

APPENDIX 4

Review of Reported Water Quality Related Problems

Water quality in Novi's lakes is a major concern for many residents. Many have experienced nuisance algal blooms as a result of over-enrichment and many have significant sediment accumulations. The City of Novi's SWPPI establishes the target of 50 µg/L. Total Phosphorus in dry weather for systems with impoundments. Almost all of Novi's waters have impoundments downstream. MDEQ sampled the Walled Lake Branch at 12 Mile Road on June 26, 2000, and determined the Total Phosphorus concentration to be 120 µg/L. This is more than double the target value.

The Department of Environmental Quality (DEQ), in partnership with the Michigan Lake and Stream Associations, Inc. (ML&SA), developed the Cooperative Lakes Monitoring Program (CLMP) as a cost-effective method for citizens to monitor water quality and to document changes in lake quality over time. A group of volunteers utilized this program to collect samples from Walled Lake to generate the data in Table 4.1 from 2000 to 2002.

Table 4.1 – Walled Lake Volunteer Sampling Results

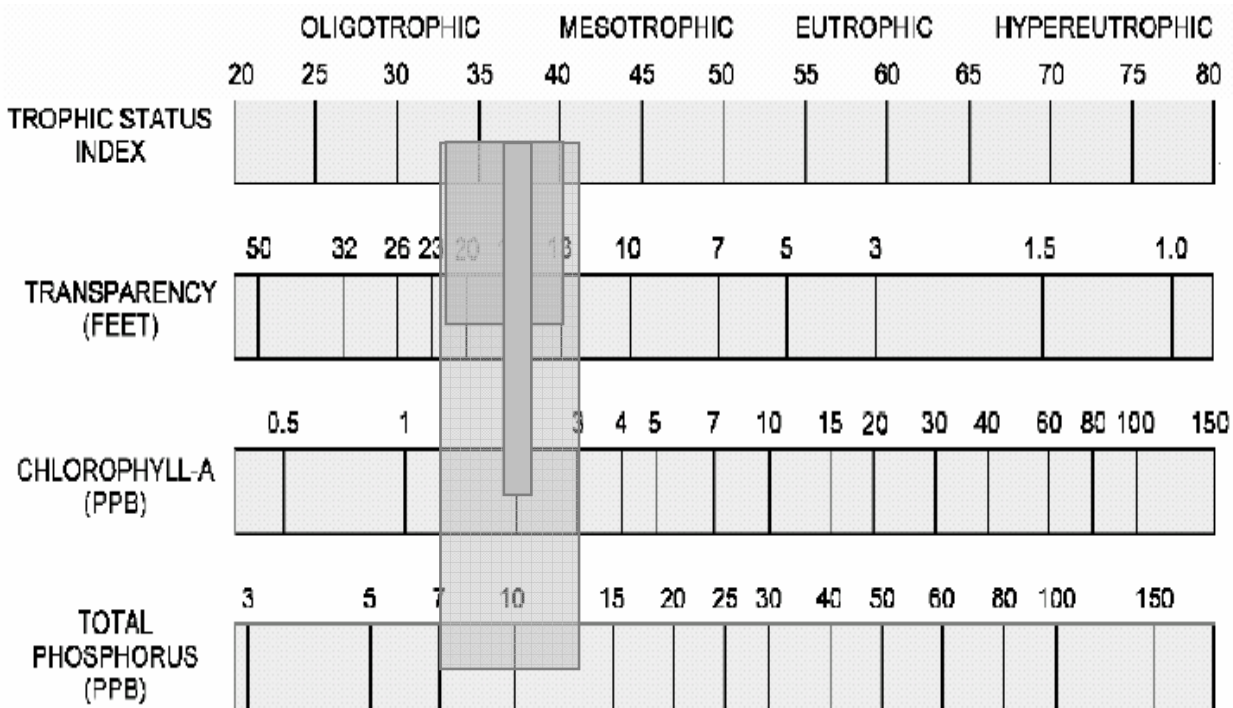
Year	Secchi Disk Transparency (feet)						Carlson TSI _{sd}	Total Phosphorus (µg/L)		Carlson TSI _{tp}
	Number of Readings	Min	Max	Mean	Median	Standard Deviation	Transparency	Spring	Late Summer	Summer TP
2000	10	9.5	19.0	14.3	14.5	3.08	39	16		
2001	12	7.7	16.8	13.1	13.3	2.33	40		7	32
2002	12	15.3	25.3	22.0	22.1	3.33	33	10	13	41

Year	Chlorophyll a (µg/L)						Standard Deviation	Carlson TSI _{chl}	
	May	June	July	Aug	Sept	Mean			Median
2000	2	2	6						
2001	1	2	3	2	2	2.0	2	0.7	37
2002	1 <a	1 a	2	3	2	1.7	2	1.0	37

Notes:

- < Sample value is less than limit of quantification (1 µg/L).
- a Sample not collected during the designated sampling period.

Carlson's Trophic State Index



(Source: Minnesota Pollution Control Agency)

Note: Other factors are considered by most limnologists to determine the Trophic State of a lake. The Carlson Index should be used as a guide. Other factors include species present, species diversity, water depth, temperature profile by month, and dissolved oxygen profile by month.

These data are summarized on the chart of "Carlson's Trophic State Index". Trophic State is explained in Table 4.2. This indicates that Walled Lake is border-line Oligotrophic/Mesotrophic. This is usually considered a very high quality lake for southeast Michigan. However this conclusion is inconsistent with a study conducted by the Rouge Program Office in 1994-95 (RPO-MOD-TM10.00). The Phosphorus concentration of the lake (7 to 16 µg/L) can be assumed to also be the concentration of the Middle Rouge River at South Lake Drive where Walled Lake drains. The DEQ data indicated a concentration of 120 µg/L at 12 Mile Road only about a mile downstream. The ten-fold increase in phosphorus concentration can reasonably be attributed to the Walled Lake/Novi Wastewater Treatment Plant that discharges to the Middle Rouge River north of 12 Mile Road.

Table 4.2 – Explanation of Trophic States

Lake Trophic State*	Lake Characteristics (dominant fish)
Oligotrophic - low productivity	Cold, deep lakes that maintain dissolved oxygen at all depths (lake trout)
Mesotrophic – moderate productivity	Lakes in transition. Warmer, shallower water. Bottom water occasionally loses all dissolved oxygen. (bass and pike)
Eutrophic – high productivity	Warm shallow lakes with bottom water often without dissolved oxygen. (bass, pike, carp)
Hyper-Eutrophic – very high productivity	Warm shallow lakes seldom with dissolved oxygen near the bottom, experiencing nuisance algal blooms and fish-kills. (carp)

Notes:

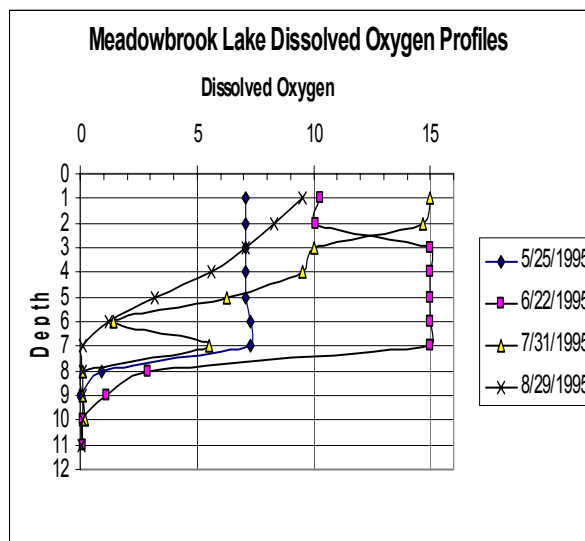
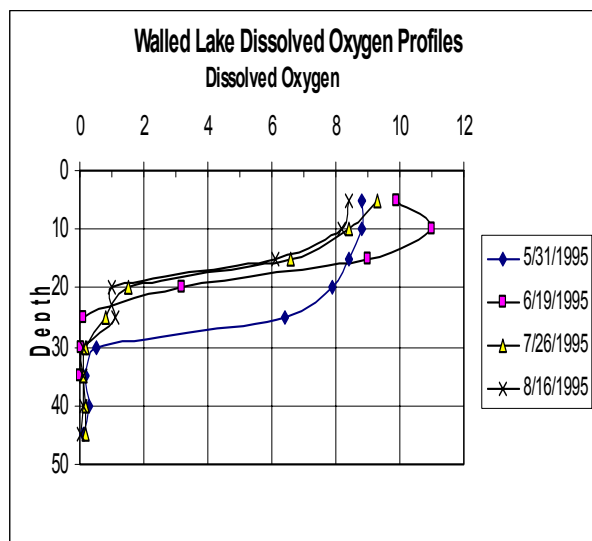
- Other factors are considered by most limnologists to determine the Trophic State of a lake. Other factors include phosphorus concentration, species diversity, water clarity, and chlorophyll-a concentrations.
- Hyper-Eutrophic lakes are considered by MDEQ as non-attainment waters.

The Rouge Program Office 1994-95 study included limnological analyses and macrophyte distribution and abundance measurements at four lakes on the Middle Branch of the Rouge River: Walled Lake, Meadowbrook Lake, Phoenix Lake, and Newburgh Lake. Most of the data indicated that all four lakes are moderately to highly Eutrophic, especially when judged by secchi depth, total phosphorus, total nitrogen, chlorophyll a, and algae community composition. Overall, Walled Lake was the least Eutrophic and Meadowbrook Lake the most. Nitrate and total phosphorus concentrations increased sharply between Walled Lake and Meadowbrook Lake, partly due to the Walled Lake wastewater treatment plant discharge. All four lakes were strongly stratified during the summer of 1995, with epilimnetic dissolved oxygen concentrations near or exceeding saturation, and hypolimnetic concentrations less than 2 mg/L. Algae characteristic of Eutrophic conditions were common in all lakes, especially Meadowbrook Lake, Phoenix Lake and Newburgh Lake. The macrophyte community in Walled Lake was diverse and abundant in shallow waters along the shore. Macrophytes were missing from Meadowbrook Lake and Phoenix Lake for unknown reasons. Selected data extracted from the report are presented in Table 4.3. The Meadowbrook Lake Inlet Phosphorus Concentration compares well with the MDEQ sample from the Middle Rouge at 12 Mile Road.

Table 4.3 – Rouge Program Office Middle Rouge Lake Study

	Secchi Disk Transparency (feet)		Total Phosphorus (µg/L)		Chlorophyll a (µg/L)		Total Phosphorus (µg/L)
	Walled Lake	Meadowbrook Lake	Walled Lake	Meadowbrook Lake	Walled Lake	Meadowbrook Lake	Meadowbrook Lake Inlet
Oct 94	9.50	0.75	<10	70	13.6	12.2	130
May 95	6.25	1.30	40	119	17.7	22.2	<20
Jun 95	13.75	4.50	38	29	89.8	339.4	110
Jul 95	4.85	3.35	20	118	49.1	279.8	130
Aug 95	12.10	5.35	<20	120	20.3	58.9	150

These data, if plotted on the Carlson's Index diagram, would lead to the conclusion that Walled Lake is Mesotrophic to Hypereutrophic. Dissolved Oxygen data from the study are plotted for Walled Lake and Meadowbrook Lake in the charts below. The similar profiles clearly show permanent anoxic conditions in the hypolimnion of both lakes leading to the conclusion that they are Eutrophic.



The study concluded that the current water problems in the three impoundments (Meadowbrook Lake, Phoenix Lake, and Newburgh Lake) are more a reflection of water quality in the Middle Branch as a whole, rather than due to site-specific conditions (point sources). Consequently, improved water quality in the impoundments will only follow water quality improvements in the upper Middle Branch. General steps which would improve water quality throughout the Middle Branch include reducing nutrients and solids inputs; controlling storm water inputs; controlling streambank erosion; preventing further destruction of riparian habitat, especially streamside wetlands and forests; and possibly deepening selected areas of one or more impoundments to improve fish habitat.

The MDEQ conducted a Habitat and Macroinvertebrate Assessment at four locations in Novi in June & July 2000. A map of these locations is shown in Figure 4.1. It was concluded that the Walled Lake Branch at Novi Road had Slightly Impaired Habitat and Acceptable Macroinvertebrate Populations, Thornton Creek at 9 Mile Road had Moderately Impaired Habitat and Acceptable Macroinvertebrate Populations, Bishop Creek at 12 Mile Road had Moderately Impaired Habitat and Poor Macroinvertebrate Populations, and Ingersol Creek at 10 Mile had Severely Impaired Habitat and Poor Macroinvertebrate Populations. It was also concluded that "Flow stability scores at (the Bishop and Ingersol locations) indicated a relatively flashy hydrologic regime in the surveyed reaches, likely due to increasing suburban development and storm water runoff." Novi's SWPPI established a target to improve these Habitat Scores to "Slightly Impaired" or better by 2015.