RICE CREEK WATERSHED STREAM HEALTH EVALUATION PROGRAM (SHEP)

2007 BENTHIC MACROINVERTEBRATE STREAM MONITORING REPORT

January 2008

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A Collaborative Effort

The Stream Health Evaluation Program partners include The Minnesota Pollution Control Agency, Friends of the Mississippi River, Minnesota Waters, Rice Creek Watershed District, Anoka Conservation District, University of Minnesota Water Resource Center, City of Lino Lakes, Anoka County Parks, The Wargo Nature Center and local land owners.

Rice Creek Watershed Stream Health Evaluation Program
2007 Field Summary

Table of Contents

1.0 BACKGROUND……3

1.1 A New Model
1.2 Rice Creek SHEP
1.3 The Rice Creek Watershed

2.0 METHODS……6

2.1 Volunteer Recruitment
2.2 Team Assignment
2.3 Training
2.4 Site Selection
2.5 Field Sampling
2.6 Lab Identification
2.7 Quality Assurance / Quality Control
2.8 Reporting of Results

3.0 MONITORING TERMS……..…..9

3.1 Macroinvertebrate Monitoring Terms
3.2 Hilsenhoff Family Level Biotic Index

4.0 2007 SHEP FIELD RESULTS…….……...…...12

4.1 Hardwood Creek & Clearwater Creek Sites
4.2 Rice Creek Re-Meander Sites
4.3 Locke Lake Sites

5.0 SHEP VOLUNTEER EXPERIENCE EVALUATION……..22

5.1 Introduction
5.2 Evaluation Summary
5.3 Evaluation Conclusions

APPENDICES
Appendix A: Rice Creek Watershed District Map
Appendix B: 2007 SHEP Sample Data Sheets

1.0 BACKGROUND

Over the past 15 years, the Minnesota Pollution Control Agency (MPCA) has been developing 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, by surveying aquatic organisms that grow, develop and reproduce over time, provides for a more complete picture of the ecological health of our waters.

In 1997, in collaboration with local partners, Minnesota Pollution Control Agency (MPCA) scientists developed a citizen wetland monitoring program based upon these bioassessment techniques. 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 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 in the state of Minnesota. Modeled after WHEP, the Stream Health Evaluation Program (SHEP) uses trained 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. Now in its second year, SHEP is 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), 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 is made possible by the Rice Creek Watershed District. Matching resources for the 2007 SHEP season were provided by Friends of the Mississippi River and Minnesota Waters.

The program recruited 26 adult volunteers organized in three teams to monitor a total of six sites in the fall of 2007. 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.

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.

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 professionals, 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 26 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 26 SHEP volunteers in 2007, 18 were returning volunteers who also participated in 2006.

2.2 Team Assignment

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

Team One:
Monitoring Location: Hardwood Creek & Clearwater Creek
Team Leader: Gary Averbeck
Team Members: Jim Bukowski, Mike Zelenak, Tere O'Connell, Wayne LeBlanc, Catherine Nicholson, Wendy Barron, Barbara Bor

Team Two:
Monitoring Location: Rice Creek
Team Leader: Gwen & Frank Neumann
Team Members: Bob Bartlett, Don Vegoe, Glenn Fuchs, Julie Glanton, Ralph Butkowski, Sarah Sevcik, Amanda Baribeau

Team Three:
Monitoring Location: Locke Lake
Team Leader: Cathi Lyman-Onkka
Team Members: Ed Doberstein, Bill Radmer, Marilyn Radmer, Analiese Miller, Ted McCaslin, Cheryl Boyes, Tony Andrea, 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 25th 2007 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 10th and October 20th 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 2007 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 2007. 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 Lab Identification

SHEP teams sorted and identified macroinvertebrate samples during multiple lab sessions throughout September, October and November 2007. 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 control review.

2.7 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. Minnesota Waters 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 2007 season was 96.5% correct.

2.8 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. Additionally, Minnesota Waters will distribute final reports to RCWD staff and SHEP volunteers in February 2008.

3.0 MONITORING TERMS

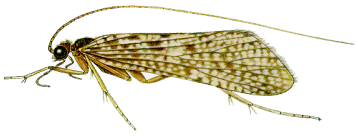
3.1 Monitoring Terms

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

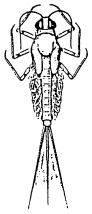
Benthic – of, relating to, or happening on stream, lake or ocean bottoms.

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." The lowest (best) FBI value reported by our monitoring was above Locke Lake (5.0). The highest (poorest) FBI value reported is 8.8 above the Rice Creek Remeander.

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.

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	Water Quality	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 2007 FIELD SAMPLING RESULTS

4.1 Hardwood and Clearwater 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 lies in the cities of Lino Lakes and Centerville.

Clearwater Creek is 8.33 miles long and drains an area of 62 square miles in 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.

Hardwood Creek is listed by the Minnesota Pollution Control Agency as impaired for aquatic life, due to sedimentation, low dissolved oxygen and nutrient enrichment. Studies indicate that approximately 30 percent or more of phosphorus load to Peltier Lake comes from Hardwood Creek. Clearwater Creek is listed as impaired for aquatic life, due to fecal coli form, low dissolved oxygen, and negatively impacted aquatic insect communities.

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. Currently, Total Maximum Daily Load (TMDL) studies are on-going in both Hardwood Creek and Lake Peltier.

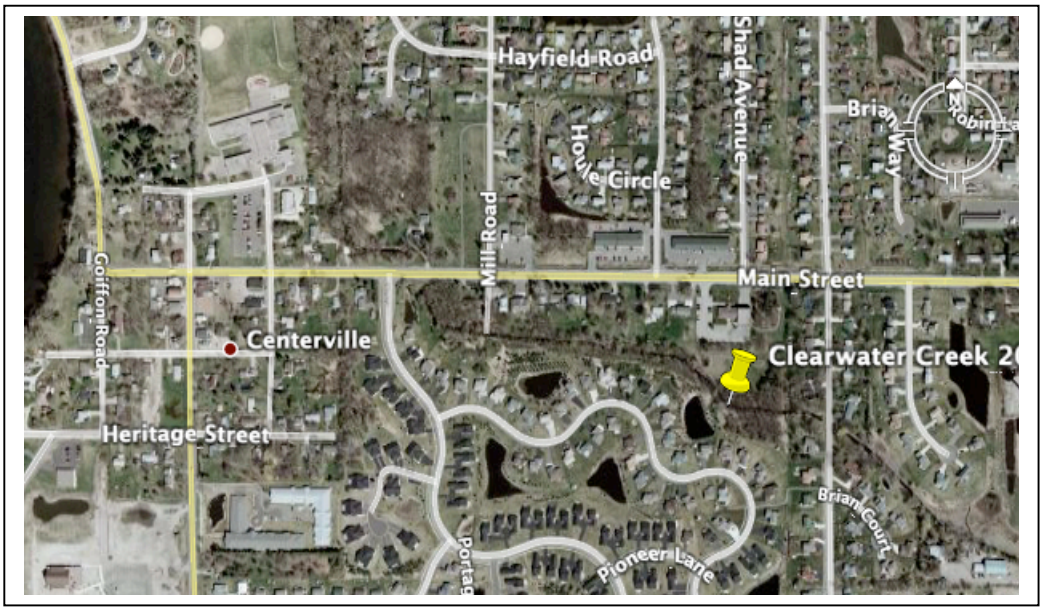
4.1.2 Site Maps

Below is a map of the 2007 Hardwood and Clearwater Creek sampling locations. Due to land access considerations at the 2006 SHEP sites on Hardwood Creek, a new sampling site was chosen on Hardwood Creek. In addition, a second new site was added on Clearwater Creek.

The pins on the site maps 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.

2007 Hardwood Creek sampling location.

2007 Clearwater Creek sampling location.



4.1.3 Sampling Methodology

Team Leader: Gary Averbeck
Team Members: Jim Bukowski, Mike Zelenak, Tere O'Connell, Wayne LeBlanc, Catherine Nicholson, Wendy Barron, Barbara Bor

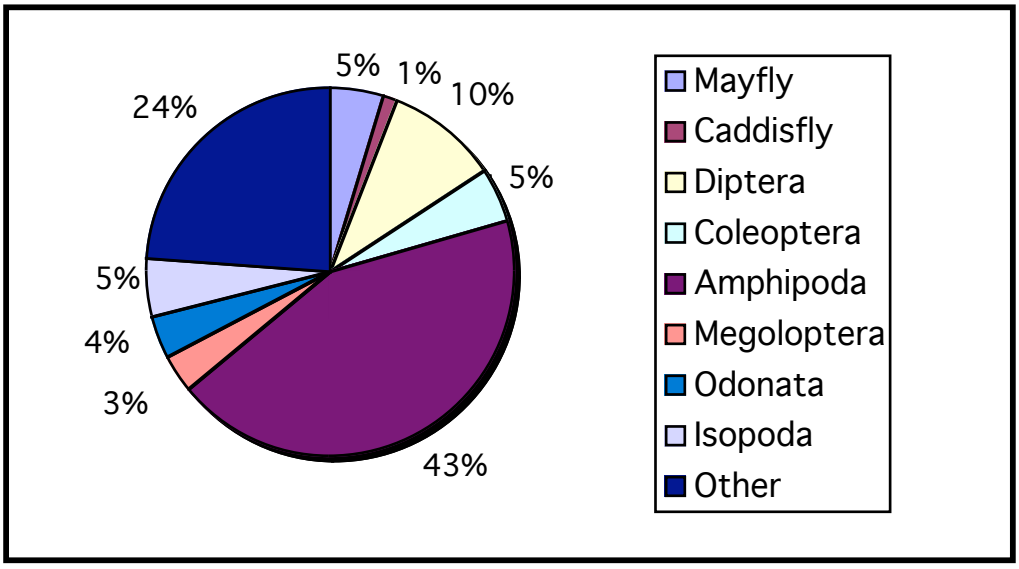
SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location. At least 20 dip-net samples (or 'jabs') were taken from across all major habitat types in the reach. MPCA and MN Waters staff members performed site visits to assure monitoring was performed according to MPCA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

4.1.4 Field Sampling Results

2007 Results for Hardwood Creek

Date	# Identified	Family Biotic Index	EPT	Number of Families	Dominant Family	Dominant Family % Overall
09/08/07	162	7.2	4	24	Hyalellidae	41%



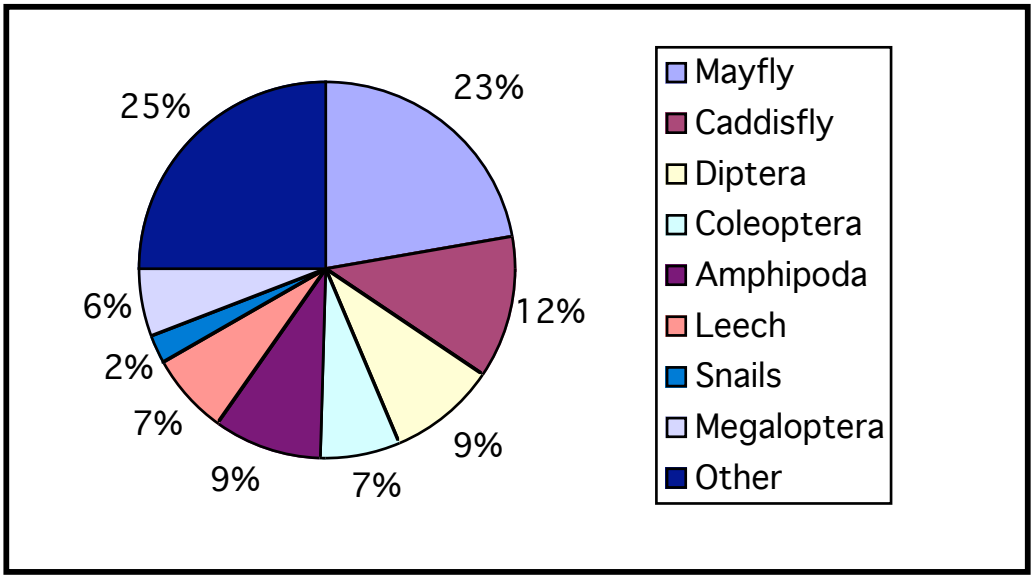
Hardwood Creek – 2007

This year's field sampling results produced a Family Biotic Index (FBI) score of 7.1 for the Hardwood Creek site. This score is rated as "Poor" on the Family Biotic Index water quality rating chart. The dominant family in the aquatic community was a type of

Amphipoda call Hyalellidae. Order Amphipoda can survive in degraded water conditions and this may indicate that aquatic habitat in Hardwood Creek is poor.

2007 Results for Clearwater Creek

Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
9/8/07	84	5.9	4	19	Heptageniidae	19%
QA/QC Check						
10/17/07	155	5.9	4	20	Hyalellidae	19.4%



Clearwater Creek - 2007

Clearwater Creek was given a Family Biotic Index score of 5.9. This score corresponds to a water quality rating of Fairly Poor according to this metric. The dominant family is Heptageniidae which is in the Order Ephemoptera, also known as mayflies. Mayflies are aquatic insects that have a moderate to sensitive tolerance to pollution.

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

The cross check produced a similar score of 5.9 for the Clearwater Creek site. The difference in dominant family may be a result in the different sampling dates at this site. Several major rain events occurred during the 2007 sampling season and this may be reflected in the cross check data.

4.2 Rice Creek Re-Meander

4.2.1 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 is 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 is to restore the historical winding flow path and surrounding wetland hydrology for this reach of stream, which was 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. The SHEP sites were selected 'above' and 'below' in part to gauge the long term stream health changes that result from this restoration activity.

4.2.2 Site Map

Below is a map of the 2007 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.

2007 Rice Creek Re-Meander Sampling Locations

4.2.3 Sampling Methodology

Team Leaders: Gwen & Frank Neumann

Team Members: Bob Bartlett, Don Vegoe, Glenn Fuchs, Julie Glanton, Ralph Butkowski, Sarah Sevcik, Amanda Baribeau

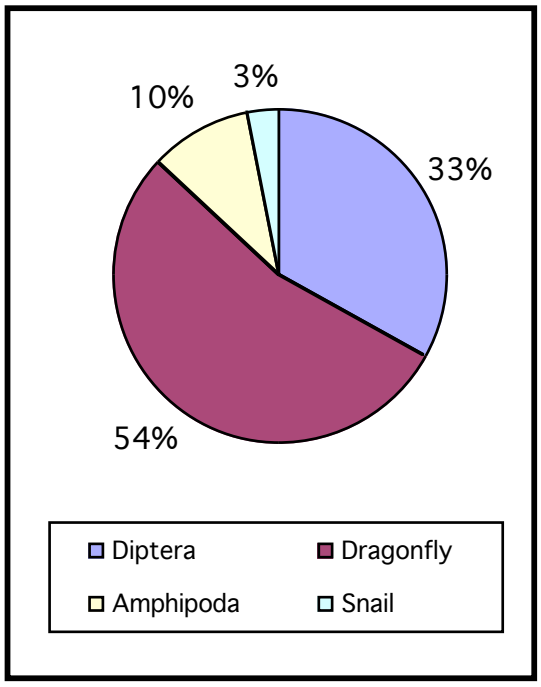
SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location. At least 20 jabs were taken from across all major habitat types in the reach. MPCA and MN Waters staff members performed site visits to assure monitoring was performed according to MPCA guidelines and protocols.

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.

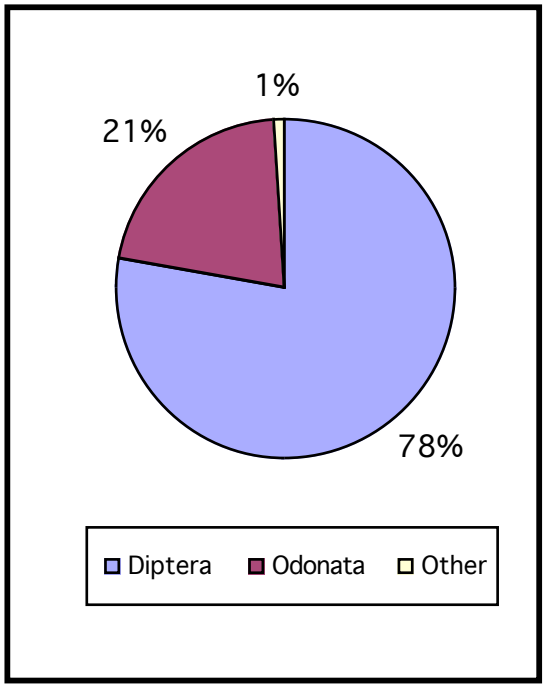
4.2.4 Field Sampling Results

2007 Results for Rice Creek

Date	# Identified	Family Biotic Index	EPT	Number of Families	Dominant Family	Dominant Family % Overall
Above Restoration						
11/13/2007	137	7.9	0	5	Coenagrionidae	54.5%
Below Restoration						
11/15/2007	169	6.7	1	8	Chironomidae	62.7%
QA/QC Check - below restoration						
10/6/2007	86	6.8	2	14	Coenagrionidae	29.0%



Rice Creek Above – 2007



Rice Creek Below - 2007

The above restoration sampling site of Rice Creek was rated a 7.9 on the Family Biotic Index which indicates a water quality rating of "Very Poor". The Below Restoration site rates a slightly better score of 6.7 that reflects a "Poor" water quality rating.

The dominant family in the Above Restoration site is a damselfly while the dominant family at the Below Restoration is a type of midge called Chironomid. Damselflies are usually found in streams that have moderately good water quality while midges can survive in a wide range of water quality conditions.

An interesting note: during this sampling season, the cross check for the Below Restoration indicated the same dominant family of damselfly as the Above Restoration site. The aquatic insect community data for the 2007 sampling season indicates that Rice Creek is still heavily impacted by environmental stressors.

Interpretation of the Hilsenhoff Biotic Index		
Sampling Site	**2006**	**2007**
Above restoration	8.8	7.9
Below restoration	8.3	6.7

A comparison of the 2006 and 2007 Family Biotic Index for Rice Creek seems to indicate an overall improvement in water quality. The Below Restoration Rice Creek sampling site Family Biotic Index has improved from a water quality rating of "Very Poor" to "Poor". It will be interesting to note if the water quality improvement trend continues in subsequent sampling seasons.

The cross check produced a similar score of 6.8 for the 'below restoration' site. This variation reflects natural stream monitoring variability and is within the statistical variability of this index.

4.3 Locke Lake

4.3.1 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.

4.3.2 Site Map

Below is a map of the 2007 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.

2007 Locke Lake Sampling Locations

4.3.3 Sampling Methodology

Team Leader: Cathi Lyman-Onkka

Team Members: Ed Doberstein, Bill Radmer, Marilyn Radmer, Analiese Miller, Ted McCaslin, Cheryl Boyes, Tony Andrea, Susan Young

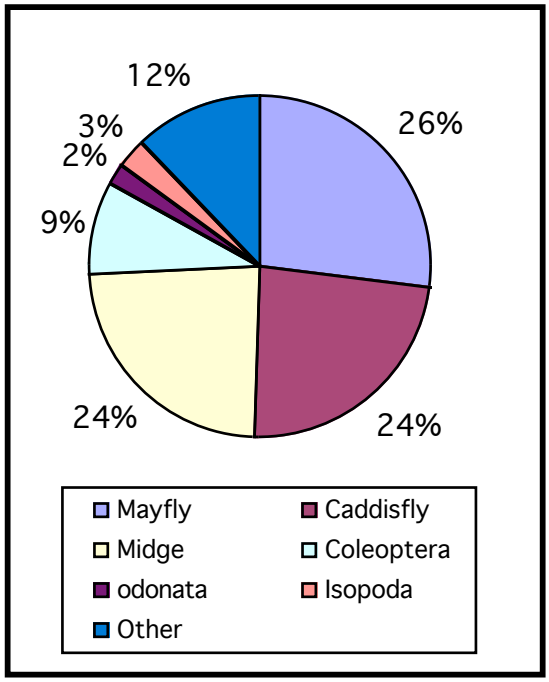
SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location. At least 20 jabs were taken from across all major habitat types in the reach. Habitat types include snags and woody debris, vegetated banks, cobble, and sand/fine sediment bottom areas. MPCA and MN Waters staff 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.

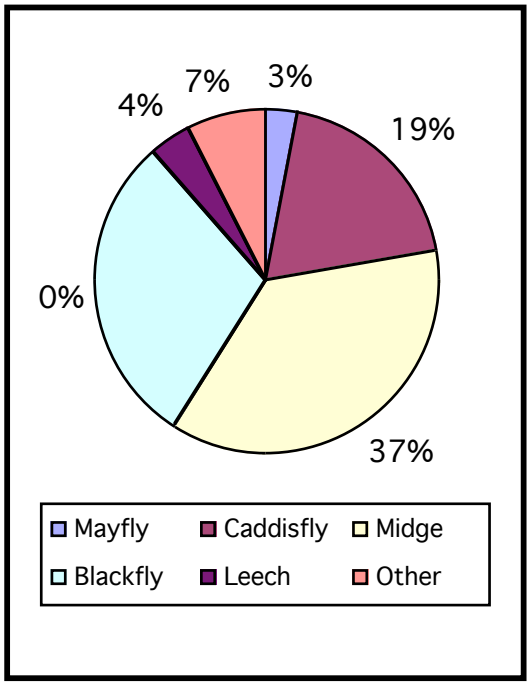
4.3.4 Field Sampling Results

2007 Results for Locke Lake Creek

Date	# Identified	Family Biotic Index	EPT	Number of Families	Dominant Family	Dominant Family % Overall
Above Locke Lake						
9/9/2007	103	5.1	3	13	Baetidae	26.2%
Below Locke Lake						
9/16/2007	257	5.7	2	9	Chironomidae	36.6%
QA/QC Check - below Locke Lake						
9/22/2007	87	5.4	2	9	Gammaridae	23.0%



Locke Lake Above – 2007



Locke Lake Below - 2007

The Family Biotic Index (FBI) for 2007 shows that the Locke Lake Above and Locke Lake Below restoration sites are very similar. The FBI of 5.1 and 5.7 indicate water quality rated as "Fair".

The Dominant Family changes from a mayfly family in the Above Restoration site to a midge family called Chironomidae. Mayflies are usually found in moderate to good water quality habitats while Chironomidae are found in a wide range of water quality conditions that range from poor to moderate.

Interpretation of the Hilsenhoff Biotic Index		
Sampling Sites	**2006**	**2007**
Above Locke Lake	5.0	5.1
Below Locke Lake	5.3	5.7
QA/QC check below restoration	4.3	5.4

A comparison between 2006 and 2007 Biotic Index scores indicates there has not been significant change from one sampling season to the next. Water quality ratings have remained in the "Fairly Poor" to "Fair" range.

The cross check produced a similar score for the 5.7 and 5.4 for the 'below restoration' site. This variation reflects natural stream monitoring variability and is within the statistical variability of this index.

5.0 SHEP WORKSHOP EVALUATIONS

5.1 Introduction

During the 2007 SHEP season, program partners Friends of the Mississippi River and Minnesota Waters conducted evaluations of the effectiveness of our field and laboratory training sessions in order to improve SHEP training protocols in future seasons.

The goals of the field and laboratory workshops were to promote a better understanding of stream macroinvertebrate sampling, processing, identification, and to certify citizens to monitor streams for assessment. Citizen monitors should be familiar with:

- Hands on experience in sampling for benthic macroinvertebrates
- Hands on experience in performing a habitat assessment
- Hands on experience in measuring stream flow
- Reasons for measuring benthic macroinvertebrates to assess stream water quality
- Macroinvertebrate monitoring sample processing
- Macroinvertebrate identification to Family level

As mentioned in Section 2.3 of this report, 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 macroinvertebrate identification procedures.

The first training session, held on August 25th 2007 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 10th and October 20th 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.

Both qualitative and quantitative written questions were used to assess all aspects of the program's effectiveness in reaching its goals. Twenty-five (25) participants representing three SHEP sampling teams attended the August 25th, 2007 workshop. Twenty-two (88%) of the evaluations were returned. Twenty-one (21) participants representing three SHEP sampling teams attended the October 10th and October 20th workshops. Sixteen (76%) of the evaluations were returned.

A pre and post workshop evaluation was used to assess each workshop's effectiveness. Each evaluation included 3 to 4 quantitative questions in which the attendees were asked to rank their knowledge, skill and confidence in specific topic areas covered in the workshop before and after the training sessions were completed.

Participants were also asked to rank other measures of the training sessions, including:

- Quality of the meeting environment (room, set-up and food)
- The usefulness of the presentations
- The quality of the field demonstrations
- The quality of the laboratory demonstrations
- How well the components and requirements of SHEP were explained
- The effectiveness of facilitators
- How well the training sessions met their expectations

In the qualitative portion of the evaluation, SHEP volunteers were asked to discuss the following:

- The knowledge/skills areas they needed the most help with
- Their opinion on the length of the training sessions
- The least and most useful portions of the training sessions
- How adequately prepared they were to conduct monitoring and laboratory macroinvertebrate identification
- How to improve the training sessions
- What type of additional training, if any, they would like

5.2 SHEP Evaluation Summary

5.2.1 Quantitative Pre and Post Evaluation Comparison

A Student T-test was run on each paired pre and post training question to determine if there was any significant increase in knowledge, skill or confidence in specific key topic areas. A probability (p) level of $p \leq 0.05$ was used.

Any question pair in which the calculated T-test value was less than 0.05 was considered statistically significant. This correlates to a 95% chance of identifying an increase in knowledge, skill or confidence when there is one and a 5% chance of identifying an increase in knowledge, skill or confidence when one does not actually exist.

There was a significant increase in learning during the workshop in all skills and confidence subject areas. For a complete list of questions and the corresponding statistics, refer to tables below.

5.2.2 **TABLE 1.**

Statistical evaluation of pre and post questions in specific topic areas presented at the August 25th, 2007 SHEP training session held at Wargo Nature Center in Lino Lakes, Minnesota.

QUESTION	***PRE MEAN**	***POST MEAN**	**T-TEST**	**P≤0.05 ** **
Rank your skills and confidence with basic macroinvertebrate monitoring knowledge/Why monitor bugs	3.41	4.23	0.00	**SIG**
Rank your skills and confidence with macroinvertebrate field sampling methods	3.05	4.27	0.00	**SIG**
Rank your skills and confidence with habitat assessment methods	3.05	4.27	0.00	**SIG**

* 1 = lowest ranking 5 = highest ranking

** SIG = Significant NS = Not Significant

5.2.3 **TABLE 2.**

Statistical evaluation of pre and post questions in specific topic areas presented at the October 10th, 2007 SHEP training session held at Wargo Nature Center in Lino Lakes, Minnesota.

QUESTION	***PRE MEAN**	***POST MEAN**	**T-TEST**	**P≤0.05 ** **
Rank your skills and confidence in processing macroinvertebrate samples	2.57	4	0.00	**SIG**
Rank your skills and confidence in macroinvertebrate sample identification	2.67	4.33	0.00	**SIG**
Rank your skills and confidence in using the taxonomy key	3	4.57	0.00	**SIG**
Rank your skills and confidence in understanding data analysis and interpretation	3.17	4.17	0.04	**SIG**

* 1 = lowest ranking 5 = highest ranking

** SIG = Significant NS = Not Significant

5.2.4 **TABLE 3.**

Statistical evaluation of pre and post questions in specific topic areas presented at the October 20th, 2007 SHEP training session held at Wargo Nature Center in Lino Lakes, Minnesota.

QUESTION	*PRE MEAN	*POST MEAN	T-TEST	P≤0.05 **
Rank your skills and confidence in processing macroinvertebrate samples	2.13	3.75	0.00	**SIG**
Rank your skills and confidence in macroinvertebrate sample identification	2.63	3.63	0.00	**SIG**
Rank your skills and confidence in using the taxonomy key	2.88	3.88	0.00	**SIG**
Rank your skills and confidence in understanding data analysis and interpretation	3	4	0.00	**SIG**

* 1 = lowest ranking 5 = highest ranking

** SIG = Significant NS = Not Significant

5.2.5 Additional Quantitative Rankings

Our August 25th 2007 SHEP training workshop evaluation also included quantitative rankings of six core workshop components:

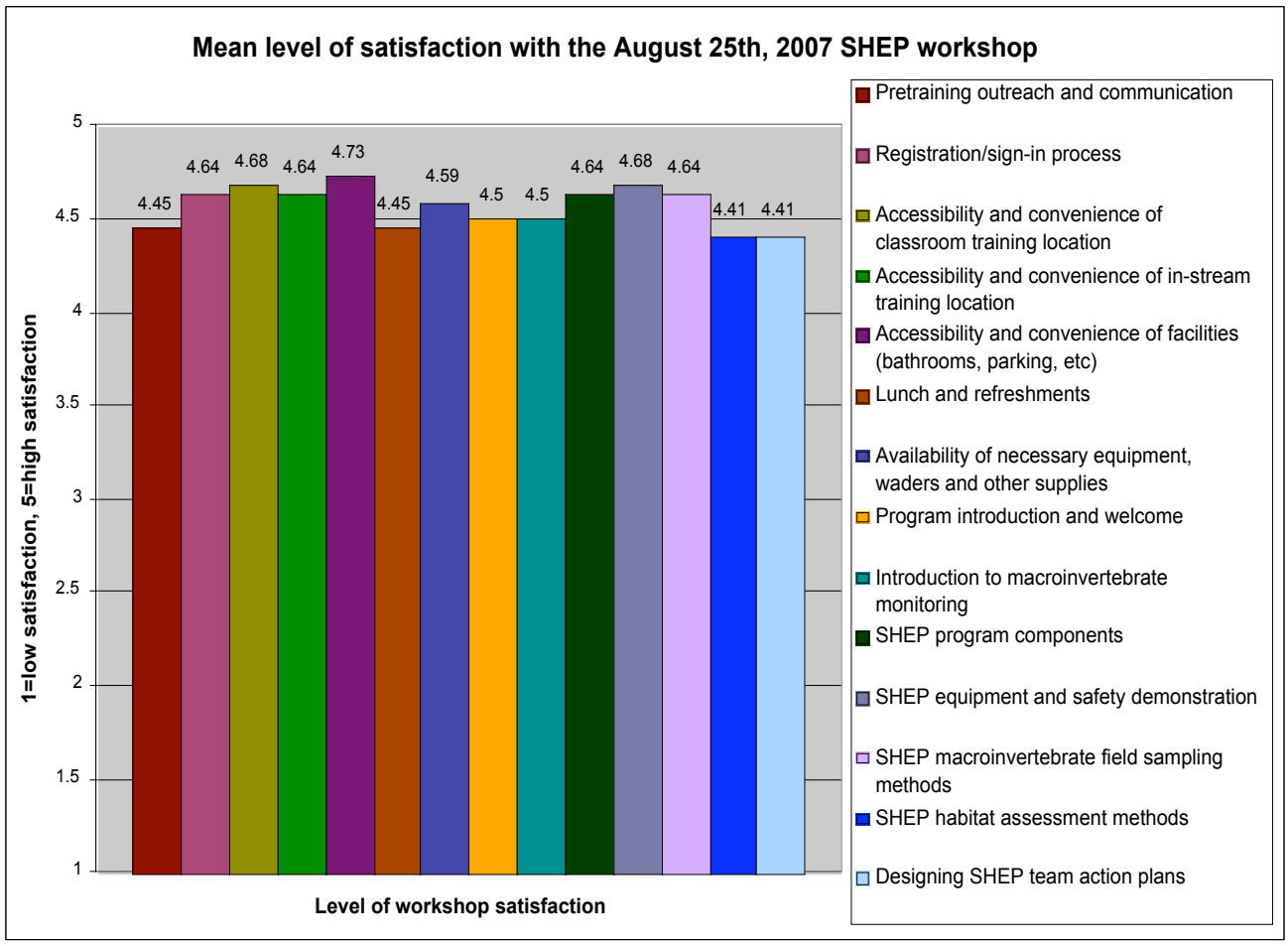
- The quality of the meeting environment
- The usefulness of the macroinvertebrate presentation
- The usefulness of the field training stations
- How well the program components were explained
- The Effectiveness of the facilitators
- Satisfaction with designing SHEP team action plans.

Our October 10th and October 20th 2007 SHEP training workshop evaluations also included quantitative rankings of six core workshop components:

- The quality of the meeting environment
- Stream sampling experience review
- Introduction to processing samples
- Introduction to the taxonomic key
- Benthic macroinvertebrate identification training
- Data analysis and interpretation

Participants were also asked to comment on each of the questions. The mean rankings are represented in the following charts.

5.2.6 **CHART 1.**
Quantitative evaluation rankings of the SHEP training workshop held at the Wargo Nature Center on August 25, 2007.

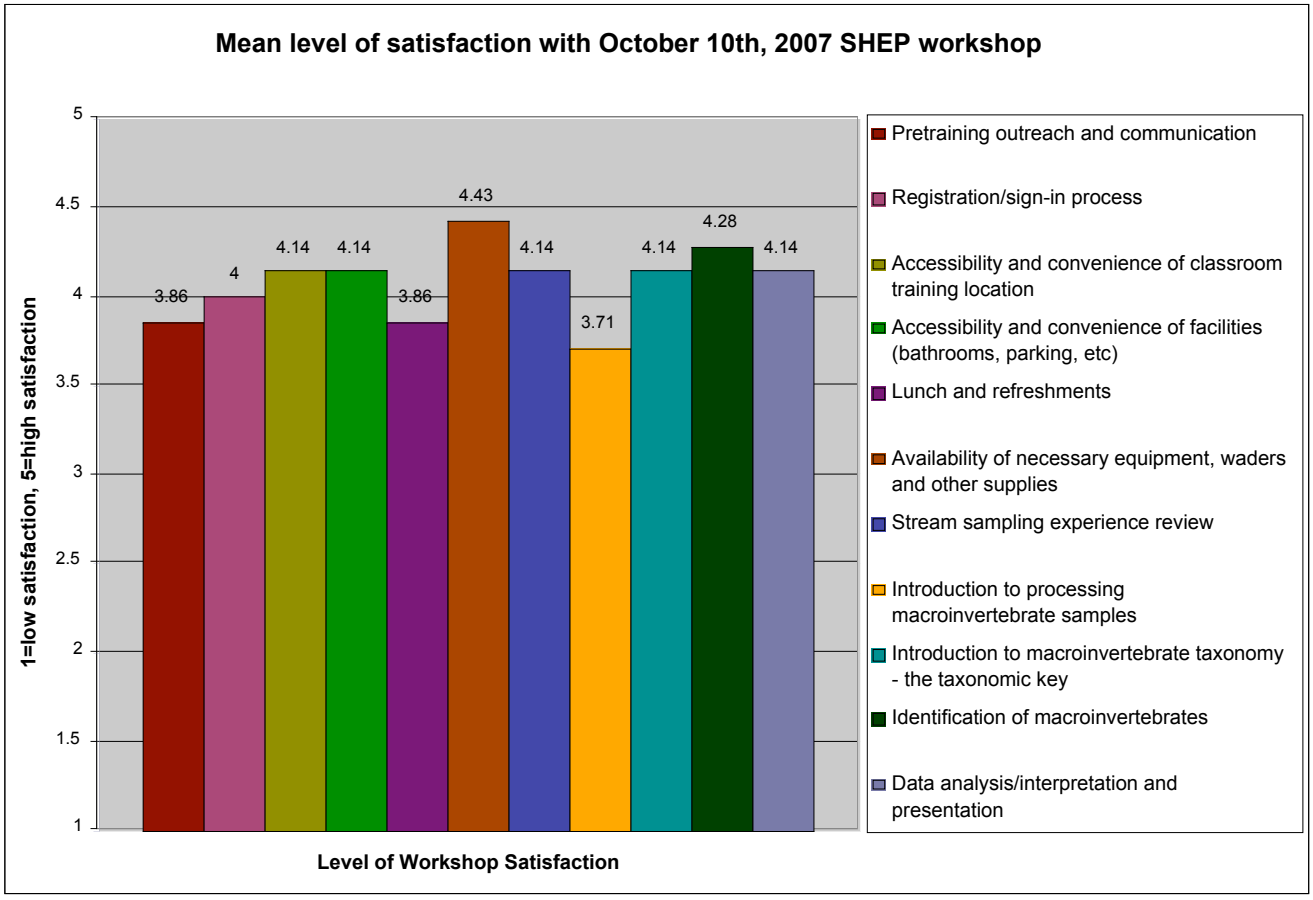


* 1 = lowest ranking 5 = highest ranking

Overall, the participants in the August 25th 2007 SHEP training workshop expressed a very high level of satisfaction in all six areas of the program.

5.2.7 **CHART 2.**

Quantitative evaluation rankings of the SHEP laboratory training held at the Wargo Nature Center on October 10th, 2007.

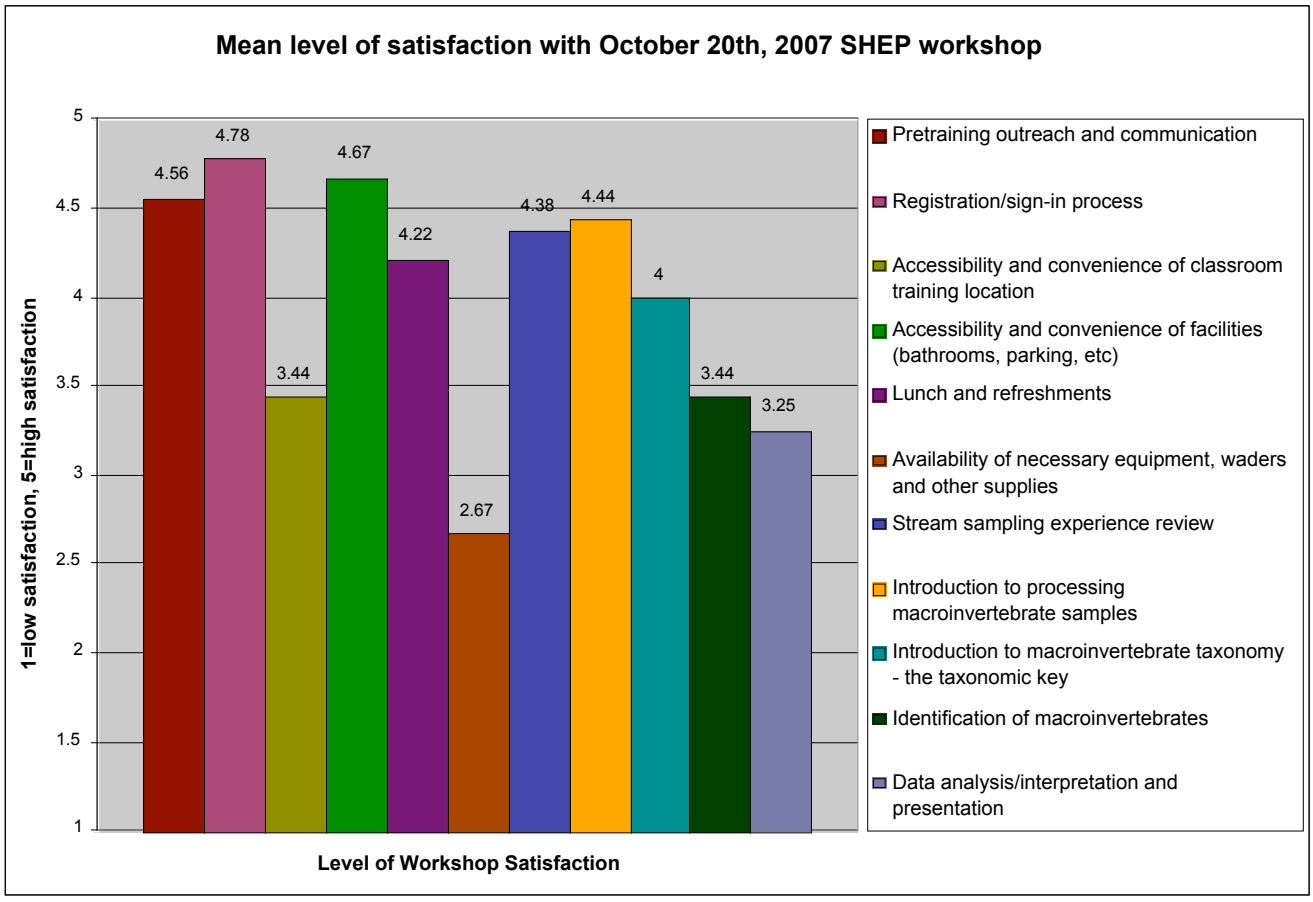


* 1 = lowest ranking 5 = highest ranking

Overall, the participants in the October 10th 2007 SHEP training workshop expressed a high level of satisfaction in all six areas of the program.

5.2.8 **CHART 3.**

Quantitative evaluation rankings of the SHEP laboratory training held at the Wargo Nature Center on October 20th, 2007.



* 1 = lowest ranking 5 = highest ranking

Overall the participants in the October 20th SHEP training workshop expressed a high level of satisfaction with some areas of the program, and less satisfaction with other program areas.

5.2.9 **Volunteer Experience**

As an additional part of the SHEP training evaluation, volunteers were given the opportunity to respond to open-ended qualitative evaluation questions for the field training workshop and laboratory training workshops. Overall, participants seemed pleased with their experiences.

SHEP Field Training Workshop Evaluations
The following is a summary of the qualitative evaluation responses for the August 25th 2007 SHEP field training workshop:

All of the participants indicated that the length of the workshop was the right length. A couple of comments indicated that participants were more satisfied with this year's training. The majority of the participants found the hands-on experience with sampling techniques was the most valuable part of the training workshop. The opportunity to meet their team members was also very important to the participants. Some participants felt that it would be helpful to cover Habitat Assessment questions together before departing to the stream training. A few comments were made that volunteers should have available dates in mind before they arrive at the training workshop. It was also suggested that a few more instructors for the field training would be valuable.

The majority of participants indicated that they were comfortable performing the SHEP protocols. Additionally, participants expressed interest in attending WHEP and aquatic plants identification trainings. They were also interested in attending trainings that cover other monitoring opportunities. Two suggestions included: distributing the SHEP monitoring manual in advance of the workshop and improving the habitat assessment portion of the training.

SHEP Laboratory Training Workshops Evaluations
The following is a summary of the qualitative evaluation responses for the SHEP laboratory training workshops:

All of the participants indicated that the length of the workshop was the right length.
Participants thought the hands-on training, practice using the taxonomic key, and practice with experts were the most valuable parts of the workshop. Some participants indicated less technical language was needed for non-science trained volunteers. Other participants were hoping to process samples at this lab training workshop. Some participants thought the October 20th workshop – where unforeseen scheduling conflicts impacted trainer and equipment availability – could have been improved.

Most participants said they felt confident in their macroinvertebrate identification, though some participants said they would need time and experience to feel comfortable and confident in their ability to identify macroinvertebrates.

5.3 Evaluation Conclusions

5.3.1 Positive aspects of existing program

Most comments regarding the SHEP workshops were very positive. There was statistically significant learning in all goal areas, and participants seemed satisfied with the information presented.

Additionally, interaction and questioning between presenters and attendees was positive. There were many returning volunteers who participated in last year's workshop, and participants seemed to find this year's workshop experience an improvement.

Finally, each team demonstrated outstanding accuracy in macroinvertebrate identification with an average of 96.5% accuracy for the 2007 SHEP season. This level of accuracy suggests that the field and laboratory trainings achieved the primary goal of ensuring SHEP volunteers were able to achieve accurate sampling results during the 2007 SHEP season.

5.3.2 Areas identified for improvement

Volunteers commented on possible improvements to the Stream Health Evaluation Program training sessions, which touched on a number of program components. These areas of improvement are detailed below:

- Habitat Assessment: Volunteers expressed a desire to review habitat assessment protocols as a whole, rather than in their teams. The SHEP habitat assessment portion of the field training session should be amended to incorporate a full-group habitat assessment training in future seasons. Additional training staff may also be of value in the habitat assessment portion of the field training session.

- Scheduling: Some volunteers did not have their personal calendars with them at the August 25th field training session. Program staff must emphasize that SHEP volunteers should bring their personal calendars or lists of available dates and times with them to the initial SHEP training session.

- SHEP Manual: Some volunteers expressed an interest in receiving the SHEP manual before the initial field training session. FMR and/or Minnesota Waters staff will consider distributing an electronic version of the SHEP manual for the volunteers to review prior to the SHEP season.

- Field Training Access: The field training site, Clearwater Creek, was difficult for some older volunteers to access. Future SHEP field training sessions may consider an alternative stream sampling site.

- Trainer Availability: Due to a family emergency, an unexpected staff absence introduced some challenges during one of the SHEP laboratory sessions. Alternate trainers and laboratory training supplies should be on call for future lab training sessions in the event of unexpected absences.

- Sample Processing Training: Some SHEP volunteers suggested that a training session on sample processing protocol should be included in the SHEP training sessions. SHEP staff will consider adding a sample processing training in future SHEP seasons.

5.3.4 Staff recommendations for improvement

SHEP program staff from Friends of the Mississippi River, Minnesota Waters and the Minnesota Pollution Control Agency conducted a training debrief and review session following our 2007 training sessions. Staff expressed strong satisfaction with the organization and execution of the SHEP training sessions as a whole. Areas identified by staff for future improvement include:

- Time Management: SHEP staff felt there was enough time to during the August 25th field training to demonstrate the sampling protocols, but concluded that an additional 10-15 more minutes could be added to end of the day to give SHEP teams adequate time to set their field sampling and laboratory dates.

- SHEP Manual: Future manuals would be improved for current practices. Minor modifications could alleviate confusion for volunteers.

- Laboratory Staff Support: SHEP staff concluded that having professionals work with the teams during the ID sessions is very beneficial to the accuracy of the identifications and the efficiency of the QA/QC. This practice should be continued in future seasons.

- Vial Management: Following lab identification sessions, SHEP volunteers place identified macroinvertebrates in labeled vials for storage and use in the QA/QC portion of the program. Trainers suggest that the vial labels be expanded to include the team names as well as the site name, number of individuals per vial, and name of invertebrate family. In addition, it is suggested that each team have a vial-holder for easier transportation.

- Laboratory and Field Data Sheet Management: Not all SHEP teams promptly turned in field and lab data sheets to program staff. Program staff should reinforce proper data sheet management protocols with SHEP team leaders during future seasons.

- Macroinvertebrate Identification: SHEP volunteer teams were not consistent in choosing whether or not to count pupae, empty shells and macroinvertebrate exoskeletons as a part of their lab identification sessions. The program should also provide the teams with instructions on the inclusion or exclusion of these identifications during future seasons.

The Minnesota Legislature, through the MPCA, has provided State funds for this Program through the Clean Water Legacy Act for Surface Water Assessment Grants.