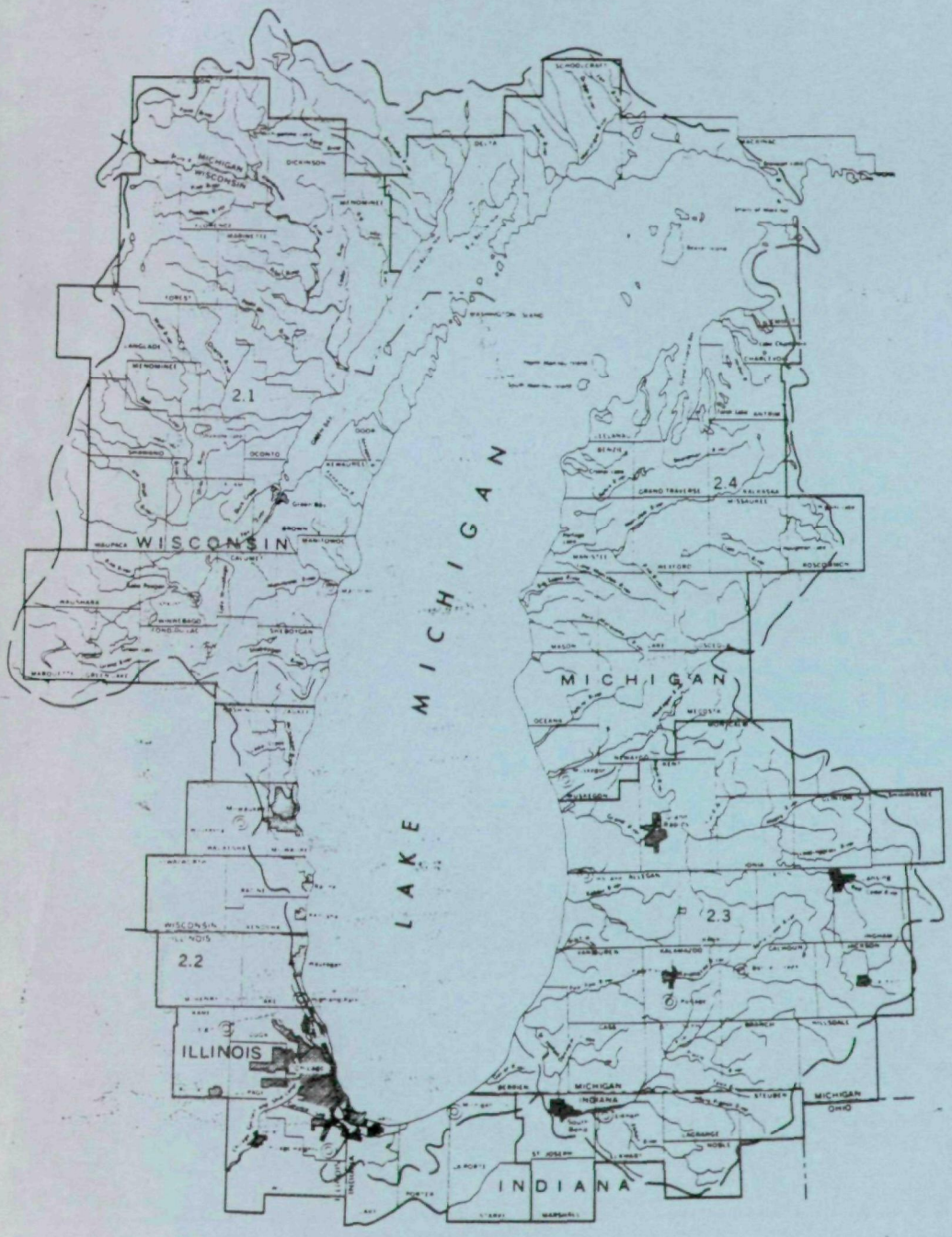
REPORT ON LAKE MICHIGAN

TOTAL MAXIMUM DAILY LOAD REQUIREMENTS



VICINITY MAP

US Environmental Prot Agency
Region V, Water Division
Chicago, Illinois

MAY 16 1985

BACKGROUND AND PURPOSE

BACKGROUND

In the summer of 1980, the beaches in Chicago were closed on numerous occasions because of high fecal coliform counts. The problem was ultimately traced to a breakdown in the Hammond Sanitary District's Robertsdale Pump Station. Although the pump station was eventually repaired, Illinois Attorney General William Scott brought suit against the parties which he felt were responsible for the pollution.

Scott's original arguments were discounted by the U.S. District Court for Northern Illinois. On appeal, however, the Seventh Circuit Court of Appeals [1] redefined USEPA responsibilities regarding development of total maximum daily loads (TMDL). Briefly, the states must determine where TMDLs are required, develop the required TMDLs and submit them to USEPA for approval and eventual incorporation in water quality management plans. If a state fails over a long period of time to submit proposed TMDLs, this prolonged failure may amount to the "constructive submission" by the state of no TMDLs. USEPA must review and then approve or disapprove that decision. If USEPA disapproves, it must then act within 30 days to establish a TMDL for the waters in question.

On December 5, 1984, the U.S. District Court issued an order which required the states bordering Lake Michigan to reach decisions on TMDLs by March 6, 1985. Region V is to review and either approve or disapprove those decisions. For any state decisions not to propose a TMDL where USEPA concludes that a TMDL is in fact necessary, the Region is required to act within 30 days to establish the required TMDLs.

PURPOSE AND USE

This analysis constitutes an independent (Region V) review of the water quality conditions and needs of Lake Michigan within the context of the TMDL requirements of the Act and each state's response to those needs. The study, therefore, provides the basis for the Regional conclusions and the position described herein.

SUMMARY

In response to an order by the U.S. District Court for Northern Illinois in the matter of Scott vs. Hammond, et. al.,(7 C.C.A., Nos 81-2884 and 81-2885), Illinois, Indiana, Michigan and Wisconsin considered the need for total maximum daily load (TMDL) calculations to protect the water quality of Lake Michigan, and communicated their positions to Region V in early March 1985.

Region V in turn has reviewed those positions in light of current research, available data, state water quality standards, agency guidance, and statutory requirements. This report was developed to document the review process and establish a basis for further initiatives. Essentially, the positions taken by each state are defensible for the moment but not for all of the reasons cited.

A number of substances are violating the established water quality standards or are otherwise impacting a beneficial use of Lake Michigan. These substances are identified in Section 5. Unfortunately, lack of data and the proper technical conditions preclude development of TMDLs for many of those substances at this time. However, Region V has recommended that the Water Quality Standards Work Group comprised of state and federal officials undertake the development of a detailed program to address data deficiencies and arrive at firm TMDL conclusions.

TABLE OF CONTENTS

LIST OF TABLES

SECTION 1

INTRODUCTION

1.1 Purpose

The purpose of this study is to evaluate the positions of the States of Illinois, Indiana, Michigan and Wisconsin with regard to the need for total maximum daily loads (TMDLs) to control discharges into Lake Michigan. This study was undertaken in response to the decision by the Seventh Circuit Court of Appeals. Succinctly, in its decision dated August 16, 1984, in Scott vs. Hammond, et.al., (7C.C.A., Nos. 81-2884 and 81-2885), the Seventh Circuit Court of Appeals concluded that a state's failure within the past four years to promulgate and submit TMDLs to USEPA for approval or disapproval pursuant to Section 303 may constitute a constructive decision by the state that no TMDL is required for a particular waterway. This decision is reviewable by USEPA under the provisions of Section 303 of the Clean Water Act. Under the Court's interpretation in this specific case, states bordering Lake Michigan were required to submit an identification of waters requiring TMDLs on June 26, 1979. The Court concluded that as no proposed TMDLs for Lake Michigan had been submitted to USEPA, the possibility arose that the states had made a specific decision that no TMDLs were required and USEPA in its turn should review this decision. On December 5, 1984, the U.S. District Court for northern Illinois issued an order which required the states bordering Lake Michigan to reach decisions on proposed TMDLs by March 6, 1985. This study provides the basis for the Region V review and recommendations for follow on actions.

1.2 Scope

The scope of this analysis covers known or anticipated pollution problems in Lake Michigan, distribution, sources and control approaches. Certain pollution problems and control approaches are not readily amenable to TMDL calculation because the discharge of pollutants occurs on an event basis rather than a daily basis or because there is no definable point source of discharge. Event related loadings involve nonpoint sources such as agricultural runoff, as well as selected point sources such as urban and combined sewer overflows (CSOs) or storm sewer discharges. The events which stimulate the discharge are storm events which may meet specific recurrence, duration and intensity criteria. Nonpoint source (NPS) loadings are integrated within a TMDL but are usually time scaled against annual loadings or a TMDL is set equal to a design event. Under the proper technical and analytical conditions, TMDLs can be calculated for nonpoint, diffuse, and storm loadings.

This analysis will evaluate:

(1) Individual state positions regarding the designation of water quality limited segments of Lake Michigan, i.e., those segments that require TMDL calculation.

(2) Individual State positions on the specific pollutants which may require TMDL calculation.

(3) The reasonableness of TMDL development schedules where TMDL preparation is required.

(4) The identification of any appropriate actions required by USEPA.

This analysis will not develop actual TMDLs or allocate the loads to achieve the TMDL. This analysis is of sufficient depth and scope to screen waterbodies or portions of Lake Michigan for the purpose of identifying areas and pollutants that require further analysis and possible TMDL preparation. It addresses emerging problems only to the extent of available data and analyses.

SECTION 2

DEFINITIONS

2.1 The Act

The Clean Water Act, as amended, 33 U.S.C. 1251 et.seq.

2.2 Effluent Limited Segment

A waterbody where technology-based controls (secondary treatment, best practicable treatment, best available treatment) are sufficient to meet WQS. Such waterbodies do not require the development of TMDLs or wasteload allocations (WLAs).

2.3 Water Quality Limited Segment

Any segment where it is known that water quality does not meet applicable WQS, and/or is not expected to meet applicable WQS, even after the application of the technology-based effluent limitations required by Sections 301(b) and 306 of the Act.

2.4 Load or Loading

An amount of matter or thermal energy that is introduced into a receiving water; to introduce matter or thermal energy into a receiving water. Loading may be either man-caused (pollutant loading) or natural (natural background loading).

2.5 Loading Capacity

The greatest amount of loading that a water can receive without violating WQSs.

2.6 Load Allocation

The portion of a receiving water's loading capacity that is attributed either to one of its existing or future nonpoint sources (NPS) of pollution or to natural background sources. Load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural NPS loads should be distinguished.

2.7 Wasteload Allocation (WLA)

The portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation.

2.8 Total Maximum Daily Load (TMDL)

The sum of the individual WLAs for point sources and load allocations for NPS and natural background. If a receiving water has only one point source discharger, the TMDL is the sum of that point source WLA plus the load allocations for any NPS of pollution and natural background sources, tributaries, or adjacent segments. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure. If best management practices (BMPs) or other NPS pollution controls make more stringent load allocations practicable, then WLAs can be made less stringent. Thus, the TMDL process provides for NPS control tradeoffs.

2.9 Pollution

The man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water.

2.10 Water Quality Standards

Provisions of state or federal law which consist of a designated use or uses for the waters of the United States and water quality criteria for such waters based upon such uses. WQS are to protect the public health or welfare, enhance the quality of water and serve the purposes of the Act.

2.11 Mixing Zones

A limited area or volume of water contiguous to a discharge where initial mixing of the discharge and receiving water occurs. The WQSs applicable to mixing zones are typical less stringent than those of the receiving waters.

SECTION 3

TOTAL MAXIMUM DAILY LOAD DISCUSSION

3.1 General Water Quality Standards and Total Maximum Daily Load Requirements

3.1.1 Water Quality Standards

The review and adoption of WQS is the responsibility of each state as specified by Section 303(e) of the Clean Water Act [2]. At least once every three years the states are required to review and, where appropriate, revise or adopt new WQS. As stated in the Act, standards "shall be such as to protect public health or welfare, enhance the quality of water and serve the purpose of the Act".

WQS serve a variety of functions. WQS:

(1) Provide the basic goals for water quality.

(2) Provide the regulatory basis for establishment of controls beyond technology based. Such water quality-based controls are normally derived through the process of calculating TMDLs and WLAs.

(3) Serve as a benchmark for progress in meeting water quality goals.

Standards are comprised of two principal features:

(1) The beneficial uses to be protected.

(2) The water quality criteria sufficient to protect the use.

Table 3.1 outlines the water quality criteria for Lake Michigan as adopted by Illinois, Indiana, Michigan and Wisconsin. Table 3.1 also lists criteria as recommended by USEPA [3], [4] and the Great Lakes Water Quality Agreement of 1978 [5]. As is evident from the table, practically all of the water quality criteria are expressed in terms of concentration, or mass per unit volume, and are expressed as maximum concentrations (maximum mass/volume).

In actual application, the state WQS serve as the basis for calculating TMDLs/WLAs. USEPA and the 1978 Agreement criteria are advisory. However, if a state's standards are clearly unprotective, USEPA is required by the Clean Water Act, Section 303(c), to promulgate protective federal criteria.

The states bordering Lake Michigan have recently initiated or completed a review of the WQS for Lake Michigan. Table 3.2 reflects the status of these reviews. All of the bordering states require their waters to be "free from" toxic substances in "toxic" amounts. However, none of the states have translated these narrative criteria into numerical water quality criteria. This impairs their ability to determine where TMDLs are needed.

Table 3.1 WATER QUALITY CRITERIA FOR LAKE MICHIGAN IN ug/l [1]

‡ = milligrams/liter

PARAMETER	US Environmental Prot Agency [2] Aquatic Life [4]	Human Health [3] 10E-5	10E-6	Toxic	US-Canadian Agreement [5]	Illinois [6]	Indiana [7]	Michigan [8]	Wisconsin [9]
Ammonia-N (Total)	---	---	---	---	500	20	50	---	---
Ammonia (un-ionized)	[11]	---	---	---	20	---	20	---	---
Antimony	---	---	---	---	---	---	---	---	---
Arsenic (Trivalent-total)	---	0.022	0.0022	---	50	50	50	---	---
Asbestos	---	[19]	[19]	---	---	---	---	---	---
Barium (mg/l)	[12]	---	---	‡ 1.0	---	‡ 1.0	‡ 1.0	---	---
Beryllium	---	0.068	0.0068	---	---	---	---	---	---
Dissolved Oxygen (mg/l)	‡ 5.0	---	---	---	‡ 6.0	90%	‡ 7.0	‡ 6.0	‡ 5.0
Cadmium (Total)	[13]	---	---	10	0.2	10	10	---	---
Chromium (Hexavalent-total)	0.29	---	---	50	50	---	50	---	---
Chromium (Trivalent-total)	---	---	---	---	50	50	---	---	---
Chloride (mg/l)	---	---	---	---	---	12	15	---	---
Copper (Total)	5.6	---	---	---	5	5	---	---	---
Fecal Coliform (#/100ml)	---	200	(swimming)	---	Free from	20	20	200	200
Iron (Total)	1000	---	---	---	300	1000	150	---	---
Lead (Total)	[20]	---	---	---	25	50	50	---	---
Mercury (Total)	0.2	---	---	0.14	0.2	0.2	0.05	---	---
Nickel (Total)	[14]	---	---	13.4	25	---	---	---	---
Phosphorous	---	---	---	---	---	7	30	---	---
Selenium	35	---	---	10	10	10	10	---	---
Silver (Total)	0.12	---	---	50	0.1	30	50	---	---
Thallium	---	---	---	---	---	---	---	---	---
Zinc (Total)	47	---	---	---	---	30	---	---	---
Mixing Zones						[15]	[16]	[17]	[18]

‡‡ NOTES ‡‡

1. All values are in micrograms/liter (ug/l) unless noted otherwise
2. Source "Water Quality Criteria", FR 45 No 231, Nov 1980.
3. Human health values are related to incremental cancer risk levels and are based on ave fish and water consumption.
4. Chronic protection levels are specified as a 24 hr average.
5. Source "Great Lakes Water Quality Agreement of 1978" between the US and Canada.
6. Source "Chapter 3 IPCB Rules", water quality standards for L. Mich. Where toxic substance criteria are not listed, state develops criterion by using 1/10th of the 96hr TLm for native fish and fishfood organisms.
7. Source 330 IAC 2-1, Indiana WQ Standards for Lake Michigan. Where toxic substance criteria are not listed, state develops criteria based on site specific analysis.
8. Source R 323 Part 4 of the Michigan Administrative Code. Where toxic substances criteria are not listed, state develops the criteria via the procedures under Rule 57.
9. Source NR 102 Wisconsin Administrative Code. Where criteria for toxic substances are not listed, state develops criteria on a case by case basis.
10. IJC objective is based on 0.1 ug/g of tissue.
11. USEPA guidance is 20 ug/l coldwater fishery and 50 ug/l of un-ionized ammonia for warmwater fisheries.
12. Public water supply guidance is 1 mg/l.
13. ug/l cadmium = 2.718 E(1.05 [ln hardness]-8.53) as 24hr ave
14. ug/l nickel = 2.718 E(0.76[ln hardness]+1.06) as 24hr ave
15. Mixing zone restricted to radius of 600 ft
16. Mixing zone restricted to arc of 1000 ft
17. Mixing zone determined on case by case basis.
19. Asbestos concentrations for carcinogen risk levels of 10E-5, 10E-6 and 10E-7 are 300,000 - 30,000 - 3,000 fibers per liter respectively.
20. ug/l lead = 2.718 E(2.35[ln hardness]-9.48) as 24hr ave

Table 3.1 WATER QUALITY CRITERIA FOR LAKE MICHIGAN IN ug/l [1]

PARAMETER	US Environmental Prot Agency [2] Aquatic Life [4]	Human Health [3] 10E-5	10E-6	10E-7	US-Canadian Agreement [5]	Illinois [6]	Indiana [7]	Michigan [8]	Wisconsin [9]
Acenaphthene (PAH)	520	---	---	---	---	---	---	---	---
Acenaphthylene (PAH)	---	---	---	---	---	---	---	---	---
Acrolein	21	---	---	---	---	---	---	---	---
Acrylonitrile	2600	0.58	0.058	0.006	---	---	---	---	---
Anthracene (PAH)	---	---	---	---	---	---	---	---	---
Benzene	---	6.6	0.66	0.066	---	---	---	---	---
Benzidine	---	0.0012	0.00012	0.00001	---	---	---	---	---
Benzo(a)anthracene (PAH)	---	---	---	---	---	---	---	---	---
Benzo(a)pyrene (PAH)	---	---	---	---	---	---	---	---	---
Benzo(b)fluoranthene (PAH)	---	---	---	---	---	---	---	---	---
Benzo(k)fluoranthene (PAH)	---	---	---	---	---	---	---	---	---
Benzo(g,h,i)perylene (PAH)	---	---	---	---	---	---	---	---	---
Bromoform (tribromomethane)	---	1.9	0.19	0.019	---	---	---	---	---
Carbon Tetrachloride	---	4	4	0.04	---	---	---	---	---
Chlorinated Benzenes	50	---	---	---	---	---	---	---	---
Chlorobenzene	---	---	---	---	---	---	---	---	---
Dichlorobenzene	763	---	---	---	---	---	---	---	---
1,2-Dichlorobenzene	---	---	---	---	---	---	---	---	---
1,3-Dichlorobenzene	---	---	---	---	---	---	---	---	---
1,4-Dichlorobenzene	---	---	---	---	---	---	---	---	---
1,2,4-Trichlorobenzene	---	---	---	---	---	---	---	---	---
1,2,4,5-Tetrachlorobenzene	---	---	---	---	---	---	---	---	---
Pentachlorobenzene	---	---	---	---	---	---	---	---	---
Hexachlorobenzene	---	0.0072	0.00072	0.000072	---	---	---	---	---
Chlorinated Ethanes	---	---	---	---	---	---	---	---	---
chloroethane	---	---	---	---	---	---	---	---	---
1,1-Dichloroethane	---	---	---	---	---	---	---	---	---
1,2-Dichloroethane	20000	9.4	0.94	0.094	---	---	---	---	---
1,1,1-Trichloroethane	---	---	---	---	---	---	---	---	---
1,1,2-Trichloroethane	9400	6	0.6	0.06	---	---	---	---	---
1,1,1,2-Tetrachloroethane	---	---	---	---	---	---	---	---	---
1,1,2,2-Tetrachloroethane	2400	1.7	0.17	0.017	---	---	---	---	---
Pentachloroethane	1100	---	---	---	---	---	---	---	---
Hexachloroethane	540	19	1.9	0.19	---	---	---	---	---
Chlorinated Ethylenes	---	---	---	---	---	---	---	---	---
Dichloroethylenes	---	---	---	---	---	---	---	---	---
1,1 Dichloroethylene	---	0.33	0.033	0.0033	---	---	---	---	---
Cis-1,2-Dichloroethylene	---	---	---	---	---	---	---	---	---
Trans-1,2-Dichloroethylene	---	---	---	---	---	---	---	---	---
Trichloroethylene	21900	27	2.7	0.27	---	---	---	---	---
Tetrachloroethylene	840	8	0.8	0.08	---	---	---	---	---
Chlorinated Propanes	---	---	---	---	---	---	---	---	---
Dichloropropanes	5700	---	---	---	---	---	---	---	---
1,2-Dichloropropane	---	---	---	---	---	---	---	---	---
Chlorinated Propenes	---	---	---	---	---	---	---	---	---
Dichloropropenes	244	---	---	---	---	---	---	---	---
Cis-1,3-Dichloropropene	---	---	---	---	---	---	---	---	---
Trans-1,3-Dichloropropene	---	---	---	---	---	---	---	---	---

Table 3.1 WATER QUALITY CRITERIA FOR LAKE MICHIGAN IN ug/l [1]

PARAMETER	US Environmental Prot Agency [2] Aquatic Life [4]	Human Health [3] 10E-5	10E-6	10E-7	US-Canadian Agreement [5]	Illinois [6]	Indiana [7]	Michigan [8]	Wisconsin [9]
Choroalkyl Ethers	---	---	---	---	---	---	---	---	---
Bis(Chloromethyl) ether	---	0.000038	0.0000038	0.0000003	---	---	---	---	---
Bis(2-Chloroethyl) ether	---	0.3	0.03	0.003	---	---	---	---	---
Bis-(2-Chloroisopropyl) ethe	---	---	---	---	---	---	---	---	---
Bis-2-Chloroethoxymethane	---	---	---	---	---	---	---	---	---
2-Chloroethylvinyl ether	---	---	---	---	---	---	---	---	---
Chloroform	1240	1.9	0.19	0.019	---	---	---	---	---
Chlorinated Naphthalenes	---	---	---	---	---	---	---	---	---
2-Chloronaphthalene	---	---	---	---	---	---	---	---	---
Chrysene (PAH)	---	---	---	---	---	---	---	---	---
Cyanide	3.5	---	---	---	---	25	10	---	---
Dibenzo (a,h) anthracene (PAH)	---	---	---	---	---	---	---	---	---
Dichlorobenzidines	---	0.103	0.0103	0.00103	---	---	---	---	---
3,3-Dichlorobenzidine	---	---	---	---	---	---	---	---	---
2,4-Dinitrotoluene	230	1.1	0.11	0.011	---	---	---	---	---
2,6-Dinitrotoluene	---	---	---	---	---	---	---	---	---
1,2-Diphenylhydrazine	---	0.422	0.042	0.004	---	---	---	---	---
Ethylbenzene		---	---	---	---	---	---	---	---
Fluoranthene (PAH)	---	---	---	---	---	---	---	---	---
Fluorene (PAH)	---	---	---	---	---	---	---	---	---
Haloethers	122	---	---	---	---	---	---	---	---
4-Bromophenylphenyl ether	---	---	---	---	---	---	---	---	---
4-Chlorophenylphenyl ether	---	---	---	---	---	---	---	---	---
Halomethanes	---	---	---	---	---	---	---	---	---
Bromomethane	---	1.9	0.19	0.019	---	---	---	---	---
Chloromethane	---	1.9	0.19	0.019	---	---	---	---	---
Dichloromethane	---	1.9	0.19	0.019	---	---	---	---	---
Tribromomethane (Bromoform)	---	1.9	0.19	0.019	---	---	---	---	---
Bromodichloromethane -	---	---	---	---	---	---	---	---	---
(Di-bromodichloromethane)	---	1.9	0.19	0.019	---	---	---	---	---
Dichlorodifluoromenthane	---	---	---	---	---	---	---	---	---
Trichlorofluoromethane	---	---	---	---	---	---	---	---	---
Hexachlorobutadiene	9.3	4.47	0.45	0.045	---	---	---	---	---
Hexachlorocyclopentadiene	5.2	---	---	---	---	---	---	---	---
Indeno-(1,2,3-cd)pyrene PAH	---	---	---	---	---	---	---	---	---
Isophorone	---	---	---	---	---	---	---	---	---
Naphthalene (PAH)	620	---	---	---	---	---	---	---	---
Nitrobenzene	---	---	---	---	---	---	---	---	---
Nitrosamines	---	---	---	---	---	---	---	---	---
N-Nitrosodimethylamine	---	0.014	0.0014	0.00014	---	---	---	---	---
N-Nitrosodiethylamine	---	0.008	0.0008	0.00008	---	---	---	---	---
N-Nitrosodiphenylamine	---	49	4.9	0.49	---	---	---	---	---
N-Nitrosodi-n-propylamine	---	---	---	---	---	---	---	---	---
N-Nitrosodi-n-butylamine	---	0.064	0.0064	0.00064	---	---	---	---	---
N-Nitrosopyrrolidine	---	0.16	0.016	0.0016	---	---	---	---	---
Phenanthrene (PAH)	---	---	---	---	---	---	---	---	---

Table 3.1 WATER QUALITY CRITERIA FOR LAKE MICHIGAN IN ug/l [1]

PARAMETER	US Environmental Prot Agency [2] Aquatic Life [4]	Human Health [3] 10E-5	10E-6	10E-7	US-Canadian Agreement [5]	Illinois [6]	Indiana [7]	Michigan [8]	Wisconsin [9]
Phenols	---	---	---	---	---	---	---	---	---
Phenol	2560	---	---	---	---	---	---	---	---
Chlorinated Phenols	---	---	---	---	---	---	---	---	---
2-Chlorophenol	2000	---	---	---	---	---	---	---	---
3-Chlorophenol	---	---	---	---	---	---	---	---	---
4-Chlorophenol	---	---	---	---	---	---	---	---	---
2,3-Dichlorophenol	---	---	---	---	---	---	---	---	---
2,4-Dichlorophenol	365	---	---	---	---	---	---	---	---
2,5-Dichlorophenol	---	---	---	---	---	---	---	---	---
2,6-Dichlorophenol	---	---	---	---	---	---	---	---	---
3,4-Dichlorophenol	---	---	---	---	---	---	---	---	---
2,4,5-Trichlorophenol	---	---	---	---	---	---	---	---	---
2,4,6-Trichlorophenol	970	12	1.2	0.12	---	---	---	---	---
2,3,4,6-Tetrachlorophenol	---	---	---	---	---	---	---	---	---
Pentachlorophenol	3.2	---	---	---	---	---	---	---	---
2-Methyl-4-Chlorophenol	---	---	---	---	---	---	---	---	---
3-Methyl-4-Chlorophenol	---	---	---	---	---	---	---	---	---
3-Methyl-4-Chlorophenol	---	---	---	---	---	---	---	---	---
3-Methyl-6-Chlorophenol	---	---	---	---	---	---	---	---	---
2,4-Dimethylphenol	---	---	---	---	---	---	---	---	---
Nitrophenols	150	---	---	---	---	---	---	---	---
2-Nitrophenol	---	---	---	---	---	---	---	---	---
4-Nitrophenol	---	---	---	---	---	---	---	---	---
Dinitrophenol	---	---	---	---	---	---	---	---	---
2-Methyl-4,6-Dinitrophenol (2,4-Dinitroo-cresol)	---	---	---	---	---	---	---	---	---
Phthalate Esters	3	---	---	---	---	---	---	---	---
Dimethylphthalate	---	---	---	---	---	---	---	---	---
Diethylphthalate	---	---	---	---	---	---	---	---	---
Dibuthyl-phthalate	---	---	---	---	4	---	---	---	---
Di-n-butylphthalate	---	---	---	---	---	---	---	---	---
Di-n-octylphthalate	---	---	---	---	---	---	---	---	---
Butylbenzylphthalate	---	---	---	---	---	---	---	---	---
Bis(2-ethylhexyl) phthalate	---	---	---	---	---	---	---	---	---
(Di-2-Ethylhexyl-phthalate	---	---	---	---	0.6	---	---	---	---
Polychlorinated Biphenyls	0.014	0.00079	0.000079	0.0000079	[10]	---	0.001	---	---
PCB 1016	---	---	---	---	---	---	---	---	---
PCB 1221	---	---	---	---	---	---	---	---	---
PCB 1232	---	---	---	---	---	---	---	---	---
PCB 1242	---	---	---	---	---	---	---	---	---
PCB 1248	---	---	---	---	---	---	---	---	---
PCB 1254	---	---	---	---	---	---	---	---	---
PCB 1260	---	---	---	---	---	---	---	---	---
Polynuclear Aromatic Hydrocarbons (PAH)	---	0.028	0.0028	0.00028	---	---	---	---	---
Pyrene (PAH)	---	---	---	---	---	---	---	---	---
Toluene	---	---	---	---	---	---	---	---	---
Vinyl Chloride	---	20	2	0.2	---	---	---	---	---
Xylenes	---	---	---	---	---	---	---	---	---

Table 3.1 WATER QUALITY CRITERIA FOR LAKE MICHIGAN IN ug/l [1]

PARAMETER	US Environmental Prot Agency [2] Aquatic Life [4]	Human Health [3] 10E-5	10E-6	10E-7	US-Canadian Agreement [5]	Illinois [6]	Indiana [7]	Michigan [8]	Wisconsin [9]
Aldrin	---	0.74	0.074	0.0074	0.001	1	---	---	---
Chlordane	0.0043	4.6	0.46	0.046	---	3	---	---	---
Dieldrin (Aldrin metabolite)	0.0019	0.71	0.071	0.0071	0.001	1	---	---	---
DDT and Metabolites	---	---	---	---	---	---	---	---	---
DDT	0.001	0.24	0.024	0.0024	0.003	50	---	---	---
TDE	---	---	---	---	---	---	---	---	---
DDE	---	---	---	---	---	---	---	---	---
DDD	---	---	---	---	---	---	---	---	---
Endosulfan	0.056	---	---	---	---	---	---	---	---
Endosulfan I	---	---	---	---	---	---	---	---	---
Endosulfan II	---	---	---	---	---	---	---	---	---
Endosulfan sulfate	---	---	---	---	---	---	---	---	---
Endrin	0.0023	---	---	---	0.02	0.2	---	---	---
Endrin Aldehyde	---	---	---	---	---	---	---	---	---
Heptachlor	0.0038	2.78	0.28	0.028	0.001	0.1	---	---	---
Heptachlor epoxide	---	---	---	---	0.001	0.1	---	---	---
(Heptachlor metabolite)	---	---	---	---	---	---	---	---	---
Hexachlorocyclohexanes	---	---	---	---	---	---	---	---	---
(HCH, or BHC isomers)	---	---	---	---	---	---	---	---	---
Alpha - HCH	---	92	9.2	0.92	---	---	---	---	---
Beta - HCH	---	163	16.3	1.63	---	---	---	---	---
Gamma - HCH (Lindane)	0.08	186	18.6	1.86	0.01	---	---	---	---
Delta - HCH	---	---	---	---	---	---	---	---	---
Technical - HCH, or BHC isom	---	123	12.3	1.23	---	---	---	---	---
2,3,7,8 - TCDD (Dioxin)	0.00001	1.3 E-7	1.3 E-8	1.3 E-9	---	---	---	---	---
Toxaphene	0.013	7.1	0.71	0.07	0.08	5	---	---	---

1. All values are in micrograms/liter (ug/l) unless noted otherwise
2. Source "Water Quality Criteria", FR 45 No 231, Nov 1980.
3. Human health values are related to increamental cancer risk levels and are based on ave fish and water consumption.
4. Chronic protection levels are specified as a 24 hr average.
5. Source "Great Lakes Water Quality Agreement of 1978" between the US and Canada.
6. Source "Chapter 3 IPCB Rules", water quality standards for L. Mich. Where toxic substance criteria are not listed, state develops criterion by using 1/10th of the 96hr TLm for native fish and fishfood organisms.
7. Source 330 IAC 2-1, Indiana WQ Standards for Lake Michigan. Where toxic substance criteria are not listed, state develops criteria based on site specific analysis.
8. Source R 323 Part 4 of the Michigan Administrative Code. Where toxic substances criteria are not listed, state develops the criteria via the procedures under Rule 57.
9. Source NR 102 Wisconsin Administrative Code. Where criteria for toxic substances are not listed, state develops criteria on a case by case basis.
10. IJC objective is based on 0.1 ug/g of tissue.
11. USEPA guidance is 20 ug/l coldwater fishery and 50 ug/l of un-ionized ammonia for warmwater fisheries.
12. Public water supply guidance is 1 mg/l.
13. ug/l cadmium = 2.718 E(1.05 [ln hardness]-8.53) as 24hr ave
14. ug/l nickel = 2.718 E(0.76[ln hardness]+1.06) as 24hr ave
15. Mixing zone restricted to radius of 600 ft
16. Mixing zone restricted to arc of 1000 ft
17. Mixing zone determined on case by case basis.
19. Asbestos concentrations for carcinogen risk levels of 10E-5, 10E-6 and 10E-7 are 300,000 - 30,000 - 3,000 fibers per liter respectively.
20. ug/l lead = 2.718 E(2.35[ln hardness]-9.48) as 24hr ave

TABLE 3.2

WQS REVIEW STATUS LAKE MICHIGAN WATERS

State	Parameter Coverage	Date Completed	Date Approved
Illinois	All	December 1984	February 1985
Indiana	All	In Progress	
Michigan	All	February 1985	March 1985
Wisconsin	All	October 1984	January 1985

3.1.2 Total Maximum Daily Load and Wasteload Allocation Requirements

The Clean Water Act [2] provides the basic requirements for the development of TMDLs and WLAs. Section 303(d) specifically calls for each state to:

(1) Identify those waters within the boundaries for which the effluent limitations of Sections 301(b)(1)(A) and 301(b)(1)(B) [technology based] are not stringent enough to implement "... any water qualty standard applicable to such waters".

(2) Prioritize such waters.

(3) Identify these waters where the thermal requirements of Section 301 are not stringent enough to "... assure the protection and propagation of a balanced indigenous population of shellfish, fish and wildlife."

(4) Establish for the waters identified, and in accordance with the priority ranking, the TMDL for pollutants suitable for TMDL calculation. "Such load shall be established at a level necessary to implement the applicable WQS with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality."

(5) Submit to the Administrator for his approval, the waters identified and the TMDLs established. The Administrator then approves or disapproves the TMDL within 30 days of submission. If disapproval occurs, the Administrator must establish the TMDL within 30 days of disapproval.

(6) Upon approval, incorporate the TMDLs into the state water quality management plans required by Sections 303(e) and 208.

3.2 Total Maximum Daily Load Development Process

The process of identifying waters that may require a TMDL and the process of establishing or developing a TMDL are quite similar except that the latter process is more detailed and often based on more comprehensive data. The key steps of either process include:

(1) Assess current water quality in the context of established WQSs and available data.

(2) Isolate problem areas and pollutants of concern. Identify emerging problems or marginal water quality situations.

(3) Identify and quantify major sources of the pollutant or pollutants of concern.

(4) Estimate water quality under design conditions. The design conditions should assume application of best management practices (BMPs) for non-point sources (NPSs) and technology based controls [Sections 301(b)(1)(A) and 301(b)(1)(B) of the Act] for point sources. If technology based controls have not been defined for selected point source categories, the analyst should substitute existing discharge limitations where available.

If, as a result of step 4, the water quality criteria will be attained, then the waterbody under consideration is termed "effluent limited" (see definitions in Section 2). For effluent limited segments or waterbodies, a TMDL need not be calculated.

If step 4 indicates that the water quality criteria will not be attained, i.e., the technology based effluent limitations are not stringent enough or are not available, then the segment or waterbody should be designated as "water quality limited" (see definitions in Section 2). Water quality limited segments require the establishment of TMDLs "... at a level necessary to implement the applicable water quality standards ..."

Figure 3.1 describes the key dynamics and variables in calculating annual loadings to a lake or reservoir and the resultant in lake concentrations. In this example:

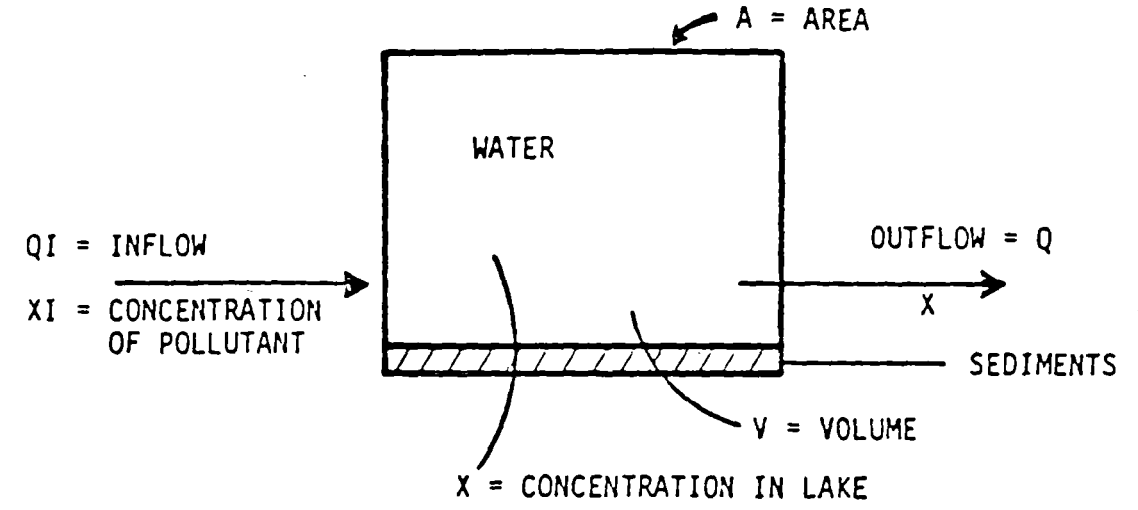
P = In-Lake Phosphorus Concentration

PI = Inflow Phosphorus Concentration

QI = Rate of Water Inflow (Annual)

L_p = Phosphorus Load (Annual)

This is a rather simple description of the aspects which influence Lake Michigan's water quality, but it demonstrates the basic integration of pollutant concentration (PI), lake inflows (QI) and outflows (Q), load (L_p), transformation rates (K), volume (V) and time (T). The time component is based on the yearly cycle because diffuse loadings from



For Examole - Phosphorus, P = X

LOADING

$$Lp = QI \cdot PI / A, \ mg/m^2 \ year$$

MASS BALANCE

Assumptions: completely mixed, steady state, $Q \cong QI$, annual average rates are constant

Definitions: Mean depth, $\bar{Z} = V/A$; hydraulic flushing or dilution rate, $D = Q/V$; hydraulic loading, $q_s = Q/A$; $M = QI \cdot PI$; K = net rate of solid phase removal and release (proportional to P), typically negative when averaged over the annual cycle.

$$\frac{dP}{dt} = \frac{Q \cdot PI}{V} - \frac{Q \cdot P}{V} - KP = 0$$

Solving for P,

$$P = \frac{D \cdot PI}{D + K} \qquad \text{(Mass Balance Form)}$$

$$P = \frac{M}{Q}\left(\frac{D}{D + K}\right) \qquad \text{(Mass Inflow Form)}$$

$$P = \frac{Lp}{\bar{Z}\ (D + K)} \qquad \text{(Loading Form)}$$

FIGURE 3-1 FORMULATIONS FOR EVALUATING MANAGEMENT OPTIONS FOR POLLUTANTS IN LAKES AND RESERVOIRS

NPS and atmospheric deposition are heavily affected by seasonal factors such as greater load delivery from NPS in the Spring than in the Fall when precipitation declines. The annual cycle allows for consideration of the "seasonal variation" as mentioned in Section 303(d) of the Act. Once annual loadings are defined in terms of rates and sources, control strategies can be tested which provide for reduced loadings. Upon selection of a control strategy that yields the required in-lake concentration, P in the example, the annual maximum load is disaggregated among its diffuse and point source components. The point source annual WLA can then be divided by 365 to produce the point source TMDL.

3.3 Open Lake vs. Nearshore Total Maximum Daily Loads

While Lake Michigan exhibits many characteristics typical of lakes and reservoirs, its immense size is certainly not typical of usual waterbodies where TMDLs are considered. This has resulted in some issues on the appropriateness of open lake vs. nearshore TMDLs.

For instance, the total volume of the lake is on the order of 1,180 cubic miles [8]. The average retention time is about 100 years, which indicates that waters in the lower depths probably require many more years before exchange occurs. Practically speaking, this means that what is discharged to the lake remains in the lake. Of course, this consideration is tempered by transformation mechanisms which may cause a substance to decay to the basic elements, volatilize, or otherwise leave the system. As an example, while the half life of BOD is about three days, certain PCB Aroclors may have a half life on the order of 15-20 years [9]. DDT is another persistent molecule that has been a historical problem in the Great Lakes.

As indicated in Appendix 1, none of the States bordering Lake Michigan support the need for lake-wide or open lake TMDLs. Both Michigan and Wisconsin support nearshore analyses to define TMDLs and mixing zones. They argue that with proper control at river mouths or nearshore discharge locations, open lake WQSs should be met.

The arguments which have been raised favoring nearshore analyses and "isolated" TMDL calculations include:

(1) The entire lake is not available to assimilate wastes from distant sources. As an example, if PCB has been identified as a problem in Lower Green Bay, why consider any of the waters in the south end of Lake Michigan as part of either the problem or the solution in Green Bay?

(2) Water quality criteria form the bases for enforceable NPDES permits. The TMDL is a vehicle to translate the criteria into control requirements at individual sources. If the criteria are met at the edge of the mixing zone, outfall or river mouth, why extend the TMDL any further?

(3) The law only requires TMDL calculation where technology based controls are insufficient to meet any "water quality standard applicable to such waters". If the standard is being met in open waters, a load allocation or TMDL is not required.

The arguments which have been raised favoring lake-wide TMDL calculation include:

(1) The open lake standards are not being met since the fish in the open waters are contaminated by persistent toxic chemicals to the extent that interstate shipment of commercial fish is restricted and fish consumption advisories are routinely issued to help protect the public.

(2) Open lake standards are not being achieved as evidenced by periodic violations of the fecal coliform, ammonia, and cyanide standards. Selenium and silver are elevated and appear to be lake-wide problems.

(3) Open lake response is delayed because of the lake's tremendous reservoir capacity. Problems may become detectable lake-wide after several years from the initial discharge.

(4) Nearshore analyses do not consider the substantial load contribution to Lake Michigan from atmospheric deposition. As such, nearshore analyses cannot focus on the total problem.

In conclusion, there are arguments for and against lake-wide TMDLs. However, the law is reasonably clear about where and when TMDLs are necessary. Section 303(d)(1)(A) says that, "Each State shall identify those waters within its boundaries for which the effluent limitations required by Section 301(b)(1)(A) and Section 301(b)(1)(B) are not stringent enough to implement any water quality standard applicable to such waters." Section 303(d)(1)(C) continues, "Each State shall establish for the waters identified in paragraph (1)(A) of this subsection ... the total maximum daily loads ... at a level necessary to implement the applicable water quality standards ..."

In the case of Lake Michigan there are specific areas which routinely fail to meet specific water quality criteria such as the fecal coliform and low dissolved oxygen problems in lower Green Bay and similar problems in Milwaukee Harbor. These types of problems can be addressed via nearshore analyses and TMDLs. On the other hand, the quality of water for the entire lake, top to bottom, is impacted so severely by selected pollutants that the lake's immense assimilative capacity is already exceeded. Examples in this category are PCBs, selenium and silver. Table 3.3 depicts the parameter, current lake-wide concentrations, the water quality criteria recommended by USEPA and the associated use impact.

TABLE 3.3

PARAMETERS EXCEEDING CRITERIA LAKE-WIDE IN LAKE MICHIGAN

Parameter	Current Quality	Reference	USEPA Recommended Criteria [4]	Use Impact
PCBs	7-9 ng/l	[15]	0.079 ng/l	Human Health
Selenium	5-10 ug/l	[12]	10 ug/l	Aquatic Life
Silver	2-3 ug/l	[12]	0.12 ug/l	Aquatic Life

Parameter	Fish Tissue Concentration	Reference	FDA Action Level	Use Impact
PCBs	4-26 ppm	[15]	2 ppm	Human Health
Chlordane	0.6 ppm	*	0.3 ppm	Human Health
DDT	5 ppm	*	5 ppm	Human Health
Dieldrin	0.4 ppm	*	0.3 ppm	Human Health

*From Prepublished Report on "Contaminant Trends in Lake Trout from the Upper Great Lakes" by Devault, Willfond and Hasselberg for Great Lakes National Program Office.

3.4 Total Maximum Daily Loads Relationship to Wet Weather Loadings

Lake Michigan is currently impacted by wet weather induced loadings from selected point and NPS. These impacts are sufficient to cause periodic violations of the WQS.

Some examples of wet weather impacts include:

(1) Combined sewer overflow (CSO) discharges to the inner harbor at Milwaukee, with possible carryover to the outer harbor.

(2) CSO discharges in the vicinity of the Indiana Harbor and Ship Canal.

(3) CSO Discharges from Michigan City, Indiana.

(4) Backflow of the Chicago River at the Chicago and Wilmette locks.

(5) Nutrient loadings from agriculture, primarily in the Green Bay and Milwaukee Harbor areas.

(6) Chloride loadings from road salting operations in the lower portion of Lake Michigan.

The above sources and related problems add to the complexity of the water quality problems in the lake. The list could also include pollutant loadings from air deposition. Because of the intermittent loading nature of these sources and numerous factors which influence loading rates, such problems are difficult to quantify and characterize. Nevertheless, under the proper technical and analytic conditions, TMDLs can be developed for wet weather loadings.

SECTION 4

STATE RESPONSES TO THE CLEAN WATER ACT REQUIREMENTS

4.1 Historical Actions

The recent actions concerning TMDLs on Lake Michigan as part of the Scott Decision should not be interpreted as the only actions which have been accomplished on the subject. All of the bordering states previously reviewed the requirements and made explicit TMDL decisions in the 1973-1974 period. These decisions are discussed below.

4.1.1 Illinois

Illinois originally designated all of the waterbody segments in the state as water quality limited. This meant that at least a portion of each segment required water quality based controls for point sources. The Lake Michigan waters were incorporated in segments A-02, A-03, A-04 and A-12.

With regard to these particular segments, the primary TMDL calculations required pertained to the Chicago River, Cal-Sag Channel, North Shore Channel and the Sanitary and Ship Canal. The WLA requirements were originally accomplished by MSDGC and later verified by the Northeastern Illinois Planning Commission's "208" water quality management plan. Control facilities are currently under construction. No particular TMDL needs were identified for Illinois Lake Michigan waters because state and local agencies have since the turn of the century, pursued a policy of eliminating direct discharges to the lake. Remaining discharges include a wet weather treatment facility near Waukegan, Illinois and several separate storm sewer discharge locations. There is also a permitted discharge from Outboard Marine Corporation at Waukegan that contains PCBs in the effluent.

4.1.2 Indiana

Indiana designated four segments which included the shoreline portions of Lake Michigan as water quality limited and requiring TMDLs. These included segments 1W1, 2W1, 3W1 and 4W1.

As with Illinois, these segments were designated water quality limited based on the incorporation of interior waters as part of the segments rather than Lake Michigan. The TMDL for Grand Calumet River (1W1) has been prepared in draft form and will be finished by September 1. The TMDL for Deep River (2W1) was completed by the Northwestern Indiana Regional Planning Commission in 1981 and included TMDLs for portions of the Little Calcumet River (3W1). The final segment, Trail Creek (4W1), has a TMDL that was completed by the state in 1984.

The TMDL for segment 1W1 includes the Indiana Harbor and Ship Canal. One of the principal controlling features of the TMDL is the need to meet open Lake Michigan WQS at the harbor mouth.

4.1.3 Michigan

Michigan updated its water quality segment list in 1979, at which time 19 segments were designated water quality limited. None of these included Lake Michigan waters.

4.1.4 Wisconsin

Wisconsin originally designated Green Bay as the only Lake Michigan segment being water quality limited. The Milwaukee River M.P.3 to M.P.0 was also water quality limited and has an impact on harbor quality. TMDLs for both of these waters are in progress.

4.2 Current State Actions

On December 28, 1984, Region V forwarded a letter to each of the bordering states requesting that they review the Scott vs. Hammond action and formally state their position with regard to the need to prepare TMDLs for Lake Michigan. Those responses were received on or about March 6 and are summarized as follows. The original letters are reproduced in Appendix 1.

4.2.1 Illinois

The Illinois EPA stated that no TMDLs were required for any Illinois discharges to Lake Michigan.

Illinois also stated that there were interstate water quality concerns which USEPA should help to resolve. This point was not expanded to identify particular waters or pollutants.

4.2.2 Indiana

Indiana indicated that the waters of Lake Michigan within Indiana's border are meeting current WQS except for occasional violation of "total phosphorus, phenolics, DO, cyanide and fecal coliform". These violations were attributed to CSOs and dry weather bypasses. The state concluded that no TMDLs were necessary for Indiana waters.

4.2.3 Michigan

Michigan DNR indicated that for conventional pollutants (BOD, suspended solids, fecal coliform and pH), technology based controls are fully adequate and TMDLs are not necessary. In terms of toxicants, Michigan DNR underscored the need to perform analyses to define mixing zones and otherwise assure the adequacy of technology based controls in meeting Lake Michigan WQS. Michigan strongly opposed whole-lake TMDLs for several reasons.

4.2.4 Wisconsin

Wisconsin stated that with the possible exception of phosphorus, the state did not believe it feasible to establish TMDLs for the entirety of Lake Michigan. The state does support TMDL development for specific nearshore areas. Four such areas were identified and are listed in Table 4.0 below.

TABLE 4.0

NEARSHORE AREA TMDLs IN WISCONSIN

Area	Pollutant	Status	Complete
Lower Green Bay	BOD Ammonia	In Progress	September 1985
Peshtigo River	BOD	In Progress	September 1985
Oconto River	BOD	In Progress	September 1986
Milwaukee Harbor	BOD Phosphorus	In Progress	December 1985

Although Wisconsin does not currently support lake-wide TMDLs, lake-wide impacts and problems are used as arguments for control at specific discharge points. Wisconsin shares several of the same reservations as Michigan regarding the feasibility of establishing lake-wide TMDLs for many parameters because:

(1) The environmental fate and dynamics of many toxic pollutants are not presently understood.

(2) Sources and loadings are not adequately documented.

(3) Transformation and ecosystem impacts are not presently understood.

SECTION 5

USEPA EVALUATION OF STATE POSITIONS ON TMDLs

5.1 Evaluation Methodology

The evaluation of State positions on the need for TMDLs follows a two level screening process. It should be understood that neither the states nor USEPA have sufficient data and research to completely describe all of the environmental problems of Lake Michigan, all pollutants of concern, all environmental pathways, all environmental ramifications, nor all of the solutions. The point is that the screening process may surface factors which prevent the states or USEPA from making a final decision on the need for TMDLs at this time.

The Court of Appeals had the wisdom to recognize this in a statement made on page 8 of the decision [1].

> "[T]he district court may order the EPA to proceed as if the states had submitted proposals of no TMDL's unless the EPA promptly comes forward with persuasive evidence indicating that the states are, or will soon be, in the process of submitting TMDL proposals or that some factor ... has made TMDL submissions impracticable ". (Emphasis added.)

We add that for some pollutant problems controls focusing only on point sources will be inadequate to solve the problem. These would include problems with negligible point source contributions or those caused by diffuse sources such as sediment loadings, air deposition, in place pollutants, agricultural and urban runoff. Integrated management programs may be needed to control diffuse sources. Such programs are available under Section 208 of the Clean Water Act to address nonpoint sources, the Toxic Substance Control Act, the Clean Air Act and the Resource Conservation and Recovery Act. The TMDL approach can serve to focus these various sources and facilitate integrated management.

The following subsections describe the process of screening Lake Michigan water quality problems in support of USEPA's response to the district court. That response may take one of five possible courses:

(1) TMDLs are required and are completed, underway or scheduled by the states.

(2) Data collection is necessary to characterize the problem and sources of pollution.

(3) TMDLs are not necessary and the problem is appropriately addressed via other environmental legislation.

(4) Basic research is necessary to develop mathematical models capable of calculating a TMDL.

(5) TMDLs are required, there are no factors which make "... TMDL submissions impracticable". USEPA must undertake TMDL development.

5.1.1 First Level Screen Water Quality Assessment

(1) Assess current water quality in the context of established and recommended water quality standards as well as available data, literature and research.

(2) Isolate problem areas and pollutants of concern. Identify lake-wide problems (problems or emerging problems that impact the water or waters uses of at least two states).

(3) Compare the pollutant with completed, ongoing, or planned TMDL activities by bordering states. If the problem is localized and will be adequately addressed by a state TMDL, the pollutant and problem will be eliminated from further screeing. All other problems and pollutants of concern will be carried to a second level screen.

5.1.2 Second Level Screen - TMDL Determination

(1) Identify known or probable sources of the pollutant and quantify contribution to Lake Michigan by major source.

(2) If source identification and rough quantification cannot be made, recommend a data collection program pursuant to Sections 106, 108, 208 and 308 of the CWA.

(3) For remaining problems and pollutants, determine whether adequate large lake models are available to quantify sources, loadings and control programs at higher resolution than afforded by a screening process. If models are not available, recommend basic research pursuant to Section 304 of the CWA.

(4) For remaining pollutant and problems needing TMDL development but not identified by the States, recommend TMDL development by USEPA's Large Lakes Research Station in cooperation with Region V's Water Division and Great Lakes National Program Office.

5.2 Region V Analysis

5.2.1 General Discussion of Water Quality Issues

A discussion of the water quality of Lake Michigan should out of necessity reference the most current data bases, studies and evaluations of the lake's quality, characteristics, and problems. One of the most complete reference documents consists of the annual report on Great Lakes water quality as published by the Great Lakes Water Quality Board for the U.S. - Canadian International Joint Commission (IJC).

This report serves to partially satisfy the provision of the 1972 Water Quality Agreement between the United States and Canada that a surveillance program be established"...to monitor the quality of boundary waters to ensure that the objectives are being met."

The 1983 report published by the IJC is the latest annual report available [11]. This report describes four Class "A" areas of concern in Lake Michigan. Class "A" areas are those that display significant environmental degradation and severe impairment of beneficial uses and those areas are listed in Table 5.1.

TABLE 5.1

Water Body/Area	Environmental Problem
Fox River and Lower Green Bay, Wisconsin	High phosphorus, BOD, ammonia, heavy metals and PCB levels in the water column and sediment. Low dissolved oxygen, fish flesh contamination by organic chemicals.
Milwaukee Estuary, Wisconsin	High phosphorus, nutrient BOD, PCB and fecal coliform levels. Low dissolved oxygen, fish flesh contamination by organic chemicals.
Waukegan Harbor, Illinois	Sediment, water and fish flesh contaminates with PCBs.
Grand Calumet River, Indiana Harbor and Ship Canal, Indiana	High BOD, ammonia, fecal coliform, heavy metals and organic chemicals. High fish mortality, fish flesh and sediment contamination by organic chemicals.

Table 5.2 summarizes the water quality problems listed above as well as others described in several current studies of Lake Michigan water quality. The notes accompanying Table 5.2 contain important supplemental information as well as the basic reference which provided the data.

It is important to understand that the pollutants which impact Lake Michigan water quality stem from a variety of sources:

(1) point source discharges

(2) nonpoint sources

(3) air deposition

(4) sediment resuspension/exchange

(5) groundwater and seepage

Table 5.2 LAKE MICHIGAN POLLUTANT PROBLEMS AND RECOMMENDED ACTION

PROBLEM POLLUTANTS	USE IMPACTS	IMPACT LOCATION	TMDL STATUS	SOURCE ID	LOADINGS PERCT BY SOURCE POINT	DIFFUSE	SEE NOTE	AVAIL MODELS	RECOMMENDED TMDL ACTION
CONVENTIONAL POLLUTANTS									
BIOLOGICAL OXYGEN DEMAND	FISHERY	SEE NOTE (1)	IN PROGRESS	IN PROGRESS	TBA	TBA	(5)	YES	DEVELOP TMDL
FECAL COLIFORM	SWIMMING	SEE NOTE (2)	IN PROGRESS	IN PROGRESS	> 90%	< 10%	(4)(5)	YES	DEVELOP TMDL
NONCONVENTIONAL POLLUTANTS									
AMMONIA	FISHERY	L GREEN BAY	IN PROGRESS	IN PROGRESS	TBA	TBA	(5)	YES	DEVELOP TMDL
PHOSPHOROUS	MULTIPLE	LAKE-WIDE	COMPLETED (3)	COMPLETED (3)			(6)	YES	COMPLETED
RADIONUCLIDES	MULTIPLE	HURON/ONTARIO		COMPELTED(11)			(11)		NONE L MICH
TOXIC POLLUTANTS									
BANNED ORGANIC TOXINS									
ALDRIN/DIEL (PART BAN)	FISH CONSUMP	LAKE-WIDE	NOT REQUIRED						NO TMDL NEEDED
CHLORDANE (PART BAN)	FISH CONSUMP	LAKE-WIDE	NOT REQUIRED						NO TMDL NEEDED
DDT	FISH CONSUMP	LAKE-WIDE	NOT REQUIRED	COMPLETED(10)			(10)	YES	NO TMDL NEEDED
HEPTACHLOR (PART BAN)	FISH CONSUMP	LAKE-WIDE	NOT REQUIRED						NO TMDL NEEDED
PCB (PART BAN)	FISH CONSUMP	LAKE-WIDE	MAY BE REQUIRED	INCOMPLETE	< 40%	> 60%	(10)	YES	ACQUIRE DATA
TOXAPHENE (PART BAN)	FISH CONSUMP	LAKE-WIDE	NOT REQUIRED						NO TMDL NEEDED
OTHER ORGANIC TOXINS									
CHLORINATED BENZENES	FISHERY		MAY BE REQUIRED	INCOMPLETE					ACQUIRE DATA
HEXACHLOROBENZENE	FISH CONSUMP		MAY BE REQUIRED	INCOMPLETE					ACQUIRE DATA
HEXACHLORDCYCLOHEXANE	FISH CONSUMP		MAY BE REQUIRED	INCOMPLETE					ACQUIRE DATA
POLYN AROMATIC HYDROCAR	FISH CONSUMP	SEE NOTE (9)	MAY BE REQUIRED	INCOMPLETE	< 10%	> 90%	(9)		ACQUIRE DATA
POLYCHLOR DIBENZOFURAN	MULTIPLE	SEE NOTE (8)	MAY BE REQUIRED	INCOMPLETE			(8)		ACQUIRE DATA
2,3,7,8 TCDD DIOXIN	MULTIPLE	SEE NOTE (8)	MAY BE REQUIRED	INCOMPLETE			(8)		ACQUIRE DATA
METALS & TRACE ELEMENTS									
ARSENIC	NONE WQS MET	SEE NOTE (12)	NOT REQUIRED				(12)	YES	NO TMDL NEEDED
CADMIUM	NONE WQS MET	SEE NOTE (12)	NOT REQUIRED				(12)	YES	NO TMDL NEEDED
IRON	NONE WQS MET	SEE NOTE (12)	NOT REQUIRED				(12)	YES	NO TMDL NEEDED
LEAD	NONE WQS MET	SEE NOTE (12)	NOT REQUIRED				(12)	YES	NO TMDL NEEDED
MERCURY	NONE WQS MET	SEE NOTE (12)	NOT REQUIRED				(12)	YES	NO TMDL NEEDED
SELENIUM	FISHERY	SEE NOTE (12)	MAY BE REQUIRED	INCOMPLETE			(12)	YES	ACQUIRE DATA
SILVER	FISHERY	SEE NOTE (12)	MAY BE REQUIRED	INCOMPLETE			(12)	YES	ACQUIRE DATA

SEE SUPPLEMENTAL NOTES

TABLE 5.2

SUPPLEMENTAL NOTES

1. Lower Green Bay, Peshitigo River, Oconto River, Milwaukee River and Harbor. See Appendix 1, this report.

2. Storm related fecal coliform violations reported in the vicinity of Hammond and Michigan City, Indiana, Milwaukee Harbor, Chicago and Wilmette Harbors. See Appendix 1, this report.

3. Point source phosphorous limited to 1 mg/l for POTWs discharging 1 MGD or more. Reference: Annex 3, Great Lakes Water Quality Agreement of 1978 [5].

4. Percent of point source contribution estimated. TMDLs not appropriate because loadings originate from combined sewer overflows on an storm event rather than daily basis. Fecal coliform is not a persistent pollutant. Effects are localized.

5. See State responses to TMDL needs, appendix 1, this report.

6. See reference [5] Section 8, this report.

7. Toxaphene registration was withdrawn by USEPA for most uses in 1982. Toxaphene has been found in fish filets at high levels. The pathways and fate in the Great Lakes remain largely unknown, although the atmosphere is a major source. The Great Lakes State Advisory Board recommended further research on the substance. See reference [11] Section 8, this report.

8. The Surveillance Appendix of the 1983 Report on Great Lakes Water Quality [12], reflected dioxin (2,3,7,8 TCDD) and polychlorinated dibenzofurans as two groups of aromatic compounds of emerging and increasing concern in the Great Lakes. Although these highly toxic substances have been detected in fish at several locations in the Great Lakes, the sources, pathways and fate remain largely unknown.

9. The Surveillance appendix of the 1983 Report on Great Lakes Water Quality identified polyaromatic hydrocarbons (PAH) as an emerging toxicant issue. PAHs result from incomplete combusion of organic materials, such as forest fires, and are therefore, ubiquitous but concentrations rise as urbanization increases. Air deposition its predominant source of PAH loading to it Great Lakes [12].

10. The Surveillance Appendix of the 1983 Report on Great Lakes Water Quality [12] stated that PCBs and DDT in Lake Michigan are the highest contaminant levels of any of the Great Lakes. DDT is a historical problem which will require many more years before acceptable levels are reached. Unlike DDT, the ban on PCB production and most uses is much more recent and PCB is being discharged by a number of sources.

TABLE 5.2 (CONTINUED)

SUPPLEMENTAL NOTES

11. Radiological quality was reported as satisfactory in all locations except the Serpent River and Port Hope Harbor in Lakes Huron and Ontario respectively. Reference [13] appendix on Radioactivity to the 1983 report on Great Lakes Water Quality.

12. Of numerous trace metals evaluated, Ronald Rossman [14] reported only selenium and silver as exceeding IJC objectives in Lake Michigan.

When viewing the problems of Lake Michigan, one must consider its tremendous surface area at 22,300 square miles. Wet and dry air deposition is not important in most TMDL analyses. However, for the Great Lakes, air deposition is often the largest single source of pollutant loadings. For some parameters, the key to clean water may literally be clean air. Table 5.2 lumps sources (2) through (5) above as diffuse sources of pollutant load.

Volume is also a major consideration because this huge reservoir of fresh water requires on the order of 100 years to flush or provide a complete exchange of water. Consequently, the effect of a new conservative pollutant introduced will be delayed as the lake mixes slowly. Conversely, the beneficial effects of removing a pollutant load will also be delayed due to the long time frame necessary to reach equilibrium with the new quality of inflow.

As such, some of the problems discussed are "historical" in that we are dealing with the artifacts of a period when use and manufacture of the pollutant was widespread and insufficiently controlled. DDT is a substance which fits this description since it was banned entirely many years ago but can still be found in fish tissue at unacceptable levels. For most of the banned substances, point sources no longer contribute significant loadings. PCB is a possible exception since point sources still contribute a significant share of the total lake loading. PCBs and other lake-wide problems are discussed more thoroughly below.

The following sections discuss problem pollutants by category and summarize Region V findings with regard to one of the five possible TMDL positions discussed in Section 5.1.

5.2.2 Conventional Pollutants

Biochemical oxygen demand (BOD) and fecal coliform organisms are conventional pollutants which are causing impacts in selected nearshore areas (see Table 5.2). In responding to these problems, the bordering States are instituting programs including TMDL preparation, necessary to achieve the water quality criteria and eliminate use impacts. Lake Michigan waters and/or tributaries with TMDLs for BOD prepared or in progress include:

WATERS	STATE	STATUS
North Shore Channel	Illinois	Completed
Chicago River	Illinois	Completed
Cal-Sag Channel	Illinois	Completed
Indiana Harbor	Indiana	In Progress
Trail Creek	Indiana	Completed

WATERS	STATE	STATUS
Milwaukee Harbor	Wisconsin	In Progress
Lower Green Bay	Wisconsin	In Progress
Oconto River	Wisconsin	In Progress
Preshtigo River	Wisconsin	In Progress

The sources of fecal coliform contamination in selected nearshore areas are caused almost exclusively by storm induced discharges and runoff. Runoff from NPS is not subject to NPDES permit limitations. However, discharges from combined sewers are subject to permit limitations. The limitations ordinarily require sampling and development of water quality based control programs keyed to a statistically recurring storm events rather than daily limitations. As such, TMDLs can be developed but the averaging period for compliance must be shifted from daily limits to event average limits. Consequently, TMDLs are necessary to solve the remaining fecal coliform problems in nearshore areas. Wisconsin is developing TMDLs that will address fecal coliform. Illinois is implementing the MSDGC TARP program to control Chicago discharges. Indiana has completed preliminary studies for selected CSO problems and is in the process of implementing a solution for Michigan City.

Conventional Pollutants Summary:

TMDL Aspect	Region V Findings
WQS Violations	Fecal Coliform and BOD_5
Pollutant Sources	Point and Nonpoint Sources
Significant Point Sources	Documented
Locations	Mutiple - See Table 5.1
Technology Based Controls	Inadequate to Meet WQS
TMDLs Required	Yes
Nearshore or Lake-Wide	Nearshore
Practicability of TMDL	Practicable
TMDL Status	Scheduled, In Progress or Completed
State TMDL Proposals	Satisfactory
USEPA Required Actions	Approve TMDL Proposals

Comments: None

5.2.3 Nonconventional Pollutants

Nonconventional pollutants include ammonia, iron, phosphorous and radionuclides. In terms of ammonia, the State responses identify lower Green Bay as the only area significantly impacted by ammonia. Ammonia did not surface as a problem in the Draft Indiana Harbor Ship Canal TMDL for areas outside the harbor. Further reductions in ammonia are expected at East Chicago and Michigan City, Indiana as control programs progress.

Iron was discounted as a problem in a recent paper by Ronald Rossman, 1984 [14]. His data show compliance with the International Joint Commission objectives for this metal in Lake Michigan waters.

Phosphorus is perhaps the most studied substance in the Great Lakes. Annex 3 to the 1978 Great Lakes Water Quality Agreement limits the discharge of total phosphorus from point sources 1 MGD to 1 mg/l concentration. The United States and Canada feel this is sufficient to achieve desired water quality in Lake Michigan. Consequently, there is no need for a phosphorus TMDL.

A thorough discussion of radiological quality is included as an Appendix on Radioactivity to the 1983 Report on Great Lakes Water Quality [13]. The appendix cites only two areas of concern in Lake Huron and Lake Ontario. Consequently, this family of substances will not be addressed further, since there no documented problems in Lake Michigan.

Nonconventional Pollutants Summary:

TMDL Aspect	Region V Findings
WQS Violations	Ammonia and Phosphorus
Pollutant Sources	Point and Nonpoint Sources
Significant Point Sources	Documented
Locations	Nutrient Impacts -- Lake-wide
	Ammonia -- Lower Green Bay
Technology Based Controls	Inadequate
TMDLs Required	Yes
Nearshore or Lake-Wide	Ammonia -- Nearshore
TMDL Status	In Progress
State TMDL Proposals	Satisfactory
USEPA Required Actions	Approve TMDL Proposals

Comments: Annex 3 to the U.S. - Canadian Water Quality Agreement provides adequate point source controls for phosphorus.

5.2.4 Toxic Pollutants

As a group, toxic substances constitute the greatest threat to the water quality and beneficial uses of Lake Michigan. the following sections discuss the toxic pollutant problems and are organized into three groups: banned organic toxins, other organic toxins, and the metals and trace elements.

5.2.4.1 Banned Organic Toxins

The persistency, toxicity, and bioaccumulative characteristics of the banned toxins listed in Table 5.2 provide the basic reasons for government actions taken to eliminate these substances from the environment. Collectively, these substances have caused considerable damage to the fisheries of Lake Michigan and numerous other waters. They have and will continue for some years to create a threat to the public from the consumption of contaminated fish flesh.

DDT levels in Lake Michigan fish have fallen dramatically since the DDT ban went into effect. The ban on the other substances are expected to be equally effective in the long term. PCB may be an exception, at least in the short-term since it is still in use for limited purposes and since there is considerable recycling of the substance in materials such as reprocessed waste paper. Consequently, limitations on point sources are appropriate. Region V is not recommending TMDL development at this time for total loading to Lake Michigan because existing loads are not well defined and all sources have not been identified and quantified. Reference [12] indicates that atomospheric deposition may account for over 60% of the total annual load to the lake.

In addition to defining sources and loads, other actions are necessary before a final decision can be reached on the need for a TMDL. One of those actions involves development of a water quality standard for open lake water by Illinois, Michigan and Wisconsin. Indiana is the only state that has articulated a Lake Michigan PCB WQS at 1 nannogram/liter. This is close to the USEPA 10^{-5} risk level value at 0.79 nannograms/liter. Illinois has no specific procedure for deriving WQ criteria for the protection of human health, although IEPA is said to be developing one. Michigan has an excellent procedure patterned after the USEPA guidance, but there is no indication that the state applied that procedure to derive a numerical criterion for PCB. Wisconsin references USEPA guidance in its WQ standards and is also developing procedures of its own. Finally, it is also believed that large

lake models which are available for PCB TMDL development require refinements and enhancements to improve their reliability. Consequently, there are several factors which make a decision on PCBs impracticable at present.

Banned Organic Toxins Summary:

TMDL Aspect	Region V Findings
WQS Violations	PCB in Water Column and Fish Flesh Contamination
Pollutant Sources	Partially Defined
Significant Point Sources	Partially Defined
Locations	Lake-Wide
Technology Based Controls	Inadequate to Meet WQS
TMDLs Required	May be Required
Nearshore or Lake-Wide	Lake-Wide
Practicability of TMDL	Impracticable at Present
State TMDL Proposals	Satisfactory
USEPA Required Actions	See Comments

Comments: Federal action under appropriate rules to fully or partially ban the manufacture and use of the substances listed in Table 5.2 will eventually eliminate these substances as problem pollutants. PCB maybe an exception at least in the short term. Several factors render a decision on the need for a TMDL for PCBs impracticable at present. Section 7 of this report outlines actions which Region V will take or recommend to remove those factors and reach a TMDL decision.

5.2.4.2 Other Organic Toxins

The group of substances listed in Table 5.2 as "Other Organic Toxins" share the distinction of being detected in fish flesh in some locations of Lake Michigan, being highly toxic, and generally lacking data concerning loadings, sources, distribution and environmental fate. The IJC refers to these substances as emerging problems in the Great Lakes [12] which require more surveillance and analysis.

In addtion to this general lack of data, none of the states bordering Lake Michigan have articulated specific numerical criteria for these substances although USEPA has published criteria guidance. Table 3.1 summarizes state water quality criteria and USEPA guidance. The states need not adopt specific numerical criteria if they have acceptable procedures for generating criteria when the need arises. Michigan has such an approach although the balance of states bordering Lake Michigan are only in the process of developing such procedures. A final factor which influences the practicability of developing TMDL concerns water quality models. Although such models may be available, it is suggested that considerable development and enhancement would be necessary to derive one which would yield reasonable confidence in results for the substances listed.

Collectively, these factors render a decision on the need for a TMDL impracticable at present.

Other Organic Toxins Summary:

TMDL Aspect	Region V Findings
WQS Violations	Inadequate Data
Pollutant Sources	Inadequate Data
Significant Point Sources	Unknown
Locations	Partially Defined
Technology Based Controls	Probably Inadequate
TMDL Required	May be Required
Nearshore or Lake-Wide	Unknown
Practicability of TMDL	Impracticable at Present
State TMDL Responses	Satisfactory
USEPA Regional Action	See Comments

Comments: Section 7 of this report describes actions to be undertaken or recommended by Region V to remove the factors which make a decision or the need for a TMDL impracticable present.

5.2.4.3 Metals and Trace Elements

Many of the metals in Table 5.2 were originally listed as candidates for TMDL preparation. However, as part of the screening process it was found that several of these metals

are now in compliance with all applicable WQ standards as a result of several years of declining lake concentrations. This reflects favorably upon past pollution control efforts as well as the lake's ability to respond to declining loads. The remaining metals are discussed as follows:

Selenium

Ambient values do not currently violate state WQS or USEPA recommended criteria at 10 ug/l. However, the selenium concentration trend is on the rise and the IJC objective for this substances is only 1 ug/l. As such, a TMDL may be necessary to prevent future violations of the existing standards.

The WQ standard should be reviewed to determine whether 10 ug/l is sufficient to protect the beneficial uses or whether the criteria should be lowered to match IJC objectives.

Silver

The ambient concentrations of silver are low at 2-3 ug/l and within current Illinois and Indiana WQ criteria at 30 and 50 ug/l respectively. However, the ambient concentrations do exceed the 0.1 ug/l level recommended by USEPA and the IJC for the protection of aquatic life. Michigan and Wisconsin develop case-by-case toxic substance criteria, but have not established one for silver in the lake waters. Consequently, action is required by the bordering states to review the WQS for this particular substance as well as others mentioned above. At the conclusion of that process, the decision on the need for a TMDL should be reviewed.

Metals and Trace Elements Summary:

TMDL Aspect	Region V Findings
WQS Violations	Potential, WQS Require Review (Ag, Se)
Pollutant Sources	Defined
Significant Point Sources	Yes
Locations	Partially Defined
Technology Based Controls	May be inadequate
TMDLs Required	May be required
Nearshore or Lake-Wide	Potentially Lake-Wide
Practicability of TMDL	Practicable

TMDL Aspect	Region V Findings
State TMDL Response	See Comments
USEPA Required Action	See Comments

Comments: The need for a TMDL for the metals listed is largely contingent on the state review of WQ standards on the part of Illinois and Indiana and development of numerical criteria on the part of Michigan and Wisconsin. Section 7 outlines actions which Region V will take or recommend to eliminate questions concerning the need for TMDLs.

SECTION 6

REGION V CONCLUSIONS ON STATE TMDL POSITIONS

6.0 General Comments

As discussed at the beginning of Section 5, Region V's response to the State's TMDL proposals, or non-proposals, could take several courses depending on the substance, the available data base and other factors. Where factors have made a decision on the the need for a TMDL impracticable at the present, these factors are identified and will be addressed.

6.1 Conclusions on Illinois

Region V finds that Illinois provided insufficient justification to defend its position that there is no need to develop TMDLs for any Illinois discharges. However, the independent review by Region V is sufficient to sustain Illinois' position regarding conventional and nonconventional substances.

In terms of toxic pollutants, Region V has identified 9 substances which may require lake-wide or nearshore TMDLs to achieve protective water quality criteria. The lack of data on sources, distribution, fate and impact make a decision on the need for TMDLs impracticable at present. Therefore, Illinois' position on toxic substances is sustainable for the momemt but not for the reasons cited. Illinois will be requested to review its water quality criteria and to assist in the acquisition of necessary environmental data.

6.2 Conclusions on Indiana

Region V finds that Indiana provided insufficient justification to defend its position that Indiana, Lake Michigan waters do not require TMDLs in order to meet the water quality standards. However, the independent review by Region V is sufficient to sustain Indiana's position regarding conventional and nonconventional sustances. Indiana also neglected to mention the draft WLA which it completed on the Indiana Harbor and Ship Canal/Grand Calumet River.

In terms of toxic substances, Region V has identified 9 pollutants which may require lake-wide or nearshore TMDLs. As mentioned above, the lack of data and other factors render a decision on the need for TMDLs impracticable at the present. Therefore, Indiana's position on toxic substance TMDLs is sustainable for the moment, but not for the reasons cited. Indiana will be requested to review its water quality criteria and to assist in the acquistion of environmental data.

6.3 Conclusions on Michigan

Region V finds that Michigan provided insufficient justification to defend its position of no TMDLs required for conventional pollutants. However, the independent review by Region V is sufficient to support Michigan's position.

In terms of nonconventional and toxic pollutants, Michigan expressed the opinion that technology based controls are "generally" sufficient to protect the water quality of Lake Michigan. The State then expressed several basic misunderstandings of the TMDL process by:

(1) Implying that the entire lake volume must be considered in developing a TMDL.

(2) Establishing limits based on a "calculated volume of dilution water" and failing to recognize that this is a customary aspect of the TMDL process.

(3) Stating that the TMDL process fails to address, diffuse and nonpoint sources. Such loadings must be integrated with the point source loadings to derive a point source TMDL that is meaningful in the contexts of all loadings to a water body.

(4) Implying that the TMDL process does not support anti-degradation provisions. On the contrary, anti-degradation could be a driving force for controls beyond technology based limits.

Michigan pointed out that loadings from air transport and nonpoint sources cannot be accurately predicted. Region V believes that these source loadings can be predicted accurately enough to model and manage. However, sufficient data is necessary to accomplish this. Regarding 9 toxic substances, Region V finds insufficient data currently available to reach a decision on the need for a TMDL.

In conclusion, the Michigan response on proposed TMDLs is approvable for the moment but not for all of the reasons cited. Michigan will be requested to apply their Rule 57 and develop specific numeric criteria for the 9 substances which may require TMDLs. Michigan will also be requested to acquire environmental data concerning sources, quantities or distribution of the substances listed as potential candidates for TMDLs.

6.4 Conclusions on Wisconsin

The Wisconsin position on TMDLs is very defensible and reflects the State's experience in a wide variety of water quality based TMDLs and actions. Region V applauds their efforts to load allocate the conventional and non-conventional substances as identified.

In terms of toxic substances, the rationale for no TMDL proposals matches that of Region V. The lack of key environmental data precludes a TMDL decision at this time. Therefore, Wisconsin TMDL proposal is approvable for the moment. Wisconsin, however, will be asked to develop specific numerical water quality criteria for the 9 substances listed as candidates for TMDL development, and will be asked to assist in acquiring key environmental data necessary to remove the obstacles which render a TMDL decision impracticable at the present time.

SECTION 7

REQUIRED ACTIONS BY REGION V

Region V must complete several actions relative to the identification and establishment of TMDLs to protect Lake Michigan water quality. In addition to reviewing State TMDL proposals which is accomplished in this report, Region V must:

(1) Formally approve or disapprove the State identification of waters requiring TMDLs.

(2) Remove those factors which render a TMDL decision impracticable at present.

(3) Review TMDL decisions periodically as new data is acquired and analyzed.

(4) Integrate management programs with other offices or agencies as necessary to satisfy the water quality requirements of Lake Michigan.

(5) Prepare TMDLs for pollutants where the State decision not to prepare TMDLs is indefensible.

Aside from the approval of State positions on TMDLs which will be based on Section 6 of this report, the most immediate need is to address those factors which restrict the ability to make sound TMDL decisions at present. Essentially, those factors include:

(1) Establishment or confirmation of the Lake Michigan water quality criteria by the bordering States. USEPA and the IJC should have a role in this process in terms of selenium due to the stringency of the IJC objectives.

(2) Expansion of the data base on the 9 toxic substances listed in Table 5.2 where acquisition of data is recommended. Such data should include further coverage of potential impact locations, characteristics source identification and load quantification.

(3) Review of available large lake models to assure that modeling can be accomplished for the substances in question at approximately the 80 percent overall confidence level.

Upon completion of the above items, the States and Region V should be in position to review TMDL decisions and update them as appropriate.

Inasmuch as the States bordering Lake Michigan have a common interest in protecting the quality of the lake, and since a Region V Water Quality Standards Work Group was recently organized for the purpose of exchanging information and addressing common problems, it is proposed that the work group consider the needs identified above and develop a detailed process for satisfying those needs with regard to Lake Michigan. The Region V Water Division, in cooperation with Great Lakes National Program Office will support the work group in its deliberations and in implementing the program derived from that work.

Given the critical nature of the work at hand and the potential to subordinate that work to other priority needs, Region V finds it advisable to establish maximum time frames for certain essential tasks as follows:

(1) Water Quality Criteria -- Where USEPA has published 304(a) criteria guidance, the States should apply that guidance and recommend protective water quality criteria by September 30, 1985. Where formal State adoption may be appropriate, hearing should be in progress by November 30, 1985.

(2) Source Identification -- A program to acquire data on potential sources of the 9 substances listed in Table 5.2 should be in place by November 30, 1985.

(3) Load Quantification -- A program to summarize available loading data and develop new information should be in place by November 30, 1985.

(4) Update TMDL Decisions -- By March 30, 1986, each State should review the water quality status of Lake Michigan and confirm or update its position with respect to the need for TMDLs. Region V will review those positions and provide a response to each State.

(5) Large Lake Models -- By March 30, 1986, Region V in cooperation with the Large Lakes Research Station will report on the availability and reliability of large lake models capable of assisting in a TMDL/WLA process.

SECTION 8

REFERENCES

1. Scott vs. Hammond, et.al., (7 C.C.A., Nos. 81-2884 and 81-2885), Seventh Circuit Court of Appeals, 1984.

2. Clean Water Act, Public Law 92-500, as amended, 33 U.S.C. 1251 et seq.

3. U.S. Environmental Protection Agency, 1976. Quality Criteria for Water. Office of Water Regulations and Standards, U.S. Environmental Protection Agency, Washington, D.C.

4. U.S. Environmental Protection Agency, 1080. Water Quality Criteria Documents: Availability. Federal Register, Volume 45, No. 231, November 28, 1980.

5. United States of America and Canada, 1978. Great Lakes Water Quality Agreement of 1978. November 22, 1978.

6. U.S. Environmental Protection Agency, 1985. Water Quality Planning and Management Regulation. 40 CFR Part 130, Federal Register, Volume 50, No. 8, January 11, 1985.

7. U.S. Environmental Protection Agency, 1983. Environmental Management Report. U.S. Environmental Protection Agency, Region V, Chicago, Illinois, May 1983.

8. Great Lakes Basin Commission, 1975. Great Lakes Framework Study, Appendix 11. Great Lakes Basin Commission, Ann Arbor, Michigan, 1975.

9. Fries, G.F. and Marrow, G.S., 1981. Chlorobiphenyl Movement from Soil to Soybean Plants. J. Agriculture Food and Chemicals. 29:757-759.

10. U.S. Environmental Protection Agency, 1982. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants, Parts 1 and 2. U.S. Environmental Protection Agency, Washington, D.C. EPA 600/6-82-004.

11. Great Lakes Science Advisory Board, 1983. Great Lakes Science Advisory Board Report to the International Joint Commission. 1983 Annual Report. Windsor, Ontario, 1983.

12. Great Lakes Water Quality Board, 1983. 1983 Report on Great Lakes Water Quality. Windsor, Ontario, 1983.

13. Great Lakes Water Quality Board, 1983. 1983 Report on Great Lakes Water Quality, Appendix on Radioactivity. Windsor, Ontario, 1983.

14. Rossman, Rudd, 1984. Trace Metal Concentrations in Offshore Waters of Lake Erie and Lake Michigan. University of Michigan, Ann Arbor, Michigan, 1984.

15. Rodger, P.W. and Swaine, W.R., 1983. Analysis of Polychlorinated Biphenyl (PB) Loading Trends in Lake Michigan: Great Lakes Res. 9(4):548-558.

APPENDIX 1

STATE RESPONSES

Illinois Environmental Protection Agency · 2200 Churchill Road, Springfield, IL 62706

217/782-3362

March 6, 1985

Mr. Charles Sutfin
Director, Water Division
USEPA, Region V
230 South Dearborn
Chicago, Illinois 60604

Dear Mr. Sutfin:

In response to your letter of December 28, 1984, and subsequent communications with your staff, the Agency has reviewed the court orders and other documentation on the Scott vs. Hammond decision on Lake Michigan TMDL's.

Your staff asked the Agency to provide opinion on the use of the TMDL process to address issues raised in Scott vs. Hammond. We do not want to be placed in the position of second guessing the courts as to whether TMDL's are appropriate tools to resolve the problems that prompted the Scott vs. Hammond action. We can, however, state that problems do exist that are creating interstate water quality concerns and that USEPA should have a role in the resolution of those problems.

As part of the original documentation of the action that ultimately resulted in the Scott vs. Hammond decision, the probable source of the problems were identified. None of the identified sources were in Illinois. One of Illinois' prime concerns is the protection of Lake Michigan and the Chicago area water supply. Our programs have been aimed at elimination of significant sources of pollution to the Lake. We do not believe that there would be a need to develop TMDL's for any Illinois discharges as a response to the court's action.

A related issue is the apparent USEPA interpretation of Scott vs. Hammond. WLA guidance documents imply that the court action established a national precedent for USEPA to step in and develop TMDL's when, in USEPA's opinion, the states were not proceeding in a timely manner. We do not believe that such broad national precedent has been set by this case. The waters of Lake Michigan are divided into the jurisdictions of four states. Any attempt by our state to establish TMDL's for impacts outside of its jurisdiction are very likely to conflict with those prepared by another state. In a situation where TMDL's are likely to have interstate implications, it is entirely appropriate for USEPA to take the lead or serve in a coordination role to assure program consistency. We believe that this is what the courts are saying in Scott vs. Hammond. The interpretation that USEPA should intervene in the TMDL process on a national basis when only intrastate issues are involved, appears to be far too broad to be supported by the opinions of the courts.

We trust that the above provides you with insight into Illinois' position in the Scott vs. Hammond decision and responds to the questions raised by your staff and those contained in your December 28, 1984 letter. If you have any questions please advise.

Sincerely,

Eugene F. Seebald, P.E., Manager
Division of Water Pollution Control

EFS:JP:ds:0402E/18-19

cc: Roger Kanerva
Steve Ewart
Jim Park

STATE OF INDIANA

INDIANAPOLIS 46206-1964

STREAM POLLUTION CONTROL BOARD

1330 West Michigan Street
P. O. Box 1964

February 20, 1985

Mr. Michael W. MacMullen, Chief
Water Quality Planning Section
U.S. EPA, Region V
230 South Dearborn Street
Chicago, IL 60604

Dear Mr. MacMullen:

Re: Total Maximum Daily Load (TMDL)
for Lake Michigan Waters

In response to your request concerning the assessment of the need for determining the TMDL for Lake Michigan waters, we offer the following comments.

The TMDL requirements in Regulations 40 CFR Part 130 seem to be developed primarily for water bodies that cannot meet existing water quality standards. The excellent water quality conditions that now exist in the Indiana portion of Lake Michigan appear to exempt Indiana from this requirement. The above assessment is based on our long-term monitoring station records and an intensive lake sampling program conducted by the Indiana State Board of Health in 1980-1981. No serious violations of water quality standards were found during the past few years. Occasionally, total phosphorus, phenolics, DO, cyanide, and fecal coliform would violate standards. This, however, was not the trend, but an ephemeral occurrence usually located near harbor mouths. We believe that those occasional violations were mainly caused by municipal CSO and bypasses.

Since 1981, several major bypass and CSO correction works were completed in the Calumet area. The City of Hammond has completed their Robertsdale lift station correction project and the Hohman Avenue sewer separation project. The City of East Chicago has corrected its secondary bypass and the Jeorse Park overflow problems. These correction works have reduced water quality standard violations in Lake Michigan waters. The impending municipal sludge lagoon controls and the proposed additional advanced wastewater treatment for East Chicago and Michigan City would further improve the Lake Michigan water quality.

In conclusion, we feel that there is no practical need for developing TMDLs for Indiana portions of Lake Michigan waters.

Very truly yours,

E. A. Bohner

Earl A. Bohner
Technical Secretary

TPC/JLW/jb

STATE OF MICHIGAN

NATURAL RESOURCES COMMISSION
THOMAS J. ANDERSON
E. R. CAROLLO
MARLENE J. FLUHARTY
STEPHEN F. MONSMA
O. STEWART MYERS
RAYMOND POUPORE
HARRY H. WHITELEY

JAMES J. BLANCHARD, Governor

DEPARTMENT OF NATURAL RESOURCES

STEVENS T. MASON BUILDING
BOX 30028
LANSING, MI 48909

RONALD O. SKOOG, Director

March 6, 1985

Mr. Charles Sutfin, Director
Water Division
U.S. EPA, Region V
230 South Dearborn
Chicago, Illinois 60604

Dear Mr. Sutfin:

This is in response to your letter of December 28, 1984, regarding the Scott decision, which sets forth a requirement for EPA and the states to develop total maximum daily loadings to Lake Michigan.

For conventional pollutants, technology-based limitations dictate sufficiently high effluent quality to protect the water quality of Lake Michigan. Ambient water sampling of the open lake water has not demonstrated any water quality concerns resulting from point source discharges of conventional pollutants. Certain near-shore and river mouth areas have been shown to be impacted by conventional pollutants, but the sources of the discharges are either historical or nonpoint related. Therefore, it is not necessary to develop total maximum daily loadings for conventional pollutants.

For non-conventional pollutants, including toxic pollutants, technology-based limitations would generally provide sufficiently stringent effluent limitations to protect water quality. However, water quality assessments may be necessary for certain pollutants. Such assessments should not be based on total maximum daily loads to the Lake. Michigan water quality standards require that acceptable water quality be met immediately after mix with the receiving waters. Therefore, mixing zones are established on a case-by-case basis in accordance with Michigan rules. Utilizing the mixing zone and reasonable assumptions for mix characteristics, effluent limits are established such that after mixing with the calculated volume of dilution water, state water quality standards are met.

The regulation of point source discharges through the use of total daily maximum loadings on a whole-lake basis fails to address major inputs of pollutants such as those resulting from air transport and nonpoint sources. Further, these loadings cannot be accurately predicted. Michigan water quality standards do not provide for a total maximum daily loading calculation on a whole-lake basis.

We strongly oppose such an approach. It is not consistent with state regulations, and will not provide adequate protection to Lake Michigan.

If you would like to discuss this in further detail, please contact me.

Sincerely,

Paul D. Zugger, Chief
Surface Water Quality Division
(517) 373-1949

PDZ:ckp
cc: Gary Guenther

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Carroll D. Besadny
Secretary

BOX 7921
MADISON, WISCONSIN 53707

March 5, 1985 IN REPLY REFER TO: 8250

Mr. Charles H. Sutfin, Director
Water Division
U.S. EPA-Region V
230 South Dearborn
Chicago, IL 60604

Dear Mr. Sutfin:

In response to your letter of December 28, 1984, Dale Bryson's memo of January 8, 1985 and intervening discussions and meetings, the Wisconsin Department of Natural Resources has developed its position with respect to the Scott vs. Hammond, et. al. decision. This decision requires the states bordering Lake Michigan to identify waters subject to water quality based effluent limits and subsequently to establish total maximum daily loads for such waters to achieve water quality standards.

The State of Wisconsin, as an active part of its water quality management program, has pursued to the extent possible the issuance of water quality based permits where necessary to meet water quality standards. However with the possible exception of phosphorous, the Department does not believe it is feasible at this point to establish TMDL's for specific pollutants as they affect they entirety of Lake Michigan. Rather, specific areas of the lake are candidates for TMDL's. These specific areas are located in the immediate vicinity of point source dischargers or areas directly influenced by point source dischargers. Some examples are on the attachment.

The requirement for phosphorous removal for treatment facilities discharging to Lake Michigan is based upon reducing the loading of phosphorous to the lake. The methodology for accomplishing this reduction is provided under the Great Lakes water quality agreement, Annex 3, in which target annual loadings are specified. Although allocations to each jurisdiction or each discharger is not given, the method for achieving that load is provided.

Even though it is not possible to develop TMDL's for the pollutant as they affect the lakes as a whole, we envision using the impacts on the whole lake as an argument to control substances which appear to have a whole lake impact. For example, we use the fact that PCBs are a contaminant problem in some fish throughout the lake as part of the rationale for initiating control efforts at specific discharge points.

The parameters for which TMDL's are to be established should be determined on a case-by-case basis. The determination should be based on the constituents contained in the wastewater discharge from the specific point source.

As an indication of our efforts in establishing TMDL's and assuming Green Bay is part of Lake Michigan, we are currently in the process of enacting TMDL's for BOD for discharges into the Fox River based upon impacts to southern Green Bay. The Department has established or is currently in the process of establishing water quality base limits for municipal discharges covered by the pretreatment program. Parameter coverage is primarily limited to certain heavy metals and their acute toxicity effects. As we learn more about the quality of these effluents and their localized effects, parameter coverage may be expanded and chronic toxicity more directly addressed.

Bacterial effects on lake water quality are similarly "near-field" concerns which, in our opinion do not extend lake wide. Therefore, measures taken to control the discharge of bacterial-containing waste and thus limiting their total load can be taken based on localized impacts.

Certainly it is easy to envision a process and a need to establish TMDL's for pollutants entering the waters of Lake Michigan. However, it is important to realize that for many parameters it may not now be possible to do so. The establishment of TMDL's requires an understanding of the environmental fate and dynamics of pollutants including their point of origin, how they are transported, transformed and degraded, their bioavailability and bioaccumulation, etc. At this point, it is not likely this type of analysis will be possible for a substantial number of pollutants, especially those which are toxic. As our information based on these pollutants increases and our ability to conduct a noted assessment improves, we will be better able to develop TMDL's as needed to meet necessary level of water quality.

Sincerely,
Division of Environmental Standards

Lyman F. Wible
Administrator

LFW:cn

cc: Duane Schuettpelz - WRM/2
Mike Llewelyn - WRM/2
Carl Blabaum - WWM/2
Dave Hildreth - Lake Michigan District
Tom DeWitt - Northwest District
Ron Kazmierczak - Southeast District

6488Y

ATTACHMENT

TMDL's - NEAR-SHORE AREAS

Lower Green Bay	-	BOD Ammonia
Peshtigo River	-	BOD
Oconto River	-	BOD
Milwaukee	-	BOD Phosphorus