RICE CREEK WATERSHED STREAM HEALTH EVALUATION PROGRAM (SHEP)

2015 BENTHIC MACROINVERTEBRATE STREAM MONITORING REPORT

March 31st, 2016

Trevor A. Russell
Kate Clayton

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

Acknowledgements

The 2015 Rice Creek Watershed Stream Health Evaluation Program wishes to recognize the following individuals and organizations for their dedication to the success of this program.

Local Government:

The Rice Creek Watershed District
Mounds View Public Schools
Edgewood Middle School

Organizations:

Fortin Consulting

Special Recognition:

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

Katie Farber & Connie Fortin – Fortin Consulting
Gary Averbek – SHEP Team Leader
Wayne LeBlanc – SHEP Team Leader
James Brozowski – SHEP Team Leader
Courtney Jones – SHEP Team Leader
Katherine & Darrell Majkrzak – SHEP Team Leaders

2015 Rice Creek SHEP Volunteers:

The 2015 Rice Creek Watershed Stream Health Evaluation Program extends our most sincere appreciation to all of the SHEP volunteers who donated their time in the stream and in the lab last summer and fall. Each of these volunteers contributed between 30 and 80 hours of volunteer service in monitoring the health of our water resources. Thank You!

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

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

Team Three: Katherine Majkrzak*, Darrell Majkrzak*, Cathi Lyman-Onkka, Rob Schroeder, Juliette Schroeder, John Steinworth, Annika Taylor, Ross Whitmore, Susan Young, Maggie Voth.

** 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
2015 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 2015 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, Anoka County Parks, and local landowners.

Primary funding for this program was made possible by the Rice Creek Watershed District. Matching resources for the 2015 SHEP season were provided by Friends of the Mississippi River.

The program recruited 27 adult volunteers and two teen volunteers 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.

SHEP has not only become a reliable source of high-quality data, the program has an established history of recruiting and retaining dedicated volunteers. For more information on feedback about the program from 2015 SHEP volunteers, see Appendix B.

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 in 2015 were led by staff from Friends of the Mississippi River in partnership with Rice Creek Watershed District Staff. Recruitment of volunteers was conducted through previous years volunteers friends and family. No attempts were made to recruit new volunteers in to the program in 2015.

A total of 29 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 and Wayne LeBlanc
Team Members: Amy Anderson, Barbara Bor, Linda Gruntner, Tere O'Connell, Dana Raines, Robin Turner.

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, Jo Ann Morse, Kelsey Thurow, Rod Venterea, Ricco 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, Rob Schroeder, Juliette Schroeder, John Steinworth, Annika Taylor, Ross Whitmore, Susan Young, Maggie Voth.

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 29th 2015 at Edgewood Middle School in Mounds View, 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.

The second training, held on Saturday, September 26th 2015 at Edgewood Middle School, was led by FMR and Fortin Consulting staff and was designed to focus on laboratory analysis portions of the Stream Health Evaluation Program. This training session included benthic, sample sorting and sample processing, general lab skills as well as provided a venue for teams to start the identification process and ask questions.

2.4 Site Selection

Stream monitoring sites were selected by RCWD staff. Several sites included in the 2015 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. 2015 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 2015. 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 2015. 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: Clearwater Creek sample
Accuracy Score: **100%**

Team Two:
Sample: Rice Creek 'Above' sample
Accuracy Score: **99.6%**

Team Three:
Sample: Locke Lake 'Above' sample
Accuracy Score: **100%**

The overall combined QA/QC accuracy score for the 2015 Rice Creek Watershed Stream Health Evaluation Program was: 99.9%.

3.0 MONITORING TERMS

3.1 Monitoring Terms

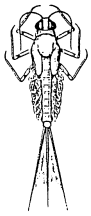
The descriptions below will help readers understand the results presented on the following pages.

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 2015 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.

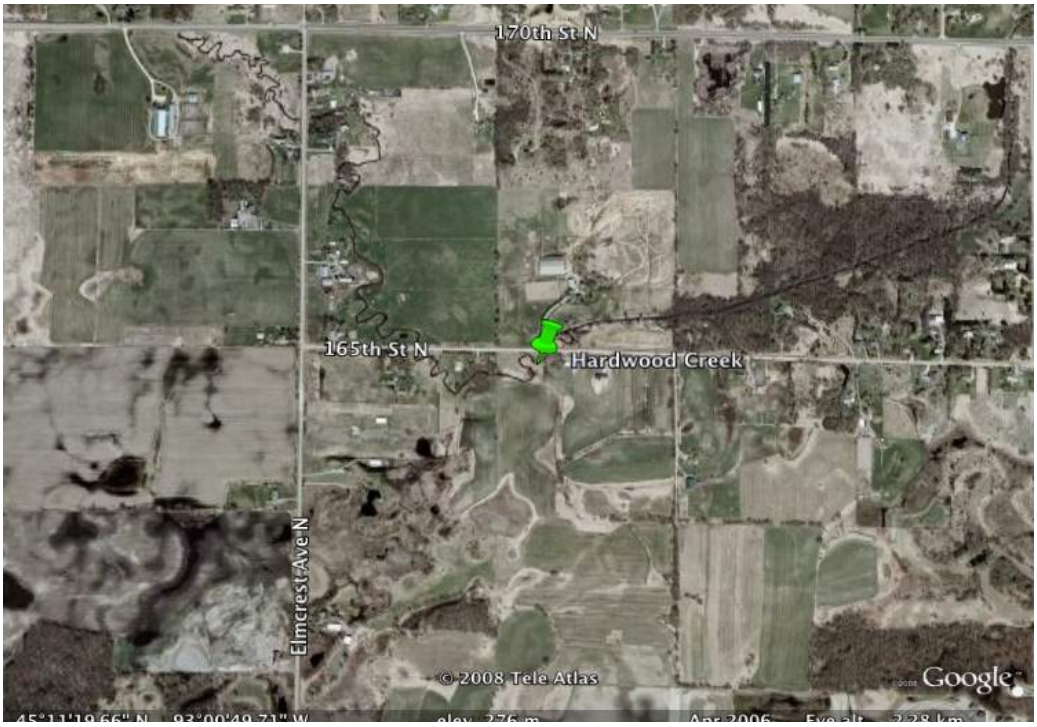
In the summer of 2006, as part of a grant from the Legislative Commission on Minnesota Resources (LCMR), three locations along Hardwood Creek that were identified as having severe bank erosion were stabilized and in-stream habitat improvement techniques were utilized.

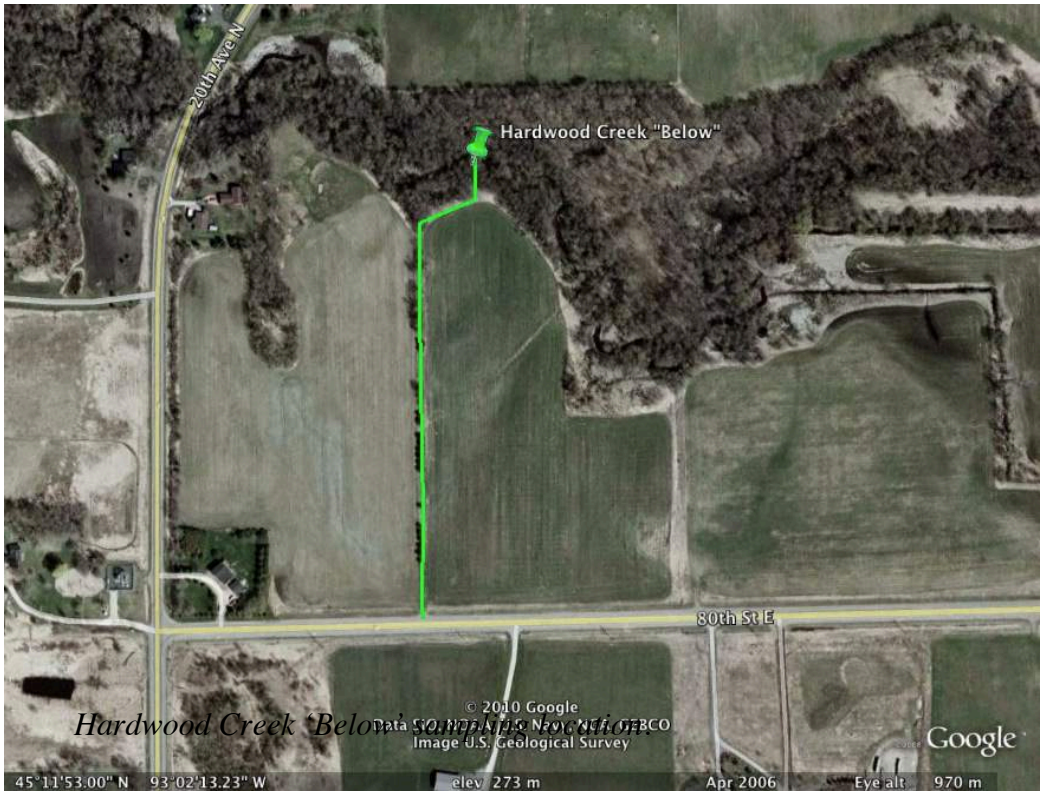
4.1.2 Site Maps

Below are maps of each of the 2015 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 and Wayne LeBlanc
Team Members: Amy Anderson, Barbara Bor, Linda Gruntner, Tere O'Connell, Dana Raines, Robin Turner.

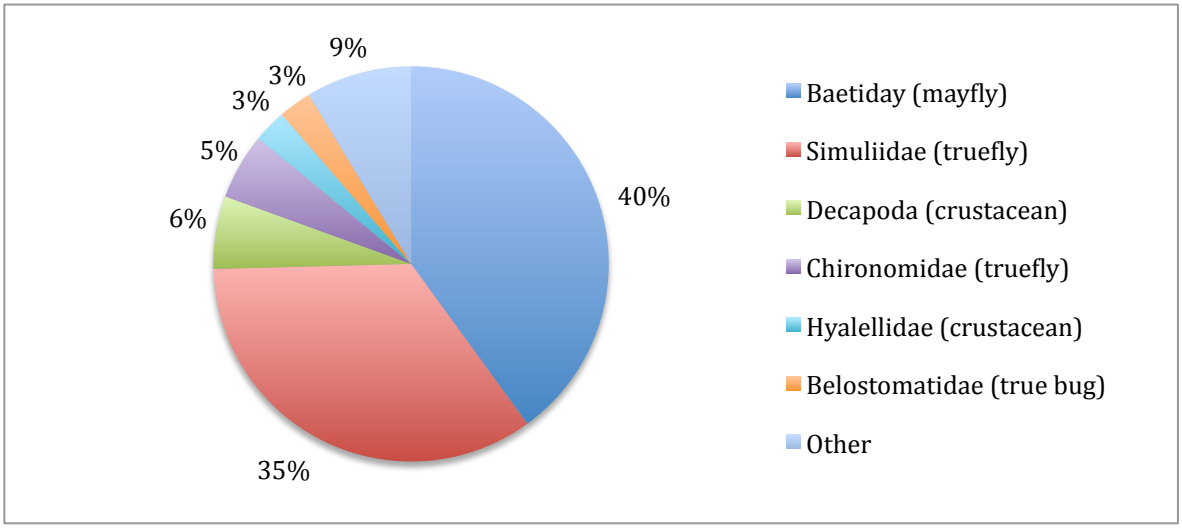
SHEP volunteers used the MPCA's multi-habitat monitoring protocol at this monitoring location. At least 20 dip-net samples (or 'jabs') were taken from across all major habitat types in the reach. Program staff members performed site visits to assure monitoring was performed according to MPCA guidelines 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%
9/05/15	184	**5.2**	4	12	Baetidae	40%

Primary Sampling Data for Hardwood Creek 'Above'



Hardwood Creek 'Above' Data Summary

Family Biotic Index (FBI): The 2015 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 trend indicates an improving stream health, although it stayed stable in the last two years. The data from year to year is variable; however, the data from 2014 and 2015 samples are nearly identical. They have similar sample sizes, dominant families, EPT families, total number of families, and FBI scores. The same EPT families have been represented in the samples for many years. Variability in family representation may be caused by environmental factors including water levels, habitat availability, or other sources of disturbance in the area.

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. 184 invertebrates were identified in this sample, this is a good sample size.

Dominant Family: The dominant family, Baetidae, has a tolerance value of 4 on a scale of 0-10. (The lower the tolerance value, the lower their tolerance to pollution). Small minnow mayflies are small, and may be very abundant in ideal conditions. They are good swimmers, and are found in streams with moderate currents or slack water. Some species are common in polluted streams. (*Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr.*)

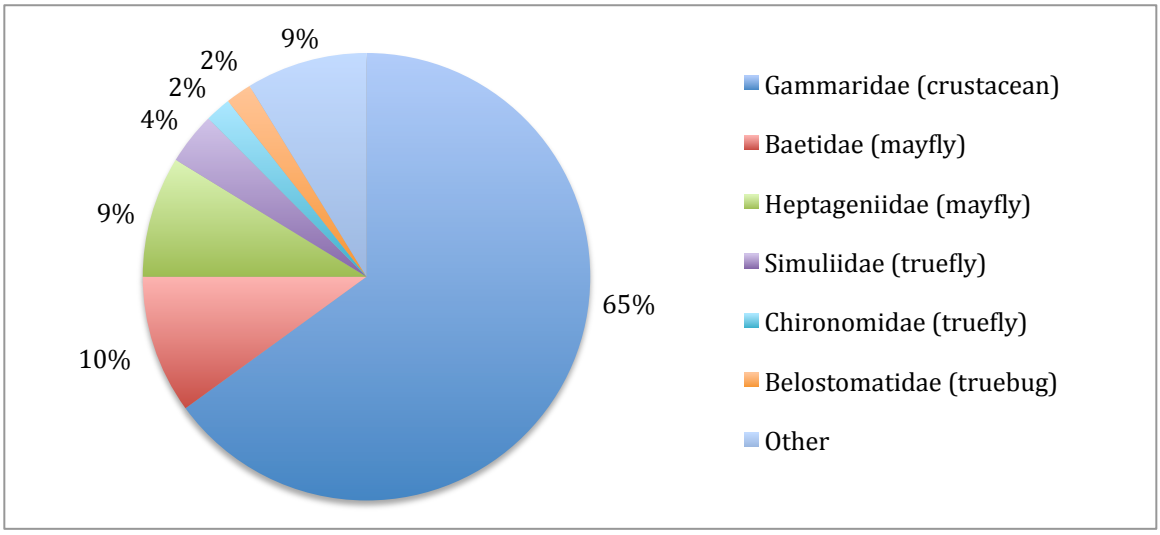
Number of Families: In 2015, 12 families were identified in the sample. This compares to 13 families in 2014 and 12 families in 2013. In general, a more diverse sample suggests a healthier stream environment.

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 2015, 4 EPT families (Baetidae (Mayflies), Heptageniidae (Mayflies), Hydropsychidae (Caddisfly), and Caenidae (Mayflies)) were identified in the sample and made up 46% 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%
9/05/15	159	**4.4**	4	13	Gammaridae	65%

Primary Sampling Data for Hardwood Creek 'Below'



Hardwood Creek 'Below' Data Summary

Family Biotic Index (FBI): Our 2015 SHEP field sampling results produced a score of 4.4 for the Hardwood Creek 'Below' site. The family biotic index (FBI) trend for Hardwood Creek Below appears stable. The overall family representation and population sizes are very similar throughout most of the years. This similarity is highlighted by stable FBI scores, dominant families, EPT families, and overall family representation. 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. 159 invertebrates were identified in this sample. This sample size is a good size.

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).

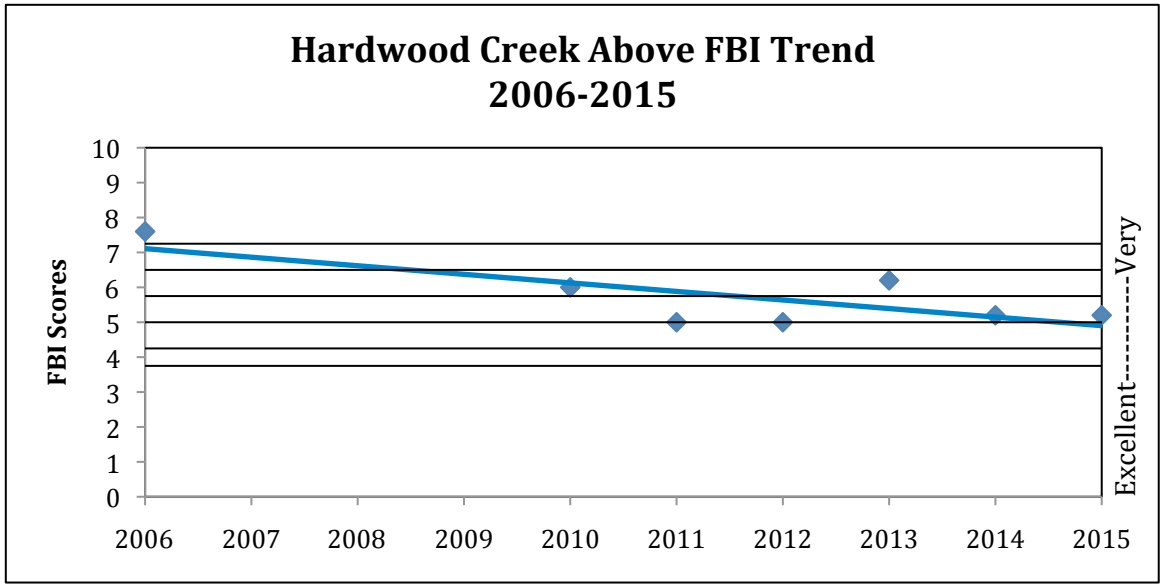
Number of Families: 13 families were identified in the sample. This compares to 10 families in 2014 and 15 families in 2013. In general, a more diverse sample suggests a healthier stream environment.

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,

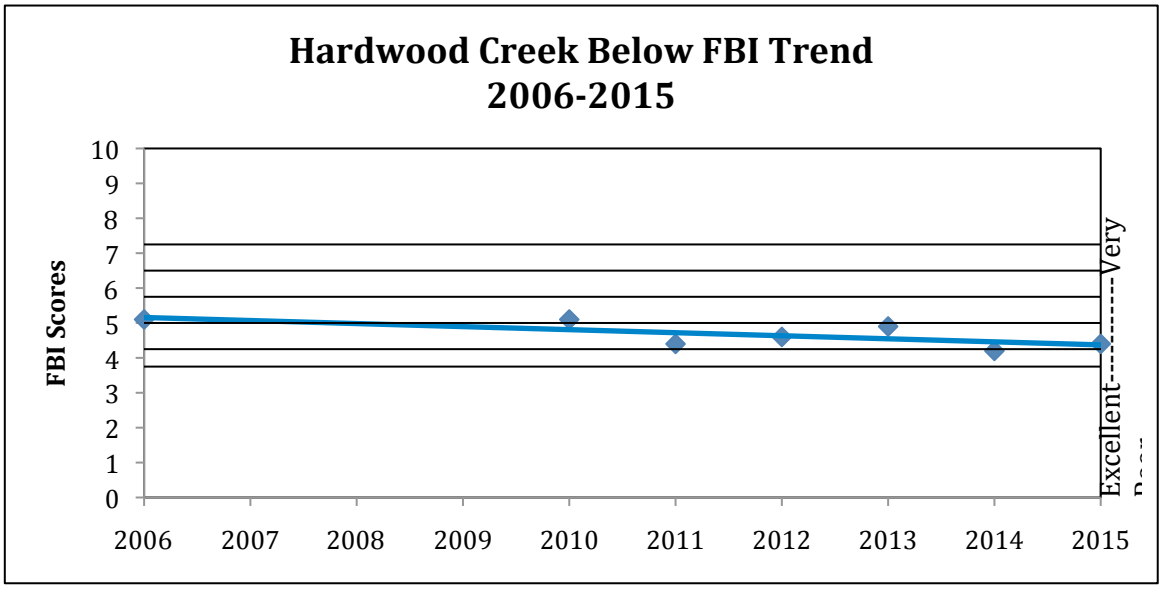
the better. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. A total of 4 EPT families (Baetidae (Mayflies), Heptageniidae (Mayflies), and Hydropsychidae (Caddisfly), Leptoceridae (Caddisfly)) were identified in the sample and made up 22% 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**	**2015**
Hardwood Creek 'Above'	7.2	6.3	6.6	6.0	5.0	5.0	6.2	5.2	5.2
Hardwood Creek 'Below'	NA	NA	NA	5.1	4.4	4.6	4.9	4.2	4.4



The FBI trend at this site indicates an improving stream health, although it stayed stable in the last two years. The data from year to year is variable; however, the data from 2014 and 2015 samples are nearly identical. They have similar sample sizes, dominant families, EPT families, total number of families, and FBI scores. The same EPT families have been represented in the samples for many years. Variability in family representation may be caused by environmental factors including water levels, habitat availability, or other sources of disturbance in the area.



The FBI trend at this site appears stable. The overall family representation and population sizes are very similar throughout most of the years. This similarity is highlighted by stable FBI scores, dominant families, EPT families, and overall family representation. The FBI score fluctuates with the annual difference in family diversity and percentage make-up.

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.

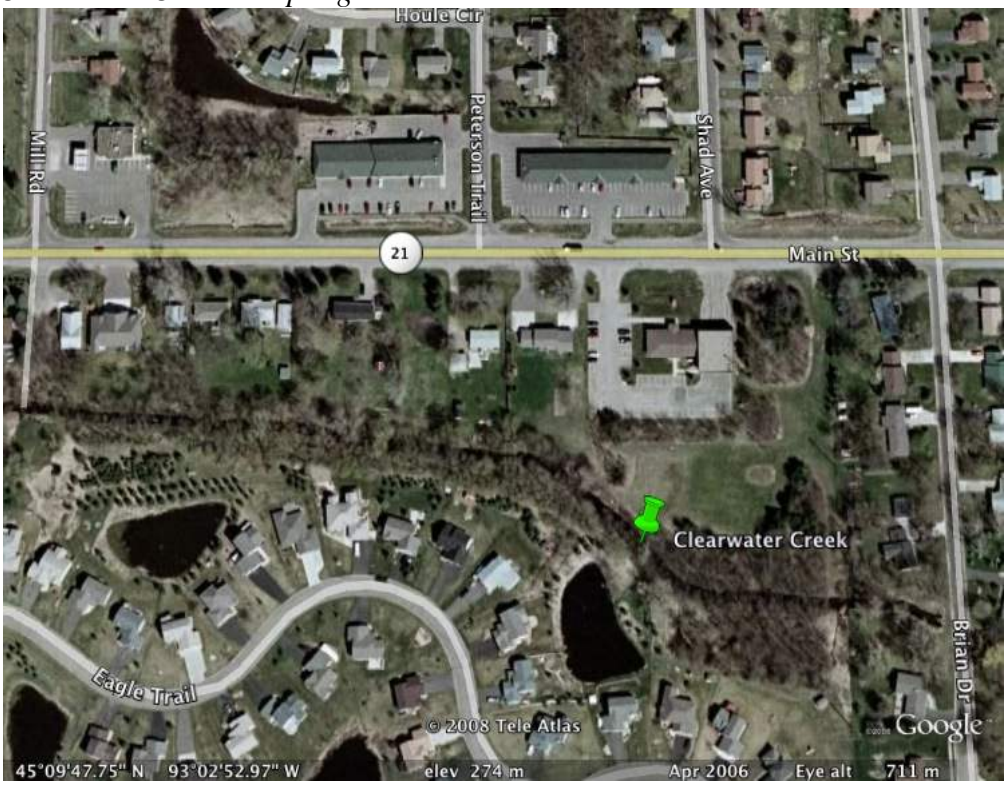
Clearwater Creek is listed as impaired for biota, though recent stream samples indicate low levels of most water quality pollutants. Additional information is available in the Rice Creek Watershed District's 2009 Stream Monitoring Report.

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.

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 and Wayne LeBlanc
Team Members: Amy Anderson, Barbara Bor, Linda Gruntner, Tere O'Connell, Dana Raines, Robin Turner.

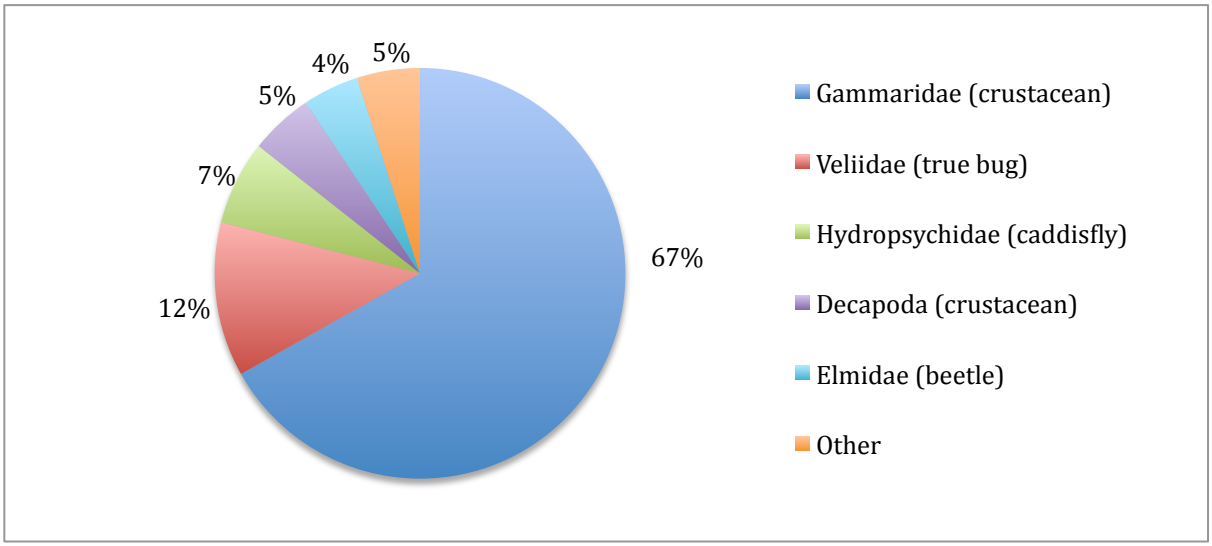
SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location. At least 20 dip-net samples (or 'jabs') were taken from across all major habitat types in the reach. Program staff members performed site visits to assure monitoring was performed according to MPCA guidelines 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%
9/05/15	181	**4.4**	3	10	Gammaridae	67%
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 4.4 for the Clearwater Creek site. This score corresponds to a "Good" rating on the Family Biotic Index stream health chart. There are several constants at this stream. FBI trend remains stable despite a few years of variability. In addition, Gammaridae has consistently dominated the samples, and EPT families are similar; however, in 2015, Heptageniidae, which has been an EPT family for most years, was not represented in the sample. In 2015, the number of families represented declined. Variability in family representation may be caused by environmental factors including water levels, habitat availability, or other sources of disturbance in the area.

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. 181 invertebrates were identified in this sample. This sample size in a good size.

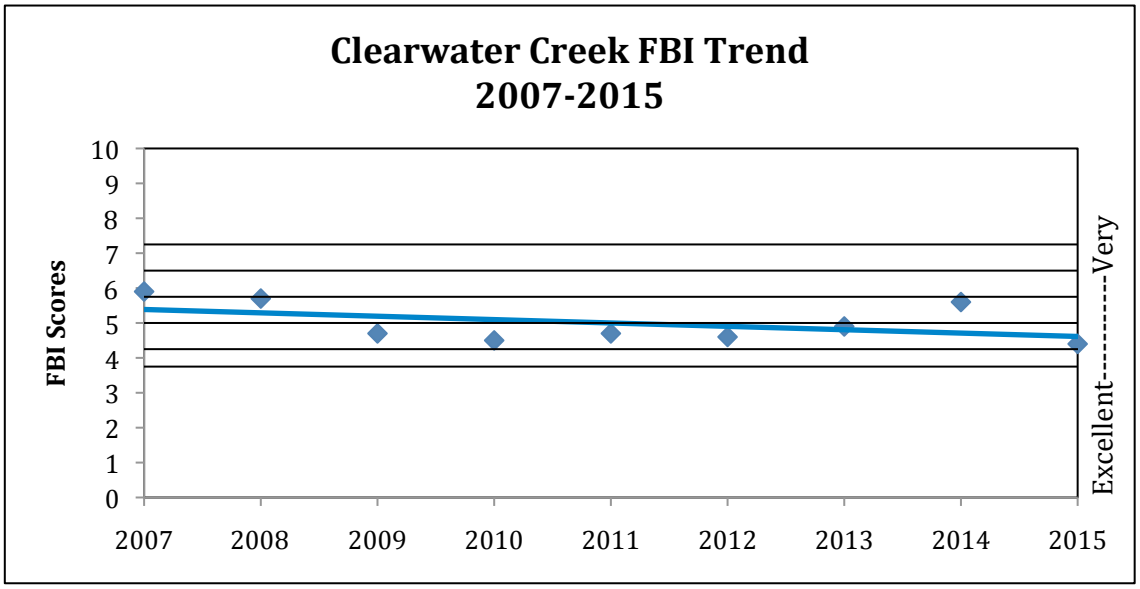
Dominant Family: The dominant family was Gammaridae have a tolerance value of 4 (moderate) on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). Gammaridae are crustaceans and related to Hyalellidaes. The differentiation between the two families is a tiny flagellum found on the antennae of the Gammaridae. They can be extremely abundant in water bodies without fish and are important in the breakdown of organic matter. They generally live in shallow regions of most waterbodies, and are found in snags and vegetation. They are an important food source for fish and other invertebrate predators. (*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 11 families in 2014 and 12 families in 2013. 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 2015, 3 EPT families (Baetidae (Mayfly), Leptoceridae (Caddisfly), and Hydropsychidae (Caddisfly)) were identified in the sample and made up 8% 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**	**2015**
Clearwater Creek	5.9	5.5	6.3	4.5	4.7	4.6	4.9	5.6	4.4
Cross Check	5.9	6.8	4.7	Na	Na	Na	Na	Na	Na



A stream health trend was created using scores calculated for family biotic index (FBI). A descending trend line indicates improvement in the stream health since organisms with sensitivity to water pollution score lower on the family biotic index.

There are several constants at this stream. FBI trend remains stable despite a few years of variability. In addition, Gammaridae has consistently dominated the samples, and EPT families are similar; however, in 2015, Heptageniidae, which has been an EPT family for most years, was not represented in the sample. In 2015, the number of families represented declined. Variability in family representation may be caused by environmental factors including water levels, habitat availability, or other sources of disturbance in the area.

4.3 Rice Creek Sites

4.3.1 Existing Conditions

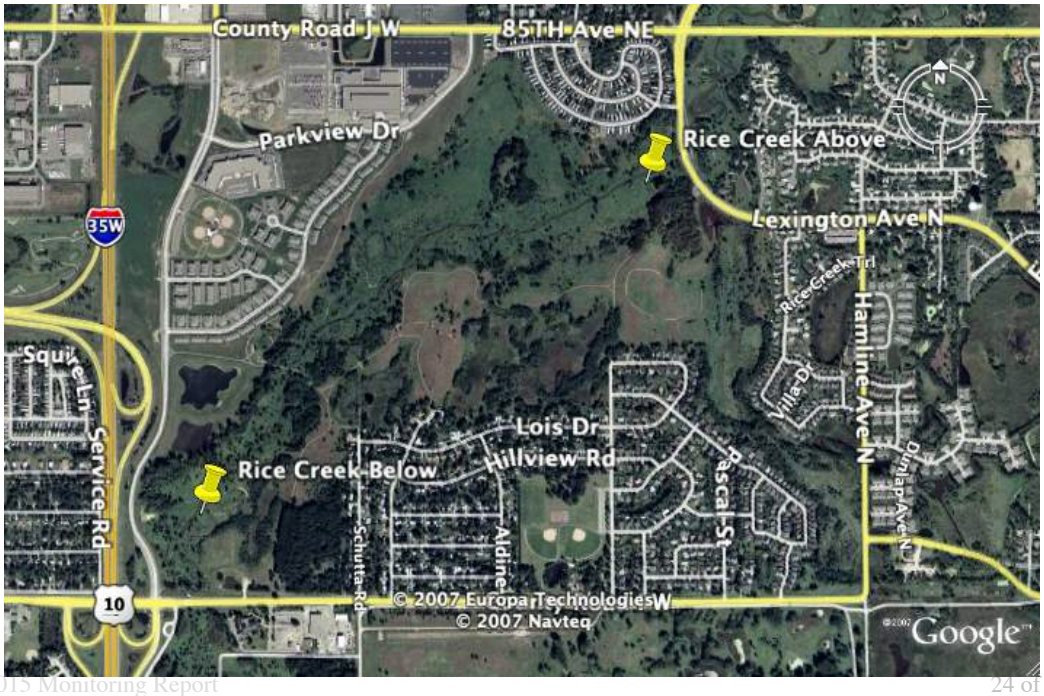
The main stem of Rice Creek run from the Rice Creek Chain of Lakes south and west through Long Lake and Locke Lake before discharging into the Mississippi River in Fridley, MN. Watershed District and Emmons & Olivier Resources Inc. completed a re-meander and restoration of a significant reach of Rice 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 Leader: James Brozowski & Courtney Jones

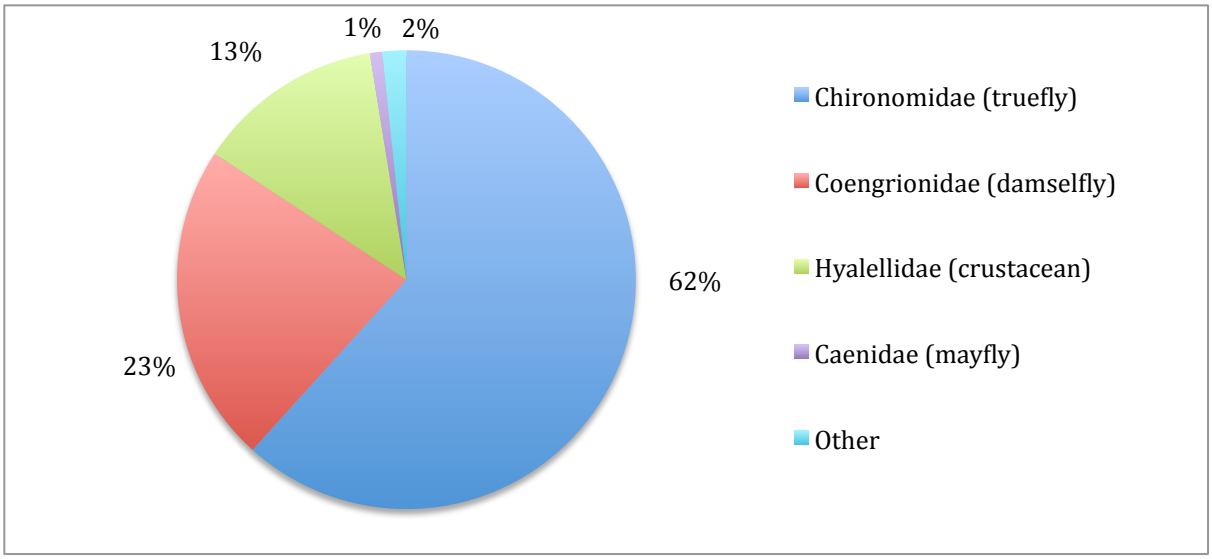
Team Members: Bob Bartlett, Ralph Butkowski, Gary Ellis, Julie Glanton, Trystan Johnson, Jo Ann Morse, Kelsey Thurow, Rod Venterea, Ricco Venterea.

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%
9/12/15	235	**6.9**	2	8	Chironomidae	62%
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 6.9 for the Rice Creek 'Above' site. This score corresponds to a "Poor" rating on the Family Biotic Index stream health chart. Despite variable scores, the FBI health trend appears to be improving. The FBI score declined in 2015 compared to 2013 and 2014; however, it is not as poor as earlier years. The family representation and percentage make-up vary from year to year. Chironomidae has remained the dominant family for three consecutive

years. The number of families represented in the sample are the lowest (8) ever identified at this site.

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. 235 invertebrates were identified in this sample. This is a good sample size.

Dominant Family: The dominant family was Chironomidae (Midges). Chironomidae dominated 62% 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).

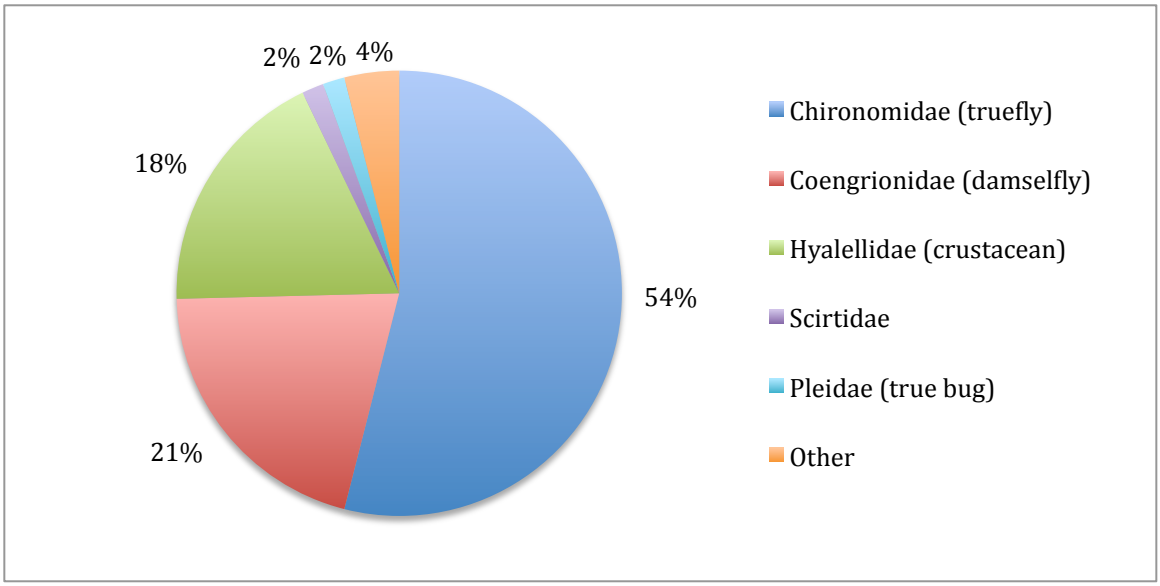
Number of Families: 8 families were identified in the sample. This compares to 11 families in 2014 and 13 families in 2013. In general, a more diverse sample suggests a healthier stream environment.

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 2015, 2 EPT families were identified in the sample (Caenidae (Mayflies) and Baetidae (Mayflies)) and made up 1% 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%
9/12/15	125	**6.8**	3	9	Chironomidae	54%
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 6.8 for the Rice Creek 'Below' site. This score corresponds to a "Poor" rating on the Family Biotic Index stream health chart. The FBI scores are variable; however, the site shows slight improvement. Chironomidae and Hyalellidae consistently dominate the samples. These families have mid to poor pollution tolerance values. The FBI score is affected by fluctuations in family representation may be caused by environmental factors including water levels, habitat availability, or other sources of disturbance in the area.

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. 125 invertebrates were identified in this sample. This is a good sized sample.

Dominant Family: The dominant family was Chironomidae (Midges). Chironomidae dominated 21% 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 9 families in 2014 and 16 families in 2013. In general, a more diverse sample suggests a healthier stream environment.

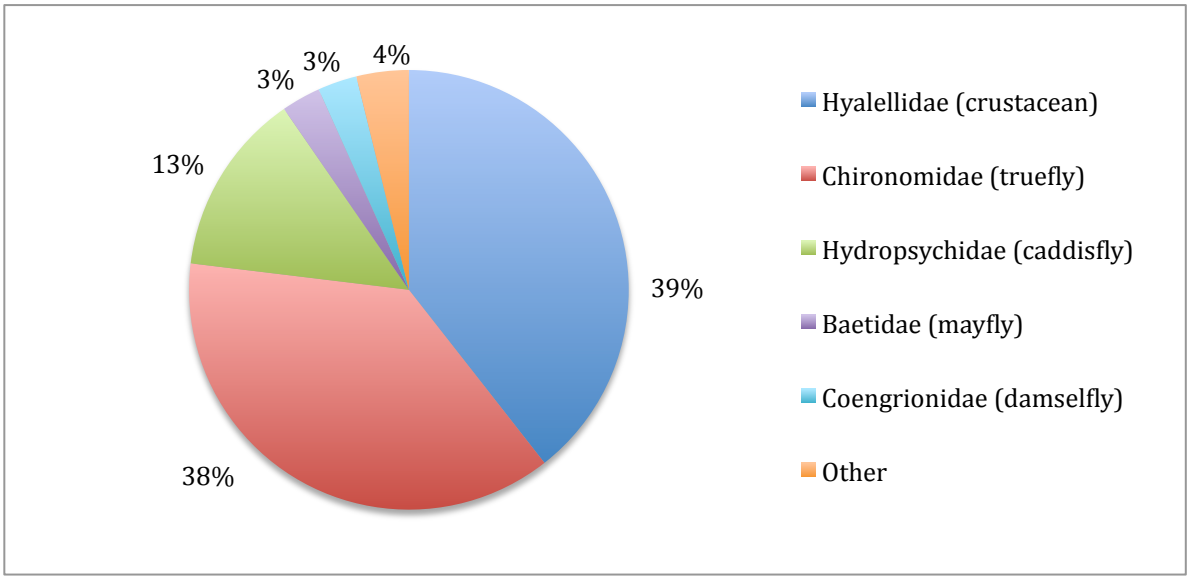
EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. In healthy streams, more than 10-12 EPT families is considered good; in an

urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. In 2015, 3 EPT families (Caenidae (Mayflies), Leptoceridae (caddisfly), and Hydropsychidae (Caddisflies)) were identified in the sample. This is an improvement from 2014 where 2 EPT families 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%
8/29/15	104	**6.7**	2	8	Hyalellidae	39%

Primary Sampling Data for Rice Creek 'Irondale'



Rice Creek 'Irondale' Data Summary

Family Biotic Index (FBI): SHEP field sampling results produced a score of 6.7 for the Rice Creek 'Irondale' site. This score corresponds to a "Poor" rating on the Family Biotic Index stream health chart. This is a decrease from the 2014 rating of 6.0, but similar to the 6.8 FBI scores in 2012 and 2013. This is the fourth 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. 104 invertebrates were identified in this sample. This is an acceptable sample size.

Dominant Family: The dominant family was Hyalellidae (scuds). Hyalellidae have a tolerance value of 8 (high) on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). Hyaliellidaes are crustaceans. They can be extrememly abundant in water bodies without fish and are important in the breakdown of organic matter. They generally live in shallow regions of most waterbodies, and are found in snags and vegetation. They are an important food source for fish and other invertebrate predators. (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

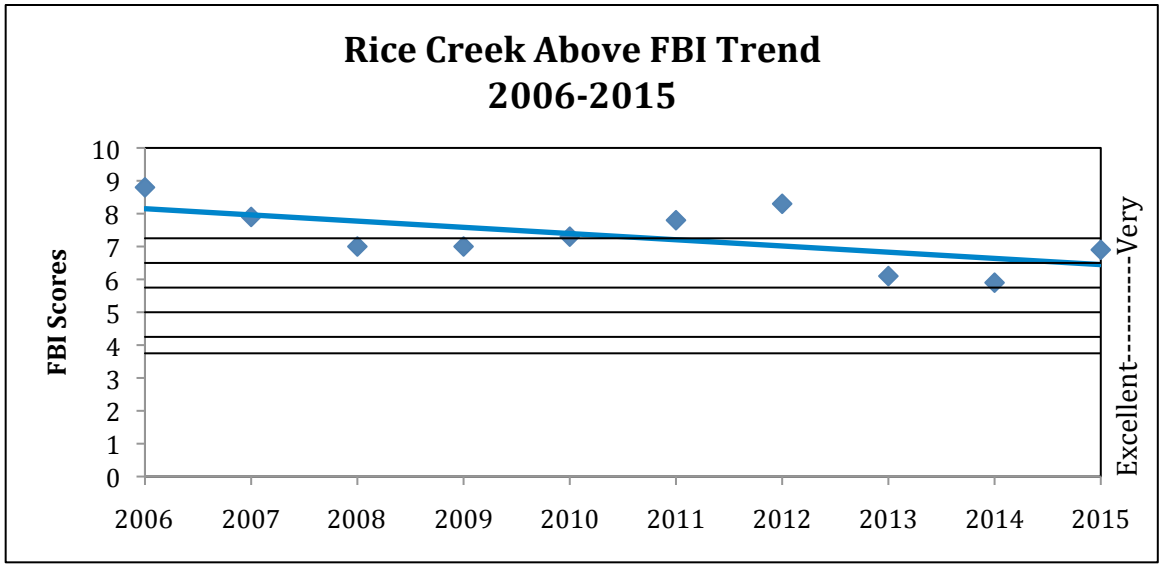
Number of Families: 8 families were identified in the sample. This is a decrease from the 13 families identified in 2014, 2013, and 2012. In general, a more diverse sample suggests a healthier stream environment.

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 2015, 2 EPT families (Baetidaae (Mayflies) and Hydropsychidae (Caddisflies)) were identified in the sample.

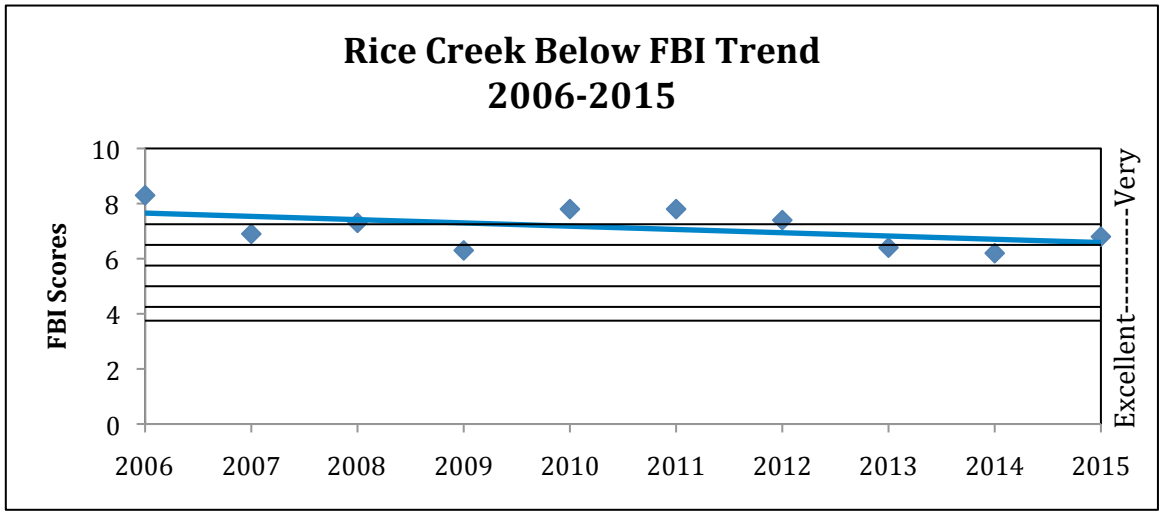
Interpretation of the Hilsenhoff Biotic Index										
Sampling Sites	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Rice Creek 'Above'	8.8	7.9	7.3	7	7.3	7.8	8.3	6.1	5.9	6.9
Rice Creek 'Below'	8.3	6.7	5.2	6.3	7.8	7.8	7.4	6.4	6.2	6.8
Rice Creek 'Irondale'	Na	Na	Na	Na	Na	Na	6.8	6.8	6.0	6.7
Cross Check 'Above'	-	-	-	6.8	7.8	-	Na	Na	Na	-
Cross Check 'Below'	6.1	6.8	5.8	-	-	7.4	Na	Na	Na	-

4.3.5 Rice Creek Overall Data Summary

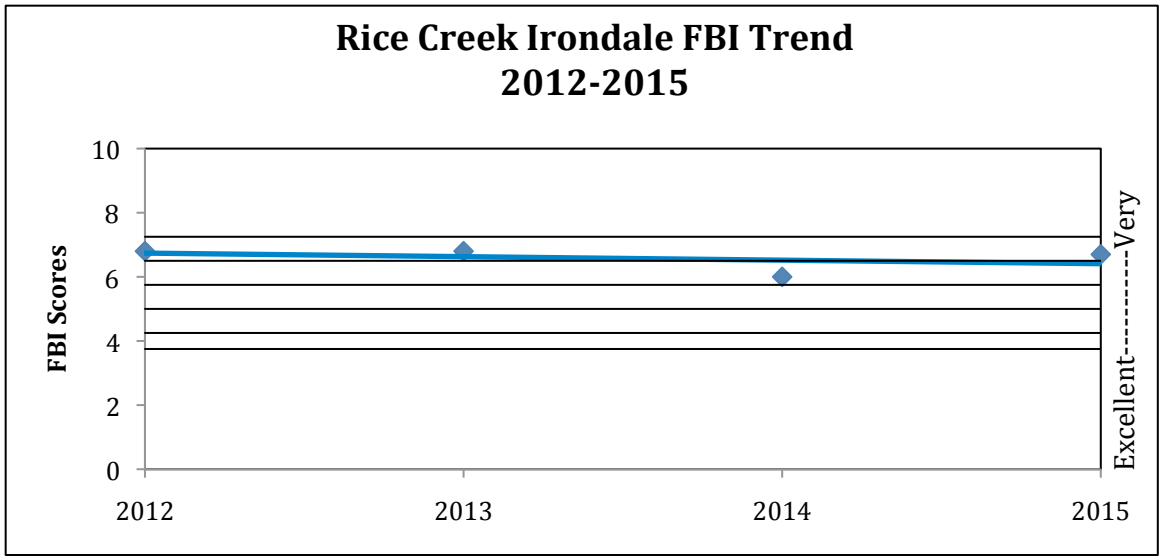
Stream health scores continue to indicate "Fairly Poor" stream health conditions overall, although FBI scores at all three sites have improved in recent years, 2015 saw many of them revert to close to 2011 and 2012 ratings. The individual families present in the samples, and their percentage make-up, have also 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.



A stream health trend was created using scores calculated for family biotic index (FBI). A descending trend line indicates improvement in the stream health since organisms with sensitivity to water pollution score lower on the family biotic index. Despite variable scores, the FBI health trend appears to be improving. The FBI score declined in 2015 compared to 2013 and 2014; however, it is not as poor as earlier years. The family representation and percentage make-up vary from year to year. Chironomidae has remained the dominant family for three consecutive years. The number of families represented in the sample are the lowest (8) ever identified at this site.



The FBI scores are variable; however, the trend line shows slight improvement. Chironomidae and Hyalellidae consistently dominate the samples. These families have mid to poor pollution tolerance values. The FBI score is affected by fluctuations in family representation may be caused by environmental factors including water levels, habitat availability, or other sources of disturbance in the area.



This is the fourth year that this site has been sampled. The FBI scores appear to be constant and stable; however, more years of data will help determine a more accurate trend. In 2015, the diversity and family make-up was altered. The number of families represented declined, the dominant family, which for three years was Chironomidae, was overcome by Hyalellidae. The sample size was acceptable, but smaller. This, along with environmental factors may have affected these changes.

4.4 **Locke Lake Area Sites**

4.4.1 Existing Conditions

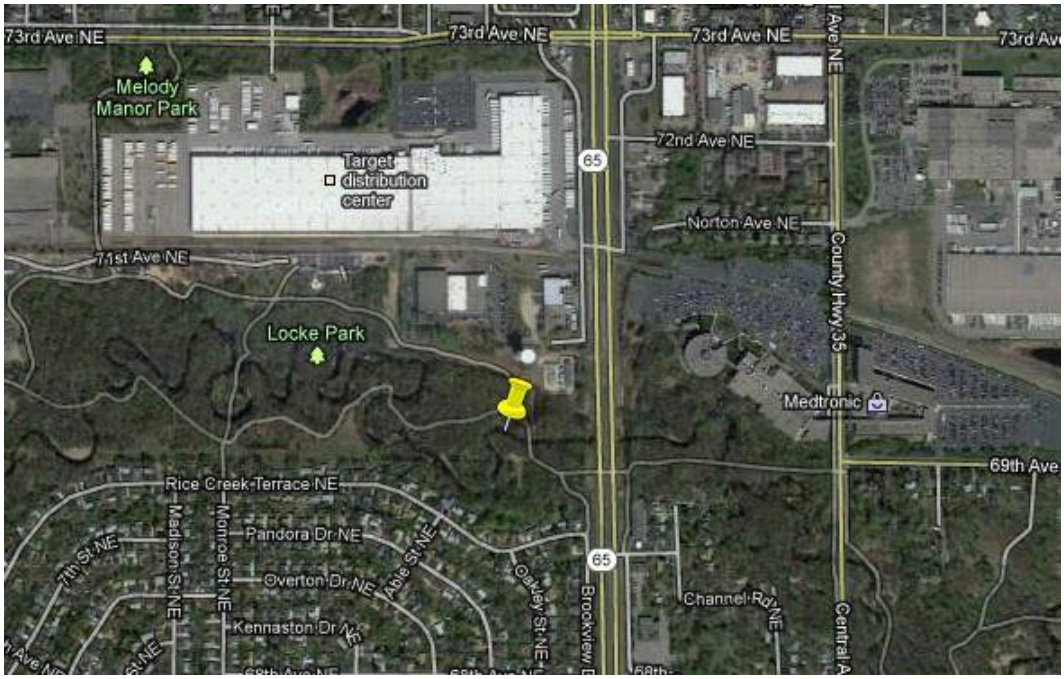
Locke Lake is located just upstream of the Rice Creek Watershed's outlet to the Mississippi River. All outflows from the Rice Creek Watershed pass through the lower reach of the Rice Creek (downstream of Long Lake) and Locke Lake before discharging into the Mississippi River. Recent activity by the Rice 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, Rob Schroeder, Juliette Schroeder, John Steinworth, Annika Taylor, Ross Whitmore, Susan Young, Maggie Voth.

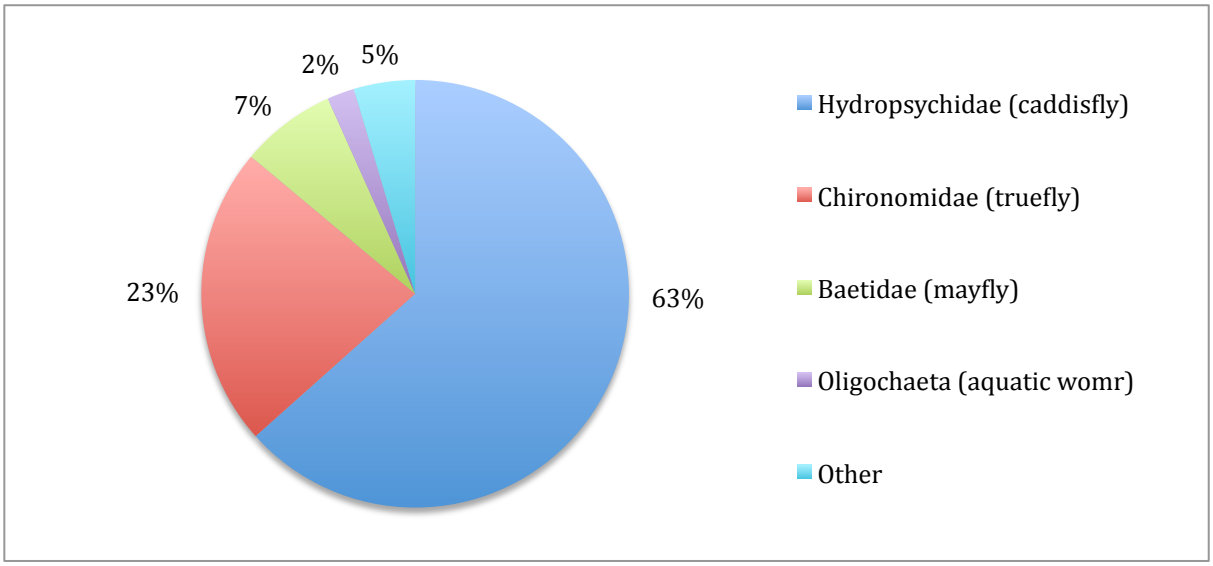
SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location. At least 20 jabs were taken from across all major habitat types in the reach. Habitat types include snags and Program staff members performed site visits to assure monitoring was performed according to MPCA 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%
9/13/15	194	**4.6**	2	10	Hydropsychidae	63%

Primary Sampling Data for Locke Lake 'Park'



Locke Lake 'Park' Data Summary

Family Biotic Index (FBI): SHEP field sampling results produced a score of 4.6 for the Rice Creek 'Park' site. This score corresponds to a "Good" rating on the Family Biotic Index stream health chart. This is the fourth year that this site has been sampled. Except for 2013, the FBI scores appear to be constant and stable; however, more years of data will help determine a more accurate trend. There is variation in the represented families and their abundances. Data is similar in 2014 and 2015.

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. 194 invertebrates were identified in this sample. This is a good sample size.

Dominant Family: The dominant family was Hydropsychidae (Caddisflies), which dominated 63% 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: 10 families were identified in the sample. This compares with 11 families identified in 2014 and in 2013. In general, a more diverse sample suggests a healthier stream environment.

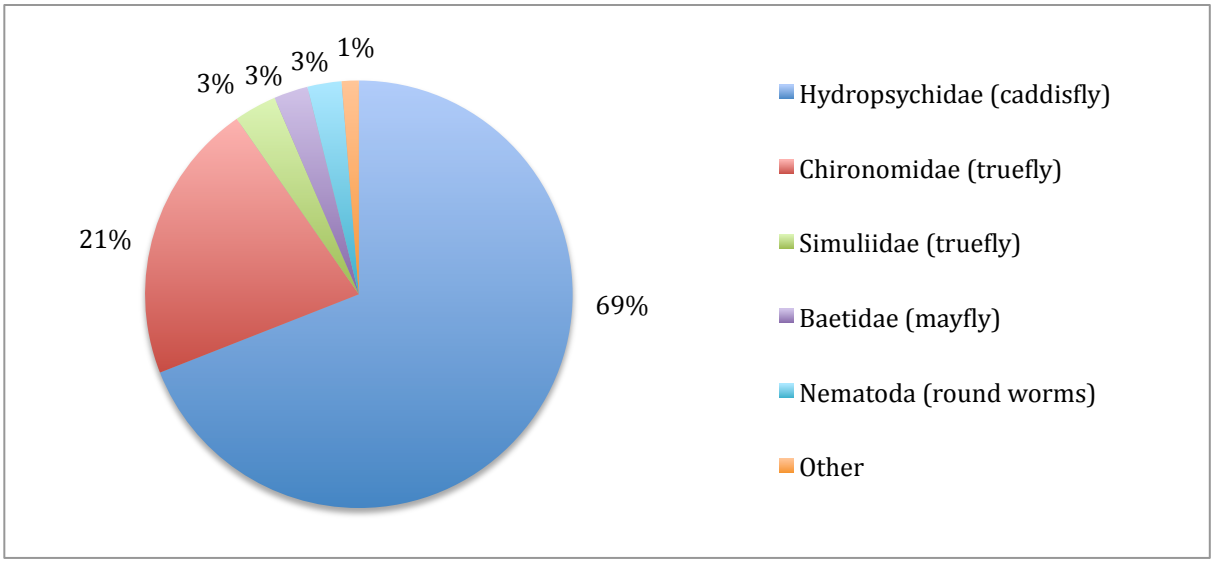
EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample,

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 2015, 2 EPT families (Baetidae (Mayflies) and Hydropsychidae (Caddisflies)) were identified and made up 70% 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%
9/13/15	310	**4.5**	2	9	Hydropsychidae	69%
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 4.5 for the Locke Lake 'Above' site. This score corresponds to a "Good" rating on the Family Biotic

Index stream health chart. The FBI scores have improved slightly every year since 2009. Data from 2014 and 2015 are very similar and are reflected in a similar FBI score, family diversity, and dominant family. The high family dominance and low diversity 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. 310 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 69% 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).

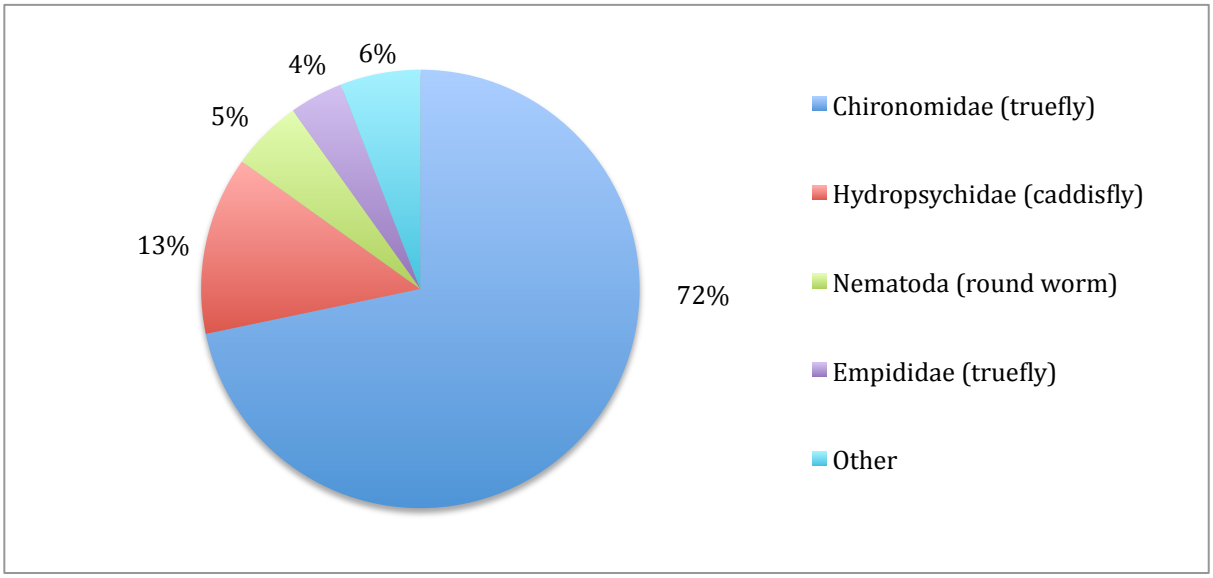
Number of Families: 9 families were identified in the sample. This compares to 9 families in 2014 and 2013. In general, a more diverse sample suggests a healthier stream environment.

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 Baetidae (Mayflies)) were identified and made up 71% 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%
9/13/15	152	**5.7**	1	10	Chironomidae	72%
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 5.7 for the Locke Lake 'Below' site. This score corresponds to a "Fair" rating on the Family Biotic Index stream health chart. The FBI trend appears stable. The dominating family, Chironomidae, has been prevalent for many years. Though the FBI scores are healthy, the heavy dominance of Chironomidae, along with low diversity, 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. 152 invertebrates were identified in this sample. This sample size is good.

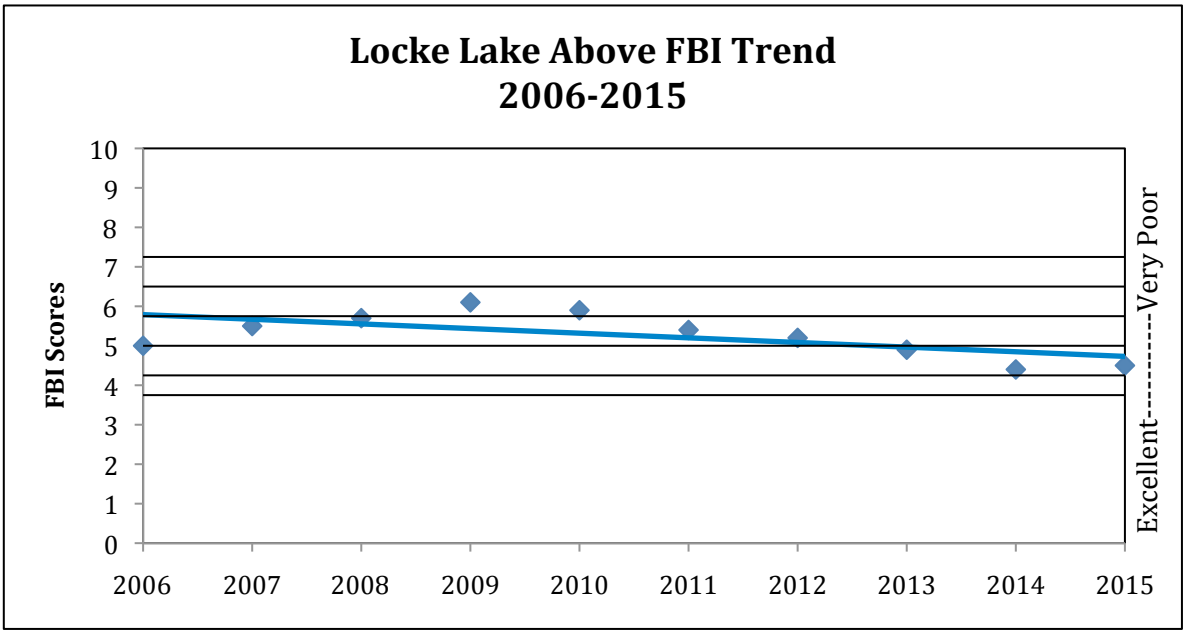
Dominant Family: The dominant family was Chironomidae (midges), which dominated 72% of the sample. Chironomidae have a tolerance value of 6 (moderate) on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are a very abundant and diverse group of aquatic insects, and it is common for them to dominate samples (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: 10 families were identified in the sample. This compares to 9 families in 2014 and 14 families in 2013. 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 2015, 1 EPT family (Hydropsychidae (Caddisflies)) were identified and made up 56% of the sample.

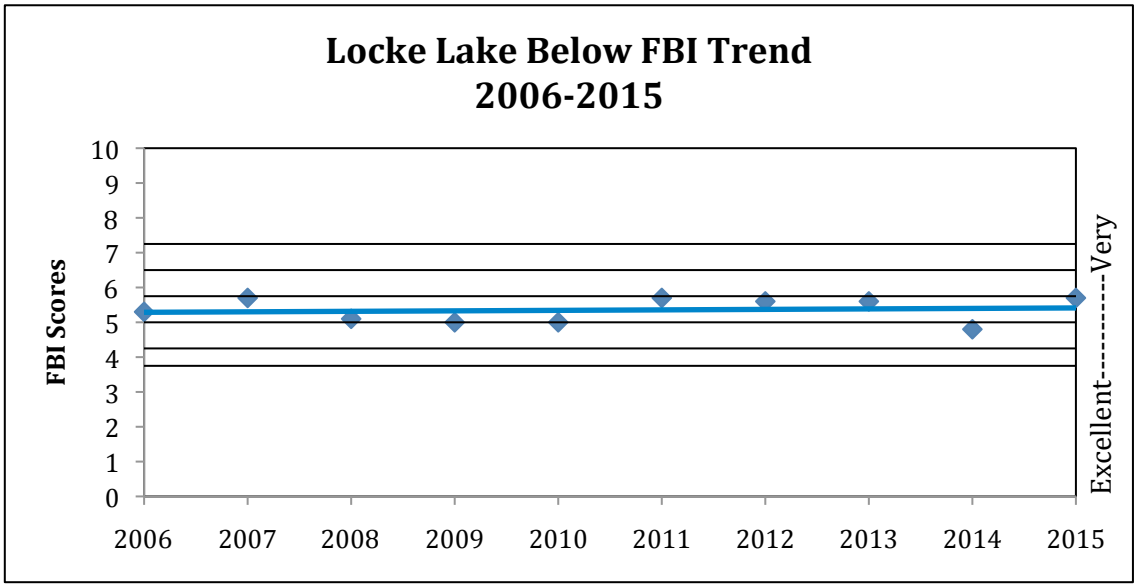
4.4.5 Locke Lake Area Overall Data Summary

Interpretation of the Hilsenhoff Biotic Index										
Sampling Sites	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Locke Lake 'Above'	5.0	5.1	5.7	6.1	5.9	5.4	5.2	4.9	4.4	4.5
Locke Lake 'Below'	5.3	5.7	5.1	5.0	5.0	5.7	5.6	5.6	4.8	5.7
Locke Lake 'Park'	Na	Na	Na	Na	Na	Na	4.7	6.4	4.9	4.6
Cross Check 'Above'	-	-	4.9	6.7	-	-	Na	Na	Na	
Cross Check 'Below'	4.3	5.4	-	-	5.6	5.1	Na	Na	Na	

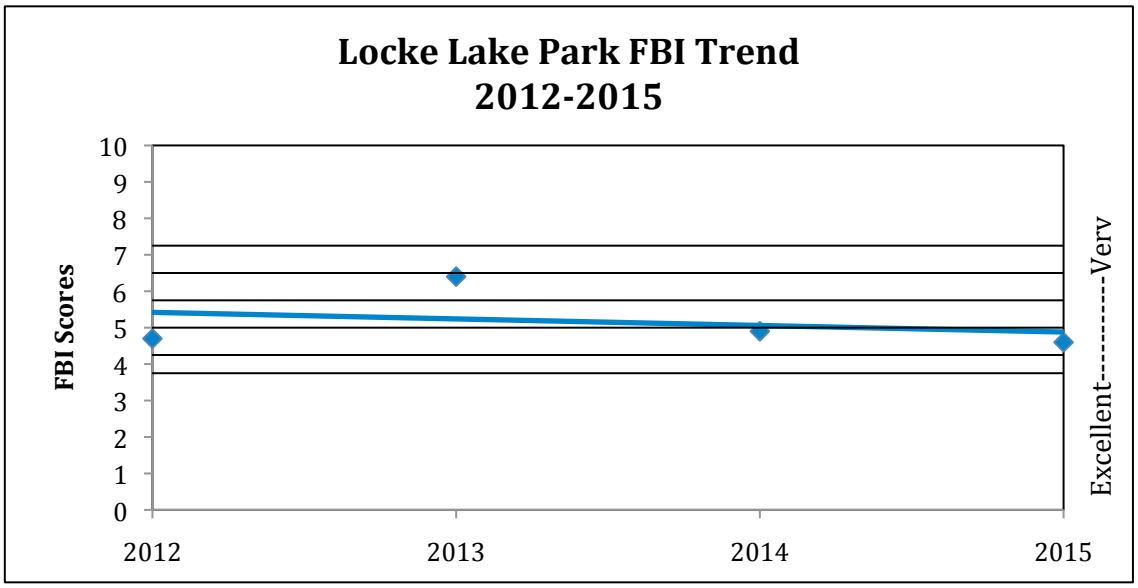


The Locke Lake sites continue to post some of the most consistently stable and encouraging stream health scores in the Rice Creek Watershed.

The 'Above" site FBI scores have improved slightly every year since 2009. Data from 2014 and 2015 are very similar and are reflected in a similar FBI score, family diversity, and dominant family. However, the high family dominance and low diversity is not ideal.

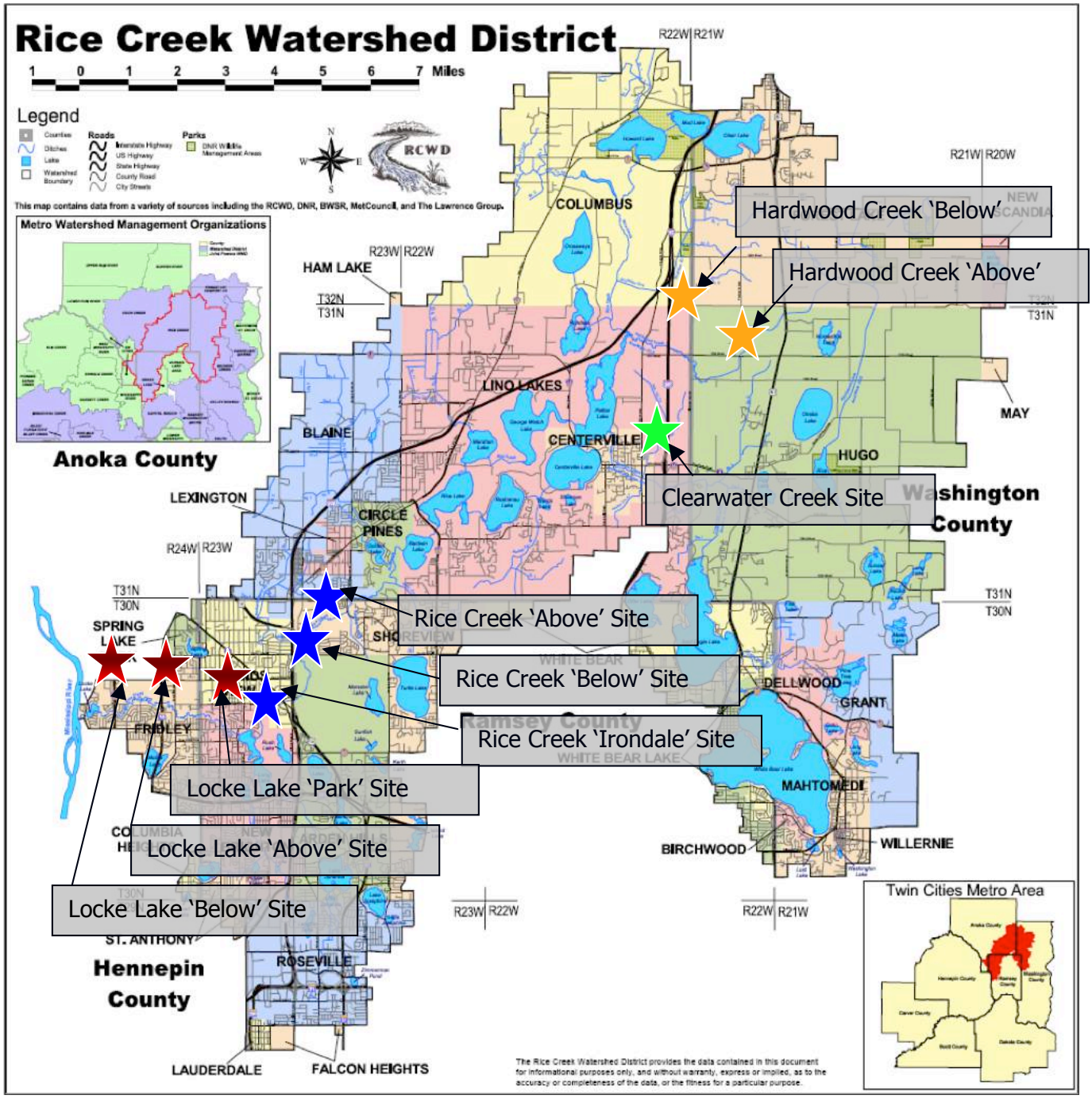


The 'Below' site The FBI trend appears stable. The dominating family, Chironomidae, has been prevalent for many years. Though the FBI scores are healthy, the heavy dominance of Chironomidae, along with low diversity, is not ideal.



This is the fourth year that this site has been sampled at the "Park" site. Except for 2013, the FBI scores appear to be constant and stable; however, more years of data will help determine a more accurate trend. There is variation in the represented families and their abundances. Data is similar in 2014 and 2015.

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



APPENDIX B: Rice Creek Watershed District
Stream Health Evaluation Program (SHEP) Volunteer Survey Results

Following the conclusion of the 2015 SHEP field and lab activities, FMR conducted a comprehensive survey of SHEP volunteers to assess their experience in the program.

A link to the original survey is available here:
https://docs.google.com/a/fmr.org/forms/d/1N3I55pLCQRUW4qs9i19gc6124a61IyA5Gd4AGHqYz0A/edit?usp=drive_web

In all, 17 of 29 recipients responded to the survey. Overall, the results reveal that 100% of respondents were satisfied or very satisfied with their SHEP experience.

In addition, 100% of respondents agreed or strongly agreed that they are more aware of Rice Creek Watershed District programs and activities as a result of their participation in SHEP, and 94% of respondents indicated that they were more likely to engage in activities to protect and restore lakes and streams in the watershed as a result of their SHEP experience.

A complete summary of the 2015 SHEP volunteer survey results is available here:
https://docs.google.com/spreadsheets/d/1QIo-hcWdjxSunhVE9xY8UXSEt_a-Hn8ZYTi56E4ZU_U/edit - gid=751750022