2.5 Impairments and Critical Areas

As shown throughout Chapter 2, there are various pollutants, also known as impairments, that reduce the water quality of the Watershed, and this presents challenges to meeting the designated and desired uses.

Analysis of existing data indicates that the Watershed has areas of medium-quality and low-quality waters that require mitigation of existing impairments. This section summarizes current impairments in the watershed and identifies the sources and causes of those impairments. There are both general impairments which occur across the Watershed and there are also specific impairments that are occurring in particular locations and tied directly to TMDLs.

2.5.1 General Impairments

The authors, with assistance from the Advisory Committee have compiled and updated the information necessary to identify and understand these impairments and their sources and causes. This list of impairments (Table 2.9) comes from synthesis and inference of the results presented in this chapter. It is not meant to be comprehensive of all possible impairments to aquatic systems, but those of concern to this Watershed.

*Table 2.9. Impairments, Sources and Causes in the Watershed. Order of impairments within and between categories does not imply magnitude of impact*

| **Impairment 1: Nutrient Loading** | |
| --- | --- |
| **Sources** | **Causes** |
| 1. NPDES permitted facilities | Nutrients in effluent |
| 2. Fertilizers from residential, commercial, and golf courses | Lack of buffers  Nutrient control ordinances lacking teeth or too permissive  Lack of nutrient management plans  Overuse/improper application of fertilizers |
| 3. Excessive runoff from developed areas | Lack of BMPs at existing development areas  Impervious surfaces  Poor storm drain maintenance |
| 4. Legacy nutrients in lake / impoundment sediment | Sediment deposition  Resuspension during storm events  Dissolution during summer stratification |
| 5. Illicit discharges | Aging sanitary sewer infrastructure  Inadequate inspection/detection and repair due to cost |
| 6. Pet and wildlife waste | Wildlife in storm drains  Improper disposal of pet waste  Artificial ponds and mowed grass increases habitat for waterfowl, wildlife |
| 7. Agricultural runoff | Lack of nutrient management plans  Lack of BMPs (upland and riparian buffers)  Exposed soils |
| 8. Loss of ecosystem services that attenuate polluted runoff | Conversion of natural areas (natural green infrastructure) to agriculture, housing, transportation, commercial, manufacturing, etc. and “gray,” built infrastructure |

| **Impairment 2: Altered Hydrology** | |
| --- | --- |
| **Sources** | **Causes** |
| 1. Loss of riparian vegetation | Conversion of riparian woodlands, wetlands, grasslands, and flood plains to agriculture and development. |
| 2. Runoff from developed areas | Lack of BMPs at existing development areas  Impervious surfaces  Removal of woodland/forest, wetlands, and other pervious areas |
| 3. Runoff from construction sites, new development | Removal of woodland/forest, wetlands, and other pervious areas  Decentralized development increasing imperviousness  Lack of resources for enforcement/inspection  Site exemptions  Lack of education on alternatives |
| 4. Engineered drains and streams | Loss of connection between stream and floodplain from channelization  Loss of storage and infiltration capacity  Removal of riparian buffer |
| 5. Impoundment of streams | Dam construction |

| **Impairment 3: Sedimentation, Soil Erosion** | |
| --- | --- |
| **Sources** | **Causes** |
| 1. Loss of native vegetation and soils | Conversion of natural area and ecologically developed soil system to agriculture and development. |
| 2. Eroding lakeshores, stream banks, and channels | Flashy flows  Channelization  Drain maintenance  Eroding crossing embankments  Clear cutting/lack of riparian buffers  Removal of woody debris in shallows of lakes  Wave action from wind and boats |
| 3. Construction sites | Clear cutting/lack of riparian buffers  Lack of resources for enforcement/inspection  Lack of soil erosion BMPs and BMP education  Insufficient penalties for noncompliance with  ordinances  Exposed soils  Site exemptions |
| 4. Developed areas | Lack of BMPs at existing development areas  Impervious surfaces  Clearcutting/lack of riparian buffers |
| 5. Roads | Poorly designed/maintained road stream crossings  Poor road maintenance |
| 6. Sediments in impoundments | Legacy sedimentation, settling, then resuspension  Ineffective maintenance of dams |
| 7. Agricultural field runoff | Lack of BMPs (upland and riparian buffers)  Exposed soils |

| **Impairment 4: Pathogens** | |
| --- | --- |
| **Sources** | **Causes** |
| 1. Illicit Discharges | Aging development sanitary sewer infrastructure |
| 4. Pet and wildlife waste | Wildlife in storm drains  Improper disposal of pet waste (runoff from paved areas)  Ponds and mowed grass increase habitat for waterfowl, wildlife |
| 5. Livestock waste from agricultural operations | Lack of BMPs |

| **Impairment 5: Salts, Organic Compounds and Heavy Metals** | |
| --- | --- |
| **Sources** | **Causes** |
| 1. Legacy pollution | PCBs in numerous water bodies (Table 1.3)  PFOS from industrial facilities; fire-fighting foam;  Illegal dumping |
| 2. Developed areas | Lack of stormwater BMPs  PAH pollution from coal tar driveway sealants  Pharmaceuticals/Endocrine Disruptors in the water  Waste incineration (atmospheric deposition)  Illegal dumping  Illicit connections |
| 3. Roads | Auto emissions  Lack of BMPs during road deicing  Poor road maintenance |
| 4. NPDES permitted facilities | Inadequate inspection  Lack of BMPs (upland and riparian buffers) |
| 5. Turfgrass chemicals from residential, commercial lawns | Improper lawn care  Illegal disposal |
| 6. Agricultural runoff | Lack of BMPS (upland, riparian buffers) |

|  |  |
| --- | --- |
| **Impairment 6: High Water Temperature** | |
| **Sources** | **Causes** |
| 1. Loss of upland and riparian native vegetation and soils | Conversion of natural areas and soils to development and agriculture |
| 2. Directly connected impervious areas | Heated stormwater from urban areas  Lack of groundwater recharge |
| 3. Eroded soil areas | Soil erosion from channel and upland |
| 4. Solar heating | Lack of vegetated canopy in riparian zone  Impounded waters |

|  |  |
| --- | --- |
| **Impairment 7: Debris/Litter** | |
| **Sources** | **Causes** |
| 1. Roadways, parks, urban areas, residential areas | Illegal littering/dumping  Unsecured garbage containers and vehicles Inadequate refuse containers |

2.5.2 Specific Impairments: Critical Areas

In order to establish an effective plan for addressing the key threats and impairments in the watershed, it is helpful to determine which areas in the watershed are contributing the most to its impairment. These “Critical Areas” contribute a disproportionately large amount of pollutants of concern to the identified water quality problems.

The first step in identifying critical areas is to examine the TMDL coverage of impaired waters detailed in Table 1.2, followed by other problems areas that have been identified through HRWC’s analysis of the current conditions.

2.5.2.1 Phosphorus Critical Areas

In December of 1993, a 12-month phosphorus loading analysis was initiated by EGLE to investigate the water quality of the Middle Huron. The analysis showed that Ford and Belleville lakes were impaired as they failed to meet water quality standards due to phosphorus enrichment, which contributed to nuisance algae blooms. Based on water quality sampling and accepted mathematical models, a phosphorus TMDL of 50 µg/L at Michigan Avenue and 30 µg/L in Belleville Lake was established for the months of April to September. This TMDL was originally approved by the U.S. EPA in 2000 and then updated in 2004 and 2010. It was completely revised and approved by EPA in 2019 (Appendix D). This revised version ramped the phosphorus concentration target down to 30 µg/L in Ford Lake, while keeping the Belleville Lake target at 30 µg/L. It also extended the total load from six months to 12 months, covering the entire year.

According to EGLE, meeting the goals of the TMDL should result in the attainment of water quality standards for Ford and Belleville Lakes, in addition to meeting the requirements of Water Quality Standard R 323.1060(2) which states “nutrients shall be limited to the extent necessary to prevent stimulation of growths of aquatic rooted, attached, suspended, and floating plants, fungi, or bacteria which are or may become injurious to the designated uses of the waters of the state.”

The TMDL estimates that the annual total phosphorus load to Ford Lake is 76,620 lbs/year. This estimate is based on point source reporting, and a land use model. The TMDL states that EGLE monitoring data shows a significant decline in phosphorus concentrations at river monitoring sites that is also consistent with a 20% decline in phosphorus concentrations observed by HRWC and an 11-23% decline observed by Dr. John Lehman. An estimated 31% of the EGLE-estimated phosphorus load was derived from direct point sources, 12% was from stormwater (MS4) sources, mostly within other sections of the watershed, and the remainder (57%) was from nonpoint sources. Most of the load contributed from this watershed comes from these nonpoint sources. According to the EGLE model, agriculture makes up 44% of the nonpoint sources. Of the three middle Huron watersheds, the upper watershed (Section 1) has the largest agricultural area and the greatest percent of cover.

HRWC assessed monitoring data collected since 2003 to estimate loading from tributary drainages at multiple times since the original TMDL was developed. Most recently, HRWC worked with Dr. Tim Maguire to develop landscape-adjusted, April-September seasonal loading estimates for multiple drainages in the Middle Huron watershed using monitoring data from HRWC’s Chemistry and Flow Monitoring Program. Across the most recent five years (2014-2018), total phosphorus loads ranged from 6,149 to 34,410 lbs per season with an average of 18,692 lbs/season. This 6-month mean translates to an estimate of 37,384 lbs for a complete year. This represents a 53% reduction in phosphorus loading from the estimate in the original TMDL.

Despite this decline in loading to Ford Lake, neither Ford nor Belleville Lake is showing any trend in lake phosphorus concentrations, based on periodic lake monitoring by EGLE. Because of this, the revised TMDL set new loading goals. EGLE used two lake models to estimate that each lake would need to reach a total phosphorus concentration of 30 µg/l to reach a healthy aquatic trophic status. Maintaining current trends of load reductions, and increasing reductions with activities recommended in Chapter 4 of this plan may eventually reduce phosphorus concentrations over the very long term (one or multiple decades).

The revised TMDL sets annual and daily load targets for Ford Lake and Belleville Lake (Table 2.10). The Belleville Lake targets rely primarily on load reductions from Ford Lake upstream, internal lake management, and stormwater MS4 reductions.

*Table 2.10 Ford Lake TMDL Loading and Target Load Goals*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **EGLE Current Load Estimate (lbs/yr)** | **TMDL Goal (lbs/yr)** | **Reduction (%)** | **TMDL Goal (lbs/day)** |
| **Nonpoint Load Allocations** |  |  |  |  |
| Huron River Upstream | 19,000 | 15,000 | 21% | 41.1 |
| Urban | 3,000 | 800 | 73% | 2.2 |
| Agriculture | 19,000 | 7,000 | 63% | 19.2 |
| Other | 500 | 500 | 0% | 1.4 |
| Internal Load | 2,000 | 480 | 76% | 1.3 |
| Precipitation, Deposition | 130 | 130 | 0% | 0.4 |
| **LA Total** | **43,630** | **23,910** | **45%** | **65.5** |
| **Point Waste Load Allocations** |  |  |  |  |
| **WWTPs** |  |  |  |  |
| Ann Arbor | 22,000 | 8,980 | 59% | 24.6 |
| Chelsea | 600 | 560 | 7% | 1.5 |
| Dexter | 270 | 180 | 33% | 0.5 |
| Loch Alpine | 510 | 95 | 81% | 0.3 |
| Thornton Farms | 200 | 45 | 78% | 0.1 |
| **Other** |  |  |  |  |
| Chrysler-Chelsea Proving | 40 | 40 | 0% | 0.1 |
| Sweepster | 100 | 100 | 0% | 0.3 |
| Thetford/Norcold | 40 | 40 | 0% | 0.1 |
| UM Power Plant | 20 | 20 | 0% | 0.1 |
| Ann Arbor Drinking Water Plant | 30 | 30 | 0% | 0.1 |
| Point WLA Total | 23,810 | 10,090 | 58% | 27 |
| **Aggregate Stormwater MS4s** | 9,180 | 2,500 | 73% | 7 |
| **WLA Total** | 32,990 | 12,590 | 62% | 34 |
|  |  |  |  |  |
| Margin of Safety | NA | Implicit (0) |  | 0 |
| **Total Load** | 76,620 | 36,500 | 52% | 100 |

The TMDL target goal requires that the entire Middle Huron watershed reduce phosphorus loading by 52% from the EGLE loading estimate. This load from upstream sources has certainly been reduced, based on EGLE and HRWC monitoring. However, since lake concentrations have not changed significantly, it is necessary to continue to reduce loading from upstream sources. Since the lake concentrations are very slow to change, it is likely that it will require decades of low loading, in addition to active lake management, to reduce in-lake phosphorus concentrations.

*Creekshed Breakdown*

In an effort to determine critical areas for reducing phosphorus inputs, HRWC continues to monitor the watershed and estimate loading and changes in loading from tributary creeksheds and subsections of the Middle Huron watershed. Table 2.11 presents two sets of estimates of total phosphorus loading. The first estimates are based on four years of early monitoring program data and were produced using USGS P-load software. The second set were produced by a landscape-integrated GIS model that incorporated stream discharge and TP concentrations collected across the entire Huron River watershed for the most recent five years through 2018. Both are established in the table as mass-balance models. Certain caveats for the 2014-2018 model should be considered. The estimate for the river at N. Territorial Road is likely overestimated due to a lack of sufficient data upstream.

*Table 2.11. Estimates of Total Phosphorus Loading*

|  |  |  |  |
| --- | --- | --- | --- |
| **Location** | **TP Mean Daily Load Est. (2003-2006)** | **TP Mean Daily Load Est. (2014-18)** | **Difference (%)** |
| Huron @ N. Territorial (upstream, incoming water effects) | 38.34 | 59.15 | 35.2% |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

In summary, while phosphorus loading into Ford and Belleville Lakes has decreased by 29% since sampling began in 2003, the TP Mean Daily Load estimates are showing that inputs have only increased substantially from both the incoming waters that are outside of this plan, and more interestingly, from Mill Creek. Mill Creek contributes by far the greatest phosphorus load to Ford and Belleville Lakes with a 38% increase since 2006 according to the modeling.

The BANCs analysis (Bank Assessment for Non-point source Consequences of Sediment, Appendix G) gets at these critical phosphorus areas in another way; by assessing the amount of sediment eroding into the creek. Figure 2.16 shows the highest erosive reaches in the Watershed.

2.5.2.2 Bacteria Impairments

The latest TMDL for the Watershed is Michigan’s statewide TMDL for bacteria (Appendix F), which was approved by the U.S. EPA on July 29, 2019, and there was an addendum released in 2022.[[1]](#endnote-2) The data show that both Snidecar Drain and the Huron River in AUID 040900050403 (Figure 1.2, Table 1.2) exceeded the 30-Day Standard and are non-attaining for full body contact. Snidecar Drain is also impaired for partial body contact. No implementation plan has yet been developed by affected stakeholders.

To remove the reaches from the impaired waters list, it will need to meet the water quality standard for pathogens. For the TMDL, the standard organism count of 130 per 100 milliliters (ml) as a 30-day geometric mean between May 1 to October 31 is used.

Van Buren Township Park on Belleville Lake has been monitored consistently for *E. coli* since 2005. Between 2005 and 2018, the public park beach has been closed due to high bacteria levels 13 times, for a total of 111 days. According to current data available by EGLE’s BeachGuard database, the most recent closure on September 5th, 2018 lasted 26 days, the longest closure since July of 2008.[[2]](#endnote-3) On September 4th, *E. coli* counts at Van Buren Township Park Beach were 481 *E. coli* per 100mL of water, exceeding the maximum state WQS of 300 *E. coli* / 100mL.

A study of what could be done at Van Buren Township Park to improve *E. Coli* conditions would be valuable and is recommended.

2.5.2.3 Fish Consumption Advisory on the Huron River: Perflurooctane Sulfonate (PFOS) Impairment

The Huron River from North Wixom Road in Milford to I-275 near New Boston currently fails to meet the Fish Consumption designated use in the 2022 EGLE Integrated Report, including the Huron River section contained in the Watershed of this Management Plan. According to the Integrated Report, “A water body is considered to not support the fish consumption designated use if either the MDHHS has issued a site-specific fish consumption advisory for that water body or ambient water column concentrations exceed WQS (water quality standard).” In August 2018, EGLE reported high levels of polyfluoroalkyl substances (PFOS, a family of synthetic chemicals) were found in dangerous concentrations in the tissues of fish from Kent Lake. Further testing revealed high levels in numerous places in the Huron and the Michigan Department of Health and Human Services issued a “Do Not Eat Fish” advisory for the length of the Huron River as noted previously. Groundwater and surface water testing was conducted.

In 2019, surface water samples collected by EGLE from Willow Run Creek indicated elevates levels of numerous PFAS compounds, including PFOS (92 ppt), PFOA (6 ppt), and other now-regulated chemicals. Numerous other PFAS compounds that are unregulated but possibly toxic have been detected. Currently, Willow Run is one of the highest sources of PFAS to the main stem of the Huron River by concentration. The RACER Willow Run is listed as an MPART PFAS site. Remediation activities are currently managed through the RACER Trust. Since 1980, the Site has been regulated as a facility under the Resource Conservation and Recovery Act (RCRA). The area of greatest concentration is not open to the public and is not a major direct contact concern.

EGLE’s work on PFAS in the Huron River Watershed and the entire state is ongoing and rapidly changing. Up to date information can most reliably be found on the Michigan PFAS Action Response Team website, https://www.michigan.gov/pfasresponse/.

Legacy pollution issues are complicated and expensive. Ongoing operations that release PFOS to the environment can be fixed, such as the first high source of PFOS found in the Huron Watershed from an industrial facility in Wixom, which was able to drastically reduce their input. Yet contaminated groundwater poses a high challenge for cleanup and it is not clear when PFOS levels in the Huron will fall enough for the “Do Not Eat” fish advisory to be lifted. This could be an issue that persists for decades to come. In any case, in terms of needed next steps, further water monitoring is needed to discover new sources of PFOS and to expand testing of PFOS in fish fillets to better understand how the bioaccumulation in fish population changes over time.

1. Michigan Department of Environment, Great Lakes, and Energy. 2022. Statewide E. coli Total Maximum Daily Load (TMDL) Addendum – 2022. <https://www.michigan.gov/egle/-/media/Project/Websites/egle/Documents/Programs/WRD/SWAS/TMDL-Ecoli/statewide-ecoli-tmdl-2022-addendum.pdf>. Accessed August 2023 [↑](#endnote-ref-2)
2. Michigan Department of Environment, Great Lakes, and Energy Beach Guard Database. <https://www.egle.state.mi.us/beach/BeachDetail.aspx?BeachID=291>. Accessed April 2023.

   [↑](#endnote-ref-3)