RICE CREEK WATERSHED STREAM HEALTH EVALUATION PROGRAM (SHEP)

2012 BENTHIC MACROINVERTEBRATE STREAM MONITORING REPORT

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Trevor A. Russell

Friends of the Mississippi River
360 Robert Street North Suite 400
Saint Paul, Minnesota 55101
www.fmr.org

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Team One: Gary Averbeck*, Amy Anderson, Linda Gruntner, Barb Hoernemann, Wayne LeBlanc, Tere O'Connell, Jason Papenfuss, Dana Raines, Rob Turner, Don Vegoe.

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Team Three: Katherine Majkrzak*, Trisha Flaherty, May Hangartner, Ryan Hangartner, Jaime Haueter, Alex Haueter, Cathi Lyman-Onkka, Marilyn Radmer, Susan Young.

** SHEP Team Leader.*

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
2012 Field Monitoring Report

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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 2012 SHEP was led by Friends of the Mississippi River (FMR) 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, City of Centerville, Anoka County Parks, The Wargo Nature Center, and local landowners.

Primary funding for this program was made possible by the Rice Creek Watershed District. Matching resources for the 2012 SHEP season were provided by Friends of the Mississippi River.

The program recruited 30 adult volunteers organized in three teams to monitor a total of nine sites in the fall of 2012. 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.

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 Above, Hardwook Creek Below, Clearwater Creek
Team Leader: Gary Averbeck
Team Members: Amy Anderson, Linda Gruntner, Barb Hoernemann, Wayne LeBlanc, Tere O'Connell, Jason Papenfuss, Dana Raines, Rob Turner, Don Vegoe

Team Two:
Monitoring Location: Rice Creek Area
Site Names: Rice Creek Above, Rice Creek Below, Rice Creek Irondale.
Team Leader: Ralph Butkowski
Team Members: Bob Bartlett, Jim Dorsey, Gary Ellis, Matt Hannah, Mari Ito, James Brozowski, Rod Venterea, Eileen Zierdt

Team Three:
Monitoring Location: Locke Lake Area
Site Names: Locke Lake Above, Locke Lake Below, Rice Creek Park
Team Leader: Katherine Majkrzak
Team Members: Trisha Flaherty, May Hangartner, Ryan Hangartner, Jaime Haueter, Alex Haueter, Cathi Lyman-Onkka, Marilyn Radmer, 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 Saturday, August 25th 2012 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 Fortin Consulting staff. FMR 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 volunteer participation, program staff organized the second training sessions on Wednesday, September 26th and Saturday, September 29th 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 FMR and Fortin Consulting 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 2012 SHEP season were upstream or downstream of recent watershed restoration activity. A detailed description of monitoring sites is included in section 4.0 of this report. SHEP sites include:

- Hardwood Creek 'Above'
- Hardwood Creek 'Below'
- Clearwater Creek
- Rice Creek 'Above'
- Rice Creek 'Below'
- Rice Creek 'Irondale' – *new site in 2012*
- Locke Lake 'Park' – *new site in 2012*
- Locke Lake 'Above'
- Locke Lake 'Below'

2.5 Field Sampling

SHEP volunteer teams monitored nine stream sites across the Rice Creek Watershed during the fall of 2012. This represents an increase in three sites from the previous six sites monitored from 2006 through 2012. FMR and Fortin Consulting 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.

Project staff from the FMR or Fortin Consulting made in-field team visits whenever possible. These visits are conducted to ensure the teams were following the correct protocols in collecting and preserving macroinvertebrates and conducting habitat assessments.

2.6 Lab Identification

SHEP teams sorted and identified macroinvertebrate samples during multiple lab sessions throughout September and October 2012. 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.

2.7 Quality Assurance/Quality Control (QA/QC)

A Quality Assurance/Quality Control (QA/QC) check was 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 samples selected for QA/QC were as follows:

Team One:
Sample: Hardwood Creek 'Above' sample
Accuracy Score: 99%

Team Two:
Sample: Rice Creek 'Below' sample
Accuracy Score: 96.2%

Team Three:
Sample: Rice Creek 'Park' sample
Accuracy Score: 87.5%

The overall combined QA/QC accuracy score for the 2012 Rice Creek Watershed Stream Health Evaluation Program was: 91.5%.

3.0 MONITORING TERMS

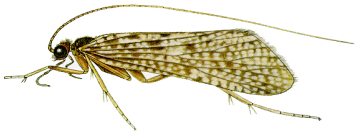
3.1 Monitoring Terms

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

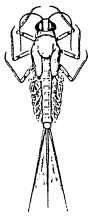
Benthic – of, relating to, or happening on stream, lake or ocean bottoms.

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 4.4 score at Hardwood Creek 'Below' in 2011. The highest (poorest) historical FBI value reported was an 8.8 at the Rice Creek 'Above' site 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 (20) was discovered at the Hardwood Creek 'Below' site, while the fewest number of families (10) were found at the Rice Creek 'Above' 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 identified, the information is still useful, but we cannot be as confident about characterizing the site's health. Teams in this circumstance will select another sub-sample of a site sample and identify all organisms in the second sub-sample in addition to the original sub sample. Scores are tallied based on the combination of both sub-sample results, often resulting in larger numbers of individual macroinvertebrates identifies.

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).

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 2012 FIELD SAMPLING RESULTS

4.1 Hardwood Creek Sites

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.

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.

Hardwood Creek is listed as impaired for biota (fish) on the lower portion of the creek (downstream of Highway 61), and low dissolved oxygen (DO) for the full length of the creek. The natural background level of DO is used as the water quality endpoint above Highway 61 due to naturally low oxygen levels occurring in that wetland-dominated part of the watershed.

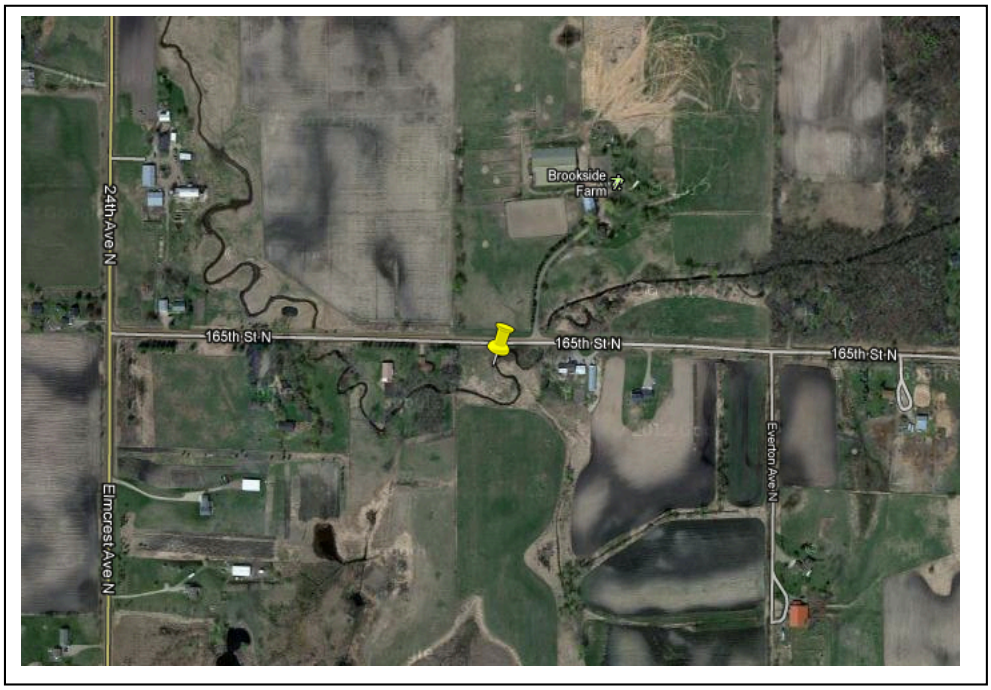
A Total Maximum Daily Load (TMDL) study began in 2004 and addresses the impairments on Hardwood Creek. The TMDL is a collaborative effort between the MPCA and Rice Creek Watershed District. The TMDL was approved by the Minnesota Pollution Control Agency (MPCA) in 2009.

4.1.2 Site Maps

Below *(page 14)* are maps of each of the 2012 Hardwood sampling locations. The pins on each site map 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.

The Hardwood Creek 'Above' site was first included in the SHEP sampling protocol in 2007. The 'Below' site was added to the SHEP monitoring protocol for the 2010 season.

2012 Hardwood Creek 'Above' sampling location.



2012 Hardwood Creek 'Below' sampling location.

4.1.3 Sampling Methodology

Team Leader: Gary Averbeck

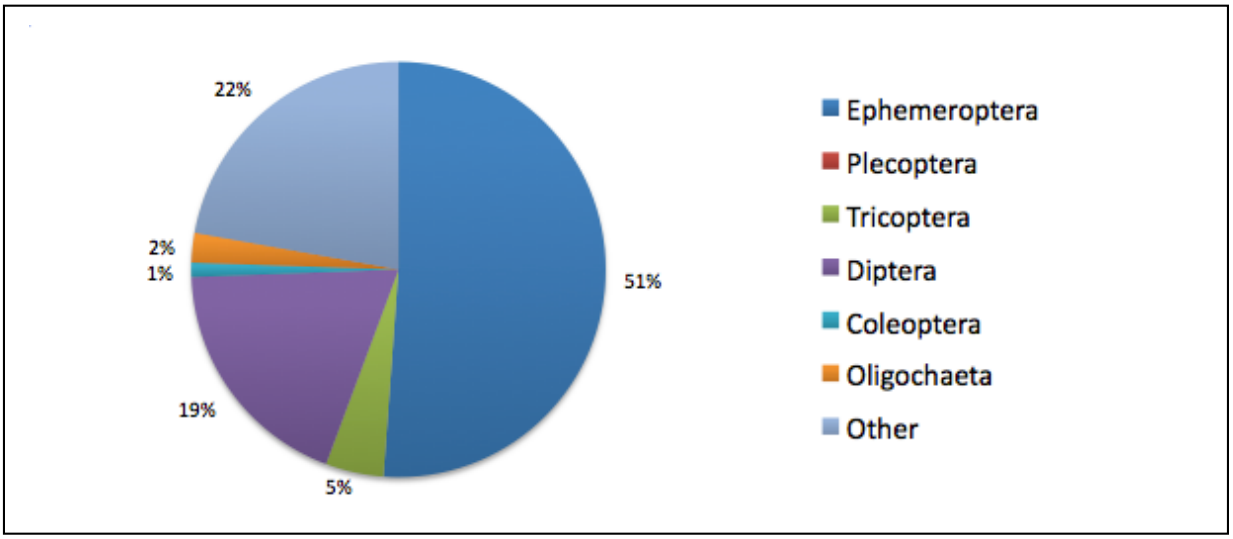
Team Members: Amy Anderson, Linda Gruntner, Barb Hoernemann, Wayne LeBlanc, Tere O'Connell, Jason Papenfuss, Dana Raines, Rob Turner, Don Vegoe.

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, labeled and scored.

4.1.4a Field Sampling Results for Hardwood Creek "Above" Site

Historical Field Results for Hardwood Creek 'Above' 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%
9/12/09	193	**6.6**	4	18	Chironomidae	38%
9/11/10	121	**6.0**	3	18	Hyalellidae	30%
8/20/11	115	**5.0**	3	13	Gammaridae	43%
10/2/12	177	**5.0**	5	18	Heptageniidae	39.5%
Cross-Check Results: N/A						



Hardwood Creek 'Above' Data Summary

Family Biotic Index (FBI): Our 2012 SHEP field sampling results produced a score of 5.0 for the Hardwood Creek 'Above' site. This score corresponds to a "Good" rating on the Family Biotic Index stream health chart. This is consistent with 2011 results (5.0), and represents a continued improvement in stream health from 2007 (7.2) to 2012 (5.0). In 2012, a larger, more diverse sample was identified. However, with more families with high tolerance values, the FBI score remained stable.

Number of individuals: A large sample offers more confidence for a more reliable data set. SHEP protocol requires a minimum of 100 individual invertebrates to be picked and identified per sample. 177 invertebrates were identified in this sample. This sample size is adequate.

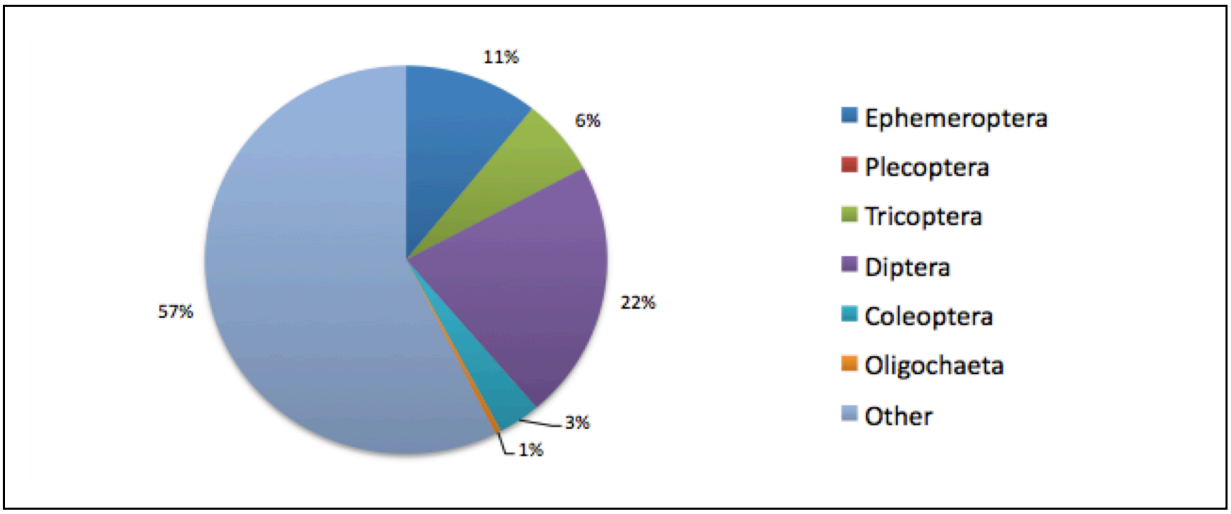
Dominant Family: The dominant family was Heptageniidae (mayfly). Heptageniidae dominated 39.5% of the sample, and has a tolerance value of 4 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). These flathead mayflies have flattened head, body, and legs. This makes them well adapted to quick water currents by allowing water to flow over their body with less friction. They live on the surface of rocks, logs, vegetation, and leaves; and they feed on algae and microorganisms growing on rocks. (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: In 2012, 18 families were identified in the sample. This compares to 13 families in 2011 and 18 families in 2010. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. More than 10-12 families is considered good. In 2012, 5 EPT families were identified in the sample and made up 55% of the sample.

4.1.4b Field Sampling Results for Hardwood Creek "Below" Site

Historical Field Results for Hardwood Creek 'Below' Site						
Date	# Identified	Family Biotic Index	EPT	Number of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
9/20/10	136	**5.1**	3	16	Gammaridae	38%
8/20/11	154	**4.4**	3	11	Gammaridae	60.4%
10/2/12	210	**4.6**	4	20	Gammaridae	51.4%



Hardwood Creek 'Below' Data Summary

Family Biotic Index (FBI): Our 2012 SHEP field sampling results produced a score of 4.6 for the Hardwood Creek 'Below' site. This score corresponds to a "Good" rating on the Family Biotic Index stream health chart. This is consistent with stream health scores

from 2010 (5.1) and 2011 (4.4). In 2012, a larger and more diverse sample was identified, but more families with high tolerance values were present, so the FBI average remained stable.

Number of individuals: A large sample offers more confidence for a more reliable data set. SHEP protocol requires a minimum of 100 individual invertebrates to be picked and identified per sample. 210 invertebrates were identified in this sample. This sample size is good.

Dominant Family: The dominant family was Gammaridae (scuds). Gammaridae dominated 51.4% of the sample, and has a tolerance value of 4 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are closely related to Hyalellidae (note the pollution tolerance difference). The distinction between the two families is the flagellum found on the antennae of Gammaridae. They are important food sources for fish and invertebrate predators. They can be extremely abundant in water bodies without fish and are important in the breakdown of organic matter. (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: In 2012, 20 families were identified in the sample. This compares to 11 families in 2011 and 16 families in 2010. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. More than 10-12 families is considered good. In 2012, 4 EPT families were identified in the sample and made up 17% of the sample.

4.1.5 Hardwood Creek Overall Data Summary

Interpretation of the Hilsenhoff Biotic Index						
Sampling Sites	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Hardwood Creek 'Above'	**7.2**	**6.3**	**6.6**	**6.0**	**5.0**	**5.0**
Hardwood Creek 'Below'	Na	Na	Na	**5.1**	**4.4**	**4.6**

Hardwood Creek continues to show improvement, and initial findings indicate that an abundance of habitat and modest organic pollution levels contribute to good overall stream health in this portion of the watershed.

The Family Biotic Index score of 5.3 at the Hardwood Creek 'Above' site, and the Family Biotic Index score of 4.6 at the Hardwood Creek 'Below' site, indicate a stream health score of "Good".

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.

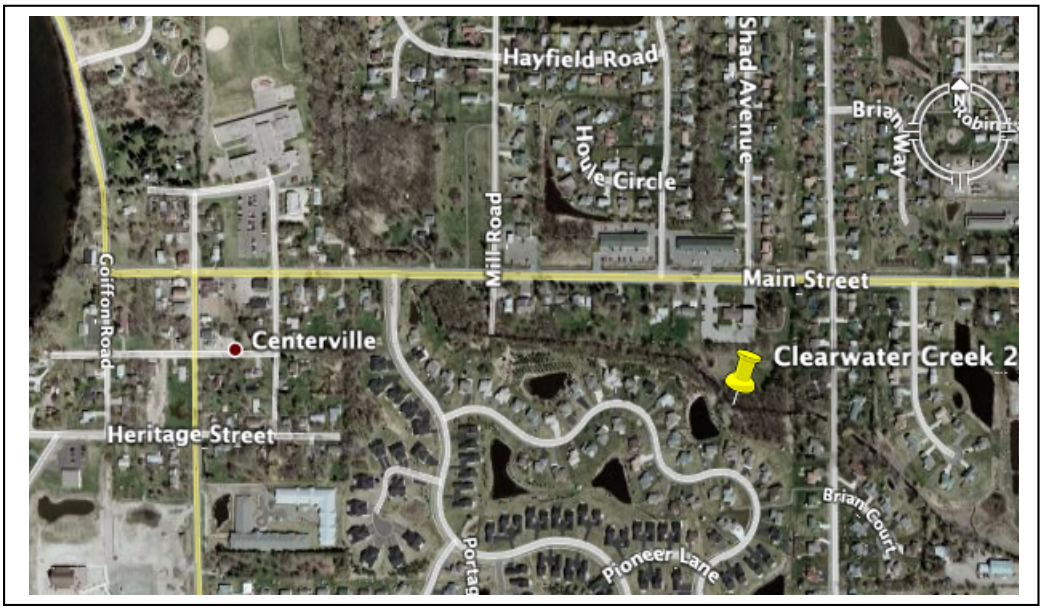
Clearwater Creek is listed as impaired for aquatic life, due to fecal coliform, low dissolved oxygen, and negatively impacted aquatic insect communities.

4.2.2 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 - 2012. This site also served as our 2012 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.

2012 Clearwater Creek sampling location.



4.2.3 Sampling Methodology

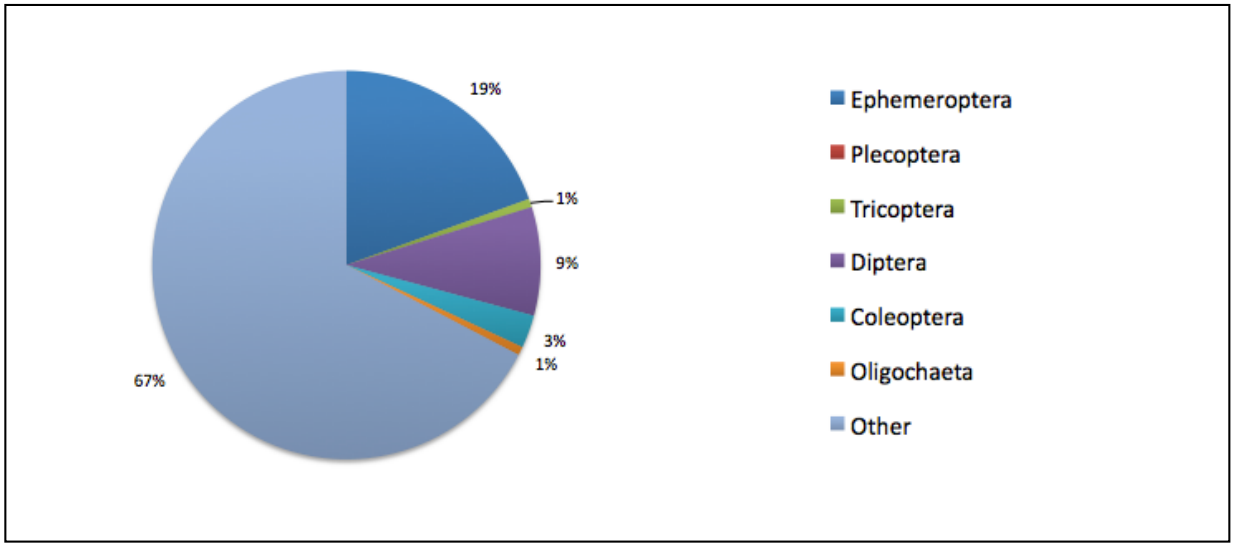
Team Leader: Gary Averbeck
Team Members: Amy Anderson, Linda Gruntner, Barb Hoernemann, Wayne LeBlanc, Tere O'Connell, Jason Papenfuss, Dana Raines, Rob Turner, Don Vegoe

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, labeled and scored.

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%
9/12/09	152	**6.3**	5	18	Hydropsychidae	17%
9/11/10	135	**4.5**	2	10	Gammaridae	76%
9/11/11	363	**4.7**	4	19	Gammaridae	43%
10/2/12	146	**4.6**	2	16	Gammaridae	55.5%
Cross Check Results:						
10/17/07	155	**5.9**	4	20	Hyalellidae	19.4%
9/7/08	109	**6.8**	5	15	Corixidae	22%
9/26/09	113	**4.7**	3	14	Hydropsychidae	43%



Clearwater Creek Data Summary

Family Biotic Index (FBI): Our 2012 SHEP field sampling results produced a score of 4.6 for the Clearwater Creek site. This score corresponds to a "Good" rating on the Family Biotic Index stream health chart. This is consistent with stream health scores from 2010 (4.5) and 2011 (4.7).

Number of individuals: A large sample offers more confidence for a more reliable data set. SHEP protocol requires a minimum of 100 individual invertebrates to be picked and identified per sample. 146 invertebrates were identified in this sample. This sample size is adequate.

Dominant Family: The dominant family was Gammaridae (scuds). Gammaridae dominated 55.5% of the sample, and has a tolerance value of 4 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are closely related to Hyalellidae (note the pollution tolerance difference). The distinction between the two families is the flagellum found on the antennae of Gammaridae. They are important food sources for fish and invertebrate predators. They can be extremely abundant in water bodies without fish and are important in the breakdown of organic matter. (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: In 2012, 16 families were identified in the sample. This compares to 19 families in 2011 and 10 families in 2010. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. More than 10-12 families is considered good. In 2012, 2 EPT families were identified in the sample and made up 20% of the sample.

4.2.5 Clearwater Creek Overall Data Summary

Interpretation of the Hilsenhoff Biotic Index						
Sampling Sites	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Clearwater Creek	**5.9**	**5.5**	**6.3**	**4.5**	**4.7**	**4.6**
Cross Check	5.9	6.8	4.7	Na	Na	Na

Overall, Clearwater Creek site results indicate relatively stable stream conditions, with increasing populations of lower pollution tolerance families in the last three seasons.

Clearwater Creek continues to post some of the strongest stream health scores in the Rice Creek Watershed. The 2012 Family Biotic Index score of 4.6 indicates a stream health score of "Good".

4.3 Rice Creek Sites

4.3.1 Existing Conditions

The Rice Creek Watershed District and Emmons & Olivier Resources Inc. completed a re-meander and 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 two of the 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.

A third site, Rice Creek 'Irondale', was introduced in 2012 further downstream of the restoration area.

4.3.2 Site Map

Below are maps of the three 2012 Rice Creek 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.

2012 Rice Creek 'Above' and 'Below' Sampling Locations

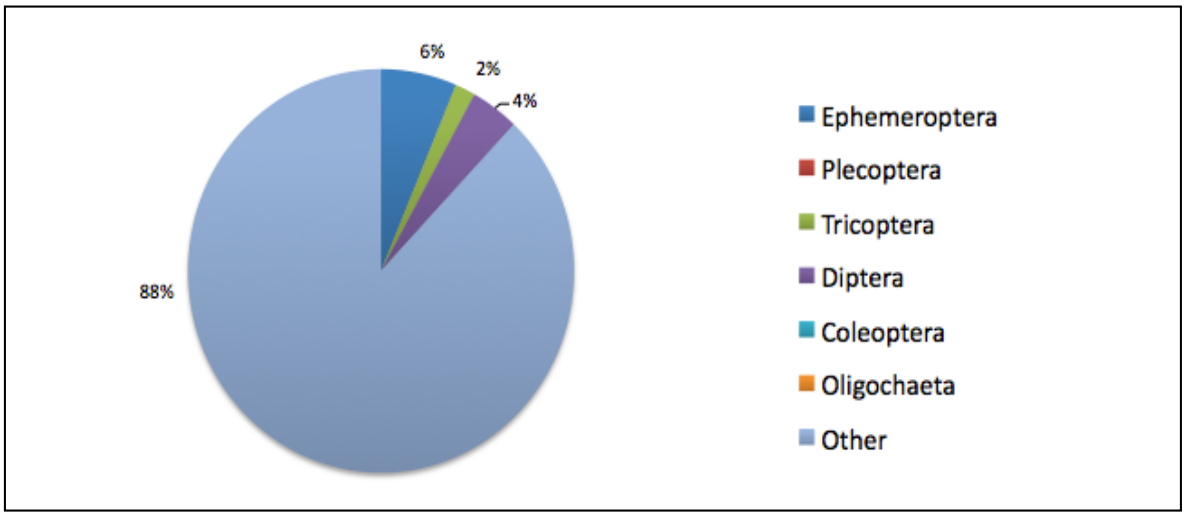
2012 Rice Creek 'Irondale' Sampling Location

4.3.3 Sampling Methodology
Team Leader: Ralph Butkowski
Team Members: Bob Bartlett, Jim Dorsey, Gary Ellis, Matt Hannah, Mari Ito, James Brozowski, Rod Venterea, 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, labeled and scored.

4.3.4a Field Sampling Results - Rice Creek 'Above' Site

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	Hyalellidae	38%
9/5/2009	103	**7.0**	3	11	Chironomidae	51%
9/26/10	227	**7.3**	6	11	Hyalellidae	66%
9/18/11	612	**7.8**	3	15	Hyalellidae	70%
9/22/12	174	**8.3**	4	10	Coengrionidae	52.9%
Cross Check Results:						
9/20/09	421	**6.8**	4	14	Chironomidae	40%
9/18/10	510	**7.8**	3	11	Hyalellidae	75%



Rice Creek 'Above' Data Summary

Family Biotic Index (FBI): Our 2012 SHEP field sampling results produced a score of 8.3 for the Rice Creek 'Above' site. This score corresponds to a "Very Poor" rating on the Family Biotic Index stream health chart. The FBI has declined. The dominating family in 2012 has a higher tolerance to pollution to that of 2011, which lowered the FBI average. In addition, the diversity declined in 2012, which included fewer families with low tolerance values.

Number of individuals: A large sample offers more confidence for a more reliable data set. SHEP protocol requires a minimum of 100 individual invertebrates to be picked and identified per sample. 174 invertebrates were identified in this sample. This sample size is adequate.

Dominant Family: The dominant family was Coengrionidae (damselfly). Coengrionidae dominated 52.9% of the sample, and has a tolerance value of 9 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). Narrow-winged damselflies, or pond damselflies, are most commonly found on vegetation around the perimeter of lakes and wetlands; however, some species are found on rocks and vegetation in streams. They prefer dense vegetation. Coengrionidaes are the most common damselfly family. (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr). They are predators and prey on mosquito larva. They use their tails for breathing. (Aquatic Entomology, McCafferty, W.P).

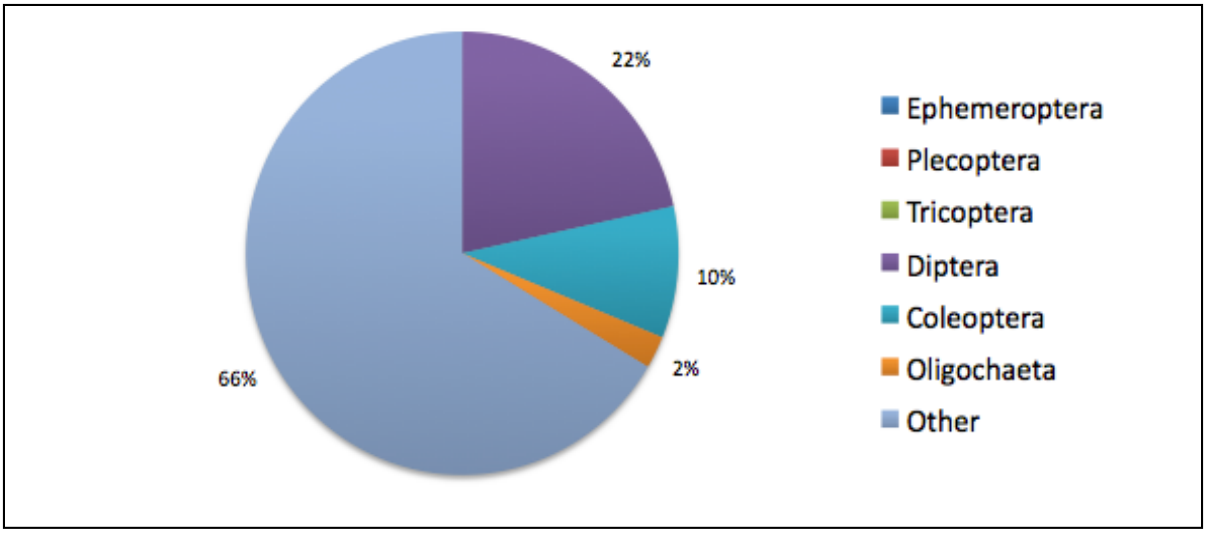
Number of Families: In 2012, 10 families were identified in the sample. This compares to 15 families in 2011 and 11 families in 2010. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. More than 10-12 families is considered good. In 2012, 4 EPT families were identified in the sample and made up 8% of the sample.

4.3.4b Field Sampling Results - Rice Creek 'Below' Site

Rice Creek 'Below' – 2012 Primary Sampling Data

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	**6.7**	0	5	Coenagrionidae	54.5%
9/6/08	178	**5.2**	2	7	Corixidae	34%
9/6/09	110	**6.3**	2	8	Simuliidae	65%
9/26/10	680	**7.8**	4	15	Hyalellidae	80%
9/18/11	347	**7.8**	3	15	Hyalellidae	75%
9/22/12	129	**7.4**	0	17	Hyalellidae	39.5%
Cross Check Results:						
10/1/06	142	**6.1**	4	14	Simuliidae	48%
10/6/07	86	**6.8**	2	14	Chironomidae	62.7%
10/12/08	248	**5.8**	4	13	Chironomidae	29%
9/18/11	1409	**7.4**	3	17	Hyalellidae	58%



Rice Creek 'Below' Data Summary

Family Biotic Index (FBI): Our 2012 SHEP field sampling results produced a score of 7.4 for the Rice Creek 'Below' site. This score corresponds to a "Very Poor" rating on the Family Biotic Index stream health chart. The FBI score improved from previous years. The diversity of the sample increased, while the dominance of Hyalellidae lessened. Those families with lower tolerance values lowered the FBI average.

Number of individuals: A large sample offers more confidence for a more reliable data set. SHEP protocol requires a minimum of 100 individual invertebrates to be picked and identified per sample. 129 invertebrates were identified in this sample. This sample size is adequate.

Dominant Family: The dominant family was Hyalellidae (scuds). Hyalellidae dominated 39.5% of the sample, and has a tolerance value of 8 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are closely related to Gammaridae (note the pollution tolerance difference). The distinction between the two families is the flagellum found on the antennae of Gammaridae. They are important food sources for fish and invertebrate predators. They can be extremely abundant in water bodies without fish and are important in the breakdown of organic matter. (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

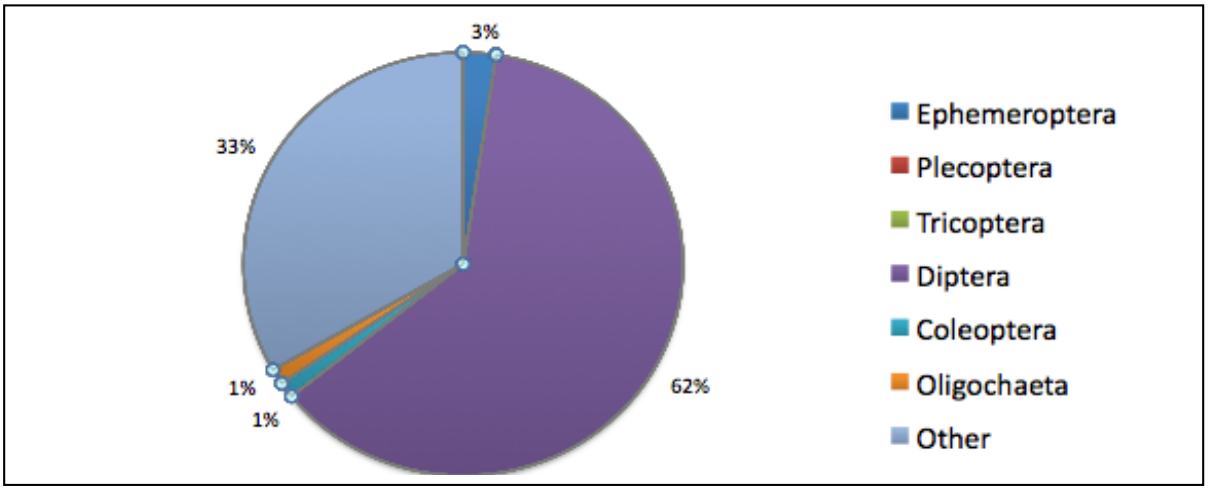
Number of Families: In 2012, 17 families were identified in the sample. This compares to 15 families in 2011 and 15 families in 2010. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. More than 10-12 families is considered good. In 2012, no EPT families were identified in the sample.

4.3.4c Field Sampling Results - Rice Creek 'Irondale' Site

Rice Creek 'Irondale' – 2012 Primary Sampling Data

Historical Field Results for Rice Creek 'Irondale' Site						
Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
9/2/12	165	**6.8**	2	13	Chironomidae	60.6%



Rice Creek 'Irondale' Data Summary

Family Biotic Index (FBI): Our 2012 SHEP field sampling results produced a score of 6.8 for the Rice Creek 'Irondale' site. This score corresponds to a "Poor" rating on the

Family Biotic Index stream health chart. This is the first year data has been collected at this site, and as a result no trend analysis information is available.

Number of individuals: A large sample offers more confidence for a more reliable data set. SHEP protocol requires a minimum of 100 individual invertebrates to be picked and identified per sample. 165 invertebrates were identified in this sample. This sample size is adequate.

Dominant Family: The dominant family was Chironomidae. Chironomidae dominated 60.6% of the sample, and has a tolerance value of 6 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are a very abundant and diverse group of aquatic insects, and it is common for them to dominate samples (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: In 2012, 13 families were identified in the sample. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. More than 10-12 families is considered good. In 2012, 2 EPT families were identified in the sample and made up 2% of the sample.

4.1.5 Rice Creek Overall Data Summary

Interpretation of the Hilsenhoff Biotic Index							
Sampling Sites	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Rice Creek 'Above'	**8.8**	**7.9**	**7.3**	**7.0**	**7.3**	**7.8**	**8.3**
Rice Creek 'Below'	**8.3**	**6.7**	**5.2**	**6.3**	**7.8**	**7.8**	**7.4**
Rice Creek 'Irondale'	Na	Na	Na	Na	Na	Na	**6.8**
Cross Check 'Above'	-	-	-	6.8	7.8		Na
Cross Check 'Below'	6.1	6.8	5.8	-	-	7.4	Na

While these sites had shown some improvement in recent years, recent stream health scores remain elevated and indicate "Very Poor" stream health conditions overall. The Family Biotic Index score of 8.3 at the Rice Creek 'Above' site and the Family Biotic Index score of 7.4 at the Rice Creek 'Below' site indicates a stream health score of "Very Poor".

The Rice Creek 'Irondale' site, which was a new monitoring location in 2012, showed a stream health score of 6.8, indicating a stream health score "Poor". Further long-term sampling data is required in order to more accurately gauge the overall rate of stream health change at these sites.

4.4 Locke Lake Area Sites

4.4.1 Existing Conditions

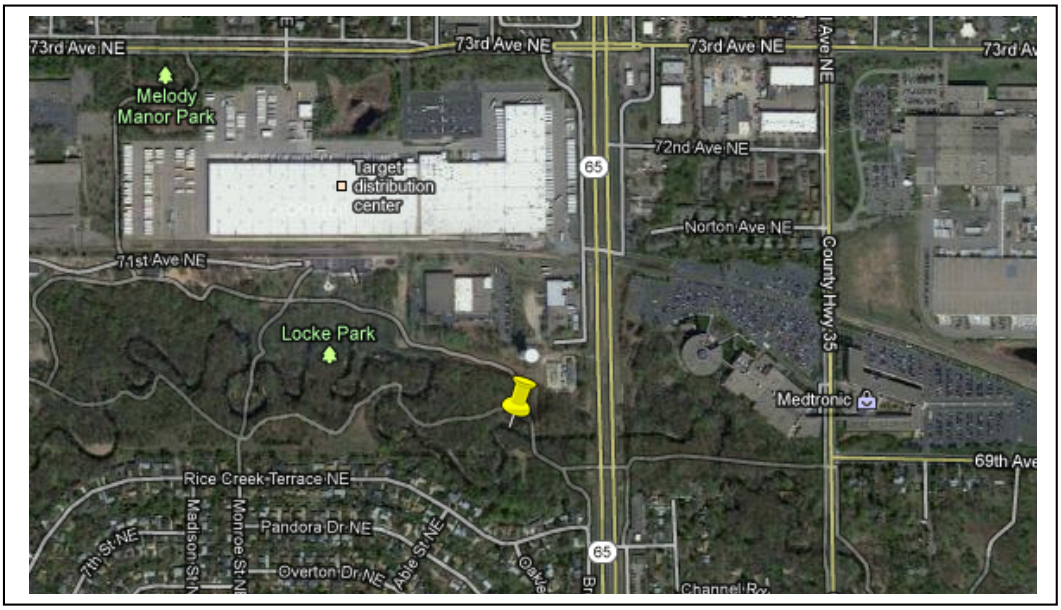
Locke Lake is located just upstream of the Rice Creek Watershed's outlet to the Mississippi River. All outflows from the Rice Creek Watershed passes through Locke Lake and flows directly into the Mississippi River. Recent activity by the Rice Creek Watershed District has focused on installing shoreland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

4.4.2 Site Map

Below are maps of the 2012 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.

2012 Locke Lake 'Above' and 'Below' Sampling Locations

2012 Locke Lake 'Park' Sampling Location



4.4.3 Sampling Methodology

Team Leader: Katherine Majkrzak

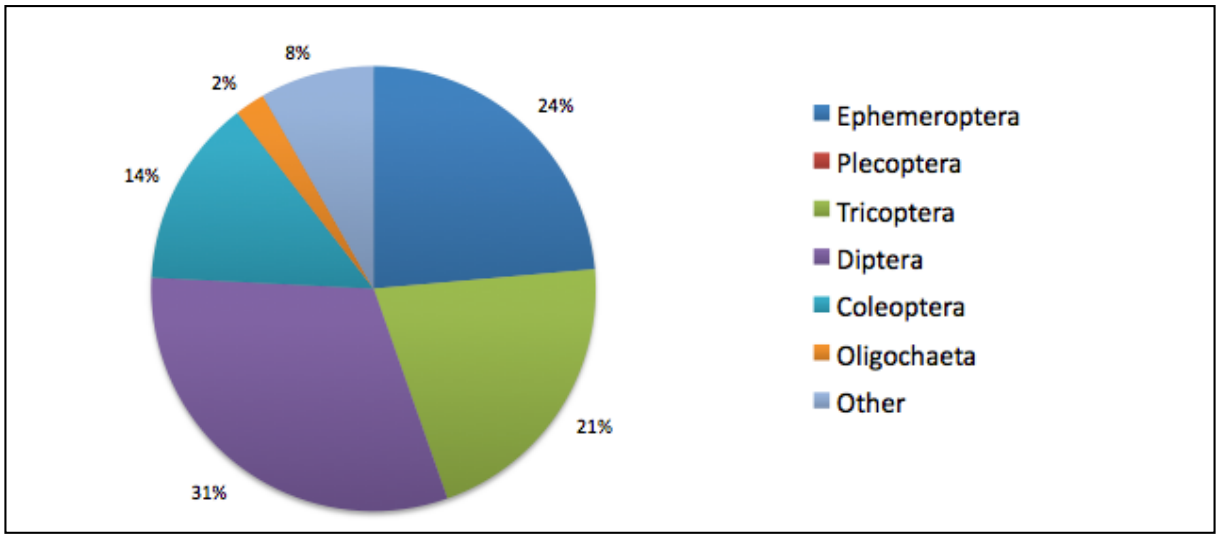
Team Members: Trisha Flaherty, May Hangartner, Ryan Hangartner, Jaime Haueter, Alex Haueter, Cathi Lyman-Onkka, Marilyn Radmer, Susan Young

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, labeled and scored.

4.4.4a Field Sampling Results for Locke Lake 'Above' Site

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//08	163	**5.7**	4	14	Chironomidae	30%
9/13/09	115	**6.1**	3	18	Chironomidae	37%
9/12/10	123	**5.9**	4	13	Chironomidae	43%
9/11/11	362	**5.4**	3	12	Simuliidae	62%
9/9/12	314	**5.2**	6	18	Chironomidae	29.3%
Cross Check Results:						
9/20/08	115	**4.9**	4	17	Hydropsychidae	33%
9/19/09	107	**6.7**	4	14	Corixidae	36%



Locke Lake 'Above' Data Summary

Family Biotic Index (FBI): Our 2012 SHEP field sampling results produced a score of 5.2 for the Locke Lake 'Above' site. This score corresponds to a "Fair" rating on the Family Biotic Index stream health chart. This shows some improvement in stream health scores from 2010 (5.9) and 2011 (5.2). In 2012, the diversity increased, and the dominating family was modest. Despite the lack of EPT families in the sample, more families with lower tolerance to pollution were present in the sample.

Number of individuals: A large sample offers more confidence for a more reliable data set. SHEP protocol requires a minimum of 100 individual invertebrates to be picked and identified per sample. 314 invertebrates were identified in this sample. This sample size is excellent.

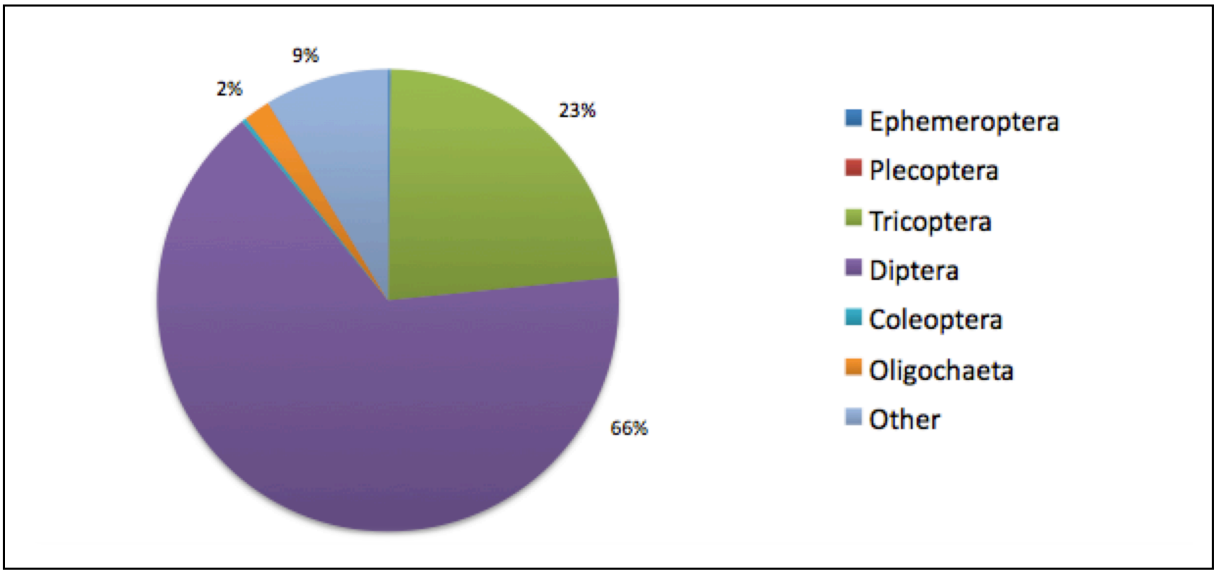
Dominant Family: The dominant family was Chironomidae. Chironomidae dominated 29.3% of the sample, and has a tolerance value of 6 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are a very abundant and diverse group of aquatic insects, and it is common for them to dominate samples (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: In 2012, 18 families were identified in the sample. This compares to 12 families in 2011 and 13 families in 2010. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. More than 10-12 families is considered good. In 2012, 6 EPT families were identified and made up 45% of the sample.

4.4.4b Field Sampling Results for Locke Lake 'Below' Site

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%
10/11/08	315	**5.1**	5	13	Hydropsychidae	41%
9/13/09	498	**5.0**	2	12	Hydropsychidae	48%
9/12/10	197	**5.0**	5	11	Chironomidae	42%
9/11/11	2536	**5.7**	3	13	Simuliidae	80%
9/9/12	629	**5.6**	3	15	Chironomidae	61.4%
Cross Check Results:						
10/8/06	137	**4.3**	3	10	Hydropsychidae	85%
9/22/07	87	**5.4**	2	9	Gammaridae	23%
10/2/10	100	**5.6**	3	12	Simuliidae	33%
9/3/11	205	**5.1**	4	12	Chironomidae	35%



2012 Locke Lake 'Below' Data Summary

Family Biotic Index (FBI): Our 2012 SHEP field sampling results produced a score of 5.6 for the Locke Lake 'Below' site. This score corresponds to a "Fair" rating on the Family Biotic Index stream health chart. This compares to stream health scores from 2010 (5.0) and 2011 (5.7). The 2012 FBI score is similar to 2011, though a higher diversity of invertebrates with lower tolerance values helped the FBI score slightly.

Number of individuals: A large sample offers more confidence for a more reliable data set. SHEP protocol requires a minimum of 100 individual invertebrates to be picked and identified per sample. 629 invertebrates were identified in this sample. This sample size is excellent.

Dominant Family: The dominant family was Chironomidae. Chironomidae dominated 61.4% of the sample, and has a tolerance value of 6 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are a very abundant and diverse group of aquatic insects, and it is common for them to dominate samples (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

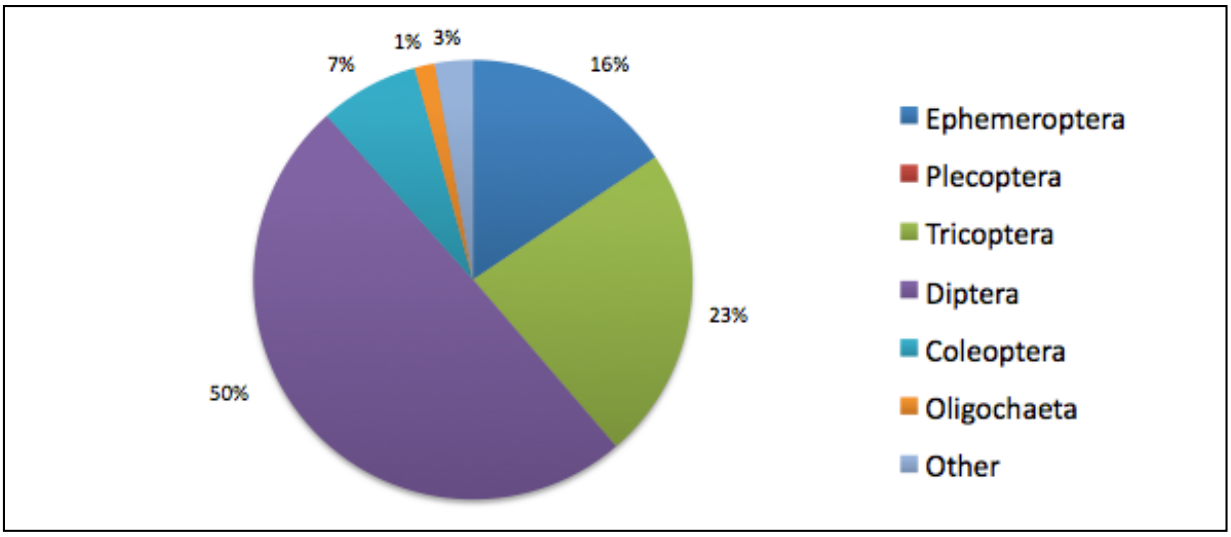
Number of Families: In 2012, 15 families were identified in the sample. This compares to 13 families in 2011 and 11 families in 2010. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. More than 10-12 families is considered good. In 2012, 3 EPT families were identified and made up 23% of the sample.

4.4.4c Field Sampling Results for Locke Lake 'Park' Site

2012 Locke Lake 'Park' Primary Sampling Data

Historical Field Results for Locke Lake 'Park' Site						
Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
9/9/12	463	**4.7**	3	14	Chironomidae	31.7%



2012 Locke Lake 'Park' Data Summary

Family Biotic Index (FBI): Our 2012 SHEP field sampling results produced a score of 4.7 for the Rice Creek 'Park' site. This score corresponds to a "Good" rating on the Family Biotic Index stream health chart.

Number of individuals: A large sample offers more confidence for a more reliable data set. SHEP protocol requires a minimum of 100 individual invertebrates to be picked and identified per sample. 463 invertebrates were identified in this sample. This sample size is excellent.

Dominant Family: The dominant family was Chironomidae. Chironomidae dominated 31.7% of the sample, and has a tolerance value of 6 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are a very abundant and diverse group of aquatic insects, and it is common for them to dominate samples (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: In 2012, 14 families were identified in the sample.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample,

the better. More than 10-12 families is considered good. In 2012, 3 EPT families were identified and made up 28% of the sample.

4.1.5 Locke Lake Area Overall Data Summary

Interpretation of the Hilsenhoff Biotic Index							
Sampling Sites	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Locke Lake 'Above'	**5.0**	**5.1**	**5.7**	**6.1**	**5.9**	**5.4**	**5.2**
Locke Lake 'Below'	**5.3**	**5.7**	**5.1**	**5.0**	**5.0**	**5.7**	**5.6**
Locke Lake 'Park'	Na	Na	Na	Na	Na	Na	**4.7**
Cross Check 'Above'	-	-	4.9	6.7	-	-	Na
Cross Check 'Below'	4.3	5.4	-	-	5.6	5.1	Na

The Locke Lake sites continue to post some of the most consistently stable and encouraging stream health scores in the Rice Creek Watershed.

The Family Biotic Index (FBI) for 2012 shows that all three of the Locke Lake area sites show strong stream health scores. The Family Biotic Index score of 5.2 at the Locke Lake 'Above' site and the Family Biotic Index score of 5.6 at the Locke Lake 'Below' site indicates a stream health score of "Fair".

The Locke Lake 'Park' site, which was a new monitoring location in 2012, showed a stream health score of 4.7, indicating a stream health score "Fair".

Further long-term sampling data is required in order to more accurately gauge the overall rate of stream health change at these sites.

APPENDIX A: 2012 Rice Creek Watershed District
Stream Health Evaluation Program (SHEP) Sampling Sites