RICE CREEK WATERSHED STREAM HEALTH EVALUATION PROGRAM (SHEP)

2008 BENTHIC MACROINVERTEBRATE STREAM MONITORING REPORT

March 2009

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Acknowledgements

The 2008 Rice Creek Watershed Stream Health Evaluation Program wishes to recognize the following individuals and organizations for their dedication to the success of this program.

Local Government:

The Rice Creek Watershed District
Anoka County Parks

Organizations:

Friends of the Mississippi River
Fortin Consulting
Minnesota Waters

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The Rice Creek Watershed Stream Health Evaluation Program wishes to thank the following partners, without whom this program would not be possible:

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2008 Rice Creek SHEP Volunteers:

The 2008 Rice Creek Watershed Stream Health Evaluation Program extends our most sincere appreciation to all of the SHEP volunteers who donated their time in the stream and in the lab last summer and fall. Each of these volunteers contributed between 30 and 50 hours of volunteer service in monitoring the health of our water resources. Thank You!

Team One: Gary Averbeck, Jim Bukowski, Dana Raines, Linda Gruntner, Barb Hoernemann, Wayne LeBlanc, Tere O'Connell, Don Vegoe, Sarah Sevcik.

Team Two: Gwen & Frank Neumann, Bob Bartlett, Barbara Bor, Ralph Butkowski, Glenn Fuchs, Susan Fuller, Julie Glanton, Debbie Hartman, Eileen Zierdt

Team Three: Cathi Lyman-Onkka, Wendy Barron, Christy Dolph, Katherine Majkrzak, Elan Majkrzak, Analiese Miller, Bill Radmer, Marilyn Radmer, Nancy Wilberts, Susan Young.

For more information on the Rice Creek Watershed Stream Health Evaluation Program or for a copy of this report, please contact Friends of the Mississippi River or visit www.fmr.org

Rice Creek Watershed Stream Health Evaluation Program
2008 Field Summary

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1.0 BACKGROUND

In an effort to obtain a more comprehensive understanding of the health of our water resources, the Minnesota Pollution Control Agency (MPCA) and other agencies have, over the last 15 years, developed new protocols and indices for the biological assessment of streams. Because aquatic organisms express a range of tolerances to environmental conditions, biological assessment can be a powerful quantitative tool in understanding the health of water resources. Biological monitoring provides a more complete picture of the ecological health of our waters.

By surveying aquatic organisms that grow, develop and reproduce, we can observe any changes occurring to our waters over time. The National River Watch Network states that five years of data should be collected in order to perform a biological characterization of a sample site.

In the early 1990's, Riverwatch, a National volunteer river monitoring program brought to Minnesota to engage schools in river monitoring. The program was started by the Mississippi Headwaters Board and taken over by Hennepin County, and eventually spread across the Twin Cities metropolitan area.

In 1997, a citizen wetland monitoring program was formed by local partners and Minnesota Pollution Control Agency (MPCA) to evaluate wetland health. Sampling methods and evaluation metrics were developed by MPCA scientists to measure the health of the local wetlands. This Wetland Health Evaluation Program (WHEP) is now an award winning and nationally recognized program that uses citizen volunteers to monitor the biological health of local wetlands. Multiple layers of quality control, volunteer training, and the use of rigorous protocols assure scientifically valid monitoring results. Volunteers enjoy the program, and often become more engaged in wetland and watershed issues and stewardship within their communities.

1.1 A New Model

The Stream Health Evaluation Program (SHEP) is a new model for volunteer stream monitoring modeled after WHEP and Riverwatch. The Stream Health Evaluation Program (SHEP) uses trained adult volunteers to evaluate the biological health of streams using advanced bioassessment protocols and indices specifically developed for this region. The program thoroughly monitors volunteer data collection and lab identification techniques to ensure compatibility with established protocols. Complete data cross-checks and programmatic evaluation ensure accurate and timely data that is quality certified.

The Stream Health Evaluation Program (SHEP) provides local communities and watershed organizations with a premier volunteer benthic macroinvertebrate monitoring program that produces reliable data and actively engages citizens in the work of the watershed.

SHEP, a new model for water quality assessment:

- Monitors the health of valuable water resources
- Uses research-based multiple index metrics
- Professionally trains adult volunteers
- Utilizes multiple levels of quality control to ensure quality results
- Provides relevant, reliable data to local decision makers
- Engages citizens in water resource management and assessment
- Promotes water resource health to community members
- Promotes partnership between local governments, state agencies and community residents.

1.2 Rice Creek SHEP

SHEP was first implemented in a pilot phase into the Rice Creek Watershed District in the summer and fall of 2006. In 2008 SHEP was led by Friends of the Mississippi River (FMR) and Minnesota Waters (Minnesota Waters) in partnership with the Rice Creek Watershed District (RCWD), Minnesota Pollution Control Agency (MPCA), and Fortin Consulting. Local program partners included the Anoka Conservation District, University of Minnesota Water Resource Center, City of Lino Lakes, Anoka County Parks, The Wargo Nature Center and local land owners.

Primary funding for this program was made possible by the Rice Creek Watershed District. Matching resources for the 2008 SHEP season were provided by Friends of the Mississippi River and Minnesota Waters.

The program recruited 30 adult volunteers organized in three teams to monitor a total of six sites in the fall of 2008. These sites were located in Hardwood Creek, Clearwater Creek, Rice Creek, and the inlet/outlet of Locke Lake. Some sites were chosen in part to gauge the effects of recent restoration and stewardship activity. For more information on site selection, see section 4.0.

The SHEP monitoring protocol was divided into two sections: a physical habitat assessment and a biological assessment of benthic macroinvertebrates. Volunteers participated in 1.5 days of training, covering the in-stream physical assessment and macroinvertebrate collection methods, and laboratory macroinvertebrate identification procedures. For more information on site selection, see section 2.0.

Each volunteer team collected physical assessment data and benthic macroinvertebrate samples at each site. In addition, each team also cross-checked one site sampled by another team. This was done to improve overall sampling quality and monitor standardized sampling methodology.

After macroinvertebrate collection was completed, volunteers participated in laboratory analysis sessions to identify samples. The samples were later cross-checked by macroinvertebrate identification professionals at Fortin Consulting, and results were reported to program partners, local governments and made available to the general public.

1.3 The Rice Creek Watershed

Watershed Districts are special purpose units of local government whose boundaries follow those of a natural watershed. The Rice Creek Watershed District was established in 1972 to conserve and restore the water resources of the District for the beneficial use of current and future generations. It is a governmental organization managed by a Board of Managers appointed by the county commissions of Anoka, Ramsey, and Washington Counties.

The Rice Creek watershed drains portions of Anoka, Hennepin, Ramsey, and Washington Counties. The watershed occupies portions of Arden Hills, Birchwood, Blaine, Centerville, Circle Pines, Columbia Heights, Columbus, Dellwood, Falcon Heights, Forest Lake, Fridley, Grant, Hugo, Lauderdale, Lexington, Lino Lakes, Mahtomedi, May Township, Mounds View, New Brighton, New Scandia Township, Roseville, St. Anthony, Shoreview, Spring Lake Park, White Bear Lake, White Bear Township and Willernie.

Rice Creek's principal tributaries are Hardwood Creek, which drains an area of 44 square miles in the cities of Hugo, Forest Lake, and Lino Lakes; and Clearwater Creek which drains a 62 square mile area of White Bear Lake, White Bear Township, Hugo, Lino Lakes, and Centerville. Both tributaries join Rice Creek in Anoka County as part of the Rice Creek Chain of Lakes.

The Rice Creek has its source at Clear Lake in the City of Forest Lake and flows generally southwestwardly through Anoka and Ramsey Counties, through the cities of Columbus, Lino Lakes, Circle Pines, Shoreview, Arden Hills, Mounds View, New Brighton and Fridley. It joins the Mississippi River at Manomin County Park in Fridley. The creek drops about 84 feet along its course, with most of the drop occurring in the 8 miles upstream of its mouth.

About 10 percent of the watershed's surface area is occupied by lakes, the largest of which are White Bear Lake and Bald Eagle Lake. About 13 percent of the watershed consists of wetland areas.

2.0 METHODS

2.1 Volunteer Recruitment

Volunteer recruitment efforts were led by staff from Friends of the Mississippi River in partnership with Rice Creek Watershed District Staff. Recruitment of volunteers was conducted through news releases, list-serves, flyers, city and county publications, presentations, tabling at events and through communication with interested volunteers in existing local programs.

A total of 30 SHEP volunteers were recruited for this program. Volunteers were divided into three teams. Each team was lead by a Team Leader. Team Leaders are an integral part of SHEP and were selected by project staff. Team Leaders received a small stipend and were responsible for managing monitoring activities and communication within his/her team.

An analysis of volunteer recruitment methods showed that volunteers entered the program through a variety of sources. Roughly 42% registered through direct contact with Friends of the Mississippi River. Notices in local print media produced 15% of volunteers, while the Master Naturalists Program (11 %) and Master Gardeners Program (8%) were additional sources of volunteer interests. Roughly 24% of volunteers discovered the program through other means including word of mouth. Of the 30 SHEP volunteers in 2008, 20 were returning volunteers who also participated in 2007.

2.2 Team Assignments

SHEP volunteers were assigned to one of three teams. Team leaders, team members and monitoring location assignments are listed below.

Team One:
Monitoring Locations: Hardwood Creek & Clearwater Creek
Site Names: Hardwood Creek, Clearwater Creek
Team Leader: Gary Averbeck
Team Members: Jim Bukowski, Dana Raines, Linda Gruntner, Barb Hoernemann, Wayne LeBlanc, Tere O'Connell, Don Vegoe, Sarah Sevcik.

Team Two:
Monitoring Location: Rice Creek
Site Names: Rice Creek 'Above', Rice Creek 'Below'
Team Leader: Gwen & Frank Neumann
Team Members: Bob Bartlett, Barbara Bor, Ralph Butkowski, Glenn Fuchs, Susan Fuller, Julie Glanton, Debbie Hartman, Eileen Zierdt

Team Three:
Monitoring Location: Locke Lake inlet & outlet
Site Names: Locke Lake 'Above', Locke Lake 'Below'
Team Leader: Cathi Lyman-Onkka

Team Members: Wendy Barron, Christy Dolph, Katherine Majkrzak, Elan Majkrzak, Analiese Miller, Bill Radmer, Marilyn Radmer, Nancy Wilberts, Susan Young.

2.3 Training

Advanced volunteer training is essential to the success of SHEP. Volunteers participated in 1.5 days of training in the MPCA's macroinvertebrate sampling protocols. This training covered in-stream habitat assessment and macroinvertebrate collection methods, along with laboratory procedures for identification of macro-invertebrates.

The first training session, held on August 23rd 2008 at the Wargo Nature Center in Lino Lakes, included an introduction to macroinvertebrate monitoring, habitat assessment protocols, stream flow measurement protocols and featured macroinvertebrate collection methods under the guidance of Minnesota Pollution Control Agency (MPCA) and Minnesota Waters staff. Program staff also introduced the Rice Creek watershed sampling sites, reviewed each SHEP team's sampling logistics, and distributed necessary sampling equipment.

To allow for maximum student participation, program staff organized the second training sessions on October 4th and October 15th at the Wargo Nature Center. SHEP volunteers were asked to participate in at least one of these two sessions, though volunteers were permitted to attend both if desired.

These sessions were led by MPCA and Minnesota Waters staff and were designed to focus on laboratory analysis portions of the Stream Health Evaluation Program. These training sessions included benthic macroinvertebrate stream sampling history, sample sorting and sample processing, as well as general lab skills and 'family level' macroinvertebrate identification techniques.

2.4 Site Selection

Stream monitoring sites were selected by RCWD staff. Several sites included in the 2008 SHEP season were upstream or downstream of recent watershed restoration activity. A detailed description of the monitoring is included in section 4.0 of this report.

2.5 Field Sampling

SHEP volunteer teams monitored six stream sites across the Rice Creek Watershed during the fall of 2008. MPCA and Minnesota Waters staff members performed site visits to assure monitoring was performed according to MPCA guidelines and protocols.

SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location throughout the watershed. The multi-habitat approach samples major habitats in proportional representation within each sampling reach. Benthic macroinvertebrates are collected systematically from all available in-stream habitats by jabbing with a D-frame dip net. At least 20 samples or 'jabs' were taken from across all major habitat types in the

reach. Habitat types included snags and woody debris, vegetated banks, cobble, and sand/fine sediment bottom areas.

2.6 Cross-Checks

In an effort to improve our data and ensure that each team is implementing field sampling protocols correctly, each SHEP team cross-checked one of another team's sites.

2008 Cross-Check Protocol

Team One:
Monitoring Locations: Hardwood Creek & Clearwater Creek
Cross-Check Location: Locke Lake 'Above'

Team Two:
Monitoring Location: Rice Creek Re-meander
Cross-Check Monitoring Location: Clearwater Creek

Team Three:
Monitoring Location: Locke Lake inlet & outlet
Cross-Check Monitoring Location: Rice Creek 'Below'

During cross-checks, SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location throughout the watershed. The multi-habitat approach samples major habitats in proportional representation within each sampling reach. Benthic macroinvertebrates are collected systematically from all available in-stream habitats by jabbing with a D-frame dip net. At least 20 samples or 'jabs' were taken from across all major habitat types in the reach. Habitat types included snags and woody debris, vegetated banks, cobble, and sand/fine sediment bottom areas.

This dual-purpose cross-check allowed SHEP to collect additional data from cross-checked sites, but more importantly helped program staff determine whether or not all teams were following similar protocols in the field. A description of cross-check data, and an interpretation of any variance between sampling scores and cross-checked scores at each site, is included in section 4.0 of this report.

2.7 Lab Identification

SHEP teams sorted and identified macroinvertebrate samples during multiple lab sessions throughout September, October and November 2008. Lab identification sessions were held in partnership with Anoka County Parks at the Wargo Nature Center in Lino Lakes, Minnesota.

Lab sessions identified the taxonomic classification of benthic macroinvertebrate samples from each sampling site. Using taxonomic keys, SHEP volunteers identified the Kingdom, Phylum, Class, Order and Family of macroinvertebrate organisms.

Once identified, samples were sorted and labeled prior to being submitted to project staff for quality assurance / quality control.

2.8 Quality Assurance/Quality Control (QA/QC)

Project staff from the MPCA and/or Minnesota Waters visited each team a minimum of one time during field sampling. These visits were conducted to ensure the teams were following the correct protocols in collecting and preserving macroinvertebrates and conducting habitat assessments.

A Quality Assurance/Quality Control (QA/QC) check was also performed on macroinvertebrate samples identified by SHEP volunteers. Fortin Consulting staff performed a QA/QC check on 33% of the macroinvertebrates identified by all three teams. The overall accuracy of volunteer identified benthic macroinvertebrates for the 2008 season was 96.5% correct.

2.9 Reporting of Results

FMR staff and volunteers are currently presenting a summary of the program results to local audiences upon request. SHEP 2008 spring presentations will include some or all of the following boards and commissions:

The City of Lino Lakes Environmental Commission
The City of Shoreview Environmental Quality Commission
The City of Fridley Environmental Quality & Energy Commission
The City of Forest Lake City Council
The City of Centerville Planning and Zoning Commission
The Rice Creek Watershed District Citizen Advisory Commission
The Metro Watershed Partners

The final written program report will be made available through project partner websites and will be made available for partners, volunteers, state & local agencies as well as interested citizens via online download at www.fmr.org.

3.0 MONITORING TERMS

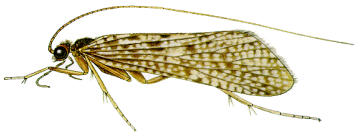
3.1 Monitoring Terms

The descriptions below will help readers understand the results presented on the following pages.

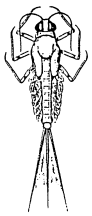
Benthic – of, relating to, or happening on stream, lake or ocean bottoms.

Complete Metamorphosis - occurs in the Diptera, Megaloptera, Coleoptera, Trichoptera and Lepidoptera. The life cycle includes the following stages: egg, larva, pupa and adult.

Trichoptera (caddisfly) larva



Trichoptera (caddisfly) Adult



Ephemeroptera (mayfly)

Larva*Ephemeroptera (mayfly) Adult*

Dominant Family -The family which comprises the largest single portion of the invertebrate sample.

Dominant Family % Overall - The dominant family's percentage of the total invertebrate sample. This metric indicates how dominant a single family is at a site. A high percent dominance is suboptimal. It indicates a less diverse community of macroinvertebrates.

EPT - The number of mayfly (**E**phemeroptera), stonefly (**P**lecoptera), and caddisfly (**T**richoptera) families in the sample. These families represent the pollution intolerant insects. A higher EPT score reflects better water quality than a lower one.

Family – In the taxonomic rank, family appears as follows: Phylum, Class, Order, Suborder, Family, Subfamily, Genus, and Species. An example of an order is "Mayflies or Ephemeroptera". An example of a family is Heptageniidae or Flat Head Mayfly. Family is the level of identification used in this protocol.

Family Biotic Index (FBI) – Each macroinvertebrate family is assigned a pollution tolerance number between 0 and 10 depending on its sensitivity to pollution. A score of

zero indicates very sensitive to organic pollution. A 10 indicates very tolerant of organic pollution. The FBI for a site is the weighted average of the biotic indexes for all of the invertebrates in the sample. The FBI summarizes the various pollution tolerance values of all families in a sample. Pollution intolerant families such as stoneflies (FBI of 0 – 2) can only survive in excellent water quality. Pollution tolerant organisms such as leeches and aquatic earthworms can live in clean water or poor quality water. They have high FBI values (8 – 10). According to Hilsenhoff, who developed this metric, "Use of the FBI is advantageous for evaluating the general status of organic pollution in streams within a watershed for the purpose of deciding which streams or watersheds should be studied further."

Historically, the lowest (best) FBI value reported by our monitoring was a 4.3 score during a cross check at the 'Above' Locke Lake site in 2006. The highest (poorest) historical FBI value reported was an 8.8 above the Rice Creek Re-meander in 2006.

Index of Biotic Integrity (IBI): "A synthesis of diverse biological information that numerically depicts associations between human influence and biological attributes. It is composed of several biological attributes or 'metrics' that are sensitive to changes in biological integrity caused by human activities."
Source: Volunteer Surface Water Monitoring Guide, MPCA, 2003

Incomplete Metamorphosis - occurs in the Ephemeroptera, Plecoptera, Odonata and Hemiptera. The life cycle includes the following stages: egg, early instar larva, late instar larva and adult. This program monitors the larval stages of development.

Macroinvertebrate – An invertebrate that can be seen with the naked eye.

Metric- A measure of stream health calculated using data from the macroinvertebrate monitoring. The family biotic index (FBI), EPT and number of families (family richness) are examples of metrics. Metrics are used to help analyze and interpret biological data. Metrics are often compared to charts that place the values into stream health categories.

Number of Families - The number of different benthic macroinvertebrate families found at the site, also known as family richness. In general, more diversity is better. Therefore a larger number of families may reflect a healthier community than a smaller number. The largest number of families (16) were discovered at the Hardwood Creek 'above' site, while the fewest number of families (8) were found at the Rice Creek 'below' sampling location.

Number of Organisms Identified- The protocol used requires a minimum of 100 organisms to confidently assess a site. When fewer than 100 organisms are collected, the information is still useful, but we cannot be as confident about characterizing the site's health.

Water Quality - refers to anything that might affect the invertebrates living in the river for part of their life cycle (such as nutrients, oxygen, sediment, organic pollution, toxins,

stream flow, and quality of habitat).

Source: Fortin Consulting, 215 Hamel Road, Hamel MN 55340

3.2 Hilsenhoff Family Level Biotic Index

The family level biotic index (FBI) for a site is the weighted average of the biotic indexes for all of the invertebrates in the sample. The FBI summarizes the various pollution tolerance values of all families in a sample. The FBI score for a particular monitoring site corresponds to a likely degree of organic pollution present at that location. As such, the FBI score is a useful tool for evaluating the general status of organic pollution in streams within a watershed.

Evaluation of water quality using Hilsenhoff's Family Level Biotic Index

Family Biotic Index	Stream Health	Degree of Organic Pollution
0.00-3.75	Excellent	Organic pollution unlikely
3.76-4.25	Very good	Possible slight organic pollution
4.26-5.00	Good	Some organic pollution probable
5.01-5.75	Fair	Fairly substantial pollution likely
5.76-6.50	Fairly poor	Substantial pollution likely
6.51-7.25	Poor	Very substantial pollution likely
7.26-10.0	Very poor	Severe organic pollution likely

Source: Hilsenhoff, 1988

4.0 2008 FIELD SAMPLING RESULTS

4.1 Hardwood Creek

4.1.1 Existing Conditions

Hardwood Creek drains an area of 24 square miles in the cities of Hugo, Forest Lake, and Lino Lakes. Its headwaters drain from Rice Lake through Hardwood Creek before emptying into Lake Peltier at the head of the Chain of Lakes, which is located in the cities of Lino Lakes and Centerville.

Hardwood Creek is listed by the Minnesota Pollution Control Agency as impaired for aquatic life, due to sedimentation, low dissolved oxygen and nutrient enrichment.

In the summer of 2006, as part of a grant from the Legislative Commission on Minnesota Resources (LCMR), three locations along Hardwood Creek that were identified as having severe bank erosion were stabilized and in-stream habitat improvement techniques were utilized.

4.1.2 Site Maps

Below is a map of the 2008 Hardwood sampling location. Due to land access considerations at the original 2006 Hardwood Creek site, a new sampling site was chosen on Hardwood Creek in 2007, and sampling was repeated again at the same location in 2008.

The pin on the site map corresponds to the midpoint of the sampled stream reach. Each stream reach sampled is referred to as the 'sampling site' for the purposes of this report.

2008 Hardwood Creek sampling location.

4.1.3 Sampling Methodology

Team Leader: Gary Averbeck

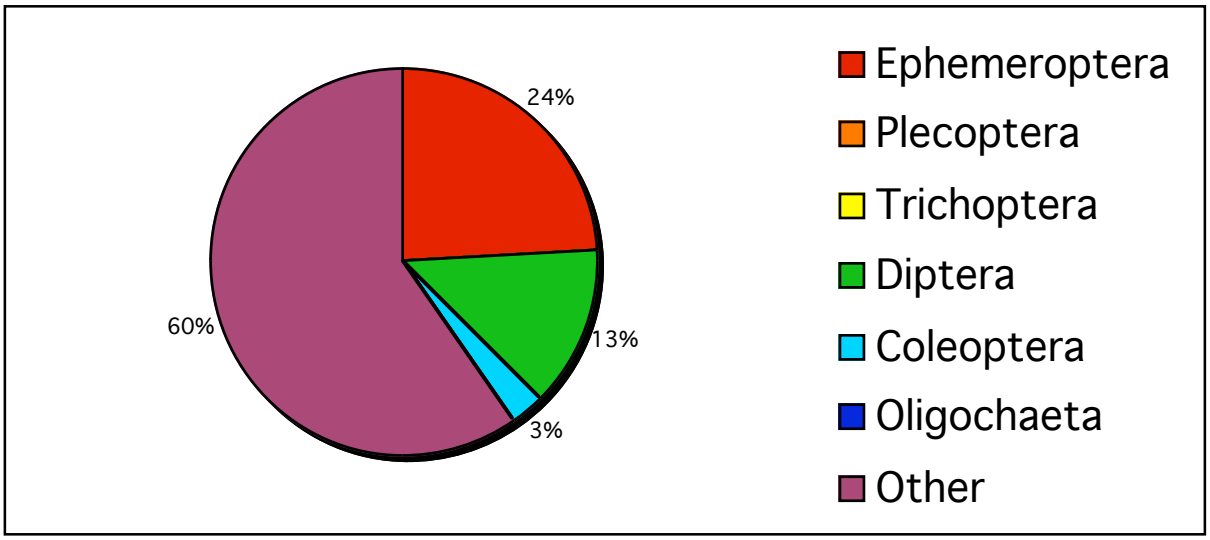
Team Members: Jim Bukowski, Dana Raines, Linda Gruntner, Barb Hoernemann, Wayne LeBlanc, Tere O'Connell, Don Vegoe, Sarah Sevcik.

SHEP volunteers used the MPCA's multi-habitat monitoring protocol at this monitoring location. At least 20 dip-net samples (or 'jabs') were taken from across all major habitat types in the reach. Program staff members performed site visits to assure monitoring was performed according to MPCA guidelines and protocols.

In the lab, analysis was done to identify macroinvertebrates from each sampling site. Using taxonomic keys, SHEP volunteers identified the Kingdom, Phylum, Class, Order and Family of macroinvertebrate organisms. Once identified, samples were sorted and labeled prior to being submitted to project staff for quality control review.

4.1.4 Field Sampling Results

Historical Field Results for Hardwood Creek Site						
Date	# Identified	Family Biotic Index	EPT	Number of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
09//08/07	162	**7.2**	4	24	Hyalellidae	41%
09/20/08	143	**6.3**	5	19	Decapoda	24%
Cross-Check Results:						
na						



Hardwood Creek – 2008 Primary Sampling Data

Our 2008 SHEP field sampling results produced a Family Biotic Index (FBI) score of 6.3 for the Hardwood Creek site. This score corresponds to a "Fairly Poor" rating on the Family Biotic Index stream health chart. This represents an improvement over a 2007 score of 7.2.

The dominant family in the aquatic community was Decapoda (crayfish). They live in a variety of habitats from small streams to large rivers. They will burrow in the substrate, or keep hold of rocks, logs, and snakes along streams. Decapoda's stream health tolerance value is 6, meaning that it can survive in water with moderate to substantial organic pollution.

Interpretation of the Hilsenhoff Biotic Index		
Sampling Sites	**2007**	**2008**
Hardwood Creek	7.2	6.3

4.2 Clearwater Creek

4.2.1 Existing Conditions

Clearwater Creek is 8.33 miles long and drains an area of 62 square miles of White Bear Lake, White Bear Township, Hugo, Lino Lakes, and Centerville. Both tributaries join Rice Creek in Anoka County as part of the Chain of Lakes.

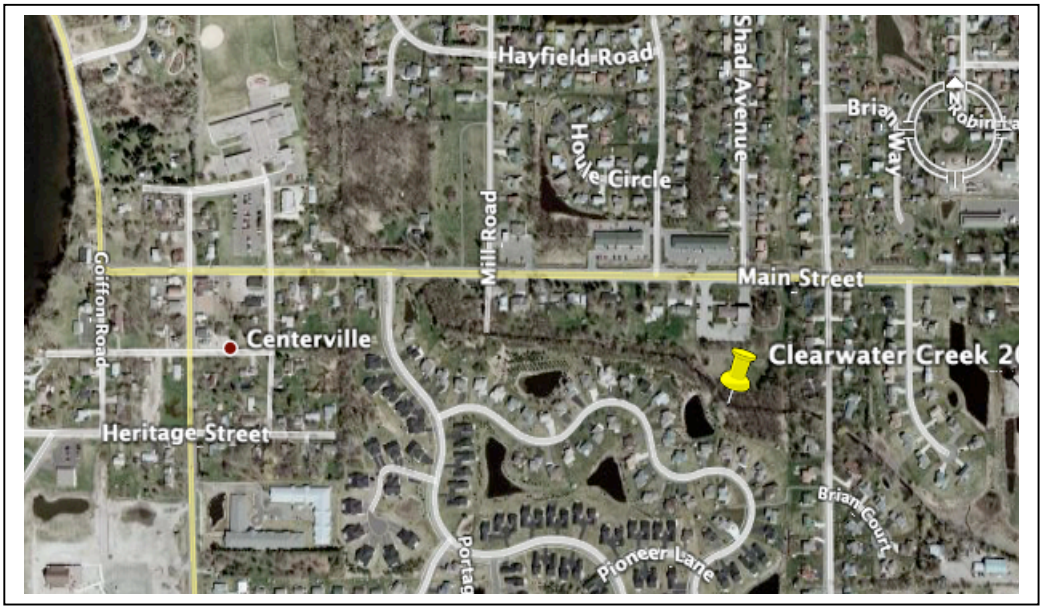
Clearwater Creek is listed as impaired for aquatic life, due to fecal coliform, low dissolved oxygen, and negatively impacted aquatic insect communities.

4.2.3 Site Maps

Below is a map of the Clearwater Creek sampling location. The Clearwater Creek site was sampled for the first time in 2007, and sampling was repeated again at the same location in 2008. This site also served as our 2008 volunteer field training site.

The pin on the site map corresponds to the midpoint of the sampled stream reach. Each stream reach sampled is referred to as the 'sampling site' for the purposes of this report.

2008 Clearwater Creek sampling location.



4.2.3 Sampling Methodology

Team Leader: Gary Averbeck
Team Members: Jim Bukowski, Dana Raines, Linda Gruntner, Barb Hoernemann, Wayne LeBlanc, Tere O'Connell, Don Vegoe, Sarah Sevcik.

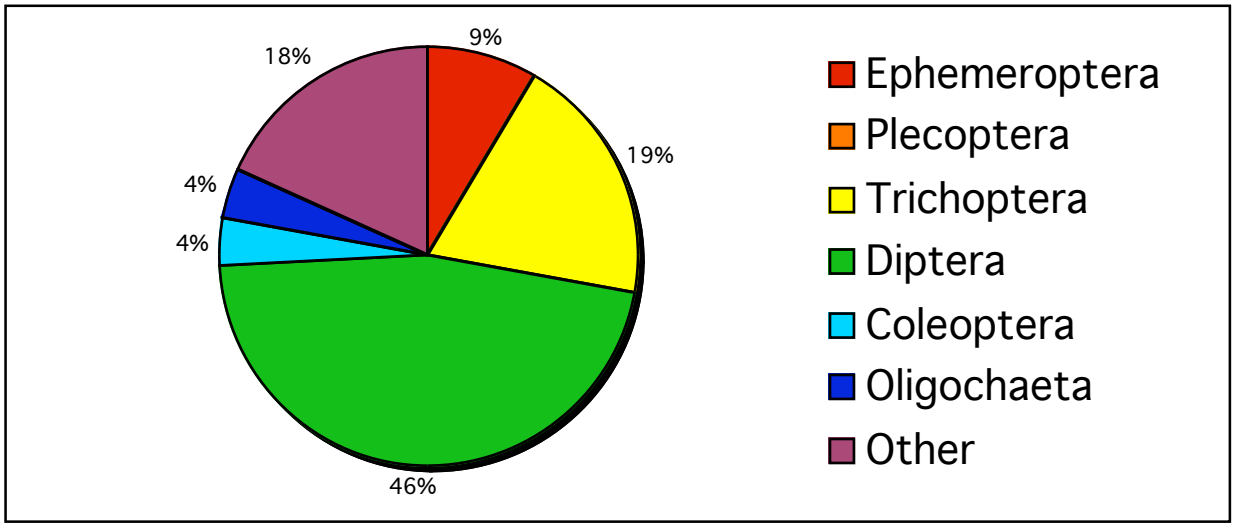
SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location. At least 20 dip-net samples (or 'jabs') were taken from across

all major habitat types in the reach. Program staff members performed site visits to assure monitoring was performed according to MPCA guidelines and protocols.

Lab analysis identified the taxonomic classification of benthic macroinvertebrate samples from each sampling site. Using taxonomic keys, SHEP volunteers identified the Kingdom, Phylum, Class, Order and Family of macroinvertebrate organisms. Once identified, samples were sorted and labeled prior to being submitted to project staff for quality control review.

4.2.4 Field Sampling Results

Historical Field Results for Clearwater Creek Site						
Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
9/8/07	84	**5.9**	4	19	Heptageniidae	19%
9/8/08	100	**5.5**	3	17	Chironomidae	41%
Cross Check Results:						
10/17/07	155	**5.9**	4	20	Hyalellidae	19.4%
9/7/08	109	**6.8**	5	15	Corixidae	22%



Clearwater Creek – 2008 Primary Sampling Data

Our 2008 sampling results gave Clearwater Creek a Family Biotic Index score of 5.5. This score corresponds to a stream health rating of Fair according to this metric. This represents an improvement in stream conditions from 2007.

The dominant family is Chironomidae, which is in the Order Diptera. Chironomidae, an important food source for insects, fish, and birds, are the most abundant and diverse group of aquatic insects. They are found in almost any water body.

The biotic indices scores calculated for Clearwater Creek seem to indicate a stream that is moderately stressed by incoming pollutants.

Interpretation of the Hilsenhoff Biotic Index		
Sampling Sites	**2007**	**2008**
Clearwater Creek	5.9	5.5
Cross Check	5.9	6.8

4.3 Rice Creek Re-Meander

4.3.1 Existing Conditions

The Rice Creek Watershed District and Emmons & Olivier Resources Inc., recently completed the restoration of a significant reach of Rice Creek. The project was entirely within Rice Creek North Regional Park and includes a stretch of Rice Creek located between County Road J, Lexington Avenue and County Road I.

The goal of the project was to restore the historical winding flow path and surrounding wetland hydrology for this reach of stream, which was originally straightened in the early 1900's. Many benefits of this project, such as habitat enhancement, water quality improvement and enriched recreation opportunities, have already begun to be realized. While these SHEP sampling sites are titled 'above' and 'below' for descriptive purposes, both sites are within the boundaries of the restoration. The monitoring sites were selected at the beginning and end of the restoration in part to gauge the long-term stream health changes that result from this restoration activity.

4.3.2 Site Map

Below is a map of the 2008 Rice Creek Re-Meander sampling locations. The pins correspond to the midpoint of the sampled stream reach. Each stream reach sampled is referred to as the 'sampling site' for the purposes of this report.

2008 Rice Creek Re-Meander Sampling Locations

4.3.3 Sampling Methodology

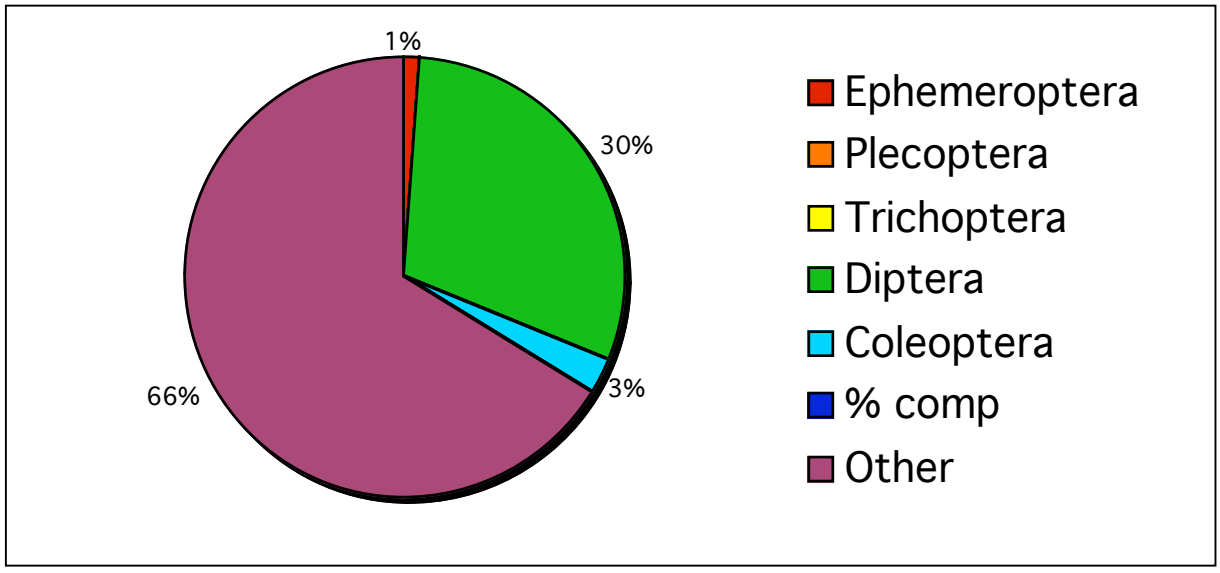
Team Leader: Gwen & Frank Neumann
Team Members: Bob Bartlett, Barbara Bor, Ralph Butkowski, Glenn Fuchs, Susan Fuller, Julie Glanton, Debbie Hartman, Eileen Zierdt

SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location. At least 20 jabs were taken from across all major habitat types in the reach. Program staff members performed site visits to assure monitoring was performed according to MPCA guidelines and protocols.

Lab analysis identified the taxonomic classification of benthic macroinvertebrate samples from each sampling site. Once identified, samples were sorted and labeled prior to being submitted to project staff for quality control review.

4.3.4 Field Sampling Results

Historical Field Results for Rice Creek 'Above' Site						
Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
9/1/06	180	**8.8**	2	11	Coenagrionidae	87%
11/13/07	137	**7.9**	0	5	Coenagrionidae	54.5%
9/6/2008	169	**7.3**	2	14	Hyaliellidae	38%
Cross Check Results:						
na						

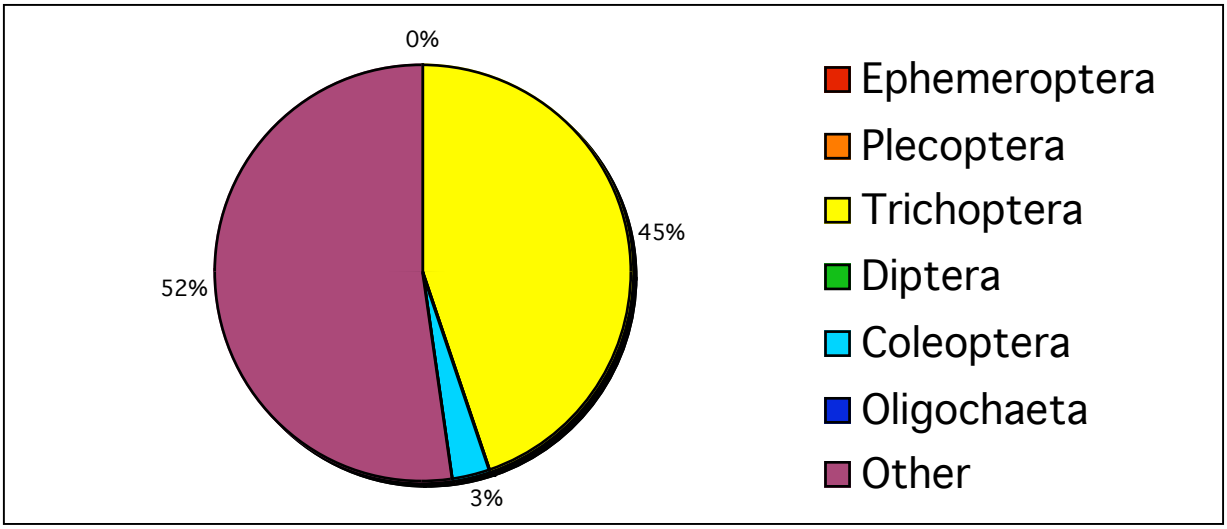


Rice Creek "Above" - 2008 Primary Sampling Data

Our 2008 sampling results show that the Rice Creek 'above' monitoring site received a 7.3 Family Biotic Index score, which indicates a water quality rating of "Very Poor".

The dominant family at the "Above" site was Hyaliellidae. Hyalellidae are a type of crustacean typically called Scuds. Scuds commonly occur in the shallow regions of streams, springs, and lakes. They are generally found in snags and bank vegetation and can be extremely abundant in water bodies without fish ad other predators. Scuds have a stream health tolerance value of 8 (high).

Historical Field Results for Rice Creek 'Below' Site						
Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
9/1/06	117	**8.3**	2	12	Coenagrionidae	65%
11/13/07	137	**7.9**	0	5	Coenagrionidae	54.5%
9/6/2008	178	**5.2**	2	7	Corixidae	34%
Cross Check Results:						
10/1/06	142	**6.1**	4	14	Simuliidae	48%
10/6/07	86	**6.8**	2	14	Chironomidae	62.7%
10/12/2008	248	**5.8**	4	13	Chironomidae	29%



Rice Creek "Below" - 2008 Primary Sampling Data

Our 2008 sampling results show that the Below Restoration site received a 5.2 that reflects a "Fair" stream health rating.

The dominant family at the "Below" sites was also Hyaliellidae. Hyalellidae are a type of crustacean typically called Scuds. Scuds commonly occur in the shallow regions of streams, springs, and lakes. They are generally found in snags and bank vegetation and can be extremely abundant in water bodies without fish ad other predators. Scuds have a stream health tolerance value of 8 (high).

Interpretation of the Hilsenhoff Biotic Index			
Sampling Site	**2006**	**2007**	**2008**
'Above' restoration	8.8	7.9	7.3
'Below' restoration	8.3	6.7	5.2
Cross Check (Below)	6.1	6.8	5.8

A comparison of the 2006, 2007 and 2008 Family Biotic Index for both Rice Creek sites seems to indicate an overall improvement in stream health.

The 'above' site is experiencing gradually improved stream health scores, indicating that the restoration activity is improving stream conditions, even at its most up-stream edges.

The 'below' sampling site Family Biotic Index has improved from a water quality rating of "Very Poor" to "Poor" and then to "Fair". The dramatic improvement in the 'below' site indicates that the remaindered stretch of Rice Creek is maturing to an increasingly healthy water resource.

4.4 Locke Lake

4.4.1 Existing Conditions

Locke Lake is located just upstream of the Rice Creek Watershed's outlet to the Mississippi River. All outflows from the Rice Creek Watershed passes through Locke Lake and flows directly into the Mississippi River. Recent activity by the Rice Creek Watershed District has focused on installing shoreland restoration and shoreland stabilization measures on properties adjacent to Locke Lake.

4.4.2 Site Map

Below is a map of the 2008 Locke Lake sampling locations. The pins correspond to the midpoint of the sampled stream reach. Each stream reach sampled is referred to as the 'sampling site' for the purposes of this report.

2008 Locke Lake Sampling Locations

4.4.3 Sampling Methodology

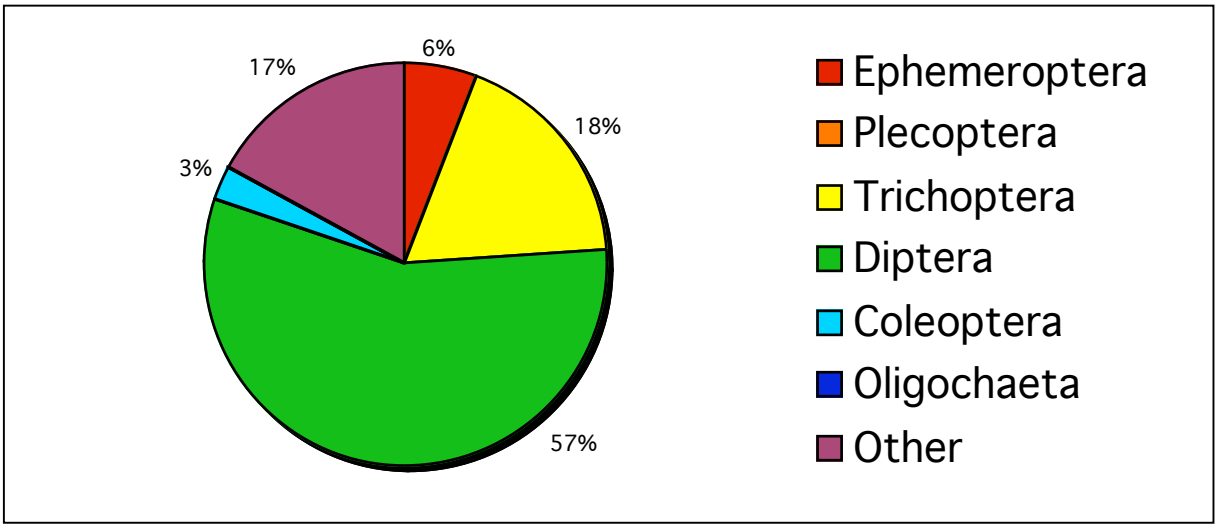
Team Leader: Cathi Lyman-Onkka
Team Members: Wendy Barron, Christy Dolph, Katherine Majkrzak, Elan Majkrzak, Analiese Miller, Bill Radmer, Marilyn Radmer, Nancy Wilberts, Susan Young.

SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location. At least 20 jabs were taken from across all major habitat types in the reach. Habitat types include snags and Program staff members performed site visits to assure monitoring was performed according to MPCA guidelines and protocols.

Lab analysis identified the taxonomic classification of benthic macroinvertebrate samples from each sampling site. Using taxonomic keys, SHEP volunteers identified the Kingdom, Phylum, Class, Order and Family of macroinvertebrate organisms. Once identified, samples were sorted and labeled prior to being submitted to project staff for quality control review.

4.4.4 Field Sampling Results

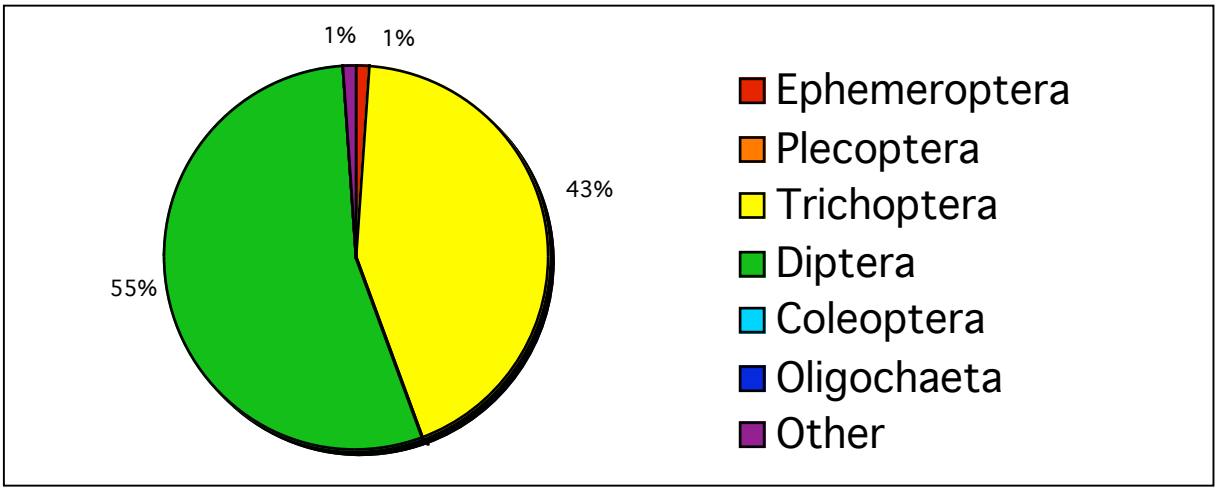
Historical Field Results for Locke Lake Creek 'Above' Site						
Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
9/28/06	95	**5.0**	2	12	Hydropsychidae	58%
9/9/07	103	**5.1**	3	13	Baetidae	26.2%
10/11//2008	163	**5.7**	4	14	Chironomidae	30%
Cross Check Results:						
9/20/2008	115	**4.9**	4	17	Hydropsychidae	33%



Locke Lake "Above" – 2008 Primary Sampling Data

The dominant family is Chironomidae, which is in the Order Diptera. Chironomidae, an important food source for insects, fish, and birds, are the most abundant and diverse group of aquatic insects. They are found in almost any water body and it is common for chironomids to comprise more than 50% of the species richness.

Historical Field Results for Locke Lake 'Below' Site						
Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
9/28/06	111	**5.3**	3	8	Chironomidae	43%
9/16/07	257	**5.7**	2	9	Chironomidae	36.6%
10/11/2008	315	**5.1**	5	13	Hydropsychidae	41%
Cross Check Results:						
10/8/06	137	**4.3**	3	10	Hydropsychidae	85%
9/22/07	87	**5.4**	2	9	Gammaridae	23%



Locke Lake "Below "- 2008 Primary Sampling Data

The Dominant Family at the "Below" site was Hydropsychidae, a common net-spinning caddisfly. These have a tolerance value of 4 (moderate) and are usually found in moderate to good water quality habitats with areas with cobble or bedrock in order to attach their nets for food collection. In some situations, such as below pond outflows and downstream of sewage treatment plants, they can reach large densities.

The Family Biotic Index (FBI) for 2008 shows that the Locke Lake 'Above' and Locke Lake 'Below' sites are very similar. The Family Biotic Index score of 5.7 above Locke Lake indicates a stream health score "Fair". The Family Biotic Index score of 5.1 above Locke Lake indicates a stream health score "Fair".

Interpretation of the Hilsenhoff Biotic Index			
Sampling Sites	**2006**	**2007**	**2008**
Above Locke Lake	5.0	5.1	5.7
Below Locke Lake	5.3	5.7	5.1
Cross Check ('Above')			4.9
Cross Check ('Below')	4.3	5.4	

A comparison between 2006, 2007 & 2008 Family Biotic Index scores indicates there has not been significant change from one sampling season to the next. Stream health ratings have remained in a narrow range between 4.9 and 5.7 consistently. These scores indicate that stream health conditions at these sites are superior to other stream reaches in the Rice Creek.

The cross check produced a similar score of 4.9 for the 'Above' site. This variation reflects natural stream monitoring variability and is within the statistical variability of this index.