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Analysis of Changes in Macroinvertebrate Communities on the Mill Creek Watershed Resulting from Passive Treatment of Acid Mine Drainage

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Analysis of Changes in Macroinvertebrate Communities on the Mill Creek Watershed
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Amy B. Myers

Abstract

Little Mill Creek is a first order stream located in Clarion and Jefferson Counties that has been extensively degraded by Acid Mine Drainage (AMD). Since 1991, the Mill Creek Coalition has installed over 20 passive treatment systems to treat AMD in the watershed. Since 1997, macroinvertebrate samples have been taken from Mill Creek and Little Mill Creek. While improvement in water chemistry is an important first step, it is really only the beginning in ecosystem recovery. This research was centered on Little Mill Creek because it was an extensively damaged tributary in the watershed and up to this point has had the most treatment. The goal of this research was to determine to what extent macroinvertebrate populations have changed as AMD treatment systems have been constructed. Macroinvertebrate diversity, generic richness, relative abundance and species accumulation were assessed for the years 1997 to 2006. Analyses of these metrics showed overall improvement between 1997 and 2004 for the entire stream. Results varied between in the site by site analyses; however, no statistical significance was calculated. Most sites did show improve through 2004 when treatment system decline led to deterioration of water quality and decreases in macroinvertebrate populations.

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INTRODUCTION

Pennsylvania has a rich history rooted in the coal mining industry. Used to fuel the steel and iron industries since 1902, rural Pennsylvania has been one of the leading producers of coal in the country (Pennsylvania Historical and Museum Commission 2003). Pennsylvania's coal mining heritage has not come without cost. The most common method employed for coal removal in Pennsylvania throughout the twentieth century was strip-mining. Strip-mining involves the removal of a long thin layer of overlying soil and rock known as overburden, which allows for the removal of the underlying coal seam. Strip-mining practices have resulted in the frequent occurrence of Acid Mine Drainage (AMD). AMD is formed when fracturing of the overburden from mining allows groundwater to percolate through bedrock strata that were formerly impermeable. These strata often contain high concentrations of iron pyrite (FeS_2) as well as other metals. When rain and groundwater leach the metals from the bedrock, the water source can become very acidic and carry the metals to the surface where they react with oxygen. This reaction results in precipitation of the metals from the water onto the substrate (Nyogi *et al.* 2001). The poor water quality combined with the precipitate covering the substrate can be detrimental to macroinvertebrate abundance and diversity (DeNicola and Stapleton 2002). AMD has caused the degradation of over 12,000 km of streams within the Northeastern United States, with 80% of that total (9,600 km) in watersheds in Pennsylvania and West Virginia (United States Environmental Protection Agency 1997A). The Environmental Protection Agency (1997B) estimated that it will cost approximately $15 billion to clean-up the states' streams.

Little Mill Creek is a first order stream in Clarion and Jefferson Counties in Pennsylvania that has been negatively impacted by acid mine drainage through coal mining activity (Figure 1) (Appendix A). Prior to treatment, average water quality was very poor with mean pH between 3.5-4.0 and very high concentrations of metals. Due to the poor water quality, all fish populations within the polluted reaches of the stream were extirpated and only acid-tolerant macroinvertebrate taxa remained. Fragmented macroinvertebrate populations between polluted reaches of Little Mill Creek, exhibited limited productivity and drift (Turner *et al*. 2000).

The Mill Creek Coalition was formed in 1990. Since its inception, its partners and supporting agencies have identified over 60 acid mine discharges within the 35,800 acre Mill Creek Watershed, including sites located on Little Mill Creek. In 1991, the first passive treatment system (PTS) was installed on Mill Creek. The first PTS on Little Mill Creek was installed in 1995 (Table 1).

Passive treatment is designed to generate alkalinity and neutralize acid resulting in the precipitation of contaminating metals prior to entering the stream (EADS Group and Dietz-Gourley Consulting 2006). In order to accomplish this, the PTS on the Mill Creek Watershed primarily utilize three types of treatment cells; Anoxic Limestone Drains (ALD), Successive Alkalinity Producing Systems (SAPS) and Aerobic Pond/Wetlands. An ALD is a buried channel of approximately three to five feet of limestone (Figure 2). This cell is typically used to generate alkalinity in areas where pH is above five and iron is mainly ferrous iron. SAP Systems are also known as vertical flow wetlands. The SAPS on Mill Creek are all designed with three to four feet of standing water over six inches of mushroom compost, which lies over three to four feet of limestone. An underground piping system is within the limestone. A valve or a standpipe system is used to control water levels (Figure 3). Aerobic pond/wetlands are also known as settling ponds and generally have one to five feet of water. They are used for metal removal via precipitation, typically iron in the Mill Creek Watershed (Figure 4) (EADS Group and Dietz-Gourley Consulting 2006). Currently, there are 20 PTS within the watershed, most of which are on Little Mill Creek (Figure 1). Since the installation of passive treatment systems, water quality on both Mill Creek and Little Mill Creek has shown improvement. Both Mill Creek and Little Mill Creek now have a pH between 5.0 and 6.5 and very little to no acidity. Metal concentrations have declined at the majority of the sampling sites.

Acid mine drainage is a widespread environmental issue, and according to Adams *et al.* (2005) a number of studies have examined the recovery rate of aquatic ecosystems following anthropogenic disturbances. However, there is no widely accepted protocol for quantifying the recovery of disturbed ecosystems. Furthermore, there are no criteria that establish the point at which stream recovery is adequate (Adams *et al*. 2005). As a result, each study uses different methods and points of recovery for stream ecosystems. Some studies center on habitat improvement in the streams (Brooks *et al.* 2002) while other studies focus on water chemistry (LeFevre and Sharpe 2002, DeNicola and Stapleton 2002, and Adams *et al.* 2005). I evaluated the recovery of macroinvertebrate communities in a stream following improvements in water chemistry; therefore studies focusing on water chemistry were used for reference for this study.

A study conducted in the Colorado Rocky Mountains evaluated litter breakdown rate in several streams impacted by varying levels of mine drainage (Nyogi *et al*. 2001). It was found that reaches with the highest levels of metal oxides contained few to no shredding invertebrates. This lack of shredders decreased the rate of litter breakdown in affected streams (Nyogi *et al.* 2001). The streams in Colorado were contaminated by zinc in addition to dissolved metal hydroxides. Little Mill Creek is contaminated chiefly by iron and aluminum, which have been shown to have negative impacts on populations of shredding invertebrates (Pennsylvania Department of Environmental Protection 2005).

Another study was conducted in the Bear Run Watershed located in southwestern Pennsylvania (LeFevre and Sharpe 2002). This study showed that the recovery rate of macroinvertebrate populations depended on the sample point downstream distance from the treatment system discharge. Standing crop, number of taxa, and Shannon-Weaver diversity index showed negative impacts to macroinvertebrate populations 300 meters downstream from the treatment system but improved macroinvertebrate populations 1,600 meters downstream from the treatment system, suggesting that downstream location of the sampling site may influence the results (LeFevre and Sharpe 2002). The Bear Run Drainage differs from Little Mill Creek in that remediation on Bear Run was done through the use of limestone sand applied to neutralize acidic water. Limestone sand was not one of the treatment methods employed on Little Mill Creek.

Finally, a study conducted on Slippery Rock Creek by DeNicola and Stapleton (2002) utilized a system similar to ones on Little Mill Creek in which an ALD is followed by an oxidation/retention pond/wetland. This study showed that while the goal of AMD remediation is improved water quality, heavy metal precipitates such as iron and particularly aluminum result in negative impacts to benthic macroinvertebrate communities.

Although a number of aquatic invertebrates have been shown to be tolerant of high levels of dissolved iron, several studies have suggested that remediated streams with neutral pHs, low dissolved metals but loose precipitates of ferric iron hydroxides have severely impacted benthic fauna (DeNicola and Stapleton 2002, Mitchell and Stapp 1996, and United States Environmental Protection Agency 1997B). Negative impacts of precipitates include burial of the substrata, clogging of macroinvertebrate gill surfaces, reduced vision, disrupted feeding, and general abrasiveness (DeNicola and Stapleton 2002).

While improvements in water chemistry are important, it only marks the beginning of ecosystem recovery. With one exception all of the PTS on Little Mill Creek were installed prior to the year 2001. Therefore, sufficient time has elapsed for increases in the macroinvertebrate community to be observed and correlated with the installation of each PTS. I hypothesized that macroinvertebrate populations would exhibit increased generic richness, abundance, diversity, and species accumulation as a result of treatment of acid mine drainage. To test this hypothesis, I looked for any improvement in macroinvertebrate communities in Little Mill Creek as well as any correlation between improvements in water chemistry and macroinvertebrate recovery. Generic richness measures the number of genera per sampling site. Relative abundance shows the number of organisms at one location or time relative to the number of organisms at another location or time. Alpha (local diversity within a site) and beta diversity (over the entire stream) were both calculated. Simpson's diversity is a measure of diversity often used to quantify the biodiversity of a habitat. It takes into account the number of species present, as well as the abundance of each species. Significance in overall generic richness, abundance, and beta diversity changes was determined through independent samples T-tests. A Post Hoc Tukey Test was used to identify homogenous subsets with similar diversity, richness, and abundance from year to year. A species accumulation curve was constructed to show the addition of taxa to the community from sampling sites at the headwaters to those further downstream. A species accumulation curve depicted the number of observed species as a function of some measurement of the sampling effort required to observe them (Colwell *et al.* 2004). Compositional evaluation parameters used included EPT Sensitivity Index and Jaccards Similarity Index. Attributes of water quality that were utilized for comparison were pH, total dissolved aluminum, and total dissolved iron concentrations. Acidic pH has been shown to have higher impacts on macroinvertebrate populations than high metal concentration, especially in streams where there is persistent exposure to high metal concentrations (Courtney and Clements 2000). In addition, increased levels of total dissolved aluminum has been associated with elevated concentrations of other metals (Yuan and Norton 2003).

MATERIALS & METHODS

I was involved in annual macroinvertebrate sampling from 2004-2006 (Table 2). In addition, aquatic macroinvertebrate samples were collected quarterly for the majority of the years between 1997, 1999, and 2000 on both Little Mill Creek and its receiving stream, Mill Creek (Table 2). For 1997, 1999, and 2000, one round of samples taken during the summer were used for analysis in order to keep sampling frequency and sampling time of year consistent for all years. The water quality data that was selected for analysis was taken from the same month as the macroinvertebrate sample and is only one of many samples taken at each sample location (Appendix B). There were 11 sample locations on Little Mill Creek labeled LM01 through LM11, beginning at its headwaters with LM01 downstream to its mouth at Mill Creek, labeled LM11 (Table 3, Figure 1). These 11 sampling sites were used to assess the macroinvertebrate assemblages and evaluate the effects of passive treatment. Sampling sites were located upstream and downstream of the each passive treatment system. Following the installation of each treatment system (Table 1), corresponding changes in macroinvertebrate communities should be discernable at downstream sampling locations. To assess the impact Little Mill Creek's influx has on Mill Creek, three sample sites above and below the mouth of Little Mill Creek were examined. Sampling methods employed were rapid bio-assessments via kick-net sampling.

Kick-net sampling utilized a D-frame net. The net was positioned approximately one meter downstream of a partner who kicked the substrate, from which the particulates were carried downstream into the net. At each sample location two, one-minute kick-net samples were taken. One sample was taken in a fast, shallow riffle, while the second sample was taken in a slow-moving, deep pool. The kick-net samples were also supplemented by ten people-minutes (*i.e.* one person picking for ten minutes, two people picking for five minutes each, *etc*.) of handpicking from rocks or other benthic debris in a representative cross-section of the stream.

Macroinvertebrates were identified to genus by me, Bridgette VonEden, or Heather Zuraski (Merrit and Cummins 1996). Generic taxonomic resolution is adequate for this type of assessment (Waite *et al.* 2004). All macroinvertebrates were identified using a dissecting microscope with the exception of the Chironomidae (Diptera). The heads of chironomids were removed and mounted in ventral view so that identifying characters could be seen under a compound light microscope. In instances where there were 20 or more individuals from the same site, the midges were sub-sampled based on morphological characters visible under a dissecting microscope and six individuals were mounted for identification. Macroinvertebrate genera and quantity were entered into a Microsoft Excel spreadsheet for analyses (Version XP).

Data analysis utilized *Ecological Quantitative Analysis Software* that accompanies McGraw-Hill's Field and Laboratory Methods for General Ecology, 4th Edition (Brower *et al.* 1998) and EstimateS (Version 8.0.0) Software developed by R.K. Colwell (2006). Evaluation of the recovery of macroinvertebrate populations on Little Mill Creek included emergent properties in the form of generic richness, accumulation, diversity and evenness, as well as composition properties including EPT sensitivity and similarity indices. With the exception of species accumulation and similarity, these data were evaluated by individual site and for the entire stream between the years 1997 and 2006.

RESULTS

Raw data used for analysis is included in Appendix C. Data from 2002 and 2003, while included this raw data set, was not used for analysis because sampling effort during this time was inconsistent with effort put into other years.

Individual Site Analysis for 1997-2006: LM01, the headwaters of Little Mill Creek, was only minimally affected by AMD. Habitat at LM01 had classic riffle-pool areas with small cobble substrate and shrubby riparian area. LM01 exhibited annual increases in generic richness and abundance from 1997 through 2004 (Table 4). Coincidentally, composition at LM01 varied in percentages of Ephemeroptera, Plecoptera and Trichoptera until 2004 when EPT percentages were at their highest. Following 2004 there was a slight decline in each of these three taxa at this site (Table 5), which is consistent with richness data. In contrast, the percentages of dipterans, specifically the family Chironomidae showed the inverse. Dipterans declined in 2000 when EPT taxa were high. In 2004, while EPT numbers increased again, the number of dipterans declined and did not begin to increase again until Ephemeroptera, Plecoptera, and Trichoptera numbers began to decrease through 2005 and 2006. Other groups that were consistently represented at LM01 included Odonata, Coleoptera, Megaloptera, Hemiptera, and Decapoda (Appendix C).

Simpson's diversity showed annual increases from 1997 through 2000 followed by a slight drop in 2001 before increasing again in 2004 and further in 2005 (Figure 5). Decreases were observed in Simpson's diversity in 2006 (Figure 5). A trend similar to diversity can be observed in pH and iron levels from 1999 through 2001, but from 2004 to 2006 when diversity is highest, pH is lowest (Figure 5). In

2005 there was a decrease in richness and abundance (Table 4). Simpson's diversity levels fluctuate but remain high and the number of EPT taxa increases (Figure 5, Table 5). At the same time, pH at LM01 increased to almost 7.0 and iron levels dropped to near zero (Figure 5, Table 4).

The habitat at LM02 contained riffle-pool areas with a more developed forested riparian area. Between LM01 and LM02, there are four AMD discharges (Figure 6). There are two discharges at a site known as the Morrow site (Figure 6). The larger of these two discharges was treated in 1998, while the smaller discharge remains as yet untreated. Another passive treatment system was installed that same year at the Beagle site (Figure 6). The final discharge between sampling sites LM01 and LM02 is the Bog site which was treated in 1999 (Figure 6). Following the installation of the Bog PTS, water quality improved showing lower metal concentrations and acidity with high pH and alkalinity (Appendix A). After treatment of three of the four discharges between these sites, macroinvertebrates at LM02 showed annual fluctuating generic richness during construction years of 1999 and 2000 (Table 4). In 2001, richness was highest at 29 genera. After 2004, richness declined annually through 2006 (Table 4). The same trend was observed for generic abundance (Table 4). In general, when pH was high, diversity increased at this site; however, the pH remained lower at LM02 than LM01, so diversity was not as high at LM02. With lower pH, more dissolved aluminum and iron were also present at this site showing an inverse relationship between pH and dissolved metal concentration (Figure 7).

The biggest difference in assemblage composition between LM01 and LM02 was the loss of all Ephemeroptera, which contributes to the declines observed in generic richness. EPT Sensitivity Index values were also much lower at this site with Trichoptera the only representative consistently found (Table 5). Similarly to LM01, values for EPT Index were inversely proportional to percentages of Diptera, particularly Chironomidae (Table 5). Odonates, megalopterans, coleopterans, and decopods were consistently represented at LM02 (Appendix C).

Between LM02 and LM03 six treatment systems were installed on the old Filson Property (Figure 6). Filson 5 and Filson 6 were installed in 1994, followed by Filson 1, 2 and 3, which were installed in 1995 and redesigned in 2001. Filson 4 was installed in 2000. Little Mill Creek at LM03 was channelized and heavily silted. This section was deep and slow moving. Earliest invertebrate data collected for LM03 occurred in 1997 when 30 individuals were collected, but only five different taxa (Table 4). During the construction of Filson 4 and the redesign of Filson 1, 2, and 3, richness and the number of individuals sampled fluctuated with 25 individuals and 12 genera collected in 2000 and 94 individuals and 18 genera sampled the following year. Generic richness in 2004 dropped to 11 with 71 individuals sampled. Through 2005 and 2006 richness and the number of individuals sampled decreased further (Table 4). Simpson's Diversity Index fluctuations for LM03 corresponded to pH and dissolved metal concentration showing the same relationship observed at LM02 (Figure 8).

The majority of individuals sampled each year from LM03 were dipterans, and the majority of those were from the family Chironomidae. However, only six specimens were collected. Chironomids increased through 2006 when that was all that was collected (Table 5). Ephemeroptera and Plecoptera were only found at this site in 2001 and only one individual from each order was found. Trichoptera were found at this site from 1999 through 2001 and were the most represented in the EPT sensitivity index value (Table 5). Other orders collected from LM03 were Odonata, Megaloptera, Coleoptera, and Hemiptera, and their numbers all declined over the years (Appendix C).

A seventh, untreated discharge from the Filson property enters between LM03 and LM04 and LM05 (Figure 6). Habitat at LM04 was deep slow moving pools which were also heavily silted. LM05 was shallower and with a substrate consisting of large boulders coated with iron precipitate. Richness increased annually from 1997 to 2001 at LM04 followed by annual decreases between 2004 through 2006 (Table 4). Simpson’s Diversity showed decreases at LM04 through 2001 before increasing again in 2004 and 2005 which was the same as pH and metal concentrations (Figure 9). Similar to LM03, dipterans comprised most of the macroinvertebrate community at LM04 (Table 5). No Ephemeroptera were collected from this site and only a few Plecoptera were collected on one occasion in 1999. Trichoptera were consistently found at LM04 between 1999 and 2005.

Data could only be obtained for four sampling years at LM05. Richness data for LM05 fluctuated each year. In 2004 there were 14 taxa found, while in 2005 there were six taxa found, and finally 12 taxa were found in 2006. Similar fluctuations were observed in the number of individuals collected (Table 4). Simpson’s diversity steadily increased through 2006, as did iron, although only three years of diversity data were available (Figure 10). Also, no Ephemeroptera or Plecoptera were found at this site. Some Trichoptera were found in 2004 and 2005 but not in 2006 (Table 6).

The REM site was the most recent and the largest PTS to be installed on Little Mill Creek. REM was installed in 2005 between sites LM06 and LM07 (Figure 11) Habitat at LM06 was much like LM03, a silted deep channel. LM07 consisted of a deep channel as well, but was less silted with more, large cobble substrate. Fluctuations in richness, the number of individuals sampled and Simpson's diversity were observed at both LM06 and LM07 for all years sampled (Table 4, Figures 12, 13). Concentrations of iron and aluminum, as well as pH fluctuated yearly as did invertebrate populations (Figures 12, 13). The highest richness values occurred in 2004 at both sites with 19 at LM06 and 16 at LM07. These two sites showed annual decreases in 2005 and 2006 in both richness and the number of individuals sampled immediately following the construction of the PTS. Taxonomic compositions of LM05, LM06, and LM07 were comparable to the previous two sites with Chironomidae representing the majority of the communities (Table 5).

Between LM08 and LM09 there is a site which was actively mined until 2005 (Figure 14). Little Mill Creek becomes wider and shallower at LM08 and LM09. The substrate is smaller cobble covered in iron precipitate. Water chemistry at LM08 improved from 1995 through 1997, but there is no data available between 1997 and 2000 (Appendix A). When samples were taken between 2000 and 2006, pH remained between 4.0 and 5.5 with up to 30 ppm acidity and high sulfate levels. This was very similar to data from LM09 through 2006. Generic richness decreased annually from 2004 to 2006 at both LM08 and LM09. Conversely, macroinvertebrate populations exhibited annual increases in diversity at LM08 from 1997 to 2006 except in 2005 (Figure 15). Diversity also showed annual increases at LM09 from 1997 to 2005 (Figures 16). Plecoptera and Trichoptera were found in 2004 but not any other year at either site. No EPT taxa were found in 2006.

There are two treatment sites, Markle/Kotchey site constructed in 2000, and the Brown/Zerby (Hanlan) Site constructed in 2001 which are located between LM09 and LM10 (Figure 17). DEP's Bureau of Abandoned Mine Reclamation (BAMR) installed PTS; however the systems are undersized and only treating about 30% of the AMD flow at these sites. Water quality at LM10 is very similar to LM09 (Appendix A). In addition, macroinvertebrate richness and diversity improved through 2005 (Figure 18) but richness dropped in 2005 and 2006 (Figure 18, Table 4).

A second BAMR system was installed at the Shofestal/Zerby site between LM10 and LM11 (Figure 17). Again, the PTS is antiquated at this site and only treating about 30% of the AMD flow. In addition there is an untreated discharge known as the Clark Well Site flowing into Little Mill Creek between LM10 and LM11 (Figure 17). The combination of untreated discharges and failing treatment systems gave this site the poorest water quality of all sites, so it stands to reason that macroinvertebrates collected at this site were mostly acid-tolerant chironomids. The pH at this site was only in the 3.0 to 4.0 range with high acidity (Appendix B), so no Ephemeroptera or Plecoptera were ever found there. Only five genera were collected at LM11 in 1999 when 13 individuals were found and in 2004 when eight individuals were collected (Table 4). No individuals were collected in 2005 and seven genera with 28 individuals were sampled in 2006 (Table 4). Diversity at LM11 improved between 1999 and 2004, but no invertebrates were found in 2005 and diversity was decreased from 2004 in 2006 (Figure 19). The remaining three sites LM09, LM10 and LM11 showed similar taxonomic composition as LM08 (Table 5).

Stream Reach Analysis Comparing 1999-2006: In addition to looking at the sites individually, I also evaluated the effect passive treatment has had on the stream's overall insect community. The same parameters evaluated within sites were also compared among sites along the entire length of the stream. In addition, species accumulation curves were constructed to determine the distribution of new taxa throughout the stream for each year sampled.

Richness throughout the total length of the stream varied from year to year (Table 6) however, this variation was not significant as indicated by an independent samples t-test, which yielded a $P>0.05$. Richness in 1997 of 15 genera was lower than that observed in later years. In 1999, there was an increase in richness to 46 genera with additional increases in 2000 and 2001 to 53 and 60 genera respectively (Table 6). In 2004 richness was at its highest with 73 genera collected. In 2005 and 2006 richness declined slightly below 2000 and 2001 levels with 49 and 43 genera respectively (Table 6). The variation in the number of individuals sampled for each year was not significant with $P>0.05$. Univariate analysis compared the average generic richness values per site for each year to each other (i.e. the average richness for 1997 was compared to 1999, 2000, 2001, etc). Upon comparison, the averages were grouped into two subsets (A and B) based on statistical significance from each other. A third group, AB was not statistically significant from either the A group or the B group. The average richness for Little Mill Creek in 1997 was just over five genera per site. This was lower than the average in 2006 which averaged about eight genera per site for that year. These two years composed subset A. In 1999 there was an increase in average richness to 10 genera per site. This increase continued through 2000. In 2001 average richness was 24 genera per site, which was the only year in subset B, meaning it was the only year to be statistically significant from all the other years (Figure 20). Other years were considered to be transition years between subsets A and B. Univariate analyses of the average generic abundance sampled per site each year did not yield significant subgroups (Figure 21).

Overall macroinvertebrate diversity for the entire stream was calculated using Simpson's Diversity Index. T-tests showed a significant ($P<0.05$) increase in diversity from 1997 to 2006. Figure 22 shows the average Simpson's diversity per site for the years 1997 to 2006 for Little Mill Creek from the headwaters to the mouth of Little Mill Creek. Average diversity per site in 1997 was much lower than diversity in 2004 and 2005. Post Hoc tests subdivided the yearly average diversity into groups A and B that varied significantly from each other (Figure 22). Average diversity values 2000, 2004, and 2005 (subset B) were significantly higher than values from 1997 (subset A).

The species accumulation curves (Figure 23) showed that the rate of new taxa added at each consecutive downstream site remained consistent across all years sampled. Different numbers of taxa were being found (which is why there was separation), but the slope of each curve remained similar throughout the years sampled.

Little Mill Creek's Impacts on Mill Creek: Generic richness for the three Mill Creek sampling sites above the mouth of Little Mill Creek was equal to or higher than the three sites below Little Mill Creek for all years sampled but one (Table 7). However, statistically, generic richness variation between sampling sites above and below the mouth of Little Mill Creek was not statistically significant ($P>0.05$). The number of individuals sampled varied from year to year and between the upper and lower sampling sites (Table 7). The highest numbers of individuals were found in 1999 with 262 from the upper sites and 440 from the lower sites. While not statistically significant ($P>0.05$), Simpson's Diversity was higher above the mouth of Little Mill Creek during three of the six sampling years (Figure 24). In 2006, Simpson's Diversity was the same above and below Little Mill Creek.

Regarding community composition, the EPT Sensitivity Index on Mill Creek was higher above the mouth of Little Mill Creek than below in all years but one (Table 8). No mayflies, stoneflies or caddisflies were collected below the mouth of Little Mill in 2006. Below Little Mill Creek, dipterans composed the majority of populations in all years. EPT indices were low for the sites below Little Mill Creek for all years. Given these community composition percentages, it is not surprising that Jaccard's Similarity Coefficient was very low in every year (Table 9).

DISCUSSION

I hypothesized that macroinvertebrate communities would exhibit increases in calculated biological metrics following the treatment of acid mine drainage. As with any research involving natural communities, there are usually factors which cannot be controlled as they would be in a laboratory environment. These issues can often affect the outcome of the matters being studied. There are many factors which could have had an effect on the recovery of Little Mill Creek's macroinvertebrate populations which are secondary to the acid mine drainage treatment. These factors are discussed in detail below.

Individual Site Analysis for 1997-2006: Considering each sampling site individually, some sites on Little Mill Creek had greater abundances and higher diversity of macroinvertebrates than others. The first sampling site at the headwaters of Little Mill Creek has not been impacted by acid mine drainage. Water quality at this site has remained the same since water testing began in 1994. So, it stands to reason that this site should have high richness, abundance, and diversity. Generic composition at LM01 was healthy. EPT sensitivity index was high as was abundance of other taxa indicative of good water quality and prime benthic habitat.

There are several factors which contributed to the differences observed in the macroinvertebrate assemblages and these factors varied at each site below the treatment systems. One such factor was the level of the treatment from upstream treatment systems. The Mill Creek Coalition recently contracted Deitz-Gourley Consulting and the EADS Group (2006) to produce an Operation, Maintenance, and Repair Plan (OM&R Plan). This plan was based on water chemistry flowing into and out of the treatment systems. Their findings showed that some of the treatment systems are in need of repair or replacement. This is to be expected after 10-15 years of operation on a highly-polluted stream. Theoretically, treatment systems are designed to last at least 20 years, but several site-specific factors such as water chemistry, hydrology, structural integrity of the limestone and bacterial processes can decrease PTS longevity (Hedin *et al.* 1994). Declines in treatment system efficiency have resulted in decreased water quality at several sites and have caused steady decreases in Simpson's diversity and community composition. Water quality conditions in Little Mill Creek were likely tolerated by sensitive taxa when these systems were working properly, so decline in water quality had an immediate effect on pollution-sensitive taxa. This was evident at most sites in the lack of Ephemeroptera and Plecoptera downstream of LM01. These declines were observed at LM02, LM03, LM06, LM07, and LM09, LM10 and LM11.

The Beagle Treatment Site, located between sites LM01 and LM02, was found to be performing inadequately and was recommended for complete removal and replacement according to the OM&R Plan. The six Filson Sites, situated between sites LM02 and LM03 were among the first PTS to be installed on Little Mill Creek (Table 1) and as such are in need of renovation as evident by observable decline in water quality (Table 5), decreased macroinvertebrate assemblages and the OM&R Plan. Water quality at LM03 decreased from 1994-1999 (Table 5), but following PTS reconstruction and installation of a PTS at Filson 4 in 2001, water quality increased until PTS efficiency began to decline in 2004 through 2006. Macroinvertebrate metrics increased from 1997 peaking when all EPT taxa were found in 2001. However, subsequent failure of these PTS and the resulting declines in water quality resulted in declines in richness, abundance, and diversity at LM03 from 2004 with no EPT taxa were found there in 2006. Concentrations of iron and manganese were consistently slightly higher at LM03 than at the previous two upstream sites (Table 6). These heavy metals have been shown to negatively impact macroinvertebrate populations (DeNicola and Stapleton 2002).

The REM site, recently installed in 2005, is currently functioning well in removal of most of the iron and aluminum from the two discharges being treated. Due to the level of AMD pollution and the size of the system resulting from property constraints, the REM PTS requires a monthly flushing schedule in order to keep the system functional. All of the water flushed through the system is discharged at the end into Little Mill Creek with minimal treatment. This monthly influx of untreated water could also be contributing to the lack of increases in macroinvertebrate at and below the REM site. All other treatment systems on both Mill Creek and Little Mill Creek are flushed only once or twice a year. The REM PTS has worked well for its first two years, but an undersized system will lead that system to fail sooner and as previously stated, the REM PTS may be showing signs that it is already beginning to fail with decreased water quality and invertebrate declines in 2006.

The three PTS which were installed by BAMR on the lower end of Little Mill Creek are not functioning at optimal efficiency and currently provide little treatment of AMD as indicated by water quality within the system. Recent water quality data at LM09 through LM11 from 2004 through 2006 shows improvements over data collected between 1993 and 2000 at (Table 5). These improvements in water quality and invertebrate communities at LM09 through LM11 followed the accumulated effects of AMD treatment systems upstream. The macroinvertebrate community was extremely poor in richness and diversity with no EPT taxa in 1997, but the community then showed increases in richness and diversity through 2004 when Plecoptera and Trichoptera were found at LM09 and LM10.

In addition, there are discharges that are still untreated on Little Mill Creek. Untreated discharges are located immediately upstream from LM02, LM04, LM09, LM10, and LM11. Untreated AMD discharges result in changes in water chemistry at these sample sites as well as all of the sampling locations downstream. There is a small discharge near the Morrow Site upstream from LM02 that is untreated to date. Slight traces of aluminum were found at LM02, as well as twice the amount of manganese and sulfates as observed at LM01 (Table 5). However, the pH at LM02 was well above 6.0, just like at LM01, so even small amounts of these metals could result in diversity and EPT declines at LM02 (Figure 7). A seventh untreated site on the Filson Property flows into the stream above LM04 and therefore impacts the macroinvertebrate populations found there. Declines in macroinvertebrate populations at LM04 are most likely linked to declines in water quality resulting from the untreated discharge (Figure 6). Acidity is much higher at LM04 than at LM01 as well as iron, manganese and sulfate concentrations. Richness and abundance were lower at LM04 than at LM03. Simpson’s diversity has been in a continual decline from LM02 downstream. Corresponding decreases in pH and increases in dissolved metal concentrations were also observed (Figures 7, 8, 9). Ephemeroptera were not found anywhere downstream of LM01. In addition, while Plecoptera were found a few sites downstream of LM01, they were not found at every site below LM01 or consecutively/consistently throughout the nine years of sampling. The absence of Ephemeroptera and Plecoptera greatly reduced the EPT sensitivity index at downstream sampling locations. Dipterans, particularly Chironomidae now occupy the niches vacated by Ephemeroptera and Plecoptera. Several Ephemeroptera and Plecoptera taxa are extremely sensitive to pollutants, particularly aluminum, associated with acid mine drainage (Yuan and Norton 2003), thus these taxa are not commonly found as AMD pollutants accumulate downstream.

Many aquatic macroinvertebrates are microhabitat specialists having specific substrate and water requirements. Some sampling sites on Little Mill Creek such as LM03, LM04, and LM06 have slow-moving water with many deep, silted holes providing less than ideal conditions for some macroinvertebrate taxa. These sites often have similar taxonomic composition to each other. Dipterans represented about half of the macroinvertebrate populations at LM03, LM04 and LM06 with the majority being chironomids. Chironomid genera found at these sites, such as *Cricotopus*, *Chironomus*, and *Paratendipes* are burrowers (Merritt and Cummins 1996). A number of caddisfly genera found at these sites were from the families Phryganeidae and Limnephilidae. Both families are considered climbers, adapted for living on detrital debris such as submerged branches, roots and vegetation (Merritt and Cummins 1996). Other sites such as LM07, LM08 and LM09 are deep, like the previous sites, but have large rock substrates as opposed to the silty substrates previously mentioned. The most common macroinvertebrates found at these sites were hydropsychid caddisflies, which are clingers that have behavioral and morphological adaptations to attach themselves to surfaces in lotic, erosional habitats (Merritt and Cummins 1996). The remaining sites would also be considered lotic, but the substrate is composed of smaller cobble and gravel. These sites have a combination of both burrowers and clingers resulting in slightly more diverse macroinvertebrate populations than sites more favorable to either burrowers or clingers.

Between LM04 and LM05 is a bridge on State Route 949. At that location the stream widens and remains deep with a substrate of large rocks. While there was less siltation at this site, there was more precipitated iron covering the rocks. The pH at LM05 dropped to the 5.0 range and iron, aluminum, and manganese levels increased (Table 5, Figure 10). The EPT Sensitivity dropped to less than 10%. No Ephemeroptera or Plecoptera have been found at this site and Trichoptera populations are low compared to LM01. Diptera populations are diverse and a few other orders of insects have also been found at LM05 explaining the high diversity measured at this site.

Another factor that could potentially affect outcomes at each site was precipitated metals coating the substrata. Metal precipitates have been found to negatively impact benthic macroinvertebrate populations, specifically in areas where the current is slow. (DiNicola and Stapleton 2002). Slow currents result in accumulation of these metals, particularly iron and aluminum, on the stream bottom. In faster currents metal precipitates often remain suspended, not attaching to the substrate and smothering macroinvertebrate communities.

Finally, sampling conditions and sampling effort may have varied from site to site and between each of the sampling years. While the locations remained consistent, the stream morphology most likely changed slightly between 1997 and 2006. Water quality conditions are extremely variable with water level. Changes in flow greatly affect water chemistry, especially pH and dissolved metal concentrations. These abrupt changes in water chemistry lead macroinvertebrates to drift out of sampling locations in search of better water which resulted in changes in macroinvertebrate diversity and community composition. With regard to sampling methods, sampling was designed to survey a riffle and a pool at each sampling site. Some of the sites do not have a riffle. At these sampling sites, the “riffle” was the head or tail of a pool where the water is typically moving faster than within the pool itself, affecting taxonomic composition, abundance, and diversity. Sampling site locations with respect to treatment systems may have affected results. One study found that sampling sites closer to the treatment system provided smaller, less diverse macroinvertebrate communities than sampling sites further downstream (LeFevre and Sharpe 2002). Little Mill Creek has 12 passive treatment systems along its approximately 10 km length, so spacing sampling locations further apart would not have been possible. Sampling effort differed among the several individuals who sampled over the nine years of data collection. I conducted sampling efforts at every site from 2004 to 2006. Some sample sites were sampled more consistently than others by previous individuals. There were also different people doing the invertebrate identifications between 1997 and 2004. I did the identifications for the 2004 through 2006 sample years. All of the above factors had potential influences on the results of this study.

Stream Reach Analysis for 1997-2006: Despite the results of the site by site analysis, analysis of the entire length of Little Mill Creek illuminated definite improvement between 1997 and 2006. While changes in richness were not shown to be statistically significant by an independent samples T-test, there were increases in richness from 1997 and 1999 to 2004 through 2006. These data lend support to the hypothesis that macroinvertebrate populations have increased since the installation of the passive treatment systems and subsequent improvements in water quality. In addition, the univariate analysis comparing significance in the average generic richness between the years sampled revealed a significant difference between 1997 and 2001, but no significant difference between 1997 and 2006 (Figure 20). This shows that the yearly average richness did improve between 1997 and 2001 but declined from 2001 to 2006. A similar trend was shown in yearly average abundance (Figure 21) and yearly average diversity (Figure 22) though not with statistical significance. Declines were most likely the result of treatment system decline contributing to poorer water quality. Without the data from 2002 and 2003, it is apparent that richness and the number of individuals sampled (Table 7) as well as yearly average richness (Figure 16), yearly average abundance (Figure 17) and yearly average diversity (Figure 18) show increases through 2004 when the treatment systems begin to show signs of decline. Collections from 2004 had the highest generic richness values. Samples for 2004 were taken earlier in the year than the samples for all of the other years. Time of year may be important in providing the best representation of the macroinvertebrate populations of Little Mill Creek. Many of the insects have already molted from their larval form into their adult form by June, July and August when most of the samples were taken. By taking the samples either before larvae have molted to adults or later, after eggs have hatched into new larvae, a more representative community could be sampled.

In addition to richness increases, the positive increases in Simpson's diversity between 1997 and 2006 were found to be statistically significant. This provides more support for my hypothesis that macroinvertebrate communities would increase following passive treatment of AMD. For the 2004 and 2005 sampling years, every site showed increased diversity when compared to the 1997 and 1999 sampling years. This trend was also reflected in the univariate analysis of the yearly average Simpson's Diversity Index which showed an immediate statistically significant increase between 1997 and 1999 (Figure 22). These increases were most likely due to whole-stream improvements in water chemistry and benthic habitat.

Little Mill Creek's Impacts on Mill Creek: The hypothesis was not supported in regard to the impacts of Little Mill Creek on Mill Creek. The results showed that Little Mill Creek is having some effect on Mill Creek. At the mouth of Little Mill Creek there are two well defined bands marking where the pH increases to the levels required to precipitate aluminum and iron. The number of individuals collected below Little Mill Creek was higher than the number sampled above, which would normally be a positive indicator, but fewer taxa were found below Little Mill Creek and those taxa found were generally pollution tolerant. However, statistical analysis did not reveal any statostocally significant changes in richness, diversity, or abundance between the sites above Little Mill Creek and those below. This was most likely due to a small sample size used for comparison. There were only three sample sites below Little Mill Creek compared to three samples sites above Little Mill Creek. Simpson's diversity was also found to be lower below Little Mill Creek, although without statistical significance. While no statistical significance in richness or diversity was found, raw data does show decreases in generic richness and diversity below Little Mill Creek lending support to Little Mill Creek's negative impact on Mill Creek (Appendix C). Also supporting this observation is the low Jaccard's Similarity Coefficient between individuals sampled above the mouth of Little Mill Creek to that below the mouth. This is most likely due to poor water quality at the mouth of Little Mill Creek where pH drops to between 3.0 and 4.0. There is also aluminum, iron, and high concentrations of manganese in Mill Creek at the mouth of Little Mill Creek. In addition to the inputs from Little Mill Creek, there are three other tributaries which have untreated AMD discharges that enter Mill Creek below Little Mill Creek (Figure 25). Mill Creek may have the buffering capacity to absorb the impact of Little Mill Creek but not the combined impact of all four tributaries. Streams such as Mill Creek, in the western part of Pennsylvania, are freestone streams. Unlike the natural limestone streams that are more common in the central and eastern part of the state, freestone streams have a relatively low buffering capacity (Lindsey *et al*. 1998).

CONCLUSION

My hypothesis was that macroinvertebrate communities would show positive trends in richness, abundance, diversity, and species accumulation with treatment of acid mine drainage. As evident by the overall stream analysis, Little Mill Creek has shown positive trends in these biological metrics. Generic richness and abundance showed positive trends from 1997 to 2006 though not statistically significant increases. Simpson's diversity did show statistically significant increases between 1997 and 2006.

Although not as evident in the site by site analysis, macroinvertebrate populations did show positive trends in diversity between 1997 and 2006, with populations fluctuating between these years. Positive trends in generic richness and abundance were shown between 1997 and 2004 at all sites with slight decreases in these metrics in 2005 and 2006. Decreases noted in 2005 and 2006 support assessments made by Mill Creek's Operation, Maintenance and Repair Plan that several PTS have exceeded their lifespan and are beginning to fail. There was greater variability among sites when compared to trends stream-wide because individual site conditions change from one site to the next in several different ways including habitat type, water quality and an individual's sampling efforts. These site variables also impacted taxonomic composition at each site because macroinvertebrates are known microhabitat specialists.

The hypothesis was not supported with regard to the impact of Little Mill Creek on Mill Creek. Generic richness and diversity dropped at sampling sites downstream of Little Mill Creek's mouth on Mill Creek. Water chemistry at Mill Creek sampling sites below Little Mill Creek showed increases in dissolved and precipitated metals and decreases in pH to 4.0. However, these changes cannot all be attributed to the addition of Little Mill Creek, as three other tributaries also enter Mill Creek further downstream.

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CHAPTER 2

FIGURES
TABLES

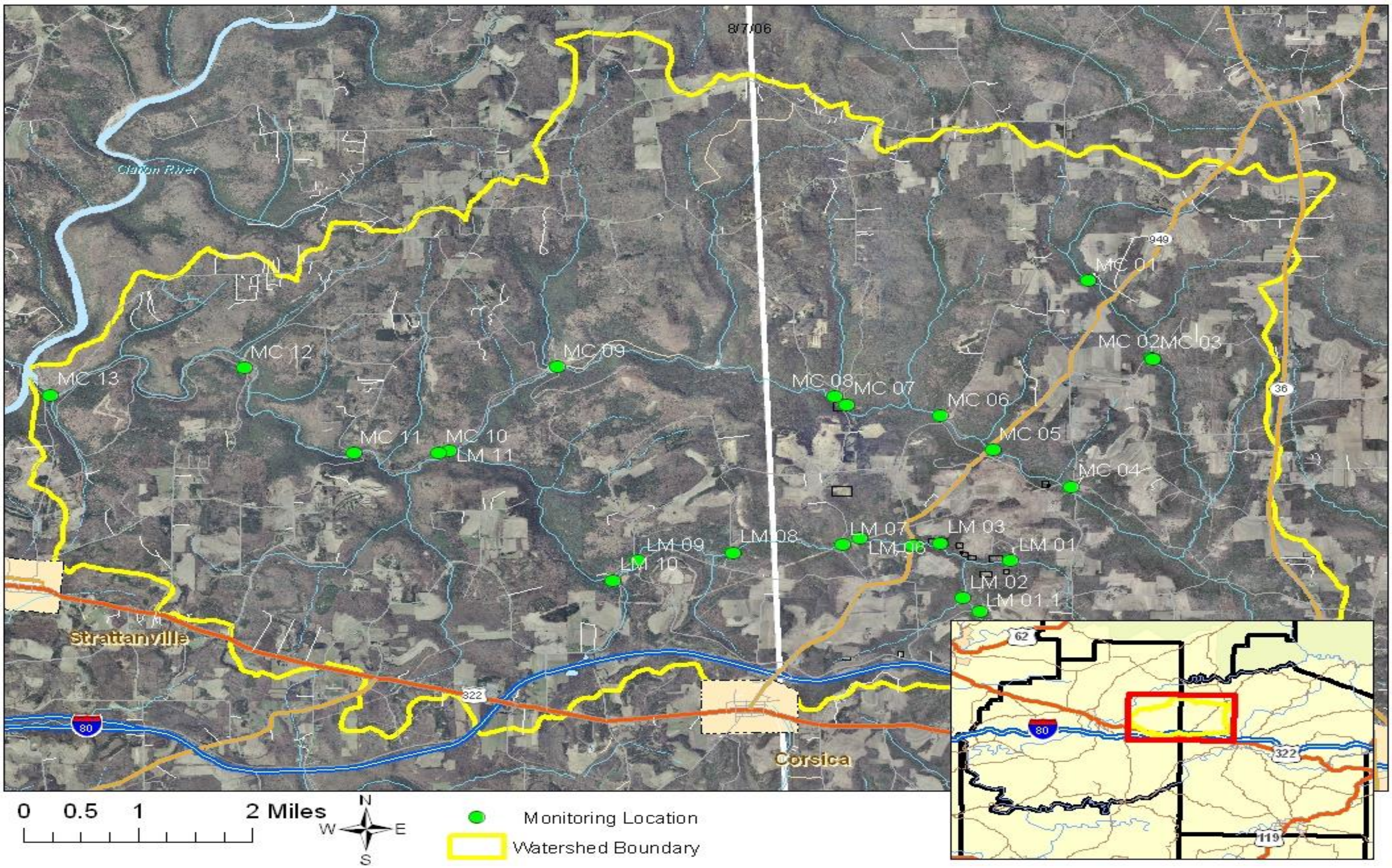
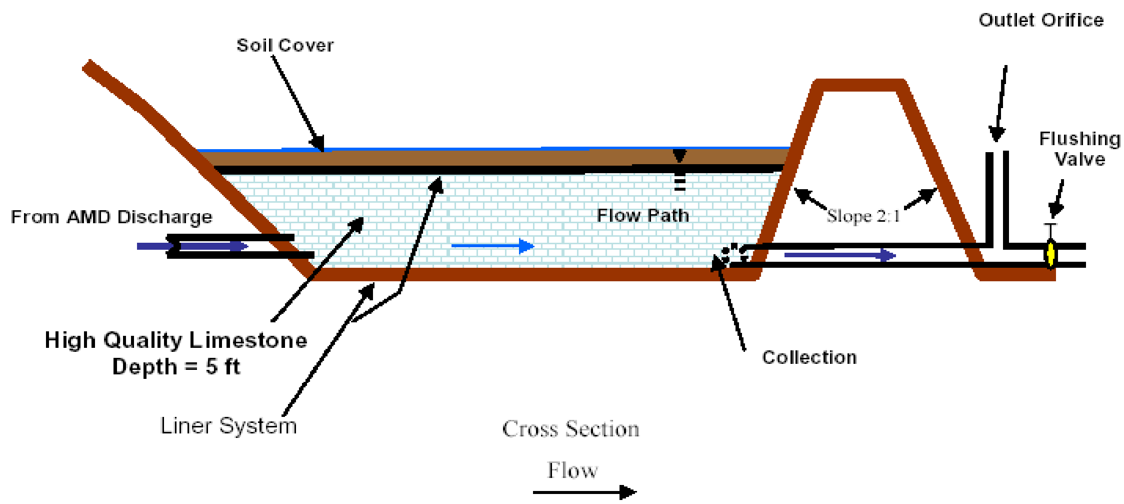
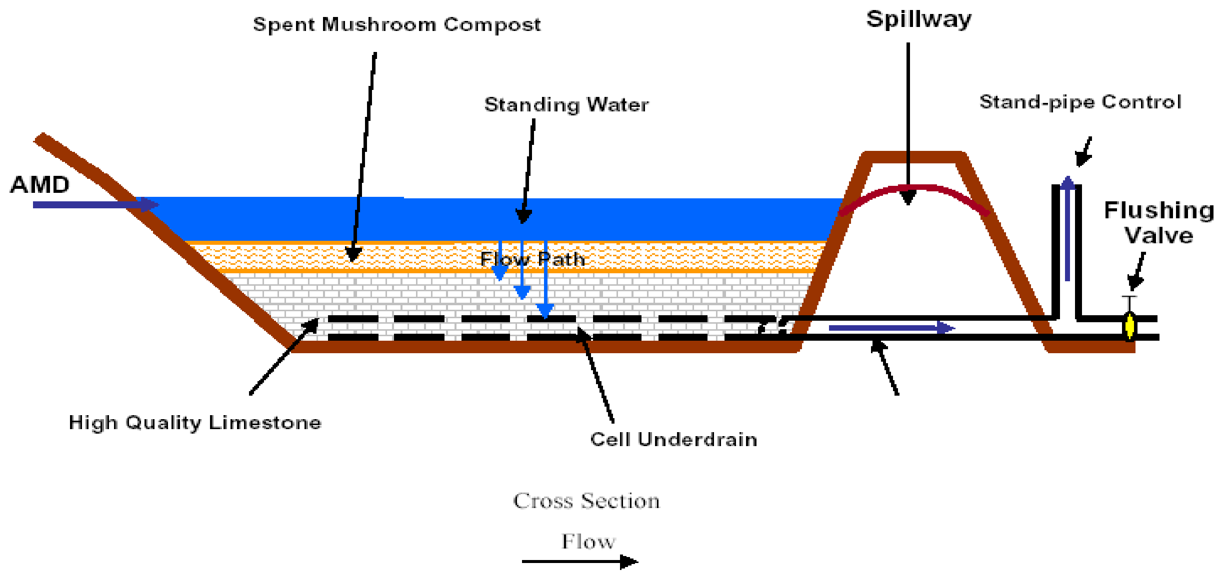


Figure 1: Mill Creek Watershed map showing locations of sample points and treatment systems.



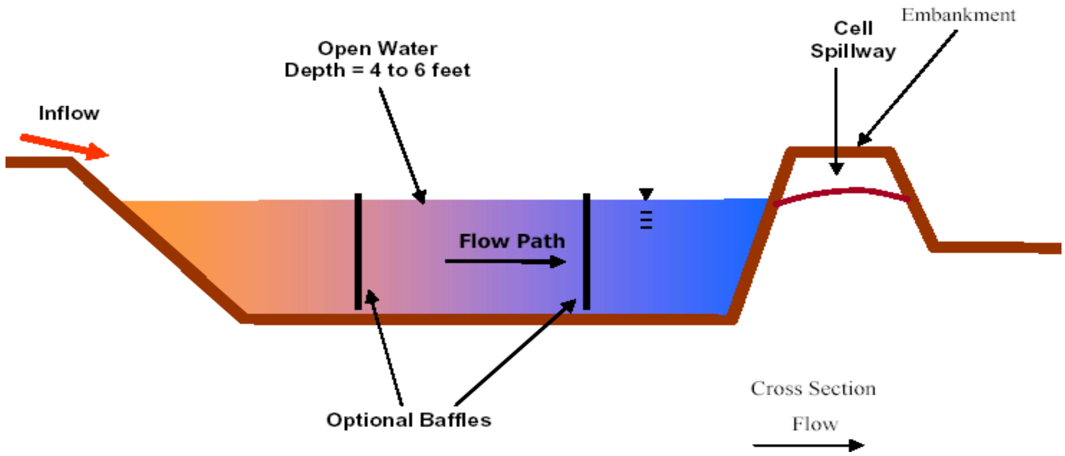
(EADS Group Inc. and Dietz-Gourley Consulting LLC 2006)

Figure 2: Typical Anoxic Limestone Drain (ALD) on the Mill Creek Watershed.



(EADS Group Inc. and Dietz-Gourley Consulting, LLC 2006)

Figure 3: Typical Successive Alkalinity Producing System (SAPS) on the Mill Creek Watershed



(EADS Group Inc., Dietz-Gourley Consulting, LLC 2006)

Figure 4: Typical Aerobic Pond/Wetland on the Mill Creek Watershed.

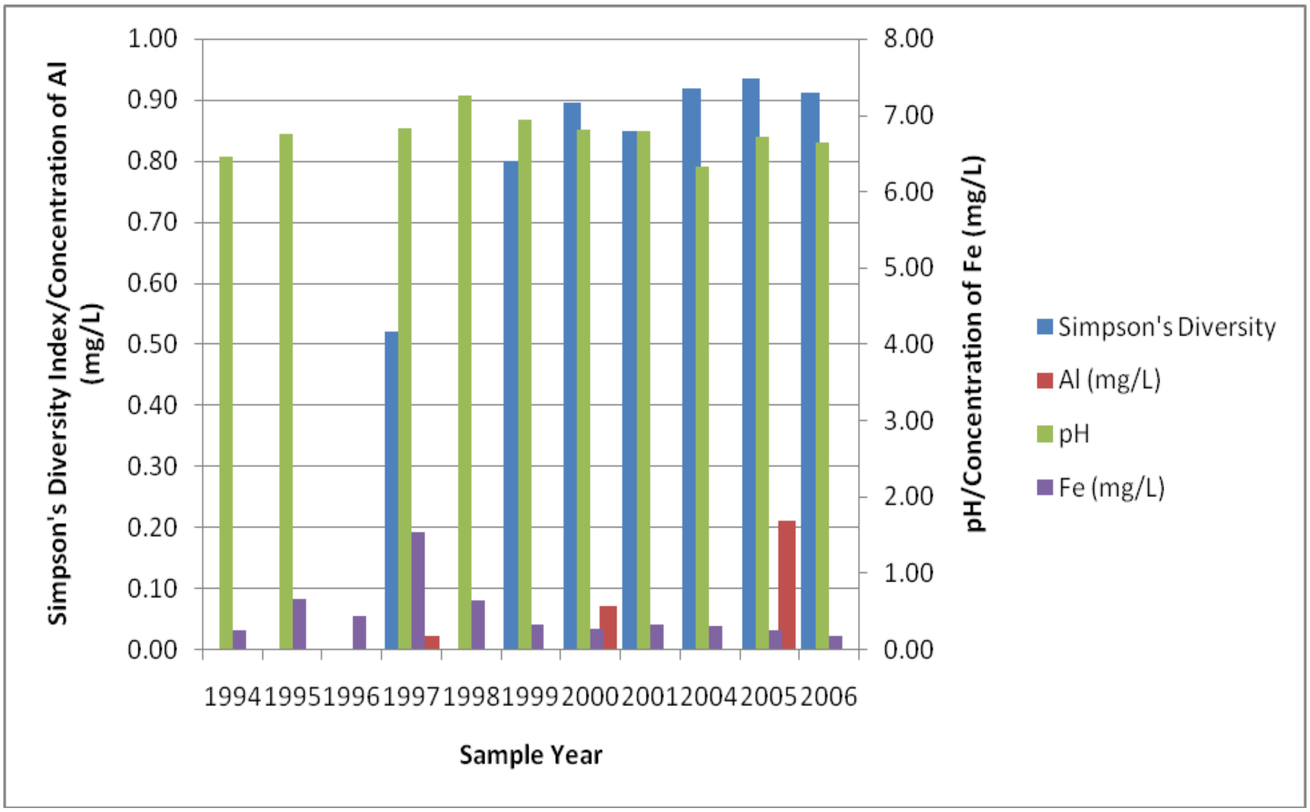


Figure 5: Bar graph showing the relationships between water quality and Simpson's Diversity Index for LM01 from 1994-2001, 2004-2006. Gaps represent no data and/or uncollected years.

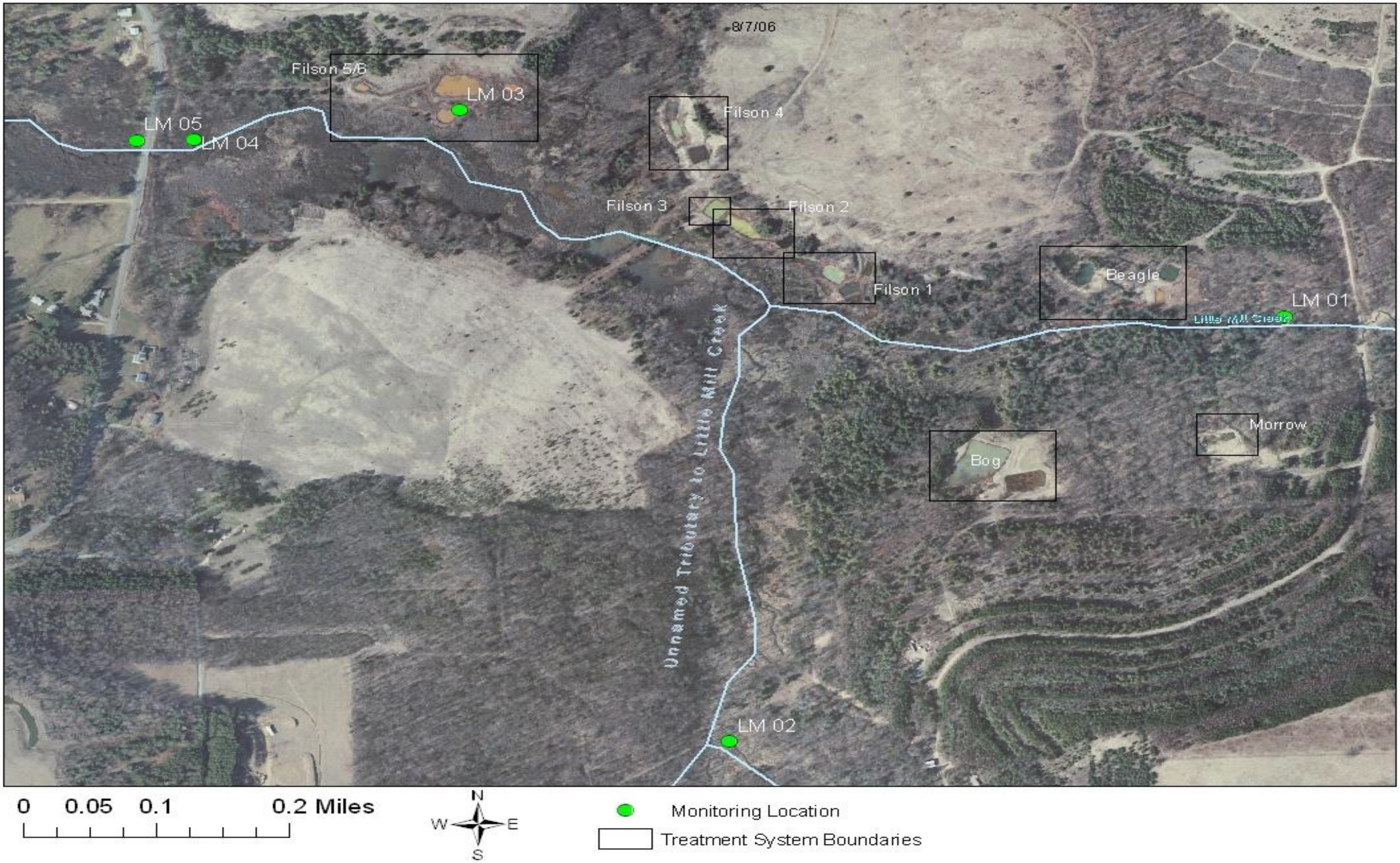


Figure 6: Little Mill Creek sampling locations LM01-LM05 showing location of passive treatment system in between the sampling location.

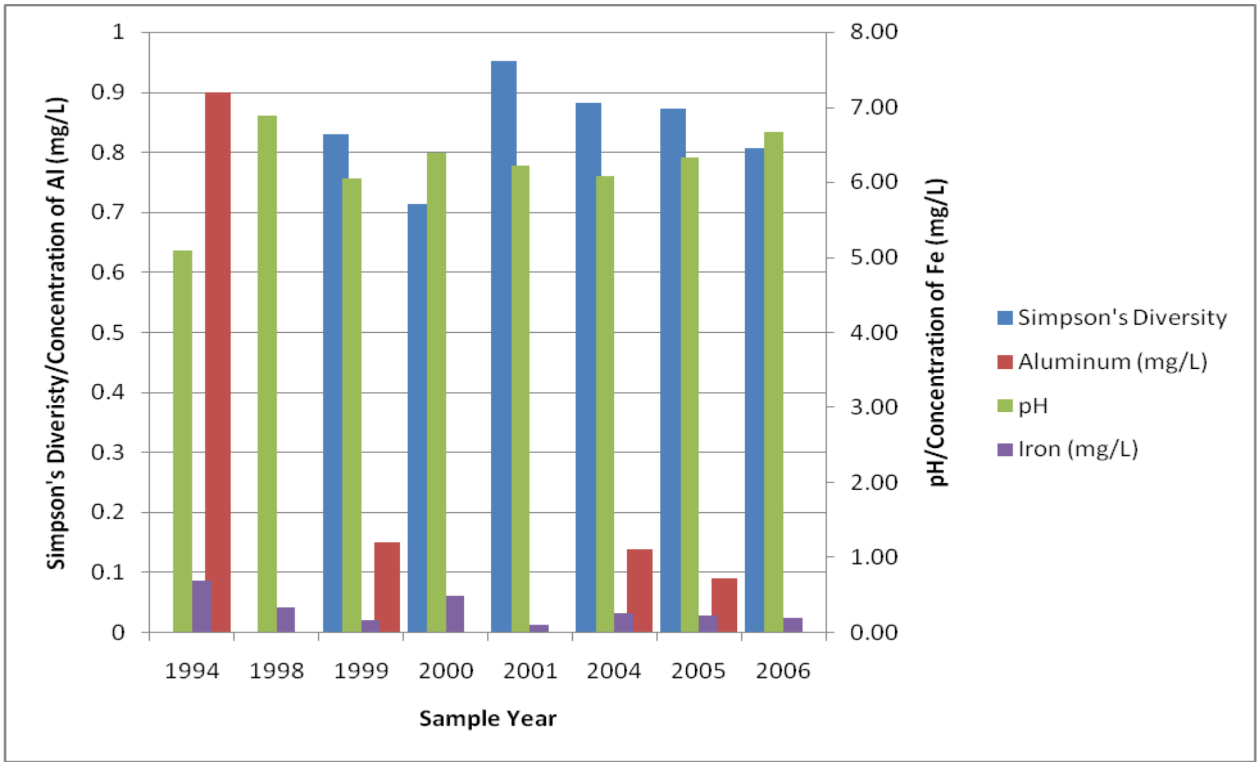


Figure 7: Bar graph showing the relationships between water quality and Simpson's Diversity Index for LM02 from 1994-2006. Gaps represent no data and/or uncollected years.

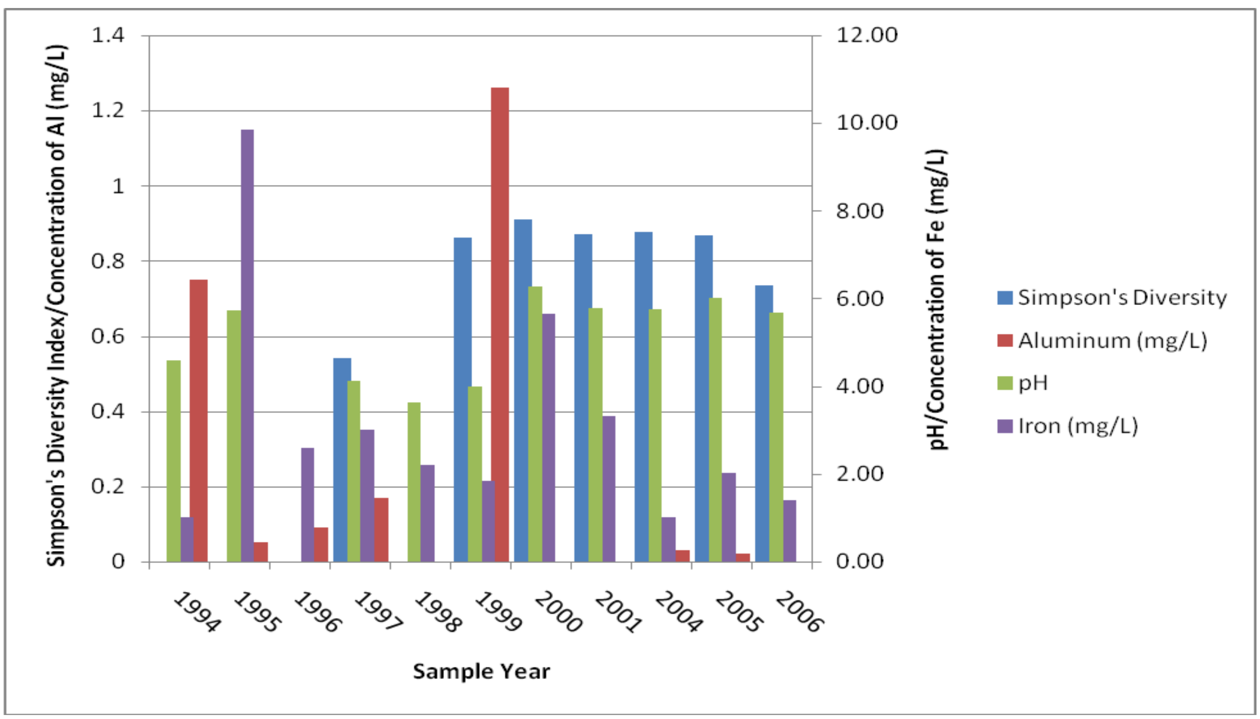


Figure 8: Bar graph showing the relationships between water quality and Simpson's Diversity Index for LM03 from 1994-2001, 2004-2006. Gaps represent no data and/or uncollected years.

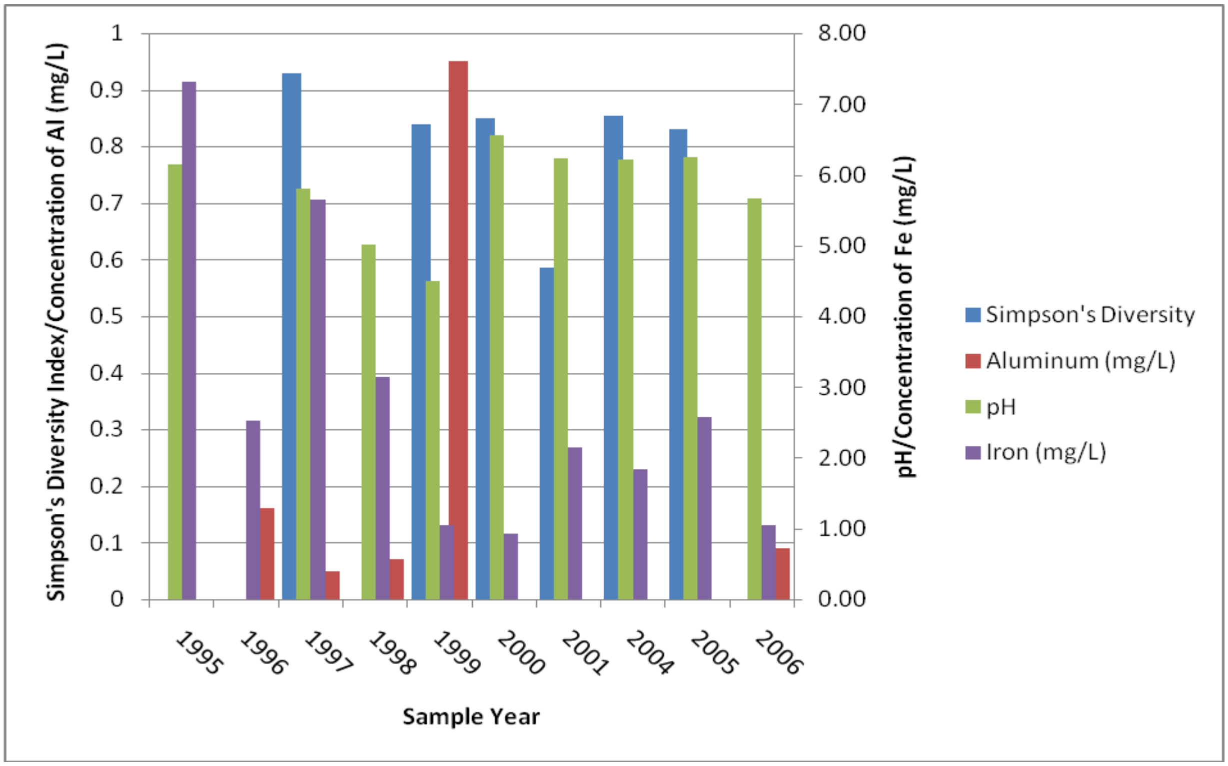


Figure 9: Bar graph showing the relationships between water quality and Simpson's Diversity Index for LM04 from 1995-2001, 2004-2006. Gaps represent no data and/or uncollected years.

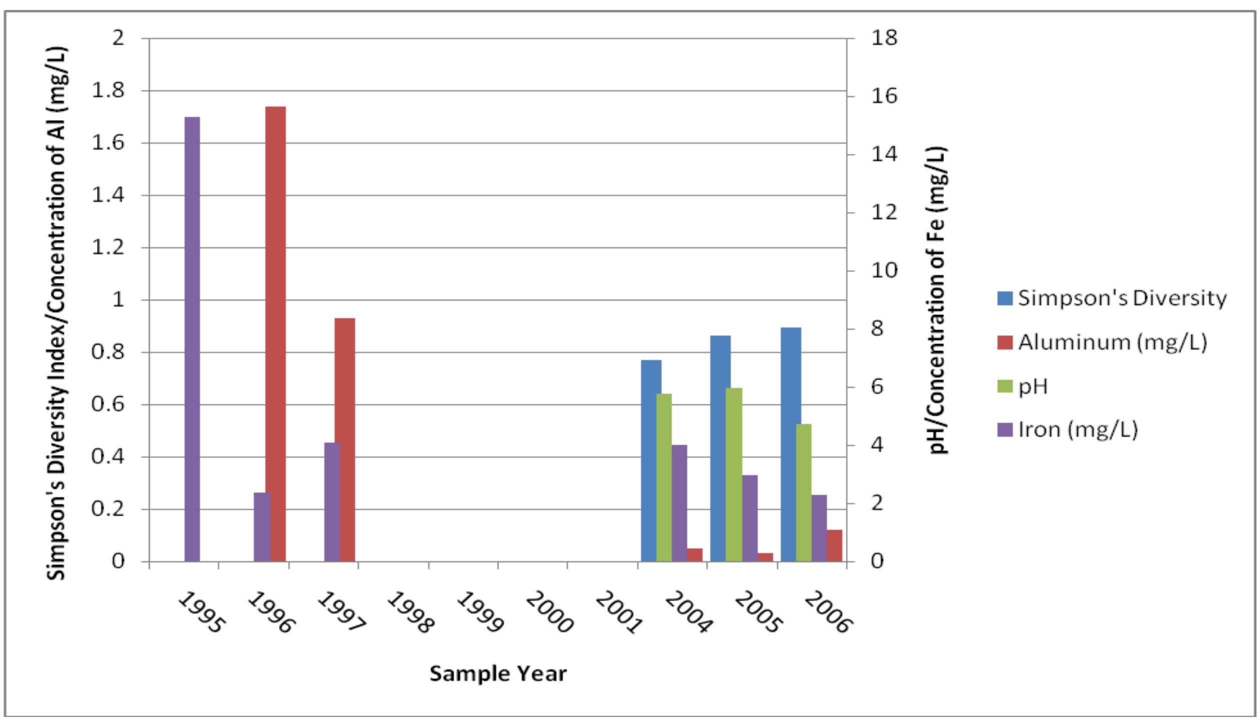


Figure 10: Bar graph showing the relationships between water quality and Simpson's Diversity Index for LM05 from 1995-2001, 2004-2006. Gaps represent no data and/or uncollected years.

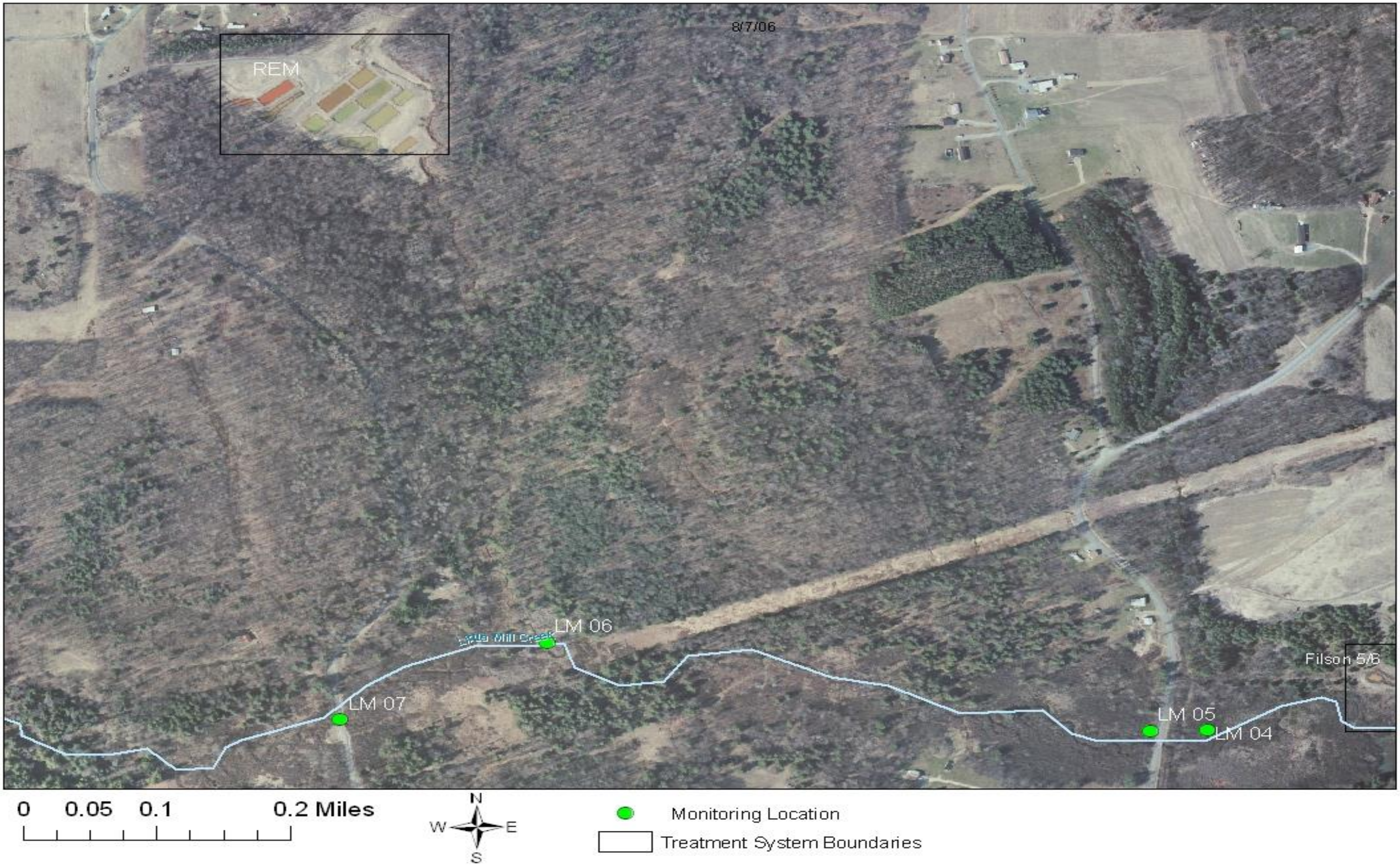


Figure 11: Little Mill Creek sampling locations LM04-LM07 showing location of passive treatment system in between the sampling locations.

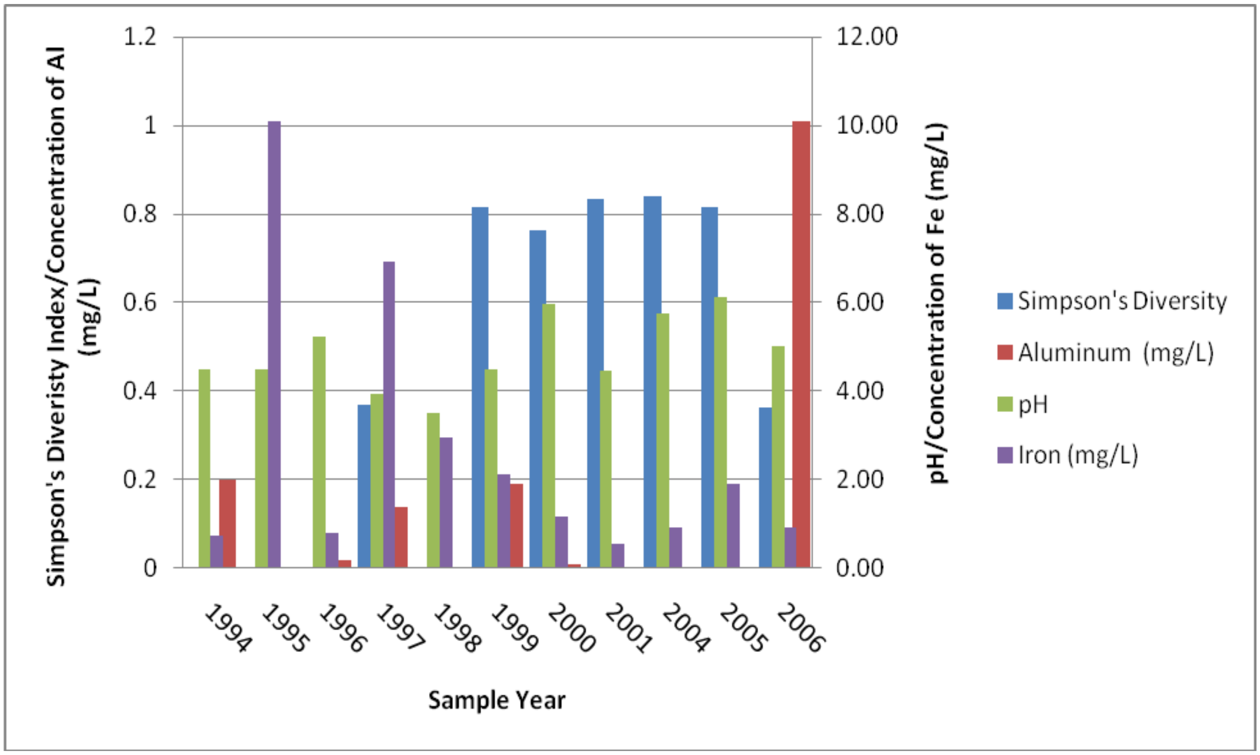


Figure 12: Bar graph showing the relationships between water quality and Simpson's Diversity Index for LM06 from 1994-2001, 2004-2006. Gaps represent no data and/or uncollected years.

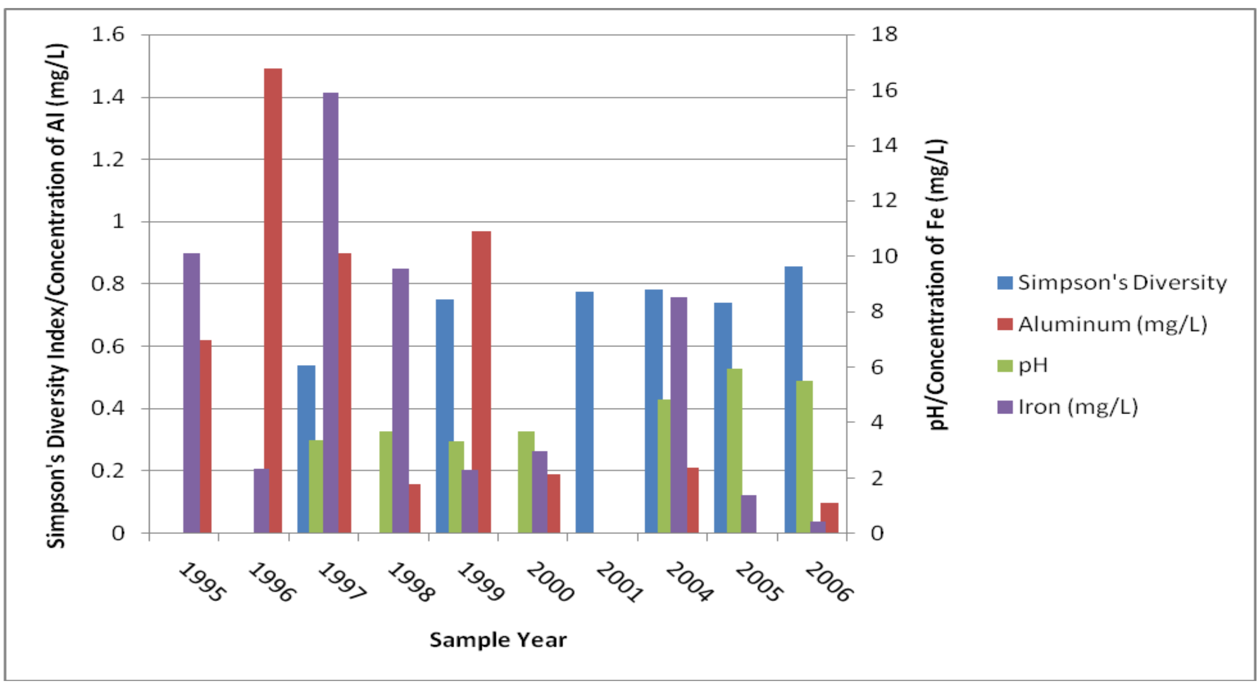


Figure 13: Bar graph showing the relationships between water quality and Simpson's Diversity Index for LM07 from 1995-2001, 2004-2006. Gaps represent no data and/or uncollected years.

Figure 14: Little Mill Creek sampling locations LM08-LM09, showing mine site active through 2005 and BAMR treatment system.

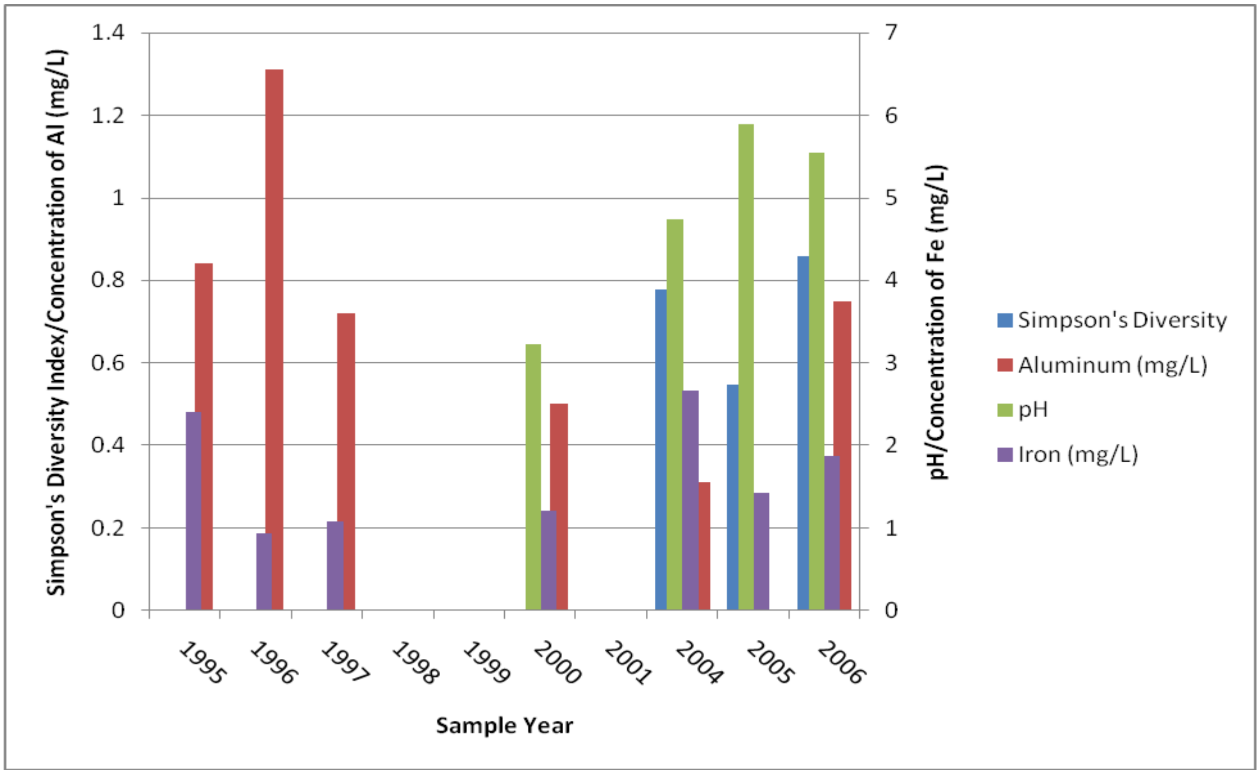


Figure 15: Bar graph showing the relationships between water quality and Simpson's Diversity Index for LM08 from 1995-2001, 2004-2006. Gaps represent no data and/or uncollected years.

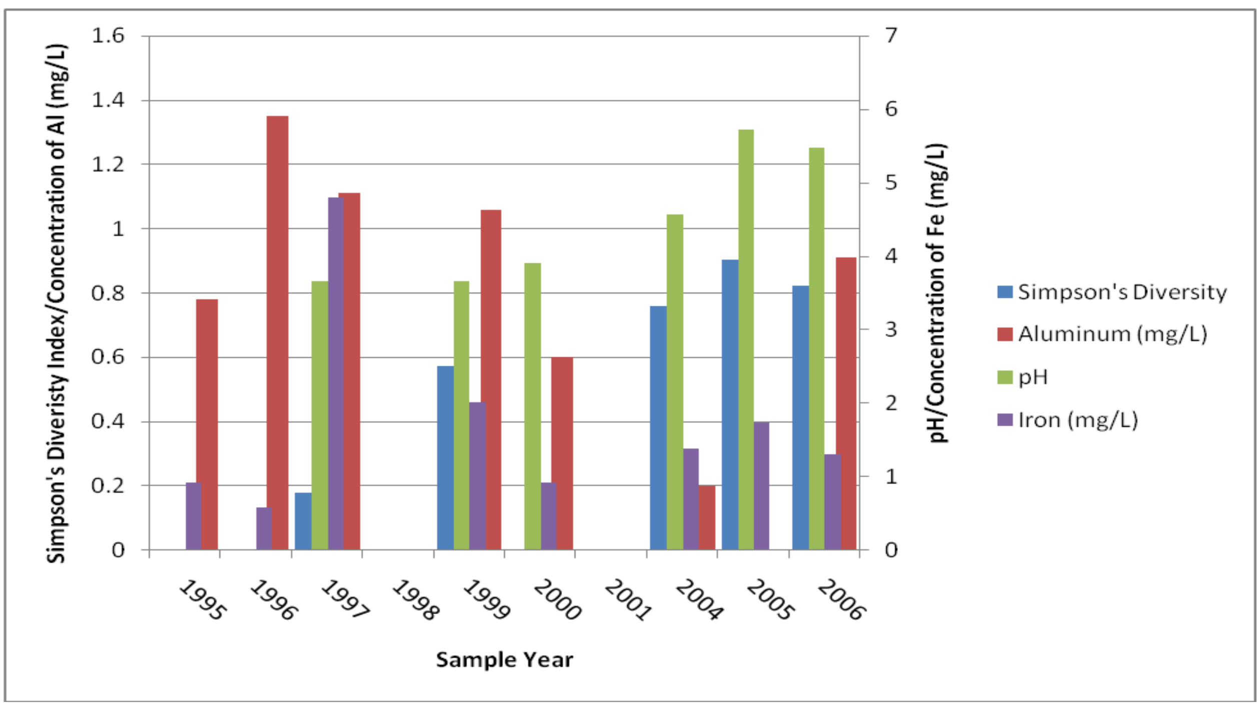


Figure 16: Bar graph showing the relationships between water quality and Simpson's Diversity Index for LM09 from 1995-2001, 2004-2006. Gaps represent no data and/or uncollected years.

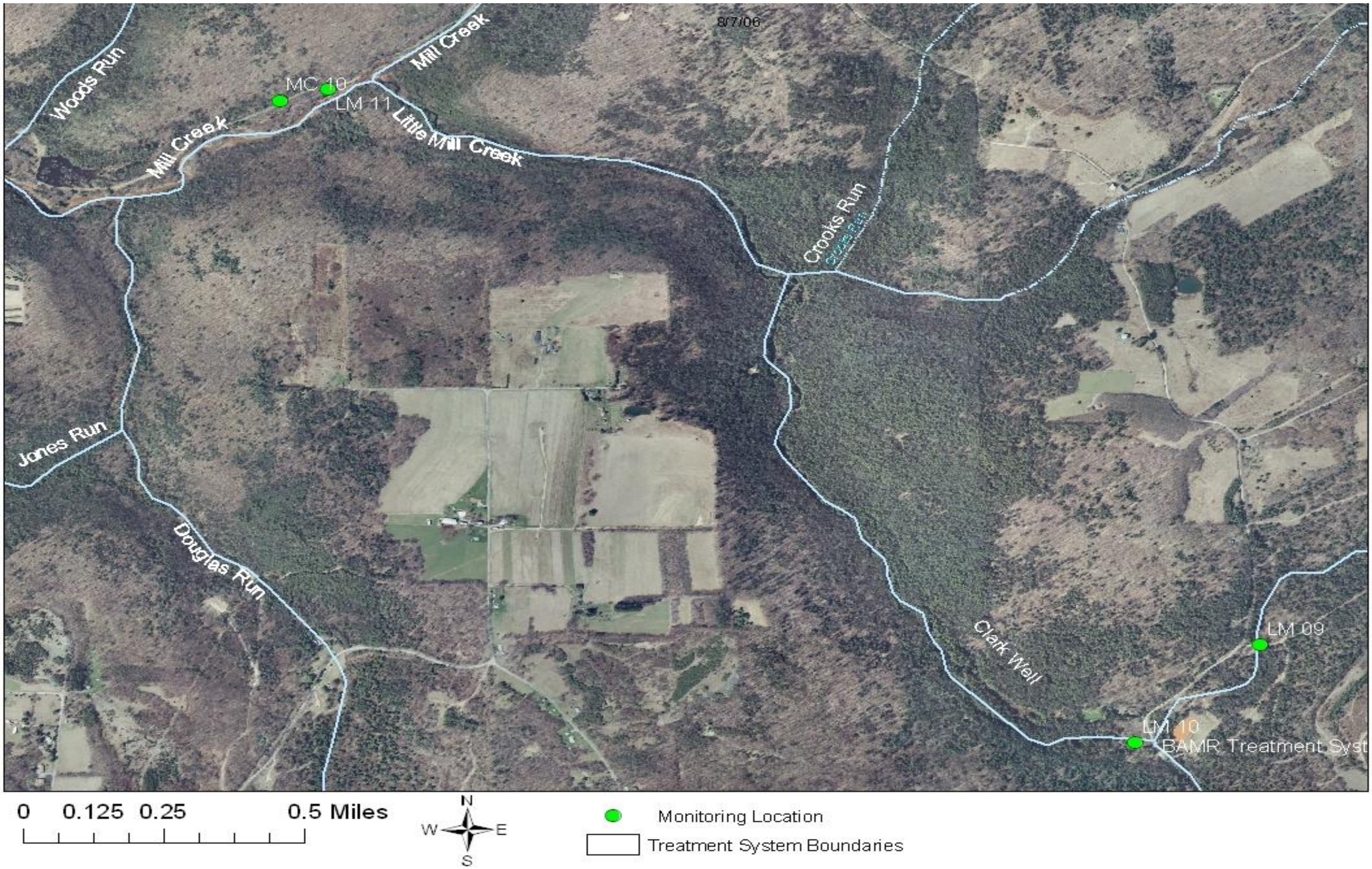


Figure 17: Little Mill Creek sampling locations LM09 and LM11, showing BAMR treatment systems, and Clark Well Site.

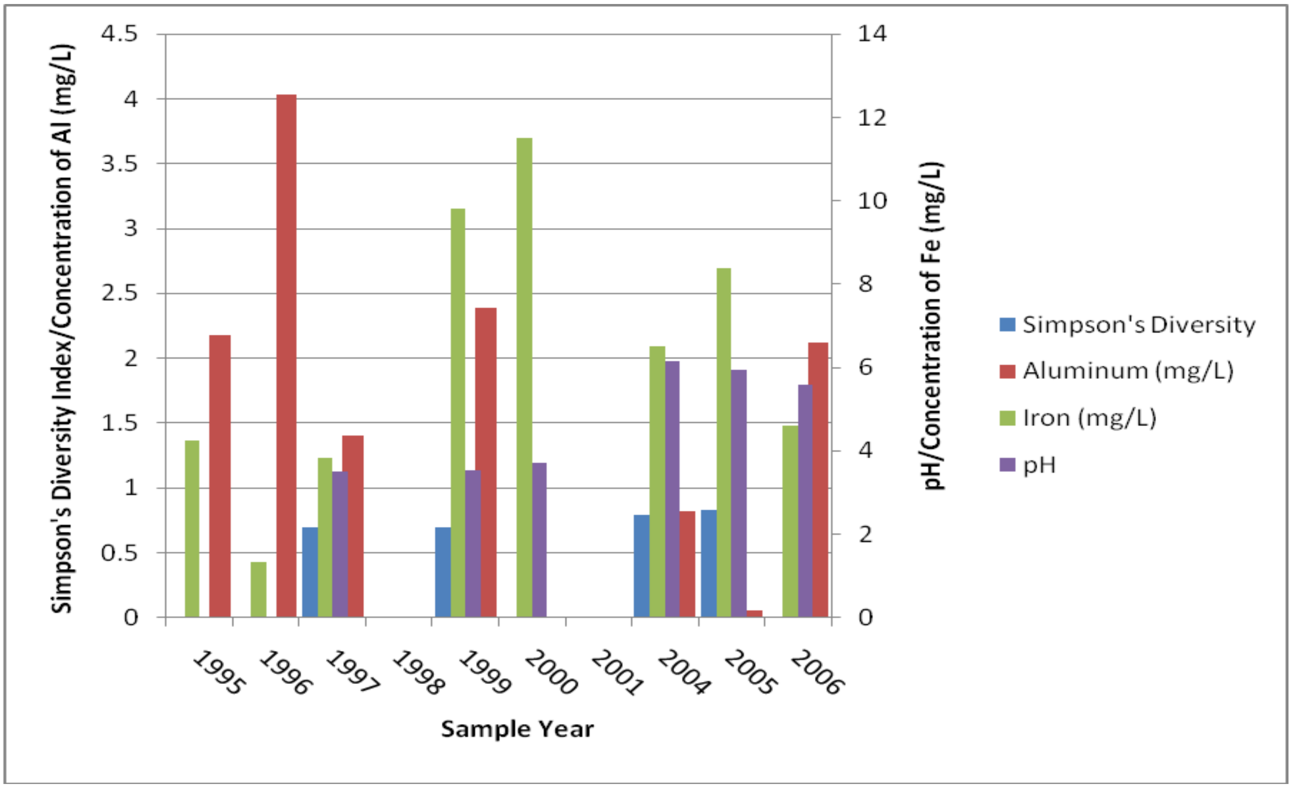


Figure 18: Bar graph showing the relationships between water quality and Simpson's Diversity Index for LM10 from 1995-2001, 2004-2006. Gaps represent no data and/or uncollected years.

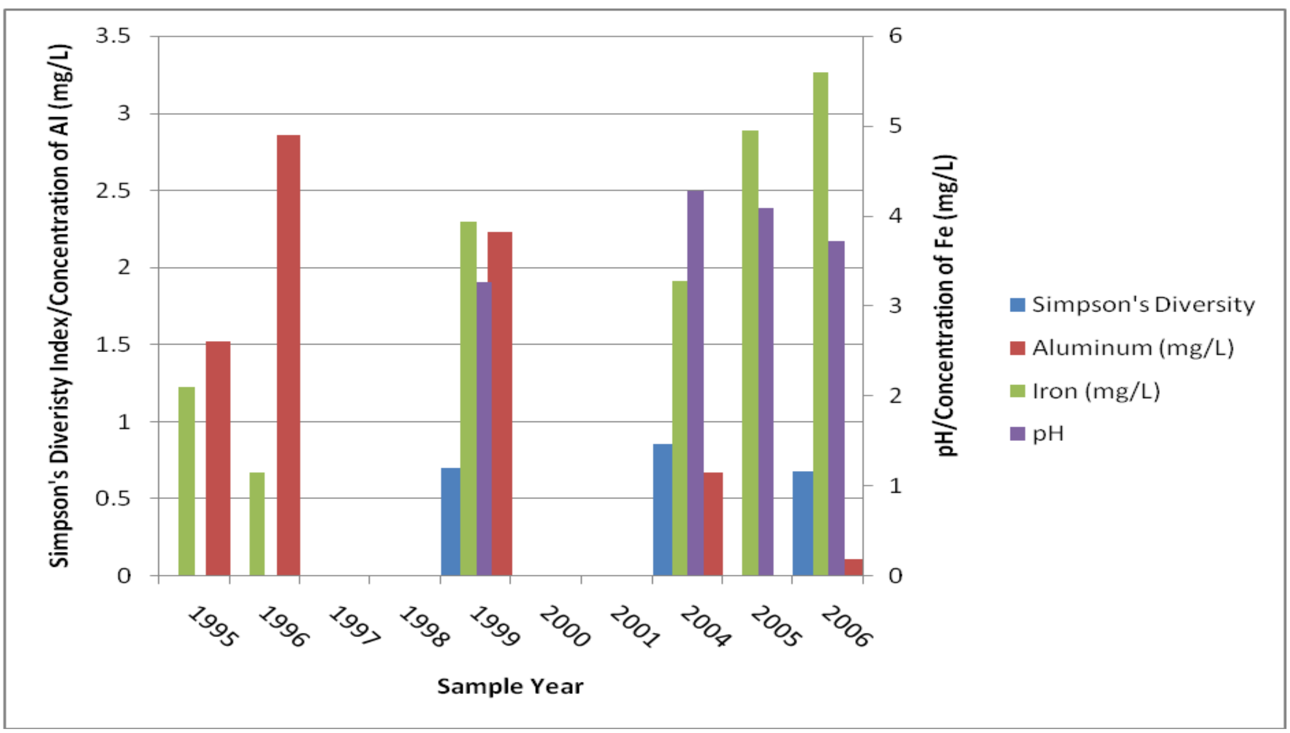


Figure 19: Graph showing the relationships between water quality and Simpson's Diversity Index for LM11 from 1995-2001, 2004-2006. Gaps represent no data and/or uncollected years.

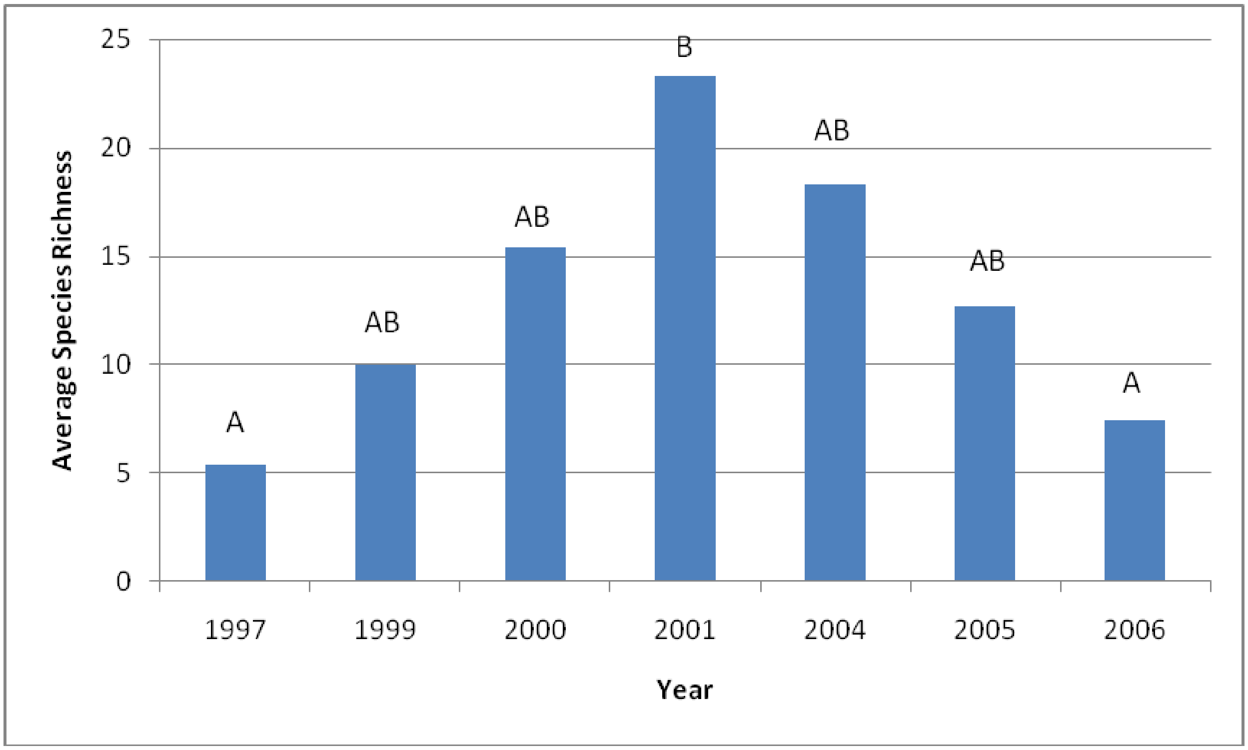


Figure 20: Yearly average richness for all sites combined on Little Mill Creek. A, B and AB subgroups represent statistical significance between subsets A and B when each year was compared.

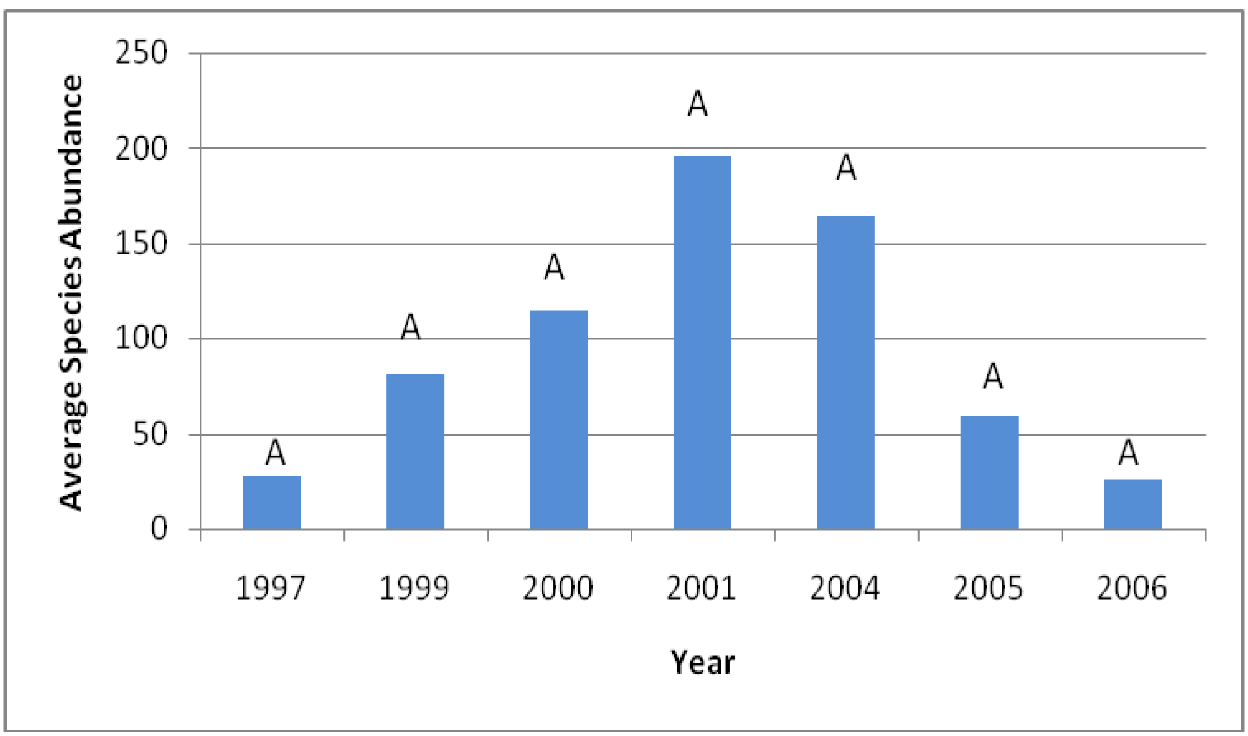


Figure 21: Yearly average abundance for all sites combined on Little Mill Creek. A, B and AB subgroups represent statistical significance between subsets A and B when each year was compared.

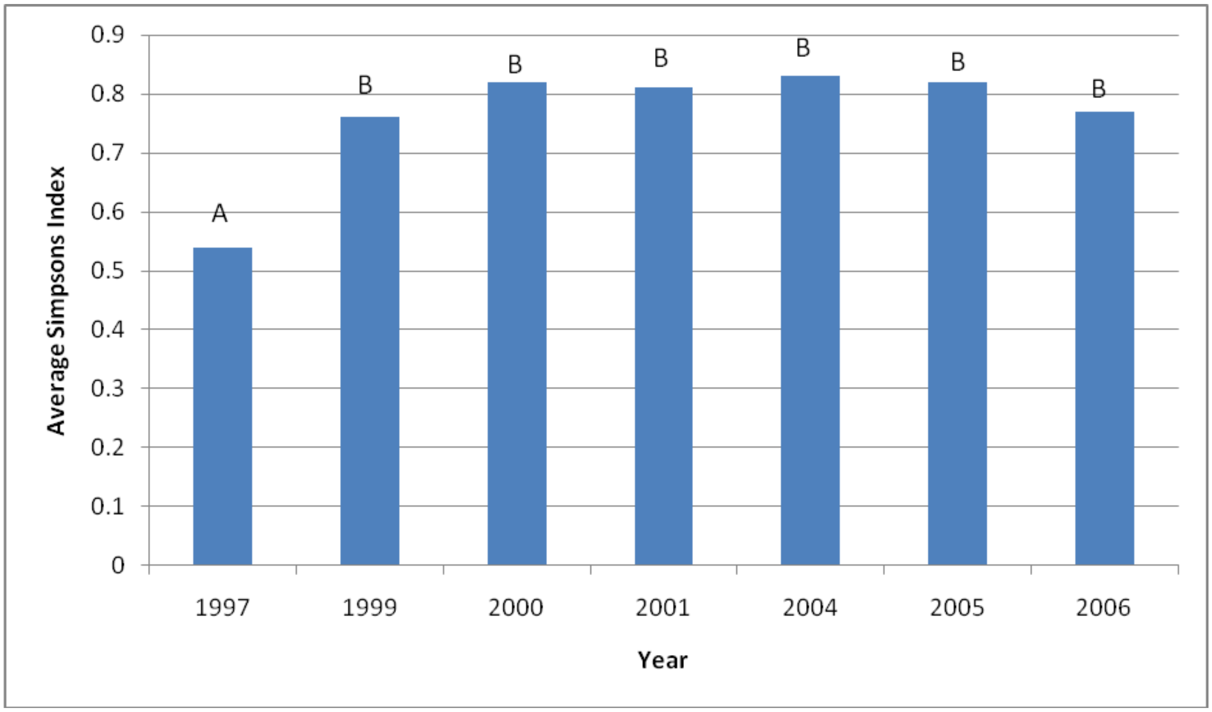


Figure 22: Yearly average Simpson's Diversity for all sites combined on Little Mill Creek. A and B subgroups represent statistical significance between subsets A and B when each year was compared.

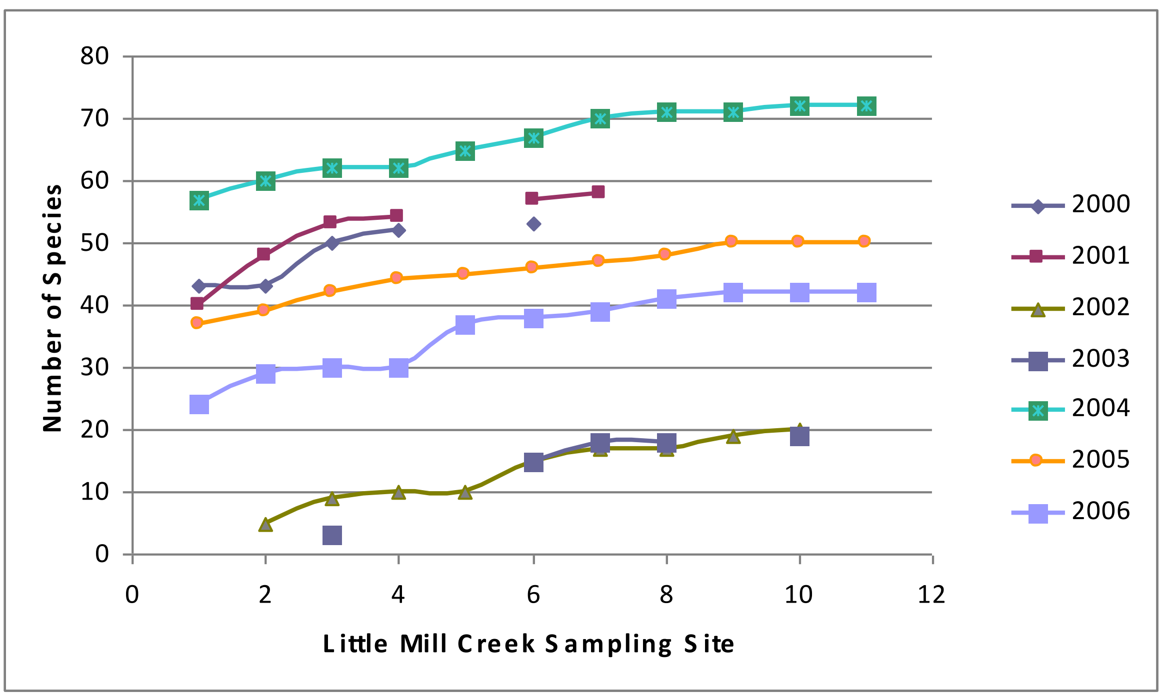


Figure 23: Species Accumulation Curves for Little Mill Creek from 2000 to 2006 beginning at the headwaters accumulating downstream to the mouth at Mill Creek with gaps representing uncollected years. No species list available for 1997 and 1999.

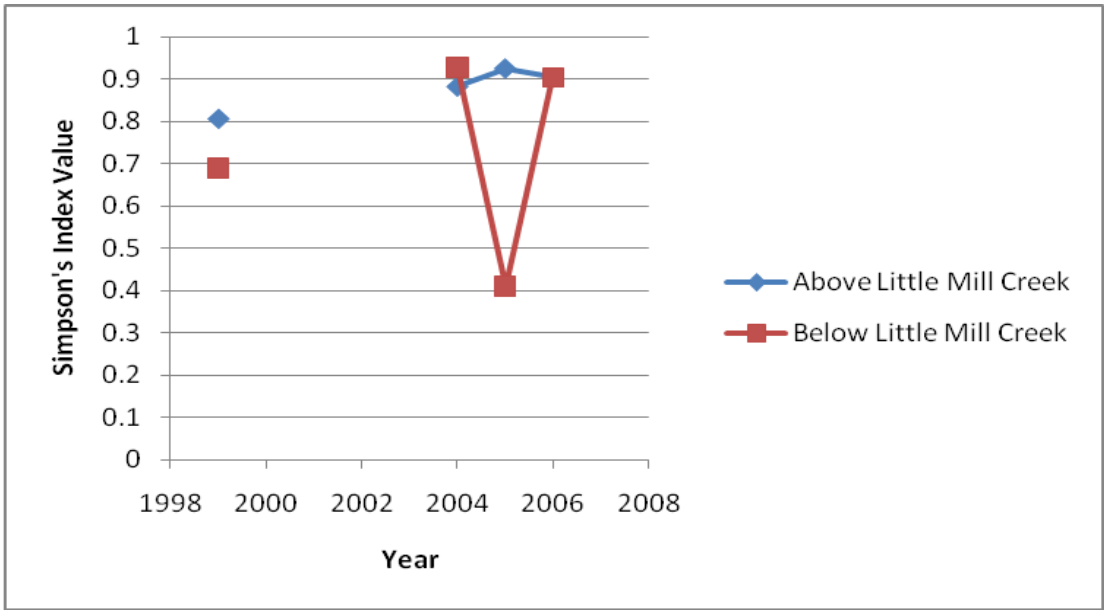


Figure 24: Simpson Diversity Index for three Mill Creek sampling sites above the mouth of Little Mill Creek and three sampling sites below the mouth of Little Mill Creek from 1999-2006.

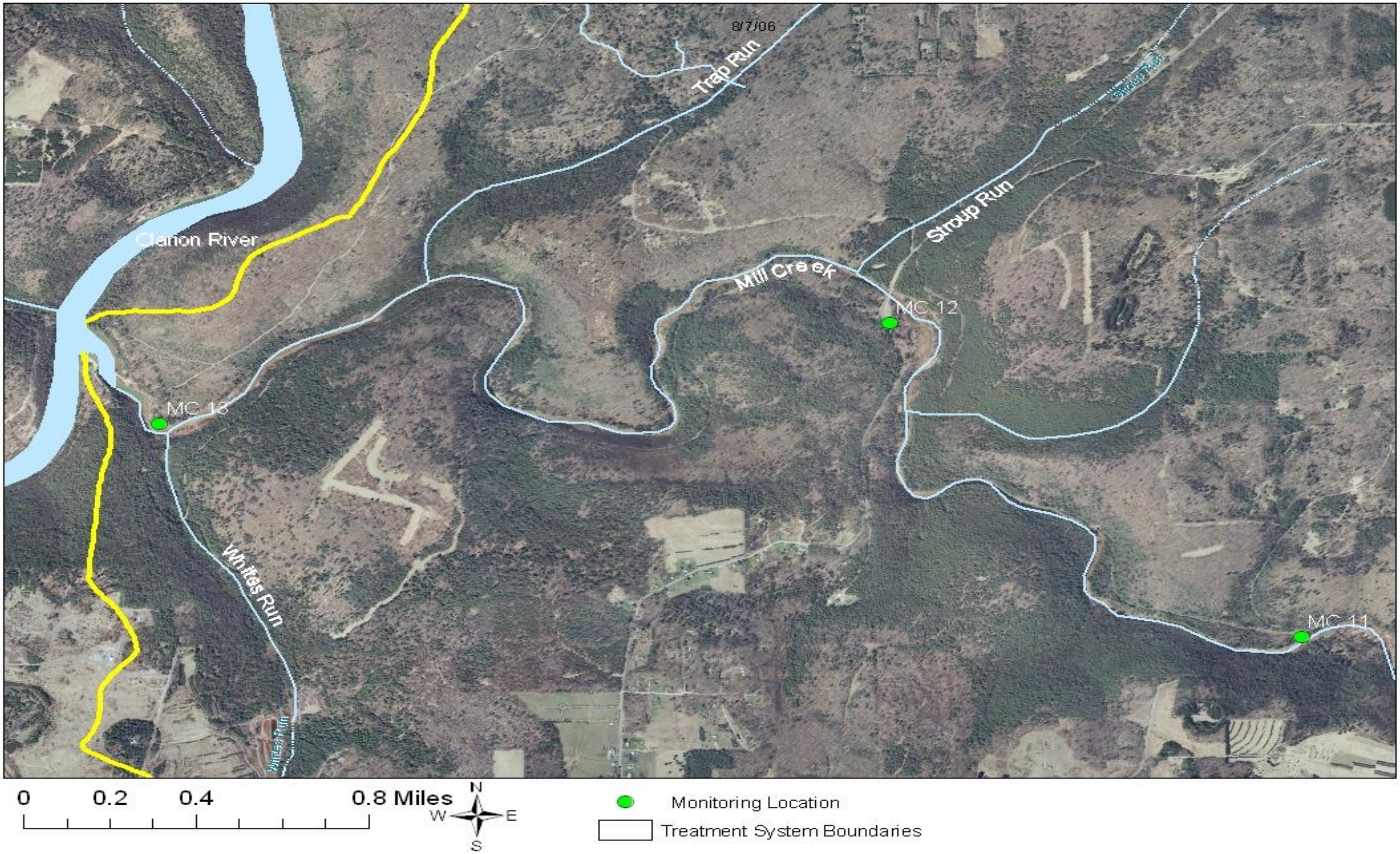


Figure 25: Mill Creek sampling sites below Little Mill Creek showing where untreated tributaries enter Mill Creek.

Site Name	Year Built	System Type	Stream
Howe Bridge	1991 *Modified in 2002*	ALD/Aerobic Pond/SAPS	Mill Creek
Schnepp Road 1/2	1992	ALD/Settling Ponds/SAPS	Mill Creek
Alder Bog	1992	Open Limestone Channel	Mill Creek
Filson 5/6	1994	ALDs/Aerobic Ponds/SAPS	Little Mill Creek
Filson 1/2/3	1995-2001	SAPS	Little Mill Creek
McKinley 1	1996	SAPS/Aerobic Pond	Little Mill Creek
Beagle Site	1998	Aluminator®	Little Mill Creek
Morrow 1	1998	ALD/Aerobic Pond	Little Mill Creek
McKinley 2	1999	SAPS/Aerobic Pond	Little Mill Creek
Bog Site	1999	SAPS	Little Mill Creek
Daiva	2001	ALD/Aerobic Pond	Mill Creek
Simpson 1	2000	ALD/Aerobic Pond	Mill Creek
Filson 4	2000	SAPS/Settling Pond/ALD	Little Mill Creek
REM	2005	SAPS/Settling Ponds/ALD	Little Mill Creek

Table 1: Installation years of Mill Creek Coalition passive treatment systems.

Year	Sites Sampled	Frequency	Collector
1997	LM01, LM03, LM04, LM06, LM07, LM09, LM10,	4/year	Ryan Bernecky
1999	LM01, LM02, LM03, LM04, LM06, LM07, LM09, LM10, LM11	4/year	Ray Ewing, Doug Raybuck
2000	LM01, LM02, LM03, LM04, LM06,	4/year	Steve Seiler, Seth Brown, Doug Raybuck
2001	LM01, LM02, LM03, LM04, LM06, LM07,	4/year	Seth Brown, Marie Shreckengost, Kim Lanick
2002	LM02, LM03, LM06, LM07, LM08, LM09, LM10,	Unknown	Gavin Ferris, Jake Kepler
2003	LM06, LM07, LM08, LM10	1/year	Gavin Ferris, Jake Kepler
2004	LM01, LM02, LM03, LM04, LM05, LM06, LM07, LM08, LM09, LM10, LM11	1/year	Amy Myers, Ryan Miller
2005	LM01, LM02, LM03, LM04, LM05, LM06, LM07, LM08, LM09, LM10, LM11	1/year	Amy Myers, Michael Pettyjohn
2006	LM01, LM02, LM03, LM04, LM05, LM06, LM07, LM08, LM09, LM10, LM11	1/year	Amy Myers Craig Makaukfa

Table 2: Sampling information for each of the nine years sampled.

Site	Location	Latitude	Longitude
LM01	Above all treatment systems	41.12.21	79.09.49
LM02	McKinley trib. at gas well	41.11.87	79.09.98
LM03	Below Filson 1,2, & 4 -- above Filson 5/6	41.12.39	79.10.20
LM04	Below Filson 5/6 -- above Filson 7	41.12.37	79.10.43
LM05	at 949 bridge	41.12.37	79.10.48
LM06	below 949 bridge -- above REM	41.12.45	79.11.00
LM07	Howe Road	41.12.39	79.11.18
LM08	Wishart Road	41.12.33	79.12.29
LM09	Red Bridge above Markle	41.12.27	79.13.24
LM10	Markle Bridge -- T566 (Below bridge)	41.12.09	79.13.50
LM11	Confluence with Mill Creek	41.13.34	79.15.12
MC07	Above Howe Bridge	41.13.71	79.11.10
MC08	Below Howe Bridge (above Rankin Run)	41.13.42	79.13.87
MC09	Old State Road Bridge -- T562	41.14.11	79.14.01
MC10	Below confluence with Little Mill	41.13.32	79.15.22
MC11	"Bridge Out" Bridge -- T490	41.13.33	79.16.08
MC12	Fisher Road Bridge	41.14.15	79.17.16
MC13	Mouth of Mill Creek (above backwater)	41.13.92	79.19.12

Table 3: Identification of sample locations on Little Mill Creek (=LM) and Mill Creek (=MC) using NAD 83 UTM coordinate system

Site	Year	Generic Richness	# of Individuals
LM01			
	1997	15	87
	1999	22	208
	2000	43	454
	2001	46	587
	2004	57	1139
	2005	37	205
LM02			
	1999	14	105
	2000	6	17
	2001	29	151
	2004	19	90
	2005	11	24
	2006	7	19
LM03			
	1997	5	30
	1999	10	69
	2000	12	25
	2001	18	94
	2004	11	71
	2005	5	10
	2006	3	6

LM04	1997	5	6
	1999	8	50
	2000	8	27
	2001	15	80
	2004	14	63
	2005	12	42
	2006	2	2
LM05			
	2004	14	75
	2005	6	12
	2006	12	29
LM06			
	1997	4	15
	1999	10	47
	2000	8	49
	2001	17	127
	2004	19	111
	2005	11	32
	2006	3	15
LM07			
	1997	4	42
	1999	7	66
	2001	15	137
	2004	16	80
	2005	9	63
	2006	4	7
LM08			
	2004	21	84
	2005	16	150
	2006	12	36
LM09			
	1997	2	21
	1999	8	109
	2004	14	62
	2005	12	37
	2006	7	19
LM10			
	1997	3	5
	1999	6	65
	2004	11	25
	2005	8	18
	2006	1	1
LM11			
	1999	5	13
	2004	5	8
	2006	7	28

Table 4: Generic richness and number of individuals found for sampling sites LM01-LM11 for the sampled years 1997 through 2006.

Site	Year	%Ephemeroptera	%Plecoptera	%Trichoptera	%EPT	%Chironomidae	%Diptera
LM01							
	1997	2.30%	3.45%	11.49%	17.24%	0.00%	3.45%
	1999	2.01%	14.16%	11.24%	27.41%	53.31%	62.95%
	2000	9.47%	27.97%	19.38%	56.83%	22.47%	37.89%
	2001	3.92%	17.89%	5.79	27.60%	60.99%	63.54%
	2004	20.02%	25.99%	28.62%	74.63%	15.19%	18.35%
	2005	12.68%	12.20%	33.17%	58.05%	24.88%	29.27%
	2006	13.56%	7.63%	15.25%	36.44%	54.24%	55.93%
LM02							
	1999	0.00%	0.00%	27.87%	27.87%	24.70%	29.85%
	2000	0.00%	0.00%	0.00%	0.00%	52.94%	88.24%
	2001	0.00%	17.88%	19.21%	37.09%	25.83%	45.03%
	2004	0.00%	0.00%	11.11%	11.11%	47.78%	71.11%
	2005	0.00%	12.50%	37.50%	50.00%	45.83%	50.00%
	2006	0.00%	0.00%	10.53%	10.53%	57.89%	84.21%
LM03							
	1997	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	1999	0.00%	0.00%	11.29%	11.29%	38.38%	42.93%
	2000	0.00%	0.00%	20.00%	20.00%	24.00%	28.00%
	2001	1.06%	1.06%	17.02%	19.14%	39.36%	44.68%
	2004	0.00%	0.00%	0.00%	0.00%	70.42%	71.83%
	2005	0.00%	0.00%	0.00%	0.00%	40.00%	70.00%
	2006	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%
LM04							
	1997	0.00%	0.00%	0.00%	0.00%	0.00%	16.67%
	1999	0.00%	7.14%	21.97%	29.11%	25.08%	25.08%
	2000	0.00%	0.00%	44.44%	44.44%	14.81%	22.22%
	2001	0.00%	0.00%	3.75%	3.75%	73.75%	82.50%
	2004	0.00%	0.00%	34.92%	34.92%	38.10%	63.49%
	2005	0.00%	0.00%	2.38%	2.38%	71.43%	78.57%
	2006	0.00%	0.00%	0.00%	0.00%	50.00%	100.00%
LM05							
	2004	0.00%	0.00%	3.00%	3.00%	32.00%	38.67%
	2005	0.00%	0.00%	16.67%	16.67%	58.33%	58.33%
	2006	0.00%	0.00%	0.00%	0.00%	62.07%	82.76%
LM06							
	1997	0.00%	0.00%	0.00%	0.00%	6.66%	6.66%
	1999	0.00%	1.52%	2.27%	3.79%	56.40%	60.19%
	2000	0.00%	0.00%	16.33%	16.33%	34.69%	40.82%
	2001	0.00%	7.09%	1.57%	8.66%	65.35%	69.29%
	2004	0.00%	0.00%	7.21%	7.21%	45.95%	55.86%
	2005	0.00%	0.00%	3.13%	3.13%	40.63%	56.25%
	2006	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%
LM07							
	1997	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	1999	0.00%	0.00%	2.89%	2.89%	77.27%	77.27%
	2001	0.00%	0.00%	3.65%	3.65%	69.34%	73.72%
	2004	0.00%	0.00%	38.75%	38.75%	13.75%	15.00%
	2005	0.00%	0.00%	11.11%	11.11%	50.79%	82.54%
	2006	0.00%	0.00%	0.00%	0.00%	42.86%	42.86%

LM08							
	2004	0.00%	3.57%	1.19%	4.76%	38.10%	45.24%
	2005	0.00%	0.00%	5.33%	5.33%	55.33%	59.33%
	2006	0.00%	0.00%	5.56%	5.56%	66.67%	69.44%
LM09							
	1997	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	1999	0.00%	0.00%	5.61%	5.61%	78.21%	78.21%
	2002	0.00%	0.00%	6.45%	6.45%	54.84%	54.84%
	2004	0.00%	1.61%	58.06%	59.67%	29.03%	30.65%
	2005	0.00%	0.00%	13.52%	13.51%	48.65%	51.35%
	2006	0.00%	0.00%	0.00%	0.00%	89.47%	89.47%
LM10							
	1997	0.00%	0.00%	60.00%	60.00%	0.00%	0.00%
	1999	0.00%	0.00%	0.00%	0.00%	73.19%	73.19%
	2004	0.00%	0.00%	56.00%	56.00%	8.00%	40.00%
	2005	0.00%	5.56%	27.78%	33.34%	61.11%	66.67%
	2006	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%
LM11							
	1999	0.00%	0.00%	7.89%	7.89%	59.40%	59.40%
	2004	0.00%	0.00%	5.00%	5.00%	25.00%	25.00%
	2006	0.00%	0.00%	3.57%	3.57%	53.57%	53.57%

Table 5: Community composition properties including EPT sensitivity index values for Little Mill Creek sampling sites from 1997-2006.

Little Mill Creek	**1997**	**1999**	**2000**	**2001**	**2004**	**2005**	**2006**
Generic Richness	15	46	53	60	73	49	43
# of Individuals	66	369	572	1160	1809	639	280

Table 6: Total Generic Richness and number of individuals sampled throughout Little Mill Creek for each sampling year.

Year	**# of Genera Above LMC**	**# of Ind. Above LMC**	**# of Genera Below LMC**	**# of Ind Below LMC**
1999	29	262	14	440
2004	29	100	29	114
2005	19	48	19	246
2006	22	69	10	32

Table 7: Species richness and number of individuals found for three Mill Creek sampling sites above and three sampling sites below Little Mill Creek (LMC) for each sampling year.

Year	**%EPT Above LMC**	**%Diptera Above LMC**	**%EPT Below LMC**	**%Diptera Below LMC**
1999	18.70%	68.32%	0.07%	74.77%
2004	62.00%	31.00%	15.80%	74.56%
2005	43.75%	43.75%	1.63%	87.80%
2006	47.83%	47.83%	0.00%	71.88%

Table 8: EPT Sensitivity Index and percent Diptera for three Mill Creek sampling sites above the mouth of Little Mill Creek and three sampling sites below the mouth of Little Mill Creek from 1999-2006.

Year	Jaccards Coefficient
1999	0.303
2004	0.2889
2005	0.4074
2006	0.28

Table 9: Jaccard's Similarity Coefficient comparing the macroinvertebrate population of Mill Creek above Little Mill Creek to that below Little Mill Creek.

CHAPTER 3

APPENDIX A
APPENDIX B
APPENDIX C

Company Name	Permit Number	Mine Name	Date Issued	Acerage	Coal Seam(s)	Status
R.D Baughman Coal Co.	3379111	Richey #75	10/19/1979	67.0	C	Inactive
Ben Hal	33030103	C&K #13	11/21/2003	11.5	LK	Issued - Stage II
Bracken Const. Co.	3874SM19	Reed	8/2/1974	164.8	LK, MK, UK	Inactive
Brookvalley Coal Co.	3778BC12	Mock #1				Returned
C&K Coal Co.	3874SM15	No. 36		387.0	LC, UC, LK	Inactive
C&K Coal Co.	3875SM37	Stahlman #40	6/10/1976	155.0	MK, LK	Treatment Trust
C&K Coal Co.	3376SM6	Stahlman #43		451.0	LC, UC, LK, B	Inactive
C&K Coal Co.	38A76SM14	Stahlman #45	2/28/1987	125.0	LK, MK	Stage III (12/12/88)
C&K Coal Co.	38A76SM26	C&K #123	4/7/1977	110.0	LK, MK	Inactive
C&K Coal Co.	33800141	Stahlman #59	11/24/1980	119.0	LK, LC, UC, B	Inactive
C&K Coal Co.	33810127	Kennedy-Harding-Cowan	10/10/1986	72.0	LK, MK	Cancelled (8/12/91)
Calvin Gray	33990810	Calvin 1	12/1/1999	2.9		Issued - Small Non-Coal
Chernicky Coal Co.	16800115	Haugh		134.5	LC, UC	Denied (2/1/82)
Colt Resources Inc.	38A77SM6	Colt #16	11/7/1977	62.5	LK	Stage III (2/8/88)
Colt Resources Inc.	3777SM20	Herold	10/27/1977	276.5	LC, UC, LK	Inactive
Colt Resources Inc.	16810118	Herold		66.0	LK, LC, UC	Denied (10/27/82)
Doverspike Bros. Coal Co.	38A77SM40	Park	11/14/1977	236.0	LK, MK	Inactive
Doverspike Bros. Coal Co.	33820127	Sigel		76.0	LK, MK, C, B	Withdrawn (3/9/83)
Esquire Fuel Co.	38A78BC6	Eldred	1/31/1979	336.0	LK, C, B	Inactive
Farview Coal Co.	3875SM7	Park	6/16/1976	274.0	MK, B	Inactive
Glacial Minerals Inc.	3676SM39	Strattanville		154.0		Inactive
Glacial Minerals Inc.	3677SM20	Dilley				Inactive
Glacial Minerals Inc.	16803011	Vosburg		89.5		Inactive

Company Name	Permit Number	Mine Name	Date Issued	Acerage	Coal Seam(s)	Status
Glacial Minerals Inc.	16810116	Mock #1		419.0	LK, UC, UC	Withdrawn (1/30/84)
H&G Coal and Clay	3775SM9	H&G #39		30.5	LC	Denied (8/12/75)
H&G Coal and Clay	3677SM22	H&G #43	8/8/1977	125.0	UC, LK	Inactive
H&G Coal and Clay	38A77SM36	Lawson	2/2/1978	11.5	LK	Inactive
H&G Coal and Clay	16800111	H&G #43				Inactive
Mauersberg Coal Co.	3675SM27	Terwiliger	6/23/1976	191.3	LK, UK, B	Inactive
MSM Coal Co. Inc	3379138	Lawson	6/10/1980	11.7	LK, UK, B	Inactive
MSM Coal Co. Inc	33020106	Corsica	5/27/2003	33.8	LK	Issued - Stage I
MSM Coal Co. Inc	33040102	Songer-Monks	9/17/2004	35.0	LK	Issued - Stage I
Neiswonger Const. Inc.	16-06-08	Shofestall GFCC	6/20/2006	13.4	LK Incidental	Issued - Active
R.E.M. Coal Co. Inc.	3874SM2	Ditty	11/17/1975	190.2	LK, MK, C	Stage III (11/20/87)
R.E.M. Coal Co. Inc.	3874SM44	Smail				Inactive
R.E.M. Coal Co. Inc.	3875SM19	Sigel	12/10/1975	90.0	LK	Inactive
R.E.M. Coal Co. Inc.	3875SM55	Stahlman #52	3/31/1981	30.0	LK	Stage III (11/20/87)
R.E.M. Coal Co. Inc.	33800111	Waterhouse	9/19/1980	26.0	LK	Inactive
R.E.M. Coal Co. Inc.	33800140	Orcutt		123.5		Inactive
R.E.M. Coal Co. Inc.	33820101	Morris	11/15/1983	44.0	LK	Stage III (7/24/91)
R.E.M. Coal Co. Inc.	33820124	Mumford		49.0	B	Cancelled (2/13/84)
R.E.M. Coal Co. Inc.	16860107	Fleming		99.0	LK, MK	Denied (10/7/86)
Shaffer Mining Co.	3875SM38	Miliron	9/8/1975	124.0		Inactive
Shaffer Mining Co.	38A78BC11	Brewster		60.0		Inactive
Shaffer Mining Co.	3379118	Bullers	5/11/1979	107.0		Inactive
Sky Haven Coal Co.	33800131	Wilson		241.0	C, Clay	Deined (5/25/82)
Sky Haven Coal Co.	16990105	Corsica	9/22/2000	132.3	LK	Issued - Stage II
Strishock Coal Co.	16820118	Servey		122.0	LC	Cancelled (6/10/83)
Strishock Coal Co.	33920101	Exit 14		56.3		Inactive

Company Name	Permit Number	Mine Name	Date Issued	Acerage	Coal Seam(s)	Status
TDK Coal Sales	33960109	Winters	3/3/1998	157.4	LK	Issued - Stage I
Thompson Fuel Co.	33810105	Hazen		80.4		Voided
W.P. Stahlman Coal Co. Inc.	3870BSM9	Stahlman #31	3/18/1974	65.0	UC, LC	Inactive
W.P. Stahlman Coal Co. Inc.	3874SM15	Stahlman #36				Transferred to C&K
W.P. Stahlman Coal Co. Inc.	3875SM37	Stahlman #40				Transferred to C&K
W.P. Stahlman Coal Co. Inc.	3875SM55	Stahlman #42				Transferred to R.E.M.
W.P. Stahlman Coal Co. Inc.	3776SM6	Stahlman #43				Transferred to C&K
W.P. Stahlman Coal Co. Inc.	16800117	Stahlman #56		72.5	UC, LC	Denied (4/24/81)
W.P. Stahlman Coal Co. Inc.	33800141	Stahlman #59				Transferred to C&K
W.P. Stahlman Coal Co. Inc.	33810127	Stahlman #61				Transferred to C&K
W.P. Stahlman Coal Co. Inc.	33820141	Stahlman #66				Denied (2/14/84)
W.P. Stahlman Coal Co. Inc.	33820152	Stahlman #68				Denied (2/14/84)
Zacherl Coal Co. Inc.	3674SM14	Zacherl #29	3/31/1978	281.0	C, LK	Stage III (4/13/86)

Appendix A: Table showing the historic permitted coal mines within the Mill Creek Watershed. Information taken from the PA DEP Total Maximum Daily Load (TMDL) Report.

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM01									
	10-Jun-94	205	6.90	11.00	0.00	<0.01	0.83	0.33	101.73
	14-Jul-94	197	6.49	1.20	0.00	<0.01	0.78	0.27	44.32
	15-Aug-94	115	6.46	0.00	0.00	<0.01	0.25	0	41.87
	16-Sep-94	183	6.59	15.00	0.00	<0.01	0	0	76.7
	20-Oct-94	220	6.64	19.00	0.00	<0.01	0.2	0	56.95
	18-Nov-94	100	6.64	23.00	4.60	<0.01		0	28.36
	20-Dec-94	100	6.58	92.00	13.00	<0.01	0.17	0	36.82
	16-Jan-95	89	5.87	0.00	0.00	<0.01	0.31	0	30.71
	25-Feb-95	49	6.28	0.00	0.00	<0.01	0.12	0	45.52
	26-Mar-95	110	6.51	16.00	0.00	<0.01	0.03	0.05	49.51
	22-Apr-95	110	6.74	3.80	0.00	<0.01	0.2	0	49.56
	25-May-95	80	6.48	21.00	1.40	<0.01	0.24	0	28.37
	21-Jun-95	120	6.31	19.00	14.60	<0.01	1.36	0.81	49
	19-Jul-95	155	6.48	33.00		<0.01	1.62	0.7	83.66
	16-Aug-95	500	6.75	37.50	0.00	<0.01	0.65	0.63	247.06
	22-Sep-95	550	6.66	39.00	0.00	<0.01	1.23	0.48	390.39
	29-Oct-95	250	7.32	63.00	15.00	<0.01	0.32	0.26	245.19
	22-Nov-95	90	6.52	13.00	6.90	<0.01	0.02	0	34.91
	18-Dec-95	90	6.57	73.00	7.20	<0.01	0.11	0.14	43.94
	17-May-96	230	6.84	2.50	6.00	0.03	0.18	0.27	95.38
	13-Aug-96	185		14.00	10.00	<0.01	0.42	0.32	73.73
	27-May-97	55	6.42	0.00	8.00	0.02	0.39	0.29	33.79
	09-Jun-97	597		11.20	18.81	0.45	3.1	8.64	262
	23-Jul-97	270	6.54	2.50	14.00	0	0.4	0.11	112
	05-Aug-97	355	6.82	35.00	0.00	0.02	1.53	0.43	149.3
	13-Oct-97	260	6.38	23.00	0.00	<0.01	0.39	0.42	122.47
	15-Jul-98		7.16	7.80	0.00	0.21	0.62	0.48	146.46

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM01 (Cont)									
	28-Sep-98	560	7.25	32.00	0.00	0	0.63	0.07	359.74
	06-May-99	170	6.39	2.50	2.00	<0.01	0.16	0.18	50.62
	21-Jul-99	382	6.93	20.00	0.00	<0.01	0.31	0.43	124.86
	27-Oct-99	296	6.75	12.00	0.00	<0.01	0.23	0.12	112.4
	24-Nov-99	220	6.63	27.00	0.00	<0.01	0.33	<0.01	90.2
	30-Dec-99	87	6.57	17.00	0.00	0.01	0.08	<0.01	40.25
	17-Jan-00	140	6.32	1.20	5.00	0.02	0.16	<0.01	51.19
	28-Feb-00	90	6.12	1.20	0.00	0.03	0.73	2.29	20.58
	31-Mar-00	92	6.99	6.50	10.00	<0.01	0.2	0.32	47.64
	25-Apr-00	100	6.71	25.00	6.00	0.01	0.22	0.14	58.35
	31-May-00	223	6.66	19.00	0.00	0.01	0.16	<0.01	75.12
	29-Jun-00	100	6.75	0.00	2.00	<0.01	0.28	<0.01	46.02
	31-Jul-00	308	6.85	0.00	2.00	<0.01	0.53	0.47	97.9
	25-Aug-00	294	6.80	32.00	0.00	0.07	0.26	0.76	62.27
	22-Sep-00	225	6.48	2.50	0.00	<0.01	0.1	0.65	84.26
	20-Oct-00	176	6.68	23.00	12.00	<0.01	0.24	<0.01	46.76
	15-Jan-01	117	6.51	19.00	0.00	<0.01	0.01	<0.01	57.76
	26-Feb-01	140	6.20	24.00	2.00	0.01	0.04	<0.01	35.12
	23-Mar-01	97.9	5.90	7.80	15.00	<0.01	0.02	1.65	17.69
	20-Apr-01	57.8	6.17	11.00	6.00	<0.01	<0.01	0.15	78.3
	30-May-01	202	6.19	0.00	2.00	0.02	0.14	0.09	57.38
	21-Jun-01	297	6.78	24.00	2.00	<0.01	0.32	0.19	72.5
	31-Oct-02	177	6.60	7.80	114.00	<0.01	0.33	7.49	62.09
	15-Jun-04	111	5.99	11.00	2.80	<0.01	0.53	1.05	10.66
	09-Aug-04	141	6.32	0.00	8.00	<0.01	0.3	0.86	60.05
	24-May-05	184	6.04	7.80	32.00	<0.01	0.27		73
	21-Jul-05	281	6.71	0.00	0.00	0.21	0.24	2.8	67.19
	23-May-06	135	6.63	0.00	0.00	<0.01	0.16	0.96	37.68

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM02									
	10-Jun-94	800	3.76	0.00	57.80	1.43	4.8	14.43	445.74
	14-Jul-94	720	3.88	0.00	34.90	1.35	4.04	16.62	403.06
	15-Aug-94	327	5.09	0.00	30.00	0.9	0.69	3.65	179.02
	16-Sep-94	680	4.23	0.00	32.60	1.58	2.32	6.4	401.16
	20-Oct-94	690	3.98	0.00	86.00	1.6	3.75	16.28	449.21
	18-Nov-94	390	4.54	0.00	29.40	0.63	0.64	9.12	243.3
	20-Dec-94	300	4.91	0.00	38.00	0.99	1.8	8.53	269.18
	12-Oct-98	610	6.88	0.00	0.00	0	0.34	5.04	188.27
	13-May-99	680	5.28	25.00	10.00	0.88	0.32	11.18	357.36
	21-Jul-99	895	6.05	0.00	10.00	0.15	0.17	9.18	336.73
	27-Oct-99	734	6.01	0.00	10.00	0.01	0.12	4.89	343.31
	24-Nov-99	650	5.93	15.00	0.00	0.01	0.1	4.61	337.58
	30-Dec-99	281	6.84	25.00	0.00	0.01	0.24	5.85	290.87
	17-Jan-00	550	6.58	20.00	20.00	0.04	0.25	4.8	273.9
	28-Feb-00	450	6.26	9.20	4.00	0.11	1.88	6.18	107.99
	31-Mar-00	334	6.55	9.20	2.00	0.22	0.24	6.68	296.49
	25-Apr-00	580	6.01	20.00	34.00	0.13	0.24	6.13	274.44
	31-May-00	523	6.64	19.00	18.00	0.15	0.31	7.3	329.69
	29-Jun-00	510	6.70	0.00	12.00	0.07	0.43	4.03	227.63
	31-Jul-00	730	6.72	0.00	6.00	0.06	4.88	13.41	356.14
	25-Aug-00	765	6.39	39.00	2.00	<0.01	0.49	1.11	247.67
	22-Sep-00	497	5.65	2.50	0.00	<0.01	0.12	3.9	266.4
	20-Oct-00	505	6.67	25.00	10.00	<0.01	0.09	5.06	240.65
	15-Jan-01	396	6.58	16.00	0.00	0.02	0.05	3.14	256.48
	26-Feb-01	520	6.35	37.00	5.00	0.01	0.06	5.47	211.07
	23-Mar-01	280.6	6.20	7.80	7.00	<0.01	0.07	4.16	149.74
	20-Apr-01	159	5.80	9.20	13.00	0.5	0	3.44	216.19
	30-May-01	466	6.17	0.00	9.80	0.05	0.67	4.91	296.55

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM02 (cont.)									
	21-Jun-01	700	6.22	4.00	10.00	<0.01	0.11	8.74	184.52
	31-Oct-02	449	6.45	6.50	8.00	0.04	0.74	3.09	262
	15-Jun-04	402	6.53	21.00	0.00	0.55	0.81	1.05	144.93
	09-Aug-04	451	6.08	0.00	26.00	0.14	0.26	8.77	341.8
	13-Jun-05	630	5.32	5.20	24.00	0.24	0.26	4.24	356.8
	21-Jul-05	592	6.33	0.00	4.00	0.09	0.23	6.42	699.8
	20-Jun-06	646	6.67	0.00	32.00	<0.01	0.2	7.49	415.57
LM03									
	10-Jun-94	840	3.65	0.00	61.00	1.21	5.3	14.13	450.98
	14-Jul-94	810	3.64	0.00	51.00	1.23	4.11	15.18	391.87
	15-Aug-94	350	4.58	0.00	25.20	0.75	1.02	4.39	196.83
	16-Sep-94	600	4.13	0.00	48.00	1.36	1.83	14.35	396.79
	20-Oct-94	650	4.59	5.20	41.60	1.19	1.91	13.83	439.59
	18-Nov-94	360	4.92	0.00	39.00	0.51	0.74	7.68	260.15
	20-Dec-94	320	5.17	2.50	26.30	0.67	1.93	8.99	285.27
	16-Jan-95	292	4.84	0.00	13.20	0.25	0.77	5.43	197.67
	25-Feb-95	355	4.92	1.20	46.60	0.8	2.71	8.4	257.96
	26-Mar-95	430	4.51	0.00	17.60	1.72	1.53	9.67	272.03
	23-Apr-95	420	4.35		33.40	0.94	1.81	9.74	267.45
	25-May-95	265	5.02	0.00	12.60	0.47	0.7	4.3	148.26
	21-Jun-95	480	4.21	13.00	47.40	1.02	2.64	14.06	372.06
	19-Jul-95	450	4.25	0.00		1.15	3.83	15.72	390.17
	16-Aug-95	1050	5.73	15.00	57.80	0.05	9.85	23.13	624.84
	22-Sep-95	900	5.43	210.00	68.20	0.37	9.22	24.61	721.55
	29-Oct-95	575	5.46	31.00	0.00	0.04	3.95	18.45	357.45
	22-Nov-95	300	5.53	6.50	13.20	0.16	1.06	3.77	135.93
	18-Dec-95	300	5.20	0.00	24.00	0.12	1.7	6.99	201.18
	09-Apr-96	425	4.55	5.20	48.00	1.36	3.9	17.56	507.24

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM03 (cont)									
	17-Jun-96	980	4.16	0.00	48.00	0.02	2.34	18.92	457
	13-Aug-96	700		0.00	32.00	0.09	2.6	18.45	406.54
	27-May-97	358	4.47	0.00	20.00	0.09	1.38	7.31	153.75
	23-Jul-97	730	4.55	0.00	48.00	0.11	3.58	14.17	391
	05-Aug-97	900	4.12	9.20	66.00	0.17	3.01	17.64	465.02
	13-Oct-97	400	5.43	0.00	54.00	0.08	4.41	12.11	379.52
	15-Jul-98		3.63	0.00	84.00	0	2.2	19.66	531.6
	28-Sep-98	870	4.55	0.00	38.00	0.03	3.12	12.49	561.1
	06-May-99	760	4.37	0.00	49.00	0.9	0.86	12.96	193.03
	21-Jul-99	973	4.00	0.00	30.00	1.26	1.83	17.97	422.01
	27-Oct-99	726	5.55	0.00	30.00	0.18	1.78	7.87	325.29
	24-Nov-99	721	5.84	5.20	12.60	0.19	1.88	9.89	370.36
	30-Dec-99	277	6.14	16.00	12.00	0.13	1.81	7.49	297.87
	17-Jan-00	540	5.79	13.00	220.00	0.08	1.8	8.09	276.57
	28-Feb-00	380	5.69	2.50	2.00	0.14	0.74	2.76	102.91
	31-Mar-00	332	5.90	0.00	30.00	0.17	1.12	6.83	302.45
	25-Apr-00	410	5.24	9.00	34.00	0.21	0.53	5.33	257.87
	31-May-00	580	5.50	5.20	33.00	0.29	1.06	7.83	389.81
	29-Jun-00	460	6.21	0.00	18.00	0.07	1.17	4.6	238.79
	31-Jul-00	800	6.46	0.00	22.00	0.12	1.29	0.5	387.18
	25-Aug-00	670	6.26	15.00	22.00	<0.01	5.64	11.56	279.97
	22-Sep-00	530	6.13	12.00	12.00	<0.01	4.85	2.33	289.35
	20-Oct-00	500	6.34	19.50	12.50	<0.01	2.52	5.54	240.54
	15-Jan-01	390	6.03	19.00	6.00	0.03	0.93	1.75	286.97
	26-Feb-01	480	6.11	23.00	11.00	0.02	0.92	1.92	203.6
	23-Mar-01	130.3	5.10	0.00	11.00	0.013	0.73	6.16	126.6
	20-Apr-01	243	5.78	9.20	15.00	0.02	0.08	2.29	183.95
	30-May-01	490	5.56	0.00	29.80	<.01	1.21	6.39	308.59

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM03 (cont.)									
	21-Jun-01	767	5.79	0.00	16.00	<.01	3.32	13.06	451.03
	31-Oct-02	443	6.03	1.20	194.00	0.8	1.67	7.38	258
	15-Jun-04	3.63	5.99	6.50	3.20	0.59	1.28	4.82	132.82
	09-Aug-04	455	5.76	0.00	24.00	0.03	1.02	7.78	314.1
	13-Jun-05	680	5.91	0.00	20.00	0.06	2.01	5.77	375.9
	25-Jul-05	685	6.02	0.00	10.00	0.02	2.03	6.24	530.91
	02-Jun-06	540	5.67	5.20	20.00		1.39	9.3	368.48
LM04									
	16-Jan-95	290	5.12	0.00	12.20	0.22	0.59	5	189.53
	25-Feb-95	370	5.25	0.00	31.80	0.49	2.42	8.74	319.69
	26-Mar-95	430	4.79	0.00	26.40	1.72	0.92	9.67	291.91
	23-Apr-95	440	4.83	9.20	30.80	0.83	1.35	9.62	283.84
	25-May-95	280	4.72	12.00	18.40	0.47	0.35	4.29	149.55
	21-Jun-95	490	5.16	5.20	27.40	0.52	3.82	12.79	384.89
	19-Jul-95	440	5.23	0.00		0.25	3.64	16.27	366.26
	16-Aug-95	1000	6.14	25.10	36.60	<0.01	7.32	19.53	479.84
	22-Sep-95	875	5.80	31.00	60.70	<0.01	9.95	18.37	632.05
	29-Oct-95	600	6.41	63.00	33.40	0.09	3.75	15.35	400.46
	22-Nov-95	280	5.64	11.00	16.80	0.12	1	5.23	140.96
	18-Dec-95	300	5.59	0.00	18.00	0.1	2.06	8.53	203.18
	03-Mar-96		5.54	0.00	22.00	0.72		6.83	235.84
	09-Apr-96	435	5.16	5.20	38.00	0.56	2.79	19.62	481.31
	17-Jun-96	800	3.93	0.00	42.00	0.03	2.54	18.15	439.73
	13-Aug-96	700		0.00	26.00	0.16	2.53	17.45	372.8
	17-Feb-97	313	5.05	0.00	46.00	0.43	4.14	13.19	41.77
	27-May-97	375	4.94	0.00	20.00	0.07	3.17	7.78	174.27
	23-Jul-97	740	5.08	0.00	48.00	0.01	6.95	13.97	409
	05-Aug-97	800	5.81	16.00	64.00	0.05	5.65	17.4	392.51

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM04 (cont)									
	13-Oct-97	500	5.77	1.20	42.00	0.04	5.66	11.13	373.84
	15-Jul-98		4.41	0.00	62.00	1.99		18.38	521.83
	28-Sep-98	900	5.02	0.00	64.00	0.07	3.15	16.06	596.74
	11-Dec-98	880	4.44	2.50	38.00	0.64	0.38	15.57	456.28
	06-May-99	780	4.86	0.00	34.00	0.54	2.57	12.24	198.51
	21-Jul-99	939	4.50	0.00	28.00	0.95	1.05	13.98	404.22
	27-Oct-99	722	5.67	0.00	24.00	0.12	4.63	8.81	334.3
	24-Nov-99	719	6.04	13.00	12.40	0.08	2.46	9.17	355.52
	30-Dec-99	281	6.25	18.00	4.00	0.07	2.33	7.48	303.57
	17-Jan-00	530	5.94	0.00	70.00	0.06	1.93	6.46	291.9
	28-Feb-00	370	5.85	3.80	4.00	0.08	0.21	6.36	114.34
	31-Mar-00	323	6.25	2.50	16.00	0.19	1.24	6.21	310.4
	25-Apr-00	540	5.64	9.00	33.00	0.14	0.45	6.52	259.86
	31-May-00	587	6.08	20.00	9.00	0.06	1.34	7.82	394.34
	29-Jun-00	460	6.23	0.00	26.00	0.05	1.57	4.68	243.14
	31-Jul-00	760	6.45	0.00	20.00	0.1			381.51
	25-Aug-00	780	6.56	27.00	10.00	<0.01	0.93	7.03	274.16
	22-Sep-00	590	5.97	26.00	20.00	<0.01	1.24	7.01	306.5
	20-Oct-00	590	6.54	25.00	14.00	<0.01	2.91	5.93	252.44
	14-Dec-00	212.7	5.64	0.00	14.00	<0.01	0.24	4.89	176
	15-Jan-01	379	6.00	21.50	14.50	0.01	0.95	6.7	290
	26-Feb-01	141.3	6.99	29.00	26.00	0.03	1.04	6.56	216.04
	23-Mar-01	120.5	6.90	1.20	19.00	0.04	0.46	4.6	118.61
	20-Apr-01	245.8	5.88	3.75	15.00	0.02	0.63	4.72	166.75
	30-May-01	505	5.86	0.00	18.40	<0.01	1.58	6.2	318.22
	21-Jun-01	757	6.23	2.00	42.00	<0.01	2.14	12.24	429.76
	31-Oct-02	445	6.03	6.50	14.00	0.05	1.91	7.31	296
	15-Jun-04	380	6.05	29.00	0.20	0.46	1.08	5.91	120.7

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM04 (cont.)									
	09-Aug-04	505	6.22	0.00	22.00	<0.01	1.84	8	369.5
	08-Jun-05	450	5.55	3.80	0.01	0.05	1.23	5.48	228.8
	25-Jul-05	668	6.25	0.00	8.00	<0.01	2.57	4.53	573.91
	20-Jun-06	652	5.66	0.00	18.00	0.09	1.05	8.33	436.98
LM05									
	05-Feb-93	850		0.00	94.00		0.58	7.41	501.5
	21-Feb-93		3.90	0.00	48.00	2.7	11.8	18.1	483
	22-Jul-93	950		0.00	122.00	0.18	4.5	9.06	665
	05-Aug-93	700		0.00	72.00	0.14	4.35	6.7	416
	02-Sep-93	1000		0.00	134.00	0.15	5.6	6.6	613
	28-Oct-93	500		0.00	86.00	0.08	3.4	4.15	429
	18-May-94	600		0.00	94.00	0.6	3.7	6.28	448
	13-Sep-95			19.00	70.00	<0.50	15.3	24.6	
	12-Oct-95			15.80	44.00	<0.50	5.58	16.7	
	21-Nov-95			8.40	26.00	<0.50	2.08	6.67	
	06-Dec-95			10.00	28.00	<0.50	1.28	6.56	
	03-Apr-96			8.00	40.00	1.05	1.93	10.5	
	07-May-96			7.00	26.00	0.6	2.52	8.06	
	06-Jun-96			7.60	44.00	1.16	2.08	13.7	
	10-Jul-96			11.20	44.00	0.7	2.98	16.5	408.5
	06-Aug-96			8.20	60.00	1.74	2.34	18.6	486.6
	30-Sep-96	418		10.20	17.80	0.19	1.9	6.23	161
	09-Oct-96	765		12.60	54.00	1.31	6.71	15.3	391
	14-Nov-96	546		11.40	14.60	0.4	3.16	7.84	206
	09-Dec-96	564		9.60	16.00	0.98	2.77	8.99	302
	06-Jan-97	503		11.40	12.40	0.64	2.57	7.97	155
	06-Feb-97	387		10.20	34.00	0.53	2.18	5.12	167
	05-Mar-97	490		10.00	15.20	0.8	2.04	6.23	169

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM05 (cont)									
	16-Apr-97	590		11.40	24.00	0.91	3.54	9.1	212
	19-May-97	680		7.80	44.00	0.93	4.08	10.6	302
	15-Jun-04	386	5.29	0.00	1.40	0.43	1.11	6.63	126.09
	09-Aug-04	480	5.75	0.00	30.00	0.05	3.99	7.91	372.6
	08-Jun-05	457	5.26	0.00	0.02	0.13	1.28	5.69	260.4
	25-Jul-05	685	5.96	0.00	12.00	0.03	2.95	4	596
	20-Jun-06	671	4.73	0.00	24.00	0.12	2.29	9.25	469.1
LM06									
	07-Jun-93	950		0.00	122.00	0.6	4.9	15.8	614
	10-Jun-93	360		0.00	26.00	0.15	1.1	3.5	252
	21-Jun-93	700		0.00	132.00	0.43	6.9	8.3	526
	10-Jun-94	850	3.55	0.00	73.80	1.14	5.15	16.35	430
	14-Jul-94	800	3.42	0.00	51.00	1.1	4.86	16.54	409.07
	15-Aug-94	332	4.48	0.00	15.60	0.2	0.73	3.45	183.64
	16-Sep-94	610	3.85	0.00	38.70	1.21	2.41	14.34	389.79
	20-Oct-94	650	4.11	0.00	41.60	0.67	1.95	14.25	388.75
	18-Nov-94	370	4.35	0.00	21.80	0.48	0.55	9.23	301.9
	20-Dec-94	360	5.29	1.20	24.40	0.58	1.82	8.27	258.44
	16-Jan-95	295	4.06	0.00	13.80	0.17	0.83	6	188.85
	25-Feb-95	340	4.99	0.00	14.40	0.51	3.66	8.26	288.83
	26-Mar-95	435	4.61	0.00	30.80	0.99	3.34	8.98	279.49
	23-Apr-95	400	4.59	6.50	38.40	0.68	2.92	9.34	321.02
	25-May-95	280	4.63	0.00	16.80	0.36	1.03	3.91	174.05
	21-Jun-95	490	4.45	5.20	45.60	0.51	3.09	13.06	351.54
	19-Jul-95	460	4.09	0.00		0.57	4.62	16.24	363.27
	16-Aug-95	1000	4.49	0.00	68.20	<0.01	10.1	21.06	629.85
	22-Sep-95	910	4.18	6.50	67.00	0.03	11.5	20.45	657.16
	29-Oct-95	600	4.03	0.00	23.00	0.63	1.76	17.08	468.23

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM06 (cont)									
	21-Nov-95	280	4.78	5.20	13.60	0.03	0.89	4.74	140.96
	18-Dec-95	300	5.18	11.00	28.00	1.59	2.55	8.48	212.53
	17-Jun-96	840	5.24	0.00	52.00	0.02	0.79	18.25	441.06
	13-Aug-96	700		0.00	58.00	0.06	3.04	18.84	347.93
	27-May-97	370	3.98	0.00	22.00	0.04	1.19	7.6	186.18
	23-Jul-97	730	4.04	0.00	52.00	0.19	10.15	14.42	353
	05-Aug-97	890	3.94	3.80	54.00	0.14	6.91	17.4	449.2
	13-Oct-97	450	4.30	0.00	36.00	0.05	5.97	13.62	334.09
	15-Jul-98		3.52	0.00	86.00	0	2.95	19.76	527.93
	06-May-99	740	4.58	0.00	28.00	1.04	0.73	14.48	194.25
	21-Jul-99	1054	3.56	0.00	35.00	1.02	1.8	18.33	431.41
	27-Oct-99	740	4.48	0.00	26.00	0.19	2.11	10.07	337.31
	24-Nov-99	737	5.10	6.50	18.00	0.13	2.21	5.55	349.98
	30-Dec-99	192	6.11	3.80	12.00	0.1	3.6	7.84	295.96
	17-Jan-00	540	5.92	20.00	120.00	0.07	2.23	6.08	245.23
	28-Feb-00	370	5.66	1.20	4.00	0.08	0.52	3.33	106.72
	31-Mar-00	590	6.04	0.00	18.00	0.11	1.64	5.55	306.43
	25-Apr-00	480	5.47	11.00	28.00	0.17	0.77	6.56	241.3
	30-May-00	700	5.19	25.00	18.00	0.1	1.44	6.12	427.31
	29-Jun-00	460	5.98	0.00	31.00	0.03	1.54	5.11	284.09
	31-Jul-00	760	6.31	0.00	24.00	0.17	1.87	7.97	374.78
	25-Aug-00	700	5.96	11.00	41.00	0.01	1.18	8.38	279.32
	22-Sep-00	570	5.83	17.00	22.00	<0.01	2.2	7.54	298.98
	20-Oct-00	570	6.37	16.00	11.00	<0.01	2.46	5.27	254.93
	15-Jan-01	309	6.06	21.00	7.00	0.02	3.93	7.37	311.86
	26-Feb-01	500	6.15	27.00	9.00	0.03	3.73	7.09	211.69
	23-Mar-01	118	6.70	1.20	0.00	0.04	0.36	5.4	103.24
	20-Apr-01	244	5.83	13.00	13.00	0.02	0.34	4.74	175.42

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM06 (cont.)									
	30-May-01	494	5.61	0.00	16.00	<0.01	1.45	7.81	314.37
	21-Jun-01	743	4.47	0.00	2.00	<0.01	0.55	13.23	458.1
	31-Oct-02	440	5.76	0.00	16.00	0.03	2.77	6.11	295
	15-Jun-04	355	6.51	6.50	0.20	0.4	1.57	4.42	122.1
	09-Aug-04	486	5.76	0.00	16.00	<0.01	0.93	7.51	297.2
	13-Jun-05	660	4.97	0.00	30.00	0.08	1.22	6.08	430.2
	28-Jul-05	538	6.13	0.00	14.00	<0.01	1.9	9.35	192.01
	23-Jun-06	673	5.01	1.20	22.00	1.01	0.93	10.96	444.11
LM07									
	21-Feb-93		3.56	0.00	51.00	2.6	9.9	18.9	479
	27-May-93	900		0.00	86.00	1	4.5	12.5	663
	10-Jun-93	350		0.00	26.00	0.12	0.7	1.6	215
	24-Jun-93	750		0.00	110.00	0.41	5.6	11.1	582
	22-Jul-93	1200		0.00	166.00	0.32	4.5	12	208
	05-Aug-93	850		0.00	92.00	0.27	3	7.05	429
	02-Sep-93	1200		0.00	1.92	0.27	4.9	7.41	663
	28-Oct-93	600		0.00	108.00	0.24	0.2	4.78	489
	07-Aug-95			0.00	76.00	0.62	10.1	24.1	
	13-Sep-95			0.00	174.00	1.44	18.6	34.1	
	12-Oct-95			0.00	78.00	0.84	5.48	19.2	
	13-Nov-95			0.00	38.00	0.66	1.86	7.69	
	06-Dec-95			4.20	38.00	<0.50	1.47	6.88	
	20-Feb-96			1.60	64.00	1.49	6	14.5	
	03-Apr-96			2.60	52.00	1.11	1.37	11.1	
	07-May-96			4.20	26.00	0.52	0.95	7.36	
	06-Jun-96			0.00	64.00	1.52	2.13	16.9	
	10-Jul-96			0.00	64.00				440
	06-Aug-96			0.00	70.00	1.49	2.34	18.8	466.2

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM07 (cont)									
	30-Sep-96	379		7.80	17.00	0.61	1.62	5.88	153
	09-Oct-96	722		7.40	52.00	1.06	3.19	13.1	346
	14-Nov-96	495		6.80	13.80	0.42	2.1	7.22	166
	09-Dec-96	533		6.00	22.00	0.74	2.27	8.31	212
	06-Jan-97	499		7.40	14.60	0.77	1.4	8.09	164
	06-Feb-97	357		7.20	34.00	0.48	1.54	4.82	136
	05-Mar-97	458		6.80	15.00	0.73	1.25	5.64	156
	16-Apr-97	579		6.60	26.00	0.83	2.29	9.08	197
	19-May-97	650		3.60	38.00	0.84	1.72	10	230
	27-May-97	385	3.61	0.00	30.00	0.05	4.33	8.4	182.21
	09-Jun-97	613		2.40	24.00	0.61	2.16	9.84	199
	23-Jul-97	900	3.28	0.00	80.00	0.08	9.64	17.13	444
	05-Aug-97	1150	3.38	0.00	124.00	0.9	15.89	24.75	579.72
	13-Oct-97	680	3.58	0.00	98.00	0.9	3.19	19.82	473.22
	28-Sep-98	1300	3.67	0.00	130.00	0.16	9.54	26.82	807.91
	06-May-99	750	3.94	0.00	27.00	1.23	1.29	14.38	379.88
	21-Jul-99	1151	3.34	0.00	64.00	0.97	2.28	14.65	458.63
	26-Jul-00	912	3.70	0.00	76.00	0.19	2.96	15.9	512.31
	31-Oct-02	468	3.92	0.00	36.00	0.04	6.38	7.62	312.29
	15-Jun-04	348	6.02	6.50	0.00	0.46	2.52	5.15	101.87
	09-Aug-04	452	4.83	0.00	50.00	0.21	8.52	10.21	347.96
	13-Jun-05	700	5.05	38.00	30.00	<0.01	1.72	7.18	441.3
	25-Jul-05	724	5.94	0.00	28.00	<0.01	1.4	7.28	464.66
	20-Jun-06	680	5.53	0.00	20.00	0.1	0.44	10.26	453.81
LM08									
	07-Aug-95			0.00	48.00	0.84	2.4	19.4	
	13-Sep-95			0.00	104.00	2.17	4.7	23.4	
	12-Oct-95			0.00	64.00	1.04	3.35	16.5	

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM08 (cont)									
	13-Nov-95			3.00	30.00	0.65	1.29	6.49	
	06-Dec-95			6.40	34.00	0.55	1.13	5.68	
	22-Jan-96			8.20	19.20	<0.50	1.35	3.46	
	20-Feb-96			5.00	48.00	1.28	2.77	11	
	03-Apr-96			5.60	38.00	0.96	1.01	8.35	
	07-May-96			5.80	17.60	0.53	0.76	5.29	
	06-Jun-96			0.00	52.00	1.52	1.12	14.6	<10.00
	10-Jul-96			0.00	44.00	0.73	1.11	12.5	353.9
	06-Aug-96			0.00	56.00	1.31	0.94	1.47	397.9
	09-Oct-96	339		8.40	1,380.00	0.34	1.32	4.52	133
	09-Oct-96	654		9.80	40.00	0.87	1.98	10.5	98
	14-Nov-96	432		8.40	8.40	0.4	1.76	5.7	146
	09-Dec-96	474		8.40	18.00	0.72	1.92	6.53	201
	06-Jan-97	456		9.00	11.80	0.95	1.49	6.8	131
	06-Feb-97	314		8.40	30.00	0.52	1.18	3.77	129
	05-Mar-97	393		8.00	11.20	0.73	1.18	4.6	137
	16-Apr-97	494		9.00	16.80	0.81	1.32	6.6	164
	19-May-97	595		5.80	40.00	1	1.33	8.8	224
	09-Jun-97	535		5.60	17.20	0.72	1.08	7.85	189
	26-Jul-00	860	3.22	0.00	16.00	0.5	1.21	11.16	465.19
	26-Jul-00	1120	3.80	0.00	28.00	0.5	12.4	12.4	465.19
	15-Jun-04	313	5.05	1.20	1.20	0.67	2.52	4.17	114.8
	10-Aug-04	431	4.74	0.00	18.00	0.31	2.66	7.62	318.4
	13-Jun-05	637	5.06	0.00	36.00	0.07	1.29	5.15	395.1
	28-Jul-05	458	5.89	0.00	16.00	<0.01	1.43	6.83	151.81
	23-Jun-06	432	5.55	0.00	8.00	0.75	1.87	5.54	251.47
LM09									
	21-Feb-93		3.73		40.00	2.2	4.6	15.5	459

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM09 (cont)									
	27-May-93	850		0.00	58.00	0.58	1.45	8.2	567
	10-Jun-93	305		0.00	20.00	0.19	0.75	15	148
	24-Jun-93	700		0.00	72.00	0.43	0.98	7.05	460
	12-Jul-93	1100		0.00	82.00	0.45	1.21	6.35	615
	22-Jul-93	1000		0.00	92.00	0.35	1.15	9.06	590
	05-Aug-93	600		0.00	66.00	0.27	0.98	5.95	526
	02-Sep-93	1200		0.00	132.00	0.29	1.82	5.95	663
	28-Oct-93	500		0.00	100.00	0.28	0.6	4.27	539
	18-May-94	500		0.00	39.20	0.53	0.98	4.15	419
	07-Aug-95	1144		0.00	36.00	0.78	0.92	16.5	484
	12-Oct-95			0.00	64.00	1.04	3.35	16.5	381
	05-Apr-96	654		7.40	30.00	1.12	0.82	9.32	296
	23-May-96	660		6.20	52.00	1.02	0.6	9.15	261
	24-Jun-96	432		9.60	22.00	1.72	2.2	5	168
	08-Aug-96	1000		2.40	50.00	1.35	0.59	16.6	507
	04-Sep-96	800		0.00	46.00	0.73	1.21	11.9	379
	09-Oct-96	706		8.00	40.00	0.97	1.66	10.2	71
	14-Nov-96	468		9.80	10.40	0.53	1.44	5.7	173
	09-Dec-96	518		8.60	15.40	0.82	1.58	6.52	356
	06-Jan-97	493		13.00	20.00	0.64	0.78	5.4	201
	05-Mar-97	440		10.20	16.00	0.78	1	4.8	118
	16-Apr-97	539		9.60	15.40	0.96	1.13	6.15	212
	19-May-97	578		5.80	30.00	1.25	1.14	7.82	120
	27-May-97	349	3.92	0.00	18.00	0.82	0.58	6.63	165.66
	09-Jun-97	588		6.00	15.00	0.76	0.74	7.42	217
	23-Jul-97	800	3.40	0.00	52.00	1.08	0.84	1.03	394
	05-Aug-97	1000	3.66	0.00	64.00	1.11	4.8	17.53	509.84
	13-Oct-97	600	3.73	0.00	74.00	0.9	0.8	15.75	417.14

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM09 (cont.)									
	06-May-99	720	4.19	0.00	21.00	1.05	1.25	10.31	349.45
	21-Jul-99	1013	3.66	0.00	33.00	1.06	2.02	12.9	401.08
	26-Jul-00	833	3.91	0.00	14.00	0.6	0.93	13.36	462.7
	15-Jun-04	340	5.86	3.80	0.00	0.5	1.64	3.82	110.8
	10-Aug-04	424	4.57	0.00	34.00	0.2	1.39	7.49	332
	13-Jun-05	650	5.41	0.00	36.00	0.17	2.17		399.8
	28-Jul-05	483	5.72	0.00	0.00	<0.01	1.74	7.44	166.17
	23-Jun-06	465	5.47	0.00	18.00	0.91	1.3	6.58	279.89
LM10									
	12-Mar-93				27.00	1.9	2.6	6.6	236
	07-Aug-95	1257		0.00	64.00	2.18	4.25	17	531
	05-Apr-96	737		2.00	44.00	2.56	1.66	9.52	315
	23-May-96	740		3.60	66.00	2.29	1.36	8.82	146
	24-Jun-96	455		8.00	30.00	2.38	2.3	4.85	
	08-Jul-96	921		0.00	50.00	2.16	1.33	12	374
	08-Aug-96	1103		0.00	76.00	4.03	1.34	16.4	550
	04-Sep-96	924		0.00	74.00	2.76	2.64	13.4	427
	09-Oct-96	776		5.20	54.00	1.86	2.13	10.4	319
	14-Nov-96	503		8.40	14.00	1.4	2.23	6.09	180
	09-Dec-96	597		6.60	28.00	2.01	2.46	6.67	333
	06-Jan-97	545		13.00	28.00	1.39	1.46	5.93	215
	07-Feb-97	383		7.40	36.00	1.17	1.57	3.89	170
	05-Mar-97	499		7.60	24.00	1.51	1.51	4.91	168
	16-Apr-97	612		7.60	28.00	1.88	2	6.38	234
	19-May-97	629		4.20	34.00	1.73	1.72	8.11	252
	27-May-97	400	3.67	0.00	26.00	1.06	2.62	5.44	202.73
	09-Jun-97	665		2.80	28.00	1.35	1.38	8.01	248
	23-Jul-97	880	3.32	0.00	64.00	1.82	5.48	12.78	470

Site	Date	Conductivity (umhos)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	Sulfate (mg/L)
LM10 (cont.)									
	05-Aug-97	510	3.50	0.00	100.00	1.4	3.82	17.13	550.72
	13-Oct-97	730	3.55	0.00	98.00	1.17	2.79	16.88	476.77
	06-May-99	850	4.02	0.00	50.00	2.76	4.04	11.62	421.87
	21-Jul-99	1172	3.55	0.00	73.00	2.39	9.82	15.93	474.32
	26-Jul-00	925	3.71	0.00	34.00	<0.01	11.5	7.16	614.11
	15-Jun-04	371	5.75	6.50	0.60	0.84	4.25	4.66	141.9
	10-Aug-04	465	6.16	65.00	38.00	0.82	6.51	8.05	392.6
	13-Jun-05	730	5.39	0.00	40.00	0.83	9.16	5.39	484.4
	28-Jul-05	603	5.95	0.00	34.00	0.06	8.38	8.02	157.55
	23-Jun-06	508	5.59	0.00	14.00	2.12	4.61	6.27	327.26
LM11									
	22-Jun-92	1080		0.00	122.00	0.71	3.15	9.06	518
	07-Aug-95	1090		0.00	48.00	1.52	2.1	11.6	404
	05-Apr-96	660		0.00	38.00	1.92	1.83	8.13	272
	24-Apr-96			0.00	34.00	1.37	1.48	5.92	223
	13-Aug-96			0.00	36.00	2.86	1.15	9.99	345.6
	09-Oct-96	699		3.20	46.00	1.99	1.55	8.95	326
	29-Apr-99	530	3.93	0.00	30.00	1.6	1.23	4.34	409.84
	20-Jul-99	1227	3.26	0.00	106.00	2.23	3.94	10.73	619.61
	17-Jul-04	544	3.69	0.00	24.00	1.06	6.85	10.35	413.74
	11-Aug-04	447	4.28	0.00	32.00	0.67	3.28	7.39	352.6
	08-Jun-05	500	4.91	13.00	36.00	0.42	5.11	5.39	335.1
	28-Jul-05	596	4.09	0.00	28.00	<0.01	4.95	7.02	172.87
	21-Jun-06	582	3.72	0.00	32.00	0.11	5.6	7.2	529.94

Appendix B: Water quality data for Little Mill Creek Sampling Sites.

Site	**Year**	**Order**	**Family**	**Genus**	**# of Individuals**
LM01	2000	Ephemeroptera	Ephemerellidae	*Ephemerella*	27
		Ephemeroptera	Ephemerellidae	*Eurylophella*	1
		Ephemeroptera	Ephemeridae	*Ephemera*	2
		Ephemeroptera	Baetidae	*Baetis*	2
		Ephemeroptera	Ameletidae	*Ameletus*	6
		Ephemeroptera	Leptophlebiidae	*Leptophlebia*	5
		Plecoptera	Leuctridae	*Leuctra*	7
		Plecoptera	Perlidae	*Acroneuria*	10
		Plecoptera	Perlodidae	*Isoperla*	86
		Plecoptera	Perlodidae	*Diploperla*	1
		Plecoptera	Perlodidae	*Cultus*	4
		Plecoptera	Capniidae	*Allocapnia*	19
		Trichoptera	Hydropsychidae	*Diplectrona*	6
		Trichoptera	Hydropsychidae	*Hydropsyche*	13
		Trichoptera	Hydropsychidae	*Cheumatopsyche*	36
		Trichoptera	Philipotamidae	*Chimarra*	1
		Trichoptera	Philipotamidae	*Wormaldia*	1
		Trichoptera	Uenoidae	*Neophylax*	19
		Trichoptera	Limnephilidae	*Pycnopsyche*	1
		Trichoptera	Limnephilidae	*Platycentropus*	1
		Trichoptera	Limnephilidae	*Hydatophylax*	2
		Trichoptera	Rhyacophilidae	*Rhyacophila*	8
		Diptera	Chironomidae		102
		Diptera	Tipulidae	*Limnophila*	5
		Diptera	Tipulidae	*Pseudolimnophila*	1
		Diptera	Tipulidae	*Antocha*	1
		Diptera	Tipulidae	*Dicranota*	2
		Diptera	Tipulidae	*Tipula*	10
		Diptera	Tipulidae	*Hexatoma*	4
		Diptera	Tabanidae	*Chrysops*	8
		Diptera	Simulidae	*Simulium*	1
		Diptera	Simulidae	*Prosimulium*	22
		Diptera	Ceratopogonidae	*Bezzia*	2
		Diptera	Ceratopogonidae	*Probezzia*	12
		Diptera	Empididae	*Hemerodromia*	1
		Diptera	Empididae	*Chelifera*	1
		Odonata	Cordulegastridae	*Cordulegaster*	1
		Coleoptera	Dytiscidae	*Liodessus*	1
		Coleoptera	Elmidae	*Dubiraphia*	6
		Megaloptera	Sialidae	*Sialis*	1
		Megaloptera	Corydalidae	*Nigronia*	8
		Decapoda	Cambaridae	*Oronectes*	1
		Oligochaete			6
	2001	Ephemeroptera	Baetidae	*Baetis*	5
		Ephemeroptera	Ephemeridae	*Litobrancha*	5
		Ephemeroptera	Ephemerellidae	*Drunella*	4
		Ephemeroptera	Ephemerellidae	*Ephemerella*	3

Site	**Year**	**Order**	**Family**	***Genus***	**# of Individuals**
LM01	2001	Ephemeroptera	Ephemerellidae	*Eurylophella*	2
		Ephemeroptera	Ephemerellidae	*Serratella*	4
		Plecoptera	Chloroperlidae	*Sweltsa*	12
		Plecoptera	Perlidae	*Acroneuria*	2
		Plecoptera	Perlodidae	*Isoperla*	7
		Plecoptera	Leuctridae	*Leuctra*	9
		Plecoptera	Nemouridae	*Amphinemura*	75
		Trichoptera	Hydropsychidae	*Cheumatopsyche*	1
		Trichoptera	Hydropsychidae	*Hydropsyche*	9
		Trichoptera	Hydroptilidae	*Hydroptila*	6
		Trichoptera	Limnephilidae	*Hydatophylax*	5
		Trichoptera	Lepidostomatidae	*Lepidostoma*	1
		Trichoptera	Goerinae	*Goera*	4
		Trichoptera	Uenoidae	*Neophylax*	2
		Trichoptera	Philopotamidae	*Dolophilodes*	1
		Trichoptera	Phryganeidae	*Ptilostomis*	5
		Diptera	Ceratopogonidae	*Bezzia*	1
		Diptera	Ceratopogonidae	*Probezzia*	5
		Diptera	Chironomidae	*Tanytarsini*	77
		Diptera	Chironomidae	*Chironomini*	183
		Diptera	Chironomidae	**Tanypodinae*	15
		Diptera	Chironomidae	**Orthocladiinae*	76
		Diptera	Chironomidae pupa		7
		Diptera	Empididae	*Chelifera*	1
		Diptera	Simuliidae	*Simulium*	1
		Diptera	Tabanidae	*Chrysops*	4
		Diptera	Tipulidae	*Antocha*	3
		Odonata	Cordulegastridae	*Cordulegaster*	1
		Odonata	Gomphidae	*Gomphus*	2
		Megaloptera	Corydalidae	*Nigronia*	3
		Megaloptera	Sialidae	*Sialis*	2
		Coleoptera	Dytiscidae	*Hydroporus*	3
		Coleoptera	Elmidae	*Dubiraphia*	23
		Coleoptera	Elmidae	*Promoresia*	1
		Coleoptera	Hydrophilidae	*Hydrobius*	1
		Araneida			1
		Collembola			1
		Hydra			2
		Oligochaeta			6
		Isopoda	Assellidae	*Asellus*	1
		Class Gastropoda	Lymnaeidae		2
		Oligochaeta			3
	2002	No Data			
	2003	No Data			
	2004	Ephemeroptera	Baetidae	*Acerpenna*	31
		Ephemeroptera	Baetidae	*Baetis*	23
		Ephemeroptera	Baetidae	*Centroptileon*	3

Site	**Year**	**Order**	**Family**	***Genus***	**# of Individuals**
LM01	2004	Ephemeroptera	Baetidae	*Procleon*	15
		Ephemeroptera	Ephemerellidae	*Eurylophella*	1
		Ephemeroptera	Ephemerellidae	*Ephemerella*	117
		Ephemeroptera	Ephemeridae	*Hexagenia*	3
		Ephemeroptera	Heptogeniidae	*Stenacron*	4
		Ephemeroptera	Heptogeniidae	*Cinygmula*	5
		Ephemeroptera	Heptogeniidae	*Heptogenia*	16
		Ephemeroptera	Potamanthidae	*Anthopotomis*	3
		Ephemeroptera	Leptophlebidae	*Leptophlebia*	30
		Plecoptera	Perlidae	*Isoperla*	3
		Plecoptera	Perlidae	*Acroneuria*	28
		Plecoptera	Leuctridae	*Leuctra*	211
		Plecoptera	Peltoperlidae	*Peltoperla*	3
		Plecoptera	Capniidae	*Allocapnia*	50
		Plecoptera	Nemouridae	*Amphinemura*	1
		Trichoptera	Lepidostomatidae	*Lepidostoma*	2
		Trichoptera	Polycentropodidae	*Polycentropis*	2
		Trichoptera	Limnephilidae	*Hydatophylax*	6
		Trichoptera	Limnephilidae	*Pycnopsyche*	2
		Trichoptera	Hydropsychidae	*Diplectrona*	52
		Trichoptera	Hydropsychidae	*Hydropsyche*	150
		Trichoptera	Hydropsychidae	*Cheumatopsyche*	46
		Trichoptera	Phryganeidae	*Oligostomis*	8
		Trichoptera	Philopotamidae	*Chimarra*	58
		Diptera	Ciratopogonidae	*Probezzia*	3
		Diptera	Ciratopogonidae	*Bezzia*	2
		Diptera	Tipulidae	*Tipula*	2
		Diptera	Tipulidae	*Dicranota*	18
		Diptera	Tipulidae	*Hexatoma*	4
		Diptera	Simuliidae	*Simulium*	7
		Diptera	Chironomidae	*Tanytarsus*	14
		Diptera	Chironomidae	*Thienemmanemyia*	34
		Diptera	Chironomidae	*Polypedilum*	95
		Diptera	Chironomidae	*Pseudoorthocladius*	1
		Diptera	Chironomidae	*Tribelos*	3
		Diptera	Chironomidae	*Cryptochironomus*	1
		Diptera	Chironomidae	*Eukiefferiella*	3
		Diptera	Chironomidae	*Nanocladius*	4
		Diptera	Chironomidae	*Orthocladius*	4
		Diptera	Chironomidae	*Chironomus*	1
		Diptera	Chironomidae	*Parametrilnemus*	12
		Diptera	Chironomidae	*Microtendipes*	1
		Odonata	Gomphidae	*Gomphus*	6
		Odonata	Gomphidae	*Lanthus*	1
		Odonata	Gomphidae	*Arigomphis*	1
		Odonata	Cordulegastridae	*Cordulegaster*	2
		Odonata	Calopterygidae	*Calopteryx*	1

Site	**Year**	**Order**	**Family**	***Genus***	**# of Individuals**
LM01	2004	Megaloptera	Sialidae	*Sialis*	1
		Megaloptera	Corydalidae	*Nigronia*	14
		Coleoptera	Elmidae	*Promoresia*	25
		Hemiptera	Gerridae	*Gerris*	1
		Hemiptera	Gerridae	*Metrobates*	2
		Decapoda	Camberidae	*Oronectes*	3
	2005	Ephemeroptera	Baetidae	*Centroptileon*	3
		Ephemeroptera	Baetidae	*Acerpenna*	2
		Ephemeroptera	Ephemerellidae	*Ephemerella*	5
		Ephemeroptera	Heptageneidae	*Heptagenea*	6
		Ephemeroptera	Leptophlebidae	*Paraleptophelbia*	6
		Ephemeroptera	Leptophlebidae	*Leptophlebia*	4
		Plecoptera	Leuctridae	*Leuctra*	6
		Plecoptera	Capniidae	*Allocapnia*	7
		Plecoptera	Perlidae	*Acroneuria*	6
		Plecoptera	Nemouridae	*Amphinemura*	6
		Trichoptera	Hydropsychidae	*Hydropsyche*	27
		Trichoptera	Hydropsychidae	*Diplectrona*	3
		Trichoptera	Philopotamidae	*Chimarra*	37
		Trichoptera	Limnephilidae	*Grammotaulis*	1
		Diptera	Tabanidae	*Chrysops*	1
		Diptera	Tipulidae	*Tipula*	3
		Diptera	Tipulidae	*Dicranota*	3
		Diptera	Tipulidae	*Hexastoma*	1
		Diptera	Chironomidae	*Polypedilum*	10
		Diptera	Chironomidae	*Thienemmanemyia*	6
		Diptera	Chironomidae	*Tribelos*	4
		Diptera	Chironomidae	*Criptochironomus*	5
		Diptera	Chironomidae	*Pseudoorthocladius*	3
		Diptera	Chironomidae	*Paratendipes*	15
		Diptera	Chironomidae	*Tanytarsus*	2
		Diptera	Chironomidae	*Heterotrissocladius*	4
		Diptera	Chironomidae	*Cricotopus*	1
		Diptera	Chironomidae	*Chironomus*	1
		Diptera	Ciratopogonidae	*Probezzia*	1
		Odonata	Gomphidae	*Arigomphis*	4
		Odonata	Gomphidae	*Lanthus*	2
		Odonata	Cordulegastridae	*Cordulegaster*	2
		Odonata	Calopterygidae	*Calopteryx*	1
		Megaloptera	Sialidae	*Sialis*	4
		Megaloptera	Corydalidae	*Nigronia*	9
		Collembola	Entomobyidae	*Sinella*	1
		Decapoda	Camberidae	*Oronectes*	3
	2006	Ephemeroptera	Baetidae	*Centroptileon*	4
		Ephemeroptera	Baetidae	*Procleon*	2
		Ephemeroptera	Leptophlebidae	*Leptophlebia*	4
		Ephemeroptera	Heptageneidae	*Heptagenea*	6

Site	**Year**	**Order**	**Family**	***Genus***	**# of Individuals**
LM01	2006	Plecoptera	Leuctridae	*Leuctra*	6
		Plecoptera	Perlidae	*Acroneuria*	3
		Trichoptera	Hydropsychidae	*Diplectrona*	3
		Trichoptera	Hydropsychidae	*Hydropsyche*	3
		Trichoptera	Limnephilidea	*Hydatophylax*	1
		Trichoptera	Philopotamidae	*Chimarra*	9
		Trichoptera	Limnephilidea	*Pycnopsyche*	2
		Diptera	Tipulidae	*Dicranota*	1
		Diptera	Tipulidae	*Hexatoma*	1
		Diptera	Chironomidae	*Polypedilum*	6
		Diptera	Chironomidae	*Eukiefferiella*	1
		Diptera	Chironomidae	*Tanytarsus*	10
		Diptera	Chironomidae	*Procladius*	1
		Diptera	Chironomidae	*Paratendipes*	2
		Diptera	Chironomidae	*Tribelos*	1
		Diptera	Chironomidae	*Microtendipes*	18
		Diptera	Chironomidae	*Chironomus*	25
		Odonata	Cordulegastridae	*Cordulegaster*	2
		Odonata	Gomphidae	*Lanthus*	3
		Megaloptera	Corydalidae	*Nigronia*	4
LM02	2000	Diptera	Chironomidae		9
		Diptera	Tipulidae	*Tipula*	1
		Diptera	Tabanidae	*Chrysops*	2
		Diptera	Simulidae	*Prosimulium*	2
		Diptera	Ceratopogonidae	*Bezzia*	1
		Oligochaete			2
	2001	Plecoptera	Leuctridae	*Leuctra*	11
		Plecoptera	Nemouridae	*Amphinemura*	16
		Trichoptera	Hydropsychidae	*Diplectrona*	11
		Trichoptera	Hydropsychidae	*Hydropsyche*	1
		Trichoptera	Hydroptilidae	*Hydroptila*	1
		Trichoptera	Limnephilidae	*Hydatophylax*	8
		Trichoptera	Limnephilidae	*Limnephilus*	2
		Trichoptera	Lepidostomatidae	*Lepidostoma*	6
		Diptera	Ceratopogonidae	*Bezzia*	2
		Diptera	Ceratopogonidae	*Probezzia*	7
		Diptera	Chironomidae	**Tanypodinae*	7
		Diptera	Chironomidae	**Orthocladiinae*	11
		Diptera	Chironomidae	***Tanytarsini*	7
		Diptera	Chironomidae	***Chironomini*	12
		Diptera	Chironomidae	*Chironomidae pupa*	2
		Diptera	Empididae	*Hemerodromia*	1
		Diptera	Tabanidae	*Chrysops*	6
		Diptera	Tipulidae	*Pseudolimnophila*	1
		Diptera	Tipulidae	*Limnophila*	5
		Diptera	Tipulidae	*Tipula*	7
		Odonata	Cordulegastridae	*Cordulegaster*	2

Site	Year	Order	Family	*Genus*	# of Individuals
LM02	2001	Odonata	Calopterygidae	*Calopteryx*	2
		Megaloptera	Sialidae	*Sialis*	4
		Coleoptera	Elmidae	*Dubiraphia*	1
		Lepidoptera	Pyralidae		4
		Decapoda	Cambaridae	*Oronectes*	1
		Collembola			2
		Oligochaeta			5
		Class Bivalvia	Sphaeriidae		6
	2002	Diptera	Chironomidae	*Cricotopus*	3
		Diptera	Chironomidae	*Polypedilum*	3
		Diptera	Chironomidae	*Chironomus*	1
		Diptera	Chironomidae	*Tanytarsus*	2
		Diptera	Ceratopogonidae	*Stilobezzia*	1
	2003	No Data			
	2004	Trichoptera	Phryganeidae	*Oligostomis*	3
		Trichoptera	Hydropsychidae	*Diplectrona*	5
		Trichoptera	Limnephilidae	*Pynchopsyche*	1
		Trichoptera	Lepedostomatidae	*Lepedostoma*	1
		Diptera	Tabanidae	*Chrysops*	2
		Diptera	Tipulidae	*Hexotoma*	10
		Diptera	Tipulidae	*Tipula*	9
		Diptera	Chironomidae	*Chironomus*	24
		Diptera	Chironomidae	*Polypedilulm*	3
		Diptera	Chironomidae	*Procladius*	4
		Diptera	Chironomidae	*Parametrilnemus*	2
		Diptera	Chironomidae	*Paratendipes*	1
		Diptera	Chironomidae	*Tribelos*	4
		Diptera	Chironomidae	*Thienemmanemyia*	4
		Diptera	Chironomidae	*Orthocladius*	1
		Odonata	Corduliidae	*Somatochlora*	1
		Odonata	Cordulegastridae	*Cordulegaster*	1
		Megaloptera	Sialidae	*Sialis*	13
		Decapoda	Camberidae	*Oronectes*	2
	2005	Plecoptera	Neumura	*Amphinemura*	3
		Trichoptera	Hydropsychidae	*Diplectrona*	8
		Trichoptera	Limnephilidae	*Grammotaulius*	1
		Diptera	Chironomidae	*Tanytarsus*	2
		Diptera	Chironomidae	*Chironomus*	1
		Diptera	Chironomidae	*Polypedilum*	2
		Diptera	Chironomidae	*Paratendipes*	2
		Diptera	Chironomidae	*Tribelos*	1
		Diptera	Chironomidae	*Clinotanypus*	2
		Diptera	Chironomidae	*Eukieferella*	1
		Diptera	Ciratopogonidae	*Probezzia*	1
	2006	Trichoptera	Limnephilidae	*Hydatophylax*	1
		Trichoptera	Phychomyiidae	*Psychomyia*	1
		Diptera	Tabanidae	*Chrysops*	4

Site	**Year**	**Order**	**Family**	***Genus***	**# of Individuals**
LM02	2006	Diptera	Chironomidae	*Heterotrissocladius*	7
		Diptera	Chironomidae	*Procladius*	4
		Diptera	Chironomidae	*Sphatromios*	1
		Megaloptera	Sialidae	*Sialis*	1
LM03	2000	Trichoptera	Phryganiidae	*Ptilostomis*	2
		Trichoptera	Hydropsychidae	*Hydropsyche*	1
		Trichoptera	Limnephilidae	*Limnephilus*	2
		Diptera	Chironomidae		6
		Diptera	Ceratopogonidae	*Bezzia*	1
		Odonata	Cordulegastridae	*Chromagrion*	4
		Odonata	Coengrionidae	*Coengrion*	1
		Odonata	Aeshnidae	*Anax*	1
		Odonata	Aeshnidae	*Boyeria*	1
		Coleoptera	Gyrinidae	*Gyrinus*	2
		Megaloptera	Sialidae	*Sialis*	3
		Oligochaete			1
	2001	Ephemeroptera	Ephemerellidae	*Baetis*	1
		Plecoptera	Nemouridae	*Amphinemura*	1
		Trichoptera	Limnephilidae	*Hydatophylax*	12
		Trichoptera	Phryganeidae	*Ptilostomis*	3
		Trichoptera	Polycentropodidae	*Polycentropus*	1
		Diptera	Ceratopogonidae	*Bezzia*	1
		Diptera	Ceratopogonidae	*Probezzia*	1
		Diptera	Chironomidae	**Tanypodinae*	6
		Diptera	Chironomidae	**Orthocladiinae*	8
		Diptera	Chironomidae	***Chironomini*	23
		Diptera	Culicidae	*Culex*	1
		Diptera	Tabanidae	*Chrysops*	2
		Odonata	Aeshnidae	*Boyeria*	1
		Odonata	Coenagrionidae	*Chromagrion*	3
		Megaloptera	Sialidae	*Sialis*	5
		Coleoptera	Dytiscidae	*Hydroporus*	5
		Coleoptera	Curculionidae		1
		Oligochaeta			19
	2002	Trichoptera	Phryganeidae	*Oligostomis*	1
		Diptera	Chironomidae	*Tanytarsus*	1
		Odonata	Aeschnidae	*Aeschna*	1
		Megaloptera	Sialidae	*Sialis*	1
		Coleoptera	Scirtidae	*Scirtes*	1
	2003	Odonata	Calopterygidae	*Calopteryx*	1
		Diptera	Chironomidae	*Tribelos*	61
		Coleoptera	Dytiscidae	*Hydroporus*	1
	2004	Megaloptera	Sialidae	*Sialis*	15
		Odonata	Corduliidae	*Somatochlora*	4
		Odonata	Aeshnidae	*Anax*	1
		Diptera	Tabanidae	*Chrysops*	1
		Diptera	Chironomidae	*Clinotanypus*	11

Site	**Year**	**Order**	**Family**	***Genus***	**# of Individuals**
LM03	2004	Diptera	Chironomidae	*Procladius*	6
		Diptera	Chironomidae	*Polypedilum*	11
		Diptera	Chironomidae	*Thienemmanemyia*	7
		Diptera	Chironomidae	*Tribelos*	10
		Diptera	Chironomidae	*Chironomus*	4
		Diptera	Chironomidae	*Clinotanypus*	1
	2005	Hemiptera	Corixidae	*Neocorixa*	1
		Megaloptera	Sialidae	*Sialis*	2
		Diptera	Chironomidae	*Procladius*	2
		Diptera	Chironomidae	*Thienemmanemyia*	2
		Diptera	Ciratopogonidae	*Bezzia*	3
	2006	Diptera	Chironomidae	*Thienemmanemyia*	3
		Diptera	Chironomidae	*Procladius*	1
		Diptera	Chironomidae	*Tanytarsus*	2
LM04	2000	Trichoptera	Phryganiidae	*Ptilostomis*	1
		Trichoptera	Limnephilidae	*Onocosmoecus*	6
		Trichoptera	Limnephilidae	*Limnephilus*	5
		Diptera	Chironomidae		4
		Diptera	Ceratopogonidae	*Bezzia*	2
		Megaloptera	Sialidae	*Sialis*	7
		Hemiptera	Notonectidae	*Notonecta*	1
		Oligochaete			1
	2001	Trichoptera	Limnephilidae	*Limnephilus*	1
		Trichoptera	Phryganeidae	*Ptilostomis*	2
		Diptera	Ceratopogonidae	*Bezzia*	3
		Diptera	Ceratopogonidae	*Probezzia*	1
		Diptera	Chironomidae	**Tanypodinae*	2
		Diptera	Chironomidae	**Orthocladiinae*	6
		Diptera	Chironomidae	***Chironomini*	51
		Diptera	Tabanidae	*Chrysops*	1
		Diptera	Tipulidae	*Ormosia*	1
		Diptera	Tipulidae	*Tipula*	1
		Diptera	Libellulidae	*Plathemis*	1
		Megaloptera	Sialidae	*Sialis*	5
		Class Bivalvia	Sphaeriidae		1
		Class Bivalvia	Planorbidae		1
		Oligochaeta			3
	2002	Megaloptera	Sialidae	*Sialis*	4
		Diptera	Chironomidae	*Tribelos*	6
		Diptera	Chironomidae	*Tanytarsus*	2
	2003	No Data			
	2004	Trichoptera	Phryganeidae	*Oligostomis*	3
		Trichoptera	Hydropsychidae	*Diplectrona*	18
		Diptera	Tipulidae	*Tipula*	6
		Diptera	Tabanidae	*Chrysops*	8
		Diptera	Chironomidae	*Pseudoorthocladius*	12
		Diptera	Chironomidae	*Thienemmanemyia*	7

Site	**Year**	**Order**	**Family**	***Genus***	**# of Individuals**
LM04	2004	Diptera	Chironomidae	*Paratendipes*	1
		Diptera	Chironomidae	*Polypedilum*	1
		Diptera	Chironomidae	*Clinotanypus*	2
		Diptera	Chironomidae	*Tribelos*	1
		Diptera	Ciratopogondae	*Probezzia*	1
		Diptera	Ciratopogondae	*Bezzia*	1
		Trichoptera	Lepidostomatidae	*Lepidostoma*	1
		Hemiptera	Gerridae	*Metrobates*	1
	2005	Trichoptera	Phryganeidae	*Oligostomis*	1
		Diptera	Tipulidae	*Tipula*	3
		Diptera	Chironomidae	*Tribelos*	1
		Diptera	Chironomidae	*Brillia*	1
		Diptera	Chironomidae	*Polypedilum*	1
		Diptera	Chironomidae	*Crycotopus*	1
		Diptera	Chironomidae	*Clinotanypus*	12
		Diptera	Chironomidae	*Procladius*	11
		Diptera	Chironomidae	*Pseudoorthocladius*	1
		Diptera	Chironomidae	*Thienemmanemyia*	2
		Megaloptera	Sialidae	*Sialis*	7
		Decapoda	Camberidae	*Oronectes*	1
	2006	Diptera	Chironomidae	*Thienemmanemyia*	1
		Diptera	Tabanidae	*Chrysops*	1
LM05	2000	No Data			
	2001	No Data			
	2003	No Data			
	2004	Trichoptera	Lepidostomatidae	*Lepidostoma*	1
		Trichoptera	Limnephilidae	*Hydatophylax*	2
		Diptera	Tipulidae	*Dicranota*	1
		Diptera	Tabanidae	*Chrysops*	4
		Diptera	Chironomidae	*Clinotanypus*	2
		Diptera	Chironomidae	*Tribelos*	4
		Diptera	Chironomidae	*Chironomus*	16
		Diptera	Chironomidae	*Heterotrissocladius*	1
		Diptera	Chironomidae	*Procladius*	1
		Odonata	Coengrionidae	*Coenagrion*	2
		Odonata	Corduliidae	*Stomatochlora*	2
		Megaloptera	Sialidae	*Sialis*	32
		Hemiptera	Corixidae	*Neocorixa*	6
		Coleoptera	Dytiscidae	*Hydroporus*	1
	2005	Trichoptera	Limnephilidae	*Hydatophylax*	2
		Diptera	Chironomidae	*Procladius*	4
		Diptera	Chironomidae	*Polypedilum*	2
		Diptera	Chironomidae	*Tanytarsus*	1
		Megaloptera	Sialidae	*Sialis*	2
		Decapoda	Camberidae	*Oronectes*	2
	2006	Diptera	Tabanidae	*Chrysops*	2
		Diptera	Chironomidae	*Procladius*	4

Site	**Year**	**Order**	**Family**	***Genus***	**# of Individuals**
LM05	2006	Diptera	Chironomidae	*Polypedilum*	1
		Diptera	Chironomidae	*Chironomus*	4
		Diptera	Chironomidae	*Clinotanypus*	8
		Diptera	Chironomidae	*Nanocladius*	1
		Diptera	Ciratopogonidae	*Probezzia*	2
		Diptera	Ciratopogonidae	*Bezzia*	2
		Odonata	Corduliidae	*Didymops*	1
		Megaloptera	Sialidae	*Sialis*	2
		Coleoptera	Elmidae	*Promoresia*	1
		Decapoda	Camberidae	*Oronectes*	1
LM06	2000	Trichoptera	Phryganiidae	*Ptilostomis*	6
		Trichoptera	Polycentropdidae	*Polycentropus*	1
		Trichoptera	Limnephilidae	*Limnephilus*	1
		Diptera	Chironomidae		17
		Diptera	Ceratopogonidae	*Bezzia*	3
		Odonata	Cordulegastridae	*Chromagrion*	2
		Odonata	Aeshnidae	*Boyeria*	3
		Megaloptera	Sialidae	*Sialis*	16
	2001	Plecoptera	Capniidae	*Allocapnia*	5
		Plecoptera	Chloroperlidae	*Sweltsa*	1
		Plecoptera	Perlodidae	*Diploperla*	1
		Plecoptera	Taeniopterygidae	*Taeniopteryx*	2
		Trichoptera	Hydropsychidae	*Hydropsyche*	1
		Trichoptera	Polycentropodidae	*Polycentropus*	1
		Diptera	Ceratopogonidae	*Bezzia*	1
		Diptera	Ceratopogonidae	*Probezzia*	1
		Diptera	Chironomidae	**Tanypodinae*	19
		Diptera	Chironomidae	**Orthocladiinae*	37
		Diptera	Chironomidae	***Chironomini*	21
		Diptera	Chironomidae	***Tanytarsini*	4
		Diptera	Chironomidae	*Chironomidae pupa*	2
		Diptera	Tabanidae	*Chrysops*	3
		Odonata	Libellulidae	*Plathemis*	1
		Megaloptera	Sialidae	*Sialis*	23
		Oligochaeta			4
	2002	Trichoptera	Phryganeidae	*Oligostomis*	3
		Trichoptera	Hydropsychidae	*Diplectrona*	13
		Diptera	Chironomidae	*Thienemmanimyia*	1
		Diptera	Chironomidae	*Tribelos*	9
		Diptera	Chironomidae	*Xestochironomus*	1
		Diptera	Chironomidae	*Tanytarsus*	2
		Diptera	Chironomidae	*Polypedilum*	5
		Diptera	Ciratopogonidae	*Bezzia*	1
		Odonata	Calopterygidae	*Calopteryx*	1
		Megaloptera	Sialidae	*Sialis*	29
	2003	Trichoptera	Hydropsychidae	*Diplectrona*	6
		Trichoptera	Phryganeidae	*Oligostomis*	1

Site	**Year**	**Order**	**Family**	***Genus***	**# of Individuals**
LM06	2003	Trichoptera	Hydropsychidae	*Cheumatopsyche*	1
		Diptera	Tipulidae	*Hexatoma*	1
		Diptera	Chironomidae	*Tribelos*	23
		Diptera	Chironomidae	*Chironomus*	5
		Diptera	Chironomidae	*Thienemmanemyia*	3
		Diptera	Chironomidae	*Parametrilcnemus*	2
		Diptera	Chironomidae	*Pseudoorthocladius*	1
		Diptera	Chironomidae	*Xestochironomus*	1
		Diptera	Chironomidae	*Polypedilum*	34
		Diptera	Chironomidae	*Microtendipes*	1
		Diptera	Empididae	*Chelifera*	1
	2004	Trichoptera	Hydropsychidae	*Hydropsyche*	1
		Trichoptera	Hydropsychidae	*Diplectrona*	7
		Diptera	Epididae	*Effedra*	2
		Diptera	Tabanidae	*Chrysops*	6
		Diptera	Tipulidae	*Tipula*	3
		Diptera	Chironomidae	*Tribelos*	17
		Diptera	Chironomidae	*Paratendipes*	3
		Diptera	Chironomidae	*Pseudoorthocladius*	4
		Diptera	Chironomidae	*Thienemmanemyia*	6
		Diptera	Chironomidae	*Cricotopus*	2
		Diptera	Chironomidae	*Polypedilum*	3
		Diptera	Chironomidae	*Clinotanypus*	3
		Diptera	Chironomidae	*Parametrilnemus*	3
		Diptera	Chironomidae	*Heterotrissocladius*	7
		Diptera	Chironomidae	*Polypedilum*	2
		Diptera	Chironomidae	*Tanytarsus*	1
		Odonata	Corduliidae	*Somatochlora*	1
		Megaloptera	Sialidae	*Sialis*	39
		Decapoda	Camberidae	*Oronectes*	1
	2005	Trichoptera	Phryganeidae	*Oligostomis*	1
		Diptera	Tipulidae	*Hexastoma*	1
		Diptera	Simuliidae	*Simulium*	1
		Diptera	Chironomidae	*Procladius*	3
		Diptera	Chironomidae	*Pseudoorthocladius*	3
		Diptera	Chironomidae	*Thienemmanemyia*	3
		Diptera	Chironomidae	*Cryptochironomus*	1
		Diptera	Chironomidae	*Tanytarsus*	2
		Diptera	Chironomidae	*Polypedilum*	1
		Diptera	Tabanidae	*Chrysops*	3
		Megaloptera	Sialidae	*Sialis*	13
	2006	Diptera	Chironomidae	*Tribelos*	12
		Diptera	Chironomidae	*Pseudoorthocladius*	2
		Diptera	Chironomidae	*Heterotrissocladius*	1
LM07	2000	No Data			
	2001	Trichoptera	Polycentropodidae	*Polycentropus*	3
		Trichoptera	Hydropsychidae	*Hydropsyche*	2

Site	**Year**	**Order**	**Family**	***Genus***	**# of Individuals**
LM07	2001	Diptera	Ceratopogonidae	*Bezzia*	2
		Diptera	Chironomidae	**Tanypodinae*	4
		Diptera	Chironomidae	**Orthocladiinae*	38
		Diptera	Chironomidae	***Tanytarsini*	4
		Diptera	Chironomidae	***Chironomini*	47
		Diptera	Chironomidae	*Chironomidae pupa*	2
		Diptera	Tabanidae	*Chrysops*	4
		Odonata	Coenagrionidae	*Chromagrion*	2
		Odonata	Coenagrionidae	*Coenagrion*	1
		Megaloptera	Corydalidae	*Nigronia*	1
		Megaloptera	Sialidae	*Sialis*	25
		Hemiptera	Corixidae		1[#]
		Oligochaeta			1
		Trichoptera	Polycentropodidae	*Polycentropus*	1
		Megaloptera	Sialidae	*Sialis*	6
		Hemiptera	Corixidae	*Neocorixa*	3
	2002	Trichoptera	Polycentropodidae	*Polycentropus*	1
		Megaloptera	Sialidae	*Sialis*	6
		Hemiptera	Corixidae	*Neocorixa*	3
	2003	Megaloptera	Sialidae	*Sialis*	1
		Diptera	Tabanidae	*Chrysops*	1
		Diptera	Chironomidae	*Tanytarsus*	2
		Diptera	Chironomidae	*Chironomus*	1
		Diptera	Chironomidae	*Thienemmanemyia*	4
		Diptera	Chironomidae	*Xestochironomus*	1
	2004	Trichoptera	Hydropsychidae	*Diplectrona*	27
		Trichoptera	Hydropsychidae	*Diplectrona*	1
		Trichoptera	Phryganeidae	*Oligostomis*	2
		Trichoptera	Limnephilidae	*Hydatophylax*	1
		Diptera	Tabanidae	*Chrysops*	1
		Diptera	Chironomidae	*Tribelos*	6
		Diptera	Chironomidae	*Heterotrissocladius*	1
		Diptera	Chironomidae	*Procladius*	1
		Diptera	Chironomidae	*Polypedilum*	1
		Diptera	Chironomidae	*Parametrilnemus*	1
		Diptera	Chironomidae	*Thienemmanemyia*	1
		Odonata	Libellulidae	*Lebellula*	1
		Megaloptera	Sialidae	*Sialis*	25
		Hemiptera	Gerridae	*Metrobates*	2
		Hemiptera	Corixidae	*Neocorixa*	7
		Coleoptera	Dytiscidae	*Hydroporus*	2
	2005	Trichoptera	Hydropsychidae	*Hydropsyche*	2
		Trichoptera	Hydropsychidae	*Diplectrona*	5
		Megaloptera	Sialidae	*Sialis*	4
		Diptera	Simuliidae	*Simulium*	20
		Diptera	Chironomidae	*Polypedilum*	3
		Diptera	Chironomidae	*Parametrilnemus*	2

Site	**Year**	**Order**	**Family**	***Genus***	**# of Individuals**
LM07	2005	Diptera	Chironomidae	*Tribelos*	1
		Diptera	Chironomidae	*Tanytarsus*	25
		Diptera	Chironomidae	*Procladius*	1
	2006	Megaloptera	Sialidae	*Sialis*	2
		Odonata	Coengrionidae	*Argia*	2
		Diptera	Chironomidae	*Nanocladius*	1
		Diptera	Chironomidae	*Tanytarsus*	2
LM08	2000	No Data			
	2001	No Data			
	2002	Trichoptera	Polycentropodidae	*Polycentropus*	2
		Diptera	Chironomidae	*Polypedilum*	4
		Diptera	Chironomidae	*Tribelos*	8
		Diptera	Chironomidae	*Chironomus*	1
		Odonata	Calopterygidae	*Calopteryx*	1
		Odonata	Aeschnidae	*Aeschna*	2
		Megaloptera	Sialidae	*Sialis*	20
	2003	Diptera	Chironomidae	*Tanytarsus*	1
		Diptera	Chironomidae	*Tribelos*	1
		Diptera	Chironomidae	*Polypedilum*	1
		Diptera	Chironomidae	*Thienemmanemyia*	1
	2004	Plecoptera	Leuctridae	*Leuctra*	1
		Plecoptera	Taeniopterygidae	*Taeniopteryx*	2
		Trichoptera	Phryganeidae	*Oligostomis*	1
		Diptera	Tabanidae	*Chrysops*	1
		Diptera	Tipulidae	*Hexatoma*	3
		Diptera	Tipulidae	*Tipula*	1
		Diptera	Tipulidae	*Dicranota*	1
		Diptera	Chironomidae	*Thienemmanemyia*	4
		Diptera	Chironomidae	*Tribelos*	9
		Diptera	Chironomidae	*Polypedilum*	2
		Diptera	Chironomidae	*Pseudoorthocladius*	6
		Diptera	Chironomidae	*Diplocladius*	2
		Diptera	Chironomidae	*Heterotrissocladius*	2
		Diptera	Chironomidae	*Tanytarsus*	3
		Diptera	Chironomidae	*Chironomus*	1
		Diptera	Chironomidae	*Paratendipes*	1
		Diptera	Chironomidae	*Procladius*	1
		Diptera	Chironomidae	*Parametrilnemus*	1
		Megaloptera	Sialidae	*Sialis*	38
		Hemiptera	Corixidae	*Neocorixa*	3
		Hemiptera	Gerridae	*Metrobates*	1
	2005	Trichoptera	Hydropsychidae	*Diplectrona*	8
		Diptera	Tipulidae	*Hexastoma*	3
		Diptera	Chironomidae	*Tanytarsus*	29
		Diptera	Chironomidae	*Polypedilum*	9
		Diptera	Chironomidae	*Procladius*	31
		Diptera	Chironomidae	*Thienemmanemyia*	4

Site	**Year**	**Order**	**Family**	***Genus***	**# of Individuals**
LM08	2005	Diptera	Chironomidae	*Pseudoorthocladius*	4
		Diptera	Chironomidae	*Paratendipes*	2
		Diptera	Chironomidae	*Chironomus*	2
		Diptera	Chironomidae	*Tribelos*	1
		Diptera	Simuliidae	*Simulium*	2
		Diptera	Tabanidae	*Chrysops*	1
		Diptera	Chironomidae	*Brillia*	1
		Odonata	Aeschnidae	*Aeschna*	4
		Megaloptera	Sialidae	*Sialis*	100
		Megaloptera	Corydalidae	*Nigronia*	4
	2006	Trichoptera	Hydropsychidae	*Hydropsyche*	2
		Megaloptera	Sialidae	*Sialis*	9
		Diptera	Empididae	*Chelifdra*	1
		Diptera	Chironomidae	*Cricotopus*	1
		Diptera	Chironomidae	*Tanytarsus*	2
		Diptera	Chironomidae	*Polypedilum*	5
		Diptera	Chironomidae	*Procladius*	2
		Diptera	Chironomidae	*Tribelos*	2
		Diptera	Chironomidae	*Heterotrissocladius*	1
		Diptera	Chironomidae	*Thienemmanemyia*	2
		Diptera	Chironomidae	*Paratendipes*	8
		Diptera	Chironomidae	*Pseudoorthocladius*	1
LM09	2000	No Data			
	2001	No Data			
	2002	Megaloptera	Corydalidae	*Nigronia*	1
		Trichoptera	Hydropsychidae	*Diplectrona*	2
		Megaloptera	Sialidae	*Sialis*	8
		Hemiptera	Corixidae	*Neocorixa*	3
		Diptera	Chironomidae	*Tanytarsus*	10
		Diptera	Chironomidae	*Polypedilum*	1
		Diptera	Chironomidae	*Cricotopus*	5
		Diptera	Chironomidae	*Nanocladius*	1
	2003	No Data			
	2004	Plecoptera	Perlodidae	*Isoperla*	1
		Trichoptera	Hydropsychidae	*Diplectrona*	29
		Trichoptera	Limnephilidae	*Hydatophylax*	2
		Trichoptera	Hydropsychidae	*Hydropsyche*	5
		Diptera	Tipulidae	*Tipula*	1
		Diptera	Chironomidae	*Polypedilum*	4
		Diptera	Chironomidae	*Chironomus*	7
		Diptera	Chironomidae	*Pseudoorthocladius*	4
		Diptera	Chironomidae	*Tribelos*	2
		Diptera	Chironomidae	*Tanytarsus*	1
		Megaloptera	Sialidae	*Sialis*	1
		Megaloptera	Corydalidae	*Nigronia*	2
		Coleoptera	Elmidae	*Promoresia*	1
		Hemiptera	Corixidae	*Neocorixa*	2

Site	**Year**	**Order**	**Family**	***Genus***	**# of Individuals**
LM09	2005	Trichoptera	Hydropsychidae	*Deplectrona*	5
		Diptera	Tabanidae	*Chrysops*	1
		Diptera	Chironomidae	*Nanocladius*	2
		Diptera	Chironomidae	*Tanytarsus*	3
		Diptera	Chironomidae	*Tribelos*	2
		Diptera	Chironomidae	*Polypedilum*	3
		Diptera	Chironomidae	*Chironomus*	1
		Diptera	Chironomidae	*Procladius*	6
		Diptera	Chironomidae	*Paratendipes*	1
		Megaloptera	Sialidae	*Sialis*	6
		Hemiptera	Corixidae	*Neocorixa*	6
		Coleoptera	Elmidae	*Promoresia*	1
	2006	Megaloptera	Sialidae	*Sialis*	2
		Diptera	Chironomidae	*Polypedilum*	4
		Diptera	Chironomidae	*Tanytarsus*	7
		Diptera	Chironomidae	*Thienemmanemyia*	2
		Diptera	Chironomidae	*Paratendipes*	1
		Diptera	Chironomidae	*Cryptochironomus*	1
		Diptera	Chironomidae	*Procladius*	2
LM10	2000	No Data			
	2001	No Data			
	2002	Trichoptera	Hydropsychidae	*Diplecrona*	7
		Diptera	Ciratopogonidae	*Bezzia*	1
		Diptera	Chironomidae	*Cricotopus*	6
		Diptera	Chironomidae	*Nanocladius*	1
		Diptera	Chironomidae	*Parametricnemus*	1
	2003	Diptera	Chironomidae	*Limnophytes*	1
	2004	Trichoptera	Hydropsychidae	*Diplectrona*	11
		Trichoptera	Limnephilidae	*Grannotautis*	1
		Trichoptera	Limnephilidae	*Hydatophylax*	1
		Trichoptera	Polycentropodidae	*Polycentropus*	1
		Diptera	Tipulidae	*Dicranota*	1
		Diptera	Tipulidae	*Tipula*	1
		Diptera	Chironomidae	*Parametrilcnemus*	1
		Diptera	Chironomidae	*Pseudoorthocladius*	1
		Hemiptera	Corixidae	*Neocorixa*	3
		Hemiptera	Gerridae	*Gerris*	1
		Megaloptera	Sialidae	*Sialis*	3
	2005	Plecoptera	Leuctridae	*Leuctra*	1
		Trichoptera	Hydropsychidae	*Diplectrona*	5
		Diptera	Tipulidae	*Tipula*	1
		Diptera	Chironomidae	*Tribelos*	1
		Diptera	Chironomidae	*Polypedilum*	6
		Diptera	Chironomidae	*Pseudoorthocladius*	2
		Diptera	Chironomidae	*Chironomus*	1
		Diptera	Chironomidae	*Paratendipes*	1
	2006	Diptera	Chironomidae	*Tribelos*	1

Site	**Year**	**Order**	**Family**	***Genus***	**# of Individuals**
LM11	2000	No Data			
	2001	No Data			
	2002	No Data			
	2003	No Data			
	2004	Trichoptera	Lepidostomatidae	*Lepidostoma*	3
		Trichoptera	Phryganeidae	*Oligostomis*	1
		Diptera	Chironomidae	*Tanytarsus*	2
		Odonata	Gomphidae	*Gomphus*	1
		Decapoda	Camberidae	*Oronectes*	1
	2005	No Specimens Collected			
	2006	Trichoptera	Hydropsychidae	*Diplectrona*	1
		Diptera	Chironomidae	*Chironomus*	11
		Diptera	Chironomidae	*Polypedilum*	1
		Diptera	Chironomidae	*Tribelos*	1
		Diptera	Chironomidae	*Paratendipes*	1
		Diptera	Chironomidae	*Nanocladius*	1
		Megaloptera	Sialidae	*Sialis*	12

Appendix C: Macroinvertebrate taxonomic data for all Little Mill Creek sampling sites.