than the other sites and it is common for tributaries to be less impacted by flooding.

Sample Site #9 Evaluation Discussions: Sample Site #9 received ecological health rating of "FAIR" in both 2005 and 2006 based on the IDEQ standards. The ISMI scores for both years on Site #9 were higher than the watershed average scores. These ratings include the Plecoptera metrics, which don't properly evaluate the true ecological conditions for spring-fed systems.

At Site #9, the Modified SMI and Idaho SMI were very similar with the MSMI score of 44.08 in 2005 and 50.48 in 2006, compared to ISMI scores of 43.40 (2005) and

46.77 (2006). Both years the MSMI scores placed the site in the "FAIR" category. The ratings would normally indicate that conditions are satisfactory, but improvements should be made. However, these ratings could be misleading because the total impact from the restoration in 2004 may not be seen for a few more years

One reason the ratings may be misleading is because rehabilitation efforts create a lot of disturbance, which can negatively impact the stream biota in the short term of events. However, the long-term outlook for the aquatic insects as they become more established in the local stream system, increased metric scores as healthy assemblages are established. The analysis of Site #9 shows an increase in the SMI scores between 2005 and 2006 (Tables 20 and 21). Even with the positive differences seen between 2005 and 2006, the site could be further improved by planting more shrubs/trees in the riparian zone. The true impacts of stream restoration at this site can only be evaluated and understood by future sampling and monitoring. If sampled two years in the future, results similar to those observed at Site #8 would be expected. This would be anticipated as the system would be more recovered from the 2004 restoration effort.

Sample Site #10: Upper Grove Tributary (Un-restored Site)

Sample Site #10 is located on Tom O'Gara's property, 250 m north-east of Site #8 and Site #9. The site has been negatively impacted by past grazing practices. The Upper Grove Creek tributary, the un-restored site, is very wide and shallow (Illustrations 29 and 33). The site was selected for sampling based on the degraded conditions of the tributary. The degraded Sample Site #10 was chosen to be compared to Site #8 and Site #9, where rehabilitation work has been completed to mimic pre-disturbance conditions.

Upon visual inspection the riparian vegetation at Site #10 is dominated by grasses and brush lining the banks. The stream banks are not well defined as the banks are more like a marsh that gradually rises into dry land. The streambed consists mostly of smaller rocks, gravels, interspersed with fine sediments. Aquatic/riparian plants are seen throughout the stream channel (Illustration 34). Even with shallow depths, the water appears to be absent of riffles because of the slower moving currents.

The average SMI scores for the four sub-samples at Site #10 (2005) were 52.65 for the ISMI and 54.91 for the MSMI (Table 22). Both scores correspond to the ecological health rating of "GOOD." In 2006, the scores were lower with ISMI and MSMI values of 46.59 and 51.65, respectively (Table 23). The ISMI resulted in a "FAIR" rating, while the MSMI resulted in a "GOOD" rating. The overall SMI score for individual metrics are discussed below.

Total Taxa: Sampling Site #10 averaged 22.50 taxa in 2005, which resulted in a species taxa metric of 66.18 (Table 22). The 2005 overall watershed average for the number of species was 19.65, with a corresponding metric score of 57.79. In 2006, the number of species dropped to 21.50 taxa resulting in a metric score of 63.24 (Table 23). The overall watershed average in 2006 was 20.57 taxa and a metric score of 60.49.

Ephemeroptera Taxa: The average number of Ephemeroptera taxa in 2005 was 4.00 and 3.50 in 2006, resulting in metric scores of 44.44 and 38.89, respectively (Tables 22 and 23). The overall watershed averages were slightly higher with 5.10 taxa in 2005 and 4.78 taxa in 2006. These corresponded to metrics scores of 56.67 (2005) and 53.15 (2006). The Ephemeroptera data was consistent over the two-year sampling period.

Plecoptera Taxa: The average number of stonefly taxa collected was 2.75 in 2005 and 3.00 in 2006 (Tables 22 and 23). This resulted in metric scores of 45.83 (2005)

Illustration 33. Sample Site #10 has a widened channel and very shallow depths due to the past grazing practices. The shallow depth has resulted in emergent aquatic vegetation across the channel.

Illustration 34. The streambed of Sample Site #10 consists mostly of small rocks and gravels. A wide variety of aquatic plants lined the stream bottom.

Table 22. The raw data and calculated SMI scores for the biological assessment of Sample Site #10 (Upper Grove Tributary, Un-restored) conducted in August 2005.

Metric	Reference Value*	Un-rest. Sample 1	Un-rest. Sample 2	Un-rest. Sample 3	Un-rest. Sample 4	Un-rest. Average	Watershed** avg. 2005
Species Taxa	34.00	26.00	24.00	19.00	21.00	22.50	19.65
Metric Score	100.00	76.47	70.59	55.88	61.76	66.18	57.79
Ephemeroptera Taxa	9.00	4.00	5.00	3.00	4.00	4.00	5.10
Metric Score	100.00	44.44	55.56	33.33	44.44	44.44	56.67
Plecoptera Taxa	6.00	3.00	3.00	3.00	2.00	2.75	0.90
Metric Score	100.00	50.00	50.00	50.00	33.33	45.83	15.00
Trichoptera Taxa	7.00	7.00	5.00	4.00	5.00	5.25	3.93
Metric Score	100.00	100.00	71.43	57.14	71.43	75.00	56.07
Percent Plecoptera	20.00	10.34	0.74	11.62	12.19	8.72	1.70
Metric Score	100.00	51.70	3.70	58.10	60.95	43.61	8.52
Hilsenhoff Biotic Index	2.70	4.75	5.20	4.30	4.60	4.71	4.59
Metric Score	100.00	71.92	65.75	78.08	73.97	72.43	74.09
Percent Five Dominant Taxa	64.00	77.58	91.24	82.49	86.72	84.51	85.48
Metric Score	100.00	62.28	24.33	48.64	36.89	43.03	40.34
Scraper Taxa	8.00	2.00	2.00	0.00	1.00	1.25	1.50
Metric Score	100.00	25.00	25.00	0.00	12.50	15.63	18.75
Clinger Taxa	17.00	13.00	14.00	9.00	10.00	11.50	10.50
Metric Score	100.00	76.47	82.35	52.94	58.82	67.65	59.12
Idaho SMI Score	100.00	62.03	49.86	48.24	50.46	52.65	42.73
Ecological Health Rating	VERY GOOD	GOOD	FAIR	FAIR	FAIR	GOOD	FAIR
*Modified SMI Score****	*100.00*	*65.23*	*56.43*	*46.57*	*51.40*	*54.91*	*51.58*
Ecological Health Rating	*VERY GOOD*	*GOOD*	*GOOD*	*FAIR*	*GOOD*	*GOOD*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2005

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics)

Table 23. The raw data and calculated SMI scores for the biological assessment of Sample Site #10 (Upper Grove Tributary, Un-restored) conducted in July 2006.

Metric	Reference Value*	Un-rest. Sample 1	Un-rest. Sample 2	Un-rest. Sample 3	Un-rest. Sample 4	Un-rest. Average	Watershed** Avg. 2006
Species Taxa	34.00	19.00	23.00	23.00	21.00	21.50	20.57
Metric Score	100.00	55.88	67.65	67.65	61.76	63.24	60.49
Ephemeroptera Taxa	9.00	3.00	4.00	4.00	3.00	3.50	4.78
Metric Score	100.00	33.33	44.44	44.44	33.33	38.89	53.15
Plecoptera Taxa	6.00	3.00	3.00	3.00	3.00	3.00	1.10
Metric Score	100.00	50.00	50.00	50.00	50.00	50.00	18.33
Trichoptera Taxa	7.00	5.00	5.00	6.00	4.00	5.00	4.93
Metric Score	100.00	71.43	71.43	85.71	57.14	71.43	70.36
Percent Plecoptera	20.00	2.18	0.90	1.07	2.10	1.56	0.67
Metric Score	100.00	10.90	4.50	5.35	10.50	7.81	3.36
Hilsenhoff Biotic Index	2.70	4.32	4.43	4.17	4.41	4.33	4.46
Metric Score	100.00	77.81	76.30	79.86	76.58	77.64	75.90
Percent Five Dominant Taxa	64.00	92.60	89.39	95.24	90.67	91.98	88.12
Metric Score	100.00	20.56	29.47	13.22	25.92	22.29	33.01
Scraper Taxa	8.00	0.00	2.00	3.00	2.00	1.75	1.51
Metric Score	100.00	0.00	25.00	37.50	25.00	21.88	18.85
Clinger Taxa	17.00	10.00	12.00	12.00	11.00	11.25	10.90
Metric Score	100.00	58.82	70.59	70.59	64.71	66.18	64.12
Idaho SMI Score	100.00	42.08	48.82	50.48	44.99	46.59	43.71
Ecological Health Rating	VERY GOOD	FAIR	FAIR	FAIR	FAIR	FAIR	FAIR
*Modified SMI Score****	*100.00*	*45.40*	*54.98*	*57.00*	*49.21*	*51.65*	*53.11*
Ecological Health Rating	*VERY GOOD*	*FAIR*	*GOOD*	*GOOD*	*FAIR*	*GOOD*	*GOOD*

*Reference condition for the basins bioregion

** Average values of the ten sites sampled in 2006

*** Modified SMI Score is calculated from the average of the: Species Taxa, Ephemeroptera Taxa, Trichoptera Taxa, Hilsenhoff Biotic Index, Percent Five Dominant Taxa, Scraper Taxa, and the Clinger Taxa metrics (Spring SMI score excludes the Plecoptera Taxa and Percent Plecoptera Metrics)

and 50.00 (2006). The overall watershed averages were significantly lower with 0.90 taxa in 2005 and 1.10 taxa in 2006 resulting in metric scores of 15.00 and 18.33, respectively. Site #10 tied with the nearby Site #9 for having the highest average number of distinct Plecoptera taxa. Despite being "degraded" from past cattle grazing in the early 1990's, the water temperatures on Site #10 were the coolest of the ten sites sampled and disturbance has not occurred on this tributary within the last ten years, which may describe part of the reason for the higher numbers of Plecoptera.

Trichoptera Taxa: Sample Site #10 averaged 5.25 distinct caddisflies in 2005 and 5.00 species in 2006 (Tables 22 and 23). The resulting metric scores were 75.00 (2005) and 71.43 (2006). The overall watershed averages had a lower number of Trichoptera species with an average 3.93 taxa in 2005 and 4.93 taxa in 2006, with corresponding metric scores of 56.07 and 70.36, respectively.

Percent Plecoptera: The percentage of stonefly taxa at Sample Site #10 was 8.72% resulting in the highest percent Plecoptera metric score for the entire Silver Creek watershed at 43.61 in 2005(Table 22). The percentage of Plecoptera fell to 1.56% dominance in 2006, with a resulting metric score of 7.81 (Table 23). The overall watershed averages were 1.70% in 2005 and 0.67% in 2006 resulting in metric scores of 8.52 (2005) and 3.36 (2006).

Hilsenhoff Biotic Index (HBI): The average HBI score at Site #10 was 4.71 in 2005 and 4.33 in 2006 resulting in metric scores of 72.43 and 77.64, respectively (Tables 22 and 23). The watershed HBI averages were similar when compared to Site #10 with a score of 4.59 in 2005 and 4.46 in 2006. This resulted in overall watershed metric scores of 74.09 (2005) and 75.90 (2006).

Percent Five Dominant Taxa: The five most abundant taxa accounted for 84.51% of the macroinvertebrates at Site #10 in 2005 resulting in a metric score 43.03 (Table 22). The 2005 watershed average was similar with an average 85.48% dominance resulting in a metric score of 40.34. At Sample Site #10 the five dominant taxa percentage increased to 91.98% in 2006 with a resulting metric score of 22.29 (Table 23). The 2006 overall watershed average had a higher metric score of 33.01.

Scraper Taxa: The average number of distinct scraper taxa in 2005 was 1.25 and 1.75 taxa in 2006, with corresponding metric scores of 15.63 and 21.88 (Tables 22 and 23). The entire Silver Creek watershed average for the scraper taxa metric scores were similar to Site #10, with values of 18.75 in 2005 and 18.85 in 2006.

Clinger Taxa: The average number of distinct clinger taxa was similar for both years, with 11.50 taxa in 2005 and 11.25 taxa in 2006 (Tables 22 and 23). The corresponding metric scores were 67.65 (2005) and 66.18 (2006). The entire watershed averages were slightly lower with 10.50 taxa in 2005 and 10.90 taxa in 2006 resulting in metric scores of 59.12 and 64.12, respectively. The consistency of the number of distinct clinger taxa indicates that the heavy flooding event in 2006 may have had little impact on Site #10.

Community Similarity Index: The macroinvertebrate similarity between 2005 and 2006 at Site #10 using the Wittaker-Fairbanks Percent Similarity method was 54.2% (Appendix D). This relationship indicates that some community structure shifts occurred between the two years. This was possibly caused by the 2006 flooding event or seasonal sampling differences (July 2006 vs. August 2005).

Sample Site #10 Evaluation Discussion: The un-restored Sample Site #10 received an ecological health rating of "GOOD" in 2005, but fell to "FAIR" in 2006

based on the ISMI. The ISMI scores were higher than the entire watershed average for both 2005 and 2006. Conditions at the un-restored tributary appear to be fairly good for the macroinvertebrate health.

The calculated MSMI for Site #10 was slightly higher than the ISMI, but both years resulted in ecological health ratings of "GOOD". These ratings indicate healthy conditions are present on Site #10. Based on visual inspection these findings are misleading because bank stability is low and stream habitat have been damaged by past grazing that occurred a decade ago. Possible reasons for the higher ratings are probably due to the land management surrounding the tributary because present management has greatly reduced agricultural usage. Also the spring temperature is cool. In fact, the coolest temperatures measured on the Silver Creek watershed were found on Site #10 (Appendix A). Water temperatures at the spring source remain consistent year round (roughly equivalent to the mean air temperature). Sampling Site #10 is within close proximity to the origins to the spring.

The overall water conditions are good, based on the ecological health ratings of the macroinvertebrate community. However, the fish populations are low because there are no pools or riffles present for fish to hold in. The potential for a healthy fishery and spawning grounds would be enhanced by rehabilitation effort; similar to what was completed at Site #8 and Site #9. Restoration efforts at Site #10 need to focus on narrowing the stream channel and the planting of healthy riparian vegetation including of willows and alders to stabilize the stream bank conditions.

Watershed Discussion

Overall Health

The overall health of the Silver Creek watershed was determined to be "GOOD" in both 2005 and 2006 based on the calculated MSMI scores. These ratings indicate that the ecological health of the macroinvertebrate community on Silver Creek is good, based on good water quality conditions. The individual ratings for the ten sampled sites ranged from FAIR to GOOD. The primary disturbance to the Silver Creek watershed was caused by the poor agricultural and grazing practices commonly used in the early to mid 20th century. These poor land management practices drained the near-by marshes that acted as buffer zones, which reduce erosional inputs from stream banks and reduce flooding impacts following heavy rains. The direct impact was increased erosion into Silver Creek and the consequent heavy loads of sediments that settled on the streambed. Fertilizers and pesticides flushed into the system with sediments also negatively affected the water quality, which in return degraded the ecological health of Silver Creek. In the 1960's, positive changes to help improve the Silver Creek watershed were initiated. The Nature Conservancy in cooperation with private landowners has conducted stream restoration efforts on Silver Creek to bring portions of the stream back to pre-disturbance conditions. Many local landowners have also preserved habitats and implemented Best Management Practices (BMP's) into their farming and grazing operations. Several land parcels are also under conservation easements that are managed by The Nature Conservancy. The direct results of these anthropogenic shifts have helped to establish some of the best fly fishing in the world. The current healthy fishery is directly related to the abundant food source consisting of stream macroinvertebrates. However, there is

room for improvements and long-term goal for the Silver Creek watershed would be the achievement of a "VERY GOOD" rating.

The ISMI compared to the MSMI

The Idaho Department of Environmental Quality (IDEQ) has sampled the Silver Creek watershed and found impaired conditions are present based on their ISMI ranking system. The professional opinion voiced by IDEQ scientist is that the scores were distorted and not truly representative of Silver Creek's ecological health. The scoring system for the study was based on the standard nine ISMI metrics shown in Tables 1 and 2.

In this study, the average ISMI values for 2005 and 2006 were 42.73 and 43.71, respectively. Both years received an average ecological health rating of "FAIR" for the Silver Creek watershed. The ISMI based on nine standard metrics and can be misleading. Because of the inclusion of the Plecoptera Taxa and Percent Plecoptera metrics, which usually not always present on even the most pristine spring-fed systems. Modified forms of the Plecoptera Taxa and Percent Plecoptera Taxa metrics were considered, but presently there is not a solid basis for setting new stonefly ideals.

The inclusion of Plecoptera metrics would result in misleading findings on the Silver Creek watershed. As a result of this problem, this study used the MSMI, which excludes the Plecoptera taxa and percent Plecoptera metrics. The MSMI ratings raised the ISMI values substantially, with the watershed averages rising from 42.73 to 51.58 in 2005 and from 43.71 to 53.11 in 2006. Both years the MSMI scores raised the ecological health ratings from "FAIR" to "GOOD" for the entire Silver Creek watershed. Many ecologist and scientist feel that the stream conditions are very good on Silver Creek and

consequently the "GOOD" category is a more representative rating of the system. As a result, the MSMI appears to be more appropriate in gauging Silver Creek's ecological health. Even with a need to improve the current rating method, the present MSMI is suitable to for rating the water conditions on spring-fed systems like Silver Creek.

Year to Year Differences

In April 2006, major flooding occurred on the Silver Creek watershed. Many experts speculate it was a 100 year flood event. Such dramatic disturbances will shift the aquatic community, but these impacts are short lived because of the quick recovery of many aquatic macroinvertebrates (Resh et al., 1988). The ranges of the recovery period depend on the stream type and severity of the flood. Generally the recovery period ranges from several months to three years (Fisher et al., 1982). Synder and Johnson (2006) found that even in the case of a catastrophic flood, at a 2,000 year return interval, the recovery of the macroinvertebrate assemblage was remarkably established within three years.

In this study, the Wittaker-Fairbanks Percentage Community Similarity for the ten sites sampled, averaged a 50.5% correlation between 2005 and 2006. This similarity percentage indicates that there were differences in the macroinvertebrate communities sampled in 2005 and 2006. These distinctions are most likely associated with this flooding event in 2006 and possibly with the differences associated with collecting samples in July (2006) and August (2005). However, even with these macroinvertebrate assemblage distinctions, the ecological health ratings were consistent. These ecological health ratings for 2005 and 2006 were identical for all of the ten sites sampled on Silver Creek, except Sample Site #4 (Visitor Center). Even in the midst of the natural

disturbances and the timing of sampling, the rating system of water conditions remained consistent for both years. These results point toward an aquatic community that remains relatively stable in its biological health attributes, even in the midst of shifts in the macroinvertebrate assemblage.

Stream Restoration on Upper Grove Creek

Millions of dollars are spent every year by taxpayers in the USA to improve our nation's streams. As a consequence we need to account for the effectiveness of these rehabilitation projects. Such stream restoration efforts were completed at Sample Site #8 and Site #9 on Upper Grove Creek in 2002 and 2004, respectively. Sites #8, #9, and #10 of this study all have very similar hydrologic conditions and past anthropogenic disturbance. No stream restoration has been completed on the tributary of Site #10. This site served as a reference stream of what the macroinvertebrate health would resemble if stream rehabilitation had not been completed on either Site # 8 or Site #9. However, Site #10 has had little disturbance in the past ten years and the source of the spring is too close to the sampling transect to be certain of true degraded conditions would resemble. The degraded conditions present on Site #10 are identical to the other two sites prior to stream rehabilitation. These similarities are due to the fact that they are found on the same property, only 200 m apart. These sites were a good situation for evaluating the impacts that stream restoration has had on the ecological health.

Sample Site #10, is degraded with trampled stream banks and widened channels caused by grazing. The MSMI score calculated in 2005 was 54.91 and 51.65 in 2006 (Tables 22 and 23). The resulting ecological health ratings were "GOOD". These higher ratings for such a degraded site could be associated with the cold stream temperatures,

stable substrate (smaller rocks), the close proximity of the upstream spring source, and/or because the site has remained undisturbed by cattle grazing for at least ten years and there have been no recent anthropogenic impacts.

Sample Site #8, had stream restoration completed in 2002 and resulted in one of the highest MSMI scores of the entire watershed, with a score of 65.63 in 2005 and 63.52 in 2006 (Tables 18 and 19). These scores resulted in ecological health ratings of "GOOD", which indicate there to be a presence healthy assemblage of macroinvertebrates. These scores are high and indicate high-quality water, riparian habitat, and surrounding biological conditions. This score is also higher than Site #10, indicating that stream restoration efforts have improved the stream habitat.

Sample Site #9, has also had stream restoration work completed, but more recently in 2004. The MSMI score in 2005 was only 44.08, resulting in an ecological health rating of "FAIR" (Table 20). The 2006 score rose substantially to 50.48 and was also placed in the "FAIR" category, but was close to the "GOOD" category (Table 21). The 2005 MSMI score was notably lower than the degraded site #10. The reason for a lower score can probably be associated with the recent stream rehabilitation. The restoration work does cause local disturbances to the stream system. The immediate impact to the local macroinvertebrate community is one that potentially decreases SMI scoring. However, the aquatic biota will often rebound if given enough time for the community to become re-established. By 2006, the macroinvertebrate community did show improvements, with the MSMI score rising to 50.48. Based on this change one could predict that in the near future the macroinvertebrate community's health will improve and eventually surpass Site #10 levels.

From the three sites on Upper Grove Creek during 2005 and 2006, the efforts of stream restoration appear to have improved the ecological health of this tributary to Grove Creek. To see the full impacts of restoration, future sampling will need to be carried out.

Restoration projects on Upper Grove Creek helped create pool-riffle habitats suitable for the native fish species. Upon visual observation and in association with comments by land managers the trout populations are now improved. Prior to restoration fish were reportedly absent. In addition, the riffles have also created critical spawning beds for the Silver Creek watershed. These restored sites will provide spawning locations with a habitat that will support nursery grounds for young fish. It appears that positive changes have occurred to the trout fisheries at Sites #8 and #9 since the restoration projects, compared to the un-restored tributary, Site #10, which does not have a trout fishery. However, Site #10 has a high potential to be a productive fishery, because it had the coldest waters sampled in this study and there is sufficient amounts of water flowing that would enable a healthy fishery to develop. In addition, if restoration were to occur at Site #10, the sampling of macroinvertebrates in the following years, would provide a more accurate portrait of stream restoration and its effectiveness in improving the macroinvertebrate community health.

Problems Associated with the Study and Potential Solutions

Problems are a frequent occurrence on any field project especially when new sampling techniques and analytical approaches are being adopted. This project had numerous obstacles that needed to be overcome through new adaptations in sampling and analysis. The problems associated with this study were: (1) malfunctions in the flow

meter, (2) the depth of water for standard macroinvertebrate sampling techniques, (3) an inappropriate metric scoring system for spring-fed systems, and (4) the flood event of April 2006.

The Marsh McBirney electromagnetic flow meter was used to record readings for the ten sites sampled in 2005. In 2006, the meter malfunctioned in the field and was inoperable. Fortunately flow values were made available from The Nature Conservancy and the USGS. Sites #8, #9, and #10 were recorded with a Marsh McBirney electromagnetic flow meter borrowed from The Nature Conservancy.

Silver Creek can be deep in certain sections with slower moving currents. The extension to the Hess sampler with the fork scraper made sampling possible in these deeper sections. Problems associated with this sampling technique are that the fork scraper doesn't scrub the stream substrate very well and consequently requires scooping of materials to be scrubbed by hands.

The current scoring system used by the IDEQ for the ecological health ratings (which has already been discussed), is not valid for spring-fed systems. Future research needs to focus on the sampling of spring-fed streams that have had few anthropogenic alterations to its habitat. The streams can be used as references to what healthy ecological assemblages should resemble. These systems are rare because most spring creeks are found in areas used for grazing and other agricultural practices. Some potential reference streams might be found in Yellowstone National Park or other preserves that have had minimal human induced alterations, but problems of associations may occur because of climatic and geologic differences.

Conclusions

This completed biological assessment of Silver Creek provides a reference for The Nature Conservancy and future managers about the benthic macroinvertebrate communities on the several stream segments within the watershed. Samples at ten sites were collected to assist The Nature Conservancy's with its monitoring effort of the watershed. Six of the sites sampled, were on the Silver Creek Preserve. The six sampled sites that correspond to Nature Conservancy established transects, will provide a more thorough understanding of the stream's ecological health in these locations. The other four sites are located outside the Silver Creek Preserve and will help managers understand impact of the current land practices and restoration efforts being implemented.

The determined ecological health ratings averaged "GOOD" for both sampling years in 2005 and 2006. The Float Tube Access (Site #2), Loving Creek (Site #3), Visitor Center in 2005 (Site #4), and the Tributary of Upper Grove Creek with restoration in 2004 (Site #9) received ecological health ratings of "FAIR." The remaining six sites were placed into the "GOOD" category. The overall conditions of Silver Creek appear to be healthy, with a need to improve some sites. Improvements suggested, include the planting of more woody riparian vegetation species on sites that lack trees and brush, which will provide the shade and nutrients more suitable for supporting native biota. Stream rehabilitation should include the narrowing of stream channels, where the current stream is wide and shallow. Implementation of Best Land Management practices on adjacent properties could also bring improvements. These developments would potentially help progress the state of water quality and would allow for the expansion of riparian buffer zones that surround the stream banks of Silver Creek.

Currently, suggestions are being made for stream rehabilitation on the main stem of Silver Creek. If such undertakings are to be performed, a clear plan for what changes need to occur to bring stream levels to a more suitable state for the surrounding ecosystem must be determined. Large amounts of money will be needed to ensure that these adjustments are helpful and beneficial to the stream biota. Such restoration has occurred on smaller tributaries on Silver Creek, in the Upper Grove Creek area. The fish communities on these restored tributaries have improved. This research suggests that improvements in the macroinvertebrate community have occurred on the tributary were stream rehabilitation was completed in 2002. However, the Grove Creek tributary were restoration work was completed in 2004, did not show an immediate improvement, but such enhancements may take more time for the full impacts to be seen. With Silver Creek repeatedly producing a healthy fishery, the cost in improvements should take into consideration the impacts on the local stream setting to ensure that this fishery, bringing in millions of dollars each year, and that other stream biota will continue to thrive.

Many studies have already been conducted on the Silver Creek watershed, but none has fully addressed the benthic macroinvertebrate conditions in the detail that this study has provided. The baseline information of the ten sites provides a more comprehensive understanding of the current water quality conditions present. It can also help local managers and The Nature Conservancy see the outcomes of any future changes that will occur on the watershed.

Future bioassessments made on spring-fed systems, should consider the problems associated with the current scoring and rating system addressed in this study. A better solution lies in the development of a reference guide of what healthy benthic macroinvertebrate communities should resemble in spring-fed systems. The references

need to be based on the remaining spring-fed streams that have been left relatively unaltered by humans.

The current Idaho SMI (ISMI) system is insufficient for monitoring spring-fed systems. The reason it is inadequate is because relatively few Plecoptera taxa are found in even the cleanest of spring-fed systems and the ISMI includes two Plecoptera metrics. A more accurate assessment should adopt the Modified SMI (MSMI), because it excludes the Plecoptera metrics in its scoring or a deviation from these metrics with a lower target for Plecoptera taxa and percentage, if future research proves these suggestions to be valid.

The five study objectives set forth in the beginning of this thesis have been met. The baseline information provided will help managers, regulatory agencies, and The Nature Conservancy to understand the current water quality conditions on Silver Creek and will assist in future evaluations within the Silver Creek watershed.

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Appendix A. The Physical Data Collected at each of the 10 sample sites in Silver Creek in August 2005 and July 2006

Physical Data Collected in 2005

Sample	Latitude	Longitude	Elevation (m)	Water Temp. (°C)	Wetted Width (m)	Flow (cfs)
1 USGS	43°19.02	114°6.21	1472	21.0	21.3	127.0
2 Float tube	43°18.58	114°8.34	1483	15.8	25.6	118.5
3 Loving	43°19.11	114°8.26	1490	20.0	11.6	23.4
4 Visitor	43°18.51	114°9.02	1484	19.8	21.5	103.0
5 TNC riffle	43°19.09	114°9.38	1480	19.8	21.0	95.4
6 Stalker	43°18.46	114°11.01	1490	16.0	14.3	35.4
7 L. Grove	43°19.14	114°9.42	1485	15.3	21.6	38.7
8 Restoration in 2002	43°20.34	114°10.50	1492	14.8	4.6	12.9
9 Restoration in 2005	43°20.33	114°10.40	1497	11.3	4.6	4.7
10 Un-Restored	43°20.34	114°10.35	1496	11.0	12.8	8.2

Physical Data Collected in July 2006

Sample	Latitude	Longitude	Elevation (m)	Water Temp. (°C)	Wetted Width (m)	Flow (cfs)
1 USGS	43°19.02	114°6.21	1472	19.0	21.3	145.0
2 Float tube	43°18.58	114°8.34	1483	17.0	20.0	147.7
3 Loving	43°19.11	114°8.26	1490	19.0	11.5	19.3
4 Visitor	43°18.51	114°9.02	1484	17.5	20.3	113.9
5 TNC Riffle	43°19.09	114°9.38	1480	15.5	x	x
6 Stalker*	43°18.46	114°11.01	1490	16.5	10.7	52.9
7 L. Grove	43°19.14	114°9.42	1485	15.5	21.2	22.5
8 Restoration in 2002	43°20.34	114°10.50	1492	14.5	5.0	12.6
9 Restoration In 2005	43°20.33	114°10.40	1497	12.5	2.6	3.2
10 Unrestored	43°20.34	114°10.35	1496	13.0	13.1	6.0

*Flow rates in 2006 were measured by The Nature Conservancy on a lower section of Stalker Creek and are not fully representative of the Sample Site #6 true flow rates.

Appendix B. List of the Macroinvertebrate Taxa Collected at each of the 10 Sampling Sites in the Silver Creek Watershed for 2005 and 2006

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	USGS	USGS	USGS	USGS
	Rep	1 1/4	1 2/4	1 3/4	1 4/4
	Date	08-08-2005	08-08-2005	08-08-2005	08-08-2005
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	1	2	3	4
Ephemeroptera	Acerpenna pygmaea	218	50	9	21
	Baetidae	0	0	0	0
	Baetis tricaudatus	72	11	28	23
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	8	1	0	0
	Ephemera sp.	6	3	1	0
	Ephemerella inermis/infrequens	0	0	0	0
	Paraleptophlebia sp.	317	16	104	88
	Plauditus sp.	1	0	1	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	148	34	6	3
Odonata	Coenagrion/Enallagma sp.	0	0	0	0
Plecoptera	Hesperoperla pacifica	0	0	0	0
	Isoperla sp.	0	0	0	0
	Malenka sp.	0	0	0	0
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	0	0	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	19	5	33	119
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	0	0	0	2
	Heterlimnius sp.	3	1	7	0
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	17	6	285	529
	Narpus sp.	0	0	0	0
	Optioservus sp.	11	10	20	3
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	45	4	38	76
	Tanypodinae	30	4	35	103
Diptera	Antocha sp.	0	0	0	0
	Bezzia sp.	0	0	0	0
	Chelifera/Metachela sp.	0	0	0	0

	Dicranota sp.	0	0	0	0
	Ephydridae	0	0	0	0
	Hexatoma sp.	0	0	0	1
	Limnophila sp.	0	0	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	1	0
	Simuliidae	3	2	17	3
	Stratiomyidae	0	0	1	0
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	0	0	0	0
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	20	0	0	28
	Hesperophylax sp.	0	0	0	0
	Hydropsyche sp.	542	397	521	502
	Hydroptila sp.	0	0	0	0
	Lepidostoma sp.	0	0	0	0
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	0	0	0	2
	Mystacides sp.	0	0	0	0
	Oecetis sp.	0	0	0	0
	Onocosmoecus sp.	0	0	0	0
	Oxyethira sp.	0	0	0	5
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	13	5	1	2
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	6	31	12	38
Crustacea	Amphipoda	129	72	66	134
		1,608	**652**	**1,186**	**1,682**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	USGS	USGS	USGS	USGS
	Rep	1 1/4	1 2 4	1 3/4	1 4/4
	Date	07-10-2006	07-10-2006	07-10-2006	07-10-2006
		100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	41	42	43	44
Ephemeroptera	Acerpenna pygmaea	42	35	114	14
	Baetidae	0	0	0	0
	Baetis tricaudatus	31	26	56	51
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	25	51	68	31
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	6	23	34	7
	Paraleptophlebia sp.	189	38	184	63
	Plauditus sp.	0	0	3	5
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	51	140	186	105
Odonata	Coenagrion/Enallagma sp.	1	1	9	0
Plecoptera	Hesperoperla pacifica	0	0	0	0
	Isoperla sp.	0	0	0	0
	Malenka sp.	0	0	0	0
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	0	0	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	1	0	2	3
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	1	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	1	0	1	0
	Heterlimnius sp.	0	1	1	1
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	3	5	2	3
	Narpus sp.	0	0	0	0
	Optioservus sp.	2	0	0	0
	Peltodytes sp.	0	0	0	1
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	100	143	70	112
	Tanypodinae	53	18	169	40
Diptera	Antocha sp.	0	0	0	0
	Bezzia sp.	0	0	0	0
	Chelifera/Metachela sp.	0	0	0	0
	Dicranota sp.	0	0	0	0
	Ephydridae	0	0	0	0

	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	0	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	49	1	75	66
	Stratiomyidae	0	1	0	0
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	0	0	0	0
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	101	68	40	9
	Hesperophylax sp.	0	0	0	0
	Hydropsyche sp.	139	298	39	63
	Hydroptila sp.	0	8	4	1
	Lepidostoma sp.	0	0	0	0
	Leptoceridae	0	0	0	5
	Limnephilidae	0	0	0	0
	Limnephilus sp.	0	0	0	0
	Mystacides sp.	10	1	0	0
	Oecetis sp.	3	3	0	1
	Onocosmoecus sp.	0	0	0	0
	Oxyethira sp.	0	0	1	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	0	0	0	0
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	81	27	16	23
Crustacea	Amphipoda	159	183	486	123
		1,048	**1,071**	**1,560**	**727**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Float Tube	Float Tube	Float Tube	Float Tube
	Rep	2 1/4	2 2/4	2 3/4	2 4/4
	Date	08-09-2005	08-09-2005	08-09-2005	08-09-2005
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	5	6	7	8
Ephemeroptera	Acerpenna pygmaea	198	17	96	129
	Baetidae	0	0	0	0
	Baetis tricaudatus	333	13	169	352
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	2	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	4	0	5	3
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	0	0	0	0
	Paraleptophlebia sp.	85	7	28	9
	Plauditus sp.	0	1	2	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	48	16	62	69
Odonata	Coenagrion/Enallagma sp.	4	2	1	2
Plecoptera	Hesperoperla pacifica	0	0	0	0
	Isoperla sp.	0	0	0	0
	Malenka sp.	0	0	0	0
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	2	0	1	1
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	0	0	0	0
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	0	1	3	5
	Heterlimnius sp.	0	0	0	0
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	0	0	0	0
	Narpus sp.	0	0	0	0
	Optioservus sp.	0	0	1	0
	Peltodytes sp.	0	0	1	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	1	1
Diptera-Chironomidae	Chironomidae	33	17	38	26
	Tanypodinae	15	8	10	20
Diptera	Antocha sp.	0	0	0	0
	Bezzia sp.	0	0	0	1
	Chelifera/Metachela sp.	0	0	0	0
	Dicranota sp.	0	0	0	0

	Ephydridae	0	0	0	0
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	0	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	10	2	7	17
	Stratiomyidae	0	0	0	0
	Tabanidae	0	0	1	1
	Tipula sp.	0	0	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	0	0	0	0
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	3	3	0	3
	Hesperophylax sp.	0	0	0	0
	Hydropsyche sp.	139	103	115	109
	Hydroptila sp.	0	0	0	0
	Lepidostoma sp.	0	0	0	0
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	0	0	1	1
	Mystacides sp.	0	0	0	0
	Oecetis sp.	0	0	0	0
	Onocosmoecus sp.	0	0	0	0
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	1	0
	Rhyacophila sp.	0	0	0	0
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	22	26	35	88
Crustacea	Amphipoda	152	68	182	361
		1,048	**284**	**762**	**1,198**

	Stream	Silver Creek	Silver Creek	Silver Creek
	Site	Loving Creek	Loving Creek	Loving Creek
	Rep	2 1/4	2 2/4	2 3/4
	Date	07-10-2006	07-10-2006	07-10-2006
	Percent Subsampled	100.00	100.00	100.00
	EcoAnalysts Sample ID	45	46	47
Ephemeroptera	Acerpenna pygmaea	5	1	1
	Baetidae	0	0	0
	Baetis tricaudatus	125	8	40
	Caenis sp.	0	0	0
	Callibaetis sp.	0	0	0
	Centroptilum sp.	0	0	0
	Cinygmula sp.	0	0	0
	Diphetor hageni	3	0	3
	Ephemera sp.	0	0	0
	Ephemerella inermis/infrequens	4	3	1
	Paraleptophlebia sp.	16	0	1
	Plauditus sp.	6	1	7
	Siphlonurus sp.	0	0	0
	Tricorythodes minutus	424	634	250
Odonata	Coenagrion/Enallagma sp.	0	0	0
Plecoptera	Hesperoperla pacifica	0	0	0
	Isoperla sp.	0	0	0
	Malenka sp.	0	0	0
	Sweltsa sp.	0	0	0
Hemiptera	Corixidae	2	1	1
Coleoptera	Agabus sp.	0	0	0
	Cleptelmis addenda	0	0	0
	Dubiraphia sp.	0	0	0
	Dytiscidae	0	1	0
	Elmidae	0	0	0
	Haliplus sp.	0	1	0
	Heterlimnius sp.	0	0	0
	Hexacylloepus sp.	0	0	0
	Hydrophilidae	0	0	0
	Lampyridae	0	0	0
	Lara sp.	0	0	0
	Microcylloepus sp.	0	0	0
	Narpus sp.	0	0	0
	Optioservus sp.	0	3	1
	Peltodytes sp.	0	0	0
	Stictotarsus sp.	0	0	0
Megaloptera	Sialis sp.	0	0	0
Diptera-Chironomidae	Chironomidae	25	96	12
	Tanypodinae	4	1	1
Diptera	Antocha sp.	0	0	0
	Bezzia sp.	0	0	0
	Chelifera/Metachela sp.	0	0	0
	Dicranota sp.	0	0	0

	Ephydridae	0	0	0
	Hexatoma sp.	0	0	0
	Limnophila sp.	3	0	0
	Limnophora sp.	0	0	0
	Ormosia sp.	0	0	0
	Pedicia sp.	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0
	Simuliidae	2	2	2
	Stratiomyidae	2	1	0
	Tabanidae	0	0	0
	Tipula sp.	0	0	0
	Tipulidae	0	0	0
Trichoptera	Agapetus sp.	0	0	0
	Brachycentrus americanus	0	0	0
	Glossosomatidae	0	0	0
	Helicopsyche borealis	0	1	2
	Hesperophylax sp.	0	0	0
	Hydropsyche sp.	11	3	6
	Hydroptila sp.	1	2	3
	Lepidostoma sp.	0	0	0
	Leptoceridae	2	0	0
	Limnephilidae	0	0	0
	Limnephilus sp.	0	1	0
	Mystacides sp.	0	0	0
	Oecetis sp.	2	7	0
	Onocosmoecus sp.	0	0	0
	Oxyethira sp.	0	0	0
	Phryganea sp.	0	0	0
	Rhyacophila sp.	0	0	0
	Wormaldia sp.	0	0	0
Annelida	Hirudinea	38	18	6
Crustacea	Amphipoda	115	65	129
		790	**850**	**466**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Loving Creek	Loving Creek	Loving Creek	Loving Creek
	Rep	3 1/4	3 2/4	3 3/4	3 4/4
	Date	08-09-2005	08-09-2005	08-09-2005	08-09-2005
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	9	10	11	12
Ephemeroptera	Acerpenna pygmaea	12	0	6	8
	Baetidae	0	0	0	0
	Baetis tricaudatus	0	0	0	0
	Caenis sp.	0	0	0	1
	Callibaetis sp.	0	0	0	1
	Centroptilum sp.	0	1	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	0	0	0	0
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	0	0	1	0
	Paraleptophlebia sp.	13	0	0	0
	Plauditus sp.	1	0	0	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	20	84	31	354
Odonata	Coenagrion/Enallagma sp.	1	2	0	5
Plecoptera	Hesperoperla pacifica	0	0	0	0
	Isoperla sp.	0	0	0	0
	Malenka sp.	0	0	0	0
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	2	1	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	0	0	0	0
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	2	1	4	6
	Heterlimnius sp.	1	0	0	1
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	0	0	0	0
	Narpus sp.	0	0	0	0
	Optioservus sp.	0	0	4	2
	Peltodytes sp.	0	0	1	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	65	7	11	24
	Tanypodinae	84	5	6	32
Diptera	Antocha sp.	0	0	0	0
	Bezzia sp.	0	0	0	0
	Chelifera/Metachela sp.	0	0	0	0
	Dicranota sp.	0	0	0	0

	Ephydridae	0	1	0	0
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	0	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	4	0	0	1
	Stratiomyidae	0	0	0	0
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	0	0	0	0
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	2	0	2	0
	Hesperophylax sp.	0	0	0	0
	Hydropsyche sp.	1	0	1	4
	Hydroptila sp.	0	0	0	0
	Lepidostoma sp.	0	0	0	2
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	0	0	0	0
	Mystacides sp.	0	0	0	0
	Oecetis sp.	0	0	0	1
	Onocosmoecus sp.	0	0	0	0
	Oxyethira sp.	0	1	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	0	0	0	0
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	20	36	54	28
Crustacea	Amphipoda	18	551	417	446
		244	**691**	**539**	**916**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Float Tube	Float Tube	Float Tube	Float Tube
	Rep	3 1/4	3 2/4	3 3/4	3 4/4
	Date	07-11-2006	07-11-2006	07-11-2006	07-11-2006
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	49	50	51	52
Ephemeroptera	Acerpenna pygmaea	0	0	0	0
	Baetidae	0	0	0	0
	Baetis tricaudatus	9	11	12	8
	Caenis sp.	0	0	0	0
	Callibaetis sp.	1	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	0	1	2	4
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	14	10	13	1
	Paraleptophlebia sp.	0	1	0	0
	Plauditus sp.	0	0	0	0
	Siphlonurus sp.	1	1	0	1
	Tricorythodes minutus	234	114	159	124
Odonata	Coenagrion/Enallagma sp.	0	0	0	3
Plecoptera	Hesperoperla pacifica	0	0	0	0
	Isoperla sp.	0	0	0	0
	Malenka sp.	0	0	0	0
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	1	1	1
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	0	0	1	1
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	1	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	4	1	0	0
	Heterlimnius sp.	0	0	0	0
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	0	0	0	0
	Narpus sp.	0	0	0	0
	Optioservus sp.	0	1	0	0
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	1	0	0
Diptera-Chironomidae	Chironomidae	109	118	99	50
	Tanypodinae	18	13	6	2
Diptera	Antocha sp.	0	0	0	0
	Bezzia sp.	1	0	4	0
	Chelifera/Metachela sp.	0	0	0	0
	Dicranota sp.	0	0	0	0

	Ephydridae	0	0	0	0
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	0	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	0	0	3	0
	Stratiomyidae	0	0	1	1
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	0	0	1	2
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	1	0	0	0
	Hesperophylax sp.	0	0	0	0
	Hydropsyche sp.	1	2	0	0
	Hydroptila sp.	1	0	0	0
	Lepidostoma sp.	0	0	0	0
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	0	0	0	1
	Mystacides sp.	0	0	0	0
	Oecetis sp.	0	0	2	0
	Onocosmoecus sp.	0	0	0	0
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	0	0	0	0
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	24	24	32	92
Crustacea	Amphipoda	1	4	11	12
		420	**303**	**347**	**303**

	Stream	Silver Creek Visitor Site	Silver Creek Visitor Site	Silver Creek Visitor Site	Silver Creek Visitor Site
	Site				
	Rep	4 1/4	4 2/4	4 3/4	4 4/4
	Date	08-09-2005	08-09-2005	08-09-2005	08-09-2005
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	13	14	15	16
Ephemeroptera	Acerpenna pygmaea	5	5	5	2
	Baetidae	0	0	0	0
	Baetis tricaudatus	193	65	316	140
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	4	3	23	70
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	0	0	6	2
	Paraleptophlebia sp.	0	1	2	13
	Plauditus sp.	0	0	3	1
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	1	40	4	3
Odonata	Coenagrion/Enallagma sp.	1	0	3	0
Plecoptera	Hesperoperla pacifica	0	1	0	1
	Isoperla sp.	0	0	0	0
	Malenka sp.	0	0	0	0
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	0	0	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	0	0	2	0
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	0	0	0	0
	Heterlimnius sp.	0	0	0	2
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	0	0	0	0
	Narpus sp.	0	0	0	0
	Optioservus sp.	1	0	2	2
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	5	7	48	7
	Tanypodinae	1	2	2	4
Diptera	Antocha sp.	0	0	0	0
	Bezzia sp.	0	0	0	0
	Chelifera/Metachela sp.	0	0	0	1
	Dicranota sp.	0	1	0	0

	Ephydridae	1	0	2	1
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	0	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	3	0	8	0
	Stratiomyidae	0	0	0	0
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	0	0	0	0
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	13	4	15	4
	Hesperophylax sp.	0	0	0	0
	Hydropsyche sp.	7	20	9	30
	Hydroptila sp.	0	0	0	0
	Lepidostoma sp.	0	0	0	0
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	0	0	0	0
	Mystacides sp.	0	0	0	0
	Oecetis sp.	0	0	0	0
	Onocosmoecus sp.	0	0	0	0
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	0	0	0	0
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	38	10	82	5
Crustacea	Amphipoda	111	158	640	242
		384	**317**	**1,172**	**530**

	Stream	**Silver**	**Silver**	**Silver**	**Silver**

	Site	Creek Visitor Site	Creek Visitor Site	Creek Visitor Site	Creek Visitor Site
	Rep	4 1/4	4 2/4	4 3/4	4 4/4
	Date	07-11-2006	07-11-2006	07-11-2006	07-11-2006
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	53	54	55	56
Ephemeroptera	Acerpenna pygmaea	10	0	0	3
	Baetidae	0	0	0	0
	Baetis tricaudatus	479	149	148	118
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	175	41	64	114
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	541	400	399	430
	Paraleptophlebia sp.	0	0	0	0
	Plauditus sp.	2	0	0	1
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	160	11	8	121
Odonata	Coenagrion/Enallagma sp.	0	0	0	1
Plecoptera	Hesperoperla pacifica	0	0	0	0
	Isoperla sp.	2	4	0	1
	Malenka sp.	1	0	0	0
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	0	0	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	2	1	4	1
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	0	0	0	0
	Heterlimnius sp.	0	0	0	0
	Hexacylloepus sp.	1	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	0	0	0	0
	Narpus sp.	0	0	0	0
	Optioservus sp.	1	0	0	1
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	153	210	221	196
	Tanypodinae	8	22	2	2
Diptera	Antocha sp.	0	0	0	0
	Bezzia sp.	0	0	1	0
	Chelifera/Metachela sp.	0	0	0	0
	Dicranota sp.	0	2	6	0

	Ephydridae	0	0	0	0
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	0	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	431	4	8	2
	Stratiomyidae	1	1	0	0
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	4	12	3	4
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	10	37	53	49
	Hesperophylax sp.	0	0	0	0
	Hydropsyche sp.	1	5	25	4
	Hydroptila sp.	0	0	0	0
	Lepidostoma sp.	0	0	0	0
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	0	0	0	0
	Mystacides sp.	0	0	0	0
	Oecetis sp.	1	0	0	1
	Onocosmoecus sp.	0	0	0	0
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	0	0	0	0
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	10	15	13	18
Crustacea	Amphipoda	72	26	14	53
		2,065	**940**	**969**	**1,120**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Riffle Silver Creek	Riffle Silver Creek	Riffle Silver Creek	Riffle Silver Creek
	Rep	5 1/4	5 2/4	5 3/4	5 4/4
	Date	08-09-2005	08-09-2005	08-09-2005	08-09-2005
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	17	18	19	20
Ephemeroptera	Acerpenna pygmaea	3	244	36	63
	Baetidae	0	0	0	0
	Baetis tricaudatus	149	413	649	435
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	24	54	318	120
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	12	127	62	69
	Paraleptophlebia sp.	1	118	3	66
	Plauditus sp.	0	3	0	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	5	7	9	71
Odonata	Coenagrion/Enallagma sp.	0	84	2	24
Plecoptera	Hesperoperla pacifica	0	0	0	0
	Isoperla sp.	1	0	1	1
	Malenka sp.	0	0	1	0
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	0	0	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	2	8	7	31
	Dubiraphia sp.	0	0	1	1
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	0	0	1	4
	Heterlimnius sp.	0	0	0	0
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	0	0	1	0
	Narpus sp.	0	0	0	0
	Optioservus sp.	2	5	4	10
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	8	31	29	68
	Tanypodinae	8	14	7	4
Diptera	Antocha sp.	0	0	0	0
	Bezzia sp.	0	0	0	0
	Chelifera/Metachela sp.	0	0	0	0

	Dicranota sp.	0	0	0	0
	Ephydridae	2	0	0	0
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	0	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	0	2	12	8
	Stratiomyidae	0	1	0	0
	Tabanidae	0	0	0	0
	Tipula sp.	1	1	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	3	0	0	8
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	7	1	19	43
	Hesperophylax sp.	0	0	0	0
	Hydropsyche sp.	35	28	127	137
	Hydroptila sp.	0	0	0	0
	Lepidostoma sp.	0	0	0	0
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	0	1	0	0
	Mystacides sp.	0	0	0	0
	Oecetis sp.	0	0	0	0
	Onocosmoecus sp.	0	0	0	0
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	1	0	0	1
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	9	41	62	136
Crustacea	Amphipoda	10	109	153	240
		283	**1,292**	**1,504**	**1,540**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Riffle Silver	Riffle Silver	Riffle Silver	Riffle Silver
	Rep	5 1/4	5 2/4	5 3/4	5 4/4
	Date	07-12-2006	07-12-2006	07-12-2006	07-12-2006
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	57	58	59	60
Ephemeroptera	Acerpenna pygmaea	4	0	0	0
	Baetidae	0	0	0	0
	Baetis tricaudatus	338	193	407	276
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	45	3	13	23
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	647	58	185	410
	Paraleptophlebia sp.	3	6	0	0
	Plauditus sp.	0	0	0	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	10	0	0	0
Odonata	Coenagrion/Enallagma sp.	0	0	0	0
Plecoptera	Hesperoperla pacifica	0	0	0	0
	Isoperla sp.	0	2	1	1
	Malenka sp.	0	0	0	3
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	0	0	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	1	0	0	4
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	1
	Haliplus sp.	0	0	0	0
	Heterlimnius sp.	0	0	1	0
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	1	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	1	0	0	0
	Microcylloepus sp.	0	0	0	0
	Narpus sp.	0	0	0	0
	Optioservus sp.	2	0	2	1
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	75	14	95	64
	Tanypodinae	17	4	6	14
Diptera	Antocha sp.	0	0	0	0
	Bezzia sp.	0	0	0	0

	Chelifera/Metachela sp.	0	0	0	0
	Dicranota sp.	2	1	4	3
	Ephydridae	0	0	0	2
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	0	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	1	0
	Simuliidae	40	642	34	154
	Stratiomyidae	3	0	0	4
	Tabanidae	0	0	0	0
	Tipula sp.	1	0	1	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	1	0	0	0
	Brachycentrus americanus	3	0	3	0
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	19	8	16	17
	Hesperophylax sp.	0	0	0	1
	Hydropsyche sp.	15	1	19	56
	Hydroptila sp.	2	1	1	1
	Lepidostoma sp.	0	0	0	0
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	0	0	0	0
	Mystacides sp.	0	0	0	0
	Oecetis sp.	2	0	2	0
	Onocosmoecus sp.	0	0	0	0
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	1	0	1	0
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	96	1	2	12
Crustacea	Amphipoda	71	2	1	16
		1,400	**936**	**795**	**1,063**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Stalker Creek	Stalker Creek	Stalker Creek	Stalker Creek
	Rep	6 1/4	6 2/4	6 3/4	6 4/4
	Date	08-09-2005	08-09-2005	08-09-2005	08-09-2005
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	21	22	23	24
Ephemeroptera	Acerpenna pygmaea	9	17	1	29
	Baetidae	0	0	0	0
	Baetis tricaudatus	21	101	51	44
	Caenis sp.	0	2	1	0
	Callibaetis sp.	0	1	0	2
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	15	22	41	4
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	0	1	0	0
	Paraleptophlebia sp.	5	31	24	6
	Plauditus sp.	0	0	0	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	19	140	21	79
Odonata	Coenagrion/Enallagma sp.	3	2	3	0
Plecoptera	Hesperoperla pacifica	0	0	1	0
	Isoperla sp.	0	1	0	0
	Malenka sp.	0	0	0	0
	Sweltsa sp.	0	1	0	0
Hemiptera	Corixidae	2	0	0	4
Coleoptera	Agabus sp.	6	5	11	0
	Cleptelmis addenda	811	1,133	484	57
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	7	3	2	3
	Heterlimnius sp.	7	15	1	2
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	73	107	81	43
	Narpus sp.	0	0	0	0
	Optioservus sp.	46	25	0	6
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	207	104	308	149
	Tanypodinae	44	56	104	4
Diptera	Antocha sp.	0	0	0	0
	Bezzia sp.	2	0	1	0

	Chelifera/Metachela sp.	0	0	0	0
	Dicranota sp.	3	5	0	0
	Ephydridae	1	3	0	0
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	1	0	0	0
	Limnophora sp.	7	0	4	0
	Ormosia sp.	1	0	1	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	50	16	32	2
	Simuliidae	3	7	405	12
	Stratiomyidae	6	1	2	0
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	0	0	0	1
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	47	5	1	1
	Hesperophylax sp.	0	0	0	0
	Hydropsyche sp.	668	218	294	0
	Hydroptila sp.	11	1	4	0
	Lepidostoma sp.	6	1	0	0
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	3	0	0	0
	Mystacides sp.	0	0	0	0
	Oecetis sp.	0	0	0	0
	Onocosmoecus sp.	1	0	2	0
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	4	1	5	1
	Wormaldia sp.	0	3	123	3
Annelida	Hirudinea	123	13	38	134
Crustacea	Amphipoda	1,031	176	414	354
		3,243	**2,217**	**2,460**	**940**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Stalker Creek	Stalker Creek	Stalker Creek	Stalker Creek
	Rep	6 1/4	6 2/4	6 3/4	6 4/4
	Date	07-11-2006	07-11-2006	07-11-2006	07-11-2006
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	61	62	63	64
Ephemeroptera	Acerpenna pygmaea	0	4	0	5
	Baetidae	0	0	0	0
	Baetis tricaudatus	202	217	41	121
	Caenis sp.	0	1	0	1
	Callibaetis sp.	0	6	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	21	43	19	8
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	54	6	18	54
	Paraleptophlebia sp.	12	3	0	0
	Plauditus sp.	0	3	0	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	125	72	49	74
Odonata	Coenagrion/Enallagma sp.	1	2	0	2
Plecoptera	Hesperoperla pacifica	0	0	0	0
	Isoperla sp.	0	0	0	0
	Malenka sp.	0	0	0	0
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	0	0	0
Coleoptera	Agabus sp.	23	3	0	14
	Cleptelmis addenda	212	4	314	129
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	4	1	0	1
	Heterlimnius sp.	0	0	1	0
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	5	0	0	0
	Lampyridae	1	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	21	0	90	31
	Narpus sp.	0	0	0	0
	Optioservus sp.	12	0	106	33
	Peltodytes sp.	1	0	0	0
	Stictotarsus sp.	3	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	1,044	44	211	1,237
	Tanypodinae	49	4	6	10
Diptera	Antocha sp.	0	0	0	0
	Bezzia sp.	1	1	0	3
	Chelifera/Metachela sp.	0	0	0	0
	Dicranota sp.	15	0	11	16

	Ephydridae	0	0	0	0
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	1	0	0	0
	Limnophora sp.	7	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	1	0
	Pericoma/Telmatoscopus sp.	88	3	45	7
	Simuliidae	366	2,976	48	90
	Stratiomyidae	3	0	0	1
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	1	0
	Tipulidae	0	0	2	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	3	1	0	1
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	53	11	7	0
	Hesperophylax sp.	0	0	0	0
	Hydropsyche sp.	307	4	18	126
	Hydroptila sp.	301	24	149	524
	Lepidostoma sp.	5	0	0	0
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	3	1	0	0
	Mystacides sp.	0	0	0	0
	Oecetis sp.	9	0	1	1
	Onocosmoecus sp.	3	0	0	0
	Oxyethira sp.	4	1	0	11
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	6	1	0	5
	Wormaldia sp.	3	0	1	0
Annelida	Hirudinea	22	22	70	144
Crustacea	Amphipoda	931	103	245	1,603
		3,921	**3,561**	**1,454**	**4,252**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Lower Grove	Lower Grove	Lower Grove	Lower Grove
	Rep	7 1/4	7 2/4	7 3/4	7 4/4
	Date	08-10-2005	08-10-2005	08-10-2005	08-10-2005
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	25	26	27	28
Ephemeroptera	Acerpenna pygmaea	4	120	16	165
	Baetidae	9	10	11	7
	Baetis tricaudatus	422	739	658	719
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	171	271	464	200
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	51	177	116	37
	Paraleptophlebia sp.	1	186	74	117
	Plauditus sp.	0	0	1	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	12	276	64	197
Odonata	Coenagrion/Enallagma sp.	0	0	0	0
Plecoptera	Hesperoperla pacifica	0	0	0	0
	Isoperla sp.	0	0	0	0
	Malenka sp.	0	0	0	0
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	0	0	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	0	1	4	0
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	1	0
	Elmidae	0	0	0	0
	Haliplus sp.	0	0	0	0
	Heterlimnius sp.	0	0	0	0
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	0	0	0	0
	Narpus sp.	0	0	0	0
	Optioservus sp.	8	0	5	2
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	42	13	28	19
	Tanypodinae	9	9	14	10
Diptera	Antocha sp.	0	0	0	0
	Bezzia sp.	0	0	0	0
	Chelifera/Metachela sp.	0	0	0	0
	Dicranota sp.	0	0	0	0

	Ephydridae	0	0	0	0
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	0	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	76	6	46	1
	Stratiomyidae	0	0	0	1
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	0	0	0	0
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	49	1	118	13
	Hesperophylax sp.	0	0	0	0
	Hydropsyche sp.	24	1	10	1
	Hydroptila sp.	0	0	2	0
	Lepidostoma sp.	0	0	0	0
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	0	0	0	0
	Mystacides sp.	0	0	0	0
	Oecetis sp.	0	0	0	0
	Onocosmoecus sp.	0	0	0	0
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	1	0	1	0
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	11	42	63	58
Crustacea	Amphipoda	69	102	79	59
		959	**1,954**	**1,775**	**1,606**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Lower Grove	Lower Grove	Lower Grove	Lower Grove
	Rep	7 1/4	7 2/4	7 3/4	7 4/4
	Date	07-12-2006	07-12-2006	07-12-2006	07-12-2006
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	65	66	67	68
Ephemeroptera	Acerpenna pygmaea	0	0	0	0
	Baetidae	0	0	0	0
	Baetis tricaudatus	247	364	503	274
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	10	9	12	85
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	360	470	253	345
	Paraleptophlebia sp.	0	0	0	13
	Plauditus sp.	0	0	0	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	4	0	6	0
Odonata	Coenagrion/Enallagma sp.	0	0	0	0
Plecoptera	Hesperoperla pacifica	0	0	0	0
	Isoperla sp.	1	0	1	13
	Malenka sp.	1	1	0	4
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	0	0	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	0	3	1	0
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	1
	Haliplus sp.	0	0	0	0
	Heterlimnius sp.	0	0	0	0
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	0	0	0	0
	Narpus sp.	0	0	0	0
	Optioservus sp.	0	0	2	0
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	41	73	58	78
	Tanypodinae	2	0	3	15
Diptera	Antocha sp.	0	0	0	0
	Bezzia sp.	0	0	0	1
	Chelifera/Metachela sp.	0	0	0	0
	Dicranota sp.	0	0	0	0

	Ephydridae	0	0	0	0
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	0	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	60	332	60	209
	Stratiomyidae	3	4	0	1
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	0	13	1	42
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	3	3	10	21
	Hesperophylax sp.	0	0	0	0
	Hydropsyche sp.	2	6	1	13
	Hydroptila sp.	0	1	0	3
	Lepidostoma sp.	1	0	0	0
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	1	0	0	0
	Mystacides sp.	0	0	0	0
	Oecetis sp.	1	1	1	0
	Onocosmoecus sp.	0	0	0	0
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	0	0	1	2
	Wormaldia sp.	0	0	0	1
Annelida	Hirudinea	22	65	16	22
Crustacea	Amphipoda	10	20	94	3
		769	**1,365**	**1,023**	**1,146**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Restored Grove 2002	Restored Grove 2002	Restored Grove 2002	Restored Grove 2002
	Rep	8 1/4	8 2/4	8 3/4	8 4/4
	Date	08-10-2005	08-10-2005	08-10-2005	08-10-2005
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	29	30	31	32
Ephemeroptera	Acerpenna pygmaea	0	1	0	0
	Baetidae	0	0	0	0
	Baetis tricaudatus	36	22	39	32
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	15	15	5	10
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	5	3	0	5
	Paraleptophlebia sp.	21	0	0	0
	Plauditus sp.	0	0	0	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	18	12	1	8
Odonata	Coenagrion/Enallagma sp.	0	0	0	0
Plecoptera	Hesperoperla pacifica	0	0	3	2
	Isoperla sp.	0	0	0	0
	Malenka sp.	20	0	1	2
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	0	0	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	0	2	0	0
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	0	0	0	0
	Heterlimnius sp.	185	147	125	141
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	2	0	0	0
	Narpus sp.	0	1	0	0
	Optioservus sp.	16	18	3	19
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	248	441	251	610
	Tanypodinae	15	8	3	19
Diptera	Antocha sp.	0	1	0	1
	Bezzia sp.	0	0	0	0
	Chelifera/Metachela sp.	0	0	0	0

	Dicranota sp.	3	4	10	0
	Ephydridae	2	0	0	0
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	4	1	1
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	31	14	74	87
	Stratiomyidae	1	1	0	0
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	0	0
	Tipulidae	0	3	1	0
Trichoptera	Agapetus sp.	0	5	1	0
	Brachycentrus americanus	25	5	7	12
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	15	3	12	63
	Hesperophylax sp.	0	2	2	0
	Hydropsyche sp.	12	16	22	58
	Hydroptila sp.	125	9	2	11
	Lepidostoma sp.	11	3	18	36
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	0	1	0	1
	Mystacides sp.	0	0	0	0
	Oecetis sp.	0	0	0	0
	Onocosmoecus sp.	0	0	1	1
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	26	68	38	27
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	42	52	23	98
Crustacea	Amphipoda	53	54	25	19
		927	**915**	**668**	**1,263**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Restored Grove 2002	Restored Grove 2002	Restored Grove 2002	Restored Grove 2002
	Rep	8 1/4	8 2/4	8 3/4	8 4/4
	Date	07-12-2006	07-12-2006	07-12-2006	07-12-2006
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	69	70	71	72
Ephemeroptera	Acerpenna pygmaea	0	0	0	0
	Baetidae	0	0	0	0
	Baetis tricaudatus	59	87	89	32
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	1	5	0	2
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	37	2	7	1
	Paraleptophlebia sp.	1	4	1	11
	Plauditus sp.	0	0	0	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	1	2	1	1
Odonata	Coenagrion/Enallagma sp.	0	0	0	0
Plecoptera	Hesperoperla pacifica	0	0	0	0
	Isoperla sp.	0	0	1	6
	Malenka sp.	10	4	6	19
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	4	4	0	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	0	1	0	857
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	0	0	0	0
	Heterlimnius sp.	156	338	251	0
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	1	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	0	0	0	0
	Narpus sp.	0	0	0	0
	Optioservus sp.	39	66	99	42
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	164	493	597	298
	Tanypodinae	4	12	6	11
Diptera	Antocha sp.	5	9	0	1
	Bezzia sp.	0	0	0	0

	Chelifera/Metachela sp.	5	3	0	1
	Dicranota sp.	8	6	9	3
	Ephydridae	0	0	0	0
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	1	4	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	1	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	261	417	488	173
	Stratiomyidae	0	0	0	0
	Tabanidae	0	0	0	0
	Tipula sp.	1	2	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	1	1	1	0
	Brachycentrus americanus	19	2	11	21
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	69	4	45	2
	Hesperophylax sp.	2	0	1	0
	Hydropsyche sp.	0	1	1	0
	Hydroptila sp.	10	2	17	0
	Lepidostoma sp.	0	0	0	0
	Leptoceridae	0	0	0	0
	Limnephilidae	0	6	2	0
	Limnephilus sp.	2	0	1	0
	Mystacides sp.	0	0	0	0
	Oecetis sp.	44	2	16	0
	Onocosmoecus sp.	0	0	1	0
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	64	40	48	27
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	17	7	7	8
Crustacea	Amphipoda	68	35	20	8
		1,053	**1,557**	**1,730**	**1,524**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Restored Grove 2002	Restored Grove 2002	Restored Grove 2002	Restored Grove 2002
	Rep	9 1/4	9 2/4	9 3/4	9 4/4
	Date	08-10-2005	08-10-2005	08-10-2005	08-10-2005
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	33	34	35	36
Ephemeroptera	Acerpenna pygmaea	0	0	0	0
	Baetidae	0	0	0	0
	Baetis tricaudatus	358	262	210	289
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	0	0	0
	Diphetor hageni	0	0	0	0
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	211	14	98	78
	Paraleptophlebia sp.	2	6	1	0
	Plauditus sp.	0	0	0	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	0	0	0	0
Odonata	Coenagrion/Enallagma sp.	0	0	0	0
Plecoptera	Hesperoperla pacifica	80	72	15	16
	Isoperla sp.	3	0	1	4
	Malenka sp.	89	59	5	5
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	0	0	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	0	0	0	0
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	0	0	0	0
	Heterlimnius sp.	31	73	3	4
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	0	0	0	0
	Narpus sp.	0	0	0	0
	Optioservus sp.	3	0	0	0
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	911	263	829	376
	Tanypodinae	4	3	0	3
Diptera	Antocha sp.	3	0	0	0
	Bezzia sp.	0	0	0	0

	Chelifera/Metachela sp.	0	0	0	0
	Dicranota sp.	9	8	2	9
	Ephydridae	0	0	0	0
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	0	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	1	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	14	2	25	7
	Stratiomyidae	1	2	0	1
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	3	0	0	0
	Brachycentrus americanus	0	0	0	1
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	0	0	0	0
	Hesperophylax sp.	0	0	5	9
	Hydropsyche sp.	5	0	1	0
	Hydroptila sp.	135	3	3	8
	Lepidostoma sp.	0	0	0	0
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	2	0	0	1
	Mystacides sp.	0	0	0	0
	Oecetis sp.	0	0	0	0
	Onocosmoecus sp.	2	0	1	0
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	51	30	5	28
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	14	46	13	17
Crustacea	Amphipoda	25	0	2	1
		1,956	**844**	**1,219**	**857**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Restored Grove 2002	Restored Grove 2002	Restored Grove 2002	Restored Grove 2002
	Rep	9 1/4	9 2/4	9 3/4	9 4/4
	Date	07-12-2006	07-12-2006	07-12-2006	07-12-2006
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	73	74	75	76
Ephemeroptera	Acerpenna pygmaea	0	0	0	0
	Baetidae	0	0	0	0
	Baetis tricaudatus	515	332	320	293
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	1	8	0
	Diphetor hageni	0	0	2	0
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	599	286	235	1,320
	Paraleptophlebia sp.	0	0	2	0
	Plauditus sp.	0	0	0	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	0	0	0	0
Odonata	Coenagrion/Enallagma sp.	0	0	0	0
Plecoptera	Hesperoperla pacifica	1	9	15	5
	Isoperla sp.	16	13	12	19
	Malenka sp.	67	67	45	19
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	0	0	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	0	0	0	0
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	0	0	0	0
	Heterlimnius sp.	14	27	38	15
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	3	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	0	0	0	0
	Narpus sp.	0	0	0	0
	Optioservus sp.	1	1	3	0
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	776	832	1,270	497
	Tanypodinae	4	3	4	0
Diptera	Antocha sp.	1	0	6	0
	Bezzia sp.	0	0	0	1

	Chelifera/Metachela sp.	0	0	4	0
	Dicranota sp.	3	8	0	3
	Ephydridae	2	1	1	1
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	1	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	69	37	33	17
	Stratiomyidae	0	0	0	1
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	5	9	4	10
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	0	0	0	0
	Hesperophylax sp.	0	1	0	22
	Hydropsyche sp.	0	0	0	0
	Hydroptila sp.	71	73	43	26
	Lepidostoma sp.	27	6	0	20
	Leptoceridae	0	0	0	0
	Limnephilidae	4	0	0	0
	Limnephilus sp.	0	0	0	0
	Mystacides sp.	0	0	0	0
	Oecetis sp.	0	0	0	0
	Onocosmoecus sp.	4	0	0	2
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	17	25	96	8
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	15	7	11	6
Crustacea	Amphipoda	7	6	0	66
		2,221	**1,745**	**2,152**	**2,351**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Non-restored Grove	Non-restored Grove	Non-restored Grove	Non-restored Grove
	Rep	10 1/4	10 2/4	10 3/4	10 4/4
	Date	08-10-2005	08-10-2005	08-10-2005	08-10-2005
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	37	38	39	40
Ephemeroptera	Acerpenna pygmaea	0	0	0	0
	Baetidae	0	6	0	0
	Baetis tricaudatus	244	384	498	234
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	4	1	0	1
	Diphetor hageni	0	0	0	0
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	14	8	20	33
	Paraleptophlebia sp.	2	2	3	21
	Plauditus sp.	0	0	0	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	0	0	0	0
Odonata	Coenagrion/Enallagma sp.	0	0	0	0
Plecoptera	Hesperoperla pacifica	28	1	35	26
	Isoperla sp.	0	2	2	0
	Malenka sp.	84	7	117	141
	Sweltsa sp.	1	0	0	0
Hemiptera	Corixidae	0	0	0	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	0	1	0	0
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	1
	Elmidae	0	0	0	0
	Haliplus sp.	0	0	0	0
	Heterlimnius sp.	77	13	78	131
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	0	0	0	0
	Narpus sp.	0	0	0	0
	Optioservus sp.	4	2	0	0
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	298	747	233	447
	Tanypodinae	42	0	5	5
Diptera	Antocha sp.	16	13	0	2
	Bezzia sp.	0	0	0	0
	Chelifera/Metachela sp.	1	3	0	0

	Dicranota sp.	6	25	41	26
	Ephydridae	16	28	16	1
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	0	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	3	0	10	0
	Stratiomyidae	2	5	2	2
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	2	2	2	3
	Glossosomatidae	0	0	0	0
	Helicopsyche borealis	0	0	0	0
	Hesperophylax sp.	1	0	0	0
	Hydropsyche sp.	5	6	0	1
	Hydroptila sp.	145	44	167	235
	Lepidostoma sp.	9	2	19	11
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	0	0	0	0
	Mystacides sp.	0	0	0	0
	Oecetis sp.	0	0	0	0
	Onocosmoecus sp.	1	0	0	0
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	10	2	6	5
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	49	17	19	7
Crustacea	Amphipoda	29	26	52	37
		1,093	**1,347**	**1,325**	**1,370**

	Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
	Site	Non. Restored Grove	Non. Restored Grove	Non. Restored Grove	Non. Restored Grove
	Rep	10 1/4	10 2/4	10 3/4	10 4/4
	Date	07-12-2006	07-12-2006	07-12-2006	07-12-2006
	Percent Subsampled	100.00	100.00	100.00	100.00
	EcoAnalysts Sample ID	77	78	79	80
Ephemeroptera	Acerpenna pygmaea	0	0	0	0
	Baetidae	0	0	0	0
	Baetis tricaudatus	1,332	791	920	1,646
	Caenis sp.	0	0	0	0
	Callibaetis sp.	0	0	0	0
	Centroptilum sp.	0	0	0	0
	Cinygmula sp.	0	9	2	3
	Diphetor hageni	0	0	0	0
	Ephemera sp.	0	0	0	0
	Ephemerella inermis/infrequens	168	193	65	63
	Paraleptophlebia sp.	2	14	1	0
	Plauditus sp.	0	0	0	0
	Siphlonurus sp.	0	0	0	0
	Tricorythodes minutus	0	0	0	0
Odonata	Coenagrion/Enallagma sp.	0	0	0	0
Plecoptera	Hesperoperla pacifica	1	4	2	5
	Isoperla sp.	20	2	7	14
	Malenka sp.	28	12	5	35
	Sweltsa sp.	0	0	0	0
Hemiptera	Corixidae	0	0	0	0
Coleoptera	Agabus sp.	0	0	0	0
	Cleptelmis addenda	0	0	0	0
	Dubiraphia sp.	0	0	0	0
	Dytiscidae	0	0	0	0
	Elmidae	0	0	0	0
	Haliplus sp.	0	0	0	0
	Heterlimnius sp.	30	160	58	70
	Hexacylloepus sp.	0	0	0	0
	Hydrophilidae	0	0	0	0
	Lampyridae	0	0	0	0
	Lara sp.	0	0	0	0
	Microcylloepus sp.	0	0	0	0
	Narpus sp.	0	0	0	0
	Optioservus sp.	0	1	1	1
	Peltodytes sp.	0	0	0	0
	Stictotarsus sp.	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0
Diptera-Chironomidae	Chironomidae	38	163	62	113
	Tanypodinae	0	3	1	7
Diptera	Antocha sp.	1	6	0	0
	Bezzia sp.	0	0	0	0

	Chelifera/Metachela sp.	1	8	3	7
	Dicranota sp.	0	1	1	3
	Ephydridae	0	0	1	5
	Hexatoma sp.	0	0	0	0
	Limnophila sp.	0	0	0	0
	Limnophora sp.	0	0	0	0
	Ormosia sp.	0	0	0	0
	Pedicia sp.	0	0	0	0
	Pericoma/Telmatoscopus sp.	0	0	0	0
	Simuliidae	8	8	6	12
	Stratiomyidae	45	10	9	65
	Tabanidae	0	0	0	0
	Tipula sp.	0	0	0	0
	Tipulidae	0	0	0	0
Trichoptera	Agapetus sp.	0	0	0	0
	Brachycentrus americanus	10	2	7	8
	Glossosomatidae	0	0	1	0
	Helicopsyche borealis	0	0	0	0
	Hesperophylax sp.	2	3	2	0
	Hydropsyche sp.	0	0	0	0
	Hydroptila sp.	490	480	136	437
	Lepidostoma sp.	3	17	1	1
	Leptoceridae	0	0	0	0
	Limnephilidae	0	0	0	0
	Limnephilus sp.	0	0	0	0
	Mystacides sp.	0	0	0	0
	Oecetis sp.	0	0	0	0
	Onocosmoecus sp.	0	0	0	0
	Oxyethira sp.	0	0	0	0
	Phryganea sp.	0	0	0	0
	Rhyacophila sp.	4	2	1	22
	Wormaldia sp.	0	0	0	0
Annelida	Hirudinea	43	71	11	21
Crustacea	Amphipoda	18	39	0	33
		2,244	**1,999**	**1,303**	**2,571**

Appendix C. The 103 Metrics Calculated by the EcoAnalsts, Inc. Software Package for the Silver Creek Watershed in 2005 and 2006

Stream	**Silver Creek**	**Silver Creek**	**Silver Creek**	**Silver Creek**
Site	**USGS**	**USGS**	**USGS**	**USGS**
Rep	**1 1/4**	**1 2/4**	**1 3/4**	**1 4/4**
Date	**08-08-2005**	**08-08-2005**	**08-08-2005**	**08-08-2005**
Percent Subsampled	**100.00**	**100.00**	**100.00**	**100.00**
EcoAnalysts Sample ID	**1**	**2**	**3**	**4**
Abundance Measures				
Corrected Abundance	1608.00	652.00	1186.00	1682.00
EPT Abundance	1345.00	517.00	671.00	674.00
Dominance Measures				
Dominant Taxon	Hydropsyche sp.	Hydropsyche sp.	Hydropsyche sp.	Microcylloepus sp.
Dominant Abundance	542.00	397.00	521.00	529.00
2nd Dominant Taxon	Paraleptophlebia sp.	Amphipoda	Microcylloepus sp.	Hydropsyche sp.
2nd Dominant Abundance	317.00	72.00	285.00	502.00
3rd Dominant Taxon	Acerpenna pygmaea	Acerpenna pygmaea	Paraleptophlebia sp.	Amphipoda
3rd Dominant Abundance	218.00	50.00	104.00	134.00
% Dominant Taxon	33.71	60.89	43.93	31.45
% 2 Dominant Taxa	53.42	71.93	67.96	61.30
% 3 Dominant Taxa	66.98	79.60	76.73	69.26
Richness Measures				
Species Richness	19.00	17.00	19.00	19.00
EPT Richness	10.00	8.00	8.00	9.00
Ephemeroptera Richness	7.00	6.00	6.00	4.00
Plecoptera Richness	0.00	0.00	0.00	0.00
Trichoptera Richness	3.00	2.00	2.00	5.00
Chironomidae Richness	2.00	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	17.00	15.00	17.00	17.00
Rhyacophila Richness	1.00	1.00	1.00	1.00
Community Composition				
% Ephemeroptera	47.89	17.64	12.56	8.03
% Plecoptera	0.00	0.00	0.00	0.00
% Trichoptera	35.76	61.66	44.01	32.05
% EPT	83.64	79.29	56.58	40.07
% Coleoptera	3.11	3.37	29.09	38.82
% Diptera	4.85	1.53	7.76	10.88
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	18.59	9.51	3.20	2.62
% Brachycentridae	0.00	0.00	0.00	0.00
% Chironomidae	4.66	1.23	6.16	10.64
% Ephemerellidae	0.00	0.00	0.00	0.00
% Hydropsychidae	33.71	60.89	43.93	29.85
% Odonata	0.00	0.00	0.00	0.00
% Perlidae	0.00	0.00	0.00	0.00
% Pteronarcyidae	0.00	0.00	0.00	0.00
% Simuliidae	0.19	0.31	1.43	0.18

Functional Group Composition				
% Filterers	33.89	61.20	45.36	30.02
% Gatherers	61.13	31.13	48.90	59.16
% Predators	3.05	6.13	4.05	8.56
% Scrapers	1.93	1.53	1.69	1.84
% Shredders	0.00	0.00	0.00	0.12
% Piercer-Herbivores	0.00	0.00	0.00	0.30
% Unclassified	0.00	0.00	0.00	0.00
Filterer Richness	2.00	2.00	2.00	2.00
Gatherer Richness	12.00	11.00	13.00	9.00
Predator Richness	3.00	3.00	3.00	4.00
Scraper Richness	2.00	1.00	1.00	2.00
Shredder Richness	0.00	0.00	0.00	1.00
Piercer-Herbivore Richness	0.00	0.00	0.00	1.00
Unclassified	0.00	0.00	0.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.88	0.65	0.77	0.84
Shannon-Weaver H' (log 2)	2.91	2.18	2.57	2.78
Shannon-Weaver H' (log e)	2.02	1.51	1.78	1.93
Margalef's Richness	2.44	2.47	2.54	2.42
Pielou's J'	0.69	0.53	0.60	0.65
Simpson's Heterogeneity	0.81	0.61	0.74	0.79
Biotic Indices				
% Indiv. w/ HBI Value	77.18	87.12	98.65	98.57
Hilsenhoff Biotic Index	4.10	4.83	4.74	4.90
% Indiv. w/ MTI Value	52.05	71.63	74.70	65.46
Metals Tolerance Index	4.64	4.85	4.63	4.43
% Indiv. w/ FSBI Value	70.46	73.62	60.79	44.05
Fine Sediment Biotic Index	35.00	35.00	36.00	29.00
FSBI - average	1.84	2.06	1.89	1.53
FSBI - weighted average	3.95	4.75	4.37	4.15
% Indiv. w/ TPM Value	52.92	71.32	56.58	43.40
Temp. Pref. Metric - average	2.00	2.24	2.16	1.74
TPM - weighted average	2.55	2.19	2.66	3.08
DEQ MBI (Snake River Basin/High Desert)	3.82	3.07	3.20	3.25
DEQ MBI (Middle Rockies)	3.92	3.16	3.26	3.31
Karr BIBI Metrics				
Long-Lived Taxa Richness	5.00	5.00	5.00	3.00
Clinger Richness	12.00	10.00	10.00	10.00
% Clingers	53.30	72.39	77.49	72.18
Intolerant Taxa Richness	3.00	3.00	3.00	3.00
% Tolerant Individuals	0.00	0.00	0.09	0.12
% Tolerant Taxa	0.00	0.00	5.26	5.26
Coleoptera Richness	4.00	4.00	4.00	4.00
Montana DEQ Metrics				
MT Biotic Index	4.10	4.83	4.74	4.90
C-Gatherers + C- Filterers	95.02	92.33	94.27	89.18

% Scraper + %Shredder	1.93	1.53	1.69	1.96
% Univoltine	26.24	5.37	39.12	47.62
% Multivoltine	14.49	13.19	9.53	11.59
% Semivoltine	11.63	8.13	5.65	7.43
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	33.71	60.89	43.93	29.85
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	27.07	4.23	9.06	5.49
% Non-Insect Individuals	8.40	15.80	6.58	10.23
% Non-Insect Taxa	10.53	11.76	10.53	10.53
% Crustacea + Mollusca	8.02	11.04	5.56	7.97
Average Abundance (per taxon)	84.63	38.35	62.42	88.53
NYDEC PMA Metrics				
% Crustacea	8.02	11.04	5.56	7.97
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	86.94	82.98	87.27	79.13
UIN	**940-1**	**940-2**	**940-3**	**940-4**

Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
Site	USGS	USGS	USGS	USGS
Rep	1 1/4	1 2 4	1 3/4	1 4/4
Date	07-10-2006	07-10-2006	07-10-2006	07-10-2006
Percent Subsampled	100.00	100.00	100.00	100.00
EcoAnalysts Sample ID	41	42	43	44
Abundance Measures				
Corrected Abundance	1048.00	1071.00	1560.00	727.00
EPT Abundance	597.00	691.00	729.00	355.00
Dominance Measures				
Dominant Taxon	Paraleptophlebia sp.	Hydropsyche sp.	Amphipoda	Amphipoda
Dominant Abundance	189.00	298.00	486.00	123.00
2nd Dominant Taxon	Amphipoda	Amphipoda	Tricorythodes minutus	Chironomidae
2nd Dominant Abundance	159.00	183.00	186.00	112.00
3rd Dominant Taxon	Hydropsyche sp.	Chironomidae	Paraleptophlebia sp.	Tricorythodes minutus
3rd Dominant Abundance	139.00	143.00	184.00	105.00
% Dominant Taxon	18.03	27.82	31.15	16.92
% 2 Dominant Taxa	33.21	44.91	43.08	32.32
% 3 Dominant Taxa	46.47	58.26	54.87	46.77
Richness Measures				
Species Richness	21.00	20.00	21.00	21.00
EPT Richness	10.00	11.00	11.00	12.00
Ephemeroptera Richness	6.00	6.00	7.00	7.00
Plecoptera Richness	0.00	0.00	0.00	0.00
Trichoptera Richness	4.00	5.00	4.00	5.00
Chironomidae Richness	2.00	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	19.00	18.00	19.00	19.00
Rhyacophila Richness	0.00	0.00	0.00	0.00
Community Composition				
% Ephemeroptera	32.82	29.23	41.35	37.96
% Plecoptera	0.00	0.00	0.00	0.00
% Trichoptera	24.14	35.29	5.38	10.87
% EPT	56.97	64.52	46.73	48.83
% Coleoptera	0.76	0.56	0.38	1.10
% Diptera	19.27	15.22	20.13	29.99
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	9.35	10.46	15.45	13.89
% Brachycentridae	0.00	0.00	0.00	0.00
% Chironomidae	14.60	15.03	15.32	20.91
% Ephemerellidae	0.57	2.15	2.18	0.96
% Hydropsychidae	13.26	27.82	2.50	8.67
% Odonata	0.10	0.09	0.58	0.00
% Perlidae	0.00	0.00	0.00	0.00
% Pteronarcyidae	0.00	0.00	0.00	0.00
% Simuliidae	4.68	0.09	4.81	9.08

Functional Group Composition				
% Filterers	17.94	27.92	7.31	17.74
% Gatherers	58.40	58.26	75.19	70.98
% Predators	13.26	4.58	12.44	8.80
% Scrapers	9.83	6.35	2.56	1.24
% Shredders	0.57	2.15	2.18	1.10
% Piercer-Herbivores	0.00	0.75	0.32	0.14
% Unclassified	0.00	0.00	0.00	0.00
Filterer Richness	2.00	2.00	2.00	2.00
Gatherer Richness	11.00	11.00	12.00	12.00
Predator Richness	5.00	4.00	3.00	3.00
Scraper Richness	2.00	1.00	1.00	1.00
Shredder Richness	1.00	1.00	1.00	2.00
Piercer-Herbivore Richness	0.00	1.00	2.00	1.00
Unclassified	0.00	0.00	0.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	1.05	0.95	0.98	1.05
Shannon-Weaver H' (log 2)	3.49	3.16	3.24	3.50
Shannon-Weaver H' (log e)	2.42	2.19	2.25	2.42
Margalef's Richness	2.88	2.72	2.72	3.04
Pielou's J'	0.79	0.73	0.74	0.80
Simpson's Heterogeneity	0.89	0.85	0.85	0.89
Biotic Indices				
% Indiv. w/ HBI Value	91.13	83.66	80.58	82.94
Hilsenhoff Biotic Index	4.73	4.90	4.49	4.86
% Indiv. w/ MTI Value	40.17	58.36	32.44	46.49
Metals Tolerance Index	3.95	4.12	3.63	4.01
% Indiv. w/ FSBI Value	42.37	54.62	36.79	44.70
Fine Sediment Biotic Index	29.00	34.00	36.00	36.00
FSBI - average	1.38	1.70	1.71	1.71
FSBI - weighted average	3.52	4.44	3.53	3.95
% Indiv. w/ TPM Value	38.65	64.52	34.29	60.52
Temp. Pref. Metric - average	2.00	1.85	2.05	2.05
TPM - weighted average	3.48	2.95	3.53	3.73
DEQ MBI (Snake River Basin/High Desert)	3.94	3.76	3.59	3.80
DEQ MBI (Middle Rockies)	4.03	3.87	3.68	3.90
Karr BIBI Metrics				
Long-Lived Taxa Richness	4.00	2.00	3.00	3.00
Clinger Richness	11.00	10.00	12.00	13.00
% Clingers	38.74	56.12	30.58	46.77
Intolerant Taxa Richness	2.00	2.00	2.00	2.00
% Tolerant Individuals	0.52	0.56	0.80	0.17
% Tolerant Taxa	14.29	15.00	9.52	4.76
Coleoptera Richness	5.00	2.00	4.00	4.00
Montana DEQ Metrics				
MT Biotic Index	4.73	4.90	4.49	4.86
C-Gatherers + C- Filterers	76.34	86.18	82.50	88.72

% Scraper + %Shredder	10.40	8.50	4.74	2.34
% Univoltine	33.49	21.29	29.42	31.64
% Multivoltine	36.16	31.84	47.05	39.61
% Semivoltine	5.25	13.17	12.12	14.99
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	13.26	27.82	2.50	8.67
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	20.42	6.81	17.34	11.61
% Non-Insect Individuals	22.90	19.61	32.18	20.08
% Non-Insect Taxa	9.52	10.00	9.52	9.52
% Crustacea + Mollusca	15.17	17.09	31.15	16.92
Average Abundance (per taxon)	49.90	53.55	74.29	34.62
NYDEC PMA Metrics				
% Crustacea	15.17	17.09	31.15	16.92
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	62.50	65.36	52.50	59.01
UIN	**940-41**	**940-42**	**940-43**	**940-44**

Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
Site	Float Tube	Float Tube	Float Tube	Float Tube
Rep	2 1/4	2 2/4	2 3/4	2 4/4
Date	08-09-2005	08-09-2005	08-09-2005	08-09-2005
Percent Subsampled	100.00	100.00	100.00	100.00
EcoAnalysts Sample ID	5	6	7	8
Abundance Measures				
Corrected Abundance	1048.00	284.00	762.00	1198.00
EPT Abundance	810.00	160.00	481.00	675.00
Dominance Measures				
Dominant Taxon	Baetis tricaudatus	Hydropsyche sp.	Amphipoda	Amphipoda
Dominant Abundance	333.00	103.00	182.00	361.00
2nd Dominant Taxon	Acerpenna pygmaea	Amphipoda	Baetis tricaudatus	Baetis tricaudatus
2nd Dominant Abundance	198.00	68.00	169.00	352.00
3rd Dominant Taxon	Amphipoda	Hirudinea	Hydropsyche sp.	Acerpenna pygmaea
3rd Dominant Abundance	152.00	26.00	115.00	129.00
% Dominant Taxon	31.77	36.27	23.88	30.13
% 2 Dominant Taxa	50.67	60.21	46.06	59.52
% 3 Dominant Taxa	65.17	69.37	61.15	70.28
Richness Measures				
Species Richness	14.00	14.00	22.00	19.00
EPT Richness	7.00	7.00	10.00	8.00
Ephemeroptera Richness	5.00	5.00	7.00	5.00
Plecoptera Richness	0.00	0.00	0.00	0.00
Trichoptera Richness	2.00	2.00	3.00	3.00
Chironomidae Richness	2.00	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	12.00	12.00	20.00	17.00
Rhyacophila Richness	0.00	0.00	0.00	0.00
Community Composition				
% Ephemeroptera	63.74	19.01	47.77	46.91
% Plecoptera	0.00	0.00	0.00	0.00
% Trichoptera	13.55	37.32	15.35	9.43
% EPT	77.29	56.34	63.12	56.34
% Coleoptera	0.00	0.35	0.66	0.42
% Diptera	5.53	9.51	7.35	5.43
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	51.05	10.92	35.96	40.40
% Brachycentridae	0.00	0.00	0.00	0.00
% Chironomidae	4.58	8.80	6.30	3.84
% Ephemerellidae	0.00	0.00	0.00	0.00
% Hydropsychidae	13.26	36.27	15.09	9.10
% Odonata	0.38	0.70	0.13	0.17

% Perlidae	0.00	0.00	0.00	0.00
% Pteronarcyidae	0.00	0.00	0.00	0.00
% Simulilidae	0.95	0.70	0.92	1.42
Functional Group Composition				
% Filterers	14.22	36.97	16.01	10.52
% Gatherers	81.39	49.30	77.03	79.63
% Predators	3.91	12.68	6.30	9.43
% Scrapers	0.29	1.06	0.13	0.25
% Shredders	0.00	0.00	0.26	0.08
% Piercer-Herbivores	0.19	0.00	0.13	0.08
% Unclassified	0.00	0.00	0.13	0.00
Filterer Richness	2.00	2.00	2.00	2.00
Gatherer Richness	7.00	8.00	10.00	8.00
Predator Richness	3.00	3.00	5.00	6.00
Scraper Richness	1.00	1.00	1.00	1.00
Shredder Richness	0.00	0.00	2.00	1.00
Piercer-Herbivore Richness	1.00	0.00	1.00	1.00
Unclassified	0.00	0.00	1.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.84	0.83	0.91	0.82
Shannon-Weaver H' (log 2)	2.80	2.77	3.02	2.71
Shannon-Weaver H' (log e)	1.94	1.92	2.09	1.88
Margalef's Richness	1.87	2.30	3.16	2.54
Pielou's J'	0.73	0.73	0.68	0.64
Simpson's Heterogeneity	0.82	0.79	0.84	0.79
Biotic Indices				
% Indiv. w/ HBI Value	76.53	88.03	78.87	83.47
Hilsenhoff Biotic Index	4.25	5.00	4.54	4.55
% Indiv. w/ MTI Value	51.43	48.24	47.90	46.58
Metals Tolerance Index	4.85	4.82	4.72	4.80
% Indiv. w/ FSBI Value	58.11	48.94	50.00	45.33
Fine Sediment Biotic Index	20.00	16.00	24.00	21.00
FSBI - average	1.43	1.14	1.09	1.11
FSBI - weighted average	4.50	4.73	4.59	4.81
% Indiv. w/ TPM Value	54.29	53.17	52.36	48.25
Temp. Pref. Metric - average	1.64	1.36	1.23	1.26
TPM - weighted average	3.99	2.64	3.62	4.05
DEQ MBI (Snake River Basin/High Desert)	3.50	3.14	3.74	3.40
DEQ MBI (Middle Rockies)	3.58	3.21	3.83	3.47
Karr BIBI Metrics				
Long-Lived Taxa Richness	2.00	1.00	4.00	3.00
Clinger Richness	6.00	7.00	10.00	8.00
% Clingers	51.24	48.94	48.03	46.66
Intolerant Taxa Richness	1.00	1.00	1.00	1.00
% Tolerant Individuals	0.75	1.20	1.33	0.90
% Tolerant Taxa	14.29	14.29	22.73	21.05
Coleoptera Richness	0.00	1.00	3.00	1.00

Montana DEQ Metrics				
MT Biotic Index	4.25	5.00	4.54	4.55
C-Gatherers + C- Filterers	95.61	86.27	93.04	90.15
% Scraper + %Shredder	0.29	1.06	0.39	0.33
% Univoltine	12.69	11.27	10.10	4.67
% Multivoltine	47.90	30.99	48.69	61.94
% Semivoltine	4.77	5.63	8.53	5.93
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	13.26	36.27	15.09	9.10
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	10.60	2.80	4.66	0.90
% Non-Insect Individuals	16.60	33.10	28.48	37.48
% Non-Insect Taxa	14.29	14.29	9.09	10.53
% Crustacea + Mollusca	14.50	23.94	23.88	30.13
Average Abundance (per taxon)	74.86	20.29	34.64	63.05
NYDEC PMA Metrics				
% Crustacea	14.50	23.94	23.88	30.13
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	78.82	58.10	65.22	58.68
UIN	**940-5**	**940-6**	**940-7**	**940-8**

Stream	**Silver Creek**	**Silver Creek**	**Silver Creek**
Site	**Loving Creek**	**Loving Creek**	**Loving Creek**
Rep	**2 1/4**	**2 2/4**	**2 3/4**
Date	**07-10-2006**	**07-10-2006**	**07-10-2006**
Percent Subsampled	**100.00**	**100.00**	**100.00**
EcoAnalysts Sample ID	**45**	**46**	**47**
Abundance Measures			
Corrected Abundance	790.00	850.00	466.00
EPT Abundance	599.00	661.00	314.00
Dominance Measures			
Dominant Taxon	Tricorythodes minutus	Tricorythodes minutus	Tricorythodes minutus
Dominant Abundance	424.00	634.00	250.00
2nd Dominant Taxon	Baetis tricaudatus	Chironomidae	Amphipoda
2nd Dominant Abundance	125.00	96.00	129.00
3rd Dominant Taxon	Amphipoda	Amphipoda	Baetis tricaudatus
3rd Dominant Abundance	115.00	65.00	40.00
% Dominant Taxon	53.67	74.59	53.65
% 2 Dominant Taxa	69.49	85.88	81.33
% 3 Dominant Taxa	84.05	93.53	89.91
Richness Measures			
Species Richness	19.00	20.00	17.00
EPT Richness	11.00	10.00	10.00
Ephemeroptera Richness	7.00	5.00	7.00
Plecoptera Richness	0.00	0.00	0.00
Trichoptera Richness	4.00	5.00	3.00
Chironomidae Richness	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	17.00	18.00	15.00
Rhyacophila Richness	0.00	0.00	0.00
Community Composition			
% Ephemeroptera	73.80	76.12	65.02
% Plecoptera	0.00	0.00	0.00
% Trichoptera	2.03	1.65	2.36
% EPT	75.82	77.76	67.38
% Coleoptera	0.00	0.59	0.21
% Diptera	4.56	11.76	3.22
% Oligochaeta	0.00	0.00	0.00
% Baetidae	17.59	1.18	10.94
% Brachycentridae	0.00	0.00	0.00
% Chironomidae	3.67	11.41	2.79
% Ephemerellidae	0.51	0.35	0.21
% Hydropsychidae	1.39	0.35	1.29
% Odonata	0.00	0.00	0.00
% Perlidae	0.00	0.00	0.00
% Pteronarcyidae	0.00	0.00	0.00
% Simuliidae	0.25	0.24	0.43

Functional Group Composition			
% Filterers	1.65	0.59	1.72
% Gatherers	91.52	94.94	95.06
% Predators	5.95	3.18	1.50
% Scrapers	0.00	0.47	0.64
% Shredders	0.51	0.47	0.21
% Piercer-Herbivores	0.38	0.35	0.86
% Unclassified	0.00	0.00	0.00
Filterer Richness	2.00	2.00	2.00
Gatherer Richness	10.00	8.00	8.00
Predator Richness	4.00	4.00	2.00
Scraper Richness	0.00	2.00	2.00
Shredder Richness	1.00	2.00	1.00
Piercer-Herbivore Richness	2.00	2.00	2.00
Unclassified	0.00	0.00	0.00
Diversity/Evenness Measures			
Shannon-Weaver H' (log 10)	0.67	0.43	0.59
Shannon-Weaver H' (log 2)	2.23	1.42	1.96
Shannon-Weaver H' (log e)	1.55	0.99	1.36
Margalef's Richness	2.70	2.82	2.60
Pielou's J'	0.53	0.33	0.48
Simpson's Heterogeneity	0.66	0.42	0.63
Biotic Indices			
% Indiv. w/ HBI Value	44.94	25.18	44.64
Hilsenhoff Biotic Index	4.50	5.39	4.33
% Indiv. w/ MTI Value	72.66	78.35	66.31
Metals Tolerance Index	4.21	4.01	4.12
% Indiv. w/ FSBI Value	74.30	76.82	65.45
Fine Sediment Biotic Index	31.00	26.00	32.00
FSBI - average	1.63	1.30	1.88
FSBI - weighted average	4.17	4.02	4.15
% Indiv. w/ TPM Value	75.95	88.59	68.45
Temp. Pref. Metric - average	2.00	1.80	2.00
TPM - weighted average	2.81	2.44	2.53
DEQ MBI (Snake River Basin/High Desert)	3.29	2.77	3.10
DEQ MBI (Middle Rockies)	3.40	2.87	3.19
Karr BIBI Metrics			
Long-Lived Taxa Richness	2.00	4.00	3.00
Clinger Richness	8.00	10.00	9.00
% Clingers	72.66	77.88	67.38
Intolerant Taxa Richness	2.00	1.00	2.00
% Tolerant Individuals	1.69	4.67	0.48
% Tolerant Taxa	15.79	20.00	5.88
Coleoptera Richness	0.00	3.00	1.00
Montana DEQ Metrics			
MT Biotic Index	4.50	5.39	4.33
C-Gatherers + C- Filterers	93.16	95.53	96.78
% Scraper + %Shredder	0.51	0.94	0.86

% Univoltine	6.71	12.00	3.22
% Multivoltine	32.53	10.24	39.91
% Semivoltine	53.92	75.18	54.08
Community Tolerance Quotient	-99.00	-99.00	-99.00
% Hydropsychinae	1.39	0.35	1.29
Lake Metrics			
% Orthocladiinae	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00
% Intolerant	5.63	1.40	0.96
% Non-Insect Individuals	19.37	9.76	28.97
% Non-Insect Taxa	10.53	10.00	11.76
% Crustacea + Mollusca	14.56	7.65	27.68
Average Abundance (per taxon)	41.58	42.50	27.41
NYDEC PMA Metrics			
% Crustacea	14.56	7.65	27.68
% Mollusca	0.00	0.00	0.00
% Non-Chironomidae	76.96	78.82	68.24
UIN	**940-45**	**940-46**	**940-47**

Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
Site	Loving Creek	Loving Creek	Loving Creek	Loving Creek
Rep	3 1/4	3 2/4	3 3/4	3 4/4
Date	08-09-2005	08-09-2005	08-09-2005	08-09-2005
Percent Subsampled	100.00	100.00	100.00	100.00
EcoAnalysts Sample ID	9	10	11	12
Abundance Measures				
Corrected Abundance	244.00	691.00	539.00	916.00
EPT Abundance	49.00	86.00	41.00	371.00
Dominance Measures				
Dominant Taxon	Tanypodinae	Amphipoda	Amphipoda	Amphipoda
Dominant Abundance	84.00	551.00	417.00	446.00
2nd Dominant Taxon	Chironomidae	Tricorythodes minutus	Hirudinea	Tricorythodes minutus
2nd Dominant Abundance	65.00	84.00	54.00	354.00
3rd Dominant Taxon	Tricorythodes minutus	Hirudinea	Tricorythodes minutus	Tanypodinae
3rd Dominant Abundance	20.00	36.00	31.00	32.00
% Dominant Taxon	34.43	79.74	77.37	48.69
% 2 Dominant Taxa	61.07	91.90	87.38	87.34
% 3 Dominant Taxa	69.26	97.11	93.14	90.83
Richness Measures				
Species Richness	14.00	11.00	13.00	16.00
EPT Richness	6.00	3.00	5.00	7.00
Ephemeroptera Richness	4.00	2.00	3.00	4.00
Plecoptera Richness	0.00	0.00	0.00	0.00
Trichoptera Richness	2.00	1.00	2.00	3.00
Chironomidae Richness	2.00	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	12.00	9.00	11.00	14.00
Rhyacophila Richness	0.00	0.00	0.00	0.00
Community Composition				
% Ephemeroptera	18.85	12.30	7.05	39.74
% Plecoptera	0.00	0.00	0.00	0.00
% Trichoptera	1.23	0.14	0.56	0.76
% EPT	20.08	12.45	7.61	40.50
% Coleoptera	1.23	0.14	1.67	0.98
% Diptera	62.70	1.88	3.15	6.22
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	5.33	0.14	1.11	0.98
% Brachycentridae	0.00	0.00	0.00	0.00
% Chironomidae	61.07	1.74	3.15	6.11
% Ephemerellidae	0.00	0.00	0.19	0.00
% Hydropsychidae	0.41	0.00	0.19	0.44
% Odonata	0.41	0.29	0.00	0.55
% Perlidae	0.00	0.00	0.00	0.00

% Pteronarcyidae	0.00	0.00	0.00	0.00
% Simuliidae	1.64	0.00	0.00	0.11
Functional Group Composition				
% Filterers	2.05	0.00	0.19	0.55
% Gatherers	54.10	93.20	87.01	91.81
% Predators	43.03	6.22	11.13	7.21
% Scrapers	0.82	0.00	1.11	0.22
% Shredders	0.00	0.14	0.37	0.22
% Piercer-Herbivores	0.00	0.43	0.19	0.00
% Unclassified	0.00	0.00	0.00	0.00
Filterer Richness	2.00	0.00	1.00	2.00
Gatherer Richness	8.00	5.00	5.00	8.00
Predator Richness	3.00	3.00	2.00	4.00
Scraper Richness	1.00	0.00	2.00	1.00
Shredder Richness	0.00	1.00	2.00	1.00
Piercer-Herbivore Richness	0.00	2.00	1.00	0.00
Unclassified	0.00	0.00	0.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.81	0.32	0.40	0.53
Shannon-Weaver H' (log 2)	2.69	1.07	1.32	1.77
Shannon-Weaver H' (log e)	1.86	0.74	0.91	1.23
Margalef's Richness	2.36	1.53	1.91	2.20
Pielou's J'	0.71	0.31	0.36	0.44
Simpson's Heterogeneity	0.79	0.35	0.39	0.61
Biotic Indices				
% Indiv. w/ HBI Value	86.48	87.84	93.14	60.48
Hilsenhoff Biotic Index	6.09	4.26	4.46	4.53
% Indiv. w/ MTI Value	11.48	12.74	7.42	40.07
Metals Tolerance Index	3.93	3.97	4.08	3.98
% Indiv. w/ FSBI Value	14.34	12.16	6.86	39.41
Fine Sediment Biotic Index	16.00	4.00	16.00	17.00
FSBI - average	1.14	0.36	1.23	1.06
FSBI - weighted average	3.31	4.00	3.92	4.01
% Indiv. w/ TPM Value	37.30	13.46	9.09	42.36
Temp. Pref. Metric - average	1.50	0.73	1.46	1.81
TPM - weighted average	4.33	2.20	2.82	2.23
DEQ MBI (Snake River Basin/High Desert)	2.62	1.68	1.82	2.70
DEQ MBI (Middle Rockies)	2.65	1.66	1.82	2.74
Karr BIBI Metrics				
Long-Lived Taxa Richness	2.00	2.00	3.00	3.00
Clinger Richness	7.00	3.00	6.00	7.00
% Clingers	12.70	12.45	7.98	40.28
Intolerant Taxa Richness	1.00	1.00	1.00	1.00
% Tolerant Individuals	1.42	0.82	1.00	2.35
% Tolerant Taxa	14.29	27.27	15.38	25.00
Coleoptera Richness	2.00	1.00	3.00	3.00

Montana DEQ Metrics				
MT Biotic Index	6.09	4.26	4.46	4.53
C-Gatherers + C- Filterers	56.15	93.20	87.20	92.36
% Scraper + %Shredder	0.82	0.14	1.48	0.44
% Univoltine	66.39	1.74	3.34	6.33
% Multivoltine	11.07	80.32	78.66	49.78
% Semivoltine	8.61	12.45	6.68	38.97
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	0.41	0.00	0.19	0.44
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	6.16	0.16	0.20	0.36
% Non-Insect Individuals	15.57	84.95	87.38	51.75
% Non-Insect Taxa	14.29	18.18	15.38	12.50
% Crustacea + Mollusca	7.38	79.74	77.37	48.69
Average Abundance (per taxon)	17.43	62.82	41.46	57.25
NYDEC PMA Metrics				
% Crustacea	7.38	79.74	77.37	48.69
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	23.36	13.31	9.46	42.14
UIN	**940-9**	**940-10**	**940-11**	**940-12**

Stream	**Silver Creek**	**Silver Creek**	**Silver Creek**	**Silver Creek**
Site	**Float Tube**	**Float Tube**	**Float Tube**	**Float Tube**
Rep	**3 1/4**	**3 2/4**	**3 3/4**	**3 4/4**
Date	**07-11-2006**	**07-11-2006**	**07-11-2006**	**07-11-2006**
Percent Subsampled	**100.00**	**100.00**	**100.00**	**100.00**
EcoAnalysts Sample ID	**49**	**50**	**51**	**52**
Abundance Measures				
Corrected Abundance	420.00	303.00	347.00	303.00
EPT Abundance	262.00	140.00	189.00	141.00
Dominance Measures				
Dominant Taxon	Tricorythodes minutus	Chironomidae	Tricorythodes minutus	Tricorythodes minutus
Dominant Abundance	234.00	118.00	159.00	124.00
2nd Dominant Taxon	Chironomidae	Tricorythodes minutus	Chironomidae	Hirudinea
2nd Dominant Abundance	109.00	114.00	99.00	92.00
3rd Dominant Taxon	Hirudinea	Hirudinea	Hirudinea	Chironomidae
3rd Dominant Abundance	24.00	24.00	32.00	50.00
% Dominant Taxon	55.71	38.94	45.82	40.92
% 2 Dominant Taxa	81.67	76.57	74.35	71.29
% 3 Dominant Taxa	87.38	84.49	83.57	87.79
Richness Measures				
Species Richness	15.00	15.00	15.00	15.00
EPT Richness	8.00	7.00	6.00	7.00
Ephemeroptera Richness	5.00	6.00	4.00	5.00
Plecoptera Richness	0.00	0.00	0.00	0.00
Trichoptera Richness	3.00	1.00	2.00	2.00
Chironomidae Richness	2.00	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	13.00	13.00	13.00	13.00
Rhyacophila Richness	0.00	0.00	0.00	0.00
Community Composition				
% Ephemeroptera	61.67	45.54	53.60	45.54
% Plecoptera	0.00	0.00	0.00	0.00
% Trichoptera	0.71	0.66	0.86	0.99
% EPT	62.38	46.20	54.47	46.53
% Coleoptera	1.19	0.66	0.29	0.33
% Diptera	30.48	43.23	32.56	17.49
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	2.38	3.96	4.03	3.96
% Brachycentridae	0.00	0.00	0.29	0.66
% Chironomidae	30.24	43.23	30.26	17.16
% Ephemerellidae	3.33	3.30	3.75	0.33
% Hydropsychidae	0.24	0.66	0.00	0.00
% Odonata	0.00	0.00	0.00	0.99
% Perlidae	0.00	0.00	0.00	0.00

% Pteronarcyidae	0.00	0.00	0.00	0.00
% Simuliidae	0.00	0.00	0.86	0.00
Functional Group Composition				
% Filterers	0.24	0.66	1.15	0.66
% Gatherers	85.48	82.84	82.13	66.34
% Predators	10.48	12.54	12.68	32.01
% Scrapers	0.24	0.33	0.00	0.00
% Shredders	3.33	3.30	3.75	0.66
% Piercer-Herbivores	0.24	0.33	0.29	0.33
% Unclassified	0.00	0.00	0.00	0.00
Filterer Richness	1.00	1.00	2.00	1.00
Gatherer Richness	7.00	8.00	7.00	8.00
Predator Richness	4.00	3.00	4.00	3.00
Scraper Richness	1.00	1.00	0.00	0.00
Shredder Richness	1.00	1.00	1.00	2.00
Piercer-Herbivore Richness	1.00	1.00	1.00	1.00
Unclassified	0.00	0.00	0.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.58	0.66	0.68	0.66
Shannon-Weaver H' (log 2)	1.92	2.20	2.27	2.21
Shannon-Weaver H' (log e)	1.33	1.53	1.57	1.53
Margalef's Richness	2.32	2.45	2.39	2.45
Pielou's J'	0.49	0.56	0.58	0.57
Simpson's Heterogeneity	0.62	0.70	0.70	0.71
Biotic Indices				
% Indiv. w/ HBI Value	44.29	62.38	54.18	59.08
Hilsenhoff Biotic Index	5.80	5.75	5.61	6.26
% Indiv. w/ MTI Value	62.86	46.86	56.77	46.86
Metals Tolerance Index	3.97	3.99	3.98	3.94
% Indiv. w/ FSBI Value	61.67	46.53	54.18	46.20
Fine Sediment Biotic Index	23.00	28.00	26.00	26.00
FSBI - average	1.53	1.87	1.73	1.73
FSBI - weighted average	4.04	4.05	4.07	4.09
% Indiv. w/ TPM Value	87.86	85.48	83.86	63.04
Temp. Pref. Metric - average	1.80	1.87	2.53	2.20
TPM - weighted average	3.12	3.65	3.38	3.00
DEQ MBI (Snake River Basin/High Desert)	2.72	2.80	2.80	2.71
DEQ MBI (Middle Rockies)	2.80	2.86	2.86	2.77
Karr BIBI Metrics				
Long-Lived Taxa Richness	2.00	4.00	3.00	3.00
Clinger Richness	6.00	7.00	7.00	5.00
% Clingers	59.52	43.23	51.87	45.87
Intolerant Taxa Richness	1.00	2.00	2.00	2.00
% Tolerant Individuals	2.69	1.06	2.13	2.79
% Tolerant Taxa	13.33	13.33	20.00	20.00
Coleoptera Richness	2.00	2.00	1.00	1.00
Montana DEQ Metrics				

MT Biotic Index	5.80	5.75	5.61	6.26
C-Gatherers + C- Filterers	85.71	83.50	83.29	67.00
% Scraper + %Shredder	3.57	3.63	3.75	0.66
% Univoltine	33.81	47.19	34.58	19.14
% Multivoltine	4.29	5.61	9.80	7.92
% Semivoltine	55.95	38.61	46.40	41.58
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	0.24	0.66	0.00	0.00
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	7.53	5.82	7.45	1.68
% Non-Insect Individuals	5.95	9.24	12.39	34.32
% Non-Insect Taxa	13.33	13.33	13.33	13.33
% Crustacea + Mollusca	0.24	1.32	3.17	3.96
Average Abundance (per taxon)	28.00	20.20	23.13	20.20
NYDEC PMA Metrics				
% Crustacea	0.24	1.32	3.17	3.96
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	63.81	47.52	57.35	48.51
UIN	**940-49**	**940-50**	**940-51**	**940-52**

Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
Site	Visitor Site	Visitor Site	Visitor Site	Visitor Site
Rep	4 1/4	4 2/4	4 3/4	4 4/4
Date	08-09-2005	08-09-2005	08-09-2005	08-09-2005
Percent Subsampled	100.00	100.00	100.00	100.00
EcoAnalysts Sample ID	13	14	15	16
Abundance Measures				
Corrected Abundance	384.00	317.00	1172.00	530.00
EPT Abundance	223.00	139.00	383.00	266.00
Dominance Measures				
Dominant Taxon	Baetis tricaudatus	Amphipoda	Amphipoda	Amphipoda
Dominant Abundance	193.00	158.00	640.00	242.00
2nd Dominant Taxon	Amphipoda	Baetis tricaudatus	Baetis tricaudatus	Baetis tricaudatus
2nd Dominant Abundance	111.00	65.00	316.00	140.00
3rd Dominant Taxon	Hirudinea	Tricorythodes minutus	Hirudinea	Diphetor hageni
3rd Dominant Abundance	38.00	40.00	82.00	70.00
% Dominant Taxon	50.26	49.84	54.61	45.66
% 2 Dominant Taxa	79.17	70.35	81.57	72.08
% 3 Dominant Taxa	89.06	82.97	88.57	85.28
Richness Measures				
Species Richness	14.00	13.00	18.00	18.00
EPT Richness	6.00	8.00	9.00	10.00
Ephemeroptera Richness	4.00	5.00	7.00	7.00
Plecoptera Richness	0.00	1.00	0.00	1.00
Trichoptera Richness	2.00	2.00	2.00	2.00
Chironomidae Richness	2.00	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	12.00	11.00	16.00	16.00
Rhyacophila Richness	0.00	0.00	0.00	0.00
Community Composition				
% Ephemeroptera	52.86	35.96	30.63	43.58
% Plecoptera	0.00	0.32	0.00	0.19
% Trichoptera	5.21	7.57	2.05	6.42
% EPT	58.07	43.85	32.68	50.19
% Coleoptera	0.26	0.00	0.34	0.75
% Diptera	2.60	3.15	5.12	2.45
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	52.60	23.03	29.61	40.19
% Brachycentridae	0.00	0.00	0.00	0.00
% Chironomidae	1.56	2.84	4.27	2.08
% Ephemerellidae	0.00	0.00	0.51	0.38
% Hydropsychidae	1.82	6.31	0.77	5.66
% Odonata	0.26	0.00	0.26	0.00
% Perlidae	0.00	0.32	0.00	0.19
% Pteronarcyidae	0.00	0.00	0.00	0.00

% Simuliidae	0.78	0.00	0.68	0.00
Functional Group Composition				
% Filterers	2.60	6.31	1.45	5.66
% Gatherers	83.07	88.01	88.99	90.57
% Predators	10.42	4.42	7.42	1.89
% Scrapers	3.65	1.26	1.45	1.13
% Shredders	0.26	0.00	0.68	0.57
% Piercer-Herbivores	0.00	0.00	0.00	0.00
% Unclassified	0.00	0.00	0.00	0.19
Filterer Richness	2.00	1.00	2.00	1.00
Gatherer Richness	6.00	7.00	9.00	9.00
Predator Richness	3.00	4.00	3.00	3.00
Scraper Richness	2.00	1.00	2.00	2.00
Shredder Richness	1.00	0.00	2.00	2.00
Piercer-Herbivore Richness	0.00	0.00	0.00	0.00
Unclassified	0.00	0.00	0.00	1.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.61	0.67	0.59	0.68
Shannon-Weaver H' (log 2)	2.02	2.24	1.96	2.26
Shannon-Weaver H' (log e)	1.40	1.55	1.36	1.57
Margalef's Richness	2.18	2.08	2.41	2.71
Pielou's J'	0.53	0.61	0.47	0.54
Simpson's Heterogeneity	0.65	0.69	0.62	0.70
Biotic Indices				
% Indiv. w/ HBI Value	98.44	85.80	98.98	98.68
Hilsenhoff Biotic Index	4.47	4.28	4.37	4.23
% Indiv. w/ MTI Value	57.81	42.27	32.68	47.92
Metals Tolerance Index	4.79	4.51	4.62	3.81
% Indiv. w/ FSBI Value	53.65	41.32	31.06	49.62
Fine Sediment Biotic Index	21.00	29.00	29.00	39.00
FSBI - average	1.50	2.23	1.61	2.17
FSBI - weighted average	4.97	4.64	4.87	4.56
% Indiv. w/ TPM Value	55.73	42.90	35.67	48.49
Temp. Pref. Metric - average	1.79	1.69	2.06	2.11
TPM - weighted average	4.84	3.63	4.81	4.08
DEQ MBI (Snake River Basin/High Desert)	2.89	2.83	2.74	3.13
DEQ MBI (Middle Rockies)	2.94	2.89	2.79	3.21
Karr BIBI Metrics				
Long-Lived Taxa Richness	2.00	2.00	3.00	4.00
Clinger Richness	7.00	6.00	9.00	9.00
% Clingers	57.81	41.96	32.59	47.74
Intolerant Taxa Richness	0.00	2.00	2.00	3.00
% Tolerant Individuals	0.26	0.00	0.26	0.00
% Tolerant Taxa	7.14	0.00	5.56	0.00
Coleoptera Richness	1.00	0.00	2.00	2.00
Montana DEQ Metrics				
MT Biotic Index	4.47	4.28	4.37	4.23

C-Gatherers + C- Filterers	85.68	94.32	90.44	96.23
% Scraper + %Shredder	3.91	1.26	2.13	1.70
% Univoltine	1.56	3.47	4.95	4.91
% Multivoltine	84.64	72.56	85.92	86.42
% Semivoltine	0.52	12.93	0.68	1.51
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	1.82	6.31	0.77	5.66
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	0.00	0.74	0.69	3.06
% Non-Insect Individuals	38.80	53.00	61.60	46.60
% Non-Insect Taxa	14.29	15.38	11.11	11.11
% Crustacea + Mollusca	28.91	49.84	54.61	45.66
Average Abundance (per taxon)	27.43	24.38	65.11	29.44
NYDEC PMA Metrics				
% Crustacea	28.91	49.84	54.61	45.66
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	59.64	44.16	34.13	51.32
UIN	**940-13**	**940-14**	**940-15**	**940-16**

Stream	Silver Creek Visitor Site	Silver Creek Visitor Site	Silver Creek Visitor Site	Silver Creek Visitor Site
Site	4 1/4	4 2/4	4 3/4	4 4/4
Rep	07-11-2006	07-11-2006	07-11-2006	07-11-2006
Date	100.00	100.00	100.00	100.00
Percent Subsampled	53	54	55	56
EcoAnalysts Sample ID				
Abundance Measures				
Corrected Abundance	2065.00	940.00	969.00	1120.00
EPT Abundance	1386.00	659.00	700.00	846.00
Dominance Measures				
Dominant Taxon	Ephemerella inermis/ infrequens	Ephemerella inermis/ infrequens	Ephemerella inermis/ infrequens	Ephemerella inermis/ infrequens
Dominant Abundance	541.00	400.00	399.00	430.00
2nd Dominant Taxon	Baetis tricaudatus	Chironomidae	Chironomidae	Chironomidae
2nd Dominant Abundance	479.00	210.00	221.00	196.00
3rd Dominant Taxon	Simuliidae	Baetis tricaudatus	Baetis tricaudatus	Tricorythodes minutus
3rd Dominant Abundance	431.00	149.00	148.00	121.00
% Dominant Taxon	26.20	42.55	41.18	38.39
% 2 Dominant Taxa	49.39	64.89	63.98	55.89
% 3 Dominant Taxa	70.27	80.74	79.26	66.70
Richness Measures				
Species Richness	21.00	16.00	15.00	19.00
EPT Richness	12.00	8.00	7.00	11.00
Ephemeroptera Richness	6.00	4.00	4.00	6.00
Plecoptera Richness	2.00	1.00	0.00	1.00
Trichoptera Richness	4.00	3.00	3.00	4.00
Chironomidae Richness	2.00	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	19.00	14.00	13.00	17.00
Rhyacophila Richness	0.00	0.00	0.00	0.00
Community Composition				
% Ephemeroptera	66.20	63.94	63.88	70.27
% Plecoptera	0.15	0.43	0.00	0.09
% Trichoptera	0.77	5.74	8.36	5.18
% EPT	67.12	70.11	72.24	75.54
% Coleoptera	0.19	0.11	0.41	0.18
% Diptera	28.72	25.43	24.56	17.86
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	32.25	20.21	21.88	21.07
% Brachycentridae	0.19	1.28	0.31	0.36
% Chironomidae	7.80	24.68	23.01	17.68
% Ephemerellidae	26.20	42.55	41.18	38.39
% Hydropsychidae	0.05	0.53	2.58	0.36
% Odonata	0.00	0.00	0.00	0.09
% Perlidae	0.00	0.00	0.00	0.00

% Pteronarcyidae	0.00	0.00	0.00	0.00
% Simuliidae	20.87	0.43	0.83	0.18
Functional Group Composition				
% Filterers	21.11	2.23	3.72	0.89
% Gatherers	51.04	46.70	47.37	54.20
% Predators	1.02	4.57	2.27	2.05
% Scrapers	0.53	3.94	5.47	4.46
% Shredders	26.25	42.55	41.18	38.39
% Piercer-Herbivores	0.00	0.00	0.00	0.00
% Unclassified	0.05	0.00	0.00	0.00
Filterer Richness	3.00	3.00	3.00	3.00
Gatherer Richness	9.00	7.00	6.00	8.00
Predator Richness	4.00	4.00	4.00	5.00
Scraper Richness	2.00	1.00	1.00	2.00
Shredder Richness	2.00	1.00	1.00	1.00
Piercer-Herbivore Richness	0.00	0.00	0.00	0.00
Unclassified	1.00	0.00	0.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.82	0.75	0.74	0.80
Shannon-Weaver H' (log 2)	2.72	2.48	2.47	2.66
Shannon-Weaver H' (log e)	1.89	1.72	1.71	1.85
Margalef's Richness	2.62	2.19	2.04	2.56
Pielou's J'	0.62	0.62	0.63	0.63
Simpson's Heterogeneity	0.81	0.74	0.75	0.79
Biotic Indices				
% Indiv. w/ HBI Value	91.62	98.83	99.17	88.84
Hilsenhoff Biotic Index	3.89	3.37	3.47	3.37
% Indiv. w/ MTI Value	87.46	70.74	73.79	75.45
Metals Tolerance Index	3.67	3.38	3.33	3.17
% Indiv. w/ FSBI Value	66.15	66.49	67.80	70.89
Fine Sediment Biotic Index	38.00	35.00	33.00	36.00
FSBI - average	1.81	2.19	2.20	1.89
FSBI - weighted average	4.35	4.28	4.25	4.16
% Indiv. w/ TPM Value	94.33	88.62	90.82	88.48
Temp. Pref. Metric - average	2.24	2.44	2.60	2.21
TPM - weighted average	4.85	5.33	5.20	4.82
DEQ MBI (Snake River Basin/High Desert)	3.81	3.46	3.45	3.77
DEQ MBI (Middle Rockies)	3.91	3.53	3.51	3.87
Karr BIBI Metrics				
Long-Lived Taxa Richness	3.00	2.00	2.00	3.00
Clinger Richness	13.00	9.00	8.00	12.00
% Clingers	61.45	28.09	32.30	37.23
Intolerant Taxa Richness	4.00	3.00	2.00	3.00
% Tolerant Individuals	0.11	0.11	0.00	0.20
% Tolerant Taxa	9.52	6.25	0.00	10.53
Coleoptera Richness	3.00	1.00	1.00	2.00
Montana DEQ Metrics				

MT Biotic Index	3.89	3.37	3.47	3.37
C-Gatherers + C- Filterers	72.15	48.94	51.08	55.09
% Scraper + %Shredder	26.78	46.49	46.65	42.86
% Univoltine	34.38	69.26	65.12	56.52
% Multivoltine	56.66	27.34	29.72	30.18
% Semivoltine	7.89	1.28	1.24	10.98
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	0.05	0.53	2.58	0.36
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	28.96	44.78	41.83	43.72
% Non-Insect Individuals	3.97	4.36	2.79	6.34
% Non-Insect Taxa	9.52	12.50	13.33	10.53
% Crustacea + Mollusca	3.49	2.77	1.44	4.73
Average Abundance (per taxon)	98.33	58.75	64.60	58.95
NYDEC PMA Metrics				
% Crustacea	3.49	2.77	1.44	4.73
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	88.23	70.96	74.20	75.98
UIN	**940-53**	**940-54**	**940-55**	**940-56**

Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
Site	Riffle Silver Creek	Riffle Silver Creek	Riffle Silver Creek	Riffle Silver Creek
Rep	5 1/4	5 2/4	5 3/4	5 4/4
Date	08-09-2005	08-09-2005	08-09-2005	08-09-2005
Percent Subsampled	100.00	100.00	100.00	100.00
EcoAnalysts Sample ID	17	18	19	20
Abundance Measures				
Corrected Abundance	283.00	1292.00	1504.00	1540.00
EPT Abundance	241.00	996.00	1225.00	1014.00
Dominance Measures				
Dominant Taxon	Baetis tricaudatus	Baetis tricaudatus	Baetis tricaudatus	Baetis tricaudatus
Dominant Abundance	149.00	413.00	649.00	435.00
2nd Dominant Taxon	Hydropsyche sp.	Acerpenna pygmaea	Diphetor hageni	Amphipoda
2nd Dominant Abundance	26.00	244.00	318.00	240.00
3rd Dominant Taxon	Diphetor hageni	Ephemerella inermis/infrequens	Amphipoda	Hydropsyche sp.
3rd Dominant Abundance	24.00	127.00	153.00	137.00
% Dominant Taxon	52.65	31.97	43.15	28.25
% 2 Dominant Taxa	61.84	50.85	64.30	43.83
% 3 Dominant Taxa	70.32	60.68	74.47	52.73
Richness Measures				
Species Richness	20.00	20.00	21.00	21.00
EPT Richness	12.00	10.00	10.00	11.00
Ephemeroptera Richness	6.00	7.00	6.00	6.00
Plecoptera Richness	1.00	0.00	2.00	1.00
Trichoptera Richness	5.00	3.00	2.00	4.00
Chironomidae Richness	2.00	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	18.00	18.00	19.00	19.00
Rhyacophila Richness	1.00	0.00	0.00	1.00
Community Composition				
% Ephemeroptera	68.55	74.77	71.61	53.51
% Plecoptera	0.35	0.00	0.13	0.06
% Trichoptera	16.25	2.32	9.71	12.27
% EPT	85.16	77.09	81.45	65.84
% Coleoptera	1.41	1.01	0.93	2.99
% Diptera	6.71	3.79	3.19	5.19
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	62.19	55.26	66.69	40.13
% Brachycentridae	1.06	0.00	0.00	0.52
% Chironomidae	5.65	3.48	2.39	4.68
% Ephemerellidae	4.24	9.83	4.12	4.48
% Hydropsychidae	12.37	2.17	8.44	8.90
% Odonata	0.00	6.50	0.13	1.56
% Perlidae	0.00	0.00	0.00	0.00

% Pteronarcyidae	0.00	0.00	0.00	0.00
% Simuliidae	0.00	0.15	0.80	0.52
Functional Group Composition				
% Filterers	13.43	2.32	9.24	9.94
% Gatherers	71.38	76.47	80.25	71.36
% Predators	6.71	10.76	4.79	10.78
% Scrapers	3.18	0.46	1.53	3.44
% Shredders	5.30	9.98	4.19	4.48
% Piercer-Herbivores	0.00	0.00	0.00	0.00
% Unclassified	0.00	0.00	0.00	0.00
Filterer Richness	3.00	2.00	2.00	3.00
Gatherer Richness	8.00	10.00	11.00	10.00
Predator Richness	4.00	3.00	4.00	5.00
Scraper Richness	2.00	2.00	2.00	2.00
Shredder Richness	3.00	3.00	2.00	1.00
Piercer-Herbivore Richness	0.00	0.00	0.00	0.00
Unclassified	0.00	0.00	0.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.82	0.91	0.78	1.01
Shannon-Weaver H' (log 2)	2.72	3.03	2.59	3.37
Shannon-Weaver H' (log e)	1.88	2.10	1.80	2.34
Margalef's Richness	3.37	2.65	2.73	2.72
Pielou's J'	0.63	0.70	0.59	0.77
Simpson's Heterogeneity	0.70	0.83	0.75	0.86
Biotic Indices				
% Indiv. w/ HBI Value	97.17	80.34	97.01	91.30
Hilsenhoff Biotic Index	4.34	4.12	4.41	4.49
% Indiv. w/ MTI Value	84.81	49.46	80.05	58.70
Metals Tolerance Index	4.38	4.24	3.78	4.12
% Indiv. w/ FSBI Value	83.39	58.90	78.52	61.62
Fine Sediment Biotic Index	51.00	32.00	33.00	43.00
FSBI - average	2.55	1.60	1.57	2.05
FSBI - weighted average	4.78	4.24	4.63	4.41
% Indiv. w/ TPM Value	84.81	52.24	81.05	62.21
Temp. Pref. Metric - average	1.95	1.85	2.05	2.05
TPM - weighted average	4.34	4.87	4.19	4.18
DEQ MBI (Snake River Basin/High Desert)	3.63	3.80	3.61	3.85
DEQ MBI (Middle Rockies)	3.76	3.90	3.71	3.96
Karr BIBI Metrics				
Long-Lived Taxa Richness	4.00	4.00	3.00	3.00
Clinger Richness	11.00	9.00	13.00	13.00
% Clingers	80.92	40.33	76.46	56.49
Intolerant Taxa Richness	5.00	2.00	4.00	5.00
% Tolerant Individuals	0.00	8.19	0.21	1.99
% Tolerant Taxa	0.00	10.00	9.52	9.52
Coleoptera Richness	2.00	2.00	5.00	4.00
Montana DEQ Metrics				

MT Biotic Index	4.34	4.12	4.41	4.49
C-Gatherers + C- Filterers	84.81	78.79	89.49	81.30
% Scraper + %Shredder	8.48	10.45	5.72	7.92
% Univoltine	12.01	22.60	6.98	14.16
% Multivoltine	67.84	45.05	76.60	55.19
% Semivoltine	3.53	1.63	1.33	7.27
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	12.37	2.17	8.44	8.90
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	6.55	23.60	4.59	10.31
% Non-Insect Individuals	6.71	11.61	14.30	24.42
% Non-Insect Taxa	10.00	10.00	9.52	9.52
% Crustacea + Mollusca	3.53	8.44	10.17	15.58
Average Abundance (per taxon)	14.15	64.60	71.62	73.33
NYDEC PMA Metrics				
% Crustacea	3.53	8.44	10.17	15.58
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	87.63	84.91	83.31	70.91
UIN	**940-17**	**940-18**	**940-19**	**940-20**

Stream	**Silver Creek**	**Silver Creek**	**Silver Creek**	**Silver Creek**
Site	**Riffle Silver**	**Riffle Silver**	**Riffle Silver**	**Riffle Silver**
Rep	**5 1/4**	**5 2/4**	**5 3/4**	**5 4/4**
Date	**07-12-2006**	**07-12-2006**	**07-12-2006**	**07-12-2006**
Percent Subsampled	**100.00**	**100.00**	**100.00**	**100.00**
EcoAnalysts Sample ID	**57**	**58**	**59**	**60**
Abundance Measures				
Corrected Abundance	1400.00	936.00	795.00	1063.00
EPT Abundance	1090.00	272.00	648.00	788.00
Dominance Measures				
Dominant Taxon	Ephemerella inermis/ infrequens	Simuliidae	Baetis tricaudatus	Ephemerella inermis/ infrequens
Dominant Abundance	647.00	642.00	407.00	410.00
2nd Dominant Taxon	Baetis tricaudatus	Baetis tricaudatus	Ephemerella inermis/ infrequens	Baetis tricaudatus
2nd Dominant Abundance	338.00	193.00	185.00	276.00
3rd Dominant Taxon	Hirudinea	Ephemerella inermis/ infrequens	Chironomidae	Simuliidae
3rd Dominant Abundance	96.00	58.00	95.00	154.00
% Dominant Taxon	46.21	68.59	51.19	38.57
% 2 Dominant Taxa	70.36	89.21	74.47	64.53
% 3 Dominant Taxa	77.21	95.41	86.42	79.02
Richness Measures				
Species Richness	25.00	14.00	20.00	20.00
EPT Richness	13.00	8.00	10.00	9.00
Ephemeroptera Richness	6.00	4.00	3.00	3.00
Plecoptera Richness	0.00	1.00	1.00	2.00
Trichoptera Richness	7.00	3.00	6.00	4.00
Chironomidae Richness	2.00	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	23.00	12.00	18.00	18.00
Rhyacophila Richness	1.00	0.00	1.00	0.00
Community Composition				
% Ephemeroptera	74.79	27.78	76.10	66.70
% Plecoptera	0.00	0.21	0.13	0.38
% Trichoptera	3.07	1.07	5.28	7.06
% EPT	77.86	29.06	81.51	74.13
% Coleoptera	0.36	0.00	0.38	0.56
% Diptera	9.86	70.62	17.74	22.67
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	27.64	20.94	52.83	28.13
% Brachycentridae	0.21	0.00	0.38	0.00
% Chironomidae	6.57	1.92	12.70	7.34
% Ephemerellidae	46.21	6.20	23.27	38.57
% Hydropsychidae	1.07	0.11	2.39	5.27

% Odonata	0.00	0.00	0.00	0.00
% Perlidae	0.00	0.00	0.00	0.00
% Pteronarcyidae	0.00	0.00	0.00	0.00
% Simulilidae	2.86	68.59	4.28	14.49
Functional Group Composition				
% Filterers	4.14	68.70	7.04	19.76
% Gatherers	39.29	23.29	65.16	36.50
% Predators	8.50	0.85	2.01	2.82
% Scrapers	1.57	0.85	2.26	1.69
% Shredders	46.36	6.20	23.40	39.13
% Piercer-Herbivores	0.14	0.11	0.13	0.09
% Unclassified	0.00	0.00	0.00	0.00
Filterer Richness	3.00	2.00	3.00	2.00
Gatherer Richness	9.00	5.00	6.00	7.00
Predator Richness	6.00	4.00	6.00	4.00
Scraper Richness	3.00	1.00	2.00	2.00
Shredder Richness	3.00	1.00	2.00	4.00
Piercer-Herbivore Richness	1.00	1.00	1.00	1.00
Unclassified	0.00	0.00	0.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.75	0.43	0.65	0.76
Shannon-Weaver H' (log 2)	2.49	1.43	2.16	2.54
Shannon-Weaver H' (log e)	1.72	0.99	1.49	1.76
Margalef's Richness	3.31	1.90	2.85	2.73
Pielou's J'	0.54	0.38	0.50	0.59
Simpson's Heterogeneity	0.72	0.48	0.67	0.76
Biotic Indices				
% Indiv. w/ HBI Value	99.00	100.00	100.00	100.00
Hilsenhoff Biotic Index	3.08	5.24	3.73	3.44
% Indiv. w/ MTI Value	80.71	97.12	86.92	88.90
Metals Tolerance Index	3.60	4.13	4.25	3.81
% Indiv. w/ FSBI Value	76.50	28.31	80.38	73.19
Fine Sediment Biotic Index	53.00	29.00	55.00	34.00
FSBI - average	2.12	2.07	2.75	1.70
FSBI - weighted average	4.32	4.67	4.67	4.40
% Indiv. w/ TPM Value	84.29	97.44	95.72	93.41
Temp. Pref. Metric - average	2.16	2.00	2.45	2.40
TPM - weighted average	5.40	5.05	5.13	5.20
DEQ MBI (Snake River Basin/High Desert)	3.86	2.17	3.48	3.64
DEQ MBI (Middle Rockies)	3.97	2.22	3.58	3.72
Karr BIBI Metrics				
Long-Lived Taxa Richness	5.00	0.00	3.00	3.00
Clinger Richness	15.00	7.00	12.00	11.00
% Clingers	34.36	90.81	62.89	50.52
Intolerant Taxa Richness	5.00	3.00	4.00	3.00
% Tolerant Individuals	0.36	0.00	0.25	0.38
% Tolerant Taxa	8.00	0.00	5.00	5.00
Coleoptera Richness	4.00	0.00	2.00	3.00

Functional Group Composition				
% Filterers	20.69	10.28	33.41	1.70
% Gatherers	69.75	84.30	59.51	82.34
% Predators	5.95	3.79	6.79	14.79
% Scrapers	2.87	1.35	0.04	0.74
% Shredders	0.34	0.23	0.08	0.00
% Piercer-Herbivores	0.40	0.05	0.16	0.43
% Unclassified	0.00	0.00	0.00	0.00
Filterer Richness	2.00	3.00	3.00	3.00
Gatherer Richness	14.00	15.00	16.00	13.00
Predator Richness	9.00	8.00	8.00	3.00
Scraper Richness	2.00	2.00	1.00	2.00
Shredder Richness	4.00	3.00	1.00	0.00
Piercer-Herbivore Richness	2.00	1.00	1.00	1.00
Unclassified	0.00	0.00	0.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.84	0.82	1.01	0.87
Shannon-Weaver H' (log 2)	2.78	2.73	3.35	2.88
Shannon-Weaver H' (log e)	1.93	1.89	2.32	1.99
Margalef's Richness	3.96	4.02	3.71	3.07
Pielou's J'	0.55	0.55	0.68	0.65
Simpson's Heterogeneity	0.79	0.71	0.87	0.80
Biotic Indices				
% Indiv. w/ HBI Value	99.14	92.92	99.11	88.51
Hilsenhoff Biotic Index	4.59	4.38	4.88	4.97
% Indiv. w/ MTI Value	30.68	30.54	43.90	21.70
Metals Tolerance Index	4.64	4.36	3.88	4.10
% Indiv. w/ FSBI Value	51.22	77.31	43.94	21.81
Fine Sediment Biotic Index	49.00	59.00	51.00	44.00
FSBI - average	1.48	1.84	1.70	2.00
FSBI - weighted average	3.44	2.82	3.19	3.58
% Indiv. w/ TPM Value	57.97	80.74	67.36	38.30
Temp. Pref. Metric - average	1.94	2.09	1.93	2.18
TPM - weighted average	4.27	5.00	4.67	4.42
DEQ MBI (Snake River Basin/High Desert)	3.56	3.42	3.71	3.05
DEQ MBI (Middle Rockies)	3.62	3.51	3.78	3.11
Karr BIBI Metrics				
Long-Lived Taxa Richness	5.00	5.00	4.00	5.00
Clinger Richness	13.00	15.00	13.00	12.00
% Clingers	53.41	80.29	56.54	26.91
Intolerant Taxa Richness	4.00	6.00	4.00	3.00
% Tolerant Individuals	0.56	0.34	0.29	1.08
% Tolerant Taxa	12.12	12.50	10.00	13.64
Coleoptera Richness	6.00	6.00	5.00	5.00
Montana DEQ Metrics				
MT Biotic Index	4.59	4.38	4.88	4.97
C-Gatherers + C- Filterers	90.44	94.59	92.93	84.04

Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
Site	Stalker Creek	Stalker Creek	Stalker Creek	Stalker Creek
Rep	6 1/4	6 2/4	6 3/4	6 4/4
Date	07-11-2006	07-11-2006	07-11-2006	07-11-2006
Percent Subsampled	100.00	100.00	100.00	100.00
EcoAnalysts Sample ID	61	62	63	64
Abundance Measures				
Corrected Abundance	3921.00	3561.00	1454.00	4252.00
EPT Abundance	1111.00	398.00	303.00	931.00
Dominance Measures				
Dominant Taxon	Chironomidae	Simuliidae	Cleptelmis addenda	Amphipoda
Dominant Abundance	1044.00	2976.00	314.00	1603.00
2nd Dominant Taxon	Amphipoda	Baetis tricaudatus	Amphipoda	Chironomidae
2nd Dominant Abundance	931.00	217.00	245.00	1237.00
3rd Dominant Taxon	Simuliidae	Amphipoda	Chironomidae	Hydroptila sp.
3rd Dominant Abundance	366.00	103.00	211.00	524.00
% Dominant Taxon	26.63	83.57	21.60	37.70
% 2 Dominant Taxa	50.37	89.67	38.45	66.79
% 3 Dominant Taxa	59.70	92.56	52.96	79.12
Richness Measures				
Species Richness	37.00	27.00	23.00	27.00
EPT Richness	16.00	16.00	9.00	12.00
Ephemeroptera Richness	5.00	9.00	4.00	6.00
Plecoptera Richness	0.00	0.00	0.00	0.00
Trichoptera Richness	11.00	7.00	5.00	6.00
Chironomidae Richness	2.00	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	35.00	25.00	21.00	25.00
Rhyacophila Richness	1.00	1.00	0.00	1.00
Community Composition				
% Ephemeroptera	10.56	9.97	8.73	6.19
% Plecoptera	0.00	0.00	0.00	0.00
% Trichoptera	17.78	1.21	12.10	15.71
% EPT	28.33	11.18	20.84	21.90
% Coleoptera	7.19	0.22	35.14	4.89
% Diptera	40.14	85.03	22.35	32.08
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	5.69	7.67	4.13	3.15
% Brachycentridae	0.08	0.03	0.00	0.02
% Chironomidae	27.88	1.35	14.92	29.33
% Ephemerellidae	1.38	0.17	1.24	1.27
% Hydropsychidae	7.83	0.11	1.24	2.96
% Odonata	0.03	0.06	0.00	0.05
% Perlidae	0.00	0.00	0.00	0.00
% Pteronarcyidae	0.00	0.00	0.00	0.00

% Simuliidae	9.33	83.57	3.30	2.12
Functional Group Composition				
% Filterers	17.32	83.71	4.61	5.10
% Gatherers	67.92	14.15	69.81	75.68
% Predators	3.65	0.93	6.12	4.59
% Scrapers	1.66	0.31	7.77	0.78
% Shredders	1.68	0.20	1.44	1.27
% Piercer-Herbivores	7.78	0.70	10.25	12.58
% Unclassified	0.00	0.00	0.00	0.00
Filterer Richness	4.00	3.00	3.00	3.00
Gatherer Richness	11.00	13.00	9.00	12.00
Predator Richness	13.00	6.00	5.00	8.00
Scraper Richness	2.00	1.00	2.00	1.00
Shredder Richness	5.00	2.00	3.00	1.00
Piercer-Herbivore Richness	2.00	2.00	1.00	2.00
Unclassified	0.00	0.00	0.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.99	0.34	1.03	0.79
Shannon-Weaver H' (log 2)	3.28	1.14	3.42	2.62
Shannon-Weaver H' (log e)	2.27	0.79	2.37	1.82
Margalef's Richness	4.35	3.18	3.02	3.11
Pielou's J'	0.63	0.24	0.76	0.55
Simpson's Heterogeneity	0.84	0.30	0.88	0.75
Biotic Indices				
% Indiv. w/ HBI Value	96.71	97.78	96.63	98.14
Hilsenhoff Biotic Index	5.04	5.80	4.87	5.01
% Indiv. w/ MTI Value	41.75	94.66	41.61	26.34
Metals Tolerance Index	4.22	4.02	4.09	4.16
% Indiv. w/ FSBI Value	34.74	10.61	53.16	25.82
Fine Sediment Biotic Index	57.00	48.00	49.00	51.00
FSBI - average	1.54	1.78	2.13	1.89
FSBI - weighted average	4.30	4.63	3.35	4.42
% Indiv. w/ TPM Value	70.80	95.39	70.08	56.87
Temp. Pref. Metric - average	1.89	1.85	2.26	1.96
TPM - weighted average	4.28	4.89	4.49	4.13
DEQ MBI (Snake River Basin/High Desert)	3.92	2.21	3.49	3.20
DEQ MBI (Middle Rockies)	4.01	2.30	3.54	3.26
Karr BIBI Metrics				
Long-Lived Taxa Richness	3.00	2.00	5.00	3.00
Clinger Richness	16.00	12.00	12.00	13.00
% Clingers	42.03	94.27	57.98	26.90
Intolerant Taxa Richness	6.00	4.00	1.00	3.00
% Tolerant Individuals	0.45	0.26	0.07	0.12
% Tolerant Taxa	10.81	11.11	4.35	14.81
Coleoptera Richness	9.00	3.00	4.00	5.00
Montana DEQ Metrics				
MT Biotic Index	5.04	5.80	4.87	5.01

C-Gatherers + C- Filterers	85.23	97.87	74.42	80.79
% Scraper + %Shredder	3.34	0.51	9.22	2.05
% Univoltine	31.06	1.68	23.11	31.87
% Multivoltine	51.52	95.28	38.24	56.07
% Semivoltine	8.90	2.13	32.39	5.55
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	7.83	0.11	1.24	2.96
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	2.19	0.32	1.28	1.44
% Non-Insect Individuals	24.31	3.51	21.66	41.09
% Non-Insect Taxa	5.41	7.41	8.70	7.41
% Crustacea + Mollusca	23.74	2.89	16.85	37.70
Average Abundance (per taxon)	106.00	131.90	63.22	157.50
NYDEC PMA Metrics				
% Crustacea	23.74	2.89	16.85	37.70
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	47.82	95.14	63.41	29.59
UIN	**940-61**	**940-62**	**940-63**	**940-64**

Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
Site	Lower Grove	Lower Grove	Lower Grove	Lower Grove
Rep	7 1/4	7 2/4	7 3/4	7 4/4
Date	08-10-2005	08-10-2005	08-10-2005	08-10-2005
Percent Subsampled	100.00	100.00	100.00	100.00
EcoAnalysts Sample ID	25	26	27	28
Abundance Measures				
Corrected Abundance	959.00	1954.00	1775.00	1606.00
EPT Abundance	744.00	1781.00	1535.00	1456.00
Dominance Measures				
Dominant Taxon	Baetis tricaudatus	Baetis tricaudatus	Baetis tricaudatus	Baetis tricaudatus
Dominant Abundance	422.00	739.00	658.00	719.00
2nd Dominant Taxon	Diphetor hageni	Tricorythodes minutus	Diphetor hageni	Diphetor hageni
2nd Dominant Abundance	171.00	276.00	464.00	200.00
3rd Dominant Taxon	Simuliidae	Diphetor hageni	Helicopsyche borealis	Tricorythodes minutus
3rd Dominant Abundance	76.00	271.00	118.00	197.00
% Dominant Taxon	44.00	37.82	37.07	44.77
% 2 Dominant Taxa	61.84	51.94	63.21	57.22
% 3 Dominant Taxa	69.76	65.81	69.86	69.49
Richness Measures				
Species Richness	16.00	15.00	20.00	16.00
EPT Richness	10.00	9.00	12.00	9.00
Ephemeroptera Richness	7.00	7.00	8.00	7.00
Plecoptera Richness	0.00	0.00	0.00	0.00
Trichoptera Richness	3.00	2.00	4.00	2.00
Chironomidae Richness	2.00	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	14.00	13.00	18.00	14.00
Rhyacophila Richness	1.00	0.00	1.00	0.00
Community Composition				
% Ephemeroptera	69.86	91.04	79.10	89.79
% Plecoptera	0.00	0.00	0.00	0.00
% Trichoptera	7.72	0.10	7.38	0.87
% EPT	77.58	91.15	86.48	90.66
% Coleoptera	0.83	0.05	0.56	0.12
% Diptera	13.24	1.43	4.96	1.93
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	63.19	58.34	64.79	67.93
% Brachycentridae	0.00	0.00	0.00	0.00
% Chironomidae	5.32	1.13	2.37	1.81
% Ephemerellidae	5.32	9.06	6.54	2.30
% Hydropsychidae	2.50	0.05	0.56	0.06
% Odonata	0.00	0.00	0.00	0.00
% Perlidae	0.00	0.00	0.00	0.00
% Pteronarcyidae	0.00	0.00	0.00	0.00

% Simuliidae	7.92	0.31	2.59	0.06
Functional Group Composition				
% Filterers	10.43	0.36	3.15	0.12
% Gatherers	76.12	87.92	78.82	92.40
% Predators	2.19	2.61	4.45	4.23
% Scrapers	5.94	0.05	6.93	0.93
% Shredders	5.32	9.06	6.54	2.30
% Piercer-Herbivores	0.00	0.00	0.11	0.00
% Unclassified	0.00	0.00	0.00	0.00
Filterer Richness	2.00	2.00	2.00	2.00
Gatherer Richness	8.00	9.00	10.00	9.00
Predator Richness	3.00	2.00	4.00	2.00
Scraper Richness	2.00	1.00	2.00	2.00
Shredder Richness	1.00	1.00	1.00	1.00
Piercer-Herbivore Richness	0.00	0.00	1.00	0.00
Unclassified	0.00	0.00	0.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.81	0.82	0.84	0.78
Shannon-Weaver H' (log 2)	2.69	2.72	2.80	2.59
Shannon-Weaver H' (log e)	1.87	1.88	1.94	1.80
Margalef's Richness	2.18	1.85	2.54	2.03
Pielou's J'	0.67	0.70	0.65	0.65
Simpson's Heterogeneity	0.76	0.79	0.78	0.75
Biotic Indices				
% Indiv. w/ HBI Value	98.33	79.73	95.44	77.46
Hilsenhoff Biotic Index	4.46	3.72	4.35	4.11
% Indiv. w/ MTI Value	84.88	75.28	83.66	72.85
Metals Tolerance Index	3.80	3.83	3.36	4.06
% Indiv. w/ FSBI Value	71.95	84.49	78.76	79.27
Fine Sediment Biotic Index	32.00	26.00	39.00	27.00
FSBI - average	2.00	1.73	1.95	1.69
FSBI - weighted average	4.63	4.22	4.36	4.38
% Indiv. w/ TPM Value	84.05	75.95	78.76	73.23
Temp. Pref. Metric - average	1.94	2.27	2.20	1.94
TPM - weighted average	4.49	4.19	4.25	4.18
DEQ MBI (Snake River Basin/High Desert)	3.51	3.69	3.89	3.56
DEQ MBI (Middle Rockies)	3.62	3.80	4.02	3.67
Karr BIBI Metrics				
Long-Lived Taxa Richness	2.00	2.00	4.00	2.00
Clinger Richness	9.00	8.00	12.00	8.00
% Clingers	80.50	66.79	77.97	70.98
Intolerant Taxa Richness	3.00	2.00	3.00	2.00
% Tolerant Individuals	0.00	0.00	0.00	0.08
% Tolerant Taxa	0.00	0.00	0.00	6.25
Coleoptera Richness	1.00	1.00	3.00	1.00
Montana DEQ Metrics				
MT Biotic Index	4.46	3.72	4.35	4.11

C-Gatherers + C- Filterers	86.55	88.28	81.97	92.53
% Scraper + %Shredder	11.26	9.11	13.46	3.24
% Univoltine	10.84	19.70	13.13	11.46
% Multivoltine	83.00	57.78	77.69	62.20
% Semivoltine	2.09	14.18	4.17	12.39
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	2.50	0.05	0.56	0.06
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	5.62	23.30	11.28	12.38
% Non-Insect Individuals	8.34	7.37	8.00	7.29
% Non-Insect Taxa	12.50	13.33	10.00	12.50
% Crustacea + Mollusca	7.19	5.22	4.45	3.67
Average Abundance (per taxon)	59.94	130.30	88.75	100.40
NYDEC PMA Metrics				
% Crustacea	7.19	5.22	4.45	3.67
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	86.34	91.50	89.63	90.91
UIN	**940-25**	**940-26**	**940-27**	**940-28**

Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
Site	Lower Grove	Lower Grove	Lower Grove	Lower Grove
Rep	7 1/4	7 2/4	7 3/4	7 4/4
Date	07-12-2006	07-12-2006	07-12-2006	07-12-2006
Percent Subsampled	100.00	100.00	100.00	100.00
EcoAnalysts Sample ID	65	66	67	68
Abundance Measures				
Corrected Abundance	769.00	1365.00	1023.00	1146.00
EPT Abundance	631.00	868.00	789.00	816.00
Dominance Measures				
Dominant Taxon	Ephemerella inermis/ infrequens	Ephemerella inermis/ infrequens	Baetis tricaudatus	Ephemerella inermis/ infrequens
Dominant Abundance	360.00	470.00	503.00	345.00
2nd Dominant Taxon	Baetis tricaudatus	Baetis tricaudatus	Ephemerella inermis/infrequens	Baetis tricaudatus
2nd Dominant Abundance	247.00	364.00	253.00	274.00
3rd Dominant Taxon	Simuliidae	Simuliidae	Amphipoda	Simuliidae
3rd Dominant Abundance	60.00	332.00	94.00	209.00
% Dominant Taxon	46.81	34.43	49.17	30.10
% 2 Dominant Taxa	78.93	61.10	73.90	54.01
% 3 Dominant Taxa	86.74	85.42	83.09	72.25
Richness Measures				
Species Richness	17.00	15.00	17.00	20.00
EPT Richness	11.00	9.00	10.00	12.00
Ephemeroptera Richness	4.00	3.00	4.00	4.00
Plecoptera Richness	2.00	1.00	1.00	2.00
Trichoptera Richness	5.00	5.00	5.00	6.00
Chironomidae Richness	2.00	1.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	15.00	14.00	15.00	18.00
Rhyacophila Richness	0.00	0.00	1.00	1.00
Community Composition				
% Ephemeroptera	80.75	61.76	75.66	62.57
% Plecoptera	0.26	0.07	0.10	1.48
% Trichoptera	1.04	1.76	1.37	7.16
% EPT	82.05	63.59	77.13	71.20
% Coleoptera	0.00	0.22	0.29	0.09
% Diptera	13.78	29.96	11.83	26.53
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	33.42	27.33	50.34	31.33
% Brachycentridae	0.00	0.95	0.10	3.66
% Chironomidae	5.59	5.35	5.96	8.12
% Ephemerellidae	46.81	34.43	24.73	30.10
% Hydropsychidae	0.26	0.44	0.10	1.13
% Odonata	0.00	0.00	0.00	0.00
% Perlidae	0.00	0.00	0.00	0.00
% Pteronarcyidae	0.00	0.00	0.00	0.00
% Simuliidae	7.80	24.32	5.87	18.24

Functional Group Composition				
% Filterers	8.06	25.71	6.06	23.12
% Gatherers	40.96	34.65	65.88	39.70
% Predators	3.38	4.84	2.15	4.62
% Scrapers	0.39	0.22	1.17	1.83
% Shredders	47.20	34.51	24.73	30.45
% Piercer-Herbivores	0.00	0.07	0.00	0.26
% Unclassified	0.00	0.00	0.00	0.00
Filterer Richness	2.00	3.00	3.00	4.00
Gatherer Richness	6.00	6.00	6.00	7.00
Predator Richness	4.00	2.00	5.00	5.00
Scraper Richness	1.00	1.00	2.00	1.00
Shredder Richness	4.00	2.00	1.00	2.00
Piercer-Herbivore Richness	0.00	1.00	0.00	1.00
Unclassified	0.00	0.00	0.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.62	0.69	0.65	0.85
Shannon-Weaver H' (log 2)	2.07	2.29	2.17	2.82
Shannon-Weaver H' (log e)	1.43	1.59	1.51	1.96
Margalef's Richness	2.41	1.94	2.31	2.70
Pielou's J'	0.51	0.59	0.53	0.65
Simpson's Heterogeneity	0.67	0.75	0.68	0.81
Biotic Indices				
% Indiv. w/ HBI Value	99.48	100.00	99.41	100.00
Hilsenhoff Biotic Index	2.98	3.70	3.57	3.66
% Indiv. w/ MTI Value	89.86	87.91	83.19	88.39
Metals Tolerance Index	3.78	3.89	4.24	3.64
% Indiv. w/ FSBI Value	81.27	63.52	76.34	69.37
Fine Sediment Biotic Index	26.00	34.00	41.00	43.00
FSBI - average	1.53	2.27	2.41	2.15
FSBI - weighted average	4.39	4.46	4.64	4.45
% Indiv. w/ TPM Value	94.41	93.19	87.68	91.97
Temp. Pref. Metric - average	2.24	2.93	2.47	2.20
TPM - weighted average	5.44	5.34	5.23	5.12
DEQ MBI (Snake River Basin/High Desert)	3.55	3.36	3.40	3.85
DEQ MBI (Middle Rockies)	3.64	3.43	3.49	3.95
Karr BIBI Metrics				
Long-Lived Taxa Richness	1.00	1.00	3.00	1.00
Clinger Richness	9.00	10.00	12.00	11.00
% Clingers	42.78	53.70	58.55	58.20
Intolerant Taxa Richness	4.00	3.00	4.00	6.00
% Tolerant Individuals	0.52	0.37	0.10	0.09
% Tolerant Taxa	11.76	13.33	5.88	5.00
Coleoptera Richness	0.00	1.00	2.00	1.00
Montana DEQ Metrics				
MT Biotic Index	2.98	3.70	3.57	3.66
C-Gatherers + C- Filterers	49.02	60.37	71.95	62.83

% Scraper + %Shredder	47.59	34.73	25.90	32.29
% Univoltine	53.32	41.10	30.99	44.76
% Multivoltine	43.04	53.48	66.47	52.09
% Semivoltine	0.52	0.22	0.88	0.09
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	0.26	0.44	0.10	1.13
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	47.45	35.46	25.17	36.56
% Non-Insect Individuals	4.16	6.23	10.75	2.18
% Non-Insect Taxa	11.76	13.33	11.76	10.00
% Crustacea + Mollusca	1.30	1.47	9.19	0.26
Average Abundance (per taxon)	45.24	91.00	60.18	57.30
NYDEC PMA Metrics				
% Crustacea	1.30	1.47	9.19	0.26
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	90.25	88.42	83.28	89.70
UIN	**940-65**	**940-66**	**940-67**	**940-68**

Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
Site	Restored Grove 2002	Restored Grove 2002	Restored Grove 2002	Restored Grove 2002
Rep	8 1/4	8 2/4	8 3/4	8 4/4
Date	08-10-2005	08-10-2005	08-10-2005	08-10-2005
Percent Subsampled	100.00	100.00	100.00	100.00
EcoAnalysts Sample ID	29	30	31	32
Abundance Measures				
Corrected Abundance	927.00	915.00	668.00	1263.00
EPT Abundance	329.00	165.00	152.00	268.00
Dominance Measures				
Dominant Taxon	Chironomidae	Chironomidae	Chironomidae	Chironomidae
Dominant Abundance	248.00	441.00	251.00	610.00
2nd Dominant Taxon	Heterlimnius sp.	Heterlimnius sp.	Heterlimnius sp.	Heterlimnius sp.
2nd Dominant Abundance	185.00	147.00	125.00	141.00
3rd Dominant Taxon	Hydroptila sp.	Rhyacophila sp.	Simuliidae	Hirudinea
3rd Dominant Abundance	125.00	68.00	74.00	98.00
% Dominant Taxon	26.75	48.20	37.57	48.30
% 2 Dominant Taxa	46.71	64.26	56.29	59.46
% 3 Dominant Taxa	60.19	71.69	67.37	67.22
Richness Measures				
Species Richness	23.00	28.00	24.00	23.00
EPT Richness	12.00	14.00	14.00	14.00
Ephemeroptera Richness	5.00	5.00	3.00	4.00
Plecoptera Richness	1.00	0.00	2.00	2.00
Trichoptera Richness	6.00	9.00	9.00	8.00
Chironomidae Richness	2.00	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	21.00	26.00	22.00	21.00
Rhyacophila Richness	1.00	1.00	1.00	1.00
Community Composition				
% Ephemeroptera	10.25	5.79	6.74	4.35
% Plecoptera	2.16	0.00	0.60	0.32
% Trichoptera	23.09	12.24	15.42	16.55
% EPT	35.49	18.03	22.75	21.22
% Coleoptera	21.90	18.36	19.16	12.67
% Diptera	32.36	52.02	50.90	56.85
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	5.50	4.15	6.59	3.33
% Brachycentridae	2.70	0.55	1.05	0.95
% Chironomidae	28.37	49.07	38.02	49.80
% Ephemerellidae	0.54	0.33	0.00	0.40
% Hydropsychidae	1.29	1.75	3.29	4.59
% Odonata	0.00	0.00	0.00	0.00
% Perlidae	0.00	0.00	0.45	0.16
% Pteronarcyidae	0.00	0.00	0.00	0.00
% Simuliidae	3.34	1.53	11.08	6.89

Functional Group Composition				
% Filterers	7.34	3.83	15.42	12.43
% Gatherers	62.46	76.17	66.77	65.00
% Predators	9.28	14.86	11.68	11.64
% Scrapers	3.34	2.84	2.40	6.49
% Shredders	4.10	1.31	3.44	3.56
% Piercer-Herbivores	13.48	0.98	0.30	0.87
% Unclassified	0.00	0.00	0.00	0.00
Filterer Richness	3.00	3.00	3.00	3.00
Gatherer Richness	9.00	11.00	6.00	7.00
Predator Richness	4.00	5.00	6.00	5.00
Scraper Richness	2.00	3.00	3.00	2.00
Shredder Richness	4.00	5.00	5.00	5.00
Piercer-Herbivore Richness	1.00	1.00	1.00	1.00
Unclassified	0.00	0.00	0.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	1.04	0.84	0.91	0.85
Shannon-Weaver H' (log 2)	3.45	2.78	3.01	2.82
Shannon-Weaver H' (log e)	2.39	1.92	2.09	1.96
Margalef's Richness	3.22	3.96	3.54	3.08
Pielou's J'	0.76	0.58	0.66	0.62
Simpson's Heterogeneity	0.86	0.73	0.80	0.74
Biotic Indices				
% Indiv. w/ HBI Value	98.06	98.58	99.85	99.37
Hilsenhoff Biotic Index	4.83	4.93	4.80	5.35
% Indiv. w/ MTI Value	58.79	37.92	54.19	40.86
Metals Tolerance Index	3.33	2.91	3.21	3.36
% Indiv. w/ FSBI Value	54.69	35.74	38.47	26.05
Fine Sediment Biotic Index	53.00	64.00	56.00	64.00
FSBI - average	2.30	2.29	2.33	2.78
FSBI - weighted average	4.70	4.74	4.89	4.88
% Indiv. w/ TPM Value	80.58	77.92	82.63	81.95
Temp. Pref. Metric - average	2.39	2.61	2.54	3.09
TPM - weighted average	4.80	5.18	5.29	5.00
DEQ MBI (Snake River Basin/High Desert)	3.62	3.20	3.34	3.11
DEQ MBI (Middle Rockies)	3.71	3.28	3.43	3.21
Karr BIBI Metrics				
Long-Lived Taxa Richness	3.00	5.00	4.00	4.00
Clinger Richness	13.00	15.00	14.00	14.00
% Clingers	56.74	36.94	49.85	37.45
Intolerant Taxa Richness	6.00	5.00	7.00	7.00
% Tolerant Individuals	0.11	0.11	0.00	0.00
% Tolerant Taxa	4.35	3.57	0.00	0.00
Coleoptera Richness	3.00	4.00	2.00	2.00
Montana DEQ Metrics				
MT Biotic Index	4.83	4.93	4.80	5.35
C-Gatherers + C- Filterers	69.80	80.00	82.19	77.43

% Scraper + %Shredder	7.44	4.15	5.84	10.06
% Univoltine	40.67	59.13	49.70	56.45
% Multivoltine	29.88	13.33	23.65	17.74
% Semivoltine	23.62	19.67	19.76	13.46
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	1.29	1.75	3.29	4.59
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	11.88	9.31	10.34	6.77
% Non-Insect Individuals	10.25	11.58	7.19	9.26
% Non-Insect Taxa	8.70	7.14	8.33	8.70
% Crustacea + Mollusca	5.72	5.90	3.74	1.50
Average Abundance (per taxon)	40.30	32.68	27.83	54.91
NYDEC PMA Metrics				
% Crustacea	5.72	5.90	3.74	1.50
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	61.38	39.34	54.79	40.93
UIN	**940-29**	**940-30**	**940-31**	**940-32**

Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
Site	Restored Grove 2002	Restored Grove 2002	Restored Grove 2002	Restored Grove 2002
Rep	8 1/4	8 2/4	8 3/4	8 4/4
Date	07-12-2006	07-12-2006	07-12-2006	07-12-2006
Percent Subsampled	100.00	100.00	100.00	100.00
EcoAnalysts Sample ID	69	70	71	72
Abundance Measures				
Corrected Abundance	1053.00	1557.00	1730.00	1524.00
EPT Abundance	320.00	162.00	249.00	122.00
Dominance Measures				
Dominant Taxon	Simuliidae	Chironomidae	Chironomidae	Cleptelmis addenda
Dominant Abundance	261.00	493.00	597.00	857.00
2nd Dominant Taxon	Chironomidae	Simuliidae	Simuliidae	Chironomidae
2nd Dominant Abundance	164.00	417.00	488.00	298.00
3rd Dominant Taxon	Heterlimnius sp.	Heterlimnius sp.	Heterlimnius sp.	Simuliidae
3rd Dominant Abundance	156.00	338.00	251.00	173.00
% Dominant Taxon	24.79	31.66	34.51	56.23
% 2 Dominant Taxa	40.36	58.45	62.72	75.79
% 3 Dominant Taxa	55.18	80.15	77.23	87.14
Richness Measures				
Species Richness	27.00	30.00	26.00	20.00
EPT Richness	14.00	15.00	17.00	10.00
Ephemeroptera Richness	5.00	5.00	4.00	5.00
Plecoptera Richness	1.00	1.00	2.00	2.00
Trichoptera Richness	8.00	9.00	11.00	3.00
Chironomidae Richness	2.00	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	25.00	28.00	24.00	18.00
Rhyacophila Richness	1.00	1.00	1.00	1.00
Community Composition				
% Ephemeroptera	9.40	6.42	5.66	3.08
% Plecoptera	0.95	0.26	0.40	1.64
% Trichoptera	20.04	3.73	8.32	3.28
% EPT	30.39	10.40	14.39	8.01
% Coleoptera	18.52	26.08	20.23	58.99
% Diptera	42.64	60.57	63.82	31.96
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	5.70	5.91	5.14	2.23
% Brachycentridae	1.80	0.13	0.64	1.38
% Chironomidae	15.95	32.43	34.86	20.28
% Ephemerellidae	3.51	0.13	0.40	0.07
% Hydropsychidae	0.00	0.06	0.06	0.00
% Odonata	0.00	0.00	0.00	0.00
% Perlidae	0.00	0.00	0.00	0.00
% Pteronarcyidae	0.00	0.00	0.00	0.00

% Simuliidae	24.79	26.78	28.21	11.35
Functional Group Composition				
% Filterers	26.59	26.97	28.90	12.73
% Gatherers	43.21	62.56	55.43	79.40
% Predators	13.11	4.43	5.26	3.61
% Scrapers	10.35	4.56	8.38	2.89
% Shredders	4.94	0.90	1.04	1.31
% Piercer-Herbivores	1.33	0.39	0.98	0.00
% Unclassified	0.47	0.19	0.00	0.07
Filterer Richness	2.00	3.00	3.00	2.00
Gatherer Richness	8.00	9.00	6.00	8.00
Predator Richness	6.00	7.00	7.00	5.00
Scraper Richness	3.00	3.00	3.00	2.00
Shredder Richness	5.00	5.00	6.00	2.00
Piercer-Herbivore Richness	2.00	2.00	1.00	0.00
Unclassified	1.00	1.00	0.00	1.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	1.04	0.79	0.81	0.63
Shannon-Weaver H' (log 2)	3.46	2.64	2.68	2.09
Shannon-Weaver H' (log e)	2.40	1.83	1.85	1.45
Margalef's Richness	3.74	3.95	3.35	2.59
Pielou's J'	0.73	0.54	0.57	0.48
Simpson's Heterogeneity	0.87	0.78	0.77	0.63
Biotic Indices				
% Indiv. w/ HBI Value	99.43	99.68	99.94	99.87
Hilsenhoff Biotic Index	4.81	5.15	5.28	4.52
% Indiv. w/ MTI Value	75.12	63.90	63.12	21.65
Metals Tolerance Index	3.43	3.65	3.71	3.74
% Indiv. w/ FSBI Value	39.03	36.74	31.50	67.13
Fine Sediment Biotic Index	57.00	66.00	53.00	48.00
FSBI - average	2.11	2.20	2.04	2.40
FSBI - weighted average	4.68	4.69	4.55	2.33
% Indiv. w/ TPM Value	72.74	92.55	90.92	94.95
Temp. Pref. Metric - average	1.96	2.77	2.31	2.45
TPM - weighted average	5.28	5.35	5.17	5.53
DEQ MBI (Snake River Basin/High Desert)	3.84	3.35	3.37	2.58
DEQ MBI (Middle Rockies)	3.94	3.42	3.47	2.62
Karr BIBI Metrics				
Long-Lived Taxa Richness	5.00	6.00	3.00	3.00
Clinger Richness	14.00	17.00	14.00	12.00
% Clingers	70.18	63.07	62.08	77.62
Intolerant Taxa Richness	6.00	6.00	8.00	6.00
% Tolerant Individuals	4.58	0.39	0.93	0.00
% Tolerant Taxa	7.41	6.67	3.85	0.00
Coleoptera Richness	2.00	4.00	2.00	2.00
Montana DEQ Metrics				
MT Biotic Index	4.81	5.15	5.28	4.52

C-Gatherers + C- Filterers	69.80	89.53	84.34	92.13
% Scraper + %Shredder	15.29	5.46	9.42	4.20
% Univoltine	29.63	36.61	40.00	26.05
% Multivoltine	49.10	36.16	39.25	14.30
% Semivoltine	19.09	26.53	20.29	59.06
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	0.00	0.06	0.06	0.00
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	12.61	3.41	4.40	5.58
% Non-Insect Individuals	8.07	2.70	1.56	1.05
% Non-Insect Taxa	7.41	6.67	7.69	10.00
% Crustacea + Mollusca	6.46	2.25	1.16	0.52
Average Abundance (per taxon)	39.00	51.90	66.54	76.20
NYDEC PMA Metrics				
% Crustacea	6.46	2.25	1.16	0.52
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	75.97	64.87	63.58	78.67
UIN	**940-69**	**940-70**	**940-71**	**940-72**

Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
Site	Restored Grove 2004	Restored Grove 2004	Restored Grove 2004	Restored Grove 2004
Rep	9 1/4	9 2/4	9 3/4	9 4/4
Date	08-10-2005	08-10-2005	08-10-2005	08-10-2005
Percent Subsampled	100.00	100.00	100.00	100.00
EcoAnalysts Sample ID	33	34	35	36
Abundance Measures				
Corrected Abundance	1956.00	844.00	1219.00	857.00
EPT Abundance	941.00	446.00	345.00	439.00
Dominance Measures				
Dominant Taxon	Chironomidae	Chironomidae	Chironomidae	Chironomidae
Dominant Abundance	911.00	263.00	829.00	376.00
2nd Dominant Taxon	Baetis tricaudatus	Baetis tricaudatus	Baetis tricaudatus	Baetis tricaudatus
2nd Dominant Abundance	358.00	262.00	210.00	289.00
3rd Dominant Taxon	Ephemerella inermis/ infrequens	Heterlimnius sp.	Ephemerella inermis/ infrequens	Ephemerella inermis/ infrequens
3rd Dominant Abundance	211.00	73.00	98.00	78.00
% Dominant Taxon	46.57	31.16	68.01	43.87
% 2 Dominant Taxa	64.88	62.20	85.23	77.60
% 3 Dominant Taxa	75.66	70.85	93.27	86.70
Richness Measures				
Species Richness	22.00	15.00	17.00	18.00
EPT Richness	12.00	7.00	11.00	10.00
Ephemeroptera Richness	3.00	3.00	3.00	2.00
Plecoptera Richness	3.00	2.00	3.00	3.00
Trichoptera Richness	6.00	2.00	5.00	5.00
Chironomidae Richness	2.00	2.00	1.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	20.00	13.00	16.00	16.00
Rhyacophila Richness	1.00	1.00	1.00	1.00
Community Composition				
% Ephemeroptera	29.19	33.41	25.35	42.82
% Plecoptera	8.79	15.52	1.72	2.92
% Trichoptera	10.12	3.91	1.23	5.48
% EPT	48.11	52.84	28.30	51.23
% Coleoptera	1.74	8.65	0.25	0.47
% Diptera	48.16	33.06	70.22	46.21
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	18.30	31.04	17.23	33.72
% Brachycentridae	0.00	0.00	0.00	0.12
% Chironomidae	46.78	31.52	68.01	44.22
% Ephemerellidae	10.79	1.66	8.04	9.10
% Hydropsychidae	0.26	0.00	0.08	0.00
% Odonata	0.00	0.00	0.00	0.00
% Perlidae	4.09	8.53	1.23	1.87
% Pteronarcyidae	0.00	0.00	0.00	0.00

% Simuliidae	0.72	0.24	2.05	0.82
Functional Group Composition				
% Filterers	0.97	0.24	2.13	0.93
% Gatherers	68.05	71.80	85.73	78.30
% Predators	8.23	18.96	2.95	8.98
% Scrapers	0.31	0.00	0.00	0.00
% Shredders	15.54	8.65	8.94	10.85
% Piercer-Herbivores	6.90	0.36	0.25	0.93
% Unclassified	0.00	0.00	0.00	0.00
Filterer Richness	2.00	1.00	2.00	2.00
Gatherer Richness	7.00	5.00	5.00	5.00
Predator Richness	6.00	6.00	5.00	6.00
Scraper Richness	2.00	0.00	0.00	0.00
Shredder Richness	4.00	2.00	4.00	4.00
Piercer-Herbivore Richness	1.00	1.00	1.00	1.00
Unclassified	0.00	0.00	0.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.77	0.80	0.47	0.66
Shannon-Weaver H' (log 2)	2.55	2.65	1.57	2.19
Shannon-Weaver H' (log e)	1.77	1.84	1.09	1.52
Margalef's Richness	2.77	2.08	2.25	2.52
Pielou's J'	0.57	0.68	0.39	0.53
Simpson's Heterogeneity	0.73	0.78	0.50	0.68
Biotic Indices				
% Indiv. w/ HBI Value	100.00	100.00	100.00	100.00
Hilsenhoff Biotic Index	4.46	4.21	5.13	4.50
% Indiv. w/ MTI Value	51.07	61.97	30.27	52.51
Metals Tolerance Index	3.59	3.66	4.16	4.15
% Indiv. w/ FSBI Value	50.10	62.44	28.22	51.58
Fine Sediment Biotic Index	53.00	37.00	44.00	44.00
FSBI - average	2.41	2.47	2.59	2.44
FSBI - weighted average	4.63	4.83	4.72	4.78
% Indiv. w/ TPM Value	94.07	88.63	97.54	91.48
Temp. Pref. Metric - average	2.23	2.67	2.47	2.50
TPM - weighted average	4.92	5.20	5.08	5.08
DEQ MBI (Snake River Basin/High Desert)	3.29	3.25	2.37	3.10
DEQ MBI (Middle Rockies)	3.38	3.31	2.43	3.18
Karr BIBI Metrics				
Long-Lived Taxa Richness	3.00	2.00	2.00	2.00
Clinger Richness	12.00	7.00	9.00	9.00
% Clingers	39.62	59.36	21.99	42.24
Intolerant Taxa Richness	8.00	5.00	7.00	6.00
% Tolerant Individuals	0.05	0.24	0.00	0.12
% Tolerant Taxa	4.55	6.67	0.00	5.56
Coleoptera Richness	2.00	1.00	1.00	1.00
Montana DEQ Metrics				
MT Biotic Index	4.46	4.21	5.13	4.50

C-Gatherers + C- Filterers	69.02	72.04	87.86	79.23
% Scraper + %Shredder	15.85	8.65	8.94	10.85
% Univoltine	65.85	45.62	77.69	60.09
% Multivoltine	27.35	31.64	19.69	35.59
% Semivoltine	5.83	17.18	1.48	2.33
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	0.26	0.00	0.08	0.00
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	22.55	21.45	10.34	15.40
% Non-Insect Individuals	1.99	5.45	1.23	2.10
% Non-Insect Taxa	9.09	6.67	11.76	11.11
% Crustacea + Mollusca	1.28	0.00	0.16	0.12
Average Abundance (per taxon)	88.91	56.27	71.71	47.61
NYDEC PMA Metrics				
% Crustacea	1.28	0.00	0.16	0.12
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	51.23	63.03	30.76	53.68
UIN	**940-33**	**940-34**	**940-35**	**940-36**

Stream	Silver Creek Restored Grove 2004	Silver Creek Restored Grove 2004	Silver Creek Restored Grove 2004	Silver Creek Restored Grove 2004
Site	9 1/4	9 2/4	9 3/4	9 4/4
Rep	07-12-2006	07-12-2006	07-12-2006	07-12-2006
Date	100.00	100.00	100.00	100.00
Percent Subsampled	73	74	75	76
EcoAnalysts Sample ID				
Abundance Measures				
Corrected Abundance	2221.00	1745.00	2152.00	2351.00
EPT Abundance	1326.00	822.00	782.00	1744.00
Dominance Measures				
Dominant Taxon	Chironomidae	Chironomidae	Chironomidae	Ephemerella inermis/ infrequens
Dominant Abundance	776.00	832.00	1270.00	1320.00
2nd Dominant Taxon	Ephemerella inermis/ infrequens	Baetis tricaudatus	Baetis tricaudatus	Chironomidae
2nd Dominant Abundance	599.00	332.00	320.00	497.00
3rd Dominant Taxon	Baetis tricaudatus	Ephemerella inermis/ infrequens	Ephemerella inermis/ infrequens	Baetis tricaudatus
3rd Dominant Abundance	515.00	286.00	235.00	293.00
% Dominant Taxon	34.94	47.68	59.01	56.15
% 2 Dominant Taxa	61.91	66.70	73.88	77.29
% 3 Dominant Taxa	85.10	83.09	84.80	89.75
Richness Measures				
Species Richness	22.00	21.00	20.00	20.00
EPT Richness	11.00	11.00	11.00	11.00
Ephemeroptera Richness	2.00	3.00	5.00	2.00
Plecoptera Richness	3.00	3.00	3.00	3.00
Trichoptera Richness	6.00	5.00	3.00	6.00
Chironomidae Richness	2.00	2.00	2.00	1.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	20.00	19.00	18.00	19.00
Rhyacophila Richness	1.00	1.00	1.00	1.00
Community Composition				
% Ephemeroptera	50.16	35.47	26.35	68.61
% Plecoptera	3.78	5.10	3.35	1.83
% Trichoptera	5.76	6.53	6.64	3.74
% EPT	59.70	47.11	36.34	74.18
% Coleoptera	0.81	1.60	1.91	0.64
% Diptera	38.50	50.54	61.25	22.12
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	23.19	19.03	14.96	12.46
% Brachycentridae	0.23	0.52	0.19	0.43
% Chironomidae	35.12	47.85	59.20	21.14
% Ephemerellidae	26.97	16.39	10.92	56.15
% Hydropsychidae	0.00	0.00	0.00	0.00

% Odonata	0.00	0.00	0.00	0.00
% Perlidae	0.05	0.52	0.70	0.21
% Pteronarcyidae	0.00	0.00	0.00	0.00
% Simuliidae	3.11	2.12	1.53	0.72
Functional Group Composition				
% Filterers	3.33	2.64	1.72	1.15
% Gatherers	59.12	68.60	76.12	37.09
% Predators	2.66	3.78	6.41	1.79
% Scrapers	0.05	0.11	0.51	0.00
% Shredders	31.65	20.69	13.06	58.87
% Piercer-Herbivores	3.20	4.18	2.00	1.11
% Unclassified	0.00	0.00	0.19	0.00
Filterer Richness	2.00	2.00	2.00	2.00
Gatherer Richness	5.00	4.00	6.00	5.00
Predator Richness	7.00	7.00	5.00	6.00
Scraper Richness	1.00	2.00	2.00	0.00
Shredder Richness	6.00	5.00	3.00	6.00
Piercer-Herbivore Richness	1.00	1.00	1.00	1.00
Unclassified	0.00	0.00	1.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.73	0.71	0.63	0.60
Shannon-Weaver H' (log 2)	2.42	2.36	2.10	2.00
Shannon-Weaver H' (log e)	1.68	1.64	1.46	1.39
Margalef's Richness	2.73	2.68	2.48	2.45
Pielou's J'	0.54	0.54	0.49	0.46
Simpson's Heterogeneity	0.75	0.71	0.61	0.62
Biotic Indices				
% Indiv. w/ HBI Value	100.00	100.00	99.81	100.00
Hilsenhoff Biotic Index	3.89	4.41	4.69	2.70
% Indiv. w/ MTI Value	63.62	51.23	39.96	74.78
Metals Tolerance Index	3.68	3.65	3.49	3.31
% Indiv. w/ FSBI Value	58.98	48.83	38.52	73.08
Fine Sediment Biotic Index	53.00	55.00	63.00	44.00
FSBI - average	2.41	2.62	3.15	2.20
FSBI - weighted average	4.35	4.39	4.56	4.18
% Indiv. w/ TPM Value	96.94	96.33	93.96	94.51
Temp. Pref. Metric - average	3.00	3.24	3.15	2.50
TPM - weighted average	5.19	5.07	5.09	5.57
DEQ MBI (Snake River Basin/High Desert)	3.55	3.17	2.81	3.44
DEQ MBI (Middle Rockies)	3.63	3.25	2.88	3.53
Karr BIBI Metrics				
Long-Lived Taxa Richness	3.00	3.00	3.00	2.00
Clinger Richness	12.00	11.00	13.00	9.00
% Clingers	35.12	34.04	29.04	17.52
Intolerant Taxa Richness	8.00	7.00	7.00	8.00
% Tolerant Individuals	0.00	0.00	0.00	0.04
% Tolerant Taxa	0.00	0.00	0.00	5.00
Coleoptera Richness	3.00	2.00	2.00	1.00

Montana DEQ Metrics				
MT Biotic Index	3.89	4.41	4.69	2.70
C-Gatherers + C- Filterers	62.45	71.23	77.83	38.24
% Scraper + %Shredder	31.70	20.80	13.57	58.87
% Univoltine	68.53	71.63	77.51	81.71
% Multivoltine	30.08	25.79	18.82	17.18
% Semivoltine	0.72	2.12	2.60	0.85
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	0.00	0.00	0.00	0.00
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	33.14	23.78	19.04	59.68
% Non-Insect Individuals	0.99	0.74	0.51	3.06
% Non-Insect Taxa	9.09	9.52	5.00	10.00
% Crustacea + Mollusca	0.32	0.34	0.00	2.81
Average Abundance (per taxon)	101.00	83.10	107.60	117.60
NYDEC PMA Metrics				
% Crustacea	0.32	0.34	0.00	2.81
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	63.89	51.40	40.29	75.80
UIN	**940-73**	**940-74**	**940-75**	**940-76**

Stream	**Silver Creek**	**Silver Creek**	**Silver Creek**	**Silver Creek**
Site	**Non-restored Grove**	**Non-restored Grove**	**Non-restored Grove**	**Non-restored Grove**
Rep	**10 1/4**	**10 2/4**	**10 3/4**	**10 4/4**
Date	**08-10-2005**	**08-10-2005**	**08-10-2005**	**08-10-2005**
Percent Subsampled	**100.00**	**100.00**	**100.00**	**100.00**
EcoAnalysts Sample ID	**37**	**38**	**39**	**40**
Abundance Measures				
Corrected Abundance	1093.00	1347.00	1325.00	1370.00
EPT Abundance	550.00	467.00	869.00	711.00
Dominance Measures				
Dominant Taxon	Chironomidae	Chironomidae	Baetis tricaudatus	Chironomidae
Dominant Abundance	298.00	747.00	498.00	447.00
2nd Dominant Taxon	Baetis tricaudatus	Baetis tricaudatus	Chironomidae	Hydroptila sp.
2nd Dominant Abundance	244.00	384.00	233.00	235.00
3rd Dominant Taxon	Hydroptila sp.	Hydroptila sp.	Hydroptila sp.	Baetis tricaudatus
3rd Dominant Abundance	145.00	44.00	167.00	234.00
% Dominant Taxon	27.26	55.46	37.58	32.63
% 2 Dominant Taxa	49.59	83.96	55.17	49.78
% 3 Dominant Taxa	62.85	87.23	67.77	66.86
Richness Measures				
Species Richness	26.00	24.00	19.00	21.00
EPT Richness	14.00	13.00	10.00	11.00
Ephemeroptera Richness	4.00	5.00	3.00	4.00
Plecoptera Richness	3.00	3.00	3.00	2.00
Trichoptera Richness	7.00	5.00	4.00	5.00
Chironomidae Richness	2.00	1.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	24.00	23.00	17.00	19.00
Rhyacophila Richness	1.00	1.00	1.00	1.00
Community Composition				
% Ephemeroptera	24.15	29.77	39.32	21.09
% Plecoptera	10.34	0.74	11.62	12.19
% Trichoptera	15.83	4.16	14.64	18.61
% EPT	50.32	34.67	65.58	51.90
% Coleoptera	7.41	1.19	5.89	9.64
% Diptera	35.13	60.95	23.17	35.26
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	22.32	28.95	37.58	17.08
% Brachycentridae	0.18	0.15	0.15	0.22
% Chironomidae	31.11	55.46	17.96	32.99
% Ephemerellidae	1.28	0.59	1.51	2.41
% Hydropsychidae	0.46	0.45	0.00	0.07
% Odonata	0.00	0.00	0.00	0.00
% Perlidae	2.56	0.07	2.64	1.90
% Pteronarcyidae	0.00	0.00	0.00	0.00

% Simuliidae	0.27	0.00	0.75	0.00
Functional Group Composition				
% Filterers	0.91	0.59	0.91	0.29
% Gatherers	61.12	88.86	65.36	63.80
% Predators	12.44	3.49	8.15	5.11
% Scrapers	0.73	0.22	0.00	0.07
% Shredders	11.44	3.34	12.98	13.58
% Piercer-Herbivores	13.27	3.27	12.60	17.15
% Unclassified	0.09	0.22	0.00	0.00
Filterer Richness	3.00	2.00	2.00	2.00
Gatherer Richness	7.00	9.00	6.00	7.00
Predator Richness	6.00	5.00	6.00	6.00
Scraper Richness	2.00	2.00	0.00	1.00
Shredder Richness	6.00	4.00	4.00	4.00
Piercer-Herbivore Richness	1.00	1.00	1.00	1.00
Unclassified	1.00	1.00	0.00	0.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.97	0.60	0.87	0.86
Shannon-Weaver H' (log 2)	3.21	2.00	2.90	2.87
Shannon-Weaver H' (log e)	2.23	1.39	2.01	1.99
Margalef's Richness	3.57	3.19	2.50	2.77
Pielou's J'	0.68	0.44	0.68	0.65
Simpson's Heterogeneity	0.84	0.61	0.80	0.81
Biotic Indices				
% Indiv. w/ HBI Value	99.91	99.78	100.00	100.00
Hilsenhoff Biotic Index	4.75	5.20	4.30	4.60
% Indiv. w/ MTI Value	59.65	38.01	75.09	62.04
Metals Tolerance Index	3.69	4.55	3.85	3.44
% Indiv. w/ FSBI Value	58.74	38.08	73.13	62.70
Fine Sediment Biotic Index	68.00	68.00	46.00	61.00
FSBI - average	2.62	2.83	2.42	2.90
FSBI - weighted average	4.66	4.80	4.55	4.38
% Indiv. w/ TPM Value	85.45	91.39	88.98	92.41
Temp. Pref. Metric - average	2.85	2.83	2.63	3.05
TPM - weighted average	4.69	4.90	4.72	4.67
DEQ MBI (Snake River Basin/High Desert)	3.82	2.90	3.53	3.49
DEQ MBI (Middle Rockies)	3.93	2.98	3.62	3.57
Karr BIBI Metrics				
Long-Lived Taxa Richness	4.00	4.00	2.00	3.00
Clinger Richness	13.00	14.00	9.00	10.00
% Clingers	57.00	35.93	69.06	56.86
Intolerant Taxa Richness	9.00	8.00	8.00	7.00
% Tolerant Individuals	0.18	0.37	0.15	0.15
% Tolerant Taxa	3.85	4.17	5.26	4.76
Coleoptera Richness	2.00	3.00	1.00	2.00
Montana DEQ Metrics				
MT Biotic Index	4.75	5.20	4.30	4.60

C-Gatherers + C- Filterers	62.03	89.46	66.26	64.09
% Scraper + %Shredder	12.17	3.56	12.98	13.65
% Univoltine	43.09	59.54	33.96	50.66
% Multivoltine	41.45	37.19	56.08	37.15
% Semivoltine	10.06	1.26	8.53	11.53
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	0.46	0.45	0.00	0.07
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	13.83	1.93	15.40	17.52
% Non-Insect Individuals	7.14	3.19	5.36	3.21
% Non-Insect Taxa	7.69	8.33	10.53	9.52
% Crustacea + Mollusca	2.65	1.93	3.92	2.70
Average Abundance (per taxon)	42.04	56.13	69.74	65.24
NYDEC PMA Metrics				
% Crustacea	2.65	1.93	3.92	2.70
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	61.76	41.35	76.68	63.80
UIN	**940-37**	**940-38**	**940-39**	**940-40**

Stream	Silver Creek	Silver Creek	Silver Creek	Silver Creek
Site	Non. Restored Grove	Non. Restored Grove	Non. Restored Grove	Non. Restored Grove
Rep	10 1/4	10 2/4	10 3/4	10 4/4
Date	07-12-2006	07-12-2006	07-12-2006	07-12-2006
Percent Subsampled	100.00	100.00	100.00	100.00
EcoAnalysts Sample ID	77	78	79	80
Abundance Measures				
Corrected Abundance	2244.00	1999.00	1303.00	2571.00
EPT Abundance	2060.00	1529.00	1150.00	2234.00
Dominance Measures				
Dominant Taxon	Baetis tricaudatus	Baetis tricaudatus	Baetis tricaudatus	Baetis tricaudatus
Dominant Abundance	1332.00	791.00	920.00	1646.00
2nd Dominant Taxon	Hydroptila sp.	Hydroptila sp.	Hydroptila sp.	Hydroptila sp.
2nd Dominant Abundance	490.00	480.00	136.00	437.00
3rd Dominant Taxon	Ephemerella inermis/ infrequens	Ephemerella inermis/ infrequens	Ephemerella inermis/ infrequens	Chironomidae
3rd Dominant Abundance	168.00	193.00	65.00	113.00
% Dominant Taxon	59.36	39.57	70.61	64.02
% 2 Dominant Taxa	81.19	63.58	81.04	81.02
% 3 Dominant Taxa	88.68	73.24	86.03	85.41
Richness Measures				
Species Richness	19.00	23.00	23.00	21.00
EPT Richness	11.00	12.00	13.00	10.00
Ephemeroptera Richness	3.00	4.00	4.00	3.00
Plecoptera Richness	3.00	3.00	3.00	3.00
Trichoptera Richness	5.00	5.00	6.00	4.00
Chironomidae Richness	1.00	2.00	2.00	2.00
Oligochaeta Richness	0.00	0.00	0.00	0.00
Non-Chiro. Non-Olig. Richness	18.00	21.00	21.00	19.00
Rhyacophila Richness	1.00	1.00	1.00	1.00
Community Composition				
% Ephemeroptera	66.93	50.38	75.83	66.59
% Plecoptera	2.18	0.90	1.07	2.10
% Trichoptera	22.68	25.21	11.36	18.20
% EPT	91.80	76.49	88.26	86.89
% Coleoptera	1.34	8.05	4.53	2.76
% Diptera	4.14	9.95	6.37	8.25
% Oligochaeta	0.00	0.00	0.00	0.00
% Baetidae	59.36	39.57	70.61	64.02
% Brachycentridae	0.45	0.10	0.54	0.31
% Chironomidae	1.69	8.30	4.83	4.67
% Ephemerellidae	7.49	9.65	4.99	2.45
% Hydropsychidae	0.00	0.00	0.00	0.00
% Odonata	0.00	0.00	0.00	0.00
% Perlidae	0.04	0.20	0.15	0.19
% Pteronarcyidae	0.00	0.00	0.00	0.00

% Simuliidae	0.36	0.40	0.46	0.47
Functional Group Composition				
% Filterers	0.80	0.50	1.00	0.78
% Gatherers	65.33	59.18	80.58	74.95
% Predators	3.03	4.15	1.77	2.80
% Scrapers	0.00	0.50	0.31	0.16
% Shredders	8.96	11.26	5.68	4.05
% Piercer-Herbivores	21.84	24.01	10.44	17.00
% Unclassified	0.04	0.40	0.23	0.27
Filterer Richness	2.00	2.00	2.00	2.00
Gatherer Richness	7.00	7.00	5.00	5.00
Predator Richness	4.00	6.00	6.00	6.00
Scraper Richness	0.00	2.00	3.00	2.00
Shredder Richness	4.00	4.00	5.00	4.00
Piercer-Herbivore Richness	1.00	1.00	1.00	1.00
Unclassified	1.00	1.00	1.00	1.00
Diversity/Evenness Measures				
Shannon-Weaver H' (log 10)	0.58	0.79	0.51	0.59
Shannon-Weaver H' (log 2)	1.93	2.62	1.70	1.95
Shannon-Weaver H' (log e)	1.34	1.82	1.18	1.35
Margalef's Richness	2.33	2.89	3.07	2.55
Pielou's J'	0.45	0.58	0.38	0.44
Simpson's Heterogeneity	0.59	0.76	0.48	0.56
Biotic Indices				
% Indiv. w/ HBI Value	99.96	99.60	99.77	99.73
Hilsenhoff Biotic Index	4.32	4.43	4.17	4.41
% Indiv. w/ MTI Value	93.36	84.44	93.09	90.24
Metals Tolerance Index	4.48	4.18	4.62	4.56
% Indiv. w/ FSBI Value	92.96	83.89	92.56	89.73
Fine Sediment Biotic Index	50.00	61.00	55.00	53.00
FSBI - average	2.63	2.65	2.39	2.52
FSBI - weighted average	4.86	4.85	4.93	4.92
% Indiv. w/ TPM Value	93.98	92.35	97.16	93.12
Temp. Pref. Metric - average	2.84	2.83	2.96	2.90
TPM - weighted average	4.41	4.51	4.83	4.54
DEQ MBI (Snake River Basin/High Desert)	3.34	3.70	3.29	3.25
DEQ MBI (Middle Rockies)	3.45	3.81	3.42	3.35
Karr BIBI Metrics				
Long-Lived Taxa Richness	2.00	3.00	3.00	3.00
Clinger Richness	10.00	12.00	12.00	11.00
% Clingers	85.74	73.89	87.95	87.63
Intolerant Taxa Richness	8.00	8.00	9.00	7.00
% Tolerant Individuals	2.01	0.50	0.69	2.54
% Tolerant Taxa	5.26	4.35	4.35	4.76
Coleoptera Richness	1.00	2.00	2.00	2.00
Montana DEQ Metrics				
MT Biotic Index	4.32	4.43	4.17	4.41

C-Gatherers + C- Filterers	66.13	59.68	81.58	75.73
% Scraper + %Shredder	8.96	11.76	5.99	4.20
% Univoltine	14.26	21.11	12.43	12.87
% Multivoltine	82.40	66.23	81.58	82.96
% Semivoltine	1.38	8.25	4.68	2.96
Community Tolerance Quotient	-99.00	-99.00	-99.00	-99.00
% Hydropsychinae	0.00	0.00	0.00	0.00
Lake Metrics				
% Orthocladiinae	0.00	0.00	0.00	0.00
Orthocladiinae Richness	0.00	0.00	0.00	0.00
% Chironomini	0.00	0.00	0.00	0.00
Chironomini Richness	0.00	0.00	0.00	0.00
% Tanytarsini	0.00	0.00	0.00	0.00
% Chironomus	0.00	0.00	0.00	0.00
% Tanytarsus	0.00	0.00	0.00	0.00
% Dicrotendipes	0.00	0.00	0.00	0.00
% Dicrotendipes + Chironomus	0.00	0.00	0.00	0.00
% Corbicula	0.00	0.00	0.00	0.00
% Manayunkia speciosa	0.00	0.00	0.00	0.00
% Intolerant	10.52	12.36	6.92	5.77
% Non-Insect Individuals	2.72	5.50	0.84	2.10
% Non-Insect Taxa	10.53	8.70	4.35	9.52
% Crustacea + Mollusca	0.80	1.95	0.00	1.28
Average Abundance (per taxon)	118.10	86.91	56.65	122.40
NYDEC PMA Metrics				
% Crustacea	0.80	1.95	0.00	1.28
% Mollusca	0.00	0.00	0.00	0.00
% Non-Chironomidae	95.59	86.19	94.32	93.23
UIN	**940-77**	**940-78**	**940-79**	**940-80**

Appendix D. The Wittaker-Fairbanks Percent Similarity Calculated by Eco Analysts, Inc. for the Silver Creek Watershed.

UI Whitaker Data 06
EcoAnalysts, Inc.
Community Similarity (Wittaker-Fairbanks Percent Similarity)

SITE	1	2	3	4	5	6	7	8	9	10
NAME	1 yr. Restored Grove	3 yr. Restored Grove	Float Tube	Loving Creek	Lower Grove	Non-restored Grove	Riffle Silver Creek	Stalker Creek	USGS	Visitor Site
% Sim.	0.763	0.618	0.229	0.448	0.530	0.542	0.505	0.566	0.499	0.347

***1 yr. Restored Grove = Site #9 (restoration in 2004)**

***3 yr. Restored Grove = Site #8 (restoration in 2002)**

		1 yr. Restored Grove 1 Pooled 2005 SIN_81	3 yr. Restored Grove 2 Pooled 2005 SIN_82	Float Tube 3 Pooled 2005 SIN_83	Loving Creek 4 Pooled 2005 SIN_84	Lower Grove 5 Pooled 2005 SIN_85
1 yr. Restored Grove	1 Pooled 2005	1.000	0.581	0.304	0.078	0.347
3 yr. Restored Grove	2 Pooled 2005	0.581	1.000	0.236	0.181	0.211
Float Tube	3 Pooled 2005	0.304	0.236	1.000	0.424	0.533
Loving Creek	4 Pooled 2005	0.078	0.181	0.424	1.000	0.212
Lower Grove	5 Pooled 2005	0.347	0.211	0.533	0.212	1.000
Non-restored Grove	6 Pooled 2005	0.728	0.567	0.365	0.114	0.362
Riffle Silver Creek	7 Pooled 2005	0.354	0.254	0.684	0.252	0.765
Stalker Creek	8 Pooled 2005	0.160	0.326	0.531	0.382	0.213
USGS	9 Pooled 2005	0.098	0.204	0.456	0.225	0.286
Visitor Site	10 Pooled 2005	0.297	0.246	0.654	0.611	0.501
1 yr. Restored Grove	1 Pooled 2006	0.763	0.546	0.234	0.065	0.285
3 yr. Restored Grove	2 Pooled 2006	0.411	0.618	0.136	0.093	0.155
Float Tube	3 Pooled 2006	0.364	0.422	0.229	0.371	0.228
Loving Creek	4 Pooled 2006	0.186	0.213	0.386	0.448	0.296
Lower Grove	5 Pooled 2006	0.415	0.263	0.390	0.121	0.530
Non-restored Grove	6 Pooled 2006	0.441	0.219	0.335	0.082	0.518
Riffle Silver Creek	7 Pooled 2006	0.418	0.271	0.400	0.117	0.490
Stalker Creek	8 Pooled 2006	0.321	0.459	0.402	0.326	0.213
USGS	9 Pooled 2006	0.200	0.336	0.629	0.510	0.447
Visitor Site	10 Pooled 2006	0.445	0.357	0.347	0.164	0.498

		Non-restored Grove 6 Pooled 2005 SIN_86	Riffle Silver Creek 7 Pooled 2005 SIN_87	Stalker Creek 8 Pooled 2005 SIN_88	USGS 9 Pooled 2005 SIN_89	Visitor Site 10 Pooled 2005 SIN_90
1 yr. Restored Grove	1 Pooled 2005	0.728	0.354	0.160	0.098	0.297
3 yr. Restored Grove	2 Pooled 2005	0.567	0.254	0.326	0.204	0.246
Float Tube	3 Pooled 2005	0.365	0.684	0.531	0.456	0.654
Loving Creek	4 Pooled 2005	0.114	0.252	0.382	0.225	0.611
Lower Grove	5 Pooled 2005	0.362	0.765	0.213	0.286	0.501
Non-restored Grove	6 Pooled 2005	1.000	0.377	0.189	0.131	0.362
Riffle Silver Creek	7 Pooled 2005	0.377	1.000	0.350	0.380	0.625
Stalker Creek	8 Pooled 2005	0.189	0.350	1.000	0.446	0.400
USGS	9 Pooled 2005	0.131	0.380	0.446	1.000	0.234
Visitor Site	10 Pooled 2005	0.362	0.625	0.400	0.234	1.000
1 yr. Restored Grove	1 Pooled 2006	0.623	0.286	0.155	0.085	0.228
3 yr. Restored Grove	2 Pooled 2006	0.445	0.162	0.369	0.162	0.139
Float Tube	3 Pooled 2006	0.376	0.206	0.238	0.172	0.175
Loving Creek	4 Pooled 2006	0.214	0.310	0.330	0.223	0.343
Lower Grove	5 Pooled 2006	0.404	0.530	0.225	0.137	0.443
Non-restored Grove	6 Pooled 2006	0.542	0.486	0.117	0.100	0.369
Riffle Silver Creek	7 Pooled 2006	0.406	0.505	0.239	0.153	0.442
Stalker Creek	8 Pooled 2006	0.386	0.310	0.566	0.288	0.387
USGS	9 Pooled 2006	0.223	0.476	0.606	0.499	0.457
Visitor Site	10 Pooled 2006	0.399	0.446	0.267	0.173	0.347

		1 yr. Restored Grove 1 Pooled 2006 SIN_91	3 yr. Restored Grove 2 Pooled 2006 SIN_92	Float Tube 3 Pooled 2006 SIN_93	Loving Creek 4 Pooled 2006 SIN_94	Lower Grove 5 Pooled 2006 SIN_95
1 yr. Restored Grove	1 Pooled 2005	0.763	0.411	0.364	0.186	0.415
3 yr. Restored Grove	2 Pooled 2005	0.546	0.618	0.422	0.213	0.263
Float Tube	3 Pooled 2005	0.234	0.136	0.229	0.386	0.390
Loving Creek	4 Pooled 2005	0.065	0.093	0.371	0.448	0.121
Lower Grove	5 Pooled 2005	0.285	0.155	0.228	0.296	0.530
Non-restored Grove	6 Pooled 2005	0.623	0.445	0.376	0.214	0.404
Riffle Silver Creek	7 Pooled 2005	0.286	0.162	0.206	0.310	0.530
Stalker Creek	8 Pooled 2005	0.155	0.369	0.238	0.330	0.225
USGS	9 Pooled 2005	0.085	0.162	0.172	0.223	0.137
Visitor Site	10 Pooled 2005	0.228	0.139	0.175	0.343	0.443
1 yr. Restored Grove	1 Pooled 2006	1.000	0.402	0.352	0.171	0.563
3 yr. Restored Grove	2 Pooled 2006	0.402	1.000	0.349	0.166	0.329
Float Tube	3 Pooled 2006	0.352	0.349	1.000	0.625	0.189
Loving Creek	4 Pooled 2006	0.171	0.166	0.625	1.000	0.227
Lower Grove	5 Pooled 2006	0.563	0.329	0.189	0.227	1.000
Non-restored Grove	6 Pooled 2006	0.366	0.188	0.141	0.172	0.478
Riffle Silver Creek	7 Pooled 2006	0.562	0.385	0.192	0.223	0.910
Stalker Creek	8 Pooled 2006	0.311	0.589	0.318	0.330	0.346
USGS	9 Pooled 2006	0.194	0.255	0.359	0.440	0.262
Visitor Site	10 Pooled 2006	0.655	0.361	0.322	0.273	0.749