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Bears Grass Creek Monitoring Report, 2004-2005

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Introduction

Bears Grass Creek is a 10.2-mile tributary of the Eau Claire River located in the Lower Eau Claire River Priority Watershed. The priority watershed project was initiated in 1983 and was completed in December 1993 (Schreiber 1993). For this project, Bears Grass Creek was split into two subwatersheds, each with different management goals. The upper subwatershed (upstream of CTH V) was managed as a Class III brook trout fishery and the project objective was to increase trout reproduction and survival. The lower subwatershed (downstream of CTH V) supports a forage fishery and the project objective was to improve the diversity of the aquatic community including insects, fish and plants. Implementation of the project involved installation of barnyard management controls, fencing to exclude livestock, riprap, sloping and seeding, and stream crossings (Schreiber 1993).

According to the final project report from 1993, the first objective (to increase trout reproduction and survival) was not met in the upper Bears Grass Creek because natural reproduction would not improve until sediments were scoured and gravel riffle areas were exposed. The second objective (to improve the diversity of the aquatic community including insects, fish and plants) was also not met in the lower portion because the improvement in the diversity of more tolerant aquatic macroinvertebrates did not represent improved water quality conditions (Schreiber, 1993).

The purpose of this report is to compare stream data in 2004 and 2005 on Bears Grass Creek to data from the 1993 report and track changes over the last 12 years.

Methods

Four sites were chosen on Bears Grass Creek for evaluation (Table 1). Methods of evaluation were chosen according to the Nonpoint Source Evaluation Monitoring Report on Bears Grass Creek (Schreiber 1993) for reasons of comparison to the 1993 study. Sites 1, 2, 3, and 4 of this study correspond to sites 1, 2, 4, and 6 of the 1993 study (Schreiber 1993). Sites 1 and 2 are located in the lower Bears Grass Creek subwatershed, while sites 3 and 4 are located in the upper subwatershed (Figure 1).

Table 1. Bears Grass Creek monitoring sites and parameters measured in 2004 and 2005.

Site	Location	Macroinvertebrates June	Macroinvertebrates Sept	Temperature	Habitat Assess. 2004 only
1	Lincoln Dr.(upstream)	X	X	X	X
2	STH 12 (upstream)				X
3	CTH V				X
4	Bears Grass Rd. (Erdman Rd.)	X	X	X	

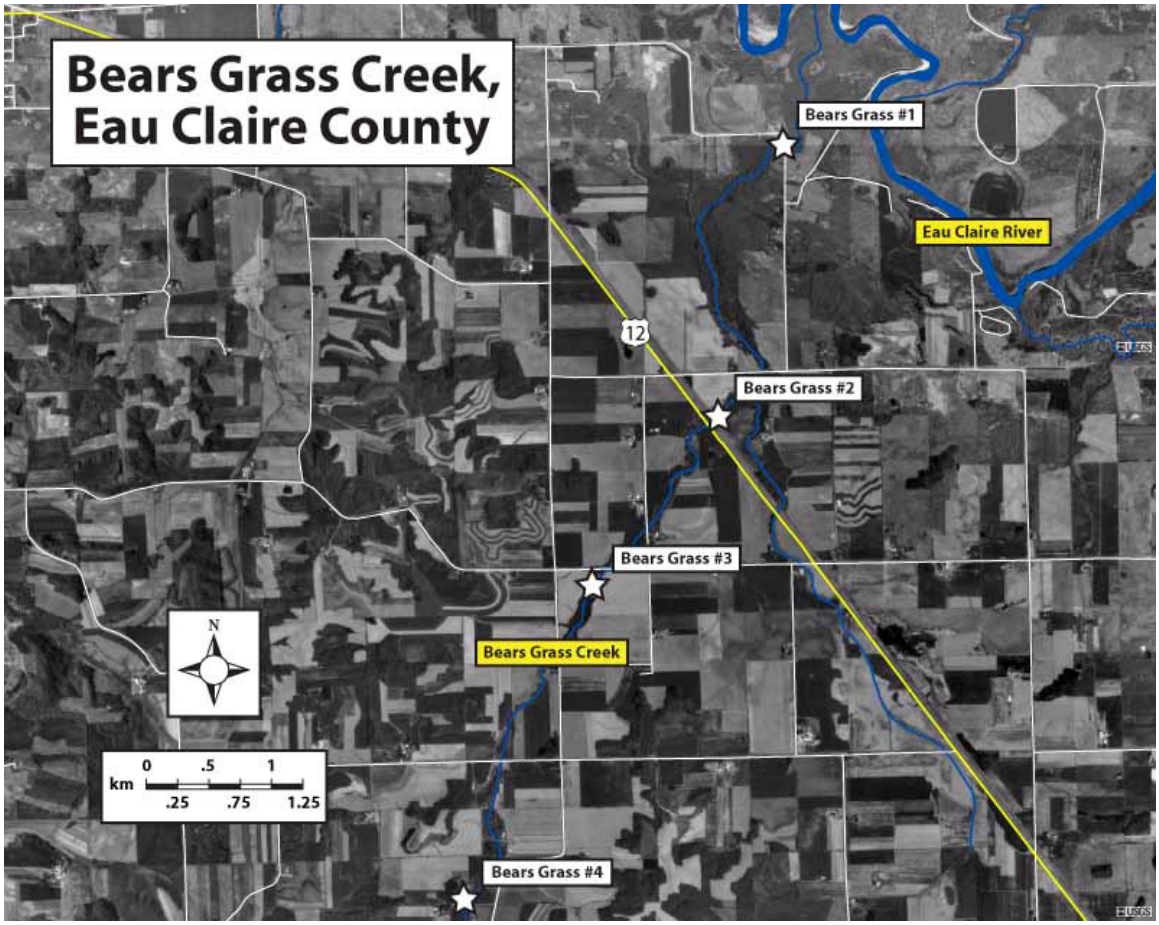

Figure 1. Map of monitoring sites on Bears Grass Creek

Macroinvertebrates

Aquatic macroinvertebrates were collected in the spring and fall in two sites. They were collected in a D-frame net, preserved in alcohol, and taken back to the lab for sorting and identification to family. Data was analyzed using the Hilsenhoff Biotic Index, family richness, percent Ephemeroptera-Plecoptera-Trichoptera (EPT), and Margalef's Diversity Index (using family diversity instead of species diversity). Hilsenhoff scores calculated in 2005 used a modified version of the index, which includes some families that were not

listed in the original 1988 index. This modified index typically raises the average score by half a point to a point. This index is more up to date and thought more accurate. More information is available: http://lakes.chebucto.org/ZOOBENTH/BENTHOS/tolerance.html.

Temperature

Continuous temperature monitoring devices (Onset Corporation 75-day HOBOs) were placed at sites 1 and 4 for the duration of the summer months in 2004 and 2005, recording instantaneous temperatures every hour from June until August/September.

Habitat Assessment

Stream habitat assessments were completed on three sites of Bears Grass Creek according to methods developed by Simonson and Lyons (1992).

Results and Discussion

Macroinvertebrates

Macroinvertebrate specimens found are listed by family in Appendices 2 and 4. Appendices 3 and 5 list index scores and water quality for each site. Macroinvertebrates were collected from Bears Grass Creek sites 1 and 4 in spring and fall 2004 and 2005. Also in spring 1992, macroinvertebrates were collected from site 1 and site 6 (same as site 4 in 2004 and 2005).

HFBI - The Hilsenhoff Family Biotic Index (HFBI) assigns tolerance values ranging from 0-10 to macroinvertebrate species based on sensitivity to organic pollution (Table 2). Note that a lower HFBI score is tied with a lesser degree of organic pollution and better water quality. The HFBI generally reflects the presence of organic pollution and occasional low dissolved oxygen levels, but may not adequeately assess other factors affecting the macroinvertebrate community such as toxins and sedimentation (Schreiber, 1993.

Table 2. Interpretation of the Hilsenhoff Biotic Index (Hilsenhoff, 1988).

0.00 – 3.50	Excellent	No apparent organic pollution
3.51 – 4.50	Very Good	Possible slight organic pollution
4.51 – 5.50	Good	Some organic pollution
5.51 – 6.50	Fair	Fairly significant organic pollution
6.51 – 7.50	Fairly Poor	Significant organic pollution
7.51 – 8.50	Poor	Very significant organic pollution
8.51 – 10.00	Very Poor	Severe organic pollution

Based on the HFBI scores, site 1 during spring 1992, 2004, and 2005 has remained relatively constant with water quality conditions ranking good or very good (Figure 2).

During the fall macroinvertebrate sampling, HFBI values at site 1 were much lower with water quality conditions ranking excellent. The seasonal variation in water quality at site 1 should be taken into consideration during future studies on Bears Grass Creek to assess possible causes higher HFBI scores and therefore lower water quality rankings in spring verses fall.

Site 4 in 1992 (named site 6), 2004 and 2005 yielded HFBI scores that were significantly higher than site 1 with water quality conditions ranking good in 1992 and fair during the rest of the sampling periods (Figure 2).

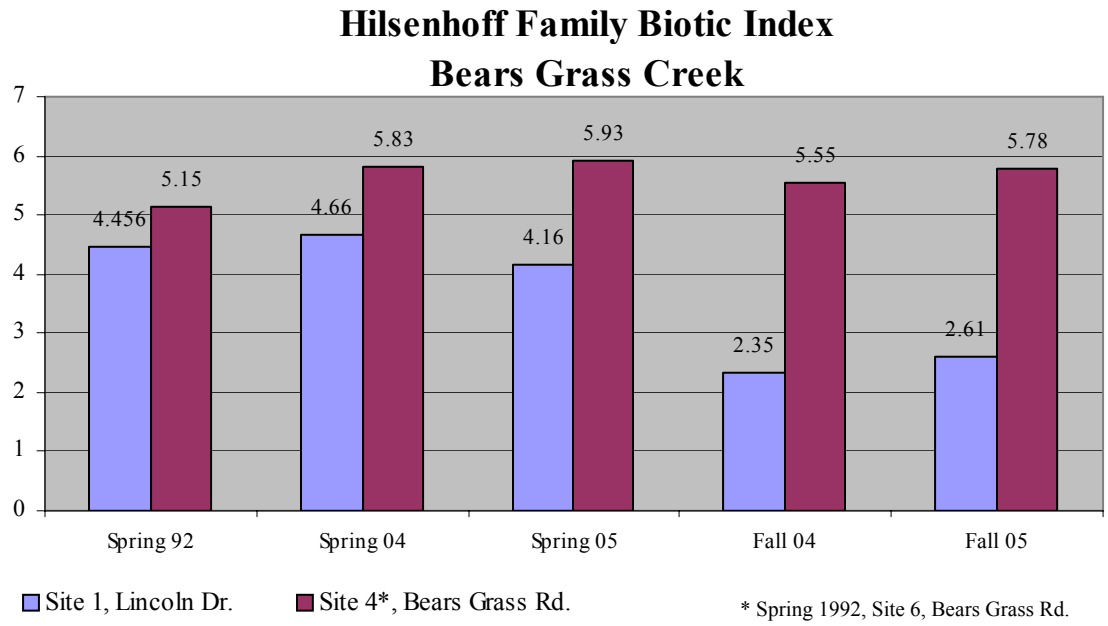

Figure 2: Comparisons among 1992, 2004, and 2005 macroinvertebrate collections. A lower value in the Hilsenhoff Index is indicative of higher quality streams.

Percent EPT – The EPT index included the count of total individuals in the orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies). The presence of these groups generally indicate clean water conditions, and absence indicates some level of pollution, provided physical conditions of the stream are acceptable (Schreiber, 1993).

Percent EPT in site 1 has increased substantially since 1992, which indicates an improvement in water quality. Site 4 percent EPT has also improved dramatically since 1992 (Figure 3).

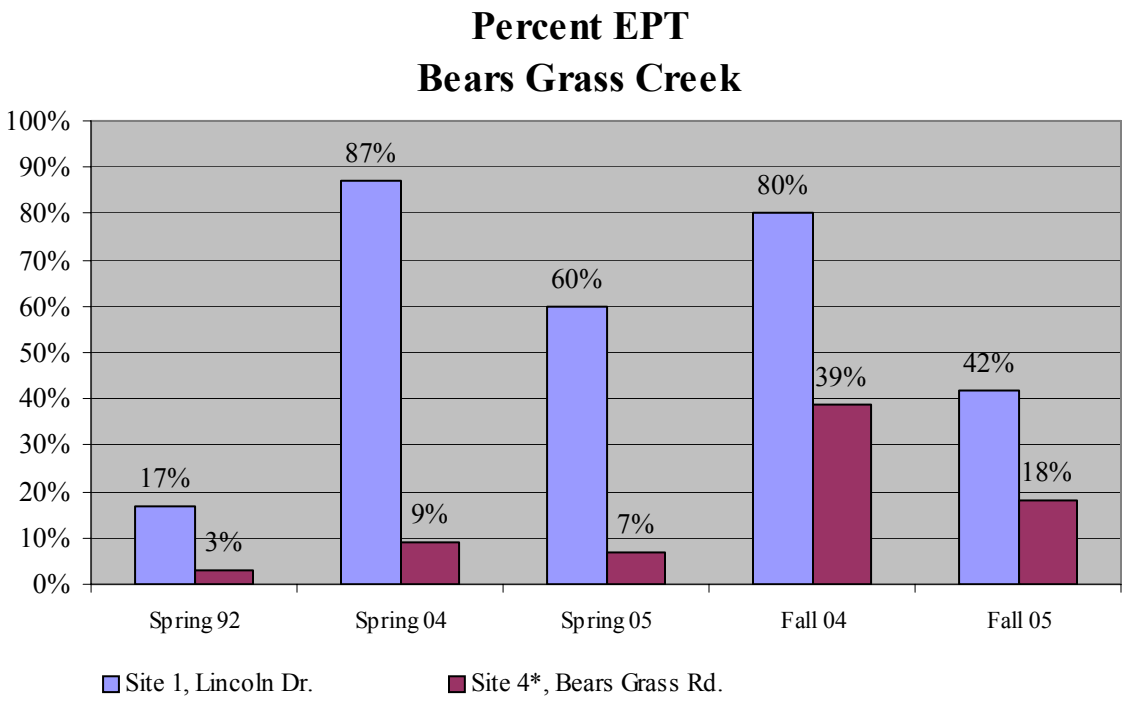

Figure 3: Comparisons among 1992, 2004, and 2005 macroinvertebrate collections. Presence of Ephemeroptera-Plecoptera-Trichoptera (EPT) indicates clean water conditions. Therefore, a higher EPT% translates to better water quality.

According to macroinvertebrate data, the stream quality has improved on the lower portion of the stream (site 1). At site 3 there are obvious signs of the restoration that took place during the priority watershed project. Lunker structures have been put in place, stream banks have been stabilized with native vegetation, and a more developed pool-riffle-run pattern has emerged. These improvements seem to have had longer term effects on the stream, improving the quality on the lower portion and thus moving towards the objectives outlined in the 1993 study.

The upper portion of the stream, however, does not show improvements according to biotic index scores. HFBI scores are in the "fair" range in the upstream-most site of our study (site 4), which indicates fairly significant organic pollution in the upper subwatershed. Time has not improved this portion of the stream, and objectives from the 1993 study have not been met.

Temperature

Since the project was completed in 1993, temperatures rose slightly at site 1 and remained constant at site 4 in 2004 (Figures 4 and 5). Mean temperatures rose slightly at both sites in 2005 (Table 3).

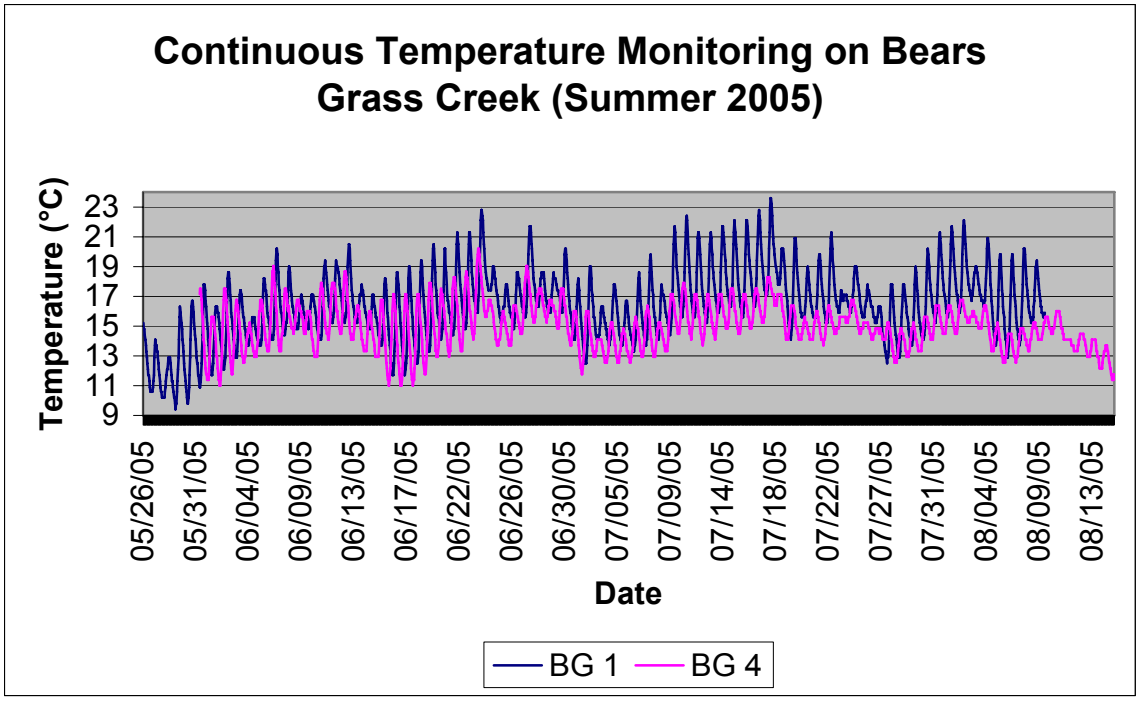

Figure 4. Temperature data collected by Onset Corporation HOBOS in Bears Grass Creek sites 1 and 4 in 2004.

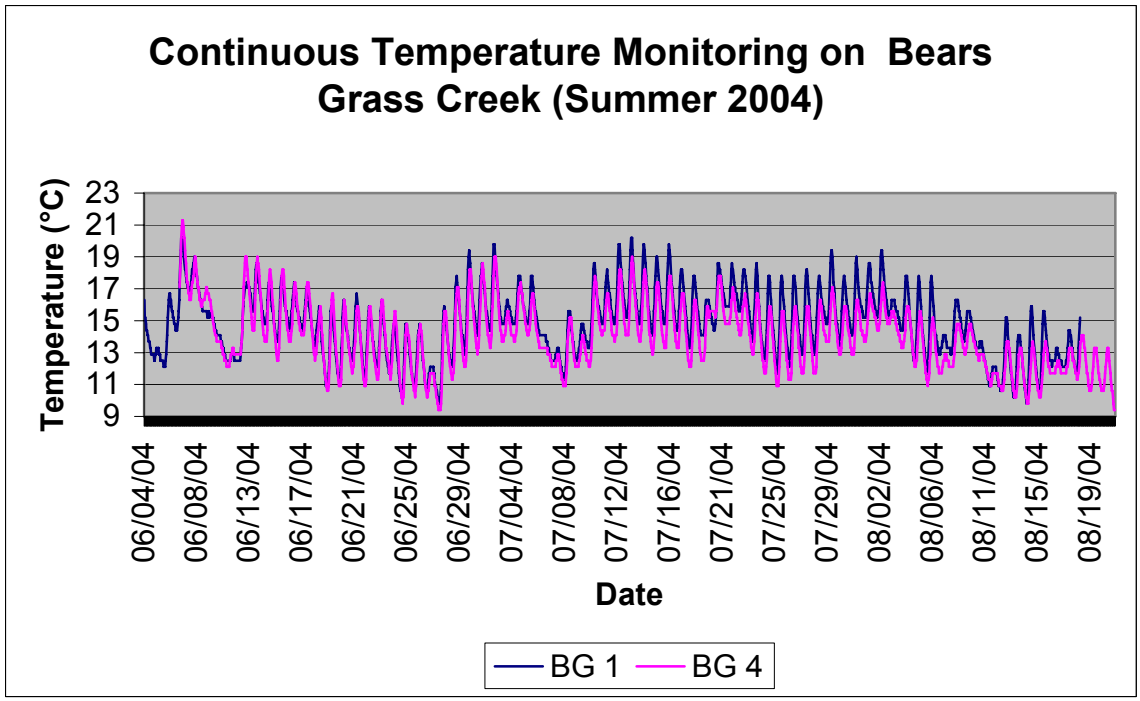

Figure 5. Temperature data collected by Onset Corporation HOBOS in Bears Grass Creek sites 1 and 4 in 2005.

Table 3. Max and mean temperature data from 1999, 2004 and 2005.

Temperatures in ºC	1993		2004		2005	
	Max	Mean	Max	Mean	Max	Mean
Site 1 – Lincoln Rd.	21.7°	13.7°	20.2°	14.9°	23.6°	16.4°
Site 4 – Bears Grass Dr.	21.2°	13.9°	21.3°	14.0°	20.2°	15.0°

According to this data and the Thermal Criteria outlined by Lyons and Wang (1996), Bears Grass Creek is a cold-water stream. In both sites, the temperatures are optimal for brook trout (11-16ºC daily optimal mean, 23.8ºC upper limit) (although temperatures rose slightly above this in 2005 at site #1) and brown trout (12-19ºC daily optimal mean, 27.2ºC upper limit) survival.

Habitat Assessment

Habitat Assessments on sites 1, 2, and 3 were given overall ratings of 60, 65, and 68 respectively (Table 4). These are all given an overall rating of "Good" according to methods developed by Simonson and Lyons (1992).

Stream width is similar to what it was in 1993, narrow upstream and wide and shallow downstream. The stream is less sandy than it was in the 1993 study. It has begun to develop more gravel and rubble areas on which macroinvertebrates can live. However, other than site 3, the stream still lacks well-developed pool-riffle-run structure and gravel riffle areas. The stream banks are still generally stable and are protected with vegetation along the entire stream (Figures 6 and 7).

The stream was restored and lunker structures were put in place at site 3, which slightly increased the habitat evaluation scores at this site. These improvements seem to have had positive effects on the lower portion of the stream, as depth of soft sediment has decreased and more riffle areas have been exposed. Again, it seems as though restorations completed in 1993 have, through time, shown slight improvements in the lower portion of the stream. More information about habitat needs to be collected upstream of site 3, as no habitat evaluations were completed in the upper subwatershed.

Table 4. Habitat Assessment in Bears Grass Creek sites 1, 2, and 3 from 2004 and sites 1, 2, and 6 from 1993. Bears Grass Creek sites 1 and 2 were the same location for 1993 and 2004. Site 6 in 1993 is the same as site 4 in 2004.

Site	Year	Mean Steam Width (m)	Mean Water Depth (m)	Mean Depth (m) of Soft Sediment	Substrate Composition	Percent Riffles
1	1993	6.16	.21	.82	100% sand	0
1	2004	6.3	.17	.19	75% sand; 18% gravel; 5% silt; 1% bedrock; 1% detritus	3
2	1993	5.00	.22	1.02	94% sand; 5% gravel; 1% detritus	6
2	2004	4.7	.19	.19	70% sand; 18% gravel; 11% silt; 1% detritus	11
6	1993	4.36	.24	.58	68% sand; 18% silt; 11% gravel; 3% detritus	8
3	2004	4.5	.38	.17	41% sand; 20% silt; 17% gravel; 14% clay; 3% detritus; 2% rubble/cobble; 3% boulder	0

Figure 6. Bears Grass Creek site 4 at Bears Grass Rd. (Erdman Rd.).

Conclusions

Since the priority watershed project was completed and the stream was assessed in 1993, Bears Grass Creek has shown a few changes, mostly for the better. The upper subwatershed has not changed much over the last decade, while the lower subwatershed seems to have improved.

The restorations at and above site 3 in 1993 seem to have had positive effects on long-term stream management in the lower portion of Bears Grass Creek. Although water temperature has slightly increased at site 1, habitat evaluations and macroinvertebrate collections have shown increases in the overall quality of the stream. The stated objective of the 1993 study, 'to improve the diversity of the aquatic community including insects, fish and plants,' is seemingly being met over time.

Figure 7. Bears Grass Creek site 4 location of HOBO.

In order for all objectives of the 1993 study to be met, improvements still need to be made in the upper portions of Bears Grass Creek. Temperatures in the entire stream are optimal for coldwater fisheries (brook and brown trout). One restricting factor may be the lack of optimal habitat for natural reproduction of trout and the macroinvertebrates necessary for their survival.

References

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Appendix 1. Flow data taken on Bears Grass Creek (8/24/2004)

	Site 1	Site 2	Site 3
Stream width (m)	6.8	4.0	3.0
Flow (ft^3/sec)	7.938	5.582	3.981
Flow (m^3/sec)	.225	.158	.113

Appendix 2. Macroinvertebrates found in Bears Grass Creek, 2004

Spring		Fall	
Site 1 (Lincoln Dr.) 3 Jun 04		**Site 1 (Lincoln Dr.) 27 Sep 04**	
Baetidae	68	Athericidae	4
Chironomidae	2	Baetidae	9
Elmidae (4A, 2L)	6	Brachycentridae	62
Gammaridae	5	Chironomidae	1
Heptigeniidae	2	Elmidae	2
Hydropsychidae	13	Gammaridae	10
Pteronarcidae	4	Heptageniidae	5
		Hydropsychidae	1
		Physidae	2
		Pteronarcidae	3
		Tipulidae	1
Total	100	Total	100
Site 4 (Bears Grass Rd.) 7 Jun 04		**Site 4 (Bears Grass Rd.) 27 Sep 04**	
Baetidae	5	Baetidae	34
Gammaridae	91	Brachycentridae	1
Limnephilidae	4	Dytiscidae	2
		Gammaridae	55
		Heptageniidae	1
		Limnephilidae	3
		Physidae	4
Total	100	Total	100

Appendix 3. Summary of macroinvertebrate analyses on sites 1 and 4, 2004

Spring 2004	**Site 1**	**Site 4**
Hilsenhoff FBI	4.66	5.83
Water Quality	Good	Fair
Degree of Organic Pollution	some	fairly significant
% EPT	87.0 %	9.0 %
Family Richness	7	3
Margalef's Diversity Index	1.30	.43
Fall 2004	**Site 1**	**Site 4**
Hilsenhoff FBI	2.35	5.55
Water Quality	Excellent	Fair
Degree of Organic Pollution	none apparent	fairly significant
% EPT	80.0%	39.0%
Family Richness	11	7
Margalef's Diversity Index	2.17	1.30

Appendix 4. Macroinvertebrates found in Bears Grass Creek, 2005

Spring		Fall	
Site 1 (Lincoln Dr.) 26 May 05		**Site 1 (Lincoln Dr.) 1 Oct 05**	
Baetidae	31	Athericidae	8
Chironomidae	29	Brachycentridae	35
Elmidae	3	Chironomidae	2
Ephemerellidae	28	Elmidae	1
Gammaridae	6	Ephemerellidae	1
Gerridae	1	Gammaridae	9
Phryganeidae	1	Heptageniidae	1
Tipulidae	1	Hydropsychidae	1
		Physidae	2
		Pteronarcyidae	4
		Tipulidae	36
Total	100	Total	100
Site 4 (Bears Grass Rd.) 31 May 05		**Site 4 (Bears Grass Rd.) 1 Oct 05**	
Baetidae	7	Baetidae	16
Chironomidae	1	Brachycentridae	1
Gammaridae	91	Gammaridae	81
Simuliidae	1	Limnephilidae	1
		Physidae	1
Total	100	Total	100

Appendix 5. Summary of macroinvertebrate analyses on sites 1 and 4, 2005

Spring 2005	**Site 1**	**Site 4**
Hilsenhoff FBI	4.16	5.93
Water Quality	Very Good	Fairly Poor
Degree of Organic Pollution	Possible Slight	Substantial
% EPT	60.0 %	7.0 %
Family Richness	8	4
Margalef's Diversity Index	1.52	.65
Fall 2005	**Site 1**	**Site 4**
Hilsenhoff FBI	2.61	5.78
Water Quality	Excellent	Fairly Poor
Degree of Organic Pollution	Any Unlikely	Substantial
% EPT	42.0%	18.0%
Family Richness	11	5
Margalef's Diversity Index	2.17	.87

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