Michigan Department of Environmental Quality
Surface Water Quality Division
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Total Maximum Daily Load (TMDL) for Phosphorus in Brighton Lake

Location: Brighton Lake is a 158 acre (64 ha) impoundment of South Ore Creek located in Livingston County just downstream of the City of Brighton (Figure 1).

Pollutant: Total Phosphorus.

Phosphorus Data and Goal:

Year	Total Phosphorus Concentration (mg/L)	Total Load to lake (pounds/year)	Actual Point Source contribution (pounds/year)	Nonpoint Source contribution (pounds/year)
1978	**0.125**	**3,100**	**2,300**	**800**
1998	**0.029**	875	0	875
1999	**0.039**	**1,070**	0	**1,070**
Average 1998-99	0.034	973	0	973

	Total Phosphorus Concentration (mg/L)	Loading Capacity (pounds/year)	Waste Load Allocation (pounds/year)	Load Allocation (pounds/year)	Margin of Safety (pounds/year)
TMDL Goal	0.030	900	0	875	25

Bold numbers indicate actual measured values.

Background: In the late 1970's, Brighton Lake was classified as a highly eutrophic to hypereutrophic lake with frequent nuisance algae blooms and impaired biological communities (Grant, 1978). Phosphorus was identified as the most controllable nutrient for reducing frequent nuisance algae growth in Brighton Lake. In 1978, the lake outlet phosphorus concentrations averaged 0.125 mg/L with a range of 0.054 mg/L to 0.24 mg/L and a total load of 3,100 pounds/year to Brighton Lake (Grant, 1978). Of the 3,100 pounds of phosphorus, approximately 75 percent was from the single upstream point source discharge, the Brighton Publicly Owned Treatment Works (POTW), and 25 percent was from nonpoint source contributions. In 1988, the Brighton POTW was upgraded to a rapid sand infiltration bed and underdrain system, and its discharge moved downstream of Brighton Lake. Currently, there are no point source phosphorus discharges upstream of Brighton Lake.

Subsequent to the relocation of the POTW discharge, overall water quality in Brighton Lake has greatly improved. This improved water quality can be attributed to significant reductions in total phosphorus loading to Brighton Lake. No nuisance algae blooms or fish kills have been reported within the past few years. In 1998, the spring turnover phosphorus concentrations had dropped from 0.125 mg/L in 1978 (Grant, 1978) to 0.029 mg/L (Alexander, 1999).

Based on this information and the rapid growth in this area, Brighton Lake was listed as a threatened waterbody on Michigan's 1998 Section 303(d) list of waterbodies needing TMDLs. The primary issue identified as threatening Brighton Lake was nutrient enrichment (phosphorus).

In April 1998, a 12-month phosphorus loading analysis was begun to confirm the appropriateness of the Reckhow Anoxic Model (Reckhow, 1978) as a phosphorus predictive tool for Brighton Lake (Alexander, 1999). This phosphorus analysis showed a total phosphorus load to Brighton Lake of 1,070 pounds from April 1998 to March 1999. The April 1999 spring turnover phosphorus concentration was 0.039 mg/L, and the predicted in-lake phosphorus concentration using the Reckhow Anoxic Model was 0.035 mg/L. Based on comparison of the actual in-lake phosphorus concentration and the predicted, the Reckhow Anoxic Model was determined to be a good predictor for phosphorus, both loading and in-lake concentration.

The goal for phosphorus concentration in Brighton Lake is 0.030 mg/L. This concentration is generally accepted in the majority of available literature as the cutoff point between eutrophic and hypereutrophic lakes. This goal was recommended in the draft TMDL for phosphorus in Brighton Lake, which was public noticed from January 18, 1999 to February 19, 1999, in which no comments opposing this goal were received. Additionally, this goal will meet the requirements of the Water Quality Standards R 323.1060(2) for plant nutrients. This rule 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."

Waste Load Allocation: Currently, there are no permitted phosphorus discharges upstream of Brighton Lake. The waste load allocation for the Brighton Lake TMDL was set at 0 pounds per year.

Load Allocation: The average nonpoint source contribution in 1998 and 1999 was 973 pounds/year, slightly more than the 800 pounds/year in 1978. Based on this information, it can be assumed that there is some variability in nonpoint source contributions, and that there may have been some increases in nonpoint source loading since 1978. A load allocation of 875 pounds/year of phosphorus was established for nonpoint source contributions to Brighton Lake. This load allocation requires an estimated average phosphorus reduction of 10 percent (98 pounds/year) in nonpoint source contributions. The total nonpoint source phosphorus load includes contributions from atmospheric deposition, ground water contribution, and immediate drainage area runoff (Alexander, 1999).

Margin of Safety: There are 25 pounds/year of phosphorus loading allocated to a margin of safety. This represents about three percent of the total capacity. This was determined to be adequate based on finding the model as a good predictor for phosphorus loading and in-lake concentrations.

Summary: The TMDL for Brighton Lake allocates 875 pounds of phosphorus to nonpoint source loads, 0 pounds of phosphorus to point source loads, and 25 pounds to a margin of safety. These loads are established on an annual basis to meet the goal of 900 pounds per year and an in-lake total phosphorus concentration of 0.030 mg/L.

References:

Alexander, M. 1999. Water quality and phosphorus loading analysis of Brighton, Kent, and Ore Lakes, Livingston and Oakland Counties, April 1998-April 1999. MDEQ, Surface Water Quality Division, Report #MI/DEQ/SWQ-99/107.

Grant, J. 1978. Water quality and phosphorus loading analysis of Brighton and Ore Lakes, 1977-1978. MDEQ, Surface Water Quality Division, Report #003230.

Reckhow, K. H. 1978. Quantitative techniques for the assessment of lake quality. Prepared for the Michigan Department of Natural Resources. 138 pp.

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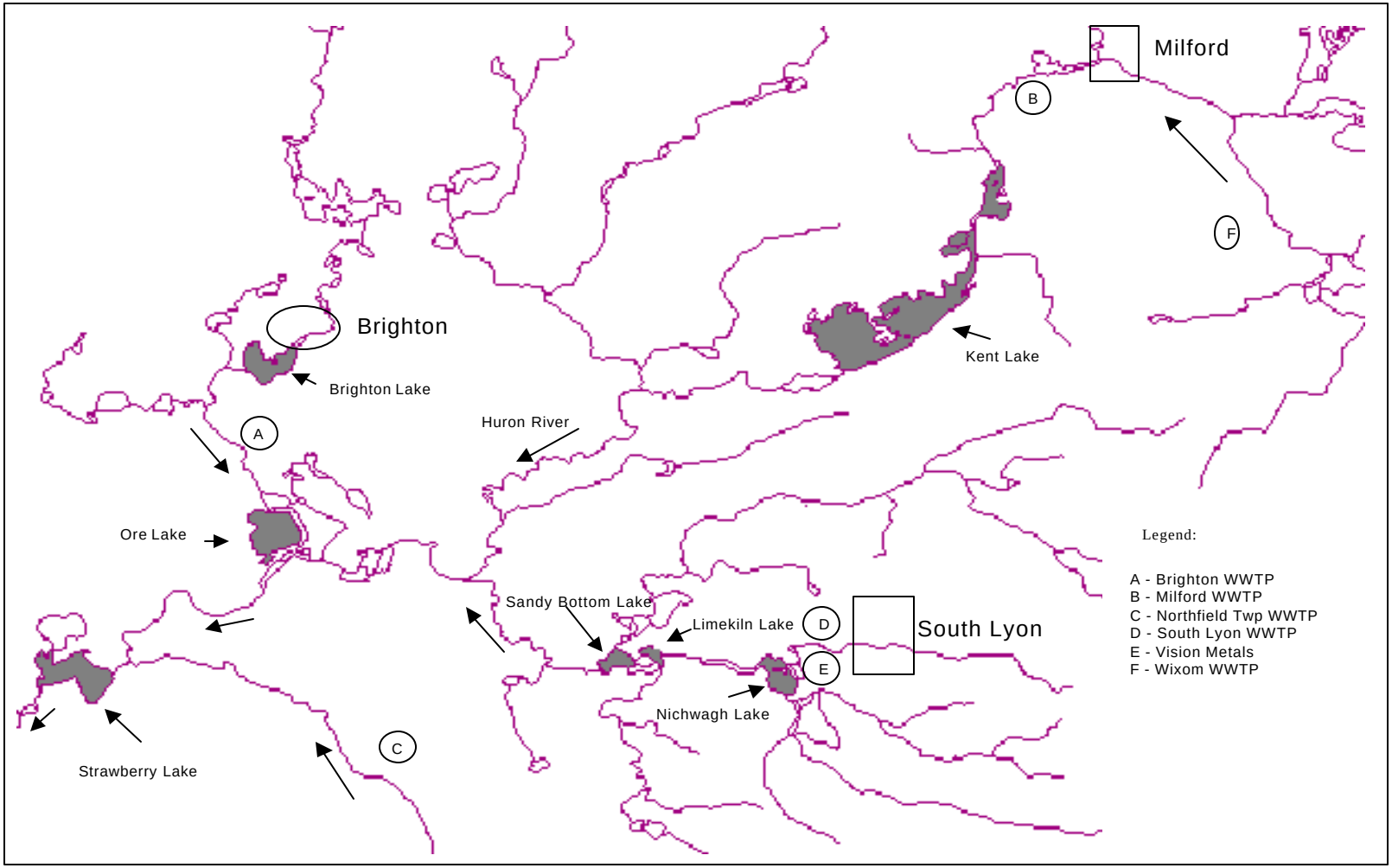

Figure 1. Upper Huron River and the Brighton Lake watershed.