# Headwaters Yellow River Watershed Water Quality Monitoring

Marshall County, Indiana

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# Document Information

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# Acronyms

| | |
|---|---|
| CFO | Confined Feeding Operation |
| CFS | Cubic Feet Per Second |
| CAFO | Confined Animal Feeding Operation |
| CSO | Combined Sewer Overflow |
| DNR | Department of Natural Resources |
| FEMA | Federal Emergency Management Agency |
| FIRM | Flood Insurance Rate Map |
| HUC | Hydrologic Unit Code |
| HSG | Hydrologic Soil Group |
| IDEM | Indiana Department of Natural Resources |
| KRBC | Kankakee River Basin Commission |
| LARE | Lake and River Enhancement |
| LID | Low-Impact Development |
| MACOG | Michiana Area Council of Government |
| NPDES | National Pollutant Discharge Elimination System |
| NRCS | Natural Resource Conservation Service |
| SWCD | Soil and Water Conservation District |
| TMDL | Total Maximum Daily Load |

| | |
|---|---|
| WMP | Watershed Management Plan |
| PCB | Polychlorinated biphenyls |

# Executive Summary

The Headwaters Yellow River watershed is a 187,000 acres watershed located in north central Indiana. Portions of the watershed are located in Marshall, St. Joseph, Elkhart, and Kosciusko Counties. The Yellow River originates north of Bremen, Indiana and flows southwest through Plymouth. Ultimately the Yellow River drains into the Kankakee River near English Lake, Indiana. There are 73 miles of streams listed as impaired for phosphorus or *E. coli* in the watershed by the Indiana Department of Environmental Management (IDEM). Of the three lakes including Pleasant, Riddles, Lake of the Woods in the watershed each is impaired for phosphorus or PCB's in fish tissue. As a result of these water quality concerns the Marshall County SWCD conducted a water quality study of the Headwaters Yellow River watershed from the spring of 2015 through the spring of 2016.

The land use of the Headwaters Yellow River watershed is dominated by row-crop agriculture and pasture. Urban land use is limited to only 8.2% of the watershed and includes Plymouth, Bremen, Nappanee, Lakeville, and La Paz. Streams of the watershed are highly degraded with widespread channelization, limited in-stream cover, and limited riparian vegetation. During twelve months of water sampling multiple issues were identified in the watershed. *E. coli* concentrations exceeded state water quality standards in approximately 69% of samples. *E. coli* concentrations exceeded state water quality standard during both stormflow and baseflow conditions, suggesting that there are point sources of *E. coli* in the watershed. Further water sampling revealed that a significant portion of the *E. coli* in the watershed is human in origin. Nutrient concentrations also regularly exceeded state water quality standards. Nitrate + nitrite concentrations exceeded state water quality standards in 15% of samples and phosphorus standards in 33% of samples.

Future improvements to the water quality of the Headwaters Yellow River watershed will require the widespread implementation of agricultural and urban management practices. Due to the prevalence of row-crop agriculture in the watershed, the implementation of long-term conservation cropping systems is the most beneficial practice to reduce nutrient loading. Additional agricultural BMP's recommended for the watershed include riparian buffers, grassed waterways, streambank stabilization, wetland restoration, blind inlets, and saturated buffers. Soil data suggests that the majority of the soils in the watershed have limited suitability for septic systems. Therefore, the development of programs that promote septic system inspection and maintenance in the watershed are recommended. Addressing the bacterial and nutrient contributions of septic systems in the watershed will likely be critical to the recovery of the watershed. Recommended urban BMP's include rain gardens, bioswales, pervious pavement, streambank stabilization, and rain harvesting.

# Introduction

## 1.1 Project Background

In 2015 the Headwaters Yellow River Watershed project was initiated by the Marshall County Soil and Water Conservation District (SWCD). The Marshall County SWCD was motivated to conduct a study of the watershed as the result of several water quality concerns related to multiple impaired waterbodies in the Headwaters Yellow River watershed. The Headwaters Yellow River watershed (10 Digit Hydrologic Code [HUC]: 0712000103) is located in north central Indiana and encompasses portions of Marshall, St. Joseph, Elkhart, and Kosciusko Counties. The Headwaters Yellow River watershed is approximately 187,300 acres and is part of the Kankakee River watershed (HUC: 07120001). The mainstem of the Yellow River originates north of Bremen in St. Joseph County and flows southwest and eventually flows through Plymouth. The Yellow River continues to flow west and drains into the Kankakee River, near English Lake. However, the Yellow River southwest of Plymouth is outside of the scope of the Headwaters Yellow River watershed project. Populated areas of the watershed include Lakeville, La Paz, Plymouth, Bremen, and Nappanee (Figure 1-1). The subsequent sections are intended to address the concerns of watershed stakeholders in a holistic manner.

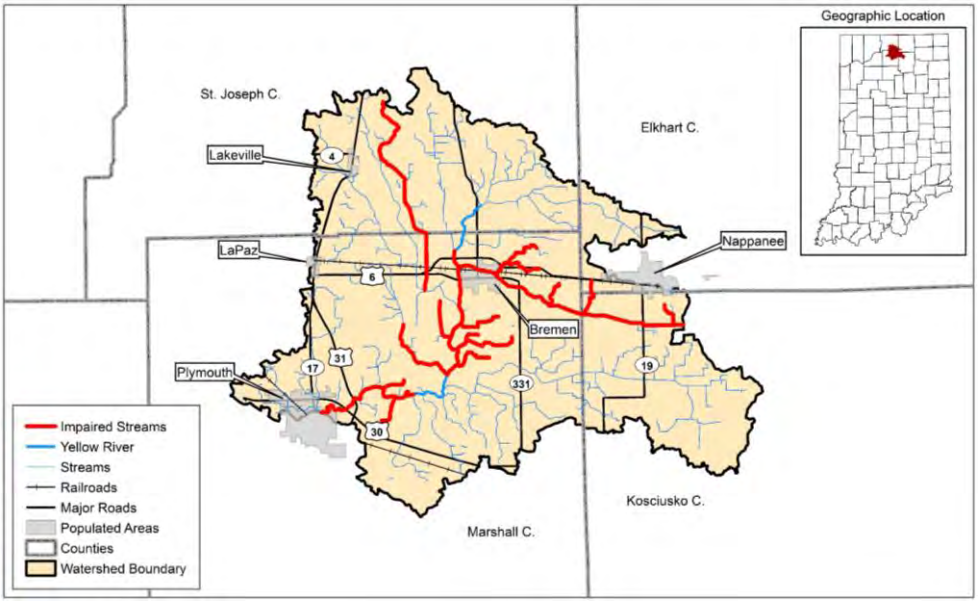


**Figure 1-1. Geographic location of the Headwaters Yellow River Watershed in Northern, Indiana.**

A watershed is an area of land that drains to a common waterway, such as a stream, lake, estuary or wetland. Using a watershed approach to restore waterbodies addresses problems in a holistic manner and keeps local stakeholders involved in the management actions selected to solve problems in the watershed. A watershed management plan (WMP) for the Headwaters Yellow River watershed will be created using the water quality data described in this report.

## 1.2 Stakeholder Concerns

A concern is an issue or topic that a stakeholder believes is relevant to the watershed. During the first steering committee meeting for the Headwaters Yellow River watershed on March of 2015, steering committee members identified topics of concern in the watershed. Many of the topics of concern were identified previously through an online survey that was distributed to watershed stakeholders. Table 1-1

presents a categorization of the concerns identified for the Headwaters Yellow River watershed. The primary categorizes of concerns in the watershed are natural resource quality, non-point source pollutant sources, and recreation opportunities. The primary concerns of the Marshall County SWCD included erosion, nutrient concentrations, *E. coli* concentrations, and recreation opportunities in the Headwaters Yellow River watershed. These water quality concerns were further validated with the listing of Lake of the Wood and 73 miles of streams in the watershed on the Indiana Department of Environmental Management (IDEM) 303(d) list of impaired waterbodies.

**Table 1-1 Headwaters Yellow River Watershed Stakeholder Concerns**

| Category | Specific Concern |
|---|---|
| *Natural Resource Quality* | Stream water quality including nutrients, sediment, and *E. coli* |
| | Introduction of excess nutrients, sediment and *E. coli* to Lake of the Woods, Pleasant Lake, and Riddles Lake |
| | Limited habitat for aquatic organisms |
| | Introduction of Atrazine to the groundwater |
| *Nonpoint Source Pollutant Sources* | Stream bank erosion |
| | Failing septic systems throughout the watershed |
| | Direct discharges of wastewater from older homes |
| | Land applications of waste material |
| *Recreational Opportunities* | Management of the Yellow River for fisheries |
| | Limited boating access to the Yellow River |
| *Miscellaneous* | Debris and tree removal along the Yellow River |
| | Rural & urban drainage |
| | Rural & urban flooding |

## 1.3 Steering Committee

The Headwaters Yellow River watershed encompasses four counties and five populated areas. Therefore, stakeholders in the watershed come from a large geographic area that includes both rural and urban communities. The steering committee for the Headwaters Yellow River Watershed project was developed to address the concerns of stakeholders that were identified using an online survey. The steering committee members listed in Table 1-2 are representatives of governmental agencies and non-profit organizations with the knowledge and skills necessary to address the concerns expressed by watershed stakeholders in Table 1-1.

**Table 1-2 List of the Headwaters Yellow River Watershed Steering Committee members and organizations.**

| Steering Committee Member | Agency/Organization |
|---|---|
| Jim Hess | Elkhart County SWCD |
| Debbie Palmer | Marshall County SWCD |
| Jeremy Cooper | St. Joseph County SWCD |
| John Lash | Kosciusko County SWCD |
| Larry Fisher | Marshall County Drainage Board |
| Matthew Longfellow | Marshall County Health Department |
| Madisson Heinl | Center for Lakes and Streams |
| Joe Skelton | Marshall County Lakes and Waters Council |
| Troy Manges | Natural Resources Conservation Service |
| Robert Yoder | Purdue University Cooperative Extension Service |
| Trend Weldy | Town of Bremen |
| Jody Melton | Kankakee River Basin Commission |
| Charlie Houin | Marshall County Farm Bureau |

# 2 Watershed History & Conditions

## 2.1 Geology/Topography

The Headwaters Yellow River watershed is located in north central Indiana (Figure 1-1), which was greatly influenced by the presence of the Wisconsin Glacier 70,000 years ago. The ice from the glacier was as thick as three miles in some places and ultimately extended just south of current day Indianapolis, Indiana (Wilson, 2008). The extreme weight of the glacier carved out bedrock from Canada and carried it southward through northern Indiana, where the debris was deposited (Wilson, 2008). As the glacier melted and began to retreat stratified drift was deposited creating a level plain called the Kankakee Outwash Plain (Wilson, 2008). The debris present in the outwash plain created fertile farmland throughout northern, Indiana. The advancing of the Wisconsin Glacier also influence the topography of northern, Indiana. As a result of the advance and retreat of the glacier the Headwaters Yellow River watershed has limited topographical relief. The highest elevation in the watershed is approximately 920 feet and the lowest elevation in the watershed is approximately 810 feet (Figure 2-2). The Yellow River has an average gradient of 1.25 feet/mile along its relatively straight 22 stream miles (Figure 1-1).

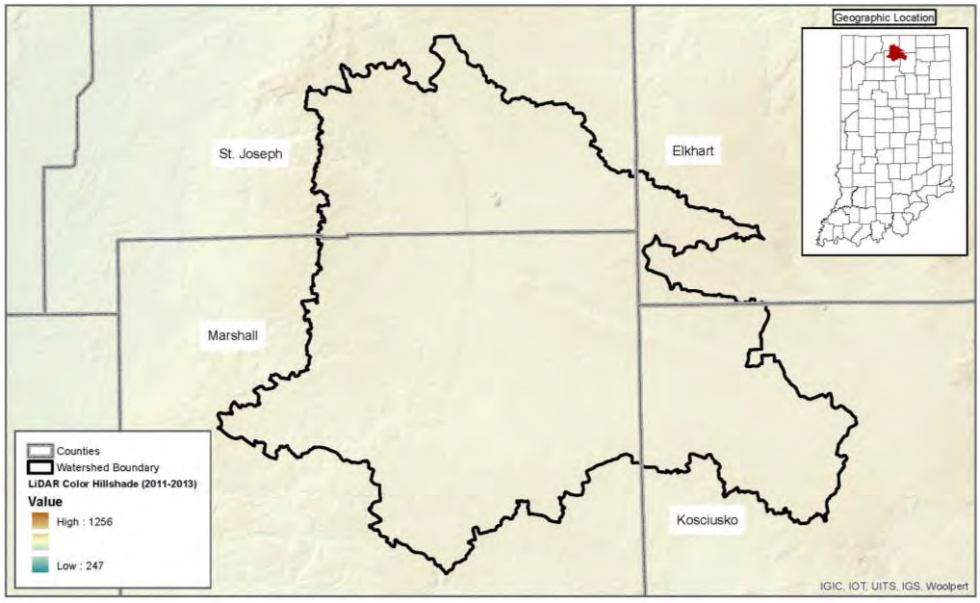


**Figure 2-2. Topography of the Headwaters Yellow River Watershed from 2011-2013 LiDAR data.**

## 2.2 Hydrology

The Headwaters Yellow River watershed (HUC: 0712000103) contains twelve subwatersheds across St. Joseph, Kosciusko, Elkhart, and Marshall Counties (Figure 2-3). The subwatershed of the Headwaters Yellow River watershed include Amery Ditch (HUC: 071200010303), Dausman Ditch (HUC: 071200010308), Elmer Seltenright Ditch (HUC: 071200010311), Fleugel Ditch (HUC: 071200010306), Headwaters Stock Ditch (HUC: 071200010304), Kline Rouch Ditch (HUC: 071200010302), Lake of the Woods (HUC: 071200010309), Lateral Ditch No. 5 (HUC: 071200010301), Lemler Ditch (HUC: 071200010307), Milner Seltenright Ditch (HUC: 071200010312), Stone Ditch (HUC: 071200010310), and West Bunch Branch (HUC: 071200010305). Included in each of these subwatersheds is a network of streams, closed drains, lakes, and wetlands.

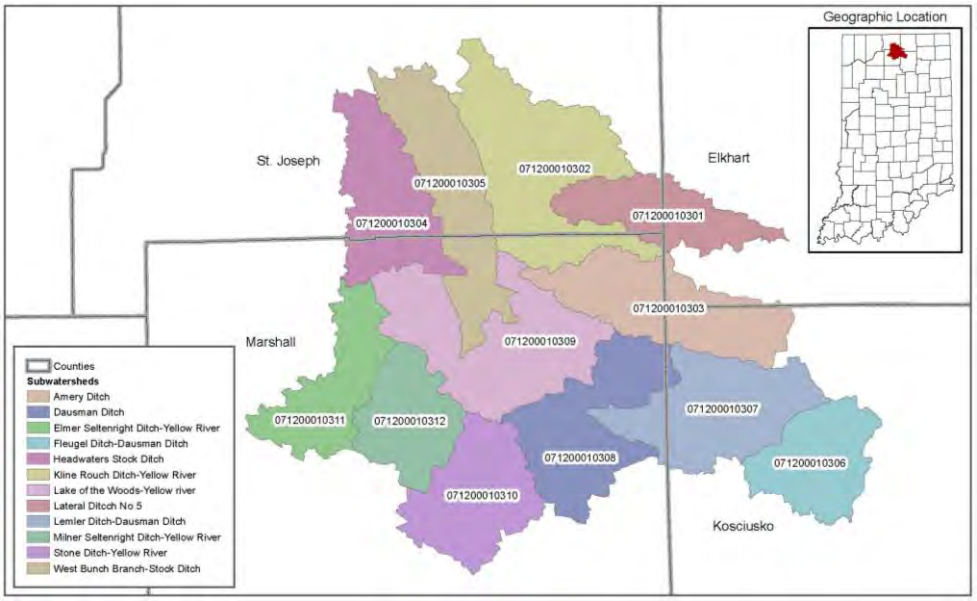


**Figure 2-3. Each of the Twelve HUC 12 Subwatershed in the Headwaters Yellow River Watershed.**

The twelve subwatershed combine to include a total of 335 miles of streams and 154 miles of closed drains. Water from streams and closed drains ultimately drain to the Yellow River, which originates in southern St. Joseph County (Figure 2-4). The headwaters of the Yellow River flows four miles south, past the west side of Bremen. The river continues in a southwesterly direction for another fourteen miles until the river reaches Plymouth in central Marshall County (Figure 2-4). Portions of the Headwaters Yellow River watershed are located in Elkhart and Kosciusko Counties; however the mainstem of the Yellow River flows only through St. Joseph and Marshall Counties. The streams and closed drains of the watershed are primarily utilized for drainage and irrigation purposes. However, the lower portion of the Yellow River in the watershed is utilized for angling despite limited access. In addition to lentic environments the Headwaters Yellow River contains numerous lotic environments.

There are three primary lakes in the watershed including Pleasant Lake (0.1 square kilometers), Riddles Lake (0.3 square kilometers), and Lake of the Woods (1.7 square kilometers) (Figure 2-4). Pleasant and Riddles Lakes are located in St. Joseph County near Lakeville. Pleasant Lake has a maximum depth of 39 feet (JFNew 2006a). Heston Ditch is the primary inlet to Pleasant Lake (JFNew 2006a). Riddles Lake has a maximum depth of 20 feet. Heston Ditch is also the primary inlet to Riddles Lakes (JFNew 2006a). Lake of the Woods is the largest lake in the watershed and is located in Marshall County southwest of Bremen. Lake of the Woods has a maximum depth of 47.9 feet (DJ Case and Associates 2005). There are five inlets to Lake of the Woods including William Forsythe Ditch, Martin Ditch, Seltenright Ditch, Bohmer Ditch, and Kuntz Ditch (DJ Case and Associates 2005). Each of these lakes is utilized by the public for multiple recreational activities including fishing, boating, and swimming.

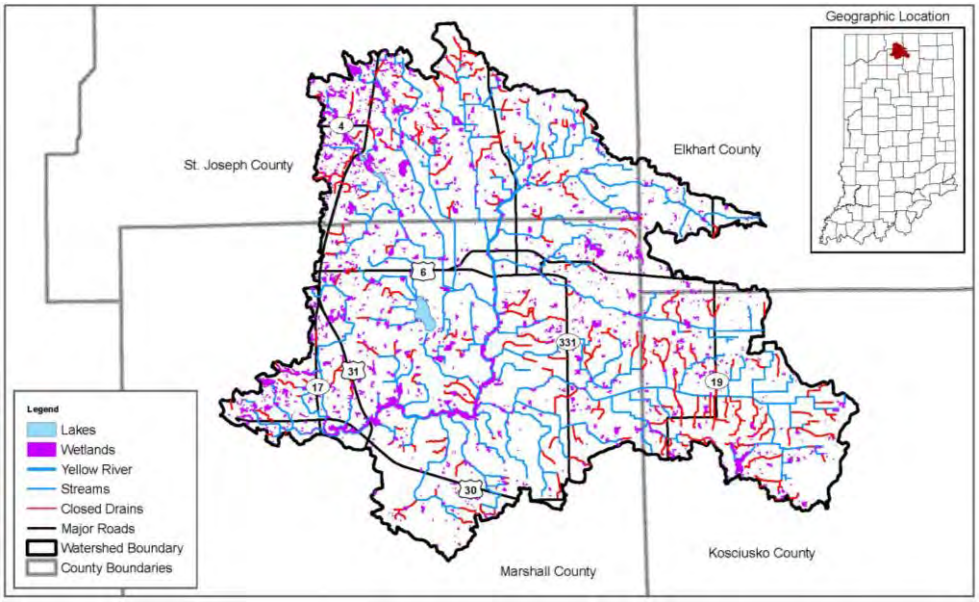


**Figure 2-4. Streams, Lakes, Wetlands, and Closed Drains Located in the Headwaters Yellow River Watershed.**

The remainder of the lotic environments in the watershed includes wetlands ranging from 169 acres to less than 0.1 acres in size. Nearly 8,000 acres of small wetlands are scattered throughout the watershed, with an average size of 3.6 acres (Figure 2-4). The National Wetland Inventory data suggests that there were once an additional 1,895 wetlands totaling 1,358 acres present in the watershed that no longer exist. The largest existing wetland is a 169 acre wetland complex in the southern portion of the watershed, which is adjacent to the Yellow River upstream from Plymouth (Figure 2-4). Nearly all of the wetland ecosystems in watershed are located on private land. It is likely that a portion of the wetlands on privately owned land are used by stakeholders for recreational activities such as waterfowl hunting. There is one protected wetland in the watershed located near Atwood in Kosciusko County. This is the location of the Glenwood Nature Preserve owned and managed by Acres Land Trust.

Seasonal changes result in significant variation in the discharge of the Yellow River. Historically, the spring months of March and April exhibit the greatest mean discharge (Figure 2-5). During these spring months the annual snowmelt combined with increasing precipitation results in dramatic increases in discharge over short periods of time. The peak discharge for the Yellow River was 5,390 cubic feet per second (cfs) in October of 1954. Conversely, the late summer months of August and September exhibit the lowest mean discharge (Figure 2-5). The dramatic increases in discharge that regularly occur in the Headwaters Yellow River watershed pose flooding risks for residents of the watershed.

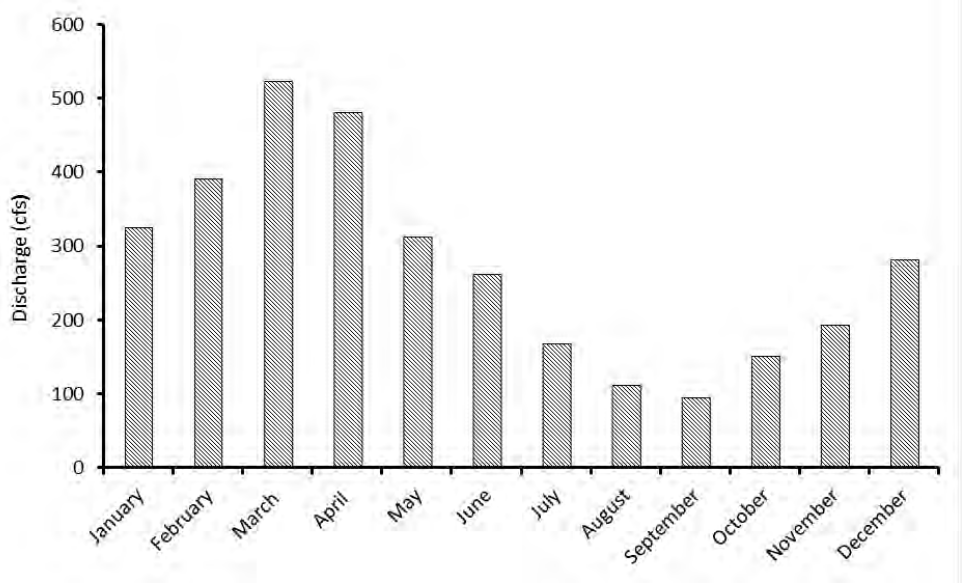


**Figure 2-5. Mean (1948-2014) monthly discharge at USGS gauging station (05516500), located on the Yellow River in Plymouth, Indiana.**

While flooding in the Headwaters Yellow River Watershed was not a primary area of concern to stakeholders, flooding concerns do exist in the watershed. Figure 2-6 displays areas of the watershed that have been determined to have a 0.2 to 1.0% chance of annual flooding. Approximately 7.0% or 13,285 acres of the Headwaters Yellow River Watershed are classified under this flooding category. Of the five populated areas in the watershed three do not appear to be located in floodplains including Lakeville, La Paz, and Nappanee (Figure 2-6). However, portions of Plymouth and Bremen are located in floodplains. Bremen has the potential to flood on the west side of town where the Yellow River flows past town and on the northeast side of town where Armey Ditch flows through town (Figure 2-6). Plymouth has the potential for flooding along the Yellow River and along Elmer Seltenright Ditch on the north side of town (Figure 2-6).

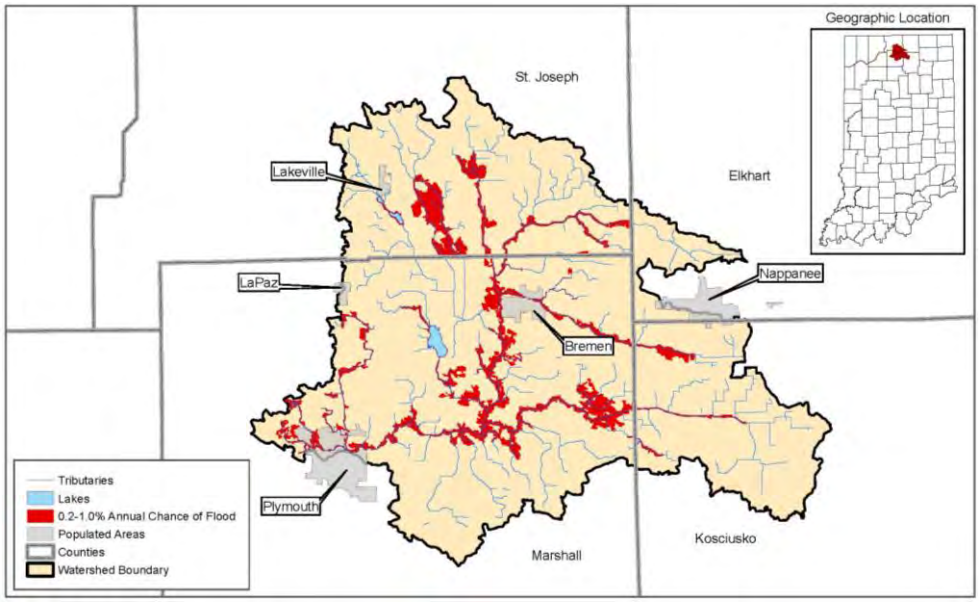


**Figure 2-6. FEMA Areas Designated as 0.2-1.0% Annual Chance of Flood in the Headwaters Yellow River Watershed.**

## 2.3 Soils

The soil types present in a watershed greatly influence hydrologic processes. Soils have unique characteristics that influence infiltration rates, erosion, and hydrology. The Headwaters Yellow River watershed contains a total of 175 soil associations, which are provided in Appendix A. Crosier loam (0-1% slopes) is the most common soil association, comprising 22% of the watershed (Appendix B). The second most common soil association is Brookston loam (0-1% slopes), comprising 14% of the watershed (Appendix B). The remaining soil associations individually account for less than 10% of the watershed (Appendix B). Each of these soil associations have unique characteristics that influence watershed-scale processes.

Hydrologic soil groups (HSG's) are determined by the water transmitting soil layer with the lowest saturated hydraulic conductivity and depth to any layer that is more or less impermeable or depth of water table (United States Department of Agriculture 2007). The four HSG categorizes are A, B, C, and D soils. Soils in HSG A have the lowest runoff potential and transmit water freely through the soil, while groups the remaining groups (B, C, and D) have increasing levels of runoff potential and decreasing water transition rates. The runoff potential and water transmission characteristics of each HSG are described in Table 2-3. The primary HSG's in the watershed are B/D (35%), followed by C/D (30%) and B (17%). There is only 1% of the watershed in the HSG C. The eastern portion of the watershed is dominated by B/D and C/D soils, while the western portion of the watershed has a greater portion of A, A/D, and B soils (Figure 2-7). HSG soil classification are closely linked to the location and quantity of hydric soils in the watershed.

**Table 2-3. Characteristics of the HSG's of the Headwaters Yellow River watershed (United States Department of Agriculture 2007).**

| Hydrologic Soil Groups | Runoff Potential | Water Transmission Rate |
|---|---|---|
| A | Low | High |
| B | Moderately Low | Moderate |
| C | Moderately High | Low |
| D | High | Very Low |

*If Group-D soils within 24 inches of the water table can be adequately drained they are assigned a dual HSG (A/D, B/D, and C/D). The first letter applies to the drained condition and second applies to the undrained condition.

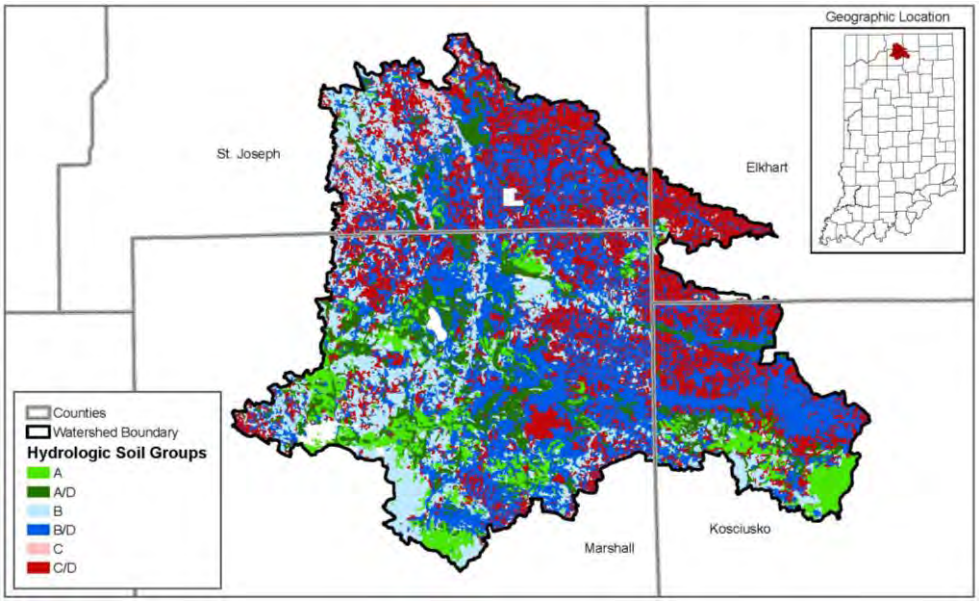


**Figure 2-7. NRCS Soil Survey Hydrologic Soil Groups in the Headwaters Yellow River Watershed.**

Hydric soils are soils that form under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part. The Headwaters Yellow River watershed contains a combination of soils that are classified as all hydric, partially hydric, and not hydric. Partially hydric soils account for 58% of the watershed, followed by not hydric at 30%, and all hydric at 12%. The southeastern portion of the watershed contains a significant portion of the hydric soils, while the southwest portion of the watershed contains a significant amount of none hydric soils (Figure 2-8). Partially hydric soils are scattered throughout the watershed, however they are particularly common in the northern portion of the watershed in the southeastern portion of St. Joseph County. (Figure 2-8).

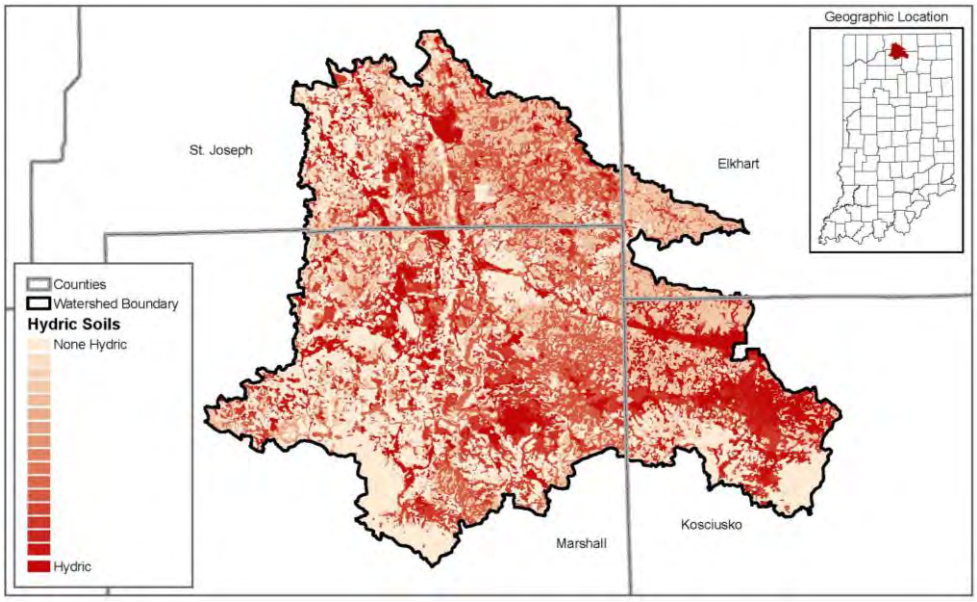


**Figure 2-8. NRCS Soil Survey Hydric Soils in the Headwaters Yellow River Watershed.**

Many of the soil types in the Headwaters Yellow River are more susceptible to erosion by wind and water. Identifying areas of the watershed that are more susceptible to erosion can assist with the prioritization of

conservation efforts to limit soil loss in the Headwaters Yellow River watershed. Approximately 84% of the Headwaters Yellow River watershed is slightly susceptible to erosion. The majority of the slightly erodible soils are located in the eastern portion of the watershed (Figure 2-9). It should be noted that the majority of the soils in the Kosciusko portion of the watershed are slightly erodible. Approximately 14% of the Headwaters Yellow River watershed is moderately susceptible to erosion. The majority of the moderately erodible soils are located in St. Joseph and Marshall Counties, in the western portion of the watershed (Figure 2-9). Less than 1% of the soil in the watershed is severely susceptible to erosion. The soils classified as severely susceptible to erosion are scattered throughout Marshall and St. Joseph County (Figure 2-9).

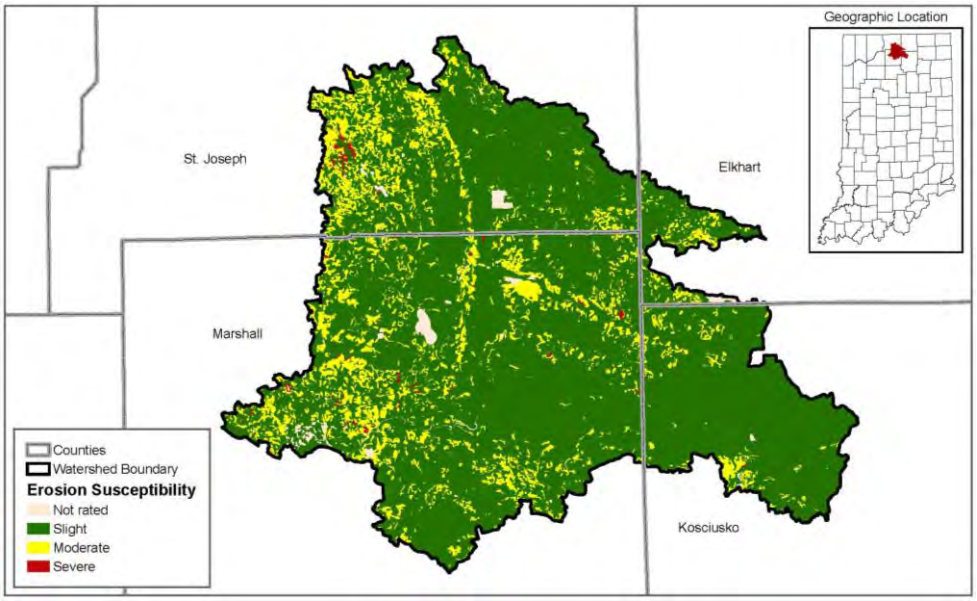


**Figure 2-9. NRCS Soil Survey Soil Erosion Susceptibility in the Headwaters Yellow River Watershed.**

The majority of the land area in the Headwaters Yellow River watershed is serviced by septic systems. Plymouth, Bremen, Nappanee, Lakeville, La Paz, and Lake of the Woods are only the portions of the watershed that are serviced by sewer systems. Therefore, an understanding of the location of soils with characteristics suitable or unsuitable for septic systems is necessary. Approximately 98% of the soils in the watershed are described as very limited for septic tank absorption fields, while only 1% are described as somewhat limited (Figure 2-10). Due to the widespread limitations in soil absorption for septic systems and the large number of rural residences in the watershed, septic tank design and maintenance should be an area of focus in the Headwaters Yellow River watershed.

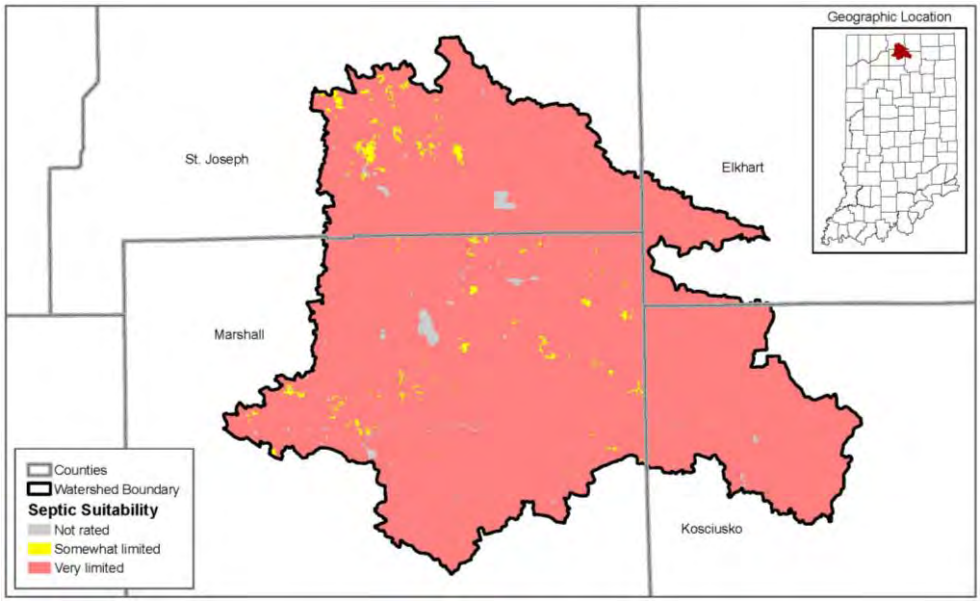


**Figure 2-10. NRCS Soil Survey Septic Tank Absorption Suitability in the Headwaters Yellow River Watershed.**

## 2.4 Land Use

Land use in the Headwaters Yellow River watershed is dominated by agriculture. Cultivated cropland comprises the majority of the watershed followed by deciduous forest, developed open space, hay/pasture, low intensity development, and woody wetlands (Table 2-4). The 2015 Natural Resource Conservation Service (NRCS) tillage transect survey suggests that approximately 19.5% of agricultural land dedicated to corn in the watershed was no-till and 49.3% of land dedicated to soybeans was no-till (Indiana State Department of Agriculture 2015). The primary areas of urban development are Plymouth, Bremen, Nappanee, La Paz, Lakeville, and Lake of the Woods (Figure 2-11). The remaining natural ecosystems in the watershed have been highly fragmented. Deciduous forest patches are isolated from each other and are commonly surrounded by a matrix of anthropomorphic land use such as development and row-crop agriculture (Figure 2-11). Deciduous forest fragments are scattered throughout the watershed, but many of the patches are concentrated along the western boundary of the watershed near Lakeville (Figure 3-10). Woody wetlands are concentrated largely along the mainstem of the Yellow River between Bremen and Plymouth, as well as the area east of Lakeville in St. Joseph County (Figure 2-11). The majority of the land in Headwaters Yellow River watershed is privately owned. There are a total of 124 acres of public land in the watershed including Centennial Park (68 acres), Sunnyside Park (24 acres), Lake of the Woods Public Access Site (2 acres), Pleasant Lake Public Access Site (3 acres), and the Lakeville Bike Trail (27 acres).

**Table 2-4. Percentage and acreage of each land-use type in the Headwaters Yellow River Watershed.**

| Land-Use | % of Watershed | Acres |
|---|---|---|
| Open Water | 0.4% | 709 |
| Developed, Open Space | 5.4% | 10,129 |
| Developed, Low Intensity | 2.1% | 3,880 |
| Developed, Medium Intensity | 0.4% | 830 |
| Developed, High Intensity | 0.3% | 577 |
| Barren Land | 0.0% | 90 |
| Deciduous Forest | 7.2% | 13,468 |
| Evergreen Forest | 0.2% | 367 |

| Land-Use | % of Watershed | Acres |
|---|---|---|
| Mixed Forest | 0.0% | 9 |
| Shrub/Scrub | 0.3% | 511 |
| Herbaceous | 0.2% | 345 |
| Hay/Pasture | 5.3% | 9,903 |
| Cultivated Crops | 76.0% | 142,307 |
| Woody Wetlands | 2.0% | 3,752 |
| Emergent Herbaceous Wetlands | 0.2% | 423 |

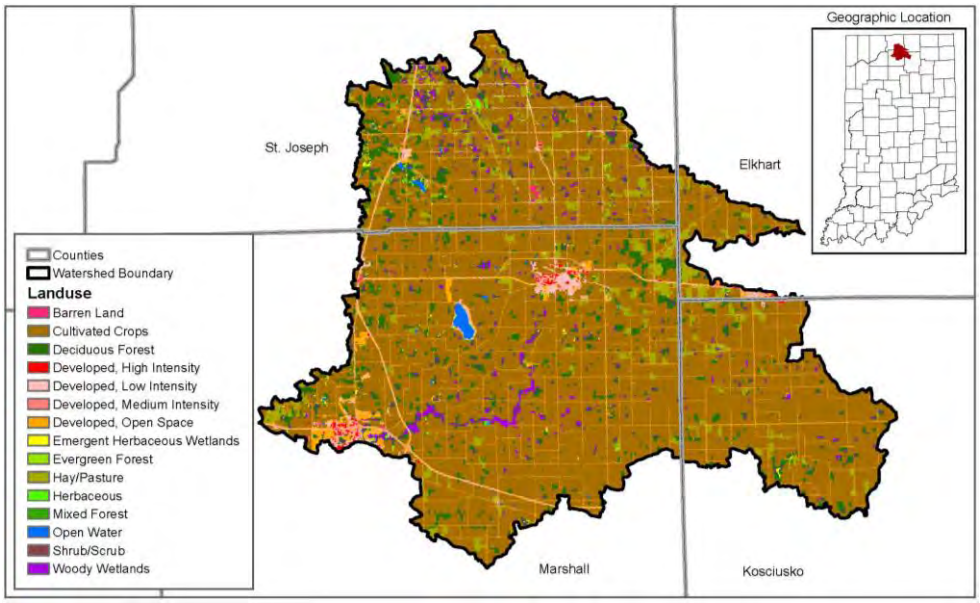


**Figure 2-11. Spatial Distribution of each Land-use Type in the Headwaters Yellow River Watershed.**

## 2.5 Other Planning Efforts

There are numerous planning efforts that have taken place or are currently taking place in the Headwaters Yellow River watershed. Figure 2-12 displays the location of each of the planning efforts in the watershed. In 2012 the Michiana Area Council of Governments (MACOG) sponsored a Watershed Management Plan (WMP) for the Heston-Stock Ditch subwatershed (Michiana Area Council of Governments 2012). The Heston-Stock Ditch subwatershed is located in the northwest portion of the Headwaters Yellow River watershed (Figure 2-12). Lake of the Woods is the largest lake in Headwaters Yellow River watershed and has been studied extensively (Figure 2-12). Lake of the Woods developed a diagnostic feasibility study in 1982 and a feasibility study in 1991 (Senft and Roberts 1982; Corporation Dynamac 1991). In 2005 the Kankakee River Basin Commission (KRBC) sponsored the completion of a WMP for Lake of the Woods in Marshall County (DJ Case and Associates 2005). The KRBC is also actively involved in the coordinating and planning of numerous ongoing conservation efforts in the Kankakee River Watershed. Pleasant and Riddles Lakes, which are located in the northwest portion the Headwaters Yellow River Watershed had a watershed diagnostic study and sediment removal plan completed in 2006 (JFNew 2006a; JFNew 2006b). A Total Maximum Daily Load (TMDL) Report was created for the Kankakee/Iroquois Watershed (Tetra Tech 2009), which includes the Yellow River watershed. Lastly, fisheries surveys were conducted on the Yellow River by the Indiana Department of Natural Resources (DNR) in 1987, 1989, and 2005 (Price 2005).

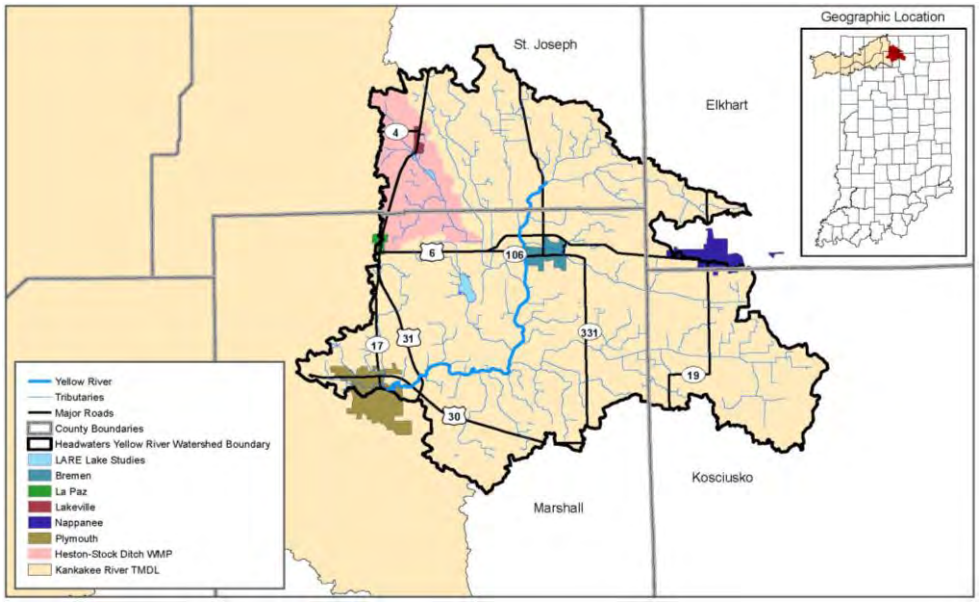


**Figure 2-12. Spatial Distribution of Previous Planning Efforts in the Headwaters Yellow River Watershed.**

In addition to studies sponsored by local non-profits, many of the local governments in the watershed have developed plans that contain information relevant to the Headwaters Yellow River WMP. Each of the counties in the Headwaters Yellow River watershed have County Comprehensive or Master Plans, which often contain sections regarding environmental objectives (Team Kosciusko County Area Plan Study 1996; Commissioners 2006; Marshall County 2013; HNTB and the St. Joseph County Area Plan Commission). Plymouth, which is the most populated municipality in watershed has a history of monitoring and planning projects to improve the water quality of the Yellow River. In 2002 the City of Plymouth prepared a study to monitor non-point source pollutants and explore ways to reduce pollutant inputs (Commonwealth Biomonitoring 2002). The City of Plymouth has also implemented practices to eliminate CSOs and reduce the frequency of overflows into the Yellow River. An examination was conducted in 2013 to monitor water quality following the implementation of these CSO improvements (Bright 2013). Lastly, the Plymouth Park and Recreation Department has received 2015 LARE funding to stabilize multiples areas of erosion along the Yellow River in Centennial Park.

## 2.6 Threatened and Endangered Species

Photo: Blanding's Turtle (FWS 2015)

The Indiana Department of Natural Resources has created a list of endangered, threatened, and rare species for each county in the state. An understanding of the endangered, threatened, and rare species is important to the watershed planning processes because of the potential to protect these species and the habitats they require. There are six endangered species, one threated species, and four rare species in the Headwaters Yellow River watershed (Table 3-4). The endangered species include the Yellow-headed blackbird (*Xanthocephalus xanthocephalus*), American Manna-grass (*Glyceria grandis*), Blanding's Turtle (*Emydoidea blandingii*), Kirtland's Snake (*Clonophis kirtlandii*), Thinleaf Sedge (*Carex sparganioides var. cephaloidea*), and Highbush-cranberry (*Viburnum opulus var. americanum*).

The Yellow-headed blackbird was documented near Plymouth where Highway 31 crosses the Yellow River. Yellow-headed blackbirds nest in marshes and forage in pastures (Sibley 2003). The American Manna-grass was documented near the Yellow River, south of Bremen and generally grows in shallow

water areas such as wetlands (Gleason and Cronquist 1991). Both the Blanding's Turtle and Kirtland's Snake were documented near Lakeville in St. Joseph County. Blandings Turtles prefer productive clean shallow water habitats (Ernst and Lovich 2009), while Kirkland's Snakes prefer open grassy areas on the edge of waterbodies (Ernst and Ernst 2003). Lastly, both the Thinleaf Sedge and Highbush-cranberry were documented near the Plymouth Airport in Marshall County. Thinleaf Sedge grows in dry woods and Highbush-cranberry grows in moist woods (Gleason and Cronquist 1991). The only high quality natural community in the watershed is a 40 acre circumnuetral bog, located near Atwood in Kosciusko County. This is the location of the Glenwood Nature Preserve owned and managed by Acres Land Trust. The state threatened Slender Cotton-grass (*Eriophorum gracile*) is located in this circumnuetral bog. The full listing of endangered, threatened, and rare species for the Headwaters Yellow River watershed is provided in Table 3-4.

**Table 3-4. Endangered, threatened and rare species in the Headwaters Yellow River Watershed (Indiana Department of Natural Resources 2015).**

| Scientific Name | Common Name | State Status | Type |
|---|---|---|---|
| *Tofieldia glutinosa* | False Asphodel | SR | Vascular Plant |
| *Xanthocephalus xanthocephalus* | Yellow-headed Blackbird | SE | Bird |
| *Platanthera orbiculata* | Large Roundleaf Orchid | SX | Vascular Plant |
| *Glyceria grandis* | American Manna-grass | SE | Vascular Plant |
| *Diervilla lonicera* | Northern Bush-honeysuckle | SR | Vascular Plant |
| *Taxidea taxus* | American Badger | SSC | Mammal |
| *Emydoidea blandingii* | Blanding's Turtle | SE | Reptile |
| *Panax trifolius* | Dwarf Ginseng | WL | Vascular Plant |
| *Pinus strobus* | Eastern White Pine | SR | Vascular Plant |
| *Gnaphalium macounii* | Winged Cudweed | SX | Vascular Plant |
| *Campeloma decisum* | Pointed Campeloma | SSC | Mollusk Gastropod |
| *Clonophis kirtlandii* | Kirtland's Snake | SE | Reptile |
| *Campeloma decisum* | Pointed Campeloma | SSC | Mollusk Gastropod |
| *Poa alsodes* | Grove Meadow Grass | SR | Vascular Plant |
| *Wetland - bog circumneutral* | Circumneutral Bog | SG | High Quality Natural Community |
| *Lymnaea stagnalis* | Swamp Lymnaea | SSC | Mollusk Gastropod |
| *Eriophorum gracile* | Slender Cotton-grass | ST | Vascular Plant |
| *Carex sparganioides var. cephaloidea* | Thinleaf Sedge | SE | Vascular Plant |
| *Viburnum opulus var. americanum* | Highbush-cranberry | SE | Vascular Plant |

SE = state endangered; ST = state threatened; SR = state rare; SSC = state species of special concern; SX = state extirpated; SG = state significant; WL = watch list

## 2.7 Summary

The Headwaters Yellow River watershed is a 187,300 acre watershed that has limited topographical relief as the result of receding of the Wisconsin Glacier. The glacial events that occurred 70,000 years ago have also shaped the soil and hydrology of the watershed. The watershed contains significant amounts of partially hydric soils, which are scattered throughout the lower elevation areas of the watershed. Malfunctioning septic systems are likely present in the watershed considering 98% of the soils in the watershed are very limited for septic tank absorption fields. Therefore, failing septic systems should be considered a potential source of pathogens to the many streams in the watershed that are impaired for *E. coli*.

The topography of the watershed has formed twelve subwatersheds, each of which contains unique combinations of lentic and lotic habitats. The Headwaters Yellow River watershed contains three primary

lakes, all of which are on the IDEM list of impaired waterbodies. As a result of these impairments each of these lakes has been extensively studied by local, state, and federal agencies in order to improve water quality. Streams of the watershed are largely fed by overland flow and the 154 miles of closed drains in the watershed. The extensive drain networks present in the watershed are a reflection of the dominance of agricultural and developed land uses in the watershed. Flooding is a common occurrence in the watershed, especially during the spring months of March and April. Plymouth and Bremen are the primary urban areas in the watershed with flooding risks.

The land use of the watershed is dominated by row-crop agriculture, with limited use of no-till and cover crop practices relative to other Indiana counties. In 2015 Approximately 14% of the row crop agricultural land dedicated to corn and 24% of the land dedicated to soybeans utilized no-till practices. Considering the widespread distribution of row-crop agricultural lands in the watershed, significant opportunities exist to promote the use of no-till practices in the watershed. The increased use of no-till practices in the watershed would improve soil health and aide in the reduction of non-point source pollutants from row-crop agriculture. Natural ecosystems are rare in the Headwaters Yellow River watershed and the majority of the natural ecosystems that remain in the watershed are not protected.

The most common natural ecosystems in the watershed are deciduous forest fragments and woody wetlands. However, there is one high quality natural area present in the watershed at the Glenwood Nature Preserve. This preserve is location of a circumneutral bog, which contains multiple rare plant species. Many of the remaining state endangered, threated, and rare species have been observed in the watershed in proximity to the limited natural areas that remain in the watershed. Of the 187,300 acres of land in the watershed, only 124 acres (<1%) is publicly owned. Therefore, future efforts to address the concerns of the watershed will need to work closely and in cooperation with private landowners.

# 3 Water Quality Monitoring Results

Water samples, macroinvertebrate surveys, and habitat surveys were completed at twelve separate sampling locations in the Headwaters Yellow River watershed from June 2015 through May 2016. Figure 3-13 displays the geographic location of each sample site in the watershed. Water samples were collected from each sample site on a monthly basis during the sampling period. During the sampling period multiple stormflow and baseflow events were captured, providing a broad representation of the condition of each stream. Lastly, macroinvertebrate and habitat surveys were completed at each site in August 2015. The subsequent sections provide a summary of the water quality, macroinvertebrate, and habitat data as well as an analysis of the trends observed in the watershed. The raw data for all parameters is provided in Appendix B.

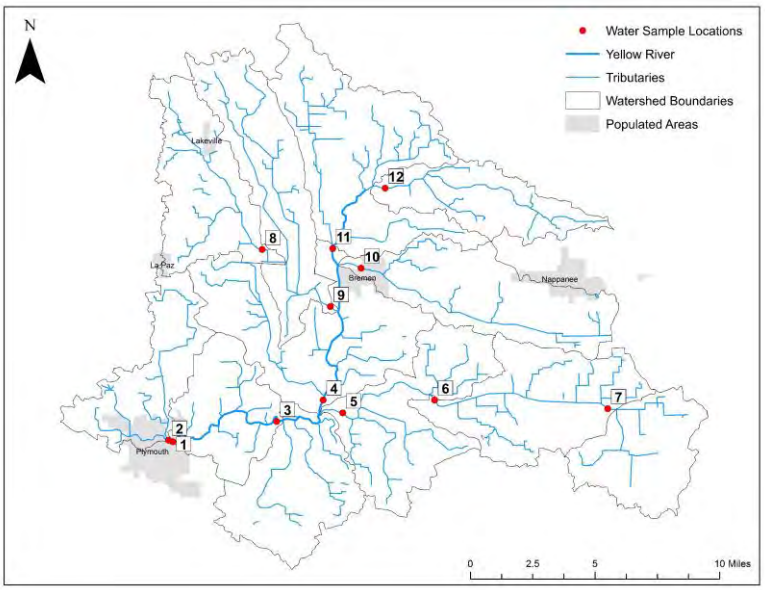


**Figure 3-13. Geographic location of each sample site in the Headwaters Yellow River Watershed.**

## 3.1 Nutrients, *E. coli*, and Sediment

### 3.1.1 Phosphorus

Over the twelve month sampling period approximately 33% of all water samples collected in the watershed exceeded state water quality standards for phosphorus. The highest average total phosphorus concentration in the Headwaters Yellow River watershed was observed at sample site #12, while the lowest average total phosphorus concentration was observed at sample site #7 (Figure 3-14). The Dausman Ditch drainage (sample site #5, #6, and #7) had low average total phosphorus concentrations relative to other portions of the watershed (Figure 3-14). The estimated annual phosphorus load using the Spreadsheet Tool for Estimating Pollutant Loads (STEPL) model for the Headwaters Yellow River watershed was 129,538 pounds per year.

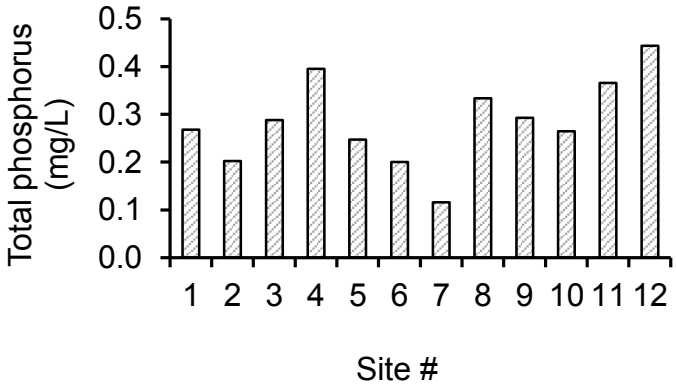


**Figure 3-14. Average total phosphorus concentration (mg/L) for each sample location in the Headwater Yellow River watershed from June 2015 through May 2016.**

### 3.1.2 Nitrogen

Over the twelve month sampling period approximately 15% of all water samples collected in the watershed exceeded state water quality standards for nitrate-N+nitrite-N. The highest average nitrate-

N+nitrite-N concentration in the Headwaters Yellow River watershed was observed at sample site #12, while the lowest average nitrate-N+nitrite-N concentration was observed at sample site #2 (Figure 3-15). The Dausman Ditch drainage (sample site #5, #6, and #7) had low average total phosphorus concentrations relative to other portions of the watershed, however nitrate-N+nitrite-N concentrations are relatively high (Figure 3-15). The estimated annual nitrogen load using the Spreadsheet Tool for Estimating Pollutant Loads (STEPL) model for the Headwaters Yellow River watershed was 652,625 pounds per year.

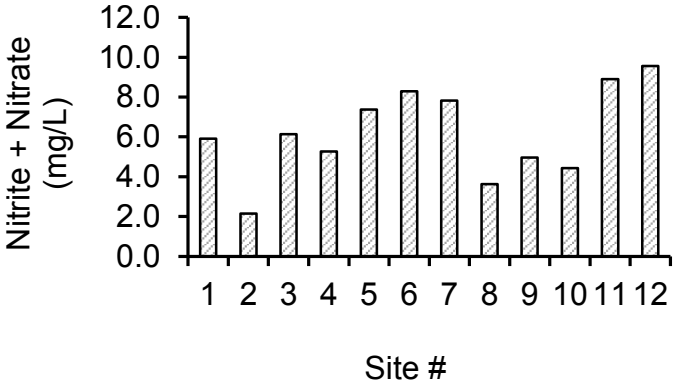


**Figure 3-15. Average nitrate-N+nitrite-N concentration (mg/L) for each sample location in the Headwater Yellow River watershed from June 2015 through May 2016.**

### *3.1.3 E. coli*

The Indiana water quality standard for one grab sample per month of *E. coli* is 235 cfu/100mL. Average *E. coli* concentrations exceed this water quality standard at each sample site in the Headwaters Yellow River watershed (Figure 3-16). Sample site #12 (Lateral Ditch No. 5 subwatershed) had the highest average *E. coli* concentration, while sample site #7 (Fleugel Ditch subwatershed) had the lowest average *E. coli* concentration (Figure 3-16). *E. coli* concentrations regularly exceeded 235 cfu/100mL during both stormflow and baseflow conditions. Approximately, 69% of all of the water samples collected in the watershed exceeded state standards for *E.coli*.

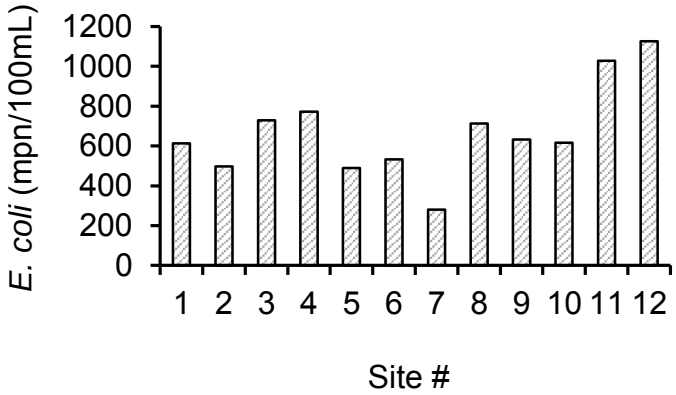


**Figure 3-16. Average *E. coli* concentration (mpn/100mL) for each sample location in the Headwater Yellow River watershed from June 2015 through May 2016.**

As a result of the high *E. coli* concentrations that were observed during baseflow conditions additional *E. coli* samples were collected on May 18th, 2016 and submitted for source tracking analysis. Source tracking samples were collected at three samples sites along the Yellow River. Sample sites included site #1 (Centennial Park, Plymouth), site #4 (7th Road, Marshall County), and site #11 (1st Road, Marshall

County). One additional sample was collected from Lateral No. 5 at site #12 (Elm Road, St. Joseph County), which has a history of high *E. coli* concentrations. Samples collected from the Yellow River suggest that the primary source of *E. coli* to the Yellow River is human in origin (Figure 3-17). In fact, 80% of the *E. coli* at site #4 was human in origin (Figure 3-17). The sample collected from Lateral No. 5 suggests that the sources of *E. coli* to the stream are equally distributed between human and animal (Figure 3-17).

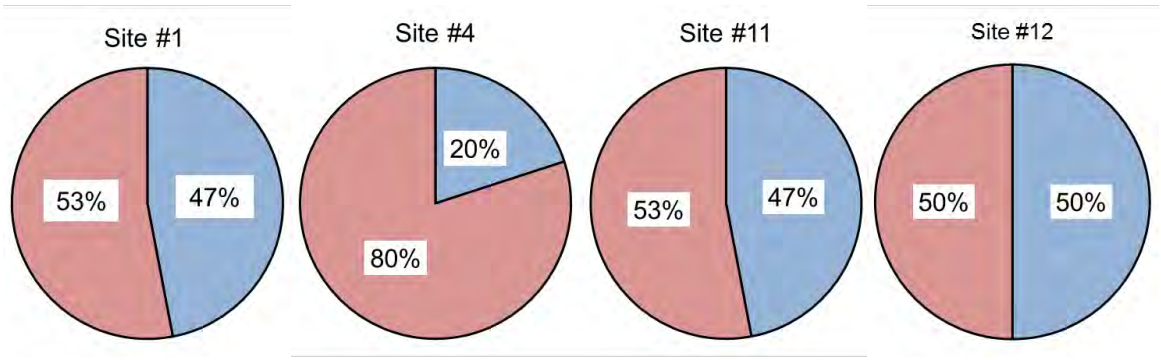


**Figure 3-17. Source tracking of *E. coli* samples collected on May 18th, 2016. Red represents the percentage of *E. coli* from human sources and blue represents the percentage of *E. coli* from animal sources.**

### 3.1.4 Sediment

During the twelve month sampling period the average total suspended solids (TSS) concentration leaving the Headwaters Yellow River watershed was 9.4 mg/L (Figure 3-18). The average TSS concentration is generally higher further upstream in the watershed, with higher average TSS concentrations at each of the sample sites (sample sites #3, #4, and #11) along the mainstem of the Yellow River (Figure 3-18). Sample sites #4 and #9 appear to be significant areas of the sediment contribution (Figure 3-18). However, the average TSS concentration for these sites may be skewed to temporary drainage maintenance activities that were taking place during some sampling events. This data also suggests that a high proportion of the sediment being transported from headwater drainages to the Yellow River drops out of the water column before reaching Plymouth. There are a large number of floodplain wetlands between Bremen and Plymouth that likely promote the removal of sediment during storm flow events (Figure 2-4). The estimated annual sediment load using the Spreadsheet Tool for Estimating Pollutant Loads (STEPL) model for the Headwaters Yellow River watershed was 24,193 tons per year.

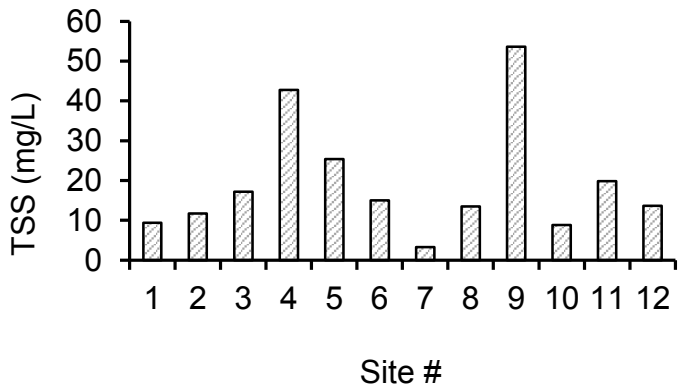


**Figure 3-18. Average TSS concentration (mg/L) for each sample location in the Headwater Yellow River watershed from June 2015 through May 2016.**

## 3.2 mIBI and QHEI

### 3.2.1 mIBI

Figure 3-19 describes the health of the macroinvertebrate community for each sample site using the mIBI. The mIBI is a biotic index that uses macroinvertebrate community structure as an indicator of stream impairment. Sample sites #1, #3, #4, #5, #6, and #9 scored between 4 and 6 on the mIBI indicating that each of these streams is slightly impaired (Figure 3-19). Sample sites #2, #7, #8, #10, #11, and #12 scored between 2 and 4 on the mIBI indicating that each of these streams is “moderately impaired” (Figure 3-19). There were no streams in the watershed that are categorized as “non-impaired” or “severely impaired” on the mIBI.

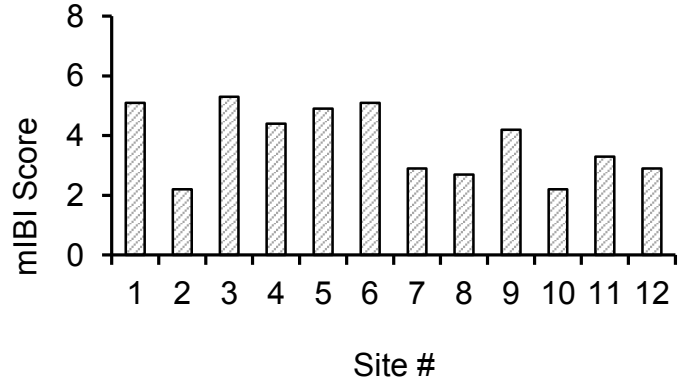


**Figure 3-19. Comparison of mIBI scores for each sample site in the Headwaters Yellow River watershed. Based on the IDEM mIBI protocol severely impaired streams have a score between 0 and 2, moderately impaired streams are between 2 and 4, slightly impaired streams are between 4 and 6, and non-impaired streams are between 6 and 8.**

### 3.2.2 QHEI

Figure 3-20 describes the available habitat at each sample site using the Qualitative Habitat Evaluation Index (QHEI). Sample site #2 had the highest QHEI score in the watershed and is categorized as having “good” habitat (Figure 3-20). Sample site #1, #3, #6, and #11 are the remaining samples sites categorized as having “good” habitat (Figure 3-20). Sample site #9 and #12 had QHEI scores between 43 and 54, which categorizes these sites as “fair” habitat (Figure 3-20). Sample site #4, #5, #7, #8, and #10 had QHEI scores between 30 and 42, which categorizes these sites as “poor” habitat (Figure 3-20). There

were no streams in the watershed that scored in the “excellent” or “very poor” habitat category. The majority of the headwater streams in the watershed and the upper portion of the Yellow River lack riparian vegetation. Riparian corridors become more common along the lower portion of the Yellow River between Plymouth and 7th Road in Marshall County.

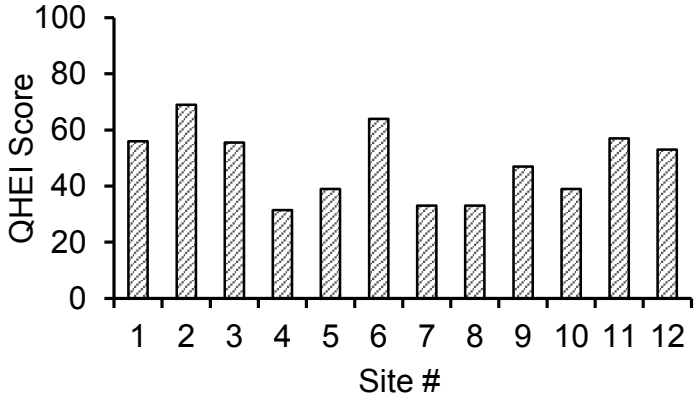


**Figure 3-20. Comparison of QHEI scores for each sample site in the Headwaters Yellow River watershed. Based on the QHEI protocol, sites with scores <30 are very poor, 30 to 42 are poor, 43 to 54 are fair, 55 to 69 are good, and >70 are excellent.**

## 3.3 Analysis of Trends

The water quality data collected from June 2015 through May 2016 in the Headwaters Yellow River watershed demonstrates that there are spatial differences in the contribution of nutrients, *E. coli*, and sediment to the Yellow River. The export of nutrients to the Yellow River appears to be influenced partially by the soils of the watershed. Hydric soils are common in Dausman Ditch, Lemler Ditch, and Fleugel Ditch subwatersheds (sample site #5, #6, and #7). Each of these subwatersheds had relatively high nitrate-N+nitrite-N concentrations and relatively low concentrations of total phosphorus. This suggests that the Dausman Ditch, Lemler Ditch, and Fleugel Ditch subwatersheds are exporting greater quantities of nitrogen via subsurface flow. The remainder of the watershed contains less hydric soil, therefore greater quantities of phosphorus are exported to the Yellow River via erosion. This is supported by relatively low TSS concentrations in areas of the watershed dominated by hydric soils and relatively high TSS concentrations in areas of the watershed with little hydric soil.

*E. coli* concentrations are the primary cause of stream impairment in the watershed and water samples collected from June 2015 through May 2016 suggest that *E. coli* concentrations exceed state water quality standards throughout the watershed. While *E. coli* concentrations regularly exceed state water quality standard at all sample sites, the northeastern portion of the watershed appears to have the highest concentrations. The Lateral Ditch No. 5 subwatershed had the both the highest average concentration of total phosphorus and *E. coli*. This suggests that fecal contamination is a significant source of *E. coli* and phosphorus to the Lateral Ditch No. 5 subwatershed. Source tracking samples collected during the spring of 2016 demonstrate that human and animal fecal waste are sources of *E. coli* and phosphorus to Lateral Ditch No. 5 and the Headwaters Yellow River watershed as a whole. Therefore, the increased implementation of agricultural BMP’s and improved human waste treatment practices will need to be addressed to reduce *E. coli* concentrations. Lastly, macroinvertebrate (mIBI) and habitat (QHEI) surveys demonstrate that the biotic communities of many of the streams in the watershed are impacted by pollutants and/or habitat.

# 4 Institutional Resources

There are several federal, state, local, and non-profit organizations that provide watershed restoration related resources. The recommendations described in Section 5 should be used to obtain funding resources from these organizations and/or build mutually beneficial partnerships. The subsequent sections describe agencies and organizes that could provide valuable resources.

## 4.1 Indiana Department of Natural Resources (IDNR)

The goal of the Division of Fish and Wildlife's Lake and River Enhancement (LARE) Section is to protect and enhance aquatic habitat for fish and wildlife, to insure the continued viability of Indiana's publicly accessible lakes and streams for multiple uses, including recreational opportunities. This is accomplished through measures that reduce non-point sediment and nutrient pollution of surface waters to a level that meets or surpasses state water quality standards. Each year the LARE program provides fund to assist with aquatic vegetation management, engineer design projects, engineering feasibility studies, lake diagnostic studies, watershed diagnostic studies, and sediment removal plans. The future acquisition of LARE funds and technical assistance will be essential to the implementation of urban and agricultural BMP's in the watershed.

The use of IDNR funding and technical assistance will be essential to the implementation of urban and agricultural BMP's in the watershed.

## 4.2 Indiana Department of Environmental Management (IDEM)

The mission of the Indiana Department of Environmental Management (IDEM) is to implement federal and state regulations to protect human health and the environment while allowing the environmentally sound operations of industrial, agricultural, commercial and governmental activities vital to a prosperous economy. The mission of IDEM's Office of Water Quality (OWQ), under the oversight of the Assistant Commissioner of OWQ, is to concentrate on fulfilling IDEM's mission where water quality is concerned. More specifically, OWQ is responsible for protecting public health and the environment by assessing the quality of surface water and groundwater through biological and chemical testing; regulating and monitoring drinking water supplies (including wellhead protection), wastewater treatment facilities and the construction of such facilities; and, protecting wetlands for proper drainage, flood protection and wildlife habitat. OWQ serves the citizens of Indiana through fulfilling responsibilities as set forth in the Clean Water Act. The use of IDEM funding and technical assistance will be essential to the implementation of urban and agricultural BMP's in the watershed.

## 4.3 Natural Resource Conservation Service (NRCS)

NRCS offers voluntary programs to eligible landowners and agricultural producers to provide financial and technical assistance to help manage natural resources in a sustainable manner. Through these programs the agency approves contracts to provide financial assistance to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, animal and related resources on agricultural lands and non-industrial private forest land. The NRCS also provides technical assistance through its voluntary Conservation Technical Assistance Program (CTA). CTA is available to any group or individual interested in conserving our natural resources and sustaining agricultural production. The use of NRCS financial and technical assistance will be essential to the implementation of agricultural BMP's in the watershed.

## 4.4 Hoosier River Watch

Hoosier Riverwatch is a program of the Indiana Department of Environmental Management, Office of Water Quality, Watershed Assessment and Planning Branch. The program began in 1996 to increase public awareness of water quality issues and concerns by training volunteers to monitor stream water quality. This resource should be utilized in the future to monitor potential water quality improvements following conservation efforts.

## 4.5 Indiana Clean Lakes Program

The Indiana Clean Lakes Program was created in 1989 as a program within the Indiana Department of Environmental Management's (IDEM) Office of Water Management. The program is administered through a grant to Indiana University's School of Public and Environmental Affairs (SPEA) in Bloomington. The Indiana Clean Lakes Program is a comprehensive, statewide public lake management program having five components including public information, technical assistance, volunteer lake monitoring, lake water quality assessment, and coordination with other state and federal lake programs.

## 4.6 Center for Lakes and Streams

The Center for Lakes & Streams at Grace College conducts research, provides resources, engages and educates residents, and collaborates with local organizations in efforts to make the lakes and streams of Kosciusko County cleaner. The Center for Lakes and Streams has a database of containing water quality data and other resources pertaining to the streams in Kosciusko County. This resource should be utilized in the future to monitor potential water quality improvements following conservation efforts.

## 4.7 Kankakee River Basin Commission

The Kankakee River Basin Commission was created by the Indiana General Assembly in 1977. The Commission represents eight County Soil and Water Conservation Districts in Northwest Indiana; Jasper, Lake, LaPorte, Marshall, Newton, Porter, Stark and St. Joseph. The Commission is composed of 24 members: a representative from each of the eight Boards of County Commissioners, the eight county surveyors or their designated employee, and a supervisor of the eight Soil and Water Conservation Districts. The KRBC was established to coordinate development in the Basin and has, since established, sought to plan and coordinate the many environmental demands placed upon the Kankakee River, its tributaries, and all the land around it. This includes flood control and drainage, as well as recreation, water quality and supply, hunting and fishing, wetlands preservation and upland soil erosion.

# 5 Management Recommendations

## 5.1 Recommended Management Measures

There are several BMP’s and management measure that can be implemented in order to reduce non-point source pollutants in surface waters and address the concerns of watershed stakeholders. The following section will describe the BMP’s and management measures that are recommended in order to improve water quality and habitat in the Headwaters Yellow River watershed. The majority of the land use in the Headwaters Yellow River watershed is agricultural. Therefore, there are many agricultural BMP’s that are recommended to be implemented throughout the watershed. No-till farming practices and cover crop utilization in the watershed is low, which suggests that there are opportunities to promote and increase the future utilization of these practices throughout the watershed. No-till farming practices have been shown to reduce soil erosion and sediment bound phosphorus to surface waters (Uri, Atwood, and Sanabria 1998). The benefits of cover crops vary based on the species that is used, however cover crops

generally reduce soil erosion and nitrate leaching from row-crop agricultural land (Snapp et al. 2005). When no-till farming and cover crops are continuously combined together intro a conservation cropping system additional soil benefits are obtained including reduced soil compaction, improved soil structure, increased organic matter, and increased available nitrogen. Due to the numerous benefits and widespread applicability conservation cropping systems are recommend throughout the watershed.

***Nutrient Reduction Recommendations***

- Increase the implementation of conservation cropping systems through education, outreach, and promotion of financial assistance programs.
- Reduce streambank erosion by addressing stabilizing areas of existing erosion.
- Reduce rill erosion by promoting financial assistance programs for the installation of grassed waterways.
- In areas of the watershed with significant subsurface drainage promote the available financial assistance programs for the installation of blind inlets and saturated buffers.
- Protect, create, enhance, and restore wetlands by promoting financial assistance programs.
- Develop an education campaign to promote the use of phosphorus-free fertilizer in both urban and rural portions of the watershed.

***E. coli Reduction Recommendations***

- Where applicable apply livestock exclusion practices by promoting financial assistance programs.
- Where applicable install filter strips between pastures and streams by promoting financial assistance programs.
- Partner with applicable county health departments to identify septic system maintenance issues.
- Partner with applicable county health departments and other agencies to develop a financial assistance program to promote septic system maintenance and repair.

***Sediment Reduction Recommendations***

- Increase the implementation of conservation cropping systems through education, outreach, and promotion of financial assistance programs.
- Reduce streambank erosion by addressing stabilizing existing areas of existing erosion.
- Reduce rill erosion by promoting financial assistance programs for the installation of grassed waterways.
- Install and/or enlarge riparian corridors along streams by promoting financial assistance programs.
- In areas of the watershed with significant subsurface drainage promote the available financial assistance programs for the installation of blind inlets.
- Protect, create, enhance, and restore wetlands by promoting financial assistance programs.

***Habitat Improvement Recommendations***

- Increase the implementation of conservation cropping systems through education, outreach, and promotion of financial assistance programs.
- Install and/or enlarge riparian corridors along streams by promoting financial assistance programs.

- Protect, create, enhance, and restore wetlands by promoting financial assistance programs.

# 6 Conclusion

The streams of the Headwaters Yellow River watershed have both degraded habitat and water quality. Excess *E. coli* from both human and animal sources are common in the Headwaters Yellow River watershed during both stormflow and baseflow conditions. The introduction of fecal contamination to the streams in the watershed is also a significant source of nutrients. High phosphorus concentrations are common in the Armey Ditch, Headwaters Stock Ditch, Kline Rouch Ditch, Lake of the Woods, Milner Seltenright Ditch, Stone Ditch, West Bunch Branch Ditch, and Lateral Ditch No. 5 subwatersheds. However, the export of nitrogen into the Yellow River primarily originates from the Dausman Ditch, Lemler Ditch, Fleugel Ditch, and Lateral Ditch No. 5 subwatershed.

Due to the prevalence of agricultural land use in the watershed the implementation of agricultural BMP's will be critical to the restoration of water quality in the watershed. The greatest water quality and habitat improvements can be obtain through the increased implementation of long-term conservation cropping systems. The increase use of conservation cropping systems in the Lateral Ditch No. 5 subwatershed is critical due to the high nutrient concentrations observed during this study. Lastly, local agencies need to develop a financial assistance program to promote septic system maintenance and repair. Addressing the contributions of malfunctioning septic systems will reduce both bacterial and nutrient loading to the Yellow River watershed.

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APPENDIX

# A

## SOIL ASSOCIATIONS

| Soil Association | Percentage (%) of the watershed |
|---|---|
| Ackerman muck, drained, 0 to 1 percent slopes | 0.01 |
| Adrian muck, drained, 0 to 1 percent slopes | 0.28 |
| Adrian muck, undrained, 0 to 1 percent slopes | 0.02 |
| Antung muck, drained, 0 to 1 percent slopes | 0.15 |
| Antung muck, undrained, 0 to 1 percent slopes | 0.00 |
| Aubbeenaubbee fine sandy loam, moderately permeable substratum, 0 to 2 percent slopes | 0.28 |
| Barry loam | 3.23 |
| Baugo silt loam, 0 to 1 percent slopes | 0.79 |
| Boyer loamy sand, 1 to 6 percent slopes | 0.23 |
| Boyer loamy sand, 6 to 12 percent slopes | 0.02 |
| Brady sandy loam | 0.55 |
| Brady sandy loam, 0 to 1 percent slopes | 1.49 |
| Brems-Morocco loamy sands, 0 to 1 percent slopes | 0.34 |
| Bristol loamy sand, 0 to 2 percent slopes | 0.03 |
| Bristol loamy sand, 2 to 5 percent slopes | 0.03 |
| Bronson sandy loam, 0 to 1 percent slopes | 0.59 |
| Bronson sandy loam, 0 to 2 percent slopes | 0.49 |
| Brookston loam, 0 to 1 percent slopes | 14.07 |
| Carmi loam, 0 to 2 percent slopes | 0.23 |
| Cohoctah loam, 0 to 1 percent slopes, frequently flooded, brief duration | 0.01 |
| Coloma loamy sand, 0 to 6 percent slopes | 0.13 |
| Coloma loamy sand, 6 to 12 percent slopes | 0.01 |
| Coloma sand, 2 to 5 percent slopes | 0.23 |
| Coloma sand, 5 to 10 percent slopes | 0.13 |
| Crosier loam, 0 to 1 percent slopes | 22.07 |
| Crosier loam, 1 to 4 percent slopes | 1.36 |
| Crumstown fine sandy loam, 0 to 1 percent slopes | 0.29 |
| Crumstown fine sandy loam, 1 to 5 percent slopes | 0.64 |
| Del Rey silt loam | 0.03 |
| Del Rey silty clay loam, 0 to 1 percent slopes | 0.14 |
| Edselton muck, drained, 0 to 1 percent slopes | 0.01 |
| Edselton muck, undrained, 0 to 1 percent slopes | 0.00 |
| Edwards muck, drained | 0.00 |
| Edwards muck, drained, 0 to 1 percent slopes | 0.06 |
| Edwards muck, undrained, 0 to 1 percent slopes | 0.01 |
| Elston sandy loam, 0 to 2 percent slopes | 0.24 |
| Gilford mucky sandy loam, 0 to 1 percent slopes | 1.32 |
| Gilford mucky sandy loam, gravelly substratum | 0.12 |
| Gilford sandy loam, 0 to 1 percent slopes | 0.10 |
| Gilford sandy loam, gravelly substratum | 0.31 |
| Gravelton loamy sand, occasionally flooded | 0.00 |
| Henrietta muck, drained, 0 to 1 percent slopes | 0.08 |
| Hillsdale sandy loam, 0 to 1 percent slopes | 0.04 |
| Hillsdale sandy loam, 1 to 5 percent slopes | 0.54 |
| Hillsdale-Oshtemo sandy loams, 10 to 18 percent slopes, eroded | 0.04 |
| Hillsdale-Oshtemo sandy loams, 5 to 10 percent slopes, eroded | 0.19 |
| Histosols and Aquolls | 0.03 |
| Histosols, 0 to 1 percent slopes, ponded | 0.00 |
| Homer sandy loam | 0.33 |
| Houghton muck, drained | 0.50 |
| Houghton muck, drained, 0 to 1 percent slopes | 2.20 |
| Houghton muck, undrained | 0.04 |
| Houghton muck, undrained, 0 to 1 percent slopes | 0.49 |
| Kosciusko sandy clay loam, 8 to 15 percent slopes, severely eroded | 0.04 |
| Kosciusko sandy loam, 0 to 2 percent slopes | 0.27 |
| Kosciusko sandy loam, 18 to 30 percent slopes | 0.00 |
| Kosciusko sandy loam, 2 to 6 percent slopes | 0.37 |
| Kosciusko sandy loam, 6 to 12 percent slopes | 0.00 |

| | |
|---|---|
| Linkville sandy loam, 0 to 1 percent slopes | 0.76 |
| Linkville sandy loam, 1 to 4 percent slopes | 0.13 |
| Madaus muck, drained, 0 to 1 percent slopes | 0.01 |
| Martinsville loam, 0 to 1 percent slopes | 0.30 |
| Martinsville loam, 1 to 5 percent slopes, eroded | 0.28 |
| Martinsville loam, 5 to 10 percent slopes, eroded | 0.00 |
| Martinsville sandy loam, 0 to 2 percent slopes | 0.14 |
| Martinsville sandy loam, 2 to 6 percent slopes | 0.01 |
| Martisco muck, drained, 0 to 1 percent slopes | 0.01 |
| Maumee loamy sand, 0 to 1 percent slopes | 0.00 |
| Maumee mucky loamy fine sand, 0 to 1 percent slopes | 0.02 |
| Maxinkuckee muck, drained, 0 to 1 percent slopes | 0.04 |
| Metea loamy sand, 0 to 2 percent slopes | 0.00 |
| Metea loamy sand, 2 to 6 percent slopes | 0.03 |
| Miami clay loam, 10 to 18 percent slopes, severely eroded | 0.02 |
| Miami clay loam, 5 to 10 percent slopes, severely eroded | 0.30 |
| Miami loam, 5 to 10 percent slopes, eroded | 0.04 |
| Milford silty clay loam, 0 to 1 percent slopes | 1.40 |
| Morocco loamy sand, 0 to 1 percent slopes | 0.00 |
| Moston muck, drained, 0 to 1 percent slopes | 0.10 |
| Moston muck, undrained, 0 to 1 percent slopes | 0.01 |
| Muskego muck, drained, 0 to 1 percent slopes | 0.20 |
| Muskego muck, undrained, 0 to 1 percent slopes | 0.02 |
| Newton loamy fine sand, 0 to 1 percent slopes | 0.01 |
| Ormas loamy sand, 0 to 2 percent slopes | 0.71 |
| Ormas loamy sand, 2 to 6 percent slopes | 0.22 |
| Ormas loamy sand, 6 to 12 percent slopes | 0.01 |
| Oshtemo fine sandy loam, 0 to 1 percent slopes | 0.02 |
| Oshtemo fine sandy loam, 1 to 5 percent slopes | 0.02 |
| Oshtemo fine sandy loam, 10 to 18 percent slopes | 0.00 |
| Oshtemo fine sandy loam, 5 to 10 percent slopes, eroded | 0.02 |
| Oshtemo sandy loam, 0 to 1 percent slopes | 1.10 |
| Oshtemo sandy loam, 1 to 5 percent slopes | 1.20 |
| Oshtemo sandy loam, 10 to 18 percent slopes | 0.03 |
| Oshtemo sandy loam, 5 to 10 percent slopes, eroded | 0.42 |
| Osolo loamy sand, 0 to 1 percent slopes | 0.01 |
| Osolo loamy sand, 1 to 5 percent slopes | 0.13 |
| Owosso sandy loam, 0 to 2 percent slopes | 0.58 |
| Palms muck, drained | 0.18 |
| Palms muck, drained, 0 to 1 percent slopes | 0.67 |
| Palms muck, gravelly substratum, drained | 0.53 |
| Palms muck, undrained, 0 to 1 percent slopes | 0.12 |
| Pinhook sandy loam, 0 to 2 percent slopes | 0.61 |
| Pits, gravel | 0.08 |
| Plainfield sand, 0 to 2 percent slopes | 0.03 |
| Plainfield sand, 12 to 18 percent slopes | 0.01 |
| Plainfield sand, 2 to 6 percent slopes | 0.04 |
| Psammaquents | 0.05 |
| Psamments | 0.04 |
| Rensselaer loam | 1.00 |
| Rensselaer loam, 0 to 1 percent slopes | 9.25 |
| Rensselaer mucky loam, 0 to 1 percent slopes | 0.17 |
| Riddles fine sandy loam, 0 to 2 percent slopes | 0.11 |
| Riddles fine sandy loam, 2 to 6 percent slopes | 0.08 |
| Riddles-Metea complex, 1 to 5 percent slopes | 0.94 |
| Riddles-Metea complex, 10 to 18 percent slopes, eroded | 0.08 |
| Riddles-Metea complex, 5 to 10 percent slopes, eroded | 0.92 |
| Riddles-Ormas-Kosciusko complex, 2 to 6 percent slopes | 0.05 |
| Riddles-Oshtemo fine sandy loams, 0 to 1 percent slopes | 2.53 |

| | |
|---|---|
| Riddles-Oshtemo fine sandy loams, 1 to 5 percent slopes | 6.52 |
| Riddles-Oshtemo fine sandy loams, 5 to 10 percent slopes, eroded | 0.11 |
| Sebewa loam, drained, 0 to 1 percent slopes | 1.06 |
| Sebewa mucky loam | 0.66 |
| Selfridge-Brems complex, 1 to 4 percent slopes | 0.03 |
| Selfridge-Brems loamy sands, 1 to 4 percent slopes | 0.04 |
| Selfridge-Crosier complex, 0 to 1 percent slopes | 0.99 |
| Shipshe sandy loam, 0 to 2 percent slopes | 1.80 |
| Shipshe sandy loam, 2 to 6 percent slopes | 0.01 |
| Southwest silt loam, 0 to 1 percent slopes | 0.22 |
| Toledo silty clay | 0.06 |
| Troxel silt loam, 0 to 1 percent slopes | 0.19 |
| Tyner loamy sand, 0 to 1 percent slopes | 0.08 |
| Tyner loamy sand, 1 to 5 percent slopes | 0.11 |
| Tyner loamy sand, 5 to 10 percent slopes | 0.06 |
| Udorthents, loamy | 0.06 |
| Udorthents, rubbish | 0.14 |
| Udorthents-Urban land complex | 0.01 |
| Urban land-Brady complex, 0 to 1 percent slopes | 0.02 |
| Urban land-Brems-Morocco complex, 0 to 1 percent slopes | 0.01 |
| Urban land-Bronson complex, 0 to 1 percent slopes | 0.00 |
| Urban land-Brookston complex, 0 to 1 percent slopes | 0.06 |
| Urban land-Coloma complex, 2 to 5 percent slopes | 0.06 |
| Urban land-Coloma complex, 5 to 10 percent slopes | 0.01 |
| Urban land-Crosier complex, 0 to 3 percent slopes | 0.42 |
| Urban land-Gilford complex, 0 to 1 percent slopes | 0.03 |
| Urban land-Oshtemo complex, 0 to 1 percent slopes | 0.03 |
| Urban land-Oshtemo complex, 1 to 5 percent slopes | 0.01 |
| Urban land-Oshtemo complex, 5 to 10 percent slopes | 0.00 |
| Urban land-Rensselaer complex, 0 to 1 percent slopes | 0.09 |
| Urban land-Riddles-Metea complex, 1 to 5 percent slopes | 0.05 |
| Urban land-Riddles-Metea complex, 10 to 18 percent slopes | 0.00 |
| Urban land-Riddles-Metea complex, 5 to 10 percent slopes | 0.01 |
| Urban land-Riddles-Oshtemo complex, 0 to 1 percent slopes | 0.08 |
| Urban land-Riddles-Oshtemo complex, 1 to 5 percent slopes | 0.03 |
| Urban land-Tyner complex, 0 to 1 percent slopes | 0.05 |
| Urban land-Tyner complex, 1 to 5 percent slopes | 0.02 |
| Urban land-Tyner complex, 5 to 10 percent slopes | 0.00 |
| Urban land-Whitaker complex, 0 to 1 percent slopes | 0.02 |
| Washtenaw loam, gravelly substratum | 0.01 |
| Washtenaw silt loam, 0 to 2 percent slopes | 0.09 |
| Water | 0.50 |
| Waterford loam, 0 to 2 percent slopes, frequently flooded, long duration | 0.03 |
| Waterford-Cohoctah loams, 0 to 2 percent slopes, frequently flooded, brief duration | 0.61 |
| Wawasee fine sandy loam, 2 to 6 percent slopes | 0.07 |
| Wawasee fine sandy loam, 6 to 12 percent slopes, eroded | 0.00 |
| Wawasee sandy clay loam, 12 to 18 percent slopes, severely eroded | 0.01 |
| Wawasee sandy loam, 2 to 6 percent slopes | 0.38 |
| Wawasee sandy loam, 6 to 12 percent slopes, eroded | 0.15 |
| Whitaker loam | 0.28 |
| Whitaker loam, 0 to 1 percent slopes | 3.10 |
| Williamstown loam, 0 to 1 percent slopes | 0.09 |
| Williamstown loam, 1 to 5 percent slopes, eroded | 0.15 |
| Williamstown loam, 5 to 10 percent slopes, eroded | 0.01 |
| Williamstown-Crosier complex, 1 to 5 percent slopes | 0.06 |
| Williamstown-Crosier loams, 1 to 5 percent slopes | 0.12 |
| Williamstown-Moon complex, 1 to 5 percent slopes | 0.06 |
| Wunabuna silt loam, drained, 0 to 1 percent slopes | 0.11 |

# APPENDIX B

## RAW DATA

| | |
|---|---|
| **Site #:** | 1 |
| **Name:** | Yellow River |
| **Lat/Long:** | 41.352961/-86.302878 |

| Sample Date | Water Temperature (Celcius) | DO (mg/L) | pH | Conductivity (us/cm) | TKN (mg/L) | $NO_2$-N+$NO_3$-N (mg/L) | $NH_3$-N (mg/L) | Total Phosphorus (mg/L) | Dissolved Phosphorus (mg/L) | Turbidity (NTU) | TSS (mg/L) | Atrazine (ug/L) | *E. coli* (mpn/100mL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/30/2015 | 18.2 | 5.95 | 7.67 | 539 | 0.707 | 9.48 | 0.069 | 0.498 | 0.396 | 27.30 | 45 | 0.76 | 2419.6 |
| 7/28/2015 | 23.3 | 4.75 | 8.39 | 674 | 0.729 | 5.40 | 0.059 | 0.325 | 0.191 | 10.70 | 10 | N/A | 686.7 |
| 8/26/2015 | 17.5 | 6.94 | 8.96 | 668 | 0.349 | 3.27 | 0.042 | 0.256 | 0.209 | 3.79 | 2 | 0.54 | 387.3 |
| 9/15/2015 | 17.6 | 7.00 | 8.66 | 690 | 0.228 | 3.48 | 0.066 | 0.260 | 0.213 | 3.93 | 2 | N/A | 248.1 |
| 10/29/2015 | 9.5 | 6.47 | 8.67 | 679 | 0.178 | 3.61 | 0.015 | 0.295 | 0.172 | 3.28 | 1 | N/A | 461.1 |
| 11/30/2015 | 5.5 | 10.12 | 7.84 | 700 | 0.966 | 6.14 | 0.052 | 0.232 | 0.188 | 4.70 | 3 | N/A | 285.1 |
| 12/14/2015 | 12.2 | 8.13 | 7.97 | 670 | 0.363 | 3.32 | 0.052 | 0.213 | 0.146 | 4.66 | 1 | N/A | 344.8 |
| 2/3/2016 | 5.3 | 11.44 | 7.92 | 655 | 0.951 | 6.28 | 0.178 | 0.390 | 0.277 | 27.70 | 9 | N/A | 1732.9 |
| 3/21/2016 | 7.2 | 11.37 | 7.82 | 504 | 0.448 | 7.40 | 0.050 | 0.157 | 0.157 | 6.92 | 6 | N/A | 275.5 |
| 4/13/2016 | 9.0 | 10.15 | 7.67 | 442 | 0.844 | 8.69 | 0.029 | 0.209 | 0.126 | 17.00 | 14 | 0.23 | 155.3 |
| 5/18/2016 | 12.6 | 9.24 | 7.35 | 482 | 0.668 | 8.31 | 0.040 | 0.228 | 0.168 | 17.90 | 15 | N/A | 135.4 |
| 5/31/2016 | 21.4 | 8.20 | 7.83 | 503 | 0.870 | 5.57 | 0.035 | 0.150 | 0.186 | 8.22 | 5 | N/A | 225.4 |

| | |
|---|---|
| **Site #:** | 2 |
| **Name:** | Elmer Seltenright Ditch |
| **Lat/Long:** | 41.353901/-86.306044 |

| Sample Date | Water Temperature (Celcius) | DO (mg/L) | pH | Conductivity (us/cm) | TKN (mg/L) | $NO_2$-N+$NO_3$-N (mg/L) | $NH_3$-N (mg/L) | Total Phosphorus (mg/L) | Dissolved Phosphorus (mg/L) | Turbidity (NTU) | TSS (mg/L) | Atrazine (ug/L) | *E. coli* (mpn/100mL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/30/2015 | 18.7 | 6.73 | 7.66 | 526 | 0.619 | 3.27 | 0.068 | 0.337 | 0.33 | 12.30 | 12 | 0.57 | 920.8 |
| 7/28/2015 | 23.2 | 5.38 | 8.19 | 662 | 0.153 | 1.86 | 0.067 | 0.251 | 0.154 | 9.97 | 19 | N/A | 488.4 |
| 8/26/2015 | 16.6 | 9.50 | 9.14 | 787 | 0.220 | 1.68 | 0.031 | 0.117 | 0.074 | 5.64 | 1 | 0.1 | 231 |
| 9/15/2015 | 17.6 | 8.10 | 8.74 | 776 | 0.325 | 1.64 | 0.035 | 0.092 | 0.035 | 7.74 | 5 | N/A | 365.4 |
| 10/29/2015 | 8.7 | 9.73 | 8.9 | 745 | 0.072 | 1.73 | 0.023 | 0.103 | 0.047 | 5.62 | 1 | N/A | 435.2 |
| 11/30/2015 | 6.4 | 11.11 | 7.89 | 716 | 1.010 | 2.54 | 0.034 | 0.076 | 0.08 | 4.30 | 4 | N/A | 116.2 |
| 12/14/2015 | 12.0 | 8.50 | 7.9 | 609 | 0.420 | 1.29 | 0.066 | 0.310 | 0.112 | 29.40 | 26 | N/A | 2417.6 |
| 2/3/2016 | 5.8 | 11.47 | 7.83 | 745 | 0.807 | 2.71 | 0.107 | 0.379 | 0.277 | 14.00 | 43 | N/A | 344.8 |
| 3/21/2016 | 7.7 | 11.30 | 8.03 | 564 | 0.560 | 2.46 | 0.041 | 0.302 | 0.267 | 4.76 | 7 | N/A | 46.4 |
| 4/13/2016 | 10.7 | 10.05 | 7.76 | 479 | 1.100 | 2.55 | 0.019 | 0.135 | 0.098 | 7.17 | 1 | 0.353 | 193.5 |
| 5/18/2016 | 11.0 | 8.43 | 7.17 | 509 | 0.702 | 2.35 | 0.046 | 0.245 | 0.137 | 17.20 | 19 | N/A | 151.5 |
| 5/31/2016 | 19.6 | 11.02 | 7.97 | 569 | 1.040 | 1.72 | 0.016 | 0.079 | 0.095 | 5.33 | 3 | N/A | 248.9 |

| | |
|---|---|
| **Site #:** | 3 |
| **Name:** | Yellow River |
| **Lat/Long:** | 41.364257/-86.222512 |

| Sample Date | Water Temperature (Celcius) | DO (mg/L) | pH | Conductivity (us/cm) | TKN (mg/L) | $NO_2$-N+$NO_3$-N (mg/L) | $NH_3$-N (mg/L) | Total Phosphorus (mg/L) | Dissolved Phosphorus (mg/L) | Turbidity (NTU) | TSS (mg/L) | Atrazine (ug/L) | *E. coli* (mpn/100mL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/30/2015 | 18.1 | 5.85 | 7.7 | 550 | 0.909 | 9.01 | 0.063 | 0.460 | 0.41 | 17.40 | 31 | 1.47 | 1732.9 |
| 7/28/2015 | 24.0 | 4.72 | 8.13 | 678 | 4.750 | 6.00 | 0.052 | 0.307 | 0.182 | 20.60 | 29 | N/A | 920.8 |
| 8/26/2015 | 16.9 | 6.74 | 8.93 | 678 | 0.890 | 3.67 | 0.026 | 0.246 | 0.164 | 5.98 | 19 | 0.54 | 648.8 |
| 9/15/2015 | 17.4 | 6.92 | 8.6 | 688 | 0.326 | 3.70 | 0.062 | 0.278 | 0.179 | 7.91 | 2 | N/A | 866.4 |
| 10/29/2015 | 8.8 | 7.69 | 8.77 | 665 | 0.223 | 3.35 | 0.015 | 0.322 | 0.219 | 5.96 | 4 | N/A | 456.9 |
| 11/30/2015 | 5.1 | 9.01 | 7.92 | 702 | 0.955 | 6.23 | 0.054 | 0.235 | 0.167 | 5.52 | 9 | N/A | 325.5 |
| 12/14/2015 | 12.3 | 7.16 | 7.97 | 655 | 0.837 | 3.52 | 0.072 | 0.257 | 0.16 | 10.00 | 8 | N/A | 517.2 |
| 2/3/2016 | 5.4 | 1.44 | 7.12 | 642 | 0.908 | 7.17 | 0.215 | 0.670 | 0.2 | 65.70 | 68 | N/A | 2419.6 |
| 3/21/2016 | 5.9 | 11.15 | 7.98 | 507 | 0.493 | 7.53 | 0.039 | 0.153 | 0.153 | 7.66 | 2 | N/A | 328.2 |
| 4/13/2016 | 8.3 | 10.33 | 7.64 | 449 | 0.626 | 8.92 | 0.030 | 0.160 | 0.095 | 13.80 | 10 | 0.444 | 156.5 |
| 5/18/2016 | 11.9 | 9.68 | 7.49 | 480 | 0.763 | 8.62 | 0.038 | 0.193 | 0.1873 | 18.70 | 16 | N/A | 191.8 |
| 5/31/2016 | 20.5 | 8.07 | 7.75 | 505 | 0.987 | 5.88 | 0.026 | 0.172 | 0.183 | 9.18 | 8 | N/A | 178.5 |

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| **Site #:** | 4 |
| **Name:** | Yellow River |
| **Lat/Long:** | 41.376512/-86.186458 |

| Sample Date | Water Temperature (Celcius) | DO (mg/L) | pH | Conductivity (us/cm) | TKN (mg/L) | $NO_2$-N+$NO_3$-N (mg/L) | $NH_3$-N (mg/L) | Total Phosphorus (mg/L) | Dissolved Phosphorus (mg/L) | Turbidity (NTU) | TSS (mg/L) | Atrazine (ug/L) | *E. coli* (mpn/100mL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/30/2015 | 18.6 | 6.02 | 7.71 | 520 | 1.220 | 8.30 | 0.066 | 0.446 | 0.4 | 26.10 | 274 | 1.72 | 2419.6 |
| 7/28/2015 | 24.3 | 5.16 | 8.22 | 678 | 0.000 | 5.09 | 0.053 | 0.352 | 0.216 | 12.00 | 14 | N/A | 579.4 |
| 8/26/2015 | 17.7 | 9.77 | 9.08 | 710 | 0.923 | 3.49 | 0.042 | 0.386 | 0.297 | 4.83 | 1 | 0.67 | 186.5 |
| 9/15/2015 | 20.1 | 7.75 | 8.66 | 719 | 0.840 | 3.82 | 0.074 | 0.483 | 0.379 | 6.38 | 6 | N/A | 816.4 |
| 10/29/2015 | 8.8 | 7.96 | 8.82 | 724 | 1.830 | 3.93 | 0.079 | 0.647 | 0.211 | 51.90 | 74 | N/A | 816.4 |
| 11/30/2015 | 4.9 | 11.30 | 7.76 | 704 | 0.778 | 6.42 | 0.063 | 0.295 | 0.219 | 5.12 | 6 | N/A | 435.2 |
| 12/14/2015 | 12.1 | 6.73 | 8.04 | 663 | 0.907 | 3.59 | 0.090 | 0.358 | 0.26 | 11.60 | 12 | N/A | 307.6 |
| 2/3/2016 | 5.1 | 11.24 | 7.8 | 640 | 1.430 | 7.26 | 0.296 | 0.976 | 0.276 | 90.70 | 96 | N/A | 2419.6 |
| 3/21/2016 | 6.4 | 11.33 | 8.02 | 492 | 3.000 | 4.21 | 0.042 | 0.153 | 0.153 | 6.62 | 4 | N/A | 686.7 |
| 4/13/2016 | 8.5 | 10.75 | 7.77 | 435 | 4.030 | 4.09 | 0.033 | 0.168 | 0.131 | 11.00 | 11 | 0.294 | 146.7 |
| 5/18/2016 | 12.0 | 9.14 | 7.58 | 469 | 0.841 | 7.81 | 0.064 | 0.272 | 0.192 | 16.50 | 12 | N/A | 307.6 |
| 5/31/2016 | 21.3 | 7.37 | 7.91 | 518 | 1.160 | 5.18 | 0.024 | 0.203 | 0.236 | 5.52 | 3 | N/A | 148.3 |

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| **Site #:** | 5 |
| **Name:** | Dausman Ditch |
| **Lat/Long:** | 41.36971/-86.174348 |

| Sample Date | Water Temperature (Celcius) | DO (mg/L) | pH | Conductivity (us/cm) | TKN (mg/L) | $NO_2$-N+$NO_3$-N (mg/L) | $NH_3$-N (mg/L) | Total Phosphorus (mg/L) | Dissolved Phosphorus (mg/L) | Turbidity (NTU) | TSS (mg/L) | Atrazine (ug/L) | *E. coli* (mpn/100mL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/30/2015 | 17.5 | 6.37 | 7.64 | 645 | 0.000 | 12.80 | 0.079 | 0.247 | 0.239 | 12.60 | 22 | 0.43 | 488.4 |
| 7/28/2015 | 24.3 | 5.59 | 8.38 | 703 | 0.000 | 7.21 | 0.043 | 0.182 | 0.122 | 26.50 | 26 | N/A | 727 |
| 8/26/2015 | 18.9 | 6.78 | 8.99 | 670 | 0.624 | 4.07 | 0.031 | 0.124 | 0.076 | 5.76 | 8 | 0.1 | 517.2 |
| 9/15/2015 | 18.6 | 7.30 | 8.63 | 626 | 0.524 | 3.13 | 0.039 | 0.067 | 0.05 | 5.45 | 8 | N/A | 461.1 |
| 10/29/2015 | 7.5 | 10.66 | 8.97 | 654 | 0.449 | 3.08 | 0.019 | 0.067 | 0.032 | 6.12 | 1 | N/A | 770.1 |
| 11/30/2015 | 5.3 | 10.18 | 7.89 | 722 | 0.576 | 6.12 | 0.044 | 0.090 | 0.03 | 8.18 | 3 | N/A | 365.4 |
| 12/14/2015 | 12.3 | 6.96 | 8.01 | 658 | 0.840 | 3.31 | 0.089 | 0.128 | 0.069 | 10.00 | 6 | N/A | 178.2 |
| 2/3/2016 | 5.3 | 11.09 | 7.68 | 591 | 2.010 | 9.37 | 0.388 | 1.500 | 0.242 | 270.00 | 201 | N/A | 1413.6 |
| 3/21/2016 | 5.7 | 12.06 | 7.8 | 521 | 0.797 | 9.83 | 0.034 | 0.258 | 0.215 | 10.30 | 11 | N/A | 307.6 |
| 4/13/2016 | 8.5 | 10.93 | 7.64 | 485 | 0.797 | 11.80 | 0.018 | 0.130 | 0.057 | 11.70 | 5 | 0.21 | 131.7 |
| 5/18/2016 | 12.0 | 10.17 | 7.66 | 506 | 0.513 | 11.00 | 0.023 | 0.140 | 0.084 | 15.10 | 12 | N/A | 235.9 |
| 5/31/2016 | 21.4 | 11.38 | 7.82 | 501 | 0.489 | 6.71 | 0.015 | 0.030 | 0.088 | 4.21 | 2 | N/A | 275.5 |

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| **Site #:** | 6 |
| **Name:** | Dausman Ditch |
| **Lat/Long:** | 41.375825/-86.100411 |

| Sample Date | Water Temperature (Celcius) | DO (mg/L) | pH | Conductivity (us/cm) | TKN (mg/L) | $NO_2$-N+$NO_3$-N (mg/L) | $NH_3$-N (mg/L) | Total Phosphorus (mg/L) | Dissolved Phosphorus (mg/L) | Turbidity (NTU) | TSS (mg/L) | Atrazine (ug/L) | *E. coli* (mpn/100mL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/30/2015 | 17.0 | 6.20 | 7.45 | 672 | 0.000 | 14.00 | 0.044 | 0.212 | 0.189 | 10.20 | 21 | 0.1 | 387.3 |
| 7/28/2015 | 23.2 | 6.26 | 8.27 | 723 | 0.895 | 8.23 | 0.018 | 0.096 | 0.086 | 13.10 | 18 | N/A | 547.5 |
| 8/26/2015 | 17.7 | 8.46 | 8.97 | 695 | 0.720 | 5.36 | 0.015 | 0.075 | 0.041 | 2.73 | 4 | 0.1 | 249.5 |
| 9/15/2015 | 17.1 | 8.24 | 8.63 | 671 | 0.375 | 4.45 | 0.038 | 0.066 | 0.036 | 4.48 | 2 | N/A | 686.7 |
| 10/29/2015 | 6.6 | 9.93 | 8.84 | 679 | 0.282 | 3.74 | 0.024 | 0.118 | 0.03 | 4.70 | 1 | N/A | 866.4 |
| 11/30/2015 | 4.1 | 12.23 | 7.8 | 745 | 0.442 | 6.43 | 0.034 | 0.071 | 0.035 | 5.11 | 2 | N/A | 248.1 |
| 12/14/2015 | 12.2 | 9.57 | 7.91 | 684 | 0.541 | 3.87 | 0.071 | 0.137 | 0.072 | 5.48 | 3 | N/A | 816.4 |
| 2/3/2016 | 5.0 | 11.42 | 7.74 | 603 | 1.310 | 10.60 | 0.239 | 1.130 | 0.289 | 152.00 | 111 | N/A | 1732.9 |
| 3/21/2016 | 4.8 | 12.38 | 7.76 | 536 | 0.880 | 10.70 | 0.026 | 0.243 | 0.217 | 10.10 | 8 | N/A | 275.5 |
| 4/13/2016 | 7.8 | 11.57 | 7.55 | 504 | 1.190 | 12.70 | 0.015 | 0.099 | 0.05 | 9.99 | 2 | 0.158 | 141.4 |
| 5/18/2016 | 13.4 | 10.55 | 7.59 | 515 | 1.180 | 12.10 | 0.016 | 0.093 | 0.055 | 7.40 | 7 | N/A | 101.9 |
| 5/31/2016 | 19.5 | 9.05 | 7.83 | 526 | 1.250 | 7.35 | 0.015 | 0.061 | 0.053 | 3.46 | 1 | N/A | 344.8 |

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| **Site #:** | 7 |
| **Name:** | Dausman Ditch |
| **Lat/Long:** | 41.369696/-85.966852 |

| Sample Date | Water Temperature (Celcius) | DO (mg/L) | pH | Conductivity (us/cm) | TKN (mg/L) | $NO_2$-N+$NO_3$-N (mg/L) | $NH_3$-N (mg/L) | Total Phosphorus (mg/L) | Dissolved Phosphorus (mg/L) | Turbidity (NTU) | TSS (mg/L) | Atrazine (ug/L) | *E. coli* (mpn/100mL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/30/2015 | 16.4 | 5.82 | 7.53 | 698 | 0.000 | 13.60 | 0.016 | 0.121 | 0.114 | 6.69 | 2 | 0.1 | 344.8 |
| 7/28/2015 | 21.2 | 6.45 | 8.03 | 725 | 0.512 | 6.93 | 0.015 | 0.095 | 0.12 | 3.70 | 2 | N/A | 365.4 |
| 8/26/2015 | 16.6 | 9.02 | 8.87 | 710 | 0.482 | 4.59 | 0.015 | 0.084 | 0.041 | 2.20 | 1 | 0.1 | 108.6 |
| 9/15/2015 | 16.8 | 8.48 | 8.67 | 703 | 0.342 | 3.28 | 0.015 | 0.063 | 0.032 | 2.22 | 1 | N/A | 222.4 |
| 10/29/2015 | 7.4 | 9.50 | 8.92 | 701 | 0.464 | 3.08 | 0.015 | 0.057 | 0.03 | 3.92 | 1 | N/A | 387.3 |
| 11/30/2015 | 4.3 | 10.71 | 7.77 | 733 | 0.679 | 5.23 | 0.015 | 0.044 | 0.031 | 3.87 | 1 | N/A | 517.2 |
| 12/14/2015 | 12.3 | 8.65 | 7.98 | 693 | 0.404 | 3.13 | 0.015 | 0.117 | 0.042 | 2.19 | 3 | N/A | 185 |
| 2/3/2016 | 5.3 | 10.49 | 7.66 | 630 | 0.920 | 12.90 | 0.099 | 0.488 | 0.222 | 49.40 | 16 | N/A | 816.4 |
| 3/21/2016 | 5.3 | 14.70 | 7.99 | 543 | 1.130 | 10.10 | <0.015 | 0.195 | 0.195 | 3.62 | 5 | N/A | 90.6 |
| 4/13/2016 | 8.5 | 14.80 | 7.75 | 520 | 0.863 | 13.10 | 0.015 | 0.030 | 0.03 | 2.90 | 1 | 0.286 | 44.8 |
| 5/18/2016 | 13.2 | 10.77 | 7.58 | 530 | 0.661 | 11.30 | 0.015 | 0.045 | 0.036 | 3.33 | 5 | N/A | 260.3 |
| 5/31/2016 | 20.0 | 7.71 | 7.66 | 541 | 0.764 | 6.71 | 0.015 | 0.050 | 0.072 | 1.50 | 1 | N/A | 29.2 |

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| **Site #:** | 8 |
| **Name:** | Heston Ditch |
| **Lat/Long:** | 41.464341/-86.232551 |

| Sample Date | Water Temperature (Celcius) | DO (mg/L) | pH | Conductivity (us/cm) | TKN (mg/L) | $NO_2$-N+$NO_3$-N (mg/L) | $NH_3$-N (mg/L) | Total Phosphorus (mg/L) | Dissolved Phosphorus (mg/L) | Turbidity (NTU) | TSS (mg/L) | Atrazine (ug/L) | *E. coli* (mpn/100mL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/30/2015 | 19.1 | 4.12 | 6.21 | 368 | 0.059 | 5.48 | 0.092 | 0.523 | 0.402 | 19.50 | 16 | 1.98 | 2419.6 |
| 7/28/2015 | 22.6 | 2.88 | 8.08 | 558 | 1.210 | 3.56 | 0.223 | 0.333 | 0.199 | 7.46 | 3 | N/A | 365.4 |
| 8/26/2015 | 17.7 | 3.79 | 8.66 | 624 | 0.811 | 2.68 | 0.105 | 0.323 | 0.189 | 5.84 | 2 | 0.56 | 77.3 |
| 9/15/2015 | 16.7 | 4.16 | 8.49 | 729 | 0.355 | 3.26 | 0.139 | 0.329 | 0.226 | 18.70 | 22 | N/A | 410.6 |
| 10/29/2015 | 7.2 | 6.87 | 8.43 | 559 | 0.788 | 1.87 | 0.234 | 0.350 | 0.155 | 16.30 | 21 | N/A | 2419.6 |
| 11/30/2015 | 4.4 | 9.29 | 6.94 | 588 | 0.681 | 3.57 | 0.172 | 0.150 | 0.13 | 5.94 | 3 | N/A | 178.9 |
| 12/14/2015 | 12.1 | 6.14 | 7.94 | 713 | 0.805 | 2.40 | 0.224 | 0.181 | 0.121 | 5.69 | 3 | N/A | 517.2 |
| 2/3/2016 | 4.6 | 10.84 | 7.49 | 590 | 1.500 | 4.57 | 0.285 | 0.860 | 0.336 | 90.10 | 67 | N/A | 1732.9 |
| 3/21/2016 | 4.2 | 10.06 | 7.62 | 440 | 1.140 | 4.39 | 0.147 | 0.299 | 0.242 | 6.19 | 7 | N/A | 82.3 |
| 4/13/2016 | 6.8 | 10.43 | 8.02 | 371 | 1.710 | 4.22 | 0.058 | 0.163 | 0.072 | 8.84 | 5 | 0.1 | 38.4 |
| 5/18/2016 | 15.9 | 9.89 | 7.8 | 358 | 1.250 | 3.77 | 0.150 | 0.258 | 0.171 | 13.90 | 5 | N/A | 71.2 |
| 5/31/2016 | 19.6 | 5.67 | 7.22 | 502 | 1.400 | 3.84 | 0.184 | 0.236 | 0.217 | 14.20 | 8 | N/A | 238.2 |

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| **Site #:** | 9 |
| **Name:** | West Bunch Branch Ditch |
| **Lat/Long:** | 41.430768/-86.180228 |

| Sample Date | Water Temperature (Celcius) | DO (mg/L) | pH | Conductivity (us/cm) | TKN (mg/L) | $NO_2$-N+$NO_3$-N (mg/L) | $NH_3$-N (mg/L) | Total Phosphorus (mg/L) | Dissolved Phosphorus (mg/L) | Turbidity (NTU) | TSS (mg/L) | Atrazine (ug/L) | *E. coli* (mpn/100mL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/30/2015 | 18.5 | 5.20 | 7.61 | 424 | 0.068 | 7.36 | 0.080 | 0.535 | 0.472 | 32.40 | 435 | 1.79 | 1413.6 |
| 7/28/2015 | 22.6 | 3.95 | 8.06 | 623 | 0.530 | 5.36 | 0.058 | 0.278 | 0.218 | 13.00 | 14 | N/A | 613.1 |
| 8/26/2015 | 16.7 | 7.53 | 8.86 | 634 | 0.611 | 3.78 | 0.036 | 0.197 | 0.166 | 4.65 | 1 | 0.46 | 686.7 |
| 9/15/2015 | 16.0 | 7.72 | 8.55 | 678 | 0.354 | 3.99 | 0.059 | 0.159 | 0.094 | 4.25 | 1 | N/A | 488.4 |
| 10/29/2015 | 7.3 | 8.55 | 8.83 | 667 | 0.307 | 2.59 | 0.124 | 0.257 | 0.123 | 8.11 | 1 | N/A | 816.4 |
| 11/30/2015 | 4.2 | 10.62 | 7.7 | 643 | 0.894 | 4.53 | 0.103 | 0.216 | 0.143 | 9.81 | 6 | N/A | 313 |
| 12/14/2015 | 12.1 | 7.94 | 7.82 | 645 | 0.894 | 2.78 | 0.112 | 0.158 | 0.109 | 9.96 | 9 | N/A | 172.3 |
| 2/3/2016 | 4.7 | 13.30 | 7.62 | 597 | 0.928 | 6.26 | 0.346 | 0.865 | 0.235 | 98.90 | 144 | N/A | 2419.6 |
| 3/21/2016 | 4.8 | 10.41 | 7.8 | 475 | 0.961 | 5.84 | 0.047 | 0.305 | 0.241 | 7.90 | 4 | N/A | 120.1 |
| 4/13/2016 | 7.3 | 10.59 | 7.73 | 397 | 0.981 | 6.33 | 0.026 | 0.170 | 0.101 | 12.40 | 14 | 0.266 | 178.5 |
| 5/18/2016 | 13.6 | 9.60 | 7.72 | 392 | 0.767 | 5.59 | 0.089 | 0.237 | 0.172 | 13.80 | 13 | N/A | 40.8 |
| 5/31/2016 | 20.1 | 8.00 | 7.68 | 488 | 0.703 | 5.14 | 0.031 | 0.132 | 0.13 | 5.76 | 1 | N/A | 325.5 |

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| **Site #:** | 10 |
| **Name:** | Middle Fork Yellow River |
| **Lat/Long:** | 41.452937/-86.156172 |

| Sample Date | Water Temperature (Celcius) | DO (mg/L) | pH | Conductivity (us/cm) | TKN (mg/L) | $NO_2$-N+$NO_3$-N (mg/L) | $NH_3$-N (mg/L) | Total Phosphorus (mg/L) | Dissolved Phosphorus (mg/L) | Turbidity (NTU) | TSS (mg/L) | Atrazine (ug/L) | *E. coli* (mpn/100mL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/30/2015 | 16.8 | 5.92 | 7.46 | 661 | 0.000 | 9.59 | 0.100 | 0.548 | 0.32 | 21.00 | 25 | 0.32 | 2419.6 |
| 7/28/2015 | 20.1 | 4.75 | 8.5 | 736 | 0.915 | 3.29 | 0.080 | 0.414 | 0.223 | 7.28 | 4 | N/A | 1046.2 |
| 8/26/2015 | 15.3 | 6.73 | 8.77 | 755 | 0.550 | 2.17 | 0.102 | 0.169 | 0.089 | 5.47 | 1 | 0.1 | 613.1 |
| 9/15/2015 | 14.9 | 6.38 | 8.45 | 773 | 0.495 | 2.27 | 0.112 | 0.152 | 0.059 | 4.47 | 4 | N/A | 292.4 |
| 10/29/2015 | 8.1 | 6.74 | 8.56 | 756 | 0.381 | 2.15 | 0.076 | 0.206 | 0.088 | 4.85 | 1 | N/A | 270 |
| 11/30/2015 | 5.5 | 9.40 | 7.57 | 799 | 0.436 | 4.72 | 0.079 | 0.190 | 0.11 | 6.27 | 2 | N/A | 98.1 |
| 12/14/2015 | 12.4 | 6.43 | 7.82 | 725 | 1.070 | 2.14 | 0.098 | 0.171 | 0.081 | 17.50 | 17 | N/A | 488.4 |
| 2/3/2016 | 6.0 | 11.52 | 7.44 | 691 | 0.749 | 5.24 | 0.303 | 0.505 | 0.321 | 38.20 | 36 | N/A | 1553.1 |
| 3/21/2016 | 5.9 | 10.09 | 7.7 | 557 | 1.210 | 5.24 | 0.110 | 0.374 | 0.247 | 13.30 | 6 | N/A | 208.4 |
| 4/13/2016 | 7.5 | 10.31 | 7.55 | 490 | 0.560 | 7.05 | 0.034 | 0.150 | 0.089 | 9.09 | 3 | 0.1 | 84.4 |
| 5/18/2016 | 13.9 | 10.91 | 7.58 | 530 | 0.559 | 6.18 | 0.030 | 0.174 | 0.086 | 5.71 | 5 | N/A | 101 |
| 5/31/2016 | 18.4 | 8.13 | 7.75 | 568 | 0.696 | 3.07 | 0.089 | 0.125 | 0.117 | 4.20 | 2 | N/A | 219.8 |

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| **Site #:** | 11 |
| **Name:** | Yellow River |
| **Lat/Long:** | 41.464536/-86.177983 |

| Sample Date | Water Temperature (Celcius) | DO (mg/L) | pH | Conductivity (us/cm) | TKN (mg/L) | $NO_2$-N+$NO_3$-N (mg/L) | $NH_3$-N (mg/L) | Total Phosphorus (mg/L) | Dissolved Phosphorus (mg/L) | Turbidity (NTU) | TSS (mg/L) | Atrazine (ug/L) | *E. coli* (mpn/100mL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/30/2015 | 17.1 | 7.31 | 6.74 | 631 | 0.000 | 12.80 | 0.060 | 0.506 | 0.401 | 24.00 | 26 | 0.34 | 1732.9 |
| 7/28/2015 | 22.1 | 4.60 | 8.61 | 728 | 0.182 | 7.78 | 0.047 | 0.352 | 0.237 | 6.38 | 3 | N/A | 1986.3 |
| 8/26/2015 | 17.0 | 5.22 | 8.82 | 774 | 0.521 | 5.88 | 0.071 | 0.489 | 0.386 | 3.80 | 1 | 1.22 | 980.4 |
| 9/15/2015 | 16.8 | 4.43 | 8.72 | 864 | 0.857 | 6.94 | 0.061 | 0.496 | 0.392 | 5.21 | 16 | N/A | 1413.6 |
| 10/29/2015 | 7.0 | 6.24 | 8.62 | 828 | 0.251 | 6.52 | 0.041 | 0.482 | 0.316 | 7.28 | 1 | N/A | 1046.2 |
| 11/30/2015 | 4.8 | 9.08 | 7.27 | 767 | 0.174 | 9.44 | 0.085 | 0.270 | 0.26 | 6.66 | 5 | N/A | 613.1 |
| 12/14/2015 | 12.3 | 6.45 | 7.9 | 778 | 1.020 | 6.01 | 0.111 | 0.297 | 0.241 | 4.56 | 4 | N/A | 290.9 |
| 2/3/2016 | 4.0 | 12.86 | 7.53 | 585 | 1.610 | 10.10 | 0.453 | 0.849 | 0.483 | 181.00 | 153 | N/A | 2419.6 |
| 3/21/2016 | 4.0 | 11.62 | 7.85 | 548 | 0.763 | 10.20 | 0.113 | 0.180 | 0.18 | 8.94 | 9 | N/A | 727 |
| 4/13/2016 | 6.0 | 10.76 | 7.71 | 466 | 1.140 | 10.40 | 0.103 | 0.211 | 0.132 | 13.70 | 11 | 0.226 | 164.3 |
| 5/18/2016 | 14.5 | 11.15 | 7.67 | 523 | 1.010 | 11.20 | 0.066 | 0.155 | 0.14 | 9.28 | 5 | N/A | 178.2 |
| 5/31/2016 | 19.2 | 7.22 | 7.35 | 581 | 2.360 | 9.55 | 0.043 | 0.100 | 0.093 | 6.71 | 4 | N/A | 791.5 |

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| **Site #:** | 12 |
| **Name:** | Lateral Number Five |
| **Lat/Long:** | 41.499349/-86.13703 |

| Sample Date | Water Temperature (Celcius) | DO (mg/L) | pH | Conductivity (us/cm) | TKN (mg/L) | $NO_2$-N+$NO_3$-N (mg/L) | $NH_3$-N (mg/L) | Total Phosphorus (mg/L) | Dissolved Phosphorus (mg/L) | Turbidity (NTU) | TSS (mg/L) | Atrazine (ug/L) | *E. coli* (mpn/100mL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/30/2015 | 17.0 | 6.62 | 7.2 | 633 | 0.000 | 15.00 | 0.081 | 0.612 | 0.388 | 48.20 | 53 | 0.71 | 2419.6 |
| 7/28/2015 | 21.9 | 5.68 | 8.6 | 754 | 0.000 | 8.38 | 0.041 | 0.271 | 0.197 | 5.58 | 3 | N/A | 980.4 |
| 8/26/2015 | 17.7 | 6.05 | 8.79 | 751 | 0.603 | 3.36 | 0.078 | 0.636 | 0.586 | 3.36 | 1 | 0.1 | 102.6 |
| 9/15/2015 | 16.9 | 5.56 | 8.7 | 722 | 0.178 | 3.01 | 0.031 | 0.488 | 0.391 | 9.53 | 6 | N/A | 2419.6 |
| 10/29/2015 | 6.3 | 8.58 | 8.8 | 768 | 0.358 | 3.24 | 0.107 | 1.120 | 0.904 | 9.43 | 1 | N/A | 2419.6 |
| 11/30/2015 | 4.2 | 10.33 | 7.43 | 787 | 0.000 | 9.36 | 0.056 | 0.347 | 0.3 | 5.85 | 10 | N/A | 325.5 |
| 12/14/2015 | 12.0 | 5.37 | 7.83 | 795 | 0.501 | 5.86 | 0.119 | 0.433 | 0.377 | 11.00 | 4 | N/A | 1732.9 |
| 2/3/2016 | 4.3 | 12.92 | 7.32 | 651 | 1.040 | 13.20 | 0.170 | 0.754 | 0.413 | 50.50 | 54 | N/A | 2419.6 |
| 3/21/2016 | 3.5 | 12.68 | 7.61 | 557 | 0.000 | 13.10 | 0.044 | 0.175 | 0.18 | 10.20 | 12 | N/A | 155.3 |
| 4/13/2016 | 6.2 | 11.40 | 7.63 | 505 | 0.757 | 14.20 | 0.031 | 0.181 | 0.111 | 8.26 | 12 | 0.224 | 82.3 |
| 5/18/2016 | 14.9 | 12.39 | 7.72 | 534 | 0.862 | 15.30 | 0.023 | 0.178 | 0.155 | 5.37 | 7 | N/A | 307.6 |
| 5/31/2016 | 18.6 | 12.87 | 7.74 | 569 | 0.673 | 10.80 | 0.018 | 0.131 | 0.172 | 2.13 | 1 | N/A | 154.1 |

# Macroinvertebrates

**(Copy this sheet as new worksheet for multiple sites)**

| | |
|---|---|
| **Stream Site** | HYR Site #1 |
| **Analyst** | Matthew Linn |
| **Date Collected** | 8/20/2015 |
| **Date Counted** | 8/25/2016 |

## Slightly Impaired

| mIBI Metric | | Metric Score |
|---|---|---|
| HBI | 4.21 | 6 |
| No. Taxa (family) | 9 | 2 |
| Total Count (# individuals) | 61 | 0 |
| % Dominant Taxa | 37.7 | 4 |
| EPT Index (# families) | 6 | 6 |
| EPT Count (# individuals) | 52 | 4 |
| EPT Count/Total Count | 0.85 | 8 |
| EPT Abun./Chir. Abun. | 52.00 | 8 |
| Chironomid Count | 1 | 8 |
| **mIBI Score** | | 5.1 |

Taxa (Scientific Name)

| Order | Family | # | EPT | # w/t | Tolerance (t) | # x t | % |
|---|---|---|---|---|---|---|---|
| *Acarina* | Hydrachnidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Crangonyctidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Gammaridae | | | 0 | | 0 | 0.00 |
| Amphipoda | Haustoriidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Talitridae | | | 0 | | 0 | 0.00 |
| Araneae | Pisauridae | | | 0 | | 0 | 0.00 |
| *Bivalvia* | *Corbicula fluminea* | | | 0 | | 0 | 0.00 |
| *Bivalvia* | Sphaeriidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Amphizoidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Chrysomelidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Curculionidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Cyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Dytiscidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Elmidae | 7 | | 7 | 4 | 28 | 11.48 |
| Coleoptera | Gyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Haliplidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Helodidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Hydrophilidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Noteridae | | | 0 | | 0 | 0.00 |
| Coleoptera | Psephenidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Staphylinidae | | | 0 | | 0 | 0.00 |
| Decopoda | Astacidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Decopoda | Cambaridae | 1 | | 0 | | 0 | 1.64 |
| Diptera | Brachyera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ceratopognidae | | | 0 | | 0 | 0.00 |
| Diptera | Chironomidae | 1 | | 1 | 6 | 6 | 1.64 |
| Diptera | Culicidae | | | 0 | | 0 | 0.00 |
| Diptera | Dolichopodidae | | | 0 | | 0 | 0.00 |
| Diptera | Empididae | | | 0 | | 0 | 0.00 |
| Diptera | Ephydridae | | | 0 | | 0 | 0.00 |
| Diptera | Nematocera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ptychopteridae | | | 0 | | 0 | 0.00 |
| Diptera | Simuliidae | | | 0 | | 0 | 0.00 |
| Diptera | Stratiomyidae | | | 0 | | 0 | 0.00 |
| Diptera | Syrphidae | | | 0 | | 0 | 0.00 |
| Diptera | Tabanidae | | | 0 | | 0 | 0.00 |
| Diptera | Tipulidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Baetidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Caenidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Ephemerellidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Heptageniidae | 23 | 23 | 23 | 4 | 92 | 37.70 |
| Ephemeroptera | Neoephemeridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Leptohyphidae | 9 | 9 | 0 | | 0 | 14.75 |
| Ephemeroptera | Ameletidae | 13 | 13 | 0 | | 0 | 21.31 |
| *Gastropoda* | Ancylidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Lymnaeidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Physidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Planorbidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Pleuroceridae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Viviparidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Belostomatidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Corixidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Gerridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Herbridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Hydrometridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Mesoveliidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Naucoridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Nepidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Notonectidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hemiptera | Pleidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Veliidae | | | 0 | | 0 | 0.00 |
| *Hirudinea* | | | | 0 | | 0 | 0.00 |
| *Hirudinea* | Glossiphoniidae | | | 0 | | 0 | 0.00 |
| Isopoda | Asillidae | | | 0 | | 0 | 0.00 |
| Lepidoptera | Langessa | | | 0 | | 0 | 0.00 |
| Megaloptera | Nigronia | | | 0 | | 0 | 0.00 |
| Megaloptera | Sialidae | | | 0 | | 0 | 0.00 |
| *Nematomorpha* | | | | 0 | | 0 | 0.00 |
| Odonata | Aeshnidae | | | 0 | | 0 | 0.00 |
| Odonata | Agrionidae | | | 0 | | 0 | 0.00 |
| Odonata | Coenagrionidae | | | 0 | | 0 | 0.00 |
| Odonata | Corduliidae | | | 0 | | 0 | 0.00 |
| Odonata | Gomphidae | | | 0 | | 0 | 0.00 |
| Odonata | Lestidae | | | 0 | | 0 | 0.00 |
| Odonata | Libellulidae | | | 0 | | 0 | 0.00 |
| Odonata | Petaluridae | | | 0 | | 0 | 0.00 |
| *Oligochaeta* | | | | 0 | | 0 | 0.00 |
| Platyhelminthes | Planaria | | | 0 | | 0 | 0.00 |
| Plecoptera | Chloroperlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlodidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Leptoceridae | 1 | 1 | 1 | 4 | 4 | 1.64 |
| Trichoptera | Brachycentridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Helicopsychidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Hydropsychidae | 3 | 3 | 3 | 4 | 12 | 4.92 |
| Trichoptera | Hydroptilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Limnephilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Odontoceridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Polycentropodidae | 3 | 3 | 3 | 6 | 18 | 4.92 |
| Trichoptera | glossosomatidae | | | | | | |
| TOTALS | | **61** | **52** | **38** | | **160.0** | 100.00 |

# Macroinvertebrates

**(Copy this sheet as new worksheet for multiple sites)**

| | |
|---|---|
| **Stream Site** | HYR Site #2 |
| **Analyst** | Matthew Linn |
| **Date Collected** | 8/20/2015 |
| **Date Counted** | 8/25/2016 |

| **mIBI Metric** | | **Metric Score** |
|---|---|---|
| HBI | 5.57 | 2 |
| No. Taxa (family) | 8 | 2 |
| Total Count (# individuals) | 29 | 0 |
| % Dominant Taxa | 48.3 | 2 |
| EPT Index (# families) | 3 | 2 |
| EPT Count (# individuals) | 7 | 0 |
| EPT Count/Total Count | 0.24 | 2 |
| EPT Abun./Chir. Abun. | 1.40 | 2 |
| Chironomid Count | 5 | 8 |
| **mIBI Score** | | 2.2 |

## Moderately Impaired

Taxa (Scientific Name)

| Order | Family | # | EPT | # w/t | Tolerance (t) | # x t | % |
|---|---|---|---|---|---|---|---|
| *Acarina* | Hydrachnidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Crangonyctidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Gammaridae | | | 0 | | 0 | 0.00 |
| Amphipoda | Haustoriidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Talitridae | | | 0 | | 0 | 0.00 |
| Araneae | Pisauridae | | | 0 | | 0 | 0.00 |
| *Bivalvia* | *Corbicula fluminea* | | | 0 | | 0 | 0.00 |
| *Bivalvia* | Sphaeriidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Amphizoidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Chrysomelidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Curculionidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Cyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Dytiscidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Elmidae | | | 0 | 4 | 0 | 0.00 |
| Coleoptera | Gyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Haliplidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Helodidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Hydrophilidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Noteridae | | | 0 | | 0 | 0.00 |
| Coleoptera | Psephenidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Staphylinidae | | | 0 | | 0 | 0.00 |
| Decopoda | Astacidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Decopoda | Palaemonidae | | | 0 | | 0 | 0.00 |
| Diptera | Brachyera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ceratopognidae | | | 0 | | 0 | 0.00 |
| Diptera | Chironomidae | 5 | | 5 | 6 | 30 | 17.24 |
| Diptera | Culicidae | | | 0 | | 0 | 0.00 |
| Diptera | Dolichopodidae | | | 0 | | 0 | 0.00 |
| Diptera | Empididae | | | 0 | | 0 | 0.00 |
| Diptera | Ephydridae | | | 0 | | 0 | 0.00 |
| Diptera | Nematocera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ptychopteridae | | | 0 | | 0 | 0.00 |
| Diptera | Simuliidae | 14 | | 14 | 6 | 84 | 48.28 |
| Diptera | Stratiomyidae | | | 0 | | 0 | 0.00 |
| Diptera | Syrphidae | | | 0 | | 0 | 0.00 |
| Diptera | Tabanidae | | | 0 | | 0 | 0.00 |
| Diptera | Tipulidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Baetidae | 4 | 4 | 4 | 4 | 16 | 13.79 |
| Ephemeroptera | Caenidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Ephemerellidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Heptageniidae | 1 | 1 | 1 | 4 | 4 | 3.45 |
| Ephemeroptera | Neoephemeridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Siphlonuridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Tricorythidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Ancylidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Lymnaeidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Physidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Planorbidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Pleuroceridae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Viviparidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Belostomatidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Corixidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Gerridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Herbridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Hydrometridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Mesoveliidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Naucoridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Nepidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Notonectidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hemiptera | Pleidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Veliidae | | | 0 | | 0 | 0.00 |
| *Hirudinea* | | 1 | | 0 | | 0 | 3.45 |
| *Hirudinea* | Glossiphoniidae | | | 0 | | 0 | 0.00 |
| Isopoda | Asillidae | | | 0 | | 0 | 0.00 |
| Lepidoptera | Langessa | | | 0 | | 0 | 0.00 |
| Megaloptera | Nigronia | | | 0 | | 0 | 0.00 |
| Megaloptera | Sialidae | | | 0 | | 0 | 0.00 |
| *Nematomorpha* | | | | 0 | | 0 | 0.00 |
| Odonata | Aeshnidae | | | 0 | | 0 | 0.00 |
| Odonata | Agrionidae | | | 0 | | 0 | 0.00 |
| Odonata | Coenagrionidae | 1 | | 1 | 9 | 9 | 3.45 |
| Odonata | Corduliidae | | | 0 | | 0 | 0.00 |
| Odonata | Gomphidae | | | 0 | | 0 | 0.00 |
| Odonata | Calopterygidae | 1 | | 1 | 5 | 5 | 3.45 |
| Odonata | Libellulidae | | | 0 | | 0 | 0.00 |
| Odonata | Petaluridae | | | 0 | | 0 | 0.00 |
| *Oligochaeta* | | | | 0 | | 0 | 0.00 |
| Platyhelminthes | Planaria | | | 0 | | 0 | 0.00 |
| Plecoptera | Chloroperlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlodidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Leptoceridae | | | 0 | 4 | 0 | 0.00 |
| Trichoptera | Brachycentridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Helicopsychidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Hydropsychidae | 2 | 2 | 2 | 4 | 8 | 6.90 |
| Trichoptera | Hydroptilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Limnephilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Odontoceridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Polycentropodidae | | | 0 | 6 | 0 | 0.00 |
| Trichoptera | glossosomatidae | | | | | | |
| TOTALS | | **29** | **7** | **28** | | **156.0** | 100.00 |

# Macroinvertebrates

**(Copy this sheet as new worksheet for multiple sites)**

| | |
|---|---|
| **Stream Site** | HYR Site #3 |
| **Analyst** | Matthew Linn |
| **Date Collected** | 8/20/2015 |
| **Date Counted** | 8/25/2016 |

## Slightly Impaired

| mIBI Metric | | Metric Score |
|---|---|---|
| HBI | 4.24 | 6 |
| No. Taxa (family) | 12 | 4 |
| Total Count (# individuals) | 117 | 2 |
| % Dominant Taxa | 44.4 | 2 |
| EPT Index (# families) | 4 | 4 |
| EPT Count (# individuals) | 92 | 6 |
| EPT Count/Total Count | 0.79 | 8 |
| EPT Abun./Chir. Abun. | 92.00 | 8 |
| Chironomid Count | 1 | 8 |
| **mIBI Score** | | 5.3 |

Taxa (Scientific Name)

| Order | Family | # | EPT | # w/t | Tolerance (t) | # x t | % |
|---|---|---|---|---|---|---|---|
| *Acarina* | Hydrachnidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Crangonyctidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Gammaridae | | | 0 | | 0 | 0.00 |
| Amphipoda | Haustoriidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Talitridae | | | 0 | | 0 | 0.00 |
| Araneae | Pisauridae | | | 0 | | 0 | 0.00 |
| *Bivalvia* | *Corbicula fluminea* | | | 0 | | 0 | 0.00 |
| *Bivalvia* | Sphaeriidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Amphizoidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Chrysomelidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Curculionidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Cyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Dytiscidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Elmidae | 2 | | 2 | 4 | 8 | 1.71 |
| Coleoptera | Gyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Haliplidae | 10 | | 0 | | 0 | 8.55 |
| Coleoptera | Helodidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Hydrophilidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Noteridae | | | 0 | | 0 | 0.00 |
| Coleoptera | Psephenidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Staphylinidae | | | 0 | | 0 | 0.00 |
| Decopoda | Cambaridae | 6 | | 0 | | 0 | 5.13 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Decopoda | Palaemonidae | | | 0 | | 0 | 0.00 |
| Diptera | Brachyera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ceratopognidae | | | 0 | | 0 | 0.00 |
| Diptera | Chironomidae | 1 | | 1 | 6 | 6 | 0.85 |
| Diptera | Culicidae | | | 0 | | 0 | 0.00 |
| Diptera | Dolichopodidae | | | 0 | | 0 | 0.00 |
| Diptera | Empididae | | | 0 | | 0 | 0.00 |
| Diptera | Ephydridae | | | 0 | | 0 | 0.00 |
| Diptera | Nematocera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ptychopteridae | | | 0 | | 0 | 0.00 |
| Diptera | Simuliidae | 2 | | 2 | 6 | 12 | 1.71 |
| Diptera | Stratiomyidae | | | 0 | | 0 | 0.00 |
| Diptera | Syrphidae | | | 0 | | 0 | 0.00 |
| Diptera | Tabanidae | | | 0 | | 0 | 0.00 |
| Diptera | Tipulidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Baetidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Caenidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Ephemerellidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Heptageniidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Neoephemeridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Leptohyphidae | 17 | 17 | 0 | | 0 | 14.53 |
| Ephemeroptera | Ameletidae | 21 | 21 | 0 | | 0 | 17.95 |
| *Gastropoda* | Ancylidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Lymnaeidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Physidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Planorbidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Pleuroceridae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Viviparidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Belostomatidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Corixidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Gerridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Herbridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Hydrometridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Mesoveliidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Naucoridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Nepidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Notonectidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hemiptera | Pleidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Veliidae | | | 0 | | 0 | 0.00 |
| *Hirudinea* | | 1 | | 0 | | 0 | 0.85 |
| *Hirudinea* | Glossiphoniidae | | | 0 | | 0 | 0.00 |
| Isopoda | Asillidae | | | 0 | | 0 | 0.00 |
| Lepidoptera | Langessa | | | 0 | | 0 | 0.00 |
| Megaloptera | Nigronia | | | 0 | | 0 | 0.00 |
| Megaloptera | Sialidae | | | 0 | | 0 | 0.00 |
| *Nematomorpha* | | | | 0 | | 0 | 0.00 |
| Odonata | Aeshnidae | 1 | | 1 | 3 | 3 | 0.85 |
| Odonata | Agrionidae | | | 0 | | 0 | 0.00 |
| Odonata | Coenagrionidae | 2 | | 2 | 9 | 18 | 1.71 |
| Odonata | Corduliidae | | | 0 | | 0 | 0.00 |
| Odonata | Gomphidae | | | 0 | | 0 | 0.00 |
| Odonata | Calopterygidae | | | 0 | 5 | 0 | 0.00 |
| Odonata | Libellulidae | | | 0 | | 0 | 0.00 |
| Odonata | Petaluridae | | | 0 | | 0 | 0.00 |
| *Oligochaeta* | | | | 0 | | 0 | 0.00 |
| Platyhelminthes | Planaria | | | 0 | | 0 | 0.00 |
| Plecoptera | Chloroperlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlodidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Leptoceridae | 2 | 2 | 2 | 4 | 8 | 1.71 |
| Trichoptera | Brachycentridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Helicopsychidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Hydropsychidae | 52 | 52 | 52 | 4 | 208 | 44.44 |
| Trichoptera | Hydroptilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Limnephilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Odontoceridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Polycentropodidae | | | 0 | 6 | 0 | 0.00 |
| Trichoptera | glossosomatidae | | | | | | |
| TOTALS | | **117** | **92** | **62** | | **263.0** | 100.00 |

# Macroinvertebrates

**(Copy this sheet as new worksheet for multiple sites)**

| | |
|---|---|
| **Stream Site** | HYR Site #4 |
| **Analyst** | Matthew Linn |
| **Date Collected** | 8/20/2015 |
| **Date Counted** | 8/25/2016 |

## Slightly Impaired

| mIBI Metric | | Metric Score |
|---|---|---|
| HBI | 5.00 | 4 |
| No. Taxa (family) | 12 | 4 |
| Total Count (# individuals) | 73 | 0 |
| % Dominant Taxa | 54.8 | 2 |
| EPT Index (# families) | 3 | 2 |
| EPT Count (# individuals) | 51 | 4 |
| EPT Count/Total Count | 0.70 | 8 |
| EPT Abun./Chir. Abun. | 51.00 | 8 |
| Chironomid Count | 1 | 8 |
| **mIBI Score** | | 4.4 |

Taxa (Scientific Name)

| Order | Family | # | EPT | # w/t | Tolerance (t) | # x t | % |
|---|---|---|---|---|---|---|---|
| *Acarina* | Hydrachnidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Crangonyctidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Gammaridae | | | 0 | | 0 | 0.00 |
| Amphipoda | Haustoriidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Talitridae | | | 0 | | 0 | 0.00 |
| Araneae | Pisauridae | | | 0 | | 0 | 0.00 |
| *Bivalvia* | *Corbicula fluminea* | | | 0 | | 0 | 0.00 |
| *Bivalvia* | Sphaeriidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Amphizoidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Chrysomelidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Curculionidae | 6 | | 0 | | 0 | 8.22 |
| Coleoptera | Cyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Dytiscidae | 6 | | 0 | | 0 | 8.22 |
| Coleoptera | Elmidae | 2 | | 2 | 4 | 8 | 2.74 |
| Coleoptera | Gyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Haliplidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Helodidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Hydrophilidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Noteridae | | | 0 | | 0 | 0.00 |
| Coleoptera | Psephenidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Staphylinidae | | | 0 | | 0 | 0.00 |
| Decopoda | Astacidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Decopoda | Palaemonidae | | | 0 | | 0 | 0.00 |
| Diptera | Brachyera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ceratopognidae | | | 0 | | 0 | 0.00 |
| Diptera | Chironomidae | 1 | | 1 | 6 | 6 | 1.37 |
| Diptera | Culicidae | | | 0 | | 0 | 0.00 |
| Diptera | Dolichopodidae | | | 0 | | 0 | 0.00 |
| Diptera | Empididae | | | 0 | | 0 | 0.00 |
| Diptera | Ephydridae | | | 0 | | 0 | 0.00 |
| Diptera | Nematocera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ptychopteridae | | | 0 | | 0 | 0.00 |
| Diptera | Simuliidae | | | 0 | 6 | 0 | 0.00 |
| Diptera | Stratiomyidae | | | 0 | | 0 | 0.00 |
| Diptera | Syrphidae | | | 0 | | 0 | 0.00 |
| Diptera | Tabanidae | | | 0 | | 0 | 0.00 |
| Diptera | Tipulidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Baetidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Caenidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Ephemerellidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Heptageniidae | 6 | 6 | 6 | 4 | 24 | 8.22 |
| Ephemeroptera | Leptohyphidae | 40 | 40 | 0 | | 0 | 54.79 |
| Ephemeroptera | Siphlonuridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Ameletidae | 5 | 5 | 0 | | 0 | 6.85 |
| *Gastropoda* | Ancylidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Lymnaeidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Physidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Planorbidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Pleuroceridae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Viviparidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Belostomatidae | 1 | | 0 | | 0 | 1.37 |
| Hemiptera | Corixidae | 1 | | 0 | | 0 | 1.37 |
| Hemiptera | Gerridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Herbridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Hydrometridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Mesoveliidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Naucoridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Nepidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Notonectidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hemiptera | Pleidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Veliidae | | | 0 | | 0 | 0.00 |
| *Hirudinea* | | | | 0 | | 0 | 0.00 |
| *Hirudinea* | Glossiphoniidae | | | 0 | | 0 | 0.00 |
| Isopoda | Asillidae | | | 0 | | 0 | 0.00 |
| Lepidoptera | Langessa | | | 0 | | 0 | 0.00 |
| Megaloptera | Nigronia | | | 0 | | 0 | 0.00 |
| Megaloptera | Sialidae | | | 0 | | 0 | 0.00 |
| *Nematomorpha* | | | | 0 | | 0 | 0.00 |
| Odonata | Aeshnidae | | | 0 | | 0 | 0.00 |
| Odonata | Agrionidae | | | 0 | | 0 | 0.00 |
| Odonata | Coenagrionidae | 2 | | 2 | 9 | 18 | 2.74 |
| Odonata | Corduliidae | 2 | | 2 | 5 | 10 | 2.74 |
| Odonata | Gomphidae | | | 0 | | 0 | 0.00 |
| Odonata | Calopterygidae | | | 0 | 5 | 0 | 0.00 |
| Odonata | Libellulidae | | | 0 | | 0 | 0.00 |
| Odonata | Petaluridae | | | 0 | | 0 | 0.00 |
| *Oligochaeta* | | | | 0 | | 0 | 0.00 |
| Platyhelminthes | Planaria | | | 0 | | 0 | 0.00 |
| Plecoptera | Chloroperlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlodidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Leptoceridae | 1 | | 1 | 4 | 4 | 1.37 |
| Trichoptera | Brachycentridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Helicopsychidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Hydropsychidae | | | 0 | 4 | 0 | 0.00 |
| Trichoptera | Hydroptilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Limnephilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Odontoceridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Polycentropodidae | | | 0 | 6 | 0 | 0.00 |
| Trichoptera | glossosomatidae | | | | | | |
| TOTALS | | **73** | **51** | **14** | | **70.0** | 100.00 |

# Macroinvertebrates

**(Copy this sheet as new worksheet for multiple sites)**

| | |
|---|---|
| **Stream Site** | HYR Site #5 |
| **Analyst** | Matthew Linn |
| **Date Collected** | 8/20/2015 |
| **Date Counted** | 8/25/2016 |

## Slightly Impaired

| mIBI Metric | | Metric Score |
|---|---|---|
| HBI | 4.79 | 4 |
| No. Taxa (family) | 10 | 2 |
| Total Count (# individuals) | 92 | 2 |
| % Dominant Taxa | 27.2 | 6 |
| EPT Index (# families) | 4 | 4 |
| EPT Count (# individuals) | 66 | 4 |
| EPT Count/Total Count | 0.72 | 8 |
| EPT Abun./Chir. Abun. | 7.33 | 6 |
| Chironomid Count | 9 | 8 |
| **mIBI Score** | | 4.9 |

Taxa (Scientific Name)

| Order | Family | # | EPT | # w/t | Tolerance (t) | # x t | % |
|---|---|---|---|---|---|---|---|
| *Acarina* | Hydrachnidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Crangonyctidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Gammaridae | | | 0 | | 0 | 0.00 |
| Amphipoda | Haustoriidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Talitridae | | | 0 | | 0 | 0.00 |
| Araneae | Pisauridae | | | 0 | | 0 | 0.00 |
| *Bivalvia* | *Corbicula fluminea* | | | 0 | | 0 | 0.00 |
| *Bivalvia* | Sphaeriidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Amphizoidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Chrysomelidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Curculionidae | 3 | | 0 | | 0 | 3.26 |
| Coleoptera | Cyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Dytiscidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Elmidae | 4 | | 4 | 4 | 16 | 4.35 |
| Coleoptera | Gyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Haliplidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Helodidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Hydrophilidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Noteridae | | | 0 | | 0 | 0.00 |
| Coleoptera | Psephenidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Staphylinidae | | | 0 | | 0 | 0.00 |
| Decopoda | Astacidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Decopoda | Palaemonidae | | | 0 | | 0 | 0.00 |
| Diptera | Brachyera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ceratopognidae | | | 0 | | 0 | 0.00 |
| Diptera | Chironomidae | 9 | | 9 | 6 | 54 | 9.78 |
| Diptera | Culicidae | | | 0 | | 0 | 0.00 |
| Diptera | Dolichopodidae | | | 0 | | 0 | 0.00 |
| Diptera | Empididae | | | 0 | | 0 | 0.00 |
| Diptera | Ephydridae | | | 0 | | 0 | 0.00 |
| Diptera | Nematocera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ptychopteridae | | | 0 | | 0 | 0.00 |
| Diptera | Simuliidae | 5 | | 5 | 6 | 30 | 5.43 |
| Diptera | Stratiomyidae | | | 0 | | 0 | 0.00 |
| Diptera | Syrphidae | | | 0 | | 0 | 0.00 |
| Diptera | Tabanidae | | | 0 | | 0 | 0.00 |
| Diptera | Tipulidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Baetidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Caenidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Ephemerellidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Heptageniidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Neoephemeridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Leptohyphidae | 7 | 7 | 0 | | 0 | 7.61 |
| Ephemeroptera | Ameletidae | 20 | 20 | 0 | | 0 | 21.74 |
| *Gastropoda* | Ancylidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Lymnaeidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Physidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Planorbidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Pleuroceridae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Viviparidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Belostomatidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Corixidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Gerridae | 1 | | 0 | | 0 | 1.09 |
| Hemiptera | Herbridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Hydrometridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Mesoveliidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Naucoridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Nepidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Notonectidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hemiptera | Pleidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Veliidae | | | 0 | | 0 | 0.00 |
| *Hirudinea* | | | | 0 | | 0 | 0.00 |
| *Hirudinea* | Glossiphoniidae | | | 0 | | 0 | 0.00 |
| Isopoda | Asillidae | | | 0 | | 0 | 0.00 |
| Lepidoptera | Langessa | | | 0 | | 0 | 0.00 |
| Megaloptera | Nigronia | | | 0 | | 0 | 0.00 |
| Megaloptera | Sialidae | | | 0 | | 0 | 0.00 |
| *Nematomorpha* | | | | 0 | | 0 | 0.00 |
| Odonata | Aeshnidae | | | 0 | | 0 | 0.00 |
| Odonata | Agrionidae | | | 0 | | 0 | 0.00 |
| Odonata | Coenagrionidae | 4 | | 4 | 9 | 36 | 4.35 |
| Odonata | Corduliidae | | | 0 | | 0 | 0.00 |
| Odonata | Gomphidae | | | 0 | | 0 | 0.00 |
| Odonata | Calopterygidae | | | 0 | 5 | 0 | 0.00 |
| Odonata | Libellulidae | | | 0 | | 0 | 0.00 |
| Odonata | Petaluridae | | | 0 | | 0 | 0.00 |
| *Oligochaeta* | | | | 0 | | 0 | 0.00 |
| Platyhelminthes | Planaria | | | 0 | | 0 | 0.00 |
| Plecoptera | Chloroperlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlodidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Leptoceridae | 25 | 25 | 25 | 4 | 100 | 27.17 |
| Trichoptera | Brachycentridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Helicopsychidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Hydropsychidae | 14 | 14 | 14 | 4 | 56 | 15.22 |
| Trichoptera | Hydroptilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Limnephilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Odontoceridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Polycentropodidae | | | 0 | 6 | 0 | 0.00 |
| Trichoptera | glossosomatidae | | | | | | |
| TOTALS | | **92** | **66** | **61** | | **292.0** | 100.00 |

# Macroinvertebrates

**(Copy this sheet as new worksheet for multiple sites)**

| | |
|---|---|
| **Stream Site** | HYR Site #6 |
| **Analyst** | Matthew Linn |
| **Date Collected** | 8/20/2015 |
| **Date Counted** | 8/25/2016 |

## Slightly Impaired

| mIBI Metric | | Metric Score |
|---|---|---|
| HBI | 4.62 | 4 |
| No. Taxa (family) | 9 | 2 |
| Total Count (# individuals) | 143 | 4 |
| % Dominant Taxa | 39.2 | 4 |
| EPT Index (# families) | 3 | 2 |
| EPT Count (# individuals) | 109 | 6 |
| EPT Count/Total Count | 0.76 | 8 |
| EPT Abun./Chir. Abun. | 21.80 | 8 |
| Chironomid Count | 5 | 8 |
| **mIBI Score** | | 5.1 |

Taxa (Scientific Name)

| Order | Family | # | EPT | # w/t | Tolerance (t) | # x t | % |
|---|---|---|---|---|---|---|---|
| *Acarina* | Hydrachnidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Crangonyctidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Gammaridae | | | 0 | | 0 | 0.00 |
| Amphipoda | Haustoriidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Talitridae | | | 0 | | 0 | 0.00 |
| Araneae | Pisauridae | | | 0 | | 0 | 0.00 |
| *Bivalvia* | *Corbicula fluminea* | | | 0 | | 0 | 0.00 |
| *Bivalvia* | Sphaeriidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Amphizoidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Chrysomelidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Curculionidae | 2 | | 0 | | 0 | 1.40 |
| Coleoptera | Cyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Dytiscidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Elmidae | 1 | | 1 | 4 | 4 | 0.70 |
| Coleoptera | Gyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Haliplidae | 1 | | 0 | | 0 | 0.70 |
| Coleoptera | Helodidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Hydrophilidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Noteridae | | | 0 | | 0 | 0.00 |
| Coleoptera | Psephenidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Staphylinidae | | | 0 | | 0 | 0.00 |
| Decopoda | Astacidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Decopoda | Palaemonidae | | | 0 | | 0 | 0.00 |
| Diptera | Brachyera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ceratopognidae | | | 0 | | 0 | 0.00 |
| Diptera | Chironomidae | 5 | | 5 | 6 | 30 | 3.50 |
| Diptera | Culicidae | | | 0 | | 0 | 0.00 |
| Diptera | Dolichopodidae | | | 0 | | 0 | 0.00 |
| Diptera | Empididae | | | 0 | | 0 | 0.00 |
| Diptera | Ephydridae | | | 0 | | 0 | 0.00 |
| Diptera | Nematocera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ptychopteridae | | | 0 | | 0 | 0.00 |
| Diptera | Simuliidae | 21 | | 21 | 6 | 126 | 14.69 |
| Diptera | Stratiomyidae | | | 0 | | 0 | 0.00 |
| Diptera | Syrphidae | | | 0 | | 0 | 0.00 |
| Diptera | Tabanidae | | | 0 | | 0 | 0.00 |
| Diptera | Tipulidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Baetidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Caenidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Ephemerellidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Heptageniidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Neoephemeridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Siphlonuridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Ameletidae | 49 | 49 | 0 | | 0 | 34.27 |
| *Gastropoda* | Ancylidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Lymnaeidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Physidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Planorbidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Pleuroceridae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Viviparidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Belostomatidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Corixidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Gerridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Herbridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Hydrometridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Mesoveliidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Naucoridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Nepidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Notonectidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hemiptera | Pleidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Veliidae | | | 0 | | 0 | 0.00 |
| *Hirudinea* | | | | 0 | | 0 | 0.00 |
| *Hirudinea* | Glossiphoniidae | | | 0 | | 0 | 0.00 |
| Isopoda | Asillidae | | | 0 | | 0 | 0.00 |
| Lepidoptera | Langessa | | | 0 | | 0 | 0.00 |
| Megaloptera | Nigronia | | | 0 | | 0 | 0.00 |
| Megaloptera | Sialidae | | | 0 | | 0 | 0.00 |
| *Nematomorpha* | | | | 0 | | 0 | 0.00 |
| Odonata | Aeshnidae | | | 0 | | 0 | 0.00 |
| Odonata | Agrionidae | | | 0 | | 0 | 0.00 |
| Odonata | Coenagrionidae | | | 0 | 9 | 0 | 0.00 |
| Odonata | Corduliidae | | | 0 | | 0 | 0.00 |
| Odonata | Gomphidae | | | 0 | | 0 | 0.00 |
| Odonata | Calopterygidae | 4 | | 4 | 5 | 20 | 2.80 |
| Odonata | Libellulidae | | | 0 | | 0 | 0.00 |
| Odonata | Petaluridae | | | 0 | | 0 | 0.00 |
| *Oligochaeta* | | | | 0 | | 0 | 0.00 |
| Platyhelminthes | Planaria | | | 0 | | 0 | 0.00 |
| Plecoptera | Chloroperlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlodidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Leptoceridae | 4 | 4 | 4 | 4 | 16 | 2.80 |
| Trichoptera | Brachycentridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Helicopsychidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Hydropsychidae | 56 | 56 | 56 | 4 | 224 | 39.16 |
| Trichoptera | Hydroptilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Limnephilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Odontoceridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Polycentropodidae | | | 0 | 6 | 0 | 0.00 |
| Trichoptera | glossosomatidae | | | | | | |
| TOTALS | | **143** | **109** | **91** | | **420.0** | 100.00 |

# Macroinvertebrates

**(Copy this sheet as new worksheet for multiple sites)**

| | |
|---|---|
| **Stream Site** | HYR Site #7 |
| **Analyst** | Matthew Linn |
| **Date Collected** | 8/20/2015 |
| **Date Counted** | 8/25/2016 |

## Moderately Impaired

| mIBI Metric | | Metric Score |
|---|---|---|
| HBI | 6.55 | 0 |
| No. Taxa (family) | 14 | 4 |
| Total Count (# individuals) | 66 | 0 |
| % Dominant Taxa | 22.7 | 6 |
| EPT Index (# families) | 4 | 4 |
| EPT Count (# individuals) | 15 | 0 |
| EPT Count/Total Count | 0.23 | 2 |
| EPT Abun./Chir. Abun. | 2.14 | 2 |
| Chironomid Count | 7 | 8 |
| **mIBI Score** | | 2.9 |

Taxa (Scientific Name)

| Order | Family | # | EPT | # w/t | Tolerance (t) | # x t | % |
|---|---|---|---|---|---|---|---|
| *Acarina* | Hydrachnidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Crangonyctidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Gammaridae | | | 0 | | 0 | 0.00 |
| Amphipoda | Haustoriidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Talitridae | | | 0 | | 0 | 0.00 |
| Araneae | Pisauridae | | | 0 | | 0 | 0.00 |
| *Bivalvia* | *Corbicula fluminea* | | | 0 | | 0 | 0.00 |
| *Bivalvia* | Sphaeriidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Amphizoidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Chrysomelidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Curculionidae | 1 | | 0 | | 0 | 1.52 |
| Coleoptera | Cyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Dytiscidae | 1 | | 0 | | 0 | 1.52 |
| Coleoptera | Elmidae | | | 0 | 4 | 0 | 0.00 |
| Coleoptera | Gyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Haliplidae | 11 | | 0 | | 0 | 16.67 |
| Coleoptera | Helodidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Hydrophilidae | 1 | | 0 | | 0 | 1.52 |
| Coleoptera | Noteridae | | | 0 | | 0 | 0.00 |
| Coleoptera | Psephenidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Staphylinidae | | | 0 | | 0 | 0.00 |
| Decopoda | Astacidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Decopoda | Palaemonidae | | | 0 | | 0 | 0.00 |
| Diptera | Brachyera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ceratopognidae | | | 0 | | 0 | 0.00 |
| Diptera | Chironomidae | 7 | | 7 | 6 | 42 | 10.61 |
| Diptera | Culicidae | | | 0 | | 0 | 0.00 |
| Diptera | Dolichopodidae | | | 0 | | 0 | 0.00 |
| Diptera | Empididae | | | 0 | | 0 | 0.00 |
| Diptera | Ephydridae | | | 0 | | 0 | 0.00 |
| Diptera | Nematocera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ptychopteridae | | | 0 | | 0 | 0.00 |
| Diptera | Simuliidae | 6 | | 6 | 6 | 36 | 9.09 |
| Diptera | Stratiomyidae | | | 0 | | 0 | 0.00 |
| Diptera | Syrphidae | | | 0 | | 0 | 0.00 |
| Diptera | Tabanidae | | | 0 | | 0 | 0.00 |
| Diptera | Tipulidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Baetidae | 2 | 2 | 2 | 4 | 8 | 3.03 |
| Ephemeroptera | Caenidae | 1 | 1 | 1 | 7 | 7 | 1.52 |
| Ephemeroptera | Ephemerellidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Heptageniidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Neoephemeridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Siphlonuridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Ameletidae | 11 | 11 | 0 | | 0 | 16.67 |
| *Gastropoda* | Ancylidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Lymnaeidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Physidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Planorbidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Pleuroceridae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Viviparidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Belostomatidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Corixidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Gerridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Herbridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Hydrometridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Mesoveliidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Naucoridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Nepidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Notonectidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hemiptera | Pleidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Veliidae | | | 0 | | 0 | 0.00 |
| *Hirudinea* | | | | 0 | | 0 | 0.00 |
| *Hirudinea* | Glossiphoniidae | | | 0 | | 0 | 0.00 |
| Isopoda | Asillidae | | | 0 | | 0 | 0.00 |
| Lepidoptera | Langessa | | | 0 | | 0 | 0.00 |
| Megaloptera | Corydalidae | 1 | | 0 | 0 | 0 | 1.52 |
| Megaloptera | Sialidae | | | 0 | | 0 | 0.00 |
| *Nematomorpha* | | | | 0 | | 0 | 0.00 |
| Odonata | Aeshnidae | 5 | | 5 | 3 | 15 | 7.58 |
| Odonata | Agrionidae | | | 0 | | 0 | 0.00 |
| Odonata | Coenagrionidae | 15 | | 15 | 9 | 135 | 22.73 |
| Odonata | Corduliidae | | | 0 | | 0 | 0.00 |
| Odonata | Gomphidae | | | 0 | | 0 | 0.00 |
| Odonata | Calopterygidae | 3 | | 3 | 5 | 15 | 4.55 |
| Odonata | Libellulidae | | | 0 | | 0 | 0.00 |
| Odonata | Petaluridae | | | 0 | | 0 | 0.00 |
| *Oligochaeta* | | | | 0 | | 0 | 0.00 |
| Platyhelminthes | Planaria | | | 0 | | 0 | 0.00 |
| Plecoptera | Chloroperlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlodidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Leptoceridae | | | 0 | 4 | 0 | 0.00 |
| Trichoptera | Brachycentridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Helicopsychidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Hydropsychidae | 1 | 1 | 1 | 4 | 4 | 1.52 |
| Trichoptera | Hydroptilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Limnephilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Odontoceridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Polycentropodidae | | | 0 | 6 | 0 | 0.00 |
| Trichoptera | glossosomatidae | | | | | | |
| TOTALS | | **66** | **15** | **40** | | **262.0** | 100.00 |

# Macroinvertebrates

**(Copy this sheet as new worksheet for multiple sites)**

| | |
|---|---|
| **Stream Site** | HYR Site #8 |
| **Analyst** | Matthew Linn |
| **Date Collected** | 8/20/2015 |
| **Date Counted** | 8/25/2016 |

## Moderately Impaired

| mIBI Metric | | Metric Score |
|---|---|---|
| HBI | 6.27 | 0 |
| No. Taxa (family) | 7 | 0 |
| Total Count (# individuals) | 38 | 0 |
| % Dominant Taxa | 50.0 | 2 |
| EPT Index (# families) | 1 | 0 |
| EPT Count (# individuals) | 19 | 0 |
| EPT Count/Total Count | 0.50 | 6 |
| EPT Abun./Chir. Abun. | 9999.00 | 8 |
| Chironomid Count | 0 | 8 |
| **mIBI Score** | | 2.7 |

Taxa (Scientific Name)

| Order | Family | # | EPT | # w/t | Tolerance (t) | # x t | % |
|---|---|---|---|---|---|---|---|
| *Acarina* | Hydrachnidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Crangonyctidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Gammaridae | | | 0 | | 0 | 0.00 |
| Amphipoda | Haustoriidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Talitridae | | | 0 | | 0 | 0.00 |
| Araneae | Pisauridae | | | 0 | | 0 | 0.00 |
| *Bivalvia* | *Corbicula fluminea* | | | 0 | | 0 | 0.00 |
| *Bivalvia* | Sphaeriidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Amphizoidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Chrysomelidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Curculionidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Cyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Dytiscidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Elmidae | 2 | | 2 | 4 | 8 | 5.26 |
| Coleoptera | Gyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Haliplidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Helodidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Hydrophilidae | 1 | | 0 | | 0 | 2.63 |
| Coleoptera | Noteridae | | | 0 | | 0 | 0.00 |
| Coleoptera | Psephenidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Staphylinidae | | | 0 | | 0 | 0.00 |
| Decopoda | Astacidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Decopoda | Palaemonidae | | | 0 | | 0 | 0.00 |
| Diptera | Brachyera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ceratopognidae | | | 0 | | 0 | 0.00 |
| Diptera | Chironomidae | | | 0 | 6 | 0 | 0.00 |
| Diptera | Culicidae | | | 0 | | 0 | 0.00 |
| Diptera | Dolichopodidae | | | 0 | | 0 | 0.00 |
| Diptera | Empididae | | | 0 | | 0 | 0.00 |
| Diptera | Ephydridae | | | 0 | | 0 | 0.00 |
| Diptera | Nematocera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ptychopteridae | | | 0 | | 0 | 0.00 |
| Diptera | Simuliidae | | | 0 | 6 | 0 | 0.00 |
| Diptera | Stratiomyidae | | | 0 | | 0 | 0.00 |
| Diptera | Syrphidae | | | 0 | | 0 | 0.00 |
| Diptera | Tabanidae | | | 0 | | 0 | 0.00 |
| Diptera | Tipulidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Baetidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Caenidae | | | 0 | 7 | 0 | 0.00 |
| Ephemeroptera | Ephemerellidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Heptageniidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Neoephemeridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Siphlonuridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Ameletidae | 19 | 19 | 0 | | 0 | 50.00 |
| *Gastropoda* | Ancylidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Lymnaeidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Physidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Planorbidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Pleuroceridae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Viviparidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Belostomatidae | 7 | | 0 | | 0 | 18.42 |
| Hemiptera | Corixidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Gerridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Herbridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Hydrometridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Mesoveliidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Naucoridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Nepidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Notonectidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hemiptera | Pleidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Veliidae | | | 0 | | 0 | 0.00 |
| *Hirudinea* | | | | 0 | | 0 | 0.00 |
| *Hirudinea* | Glossiphoniidae | | | 0 | | 0 | 0.00 |
| Isopoda | Asillidae | | | 0 | | 0 | 0.00 |
| Lepidoptera | Langessa | | | 0 | | 0 | 0.00 |
| Megaloptera | Corydalidae | | | 0 | 0 | 0 | 0.00 |
| Megaloptera | Sialidae | | | 0 | | 0 | 0.00 |
| *Nematomorpha* | | | | 0 | | 0 | 0.00 |
| Odonata | Aeshnidae | | | 0 | 3 | 0 | 0.00 |
| Odonata | Agrionidae | | | 0 | | 0 | 0.00 |
| Odonata | Coenagrionidae | 4 | | 4 | 9 | 36 | 10.53 |
| Odonata | Corduliidae | 1 | | 1 | 5 | 5 | 2.63 |
| Odonata | Gomphidae | | | 0 | | 0 | 0.00 |
| Odonata | Calopterygidae | 4 | | 4 | 5 | 20 | 10.53 |
| Odonata | Libellulidae | | | 0 | | 0 | 0.00 |
| Odonata | Petaluridae | | | 0 | | 0 | 0.00 |
| *Oligochaeta* | | | | 0 | | 0 | 0.00 |
| Platyhelminthes | Planaria | | | 0 | | 0 | 0.00 |
| Plecoptera | Chloroperlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlodidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Leptoceridae | | | 0 | 4 | 0 | 0.00 |
| Trichoptera | Brachycentridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Helicopsychidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Hydropsychidae | | | 0 | 4 | 0 | 0.00 |
| Trichoptera | Hydroptilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Limnephilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Odontoceridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Polycentropodidae | | | 0 | 6 | 0 | 0.00 |
| Trichoptera | glossosomatidae | | | | | | |
| TOTALS | | **38** | **19** | **11** | | **69.0** | 100.00 |

# Macroinvertebrates

**(Copy this sheet as new worksheet for multiple sites)**

| | |
|---|---|
| **Stream Site** | HYR Site #9 |
| **Analyst** | Matthew Linn |
| **Date Collected** | 8/20/2015 |
| **Date Counted** | 8/25/2016 |

## Slightly Impaired

| mIBI Metric | | Metric Score |
|---|---|---|
| HBI | 5.11 | 2 |
| No. Taxa (family) | 9 | 2 |
| Total Count (# individuals) | 105 | 2 |
| % Dominant Taxa | 74.3 | 0 |
| EPT Index (# families) | 4 | 4 |
| EPT Count (# individuals) | 88 | 4 |
| EPT Count/Total Count | 0.84 | 8 |
| EPT Abun./Chir. Abun. | 9999.00 | 8 |
| Chironomid Count | 0 | 8 |
| **mIBI Score** | | 4.2 |

Taxa (Scientific Name)

| Order | Family | # | EPT | # w/t | Tolerance (t) | # x t | % |
|---|---|---|---|---|---|---|---|
| *Acarina* | Hydrachnidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Crangonyctidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Gammaridae | | | 0 | | 0 | 0.00 |
| Amphipoda | Haustoriidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Talitridae | | | 0 | | 0 | 0.00 |
| Araneae | Pisauridae | | | 0 | | 0 | 0.00 |
| *Bivalvia* | *Corbicula fluminea* | | | 0 | | 0 | 0.00 |
| *Bivalvia* | Sphaeriidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Amphizoidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Chrysomelidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Curculionidae | 11 | | 0 | | 0 | 10.48 |
| Coleoptera | Cyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Dytiscidae | 1 | | 0 | | 0 | 0.95 |
| Coleoptera | Elmidae | | | 0 | 4 | 0 | 0.00 |
| Coleoptera | Gyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Haliplidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Helodidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Hydrophilidae | 2 | | 0 | | 0 | 1.90 |
| Coleoptera | Noteridae | | | 0 | | 0 | 0.00 |
| Coleoptera | Psephenidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Staphylinidae | | | 0 | | 0 | 0.00 |
| Decopoda | Astacidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Decopoda | Palaemonidae | | | 0 | | 0 | 0.00 |
| Diptera | Brachyera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ceratopognidae | | | 0 | | 0 | 0.00 |
| Diptera | Chironomidae | | | 0 | 6 | 0 | 0.00 |
| Diptera | Culicidae | | | 0 | | 0 | 0.00 |
| Diptera | Dolichopodidae | | | 0 | | 0 | 0.00 |
| Diptera | Empididae | | | 0 | | 0 | 0.00 |
| Diptera | Ephydridae | | | 0 | | 0 | 0.00 |
| Diptera | Nematocera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ptychopteridae | | | 0 | | 0 | 0.00 |
| Diptera | Simuliidae | | | 0 | 6 | 0 | 0.00 |
| Diptera | Stratiomyidae | | | 0 | | 0 | 0.00 |
| Diptera | Syrphidae | | | 0 | | 0 | 0.00 |
| Diptera | Tabanidae | | | 0 | | 0 | 0.00 |
| Diptera | Tipulidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Baetidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Caenidae | | | 0 | 7 | 0 | 0.00 |
| Ephemeroptera | Ephemerellidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Heptageniidae | 2 | 2 | 2 | 4 | 8 | 1.90 |
| Ephemeroptera | Neoephemeridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Leptohyphidae | 3 | 3 | 0 | | 0 | 2.86 |
| Ephemeroptera | Ameletidae | 78 | 78 | 0 | | 0 | 74.29 |
| *Gastropoda* | Ancylidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Lymnaeidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Physidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Planorbidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Pleuroceridae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Viviparidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Belostomatidae | 1 | | 0 | | 0 | 0.95 |
| Hemiptera | Corixidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Gerridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Herbridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Hydrometridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Mesoveliidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Naucoridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Nepidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Notonectidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hemiptera | Pleidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Veliidae | | | 0 | | 0 | 0.00 |
| *Hirudinea* | | | | 0 | | 0 | 0.00 |
| *Hirudinea* | Glossiphoniidae | | | 0 | | 0 | 0.00 |
| Isopoda | Asillidae | | | 0 | | 0 | 0.00 |
| Lepidoptera | Langessa | | | 0 | | 0 | 0.00 |
| Megaloptera | Corydalidae | | | 0 | 0 | 0 | 0.00 |
| Megaloptera | Sialidae | | | 0 | | 0 | 0.00 |
| *Nematomorpha* | | | | 0 | | 0 | 0.00 |
| Odonata | Aeshnidae | | | 0 | 3 | 0 | 0.00 |
| Odonata | Agrionidae | | | 0 | | 0 | 0.00 |
| Odonata | Coenagrionidae | 2 | | 2 | 9 | 18 | 1.90 |
| Odonata | Corduliidae | | | 0 | 5 | 0 | 0.00 |
| Odonata | Gomphidae | | | 0 | | 0 | 0.00 |
| Odonata | Calopterygidae | | | 0 | 5 | 0 | 0.00 |
| Odonata | Libellulidae | | | 0 | | 0 | 0.00 |
| Odonata | Petaluridae | | | 0 | | 0 | 0.00 |
| *Oligochaeta* | | | | 0 | | 0 | 0.00 |
| Platyhelminthes | Planaria | | | 0 | | 0 | 0.00 |
| Plecoptera | Chloroperlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlodidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Leptoceridae | 5 | 5 | 5 | 4 | 20 | 4.76 |
| Trichoptera | Brachycentridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Helicopsychidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Hydropsychidae | | | 0 | 4 | 0 | 0.00 |
| Trichoptera | Hydroptilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Limnephilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Odontoceridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Polycentropodidae | | | 0 | 6 | 0 | 0.00 |
| Trichoptera | glossosomatidae | | | | | | |
| TOTALS | | **105** | **88** | **9** | | **46.0** | 100.00 |

# Macroinvertebrates

**(Copy this sheet as new worksheet for multiple sites)**

| | |
|---|---|
| **Stream Site** | HYR Site #10 |
| **Analyst** | Matthew Linn |
| **Date Collected** | 8/20/2015 |
| **Date Counted** | 8/25/2016 |

## Moderately Impaired

| **mIBI Metric** | | **Metric Score** |
|---|---|---|
| HBI | 6.00 | 0 |
| No. Taxa (family) | 13 | 4 |
| Total Count (# individuals) | 54 | 0 |
| % Dominant Taxa | 44.4 | 2 |
| EPT Index (# families) | 3 | 2 |
| EPT Count (# individuals) | 9 | 0 |
| EPT Count/Total Count | 0.17 | 2 |
| EPT Abun./Chir. Abun. | 1.50 | 2 |
| Chironomid Count | 6 | 8 |
| **mIBI Score** | | 2.2 |

Taxa (Scientific Name)

| Order | Family | # | EPT | # w/t | Tolerance (t) | # x t | % |
|---|---|---|---|---|---|---|---|
| *Acarina* | Hydrachnidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Crangonyctidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Gammaridae | | | 0 | | 0 | 0.00 |
| Amphipoda | Haustoriidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Talitridae | | | 0 | | 0 | 0.00 |
| Araneae | Pisauridae | | | 0 | | 0 | 0.00 |
| *Bivalvia* | *Corbicula fluminea* | | | 0 | | 0 | 0.00 |
| *Bivalvia* | Sphaeriidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Amphizoidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Chrysomelidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Curculionidae | 24 | | 0 | | 0 | 44.44 |
| Coleoptera | Cyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Dytiscidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Elmidae | | | 0 | 4 | 0 | 0.00 |
| Coleoptera | Gyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Haliplidae | 5 | | 0 | | 0 | 9.26 |
| Coleoptera | Helodidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Hydrophilidae | 1 | | 0 | | 0 | 1.85 |
| Coleoptera | Noteridae | | | 0 | | 0 | 0.00 |
| Coleoptera | Psephenidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Staphylinidae | | | 0 | | 0 | 0.00 |
| Decopoda | Cambaridae | 1 | | 0 | | 0 | 1.85 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Decopoda | Palaemonidae | | | 0 | | 0 | 0.00 |
| Diptera | Brachyera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ceratopognidae | | | 0 | | 0 | 0.00 |
| Diptera | Chironomidae | 6 | | 6 | 6 | 36 | 11.11 |
| Diptera | Culicidae | | | 0 | | 0 | 0.00 |
| Diptera | Dolichopodidae | | | 0 | | 0 | 0.00 |
| Diptera | Empididae | | | 0 | | 0 | 0.00 |
| Diptera | Ephydridae | | | 0 | | 0 | 0.00 |
| Diptera | Nematocera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ptychopteridae | | | 0 | | 0 | 0.00 |
| Diptera | Simuliidae | | | 0 | 6 | 0 | 0.00 |
| Diptera | Stratiomyidae | | | 0 | | 0 | 0.00 |
| Diptera | Syrphidae | | | 0 | | 0 | 0.00 |
| Diptera | Tabanidae | | | 0 | | 0 | 0.00 |
| Diptera | Tipulidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Baetidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Caenidae | | | 0 | 7 | 0 | 0.00 |
| Ephemeroptera | Ephemerellidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Heptageniidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Neoephemeridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Leptohyphidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Ameletidae | 4 | 4 | 0 | | 0 | 7.41 |
| *Gastropoda* | Ancylidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Lymnaeidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Physidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Planorbidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Pleuroceridae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Viviparidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Belostomatidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Corixidae | 1 | | 0 | | 0 | 1.85 |
| Hemiptera | Gerridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Herbridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Hydrometridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Mesoveliidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Naucoridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Nepidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Notonectidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hemiptera | Pleidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Veliidae | | | 0 | | 0 | 0.00 |
| *Hirudinea* | | | | 0 | | 0 | 0.00 |
| *Hirudinea* | Glossiphoniidae | | | 0 | | 0 | 0.00 |
| Isopoda | Asillidae | 1 | | 1 | 8 | 8 | 1.85 |
| Lepidoptera | Langessa | | | 0 | | 0 | 0.00 |
| Megaloptera | Corydalidae | | | 0 | 0 | 0 | 0.00 |
| Megaloptera | Sialidae | | | 0 | | 0 | 0.00 |
| *Nematomorpha* | | | | 0 | | 0 | 0.00 |
| Odonata | Aeshnidae | 1 | | 1 | 3 | 3 | 1.85 |
| Odonata | Agrionidae | | | 0 | | 0 | 0.00 |
| Odonata | Coenagrionidae | 4 | | 4 | 9 | 36 | 7.41 |
| Odonata | Corduliidae | | | 0 | 5 | 0 | 0.00 |
| Odonata | Gomphidae | | | 0 | | 0 | 0.00 |
| Odonata | Calopterygidae | 1 | | 1 | 5 | 5 | 1.85 |
| Odonata | Libellulidae | | | 0 | | 0 | 0.00 |
| Odonata | Petaluridae | | | 0 | | 0 | 0.00 |
| *Oligochaeta* | | | | 0 | | 0 | 0.00 |
| Platyhelminthes | Planaria | | | 0 | | 0 | 0.00 |
| Plecoptera | Chloroperlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlodidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Leptoceridae | 2 | 2 | 2 | 4 | 8 | 3.70 |
| Trichoptera | Brachycentridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Helicopsychidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Hydropsychidae | 3 | 3 | 3 | 4 | 12 | 5.56 |
| Trichoptera | Hydroptilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Limnephilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Odontoceridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Polycentropodidae | | | 0 | 6 | 0 | 0.00 |
| Trichoptera | glossosomatidae | | | | | | |
| TOTALS | | **54** | **9** | **18** | | **108.0** | 100.00 |

# Macroinvertebrates

**(Copy this sheet as new worksheet for multiple sites)**

| | |
|---|---|
| **Stream Site** | HYR Site #11 |
| **Analyst** | Matthew Linn |
| **Date Collected** | 8/20/2015 |
| **Date Counted** | 8/25/2016 |

## Moderately Impaired

| **mIBI Metric** | | **Metric Score** |
|---|---|---|
| HBI | 5.22 | 2 |
| No. Taxa (family) | 8 | 2 |
| Total Count (# individuals) | 58 | 0 |
| % Dominant Taxa | 32.8 | 4 |
| EPT Index (# families) | 2 | 0 |
| EPT Count (# individuals) | 28 | 2 |
| EPT Count/Total Count | 0.48 | 6 |
| EPT Abun./Chir. Abun. | 7.00 | 6 |
| Chironomid Count | 4 | 8 |
| **mIBI Score** | | 3.3 |

Taxa (Scientific Name)

| Order | Family | # | EPT | # w/t | Tolerance (t) | # x t | % |
|---|---|---|---|---|---|---|---|
| *Acarina* | Hydrachnidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Crangonyctidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Gammaridae | | | 0 | | 0 | 0.00 |
| Amphipoda | Haustoriidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Talitridae | | | 0 | | 0 | 0.00 |
| Araneae | Pisauridae | | | 0 | | 0 | 0.00 |
| *Bivalvia* | *Corbicula fluminea* | | | 0 | | 0 | 0.00 |
| *Bivalvia* | Sphaeriidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Amphizoidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Chrysomelidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Curculionidae | 12 | | 0 | | 0 | 20.69 |
| Coleoptera | Cyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Dytiscidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Elmidae | 6 | | 6 | 4 | 24 | 10.34 |
| Coleoptera | Gyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Haliplidae | 1 | | 0 | | 0 | 1.72 |
| Coleoptera | Helodidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Hydrophilidae | 3 | | 0 | | 0 | 5.17 |
| Coleoptera | Noteridae | | | 0 | | 0 | 0.00 |
| Coleoptera | Psephenidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Staphylinidae | | | 0 | | 0 | 0.00 |
| Decopoda | Cambaridae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Decopoda | Palaemonidae | | | 0 | | 0 | 0.00 |
| Diptera | Brachyera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ceratopognidae | | | 0 | | 0 | 0.00 |
| Diptera | Chironomidae | 4 | | 4 | 6 | 24 | 6.90 |
| Diptera | Culicidae | | | 0 | | 0 | 0.00 |
| Diptera | Dolichopodidae | | | 0 | | 0 | 0.00 |
| Diptera | Empididae | | | 0 | | 0 | 0.00 |
| Diptera | Ephydridae | | | 0 | | 0 | 0.00 |
| Diptera | Nematocera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ptychopteridae | | | 0 | | 0 | 0.00 |
| Diptera | Simuliidae | | | 0 | 6 | 0 | 0.00 |
| Diptera | Stratiomyidae | | | 0 | | 0 | 0.00 |
| Diptera | Syrphidae | | | 0 | | 0 | 0.00 |
| Diptera | Tabanidae | | | 0 | | 0 | 0.00 |
| Diptera | Tipulidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Baetidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Caenidae | | | 0 | 7 | 0 | 0.00 |
| Ephemeroptera | Ephemerellidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Heptageniidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Neoephemeridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Leptohyphidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Ameletidae | 19 | 19 | 0 | | 0 | 32.76 |
| *Gastropoda* | Ancylidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Lymnaeidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Physidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Planorbidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Pleuroceridae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Viviparidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Belostomatidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Corixidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Gerridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Herbridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Hydrometridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Mesoveliidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Naucoridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Nepidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Notonectidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hemiptera | Pleidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Veliidae | | | 0 | | 0 | 0.00 |
| *Hirudinea* | | | | 0 | | 0 | 0.00 |
| *Hirudinea* | Glossiphoniidae | | | 0 | | 0 | 0.00 |
| Isopoda | Asillidae | | | 0 | 8 | 0 | 0.00 |
| Lepidoptera | Langessa | | | 0 | | 0 | 0.00 |
| Megaloptera | Corydalidae | | | 0 | 0 | 0 | 0.00 |
| Megaloptera | Sialidae | | | 0 | | 0 | 0.00 |
| *Nematomorpha* | | | | 0 | | 0 | 0.00 |
| Odonata | Aeshnidae | | | 0 | 3 | 0 | 0.00 |
| Odonata | Agrionidae | | | 0 | | 0 | 0.00 |
| Odonata | Coenagrionidae | 4 | | 4 | 9 | 36 | 6.90 |
| Odonata | Corduliidae | | | 0 | 5 | 0 | 0.00 |
| Odonata | Gomphidae | | | 0 | | 0 | 0.00 |
| Odonata | Calopterygidae | | | 0 | 5 | 0 | 0.00 |
| Odonata | Libellulidae | | | 0 | | 0 | 0.00 |
| Odonata | Petaluridae | | | 0 | | 0 | 0.00 |
| *Oligochaeta* | | | | 0 | | 0 | 0.00 |
| Platyhelminthes | Planaria | | | 0 | | 0 | 0.00 |
| Plecoptera | Chloroperlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlodidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Leptoceridae | | | 0 | 4 | 0 | 0.00 |
| Trichoptera | Brachycentridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Helicopsychidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Hydropsychidae | 9 | 9 | 9 | 4 | 36 | 15.52 |
| Trichoptera | Hydroptilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Limnephilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Odontoceridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Polycentropodidae | | | 0 | 6 | 0 | 0.00 |
| Trichoptera | glossosomatidae | | | | | | |
| TOTALS | | **58** | **28** | **23** | | **120.0** | 100.00 |

# Macroinvertebrates

**(Copy this sheet as new worksheet for multiple sites)**

| | |
|---|---|
| **Stream Site** | HYR Site #12 |
| **Analyst** | Matthew Linn |
| **Date Collected** | 8/20/2015 |
| **Date Counted** | 8/25/2016 |

| **mIBI Metric** | | **Metric Score** |
|---|---|---|
| HBI | 5.51 | 2 |
| No. Taxa (family) | 9 | 2 |
| Total Count (# individuals) | 49 | 0 |
| % Dominant Taxa | 30.6 | 6 |
| EPT Index (# families) | 2 | 0 |
| EPT Count (# individuals) | 20 | 2 |
| EPT Count/Total Count | 0.41 | 4 |
| EPT Abun./Chir. Abun. | 1.33 | 2 |
| Chironomid Count | 15 | 8 |
| **mIBI Score** | | 2.9 |

## Moderately Impaired

Taxa (Scientific Name)

| Order | Family | # | EPT | # w/t | Tolerance (t) | # x t | % |
|---|---|---|---|---|---|---|---|
| *Acarina* | Hydrachnidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Crangonyctidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Gammaridae | | | 0 | | 0 | 0.00 |
| Amphipoda | Haustoriidae | | | 0 | | 0 | 0.00 |
| Amphipoda | Talitridae | | | 0 | | 0 | 0.00 |
| Araneae | Pisauridae | | | 0 | | 0 | 0.00 |
| *Bivalvia* | *Corbicula fluminea* | | | 0 | | 0 | 0.00 |
| *Bivalvia* | Sphaeriidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Amphizoidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Chrysomelidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Curculionidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Cyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Dytiscidae | 1 | | 0 | | 0 | 2.04 |
| Coleoptera | Elmidae | | | 0 | 4 | 0 | 0.00 |
| Coleoptera | Gyrinidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Haliplidae | 2 | | 0 | | 0 | 4.08 |
| Coleoptera | Helodidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Hydrophilidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Noteridae | | | 0 | | 0 | 0.00 |
| Coleoptera | Psephenidae | | | 0 | | 0 | 0.00 |
| Coleoptera | Staphylinidae | | | 0 | | 0 | 0.00 |
| Decopoda | Cambaridae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Decopoda | Palaemonidae | | | 0 | | 0 | 0.00 |
| Diptera | Brachyera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ceratopognidae | | | 0 | | 0 | 0.00 |
| Diptera | Chironomidae | 15 | | 15 | 6 | 90 | 30.61 |
| Diptera | Culicidae | | | 0 | | 0 | 0.00 |
| Diptera | Dolichopodidae | | | 0 | | 0 | 0.00 |
| Diptera | Empididae | | | 0 | | 0 | 0.00 |
| Diptera | Ephydridae | | | 0 | | 0 | 0.00 |
| Diptera | Nematocera pupae | | | 0 | | 0 | 0.00 |
| Diptera | Ptychopteridae | | | 0 | | 0 | 0.00 |
| Diptera | Simuliidae | 5 | | 5 | 6 | 30 | 10.20 |
| Diptera | Stratiomyidae | | | 0 | | 0 | 0.00 |
| Diptera | Syrphidae | | | 0 | | 0 | 0.00 |
| Diptera | Tabanidae | | | 0 | | 0 | 0.00 |
| Diptera | Tipulidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Baetidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Caenidae | | | 0 | 7 | 0 | 0.00 |
| Ephemeroptera | Ephemerellidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Heptageniidae | | | 0 | 4 | 0 | 0.00 |
| Ephemeroptera | Neoephemeridae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Leptohyphidae | | | 0 | | 0 | 0.00 |
| Ephemeroptera | Ameletidae | 6 | 6 | 0 | | 0 | 12.24 |
| *Gastropoda* | Ancylidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Lymnaeidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Physidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Planorbidae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Pleuroceridae | | | 0 | | 0 | 0.00 |
| *Gastropoda* | Viviparidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Belostomatidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Corixidae | 1 | | 0 | | 0 | 2.04 |
| Hemiptera | Gerridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Herbridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Hydrometridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Mesoveliidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Naucoridae | | | 0 | | 0 | 0.00 |
| Hemiptera | Nepidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Notonectidae | | | 0 | | 0 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hemiptera | Pleidae | | | 0 | | 0 | 0.00 |
| Hemiptera | Veliidae | | | 0 | | 0 | 0.00 |
| *Hirudinea* | | | | 0 | | 0 | 0.00 |
| *Hirudinea* | Glossiphoniidae | | | 0 | | 0 | 0.00 |
| Isopoda | Asillidae | | | 0 | 8 | 0 | 0.00 |
| Lepidoptera | Langessa | | | 0 | | 0 | 0.00 |
| Megaloptera | Corydalidae | | | 0 | 0 | 0 | 0.00 |
| Megaloptera | Sialidae | | | 0 | | 0 | 0.00 |
| *Nematomorpha* | | | | 0 | | 0 | 0.00 |
| Odonata | Aeshnidae | 1 | | 1 | 3 | 3 | 2.04 |
| Odonata | Agrionidae | | | 0 | | 0 | 0.00 |
| Odonata | Coenagrionidae | 4 | | 4 | 9 | 36 | 8.16 |
| Odonata | Corduliidae | | | 0 | 5 | 0 | 0.00 |
| Odonata | Gomphidae | | | 0 | | 0 | 0.00 |
| Odonata | Calopterygidae | | | 0 | 5 | 0 | 0.00 |
| Odonata | Libellulidae | | | 0 | | 0 | 0.00 |
| Odonata | Petaluridae | | | 0 | | 0 | 0.00 |
| *Oligochaeta* | | | | 0 | | 0 | 0.00 |
| Platyhelminthes | Planaria | | | 0 | | 0 | 0.00 |
| Plecoptera | Chloroperlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlidae | | | 0 | | 0 | 0.00 |
| Plecoptera | Perlodidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Leptoceridae | | | 0 | 4 | 0 | 0.00 |
| Trichoptera | Brachycentridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Helicopsychidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Hydropsychidae | 14 | 14 | 14 | 4 | 56 | 28.57 |
| Trichoptera | Hydroptilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Limnephilidae | | | 0 | | 0 | 0.00 |
| Trichoptera | Odontoceridae | | | 0 | | 0 | 0.00 |
| Trichoptera | Polycentropodidae | | | 0 | 6 | 0 | 0.00 |
| Trichoptera | glossosomatidae | | | | | | |
| TOTALS | | **49** | **20** | **39** | | **215.0** | 100.00 |

Fair

# OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

**QHEI Score:** 56

**Stream & Location:** HYR Site #1 **RM:** ___.__ **Date:** 8/20/15

**Scorers Full Name & Affiliation:** Cardno - ML; TE

**River Code:** __-___-___ **STORET #:** _____ **Lat./Long.:** (NAD 83 - decimal °) __.____ /8_.____ Office verified location ☐

## 1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

| BEST TYPES | POOL | RIFFLE | OTHER TYPES | POOL | RIFFLE |
|---|---|---|---|---|---|
| ☐ ☐ BLDR /SLABS [10] | | | ☐ ☐ HARDPAN [4] | | |
| ☐ ☐ BOULDER [9] | | | ☐ ☐ DETRITUS [3] | ✓ | |
| ☐ ☐ COBBLE [8] | ✓ | | ☐ ☐ MUCK [2] | ✓ | |
| ☐ ☑ GRAVEL [7] | ✓ | | ☐ ☐ SILT [2] | | |
| ☐ ☑ SAND [6] | ✓ | | ☐ ☐ ARTIFICIAL [0] | | |
| ☐ ☐ BEDROCK [5] | | | | | |

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Check ONE (Or 2 & average)

| ORIGIN | QUALITY | |
|---|---|---|
| ☐ LIMESTONE [1] | | |
| ☑ TILLS [1] | SILT: ☐ HEAVY [-2] ☑ MODERATE [-1] ☐ NORMAL [0] ☐ FREE [1] | |
| ☐ WETLANDS [0] | | |
| ☐ HARDPAN [0] | | |
| ☐ SANDSTONE [0] | EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1] | |
| ☐ RIP/RAP [0] | | |
| ☐ LACUSTURINE [0] | | |
| ☐ SHALE [-1] | | |
| ☐ COAL FINES [-2] | | |

Comments

Substrate 13 Maximum 20

## 2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

| | | |
|---|---|---|
| 3 UNDERCUT BANKS [1] | ___ POOLS > 70cm [2] | ___ OXBOWS, BACKWATERS [1] |
| 2 OVERHANGING VEGETATION [1] | 2 ROOTWADS [1] | ___ AQUATIC MACROPHYTES [1] |
| ___ SHALLOWS (IN SLOW WATER) [1] | ___ BOULDERS [1] | 2 LOGS OR WOODY DEBRIS [1] |
| 2 ROOTMATS [1] | | |

AMOUNT — Check ONE (Or 2 & average)

☐ EXTENSIVE >75% [11]
☑ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover 12 Maximum 20

## 3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

| SINUOSITY | DEVELOPMENT | CHANNELIZATION | STABILITY |
|---|---|---|---|
| ☐ HIGH [4] | ☐ EXCELLENT [7] | ☑ NONE [6] | ☐ HIGH [3] |
| ☐ MODERATE [3] | ☐ GOOD [5] | ☐ RECOVERED [4] | ☑ MODERATE [2] |
| ☑ LOW [2] | ☐ FAIR [3] | ☐ RECOVERING [3] | ☐ LOW [1] |
| ☐ NONE [1] | ☑ POOR [1] | ☐ RECENT OR NO RECOVERY [1] | |

Comments

Channel 11 Maximum 20

## 4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

| EROSION (L R) | RIPARIAN WIDTH (L R) | FLOOD PLAIN QUALITY (L R) | (L R) |
|---|---|---|---|
| ☐ ☐ NONE / LITTLE [3] | ☑ ☑ WIDE > 50m [4] | ☑ ☑ FOREST, SWAMP [3] | ☐ ☐ CONSERVATION TILLAGE [1] |
| ☑ ☑ MODERATE [2] | ☐ ☐ MODERATE 10-50m [3] | ☐ ☐ SHRUB OR OLD FIELD [2] | ☐ ☐ URBAN OR INDUSTRIAL [0] |
| ☐ ☐ HEAVY / SEVERE [1] | ☐ ☐ NARROW 5-10m [2] | ☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1] | ☐ ☐ MINING / CONSTRUCTION [0] |
| | ☐ ☐ VERY NARROW < 5m [1] | ☐ ☐ FENCED PASTURE [1] | |
| | ☐ ☐ NONE [0] | ☐ ☐ OPEN PASTURE, ROWCROP [0] | |

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian 9 Maximum 10

## 5] POOL / GLIDE AND RIFFLE / RUN QUALITY

| MAXIMUM DEPTH | CHANNEL WIDTH | CURRENT VELOCITY |
|---|---|---|
| Check ONE (ONLY!) | Check ONE (Or 2 & average) | Check ALL that apply |
| ☑ > 1m [6] | ☑ POOL WIDTH > RIFFLE WIDTH [2] | ☐ TORRENTIAL [-1] ☑ SLOW [1] |
| ☐ 0.7-<1m [4] | ☐ POOL WIDTH = RIFFLE WIDTH [1] | ☐ VERY FAST [1] ☐ INTERSTITIAL [-1] |
| ☐ 0.4-<0.7m [2] | ☑ POOL WIDTH < RIFFLE WIDTH [0] | ☐ FAST [1] ☐ INTERMITTENT [-2] |
| ☐ 0.2-<0.4m [1] | | ☐ MODERATE [1] ☑ EDDIES [1] |
| ☐ < 0.2m [0] | | Indicate for reach - pools and riffles. |

**Recreation Potential**
*Primary Contact*
*Secondary Contact*
(circle one and comment on back)

Comments

Pool / Current 9 Maximum 12

**Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:** Check ONE (Or 2 & average). ☑ NO RIFFLE [metric=0]

| RIFFLE DEPTH | RUN DEPTH | RIFFLE / RUN SUBSTRATE | RIFFLE / RUN EMBEDDEDNESS |
|---|---|---|---|
| ☐ BEST AREAS > 10cm [2] | ☐ MAXIMUM > 50cm [2] | ☐ STABLE (e.g., Cobble, Boulder) [2] | ☐ NONE [2] |
| ☐ BEST AREAS 5-10cm [1] | ☐ MAXIMUM < 50cm [1] | ☐ MOD. STABLE (e.g., Large Gravel) [1] | ☐ LOW [1] |
| ☐ BEST AREAS < 5cm [metric=0] | | ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0] | ☐ MODERATE [0] |
| | | | ☐ EXTENSIVE [-1] |

Comments

Riffle / Run 0 Maximum 8

## 6] GRADIENT

( 0.95 ft/mi) ☑ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA ( 17.25 mi²)

%POOL: 10 %GLIDE: ___ %RUN: 90 %RIFFLE: ___

Gradient 2 Maximum 10

Good

# OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

**QHEI Score:** 69

**Stream & Location:** Headwaters YR site #2 **RM:** ___.___ **Date:** 8/20/15

**Scorers Full Name & Affiliation:** Cardno - ML, TF

**River Code:** ___-___-___ **STORET #:** _____ **Lat./Long.:** (NAD 83 - decimal °) __.____ /8__.____ Office verified location ☐

## 1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

| BEST TYPES | POOL | RIFFLE | OTHER TYPES | POOL | RIFFLE |
|---|---|---|---|---|---|
| ☐ ☐ BLDR /SLABS [10] | | | ☐ ☐ HARDPAN [4] | | |
| ☐ ☐ BOULDER [9] | | | ☐ ☐ DETRITUS [3] | | |
| ☐ ☑ COBBLE [8] | | 90 | ☐ ☐ MUCK [2] | | |
| ☐ ☐ GRAVEL [7] | | | ☐ ☐ SILT [2] | | |
| ☐ ☑ SAND [6] | 90 | | ☐ ☐ ARTIFICIAL [0] | | |
| ☐ ☐ BEDROCK [5] | | | | | |

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☐ 3 or less [0]

Check ONE (Or 2 & average)

| ORIGIN | QUALITY | |
|---|---|---|
| ☐ LIMESTONE [1] | SILT: ☐ HEAVY [-2] | |
| ☑ TILLS [1] | ☐ MODERATE [-1] | |
| ☐ WETLANDS [0] | ☑ NORMAL [0] | |
| ☐ HARDPAN [0] | ☐ FREE [1] | |
| ☐ SANDSTONE [0] | EMBEDDEDNESS: ☐ EXTENSIVE [-2] | |
| ☐ RIP/RAP [0] | ☐ MODERATE [-1] | |
| ☐ LACUSTURINE [0] | ☑ NORMAL [0] | |
| ☐ SHALE [-1] | ☐ NONE [1] | |
| ☐ COAL FINES [-2] | | |

Substrate: 15 (Maximum 20)

Comments

## 2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

| | | |
|---|---|---|
| 2 UNDERCUT BANKS [1] | ___ POOLS > 70cm [2] | ___ OXBOWS, BACKWATERS [1] |
| 3 OVERHANGING VEGETATION [1] | ___ ROOTWADS [1] | ___ AQUATIC MACROPHYTES [1] |
| 3 SHALLOWS (IN SLOW WATER) [1] | ___ BOULDERS [1] | 3 LOGS OR WOODY DEBRIS [1] |
| 2 ROOTMATS [1] | | |

AMOUNT — Check ONE (Or 2 & average)

☐ EXTENSIVE >75% [11]
☑ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Cover: 12 (Maximum 20)

Comments

## 3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

| SINUOSITY | DEVELOPMENT | CHANNELIZATION | STABILITY |
|---|---|---|---|
| ☐ HIGH [4] | ☐ EXCELLENT [7] | ☐ NONE [6] | ☐ HIGH [3] |
| ☑ MODERATE [3] | ☑ GOOD [5] | ☑ RECOVERED [4] | ☑ MODERATE [2] |
| ☐ LOW [2] | ☐ FAIR [3] | ☐ RECOVERING [3] | ☐ LOW [1] |
| ☐ NONE [1] | ☐ POOR [1] | ☐ RECENT OR NO RECOVERY [1] | |

Channel: 14 (Maximum 20)

Comments

## 4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

| EROSION (L R) | RIPARIAN WIDTH (L R) | FLOOD PLAIN QUALITY (L R) | (L R) |
|---|---|---|---|
| ☐ ☐ NONE / LITTLE [3] | ☑ ☐ WIDE > 50m [4] | ☑ ☐ FOREST, SWAMP [3] | ☐ ☐ CONSERVATION TILLAGE [1] |
| ☑ ☐ MODERATE [2] | ☐ ☑ MODERATE 10-50m [3] | ☐ ☐ SHRUB OR OLD FIELD [2] | ☐ ☐ URBAN OR INDUSTRIAL [0] |
| ☐ ☑ HEAVY / SEVERE [1] | ☐ ☐ NARROW 5-10m [2] | ☐ ☑ RESIDENTIAL, PARK, NEW FIELD [1] | ☐ ☐ MINING / CONSTRUCTION [0] |
| | ☐ ☐ VERY NARROW < 5m [1] | ☐ ☐ FENCED PASTURE [1] | |
| | ☐ ☐ NONE [0] | ☐ ☐ OPEN PASTURE, ROWCROP [0] | |

Indicate predominant land use(s) past 100m riparian.

Riparian: 7 (Maximum 10)

Comments

## 5] POOL / GLIDE AND RIFFLE / RUN QUALITY

| MAXIMUM DEPTH | CHANNEL WIDTH | CURRENT VELOCITY |
|---|---|---|
| Check ONE (ONLY!) | Check ONE (Or 2 & average) | Check ALL that apply |
| ☐ > 1m [6] | ☐ POOL WIDTH > RIFFLE WIDTH [2] | ☐ TORRENTIAL [-1] ☑ SLOW [1] |
| ☐ 0.7-<1m [4] | ☑ POOL WIDTH = RIFFLE WIDTH [1] | ☐ VERY FAST [1] ☐ INTERSTITIAL [-1] |
| ☑ 0.4-<0.7m [2] | ☐ POOL WIDTH < RIFFLE WIDTH [0] | ☑ FAST [1] ☐ INTERMITTENT [-2] |
| ☐ 0.2-<0.4m [1] | | ☑ MODERATE [1] ☑ EDDIES [1] |
| ☐ < 0.2m [0] | | Indicate for reach - pools and riffles. |

**Recreation Potential**
*Primary Contact*
*Secondary Contact*
(circle one and comment on back)

Pool / Current: 7 (Maximum 12)

Comments

**Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:** Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

| RIFFLE DEPTH | RUN DEPTH | RIFFLE / RUN SUBSTRATE | RIFFLE / RUN EMBEDDEDNESS |
|---|---|---|---|
| ☐ BEST AREAS > 10cm [2] | ☑ MAXIMUM > 50cm [2] | ☐ STABLE (e.g., Cobble, Boulder) [2] | ☐ NONE [2] |
| ☐ BEST AREAS 5-10cm [1] | ☐ MAXIMUM < 50cm [1] | ☑ MOD. STABLE (e.g., Large Gravel) [1] | ☑ LOW [1] |
| ☑ BEST AREAS < 5cm [metric=0] | | ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0] | ☐ MODERATE [0] |
| | | | ☐ EXTENSIVE [-1] |

Riffle / Run: 4 (Maximum 8)

Comments

## 6] GRADIENT

( 17 ft/mi) ☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☑ HIGH - VERY HIGH [10-6]

DRAINAGE AREA ( 18.4 mi²)

%POOL: ( ) %GLIDE: ( )
%RUN: ( ) %RIFFLE: ( )

Gradient: 10 (Maximum 10)

# OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

**QHEI Score:** 55.5 (Fair)

**Stream & Location:** HYR Site #3 **RM:** ___.__ **Date:** 8/20/15

**Scorers Full Name & Affiliation:** Cardno - ML, TE

**River Code:** __-___-___ **STORET #:** _____ **Lat./Long.:** (NAD 83 - decimal °) __.____ /8__.____ Office verified location ☐

## 1] SUBSTRATE

Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

| BEST TYPES | POOL | RIFFLE | OTHER TYPES | POOL | RIFFLE |
|---|---|---|---|---|---|
| ☐ ☐ BLDR /SLABS [10] | | | ☐ ☐ HARDPAN [4] | | |
| ☐ ☐ BOULDER [9] | | | ☐ ☐ DETRITUS [3] | | |
| ☐ ☐ COBBLE [8] | | | ☐ ☐ MUCK [2] | | |
| ☐ ☑ GRAVEL [7] | ✓ | ✓ | ☐ ☑ SILT [2] | ✓ | ✓ |
| ☐ ☑ SAND [6] | ✓ | ✓ | ☐ ☐ ARTIFICIAL [0] | | |
| ☐ ☐ BEDROCK [5] | | | | | |

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Check ONE (*Or 2 & average*)

| ORIGIN | QUALITY | |
|---|---|---|
| ☐ LIMESTONE [1] | SILT: ☐ HEAVY [-2] | |
| ☑ TILLS [1] | SILT: ☑ MODERATE [-1] | |
| ☐ WETLANDS [0] | SILT: ☐ NORMAL [0] | |
| ☐ HARDPAN [0] | SILT: ☐ FREE [1] | |
| ☐ SANDSTONE [0] | EMBEDDEDNESS: ☑ EXTENSIVE [-2] | |
| ☐ RIP/RAP [0] | EMBEDDEDNESS: ☐ MODERATE [-1] | |
| ☐ LACUSTURINE [0] | EMBEDDEDNESS: ☐ NORMAL [0] | |
| ☐ SHALE [-1] | EMBEDDEDNESS: ☐ NONE [1] | |
| ☐ COAL FINES [-2] | | |

*Comments*

**Substrate** 11 (Maximum 20)

## 2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

| | | | |
|---|---|---|---|
| 1 UNDERCUT BANKS [1] | 1 POOLS > 70cm [2] | ___ OXBOWS, BACKWATERS [1] | |
| 1 OVERHANGING VEGETATION [1] | 1 ROOTWADS [1] | ___ AQUATIC MACROPHYTES [1] | |
| ___ SHALLOWS (IN SLOW WATER) [1] | ___ BOULDERS [1] | 2 LOGS OR WOODY DEBRIS [1] | |
| 2 ROOTMATS [1] | | | |

**AMOUNT** Check ONE (*Or 2 & average*)

☐ EXTENSIVE >75% [11]
☑ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

*Comments*

**Cover** 14 (Maximum 20)

## 3] CHANNEL MORPHOLOGY

Check ONE in each category (*Or 2 & average*)

| SINUOSITY | DEVELOPMENT | CHANNELIZATION | STABILITY |
|---|---|---|---|
| ☐ HIGH [4] | ☐ EXCELLENT [7] | ☑ NONE [6] | ☐ HIGH [3] |
| ☑ MODERATE [3] | ☐ GOOD [5] | ☐ RECOVERED [4] | ☐ MODERATE [2] |
| ☐ LOW [2] | ☐ FAIR [3] | ☐ RECOVERING [3] | ☑ LOW [1] |
| ☐ NONE [1] | ☑ POOR [1] | ☐ RECENT OR NO RECOVERY [1] | |

*Comments*

**Channel** 11 (Maximum 20)

## 4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

| EROSION (L R) | RIPARIAN WIDTH (L R) | FLOOD PLAIN QUALITY (L R) | (L R) |
|---|---|---|---|
| ☐ ☐ NONE / LITTLE [3] | ☐ ☑ WIDE > 50m [4] | ☑ ☑ FOREST, SWAMP [3] | ☐ ☐ CONSERVATION TILLAGE [1] |
| ☐ ☑ MODERATE [2] | ☑ ☐ MODERATE 10-50m [3] | ☐ ☐ SHRUB OR OLD FIELD [2] | ☐ ☐ URBAN OR INDUSTRIAL [0] |
| ☑ ☑ HEAVY / SEVERE [1] | ☐ ☐ NARROW 5-10m [2] | ☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1] | ☐ ☐ MINING / CONSTRUCTION [0] |
| | ☐ ☐ VERY NARROW < 5m [1] | ☐ ☐ FENCED PASTURE [1] | |
| | ☐ ☐ NONE [0] | ☐ ☐ OPEN PASTURE, ROWCROP [0] | |

*Indicate predominant land use(s) past 100m riparian.*

*Comments*

**Riparian** 7.5 (Maximum 10)

## 5] POOL / GLIDE AND RIFFLE / RUN QUALITY

| MAXIMUM DEPTH | CHANNEL WIDTH | CURRENT VELOCITY |
|---|---|---|
| Check ONE (*ONLY!*) | Check ONE (*Or 2 & average*) | Check ALL that apply |
| ☑ > 1m [6] | ☑ POOL WIDTH > RIFFLE WIDTH [2] | ☐ TORRENTIAL [-1] ☐ SLOW [1] |
| ☐ 0.7-<1m [4] | ☐ POOL WIDTH = RIFFLE WIDTH [1] | ☐ VERY FAST [1] ☐ INTERSTITIAL [-1] |
| ☐ 0.4-<0.7m [2] | ☐ POOL WIDTH < RIFFLE WIDTH [0] | ☐ FAST [1] ☐ INTERMITTENT [-2] |
| ☐ 0.2-<0.4m [1] | | ☑ MODERATE [1] ☑ EDDIES [1] |
| ☐ < 0.2m [0] | | |

*Indicate for reach - pools and riffles.*

**Recreation Potential**
***Primary Contact***
***Secondary Contact***
(circle one and comment on back)

*Comments*

**Pool / Current** 10 (Maximum 12)

**Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:** Check ONE (*Or 2 & average*). ☑ NO RIFFLE [metric=0]

| RIFFLE DEPTH | RUN DEPTH | RIFFLE / RUN SUBSTRATE | RIFFLE / RUN EMBEDDEDNESS |
|---|---|---|---|
| ☐ BEST AREAS > 10cm [2] | ☐ MAXIMUM > 50cm [2] | ☐ STABLE (e.g., Cobble, Boulder) [2] | ☐ NONE [2] |
| ☐ BEST AREAS 5-10cm [1] | ☐ MAXIMUM < 50cm [1] | ☐ MOD. STABLE (e.g., Large Gravel) [1] | ☐ LOW [1] |
| ☐ BEST AREAS < 5cm [metric=0] | | ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0] | ☐ MODERATE [0] |
| | | | ☐ EXTENSIVE [-1] |

*Comments*

**Riffle / Run** 0 (Maximum 8)

## 6] GRADIENT

(0.95 ft/mi) ☑ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

**DRAINAGE AREA** (22.2 mi²)

%POOL: 10 %GLIDE: ___ %RUN: 90 %RIFFLE: ___

**Gradient** 2 (Maximum 10)

Poor

# OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

**QHEI Score:** 31.5

**Stream & Location:** HYR site #4 **RM:** ___.__ **Date:** 8/20/15

**Scorers Full Name & Affiliation:** Cardno - ML, TE

**River Code:** __-___-___ **STORET #:** _____ **Lat./ Long.:** (NAD 83 - decimal °) __.____ /8_.____ Office verified location ☐

## 1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

| BEST TYPES | POOL | RIFFLE | OTHER TYPES | POOL | RIFFLE |
|---|---|---|---|---|---|
| ☐☐ BLDR /SLABS [10] | | | ☐☐ HARDPAN [4] | | |
| ☐☐ BOULDER [9] | | | ☐☐ DETRITUS [3] | ✓ | |
| ☐☐ COBBLE [8] | | | ☐☑ MUCK [2] | | |
| ☐☐ GRAVEL [7] | | | ☐☐ SILT [2] | ✓ | |
| ☐☑ SAND [6] | | | ☐☐ ARTIFICIAL [0] | | |
| ☐☐ BEDROCK [5] | | | | | |

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Check ONE (Or 2 & average)

| ORIGIN | QUALITY |
|---|---|
| ☐ LIMESTONE [1] | ☐ HEAVY [-2] |
| ☑ TILLS [1] | ☑ MODERATE [-1] |
| ☐ WETLANDS [0] | ☐ NORMAL [0] |
| ☐ HARDPAN [0] | ☐ FREE [1] |
| ☐ SANDSTONE [0] | ☑ EXTENSIVE [-2] |
| ☐ RIP/RAP [0] | ☐ MODERATE [-1] |
| ☐ LACUSTURINE [0] | ☐ NORMAL [0] |
| ☐ SHALE [-1] | ☐ NONE [1] |
| ☐ COAL FINES [-2] | |

SILT

EMBEDDEDNESS

Comments

Substrate: 6 (Maximum 20)

## 2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

| | | |
|---|---|---|
| ___ UNDERCUT BANKS [1] | ___ POOLS > 70cm [2] | ___ OXBOWS, BACKWATERS [1] |
| 1 OVERHANGING VEGETATION [1] | ___ ROOTWADS [1] | ___ AQUATIC MACROPHYTES [1] |
| 1 SHALLOWS (IN SLOW WATER) [1] | ___ BOULDERS [1] | 1 LOGS OR WOODY DEBRIS [1] |
| 1 ROOTMATS [1] | | |

**AMOUNT** Check ONE (Or 2 & average)

☐ EXTENSIVE >75% [11]
☐ MODERATE 25-75% [7]
☑ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover: 7 (Maximum 20)

## 3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

| SINUOSITY | DEVELOPMENT | CHANNELIZATION | STABILITY |
|---|---|---|---|
| ☐ HIGH [4] | ☐ EXCELLENT [7] | ☐ NONE [6] | ☐ HIGH [3] |
| ☐ MODERATE [3] | ☐ GOOD [5] | ☐ RECOVERED [4] | ☐ MODERATE [2] |
| ☐ LOW [2] | ☐ FAIR [3] | ☐ RECOVERING [3] | ☑ LOW [1] |
| ☑ NONE [1] | ☑ POOR [1] | ☑ RECENT OR NO RECOVERY [1] | |

Comments

Channel: 4 (Maximum 20)

## 4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

| EROSION (L R) | RIPARIAN WIDTH (L R) | FLOOD PLAIN QUALITY (L R) | (L R) |
|---|---|---|---|
| ☐☐ NONE / LITTLE [3] | ☐☐ WIDE > 50m [4] | ☑☐ FOREST, SWAMP [3] | ☐☐ CONSERVATION TILLAGE [1] |
| ☑☑ MODERATE [2] | ☐☐ MODERATE 10-50m [3] | ☐☐ SHRUB OR OLD FIELD [2] | ☐☐ URBAN OR INDUSTRIAL [0] |
| ☐☐ HEAVY / SEVERE [1] | ☐☐ NARROW 5-10m [2] | ☐☐ RESIDENTIAL, PARK, NEW FIELD [1] | ☐☐ MINING / CONSTRUCTION [0] |
| | ☐☐ VERY NARROW < 5m [1] | ☐☐ FENCED PASTURE [1] | |
| | ☑☑ NONE [0] | ☐☑ OPEN PASTURE, ROWCROP [0] | |

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 3.5 (Maximum 10)

## 5] POOL / GLIDE AND RIFFLE / RUN QUALITY

| MAXIMUM DEPTH | CHANNEL WIDTH | CURRENT VELOCITY |
|---|---|---|
| Check ONE (ONLY!) | Check ONE (Or 2 & average) | Check ALL that apply |
| ☐ >1m [6] | ☑ POOL WIDTH > RIFFLE WIDTH [2] | ☐ TORRENTIAL [-1] ☑ SLOW [1] |
| ☑ 0.7-<1m [4] | ☐ POOL WIDTH = RIFFLE WIDTH [1] | ☐ VERY FAST [1] ☐ INTERSTITIAL [-1] |
| ☐ 0.4-<0.7m [2] | ☐ POOL WIDTH < RIFFLE WIDTH [0] | ☐ FAST [1] ☐ INTERMITTENT [-2] |
| ☐ 0.2-<0.4m [1] | | ☑ MODERATE [1] ☑ EDDIES [1] |
| ☐ < 0.2m [0] | | |

Indicate for reach - pools and riffles.

**Recreation Potential**
*Primary Contact*
*Secondary Contact*
(circle one and comment on back)

Comments

Pool / Current: 9 (Maximum 12)

**Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:** Check ONE (Or 2 & average). ☑ NO RIFFLE [metric=0]

| RIFFLE DEPTH | RUN DEPTH | RIFFLE / RUN SUBSTRATE | RIFFLE / RUN EMBEDDEDNESS |
|---|---|---|---|
| ☐ BEST AREAS > 10cm [2] | ☐ MAXIMUM > 50cm [2] | ☐ STABLE (e.g., Cobble, Boulder) [2] | ☐ NONE [2] |
| ☐ BEST AREAS 5-10cm [1] | ☐ MAXIMUM < 50cm [1] | ☐ MOD. STABLE (e.g., Large Gravel) [1] | ☐ LOW [1] |
| ☐ BEST AREAS < 5cm [metric=0] | | ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0] | ☐ MODERATE [0] |
| | | | ☐ EXTENSIVE [-1] |

Comments

Riffle / Run: 0 (Maximum 8)

## 6] GRADIENT (0.95 ft/mi)

DRAINAGE AREA (34.0 mi²)

☑ VERY LOW - LOW [2-4]
☐ MODERATE [6-10]
☐ HIGH - VERY HIGH [10-6]

%POOL: 10 %GLIDE: ( )
%RUN: 90 %RIFFLE: ( )

Gradient: 2 (Maximum 10)

# OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

**QHEI Score:** 39 (Poor)

**Stream & Location:** HYR Site #5 **RM:** ___.___ **Date:** 8/20/15

**Scorers Full Name & Affiliation:** Cardno - ML TE

**River Code:** ___-___-___ **STORET #:** _____ **Lat./Long.:** (NAD 83 - decimal °) __.____ /8_.____ Office verified location ☐

## 1] SUBSTRATE

Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

| BEST TYPES | POOL | RIFFLE | OTHER TYPES | POOL | RIFFLE |
|---|---|---|---|---|---|
| ☐☐ BLDR /SLABS [10] | | | ☐☐ HARDPAN [4] | | |
| ☐☐ BOULDER [9] | | | ☐☐ DETRITUS [3] | | |
| ☐☐ COBBLE [8] | ✓ | | ☐☑ MUCK [2] | ✓ | |
| ☐☐ GRAVEL [7] | ✓ | | ☐☐ SILT [2] | | |
| ☐☑ SAND [6] | ✓ | | ☐☐ ARTIFICIAL [0] | | |
| ☐☐ BEDROCK [5] | | | | | |

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Check ONE (*Or 2 & average*)

| ORIGIN | QUALITY |
|---|---|
| ☐ LIMESTONE [1] | SILT: ☐ HEAVY [-2] ☑ MODERATE [-1] ☐ NORMAL [0] ☐ FREE [1] |
| ☑ TILLS [1] | EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1] |
| ☐ WETLANDS [0] | |
| ☐ HARDPAN [0] | |
| ☐ SANDSTONE [0] | |
| ☐ RIP/RAP [0] | |
| ☐ LACUSTURINE [0] | |
| ☐ SHALE [-1] | |
| ☐ COAL FINES [-2] | |

*Comments*

**Substrate** 8 (Maximum 20)

## 2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

| | | |
|---|---|---|
| 1 UNDERCUT BANKS [1] | ___ POOLS > 70cm [2] | ___ OXBOWS, BACKWATERS [1] |
| 1 OVERHANGING VEGETATION [1] | ___ ROOTWADS [1] | ___ AQUATIC MACROPHYTES [1] |
| ___ SHALLOWS (IN SLOW WATER) [1] | ___ BOULDERS [1] | 1 LOGS OR WOODY DEBRIS [1] |
| 1 ROOTMATS [1] | | |

AMOUNT — Check ONE (*Or 2 & average*)

☐ EXTENSIVE >75% [11]
☐ MODERATE 25-75% [7]
☑ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

*Comments*

**Cover** 7 (Maximum 20)

## 3] CHANNEL MORPHOLOGY

Check ONE in each category (*Or 2 & average*)

| SINUOSITY | DEVELOPMENT | CHANNELIZATION | STABILITY |
|---|---|---|---|
| ☐ HIGH [4] | ☐ EXCELLENT [7] | ☐ NONE [6] | ☐ HIGH [3] |
| ☐ MODERATE [3] | ☐ GOOD [5] | ☐ RECOVERED [4] | ☐ MODERATE [2] |
| ☐ LOW [2] | ☐ FAIR [3] | ☐ RECOVERING [3] | ☑ LOW [1] |
| ☑ NONE [1] | ☑ POOR [1] | ☑ RECENT OR NO RECOVERY [1] | |

*Comments*

**Channel** 4 (Maximum 20)

## 4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

| EROSION (L R) | RIPARIAN WIDTH (L R) | FLOOD PLAIN QUALITY (L R) | (L R) |
|---|---|---|---|
| ☐☐ NONE / LITTLE [3] | ☐☐ WIDE > 50m [4] | ☑☐ FOREST, SWAMP [3] | ☐☐ CONSERVATION TILLAGE [1] |
| ☑☑ MODERATE [2] | ☐☐ MODERATE 10-50m [3] | ☐☐ SHRUB OR OLD FIELD [2] | ☐☐ URBAN OR INDUSTRIAL [0] |
| ☐☐ HEAVY / SEVERE [1] | ☑☐ NARROW 5-10m [2] | ☐☐ RESIDENTIAL, PARK, NEW FIELD [1] | ☐☐ MINING / CONSTRUCTION [0] |
| | ☐☐ VERY NARROW < 5m [1] | ☐☑ FENCED PASTURE [1] | |
| | ☐☑ NONE [0] | ☐☐ OPEN PASTURE, ROWCROP [0] | |

*Indicate predominant land use(s) past 100m riparian.*

*Comments*

**Riparian** 5 (Maximum 10)

## 5] POOL / GLIDE AND RIFFLE / RUN QUALITY

| MAXIMUM DEPTH | CHANNEL WIDTH | CURRENT VELOCITY | |
|---|---|---|---|
| Check ONE (*ONLY!*) | Check ONE (*Or 2 & average*) | Check ALL that apply | |
| ☐ > 1m [6] | ☑ POOL WIDTH > RIFFLE WIDTH [2] | ☐ TORRENTIAL [-1] | ☑ SLOW [1] |
| ☑ 0.7-<1m [4] | ☐ POOL WIDTH = RIFFLE WIDTH [1] | ☐ VERY FAST [1] | ☐ INTERSTITIAL [-1] |
| ☐ 0.4-<0.7m [2] | ☐ POOL WIDTH < RIFFLE WIDTH [0] | ☐ FAST [1] | ☐ INTERMITTENT [-2] |
| ☐ 0.2-<0.4m [1] | | ☑ MODERATE [1] | ☑ EDDIES [1] |
| ☐ < 0.2m [0] | | | |

*Indicate for reach - pools and riffles.*

**Recreation Potential**
***Primary Contact***
***Secondary Contact***
(circle one and comment on back)

*Comments*

**Pool / Current** 9 (Maximum 12)

**Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:** Check ONE (*Or 2 & average*). ☑ NO RIFFLE [metric=0]

| RIFFLE DEPTH | RUN DEPTH | RIFFLE / RUN SUBSTRATE | RIFFLE / RUN EMBEDDEDNESS |
|---|---|---|---|
| ☐ BEST AREAS > 10cm [2] | ☐ MAXIMUM > 50cm [2] | ☐ STABLE (e.g., Cobble, Boulder) [2] | ☐ NONE [2] |
| ☐ BEST AREAS 5-10cm [1] | ☐ MAXIMUM < 50cm [1] | ☐ MOD. STABLE (e.g., Large Gravel) [1] | ☐ LOW [1] |
| ☐ BEST AREAS < 5cm [metric=0] | | ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0] | ☐ MODERATE [0] |
| | | | ☐ EXTENSIVE [-1] |

*Comments*

**Riffle / Run** 0 (Maximum 8)

## 6] GRADIENT

( 3.3 ft/mi) ☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☑ HIGH - VERY HIGH [10-6]

**DRAINAGE AREA** ( 26.0 mi²)

%POOL: 10 %GLIDE: ___ %RUN: 90 %RIFFLE: ___

**Gradient** 6 (Maximum 10)

Good

# OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

**QHEI Score:** 64

**Stream & Location:** HYR Site #6 **RM:** ___.___ **Date:** 8/20/15

**Scorers Full Name & Affiliation:** Cardno – ML, TE

**River Code:** ___-___-___ **STORET #:** _____ **Lat./ Long.:** (NAD 83 - decimal °) __ . ____ /8 . ____ *Office verified location ☐

## 1] SUBSTRATE

Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

| BEST TYPES | POOL | RIFFLE | OTHER TYPES | POOL | RIFFLE |
|---|---|---|---|---|---|
| ☐ ☐ BLDR /SLABS [10] | | | ☐ ☐ HARDPAN [4] | | |
| ☐ ☐ BOULDER [9] | | ✓ | ☐ ☐ DETRITUS [3] | ✓ | |
| ☐ ☐ COBBLE [8] | ✓ | ✓ | ☐ ☐ MUCK [2] | | |
| ☐ ☑ GRAVEL [7] | ✓ | ✓ | ☐ ☐ SILT [2] | ✓ | ✓ |
| ☐ ☑ SAND [6] | ✓ | ✓ | ☐ ☐ ARTIFICIAL [0] | | |
| ☐ ☐ BEDROCK [5] | | ✓ | | | |

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☑ 4 or more [2] ☐ 3 or less [0]

Check ONE (*Or 2 & average*)

| ORIGIN | QUALITY |
|---|---|
| ☐ LIMESTONE [1] | SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1] |
| ☑ TILLS [1] | EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1] |
| ☐ WETLANDS [0] | |
| ☐ HARDPAN [0] | |
| ☐ SANDSTONE [0] | |
| ☐ RIP/RAP [0] | |
| ☐ LACUSTURINE [0] | |
| ☐ SHALE [-1] | |
| ☐ COAL FINES [-2] | |

*Comments*

*Substrate* 16 *Maximum 20*

## 2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

| | | | |
|---|---|---|---|
| 2 UNDERCUT BANKS [1] | 1 POOLS > 70cm [2] | ___ OXBOWS, BACKWATERS [1] | |
| 2 OVERHANGING VEGETATION [1] | ___ ROOTWADS [1] | 2 AQUATIC MACROPHYTES [1] | |
| ___ SHALLOWS (IN SLOW WATER) [1] | ___ BOULDERS [1] | ___ LOGS OR WOODY DEBRIS [1] | |
| 1 ROOTMATS [1] | | | |

**AMOUNT** Check ONE (*Or 2 & average*)

☐ EXTENSIVE >75% [11]
☑ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

*Comments*

*Cover* 13 *Maximum 20*

## 3] CHANNEL MORPHOLOGY

Check ONE in each category (*Or 2 & average*)

| SINUOSITY | DEVELOPMENT | CHANNELIZATION | STABILITY |
|---|---|---|---|
| ☐ HIGH [4] | ☐ EXCELLENT [7] | ☐ NONE [6] | ☐ HIGH [3] |
| ☐ MODERATE [3] | ☑ GOOD [5] | ☐ RECOVERED [4] | ☑ MODERATE [2] |
| ☑ LOW [2] | ☐ FAIR [3] | ☐ RECOVERING [3] | ☐ LOW [1] |
| ☐ NONE [1] | ☐ POOR [1] | ☑ RECENT OR NO RECOVERY [1] | |

*Comments*

*Channel* 10 *Maximum 20*

## 4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

| EROSION (L R) | RIPARIAN WIDTH (L R) | FLOOD PLAIN QUALITY (L R) | (L R) |
|---|---|---|---|
| ☐ ☐ NONE / LITTLE [3] | ☐ ☐ WIDE > 50m [4] | ☐ ☐ FOREST, SWAMP [3] | ☐ ☐ CONSERVATION TILLAGE [1] |
| ☐ ☐ MODERATE [2] | ☐ ☐ MODERATE 10-50m [3] | ☐ ☐ SHRUB OR OLD FIELD [2] | ☐ ☐ URBAN OR INDUSTRIAL [0] |
| ☑ ☑ HEAVY / SEVERE [1] | ☐ ☐ NARROW 5-10m [2] | ☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1] | ☐ ☐ MINING / CONSTRUCTION [0] |
| | ☐ ☐ VERY NARROW < 5m [1] | ☐ ☐ FENCED PASTURE [1] | |
| | ☑ ☑ NONE [0] | ☑ ☑ OPEN PASTURE, ROWCROP [0] | |

*Indicate predominant land use(s) past 100m riparian.*

*Comments*

*Riparian* 1 *Maximum 10*

## 5] POOL / GLIDE AND RIFFLE / RUN QUALITY

| MAXIMUM DEPTH | CHANNEL WIDTH | CURRENT VELOCITY |
|---|---|---|
| Check ONE (*ONLY!*) | Check ONE (*Or 2 & average*) | Check ALL that apply |
| ☑ > 1m [6] | ☐ POOL WIDTH > RIFFLE WIDTH [2] | ☐ TORRENTIAL [-1] ☑ SLOW [1] |
| ☐ 0.7-<1m [4] | ☑ POOL WIDTH = RIFFLE WIDTH [1] | ☐ VERY FAST [1] ☐ INTERSTITIAL [-1] |
| ☐ 0.4-<0.7m [2] | ☐ POOL WIDTH < RIFFLE WIDTH [0] | ☑ FAST [1] ☐ INTERMITTENT [-2] |
| ☐ 0.2-<0.4m [1] | | ☑ MODERATE [1] ☑ EDDIES [1] |
| ☐ < 0.2m [0] | | *Indicate for reach - pools and riffles.* |

**Recreation Potential**
***Primary Contact***
***Secondary Contact***
(circle one and comment on back)

*Comments*

*Pool / Current* 14 *Maximum 12*

**Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:** Check ONE (*Or 2 & average*). ☐ NO RIFFLE [metric=0]

| RIFFLE DEPTH | RUN DEPTH | RIFFLE / RUN SUBSTRATE | RIFFLE / RUN EMBEDDEDNESS |
|---|---|---|---|
| ☑ BEST AREAS > 10cm [2] | ☑ MAXIMUM > 50cm [2] | ☑ STABLE (e.g., Cobble, Boulder) [2] | ☐ NONE [2] |
| ☐ BEST AREAS 5-10cm [1] | ☐ MAXIMUM < 50cm [1] | ☐ MOD. STABLE (e.g., Large Gravel) [1] | ☑ LOW [1] |
| ☐ BEST AREAS < 5cm [metric=0] | | ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0] | ☐ MODERATE [0] |
| | | | ☐ EXTENSIVE [-1] |

*Comments*

*Riffle / Run* 7 *Maximum 8*

## 6] GRADIENT

( 5.7 ft/mi) ☐ VERY LOW - LOW [2-4] ☑ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

**DRAINAGE AREA** ( 27.0 mi²)

%POOL: 10 %GLIDE: ( ) %RUN: 70 %RIFFLE: 20

*Gradient* 6 *Maximum 10*

Poor

# OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

**QHEI Score:** 33

**Stream & Location:** HYR site #7 **RM:** ___.___ **Date:** 8/20/15

**Scorers Full Name & Affiliation:** Cardno - ML, TE

**River Code:** ___-___-___ **STORET #:** _____ **Lat./ Long.:** (NAD 83 - decimal °) __.____ /8_.____ Office verified location ☐

## 1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

| BEST TYPES | POOL | RIFFLE | OTHER TYPES | POOL | RIFFLE |
|---|---|---|---|---|---|
| ☐☐ BLDR /SLABS [10] | | | ☐☐ HARDPAN [4] | | |
| ☐☐ BOULDER [9] | | | ☐☐ DETRITUS [3] | ✓ | |
| ☐☐ COBBLE [8] | ✓ | | ☑ MUCK [2] | | |
| ☐☐ GRAVEL [7] | | | ☐☐ SILT [2] | ✓ | |
| ☐☑ SAND [6] | | | ☐☐ ARTIFICIAL [0] | | |
| ☐☐ BEDROCK [5] | | | | | |

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Check ONE (Or 2 & average)

| ORIGIN | QUALITY |
|---|---|
| ☐ LIMESTONE [1] | ☑ HEAVY [-2] |
| ☑ TILLS [1] | ☐ MODERATE [-1] |
| ☐ WETLANDS [0] | ☐ NORMAL [0] |
| ☐ HARDPAN [0] | ☐ FREE [1] |
| ☐ SANDSTONE [0] | ☑ EXTENSIVE [-2] |
| ☐ RIP/RAP [0] | ☐ MODERATE [-1] |
| ☐ LACUSTURINE [0] | ☐ NORMAL [0] |
| ☐ SHALE [-1] | ☐ NONE [1] |
| ☐ COAL FINES [-2] | |

SILT

EMBEDDEDNESS

Comments

Substrate: 5 (Maximum 20)

## 2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

| | | |
|---|---|---|
| 3 UNDERCUT BANKS [1] | ___ POOLS > 70cm [2] | ___ OXBOWS, BACKWATERS [1] |
| 3 OVERHANGING VEGETATION [1] | ___ ROOTWADS [1] | 3 AQUATIC MACROPHYTES [1] |
| ___ SHALLOWS (IN SLOW WATER) [1] | ___ BOULDERS [1] | ___ LOGS OR WOODY DEBRIS [1] |
| ___ ROOTMATS [1] | | |

AMOUNT — Check ONE (Or 2 & average)

☐ EXTENSIVE >75% [11]
☑ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover: 10 (Maximum 20)

## 3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

| SINUOSITY | DEVELOPMENT | CHANNELIZATION | STABILITY |
|---|---|---|---|
| ☐ HIGH [4] | ☐ EXCELLENT [7] | ☐ NONE [6] | ☐ HIGH [3] |
| ☐ MODERATE [3] | ☐ GOOD [5] | ☐ RECOVERED [4] | ☐ MODERATE [2] |
| ☑ LOW [2] | ☐ FAIR [3] | ☐ RECOVERING [3] | ☑ LOW [1] |
| ☐ NONE [1] | ☑ POOR [1] | ☑ RECENT OR NO RECOVERY [1] | |

Comments

Channel: 5 (Maximum 20)

## 4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

| EROSION (L R) | RIPARIAN WIDTH (L R) | FLOOD PLAIN QUALITY (L R) | (L R) |
|---|---|---|---|
| ☑☑ NONE / LITTLE [3] | ☐☐ WIDE > 50m [4] | ☐☐ FOREST, SWAMP [3] | ☐☐ CONSERVATION TILLAGE [1] |
| ☐☐ MODERATE [2] | ☐☐ MODERATE 10-50m [3] | ☐☐ SHRUB OR OLD FIELD [2] | ☐☐ URBAN OR INDUSTRIAL [0] |
| ☐☐ HEAVY / SEVERE [1] | ☐☐ NARROW 5-10m [2] | ☐☐ RESIDENTIAL, PARK, NEW FIELD [1] | ☐☐ MINING / CONSTRUCTION [0] |
| | ☐☐ VERY NARROW < 5m [1] | ☐☐ FENCED PASTURE [1] | |
| | ☑☑ NONE [0] | ☑☑ OPEN PASTURE, ROWCROP [0] | |

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 3 (Maximum 10)

## 5] POOL / GLIDE AND RIFFLE / RUN QUALITY

| MAXIMUM DEPTH (Check ONE (ONLY!)) | CHANNEL WIDTH (Check ONE (Or 2 & average)) | CURRENT VELOCITY (Check ALL that apply) | |
|---|---|---|---|
| ☐ > 1m [6] | ☑ POOL WIDTH > RIFFLE WIDTH [2] | ☐ TORRENTIAL [-1] | ☑ SLOW [1] |
| ☐ 0.7-<1m [4] | ☐ POOL WIDTH = RIFFLE WIDTH [1] | ☐ VERY FAST [1] | ☐ INTERSTITIAL [-1] |
| ☑ 0.4-<0.7m [2] | ☐ POOL WIDTH < RIFFLE WIDTH [0] | ☐ FAST [1] | ☐ INTERMITTENT [-2] |
| ☐ 0.2-<0.4m [1] | | ☐ MODERATE [1] | ☑ EDDIES [1] |
| ☐ < 0.2m [0] | | Indicate for reach - pools and riffles. | |

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current: 6 (Maximum 12)

**Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:** Check ONE (Or 2 & average). ☑ NO RIFFLE [metric=0]

| RIFFLE DEPTH | RUN DEPTH | RIFFLE / RUN SUBSTRATE | RIFFLE / RUN EMBEDDEDNESS |
|---|---|---|---|
| ☐ BEST AREAS > 10cm [2] | ☐ MAXIMUM > 50cm [2] | ☐ STABLE (e.g., Cobble, Boulder) [2] | ☐ NONE [2] |
| ☐ BEST AREAS 5-10cm [1] | ☐ MAXIMUM < 50cm [1] | ☐ MOD. STABLE (e.g., Large Gravel) [1] | ☐ LOW [1] |
| ☐ BEST AREAS < 5cm [metric=0] | | ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0] | ☐ MODERATE [0] |
| | | | ☐ EXTENSIVE [-1] |

Comments

Riffle / Run: 0 (Maximum 8)

## 6] GRADIENT

( 2.1 ft/mi) ☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA ( 17.9 mi²)

%POOL: ( ) %GLIDE: ( )
%RUN: (100) %RIFFLE: ( )

Gradient: 4 (Maximum 10)

Poor

# OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

**QHEI Score:** 33

**Stream & Location:** HV Stp # **RM:** ___.__ **Date:** 8/25/15

**Scorers Full Name & Affiliation:** Cardno - ML, NE

**River Code:** ___-___-___ **STORET #:** _____ **Lat./ Long.:** (NAD 83 - decimal °) __.____ /8__.____ Office verified location ☐

## 1] SUBSTRATE

Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

| BEST TYPES | POOL | RIFFLE | OTHER TYPES | POOL | RIFFLE |
|---|---|---|---|---|---|
| ☐☐ BLDR /SLABS [10] | | | ☐☐ HARDPAN [4] | | |
| ☐☐ BOULDER [9] | | | ☐☑ DETRITUS [3] | ✓ | |
| ☐☐ COBBLE [8] | ✓ | | ☐☑ MUCK [2] | ✓ | |
| ☐☐ GRAVEL [7] | ✓ | | ☐☐ SILT [2] | | |
| ☐☐ SAND [6] | ✓ | | ☐☐ ARTIFICIAL [0] | | |
| ☐☐ BEDROCK [5] | | | | | |

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Check ONE (*Or 2 & average*)

| ORIGIN | QUALITY | |
|---|---|---|
| ☐ LIMESTONE [1] | ☑ HEAVY [-2] | SILT |
| ☑ TILLS [1] | ☐ MODERATE [-1] | |
| ☐ WETLANDS [0] | ☐ NORMAL [0] | |
| ☐ HARDPAN [0] | ☐ FREE [1] | |
| ☐ SANDSTONE [0] | ☑ EXTENSIVE [-2] | EMBEDDEDNESS |
| ☐ RIP/RAP [0] | ☐ MODERATE [-1] | |
| ☐ LACUSTURINE [0] | ☐ NORMAL [0] | |
| ☐ SHALE [-1] | ☐ NONE [1] | |
| ☐ COAL FINES [-2] | | |

Comments

Substrate: 2 (Maximum 20)

## 2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

| | | |
|---|---|---|
| 1 UNDERCUT BANKS [1] | ___ POOLS > 70cm [2] | ___ OXBOWS, BACKWATERS [1] |
| 1 OVERHANGING VEGETATION [1] | ___ ROOTWADS [1] | 1 AQUATIC MACROPHYTES [1] |
| ___ SHALLOWS (IN SLOW WATER) [1] | ___ BOULDERS [1] | 1 LOGS OR WOODY DEBRIS [1] |
| ___ ROOTMATS [1] | | |

AMOUNT — Check ONE (*Or 2 & average*)

- ☐ EXTENSIVE >75% [11]
- ☐ MODERATE 25-75% [7]
- ☑ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 7 (Maximum 20)

## 3] CHANNEL MORPHOLOGY

Check ONE in each category (*Or 2 & average*)

| SINUOSITY | DEVELOPMENT | CHANNELIZATION | STABILITY |
|---|---|---|---|
| ☐ HIGH [4] | ☐ EXCELLENT [7] | ☐ NONE [6] | ☐ HIGH [3] |
| ☑ MODERATE [3] | ☐ GOOD [5] | ☐ RECOVERED [4] | ☐ MODERATE [2] |
| ☐ LOW [2] | ☐ FAIR [3] | ☐ RECOVERING [3] | ☑ LOW [1] |
| ☐ NONE [1] | ☑ POOR [1] | ☑ RECENT OR NO RECOVERY [1] | |

Comments

Channel: 6 (Maximum 20)

## 4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

| EROSION (L R) | RIPARIAN WIDTH (L R) | FLOOD PLAIN QUALITY (L R) | (L R) |
|---|---|---|---|
| ☑☑ NONE / LITTLE [3] | ☐☐ WIDE > 50m [4] | ☐☐ FOREST, SWAMP [3] | ☐☐ CONSERVATION TILLAGE [1] |
| ☐☐ MODERATE [2] | ☐☐ MODERATE 10-50m [3] | ☐☐ SHRUB OR OLD FIELD [2] | ☐☐ URBAN OR INDUSTRIAL [0] |
| ☐☐ HEAVY / SEVERE [1] | ☐☐ NARROW 5-10m [2] | ☐☐ RESIDENTIAL, PARK, NEW FIELD [1] | ☐☐ MINING / CONSTRUCTION [0] |
| | ☐☐ VERY NARROW < 5m [1] | ☐☑ FENCED PASTURE [1] | |
| | ☑☑ NONE [0] | ☑☑ OPEN PASTURE, ROWCROP [0] | |

*Indicate predominant land use(s) past 100m riparian.*

Comments

Riparian: 3 (Maximum 10)

## 5] POOL / GLIDE AND RIFFLE / RUN QUALITY

| MAXIMUM DEPTH | CHANNEL WIDTH | CURRENT VELOCITY |
|---|---|---|
| Check ONE (*ONLY!*) | Check ONE (*Or 2 & average*) | Check ALL that apply |
| ☑ > 1m [6] | ☑ POOL WIDTH > RIFFLE WIDTH [2] | ☐ TORRENTIAL [-1] ☑ SLOW [1] |
| ☐ 0.7-<1m [4] | ☐ POOL WIDTH = RIFFLE WIDTH [1] | ☐ VERY FAST [1] ☐ INTERSTITIAL [-1] |
| ☐ 0.4-<0.7m [2] | ☐ POOL WIDTH < RIFFLE WIDTH [0] | ☐ FAST [1] ☐ INTERMITTENT [-2] |
| ☐ 0.2-<0.4m [1] | | ☑ MODERATE [1] ☑ EDDIES [1] |
| ☐ < 0.2m [0] | | |

*Indicate for reach - pools and riffles.*

**Recreation Potential**
***Primary Contact***
***Secondary Contact***
(circle one and comment on back)

Comments

Pool / Current: 11 (Maximum 12)

**Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:** Check ONE (*Or 2 & average*). ☑ NO RIFFLE [metric=0]

| RIFFLE DEPTH | RUN DEPTH | RIFFLE / RUN SUBSTRATE | RIFFLE / RUN EMBEDDEDNESS |
|---|---|---|---|
| ☐ BEST AREAS > 10cm [2] | ☐ MAXIMUM > 50cm [2] | ☐ STABLE (e.g., Cobble, Boulder) [2] | ☐ NONE [2] |
| ☐ BEST AREAS 5-10cm [1] | ☐ MAXIMUM < 50cm [1] | ☐ MOD. STABLE (e.g., Large Gravel) [1] | ☐ LOW [1] |
| ☐ BEST AREAS < 5cm [metric=0] | | ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0] | ☐ MODERATE [0] |
| | | | ☐ EXTENSIVE [-1] |

Comments

Riffle / Run: 0 (Maximum 8)

## 6] GRADIENT

(2.8 ft/mi) ☑ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (22.7 mi²)

%POOL: ( ) %GLIDE: ( ) %RUN: (100) %RIFFLE: ( )

Gradient: 4 (Maximum 10)

Fair

# OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

**QHEI Score:** 47

**Stream & Location:** YR Site #9 **RM:** ___.___ **Date:** 8/25/15

**Scorers Full Name & Affiliation:** Cardno - ML, NE

**River Code:** __ - __ - __ **STORET #:** _____ **Lat./ Long.:** (NAD 83 - decimal °) __ . ____ / 18 . ____ Office verified location ☐

## 1] SUBSTRATE

Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

| BEST TYPES | POOL | RIFFLE | OTHER TYPES | POOL | RIFFLE |
|---|---|---|---|---|---|
| ☐☐ BLDR /SLABS [10] | | | ☐☐ HARDPAN [4] | | |
| ☐☐ BOULDER [9] | | | ☐☐ DETRITUS [3] | ✓ | ✓ |
| ☐☑ COBBLE [8] | | ✓ | ☐☐ MUCK [2] | ✓ | ✓ |
| ☐☐ GRAVEL [7] | | | ☐☐ SILT [2] | ✓ | ✓ |
| ☐☑ SAND [6] | ✓ | ✓ | ☐☐ ARTIFICIAL [0] | | |
| ☐☐ BEDROCK [5] | | | | | |

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Check ONE (*Or 2 & average*)

| ORIGIN | QUALITY | |
|---|---|---|
| ☐ LIMESTONE [1] | SILT: ☐ HEAVY [-2] | |
| ☑ TILLS [1] | ☐ MODERATE [-1] | |
| ☐ WETLANDS [0] | ☑ NORMAL [0] | |
| ☐ HARDPAN [0] | ☐ FREE [1] | |
| ☐ SANDSTONE [0] | EMBEDDEDNESS: ☐ EXTENSIVE [-2] | |
| ☐ RIP/RAP [0] | ☑ MODERATE [-1] | |
| ☐ LACUSTURINE [0] | ☐ NORMAL [0] | |
| ☐ SHALE [-1] | ☐ NONE [1] | |
| ☐ COAL FINES [-2] | | |

*Comments*

*Substrate* 14 *Maximum 20*

## 2] INSTREAM COVER

Indicate presence 0 to 3: **0**-Absent; **1**-Very small amounts or if more common of marginal quality; **2**-Moderate amounts, but not of highest quality or in small amounts of highest quality; **3**-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

| | | |
|---|---|---|
| 2 UNDERCUT BANKS [1] | ___ POOLS > 70cm [2] | ___ OXBOWS, BACKWATERS [1] |
| 2 OVERHANGING VEGETATION [1] | ___ ROOTWADS [1] | 1 AQUATIC MACROPHYTES [1] |
| 1 SHALLOWS (IN SLOW WATER) [1] | ___ BOULDERS [1] | 1 LOGS OR WOODY DEBRIS [1] |
| ___ ROOTMATS [1] | | |

**AMOUNT** Check ONE (*Or 2 & average*)

☐ EXTENSIVE >75% [11]
☐ MODERATE 25-75% [7]
☑ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

*Comments*

*Cover* 8 *Maximum 20*

## 3] CHANNEL MORPHOLOGY

Check ONE in each category (*Or 2 & average*)

| SINUOSITY | DEVELOPMENT | CHANNELIZATION | STABILITY |
|---|---|---|---|
| ☐ HIGH [4] | ☐ EXCELLENT [7] | ☐ NONE [6] | ☐ HIGH [3] |
| ☐ MODERATE [3] | ☐ GOOD [5] | ☐ RECOVERED [4] | ☑ MODERATE [2] |
| ☐ LOW [2] | ☐ FAIR [3] | ☐ RECOVERING [3] | ☐ LOW [1] |
| ☑ NONE [1] | ☑ POOR [1] | ☑ RECENT OR NO RECOVERY [1] | |

*Comments*

*Channel* 5 *Maximum 20*

## 4] BANK EROSION AND RIPARIAN ZONE

Check **ONE** in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

| EROSION (L R) | RIPARIAN WIDTH (L R) | FLOOD PLAIN QUALITY (L R) | (L R) |
|---|---|---|---|
| ☑☑ NONE / LITTLE [3] | ☐☐ WIDE > 50m [4] | ☐☐ FOREST, SWAMP [3] | ☐☐ CONSERVATION TILLAGE [1] |
| ☐☐ MODERATE [2] | ☐☐ MODERATE 10-50m [3] | ☐☐ SHRUB OR OLD FIELD [2] | ☐☐ URBAN OR INDUSTRIAL [0] |
| ☐☐ HEAVY / SEVERE [1] | ☐☐ NARROW 5-10m [2] | ☐☐ RESIDENTIAL, PARK, NEW FIELD [1] | ☐☐ MINING / CONSTRUCTION [0] |
| | ☐☐ VERY NARROW < 5m [1] | ☐☐ FENCED PASTURE [1] | |
| | ☑☑ NONE [0] | ☑☑ OPEN PASTURE, ROWCROP [0] | |

*Indicate predominant land use(s) past 100m riparian.*

*Comments*

*Riparian* 3 *Maximum 10*

## 5] POOL / GLIDE AND RIFFLE / RUN QUALITY

| MAXIMUM DEPTH | CHANNEL WIDTH | CURRENT VELOCITY | |
|---|---|---|---|
| Check **ONE** (*ONLY!*) | Check ONE (*Or 2 & average*) | Check ALL that apply | |
| ☐ > 1m [6] | ☐ POOL WIDTH > RIFFLE WIDTH [2] | ☐ TORRENTIAL [-1] | ☑ SLOW [1] |
| ☑ 0.7-<1m [4] | ☐ POOL WIDTH = RIFFLE WIDTH [1] | ☐ VERY FAST [1] | ☐ INTERSTITIAL [-1] |
| ☐ 0.4-<0.7m [2] | ☑ POOL WIDTH < RIFFLE WIDTH [0] | ☑ FAST [1] | ☐ INTERMITTENT [-2] |
| ☐ 0.2-<0.4m [1] | | ☑ MODERATE [1] | ☑ EDDIES [1] |
| ☐ < 0.2m [0] | | *Indicate for reach - pools and riffles.* | |

**Recreation Potential**
***Primary Contact***
***Secondary Contact***
(circle one and comment on back)

*Comments*

*Pool / Current* 8 *Maximum 12*

**Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:** Check ONE (*Or 2 & average*). ☐ NO RIFFLE [metric=0]

| RIFFLE DEPTH | RUN DEPTH | RIFFLE / RUN SUBSTRATE | RIFFLE / RUN EMBEDDEDNESS |
|---|---|---|---|
| ☑ BEST AREAS > 10cm [2] | ☑ MAXIMUM > 50cm [2] | ☐ STABLE (e.g., Cobble, Boulder) [2] | ☐ NONE [2] |
| ☐ BEST AREAS 5-10cm [1] | ☐ MAXIMUM < 50cm [1] | ☑ MOD. STABLE (e.g., Large Gravel) [1] | ☐ LOW [1] |
| ☐ BEST AREAS < 5cm [metric=0] | | ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0] | ☑ MODERATE [0] |
| | | | ☐ EXTENSIVE [-1] |

*Comments*

*Riffle / Run* 5 *Maximum 8*

## 6] GRADIENT

( 2.9 ft/mi) ☑ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

**DRAINAGE AREA** ( 26.2 mi²)

%POOL: 5 %GLIDE: ___ %RUN: 85 %RIFFLE: 10

*Gradient* 4 *Maximum 10*

Poor

# OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

**QHEI Score:** 39

**Stream & Location:** HYR Site #10 **RM:** ___.___ **Date:** 8/25/15

**Scorers Full Name & Affiliation:** Cardno - ML, NE

**River Code:** ___-___-___ **STORET #:** _____ **Lat./ Long.:** (NAD 83 - decimal °) __.____ /8__.____ Office verified location ☐

## 1] SUBSTRATE

Check *ONLY* Two substrate *TYPE BOXES*; estimate % or note every type present

| BEST TYPES | POOL | RIFFLE | OTHER TYPES | POOL | RIFFLE |
|---|---|---|---|---|---|
| ☐☐ BLDR /SLABS [10] | | | ☐☐ HARDPAN [4] | | |
| ☐☐ BOULDER [9] | | | ☐☐ DETRITUS [3] | ✓ | ✓ |
| ☐☐ COBBLE [8] | ✓ | ✓ | ☐☑ MUCK [2] | ✓ | ✓ |
| ☐☐ GRAVEL [7] | | | ☐☐ SILT [2] | | |
| ☐☑ SAND [6] | ✓ | ✓ | ☐☐ ARTIFICIAL [0] | | |
| ☐☐ BEDROCK [5] | | | | | |

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Check ONE (*Or 2 & average*)

| ORIGIN | QUALITY | |
|---|---|---|
| ☐ LIMESTONE [1] | SILT: ☐ HEAVY [-2] | |
| ☑ TILLS [1] | ☑ MODERATE [-1] | |
| ☐ WETLANDS [0] | ☐ NORMAL [0] | |
| ☐ HARDPAN [0] | ☐ FREE [1] | |
| ☐ SANDSTONE [0] | EMBEDDEDNESS: ☐ EXTENSIVE [-2] | |
| ☐ RIP/RAP [0] | ☑ MODERATE [-1] | |
| ☐ LACUSTURINE [0] | ☐ NORMAL [0] | |
| ☐ SHALE [-1] | ☐ NONE [1] | |
| ☐ COAL FINES [-2] | | |

Comments

Substrate: 7 (Maximum 20)

## 2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

| | | |
|---|---|---|
| 1 UNDERCUT BANKS [1] | ___ POOLS > 70cm [2] | ___ OXBOWS, BACKWATERS [1] |
| 1 OVERHANGING VEGETATION [1] | ___ ROOTWADS [1] | 1 AQUATIC MACROPHYTES [1] |
| 1 SHALLOWS (IN SLOW WATER) [1] | ___ BOULDERS [1] | 2 LOGS OR WOODY DEBRIS [1] |
| ___ ROOTMATS [1] | | |

AMOUNT — Check ONE (*Or 2 & average*)

☐ EXTENSIVE >75% [11]
☐ MODERATE 25-75% [7]
☑ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover: 8 (Maximum 20)

## 3] CHANNEL MORPHOLOGY

Check ONE in each category (*Or 2 & average*)

| SINUOSITY | DEVELOPMENT | CHANNELIZATION | STABILITY |
|---|---|---|---|
| ☐ HIGH [4] | ☐ EXCELLENT [7] | ☐ NONE [6] | ☐ HIGH [3] |
| ☐ MODERATE [3] | ☐ GOOD [5] | ☐ RECOVERED [4] | ☐ MODERATE [2] |
| ☑ LOW [2] | ☑ FAIR [3] | ☐ RECOVERING [3] | ☑ LOW [1] |
| ☐ NONE [1] | ☐ POOR [1] | ☑ RECENT OR NO RECOVERY [1] | |

Comments

Channel: 7 (Maximum 20)

## 4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for *EACH BANK* (*Or 2 per bank & average*)

River right looking downstream

| EROSION (L R) | RIPARIAN WIDTH (L R) | FLOOD PLAIN QUALITY (L R) | (L R) |
|---|---|---|---|
| ☑☑ NONE / LITTLE [3] | ☐☐ WIDE > 50m [4] | ☐☐ FOREST, SWAMP [3] | ☐☐ CONSERVATION TILLAGE [1] |
| ☐☐ MODERATE [2] | ☐☐ MODERATE 10-50m [3] | ☐☐ SHRUB OR OLD FIELD [2] | ☐☐ URBAN OR INDUSTRIAL [0] |
| ☐☐ HEAVY / SEVERE [1] | ☐☐ NARROW 5-10m [2] | ☐☐ RESIDENTIAL, PARK, NEW FIELD [1] | ☐☐ MINING / CONSTRUCTION [0] |
| | ☐☐ VERY NARROW < 5m [1] | ☐☐ FENCED PASTURE [1] | |
| | ☑☑ NONE [0] | ☑☑ OPEN PASTURE, ROWCROP [0] | |

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 3 (Maximum 10)

## 5] POOL / GLIDE AND RIFFLE / RUN QUALITY

| MAXIMUM DEPTH | CHANNEL WIDTH | CURRENT VELOCITY |
|---|---|---|
| Check ONE (*ONLY!*) | Check ONE (*Or 2 & average*) | Check ALL that apply |
| ☐ > 1m [6] | ☑ POOL WIDTH > RIFFLE WIDTH [2] | ☐ TORRENTIAL [-1] ☑ SLOW [1] |
| ☐ 0.7-<1m [4] | ☐ POOL WIDTH = RIFFLE WIDTH [1] | ☐ VERY FAST [1] ☐ INTERSTITIAL [-1] |
| ☑ 0.4-<0.7m [2] | ☐ POOL WIDTH < RIFFLE WIDTH [0] | ☑ FAST [1] ☐ INTERMITTENT [-2] |
| ☐ 0.2-<0.4m [1] | | ☑ MODERATE [1] ☑ EDDIES [1] |
| ☐ < 0.2m [0] | | |

Indicate for reach - pools and riffles.

**Recreation Potential**
*Primary Contact*
*Secondary Contact*
(circle one and comment on back)

Comments

Pool / Current: 8 (Maximum 12)

**Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:** Check ONE (*Or 2 & average*). ☐ NO RIFFLE [metric=0]

| RIFFLE DEPTH | RUN DEPTH | RIFFLE / RUN SUBSTRATE | RIFFLE / RUN EMBEDDEDNESS |
|---|---|---|---|
| ☐ BEST AREAS > 10cm [2] | ☐ MAXIMUM > 50cm [2] | ☐ STABLE (e.g., Cobble, Boulder) [2] | ☐ NONE [2] |
| ☑ BEST AREAS 5-10cm [1] | ☑ MAXIMUM < 50cm [1] | ☐ MOD. STABLE (e.g., Large Gravel) [1] | ☐ LOW [1] |
| ☐ BEST AREAS < 5cm [metric=0] | | ☑ UNSTABLE (e.g., Fine Gravel, Sand) [0] | ☑ MODERATE [0] |
| | | | ☐ EXTENSIVE [-1] |

Comments

Riffle / Run: 2 (Maximum 8)

## 6] GRADIENT

(2.9 ft/mi) ☑ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (27.0 mi²)

%POOL: 15 %GLIDE: ___ %RUN: 75 %RIFFLE: 10

Gradient: 4 (Maximum 10)

Fair

# OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

**QHEI Score:** 57

**Stream & Location:** HVR site #11 **RM:** ___.___ **Date:** 8/25/15

**Scorers Full Name & Affiliation:** Cardno - ML, NE

**River Code:** ___-___-___ **STORET #:** _____ **Lat./ Long.:** (NAD 83 - decimal °) __.____ /8__.____ Office verified location ☐

## 1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

| BEST TYPES | POOL | RIFFLE | OTHER TYPES | POOL | RIFFLE |
|---|---|---|---|---|---|
| ☐☐ BLDR /SLABS [10] | | | ☐☐ HARDPAN [4] | | |
| ☐☐ BOULDER [9] | | | ☐☐ DETRITUS [3] | ✓ | ✓ |
| ☐☐ COBBLE [8] | ✓ | ✓ | ☐☐ MUCK [2] | | |
| ☐☑ GRAVEL [7] | ✓ | ✓ | ☐☐ SILT [2] | ✓ | |
| ☐☑ SAND [6] | ✓ | ✓ | ☐☐ ARTIFICIAL [0] | | |
| ☐☐ BEDROCK [5] | | | | | |

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Check ONE (Or 2 & average)

| ORIGIN | QUALITY | |
|---|---|---|
| ☐ LIMESTONE [1] | ☐ HEAVY [-2] | |
| ☑ TILLS [1] | ☐ MODERATE [-1] | SILT |
| ☐ WETLANDS [0] | ☑ NORMAL [0] | |
| ☐ HARDPAN [0] | ☐ FREE [1] | |
| ☐ SANDSTONE [0] | ☐ EXTENSIVE [-2] | EMBEDDEDNESS |
| ☐ RIP/RAP [0] | ☐ MODERATE [-1] | |
| ☐ LACUSTURINE [0] | ☑ NORMAL [0] | |
| ☐ SHALE [-1] | ☐ NONE [1] | |
| ☐ COAL FINES [-2] | | |

Comments

Substrate 14 Maximum 20

## 2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

| | | |
|---|---|---|
| 2 UNDERCUT BANKS [1] | 1 POOLS > 70cm [2] | ___ OXBOWS, BACKWATERS [1] |
| 2 OVERHANGING VEGETATION [1] | ___ ROOTWADS [1] | 1 AQUATIC MACROPHYTES [1] |
| 1 SHALLOWS (IN SLOW WATER) [1] | ___ BOULDERS [1] | 1 LOGS OR WOODY DEBRIS [1] |
| ___ ROOTMATS [1] | | |

AMOUNT

Check ONE (Or 2 & average)

☐ EXTENSIVE >75% [11]
☑ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover 14 Maximum 20

## 3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

| SINUOSITY | DEVELOPMENT | CHANNELIZATION | STABILITY |
|---|---|---|---|
| ☐ HIGH [4] | ☐ EXCELLENT [7] | ☐ NONE [6] | ☐ HIGH [3] |
| ☐ MODERATE [3] | ☐ GOOD [5] | ☐ RECOVERED [4] | ☑ MODERATE [2] |
| ☐ LOW [2] | ☑ FAIR [3] | ☐ RECOVERING [3] | ☐ LOW [1] |
| ☑ NONE [1] | ☐ POOR [1] | ☑ RECENT OR NO RECOVERY [1] | |

Comments

Channel 7 Maximum 20

## 4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

| EROSION (L R) | RIPARIAN WIDTH (L R) | FLOOD PLAIN QUALITY (L R) | (L R) |
|---|---|---|---|
| ☑☑ NONE / LITTLE [3] | ☐☐ WIDE > 50m [4] | ☐☐ FOREST, SWAMP [3] | ☐☐ CONSERVATION TILLAGE [1] |
| ☐☐ MODERATE [2] | ☐☐ MODERATE 10-50m [3] | ☐☐ SHRUB OR OLD FIELD [2] | ☐☐ URBAN OR INDUSTRIAL [0] |
| ☐☐ HEAVY / SEVERE [1] | ☐☐ NARROW 5-10m [2] | ☐☐ RESIDENTIAL, PARK, NEW FIELD [1] | ☐☐ MINING / CONSTRUCTION [0] |
| | ☐☐ VERY NARROW < 5m [1] | ☐☐ FENCED PASTURE [1] | |
| | ☑☑ NONE [0] | ☑☑ OPEN PASTURE, ROWCROP [0] | |

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian 3 Maximum 10

## 5] POOL / GLIDE AND RIFFLE / RUN QUALITY

| MAXIMUM DEPTH (Check ONE (ONLY!)) | CHANNEL WIDTH (Check ONE (Or 2 & average)) | CURRENT VELOCITY (Check ALL that apply) | |
|---|---|---|---|
| ☑ > 1m [6] | ☐ POOL WIDTH > RIFFLE WIDTH [2] | ☐ TORRENTIAL [-1] | ☑ SLOW [1] |
| ☐ 0.7-<1m [4] | ☐ POOL WIDTH = RIFFLE WIDTH [1] | ☐ VERY FAST [1] | ☐ INTERSTITIAL [-1] |
| ☐ 0.4-<0.7m [2] | ☑ POOL WIDTH < RIFFLE WIDTH [0] | ☑ FAST [1] | ☐ INTERMITTENT [-2] |
| ☐ 0.2-<0.4m [1] | | ☑ MODERATE [1] | ☑ EDDIES [1] |
| ☐ < 0.2m [0] | | | |

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current 10 Maximum 12

**Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:** Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

| RIFFLE DEPTH | RUN DEPTH | RIFFLE / RUN SUBSTRATE | RIFFLE / RUN EMBEDDEDNESS |
|---|---|---|---|
| ☐ BEST AREAS > 10cm [2] | ☑ MAXIMUM > 50cm [2] | ☐ STABLE (e.g., Cobble, Boulder) [2] | ☐ NONE [2] |
| ☐ BEST AREAS 5-10cm [1] | ☐ MAXIMUM < 50cm [1] | ☐ MOD. STABLE (e.g., Large Gravel) [1] | ☑ LOW [1] |
| ☑ BEST AREAS < 5cm [metric=0] | | ☑ UNSTABLE (e.g., Fine Gravel, Sand) [0] | ☐ MODERATE [0] |
| | | | ☐ EXTENSIVE [-1] |

Comments

Riffle / Run 3 Maximum 8

## 6] GRADIENT

(4.11 ft/mi) ☐ VERY LOW - LOW [2-4] ☑ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (37.3 mi²)

%POOL: 5 %GLIDE: ___ %RUN: 90 %RIFFLE: 5

Gradient 6 Maximum 10

Fair

# OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

**QHEI Score:** 53

**Stream & Location:** HYR site #12 **RM:** ___.___ **Date:** 8/25/15

**Scorers Full Name & Affiliation:** Cardno - ML, NE

**River Code:** ___-___-___ **STORET #:** _____ **Lat./ Long.:** (NAD 83 - decimal °) __.____ /8__.____ Office verified location ☐

## 1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

| BEST TYPES | POOL | RIFFLE | OTHER TYPES | POOL | RIFFLE |
|---|---|---|---|---|---|
| ☐☐ BLDR /SLABS [10] | | | ☐☐ HARDPAN [4] | | |
| ☐☐ BOULDER [9] | | | ☐☐ DETRITUS [3] | ✓ | ✓ |
| ☐☐ COBBLE [8] | ✓ | ✓ | ☐☐ MUCK [2] | | |
| ☐☑ GRAVEL [7] | | ✓ | ☐☐ SILT [2] | ✓ | ✓ |
| ☐☑ SAND [6] | ✓ | ✓ | ☐☐ ARTIFICIAL [0] | | |
| ☐☐ BEDROCK [5] | | | | | |

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Check ONE (Or 2 & average)

| ORIGIN | QUALITY |
|---|---|
| ☐ LIMESTONE [1] | ☐ HEAVY [-2] |
| ☑ TILLS [1] | ☐ MODERATE [-1] |
| ☐ WETLANDS [0] | ☑ NORMAL [0] |
| ☐ HARDPAN [0] | ☐ FREE [1] |
| ☐ SANDSTONE [0] | ☑ EXTENSIVE [-2] |
| ☐ RIP/RAP [0] | ☐ MODERATE [-1] |
| ☐ LACUSTURINE [0] | ☐ NORMAL [0] |
| ☐ SHALE [-1] | ☐ NONE [1] |
| ☐ COAL FINES [-2] | |

SILT

EMBEDDEDNESS

Comments

Substrate 12 Maximum 20

## 2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

| | | |
|---|---|---|
| 2 UNDERCUT BANKS [1] | ___ POOLS > 70cm [2] | ___ OXBOWS, BACKWATERS [1] |
| 2 OVERHANGING VEGETATION [1] | ___ ROOTWADS [1] | 1 AQUATIC MACROPHYTES [1] |
| 2 SHALLOWS (IN SLOW WATER) [1] | ___ BOULDERS [1] | 1 LOGS OR WOODY DEBRIS [1] |
| ___ ROOTMATS [1] | | |

AMOUNT

Check ONE (Or 2 & average)

☐ EXTENSIVE >75% [11]
☑ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover 12 Maximum 20

## 3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

| SINUOSITY | DEVELOPMENT | CHANNELIZATION | STABILITY |
|---|---|---|---|
| ☐ HIGH [4] | ☐ EXCELLENT [7] | ☐ NONE [6] | ☐ HIGH [3] |
| ☐ MODERATE [3] | ☐ GOOD [5] | ☐ RECOVERED [4] | ☑ MODERATE [2] |
| ☑ LOW [2] | ☑ FAIR [3] | ☐ RECOVERING [3] | ☐ LOW [1] |
| ☐ NONE [1] | ☐ POOR [1] | ☑ RECENT OR NO RECOVERY [1] | |

Comments

Channel 8 Maximum 20

## 4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

| EROSION (L R) | RIPARIAN WIDTH (L R) | FLOOD PLAIN QUALITY (L R) | (L R) |
|---|---|---|---|
| ☑☑ NONE / LITTLE [3] | ☐☐ WIDE > 50m [4] | ☐☐ FOREST, SWAMP [3] | ☐☐ CONSERVATION TILLAGE [1] |
| ☐☐ MODERATE [2] | ☐☐ MODERATE 10-50m [3] | ☐☐ SHRUB OR OLD FIELD [2] | ☐☐ URBAN OR INDUSTRIAL [0] |
| ☐☐ HEAVY / SEVERE [1] | ☐☐ NARROW 5-10m [2] | ☐☐ RESIDENTIAL, PARK, NEW FIELD [1] | ☐☐ MINING / CONSTRUCTION [0] |
| | ☐☐ VERY NARROW < 5m [1] | ☐☐ FENCED PASTURE [1] | |
| | ☑☑ NONE [0] | ☑☑ OPEN PASTURE, ROWCROP [0] | |

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian 3 Maximum 10

## 5] POOL / GLIDE AND RIFFLE / RUN QUALITY

| MAXIMUM DEPTH | CHANNEL WIDTH | CURRENT VELOCITY |
|---|---|---|
| Check ONE (ONLY!) | Check ONE (Or 2 & average) | Check ALL that apply |
| ☐ > 1m [6] | ☐ POOL WIDTH > RIFFLE WIDTH [2] | ☐ TORRENTIAL [-1] ☑ SLOW [1] |
| ☑ 0.7-<1m [4] | ☑ POOL WIDTH = RIFFLE WIDTH [1] | ☐ VERY FAST [1] ☐ INTERSTITIAL [-1] |
| ☐ 0.4-<0.7m [2] | ☐ POOL WIDTH < RIFFLE WIDTH [0] | ☑ FAST [1] ☐ INTERMITTENT [-2] |
| ☐ 0.2-<0.4m [1] | | ☑ MODERATE [1] ☑ EDDIES [1] |
| ☐ < 0.2m [0] | | Indicate for reach - pools and riffles. |

**Recreation Potential**
*Primary Contact*
*Secondary Contact*
(circle one and comment on back)

Comments

Pool / Current 9 Maximum 12

**Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:** Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

| RIFFLE DEPTH | RUN DEPTH | RIFFLE / RUN SUBSTRATE | RIFFLE / RUN EMBEDDEDNESS |
|---|---|---|---|
| ☐ BEST AREAS > 10cm [2] | ☐ MAXIMUM > 50cm [2] | ☐ STABLE (e.g., Cobble, Boulder) [2] | ☐ NONE [2] |
| ☑ BEST AREAS 5-10cm [1] | ☑ MAXIMUM < 50cm [1] | ☑ MOD. STABLE (e.g., Large Gravel) [1] | ☐ LOW [1] |
| ☐ BEST AREAS < 5cm [metric=0] | | ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0] | ☑ MODERATE [0] |
| | | | ☐ EXTENSIVE [-1] |

Comments

Riffle / Run 3 Maximum 8

## 6] GRADIENT

( 3.8 ft/mi) ☐ VERY LOW - LOW [2-4] ☑ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA ( 16.8 mi²)

%POOL: ( ) %GLIDE: ( )
%RUN: (75) %RIFFLE: (25)

Gradient 6 Maximum 10

Scientific Methods

# Laboratory Report

Client: Cardno
Matthew Linn
708 Roosevelt Road
Walkerton, IN 46574

Report No. 17267

**Sampling location:** Yellow River
**Sample collection date**: May 18, 2016

***Serotyping***

| SMI Lab# | Site# | # of Isolates | DNA phage | I | I/II | II | III | IV | %Human | %Animal |
|---|---|---|---|---|---|---|---|---|---|---|
| 17267 | 1 | 10 | 0 | 1 | 7 | 1 | 1 | 0 | 53 | 47 |
| 17268 | 4 | 10 | 0 | 0 | 2 | 8 | 0 | 0 | 80 | 20 |
| 17269 | 11 | 10 | 0 | 0 | 9 | 1 | 0 | 0 | 53 | 47 |
| 17270 | 12 | 10 | 0 | 0 | 10 | 0 | 0 | 0 | 50 | 50 |

SMI appreciates the opportunity to provide you with this analysis. Please feel free to contact us (574-277-4078) if you have any questions regarding this report.

*Note: This report may not be reproduced, except in full, without a written approval from Scientific Methods Inc. (SMI).*

Reviewed by: _____ Date: June 3, 2016

Finalized by: _____ Date: June 3, 2016

References and definitions

## References:

Easyphage SPL, based on:

**EPA Method 1602**: Male-specific ($F^+$) and Somatic Coliphage in Water by Single Agar Layer Procedure (821-R-01-029)

**Genotyping Male-specific RNA Coliphages by Hybridization with Oligonucleotide Probes.** HSU, F.-C., Y.-S. CAROL SHIEH, J. VAN DUIN, M. J. BEEKWILDER, and M. D. SOBSEY.*Appl. Environ. Microbiol*. 61:3960-3966.

**Applying meta-analysis of male-specific RNA coliphages to determine the probable sources of fecal contamination during poultry processing.** F.-C. Hsu , Y. C. Shieh, J. Larkin, and M. D. Sobsey. ·2004. The Annual Meeting of the American Society for Microbiology, New Orleans, LA.

Definitions:

MRL: Minimum reporting limit

< = ñless than.ò It indicates the lowest reportable value by the procedure used for analysis.

pfu/100mL: plaque forming units per 100 mL

**Coliphages** belong to the group of bacterial viruses that infect and replicate exclusively within the coliform bacteria group.

**Coliphages** can be further classified as belonging to the ñmale-specificò or ñsomaticò groups depending upon their method of attachment to host cells.

**Male-specific coliphages**, also known as $F^+$coliphages, specifically infect the coliform bacteria that express physical appendages called sex pili. They are classified into F+DNA and F+RNA coliphages. Only F+RNA coliphages can be serotyped or genotyped.

**Meta-analysis** is based on a database, compiled of all data available on the published literature.