RICE CREEK WATERSHED STREAM HEALTH EVALUATION PROGRAM (SHEP)

2014 BENTHIC MACROINVERTEBRATE STREAM MONITORING REPORT

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The Rice Creek Watershed District
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Edgewood Middle School

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Fortin Consulting

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Katie Farber & Connie Fortin – Fortin Consulting
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2014 Rice Creek SHEP Volunteers:

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Team One: Gary Averbeck*, Amy Anderson, Barbara Bor, Linda Gruntner, Barb Hoernemann, Wayne LeBlanc, Tere O'Connell, Dana Raines, Robin Turner, Maggie Voth.

Team Two: James Brozowski*, Courtney Jones*, Bob Bartlett, Ralph Butkowski, Gary Ellis, Julie Glanton, Trystan Johnson, Courtney Jones, Jo Ann Morse, Kelsey Thurow, Rod Venterea.

Team Three: Katherine Majkrzak*, Darrell Majkrzak*, Cathi Lyman-Onkka, Penny Moore, Marilyn Radmer, Rob Schroeder, John Steinworth, Annika Taylor, Ross Whitmore, 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
2014 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, was 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 the 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 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.

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 2014 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 Mounds View Public Schools, Edgewood Middle School, University of Minnesota Water Resource Center, 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 2014 SHEP season were provided by Friends of the Mississippi River.

The program recruited 30 adult volunteers and one teen volunteer organized in three teams to monitor a total of nine sites in the watershed. 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 2 training sessions, covering the in-stream physical assessment and macroinvertebrate collection methods, and laboratory macroinvertebrate identification procedures. For more information on methods and training, see section 2.0.

Each volunteer team collected physical assessment data and benthic macroinvertebrate samples at three sites. 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 their 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, Barbara Bor, Linda Gruntner, Barb Hoernemann, Wayne LeBlanc, Tere O'Connell, Dana Raines, Robin Turner, Maggie Voth.

Team Two:
Monitoring Location: Rice Creek Area
Site Names: Rice Creek 'Above', Rice Creek 'Below', Rice Creek 'Irondale'.
Team Leader: James Brozowski & Courtney Jones
Team Members: Bob Bartlett, Ralph Butkowski, Gary Ellis, Julie Glanton, Trystan Johnson, Courtney Jones, Jo Ann Morse, Kelsey Thurow, Rod Venterea.

Team Three:
Monitoring Location: Locke Lake Area
Site Names: Locke Lake 'Above', Locke Lake 'Below', Rice Creek 'Park'.
Team Leaders: Katherine & Darrell Majkrzak
Team Members: Cathi Lyman-Onkka, Penny Moore, Marilyn Radmer, Rob Schroeder, John Steinworth, Annika Taylor, Ross Whitmore, Susan Young.

2.3 Training

Advanced volunteer training is essential to the success of SHEP. Volunteers participated in 2 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 16th 2014 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 Friends of the Mississippi River (FMR) 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. This training was mandatory for all volunteers in their first three years in SHEP, and optional for volunteers who had participated four or more years.

To allow for maximum volunteer participation, program staff organized the two laboratory training sessions on Thursday, September 25th and Saturday, September 27th 2014 at Edgewood Middle School. 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. SHEP volunteers in their first three years were asked to participate in at least one of these two sessions, though volunteers were permitted to attend both if desired. This training was optional for volunteers who had participated four or more years in SHEP.

2.4 Site Selection

Stream monitoring sites were selected by RCWD staff. Several sites included in the 2014 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. 2014 SHEP sites included:

- Hardwood Creek 'Above'
- Hardwood Creek 'Below'
- Clearwater Creek
- Rice Creek 'Above'
- Rice Creek 'Below'
- Rice Creek 'Irondale'
- Locke Lake 'Park'
- 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 2014. 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 October 2014. Lab identification sessions were held in partnership with Mounds View School District at Edgewood Middle School in Mounds View, 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: **100%**

Team Two:
Sample: Rice Creek 'Below' sample
Accuracy Score: **99.4%**

Team Three:
Sample: Locke Lake 'Below' sample
Accuracy Score: **96.6%**

The overall combined QA/QC accuracy score for the 2014 Rice Creek Watershed Stream Health Evaluation Program was: 98.2%.

3.0 MONITORING TERMS

3.1 Monitoring Terms

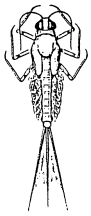
The descriptions below will help readers understand the results presented on the following pages.

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

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 indices 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 4.2 score at Hardwood Creek 'Below' in 2014. The highest (poorest) historical FBI value reported was an 8.8 score 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 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 (24) was discovered at the Hardwood Creek 'Above' site in 2007, while the fewest number of families (5) were found at both the Rice Creek 'Above' and Rice Creek 'Below' sampling locations in 2007.

Number of Organisms Identified – The protocol used requires identification of a minimum of 100 organisms to confidently assess a site. When fewer than 100 organisms are identified in a sub-sample, 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 identified.

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 indices 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 2014 FIELD SAMPLING RESULTS

4.1 Hardwood Creek Sites

4.1.1 Existing Conditions

The 24 square miles of land area draining to Hardwood Creek includes portions of May Township and the cities of Hugo, Forest Lake, and Lino Lakes in Anoka and Washington Counties. The upper two-thirds of Hardwood Creek originates south of Rice Lake, flows north to Corrie's Swamp, then turns and continues west emptying into Peltier Lake.

In 2002, Hardwood Creek was included on Minnesota's List of Impaired Waters because the amount, condition and diversity of aquatic life such as fish were too low. Furthermore, there wasn't enough oxygen in the water to support fish and aquatic insects.

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. Additional information is available in the Rice Creek Watershed District's 2009 Stream Monitoring Report.

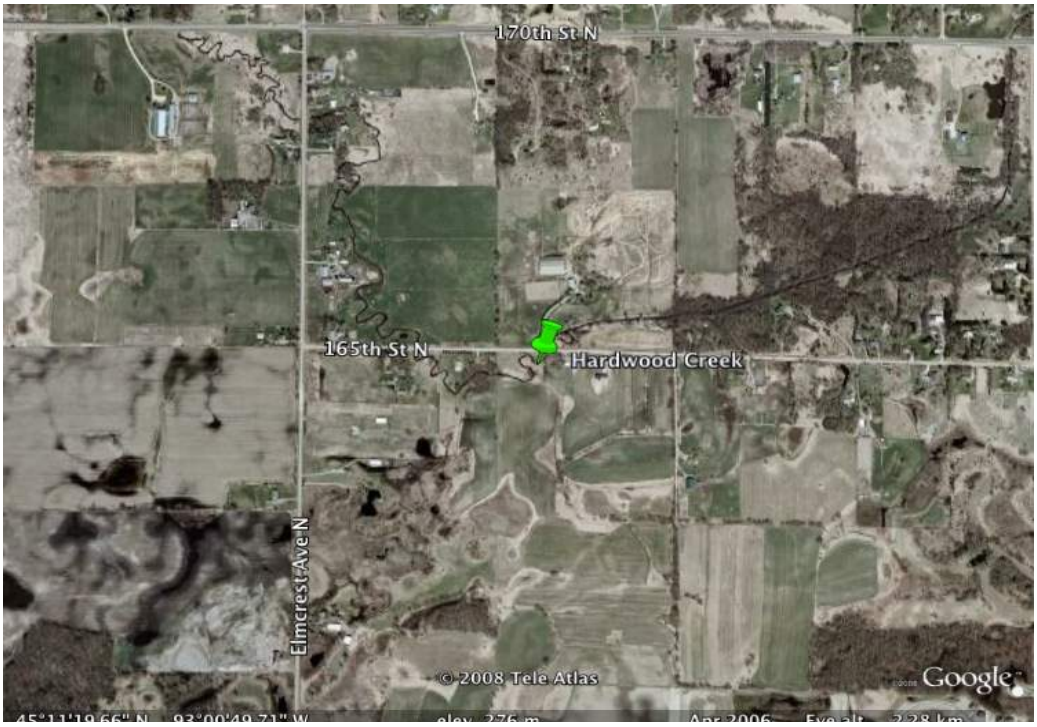
In the summer of 2006, as part of a grant from the Legislative Commission on Minnesota Resources (LCMR), three locations along Hardwood Creek that were identified as having severe bank erosion were stabilized and in-stream habitat improvement techniques were utilized.

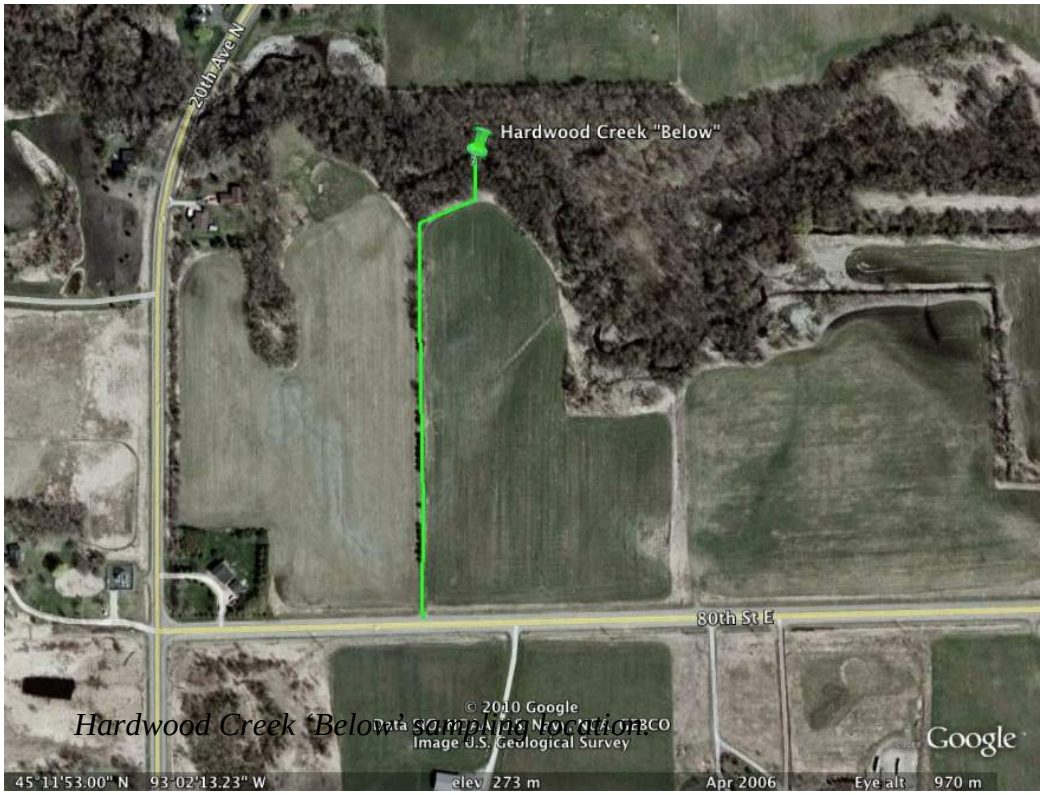
4.1.2 Site Maps

Below are maps of each of the 2014 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.

Hardwood Creek 'Above' sampling location.





Hardwood Creek 'Below' sampling location.

4.1.3 Sampling Methodology

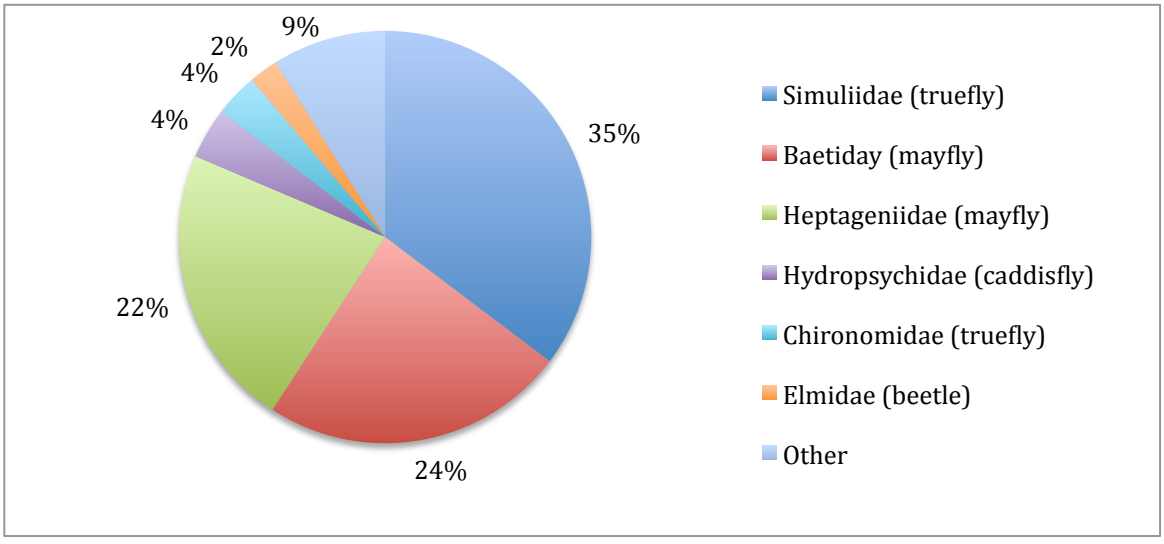
Team Leader: Gary Averbeck
Team Members: Amy Anderson, Barbara Bor, Linda Gruntner, Barb Hoernemann, Wayne LeBlanc, Tere O'Connell, Dana Raines, Robin Turner, Maggie Voth.

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%
8/25/13	157	**6.2**	3	12	Hyaliellidae	35%
9/13/14	178	**5.2**	4	13	Simuliidae	35%

Primary Sampling Data for Hardwood Creek 'Above'



Hardwood Creek 'Above' Data Summary

Family Biotic Index (FBI): The 2014 SHEP field sampling results produced a score of 5.2 for the Hardwood Creek 'Above' site. This score corresponds to a "Fair" rating on the Family Biotic Index stream health chart. The FBI score is improved in 2014 from 2013. Simuliidae (Black Flies / Trueflies) and Baetidae (Mayflies) dominated the 2014 sample, which improved the FBI score.

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. 178 invertebrates were identified in this sample. This sample size in adequate.

Dominant Family: The dominant family was Simuliidae (Black Flies / Trueflies). Simuliidae has a tolerance value of 6 on a scale of 0-10. The lower the tolerance value, the lower their tolerance to pollution). Black flies filter fine organic matter from the water. They are common in streams of the Upper Midwest and in some situations can reach huge numbers (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr.)

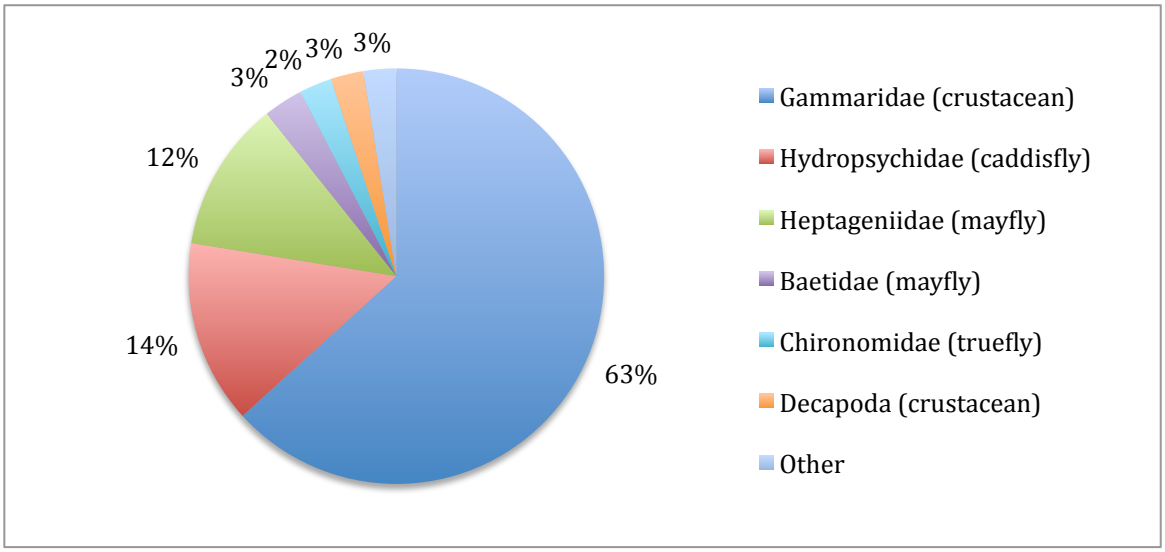
Number of Families: In 2014, 13 families were identified in the sample. This compares to 12 families in 2013 and 18 families in 2012. In general, a more diverse sample suggests a healthier stream environment.

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. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. In 2014, 4 EPT families (Baetidae (Mayflies), Heptageniidae (Mayflies), Hydropsychidae (Caddisfly), and Caenidae (Mayflies)) were identified in the sample and made up 51% 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%
8/25/13	134	**4.9**	4	15	Gammaridae	24%
9/13/14	196	**4.2**	3	10	Gammaridae	63%

Primary Sampling Data for Hardwood Creek 'Below'



Hardwood Creek 'Below' Data Summary

Family Biotic Index (FBI): Our 2014 SHEP field sampling results produced a score of 4.2 for the Hardwood Creek 'Below' site. This score corresponds to a "Very Good" rating on the Family Biotic Index stream health chart, and is a slight improvement over the stream health scores from 2011 (4.4), 2012 (4.6) and 2013 (4.4). The 4.2 FBI score is the lowest (best) stream health score registered during the history of the Stream Health Evaluation Program.

The FBI stream health trend is fairly stable at this site, and the dominant family and represented EPT families have remained constant for many years. The FBI score fluctuates with the annual difference in family diversity and percentage make-up.

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. 196 invertebrates were identified in this sample. This sample size is adequate.

Dominant Family: The dominant family was Gammaridae (Crustacean) 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. 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: 10 families were identified in the sample. This compares to 15 families in 2013 and 15 families in 2012. 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. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. A total of 3 EPT families (Baetidae (Mayflies), Heptageniidae (Mayflies), and Hydropsychidae (Caddisfly)) were identified in the sample and made up 29% 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**	**2013**	**2014**
Hardwood Creek 'Above'	7.2	6.3	6.6	6.0	5.0	5.0	6.2	5.2
Hardwood Creek 'Below'	NA	NA	NA	5.1	4.4	4.6	4.9	4.2

Hardwood Creek continues to remain stable, perhaps even improving overall, 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. Annual variations in local conditions (e.g. water levels, vegetative cover) are affecting the stream health scores.

The Family Biotic Index score of 5.2 at the Hardwood Creek ‘Above’ site indicates an overall stream health score of “Fair”. The Family Biotic Index score of 4.2 at the Hardwood Creek ‘Below’ site indicates an overall stream health score of “Good”. The Hardwood Creek 'Below' site remains one of the best-scoring sites in the Stream Health Evaluation Program.

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. Clearwater Creek empties into Peltier Lake in the Rice Creek Chain of Lakes.

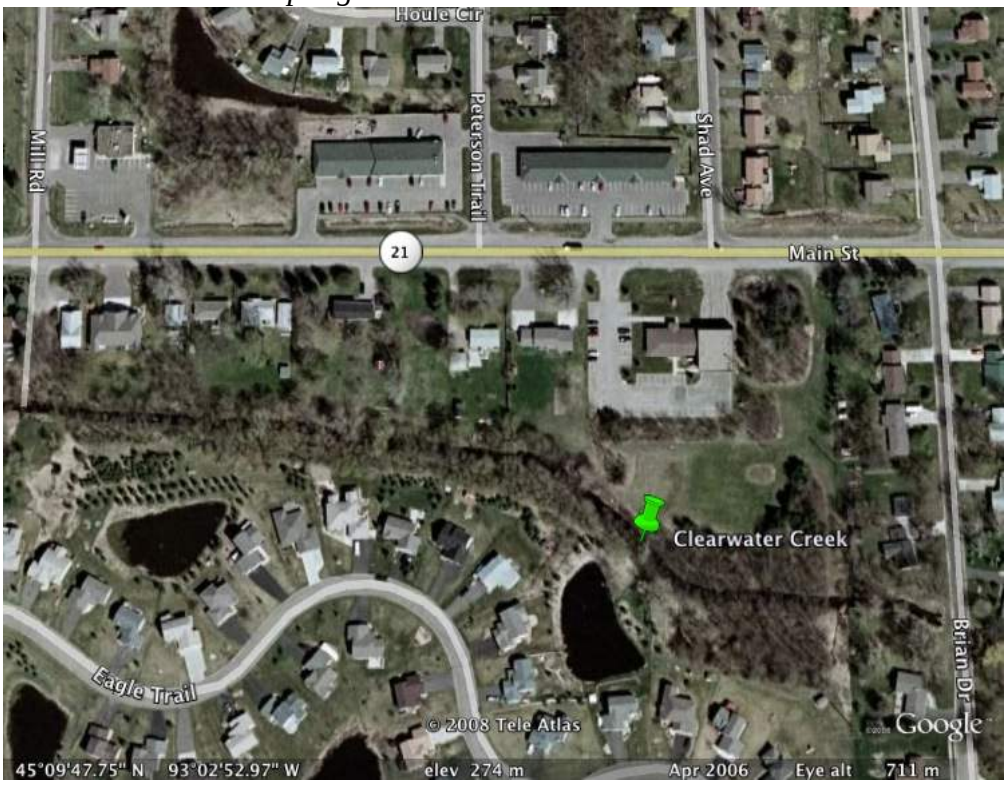
Clearwater Creek is listed as impaired for biota, though recent stream samples indicate low levels of most water quality pollutants. Additional information is available in the Rice Creek Watershed District's 2009 Stream Monitoring Report.

4.2.2 Site Maps

Below is a map of the Clearwater Creek sampling location. The Clearwater Creek site has been sampled since the 2007 SHEP season. This site also served as our 2014 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.

Clearwater Creek sampling location.



4.2.3 Sampling Methodology

Team Leader: Gary Averbeck
Team Members: Amy Anderson, Barbara Bor, Linda Gruntner, Barb Hoernemann, Wayne LeBlanc, Tere O'Connell, Dana Raines, Robin Turner, Maggie Voth.

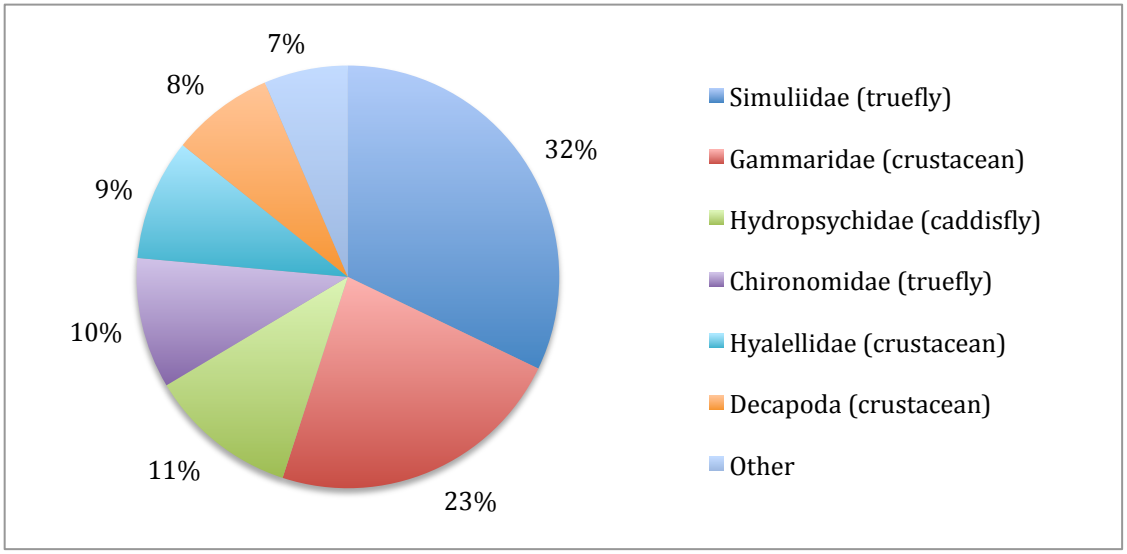
SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location. At least 20 dip-net samples (or 'jabs') were taken from across all major habitat types in the reach. Program staff members performed site visits to assure monitoring was performed according to MPCA guidelines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

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%
8/25/13	134	**4.9**	3	12	Gammaridae	58%
9/13/14	140	**5.6**	2	11	Simuliidae	32%
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%

Primary Sampling Data for Clearwater Creek



Clearwater Creek Data Summary

Family Biotic Index (FBI): Field sampling results produced a score of 5.6 for the Clearwater Creek site. This score corresponds to a "Fair" rating on the Family Biotic Index stream health chart. The FBI trend at this site appears to be fairly stable, although the 2014 FBI score fell and the dominant family changed. Simuliidae (Black Flies / Trueflies) was the dominant family in 2014. Simuliidae has not been greatly represented in prior years, so this is an obvious difference; however, Simuliidae are affected by mosquito treatments, which may influence their presence in the data.

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. 140 invertebrates were identified in this sample. This sample size in adequate.

Dominant Family: The dominant family was Simuliidae (Black Flies / Trueflies) representing 32% of the sample. Simuliidae has a tolerance value of 6 on a scale of 0-10. The lower the tolerance value, the lower their tolerance to pollution). Black flies filter fine organic matter from the water. They are common in streams of the Upper Midwest and in some situations can reach huge numbers (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr.)

Number of Families: 11 families were identified in the sample. This compares to 12 families in 2013 and 16 families in 2012. 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. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. In 2014, 2 EPT families (Heptageniidae (Mayfly) and Hydropsychidae (Caddisfly)) were identified in the sample and made up 3% of the total sample.

4.2.5 Clearwater Creek Overall Data Summary

Interpretation of the Hilsenhoff Biotic Index								
Sampling Sites	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Clearwater Creek	5.9	5.5	6.3	4.5	4.7	4.6	4.9	5.6
Cross Check	5.9	6.8	4.7					

Overall, Clearwater Creek site results indicate fairly stable stream conditions between 2010 and 2014. Changes in diversity and dominant family caused the FBI score to increase in 2014, but it remains within the range of a "Fair" rating and data is quite similar across years.

4.3 Rice Creek Sites

4.3.1 Existing Conditions

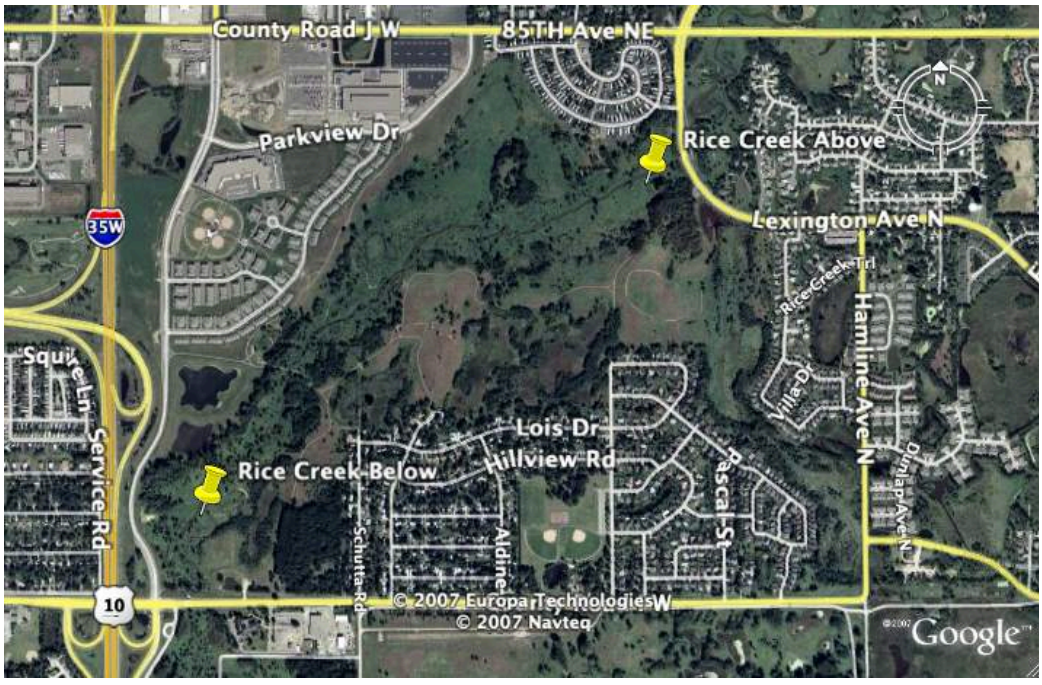
The main stem of Rice Creek run from the Rice Creek Chain of Lakes south and west through Long Lake and Locke Lake before discharging into the Mississippi River in Fridley, MN. Watershed District and Emmons & Olivier Resources Inc. completed a re-meander and restoration of a significant reach of Rice 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 to the program in 2012 further downstream of the restoration area, before the Rice Creek discharges into Long Lake.

4.3.2 Site Map

Below are maps of the three 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.

Rice Creek 'Above' and 'Below' Sampling Locations



Rice Creek 'Irondale' Sampling Location

4.3.3 Sampling Methodology

Team Leaders: James Brozowski & Courtney Jones

Team Members: Bob Bartlett, Ralph Butkowski, Gary Ellis, Julie Glanton, Trystan Johnson, Courtney Jones, Jo Ann Morse, Kelsey Thurow, Rod Venterea.

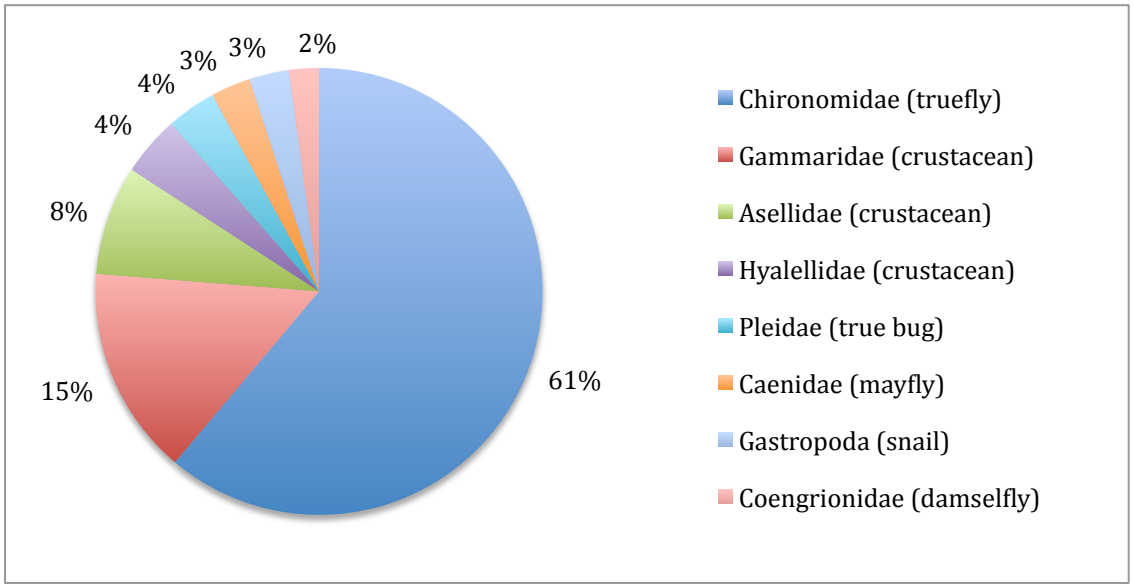
SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location. At least 20 jabs were taken from across all major habitat types in the reach. Program staff members performed site visits to assure monitoring was performed according to MPCA guidelines and protocols. Lab analysis 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 for 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%
9/21/13	480	**6.1**	1	13	Chironomidae	81.5%

9/7/14	139	**5.9**	1	11	Chironomidae	61%
Cross Check Results:						
9/20/09	421	**6.8**	4	14	Chironomidae	40%
9/18/10	510	**7.8**	3	11	Hyalellidae	75%

Primary Sampling Data for Rice Creek 'Above'



Rice Creek 'Above' Data Summary

Family Biotic Index (FBI): SHEP field sampling results produced a score of 5.9 for the Rice Creek 'Above' site. This score corresponds to a "Fairly Poor" rating on the Family Biotic Index stream health chart. The FBI health trend is improving slightly. The family representation and percentage make-up vary from year to year. 2014 and 2013 are similar. Because Chironomidae dominated the sample again in 2014 (61%), the FBI score naturally averaged closer to the Chironomidae tolerance value of 6.

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. 139 invertebrates were identified in this sample. This sample size is adequate.

Dominant Family: The dominant family was Chironomidae (Midges). Chironomidae dominated 61% of the sample, and has a tolerance value of 6 on a scale of 0-10. 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). They are predators and prey on mosquito larva, and use their tails for breathing. (Aquatic Entomology, McCafferty, W.P).

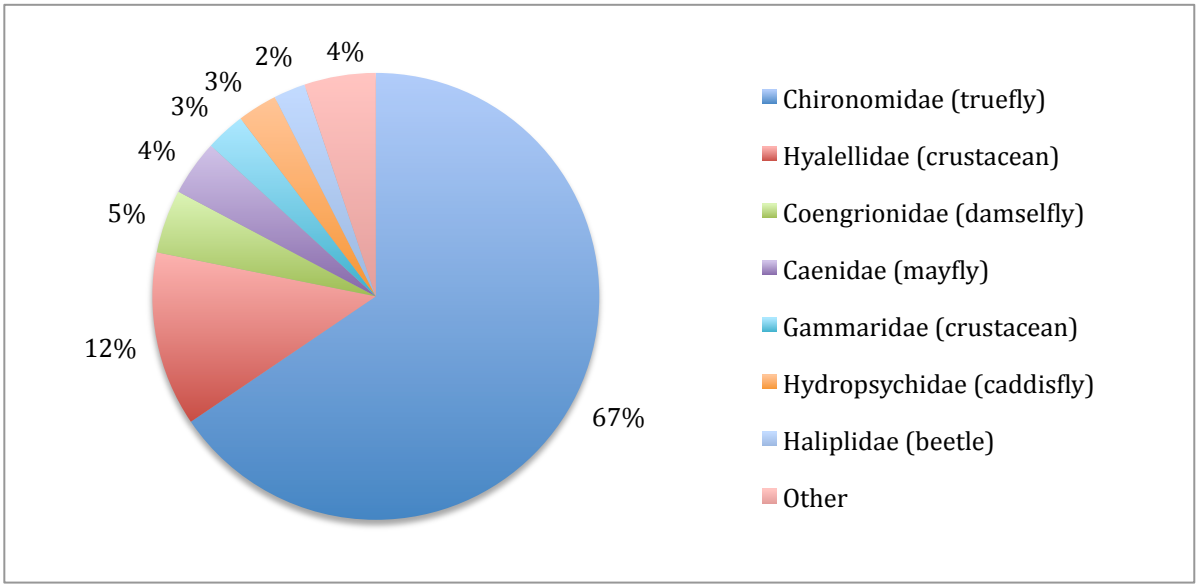
Number of Families: 11 families were identified in the sample. This compares to 13 families in 2013 and 10 families in 2012. In general, a more diverse sample suggests a healthier stream environment.

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. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. In 2014, just 1 EPT family was identified in the sample (Caenidae (Mayflies)) and made up 3% of the sample.

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

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%
9/14/13	300	**6.4**	0	16	Chironomidae	72%
8/31/14	170	**6.2**	2	9	Chironomidae	67%
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%

Primary Sampling Data for Rice Creek 'Below'



Rice Creek 'Below' Data Summary

Family Biotic Index (FBI): SHEP field sampling results produced a score of 6.2 for the Rice Creek 'Below' site. This score corresponds to a "Fairly Poor" rating on the Family Biotic Index stream health chart. The FBI health trend shows some general improvement in recent years. The FBI score and dominant family are similar to 2013 data; however the number of families declined in 2014. The number of EPT families increased in 2014.

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. 170 invertebrates were identified in this sample. This sample size is adequate.

Dominant Family: The dominant family was Chironomidae (Midges). Chironomidae dominated 67% of the sample, and has a tolerance value of 6 on a scale of 0-10. 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). They are predators and prey on mosquito larva, and use their tails for breathing. (Aquatic Entomology, McCafferty, W.P).

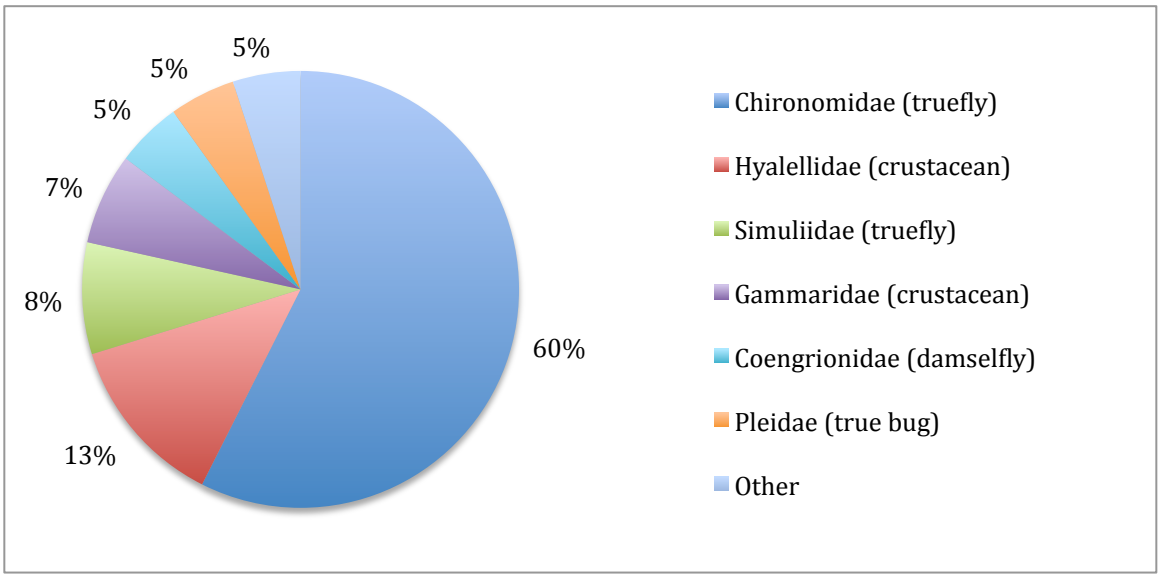
Number of Families: 9 families were identified in the sample. This compares to 16 families in 2013 and 17 families in 2012. In general, a more diverse sample suggests a healthier stream environment.

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. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. In 2014, 2 EPT families (Caenidae (Mayflies) and Hydropsychidae (Caddisflies)) were identified in the sample. This is an improvement from 2012 and 2013, when no EPT families were found.

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

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%
9/14/13	195	**6.8**	1	13	Chironomidae	46%
8/31/14	254	**6.0**	3	13	Chironomidae	60%

Primary Sampling Data for Rice Creek 'Irondale'



Rice Creek 'Irondale' Data Summary

Family Biotic Index (FBI): SHEP field sampling results produced a score of 6.0 for the Rice Creek 'Irondale' site. This score corresponds to a "Fairly Poor" rating on the Family Biotic Index stream health chart. This is an improvement over the 6.8 FBI scores in 2012 and 2013. This is the third year that this site has been sampled. The samples have remained similar, though slight variations among family diversity and abundance exist. More individuals with lower tolerance to pollution were gathered in 2014, but additional sampling is required to establish a trend.

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. 254 invertebrates were identified in this sample. This sample size is good.

Dominant Family: The dominant family was Chironomidae (Midges). Chironomidae dominated 60% of the sample, and has a tolerance value of 6 on a scale of 0-10. 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). They are predators and prey on mosquito larva, and use their tails for breathing. (Aquatic Entomology, McCafferty, W.P).

Number of Families: 13 families were identified in the sample. The same number of families was identified in 2013 and 2012. 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. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. In 2014, 3 EPT families (Baetidaae (Mayflies), Caenidae (Mayflies) and Hydropsychidae (Caddisflies)) were identified in the sample.

4.1.5 Rice Creek Overall Data Summary

Stream health scores indicate "Fairly Poor" stream health conditions overall, although FBI scores at all three sites improved in recent years. However, the individual families present in the samples, and their percentage make-up, have varied widely in each year. Further long-term sampling data is required in order to more accurately determine what are normal conditions at these sites, especially at the new Rice Creek 'Irondale' site.

Interpretation of the Hilsenhoff Biotic Index									
Sampling Sites	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Rice Creek 'Above'	8.8	7.9	7.3	7	7.3	7.8	8.3	6.1	5.9
Rice Creek 'Below'	8.3	6.7	5.2	6.3	7.8	7.8	7.4	6.4	6.2
Rice Creek 'Irondale'	Na	Na	Na	Na	Na	Na	6.8	6.8	6.0
Cross Check 'Above'	-	-	-	6.8	7.8	-	Na	Na	
Cross Check 'Below'	6.1	6.8	5.8	-	-	7.4	Na	Na	

4.4 **Locke Lake Area Sites**

4.4.1 Existing Conditions

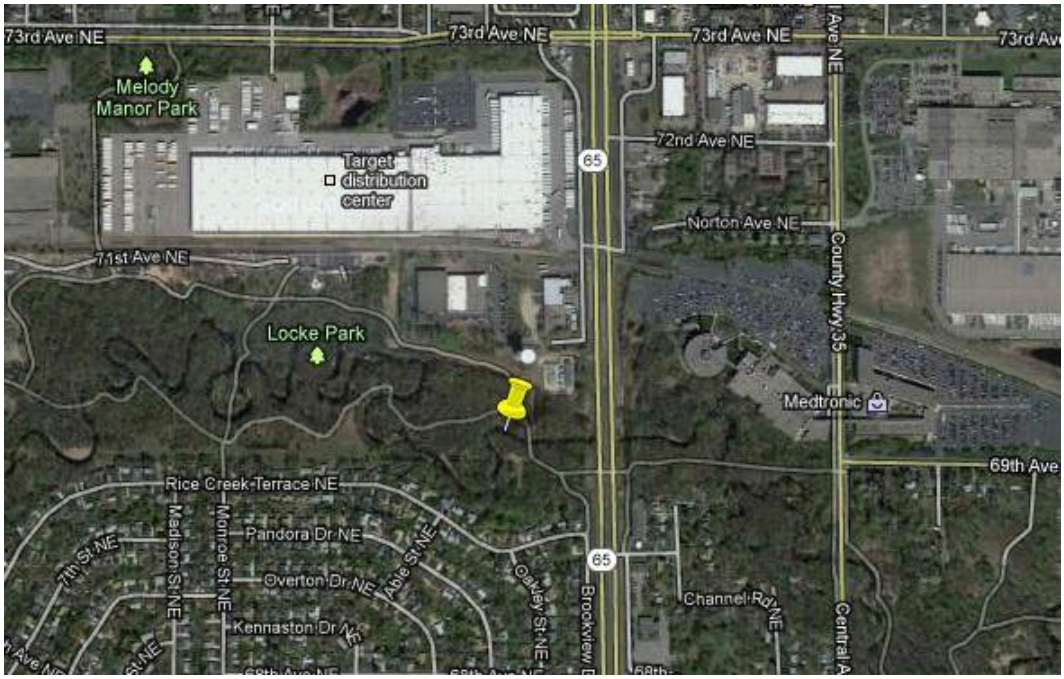
Locke Lake is located just upstream of the Rice Creek Watershed's outlet to the Mississippi River. All outflows from the Rice Creek Watershed pass through the lower reach of the Rice Creek (downstream of Long Lake) and Locke Lake before discharging into the Mississippi River. Recent activity by the Rice 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 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.

Locke Lake 'Above' and 'Below' Sampling Locations

Locke Lake 'Park' Sampling Location



4.4.3 Sampling Methodology

Team Leaders: Katherine & Darrell Majkrzak

Team Members: Cathi Lyman-Onkka, Penny Moore, Marilyn Radmer, Rob Schroeder, John Steinworth, Annika Taylor, Ross Whitmore, Susan Young.

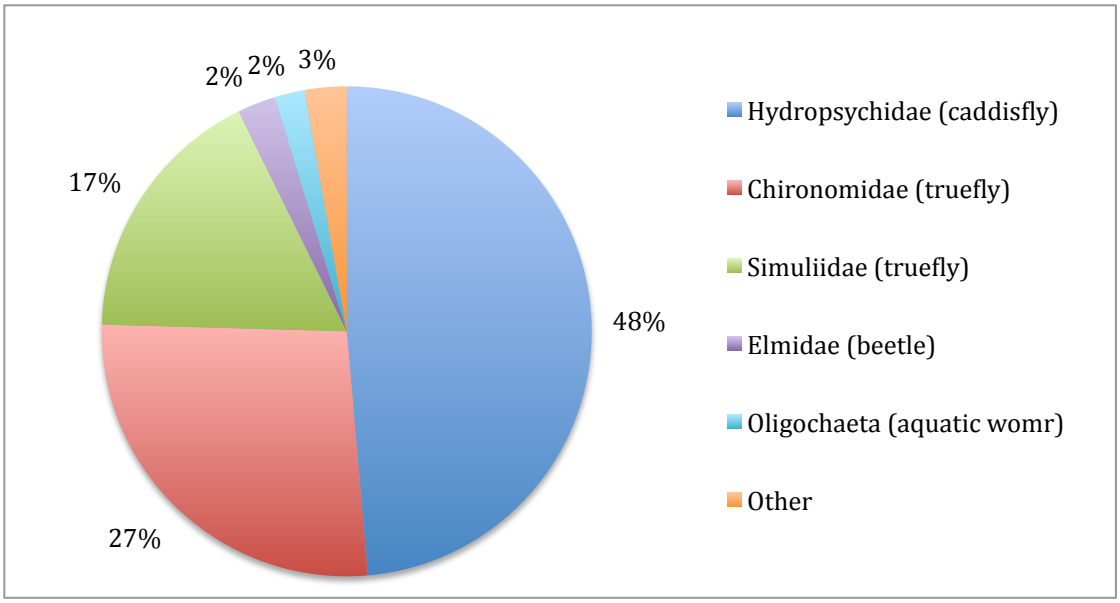
SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location. At least 20 jabs were taken from across all major habitat types in the reach. Habitat types include snags and Program staff members performed site visits to assure monitoring was performed according to MPCA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

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%
9/8/13	132	**5.5**	1	11	Nematoda	56%
9/14/14	406	**4.9**	2	11	Hydropsychidae	48%

Primary Sampling Data for Locke Lake 'Park'



Locke Lake 'Park' Data Summary

Family Biotic Index (FBI): SHEP field sampling results produced a score of 4.9 for the Rice Creek 'Park' site. This score corresponds to a "Good" rating on the Family Biotic Index stream health chart. This compares to a stream health score of 6.4 ("Fairly Poor) in 2013 and 4.7 (Good) in 2012. This is the third year that this site has been sampled. There is variation in the represented families and their abundances. More years of sampling will help identify a FBI health trend.

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. 406 invertebrates were identified in this sample. This sample size is excellent.

Dominant Family: The dominant family was Hydropsychidae (Caddisflies), which dominated 48% of the sample. Hydropsychidae are common net-spinner caddisflies, and have a tolerance value of 4 (moderate). Hydropsychidae are collectors/filterers. They are restricted to flowing waters, and are most commonly collected from areas with cobble or bedrock substrate where solid structures are available on which to attach their nets. They glean material that is collected in their nets. In some situations, such as below pond outflows and downstream of sewage treatment plants, they can reach large densities. (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: 11 families were identified in the sample. This compares with 11 families identified in 2013 and 14 in 2012. In general, a more diverse sample suggests a healthier stream environment.

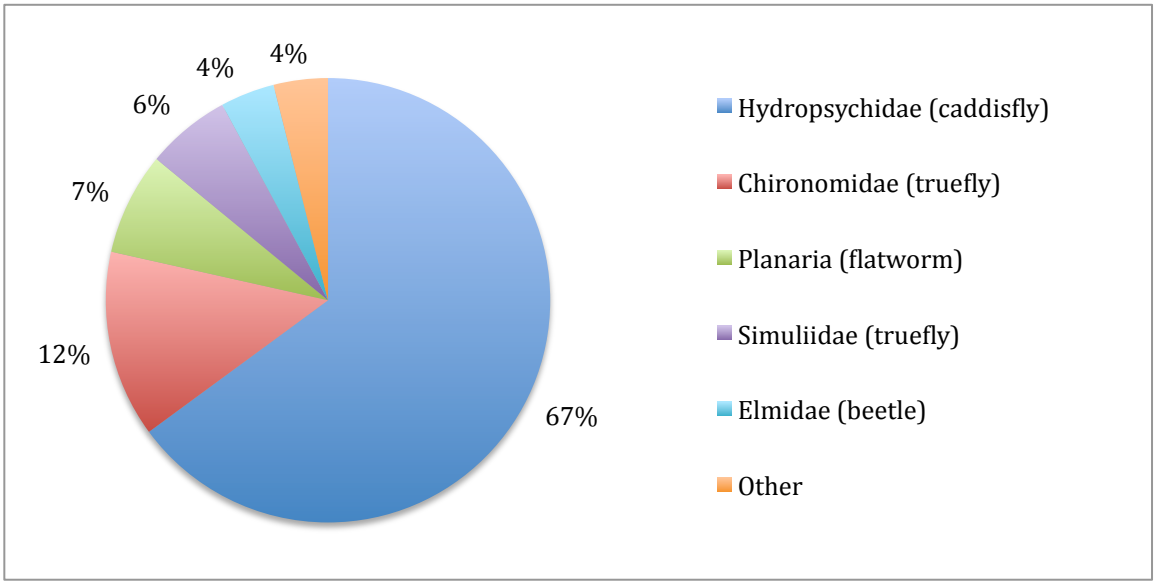
EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample,

the better. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. In 2014, 2 EPT families (Baetidae (Mayflies) and Hydropsychidae (Caddisflies)) were identified and made up 48% of the sample.

4.4.4b 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%
9/08/13	107	**4.9**	2	9	Hydropsychidae	42%
9/14/14	228	**4.4**	2	9	Hydropsychidae	67%
Cross Check Results:						
9/20/08	115	**4.9**	4	17	Hydropsychidae	33%
9/19/09	107	**6.7**	4	14	Corixidae	36%

Primary Sampling Data for Locke Lake 'Above'



Locke Lake 'Above' Data Summary

Family Biotic Index (FBI): SHEP field sampling results produced a score of 4.4 for the Locke Lake 'Above' site. This score corresponds to a "Good" rating on the Family Biotic Index stream health chart. This shows a slight improvement in stream health scores from 2013 (4.9), 2012 (5.2) and 2011 (5.4). Scores at this site have steadily improved since 2009 (6.1). In 2014, the diversity was stable, and the dominant family (Hydropsychidae) dominated an even larger portion of the sample than in 2013. While this improved the FBI score, the high dominance of a single family is not ideal.

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. 228 invertebrates were identified in this sample. This sample size is good.

Dominant Family: The dominant family was Hydropsychidae (Caddisflies). Hydropsychidae are common net-spinner caddisflies and have a tolerance value of 4 (moderate) and dominated 67% of the sample. Hydropsychidae are collectors/filterers. They are restricted to flowing waters, and are most commonly collected from areas with cobble or bedrock substrate where solid structures are available on which to attach their nets. They glean material that is collected in their nets. In some situations, such as below pond outflows and downstream of sewage treatment plants, they can reach large densities (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: 9 families were identified in the sample. This compares to 9 families in 2013 and 18 families in 2012. In general, a more diverse sample suggests a healthier stream environment.

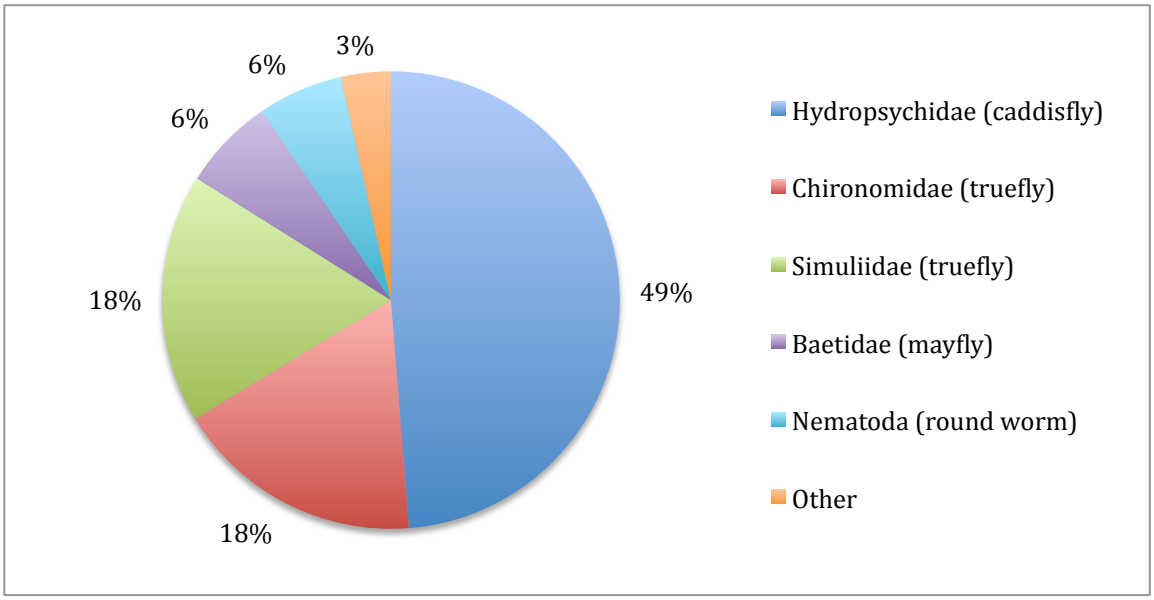
EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. 2 EPT families (Hydropsychidae (Caddisflies) and Psychomyiidae (Caddisflies)) were identified and made up 69% of the sample.

4.4.4c 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%
9/8/13	225	**5.6**	2	14	Chironomidae	57%
9/14/14	198	**4.8**	2	9	Hydropsychidae	49%
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%

Primary Sampling Data for Locke Lake 'Below'



Locke Lake 'Below' Data Summary

Family Biotic Index (FBI): SHEP field sampling results produced a score of 4.8 for the Locke Lake 'Below' site. This score corresponds to a "Good" rating on the Family Biotic Index stream health chart. This compares favorably to stream health scores from 2013 (5.6) and 2012 (5.6). This stream remains 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. 198 invertebrates were identified in this sample. This sample size is adequate.

Dominant Family: The dominant family was Hydropsychidae (Caddisflies), which dominated 49% of the sample. Hydropsychidae are common net-spinner caddisflies with a tolerance value of 4 (moderate). Hydropsychidaes are collectors/filterers. They are restricted to flowing waters, and are most commonly collected from areas with cobble or bedrock substrate where solid structures are available on which to attach their nets. They

glean material that is collected in their nets. In some situations, such as below pond outflows and downstream of sewage treatment plants, they can reach large densities. (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: 9 families were identified in the sample. This compares to 14 families in 2013 and 15 families in 2012. 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. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. In 2014, 2 EPT families (Baetidae (Mayflies) and Hydropsychidae (Caddisflies)) were identified and made up 56% 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**	**2013**	**2014**
Locke Lake 'Above'	5.0	5.1	5.7	6.1	5.9	5.4	5.2	4.9	4.4
Locke Lake 'Below'	5.3	5.7	5.1	5.0	5.0	5.7	5.6	5.6	4.8
Locke Lake 'Park'	Na	Na	Na	Na	Na	Na	4.7	6.4	4.9
Cross Check 'Above'	-	-	4.9	6.7	-	-	Na	Na	Na
Cross Check 'Below'	4.3	5.4	-	-	5.6	5.1	Na	Na	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 Locke Lake 'Above' (4.4), 'Below' (4.8), and 'Park' (4.9) sites show some of the strongest FBI scores in the watershed.

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