

# ELKHART-SOUTH BEND AQUATIC COMMUNITY MONITORING



ANNUAL REPORT  
2015

Clean  
river  
Healthy  
neighborhoods



---

ELKHART ■ SOUTH BEND

Cover Photo: Jason Jaworski with a big greater redhorse on the Elkhart River

# TABLE OF CONTENTS

INTRODUCTION .....	1
METHODS.....	5
RESULTS AND DISCUSSION .....	7
INDICIES .....	7
ST. JOSEPH RIVER .....	7
ELKHART RIVER .....	9
BOWMAN CREEK .....	10
JUDAY CREEK .....	11
YELLOW CREEK.....	11
PINE AND LILY CREEKS.....	12
LITTLE ELKHART RIVER.....	12
CHRISTIANA AND BAUGO CREEKS.....	13
FISH TISSUE .....	13
THE INFLUENCE OF DAMS IN THE ST. JOSEPH RIVER WATERSHED .....	15
CONCLUSION .....	15
ACKNOWLEDGEMENTS.....	19
REFERENCES.....	19
SUMMER 2015 (Pictures) .....	20
APPENDICES	
APPENDIX A (Metrics for biological indices)	
APPENDIX B (Fish tissue preparation and results)	
APPENDIX C (Summary of fish collected by county, 2015)	
APPENDIX D (Summary of fish collected by site, 2015)	
APPENDIX E (Summary of macroinvertebrates collected by site, 2015)	
APPENDIX F (Aerial site location maps)	



---

# AQUATIC COMMUNITY MONITORING IN ELKHART AND ST. JOSEPH COUNTIES ON THE ST. JOSEPH RIVER AND SELECTED TRIBUTARIES 2015



**Prepared by  
Daragh Deegan**

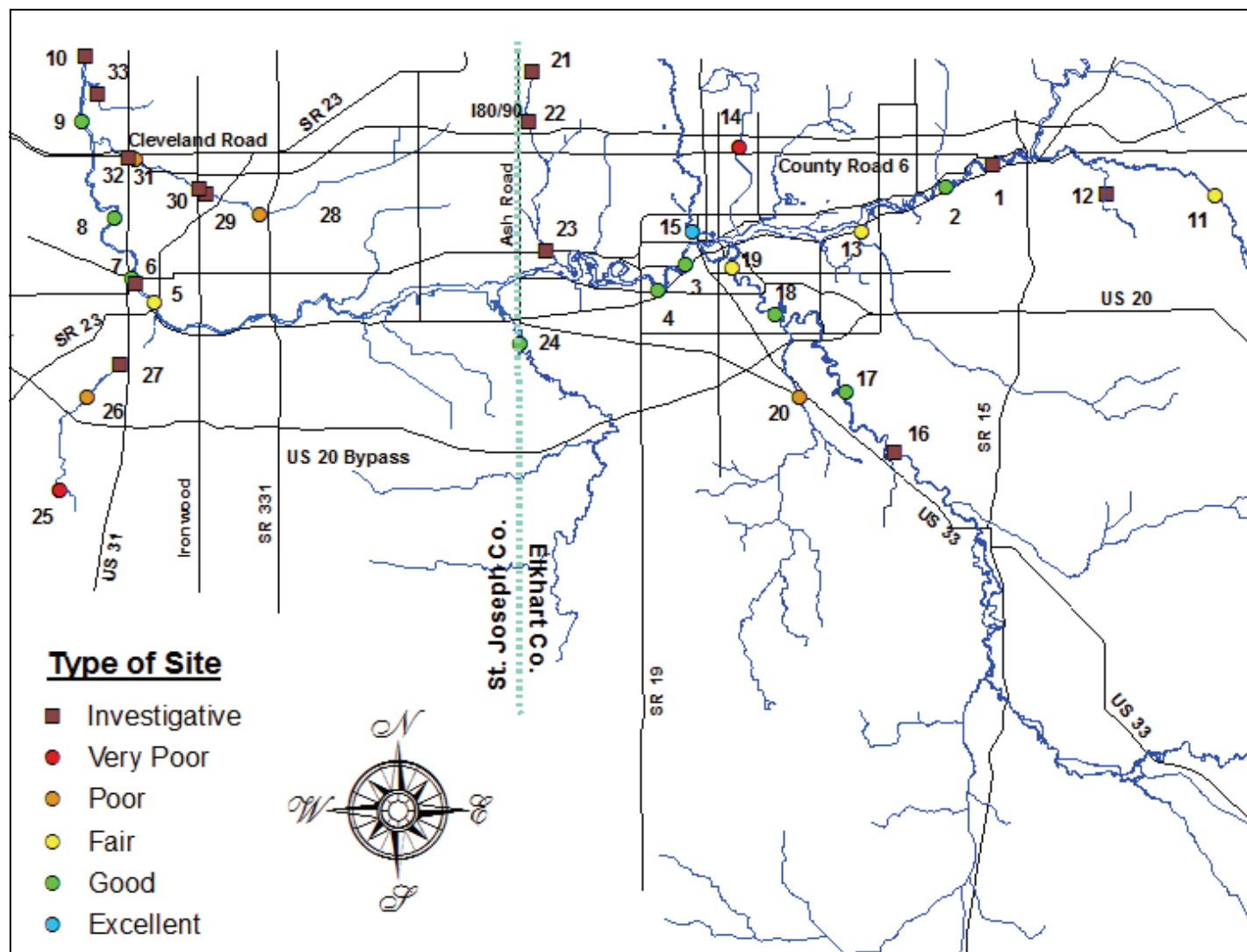
Aquatic Biologist  
April, 2016

## INTRODUCTION

For many years, the Cities of South Bend and Elkhart have collected surface water samples from our local rivers to evaluate pollutant concentrations. In 1998, the City of Elkhart initiated biological community monitoring to compliment chemical and microbial sampling and to establish a robust long-term stream monitoring program. The City of South Bend joined forces with Elkhart in 2001, and since then both communities have gathered a great deal of information on the health of our local waterways.

In the South Bend section of the St. Joseph River, 2015 marked the completion of monitoring activities for the third time. This benchmark in the timeline of the Aquatics Program has provided us with a very strong set of data to evaluate trends in stream health over the past 15 years. The data suggest positive changes in certain sections of the St. Joseph River, just in the past 15 years.

**Figure 2: Fish sampling sites in Elkhart and St. Joseph Counties and associated fish community conditions for 2015 (see Table 1 for site information)**



In 2015, the cities of Elkhart and South Bend, through the City of Elkhart's Aquatics Program, continued to monitor local fish and macroinvertebrate communities in area rivers and streams. The information gathered was integrated into an overall water quality program for each City. While the cities measure the chemical and microbial composition of local stream water, having the additional biological data gives a more accurate representation of the overall health of each stream. The way that biological communities are assembled can change as a result of a disturbance, such as a chemical spill or alteration of habitat. Chemical and microbial testing, while very important in pinpointing contaminants, is simply a snapshot of current conditions. In many cases, having both sets of data can help determine the cause and effect of disturbances to our local streams.

During the first 6 years (1998-2003), Elkhart's Aquatics Program established core fish sampling sites on the St. Joseph River and many of its pri-

mary tributaries in the Elkhart area. For 3 consecutive years, data were collected from these sites and a baseline was established for each stream. Baseline data are now used to compare with current monitoring results to determine if impairments or enhancements are taking place in Elkhart area streams.

In 2001, the City of South Bend combined forces with Elkhart's Aquatics program, establishing a unique biological monitoring partnership between municipalities. As with the Elkhart area, core sampling sites were determined and similar baselines were established for South Bend over a 6 year period (2001-2006). This year (2015) marked the third time that all long term monitoring sites were sampled since the completion of baseline monitoring.

Other sampling efforts have been conducted in both Elkhart and St. Joseph Counties, offering a comprehensive view of stream conditions for the

entire section of the St. Joseph River in Indiana. From, 2007 to 2009, baseline monitoring was completed in the Mishawaka section of the St. Joseph River. Baseline monitoring was also conducted in the Goshen area of the Elkhart River in a partnership between the Elkhart River Restoration Association and the City of Elkhart's Aquatics Program. While long-term monitoring is currently not being conducted in these areas, baseline data gathered will serve as an important reference for future biological comparisons.

The Aquatics Program consists of more than just traversing through local streams collecting fish data. A considerable portion of the Program is education. The biologist travels to local schools and watershed stakeholder group meetings, giving presentations and demonstrations, in an effort to increase awareness about the health of our local streams, and how it affects us. In 2015 alone, the Aquatics Program reached well over 3,000 Michiana residents through public presentations and demonstrations.

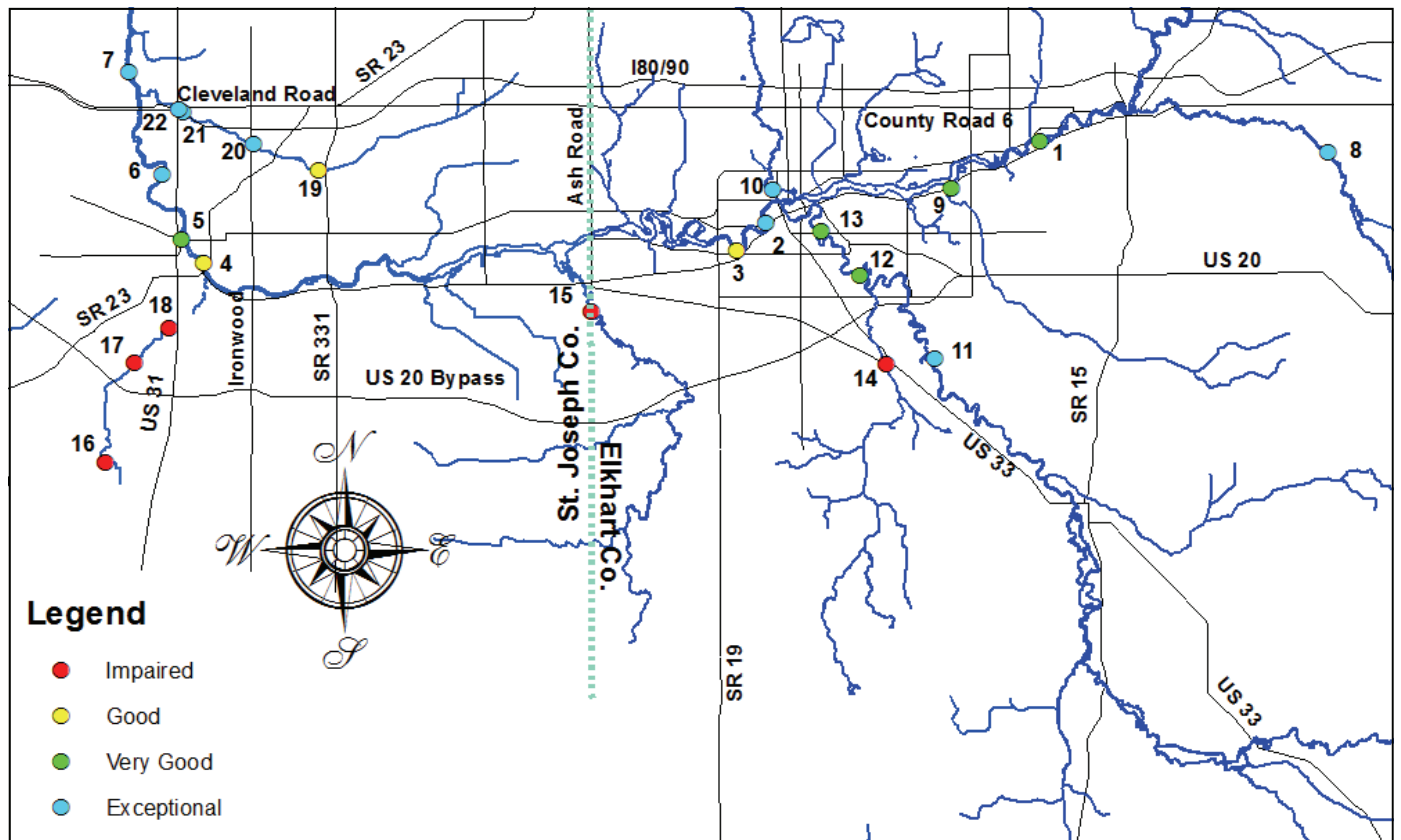
### Indices

The Index of Biotic Integrity (IBI) is the system that is used to assess the local fish communities. The IBI was developed by Dr. James Karr in 1981

as a tool for assessing water/stream quality based on the fish communities that are present. The IBI was modified by Dr. Thomas Simon in 1997 for use in the St. Joseph River Watershed. The IBI is a great tool in that complex biological information can be analyzed to provide measurements of stream quality for non-biologists and members of the general public. The IBI is comprised of 3 broad categories (species composition, trophic composition, and fish condition) which are broken down into 12 smaller categories, known as metrics (see Appendix A). These metrics are given a score based on their similarity to least impacted (reference) sites. One of 3 scores can be given for each metric: 1 (not similar to reference conditions), 3 (somewhat similar to reference conditions), or 5 (very similar to reference conditions). In general, the total score for a site will range from 12 to 60, but in an instance where no fish are present at a site, a score of 0 is given. These scores can then be graphed and placed into 1 to 5 classifications (very poor, poor, fair, good, or excellent), which describes the overall condition of the fish community being monitored.

Biologists recognize that fish community condition is a product of the water quality and the habitat that is available in any given area. Since 2003, the Aquatics Program has been assessing available habitat at all sampling locations using the Qualita-

**Figure 3: Macroinvertebrate sampling sites and associated condition for 2015 (see Table 2 for site information)**



**Table 1: Fish sampling sites and Index Scores in Elkhart and St. Joseph Counties, 2015**

Stream	Site	Site Number	Type of Site	County	Method	IBI Scores	ICI Scores	QHEI Scores
						2015	2015	2015
St. Joseph River	Arrowhead Drive	1	Investigative	Elkhart	Boat			88
	Nibbyville (A)	2	Index	Elkhart	Boat	53	44	86
	Lexington Avenue	3	Index	Elkhart	Boat	50	52	82
	McNaughton Park	4	Index	Elkhart	Boat	53	36	76
	Jefferson Blvd	5	Index	St. Joseph	Boat	41	40	73
	South Bend Dam (B)	6	Investigative	St. Joseph	Boat			79
	LaSalle Avenue	7	Index	St. Joseph	Boat	48	42	89
	Keller Park	8	Index	St. Joseph	Boat	47	VG	86
	Brick Road	9	Index	St. Joseph	Boat	47	VG	86
	St. Pats Park	10	Investigative	St. Joseph	Boat			85
Little Elkhart River*	CR 35	11	Index	Elkhart	Tote Barge	45	48	94
York-Middlebury Twp. Ditch*	County Road 108	12	Investigative	Elkhart	Back Pack			62
Pine Creek*	SR 120 Residence	13	Index	Elkhart	Tote Barge	46	42	66
Lily Creek	Park Six Drive	14	Index	Elkhart	Back Pack	<u>6</u>		<u>37</u>
Christiana Creek	NMWF	15	Index	Elkhart	Tote Barge	57	50	79
Elkhart River	County Road (17)	16	Investigative	Elkhart	Boat			87
	Oxbow Park (B)	17	Index	Elkhart	Boat	50	46	91
	EEC (A)	18	Index	Elkhart	Boat	49	42	81
	Central High School	19	Index	Elkhart	Boat	45	44	74
Yellow Creek	Concord High School	20	Index	Elkhart	Tote Barge	<u>34</u>	32	62
Cobus Creek*	County Road 2	21	Investigative	Elkhart	Tote Barge			55
	County Road 10	22	Investigative	Elkhart	Tote Barge			72
	Old US 20	23	Investigative	Elkhart	Tote Barge			80
Baugo Creek	Restoration (B)	24	Index	Elkhart	Tote Barge	48	<u>F</u>	84
Auten Ditch	Locust Road (S)	25	Index	St. Joseph	Back Pack	<u>23</u>	<u>28</u>	<u>48</u>
Bowman Creek	Chippewa Avenue	26	Index	St. Joseph	Back Pack	<u>25</u>	<u>32</u>	70

\* denotes a cool/cold water stream

Underlined values are indicative of stream impairment

F—"Fair" rating given to the macroinvertebrate community due to lost HD sampler

VG—"Very Good" rating given to the macroinvertebrate community due to lost HD sampler

Coolwater scores are in (parenthesis). Juday Creek was the only cool/coldwater stream analyzed using coolwater methods



**Table 1: Fish sampling sites and Index Scores in Elkhart and St. Joseph Counties, 2015  
(continued)**

Stream	Site	Site Number	Type of Site	County	Method	IBI Scores	ICI Scores	QHEI Scores
						2014	2014	2014
Bowman Creek	Green Tech Drive	27	Investigative	St. Joseph	Back Pack		<u>30</u>	<u>46</u>
Juday Creek*	Grape Road	28	Index	St. Joseph	Tote Barge	(33)	40	60
	Ponader Park	29	Investigative	St. Joseph	Tote Barge			<u>69</u>
	Ironwood Drive	30	Investigative	St. Joseph	Tote Barge		46	80
	Myrtle Street	31	Index	St. Joseph	Tote Barge	(26)	50	66
	SR 933	32	Investigative	St. Joseph	Tote Barge		50	70
Keifer Ditch	Auten Road	33	Investigative	St. Joseph	Back Pack			<u>45</u>

tive Habitat Evaluation Index (QHEI) (Rankin 1989). This index is similar to the IBI in its structure. It has 6 broad categories which are broken down into 21 smaller categories or metrics (Appendix A). This index will have a final score of 0 to 100 and the scores will be classified as excellent, good, fair-good, poor, and very poor. This assessment will help determine to what extent the IBI scores are being affected by habitat. It may also show specific habitat degradation issues that need to be addressed.

Fish are not the only aquatic organisms that can be monitored to determine overall health of rivers and streams. Through a sub-contract with the Midwest Biodiversity Institute (MBI, Columbus, Ohio), the Aquatics Program is also monitoring benthic (bottom dwelling) macroinvertebrates (visible animals without backbones). Twenty-two (22) sites were sampled in 2015 and results were compared to their respective baseline values or the value from the previous sampling event. The macroinvertebrate communities are assessed with the Invertebrate Community Index (ICI) developed by the Ohio Environmental Protection Agency (EPA) (Ohio EPA 1987). This index is broken down into 10 metrics (Appendix A). Like the IBI metrics, the ICI metrics are given a score based on their similarity to relatively undisturbed sites; 6 (comparable to exceptional community), 4 (comparable to typical community), 2 (slightly different from the typical community), or 1 (very different from the typical community). The site scores range from 0 to 60 and are classified similar to IBI scores. This combination of fish, habitat, macroinvertebrate, and chemical monitoring provides the cities of Elkhart and South Bend with the most comprehensive view of stream health.

The Indiana Department of Environmental Management (IDEM) has established guidelines to determine if a body of water is impaired or if its condition is supportive of aquatic life for the IBI and QHEI (IDEM 2015). The ICI is not an index used by IDEM, however, similar guidelines have been established by OHIO EPA for a nearby region, and those values are being used with the Elkhart and St. Joseph County data. Values of 36 or higher for IBI and ICI scores are indicators of a stream with the ability to support aquatic life. QHEI scores of 51 or greater indicate enough quality habitat is available to support aquatic communities.

In addition to performing water quality monitoring in the St. Joseph River basin, fish collections are conducted to determine the overall species diversity throughout the watershed. Walleye (*Sander vitreus*) and smallmouth bass (*Micropterus dolomieu*) populations are monitored from previous tagging events in cooperation with the Indiana Department of Natural Resources (IDNR). Tissue from 6 fish species was collected and analyzed for mercury and polychlorinated biphenyl (PCB) content. Current Indiana Fish Consumption Advisory data for the State of Indiana (Table 10) displays many species from the Indiana portion of the St. Joseph River Watershed. The cities involved in the Program believe it is vital to continually provide local citizens with the most updated information on fish consumption.

## Methods

For the past 17 years, the Aquatics staff has used 2 collection protocols (investigative sampling and

index sampling) to quickly catalog the major fish species and to quantify stream quality in the St. Joseph River Watershed. Investigative sites are sampled once during the season and the fish collected at these sites are identified to species, the largest and smallest specimens are measured to the nearest millimeter (mm), and all fish are counted and then released. Index sites are sampled twice during the season, with a minimum 5 week “rest” period between sampling events. Individual species maximum and minimum lengths are recorded, all fish are counted, and game fish are weighed and measured individually, while most non-game fish are mass weighed. Individual length and weight data are also collected for some of the important species like greater redhorse.

The length of stream sampled at an index site is dependent on the wetted width of the stream. The length of sites is 15 times this width, with a minimum of 50 meters and a maximum of 500 meters. Differences in sampling and processing (Foy 2004) have allowed multiple investigative sites to be sampled in a day versus 1 or 2 index sites. Every species collected at each site is verified either by retaining and preserving a small specimen for the Public Works & Utilities voucher museum or by photographing a large specimen. This practice allows for the verification of the field and lab identifications if needed.

In 2015, 8 index and 7 investigative sites were sampled in St. Joseph County and 12 index and 6 investigative sites were sampled in Elkhart County. One index sites on Baugo Creek was located right on the Elkhart/St. Joseph County border. (Figure 2 and Table 1). IBI scores were calculated for each of the index sites and an average from the 2 visits was obtained to give the final score (Table 1).

Fish were collected using either boat mounted, tote barge, or backpack electrofishing equipment.

The type of gear used depended on the size of the stream. The St. Joseph and Elkhart Rivers were sampled with the boat. Smaller, wadeable streams were sampled with the tote barge, unless the stream was extremely small and shallow, in which case, the backpack was used. Power output from the 3 devices differed. The boat output was 8-16 amperes, the tote barge was 4-6 amperes,

**Figure 4: Hester-Dendy sampler placed into the stream bed.**



and the backpack was 0.5-1.5 amperes.

During each fish sampling event, stream habitat information was methodically collected using the QHEI as developed by Ohio EPA (Rankin 1989). Given that each index site was sampled twice, scores were averaged to give a final score (Table 1).

In early July 2015, Aquatics personnel placed Hester-Dendy samplers (artificial substrates used to collect small aquatic organisms) (Figure 3) at 22 sites that were also sampled for fish (Table 2 and Figure 3) following Ohio EPA macroinvertebrate sampling procedures (Ohio EPA 1987, 1989). Of the 22 that were set, only 19 were recovered successfully due to flooding conditions and other natural variables that occurred during the summer of 2015. The data gathered from the samplers is considered a quantitative sample where species

**Table 2: Macroinvertebrate Sampling Sites, 2015**

<u>Site Number</u>	<u>Stream</u>	<u>Location</u>	<u>Site Number</u>	<u>Stream</u>	<u>Location</u>
1	St. Joseph River	Nibbyville (A)	12	Elkhart River	EEC (A)
2	St. Joseph River	Lexington Ave.	13	Elkhart River	Central High School
3	St. Joseph River	McNaughton Park	14	Yellow Creek	Concord High School
4	St. Joseph River	Jefferson Blvd.	15	Baugo Creek	Restoration (B)
5	St. Joseph River	LaSalle Ave.	16	Auten Ditch	Locust Road (S)
6	St. Joseph River	Keller Park	17	Phillips Ditch	Chippewa Ave.
7	St. Joseph River	Brick Road	18	Bowman Creek	GreenTech Drive
8	Little Elkhart River	CR 35	19	Juday Creek	Grape Road
9	Pine Creek	SR 120	20	Juday Creek	Ironwood
10	Christiana Creek	NMWF	21	Juday Creek	Myrtle Street
11	Elkhart River	Oxbow Park (B)	22	Juday Creek	State Road 933

**Table 3: Location of fish tissue collection sites for 2015**

<u>Site Number</u>	<u>Stream</u>	<u>Location</u>
1	St. Joseph River	Arrowhead Drive
2	St. Joseph River	Nibbyville (A)
3	St. Joseph River	Lexington Landing
4	St. Joseph River	Jefferson Blvd
5	St. Joseph River	Keller Park
6	Elkhart River	Oxbow Park (B)
7	Elkhart River	EEC (A)

are identified and specimens are counted. This information was then used to calculate ICI scores for each site. Qualitative sampling also took place at each site with the use of a kick net through all available habitat near the location of the sampler. This extra sampling is used to capture additional species as well as provide information to make an estimate of stream health in the case where an ICI score can not be calculated due to the loss or vandalism of a sampler.

Fish tissue in the form of skin-on fillets was collected from black crappie (*Pomoxis nigromaculatus*), brown bullhead (*Ameiurus nebulosus*), northern hogsucker (*Hypentelium nigricans*), northern pike (*Esox Lucius*), walleye (*Sander vitreus*), and yellow bullhead (*Ameiurus natalis*). Collection locations for fish tissue samples are presented in Table 3. Each tissue sample sent in for laboratory analysis (Pace Analytical, Green Bay, WI) was a composite of fillets from 3 fish of the same species from the sample reach. The shortest specimen was within 90% of the length of the longest specimen. The samples were collected following the procedures in Appendix B (this report) and Appendix III in "Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory" (1993).

Long-term index monitoring consists of rotational sampling of stream stations. Each station is visited at least once every 3 years to gather biological and chemical data and to compare against previous sampling results, and baseline data.

## Results and Discussion

During the summer of 2015, a total of 11,390 fish, representing 16 families and 65 species, were collected in Elkhart County. In St. Joseph County, 5,918 fish, representing 12 families and 54 species were collected. In total, 69 different species

were captured from the 2 counties.

Rock bass (*Ambloplites rupestris*), striped shiner (*Luxilus chrysocephalus*), and golden redhorse (*Moxostoma erythrurum*) were the most abundant species collected in Elkhart County, while smallmouth bass (*Micropterus dolomieu*), rock bass, and longear sunfish (*Lepomis megalotis*) were the most abundant in St. Joseph County. All of these species are relatively sensitive to poor stream quality which is a promising indication of the health of the St. Joseph River Watershed. For more detailed information on the number and types of fish species collected, see Appendix C.

## Indices

Fish community conditions at the index sites ranged from very poor (23) at Locust Road (S) to excellent (57) at North Main Wellfield on Christiana Creek. Macroinvertebrate community scores ranged from fair (28) at Locust Road (S) on Auten Ditch to exceptional (52) at Lexington Avenue on the St. Joseph River. Habitat quality ranged from poor (37) at Park Six Drive on Lily Creek to excellent (94) at County Road 35 on the Little Elkhart River.

Since the completion of baseline monitoring in 2006, fish IBI scores have been obtained 3 times over a period of 10 years at most Index Sites in St. Joseph County. IBI scores can be influenced by natural conditions such as flooding or drought events and sometimes it can be difficult to determine whether stream quality is improving or diminishing because of natural variability. By averaging IBI scores from the last 3 monitoring events, variability can be reduced to give a good overall picture of stream health since the completion of baseline sampling. In this report we will provide a comparison between baseline and post-baseline average IBI scores for most sites in St. Joseph County. Given that Elkhart County monitoring efforts were initiated 3 years prior, this comparison has been completed and reported in previous years (see 2012 Annual Report).

### *St. Joseph River*

The longitudinal trends in fish community condition for the entire Indiana portion of the St. Joseph River are displayed in Figure 5. Fish, macroinvertebrate, and habitat index scores are presented in Table 4.

The Elkhart County portion of the river continues to support good to excellent fish communities.

**Table 4. Index scores for St. Joseph River sites, Elkhart and St. Joseph Counties**

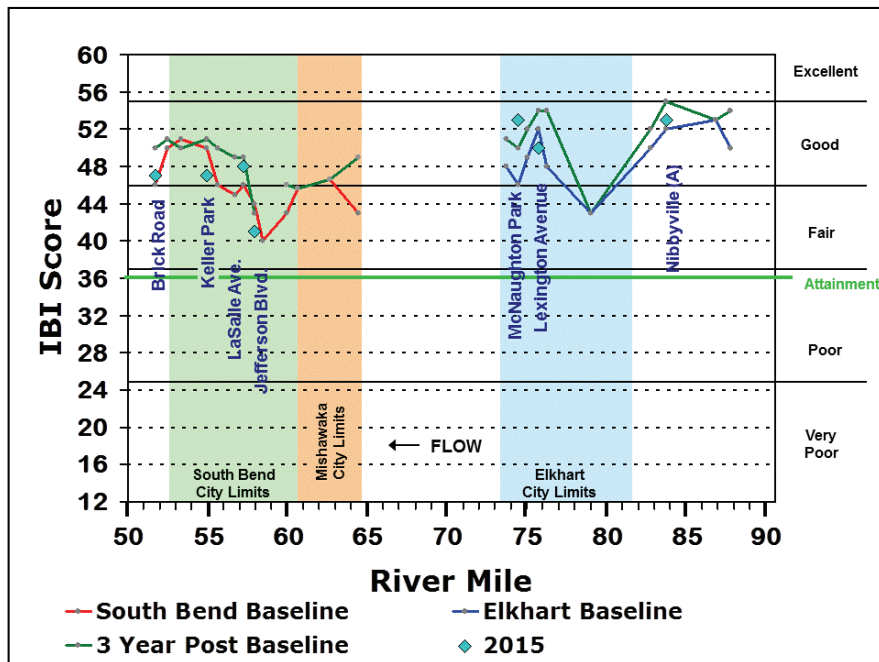
Station	County	River Mile	Fish IBI Scores				2015 Habitat Scores	(ICI) Macroinvertebrate Scores	
			Baseline	2009	2012	2015		Baseline/ Previous Score	2015
Nibbyville (A)	Elkhart	83.7	52	53	56	53	86	40	44
Lexington Avenue	Elkhart	75.7	52	52	54	50	82	48	52
McNaughton Park	Elkhart	74.4	46	51	48	53	76	38	36
Jefferson Blvd	St. Joseph	57.9	44	47	40	41	73		40
LaSalle Avenue	St. Joseph	57.2	46	50	48	48	89	41	42
Keller Park	St. Joseph	54.9	50	51	54	47	86	40	VG*
Brick Road	St. Joseph	51.7	46	54	49	47	86	43	VG*

\*VG—denotes a rating of “Very Good” for this site based on the macroinvertebrates present

Although the Homan Avenue site was not sampled in 2015, this location has the lowest IBI scores in Elkhart County. Its lower scores have a lot to do with its location within the impoundment created by the Johnson Street Dam. Impairments caused by dams are evident based on the data collected by the Aquatics Program in numerous other locations in the St. Joseph River watershed. (see Page 15 for more details on St. Joseph River dams). Of

the three sites sampled on the St. Joseph River in Elkhart County, two had scores exceeding the initial baseline while one site was slightly lower than its baseline score. The McNaughton Park site (53) scored significantly higher than its baseline value of 46.

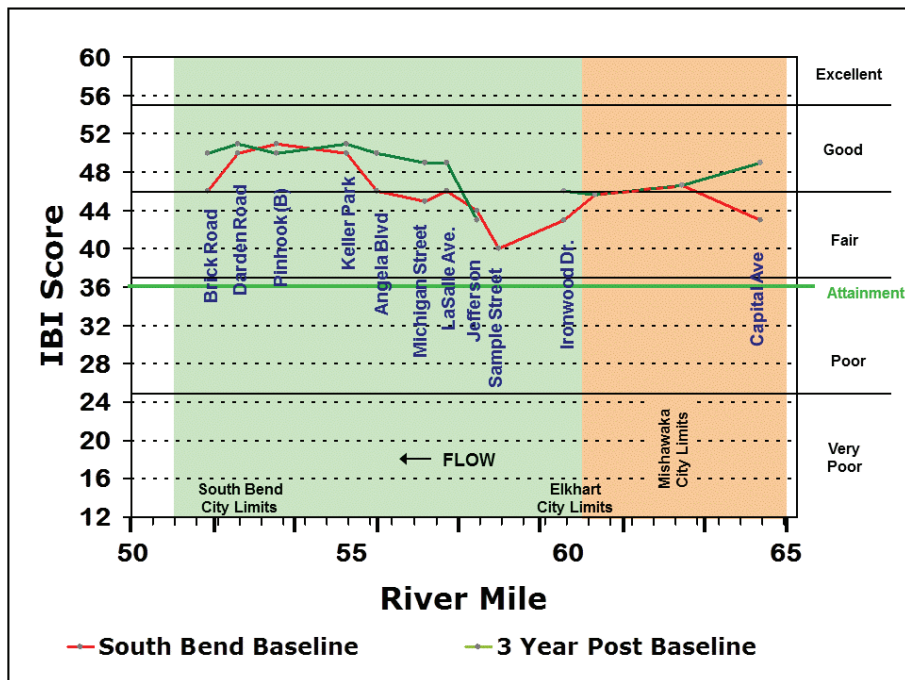
**Figure 5: IBI scores for the St. Joseph River, Elkhart and St. Joseph Counties**



While the fish community scores were very good at McNaughton Park, macroinvertebrate results were not as positive. The ICI score at McNaughton Park was 36; a score of 35 or less is considered impaired. The score at this site was also not impressive the last time it was sampled in 2012. This site is in an area of the river that is affected by the next dam downstream, causing slower moving, deeper water. The other Elkhart County sites scored well, with Lexington Avenue posting an exceptional score of 52.

In St. Joseph County, 2015 IBI scores were generally close to or slightly lower than the initial baseline values (Figure 5). However, average IBI scores since the completion of baseline sampling indicate a marked increase in stream health between LaSalle Avenue and Angela Boulevard (Figure 6). A significant increase has also occurred at Capital Avenue in Mishawaka indicating that the water quality upstream of South Bend may have improved. Starting at Keller Park and downstream to Darden Road, scores have been relatively consistent,

**Figure 6: A comparison of IBI baseline scores and post baseline average scores for St. Joseph County**



as baseline and post baseline scores have remained pretty close. It's important to note, however, that this section of the St. Joseph River has had the highest IBI scores and did not need as much improvement. The Brick Road site, downstream of South Bend, has also shown significant improvement. One area along the St. Joseph River that hasn't seen improvement and continues to "lag behind" is the section from the South Bend Dam upstream to Ironwood Drive. The South Bend Dam, and the impoundment it creates, has a strong influence on the health of the river and its fish community. (For more on the negative influence of St. Joseph River dams, see Page 15).

Macroinvertebrate scores in the South Bend section of the St. Joseph River remained fairly consistent with previous years scores (Table 4). Due to an unfavorable river conditions, Hester Dendy samplers at Keller Park and Brick Road were dam-

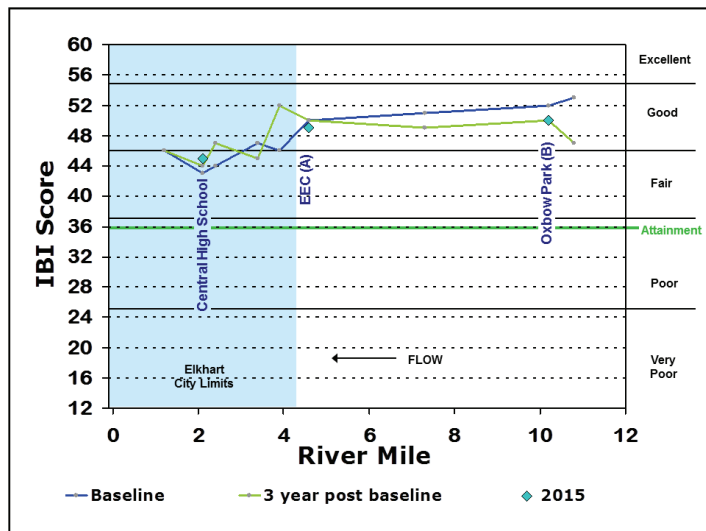
aged and valid samples were not produced at these locations. However, qualitative evaluations of the macroinvertebrate communities provided a "very good" rating for both of these sites.

An investigative fish survey was also performed below the South Bend Dam in 2015. The survey revealed large walleye in high abundance and at a rate not seen anywhere else by the Aquatics Program on the St. Joseph River.

*Elkhart River*

IBI scores for the Elkhart River remained close to initial baseline values (Figure 7, Table 5). The IBI score of 50 at Oxbow (B) was 2 lower than the initial baseline. Areas upstream of Elkhart, particularly around Oxbow Park have averaged below the base-

**Figure 7: IBI scores for the Elkhart River, Elkhart County**



**Table 5: Index scores for Elkhart River sites, Elkhart County**

Station	River Mile	Fish IBI Scores				2015 Habitat Scores	(ICI) Macroinvertebrate Scores	
		Baseline	2009	2012	2015		2012	2015
Oxbow Park (B)	10.2	52	52	47	50	91	36	46
EEC (A)	4.6	50	53	46	49	81		42
Central High School	2.1	43	45	42	45	74	42	44

**Table 6: Index scores for Bowman Creek and Juday Creek sites, St. Joseph County**

Stream	Station	Stream Mile	Fish IBI Scores (Coolwater IBI Scores)				2015 Habitat Scores	(ICI) Macroinvertebrate Scores	
			Baseline	2009	2012	2015		2012	2015
Auten Ditch	Locust Road (S)	6.0	17			23	48		28
Bowman Creek	Chippewa Avenue	3.0	13	25	25	25	70	32	32
Juday Creek	Grape Road	5.3	29 (31)	35 (35)	32 (36)	26 (33)	60	20	40
Juday Creek	Myrtle Street	1.7	21 (24)	35 (35)	24 (30)	24 (26)	66	50	50

line since the completion of baseline sampling indicating a long-term decline in the health of the fish community upstream of Elkhart. While the Elkhart River has had some strong years which were likely influenced by natural variables, overall there appears to be little improvement in the fish communities in the past 18 years. The Elkhart River maintains high quality instream and riparian habitat as indicated by its impressive QHEI scores. However, many of the tributaries of the Elkhart River have been modified significantly for drainage, causing unstable flow and associated water quality issues in the Elkhart River.

On a positive note, in 2015 three northern brook lamprey (*Ichthyomyzon fossor*) were collected from the EEC (A) site. This is only 2nd record of northern brook lamprey by the Aquatics Program. This non-parasitic lamprey is listed as an endangered species in the State of Indiana.

Macroinvertebrate ICI scores ranged from 42 to 46 at the three Elkhart River sites that were sampled. The Oxbow Park (B) site scored significantly higher from the last time it was sampled in 2012

**Table 7: Macroinvertebrate Scores for additional Bowman and Juday Creek Sites**

Stream	Station	Stream Mile	(ICI) Macroinvertebrate Scores
			2015
Bowman Creek	Green Tech Drive	2.0	30
Juday Creek	Ironwood Road	3.5	46
Juday Creek	SR 933	1.7	50

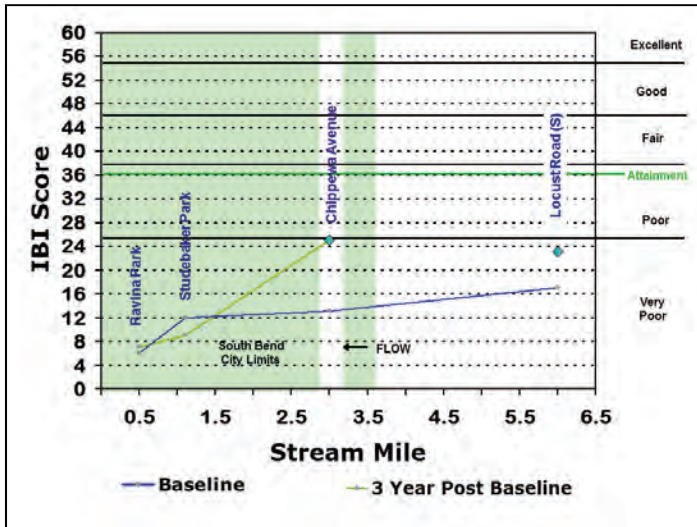
(Table 5), but significantly lower from the first two years it was sampled in 2009 and 2010. In 2012, a major drought hit the region, which may have been the cause in the decline at that time (Deegan, 2012). The ICI score at Central High School increased slightly from 2012, but was also down significantly from when the site was first sampled in 2009.

*Bowman Creek*

In 2015, all initial long-term monitoring sites on Bowman Creek were sampled for the 3rd time since the completion of baseline monitoring (Figure 8 and Table 6). Baseline sampling on at Locust Road (S) on Auten Ditch did not commence until 2013 and was completed in 2015. Auten Ditch is a tributary to Bowman Creek. Post baseline average scores between Ravina Park and Studebaker Golf Course show little improvement in this stretch of the stream. In fact, at the Golf Course, there appears to have been a decline. At Chippewa Avenue, however, there appears to have been a significant increase in stream health, with scores almost doubling since the completion of baseline sampling. Prior to 2009, illegal stream modifications occurred at Chippewa Avenue altering and impairing the habitat in the Creek (Deegan, 2012). These modifications have since been remediated, causing a very positive response in the fish community. Similar to the fish community, the macroinvertebrate community also appears to have rebounded. Data collected prior to 2009, resulted in a baseline ICI value of 11. The average ICI score since 2009 has been 31.

Macroinvertebrate sampling was also conducted at two other locations in the Bowman Creek Watershed in 2015 (Table 7). Respective scores of 28 and 30 were recorded at

**Figure 8: IBI scores for Bowman Creek, St. Joseph County**



Locust Road (South) on Auten Ditch and at Green Tech Drive on Bowman Creek. These scores fall below the attainment value of 36, indicating that both of these locations are impaired. The Locust Road (S) location is in the headwaters of Bowman Creek in an area that has agricultural and industrial land uses. The Green Tech Drive location is also influenced by similar land uses but is located in a more urban setting.

*Juday Creek*

IBI scores for Juday Creek at Grape Road and Myrtle Street show slight increases above their respective baseline values (see Coolwater IBI Scores— Table 6). Both sites lack excellent habitat, and Grape Road in particular is very straight with little to no riffle and pool habitat. The Grape Road site is also embedded with fine sand, further compromising habitat for fish at this location. While the lack of habitat in both locations may be a limitation on the fish community, assessing a coolwater stream like Juday Creek can be difficult (Deegan, 2011). Instead, we rely more on the macroinvertebrate communities as indicators of

the health of Juday Creek.

Macroinvertebrate community scores reflect considerably better stream quality than the fish community scores (Table 6). The ICI score at Myrtle street was 50 in 2015, consistent with the results from sampling in 2012. The Grape Road site also fared much better, with an ICI score of 40. The Grape Road site is one of only a few where baseline macroinvertebrate monitoring was completed from 2004 to 2007. The baseline IBI score for this location is 32, and the last time it was sampled, it had a very low score of 20. While 2015 results are promising, conditions may have been more favorable in this location in 2015. The Aquatics Program will closely monitor this location in the future.

Macroinvertebrate sampling was also conducted at two new locations on Juday Creek in 2015 (Table 7). The two locations (Ironwood Road and SR 933) had respective ICI scores of 46 and 50, which are considered exceptional overall. Both of these locations have undergone considerable natural restoration in the past few years thanks to the St. Joseph County Drainage Board and Surveyors Office.

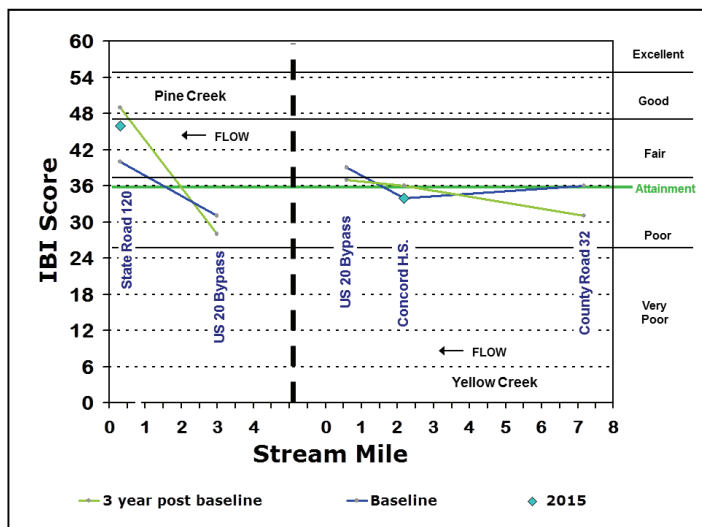
*Yellow Creek*

Yellow Creek at Concord High School has improved slightly since the completion of baseline monitoring (Figure 9). However, the score in 2015 was the same as initial the baseline score of 34. A score lower than 36 indicates that a stream is impaired. This site also had a low macroinvertebrate ICI score of 32, indicating that the macroinvertebrate community is also impaired. The last time this site was sampled in 2012, the ICI score was 44. Although a relatively large and sub-watershed, Yellow Creek continues to be one of the most stressed streams in the St. Joseph River Watershed. As noted in previous annual reports, Yellow Creek is highly modified for agricul-

**Table 8: Index scores for Yellow Creek and Pine Creek, Elkhart County**

Stream	Station	River Mile	Fish IBI Scores				2015 Habitat Scores	(ICI) Macroinvertebrate Scores	
			Baseline	2009	2012	2015		Previous	2015
Yellow Creek	Concord High School	2.2	34	33	36	34	62	44 (2012)	32
Pine Creek	State Road 120	0.2	40	51	46	45	66	38 (2009)	42
Lily Creek	Park Six Drive	2.7	15	15	6	6	37		

**Figure 9: IBI scores for Pine Creek and Yellow Creek, Elkhart County**



tural drainage. It's instability and poor water quality also contribute to degradation of the Elkhart River.

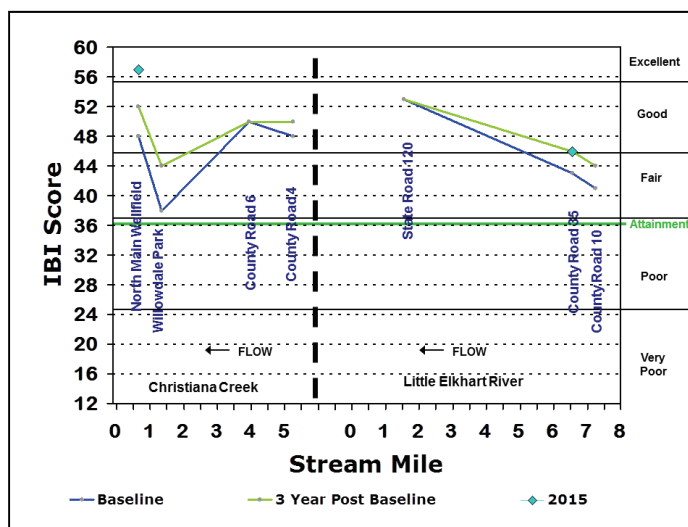
*Pine Creek*

The fish community at Pine Creek along SR 120 has improved dramatically since the completion of baseline monitoring (Figure 9 and Table 8). IBI scores peaked in 2009, when the site scored 51. During the previous sampling event in 2006, this site also had a very high score at 50. In 2012, upon arrival at the site for sampling, it was observed that "ditch maintenance" for drainage had occurred at this site (Deegan, 2013). This action had significant negative impacts on the stream, by removing and altering important habitat for aquatic life: the habitat score in 2009 was 78, but it has since plummeted to 66. The fish community scores have also dropped as a result to 46 and 45 in 2012 and 2015 respectively. ICI scores, however, do not show a significant decline in the macroinvertebrate community. The ICI score in 2015 was 42, up from 38, the last time was sampled in 2009. This does not come as a surprise, as macroinvertebrate communities do recover relatively quickly following a disturbance (Deegan, 2014).

*Lily Creek*

Of the streams monitored by the Aquatics Program in Elkhart County, Lily Creek has the most impaired fish communities (Table 8). Lily Creek enters the St. Joseph River just above the Johnson Street Dam. It has been known to run dry during warm summer months, which appears to be the main limitation on aquatic life in the creek. Lily Creek drains Simonton Lake and it is likely that

**Figure 10: IBI scores for the Little Elkhart River, Elkhart County**

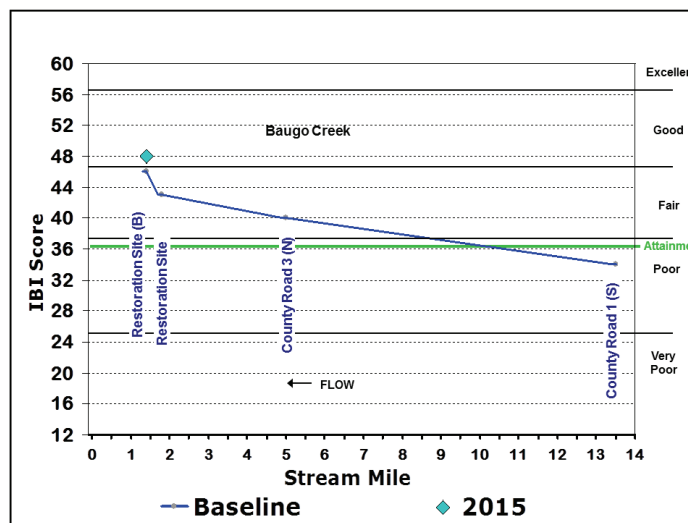


the lake control on Simonton limits the amount of water that should be naturally drained into this creek.

*Little Elkhart River*

The IBI score at the Little Elkhart River was 46 in 2015, up slightly from the last time it was sampled and slightly higher than the baseline score of 43. Long-term trends at this site suggest a slight improvement in fish community integrity (Figure 10). In 2009, IBI scores were at their highest at this location. At the time, significant watershed management efforts were being made to reduce nutrient input into the Little Elkhart River. Specifically, many cattle access exclusion projects were being implemented in the watershed. Those efforts appeared to have helped, but stream integri-

**Figure 11: IBI scores of Baugo Creek, Elkhart and St. Joseph Counties**





**Table 9: Index scores for sites on Trout Creek, Puterbaugh Creek and the Little Elkhart River, Elkhart County**

Stream	Station	River Mile	Fish IBI Scores				2015 Habitat Scores	Macroinvertebrate scores (ICI)	
			Baseline	2009	2012	2015		2012	2015
Little Elkhart River	CR 35	6.5	43	49	45	46	94	52	48
Christiana Creek	North Main Wellfield	0.7	48	53	51	57	79	52	50
Baugo Creek	Restoration (B) Site	1.4	43		46	48	84		F*

\*F—denotes a rating of “Fair” for this site based on the macroinvertebrates present

ty appears to have reduced since that time. The macroinvertebrate ICI score of 48 was down from the previous sampling event in 2012, when the site had a score of 52, but up from the score in 2009 when the site had a score of 44.

An investigative fish survey was also performed at York-Middlebury Township Ditch at CR 108. This stream is a tributary to the Little Elkhart River and converges on the Little Elkhart above Middlebury. While there were no significant findings from the survey, this little stream appears to support a nice coolwater fish community.

#### *Christiana Creek*

Christiana Creek was sampled at the North Main Wellfield (NMWF) in 2015, posting the most impressive IBI Score (57) ever recorded by the Aquatics Program. This site was also sampled in 2013 and 2014 to investigate the impacts of the dams on Christiana Creek. Both years, this site also posted very impressive IBI scores of 55. It should be noted that this site has excellent fish species diversity, and a good variety of different aquatic habitats to support a diverse fish community. Macroinvertebrate community scores also fall in the exceptional range, with scores ranging from 48 to 52 the three times it was sampled from 2009 to 2015.

#### *Baugo Creek*

In 2015, sampling was conducted at the Restoration (B) site. This site is located downstream of an area that received instream control structures called “J hooks” in 2010. While our data from 2014 sampling suggest that this restoration work has not really benefited the biological communities where the work was completed, it may have benefited the fish communities downstream at the Restoration (B) site. The IBI score in 2015 was 48, which is significantly higher than the baseline

score of 43. In 2015, the macroinvertebrate samplers were lost from Baugo Creek, but a qualitative sample indicates a “fair” rating for this site. The Aquatics Program will closely monitor this site to determine if long-term benefits remain.

### *Fish Tissue*

In 2015, tissue was collected from fish in both Elkhart and St. Joseph Counties. Collections were based on the current Fish Consumption Advisory (FCA) for area streams and potential data gaps within the FCA. The FCA provides guidance on the rate of consumption of local wild fishes (Table 10), based on the concentration of polychlorinated biphenyl (PCB) or mercury (Hg) concentrations in their tissue. It should be noted that the State FCA has more restrictive guidance for individuals that are considered to be part of the “sensitive population.” Females under the age of 50 and males under the age of 18 are considered to be part of the sensitive population. For more information on local fish consumption, visit the Indiana State Department of Health’s website (<http://www.in.gov/isdh/23650.htm>).

Many variables play a role in contaminant concentrations in fish. In general, larger fish will tend to have higher concentrations of contaminants in their tissue. Concentrations of contaminants can vary from one fish to another, so the methodology for collecting tissue samples requires collecting three fish and compositing all fish into one sample. In addition, the Aquatics Program will often sample the same fish species more than once to get a more accurate understanding of contaminant concentrations. The following narrative describes results of the Aquatics Program’s fish tissue collections from Elkhart and St. Joseph Counties in 2015:

**Table 10: Fish consumption guidance from the Indiana Fish Consumption Advisory**

Location	Species	Fish Size (inches)	Contaminant	Consumption Guidance	<u>Sensitive Population Guidance</u>
Elkhart River <i>Elkhart County</i>	Channel Catfish	ALL	PCBs	1 meal/month	<b>Do Not Eat</b>
	Northern Pike	Up to 24		Unrestricted	1 meal/week
	Rock Bass	Up to 7		Unrestricted	1 meal/week
Christiana Creek <i>Elkhart County</i>	Northern Hogsucker	Up to 14		Unrestricted	1 meal/week
	Rock Bass	Up to 7		Unrestricted	1 meal/week
	Yellow Bullhead	Up to 9		Unrestricted	1 meal/week
St. Joseph River <i>Elkhart County</i>	Bluegill	Up to 8		Unrestricted	1 meal/week
	Channel Catfish	All	PCBs	1 meal/month	<b>Do Not Eat</b>
	Common Carp	Up to 31	PCBs	1 meal/month	<b>Do Not Eat</b>
		31+	PCBs	1 meal/2 months	<b>Do Not Eat</b>
	Northern Pike	Up to 24		Unrestricted	1 meal/week
	Redhorse Species	17+	PCBs	1 meal/month	<b>Do Not Eat</b>
	Rock Bass	Up to 7		Unrestricted	1 meal/week
	Smallmouth Bass	Up to 13		Unrestricted	1 meal/week
	Walleye	25+	PCBs	1 meal/month	<b>Do Not Eat</b>
White Sucker	Up to 14		Unrestricted	1 meal/week	
St. Joseph River <i>St. Joseph County (Baugo Bay Area to Twin Branch Dam)</i>	Bluegill	Up to 8		Unrestricted	1 meal/week
	Channel Catfish	Up to 20	PCBs	1 meal/month	<b>Do Not Eat</b>
		20+	PCBs	1 meal/2 months	<b>Do Not Eat</b>
	Common Carp	Up to 15	PCBs	1 meal/week	1 meal/month
		15-20	PCBs	1 meal/month	<b>Do Not Eat</b>
		20-25	PCBs	1 meal/2 months	<b>Do Not Eat</b>
		25+	PCBs	<b>Do Not Eat</b>	<b>Do Not Eat</b>
	Largemouth Bass	Up to 13		Unrestricted	1 meal/week
	Rock Bass	Up to 8		Unrestricted	1 meal/week
Spotted Sucker	Up to 17		Unrestricted	1 meal/week	
White Sucker	Up to 14		Unrestricted	1 meal/week	
St. Joseph River <i>St. Joseph County (Twin Branch Dam to Indiana State Line)</i>	Bluegill	7+	PCBs	1 meal/2 months	<b>Do Not Eat</b>
	Channel Catfish	All	PCBs	1 meal/2 months	<b>Do Not Eat</b>
	Chinook Salmon	28+	PCBs	1 meal/2 months	<b>Do Not Eat</b>
	Common Carp	Up to 15	PCBs	1 meal/week	1 meal/month
		15-20	PCBs	1 meal/month	<b>Do Not Eat</b>
		20-25	PCBs	1 meal/2 months	<b>Do Not Eat</b>
		25+	PCBs	<b>Do Not Eat</b>	<b>Do Not Eat</b>
	Golden Redhorse	ALL	PCBs	1 meal/month	<b>Do Not Eat</b>
	Rock Bass	Up to 8	PCBs	1 meal/week	1 meal/month
	Smallmouth Bass	Up to 12	PCBs & Hg	1 meal/week	1 meal/month
	Steelhead Trout	30+	PCBs	1 meal/2 months	<b>Do Not Eat</b>
Yellow Bullhead	Up to 10	PCBs	1 meal/week	1 meal/month	
Juday Creek	White Sucker	17+	PCBs	1 meal/month	<b>Do Not Eat</b>

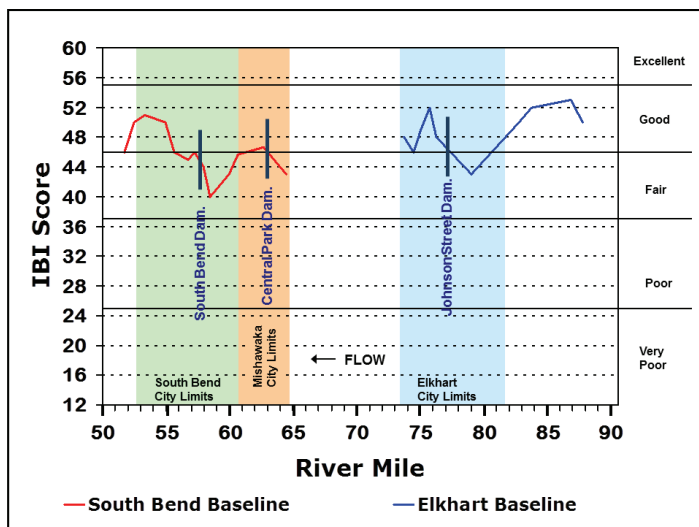
**Sensitive Population**— Females under the age of 50 and males under the age of 18  
**1 Meal**—8oz. For adults, 3oz. for children ages 3 to 6

Northern Pike, ranging in size from 32.5 to 35.2 inches were collected from Keller Park in South Bend. It seems that the Northern Pike population is doing well in South Bend. Surveys indicate that they are more abundant and several large (30+) inch fish have been collected in recent years by the Aquatics Program. Given detected concentrations on PCBs in the northern pike sample, consumption should be limited to one meal per month for fish in this size range. Do Not Eat Guidance would be recommended for the Sensitive Population. It is likely that smaller northern pike, would have lower concentrations of PCBs.

Fish tissue samples were collected from two species of catfish in 2015: brown bullhead and yellow bullhead. Brown bullhead samples were collected from Jefferson Boulevard in South Bend and at Nibbyville in Elkhart County. A single sample of yellow bullheads was also collected from Jefferson Boulevard in South Bend. Size ranges for brown bullheads were 12.9 to 13.1 inches from Jefferson Boulevard and 12.6 to 13.6 inches from Nibbyville. The size range for yellow bullheads was 10.1 to 11.5 inches. All three bullhead samples had trace amounts of PCBs and Hg, and as a result consumption should be unrestricted for the general population and 1 meal per week for the sensitive population.

Black crappie ranging in size from 8.2 to 8.4 inches were collected from Lexington Landing in Elkhart County. Larger specimens (10.2 to 10.8 inches) were also collected in 2014 from the Nibbyville site. Black crappie are not currently listed in the State FCA for Elkhart County, although they are a popular game species on the St. Joseph River. Based on low levels of PCBs and Hg, the gen-

**Figure 12: Baseline IBI scores for the St. Joseph River. The grey lines in each graph depict dams that are located on the river**



eral population can consume unlimited black crappie from Elkhart County within the size ranges mentioned above.

Three northern hogsucker samples were collected in 2015. On the St. Joseph River, one sample was collected from Keller Park in South Bend and one was collected downstream of Bristol (Arrowhead Drive), while on the Elkhart River, one sample was collected at the EEC. The sample from the EEC on the Elkhart River and the sample from Arrowhead Drive, had trace amounts of PCBs and Hg, suggesting no restrictions for consumption. However, the sample from Keller Park on the St. Joseph River did contain levels of PCBs that would restrict consumption to one meal every month for the general population. Do Not Eat Guidance would be recommended for the sensitive population.

Walleye 18.0 to 19.8 inches were collected from Oxbow Park on the Elkhart River in 2015. In 2014, walleye ranging from 14.3 to 15.1 were also collected from the Elkhart River. The sample from 2014 did not reveal high concentrations of PCBs or Hg and unrestricted guidance was recommended for the general population. The sample from 2015, which contained tissue from considerably bigger walleye has higher levels of PCBs indicating that consumption should be limited to 1 meal per week for the general population and 1 meal per month for the sensitive population.

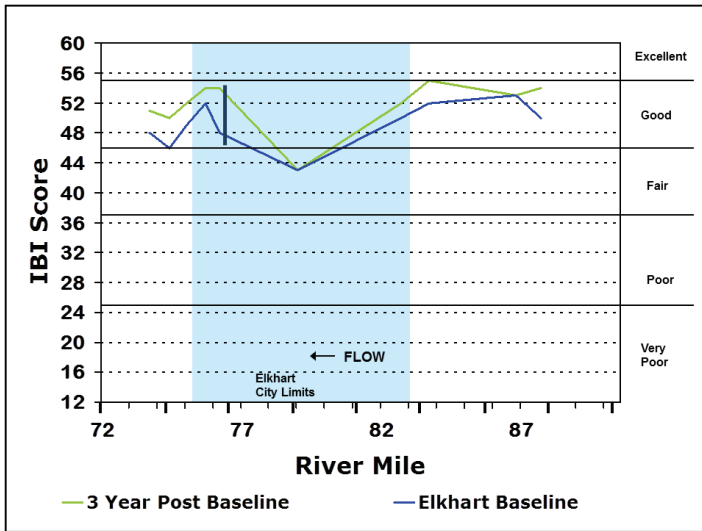
### The Influence of Dams in the St. Joseph River Watershed

In 18 years of sampling, the Aquatics Program has collected almost 450,000 fish from the St. Joseph River Watershed in Elkhart and St. Joseph Counties. While we have used these data to analyze the health of our local waterways, our accumulation of data has led to a highly robust dataset and an understanding of several factors that strongly influence our streams. One such example is the influence that dams and other instream structures have on local fish communities.

#### Influence on Fish Communities

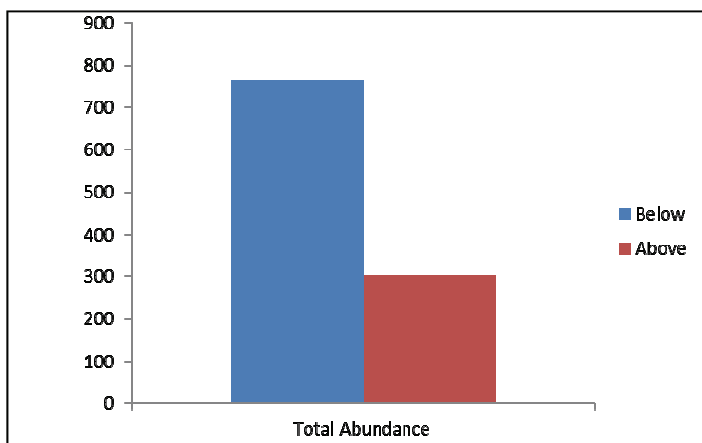
Even with initial baseline data, it is clear that the dams on the St. Joseph River strongly influence it's fish communities. Above the South Bend Dam, the Central Park Dam in Mishawaka, and the Johnson Street Dam in Elkhart, IBI scores immediately plummet (Figure 12). As mentioned in the main text of this report, dams highly modify the natural conditions upstream by slowing water

**Figure 13: Baseline and average post baseline scores for the Elkhart section of the St. Joseph River. The dark vertical line depicts the location of the Johnson Street Dam**

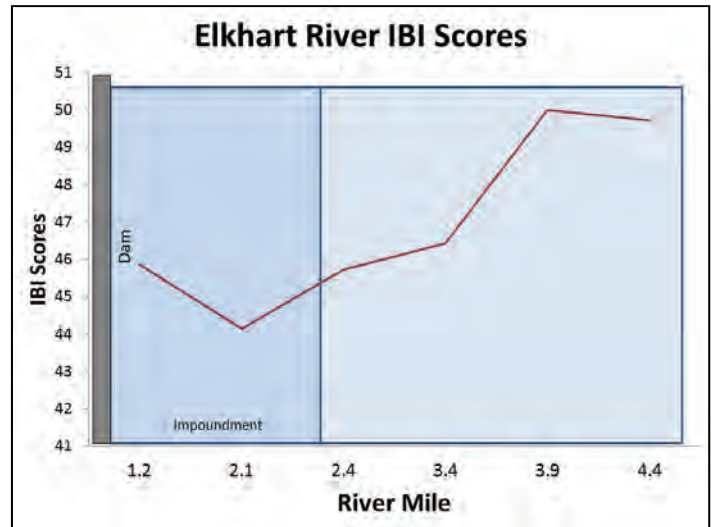


down, making it deeper, and changing the characteristics of the waterway into more of a lake-type environment. As a result, fish communities that are typical of a river environment, shift to those that are more typical of a lake system. On the upstream side of the dam, sediment is trapped, resulting in the build-up of fine sand and silt. This changes the habitat for stream species that prefer a diverse mixture of substrates including gravel and rocks. Physical conditions on the downstream side of a dam are not modified as drastically as the upstream side, although the streambed and supporting banks are starved of sediment, which leads to erosion issues and the need for strongly stabilize the banks downstream of the dam. Fish that make upstream migrations are prevented from swimming upstream, perhaps artificially increasing the abundance of fish below each dam (Figure 15).

**Figure 15: Average total abundance of all fish captured above and below the Johnson Street Dam during fish surveys (2004-2015)**



**Figure 14: Average IBI scores for the Elkhart River (1998-2015), from the Elkhart River Dam upstream to Elkhart City limits**

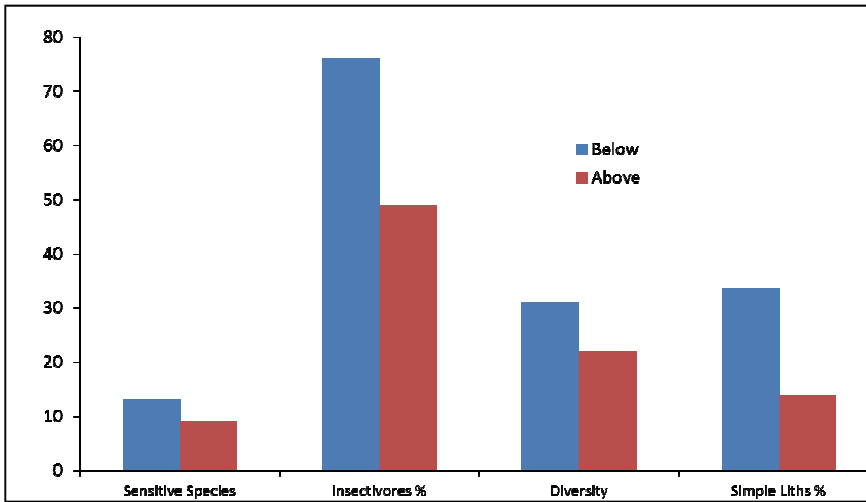


Since the completion of baseline monitoring, each initial long-term monitoring site has been sampled at least three times (Figure 13). IBI scores since the completion of baseline monitoring suggest minor increases in stream health at almost all sites in Elkhart County. One of two exceptions is the Homan Avenue site, which is located above the Johnson Street Dam. The Homan Avenue site has consistently had the lowest scores since the initiation of monitoring in Elkhart County, and with IBI scores not improving, it could be assumed that influences of the Johnson Street Dam and associated changes to habitat are an insurmountable limitation for this section of the river.

Its also important to note that once the river goes above the area that is influenced by each dam (i.e., it changes from an impoundment to a naturally flowing river), the IBI scores begin to increase. Depicted in Figure 14, average IBI scores for the Elkhart River from 1998 to 2015 substantiate this argument, and also suggest that the dam on the Elkhart River negatively influences the river upstream of the impounded area. While we recognize that water quality issues may play a role in decreasing IBI scores on the Elkhart River within City limits, the phenomenon depicted in Figure 14 is consistent with results from the St. Joseph River (Figure 12).

Characteristics of fish communities above and below dams help us understand why fish communities are considered more impaired. Figure 15 depicts the average number of fish collected during sampling events above and below the Johnson Street Dam on the St. Joseph River. The average

**Figure 16: Differences in fish community characteristics above and below the Johnson Street Dam (Survey Averages 2004-2015)**



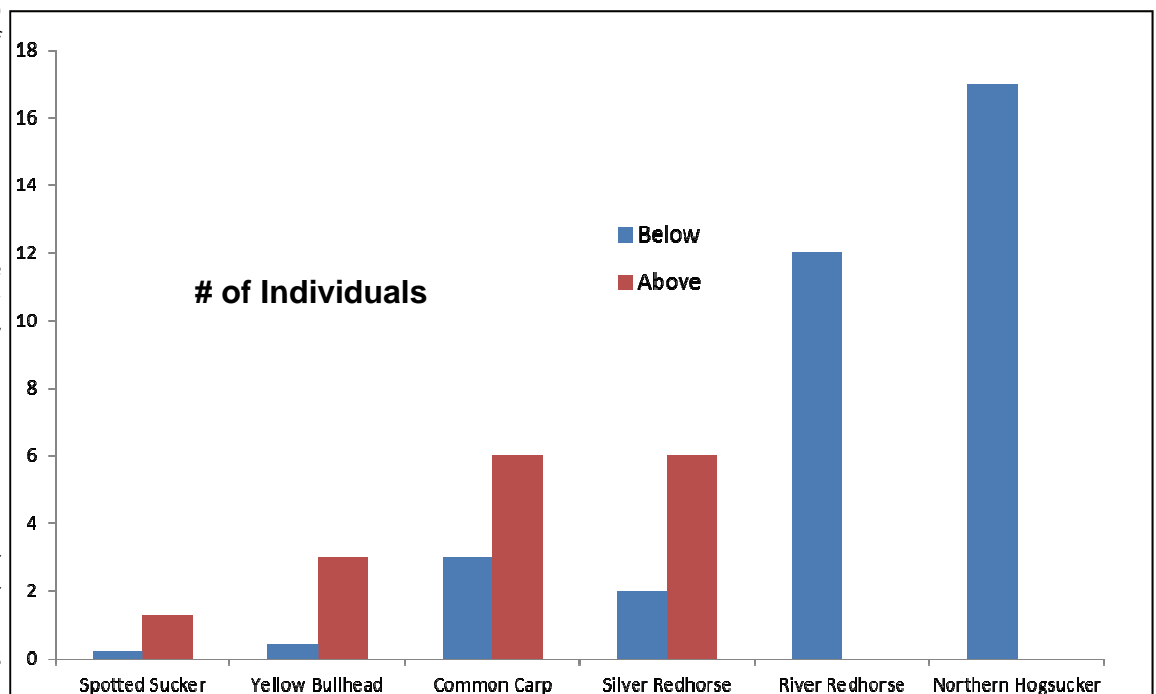
number of fish collected above the dam is less than 300 individuals, while the average number collected below the dam is almost 800 individuals. While the number below the dam is likely inflated due to the fact that fish migrate upstream and become condensed, the disparity in abundance is clear. The next site upstream of the Johnson Street dam, which is outside of the impoundment and is more representative of a natural river, averages approximately 550 individuals per sampling event.

Other interesting fish community characteristics are summarized in Figure 16. Insectivores and simple lithophils are two sensitive groups of fish that are found in much higher numbers below the Johnson Street Dam than above. Simple lithophils are fish that spawn on substrate and do not protect their eggs. Many simple lithophils require coarse substrate such as gravel, cobble and boulders for spawning; the cracks between rocks provide shelter and protection for their developing eggs. Fish species

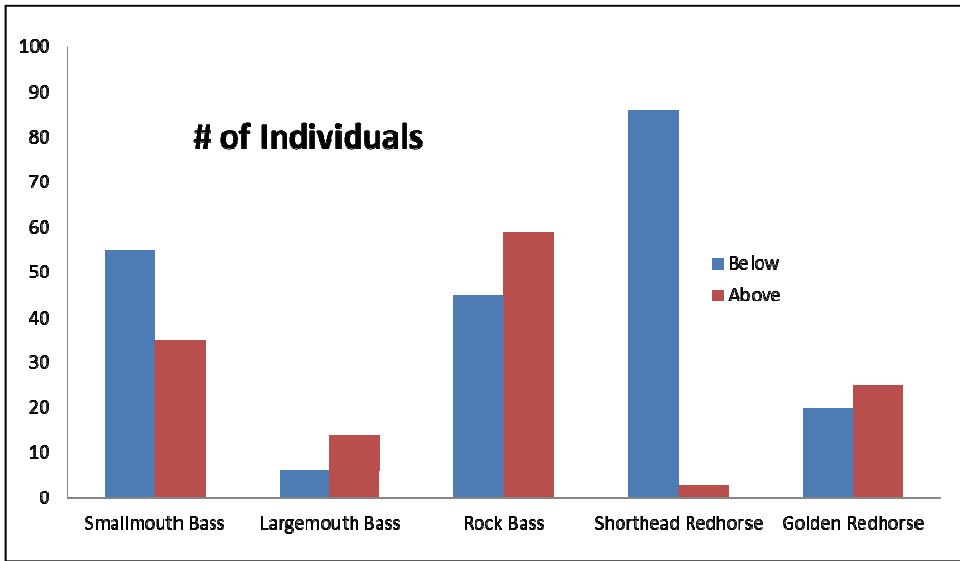
diversity and the diversity of sensitive species are also higher below the dam than above the dam, indicating that habitat and stream quality are adequate for supporting more species of fish.

With the shift from a river environment to a lake environment on the upstream side of a dam, the fish community assemblage can be somewhat predictable, where fish that prefer slow moving water or backwater areas tend to be found in more abundance. Figures 17 and 18 summarize some fish species data for above and below the Johnson Street Dam. Species that are found in higher abundance above the dam include spotted sucker, yellow bullhead, common carp, silver redhorse, golden redhorse and rock bass. There is also a predictable shift in the abundance of largemouth bass and smallmouth bass, with smallmouth bass being more abundant below the dam, and largemouth bass being more abundant above the dam. Sucker species including, river redhorse and northern hogsucker are found in high abundance below the dam, but are completely absent above the dam. Both species are simple lithophilic spawners that prefer swift, rocky habitat. Shorthead redhorse are also found in very high abundance (almost 90 individuals per sampling event) below the dam, but found in very low abundance above the dam.

**Figure 17: Average # of several fish species collected above and below the Johnson Street Dam in Elkhart (2004-2015)**



**Figure 18: Average # of several fish species collected above and below the Johnson Street Dam in Elkhart (2004-2015)**



### Ecological Impacts

Beyond fish community health and IBI scores, a major concern with dams is that they prevent fish from migrating upstream. This is problematic to the ecological balance of a stream for a number of reasons:

- 1) Many if not most native stream fish species migrate upstream: most species migrate upstream to find suitable spawning habitat.
- 2) Dams and other migration barriers essentially fragment a stream which leads to population isolation and lack of appropriate genetic dispersal among populations.
- 3) Freshwater mussels, one of the most imperiled types of animals in the United States, parasitize fish as part of their life cycle and use naturally migrating fish to disperse upstream in a river. As such, dams also prevent mussel populations from naturally dispersing.

The major dams have led to elimination of important species in the Indiana section of the St. Joseph River including lake sturgeon, flathead catfish, and natural migrating walleye from Lake Michigan. Other localized extinctions include shorthead redhorse, which are present in abundance below the Elkhart River dam, but completely absent from the Elkhart River above the dam. Black redhorse is another species that are found in high abundance below the South Bend Dam, but is not found in the river above the dam until about 30 miles upstream, where they found in low abundance in the Bristol area.

### Small Stream Issues

On smaller streams, fish migration barriers can also occur in the form of small low head dams and rock structures, but an even more common occurrence is road-stream crossings that drastically alter the stream. Culverts at stream crossings, for example, can often be perched above the stream on the downstream side. Figure 20 is an example of a perched culvert at County Road 2 on Gast Ditch. This crossing would obviously prevent fish from migrating upstream. This type of crossing is very common in the St. Joseph River Watershed, particularly on smaller streams.

Culverts are also often undersized, and back water up above the crossing, essentially causing the same effect as a dam. With undersized culverts, the velocity of water passing through the culvert is too fast to allow fish to swim through. Figure 19 shows the culvert crossing at County Road 2 on Cobus Creek that is undersized for the size of the stream, causing water to back-up and impound. As a result, fine sand and silt have built up behind the culvert. The stream averages less than 6 inches deep for several hundred yards. The resulting habitat loss and the lack of fish migration passed this undersized culvert has drastically altered the fish community; in our 2015 fish survey at this location, only 10 small fish were collected, which is deplorable for a stream this size.

**Figure 19: Road stream crossing on Cobus Creek at County Road 2 in Elkhart County.**



**Figure 20: Road stream crossing on Gast Ditch at County Road 2 in Elkhart County. Note that the culvert is perched above the stream preventing fish from travelling upstream**



### *Moving Forward*

It is apparent that dams and other fish migration barriers have a negative affect on the rivers and streams of Elkhart and St. Joseph Counties. Some of the major dams on the St. Joseph River are used for hydropower and given their age (between 100 and 200 years old), our cities have been built around them. It is not feasible to remove some of these major structures. However, there are obsolete low-head dams and other structures in our watershed that could be removed to promote biological diversity. There may also be opportunities for to improve stream crossings when road projects and improvements take place.

Removal of obsolete low head dams has become a priority for stream ecologists and natural resource agencies nationwide, as a more thorough understanding of their negative influences has been developed, along with the understanding that biological diversity needs protection from known and perceived future threats to our rivers and streams.

## **Conclusion**

Long-term biological monitoring by the Cities of Elkhart and South Bend is starting to provide a more thorough understanding of the health of our rivers and streams. Along with our rivers and streams, the Elkhart-South Bend Aquatics Program also continues to evolve by sampling more locations within the watershed, expanding our macroinvertebrate sampling program, and changing our techniques slightly to fill data gaps. In Juday Creek and other coolwater streams we will likely

put more emphasis on macroinvertebrate monitoring in the future.

In the South Bend area of the watershed, 2015 was an important year, as all initial index sites were sampled for the 3rd time since the completion of baseline sampling. On the St. Joseph River, there appears to have been an increase in stream integrity downstream of the South Bend Dam, while no improvement has occurred upstream of the dam. There also appears to have been a long-term increase in stream integrity on Bowman Creek at the Chippewa Avenue site, which is located towards the edge of South Bend City limits. Other sections of Bowman Creek in South Bend show little signs of improvement.

In this report, we also emphasized the influence of dams on the health of aquatic communities in the St. Joseph and Elkhart Rivers. Its apparent based on our data, that local dams significantly alter the habitat necessary to support natural native fish communities, while also preventing fish from migrating upstream. On a smaller scale, this condition is also observed at stream bridge crossings that have culverts, where culverts act as a barrier to natural fish movement upstream and natural sediment movement downstream.

## **Acknowledgements**

Thanks to the 2015 field crew of Jared Miller, Jason Jaworski, Neil Zook and Thomas Leonard. Thanks also to the staff of Elkhart Public Works and Utilities and their counterparts at the City of South Bend for their continued support of the Aquatics Program. Recognition is also extended to local groups such as the Michiana Walleye Association, the Elkhart River Restoration Association, Friends of the St. Joe River, and the many other groups, schools, and people that support the work of the Aquatics Program and the improvement of the St. Joseph River Watershed.

## **References**

- Aquatic Research Center of the Indiana Biological Survey. 2007. Development of Coolwater Indiana of Biotic Integrity Expectations for Use in Streams and Rivers of Indiana and Review of Existing Data. Technical Report 2007-01. Indiana Biological Survey, Aquatic Research Center, Bloomington IN.
- Deegan, 2011. Elkhart-South Bend aquatic community monitoring. Loose-leaf pub. n.p.

---

# SUMMER 2015

Deegan, 2012. Elkhart-South Bend aquatic community monitoring. Loose-leaf pub. n.p.

Deegan, 2013. Elkhart-South Bend aquatic community monitoring. Loose-leaf pub. n.p.

Foy, J. 2004. Elkhart—South Bend fish community monitoring. Loose-leaf pub. n.p.

Great Lakes Sport Fish Advisory Task Force. 1993. Appendix III, Species associated analysis and compositing of samples. in Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory.

Indiana Department of Environmental Management (IDEM). 2015. Indiana's 2014 303 (d) List of Impaired Waterways: NOC Attachment 1 Consolidated Assessment and Listing Methodology (CALM). Watershed Planning and Restoration Section. Indianapolis, IN.

Indiana State Department of Health. Fish Consumption Advisory.  
<http://www.in.gov/isdh/23650.htm>

Karr, J.R. 1981. Assessment of biotic integrity using fish communities. Fisheries 6 (6): 21-27.

Ohio Environmental Protection Agency. 1987. Biological criteria for the protection of aquatic life. Volumes I, II, III. Division of Water Quality Planning and Assessment, Surface Water Section. Columbus, Ohio.

Ohio Environmental Protection Agency. 1989. Biological criteria for the protection of aquatic life. Volume III: Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Division of Water Quality Monitoring and Assessment. Columbus, Ohio.

Rankin, E.T. 1989. The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Application. Ohio Environmental Protection Agency, Division of Water Quality Planning and Assessment. Columbus, Ohio.

Simon, T.P. 1997. Development of Index of Biotic Integrity expectations for the Ecoregions of Indiana. III. Northern Indiana Till Plain. U.S. Environmental Protection Agency, Region V, Water Division, Watershed and Non-Point Source Branch, Chicago, IL. EPA 905/R-96/002.



Jason with a beautiful Elkhart River greater redhorse



A huge South Bend longnose gar



"Goliath" sculpin vs. normal sculpin at Grape Road on Juday Creek



Neil with an extra spotty spotted gar





Jason with a big carp in South Bend



A big northern pike from Keller Park



Neil with a couple of big large-mouth bass from the Elkhart River



Thomas with a big brown trout from the Little Elkhart River



Jason with a nice bowfin on the Elkhart River



Some nice walleye collected below the South Bend Dam.



Jared with a big South Bend black crappie



Thomas with a little northern pike from the Elkhart River



A nice Christiana Creek channel kitty



Frontview of the channel catfish



A brown trout from Juday Creek

---

# APPENDICES



---

# Appendix A

## Metrics for Biological Indices

The Northern Indiana Till Plain Index of Biotic Integrity metrics used to evaluate headwater stream (<20 square miles drainage area) sites in the St. Joseph River drainage:

1. Total number of species
2. Number of darter/madtom/sculpin species
3. Percent headwater species
4. Number of minnow species
5. Number of sensitive species
6. Percent tolerant
7. Percent omnivores
8. Percent insectivores
9. Percent pioneer species (individuals)
10. Number of fish collected
11. Percent simple lithophils
12. Percent DELT anomalies

The Northern Indiana Till Plain Index of Biotic Integrity metrics used to evaluate wadeable stream (>20-<1,000 square miles drainage area) sites in the St. Joseph River drainage:

1. Total number of species
2. Number of darter species
3. Number of sunfish species
4. Number of sucker species
5. Number of sensitive species
6. Percent tolerant
7. Percent omnivores
8. Percent insectivores
9. Percent carnivores
10. Number of fish collected
11. Percent simple lithophils
12. Percent DELT anomalies

---

Invertebrate Community Index categories and metrics used to evaluate sites in the St. Joseph River drainage:

1. Total number of taxa
2. Total number of mayfly taxa
3. Total number of caddisfly taxa
4. Total number of dipteran taxa
5. Percent mayfly composition
6. Percent caddisfly composition
7. Percent tribe Tanytarsini midge composition
8. Percent other dipteran and non-insect composition
9. Percent tolerant organisms
10. Total number of qualitative EPT (mayflies, stoneflies and caddisflies) taxa

---

Qualitative Habitat Evaluation Index categories and metrics used to evaluate sites in the St. Joseph River drainage:

1. Substrate
  - type
  - number of types present
  - origin
  - silt cover
  - extent of embeddedness
  
2. Instream Cover
  - type
  - amount
  
3. Channel Morphology
  - sinuosity
  - development
  - channelization
  - stability
  
4. Riparian Zone and Bank Erosion
  - riparian width
  - floodplain quality
  - bank erosion
  
5. Pool/Glide and Riffle/Run Quality
  - maximum pool depth
  - pool/riffle morphology
  - pool/riffle/run current velocity
  - riffle/run depth
  - riffle/run substrate
  - riffle/run embeddedness
  
6. Gradient

---

The Coolwater Index of Biotic Integrity metrics used to evaluate sites in Indiana with less than or equal to 100 square miles drainage area:

1. Number of Native Species
2. Number of darter/madtom/sculpin species
3. Percent headwater species
4. Percent coolwater species
5. Percent sensitive and intolerant Species
6. Percent tolerant
7. Percent detritivore
8. Percent invertivore
9. Percent pioneer species
10. Number of fish collected (minus tolerant individuals)
11. Percent simple lithophils
12. Percent DELT anomalies

The Coolwater Index of Biotic Integrity metrics used to evaluate sites in Indiana with greater than 100 square miles drainage area:

1. Number of Native Species
2. Number of darter/madtom/sculpin species
3. Percent catostomidae (sucker family)
4. Percent coolwater species
5. Percent sensitive and intolerant Species
6. Percent tolerant
7. Percent detritivore
8. Percent invertivore
9. Percent carnivore
10. Number of fish collected (minus tolerant individuals)
11. Percent simple lithophils
12. Percent DELT anomalies

---

# Appendix B

## Fish tissue preparation and results

### Materials needed:

- Reynolds aluminum foil
- freezer wrap
- deionized (DI) water
- 1/2 gallon, 1 gallon, and jumbo size freezer bags w/write-on labels
- skinners
- stainless steel fillet knives
- knife sharpener
- scalars
- ice
- cooler

A group of three fish per species was selected based on size. The smallest fish in each group was greater than or equal to 90% of the length of the largest fish in that group. The largest fish or fish that fell into a length range for species on the advisory were selected. The fish were kept as close in size as possible within a group because the tissue from the three fish in each group was composited (mixed together) before the analyses were completed.

All of the tissue was in the form of boneless fillets taken from the fish. All of the fish had skin-on fillets taken. Before the tissue was removed, the fillet knives, scalars and skinners were cleaned and rinsed with DI water, and freezer wrap was placed where the fish were to be processed. The knives, scalars and skinners were washed in river water and rinsed with DI water after each species was processed and new freezer wrap was placed before another species

was processed. For skin-on samples, the scales were removed before the fillet was taken. It was important to be consistent with where the cut of the fillet ended and to not include any of the body cavity or viscera. Once the fillets were removed, they were rinsed in river water and then rinsed with DI water before being placed on aluminum foil. The foil was large enough to hold the three fillets for each species at a site. When all three fillets were placed on the foil, it was then wrapped and placed in a labeled freezer bag and placed on ice in a cooler. The fish tissue was placed in a freezer upon returning to the lab, and kept frozen until sent to the contract lab for analyses.



## Fish Tissue Results, Aquatics Program 2015

Station	Species	Length Range (in)	PCB Group General Population	Hg Group General Population	PCB Group Sensitive Population	Hg Group Sensitive Population
St. Joseph River Keller Park	Northern Pike	32.5-35.2	3	1	5	2
St. Joseph River Jefferson Blvd	Yellow Bullhead	9.9-10.4	1	1	2	2
Elkhart River EEC (A)	Northern Hogsucker	14.7-15.1	1	1	2	2
St. Joseph River Keller Park	Northern Hogsucker	16.1-17.4	3	1	5	2
St. Joseph River Nibbyville (A)	Brown Bullhead	12.6-13.6	1	1	2	2
St. Joseph River Arrowhead Drive	Northern Hogsucker	14.8-15.4	1	1	2	2
St. Joseph River Lexington Landing	Black Crappie	8.2-8.4	1	1	2	2
St. Joseph River Jefferson Blvd	Brown Bullhead	12.9-13.1	1	1	2	2
Elkhart River Oxbow	Walleye	18.0-19.8	2	1	3	2

Group	Guidance	Group 3	Limit consumption to 1 meal every month
Group 1	Unrestricted consumption	Group 4	Restrict consumption to 1 meal every 2 months
Group 2	Limit consumption to 1 meal per week	<b>Group 5</b>	<b>DO NOT EAT</b>

**Sensitive Population**— Females under the age of 50 and males under the age of 18  
**1 Meal**—8oz. For adults, 3oz. for children ages 3 to 6

---

# **Appendix C**

**Summary of fish collected by county, 2015**

Summary of species captured at index sites in Elkhart County, 2015

Common Name	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Rock Bass	1074	10.59	73,421	161.87	5.92
Sand Shiner	671	6.62	1,145	2.52	0.09
Smallmouth Bass	662	6.53	90,825	200.24	7.32
Spotfin Shiner	662	6.53	2,764	6.09	0.22
Golden Redhorse	652	6.43	419,561	924.97	33.81
Striped Shiner	604	5.96	6,574	14.49	0.53
Mottled Sculpin	508	5.01	2,490	5.49	0.20
Bluegill	505	4.98	34,227	75.46	2.76
White Sucker	487	4.80	82,156	181.12	6.62
Common Shiner	447	4.41	4,535	10.00	0.37
Longear Sunfish	434	4.28	12,984	28.62	1.05
Creek Chub	413	4.07	4,776	10.53	0.38
Bluntnose Minnow	369	3.64	1,072	2.36	0.09
Mimic Shiner	367	3.62	597	1.32	0.05
Northern Hog Sucker	206	2.03	65,768	144.99	5.30
Rosyface Shiner	196	1.93	429	0.95	0.03
Johnny Darter	190	1.87	247	0.54	0.02
Logperch	180	1.77	840	1.85	0.07
Rainbow Darter	162	1.60	194	0.43	0.02
Shorthead Redhorse	142	1.40	84,664	186.65	6.82
Stoneroller, Central	138	1.36	413	0.91	0.03
Hornyhead Chub	123	1.21	1,521	3.35	0.12
Green Sunfish	103	1.02	1,053	2.32	0.08
Blacknose Dace	103	1.02	505	1.11	0.04
Chestnut Lamprey	100	0.99	797	1.76	0.06
Largemouth Bass	98	0.97	25,245	55.66	2.03
Longnose Dace	52	0.51	115	0.25	0.01
Brown Trout	47	0.46	10,099	22.26	0.81
Silver Redhorse	43	0.42	75,165	165.71	6.06
Blackside Darter	38	0.37	109	0.24	0.01
Walleye	37	0.36	16,255	35.84	1.31
Redear Sunfish	36	0.35	4,463	9.84	0.36
River Redhorse	32	0.32	93,800	206.79	7.56
Pumpkinseed	28	0.28	469	1.03	0.04
Spotted Sucker	26	0.26	15,223	33.56	1.23
American Brook Lamprey	22	0.22	148	0.33	0.01
Central Mudminnow	19	0.19	101	0.22	0.01
Common Carp	18	0.18	67,700	149.25	5.46
Yellow Perch	17	0.17	134	0.30	0.01
Northern Pike	15	0.15	13,674	30.15	1.10
Yellow Bullhead	15	0.15	1,313	2.89	0.11
Grass Pickerel	12	0.12	534	1.18	0.04

Summary of species captured at index sites in Elkhart County, 2015 (continued)

Common Name	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Black Crappie	10	0.10	1,186	2.61	0.10
Greenside Darter	10	0.10	27	0.06	0.00
Longnose Gar	9	0.09	3,006	6.63	0.24
Hybrid Sunfish	8	0.08	433	0.95	0.03
Brown Bullhead	6	0.06	2,701	5.95	0.22
Brook Silverside	6	0.06	20	0.04	0.00
Bowfin	4	0.04	4,521	9.97	0.36
Golden Shiner	4	0.04	17	0.04	0.00
Brook Stickleback	4	0.04	3	0.01	0.00
Channel Catfish	3	0.03	4,757	10.49	0.38
Greater Redhorse	3	0.03	1,710	3.77	0.14
Rainbow Trout	3	0.03	1,082	2.39	0.09
Pirate Perch	3	0.03	31	0.07	0.00
Silverjaw Minnow	3	0.03	13	0.03	0.00
Northern Brook Lamprey	3	0.03	10	0.02	0.00
Quillback	2	0.02	2,900	6.39	0.23
Warmouth	2	0.02	93	0.21	0.01
Black Redhorse	1	0.01	350	0.77	0.03
Fathead Minnow	1	0.01	4	0.01	0.0003
Silver Lamprey	1	0.01	4	0.01	0.0003
Spottail Shiner	1	0.01	1	0.002	0.0001
Banded Killifish	1	0.01	1	0.002	0.0001
<b>Totals</b>	<b>10,141</b>	<b>100</b>	<b>1,240,975</b>	<b>2,736</b>	<b>100.00</b>

Summary of species captured at investigative sites in Elkhart County, 2015

Common Name	Total Number	% by Number
Striped Shiner	353	28.26
Rock Bass	103	8.25
Golden Redhorse	101	8.09
Creek Chub	70	5.60
Smallmouth Bass	68	5.44
Hornyhead Chub	67	5.36
Brown Trout	57	4.56
Mimic Shiner	39	3.12
White Sucker	32	2.56
Northern Hog Sucker	32	2.56
Common Shiner	30	2.40
Bluntnose Minnow	30	2.40
Blacknose Dace	30	2.40
Sand Shiner	29	2.32
Rosyface Shiner	28	2.24
Longear Sunfish	23	1.84
Logperch	20	1.60
Mottled Sculpin	17	1.36
Bluegill	17	1.36
Shorthead Redhorse	16	1.28
Spotfin Shiner	14	1.12
Blackside Darter	11	0.88
Largemouth Bass	9	0.72
American Brook Lamprey	8	0.64
Central Mudminnow	8	0.64
Silver Redhorse	7	0.56
Chestnut Lamprey	6	0.48
Common Carp	4	0.32
Grass Pickerel	3	0.24
Longnose Gar	3	0.24
Yellow Bullhead	3	0.24
Green Sunfish	2	0.16
Pirate Perch	2	0.16
Yellow Perch	2	0.16
Northern Pike	1	0.08
Rainbow Trout	1	0.08
Stoneroller, Central	1	0.08
Black Bullhead	1	0.08
River Redhorse	1	0.08
<b>Total</b>	<b>1,249</b>	<b>100</b>

Index Sites	10,141
Investigative Sites	1,249
<b>Elkhart County Total</b>	<b>11,390</b>

Summary of species captured at investigative sites in St. Joseph County, 2015

Common Name	Total Number	% by Number
Creek Chub	217	20.61
White Sucker	179	17.00
Mottled Sculpin	140	13.30
Smallmouth Bass	105	9.97
Rock Bass	56	5.32
Blacknose Dace	52	4.94
Longear Sunfish	39	3.70
Black Redhorse	39	3.70
Golden Redhorse	35	3.32
Bluntnose Minnow	26	2.47
Shorthead Redhorse	21	1.99
Spotfin Shiner	18	1.71
Logperch	16	1.52
Bluegill	14	1.33
Largemouth Bass	14	1.33
Johnny Darter	13	1.23
Walleye	9	0.85
Green Sunfish	7	0.66
River Redhorse	7	0.66
Spotted Sucker	6	0.57
Common Carp	4	0.38
Brown Trout	4	0.38
Quillback	4	0.38
Longnose Gar	3	0.28
Rainbow Darter	3	0.28
Spottail Shiner	3	0.28
Northern Hog Sucker	3	0.28
Rainbow Trout	3	0.28
Black Crappie	2	0.19
Brook Trout	2	0.19
Blackside Darter	2	0.19
Northern Pike	2	0.19
Greenside Darter	1	0.09
Pumpkinseed	1	0.09
Hybrid Sunfish	1	0.09
Sand Shiner	1	0.09
Chestnut Lamprey	1	0.09
<b>Total</b>	<b>1,053</b>	<b>100.00</b>

Summary of species captured at index sites in St. Joseph County, 2015

Common Name	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Smallmouth Bass	911	18.73	113,443	250.10	11.41
Longear Sunfish	598	12.29	25,546	56.32	2.57
Rock Bass	587	12.07	43,588	96.10	4.38
Creek Chub	417	8.57	10,039	22.13	1.01
Golden Redhorse	304	6.25	254,107	560.21	25.56
Bluegill	212	4.36	4,707	10.38	0.47
Mimic Shiner	190	3.91	473	1.04	0.05
Black Redhorse	188	3.86	132,104	291.24	13.29
White Sucker	161	3.31	10,894	24.02	1.10
Mottled Sculpin	139	2.86	879	1.94	0.09
Bluntnose Minnow	104	2.14	347	0.77	0.03
Central Mudminnow	92	1.89	238	0.52	0.02
Northern Hog Sucker	90	1.85	30,355	66.92	3.05
Green Sunfish	88	1.81	702	1.55	0.07
Logperch	69	1.42	896	1.98	0.09
Creek Chubsucker	63	1.29	1451	3.20	0.15
Spotted Sucker	61	1.25	21,967	48.43	2.21
Spotfin Shiner	60	1.23	340	0.75	0.03
Shorthead Redhorse	57	1.17	51,400	113.32	5.17
Quillback	49	1.01	68,300	150.58	6.87
Blacknose Dace	48	0.99	245	0.54	0.02
Chestnut Lamprey	37	0.76	359	0.79	0.04
Rainbow Trout	36	0.74	4,447	9.80	0.45
Largemouth Bass	35	0.72	8,774	19.34	0.88
Walleye	29	0.60	28,621	63.10	2.88
Johnny Darter	29	0.60	67	0.15	0.01
Blackside Darter	24	0.49	80	0.18	0.01
Longnose Gar	19	0.39	17,900	39.46	1.80
Spottail Shiner	18	0.37	42	0.09	0.00
Common Carp	14	0.29	57,900	127.65	5.82
Fathead Minnow	14	0.29	23	0.05	0.00
Northern Pike	13	0.27	36,043	79.46	3.63
Greenside Darter	13	0.27	29	0.06	0.00
Silver Redhorse	11	0.23	23,010	50.73	2.31
Greater Redhorse	10	0.21	15,056	33.19	1.51
Yellow Bullhead	9	0.18	1300	2.87	0.13
YOY Suckers (Unid.)	9	0.18	20	0.04	0.00
River Redhorse	8	0.16	22,500	49.60	2.26
Black Crappie	7	0.14	1,524	3.36	0.15
Golden Shiner	7	0.14	59	0.13	0.01
Warmouth	5	0.10	170	0.37	0.02
Pumpkinseed	5	0.10	108	0.24	0.01

Summary of species captured at index sites in St. Joseph County, 2015(continued)

Common Name	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Banded Killifish	5	0.10	9	0.02	0.00
Redear Sunfish	4	0.08	278	0.61	0.03
Brown Bullhead	3	0.06	1,324	2.92	0.13
Stonecat	3	0.06	100	0.22	0.01
Rainbow Darter	3	0.06	4	0.01	0.00
Hybrid Sunfish	2	0.04	210	0.46	0.02
Spotted Gar	1	0.02	1,100	2.43	0.11
Brown Trout	1	0.02	1,004	2.21	0.10
Yellow Perch	1	0.02	38	0.08	0.004
Common Shiner	1	0.02	6	0.01	0.0006
Rosyface Shiner	1	0.02	1	0.00	0.0001
<b>Total</b>	<b>4,865</b>	<b>100</b>	<b>994,127</b>	<b>2,192</b>	<b>100.00</b>

Index Sites	4,865
Investigative Sites	1,053
<b>St. Joseph County Total</b>	<b>5,918</b>





---

# **Appendix D**

**Summary of fish collected by site, 2015  
(Reference Table 1 for site numbers and locations)**

Stream	St. Joseph River, Elkhart County, 2015						
Site	McNaughton Park		Lexington Avenue		Nibbyville (A)		Arrowhead Drive
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	Investigative
#Banded Killifish			X				
Black Crappie		X	X	X		X	
~Black Redhorse			X				
Blackside Darter	X	X	X	X	X		X
Bluegill	X	X	X	X	X	X	X
#Bluntnose Minnow	X	X	X	X	X	X	X
Bowfin			X		X	X	
~Brook Silverside			X	X		X	
#Brown Bullhead		X			X	X	
#Channel Catfish		X			X		
Chestnut Lamprey	X		X	X	X		X
#Common Carp	X	X		X	X	X	X
Common Shiner			X				
~Golden Redhorse	X	X	X	X	X	X	X
#Golden Shiner			X				
Grass Pickerel			X		X		
~Greater Redhorse			X	X			
#Green Sunfish	X	X	X	X		X	
~Greenside Darter					X	X	
~Hornyhead Chub			X	X	X		X
Hybrid Sunfish	X		X	X	X	X	
Johnny Darter						X	
Largemouth Bass	X	X	X	X	X	X	X
~Logperch	X	X	X	X	X		X
~Longear Sunfish	X	X	X	X	X	X	X
#Longnose Gar		X		X	X	X	X
~Mimic Shiner	X	X	X	X	X	X	X
~Northern Hog Sucker	X	X	X	X		X	X
Northern Pike	X		X	X	X	X	
Pirate Perch							X
#Quillback			X				
~Rainbow Darter		X					
Rainbow Trout				X			
Redear Sunfish		X				X	
~River Redhorse	X	X	X	X			X
~Rock Bass	X	X	X	X	X	X	X
~Rosyface Shiner	X	X	X	X		X	X
~Sand Shiner		X	X	X		X	X
~Shorthead Redhorse	X	X	X	X	X	X	X
~Silver Redhorse	X	X	X	X	X	X	X

Stream	St. Joseph River, Elkhart County, 2015						
Site	McNaughton Park		Lexington Avenue		Nibbyville (A)		Arrowhead Drive
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	Investigative
~Smallmouth Bass	X	X	X	X	X	X	X
Spotfin Shiner	X	X	X	X	X	X	X
Spottail Shiner		X					
Spotted Sucker					X	X	
Striped Shiner	X				X	X	X
Walleye	X	X	X	X	X	X	
#White Sucker	X		X	X	X	X	X
#Yellow Bullhead	X		X	X	X		X
Yellow Perch					X	X	X

~ - denotes a species that is SENSITIVE to environmental disturbances such as degraded water quality or habitat  
# - denotes a species that is TOLERANT of environmental disturbances such as degraded water quality or habitat

Stream	St. Joseph River, St. Joseph County, 2015										
	Jefferson Blvd		South Bend Dam	LaSalle Ave		Keller Park			Brick Road		St. Pats Park
	1st Pass	2nd Pass		1st Pass	2nd Pass	1st Pass	2nd Pass	3rd Pass (Night)	1st Pass	2nd Pass	
#Banded Killifish							X		X	X	
Black Crappie		X	X			X	X	X		X	
~Black Redhorse			X	X	X	X	X	X	X	X	X
Blackside Darter		X		X	X			X		X	X
Bluegill	X	X	X	X	X	X	X	X	X	X	X
#Bluntnose Minnow	X	X	X	X	X	X	X	X	X	X	X
#Brown Bullhead	X	X						X			
#Central Mudminnow										X	
Chestnut Lamprey			X	X		X	X	X	X	X	
#Common Carp	X	X				X		X			X
Common Shiner								X			
#Creek Chub									X	X	
#Fathead Minnow	X										
~Golden Redhorse	X	X	X	X	X	X	X	X	X	X	X
#Golden Shiner	X	X						X			
~Greater Redhorse	X	X				X			X	X	
#Green Sunfish	X	X		X	X	X	X			X	
~Greenside Darter		X	X	X	X		X	X		X	
~Hornyhead Chub											
Hybrid Sunfish			X	X		X					
Johnny Darter											
Largemouth Bass	X	X				X	X	X	X	X	X
~Logperch		X	X		X		X			X	
~Longear Sunfish	X	X	X	X	X	X	X	X	X	X	X
#Longnose Gar			X		X	X	X				
~Mimic Shiner		X		X	X	X	X		X	X	
~Northern Hog Sucker			X	X	X	X	X	X		X	X
Northern Pike			X			X	X			X	X
Pumpkinseed		X			X					X	X
#Quillback		X	X	X	X	X	X	X	X		X
~Rainbow Darter			X				X			X	
Rainbow Trout	X			X		X					
Redear Sunfish		X			X			X			
~River Redhorse			X	X	X	X	X			X	X
~Rock Bass	X	X	X	X	X	X	X	X	X	X	X
~Rosyface Shiner					X						
~Sand Shiner											X
~Shorthead Redhorse			X	X	X	X	X		X	X	X

Stream	St. Joseph River, St. Joseph County, 2015										
Site	Jefferson Blvd		South Bend Dam	LaSalle Ave		Keller Park			Brick Road		St. Pats Park
	1st Pass	2nd Pass		1st Pass	2nd Pass	1st Pass	2nd Pass	3rd Pass (Night)	1st Pass	2nd Pass	
~Silver Redhorse				X	X	X	X		X	X	
~Smallmouth Bass	X	X	X	X	X	X	X	X	X	X	X
Spotfin Shiner				X	X		X	X	X	X	X
Spottail Shiner		X	X		X			X		X	
Spotted Gar							X				
Spotted Sucker	X	X		X		X	X	X	X		X
~Stonecat								X			
Striped Shiner											
Walleye			X	X	X	X	X	X	X	X	
Warmouth								X			
#White Sucker	X	X	X		X		X	X	X	X	X
#Yellow Bullhead	X	X							X	X	
Yellow Perch								X			
~YOY Suckers (Unid.)								X		X	

~ - denotes a species that is SENSITIVE to environmental disturbances such as degraded water quality or habitat  
# - denotes a species that is TOLERANT of environmental disturbances such as degraded water quality or habitat

Tributaries to the St. Joseph River, 2015									
Stream	Little Elkhart River		Pine Creek		Christiana Creek		Yellow Creek		Baugo Creek
Site	CR 35		SR 120		NMWF		Concord High School		Restoration (B)*
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	
~American Brook Lamprey	X	X	X						
Black Crappie						X			
#Blacknose Dace	X	X	X	X			X	X	X
Blackside Darter	X	X	X	X	X	X			X
Bluegill	X	X	X		X	X	X	X	X
#Bluntnose Minnow			X	X	X	X	X	X	X
#Brook Stickleback							X	X	
#Brown Bullhead						X			
Brown Trout	X	X							
#Central Mudminnow	X		X	X			X	X	X
#Channel Catfish						X			
Chestnut Lamprey	X	X			X	X	X	X	
Common Shiner	X	X					X	X	X
#Creek Chub	X	X		X	X	X	X	X	X
~Golden Redhorse	X		X		X	X			
#Golden Shiner	X								X
Grass Pickerel	X					X			
#Green Sunfish	X		X	X	X	X		X	
~Greenside Darter									X
~Hornyhead Chub	X				X	X	X		
Johnny Darter	X	X	X	X			X	X	X
Largemouth Bass	X	X	X			X		X	X
~Logperch	X		X	X	X	X			X
~Longear Sunfish					X				X
~Longnose Dace								X	X
~Mimic Shiner									X
Mottled Sculpin	X	X	X	X					
~Northern Hog Sucker	X	X	X		X	X			
Northern Pike					X				
Pirate Perch									X
Pumpkinseed					X	X			X
~Rainbow Darter	X	X	X	X	X	X	X	X	X
Rainbow Trout	X								
~Rock Bass	X		X	X	X	X			X
~Sand Shiner				X					X
~Shorthead Redhorse	X	X			X	X			X
~Silver Redhorse					X	X			X

Tributaries to the St. Joseph River, 2015									
Stream	Little Elkhart River		Pine Creek		Christiana Creek		Yellow Creek		Baugo Creek
Site	CR 35		SR 120		NMWF		Concord High School		Restoration (B)*
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	
Silverjaw Minnow							X		X
~Smallmouth Bass	X	X		X	X	X			X
Spotfin Shiner			X		X	X			X
Spotted Sucker					X				
Stoneroller, Central	X						X	X	X
Striped Shiner	X	X	X	X	X	X			X
Walleye					X				X
Warmouth		X							
#White Sucker	X	X	X	X	X	X	X	X	X
#Yellow Bullhead				X		X			X

~ - denotes a species that is SENSITIVE to environmental disturbances such as degraded water quality or habitat  
# - denotes a species that is TOLERANT of environmental disturbances such as degraded water quality or habitat  
\*Due to flooding conditions during the summer of 2015, Baugo Restoration (B) was only sampled on 1 occasion

Tributaries to the St. Joseph River, 2015						
Stream	Lily Creek		Cobus Creek			York-Middlebury TWP Ditch
Site	Park Six Drive		CR 2	CR 10	Old US 20	CR 108
	1st Pass	2nd Pass				
~American Brook Lamprey		No Fish			X	
#Blacknose Dace				X	X	X
Blackside Darter					X	
Bluegill			X			X
Brown Trout					X	
#Central Mudminnow			X	X		X
#Creek Chub	X		X	X	X	X
~Golden Redhorse					X	
Grass Pickerel			X			
#Green Sunfish						X
Mottled Sculpin					X	X
Northern Pike						X
Rainbow Trout						X
#White Sucker			X	X	X	
#Yellow Bullhead	X			X		

~ - denotes a species that is SENSITIVE to environmental disturbances such as degraded water quality or habitat  
# - denotes a species that is TOLERANT of environmental disturbances such as degraded water quality or habitat



Tributaries to the St. Joseph River, 2015							
Stream	Elkhart River						
Site	CR 17	Oxbow (B)		EEC (A)		Central High School	
	CR 17	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
~American Brook Lamprey	X	X	X	X	X		X
#Black Bullhead	X						
Black Crappie				X			
Blackside Darter		X	X			X	
Bluegill	X	X	X	X	X	X	X
#Bluntnose Minnow	X	X	X	X	X		X
#Central Mudminnow			X				
Chestnut Lamprey	X	X	X	X	X	X	X
#Common Carp					X		
Common Shiner	X	X	X		X		X
#Creek Chub	X	X	X	X			
#Fathead Minnow					X		
~Golden Redhorse	X	X	X	X	X	X	X
Grass Pickerel			X				
~Greater Redhorse				X			
#Green Sunfish	X	X	X	X	X		X
~Hornyhead Chub	X	X	X	X	X	X	X
Johnny Darter			X	X			X
Largemouth Bass		X	X	X	X	X	
~Longear Sunfish	X	X	X	X	X	X	X
~Mimic Shiner							X
~Northern Brook Lamprey				X			
~Northern Hog Sucker	X	X	X	X	X	X	X
Northern Pike		X	X	X	X		X
Pirate Perch	X				X		
~Rainbow Darter			X				X
Rainbow Trout				X			
Redear Sunfish			X	X	X		
~Rock Bass	X	X	X	X	X	X	X
~Rosyface Shiner	X	X	X	X	X	X	X
~Sand Shiner	X		X	X			X
Silver Lamprey		X					
~Smallmouth Bass	X	X	X	X	X	X	X
Spotfin Shiner	X	X	X	X	X	X	X
Spotted Sucker		X	X		X		
Stoneroller, Central	X		X				X
Striped Shiner	X	X	X	X	X		X
Walleye					X		X

Tributaries to the St. Joseph River, 2015							
Stream	Elkhart River						
Site	CR 17	Oxbow (B)		EEC (A)		Central High School	
	CR 17	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
Warmouth					X		
#White Sucker	X	X	X	X	X	X	X
#Yellow Bullhead	X		X	X		X	

Tributaries to the St. Joseph River, St. Joseph County, 2015							
Stream	Juday Creek						
Site	Grape Road		Ponader Park	Ironwood Drive	Myrtle Street		State Road 933
	1st Pass	2nd Pass			1st Pass	2nd Pass	
#Blacknose Dace	X	X	X	X	X	X	X
Brown Trout	X		X	X			X
Chestnut Lamprey					X		
#Common Carp			X				
#Creek Chub	X	X	X	X	X	X	X
Johnny Darter	X	X	X	X	X	X	X
Largemouth Bass			X	X		X	
Mottled Sculpin	X	X	X	X	X	X	X
~Rainbow Darter							X
Rainbow Trout							X
~Rock Bass			X	X	X	X	X
~Smallmouth Bass			X	X			X
#White Sucker	X	X	X	X	X	X	X

Tributaries to the St. Joseph River, St. Joseph County, 2015						
Stream	Auten Ditch		Bowman Creek			Keifer Ditch
Site	Locust Road (S)		Chippewa Avenue		Green Tech Drive	Auten Road
	1st Pass	2nd Pass	1st Pass	2nd Pass		
#Blacknose Dace						X
Bluegill				X		
#Central Mudminnow	X	X	X	X		
#Creek Chub	X	X	X	X	X	
#Fathead Minnow	X	X	X	X		
#Green Sunfish	X	X	X	X	X	
Largemouth Bass					X	X

~ - denotes a species that is SENSITIVE to environmental disturbances such as degraded water quality or habitat  
# - denotes a species that is TOLERANT of environmental disturbances such as degraded water quality or habitat



---

# Appendix E

## Summary of macroinvertebrates (insects) collected by site, 2015

Macroinvertebrates were collected in two ways to calculate the Invertebrate Community Index (ICI). The first method employed a sampling device known as a Hester-Dendy multi-plate sampler (HD sampler). Macroinvertebrates collected using this method were identified and counted (Quantitative column in the following tables). The second method was a sweep with a net of all the available habitat types in the area of the Hester-Dendy in an effort to identify other macroinvertebrates in the stream that may not colonize the HD samplers. Macroinvertebrates collected in this way were identified and simply counted as being present (Qualitative column).

Site: St. Joseph River - Nibbyville (A)

Date Collected: 08/17/2015 Site #: 2

Taxa Name	Quantitative	Qualitative	Tol	Taxa Name	Quantitative	Qualitative	Tol
Turbellaria	13		F	Conchapelopia sp	2		F
Crangonyx sp	0	+	MT	H. senata or T. norena	2		F
Gammarus sp	30	+	F	Nilotanypus fimbriatus	7		F
Plauditus dubius or P. virilis	1		I	Pentaneura inconspicua	24		F
Baetis intercalaris	94	+	F	Rheopelopia paramaculipennis	3		MI
Isonychia sp	4	+	MI	Corynoneura lobata	5		F
Leucrocuta sp	3	+	MI	Nanocladius (N.) spiniplenus	2		F
Stenacron sp	48	+	F	Thienemanniella xena	13		F
Maccaffertium exiguum	74	+	MI	Chironomini	2		
Maccaffertium pulchellum	18		MI	Microtendipes "caelum"	2		MI
Maccaffertium terminatum	3		MI	Microtendipes pedellus group	3		F
Teloganopsis sp	25	+	I	Polypedilum flavum	38		F
Tricorythodes sp	444	+	MI	Polypedilum (P.) fallax group	2	+	F
Caenis sp	0	+	F	Polypedilum (P.) illinoense	5		T
Anthopotamus sp	0	+	MI	Polypedilum halterale group	0	+	MT
Coenagrionidae	0	+	T	Stenochironomus sp	17		F
Argia sp	0	+	F	Tribelos fuscicorne	0	+	F
Boyeria vinosa	0	+	F	Rheotanytarsus sp	60		F
Gomphus sp	0	+	F	Tanytarsus sp	2		F
Acroneuria abnormis	1		MI	Hemerodromia sp	2		F
Chimarra obscura	5	+	MI	Campeloma decism	0	+	F
Cyrnellus fraternus	0	+	F	Elimia sp	6	+	MI
Neureclipsis sp	49		MI	Physella sp	37		T
Nyctiophylax sp	1		MI	Ferrissia sp	29		F
Polycentropus sp	1		MI	Corbicula fluminea	4	+	F
Cheumatopsyche sp	120		F	Dreissena polymorpha	0	+	F
Hydropsyche phalerata	0	+	MI				
Macrostemum zebratum	2	+	I				
Hydroptila sp	2		F	No. Quantitative Taxa:	49		
Neophylax sp	0	+	MI	No. Qualitative Taxa:	34		
Helicopsyche borealis	7		MI	Total Taxa:	67		
Nectopsyche exquisita	0	+	MI	Number of Organisms:	1310		
Oecetis avara	11		I	Qual EPT:	15		
Oecetis persimilis	4		MI	<b>ICI:</b>	<b>44</b>		
Dineutus sp	0	+	F				
Psephenus herricki	0	+	MI				
Macronychus glabratus	65	+	F				
Stenelmis sp	13	+	F				
Simulium sp	2	+	F				
Ablabesmyia mallochi	0	+	F				
Ablabesmyia rhamphe group	3		MT				

Site: St. Joseph River - Lexington Ave

Date Collected: 08/14/2015 Site #: 3

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	156		F	Nilotanypus fimbriatus	4		F
Caecidotea sp	0	+	T	Pentaneura inconspicua	12		F
Gammarus sp	0	+	F	Corynoneura lobata	8		F
Orconectes rusticus	0	+	F	Cricotopus (C.) bicinctus	1	+	T
Hydrachnidia	0	+	F	Thienemanniella xena	9		F
Plauditus dubius or P. virilis	3		I	Tvetenia discoloripes group	1		MI
Baetis intercalaris	91		F	Dicrotendipes neomodestus	0	+	F
Labiobaetis propinquus	1		MI	Glyptotendipes (G.) sp	1		MT
Isonychia sp	60	+	MI	Parachironomus sp	0	+	MT
Leucrocuta sp	8		MI	Polypedilum flavum	15		F
Stenacron sp	25	+	F	Polypedilum (P.) fallax group	1		F
Maccaffertium exiguum	331	+	MI	Polypedilum (P.) illinoense	0	+	T
Maccaffertium mediopunctatum	6		MI	Xenochironomus xenolabis	0	+	F
Maccaffertium pulchellum	34		MI	Rheotanytarsus pellucidus	1		MI
Maccaffertium terminatum	15		MI	Rheotanytarsus sp	75		F
Teloganopsis sp	71	+	I	Hemerodromia sp	6		F
Tricorythodes sp	41	+	MI	Elimia sp	5	+	MI
Coenagrionidae	0	+	T	Corbicula fluminea	0	+	F
Argia sp	0	+	F	Dreissena polymorpha	0	+	F
Macromia sp	0	+	MI				
Pteronarcys sp	0	+	MI				
Paragnetina sp	0	+	MI	No. Quantitative Taxa:	39		
Belostoma sp	0	+	T	No. Qualitative Taxa:	34		
Neoplea sp	0	+	F	Total Taxa:	60		
Corydalus cornutus	1		MI	Number of Organisms:	1309		
Chimarra obscura	8	+	MI	Qual EPT:	14		
Neureclipsis sp	11		MI	<b>ICI:</b>	<b>52</b>		
Polycentropus sp	2		MI				
Cheumatopsyche sp	197	+	F				
Ceratopsyche morosa group	1		MI				
Hydropsyche aerata	0	+	MI				
Hydropsyche phalerata	8	+	MI				
Macrostemum zebratum	76	+	I				
Hydroptilidae	1		F				
Brachycentrus numerosus	7	+	MI				
Pycnopsyche sp	0	+	MI				
Oecetis avara	1		I				
Oecetis persimilis	6		MI				
Macronychus glabratus	0	+	F				
Stenelmis sp	0	+	F				
Simulium sp	9	+	F				

Site: St. Joseph River - McNaughton Park

Date Collected: 08/14/2015 Site #: 4

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Spongillidae	0	+	F	Dicrotendipes neomodestus	11	+	F
Turbellaria	1	+	F	Endochironomus sp	0	+	MT
Oligochaeta	12		T	Glyptotendipes (G.) sp	2		MT
Hirudinida	0	+	MT	Microtendipes pedellus group	2		F
Helobdella stagnalis	0	+	T	Phaenopsectra obediens group	4		F
Caecidotea sp	0	+	T	Polypedilum flavum	9		F
Crangonyx sp	2		MT	Polypedilum (P.) fallax group	34		F
Gammarus sp	23	+	F	Polypedilum (P.) illinoense	15	+	T
Labiobaetis propinquus	0	+	MI	Polypedilum scalaenum group	6	+	F
Isonychia sp	1		MI	Stenochironomus sp	41		F
Stenacron sp	245	+	F	Tribelos fuscicorne	2		F
Maccaffertium exiguum	154	+	MI	Rheotanytarsus sp	51		F
Maccaffertium m. integrum	13		MI	Tanytarsus sepp	2		F
Maccaffertium terminatum	4		MI	Hemerodromia sp	2		F
Teloganopsis sp	2		I	Elimia sp	0	+	MI
Tricorythodes sp	86	+	MI	Corbicula fluminea	5	+	F
Ephemeraeidae	2			Dreissena polymorpha	0	+	F
Corixidae	0	+	F				
Sisyridae	0	+	F				
Cyrenellus fraternus	0	+	F	No. Quantitative Taxa:	39		
Nyctiophylax sp	47		MI	No. Qualitative Taxa:	31		
Polycentropus sp	3		MI	Total Taxa:	58		
Cheumatopsyche sp	18	+	F	Number of Organisms:	844		
Hydropsyche aerata	0	+	MI	Qual EPT:	10		
Hydropsyche phalerata	0	+	MI	<b>ICI:</b>	<b>36</b>		
Macrostemum zebratum	3	+	I				
Hydroptila sp	1		F				
Brachycentrus numerosus	1		MI				
Trienodes injustus	0	+	MI				
Staphylinidae	0	+	F				
Ancyronyx variegata	0	+	F				
Dubiraphia sp	0	+	F				
Macronychus glabratus	5	+	F				
Stenelmis sp	0	+	F				
Ablabesmyia janta	0	+	F				
Ablabesmyia mallochi	2		F				
Ablabesmyia rhamphe group	4		MT				
Hayesomyia senata or T. norena	6		F				
Pentaneura inconspicua	13		F				
Corynoneura lobata	6		F				
Cricotopus (C.) bicinctus	4		T				

Site: St. Joseph River - Jefferson Blvd

Date Collected: 08/14/2015 Site #: 5

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	72	+	F	Corynoneura lobata	6		F
Oligochaeta	3	+	T	Cricotopus (C.) bicinctus	3		T
Placobdella ornata	0	+	MT	Cricotopus sylvestris group	0	+	T
Caecidotea sp	1	+	T	Dicrotendipes neomodestus	1		F
Hyaella azteca	0	+	F	Polypedilum (Uresipedilum) flavum	3		F
Gammarus sp	29	+	F	Polypedilum (P.) fallax group	2		F
Orconectes sp	0	+	F	Polypedilum (P.) illinoense	8	+	T
Baetis intercalaris	1		F	Stenochironomus sp	3		F
Labiobaetis propinquus	1		MI	Xenochironomus xenolabis	0	+	F
Isonychia sp	1		MI	Pseudochironomus sp	1		F
Leucrocuta sp	0	+	MI	Rheotanytarsus sp	2		F
Stenacron sp	315	+	F	Viviparus georgianus	6	+	F
Maccaffertium exiguum	16	+	MI	Elimia sp	47	+	MI
Maccaffertium terminatum	0	+	MI	Physella sp	0	+	T
Tricorythodes sp	39	+	MI	Planorbella (Pierosoma) pilsbryi	5	+	T
Caenis sp	0	+	F	Ferrissia sp	1		F
Coenagrionidae	0	+	T	Corbicula fluminea	0	+	F
Sialis sp	0	+	MT	Dreissena polymorpha	0	+	F
Cyrnellus fraternus	6	+	F	Actinonaias ligamentina carinata	0	+	MI
Polycentropus sp	5	+	MI				
Cheumatopsyche sp	70	+	F				
Hydropsyche aerata	0	+	MI	No. Quantitative Taxa:	39		
Hydropsyche orris	3		MI	No. Qualitative Taxa:	37		
Hydropsyche phalerata	2		MI	Total Taxa:	60		
Macrostemum zebratum	6		I	Number of Organisms:	699		
Hydroptila sp	5		F	Qual EPT:	11		
Oxyethira sp	3		F	<b>ICI:</b>	<b>40</b>		
Pycnopsyche sp	0	+	MI				
Oecetis sp	1		F				
Halipus sp	0	+	MT				
Peltodytes sp	0	+	MT				
Ancyronyx variegata	0	+	F				
Macronychus glabratus	4	+	F				
Stenelmis sp	1	+	F				
Anopheles sp	0	+	F				
Ablabesmyia mallochi	1		F				
Ablabesmyia rhamphe group	10		MT				
H. senata or T. norena	13		F				
Nilotanytus fimbriatus	1		F				
Pentaneura inconspicua	2		F				
Procladius (Holotanytus) sp	0	+	MT				



Site: St. Joseph River - LaSalle Avenue

Date Collected: 08/13/2015

Site #: 7

Taxa Name	Quantitative	Qualitative	Tol.	
Turbellaria	15		F	
Oligochaeta	8		T	
Gammarus sp	3	+	F	
Orconectes sp	0	+	F	
Baetis intercalaris	127	+	F	No. Quantitative Taxa: 31
Isonychia sp	2		MI	No. Qualitative Taxa: 25
Stenacron sp	99	+	F	Total Taxa: 41
Maccaffertium exiguum	37	+	MI	Number of Organisms: 866
Maccaffertium mexicanum integrum	2		MI	Qual EPT: 13
Maccaffertium pulchellum	24	+	MI	<b>ICI: 42</b>
Maccaffertium terminatum	0	+	MI	
Teloganopsis sp	3		I	
Tricorythodes sp	14	+	MI	
Chimarra obscura	4		MI	
Polycentropus sp	0	+	MI	
Cheumatopsyche sp	57	+	F	
Hydropsyche orris	7	+	MI	
Hydropsyche phalerata	15	+	MI	
Macrostemum zebratum	244	+	I	
Proptila sp	0	+	I	
Hydroptila sp	10		F	
Brachycentrus numerosus	0	+	MI	
Oecetis persimilis	2		MI	
Macronychus glabratus	2	+	F	
Stenelmis sp	0	+	F	
Simulium sp	5	+	F	
Hayesomyia senata or T. norena	17		F	
Cardiocladius obscurus	2		MI	
Corynoneura lobata	2		F	
Cricotopus (C.) bicinctus	7	+	T	
N.(N.) crassicornus or N. "rectinervis"	2		F	
Tvetenia discoloripes group	20	+	MI	
Parachironomus sp	0	+	MT	
Polypedilum (Uresipedilum) flavum	9	+	F	
Polypedilum (P.) illinoense	40		T	
Stenochironomus sp	13		F	
Rheotanytarsus sp	62		F	
Hemerodromia sp	12		F	
Elimia sp	0	+	MI	
Corbicula fluminea	0	+	F	
Dreissena polymorpha	0	+	F	

Site: St. Joseph River - Keller Park

Date Collected: 08/13/2015

Site #: 8

Taxa Name	Quantitative	Qualitative	Tol.
Hirudinida		0+	MT
Caecidotea sp		0+	T
Gammarus sp		0+	F
Orconectes sp		0+	F
Plauditus dubius or P. virilis		0+	I
Baetis intercalaris		0+	F
Isonychia sp		0+	MI
Stenacron sp		0+	F
Maccaffertium mediopunctatum		0+	MI
Maccaffertium pulchellum		0+	MI
Maccaffertium terminatum		0+	MI
Teloganopsis sp		0+	I
Tricorythodes sp		0+	MI
Chimarra obscura		0+	MI
Cheumatopsyche sp		0+	F
Hydropsyche phalerata		0+	MI
Macrostemum zebratum		0+	I
Hydroptilidae		0+	F
Brachycentrus numerosus		0+	MI
Helicopsyche borealis		0+	MI
Nectopsyche exquisita		0+	MI
Petrophila sp		0+	MI
Stenelmis sp		0+	F
Simulium sp		0+	F
Cryptochironomus sp		0+	F
Glyptotendipes (G.) sp		0+	MT
Tribelos jucundum		0+	MT
Elimia sp		0+	MI
Corbicula fluminea		0+	F
Dreissena polymorpha		0+	F

No. Quantitative Taxa:	0
No. Qualitative Taxa:	30
Total Taxa:	30
Number of Organisms:	0
Qual EPT:	17
<b>ICI:</b>	<b>VG*</b>

\* Sampler was lost

VG—Very Good Qualitative Score

Site: St. Joseph River - Brick Road

Date Collected: 08/13/2015 Site #: 9

Taxa Name	Quantitative	Qualitative	Tol.	
Caecidotea sp	0	+	T	
Gammarus sp	0	+	F	
Orconectes (Procericambarus) rusticus	0	+	F	
Baetis intercalaris	0	+	F	
Isonychia sp	0	+	MI	No. Quantitative Taxa: 0
Leucrocuta sp	0	+	MI	No. Qualitative Taxa: 36
Stenacron sp	0	+	F	Total Taxa: 36
Maccaffertium pulchellum	0	+	MI	Number of Organisms: 0
Maccaffertium vicarium	0	+	MI	Qual EPT: 16
Teloganopsis sp	0	+	I	<b>ICI: VG*</b>
Tricorythodes sp	0	+	MI	
Hetaerina sp	0	+	F	* Sampler was lost
Coenagrionidae	0	+	T	VG—Very Good Qualitative Score
Argia sp	0	+	F	
Agnetina capitata complex	0	+	MI	
Belostoma sp	0	+	T	
Neoplea sp	0	+	F	
Chimarra obscura	0	+	MI	
Cynellus fraternus	0	+	F	
Cheumatopsyche sp	0	+	F	
Hydropsyche phalerata	0	+	MI	
Macrostemum zebratum	0	+	I	
Brachycentrus numerosus	0	+	MI	
Helicopsyche borealis	0	+	MI	
Peltodytes sp	0	+	MT	
Psephenus herricki	0	+	MI	
Macronychus glabratus	0	+	F	
Stenelmis sp	0	+	F	
Tipula sp	0	+	F	
Simulium sp	0	+	F	
Cricotopus (Isocladius) sylvestris group	0	+	T	
Polypedilum (P.) illinoense	0	+	T	
Tribelos jucundum	0	+	MT	
Cipangopaludina japonica	0	+	MT	
Elimia sp	0	+	MI	
Pisidium sp	0	+	MT	

Site: Little Elkhart River - County Road 35

Date Collected: 08/17/2015 Site #: 11

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	22		F	Cricotopus (C.) tremulus group	0	+	MT
Caecidotea sp	0	+	T	Cricotopus (C.) trifascia	11	+	F
Gammarus sp	4	+	F	Eukiefferiella sp	4	+	
Orconectes sp	0	+	F	Nanocladius sp	4		F
Hydrachnidia	0	+	F	Parametriocnemus sp	7		F
Baetis tricaudatus	0	+	MI	Rheocricotopus robacki	32		F
Baetis flavistriga	21	+	F	Thienemanniella xena	4		F
Baetis intercalaris	0	+	F	Tvetenia bavarica group	112	+	MI
Labiobaetis propinquus	0	+	MI	Microtendipes pedellus group	11	+	F
Iswaeon anoka	4	+	MI	P. albimanus or P. duplicatus	4		F
Stenacron sp	0	+	F	Polypedilum (Uresipedilum) aviceps	14		MI
Maccaffertium exiguum	12	+	MI	Polypedilum (Uresipedilum) flavum	28		F
Maccaffertium vicarium	90	+	MI	Polypedilum (P.) fallax group	7		F
Tricorythodes sp	0	+	MI	Polypedilum (P.) illinoense	4	+	T
Gomphus sp	0	+	F	Rheotanytarsus pellucidus	21		MI
Pteronarcys sp	0	+	MI	Rheotanytarsus sp	70		F
Paragnetina sp	0	+	MI	Hemerodromia sp	2		F
Lype diversa	12		MI	Elimia sp	1	+	MI
Cheumatopsyche sp	248	+	F	Physella sp	0	+	T
Ceratopsyche morosa group	121	+	MI	Ferrissia sp	2		F
Ceratopsyche sparna	58	+	F	Corbicula fluminea	0	+	F
Glossosoma sp	0	+	MI	Villosa iris iris	0	+	MI
Brachycentrus numerosus	13	+	MI				
Neophylax sp	0	+	MI				
Pycnopsyche sp	0	+	MI	No. Quantitative Taxa:	42		
Lepidostoma sp	2		MI	No. Qualitative Taxa:	39		
Nectopsyche diarina	0	+	MI	Total Taxa:	64		
Sperchopsis tessellata	0	+	F	Number of Organisms:	1033		
Ancyronyx variegata	1		F	Qual EPT:	19		
Macronychus glabratus	11		F	<b>ICI:</b>	<b>46</b>		
Optioservus sp	0	+	MI				
Stenelmis sp	5	+	F				
Simulium sp	4	+	F				
Conchapelopia sp	25		F				
H.senata or T.norena	4		F				
Labrundinia pilosella	4		F				
Nilotanypus fimbriatus	4		F				
Procladius (Holotanypus) sp	0	+	MT				
Pagastia orthogonia	4		F				
Brillia flavifrons group	4		F				
Corynoneura lobata	18		F				
Cricotopus (C.) bicinctus	4		T				

Site: Pine Creek - State Road 120

Date Collected: 08/21/2015 Site #: 13

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Hydra sp	4		F	Tvetenia bavarica group	103	+	MI
Turbellaria	9		F	Paratendipes sp.	0	+	F
Oligochaeta	4	+	T	Polypedilum aviceps	149	+	MI
Caecidotea sp	10	+	T	Polypedilum (Uresipedilum) flavum	63		F
Gammarus sp	80	+	F	Polypedilum (P.) illinoense	0	+	T
Orconectes sp	0	+	F	Micropsectra sp	23		MT
Baetis tricaudatus	13	+	MI	Rheotanytarsus pellucidus	11		MI
Baetis flavistriga	55	+	F	Rheotanytarsus sp	57		F
Baetis intercalaris	1		F	Tanytarsus glabrescens group sp 7	6		F
Stenacron sp	15	+	F	Hemerodromia sp	4		F
Maccaffertium vicarium	30	+	MI	Ferrissia sp	5		F
Hetaerina sp	0	+	F				
Boyeria vinosa	0	+	F				
Lype diversa	8		MI	No. Quantitative Taxa:	40		
Cheumatopsyche sp	314	+	F	No. Qualitative Taxa:	30		
Ceratopsyche morosa group	15	+	MI	Total Taxa:	51		
Ceratopsyche slossonae	64	+	MI	Number of Organisms:	1346		
Ceratopsyche sparna	37	+	F	Qual EPT:	10		
Hydropsyche depravata group	20		F	<b>ICI:</b>	<b>42</b>		
Brachycentrus numerosus	9		MI				
Pycnopsyche sp	0	+	MI				
Nectopsyche diarina	0	+	MI				
Ancyronyx variegata	1		F				
Dubiraphia quadrinotata	0	+	F				
Macronychus glabratus	7	+	F				
Optioservus sp	21	+	MI				
Stenelmis sp	0	+	F				
Antocha sp	1		MI				
Simulium sp	14	+	F				
Thienemannimyia group	23		F				
Pagastia sp	34	+	F				
Prodiamesa olivacea	0	+	MT				
Brillia flavifrons group	23	+	F				
Corynoneura lobata	16		F				
Eukiefferiella sp	6						
Nanocladius (N.) spinipenus	0	+	F				
Parametrioconemus sp	46	+	F				
Paratrichocladus sp	29		MI				
Rheocricotopus robacki	6		F				
Thienemanniella xena	10		F				

Site: Christiana Creek - North Main Wellfield

Date Collected: 08/21/2015 Site #: 15

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Hydra sp	4		F	Corynoneura lobata	26		F
Turbellaria	1		F	Cricotopus (C.) bicinctus	2		T
Nemertea	3		F	Parametriocnemus sp	1		F
Gammarus sp	2	+	F	Thienemanniella xena	13		F
Cambarus sp	0	+		Tvetenia bavarica group	3		MI
Hydrachnidia	0	+	F	Tvetenia discoloripes group	2		MI
Baetidae	0	+		Dicrotendipes sp	2		F
Plauditus sp	0	+	MI	Microtendipes "caelum"	2		MI
Baetis flavistriga	0	+	F	Paratendipes sp.	0	+	F
Baetis intercalaris	38	+	F	Polypedilum flavum	23		F
Iswaeon anoka	2		MI	Polypedilum (P.) fallax group	6		F
Isonychia sp	11	+	MI	Polypedilum scalaenum group	2		F
Stenacron sp	20	+	F	Stictochironomus sp	0	+	F
Maccaffertium exiguum	445	+	MI	Rheotanytarsus pellucidus	2		MI
Maccaffertium mediopunctatum	69	+	MI	Rheotanytarsus sp	48		F
Maccaffertium terminatum	20		MI	Tanytarsus sepp	4		F
Teloganopsis sp	21	+	I	Hemerodromia sp	3	+	F
Tricorythodes sp	13	+	MI	Elimia sp	14	+	MI
Caenis sp	6		F	Dreissena polymorpha	0	+	F
Argia sp	0	+	F	Pisidium sp	0	+	MT
Boyeria vinosa	0	+	F				
Dromogomphus sp	0	+	F				
Acroneuria internata	4	+	MI	No. Quantitative Taxa:	44		
Corydalis cornutus	0	+	MI	No. Qualitative Taxa:	34		
Chimarra sp	2		MI	Total Taxa:	62		
Neureclipsis sp	2		MI	Number of Organisms:	882		
Cheumatopsyche sp	32	+	F	Qual EPT:	16		
Ceratopsyche morosa group	4		MI	<b>ICI:</b>	<b>50</b>		
Ceratopsyche sparna	8	+	F				
Hydropsyche depravata group	4		F				
Hydropsyche phalerata	8	+	MI				
Hydroptila sp	1		F				
Brachycentrus numerosus	0	+	MI				
Pycnopsyche sp	0	+	MI				
Oecetis sp	5		F				
Dineutus sp	1	+	F				
Psephenus herricki	0	+	MI				
Macronychus glabratus	0	+	F				
Optioservus sp	0	+	MI				
Stenelmis sp	1	+	F				
Labrundinia neopilosella	1						
Pentaneura inconspicua	1		F				

Site: Elkhart River - Oxbow Park (B)

Date Collected: 08/18/2015 Site #: 17

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	1		F	Polypedilum flavum	10	+	F
Oligochaeta	1		T	Polypedilum (P.) fallax group	3		F
Caecidotea sp	0	+	T	Polypedilum (P.) illinoense	2		T
Gammarus sp	1	+	F	Stenochironomus sp	1		F
Orconectes sp	0	+	F	Rheotanytarsus sp	21		F
Hydrachnidia	0	+	F	Elimia sp	0	+	MI
Baetis flavistriga	6	+	F	Ferrissia sp	1		F
Baetis intercalaris	144	+	F	Corbicula fluminea	2	+	F
Leucrocuta sp	0	+	MI	Actinonaias ligamentina carinata	0	+	MI
Stenacron sp	0	+	F				
Maccaffertium exiguum	15	+	MI				
Maccaffertium mediopunctatum	3	+	MI	No. Quantitative Taxa:	31		
Maccaffertium pulchellum	0	+	MI	No. Qualitative Taxa:	34		
Maccaffertium terminatum	3	+	MI	Total Taxa:	50		
Tricorythodes sp	2	+	MI	Number of Organisms:	462		
Calopteryx sp	0	+	F	Qual EPT:	15		
Coenagrionidae	0	+	T	<b>ICI:</b>	<b>46</b>		
Argia sp	1		F				
Pteronarcys sp	0	+	MI				
Paragnetina sp	6	+	MI				
Neoplea sp	0	+	F				
Corydalis cornutus	0	+	MI				
Cheumatopsyche sp	9	+	F				
Ceratopsyche morosa group	17	+	MI				
Ceratopsyche sparna	151	+	F				
Nectopsyche diarina	0	+	MI				
Peltodytes sp	0	+	MT				
Psephenus herricki	0	+	MI				
Ancyronyx variegata	2	+	F				
Macronychus glabratus	3	+	F				
Stenelmis sp	0	+	F				
Simulium sp	16		F				
Hayesomyia senata or Thienemannimyia norena	1		F				
Meropelopia sp	1		F				
Cricotopus (C.) bicinctus	2		T				
Parametriocnemus sp	1		F				
Thienemanniella xena	15		F				
Tvetenia discoloripes group	20		MI				
Cryptochironomus sp	0	+	F				
Glyptotendipes (G.) sp	1		MT				
Paratendipes sp.	0	+	F				

Site: Elkhart River - EEC (A)

Date Collected: 08/17/2015 Site #: 18

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	28	+	F	Corynoneura lobata	13		F
Oligochaeta	2	+	T	Parametriocnemus sp	6		F
Erpobdella punctata	0	+	MT	Thienemanniella xena	5		F
Caecidotea sp	2	+	T	Tvetenia bavarica group	2		MI
Hyalella azteca	0	+	F	Chironomus sp	0	+	MT
Gammarus sp	5	+	F	Cryptotendipes pseudotener	0	+	F
Baetis flavistriga	0	+	F	Demicryptochironomus sp	0	+	MI
Baetis intercalaris	6		F	Dicrotendipes neomodestus	1		F
Iswaeon anoka	0	+	MI	Glyptotendipes (G.) sp	2		MT
Isonychia sp	7		MI	Microtendipes pedellus group	4	+	F
Leucrocuta sp	0	+	MI	Paratendipes sp.	0	+	F
Stenacron sp	144	+	F	Polypedilum flavum	18		F
Maccaffertium exiguum	42		MI	Polypedilum (P.) fallax group	5		F
Maccaffertium terminatum	4	+	MI	Polypedilum (P.) illinoense	5		T
Teloganopsis sp	3		I	Polypedilum scalaenum group	1		F
Tricorythodes sp	9	+	MI	Rheotanytarsus sp	9		F
Calopteryx sp	0	+	F	Tanytarsus sp	0	+	F
Hetaerina sp	1		F	Tanytarsus glabrescens group sp 7	1		F
Argia sp	0	+	F	Hydrobiidae	3		F
Pteronarcys sp	1	+	MI	Elimia sp	75	+	MI
Acroneuria frisoni	3		MI	Physella sp	0	+	T
Paragnetina sp	2		MI				
Neoplea sp	0	+	F				
Sialis sp	0	+	MT	No. Quantitative Taxa:	37		
Cheumatopsyche sp	80	+	F	No. Qualitative Taxa:	39		
Ceratopsyche morosa group	14		MI	Total Taxa:	62		
Ceratopsyche sparna	14	+	F	Number of Organisms:	42		
Brachycentrus numerosus	0	+	MI	Qual EPT:	13		
Pycnopsyche sp	0	+	MI	<b>ICI:</b>	<b>42</b>		
Helicopsyche borealis	0	+	MI				
Nectopsyche diarina	0	+	MI				
Psephenus herricki	0	+	MI				
Ancyronyx variegata	3	+	F				
Dubiraphia vittata group	0	+	F				
Macronychus glabratus	18	+	F				
Optioservus sp	0	+	MI				
Diptera	0	+					
Anopheles sp	0	+	F				
Simulium sp	0	+	F				
Nilotanypus fimbriatus	1		F				
Rheopelopia paramaculipennis	1		MI				



Site: Elkhart River - Central High School

Date Collected: 08/17/2015 Site #: 19

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	3		F	Parametricnemus sp	1		F
Oligochaeta	2		T	Thienemanniella xena	15		F
Placobdella ornata	0	+	MT	Tvetenia discoloripes group	1		MI
Crangonyx sp	0	+	MT	Cryptochironomus sp	0	+	F
Gammarus sp	60	+	F	Glyptotendipes (G.) sp	8		MT
Orconectes sp	0	+	F	Parachironomus sp	1		MT
Baetis flavistriga	21	+	F	Polypedilum flavum	16		F
Baetis intercalaris	102	+	F	Polypedilum (P.) fallax group	7		F
Labiobaetis propinquus	0	+	MI	Polypedilum (P.) illinoense	2	+	T
Proclleon viridoculare	0	+	MI	Polypedilum calaenum group	2		F
Leucrocuta sp	5	+	MI	Stictochironomus sp	0	+	F
Stenacron sp	38	+	F	Rheotanytarsus sp	10		F
Maccaffertium exiguum	40		MI	Tanytarsus glabrescens group sp 7	2		F
Maccaffertium mediopunctatum	0	+	MI	Hemerodromia sp	2		F
Maccaffertium pulchellum	20	+	MI	Elimia sp	91	+	MI
Maccaffertium terminatum	5	+	MI	Corbicula fluminea	0	+	F
Teloganopsis sp	0	+	I				
Tricorythodes sp	10	+	MI				
Argia sp	1		F				
Plecoptera	2			No. Quantitative Taxa:	36		
Pteronarcys sp	0	+	MI	No. Qualitative Taxa:	34		
Neuroptera	0	+		Total Taxa:	57		
Cheumatopsyche sp	16	+	F	Number of Organisms:	539		
Ceratopsyche morosa group	11		MI	Qual EPT:	17		
Ceratopsyche sparna	22		F	<b>ICI:</b>	<b>44</b>		
Hydropsyche phalerata	2	+	MI				
Neophylax sp	0	+	MI				
Pycnopsyche sp	0	+	MI				
Nectopsyche diarina	0	+	MI				
Peltodytes sp	0	+	MT				
Psephenus herricki	0	+	MI				
Ancyronyx variegata	0	+	F				
Dubiraphia vittata group	0	+	F				
Macronychus glabratus	2	+	F				
Optioservus sp	0	+	MI				
Stenelmis sp	0	+	F				
Conchapelopia sp	5		F				
Nilotanypus fimbriatus	3		F				
Pentaneura inconspicua	1		F				
Rheopelopia paramaculipennis	1		MI				
Corynoneura lobata	9		F				

Site: Yellow Creek - Concord High School

Date Collected: 08/18/2015 Site #: 20

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	3		F	Micropsectra sp	0	+	MT
Oligochaeta	76	+	T	Tanytarsus glabrescens grp sp 7	14		F
Erpobdella punctata	1	+	MT	Physella sp	1	+	T
Caecidotea sp	3	+	T	Ferrissia sp	68		F
Gammarus sp	107	+	F	Sphaerium sp	1		F
Orconectes sp	0	+	F				
Hydrachnidia	0	+	F				
Baetis tricaudatus	0	+	MI				
Baetis flavistriga	6	+	F				
Baetis intercalaris	1		F	No. Quantitative Taxa:	32		
Stenacron sp	71	+	F	No. Qualitative Taxa:	28		
Hetaerina sp	0	+	F	Total Taxa:	46		
Coenagrionidae	2		T	Number of Organisms:	2376		
Sigara sp	0	+	MT	Qual EPT:	5		
Cheumatopsyche sp	702	+	F	<b>ICI:</b>	<b>32</b>		
Ceratopsyche morosa group	116	+	MI				
Hydropsyche depravata group	3		F				
Ancyronyx variegata	1		F				
Dubiraphia quadrinotata	0	+	F				
Macronychus glabratus	11	+	F				
Optioservus sp	1	+	MI				
Stenelmis sp	9	+	F				
Antocha sp	8		MI				
Dixella sp	0	+	F				
Simulium sp	0	+	F				
Ceratopogonidae	8		T				
Nilotanytus fimbriatus	8		F				
Pentaneura inconspicua	14		F				
Corynoneura sp	8						
Corynoneura lobata	24		F				
Nanocladius sp	14		F				
Parametriocnemus sp	14		F				
Thienemanniella xena	24		F				
Tvetenia bavarica group	70		MI				
Cryptochironomus sp	0	+	F				
Dicrotendipes neomodestus	0	+	F				
Polypedilum flavum	904	+	F				
Polypedilum (P.) fallax group	0	+	F				
Polypedilum (P.) illinoense	83	+	T				
Stictochironomus sp	0	+	F				
Cladotanytarsus mancus group	0	+	F				

Site: Baugo Creek - Restoration (B)

Date Collected: 08/14/2015

Site #: 24

Taxa Name	Quantitative	Qualitative	Tol.	
Turbellaria	0	+	F	
Erpobdellidae	0	+	MT	
Caecidotea sp	0	+	T	
Hydrachnidia	0	+	F	
Baetis flavistriga	0	+	F	
Baetis intercalaris	0	+	F	No. Quantitative Taxa: 0
Calopteryx sp	0	+	F	No. Qualitative Taxa: 33
Argia sp	0	+	F	Total Taxa: 33
Aeshna sp	0	+	MT	Number of Organisms: 0
Boyeria vinosa	0	+	F	Qual EPT: 5
Neoplea sp	0	+	F	<b>ICI:</b> <b>F</b>
Cheumatopsyche sp	0	+	F	
Ceratopsyche morosa group	0	+	MI	* Sampler was lost
Hydropsyche depravata group	0	+	F	F—Very Good Qualitative Score
Staphylinidae	0	+	F	
Ancyronyx variegata	0	+	F	
Stenelmis sp	0	+	F	
Antocha sp	0	+	MI	
Simulium sp	0	+	F	
Ablabesmyia mallochi	0	+	F	
Cricotopus (C.) bicinctus	0	+	T	
Cryptochironomus sp	0	+	F	
Dicrotendipes neomodestus	0	+	F	
Microtendipes "caelum" (sensu Simpson & Bode, 1980)	0	+	MI	
Phaenopsectra obediens group	0	+	F	
Polypedilum (Uresipedilum) flavum	0	+	F	
Polypedilum (P.) illinoense	0	+	T	
Polypedilum (Tripodura) scalaenum group	0	+	F	
Stictochironomus sp	0	+	F	
Cladotanytarsus vanderwulpi group	0	+		
Paratanytarsus sp	0	+	F	
Physella sp	0	+	T	
Sphaerium sp	0	+	F	

Site: Auten Ditch - Locust Road (S)

Date Collected: 08/14/2015

Site #: 25

Taxa Name	Quantitative	Qualitative	Tol.		
Oligochaeta	12		T		
Erpobdella punctata punctata	2		MT	No. Quantitative Taxa:	28
Gammarus sp	52	+	F	No. Qualitative Taxa:	14
Cambarus sp	1	+		Total Taxa:	36
Baetis tricaudatus	2	+	MI	Number of Organisms:	729
Baetis flavistriga	6		F	Qual EPT:	3
Calopteryx sp	0	+	F	<b>ICI:</b>	<b>28</b>
Aeshna sp	1		MT		
Cheumatopsyche sp	12	+	F		
Hydropsyche depravata group	0	+	F		
Dubiraphia quadrinotata	2	+	F		
Optioservus sp	0	+	MI		
Stenelmis sp	1	+	F		
Anopheles sp	0	+	F		
Simulium sp	0	+	F		
Ablabesmyia mallochi	6		F		
Conchapelopia sp	25		F		
Paramerina fragilis	6		F		
Zavreliomyia sp	19		F		
Corynoneura lobata	20		F		
Nanocladius (N.) spinipennis	0	+	F		
Thienemanniella xena	4		F		
Microtendipes pedellus group	100		F		
Paratendipes albimanus or P. duplicatus	6		F		
Phaenopsectra flavipes	6		MT		
Polypedilum (Uresipedilum) aviceps	0	+	MI		
Polypedilum (Uresipedilum) flavum	163		F		
Polypedilum (P.) fallax group	100		F		
Polypedilum (P.) illinoense	13		T		
Micropsectra sp	6		MT		
Paratanytarsus sp	44		F		
Rheotanytarsus sp	94		F		
Hemerodromia sp	8		F		
Physella sp	8		T		
Planorbella (Pierosoma) pilsbryi	0	+	T		
Ferrissia sp	10		F		

Site: Bowman Creek - Chippewa Avenue

Date Collected: 08/14/2015

Site #: 26

Taxa Name	Quantitative	Qualitative	Tol.	
Ectoprocta	1		F	
Oligochaeta	2		T	
Gammarus sp	505	+	F	No. Quantitative Taxa: 36
Cambarus sp	0	+		No. Qualitative Taxa: 10
Heptageniidae	1			Total Taxa: 29
Calopterygidae	3		F	Number of Organisms: 1163
Calopteryx sp	0	+	F	Qual EPT: 2
Boyeria vinosa	2	+	F	<b>ICI: 32</b>
Cheumatopsyche sp	48	+	F	
Hydropsyche depravata group	1	+	F	
Dubiraphia sp	1		F	
Macronychus glabratus	12	+	F	
Stenelmis sp	3	+	F	
Brillia flavifrons group	7		F	
Corynoneura lobata	64		F	
Cricotopus sp	7		F	
Thienemanniella xena	10		F	
Tvetenia bavarica group	7		MI	
Microtendipes pedellus group	20		F	
Paratendipes albimanus or P. duplicatus	7		F	
Polypedilum (Uresipedilum) aviceps	113		MI	
Polypedilum (Uresipedilum) flavum	20		F	
Polypedilum (P.) fallax group	40		F	
Polypedilum (P.) illinoense	7		T	
Polypedilum (Tripodura) scalaenum group	7		F	
Rheotanytarsus sp	266	+	F	
Tanytarsus glabrescens group sp 7	7		F	
Neoplasta sp	2		MI	
Physella sp	0	+	T	

Site: Bowman Creek - Green Tech Drive

Date Collected: 08/14/2015

Site #: 27

Taxa Name	Quantitative	Qualitative	Tol.
Spongillidae	F	0	+
Hydra sp	F	93	
Turbellaria	F	132	+
Ectoprocta	F	4	+
Oligochaeta	T	139	
Erpobdella punctata punctata	MT	1	
Gammarus sp	F	2	+
Hydrachnidia	F	0	+
Baetis flavistriga	F	14	+
Baetis intercalaris	F	0	+
Stenacron sp	F	3	
Caenis sp	F	0	+
Calopterygidae	F	1	
Coenagrionidae	T	0	+
Chimarra obscura	MI	1	+
Cheumatopsyche sp	F	2	+
Hydropsyche depravata group	F	10	+
Macronychus glabratus	F	9	
Stenelmis sp	F	63	+
Simulium sp	F	8	+
Ceratopogonidae	T	9	
Ablabesmyia mallochii	F	16	
Conchapelopia sp	F	130	+
Helopelopia sp	F	0	+
Nilotanypus fimbriatus	F	48	
Corynoneura lobata	F	8	
Parametriochnemus sp	F	114	+
Dicrotendipes neomodestus	F	0	+
Microtendipes pedellus group	F	16	
Parachironomus sp	MT	16	
Paratendipes albimanus or P. duplicatus	F	0	+
Polypedilum (Uresipedilum) flavum	F	1418	+
Polypedilum (P.) fallax group	F	16	
Stenochironomus sp	F	16	
Tanytarsus sp	F	33	
Hemerodromia sp	F	27	+
Pisidiidae		2	
Sphaerium sp	F	0	+

No. Quantitative Taxa:	29
No. Qualitative Taxa:	22
Total Taxa:	38
Number of Organisms:	2351
Qual EPT:	6
<b>ICI:</b>	<b>30</b>

Site: Juday Creek - Grape Road

Date Collected: 08/25/2015

Site #: 28

Taxa Name	Quantitative	Qualitative	Tol.		
Oligochaeta	98		T		
Placobdella parasitica	0	+	MT	No. Quantitative Taxa:	27
Caecidotea sp	0	+	T	No. Qualitative Taxa:	23
Gammarus sp	54	+	F	Total Taxa:	40
Orconectes sp	0	+	F	Number of Organisms:	2533
Hydrachnidia	0	+	F	Qual EPT:	3
Baetis tricaudatus	11	+	MI	<b>ICI:</b>	<b>40</b>
Baetis flavistriga	0	+	F		
Stenacron sp	34	+	F		
Maccaffertium vicarium	2		MI		
Calopteryx sp	0	+	F		
Boyeria vinosa	0	+	F		
Lype diversa	5		MI		
Cheumatopsyche sp	171		F		
Hydropsyche depravata group	52		F		
Brachycentrus numerosus	2		MI		
Dubiraphia quadrinotata	0	+	F		
Macronychus glabratus	1	+	F		
Tipula sp	1		F		
Simulium sp	2	+	F		
Ablabesmyia sp	0	+			
Conchapelopia sp	104		F		
Meropelopia sp	81		F		
Pentaneura inconspicua	23		F		
Thienemannimyia group	0	+	F		
Pagastia sp	46	+	F		
Prodiamesa olivacea	0	+	MT		
Corynoneura lobata	64		F		
Parametrioctonus sp	23		F		
Rheocricotopus (Psilocricotopus) robacki	23		F		
Tvetenia bavarica group	69		MI		
Microtendipes pedellus group	23	+	F		
Polypedilum (Uresipedilum) aviceps	393		MI		
Polypedilum (Tripodura) scalaenum group	0	+	F		
Micropsectra sp	23		MT		
Rheotanytarsus pellucidus	393	+	MI		
Rheotanytarsus sp	810	+	F		
Tanytarsus sepp	23	+	F		
Empididae	2		F		
Corbicula fluminea	0	+	F		

Site: Juday Creek - Ironwood Road

Date Collected: 08/24/2015

Site #: 30

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	2		F
Oligochaeta	0	+	T
Caecidotea sp	1		T
Gammarus sp	2	+	F
Orconectes sp	0	+	F
Hydrachnidia	8	+	F
Baetis flavistriga	0	+	F
Baetis intercalaris	29	+	F
Stenacron sp	176	+	F
Maccaffertium exiguum	63	+	MI
Maccaffertium terminatum	23		MI
Maccaffertium vicarium	11	+	MI
Ephemera sp	0	+	MI
Neureclipsis sp	8		MI
Cheumatopsyche sp	176	+	F
Ceratopsyche morosa group	408	+	MI
Hydropsyche depravata group	490	+	F
Brachycentrus numerosus	5		MI
Helicopsyche borealis	1		MI
Nectopsyche sp	0	+	MI
Gyrinus sp	0	+	F
Macronychus glabratus	66	+	F
Optioservus sp	1		MI
Stenelmis sp	0	+	F
Simulium sp	9		F
Ablabesmyia mallochii	41		F
Conchapelopia sp	165		F
Nilotanytus fimbriatus	16		F
Pagastia sp	0	+	F
Corynoneura lobata	48		F
Parametriocnemus sp	124		F
Rheocricotopus (Psilocricotopus) robacki	124		F
Tvetenia bavarica group	83		MI
Microtendipes pedellus group	0	+	F
Phaenopsectra obediens group	0	+	F
Polypedilum (Uresipedilum) flavum	124		F
Rheotanytarsus pellucidus	248		MI
Rheotanytarsus sp	3226		F
Neoplasta sp	1		MI
Ferrissia sp	27		F
Corbicula fluminea	8	+	F

No. Quantitative Taxa:	31
No. Qualitative Taxa:	21
Total Taxa:	41
Number of Organisms:	5714
Qual EPT:	110
<b>ICI:</b>	<b>46</b>



Site: Juday Creek - Myrtle Street

Date Collected: 08/24/2015 Site #: 31

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	4	+	F	Rheocricotopus robacki	15		F
Oligochaeta	4	+	T	Thienemanniella xena	24		F
Caecidotea sp	3		T	Tvetenia bavarica group	15		MI
Gammarus sp	25	+	F	Tvetenia discoloripes group	29		MI
Orconectes sp	1	+	F	Chironomus sp	0	+	MT
Baetis flavistriga	11	+	F	Glyptotendipes (G.) sp	15		MT
Labiobaetis propinquus	0	+	MI	Microtendipes "caelum"	44		MI
Stenacron sp	214	+	F	Microtendipes pedellus group	116		F
Maccaffertium exiguum	48	+	MI	Paratendipes sp.	15	+	F
Maccaffertium terminatum	25		MI	Phaenopsectra obediens group	0	+	F
Maccaffertium vicarium	42	+	MI	Polypedilum flavum	102		F
Ephemera sp	5		MI	Polypedilum (P.) illinoense	15	+	T
Calopteryx sp	1		F	Paratanytarsus sp	44		F
Boyeria vinosa	1		F	Rheotanytarsus pellucidus	15		MI
Sigara sp	0	+	MT	Rheotanytarsus sp	843		F
Notonecta sp	0	+	T	Stempellinella fimbriata	73		MI
Lype diversa	4		MI	Neoplasta sp	1		MI
Neureclipsis sp	1		MI	Physella sp	0	+	T
Polycentropus sp	2		MI	Ferrissia sp	2		F
Cheumatopsyche sp	106	+	F				
Ceratopsyche morosa group	48	+	MI				
Ceratopsyche sparna	0	+	F	No. Quantitative Taxa:	46		
Hydropsyche depravata group	4	+	F	No. Qualitative Taxa:	32		
Brachycentrus numerosus	12	+	MI	Total Taxa:	61		
Pycnopsyche sp	1		MI	Number of Organisms:	2398		
Nectopsyche diarina	0	+	MI	Qual EPT:	11		
Peltodytes sp	0	+	MT	<b>ICI:</b>	<b>50</b>		
Sperchopsis tessellata	0	+	F				
Macronychus glabratus	41		F				
Stenelmis sp	16	+	F				
Dixella sp	0	+	F				
Anopheles sp	0	+	F				
Simulium sp	4	+	F				
Conchapelopia sp	102		F				
Helopelopia sp	15		F				
Natarsia species A	0	+	T				
Nilotanypus fimbriatus	16		F				
Procladius (Holotanypus) sp	0	+	MT				
Tanypus sp	0	+	T				
Corynoneura lobata	56		F				
Cricotopus (C.) bicinctus	29		T				
Parametrioconemus sp	189	+	F				

Site: Juday Creek - State Road 933

Date Collected: 08/24/2015 Site #: 33

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	6		F	Thienemanniella xena	16		F
Crangonyx sp	0	+	MT	Tvetenia discoloripes group	37	+	MI
Gammarus sp	0	+	F	Microtendipes "caelum"	19		MI
Orconectes sp	0	+	F	Microtendipes pedellus group	0	+	F
Hydrachnidia	0	+	F	Polypedilum (P.) fallax group	0	+	F
Baetis flavistriga	97	+	F	Polypedilum (P.) illinoense	0	+	T
Baetis intercalaris	42	+	F	Rheotanytarsus pellucidus	56		MI
Isxaeon anoka	10		MI	Rheotanytarsus sp	1383	+	F
Isonychia sp	0	+	MI	Hemerodromia sp	8		F
Stenacron sp	20	+	F	Physella sp	2	+	T
Maccaffertium exiguum	120	+	MI	Ferrissia sp	17		F
Maccaffertium terminatum	84		MI				
Maccaffertium vicarium	20	+	MI				
Teloganopsis sp	0	+	I	No. Quantitative Taxa:	34		
Tricorythodes sp	2	+	MI	No. Qualitative Taxa:	35		
Ephemera sp	0	+	MI	Total Taxa:	51		
Boyeria vinosa	1	+	F	Number of Organisms:	3602		
Chimarra obscura	0	+	MI	Qual EPT:	16		
Neureclipsis sp	4		MI	<b>ICI:</b>	<b>50</b>		
Cheumatopsyche sp	547	+	F				
Ceratopsyche morosa group	332	+	MI				
Ceratopsyche sparna	263	+	F				
Hydropsyche depravata group	163		F				
Hydroptila sp	24	+	F				
Brachycentrus numerosus	58	+	MI				
Nectopsyche diarina	0	+	MI				
Oecetis persimilis	13		MI				
Dubiraphia quadrinotata	0	+	F				
Macronychus glabratus	24		F				
Optioservus sp	0	+	MI				
Stenelmis sp	0	+	F				
Antocha sp	0	+	MI				
Tipula sp	0	+	F				
Simulium sp	10	+	F				
Conchapelopia sp	37	+	F				
Larsia sp	19		MT				
Nilotanypus fimbriatus	19		F				
Pagastia sp	37	+	F				
Cricotopus (C.) trifascia	19		F				
Parametrioctenus sp	93		F				



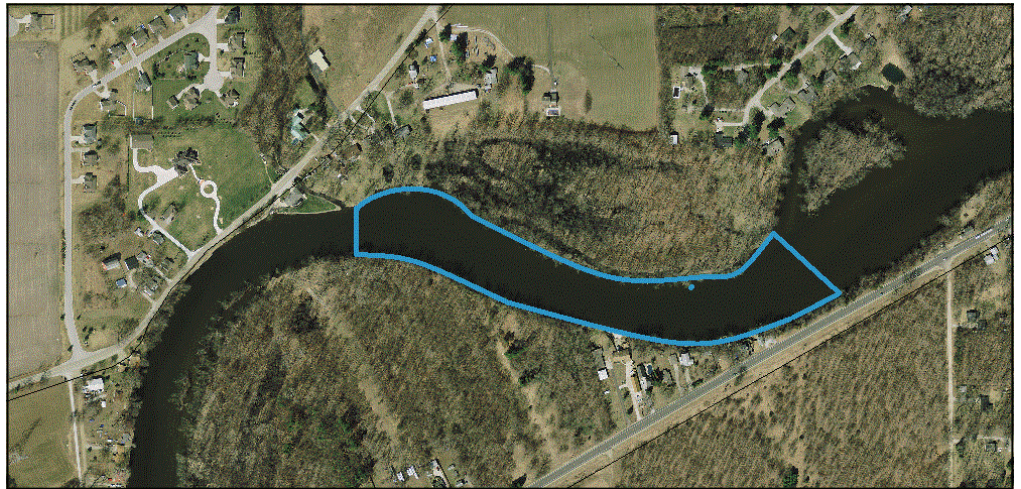
---

# **Appendix F**

## **Aerial Site Location Maps**



Site #1: St. Joseph River Arrowhead Drive



Site #2: St. Joseph River Nibbyville (A)

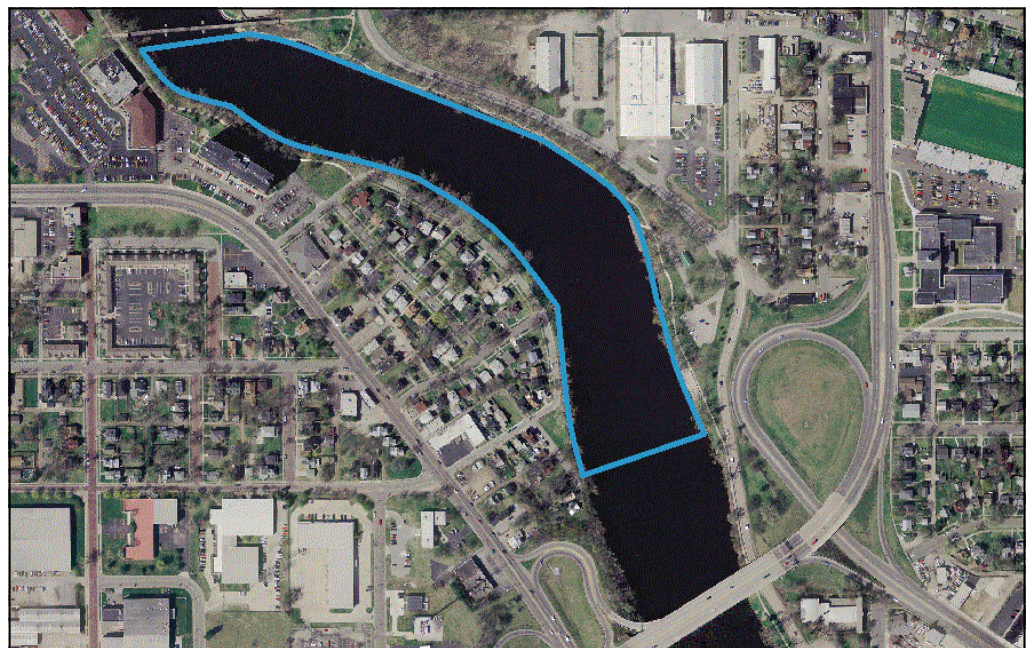


Site #3: St. Joseph River Lexington Ave.

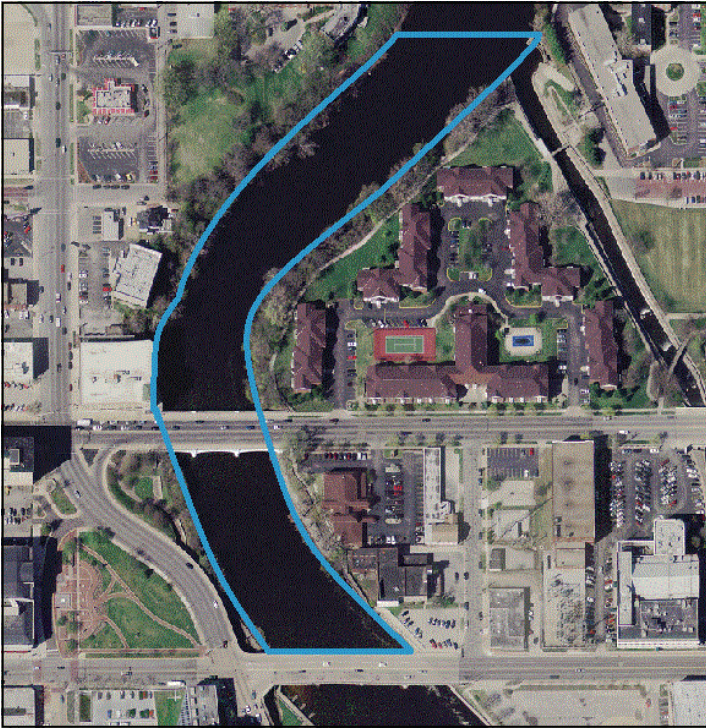


Site #4: St. Joseph River McNaughton Park

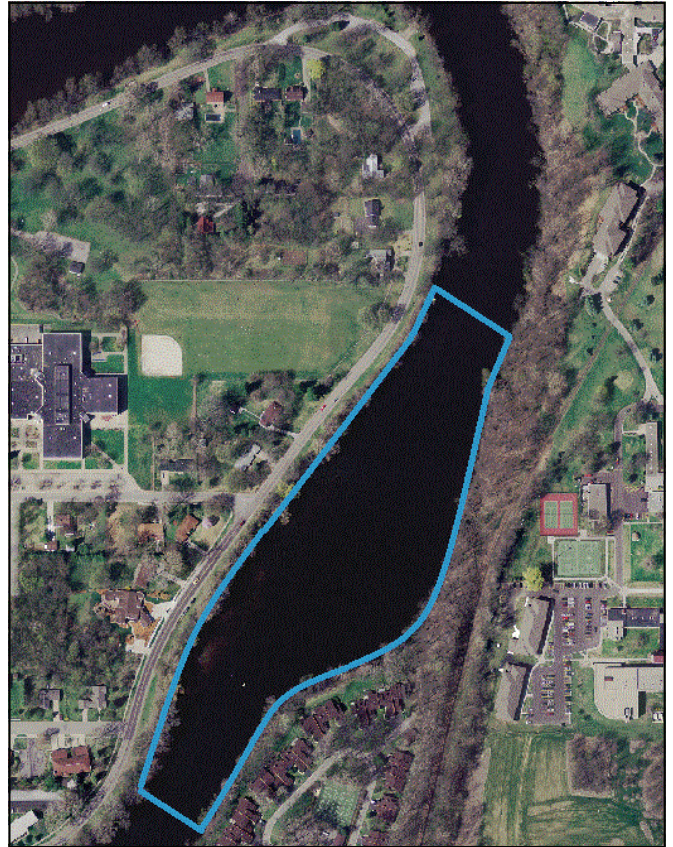
Site #5: St. Joseph River Jefferson Blvd.



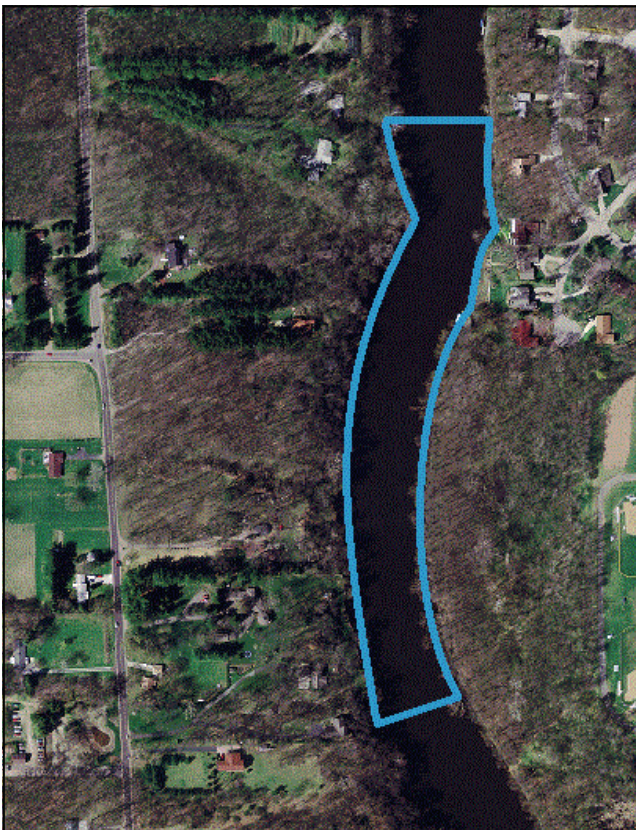
Site #6: St. Joseph River South Bend Dam (B)



Site #7: St. Joseph River LaSalle Avenue



Site #8: St. Joseph River Keller Park



Site #9: St. Joseph River Brick Road



Site #10: St. Joseph River St. Pats Park

Site #11: Little Elkhart River County Road 35



Site #12: York-Middlebury Twp. Ditch CR 108





Site #13: Pine Creek SR 120

Site #14: Lily Creek Park Six Drive



Site #15: Christiana Creek NMWF



Site #16: ER CR 17



Site #17: Elkhart River Oxbow (B)



Site #18: Elkhart River EEC (A)

Site #19: Elkhart River Central High School



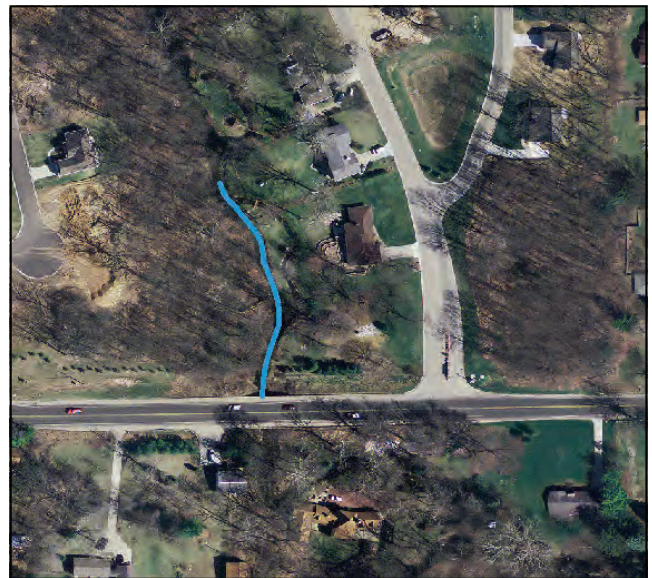
Site #20: Yellow Creek Concord High School



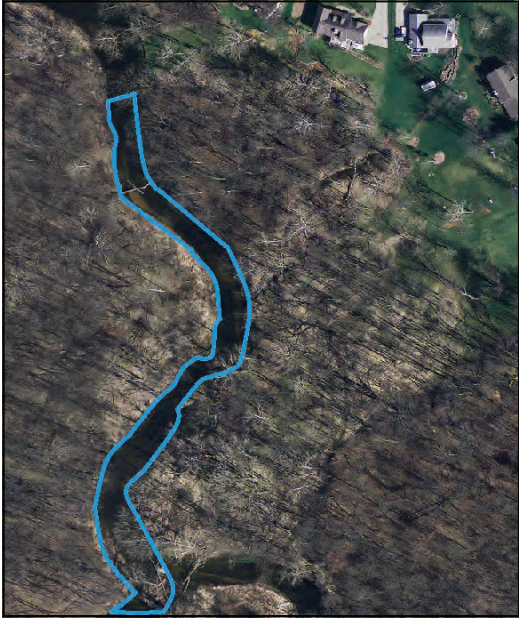
Site #21: Cobus Creek CR 2



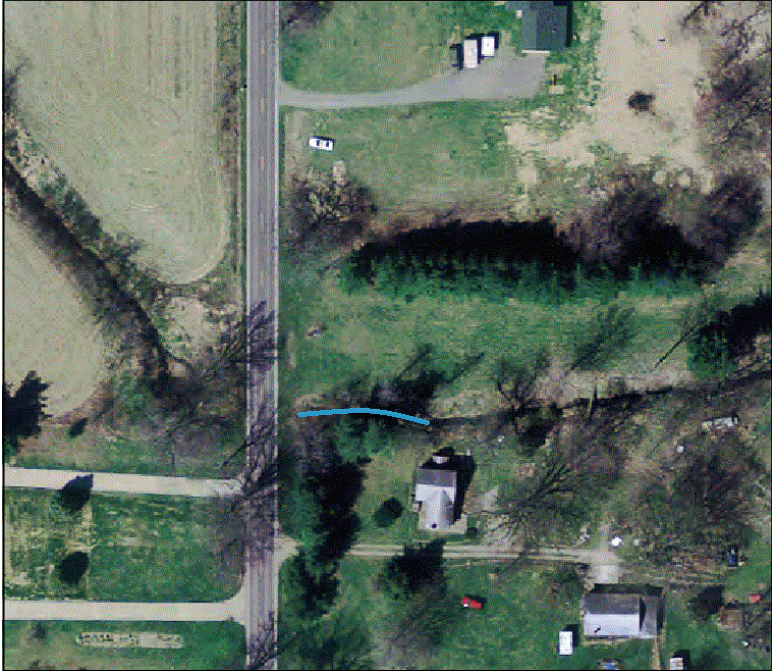
Site #22: Cobus Creek CR 10



Site #23: Cobus Creek Old US 20



Site #24: Baugo Creek Restoration (B)



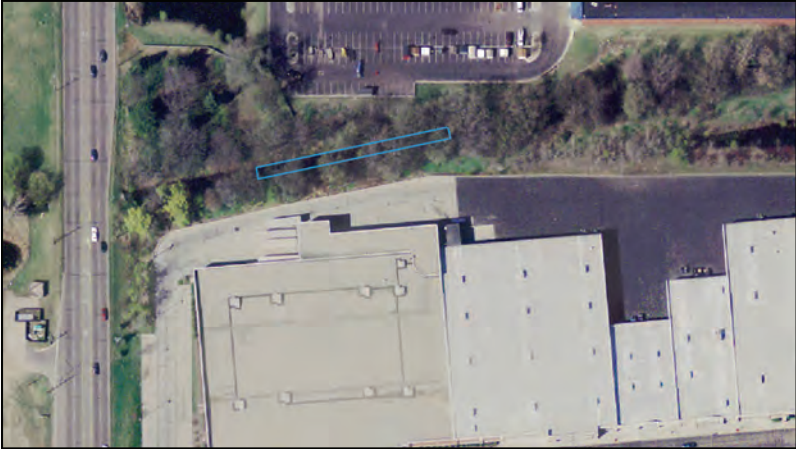
Site #25: Auten Ditch Locust Road (S)



Site #26: Bowman Creek Chippewa Avenue



Site #27: Bowman Creek Green Tech Drive



Site #28: Juday Creek Grape Road



Site #29: Juday Creek Ponader Park

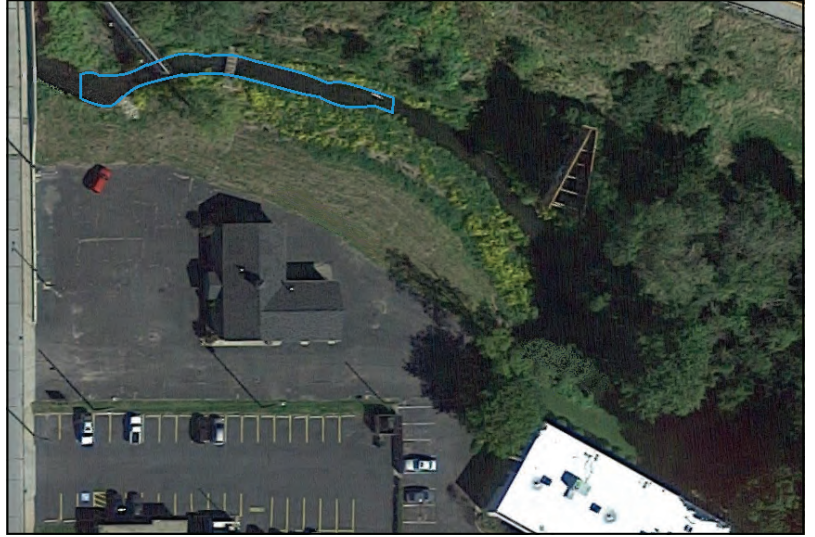


Site #30: Juday Creek Ironwood Drive



Site #31: Juday Creek Myrtle Street

Site #32: Juday Creek SR 933



Site #33: Keifer Ditch Auten Road

