

WATER QUALITY INVESTIGATIONS

SYLVAN LAKE and LAKE ANGELUS

OAKLAND COUNTY, MICHIGAN

UNITED STATES GEOLOGICAL SURVEY

January 2005

CONTENTS OF THIS REPORT

- ❖ Letter Report: January 25, 2005
- ❖ Attachment 1: Locational Map [Excluded]
- ❖ Attachment 2: Summary of Water Quality of Monitored Lakes in the Clinton River Watershed
- ❖ Attachment 3: Trophic Characteristics of Monitored Lakes in the Clinton River Watershed
- ❖ Attachment 4: Macrophyte Survey Notes [Pending]

January 25, 2005
Mr. Glenn Brown
Macomb County Health Department
43535 Elizabeth
Mount Clemens, Mi 48043

Dear Mr. Brown

Enclosed are the results of last year's water-quality investigation on Sylvan Lake and Lake Angelus. This study assessed the trophic indices and documented baseline water-quality characteristics of these lakes located in the Clinton River Watershed. We have also included data from investigations of Lake Orion near Lake Orion and Lakeville Lake near Lakeville which are also in the Clinton watershed. These last two lakes were sampled in 2003. The sampling protocol followed for all the above lakes is the USGS-Michigan Department of Environmental Quality state-wide Lake Water Quality Assessment (LWQA) monitoring program protocol. The LWQA program is described in the enclosed fact sheet: *Michigan Lakes: An Assessment of Water Quality (October 2004)*.

A summary of the sampling strategy is as follows:

The deepest location of each lake was selected for sampling. This location was then referenced with a hand-held global positioning system to determine the sampling coordinates. The recorded latitude-longitude (Lat-long) was used as part of the station identification number. Sylvan Lake and Lake Angelus was sampled twice during the year, spring and late summer, while Lake Orion and Lakeville Lake was only sampled during late summer. Spring sampling was prior to thermal stratification. Summer sampling was after stratification had occurred. At the time of sampling each lake, dissolved oxygen, pH, specific conductance and water temperature were profiled with depth to document general water-quality characteristics and determine if thermal stratification was present. Four discrete samples were collected to characterize the water-quality conditions at that location. Major nutrients were analyzed in samples collected from three feet below the surface, mid-depth, and three feet above the lake bottom; selected ions were analyzed from the mid-depth sample; chlorophyll-*a* samples were analyzed from the photic zone sample. A sequence number indicating the depth at which a sample was collected was then incorporated in the station identification number as the last two digits. The lake station identification numbering system is summarized below:

Lat-long-01 vertical profile data.

Lat-long-02 sample collected 3 ft above lake bottom.

Lat-long-03 depth integrated sample through the photic zone.

Lat-long-05 sample collected 3 ft below lake surface.

Lat-long-06 sampled collected at mid-depth or metalimnion.

A macrophyte survey was made in conjunction with the summer sampling of Sylvan Lake and Lake Angelus. These were not detailed surveys, but were meant to be used as a tool to help determine if the characteristics of the plant community within a lake are macrophyte or phytoplankton dominate. This, with knowledge of the density of these types of plants helps identify potential source of the utilization of nutrients. This is a major factor that helps determine the relationship between the indices that are used in the trophic status evaluation. Shallow lakes with abundant rooted aquatic plant and

attached algae may have measured nutrient levels during the summer months which are lower than other productive lakes with less aquatic plant growth. Aquatic plants can act as a “lock box” for nutrients; utilizing large amounts of nutrients during the growing season then releasing the nutrient at a later time during decomposition.

The Carlson Trophic-State Index (Carlson, 1977), or (TSI) was used to assess the trophic status of each lake. The Carlson Trophic-State Index ranges from 0 to 100. Summer secchi transparency measurements, Chlorophyll-*a* concentrations and total phosphorus concentrations 3 feet below the lake surface are used in the calculations. The low end of the scale represents low biological productivity (oligotrophic), the high end represents a very biologically active lake (eutrophic), and the highest end of the scale represents excessive biological productivity (hypereutrophic). The middle of the scale represents moderate biological productivity (mesotrophic).

The equations used are as follows:

$$\begin{aligned} \text{TSI}_{\text{secchi}} &= 60 - (14.41 * \ln \text{ secchi depth in meters}) \\ \text{TSI}_{\text{chlorophyll-}a} &= (9.81 * \ln \text{ Chlorophyll-}a \text{ in } \mu\text{g/L}) + 30.6 \\ \text{TSI}_{\text{phosphorus}} &= (14.42 * \ln \text{ total phosphorus in } \mu\text{g/L}) + 4.15 \end{aligned}$$

The MDEQ has adopted trophic classification boundaries to account for regional characteristics. Whereas the TSI values are averaged and less than 38 represents oligotrophic conditions, 38-48 represents mesotrophic conditions, 49-61 represents eutrophic conditions and greater than 61 represents hyperutrophic lake conditions. The overabundance of submergent macrophytes maybe an indicator of more biologically productive conditions than indicated by the TSI values alone. In the presence of dense macrophyte, the lake’s trophic status is often increased by one classification.

All data are archived in the USGS National Water Information System (NWIS) data base and are available to the public through the Internet at URL <http://mi.waterdata.usgs.gov/nwis/qw>. An additional site that would provide background information into the trophic status of other lakes in Michigan can be found at URL <http://michigan.gov/deq>, select “DEQ programs by Division” then select “Inland Lakes Monitoring”. This last site also offers excellent links to Lake Water-Quality Primers “Understanding Lake Data” and “Understanding Lake Ecology”.

We are also enclosing Scientific Report 2004-5086 “*Predicting Water Quality by Relating Secchi-Disk Transparency and Chlorophyll-a Measurements to Satellite Imagery for Michigan Inland Lakes, August 2002*”. This report documents the process of estimating trophic status by utilizing satellite imagery. This publication may be of interest to your office. As other products from the State of Michigan project become available we will include you in the distribution. If you have any questions concerning any of this data please feel free to call me.

Sincerely yours,

Russel Minnerick
U.S. Geological Survey
Field Office Chief

Reference cited

Carlson, R. E., 1977, A trophic state index for lakes: *Limnology and Oceanography*, v. 22, no. 2, p. 361-369.

Attachments

1. Lakes monitored in the Clinton River Watershed.
2. Summary of water-quality for monitored lakes in the Clinton River Watershed.
3. Trophic characteristics of monitored lakes in the Clinton River Watershed.
4. Photo-copies of original macrophyte survey notes.

cc: Stephen P. Blumer, USGS, Lansing
Stephen Rheaume, USGS, Lansing
Bruce Kresge, Lake Water Quality Committee, Lake Angelus

Attachment 2. Summary of Water Quality for Monitored lakes within the Clinton River Watershed.

423702083203401 -- SYLVAN LAKE NEAR PONTIAC, MI

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Dis- solved oxygen, mg/L (00300)	pH, water, unfltrd field, std units (00400)	Specif. conduc- tance, wat un uS/cm 25 degC (00095)	Temper- ature, water, deg C (00010)
APR 2004						
15...	1016	3.0	11.6	7.7	749	8.0
15...	1017	7.0	11.5	7.8	749	8.0
15...	1018	14.0	11.2	7.9	750	8.0
15...	1019	21.0	11.3	7.9	750	7.5
15...	1021	28.0	11.3	7.9	750	7.0
15...	1022	35.0	11.2	8.0	750	7.0
15...	1023	42.0	11.2	8.0	750	7.0
15...	1024	49.0	11.2	8.0	751	7.0
15...	1026	56.0	11.2	8.0	751	7.0
15...	1027	63.0	11.0	7.9	750	6.5
15...	1028	70.0	10.7	7.9	749	6.0
15...	1029	77.0	5.4	7.6	750	6.0
AUG						
16...	1000	3.0	8.4	8.3	715	21.5
16...	1002	10.0	8.2	8.3	714	21.5
16...	1004	17.0	7.8	8.3	715	21.0
16...	1006	21.0	7.1	8.2	719	20.5
16...	1008	24.0	3.2	7.7	745	19.5
16...	1010	27.0	.8	7.6	790	16.0
16...	1012	34.0	.6	7.7	804	12.0
16...	1014	41.0	.5	7.8	805	10.0
16...	1016	48.0	.5	7.8	804	9.0
16...	1018	57.0	.5	7.9	805	8.0
16...	1020	64.0	.5	7.9	807	8.0
16...	1022	71.0	.4	7.9	807	8.0

423702083203402 -- SYLVAN LAKE NEAR PONTIAC, MI (3 FT AB LK BOT)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Ammonia	Ammonia	Nitrite	Phos-
			+ org-N, water, unfltrd mg/L as N (00625)	water, unfltrd mg/L as N (00610)	+ nitrate water fltrd, mg/L as N (00631)	phorus, water, unfltrd mg/L (00665)
APR 2004						
15...	1025	77.0	.48	.08	.114	<.04
AUG						
16...	1055	70.0	.86	.49	<.016	<.004

423702083203403 -- SYLVAN LAKE NEAR PONTIAC, MI (PHOTIC ZONE)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Chloro- phyll a phyto- plank- ton, fluoro, ug/L (70953)
			APR 2004
15...	1010	26.0	1.2
AUG			
16...	1040	24.0	1.5

423702083203405 -- SYLVAN LAKE NEAR PONTIAC, MI (3 FT BL LK SURF)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Trans- parency Secchi disc, meters (00078)	Ammonia + org-N, water, unfltrd mg/L as N (00625)	Ammonia water, unfltrd mg/L as N (00610)	Nitrite + nitrate water fltrd, mg/L as N (00631)	Phos- phorus, water, unfltrd mg/L (00665)
APR 2004							
15...	1015	3.0	4.0	.43	.08	.112	<.04
AUG							
16...	1045	3.0	3.7	.42	.02	<.016	<.004

423702083203406 -- SYLVAN LAKE NEAR PONTIAC, MI (MID-DEPTH)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Calcium water unfltrd recover -able, mg/L (00916)	Magnes- ium, water, unfltrd recover -able, mg/L (00927)	Potas- sium, water, unfltrd recover -able, mg/L (00937)	Sodium, water, unfltrd recover -able, mg/L (00929)	ANC, wat unf fixed end pt, lab, mg/L as CaCO3 (90410)	Chlor- ide, water, fltrd, mg/L (00940)	Sulfate water, fltrd, mg/L (00945)	Ammonia + org-N, water, unfltrd mg/L as N (00625)	Ammonia water, unfltrd mg/L as N (00610)	Nitrite + nitrate water fltrd, mg/L as N (00631)	Phos- phorus, water, unfltrd mg/L (00665)
APR 2004													
15...	1020	40.0	54.1	21.8	2.4	71.3	158	127	25.4	.43	.07	.113	<.04
AUG													
16...	1050	24.0	--	--	--	--	--	--	--	.42	.04	<.016	<.004

424128083192101 -- LAKE ANGELUS NEAR CLINTONVILLE, MI (CMI)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Dis- solved oxygen, mg/L (00300)	pH, water, unfltrd field, std units (00400)	Specif. conduc- tance, wat unf uS/cm 25 degC (00095)	Temper- ature, water, deg C (00010)
APR 2004						
28...	1041	3.0	10.8	7.8	700	10.0
28...	1042	8.0	10.8	7.8	700	10.5
28...	1043	16.0	10.7	7.8	700	10.5
28...	1044	24.0	10.7	7.9	700	10.0
28...	1046	32.0	10.7	7.9	700	10.0
28...	1047	40.0	12.1	7.8	691	6.5
28...	1048	48.0	11.6	7.8	689	5.5
28...	1049	56.0	11.0	7.7	687	5.0
28...	1051	64.0	10.8	7.7	687	5.0
28...	1052	72.0	10.7	7.7	687	5.0
28...	1053	80.0	10.4	7.7	687	5.0
28...	1054	88.0	10.0	7.6	687	5.0
AUG						
23...	1001	3.0	8.9	8.5	742	21.5
23...	1002	11.0	8.7	8.5	743	21.5
23...	1003	18.0	8.5	8.5	743	21.5
23...	1004	21.0	8.6	8.5	743	21.5
23...	1006	24.0	9.7	8.4	756	20.0
23...	1007	27.0	11.4	8.4	769	17.5
23...	1008	30.0	11.0	8.5	772	14.0
23...	1009	33.0	10.3	8.5	774	12.0
23...	1011	36.0	9.9	8.4	774	10.5
23...	1012	39.0	9.8	8.4	773	10.5
23...	1013	48.0	7.5	8.2	767	7.0
23...	1014	57.0	4.6	8.2	769	5.5
23...	1015	66.0	3.5	8.1	770	5.5
23...	1016	75.0	3.0	8.1	770	5.5
23...	1017	84.0	2.4	8.2	771	5.5

424128083192102 -- LAKE ANGELUS NEAR CLINTONVILLE, MI (3FT AB LK BOT)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Ammonia + org-N, water, unfltrd mg/L as N (00625)	Ammonia water, unfltrd mg/L as N (00610)	Nitrite + nitrate water fltrd, mg/L as N (00631)	Phos- phorus, water, unfltrd mg/L (00665)
APR 2004						
28...	1110	88.0	.51	.10	.05	<.004
AUG						
23...	1010	83.0	.37	.04	.31	<.01

424128083192103 -- LAKE ANGELUS NEAR CLINTONVILLE, MI (PHOTIC ZONE)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Chloro- phyll a phyto- plank- ton, fluoro, ug/L (70953)
APR 2004			
28...	1055	36.0	1.3
AUG			
23...	0955	32.0	1.2

424128083192105 -- LAKE ANGELUS NEAR CLINTONVILLE, MI 3FT BL LK SURF

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Trans- parency Secchi disc, meters (00078)	Ammonia + org-N, water, unfltrd mg/L as N (00625)	Ammonia water, unfltrd mg/L as N (00610)	Nitrite + nitrate water fltrd, mg/L as N (00631)	Phos- phorus, water, unfltrd mg/L (00665)
APR 2004 28...	1100	3.0	5.5	.40	.03	.04	<.004
AUG 23...	1000	3.0	4.9	.38	.02	<.016	<.01

424128083192106 -- LAKE ANGELUS NEAR CLINTONVILLE, MI (MID-DEPTH)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Calcium water unfltrd recover -able, mg/L (00916)	Magnes- ium, water, unfltrd recover -able, mg/L (00927)	Potas- sium, water, unfltrd recover -able, mg/L (00937)	Sodium, water, unfltrd recover -able, mg/L (00929)	ANC, wat unf fixed end pt, lab, mg/L as CaCO3 (90410)	Chlor- ide, water, fltrd, mg/L (00940)	Sulfate water, fltrd, mg/L (00945)	Ammonia + org-N, water, unfltrd mg/L as N (00625)	Ammonia water, unfltrd mg/L as N (00610)	Nitrite + nitrate water fltrd, mg/L as N (00631)	Phos- phorus, water, unfltrd mg/L (00665)
APR 2004 28...	1105	46.0	42.6	19.2	2.5	74.9	139	141	18.4	.43	.04	.05	<.004
AUG 23...	1005	30.0	--	--	--	--	--	--	--	.39	.02	<.016	<.01

424634083143601 -- LAKE ORION NEAR LAKE ORION, MI

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Dis- solved oxygen, mg/L (00300)	pH, water, unfltrd field, std units (00400)	Specif. conduc- tance, wat unf uS/cm 25 degC (00095)	Temper- ature, water, deg C (00010)
SEP 2003						
09...	0735	3.0	7.8	7.7	545	22.5
09...	0836	8.0	7.9	7.7	545	22.5
09...	0837	13.0	7.8	7.7	545	22.5
09...	0838	18.0	5.4	7.4	554	20.5
09...	0839	23.0	7.1	7.3	560	14.5
09...	0840	28.0	7.4	7.4	554	10.0
09...	0841	33.0	6.3	7.3	553	7.5
09...	0842	38.0	4.2	7.3	553	6.0
09...	0843	43.0	1.9	7.2	557	5.5
09...	0844	48.0	1.0	7.2	562	5.0
09...	0845	53.0	.8	7.3	571	5.0

424634083143602 -- LAKE ORION NEAR LAKE ORION, MI (3 FT AB LK BOT)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Ammonia + org-N, water, unfltrd mg/L as N (00625)	Ammonia water, unfltrd mg/L as N (00610)	Nitrite + nitrate water fltrd, mg/L as N (00631)	Phos- phorus, water, unfltrd mg/L (00665)
SEP 2003 09...	0910	50.0	.60	.14	.09	<.04

424634083143603 -- LAKE ORION NEAR LAKE ORION, MI (PHOTIC ZONE)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Chloro- phyll a phyto- plank- ton, fluoro, ug/L (70953)
SEP 2003 09...	0855	28.0	--

424634083143605 -- LAKE ORION NEAR LAKE ORION, MI (3 FT BL LK SURF)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Trans- parency Secchi disc, meters (00078)	Ammonia	Ammonia	Nitrite	Phos-
				+ org-N, water, unfltrd mg/L as N (00625)	water, unfltrd mg/L as N (00610)	+ nitrate water fltrd, mg/L as N (00631)	phorus, water, unfltrd mg/L (00665)
SEP 2003	0900	3.0	4.3	.57	<.01	<.022	<.04

424634083143606 -- LAKE ORION NEAR LAKE ORION, MI (MID-DEPTH)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Calcium water unfltrd recover -able, mg/L (00916)	Magnes-	Potas-	Sodium,	ANC, wat unf	Chlor- ide, water, fltrd, mg/L (00940)	Sulfate water, fltrd, mg/L (00945)	Ammonia	Ammonia	Nitrite	Phos-
				ium, water, unfltrd recover -able, mg/L (00927)	sium, water, unfltrd recover -able, mg/L (00937)	Sodium, water, unfltrd recover -able, mg/L (00929)	ANC, wat unf fixed lab, mg/L as CaCO3 (90410)			+ org-N, water, unfltrd mg/L as N (00625)	Ammonia water, unfltrd mg/L as N (00610)	+ nitrate water fltrd, mg/L as N (00631)	phorus, water, unfltrd mg/L (00665)
SEP 2003	0905	18.0	46.7	22.6	1.8	32.1	154	66.0	32.5	.59	<.01	<.022	<.04

424952083084301 -- LAKEVILLE LAKE NEAR LAKEVILLE, MI (E.B.)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Dis- solved oxygen, mg/L (00300)	pH, water, unfltrd field, std units (00400)	Specif. conduc- tance, wat unf uS/cm 25 degC (00095)	Temper- ature, water, deg C (00010)
SEP 2003						
09...	1205	3.0	9.0	8.3	383	23.0
09...	1206	8.0	8.3	6.3	384	22.5
09...	1208	13.0	7.7	8.2	388	22.0
09...	1210	18.0	6.7	7.3	488	17.0
09...	1212	16.0	5.5	7.3	485	20.0
09...	1215	23.0	8.2	7.4	490	11.5
09...	1217	28.0	5.4	7.3	514	8.5
09...	1219	33.0	1.5	7.2	530	7.0
09...	1221	38.0	.9	7.3	535	5.5
09...	1223	43.0	.7	7.3	543	5.5
09...	1225	48.0	.6	7.3	544	5.0
09...	1227	53.0	.6	7.2	554	5.0
09...	1229	55.5	.6	7.2	560	5.0

424952083084302 -- LAKEVILLE LAKE NR LAKEVILLE, MI E.B. 3FT AB LK BOT

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Ammonia + org-N, water, unfltrd mg/L as N (00625)	Ammonia water, unfltrd mg/L as N (00610)	Nitrite + nitrate water fltrd, mg/L as N (00631)	Phos- phorus, water, unfltrd mg/L (00665)
SEP 2003 09...	1300	54.0	1.2	.60	<.022	E.03

424952083084303 -- LAKEVILLE LAKE NR LAKEVILLE, MI (E.B. PHOTIC ZONE)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Chloro- phyll a phyto- plank- ton, fluoro, ug/L (70953)
SEP 2003 09...	1245	30.0	--

424952083084305 -- LAKEVILLE LAKE NR LAKEVILLE, MI E.B.3FT BL LK SURF

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Trans- parency Secchi disc, meters (00078)	Ammonia +	Ammonia	Nitrite +	Phos- phorus, water, unfltrd mg/L (00665)
				org-N, water, unfltrd mg/L as N (00625)	water, unfltrd mg/L as N (00610)	nitrate water fltrd, mg/L as N (00631)	
SEP 2003 09...	1250	3.0	4.6	.45	<.01	<.022	<.04

424952083084306 -- LAKEVILLE LAKE NEAR LAKEVILLE, MI (E.B. MID-DEPTH)

WATER-QUALITY DATA

Date	Time	Sam- pling depth, feet (00003)	Calcium water unfltrd recover mg/L (00916)	Magnes- ium, water, unfltrd recover mg/L (00927)	Potas- sium, water, unfltrd recover mg/L (00937)	Sodium, water, unfltrd recover mg/L (00929)	ANC, wat unf fixed end pt, lab, mg/L as CaCO3 (90410)	Chlor- ide, water, fltrd, mg/L (00940)	Sulfate water, fltrd, mg/L (00945)	Ammonia +	Ammonia	Nitrite +	Phos- phorus, water, unfltrd mg/L (00665)
										org-N, water, unfltrd mg/L as N (00625)	water, unfltrd mg/L as N (00610)	nitrate water fltrd, mg/L as N (00631)	
SEP 2003 09...	1255	17.0	26.3	23.6	.9	18.0	125	39.9	25.6	.51	<.01	<.022	<.04

-- No data available

Remark codes used in this report:

< -- Less than

E -- Estimated value

Attachment 3. Trophic Characteristics of Monitored Lakes in the Clinton River Watershed.

Spring profile data indicates that lake water in Sylvan Lake was fairly well mixed at the time samples were collected. Surface water temperatures were only slightly warmer near the surface and other measured parameters were fairly uniform throughout the profile. Good dissolved oxygen was noted through the profile except near the lake bottom where the oxygen concentration dropped notably. Surface water temperatures in Lake Angelus were beginning to warm but other measured parameters were more uniform with good dissolved oxygen concentrations throughout the depth.

Both lakes were stratified at the time of the August sampling. Profile data from Sylvan Lake documents oxygen depletion in the lower strata (hypolimnion) as well as an increase of dissolved solids as indicated by the increase of specific conductance. Lake Angelus also was stratified but the decrease of dissolved oxygen and increase of dissolved solids was less noticeable in the hypolimnion.

Water clarity decreased slightly from the spring to summer in Sylvan Lake and Lake Angelus as shown by secchi disc readings. The analytical reporting level by the laboratory for phosphorus samples collected from Sylvan Lake and Lake Angelus was raised from .004 milligrams per liter to .02 milligrams per liter. The laboratory raised the reporting level for the August samples because the summer phosphorus concentrations were greater than laboratories instrument calibration range for low-level analysis. Therefore the actual phosphorus concentrations as noted in the data table (Attachment 2.) are less than the reported concentrations. Sylvan Lake's data indicates a minor increase of chlorophyll-*a* concentrations from spring to summer which is associated with phytoplankton concentrations, while Lake Angelus showed little change in the concentrations. It is probable that the macrophyte communities are utilizing much of the nutrients in both lakes. These lakes exhibit oligotrophic/mesotrophic characteristics.

The results from lake sampling in 2003 shows both Lake Orion and Lakeville Lake stratified during the summer months. Depletion of dissolved oxygen, a decrease in pH and the increase in dissolved solids were most noticeable in the hypolimnion region of Lakeville Lake. Profile data from Lake Orion also showed these characteristics but to a lesser extent. Chlorophyll data is not available and macrophyte surveys were not made on these two lakes. Limited data suggests that these lakes exhibit mesotrophic/eutrophic characteristics.

Computed trophic state index for selected lakes in the Clinton River Watershed [TSI_p, trophic state index phosphorus; TSI_{secchi}, trophic state index secchi depth; TSI_{chy-a}, trophic state index chlorophyll a; <, less than; --, no data available]

Lake	County	TSI _p	TSI _{secchi}	TSI _{chy-a}
Sylvan Lake near Pontiac, MI	Oakland	<24 ^a	41	32
Lake Angelus near Clintonville, MI	Oakland	<47 ^a	37	32
Lake Orion near Lake Orion, MI ^b	Oakland	<57 ^a	39	--
Lakeville Lake near Lakeville, MI ^b	Oakland	<57 ^a	38	--

^a Constituent detected, calculation based on minimum level of quantification.

^b Calculation based on data collected in 2003.