4. Designated Uses and Water Quality Summary

4.1. Designated and Desired Uses

The Michigan Environmental Protection Act (P.A. 451 of 1994, Part 31, Chapter 1) identifies eight[8] designated uses for Michigan's waterways:

- Agriculture – Surface water must be of the quality that it can be used for livestock watering, irrigation and spraying crops.
- Industrial water supply – Surface waters must be clean enough to be used for commercial or industrial applications or non-contact food processing.
- Public water supply at the point of intake – After conventional treatment, surface waters must provide a source of water that is safe for human consumption, food processing, and cooking.
- Navigation – Surface waters must be of the quality sufficient for passage of boat traffic.
- Warmwater fishery – Water bodies designated as warmwater fisheries should be able to sustain populations of fish species such as bass, pike, walleye and panfish.
- Habitat for other indigenous aquatic life and wildlife – Surface waters must support fish, other aquatic life and wildlife that use the water for any stage of their life cycle. This designated use also includes the protection of fish for human consumption.
- Partial body contact recreation – Residents of the state should be able to use surface waters for activities that involve direct contact with the water but does not involve the immersion of the head. Such partial body contact activities include fishing, wading, hunting and dry boating.
- Total body contact recreation between May 1 and October 31 – The waters of the state should allow for activities that involve complete submersion of the head such as swimming. Activities that have considerable risk of ingesting the water are also part of this designated use.

Designated uses are recognized uses of water established by state and federal water quality programs. In Michigan, the goal is to have all waters of the state meet all designated uses (Elaine Brown, Amy Peterson, Ruth Kline-Robach, Karol Smith, Lois Wolfson, 2000). Table 4.1 lists designated uses and their status for the Huron Creek watershed. If a designated use is not being met according to the State of Michigan's water quality standards, that use is impaired. Or more specifically, when the impairment is confirmed by state water quality testing, those portions of the water body are said to be in "non-attainment." An annually published listing of the bodies of water and stream reaches in the state of Michigan that are in non-attainment can be found in the MDEQ's Section 303(d) Report.

[8] A ninth designated use, "coldwater fishery," can also apply to certain water bodies that meet this designation. (R323.1100 of Part 4, Part 31 of PA 451.)

The MDEQ uses a rotating watershed cycle for surface water quality monitoring where each of the 58 major watersheds in the state is scheduled for monitoring at least once every five years (MDEQ Water Bureau, 2004). Huron Creek was monitored by MDEQ (as a portion of the Portage Lake watershed) in 2001 and 2006 at two locations between Sharon Avenue and Wal-Mart. In both monitoring events, concentrations of copper were in exceedance of the state aquatic life protection values (MDEQ Water Bureau, December 2007). Therefore, this portion of Huron Creek was identified as being in non-attainment of the water quality standards for aquatic life and wildlife, and was listed in the Michigan 2008 Sections 303(d), 305(b), and 314 Integrated Report (http://www.michigan.gov/documents/deq/wb-swas-ir-final-2008report_230026_7.pdf) as "Not Supporting Other Indigenous Aquatic Life and Wildlife" due to copper levels. A total maximum daily load (TMDL) is scheduled to be developed in 2013. In addition to the high copper levels, water quality testing during 2007-8 has indicated (see Section 5.1) that ammonia levels have exceeded water quality standards for aquatic life and wildlife.

Two other designated uses, Partial Body Contact Recreation and Total Body Contact Recreation are designated as impaired, due to concerns associated with contact with human wastes. As described in Section 2.2.1, homes in the Dakota Heights area are not connected to a municipal sewer system and rely on septic systems for treatment and disposal of household wastewater. These septic systems are a potential concern for the Huron Creek watershed because many of these septic systems are old, their condition is unknown, and, in several cases, the septic systems are within 100 feet of the creek. Use for partial body contact recreation occurs downstream of the Dakota Heights area, where the creek flows through the Kestner Waterfront Park. Furthermore, the creek empties into the Portage Canal approximately 700 feet east of a public swimming beach.

Table 4.1 Huron Creek Watershed Designated Uses

Designated Use	Status	Justification
Agriculture	Not threatened or impaired	- Currently, approximately 3% of the land use in the watershed is for agriculture. Land use for this purpose is not anticipated to increase in coming years. - Existing agricultural areas utilize rain for watering.
Industrial Water Supply	Not threatened or impaired	The average quantity of flow[1] is not sufficient to support industrial use.
Public Water Supply	Not threatened or impaired	- Huron Creek is not currently used as a public source of drinking water. - The average quantity of flow is not sufficient to support use as a public (or private) water supply, even if drinking water quality standards were attained. - Residents in the watershed use municipal systems or domestic groundwater wells for water supplies
Navigation	Not threatened or impaired	The average quantity of flow, size and depth are not sufficient to provide for floatation of a vessel, including canoes or kayaks.

Designated Use	Status	Justification
Warmwater Fishery	Not threatened or impaired	It is unknown if Huron Creek historically sustained fish populations. Currently no fish populations are sustained and it is not a goal to establish them.
Aquatic Life and Wildlife Habitat	Impaired	Per MDEQ report dated December 2007 and recent water quality testing[2].
Partial Body Contact Recreation	Threatened	-Dakota Heights septic systems -Use for partial body contact recreation occurs where the creek flows through the Houghton waterfront park.
Total Body Contact Recreation	Threatened	-Dakota Heights septic systems The creek empties into the Portage Canal approximately 700 feet east of a public swimming beach.
Coldwater Fishery	Not threatened or impaired	It is unknown if Huron Creek historically sustained fish populations. Currently no fish populations are sustained and it is not a goal to establish them.

1. The phrase "average quantity of flow" refers to typical flow rates in the creek based on ideal or "natural" conditions.
2. Water quality sampling results are provided in Section 5.1.

Desired uses of Huron Creek and its watershed have been determined by the Huron Creek watershed advisory committee. They are stated by the committee's vision statement:

> *"We see Huron Creek and its watershed as valuable to the residents of Houghton County in maintaining a sense of place compatible with the area's character. In particular, we desire a watershed and stream that:*
>
> 1. *Is visually attractive and includes a stream-side vegetation buffer that is visible on the landscape;*
> 2. *Provides habitat for a healthy ecosystem within an urban setting;*
> 3. *Provides opportunities for human interactions with the stream ecosystem, with the Houghton Waterfront park and the former Huron Lake being prime sites for interaction;*
> 4. *Has water quality that is consistent with the previous three goals;*
> 5. *Provides opportunities for community education (including schools, business owners, and the public in general) on the importance of healthy watersheds and in the historical uses of this particular watershed, with interpretive signs at sites of interaction being one possible form of education."*

4.2. Pollutants, Sources and Causes

Table 4.2 provides a summary of applicable designated uses and the pollutants of concern related to these uses. Also listed are potential sources of pollutants and their causes. This table provides the framework for the protection of water quality through the watershed management plan. Table 4.3 gives water quality standards for the parameters of concern in the watershed.

Table 4.2 Huron Creek Watershed Pollutants, Sources and Causes

Impaired/ Threatened Use[1]	Pollutant or Concern[2]	Sources of Pollutants	Causes of Pollutants
Aquatic Life & Wildlife Habitat (I)	Metals (Copper, k; Iron, s)	Stamp sands (k)	Historical mining activities (k)
		Landfill leachate (k)	Unlined and/or Uncapped Landfills (k)
	Sediments (k)	Bank erosion (k)	Flashy storm flows/impervious surfaces (k) Unvegetated banks (k) Steep banks (s)
		Construction (k)	Lack of erosion control/stabilization (k) Improper erosion control/installation (k) Improper construction techniques (s)
		Stormwater (k)	Sand spreading in winter (k) Lack of retention/detention, infiltration (k)
	"Flashy" Flow (k)	Impervious surfaces (k)	Lack of infiltration areas (k) Lack of stormwater retention/detention (k)
	Nutrients (s)	Old Houghton Landfill (s)	Materials disposed of in landfill (s)
		Septic systems (s)	High density/age of systems (k) Improper design/cesspools (k)
		Lack of Vegetative Buffer (k)	Lack of stream setback (k) Construction & disturbance (k)
		Stormwater (s)	Residential and commercial fertilizers (s) Lack of infiltration areas & buffers (s)
	Invasive Species (k)	"Source" vegetation seed/plant dispersal (k)	Disturbance/lack of establishment by native vegetation (k)
Partial Body Contact Recreation (T)	Bacteria (s)	Septic systems (s)	High density/age of systems (s) Improper design/cesspools (s)
Total Body Contact Recreation (T)	Bacteria (s)	Septic systems (s)	High density/age of systems (s) Improper design/cesspools (s)

[1] (I) = Impaired, (T) = Threatened.

[2] (k) = Known, (s) = Suspected.

Pollutants, sources and causes are designated as “known” if:

- Multiple water quality sampling events have documented the pollutant to be in exceedance of a state or federal standard.

- The pollutant, source or cause is readily observable under normal conditions and has been observed and/or documented.
- There is likely only one cause for the pollutant or source (i.e. historical mining activities created stamp sand piles that have been documented to leach metals such as copper and iron).

Pollutants, sources and causes are designated as "suspected" if:

- The pollutant has been documented to be in exceedance of a state or federal standard at least once.
- The pollutant, source or cause is not easily observable (i.e. nutrients entering a stream) but is likely, given conditions in the watershed (i.e. presence of commercial and residential lawn areas, and algal growth in creek).
- The pollutant, source or cause has potential to inhibit the designated use through aesthetic or physical means. An example of this would be iron flocculent reducing aesthetic value (appearance) and likely inhibiting periphyton growth due to flocculent settling and coating of the creek substrate.

Table 4.3 Water Quality Standards Relevant to Concerns in Huron Creek Watershed

Water Quality Parameter	Designated Use	Standard
Copper	FAV[1] for aquatic life protection	0.027 mg/L
	FCV[2] for aquatic life protection	0.009 mg/L
Ammonia-N	FAV[1] for aquatic life protection	0.32 mg/L
	FCV[2] for aquatic life protection	0.029 mg/L
Fecal Coliform	Total body contact recreation	130 E. coli/100 mL[3]
	Total body contact recreation	300 E. coli/100 mL[4]
	Partial body contact recreation	1,000 E. coli/100 mL[5]

[1] Final Acute Value
[2] Final Chronic Value
[3] based on 30-day geometric mean
[4] geometric mean of three or more samples taken during the same sampling event
[5] geometric mean of 3 or more samples

4.2.1. Metals: Copper and Iron

The two metals that are of concern in Huron Creek are copper and iron. Copper has been documented multiple times to be in exceedance of the Michigan Rule 57 aquatic life protection (see Table 4.3 for standards) through MDEQ and MTU water quality sampling[9] (MDEQ Water Bureau, December 2007). Because historical copper mining activities have occurred in the watershed resulting in deposited piles of stamp sand and mine rock, it lends itself as the most likely cause. Stamp sands have been shown to

[9] MTU water quality monitoring results are provided in Section 6.1.

leach various metals such as copper, silver and mercury (W. Charles Kerfoot, S.L. Harting, Ronald Rossman, John A. Robbins, Unknown).

Iron in Huron Creek is most noticeable just upstream of Sharon Avenue where plumes of yellow-orange flocculent-looking material are present year-round. Figure 4.1 shows photos from this location. This material is often referred to as "yellow-boy." Yellow boy is typically associated with elevated levels of iron that stimulate the growth of iron-loving bacteria, thereby creating a slime-like plume. As the plumes are located next to the site of the former Houghton landfill, it appears that the landfill is the source of iron for the bacteria. Yellow-orange seepage has been observed coming from the side slopes of the landfill, which is pictured in Figure 4.1. The landfill opened in the 1970's and was used for only a few years before it closed (Greer, 2007).

Although there is no Michigan aquatic life protection water quality standard for iron, the presence of plumes such as these affect the appearance and aesthetic value of the creek. The plumes also create a slime that covers the creek bottom substrate, thereby eliminating habitat for periphyton (organisms that live on the substrate) and altering the creek ecosystem. Iron concentrations in the creek and the landfill are discussed further in Chapter 5 and Chapter 7, respectively.

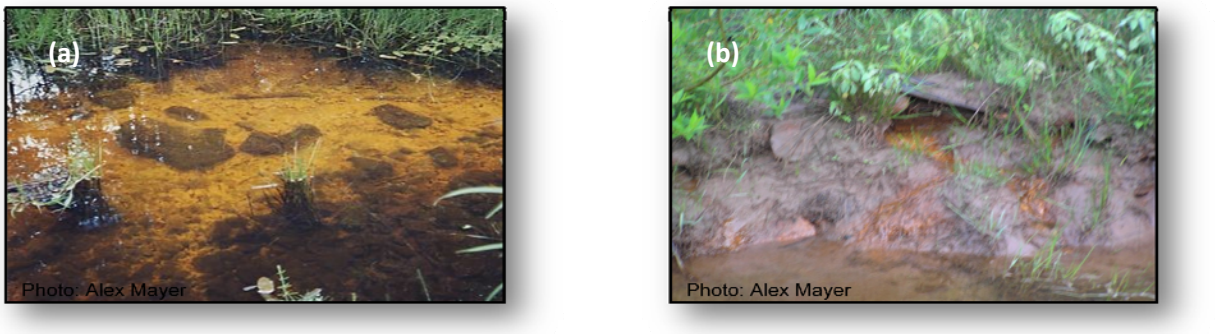

Figure 4.1 (a) Iron bacteria plume in Huron Creek and (b) leachate seepage from nearby bank

4.2.2. Sediments

Sediments are also a visible problem in Huron Creek. Bed deposition of sediment is visible at many locations, and is caused by a variety of factors.

In some cases, erosion has been caused by storm events washing away sandy bank areas that are not well vegetated. Sudden increases in the creek's water level from storm events can cause incision of the creek (creation of steep banks) which in turn can cause slumping or failing of the banks. This type of erosion is evident in Huron Creek's "tributary," Shopping Cart Creek which runs between the Copper Country Mall and the Wal-Mart storm ponds, as well as in the Houghton Waterfront Park. This is not to say that some sediment transport in a stream is abnormal. It is the excess amounts of sediment that are of concern. The amount of sediment coming down the creek is large enough to warrant the city of Houghton physically removing it from the creek bed each year in the waterfront park area.

Construction near the creek can also contribute to sediment deposition. Lack of proper erosion control can allow stormwater to wash sediments directly into the creek, or into ditches that reach the creek. Or, if the erosion control is not properly installed (for example putting stakes on the wrong side of a silt fence), it can become essentially useless. In addition to proper erosion control, construction sites need to ensure the site is properly stabilized after construction is completed. This generally includes establishment of some type of vegetation to stabilize and hold soils in place. The portion of the creek located adjacent to the landfill (just north of Sharon Avenue) is an example of a construction area that is in need of additional stabilization. Other sources of sediment in the watershed include sand from road spreading in the winter, and stormwater runoff from parking lots and other impervious areas (including the non road spreading season). Because of the relatively high amount of snow that the Houghton area receives each winter, a relatively large amount of sand is spread on roads and parking lots each year for automobile safety.

Deposition of sediment can result in covering of the creek bed substrate (rocks, gravel, woody debris) that results in loss of habitat, cover and reproduction areas for macro-invertebrates and other aquatic life such as amphibians and small fish. Sediment that remains suspended in the water also reduces visibility for predators of aquatic life. These factors can result in a total collapse of the aquatic ecosystem.

4.2.3. "Flashy" Flow

The term "flashy" flow refers to when a creek or river's water level increases then decreases more rapidly during a storm than it would under non-developed conditions. The reason why flows change more rapidly under developed conditions is because impervious surfaces (streets, roofs, parking lots) and storm sewers route rainwater to the creek much more rapidly than if the watershed was undeveloped (mostly vegetation). The peak flow rate (highest rate of flow during a storm) also tends to increase in developed watersheds. This and the rapid change of flow rate can contribute to additional erosion of stream banks. This is generally prevented through the use of stormwater management practices such as stormwater detention or retention basins and infiltration areas (bioswales, infiltration basins, rain gardens). Figure 4.2 demonstrates the differences between pre-development and post-development storm flows.

4.2.4. Nutrients

The term "nutrients" generally includes ammonia, nitrates and nitrites and phosphorus. These compounds can harm water quality by causing excessive algal growth. This excessive growth blocks sunlight for other aquatic plants leading to reduced dissolved oxygen levels, and can result in the deposition of foul-smelling algae mats when water levels are low. Algae mats can reduce aesthetic value and appearance, and prevent recreational use. Algae blooms have been most often noticed in Huron Creek in the Kestner waterfront park in the mid- to late summer months. Of the class compounds described as nutrients, only ammonia has a water quality concentration standard in Michigan (see Table 4.3 for standards).

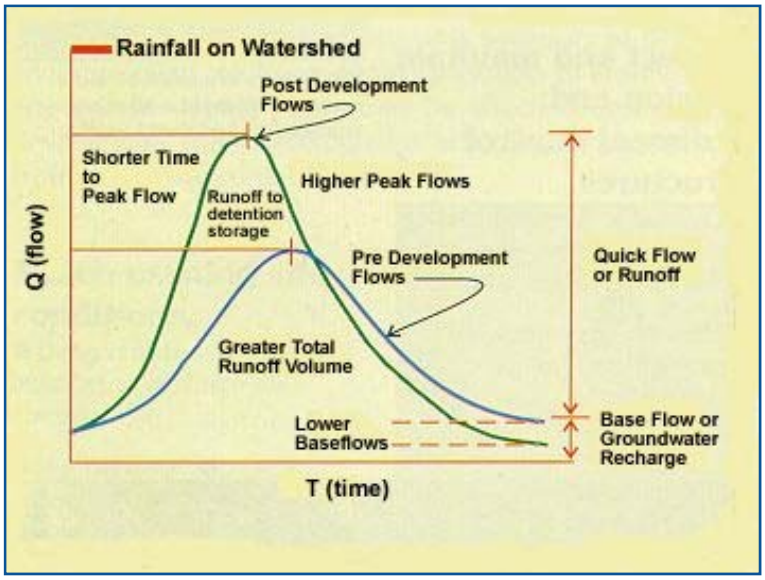

Figure 4.2 Pre- and Post-development Hydrograph Comparison[10]

Nutrients can have many sources within a watershed, especially those that have urban and residential areas. One of the most common sources is fertilizers. Fertilizers that are inappropriately applied can travel through stormwater runoff to nearby storm drains and water bodies. Examples of inappropriate application would include applying too much, applying at the wrong time of year, or too frequently. Nutrients from fertilizers can be prevented from reaching the creek by maintaining vegetative buffers or through use of stormwater infiltration areas. These areas infiltrate stormwater into the soil where natural microbial "treatment" can occur that removes the nutrients before the stormwater can reach the creek.

Aging or improperly constructed septic systems could also potentially contribute to the presence of nutrients in Huron Creek. There are residential areas in the watershed that are not connected to a municipal sewer and therefore use septic systems for sewage treatment. As mentioned in Chapter 2, the Dakota Heights neighborhood in Portage Township is suspected to have extremely old and/or inappropriately constructed septic systems. Human sewage is generally high in nutrients such as ammonia and nitrates, and depending on hydraulic interactions between the groundwater and Huron Creek, there is a potential for sewage to reach the creek (Bingham, MacInnes, & Tarbutton, 2008).

4.2.5. Invasive Species

Invasive plant species have been identified in the Huron Creek re-route mitigation area near Wal-Mart. These species include white sweet clover (*Melilotus alba*), yellow sweet clover (*Melilotus officinalis*) and spotted knapweed (*Centurea biebersteinii*), and are relatively dense in this area. Other invasive plant species have been identified within the watershed but are sparsely located compared to the creek re-route area. Invasive aquatic species (such as Eurasian milfoil) have not yet been identified in the Huron Creek watershed.

[10] http://www.env.gov.bc.ca/wat/wq/nps/NPS_Pollution/Stormwater_Runoff/SW_Main.htm

Invasive plant species generally have special physical adaptations that allow them to out-compete native species. This is detrimental to whatever habitat the species is invading (including riparian areas) as it results in the elimination of the mix of vegetation (and therefore the type of habitat) that is required by native insects, birds and other wildlife. Some invasive species have the ability to alter soil characteristics so that other plants can never re-establish. Control of these species would help prevent their spread to other portions of the watershed where other native habitats might be affected or eliminated.

4.2.6. Bacteria

Coliform bacteria such as *E. coli* exist in human sewage. These bacteria can potentially reach Huron Creek by means of leaking from aging or improperly constructed septic systems within the watershed. Coliforms are a pathogen (a biological agent that can cause illness) and therefore are of concern for any water body that is used for partial or full body contact recreation (Tarbutton, 2008). Concentrations of the bacteria were found to be in exceedance of the Michigan coliform Human Body Contact standard (see Table 4.3 for standards) at one location[11] along the creek in August 2007. However, the August 2007 sampling event is the only one out of six recent sampling events to indicate a quantifiable concentration of coliforms. Also, concentrations of all parameters measured were higher than normal during that sampling event due to an extremely low amount of flow in Huron Creek (see water quality monitoring data in Section 5.1).

4.3. Water Quality and Other Watershed Goals

The watershed management plan goals described below are based on restoration and protection of the designated uses stated in Section 4.2. They are also based on achievement of the desired watershed uses as outlined by the Huron Creek watershed advisory committee's mission statement. These goals present a conceptual picture of the anticipated future state of the watershed. These goals can be modified as necessary to meet the changing needs and desires of the watershed stakeholders.

Table 4.4 Water Quality and Other Watershed Goals for Huron Creek

Designated or Desired Use	Goals
Aquatic Life & Wildlife Habitat (Impaired)	Improve and protect aquatic and terrestrial ecosystems by: - Reducing copper and iron, sediment and nutrient levels - Reducing the "flashiness" of flow through stormwater management techniques - Protecting and improving the vegetative buffer - Controlling the establishment of invasive species
Partial Body Contact Recreation (Threatened)	Protect recreational use by reducing copper and iron, bacteria and nutrient concentrations in the creek.
Total Body Contact Recreation (Threatened)	Same goal as partial body contact.
Have a visually attractive creek corridor that is visible on the landscape	Protect and improve the vegetative buffer

[11] The location of exceedance was the "Frog Pool" (FP) sampling location (see Figure 6.1).

Designated or Desired Use	Goals
Provide habitat for a healthy ecosystem in an urban setting	Same goals as Aquatic Life & Wildlife Habitat
Provide opportunities for interaction with the creek	- Improve and restore the creek areas in the Houghton waterfront park and maintain access to creek - Encourage use of the Wal-Mart wetland mitigation area for educational and outreach purposes
Ensure water quality that is consistent with visual attractiveness, ecosystem health and safe human interaction	Same goals as Aquatic Life & Wildlife Habitat
Provide opportunities for community education	Install interpretive signs on watershed health and historical heritage