Phosphorus Reduction Implementation Plan for Brighton Lake

October 2011 — September 2016

For the purpose of achieving the Total Maximum Daily Load (TMDL) and removing the nutrient impairments of Brighton Lake

Developed by and for the Livingston Watershed Advisory Group.

October 2011

Acknowledgements

This document was produced as part of a TMDL Implementation Planning project that was funded in part through the Michigan Storm Water Program by the United States Environmental Protection Agency under assistance agreement C600E848-01 to the Livingston County Drain Commissioner for the *TMDL Implementation Planning in the Huron Chain of Lakes Watersheds* project. The contents of the document do not necessarily reflect the views and policies of the EPA, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

The authors wish to recognize the commitment of the many individuals, organizations, and communities whose resources, research, and talents have contributed to this Livingston Watershed Advisory Group initiative:

The Boards of Trustees of Brighton, Genoa, Hartland and Oceola Townships
The City Council of Brighton
The Board of Commissioners of Livingston County

Bill Creal, Michigan Department of Environmental Quality
Christe Alwin, Michigan Department of Environmental Quality
Brian Jonckheere, Livingston County Drain Commissioner
Matt Bolang, Livingston County Office of the Drain Commissioner and Livingston County Health Department
Kim Hiller, Livingston County Road Commission
Matt Schindewolf, City of Brighton

Dave Blackmar, City of Brighton
Dan Bishop, Brighton Township
Kelly Matthews, Brighton Township
Laura Rubin, Huron River Watershed Council
Pam Labadie, Huron River Watershed Council
Mark Gawronski, for the Huron River Watershed Council

Primary authors: Ric Lawson, Debi Weiker and Jonathan Doubek
Huron River Watershed Council

TABLE OF CONTENTS

1. BACKGROUND

The drainage area which provides water to Brighton Lake is located in the upper Huron River Watershed and is designated the Brighton Lake Subwatershed (Figure 1). This 23 square mile (14,730 acres) area extends from the headwaters of South Ore Creek downstream to the Brighton Lake impoundment within the southwestern portion of the City of Brighton (Figure 1). The subwatershed lies within Livingston County and comprises all or portions of Hartland, Oceola, Genoa, Brighton, and Hamburg Townships and the City of Brighton.

The Brighton Lake catchment is also part of a subsection of the Huron River Watershed known as the Huron Chain of Lakes, which comprises much of the Huron River Watershed in Livingston County.

This plan seeks to directly address the Total Maximum Daily Load (TMDL) established for Brighton Lake. Two watershed management plans have been drafted that address aspects of the TMDL: The *Brighton Lake Subwatershed Management Plan*, which was approved by

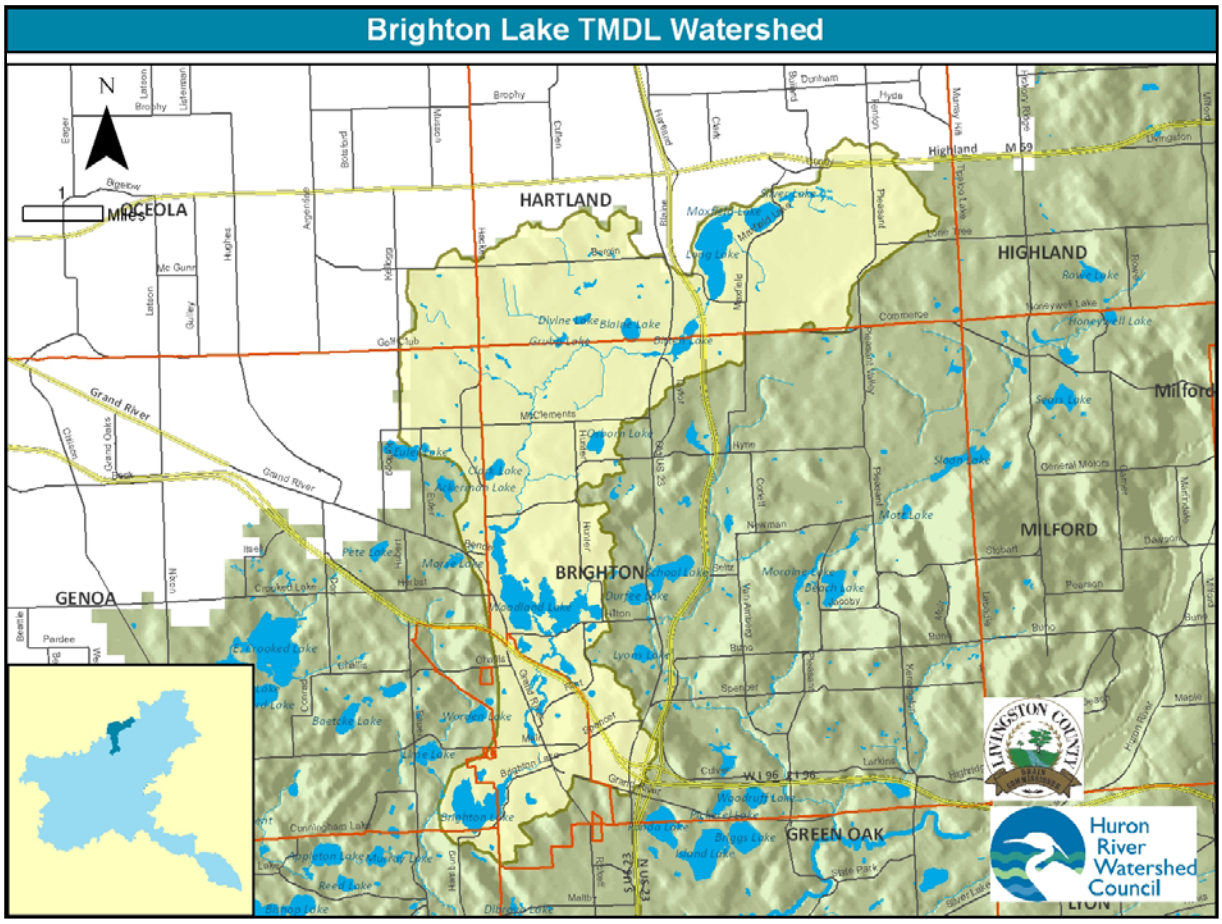


Figure 1. Watershed draining to the Brighton Lake TMDL showing its position within the Huron River Watershed.

MDEQ in 2002 and the *Huron Chain of Lakes Watershed Management Plan*, which was approved in 2007. This plan seeks to update information from those plans related to phosphorus management without duplicating the effort those plans represent. Readers should look to those plans for comprehensive watershed assessment, analysis and planning. This plan provides a summary of progress to date toward phosphorus reduction and presents a plan of action for achieving the TMDL.

Problem Definition

Based on water quality studies performed on Brighton Lake in the 1970s and 1990s, MDEQ determined that although relocation of the Brighton Wastewater Treatment Plant's discharge to downstream of the lake had improved water quality from 1970s levels, increased nonpoint source loading was threatening to negate these improvements. According to the MDEQ studies, nonpoint source phosphorus loads currently account for the entire total phosphorus load to Brighton Lake (Alexander, 1999a).

In response to these findings, MDEQ listed Brighton Lake as *threatened* on the State's 1998 303(d) list of impaired waters requiring Total Maximum Daily Load (TMDL) establishment due to excess nonpoint source phosphorus loading from upstream sources. A TMDL is the maximum amount of a particular pollutant a waterbody can assimilate without violating numerical and/or narrative water quality standards.

The threatened status was assigned to Brighton Lake because of the increased developmental pressures in the subwatershed that threaten to increase the contribution of nonpoint source pollution, resulting in an expected violation of the State's narrative water quality standards. As a result of extensive field studies, MDEQ established a TMDL of 30 micrograms per liter (μg/L) phosphorus concentration to assure satisfactory water quality for Brighton Lake (Alexander, 1999b).

In 2002, a watershed management plan titled the *Brighton Lake Subwatershed Management Plan* was developed by a community workgroup to address the phosphorus impairments. That plan included an extensive assessment of water quality conditions, potential pollutant sources and potential solutions. This current plan seeks to update information on potential phosphorus impairments, summarize progress accomplished to date, and establish new priorities for achieving the TMDL goals.

It should be noted that the threatened status assigned to Brighton Lake was removed in 2008 by the MDEQ in their impaired waters report[1].

The Nature and Sources of Phosphorus[1]

[1] *Text adapted from the website of the Michigan Department of Environmental Quality, Water Bureau, Surface Water, NPDES Permits. May 2006.*

Phosphorus (P) is an essential nutrient for all life forms, and is the eleventh-most abundant mineral in the earth's crust. In surface waters, phosphorus is usually present as phosphate (PO_4-P). Phosphorus is needed for plant growth and is required for many metabolic reactions in plants and animals. Organic phosphorus is a part of living plants and animals, their by-products, and their remains.

Generally, phosphorus is the limiting nutrient in freshwater aquatic systems. That is, if all phosphorus is used, plant growth will cease, no matter how much nitrogen is available. Phosphorus typically functions as the "growth-limiting" factor because it is usually present in very low concentrations. The natural scarcity of phosphorus can be explained by its attraction to organic matter and soil particles. Any unattached or "free" phosphorus is quickly removed from the aquatic system by algae and larger aquatic plants.

Excessive concentrations of phosphorus can quickly cause extensive growth of aquatic plants and algal blooms. Several detrimental consequences may result. Surfeit algae and plant growth can lead to depletion of the oxygen that is dissolved in the water. Water can hold only a limited supply of dissolved oxygen (DO), and it comes from only two sources — diffusion from the atmosphere and as a byproduct of photosynthesis. Excessive growth leads to depletion of DO because of nighttime respiration by living algae and plants and because of the bacterial decomposition of dead algae/plant material. Extensive bacterial decomposition of detritus can create “dead-zones”, or areas of anaerobic conditions, especially near the bottom of the water column. Depletion of DO adversely affects many animal populations and can cause fish kills due to a dearth of this metabolic necessity.

In addition to low DO problems, excessive plant growth can increase the pH of the water because plants and algae remove dissolved carbon dioxide from the water during photosynthesis, thus altering the carbonic acid-carbonate balance. Because plants and algae provide food and habitat to animals, the relative abundance shifts of the different species affects the composition of the animal community. Drinking water supplies may experience taste and odor problems, and the costs of treating drinking water can increase.

Finally, high nutrient concentrations interfere with recreation and aesthetic enjoyment of water resources by causing reduced water clarity, unpleasant swimming conditions, pungent odors, blooms of toxic and nontoxic organisms, interference with boating, and "polluted appearances." The economic implications are significant for many communities. Phosphorus may accumulate in sediment, both in deposited clays and silts and deposited organic matter. In such cases, phosphorus and other nutrients may be released from the sediment in the future. This feedback loop results in internal phosphorus loading that may have originally been deposited in lake bottoms over a period of many years. Subsequently, a reduction in phosphorus input from the nearby streams and larger watershed may not be effective in reducing algal blooms for a number of years.

Phosphorus enters surface waters from both point and nonpoint sources. The primary point source of phosphorus is sewage treatment plants. A normal adult excretes 1.3 - 1.5 g of phosphorus per day. Additional phosphorus originates from the use of industrial products, such as toothpaste, detergents, pharmaceuticals, and food-treating compounds. Primary

treatment of waste removes only 10% of the phosphorus in the waste stream; secondary treatment removes only 30%. Tertiary treatment is required to remove additional phosphorus from the water. The amount of additional phosphorus that can be removed varies with the success of the treatment technologies used. Available technologies include biological removal and chemical precipitation. The cost of subsequent levels of treatment generally increases dramatically as incremental increases in phosphorus removal get smaller.

Nonpoint sources of phosphorus include both natural and human sources. Natural sources include: 1) phosphate deposits and phosphate-rich rocks which release phosphorus during weathering, erosion, and leaching, and 2) sediments in lakes and reservoirs which release phosphorus during seasonal overturns. The primary human nonpoint sources of phosphorus include runoff from: 1) land areas being mined for phosphate deposits, 2) agricultural areas, and 3) urban/residential areas. Because phosphorus has a strong affinity for soil, generally little dissolved phosphorus will be transported in runoff. Instead, the eroded sediments from mining and agricultural areas carry the adsorbed phosphorus to the water body. However, if excessive fertilizer application or other phosphorus amendment is added, dissolved phosphorus can runoff in large amounts. Additional sources are the overboard discharge of phosphorus-containing sewage by boats, and runoff from parking lots and roadways where phosphorus in fuels and oils may wash into storm drains.

TMDL Mandate and Applicable Water Quality Goals and Regulation

Section 303(d) of the federal Clean Water Act and the U. S. Environmental Protection Agency's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop TMDLs for waterbodies that do not meet Water Quality Standards (WQS). Michigan law (R323.1100 of Part 4, Part 31 of PA 451, 1994, revised 4/2/99) mandates that all surface waters be protected for the full range of designated uses. The uses are:

- Agriculture
- Industrial water supply
- Public water supply at the point of intake
- Navigation
- Warm water fishery (or cold water fishery, where applicable)
- Other indigenous aquatic life and wildlife
- Partial body contact recreation
- Total body contact recreation between May 1 and October 31

The designated uses that were originally threatened for Brighton Lake are total body contact recreation and partial body contact recreation. Rule 100 of the Michigan WQS requires that these waterbodies be protected for total body contact recreation between May 1 and October 31.

The Clean Water Act requires that these water bodies be returned to meeting all designated uses through the TMDL development process. A TMDL quantifies the maximum amount of a pollutant a water body can accept without violating water quality standards. TMDLs are tools for achieving water quality safeguards and assessing the impact of improvements. The MDEQ is required, under Section 303(d) of the federal Clean Water Act, to determine the health of

the waters of the state. Those waters not meeting water quality standards are included in the Integrated Report. This report includes the waters that require a TMDL and sets forth a schedule for establishment. TMDL development methodology varies based on the type of pollutant causing impairment.

Rule 60 of the Michigan WQS (Part 4 of Act 451) limits phosphorus concentrations in point source discharges to 1 mg/l of total phosphorus as a monthly average. The rule states that other limits may be placed in permits when deemed necessary. The rule also requires that nutrients be limited as necessary to prevent excessive growth of aquatic plants, fungi or bacteria, which could impair designated uses of the surface water.

According to the MDEQ, phosphorus limits are placed in NPDES permits for all discharges which have the potential to contain significant quantities of phosphorus. The limit of 1 mg/l is contained in permits for discharges to surface waters which do not have substantial problems with high levels of nutrients. More stringent limits are required for discharges to surface waters which are very sensitive to nutrient inputs. Many of these surface waters are in developed areas with substantial point source and nonpoint source phosphorus inputs. In such areas, a waste load allocation may be necessary. The DEQ must determine the total amount of phosphorus (in pounds per day) which can be assimilated into the particular surface water. The DEQ then works with the dischargers to decide on appropriate phosphorus limits for each permit, without exceeding the total assimilative capacity of the surface water.

Phosphorus TMDL for Brighton Lake

In April of 1998, a 12-month phosphorus loading analysis was initiated by the MDEQ to investigate the water quality of Brighton Lake and its upstream sources. The analysis showed that Brighton Lake was threatened to fail to meet water quality standards due to phosphorus enrichment. Based on water quality sampling and accepted mathematical models, a phosphorus TMDL of 30 µg/L for Brighton Lake was established. According to MDEQ, this load should assure the attainment of water quality standards for the lake 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.”

Based on three years of scheduled monitoring and the employment of the Reckow methodology of lake trophic assessment, the TMDL estimated that the annual phosphorus load was 973 pounds/year, all of which is from nonpoint sources. Originally, the City of Brighton’s waste water treatment plant (WWTP) discharged into South Ore Creek above Brighton Lake. That outfall was subsequently moved downstream, thus removing the only point source in the Brighton Lake Watershed. MDEQ prescribed a 10% reduction (98 pounds/year) of nonpoint source phosphorus loading to the lake to meet the TMDL.

The phosphorus TMDL for Brighton Lake was approved by the USEPA in March 2000. See Appendix A for the federally approved Brighton Lake TMDL.

Water Sampling Data Summary

Additional water quality data has been collected since the original TMDL development in 1999. Brighton Lake was sampled twice per year from 2004-06 by volunteers with the Cooperative Lakes Monitoring Program – a state-sponsored program to monitor inland lakes. Spring concentrations averaged 30.3 µg/L over the three-year period, and Summer concentrations averaged 44.0 µg/L. In 2007, the Pine Creek Ridge Homeowners Association (a large development of single-family homes riparian to Brighton Lake) stopped participating in the CLMP and contracted with PLM Lake & Land Management to sample and report on the lake[2]. Their staff sampled the lake twice per year from 2007 through the current year. Their reports indicate a mean Spring concentration of 24.3 µg/L and a mean Summer concentration of 40.3 µg/L. Combining these two datasets yield a 6-year mean Spring concentration of 27.3 µg/L and a mean Summer concentration of 42.2 µg/L. Figure 2 below illustrates the sample results from both programs.

Generally, these results suggest that Brighton Lake remains below TMDL targets in the spring or early part of the recreational season, but may exceed the target during the summer. It should be noted that there is quite a bit of variability in this data, and these are samples taken at single points in time. Thus, it can be concluded that Brighton Lake periodically exceeds the target level established by the TMDL and may thus be impaired by excessive phosphorus. Anecdotally, the Pine Creek Ridge HOA reported algae blooms in the summer of 2009, which seem correlated with high phosphorus concentrations.

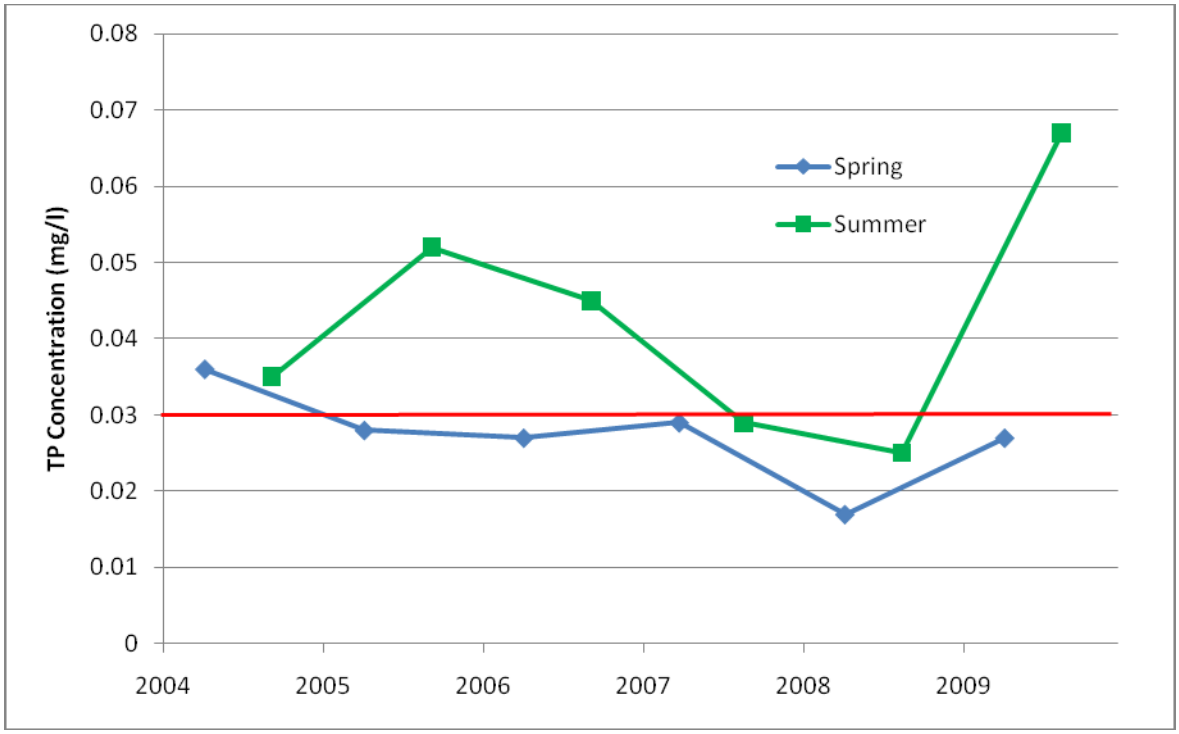


Figure 2. Total Phosphorus concentrations near the surface in Brighton Lake (deep basin) in spring and summer seasons. The red line indicates the TMDL target concentration.

In 2008, HRWC expanded their Water Quality Monitoring Program to include two sites in the Huron Chain of Lakes in Livingston County, both of which were outside of the Brighton Lake Watershed. Volunteers in that program collect samples for water quality analysis and measure stream flow at river and tributary stream sites to help characterize water quality dynamics in the Huron River Watershed. In 2010, HRWC expanded monitoring to six additional sites, including sites just upstream and downstream of Brighton Lake.

Sites are sampled twice per month between April and September. To date, results have been received for fifteen samples at each site, and two storm sample sets each, spanning from August 2010 through September 2011. Over this period, the mean total phosphorus concentration at the site on South Ore Creek just upstream of Brighton Lake was 26.7 µg/L. A site further upstream and just below the Mill Pond Dam, which collects stormwater drainage from most, but not all of the City of Brighton, averaged 25.7 µg/L over the period. The site on South Ore Creek just downstream of the Brighton Lake Dam averaged 40.7 µg/L. While the sample size at this point is small and collected over a short period of time, this data seems to indicate that phosphorus concentrations entering Brighton Lake are below the TMDL target, while concentrations in the lake and flowing out of the lake are above target levels. This further suggests that the excess phosphorus is likely originating from within the lake (lake sediments) or from direct drainage to the lake, rather than from South Ore Creek and the upstream watershed. Monitoring of temperature and dissolved oxygen across a range of depths by PLM Lake & Land Management suggests that Brighton Lake has a thermocline at 4.5 m, and dissolved oxygen levels drop to nearly zero mg/L below the thermocline. If the bottom layer of water does become anoxic, it could release phosphorus from bottom sediments.

Stream flow has been monitored above and below Brighton Lake as well. Flow estimates were measured at different water levels allowing for discharge to be estimated each time a water level is recorded. Thus far, just over one full season of flow has estimated. The mean discharge at the site upstream of Brighton Lake was 37.5 cfs. Given the range of discharge, routine sampling for TP and sampling across wet-weather (i.e. storm) events, average loading into and out of Brighton Lake was calculated. Measured at a site just upstream of the lake, the average load was estimated at 3.46 lbs/day or 1,264 lbs/year entering the lake. This level is 389 lbs/yr over the TMDL loading target of 875 lbs/yr. Further analysis is needed to include data from stormwater runoff events, better estimate stream flows from continuous discharges, and recalculate phosphorus loads. Loads should also be calculated for the site downstream of the lake. This will be added to subsequent versions of the plan after data collection and analysis is complete in September 2011.

Brighton Lake Stakeholders

The Brighton Lake Watershed lies within southeastern Livingston County and comprises portions of the municipalities Brighton, Genoa, Hamburg, Hartland, and Oceola and the City of Brighton (Figure 1). In addition, the Livingston County Drain Commissioner has jurisdiction over those tributaries (or portions thereof) designated as county drains, and Livingston County Road Commission manages drainage from county road right-of-ways. Other jurisdictions that may impact nonpoint source contributions of phosphorus and other pollutants are Brighton Area Schools, and Hartland Consolidated Schools.

Working with the guidance of statewide procedures, townships and other jurisdictions have the power to formulate land management, land use and development policy, amongst other important activities. Land and water regulation, management, and protection within the Brighton Lake Subwatershed are the responsibility of the state, county, and local governments. Private residents undertake specific unregulated actions such as yard maintenance, landscaping, and waste disposal on a daily basis.

Although state and county governments take an active role in many local policies, local governments at the city, village, and township level take a significant leadership role in land and water management by passing and enforcing safeguards that can be more protective than state laws. Working under numerous established procedures, local governments may enact ordinances to control stormwater runoff and soil erosion and sedimentation, protect sensitive habitats such as wetlands and woodlands, and establish watershed friendly development standards and lawn care and landscaping practices and so forth. Under these circumstances the local government oversees enforcement.

The stakeholders made the conscious decision to gain active involvement from the entities with more significant land ownership in the TMDL areas. This decision reflects the understanding that stakeholders with jurisdiction over minute portions of the TMDL are having little motivation to be engaged in the planning process. Many of the stakeholders meet regularly as part of the Livingston Watershed Advisory Group (WAG). All stakeholders have been invited to participate in meetings and other events pertaining to the TMDL, and programs to control phosphorus sources.

Goals for Brighton Lake

The Brighton Lake Phosphorus Management Implementation Plan sets forth a comprehensive, long-term effort to restore and protect water quality of the area with the goal of attaining the Total Maximum Daily Load for Brighton Lake. To achieve this, the plan includes efforts to reduce the most likely phosphorus sources to the lake and ensure that future activities do not add new sources.

II. Significant Progress Since TMDL Development

Twelve years have passed since the original TMDL for Brighton Lake was developed and it has been nine years since the *Brighton Lake Subwatershed Management Plan* was developed. That original plan provided several key pieces of information to provide stakeholders with direction for their efforts toward phosphorus reduction. The 2002 plan defined critical areas (priority sub-basins) for focus actions, identified probable sources and causes and developed an initial strategy to achieve water quality targets. The plan's key elements are summarized below along with a brief assessment of progress.

Assessment of the *2002 Brighton Lake Subwatershed Management Plan*

The 2002 plan divided the Brighton Lake catchment into 11 sub-basins that were used for analysis through several modeling approaches and field surveys to determine if higher phosphorus loading areas could be determined. Five of the eleven sub-basins were identified as higher priority sub-basins, or critical areas (see Figure 3). This did not significantly limit the geographical area of focus, nor describe land uses that should be the target of best management practices (BMPs).

The 2002 plan went further to identify probable pollutant sources and causes. These included:

- Nonpoint Source Runoff
    - Impervious surfaces
    - Poor land use planning
    - Lack of stormwater mitigation and runoff
- Loss of Natural Habitat
    - Lack of open space protection
- Impaired Septic Systems and Illicit Connections
- Lack of Watershed Education

Based on this, the 2002 plan prescribed a set of actions broken up into different types or targets. These included the following types of recommended actions:

- Structural stormwater BMPs
- Homeowner Structural Stormwater BMPs
- Land Use Planning and Design Standards

- Education and Awareness Campaigns
- Open Space Protection
- Septic Inspection
- Illicit Connection Detection and Elimination
- Monitoring

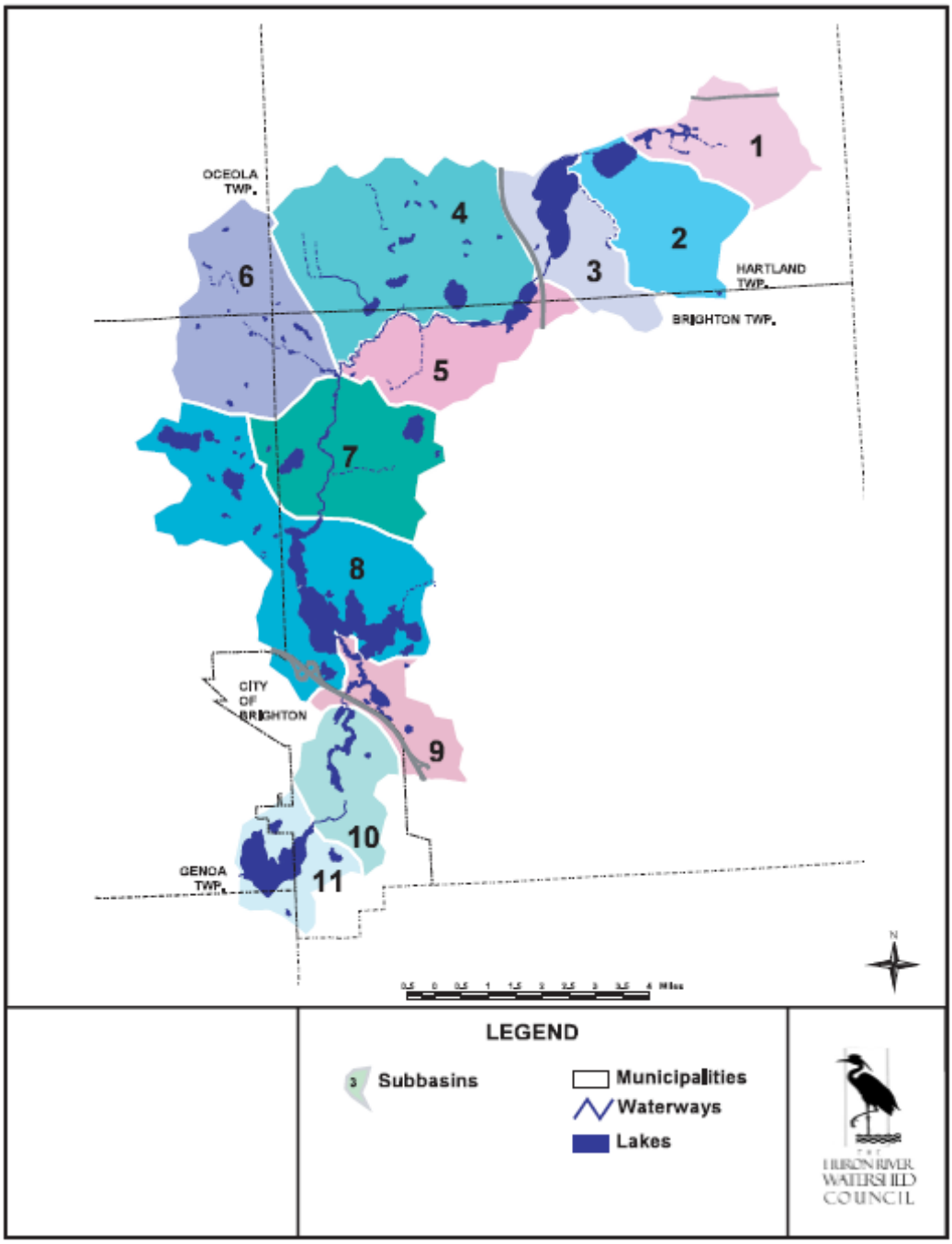


Figure 3. Priority sub-basins from the 2002 plan. 4, 7, 8, 10, and 11 were identified as priorities.

The recommended actions were general in nature and were geographically targeted to either the entire Brighton Lake catchment or the five critical area sub-basins. The plan did include a single recommended action that was site specific. It recommended streambank restoration and sediment removal along South Ore Creek from the Mill Pond to the outflow into Brighton Lake.

This original plan for Brighton Lake provided extensive background work to characterize the watershed, concerns regarding water quality, and its hydrology, population, land use, political structure and potential management practices. The plan included an appended pollutant loading model and analysis of structural BMPs. The plan concluded from this analysis that a combination of BMPs be applied as "treatment trains" where possible and retrofit applications on commercial or industrial properties would be most cost effective. The plan left the targeting of such BMPs to future efforts to be conducted by stakeholder teams.

Huron Chain of Lakes Watershed Management Plan

Following the development of the 2002 Brighton Lake plan, the Phase II stormwater program was launched and a new stakeholder group was formed to address stormwater requirements within the Watershed General Permit. The Huron Chain of Lakes Steering Committee, with guidance and assistance from HRWC, developed the *Huron Chain of Lakes Watershed Management Plan.* This plan applied to a section of the Huron River watershed downstream of Kent Lake and ending in Portage Lake. It was approved in 2006 and then revised and approved in 2007.

The Chain of Lakes plan was more general than the Brighton Lake plan and it focused on stormwater sources and management practices. It included a land use model of phosphorus and sediment loading. Using the model results, the plan concluded that the Brighton Lake catchment up to Woodland Lake was the highest priority critical area for management actions to control pollutants in runoff (see Figure 4).

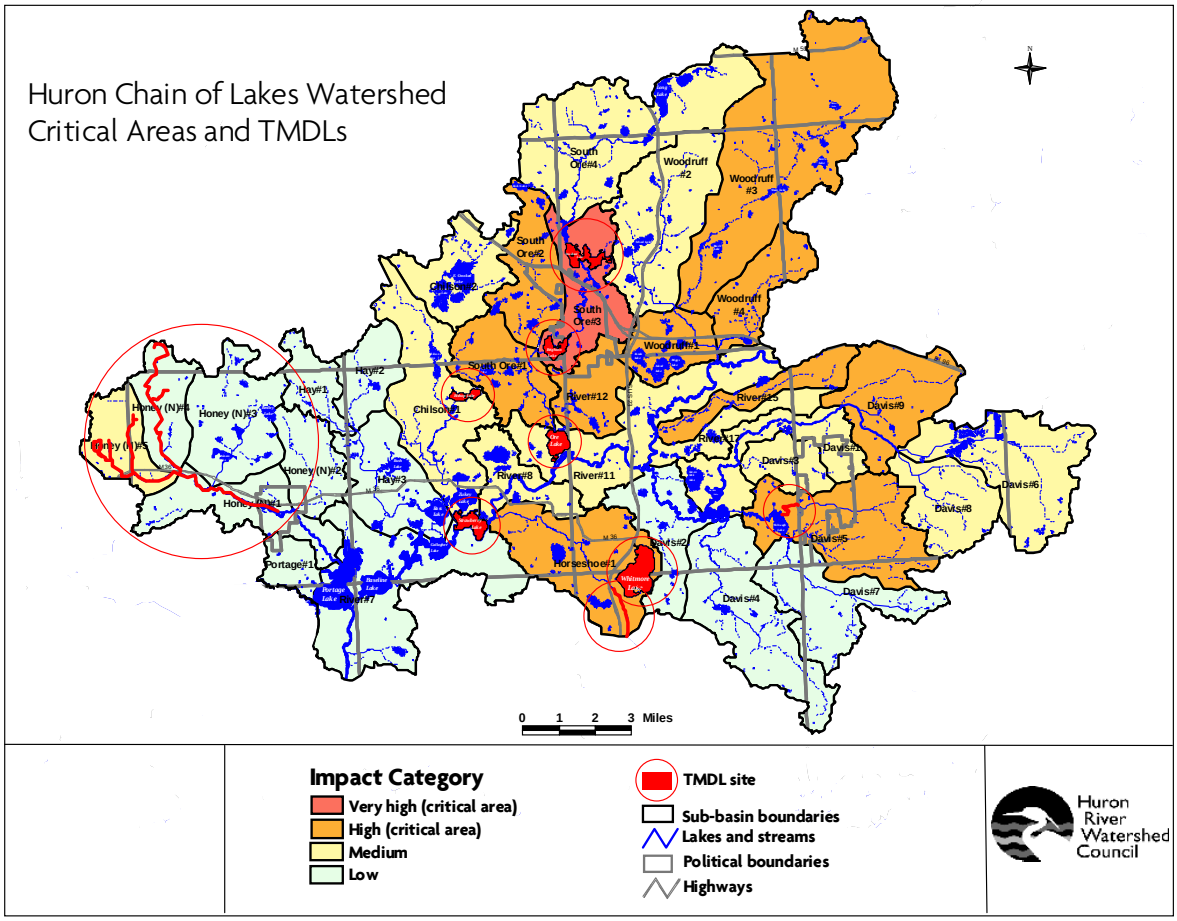
The plan included an extensive set of over 100 management activities that were categorized into eight sets:

- Managerial actions:
    - Ordinances and Policies
    - Practices
    - Studies and Inventories
    - Public Information and Education
    - Illicit Discharges Elimination
    - Coordination and Funding
- Vegetative BMPs
- Structural BMPs

Each municipality or agency that contributed to the plan committed to engaging in a set of the outlined actions. None of the recommended actions, however, were geographically specific.

Stormwater Programs

In 1995, implementation of the federal stormwater program began with Phase I being applied to large metropolitan areas. This did not include any municipalities in the Brighton area. In 2003, many municipalities and two Livingston County agencies were added to the program in Phase II, including the City of Brighton, and the townships of Brighton, Genoa, and Hartland. All agencies with municipal stormwater discharges were provided with discharge permits and required to engage in six minimum measures to reduce stormwater pollution. Many of these required activities were designed to reduce nutrient runoff and therefore helped to reduce phosphorus loading into the Brighton Lake catchment. These agencies, along with others joined together to form the Livingston Watershed Advisory Group (WAG) to work collectively to manage stormwater and improve conditions in county water resources.



In 2007, following a legal challenge, DEQ allowed many municipalities to withdraw their stormwater permit coverage. In the Brighton Lake drainage, only the county agencies, the City of Brighton and Brighton Township remain as permitted MS4s. However, some of the municipalities have continued to participate in the activities of the Livingston WAG.

Program and Project Summary

Following is a summary of significant programs and projects that have been implemented since the development of the 2002 *Brighton Lake Subwatershed Management Plan* to reduce phosphorus loading to Brighton Lake.

Stormwater Programs

Public Education

The Phase II stormwater permittees fund a Public Education Plan (PEP) that includes numerous activities to educate and inform residents and other target groups about their involvement with stormwater and how to minimize their impact on water resources. Messaging specifically targets phosphorus reduction. Partners conduct some activities individually, but also contribute to several large joint efforts that include a biannual calendar, news media ads and involvement in events.

Illicit Discharge Elimination Programs

All stormwater permittees have developed IDEP programs to inspect their stormwater system to find suspected sources of contamination, determine the ultimate sources, and eliminate any illicit connections or dumping. These programs require significant investment of time and resources, and those conducting the investigations reported few discoveries in past annual reports. However, IDEP investigations have not been completed for all parts of the stormwater system in the watershed and national and statewide evidence suggests that it remains an effective way to reduce contaminant sources.

Construction Runoff Control

All permittees have established programs for soil erosion and sediment control from new or redevelopment construction. Such developments require permits and inspections for practices to keep exposed soils on site or controlled from runoff. This has reduced a significant potential source of phosphorus.

Post-Construction Stormwater Ordinances

The City of Brighton and Brighton Township both passed post-construction stormwater ordinances that require that all new and re-development projects capture and treat the first flush of stormwater runoff and protect stream channels from erosion due to peak flow runoff. The Livingston County Drain Commissioner has established stormwater standards for

construction that municipalities within the county reference. These standards are being reviewed for potential revisions. While the ordinances do not address pre-existing developments, they will help prevent additional loading when new development occurs.

Pollution Prevention and Good Housekeeping
MS4s have all engaged in activities to educate internal staff on the state-of-the-art in pollution prevention practices and good housekeeping practices to reduce or eliminate pollution sources on their own properties and operations. Practices like spill prevention and clean-up, fertilizer reduction or elimination, vehicle maintenance and washing, have all improved since permits were originally issued, resulting in reduction in phosphorus sources.

Other Significant Programs and Projects
Beyond the required stormwater programs and projects, some partners have engaged in activities that have had a positive impact on reducing existing phosphorus sources or protecting against future sources.

City of Brighton
Street: The city regularly sweeps city streets and parking lots on a rotational basis from May through October. The sweeper is active 5 days a week during this period. Combined with sweeping by Livingston County Road Commission, street sweeping removes approximately 62 lbs of phosphorus per year.

Catch Basin Cleaning: The city also cleans out city catch basins once per week. This high frequency cleaning removes phosphorus sources from otherwise untreated road runoff. The cleanouts remove an estimated 81 lbs per year of phosphorus.

Yard and Leaf Collection: The city collects yard waste every other week from April through September and once per week in October and November. Additional leaf collection is done twice in the fall. This helps to remove residential sources of phosphorus from stormwater runoff.

Mill Pond Dredging: The city dredges the Mill Pond created by a dam on South Ore Creek. This pond accumulates sediment behind the dam before releasing flow downstream to Brighton Lake. Removing the sediment reduces the potential of its inclusion in outflow during high flow periods. Dredging also increases future sediment storage capacity.

Livingston County Road Commission
Street Sweeping: The Road Commission sweeps county roads three times a year on a rolling basis. This practice removes phosphorus sources from roadway runoff that otherwise receives little treatment.

Repair of Erosion Hot Spots: The Commission responds to concerns identified through road inspection or reported by municipalities. They prioritize road problems for repair based on a number of criteria that include the likelihood of erosion. Hot spot locations are repaired to capture and treat runoff to prevent erosion or reduce sediment from road runoff.

Livingston County Drain Commissioner

Two-stage Ditch Designs: The Commissioner and staff have identified a couple of county drains that could be redesigned to include floodplain "benches" outside of the low-flow channel. This allows for floodplain wetland development and meanders to reduce sediment transport, thereby reducing phosphorus delivery. Such channel designs have been studied and shown to be effective on a site-speicific basis. However, more research is needed to show the effectiveness of a broad application of two-stage ditches across a small watershed.

Summary of Phosphorus Loading Reduction and Current Status

HRWC and partners have collected more recent data within, upstream and downstream of Brighton Lake.

- Pine Creek Ridge HOA contracted with a company to assess Brighton Lake in April and August from 2007-09. The **mean TP concentration was 0.032 mg/l**, which is near the DEQ estimate from 10 years previous. The most recent sample, however, was 0.067, and homeowners reported algae blooms in 2009.
- Monitoring to date by HRWC[2] showed a mean concentration of 0.027 mg/l entering the lake and 0.041 mg/l leaving. The estimated phosphorus load moving into Brighton Lake is 1,264 lbs/yr, which is 389 lbs/yr over the TMDL target of 875 lbs/yr.
- Modeling using the Watershed Treatment Model (WTM), estimates an existing phosphorus load of 2,197 lbs/yr. The model further estimates that 1,182 lbs/yr of the total phosphorus load comes from stormwater. This estimate is based on vintage 2000 land use data and thus likely to be less accurate than the estimate above computed from monitoring data.

The original load estimated for the TMDL development was generated from a lake model, while the current load is based on directly measured stream data. Since the concentration in South Ore Creek upstream of Brighton Lake is less than the target concentration of 30 µg/l, and there is evidence to suggest that phosphorus loading may be emanating from internal lake

[2] Only 3 samples were collected in 2010 in August and September from the two sites bracketing Brighton Lake. 2011 data has been included through May. Additional sampling and storm event sampling will continue through September 2011.

sources (i.e. sediment), it seems that the above-estimated load reduction target is high. If internal loading is driving lake concentrations, reducing tributary loads may not have any impact on lake conditions, at least in the near term. Over time, reducing phosphorus loading could have the effect of reducing the phosphorus content of bottom sediments.

III. Current and New Programs for Phosphorus Reduction in the Brighton Lake Catchment

Measures to reduce phosphorus will include many activities that are already underway, and others that are planned and included in other management plans. Some programs and projects are required of the National Pollutant Discharge Elimination System (NPDES) municipal stormwater permittees within the watershed through Phase II of that program.

In order to meet the phosphorus reduction target for the region, the participating community partners in the Livingston WAG developed a number of different approaches, as discussed in the previous section. Many activities originally outlined in previous plans have been accomplished (see Section II) and likely resulted in significant reductions in loading to Brighton Lake, as well as lower phosphorus concentrations downstream to Ore and Strawberry Lakes, based on analysis of monitoring data (see Section II).

The earlier strategies have been updated into the 2012-2016 phosphorus reduction strategy. As discussed in Section II, the phosphorus load reduction target based on monitoring data collected through September 2011 is 389 lbs/yr. This load reduction will come primarily from continued stormwater reductions.

Table 1 is a summary of the major reduction activities to be implemented over the next five years to reduce phosphorus loading below the TMDL targets. Loading reduction estimates are based on published estimates using the Watershed Treatment Model. This list of targeted projects represents the primary strategy for reducing phosphorus inputs into Brighton Lake. Additional details on these activities, as well as other useful activities can be found in Table 2.

Table 1. Summary of the 2012-16 Phosphorus Reduction Strategy

Activity Category	P Load Reduction Estimate (lbs/yr)	Implementation Details	Cost Estimate over Five Years
Statewide fertilizer law	158	Becomes effective January 2012. Education needed.	$5,000
Construction Site Runoff Control	37	Ongoing program. Increase to regular inspection.	$250,000
Public Education Program	134	Current. Annual campaigns ongoing.	$55,000
Septic Inspection and Repair	160	Ongoing program	$50,000
Illicit Discharge Elimination	314	Program implementation underway; investigations ongoing	$139,000
Increase street sweeping and catch basin cleanouts	143	Sweeping currently occurs in City of Brighton and County roads.	$645,000
Recommended projects	29	See section below for details.	Unknown
Priority partner projects	160	Targeted for implementation 2012-16	Unknown
Totals	**1,135**		**$1.14 M +**

Thus, these activities will account for more than the needed load reduction in order to meet the reduction target for the watershed. The targeted loading reductions from these activities exceed the target for a number of reasons, all related to uncertainty. The contributors to this plan generally want to use the precautionary principle to account for uncertainty and err on the side of being overprotective. While the TMDL included excess loading up to the daily maximum that was not directly allocated (essentially a margin of safety), that margin was small. As should be clear from the loading analysis discussed in section II, loading estimates are not exact and computational methods can vary. Also, there is extensive uncertainty within the load reduction estimates, though the modelers were conservative in estimates. Further, the exact relationship between the phosphorus load entering the Brighton Lake impoundment and the phosphorus concentration in the lake itself (the ultimate target) is not clearly defined and confounded by numerous other variables. Finally, while construction and urban development

has slowed considerably in recent years, at some point it is likely to increase. Livingston County was the fastest growing in the state at the peak of development. When building increases, it is likely to put continued pressure on water resources by adding additional impervious surface and the need for substantial stormwater management.

A detailed summary of priority partner projects is included below. Following that, a complete summary of projects to reduce phosphorus pollution as planned or currently underway by the WAG partners are presented in Table 2. This table will provide a basis for partners to review progress towards meeting the TMDL for phosphorus in Brighton Lake. It includes commitments by individual local agencies in the watershed as well as commitments by the Livingston WAG as a group. Where Livingston WAG is indicated, the commitment of all permitted WAG entities is implied. Where "local governmental units" is indicated, the commitment of all non-county, permitted WAG members is implied. The contributors to this plan have developed the primary strategy in Table 1 and the top of Table 2 to meet Brighton Lake targets and are committed to doing so. Activities beyond the primary strategy will be engaged opportunistically as resources allow.

General Milestones

Specific activity milestones are included in Table 2. Generally, overall progress will be measured by monitoring. This plan was developed to achieve the loading target by 2016. It is anticipated that this could be achieved prior to that by 2014 with continued implementation of stormwater activities. However, meeting the lake concentration target of 30 µg/L will be more difficult to achieve. An interim milestone will be to achieve a mean Spring lake concentrations below 30 µg/L and mean Summer concentrations below 40 µg/L, with three consecutive years below 30 µg/L by 2016.

Priority Projects from Desktop Analysis

As part of the development of this updated Implementation Plan, HRWC conducted a desktop analysis of the Brighton Lake catchment to identify specific sites for vegetative and structural BMPs. First, previous plans were examined for key layers of geographic information to use. The following layers were found to be instructive in determining target areas:

- Watershed base layers, including watershed boundary, surface waters, roads, and jurisdictional boundaries);
- Aerial imagery;
- Direct drainage – a coverage that models areas that drain directly to surface waters, as compared to those that drain primarily through groundwater;
- Parcel boundaries;
- TP loading rate model based on land uses; and
- Storm drain system and outfalls.

Combining this evaluation with data from monitoring suggests that that area with the greatest likelihood to impact phosphorus loading into Brighton Lake are untreated impervious areas that directly connect to the lake through a stormwater system. Areas with high percentages of untreated impervious area that connect through stormwater systems to South Ore Creek downstream of Woodland Lake in the City of Brighton and Brighton Township would be good secondary targets. Further, since vegetative and structural retrofit projects can be expensive, it is recommended that project sites be selected in public areas with high visibility.

Four projects are recommended from the desktop analysis. They are described in detail below.

1. Brighton High School Retrofits[3]

Brighton High School lies in close proximity to Brighton Lake, near the heart of downtown Brighton. 70 acres in size, the land area is 36% impervious, with most of the remaining area covered in turf grass, with very little deep-rooted vegetation. The parking lots are all standard construction with drainage to catch basins and little-to-no runoff to pervious areas. The site has a large basin of as yet undetermined depth that presumably is serving as stormwater detention. However, it is unclear what portion of the drainage from the property is routed to this pond. There is evidence from stormwater system maps, which did not include information from Brighton Area Schools, that at least a portion of the area to the Northeast discharges to a channel into Brighton Lake. Similarly, the baseball fields (and perhaps more) to the Southwest appear to drain directly to Brighton Lake.

Recommended Actions:

- Work with Brighton Area Schools to obtain original design drawings to determine the designed runoff flow. Survey to verify flow paths and connectivity to and current function of the detention pond. Determine the schedule for parking lot resurfacing or other major repair work. The Brighton High School evaluation was completed as this plan was being finalized and is now included in a design report in Appendix C.

- Monitor the outfall from the detention basin during wet weather events to determine TP loading.
- Develop a concept design plan that includes a range of retrofit or redesign options including retrofitting the detention pond, adding inverted islands, rain gardens and other infiltration to directly treat runoff from impervious and turfgrass features. This concept design is now complete and included in Appendix C.
- Integrate signage and educational tours and school activities related to design and eventual development of a redevelopment project.
- Work with the school to obtain funding for project development.
- Work with the school to ensure they don't use phosphorus in their fertilizer and apply best management practices for lawn care and weed maintenance.

Timeline and Milestones:

- Site review and concept design – October 2011
- Secure funding – 2012-13
- Monitoring and project installation – 2013-14

Responsible Agencies: Brighton Area Schools, HRWC to help find grant funding.

2. <u>Shoreline Buffers and Bioengineered Shoreline Protection</u>

   Parcels directly around the perimeter of Brighton Lake are almost entirely residential and wholly privately owned. Most of the residential properties comprised of two major subdivisions:

   - Howell's Brighton Beach – an older subdivision along most of the eastern shore of the lake. This subdivision is mostly comprised of small cottages. The development includes very little deep-rooted vegetation along the shoreline buffer. Some residents have built hardened seawalls for shoreline protection.
   - *Pine Ridge* – a newer development comprised of large, independently built homes that surround most of the rest of the lake. This development is coordinated through a homeowners association that has taken an interest in lake improvement by investing in lake monitoring and establishing a phosphorus fertilizer ban.

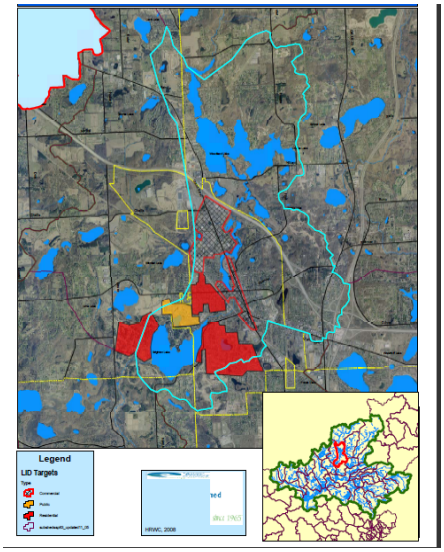
Recommended Actions:

- Work with leaders in both residential developments to find willing landowners with prominent shoreline properties to evaluate the potential for shoreline demonstrations.

- Conduct a workshop with willing residents on the benefits of shoreline buffers and bioengineered shoreline protection. Include a tour of the Bishop Lake Natural Shoreline project.
- Work with residents, homeowners associations, local contractors, and the relevant municipalities to obtain funding for demonstration projects at properties in each subdivision.
- Conduct a follow-up workshop following completion of the demonstration projects.

Timeline and Milestones:

- Meet with homeowners groups, develop interested property owners – 2012
- Secure funding for projects and homeowner education – 2012-13
- Install 2-3 projects – 2012-15



Responsible Agencies: HRWC lead with support from LCDC, City of Brighton, Brighton Township.

3. <u>Infiltration Retrofit Demonstration in Brighton Commercial District</u>

   The commercial district in the City of Brighton includes properties with over 90% impervious cover that provides little to no water quality treatment in close proximity to South Ore Creek upstream of Brighton Lake. Many of these properties are aging and due for renovation. The city's stormwater ordinance may apply to properties that are redeveloped. However, if the developer renovates buildings and parking lots within their existing footprints, no additional stormwater treatment may be required.

Recommended Actions:

- Work with the City of Brighton and local developers to develop a commercial stormwater incentive program. The program would apply to properties being redeveloped in an identified target area. Discounts on permit fees or grant monies could be provided for the installment of detention/retention, bioinfiltration or other stormwater treatment.
- Help the City of Brighton fund the program by obtaining start-up funding.
- Demonstration projects on redeveloped or improved properties.

Timeline and Milestones:

- Draft incentive program proposal, seek funding – 2012-13
- Initiate program – 2014-15

- First demonstration project – 2015

Responsible Agencies: City of Brighton, with help from HRWC

4. Residential Stormwater BMP Demonstration
   Several residential neighborhoods between Woodland Lake and Brighton Lake have been targeted for residential stormwater focus. These neighborhoods are in direct drainage areas to Brighton Lake or South Ore Creek. Two of the areas are much older developments that likely generate significant runoff, as the area is dominated by impervious surfaces directly connected to stormdrains or turfgrass providing little groundwater infiltration.

Recommended Actions:

- Work with the City of Brighton to develop and promote a neighborhood demonstration program in one of the neighborhoods. Targeting a single neighborhood for multiple projects can have the effect of "seeding" similar projects beyond the availability of grant funding.
- Conduct meetings with interested residents in each of the three neighborhoods to determine the best candidate.
- Work with the city to obtain funding for the demonstration program.
- Provide incentives for local residents to install and maintain rain gardens, rain barrels, downspout disconnects, tree-planting, and other residential infiltration practices.
- Scout locations within the target neighborhood for visible locations for larger-scale bioinfiltration projects. Include educational signage at these locations.
- Monitor resulting changes in runoff.

Timeline and Milestones:

- Draft program proposal, seek funding – 2012-14
- Initiate program – 2015
- First demonstration project – 2016

Responsible Agencies: City of Brighton, with help from HRWC

Other Priority Partner Projects

City of Brighton

Hydrodynamic Separator Installations: Install separators at major outfalls in the most heavily urbanized areas in the city to reduce sedimentation and remove pollutants before discharging to South Ore Creek. Implement 2016.

Residential Tree Planting: Inventory city residential areas and prioritize areas for opportunities to plant trees to help infiltrate stormwater. Implement 2015.

Mill Pond Enhancement: Improve the pond and park around the pond. The park receives heavy foot traffic and high visibility. Project would clean out existing sediments in pond behind dam to prevent washing downstream, add demonstration infiltration projects and goose exclusion to reduce waste. Implement 2015-16.

Greenspace Conservation: Conserve green space at two locations near wetlands within the city. The city has little remaining undeveloped green space and conservation would ensure continued stormwater treatment. Implement 2014-16.

Glenwith Pond Retrofit: A city-owned detention pond in a residential area that discharges to Brighton Lake was not designed for water quality treatment. Residents have reported significant algae issues. The pond would be redesigned to settle sediments, slow flow-through and add vegetation to absorb nutrients. Implement 2015-16.

Brighton Township

Expand Connections to WWTP: The township seeks to expand connections to its waste water treatment plant from areas in or outside the township currently being serviced by individual septic treatment or community treatment and groundwater release. Moving to centralized treatment will reduce septic failures and lower phosphorus concentrations in effluent on a per capita basis. Implement 2012-16.

Livingston County Drain Commissioner

Brighton-Genoa Drain Redesign: Redesign of drainage outlet/inlets to maximize intake capacity and reduce bank erosion along Grand River Avenue at Meier's flowerland site. P-reduction: Implement 2012.

East Ridge Drain: Redesign of drainage outlet to eliminate major erosion at outlet impacting nearby wetlands. Implement 2013.

Hartland County Drain and Outlet: Stabilize meandering downstream channel at terminus of county drain down to Long Lake. Also look for opportunities to do conservation easement/flooding easement acquisition. Implement 2012.

Brighton No. 5 Drain: Outlets of drain into Mud Lake are compromised by sedimentation since construction of drain in early 1980's. Mud Lake effectively acts as regional detention, and could be retrofitted as part of maintenance on the drainage outlets. The outlet culvert

under i-96 is a small diameter pipe over 40 years old. The project would also work with MDOT to replace the culvert. Cost: $40,000. Implement 2012.

Hawthorne Drain: Sand accumulation in stormwater system has been a persistent problem such that capture capacity of CB sumps has been exceeded despite frequent cleaning. The site will be evaluated for a sediment chamber at the southern pipe outlet. Implement 2012.

Downspout Disconnection Program: A program targeted at the area draining to Brighton No. 5 drain to relieve stormwater problems on this system. Implement 2012.

Livingston County Road Commission
Maintenance Program: Conduct ongoing maintenance of several stormwater control projects including: Hamburg Road/Winans Lake roundabout rain garden, Evergreen and McCabe Road bank stabilizations, Hamburg Road/Winans Lake bridge habitat improvement, Grand River Ave. bioretention, and numerous conservation/mitigation easements. Implement 2011-16.

Addressing Internal Loading from Brighton Lake

Gaps exist in our knowledge of the importance of particle resuspension from impoundments under anoxic conditions. Even if this plan were fully implemented and all upstream watershed sources controlled, Brighton Lake may still by plagued by high phosphorus levels and periodic algae blooms due to phosphorus release from bottom sediments. The systematic study by John Lehman, Ph.D. of the University of Michigan detailed the inputs of nutrients to Ford and Belleville lakes and the middle Huron River and concluded that incidents of algae blooms are more responsive to resuspension from lake bottom sediments than to changes in loading to the lakes from upstream. He further showed that such resuspension can be controlled by avoiding anoxic conditions during periods of thermal separation[4].

Recommended Actions:

- Brighton Lake partners, especially the homeowners surrounding the lake, should consider investing in a feasibility study to determine the potential to redesign the Brighton Lake Dam to release water from the bottom, at least during mid-summer lake separation. Creating a bottom draw may have the effect of mixing the bottom waters to keep them oxygenated and thus keeping phosphorus locked in the sediments. This could address a substantial phosphorus loading component.
- Continue monitoring lake conditions over time to improve understanding the relationship between upstream and in-lake sources of phosphorus.

Current and Proposed Projects

Primary Strategy Activities

Site/Project #	Restoration Activity	Schedule (year/qtr)	Milestones	Total Project Costs	Lead Agency	TP redux (lb/yr)
COL-1	Adopt phosphorus fertilizer law	2012	Education in 2012		State of Michigan w/ Livingston WAG education through PEP	158
COL-14-16, 19	Revise policies and continue and improve enforcement of construction controls	ongoing	Increase inspection rate by 20%	$10,000 to $25,000 per year per municipality	Local government units	37
COL-37-50	Public Education Program (PEP)	Ongoing	Survey results in 2012	$11,000 per year	Local government units; HRWC	134
COL-9	Support County-wide septic system time-of-sale and/or maintenance ordinance	ongoing	Increase inspections by 20% from 2010 levels by 2014	$300 per inspection, $3-5 k per year	Local government units	160
COL-53-62	Illicit discharge elimination program	ongoing w/ 5 year return	Complete round 1 inspections by 2013	$25,000 per year by each city and county	Local government units	314
COL-24	Practice high-powered street and parking lot sweeping and catch basin cleanouts	ongoing	Expand road area swept by 20% by 2014	$129,000 per year	City of Brighton, LCRC	143
NEW-1	Brighton High School Retrofits	2013-14	Install by 2014	TBD	City of Brighton, Brighton Area Schools	8
NEW-2	Shoreline Buffer and Bioengineering Protection	2012-15	Project targets by 2014	TBD	Livingston WAG	6
NEW-3	Commercial Retrofits	2013-16	Program by 2014	TBD	City of Brighton, HRWC	5
NEW-4	Residential Stormwater Demonstration	2013-16	Program by 2015	TBD	City of Brighton, HRWC	10
	Various partner priority projects	2011-16	Various	TBD	Livingston WAG members	160

Seconday Activities

	Review codes and ordinances and revise to improve stormwater control and nutrient assimilation, including:	2011-16			Local government units	
COL-2	- Native landscaping ordinance			$5,000 per government	Local government units	
COL-3	- No dumping ordinance			$5,000 per government	Local government units	
COL-5	- Private roads ordinance			$5,000 per government	Local government units	
COL-8	- Wetlands ordinance w/ natural features setback			$5,000 per government	Local government units	
COL-10	- Overlay zoning for riparian corridor			$5,000 per government	Local government units	
COL-12	- Incorporate Low Impact Design principles into stormwater ordinance					
COL-17	- Minimize total impervious cover in zoning ordinance					
COL-18	- Promote open space preservation in zoning ordinance and master plan					
COL-23	Inventory and deduce directly-connected impervious surfaces (e.g. downspouts)	2012-14				
COL-27	Practice alternative drain practices that improve protection of stream and riparian habitats	2011-16				
COL-28	Storm drain/catch basin marking	ongoing		$20,000 to $30,000	Local government units; HRWC	
COL-32	Inventory and stabilize eroding streambanks	Ongoing			LCDC with local governements	
COL-51	Yard Waste Collection and/or Recycling	Ongoing		Recycling station expenses	Local government units	
COL-66	Improve drain maintenance coordination with County and/or MDOT	Ongoing			LCDC, LCRC, local governments	
COL-76	Inventory and construct bioretention on public, residential and commercial properties, including:	2011-16			All	
COL-72	- Stormwater wetlands					
COL-73	- Grassed swales					
COL-74	- Vegetated filter strips					
COL-78	- Pond buffers					
COL-82	- Rain gardens					
COL-83	- Turf replacement with shrubs and trees					
COL-75	- Riparian buffers					
	Encourage or incentivize agricultural improvements including:	2011-16			Livingston WAG	
COL-79	- Agricultural conservation cover					
COL-80	- Conservation crop rotation with cover crop and mulch/no-till					
COL-81	- Wetland restoration					
COL-33	Inventory retrofit or new construction opportunities for structural practices including:	2011-16			LCDC, local governments	
COL-86	- Stormwater retention/detention basins					
COL-87	- Infiltration trenches/basins					
COL-88	- Vegetated roofs					
COL-90	- Catch basin inserts					
COL-91	- Grade stabilization structures					
COL-92	- Porous pavement					
COL-93	- Sand and organic filters					
COL-89	Technological and other upgrades at WWTPs to reduce nutrients	Ongoing			City of Brighton, Brighton Twp, Green Oak Twp	
	Inventory and prioritize road runoff issues to address the following:	Ongoing			LCRC	
COL-85	- Stabilize soils at crossing embankments					
COL-95	- Repair misaligned/obstructed culverts					

COL-96	- Stabilize road/bridge surfaces					
MS4-1	Lawn maintenance program	ongoing			Local government units, LCRC	
MS4-2	Pollution Prevention and Good Housekeeping program	ongoing			MS4s	
Totals						**1,135**

IV. Overcoming Barriers and Gaps

As framed by the terms of the TMDL, the ultimate measure of implementation success will be documented changes in water quality, showing improvement over time. Potential barriers to the complete achievement of TMDL limits and the Brighton Lake concentration target exist and must be considered in implementation planning.

Positive feedback from even the most diligent efforts may be several years in the future due to the lead time needed to implement best management practices throughout the watershed. Participants must set realistic expectations about the amount of time needed to continue identified programs while awaiting positive results. Otherwise, impatience, discouragement, or competition for limited local funding could lead to discontinuation of effective programs. Prompt communication of small successes through news releases, web sites, and community newsletters will be important to encourage the continued efforts of TMDL partner communities.

The tracking of quantitative results over time carries a set of technical and logistical challenges. Variation in weather patterns over the years of a study adds to the complexity of trend analysis of the data. Collecting correctly timed wet weather samples is particularly daunting, as personnel may not be available during a particular major summer storm occurring outside of business hours. Using trained and dedicated volunteers may become necessary in order to overcome budget constraints and to increase the number of samples and data points used in calculations.

Another challenge is the changing economic environment. With the current economic downturn, usage of current waste water treatment plants has been reduced and no new plants have been proposed. Likewise, little construction activity is occurring, so a potential source of phosphorus runoff is being minimized. As the economy recovers and Livingston County returns as a focal point of growth and expansion, further stress will be placed on waste water treatment capacity and the demand may increase for additional treatment plants, some of which could be planned for the Brighton Lake catchment. Future development and its likely impacts need to be better understood, however.

For many partners in this TMDL implementation, activities have been in place for several years and have reaped benefits, and, given the low phosphorus concentrations in water entering the lake, it appears to be on a course toward achieving an unimpaired state. Still, the target lake concentration has not been achieved and many of the current programs only recently have been put into place. However, with the current economic downturn restricting

government and institutional resources, the challenge will be to identify the most cost-effective measures and to continue funding them. Managers and programs will both need to be adaptive, while continuing to appeal to the public's expectation that the waters of our state will attain the standards set forth by Congress through the passage of the Clean Water Act in 1972.

V. Accountability Structure for Implementation

Participants, Reporting, Timeline, Monitoring, Contingency Plans

---

Participants

The stakeholders for this implementation plan are committed to continued water quality improvement in the Brighton Lake catchment. Those who have a stormwater permit to discharge runoff have accountability under that program. The permit requires that committed actions establish a timeline, include progress evaluation, and get reported to DEQ on a regular basis. Municipalities and agencies regulated under the stormwater program and working together through the Livingston WAG include:

- City of Brighton
    - Brighton Area Schools (nested)
- Brighton Township
- Livingston County Drain Commissioner
- Livingston County Road Commission

Other agencies regulated under the stormwater program, but not participating in the Livingston WAG include:

- Hamburg Township
- Brighton Area Public Schools
- Hartland Consolidated Schools
- Hartland Township

Hamburg Township and the school districts are encouraged to join the Livingston WAG to improve watershed-wide stormwater management and more efficient program implementation.

Reporting

Phase II communities and entities must submit detailed compliance plans and reports that include provisions consistent with the TMDL for phosphorus. Phase II communities with Certificates of Coverage are required to submit an approvable plan to comply with all six minimum measures, including provisions consistent with any TMDL affecting the jurisdiction or watershed.

Under their stormwater permits, these communities and organizations are obligated to develop, implement, and enforce a stormwater management program designed to reduce the discharge of pollutants from the drainage system to the "maximum extent practicable," to protect the designated uses of the waters of the state, to protect water quality, and to satisfy the appropriate water quality requirements of state and federal law. Stormwater controls designed to attain the goals of the TMDL must be incorporated into the stormwater management plan, and each permittee must implement appropriate best management practices to comply with the TMDL implementation plan. Both separately and jointly, through a coordinated public education and involvement strategy, stakeholders will also engage in communication with the public that addresses phosphorus TMDL problems, solutions, and successes.

All regulated communities have stormwater plans on file with DEQ that are publicly accessible.

The following units of government also are subject to the TMDL, but do not participate in the Livingston WAG:

- Oceola Township
- Genoa Township

The stakeholders in the Livingston WAG are committed to continued water quality improvement in the Brighton Lake contributing area. Toward this end, local governments, and the Huron River Watershed Council have been conducting a variety of actions to improve water quality and promote stewardship. Activities included bio-monitoring, septic inspection at time of sale, illicit discharge elimination, mass media educational campaigns, development standards, water resources protection ordinances, wetlands protection and wetlands restoration. Many of these actions have involved stakeholder collaboration; others are unique to individual stakeholders and their constituencies. The variety and number of these programs can be seen in detail in Table 2.

Although many ongoing actions to restore water quality and habitat in the Brighton Lake catchment are voluntary, each stakeholder has assumed responsibility to continue their efforts, as resources allow and needs dictate. Through initiating and continuing these voluntary actions, each stakeholder has assumed responsibility for a share of water quality restoration in the Huron River Basin. These discretionary programs are dependent on funding, perceived needs, sound and reliable technical assistance, clear regulatory authority, constituent support, and demonstrated effectiveness.

Livingston WAG members review the status of TMDL implementation on a quarterly basis for continuous improvement opportunities.

Additionally, the permittees are required to submit annual progress reports to the Michigan DEQ that contain the following: a description of the status of compliance with general permit conditions; an updated assessment of the water quality conditions within their jurisdiction; a description of identified water quality stresses; and a summary of all information collected and analyzed—including monitoring data. The report must include a summary of upcoming stormwater activities and a description of planned changes in BMPs or measurement of goals.

Monitoring

In 2007, and at subsequent five-year intervals, the MDEQ completed basin-wide monitoring of the Huron River watershed. Since 2008, HRWC has conducted phosphorus monitoring on behalf of Livingston WAG members, and this is expected to continue. Also in 2008, the WAG members developed a TMDL monitoring plan that expanded monitoring from two sites to many more and included wet weather event monitoring. Results from that monitoring program are included in previous sections of this plan. The monitoring plan is available online.[5]

Monitoring of lake conditions is conducted via contract through the Pine Ridge Homeowners Association. Phosphorus is sampled twice per year, along with other parameters and conditions. The consultant reports are available through the HOA. They plan to continue monitoring the lake into the foreseeable future.

Future projects under this implementation plan may incorporate additional monitoring if resources allow. Stakeholders' stormwater permit reporting will include an updated assessment of the water quality conditions within their jurisdiction in either narrative or numeric form. The purpose of this update is to show any obvious changes in phosphorus levels since the previous progress report. Change may be demonstrated by use of data collected by other sources or a group monitoring program.

Through adaptive management—a process that assesses conditions and trends throughout plan implementation, and provides feedback to stakeholders so that adjustments can be made—this Implementation Plan is intended ultimately to achieve TMDL compliance. Through the quarterly meetings of the Livingston WAG, the members will meet to review progress with this Implementation Plan. The MDEQ will track permit compliance through stormwater permit oversight, including monitoring activities that address the TMDL implementation goals. Unless the EPA determines that it is necessary to separate TMDL enforcement from the stormwater permit process, enforcement authority will reside in the MDEQ's authority under the provisions of the stormwater rules.

The partner communities within the Brighton Lake watershed take seriously the impairments that negatively impact local freshwater resources. This plan is a testament to their efforts over past

years, as well as their will to see the nutrient impairment removed and full use of the water resources restored. Past efforts in the watershed have yielded tremendous public awareness of the threats, and their sources and causes, as well as actions to mitigate the threats. It will require a continued combination of supportive citizens and well-placed on-the-ground projects to finally achieve the ultimate goal. This 5-year Implementation Plan provides the blueprint for reaching the goal of sustainable nutrient limits for Brighton Lake and downstream waters of the Huron River.

VI. REFERENCES

[1] Michigan Department of Environmental Quality, 2010. *Water Quality and Pollution Control in Michigan 2010 Sections 303(d), 305(b), and 314 Integrated Report.* http://www.michigan.gov/deq/0,1607,7-135-3313_3686_3728-12711--,00.html

[2] PLM Lake & Land Management Corp. *Lake Check Water Quality Monitoring Reports.* April 2007 through August 2009. Produced for Brighton Lake, C/O Paul Edwards.

[3] Gawronski, Mark. *Huron Chain of Lakes TMDL Project Opportunities.* HRWC, 2011.

[4] Lehman, John. (2011). Nuisance cyanobacteria in an urbanized impoundment: interacting internal phosphorus loading , nitrogen metabolism, and polymixis. *Hydrobiologia*, 661, 277-287.

[5] Huron River Watershed Council. *Huron Chain of Lakes Stormwater Plan for Addressing Total Maximum Daily Loads (TMDLs).* 2010.