

Public Review Draft

Fenwood Creek Targeted Watershed Assessment: A Water Quality Report to Protect & Restore Wisconsin Waters

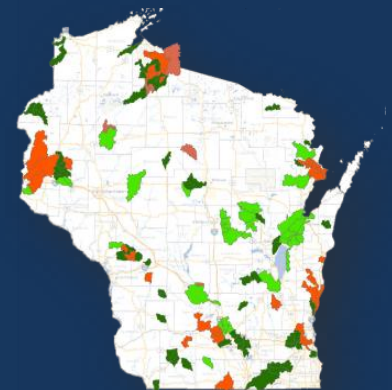
A Water Quality Monitoring Report created by the Bureau of Water Quality in support of the Clean Water Act.




*Marathon County
Monitored 2016-2017
HUC12 070700021602*



Fenwood Creek, Marathon County

Photo by Wisconsin Department of Natural Resources



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-  Find this report online at the [Fenwood Creek TWA Study](#)

EGAD # 3200-2021-xxxx
Water Quality Bureau
Wisconsin DNR

Wisconsin Water Quality Monitoring and Planning

This Water Quality Management Plan was created under the state's Water Resources Planning and Monitoring Programs. The plan reflects program priorities and the state's Water Resources Monitoring Strategy 2015-2020 and fulfills Wisconsin's Areawide Water Quality Management Plan requirements under Section 208 of the Clean Water Act. Condition information and resource management recommendations support and guide implementation priorities for the watershed planning area.

The Fenwood Creek Watershed is located in the Lower Eau Pleine Subwatershed of the Wisconsin River Basin. USEPA Approved the Wisconsin River TMDL on April 26, 2019. This HUC12 project is nested in one of the three watersheds that drain to Lake DuBay. The Fenwood Creek Targeted Watershed Assessment supports implementation efforts, including updates to the Fenwood Creek Watershed Nine Key Element Plan.

This WQM Monitoring Report is approved by the Wisconsin DNR and is a formal update to the Upper Wisconsin River Basin Water Quality Management Plan and Wisconsin's statewide Areawide Water Quality Management Plan (AWQM Plan). This plan will be forwarded to USEPA for certification as a formal update to Wisconsin's AWQM Plan.

Report Acknowledgements

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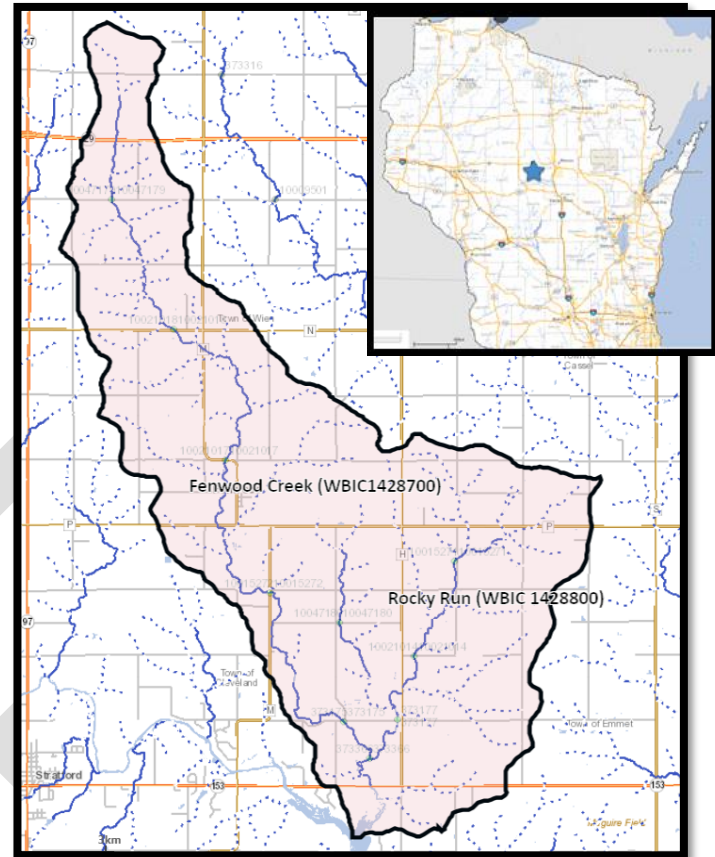
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Figure 1. Fenwood Creek Watershed Location



Targeted Watershed Assessment Summary

The Fenwood Creek watershed is a sub watershed of the Lake Dubay – Big Eau Pleine River watershed, located in Marathon County. This watershed assessment Fenwood Creek HUC 12 was conducted by WDNR in 2016 and 2017. The purpose of this assessment was to evaluate current stream health and to provide an analysis of baseline conditions. This report provides an overview of the physical characteristics including land use, a summary of resource condition, and recommendations for land and water management consistent with restoration goals. Prior to the assessment, limited data on streams in the drainage area was available. The project also supports placement and evaluation of agricultural best management practice implementation as part of the county Nine Key Element Plan.

Biological, chemical, and physical water quality data was collected throughout the watershed. Monitoring conducted at ten sites and included qualitative habitat assessments, fish and macroinvertebrate community assessments, and flow measurements (Table 12). Growing season total phosphorus (May – October) was collected at four sites by volunteers and a single total phosphorus grab sample was collected by Wisconsin Department of Natural Resources (WDNR) staff at seven sites within the watershed.

About the Watershed

The Fenwood Creek watershed is a sub watershed of the Lake Dubay – Big Eau Pleine River watershed located in Marathon County. The Fenwood Creek watershed drains approximately 24,958 acres (39 mi²) of land into the Big Eau Pleine Reservoir. Fenwood Creek represents one of three (3) major surface water tributaries that empty into the reservoir, which immediately flows into Lake DuBay, both flowages of the Upper Wisconsin River Basin. The Fenwood Creek watershed consists of two primary named streams, Fenwood and Rocky Run Creeks, and several smaller unnamed streams. Land use in the watershed is dominated by agriculture and consists of croplands (65%), woodlands (25%), and other miscellaneous land use types (10%). In 2015, Marathon County developed a Nine Key Element Plan to help address agricultural runoff in the Fenwood Creek Watershed.

Water Quality Conclusion

Overall, streams within the Fenwood Creek watershed are in fair condition. Streams flowing through agricultural dominated land use typically have higher levels of phosphorus and degraded aquatic habitat. Efforts in this watershed should focus on practices that reduce non-point source runoff from crop fields, pastures and other sources of sediment and nutrients as identified in the County's Nine Key Element Plan. The Department should seek opportunities to work collaboratively with Marathon county and other land conservation efforts in the area, and provide support through grants, partnerships and education.

Management Recommendations

- Provide outreach and educate landowners about water quality concerns within the watershed and how they can help to reduce erosion and nutrient inputs.
- Identify primary sources of phosphorus and implement various land practices to ensure a decrease in pollutants.
 - Partners should identify and prioritize work in areas where there are willing landowners, and/or in areas with the highest sources of pollutants.
- Support Marathon County in the implementation of the Fenwood Creek Nine Key Element Plan.
- Continue to protect riparian habitat along the stream banks and identify areas where riparian habitat is needed and seek support from partners to implement BMP's.
- Identify areas where wetlands have been disturbed and work with partners to restore wetlands.
- Educate and work with landowners on the benefits of no-till farming, reduction of fall tillage, cover crops, and creation and implementation of a nutrient management plan, and other BMP's that reduce runoff to surface waters.
- Educate landowners about the benefit of managing grazelands and rotational grazing.
- Provide education on aquatic invasive species (AIS) prevention and management to interested partners.
- Follow up monitoring of both Fenwood and Rocky Run Creek, should occur when significant implementation has occurred and can be demonstrated through modeling.

Abbreviations

BMP: Best Management Practice. A land management practice used to prevent or reduce nonpoint source pollution such as runoff, total suspended solids, or excess nutrients.

DATCP: Wisconsin Department of Agriculture, Trade and Consumer Protection – the state agency in partnership with DNR responsible for a variety of land and water related programs.

DNR: Department of Natural Resources. Wisconsin Department of Natural Resources is an agency of the State of Wisconsin created to preserve, protect, manage, and support natural resources.

FHMD: Fisheries and Habitat Management Database – or Fish Database – the state’s repository for fish taxonomy and auto-calculated metrics involving fish assemblage condition and related.

FIBI: Fish Index of biological integrity (Fish IBI). An Index of Biological Integrity (IBI) is a scientific tool used to gauge water condition based on biological data. Results indicate condition and provide insight into potential degradation sources. In Wisconsin, specific fish IBI tools are developed for specific natural communities. Biologists review and confirm the natural community to use the correct fish IBI tool.

HUC: Hydrologic Unit Code. A HUC is a code that represents nested hydrologic watersheds delineated by multiple agencies at the federal and state level including USGS, USFS, and Wisconsin DNR.

MIBI: Macroinvertebrate Index of biological integrity. In Wisconsin, the MIBI, or macroinvertebrate Index of biological integrity, was developed to assess macroinvertebrate community condition.

Monitoring Seq. No. Monitoring Sequence Number refers to a unique identification code generated by the Surface Water Integrated Monitoring System (SWIMS), which holds much of the state’s water quality monitoring data.

NC: Natural Community. A system of categorizing water based on inherent physical, hydrologic, and biological components. Streams and Lakes have uniquely derived systems that result in specific natural community designations for each lake and river segment in the state. These designations dictate the appropriate assessment tools which improves the condition result, reflecting detailed nuances reflecting the modeling and analysis work foundational to the assessment systems.

SWIMS ID. Surface Water Integrated Monitoring System (SWIMS) identification number is the unique monitoring station identification number for the location of monitoring data.

TMDL: Total Maximum Daily Load – a technical report required for impaired waters Clean Water Act. TMDLs identify sources, sinks and impairments associated with the pollutant causing documented impairments.

TP: Total Phosphorus - an analyzed chemical parameter collected in aquatic systems frequently positively correlated with excess productivity and eutrophication in many of Wisconsin’s waters.

TWA: Targeted Watershed Assessment. A monitoring study design centered on catchments or watersheds that uses a blend of geometric study design and targeted site selection to gather baseline data and additional collection work for unique and site-specific concerns for complex environmental questions including effectiveness monitoring of management actions, evaluation surveys for site specific criteria or permits, protection projects, and generalized watershed planning studies.

TSS: Total suspended solids – an analyzed physical parameter collected in aquatic systems that is frequently positively correlated with excess productivity, reduced water clarity, reduced dissolved oxygen and degraded biological communities.

WBIC: Water Body Identification Code. WDNR’s unique identification codes assigned to water features in the state. The lines and information allow the user to execute spatial and tabular queries about the data, make maps, and perform flow analysis and network traces.

WSLH: Wisconsin State Laboratory of Hygiene– the state’s certified laboratory that provides a wide range of analytical services including toxicology, chemistry, and data sharing.

WQC: Water quality criteria – a component of Wisconsin’s water quality standards that provide numerical endpoints for specific chemical, physical, and biological constituents.

About the Watershed

Location, Size, Land Use

The 39 mi² Fenwood Creek Watershed, located in Marathon County, drains 24,958 acres (39 mi²) of land into the Big Eau Pleine Reservoir (Figure 2). This watershed is part of the Wisconsin River Basin with several implementation efforts underway. The watershed is located adjacent to the rapidly developing Wausau – Mosinee Metropolitan Region. In 2015, Marathon County developed a Nine Key Element Plan to help address agricultural runoff in the Fenwood Creek Watershed.

The Fenwood Creek Watershed consists of two primary named streams, Fenwood and Rocky Run Creeks, and several smaller unnamed streams. Land use in the watershed is dominated by agriculture (See WisLand graphic, Figure 3, below) and consists of croplands (65%), woodlands (25%), and other miscellaneous land use types (10%).

Figure 2. Fenwood Creek Watershed and Nearby Municipalities

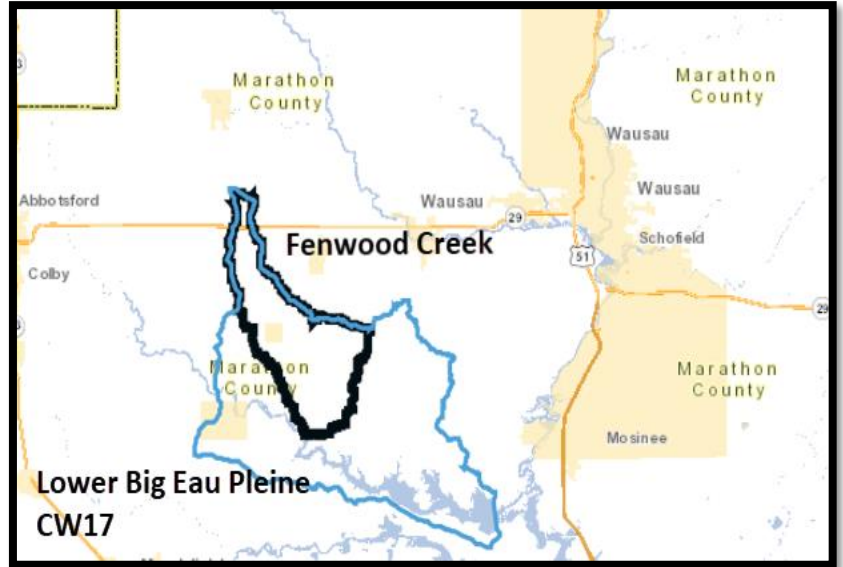
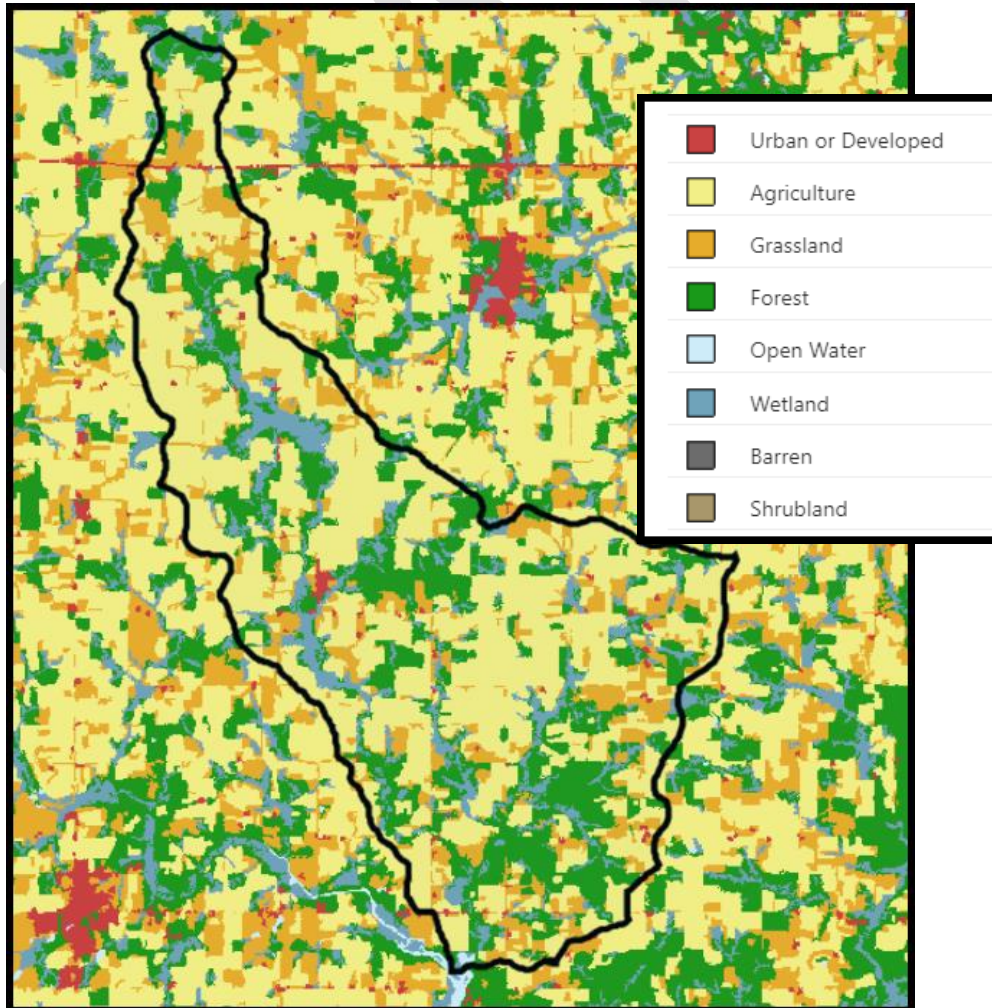


Figure 3. Fenwood Creek WisLand2Land Cover Map



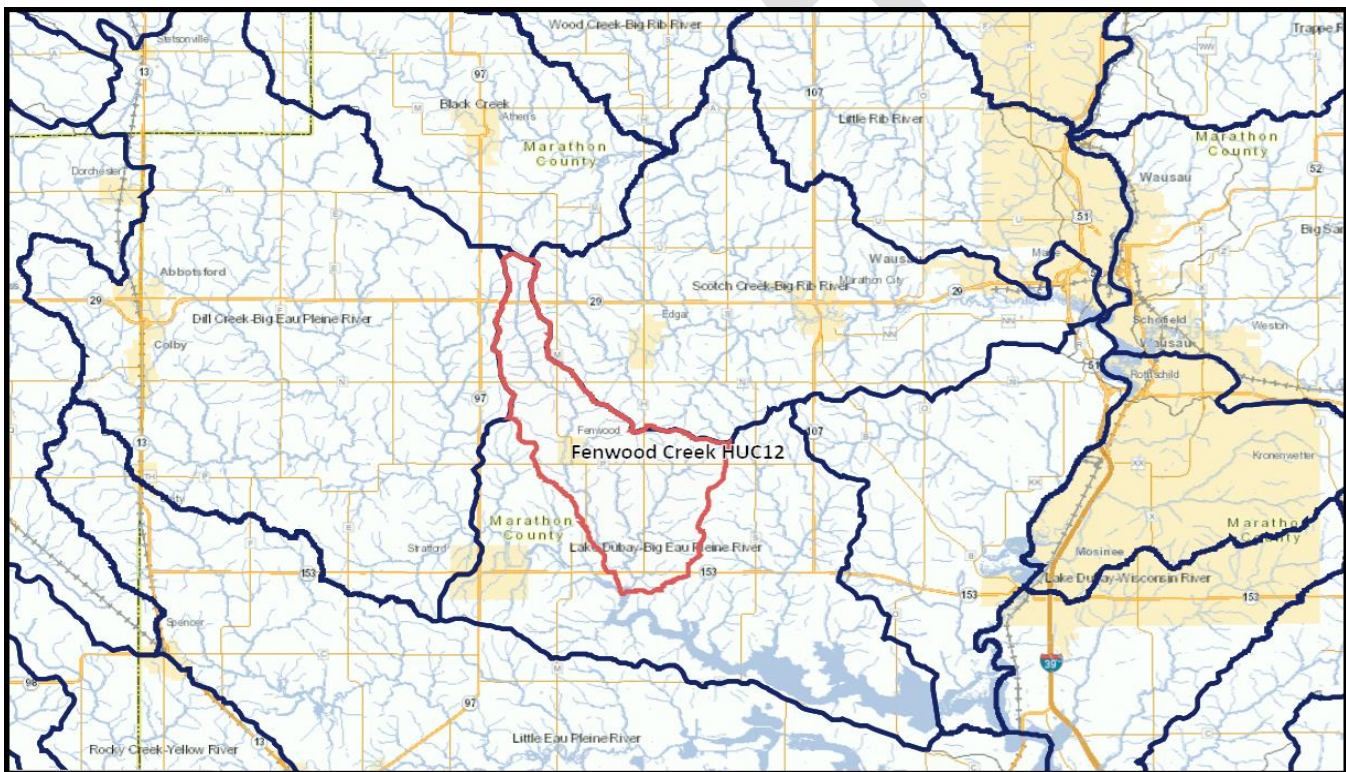
Ecological Landscapes

The Fenwood Creek Watershed is located within the **Forest Transition Ecological Landscape (EL)**. Ecological landscapes are areas of Wisconsin with different ecological attributes and management opportunities. The Forest Transition area was once entirely glaciated. The central portion was formed by older glaciations, both Illinoian and pre-Illinoian, while the eastern and western portions are covered by deposits of the Wisconsin glaciation. Glacial till is the major material deposited throughout the area. Prevalent landforms are till plains or moraines. Throughout the area, post-glacial erosion, stream cutting, and deposition formed today's floodplains, terraces, and swamps along major rivers.

Hydrology

The Fenwood Creek watershed is a sub watershed of the Lake DuBay – Big Eau Pleine River in Marathon County (Figure . Fenwood Creek represents one of three (3) major surface water tributaries that empty into the reservoir, which immediately flows into the Big Eau Pleine Reservoir and Lake DuBay, both are flowages of the Upper Wisconsin River Basin. The Fenwood Creek watershed consists of two primary named streams, Fenwood and Rocky Run Creeks, and several smaller unnamed streams.

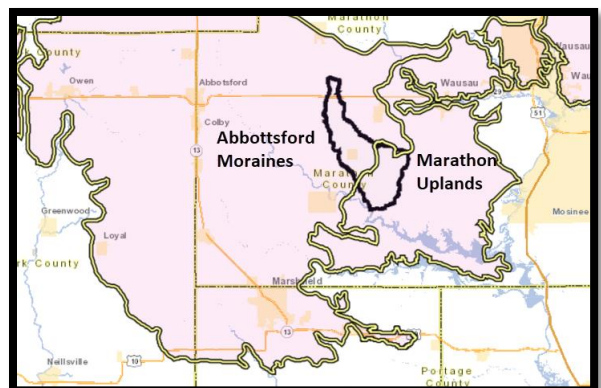
Figure 4. Fenwood Creek Watershed Hydrology



Soils

Soil descriptions are described in “Wisconsin Landtypes”(Figure 5). The watershed spans two landtypes. **Abbotsford Moraines Landtype:** The characteristic landform pattern is undulating moraine. Soils are predominantly somewhat poorly drained silt loam over acid loam till. **Marathon Uplands Landtype:** The characteristic landform pattern is rolling bedrock-controlled erosional surface. Soils are predominantly well drained silt loam over acid loam till, loamy residuum, or igneous/metamorphic bedrock.

Figure 5. Fenwood Creek Watershed and Landtype Associations



Study Design & Methods

Biological, chemical, and physical water quality data was collected throughout the watershed. Monitoring activities were completed at ten sites and included qualitative habitat assessments, fish and macroinvertebrate community assessments, and flow measurements (Figure 2). Growing season total phosphorus (May – October) was collected at four sites by volunteers and a single total phosphorus grab sample was collected by Wisconsin Department of Natural Resources (WDNR) staff at seven sites within the watershed

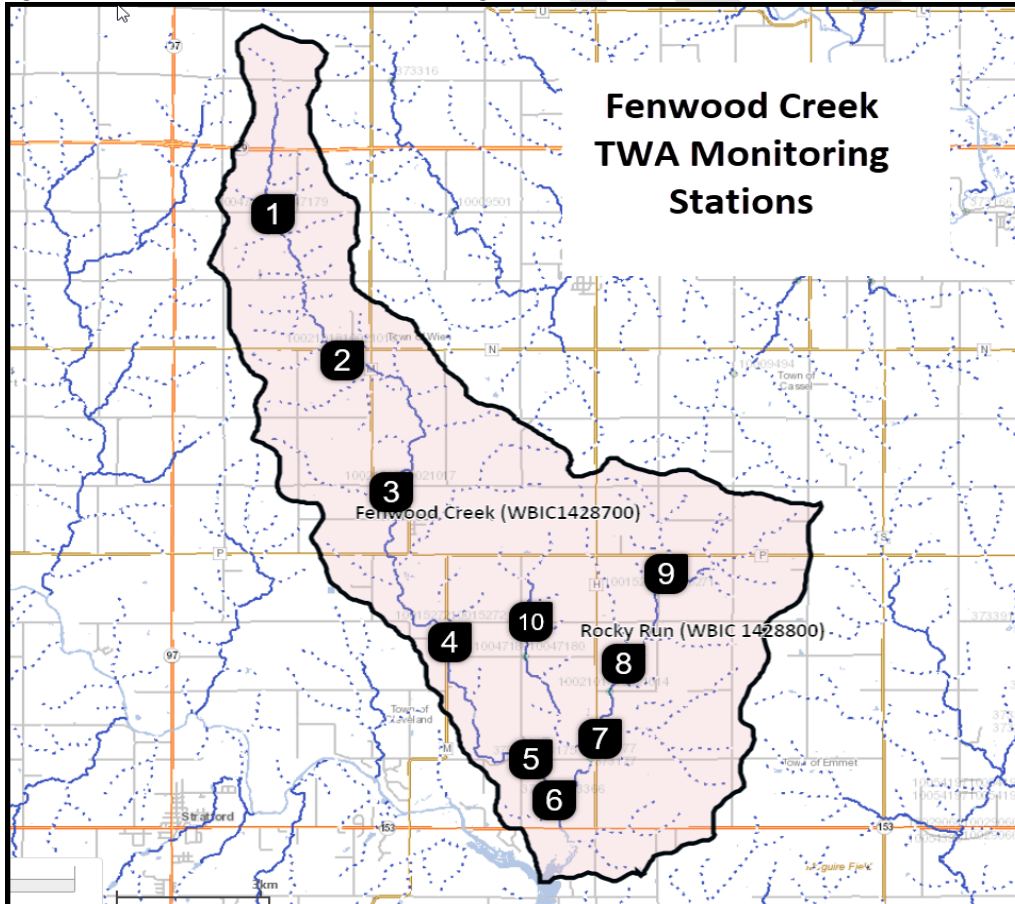
Site Selection

Monitoring stations are listed in Table 1, Figure 6.

Table 1. Fenwood Creek TWA Stations and Data Collection

#	Station	Location	WBIC	Fish Survey	Inverts	Qualitative Habitat	Water Quality
1	10047179	Fenwood Creek at Elderberry Street	1428700	X	X	X	X
2	10021018	Fenwood Creek at CTH N	1428700	X	x	X	X
3	10021017	Fenwood Creek at Blackberry Rd	1428700	X	x	X	X
4	10015272	Fenwood Creek at CTH M	1428700	X	X	X	X
5	373175	Fenwood Creek at Fairview Road	1428700	X	X	X	X
6	373366	Fenwood Creek at Hwy 153	1428700	X	X	X	X
7	373177	Rocky Run at Fairview Rd	1428800	X	X	X	X
8	10021014	Rocky Run at West Still Hill Road	1428800	X	X	X	X
9	10015271	Rocky Run at Still Hill Road	1428800	X	X	X	X
10	10047180	Unnamed Creek at Schnelle Road	1428900	X	X		x

Figure 6. Fenwood Creek Watershed Monitoring Sites



Habitat Evaluation

Qualitative habitat surveys were completed at nine sites in the Fenwood Creek watershed in the summer of 2017. Surveys were completed in conjunction with fish community assessment and followed DNR protocol (WDNR, 2007). Sites were visually evaluated and scored using seven different parameters for streams less than ten meters. Scores for each of these parameters were then summed to provide an overall rating of stream habitat quality for each site. Scores corresponded to a habitat rating of excellent, good, fair, or poor (excellent ≥ 75 , good 50-74, fair 25-49, and poor < 25). Visual observations were also documented indicating more specific substrate types, significance of bank erosion, riparian habitat types, water clarity, water level, and if any aquatic invasive species were present.

Fish Community Assemblage

Fish surveys were completed at nine sites in the Fenwood Creek watershed in the summer of 2017. Surveys were completed following DNR protocol using backpack and stream shocking equipment (WDNR, 2018). At each site, fish were collected within a section of the stream with a minimum station length of 35 times the mean stream width (MSW). Station's less than three meters in width would have a minimum station length of 100 meters. Fish were collected, identified, counted, and used to calculate the fish Index of Biotic Integrity (fIBI). The fIBI was built to reflect structural changes in fish assemblages in response to local and watershed-level disturbance, riparian condition and local habitat quality. IBI scores can range from 0 to 100 where stream quality increases as the score increases (Lyons, 1992).

Macroinvertebrate Assessment

Macroinvertebrate samples were collected in fall of 2016 at ten sites in the Fenwood Creek watershed. Macroinvertebrates were collected using a D-frame kick net with micron mesh and following DNR protocol (WDNR, 2017). Riffles were the primary targeted sampling habitat for each site. If no riffles were present, overhanging vegetation, logjams, or snags were sampled. Samples were preserved with 80-85% alcohol (isopropyl or ethanol) and sent to the University of Wisconsin - Stevens Point Aquatic Biomonitoring Laboratory for sorting and taxonomic identification.

Samples were evaluated using the Macroinvertebrate Index of Biotic Integrity (mIBI) and the Hilsenhoff Biotic Index (HBI). The mIBI is used to evaluate human disturbances, land use, and pollution within and around streams to better understand the overall quality of each stream (Weigel, 2003). The mIBI score can range from 0 to 10, where overall stream quality increases as the score increases. The HBI evaluates the tolerance value of the macroinvertebrate community in each sample to understand organic loading in each stream (Hilsenhoff, 1987). The HBI score can range from 0 to 10, where overall stream quality decreases as the score increases.

Water Chemistry Sampling

Monthly growing season (May through October) total phosphorus samples were collected in 2017 by volunteers at four sites on Fenwood and Rocky Run Creeks. In addition, single grab samples were collected at seven sites in the watershed. All water chemistry samples were completed following WDNR sampling guidelines (WDNR, 2015). Growing season samples were analyzed following principles in the Wisconsin 2016 Consolidated Assessment and Listing Methodology (WisCALM) (WDNR, 2016). The total phosphorus water quality criterion for wadeable streams in the state of Wisconsin is 0.075 mg/l according to NR 102.06 of Wisconsin Administrative Code. Exceedance of this value could result in a stream being listed as impaired.

Results

Rocky Run Creek

Rocky Run Creek is a six-mile-long cool-warm headwater stream that flows into Fenwood Creek. Electrofishing surveys were completed at three sites on Rocky Run Creek. The community consisted of a diverse forage fishery and was dominated by creek chubs, fantail and johnny darters, western blacknose and southern redbelly daces, and white suckers. All three sites had an IBI score of 100 with a rating of "good" (Table 5). All three habitat surveys on Rocky Run Creek were rated as "Good" (Table 3). Substrate consisted primarily of cobble and gravel, but boulders and sand were also present. All sites had a large riparian buffer consisting of woodlands, shrubs, and grasses with minimal bank erosion along the stream margin. The diversity of riffles, runs, pools, and bends decreased moving downstream with more runs and pools at the most downstream station. Fish cover was fairly limited throughout all stations.

Macroinvertebrate IBI and HBI scores varied between the three sites. mIBI ratings increased moving downstream from "fair" to "good" to "excellent" (Table 2). HBI ratings ranged from "excellent" at the most upstream site to "good" and "very good" at the other two downstream sites indicating minimal organic loading. Growing season total phosphorus collected at Fairview Road had a median value of 0.0604 mg/l (low = 0.0485 mg/l, high = 0.127 mg/l) which does not exceed the statewide criteria (0.075mg/l) (WDNR, 2017).

Unnamed Creek at Schnelle Road

Unnamed Creek is a small cool-warm headwater tributary of Rocky Run Creek. The fish community consisted of a diversity of forage fish including creek chubs, darters, northern redbelly and western blacknose daces, green sunfish, and white suckers. This site had an IBI

score of 70 with a rating of “good” (Table 5). It should be noted that electrofishing was challenging, due to shallow water depth and coarse substrate.

The qualitative habitat score for this unnamed creek was 50 with a rating of “good” (Table 3). Substrate consisted of mainly cobble and boulders. This site had a large riparian buffer consisting mainly of woodlands and shrubs with many overhanging tag alders. Bank erosion was minimal, with habitat consisting of a shallow run due to the water level being so low. Lack of fish cover was a limiting factor to habitat quality. A large patch of curly leaf pondweed was also spotted within the station. Both the macroinvertebrate IBI and HBI scored “good” and “very good,” respectively indicating low amounts of pollution and disturbances within this stream (Table 2).

Fenwood Creek

Fenwood Creek is a 17-mile-long tributary that flows into the Big Eau Pleine River. Fish communities and habitat were assessed at five sites along Fenwood Creek. Fish IBI scores ranged between 90 and 100 with a rating of either “good” or “excellent” (Table 5). This stream supported a cool-warm fishery dominated by brook sticklebacks, central mudminnows, common shiners, creek chubs, rainbow and johnny darters, western blacknose daces, and white suckers.



Qualitative habitat varied a great deal throughout Fenwood Creek (Table 3). The most upstream site, showed very little habitat diversity with a score of 10 and a rating of “poor.” There was little to no riparian buffer with high levels of bank erosion as a result of cattle pasturing in the stream corridor. This section of stream was primarily run habitat with a few pools and very minimal fish cover. Substrate was comprised mainly of sand and gravel with some areas of cobble and silt. Eurasian watermilfoil was abundant in bridge pools and curly leaf pondweed was found at the start of the station.

Only one site, Fenwood at County Highway N, had a rating of “good” and a score of 68. This station had a large riparian buffer consisting of shrubs, meadow grasses, and scattered hardwood trees with no bank erosion. The station contained many pools and runs with a sufficient amount of fish cover. Substrate type was mostly comprised of sand with areas of cobble and gravel scattered throughout. The other three sites, Fenwood Creek at Blackberry Road, County Highway M, and Fairview Road had habitat scores that ranged between 35 to 45 with a rating of “fair.” These sites had a large riparian buffer consisting of woodland areas, shrubs, and grasses with little to moderate levels of bank erosion. Habitat was monotonous at these sites consisting mainly of runs with a few pools. Substrate types of gravel, cobble, boulders, and sand. Fine sediments were most prevalent at the site on Blackberry Road with the other two sites having minimal fine sediments. The presence and quantity of fine sediments at these sites could be a contributing factor to the higher phosphorus concentrations observed in Fenwood Creek. Fish cover was limited at all three sites.

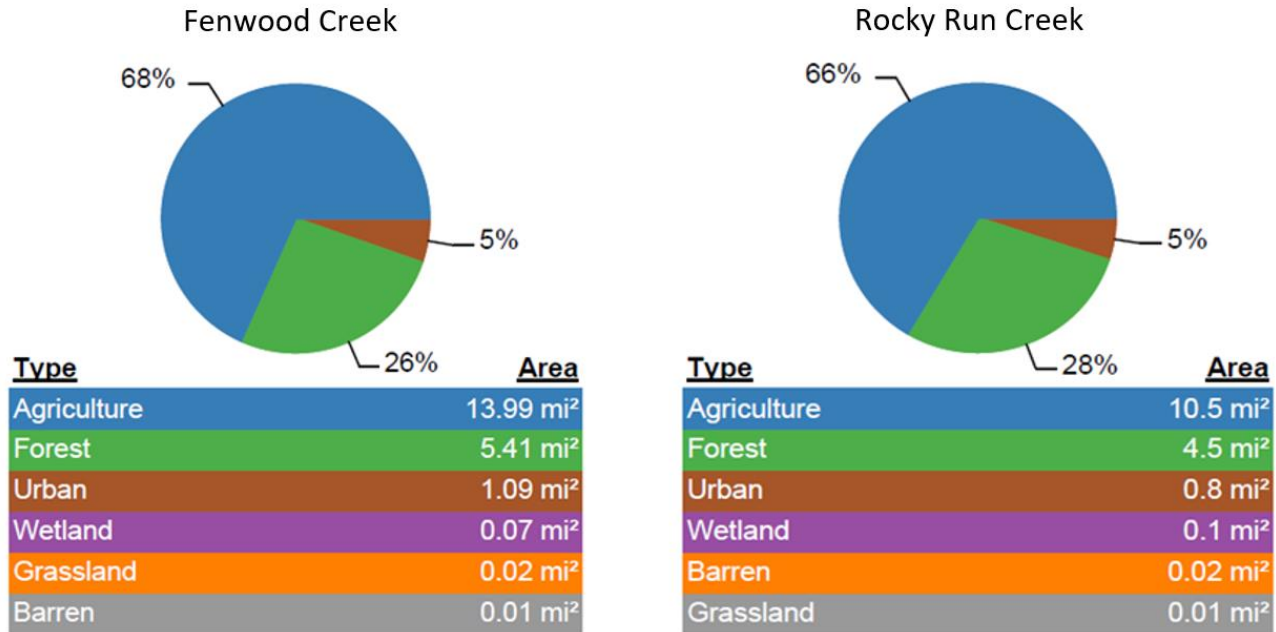
Macroinvertebrates were sampled at six sites in Fenwood Creek. mIBI ratings ranged from fair (upstream) to good (downstream sites) (Table 2). HBI ratings showed a similar trend ranging from poor at the most upstream site (Elderberry) to excellent at the most downstream site. The lower macroinvertebrate ratings at the upper most site may be a result of pastured land use and/or low flow conditions in the headwater areas of the stream.

Growing season total phosphorus samples were collected at three sites on Fenwood Creek which include: Blackberry Road, Fairview Road, and Highway 153. Median values were 0.245 mg/l (low = 0.154 mg/l, high = 0.464 mg/l), 0.141 mg/l (low = 0.114 mg/l, high = 0.287 mg/l), and 0.104 mg/l (low = 0.0949 mg/l, high = 0.197 mg/l), respectively. All sites exceed the statewide total phosphorus criteria of 0.075 mg/l (WDNR, 2017). Single grab total phosphorus samples were collected at four additional sites on Fenwood Creek. These concentrations were similar to the respective growing season samples suggesting concentrations are comparable throughout the stream and exceed the water quality standard (Table 4). Fenwood Creek is currently listed on the Section 303d Clean Water Act impaired waters list and these data support the listing.

Discussion

Land use in the Fenwood Creek Watershed is dominated by agricultural crop fields with some riparian cattle pasturing. These land use types can result in excessive sedimentation and nutrients to surface water if not properly managed on the land. Median growing season total phosphorus concentrations in Fenwood Creek all exceeded the statewide criteria and confirms the existing 303(d) impaired waters listing. Median growing season total phosphorus concentrations on Rocky Run Creek did not exceed the statewide criteria.

Figure 7. Land use comparison between Fenwood Creek and Rocky Run Creek.



Total phosphorus concentrations were nearly twice as much at every station on Fenwood Creek compared to Rocky Run Creek (Table 4). After reviewing the differences in management and land use between Fenwood Creek and Rocky Run Creek, there is not a remarkable difference in land use, which suggests that changes in land use is not the cause of higher phosphorus in the Fenwood watershed. (Figure 3). Considering these land uses are so similar, it is assumed that farming practices are also similar.

This suggests the differences in phosphorus concentrations are a result of natural variability in topography, soils, and groundwater inputs. Soil in the Fenwood Creek watershed is higher in clay content which allows for the potential of higher phosphorus adsorption whereas soil in the Rocky Run Watershed is higher in sand and therefore may have less phosphorus adsorption. Also, a preliminary review of flows in the two streams, indicates a stronger baseflow in Rocky Run which may indicate groundwater dilution of total phosphorus concentrations. Further investigation of the soils, and groundwater inputs would be needed to fully explain the apparent natural differences in the two streams.

All streams in the Fenwood Creek Watershed were modeled as cool-cold headwaters. The modeled natural communities were verified using fish communities collected during these surveys following procedures outlined by Department protocol (Lyons, 2013). Fish communities were evaluated to verify the natural community of streams within this watershed. Following this protocol, the natural community of streams were verified as cool-warm headwaters or cool-warm mainstem.

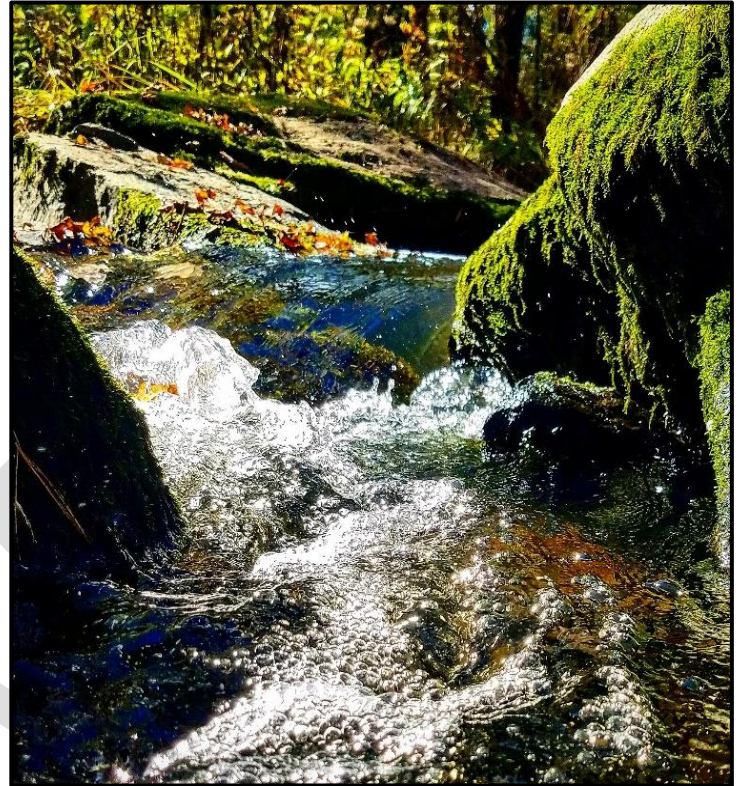
There was a total of 29 different species of fish found within the Fenwood Creek watershed (Table 6). The most common species collected throughout the watershed were brook stickleback, creek chub, fantail and johnny darters, western blacknose dace, and white sucker. A few gamefish species were also collected including largemouth bass, yellow perch, and bluegills. Of the 29 species present, four were intolerant, nine were tolerant, and 16 were intermediate. The cool-warm water fish IBI's vary slightly from site to site, but generally show "good" or "excellent" quality fish communities (Table 5). Ratings such as these indicate a healthy and diverse fish community.

In-stream habitat ratings were generally "good" or "fair" with only one site at Elderberry Road having a "poor" rating. This site was heavily pastured and as a result, habitat quality was limited by excessive bank erosion, sedimentation, lack of riffles and fish cover. Limiting factors at the other sites were lack of fish cover and absence of diversity in habitat due to minimal flow and shallow water conditions. Minimal flow doesn't allow for suitable habitat because these conditions can restrict dissolved oxygen supply and can cause wide variations in water temperature. Outside many of the stations sampled, submergent vegetation such as Eurasian watermilfoil and curly leaf pondweed were found which could be acting as beneficial fish and macroinvertebrate habitat even though they are invasive species. Invasive species can become overabundant, however, and should be monitored.

Generally, most sites surveyed had a riparian buffer greater than ten meters, however, aerial maps found additional areas along the stream with limited buffers especially in the headwater reaches of Fenwood and Rocky Run Creeks. Areas with no riparian buffer have a greater chance of allowing excess phosphorus and sedimentation to runoff into nearby streams.

Macroinvertebrate data is beneficial to analyze due to macroinvertebrates limited mobility, and the presence or absence of a species can indicate if organic pollution is present. Many of the sites in the Fenwood Creek watershed had mIBI ratings of “good” or “excellent” with only two sites having a “fair” rating (Table 2). HBI ratings showed a similar trend with only one station having a rating of “poor.” Fenwood Creek at Eldeberry Road had the lowest mIBI and HBI ratings. The riparian corridor was heavily grazed, and streambanks were eroding increasing sedimentation and possibly organic loading. This segment of stream also appears to be impacted by low flow conditions, which reduces habitat quality. Low flow conditions may result in lower oxygen concentrations from the lack of aeration and atmospheric exchange. However, this was not measured during this study. Beneficial macroinvertebrates such as mayflies, stoneflies, and caddisflies require high flow streams with immense levels of dissolved oxygen to survive. These low flow conditions in the headwaters of both Fenwood and Rocky Run Creeks did not provide suitable habitat conditions for these species.

In this watershed, mIBI scores increased in quality moving downstream. There could be many reasons for the variation including habitat selected for sampling (riffle, run, or pool), flow, water level, organic pollution levels at each site, or just natural variation between each site. Headwater areas tended to have higher levels of bank erosion and limited riparian buffers decreasing the chance for any excess nutrients to be absorbed before entering the streams. The headwater areas also had very limited flow and low water levels.



Conclusions and Recommendations

Overall, streams within the Fenwood Creek watershed are in fair condition. Streams flowing through agricultural dominated land use typically have higher levels of phosphorus and degraded aquatic habitat. Efforts in this watershed should focus on practices that reduce non-point source runoff from crop fields, pastures and other sources of sediment and nutrients as identified in the County's Nine Key Element Plan. The Department should seek opportunities to work collaboratively with Marathon county and other land conservation efforts in the area, and provide support through grants, partnerships and education.

Management Recommendations

- Provide outreach and educate landowners about water quality concerns within the watershed and how they can help to reduce erosion and nutrient inputs
- Identify primary sources of phosphorus and implement various land practices to ensure a decrease in pollutants
 - Partners should identify and prioritize work in areas where there are willing landowners, and/or in areas with the highest sources of pollutants.
- Support Marathon County in the implementation of the Fenwood Creek Nine Key Element Plan
- Continue to protect riparian habitat along the stream banks and identify areas where riparian habitat is needed and seek support from partners to implement BMP's
- Identify areas where wetlands have been disturbed and work with partners to restore wetlands
- Educate and work with landowners on the benefits of no-till farming, reduction of fall tillage, cover crops, and creation and implementation of a nutrient management plan, and other BMP's that reduce runoff to surface waters.
- Educate landowners about the benefit of managing grazelands and rotational grazing
- Provide education on aquatic invasive species (AIS) prevention and management to interested partners
- Follow up monitoring of both Fenwood and Rocky Run Creek, should occur when significant implementation has occurred and can be demonstrated through modeling.

Appendix A: References

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Appendix B. Figures and Graphs

Table 2. Macroinvertebrate mIBI and HBI in Fenwood Creek HUC 12, 2016

Stream Name and Site Location	mIBI	mIBI Rating	HBI	HBI Rating
Fenwood at Elderberry St	3.27817	Fair	7.503	Poor
Fenwood at CTH N	5.92349	Good	4.447	Very good
Fenwood at Blackberry Rd	6.13662	Good	6.013	Fair
Fenwood at CTH M	6.37918	Good	4.714	Good
Fenwood at Fairview Rd	6.38932	Good	3.321	Excellent
Fenwood at HWY 153	6.68535	Good	3.457	Excellent
Rocky Run above Still Hill Rd	4.67659	Fair	3.32	Excellent
Rocky Run at Still Hill Rd	5.78076	Good	4.764	Good
Rocky Run at Fairview Rd	7.50574	Excellent	4.673	Good
Unnamed at Schnelle Rd	6.70248	Good	4.414	Very Good

Figure 8: Fenwood Creek, MIBI Values

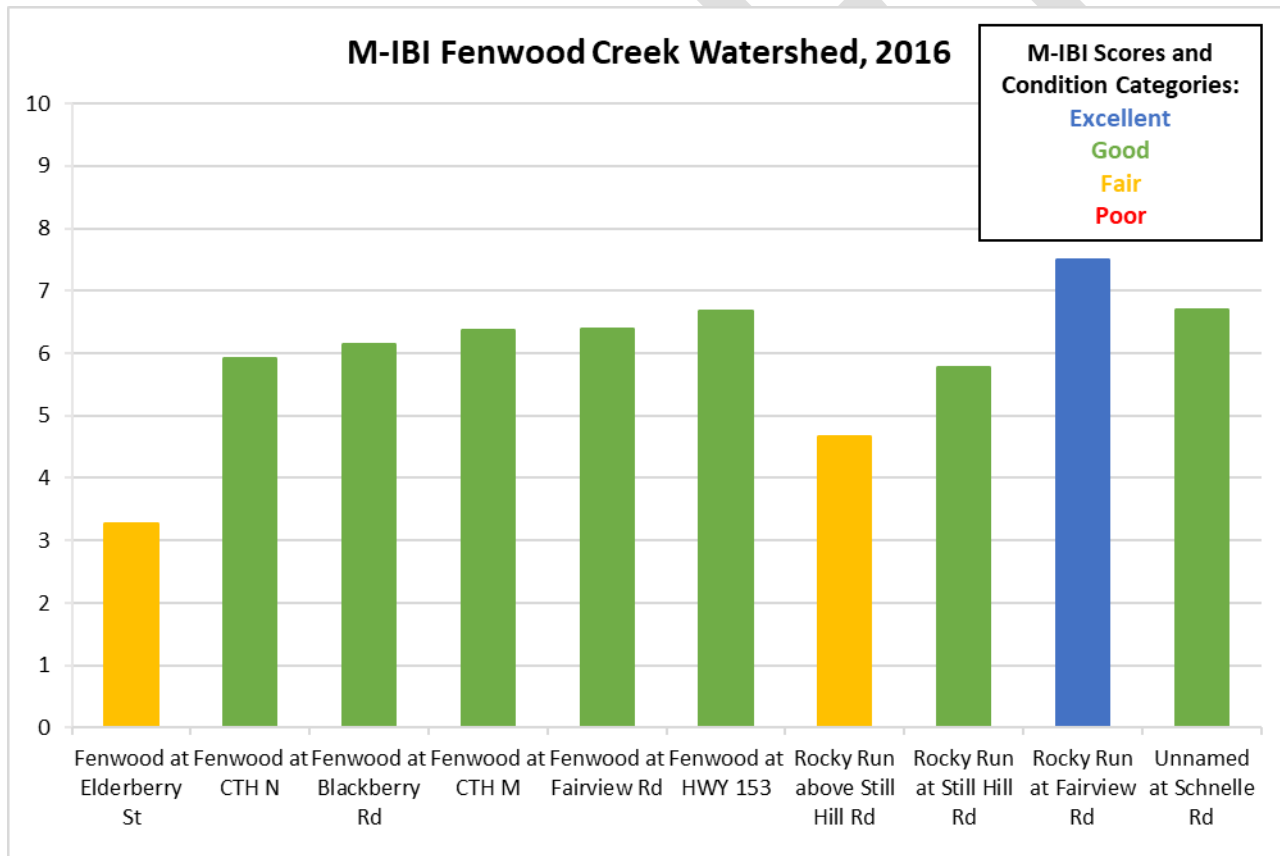


Figure 9: Fenwood Creek, HBI Values

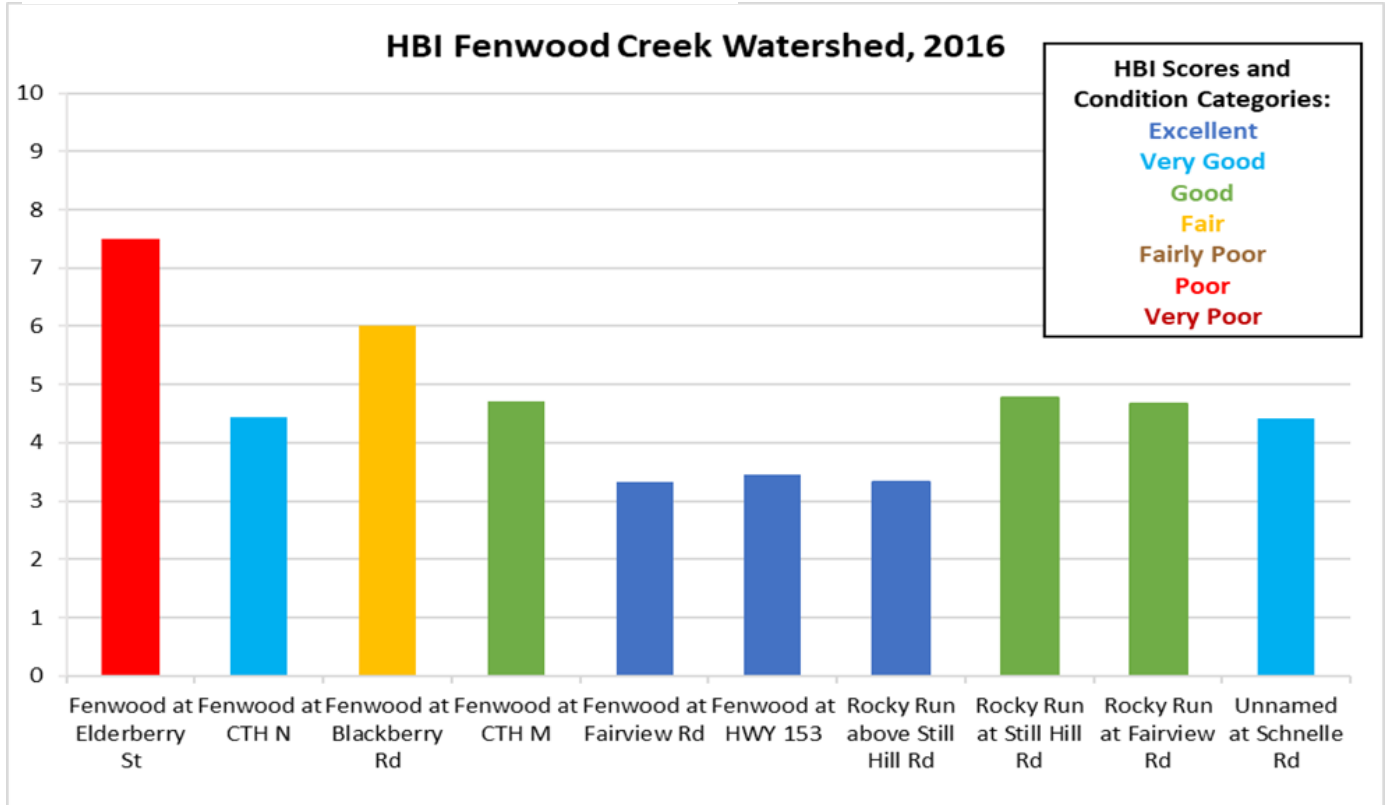


Figure 10: Fenwood Creek, Habitat Values

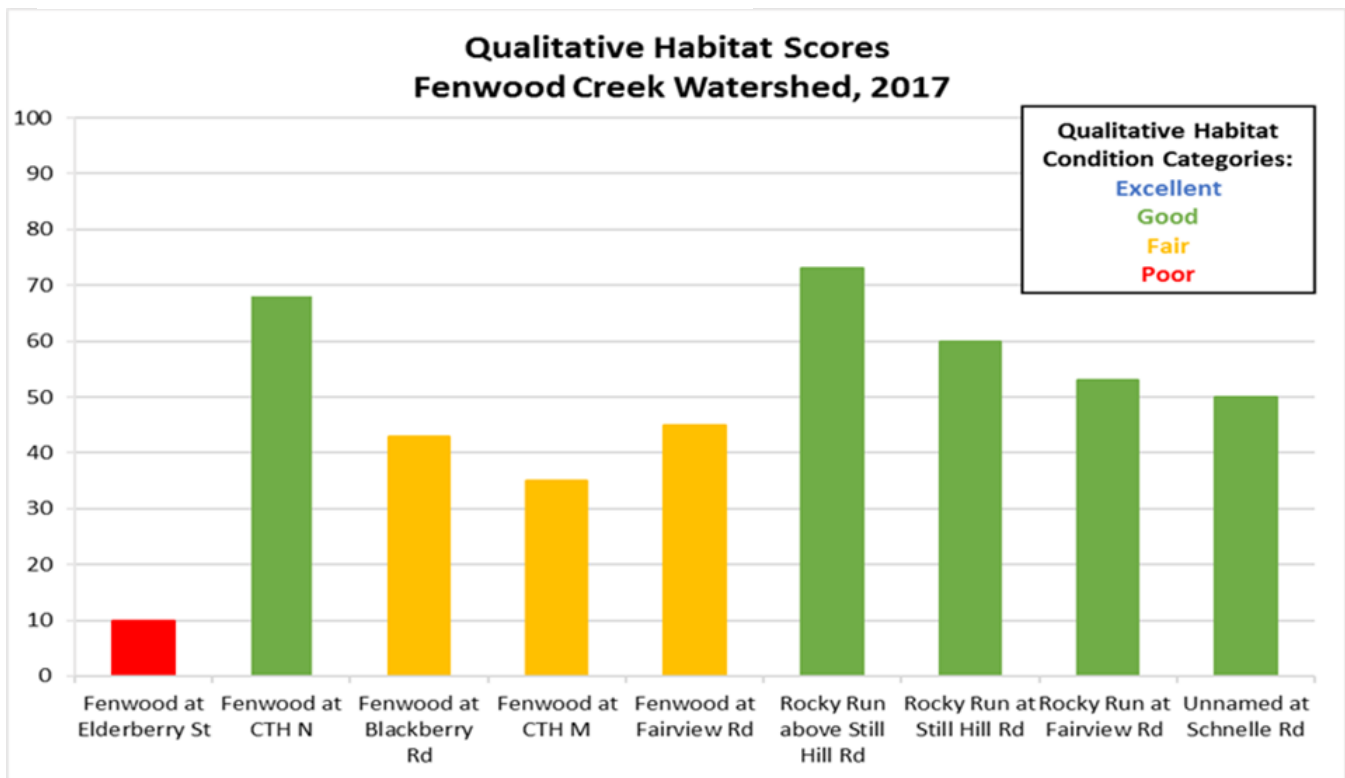


Table 3. Qualitative habitat scores in Fenwood Creek HUC 12, 2017

Stream Name, Site Location	Qualitative Habitat Score	Condition Category
Fenwood at Elderberry St	10	Poor
Fenwood at CTH N	68	Good
Fenwood at Blackberry Rd	43	Fair
Fenwood at CTH M	35	Fair
Fenwood at Fairview Rd	45	Fair
Rocky Run above Still Hill Rd	73	Good
Rocky Run at Still Hill Rd	60	Good
Rocky Run at Fairview Rd	53	Good
Unnamed at Schnelle Rd	50	Good

Table 4. Total Phosphorus in Fenwood Creek HUC 12, 2017

Stream Name, Site Location	Total Phosphorus (mg/L)
Fenwood at Elderberry St	0.183
Fenwood at CTH N	0.175
Fenwood at Blackberry Rd	0.245 (median)
Fenwood at CTH M	0.271
Fenwood at Fairview Rd	0.141 (median)
Fenwood at HWY 153	0.104 (median)
Unnamed at Schnelle Rd	0.067
Rocky Run above Still Hill Rd	0.0897
Rocky Run at Still Hill Rd	0.105
Rocky Run at Fairview Rd	0.0604 (median)

Figure 11: Fenwood Creek, Total Phosphorus Concentrations

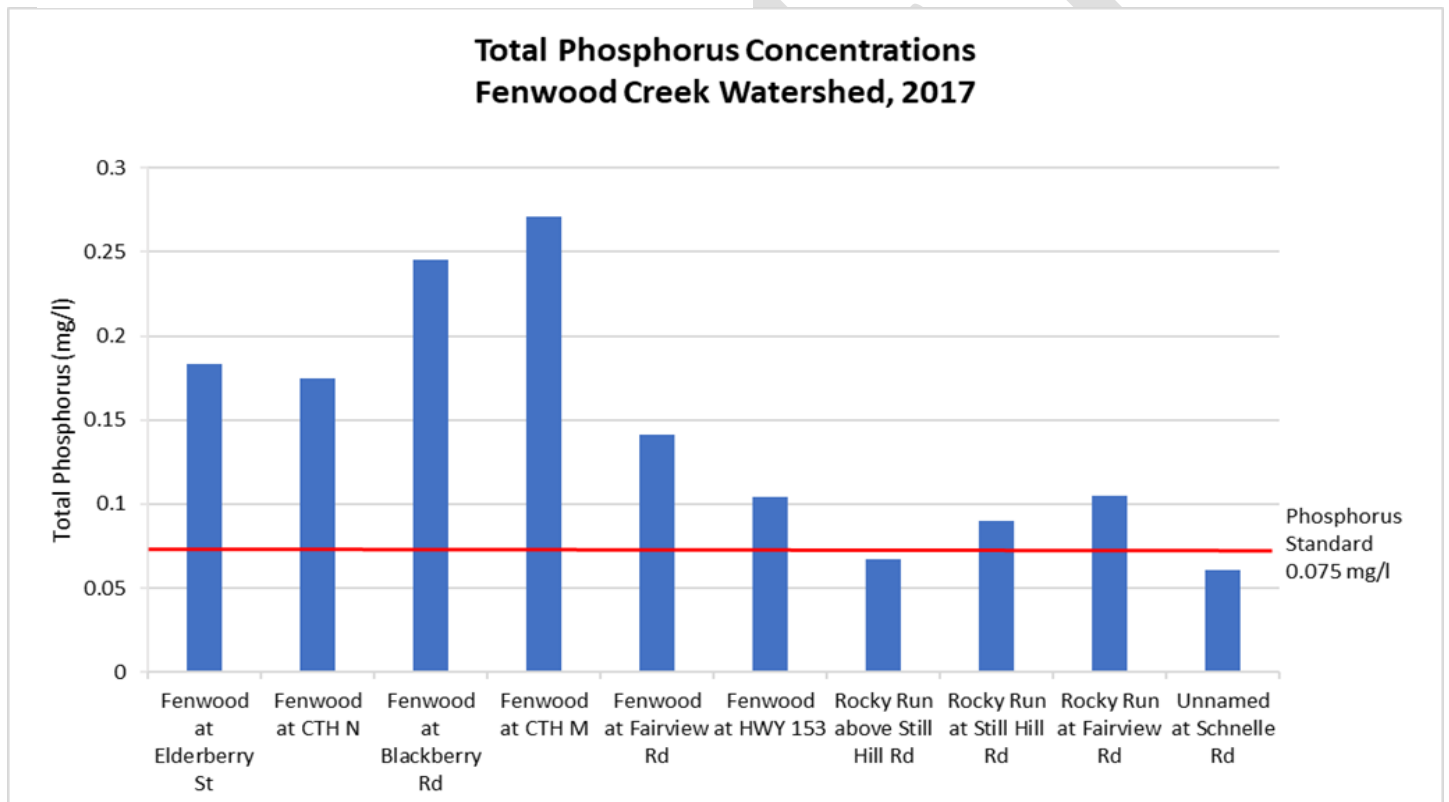


Table 5. Fish IBI Scores and Condition in the Fenwood Creek HUC 12, 2016

Stream Name and Site Location	F-IBI	Condition Category
Fenwood at Elderberry St	100	Good
Fenwood at CTH N	100	Good
Fenwood at Blackberry Rd	100	Good
Fenwood at CTH M	90	Excellent
Fenwood at Fairview Rd	100	Excellent
Rocky Run above Still Hill Rd	100	Good
Rocky Run at Still Hill Rd	100	Good
Rocky Run at Fairview Rd	100	Excellent
Unnamed at Schnelle Rd	70	Good

Figure 12: Fenwood Creek Watershed, Fish IBI Values

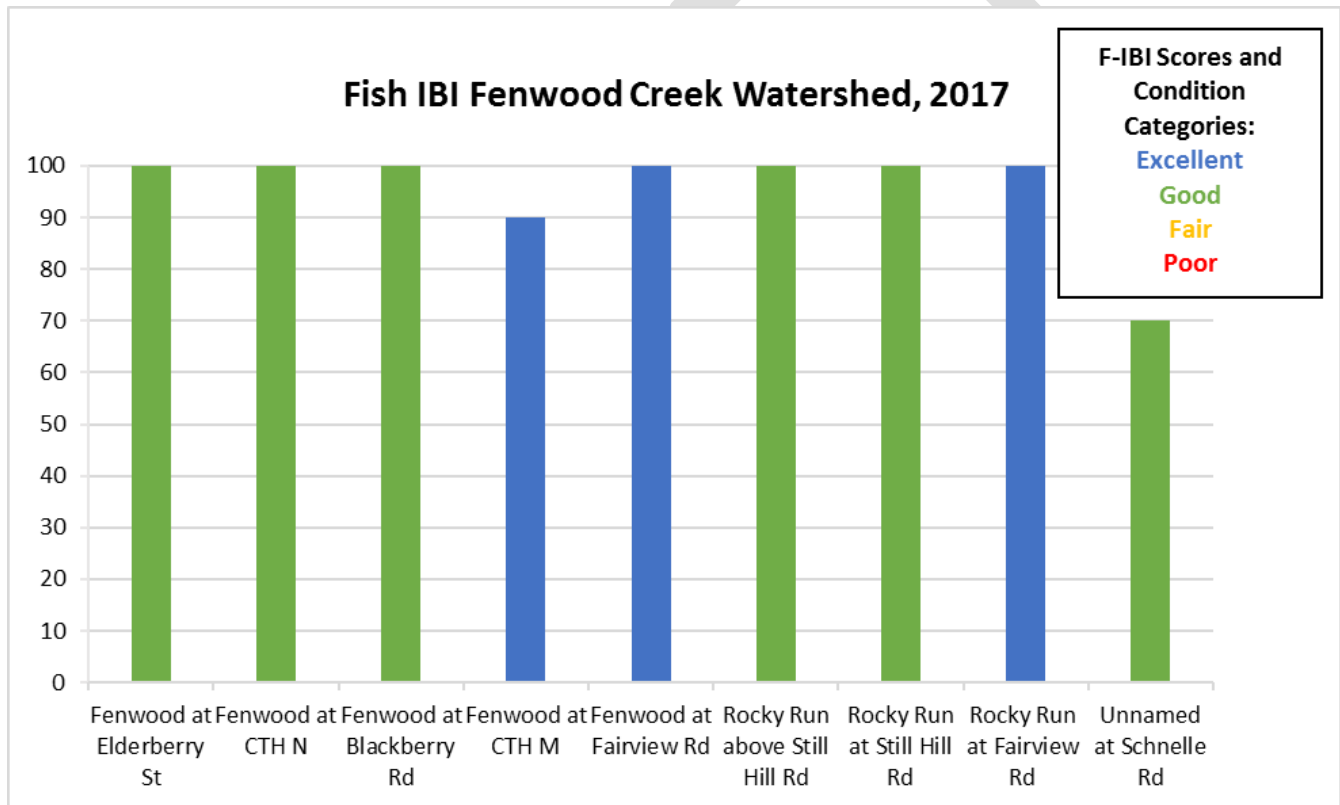


Table 6. Quantity of fish collected at each site during electrofishing survey

Species	Tolerance	Fenwood at Elderberry St	Fenwood at CTH N	Fenwood at Blackberry Rd	Fenwood at CTH M	Fenwood at Fairview Rd	Rocky Run above Still Hill Rd	Rocky Run at Still Hill Rd	Rocky Run at Fairview Dr	Unnamed at Schnelle Rd
Bigmouth Shiner	Intermediate		1		47				1	
Black Bullhead	Tolerant								2	
Blackside Darter	Intermediate				4	5		3	20	
Bluegill	Intermediate					5				
Bluntnose Minnow	Tolerant			5	10	4			1	
Brook Stickleback	Tolerant	116	50	8	53		1	9	6	4
Burbot	Intermediate								2	
Central Mudminnow	Tolerant	54	5	51	15			4	4	1
Common Shiner	Intermediate	8	8	8	105	73			74	
Creek Chub	Tolerant	20	4	37	183	33	29	122	110	18
Fantail Darter	Intermediate	1	1	7	6	10	24	43	3	5
Fathead Minnow	Tolerant	1								
Green Sunfish	Tolerant			44	6	12	6	18	43	5
Hornyhead Chub	Intermediate					8				
Iowa Darter	Intolerant			1				26		
Johnny Darter	Intermediate	14	60	60	161	23	9	89	21	11
Largemouth Bass	Intermediate					1				
Logperch	Intermediate				17	14	1	9	47	
Northern Hog Sucker	Intolerant					4				
Northern Redbelly Dace	Intermediate	15	6							
Rainbow Darter	Intolerant		1	18	74	33	1		116	8
Redbelly Dace	Intermediate			18						
Redside Dace	Intolerant						5	9	15	
Shorthead Redhorse	Intermediate					2				
Southern Redbelly Dace	Intermediate				84	8	12	22	34	
Stonerollers	Intermediate				3	66	1		12	
Western Blacknose Dace	Tolerant		7	5	99	14	46	116	79	17
White Sucker	Tolerant		9	23	211	21	18	29	96	2
Yellow Perch	Intermediate			3	1				2	

Appendix C: Watershed Fish and Aquatic Life Use Attainment

Table 7. Water Quality Standards Attainment in the Fenwood Creek Watershed

WATER ID	Waterbody Name	WBIC	Local Waterbody Name	Start Mile	End Mile	Current Use	Attainable Use	Supporting Attainable Use / Impaired Waters	Designated Use	Supporting Designated Use	Assessment	Data Quality	DNR Category	MAP

Interpreting the table:

Current Use – current condition of water based on monitoring data.

Attainable Use – “ecological potential” of water based on water type, natural community, lack of human-induced disturbances.

Supporting Use – decision on whether the water’s current condition is supporting its designated use under “water quality standards”.

Designated Use – the water’s classified use under NR102, Wisconsin Water Quality Standards, for Fish and Aquatic Life.

Assessment – field indicates what type of data or information supports the decisions in the table (current, attainable, and supporting attainable).

Data Quality – Specific data areas used for the decision (see below)

P –Physical

B – Biological

C – Chemistry

H – Habitat

PA – Pathogen

Range 1-4 (1 – lowest level, 4 most sophisticated data collection)

DNR Category Is water meeting or not meeting standards

Category 2: Water meets at least 1 WQ standard,

Category 3: Insufficient data,

Category 4A: Water is impaired, TMDL in progress,

Category 5A: Water is impaired, TMDL required.

Category 5P: Water that has total phosphorus levels that exceed the State water quality standard but which currently do not exhibit biological impairments.