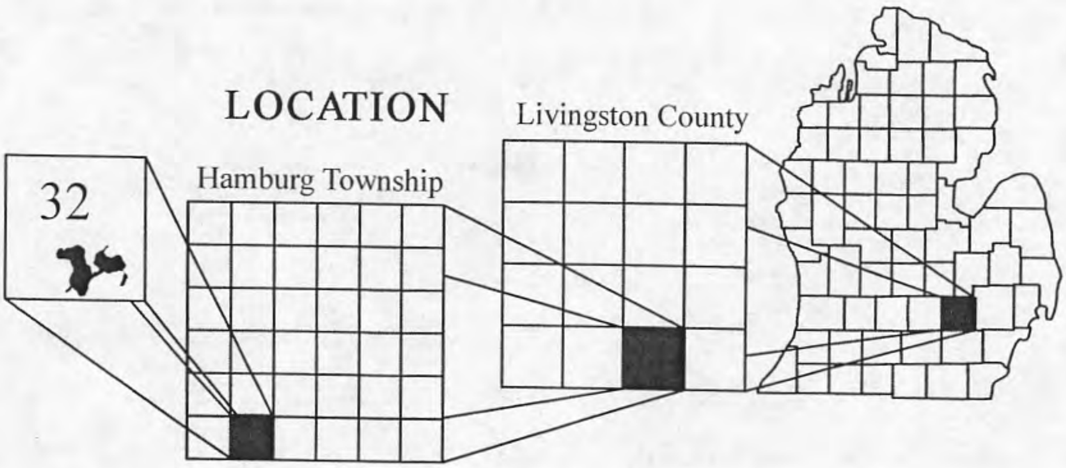
WHITEWOOD LAKE

HAMBURG TOWNSHIP
LIVINGSTON COUNTY
MICHIGAN

WATER QUALITY STUDIES
1996-2010



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WHITEWOOD LAKES

HAMBURG TOWNSHIP

LIVINGSTON COUNTY

1996 - 2010 WATER QUALITY STUDIES

WHITEWOOD LAKE DATA

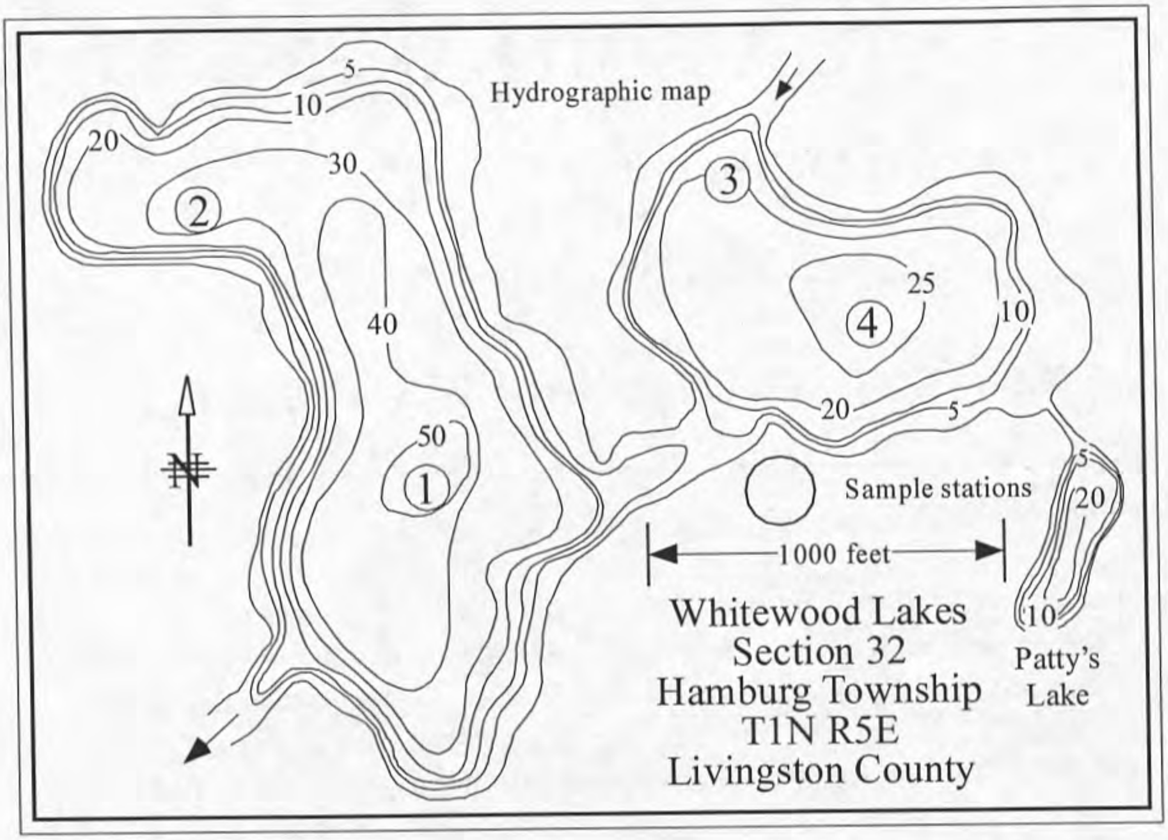
Whitewood Lake, called Whiteford Lake in the past, is a 62-acre natural hard-water kettle lake located in Section 32, Hamburg Township (T1N R5E) Livingston County, Michigan. The lake consists of a 40-acre downstream west basin and a 22-acre upstream east basin separated by a channel approximately 400 feet long. The channel depth between the two basins varies, but has a maximum depth of about 15 feet. The east basin has a maximum depth of 29 feet, a volume of 328 acre-feet, and a mean depth of 14.9 feet. The west basin has a maximum depth of 50 feet, a water volume of 1041 acre-feet, and a mean depth of 26.0 feet. The volume of both basins is 1369 acre-feet. Patty's Lake is a 2-acre, 20-foot-deep basin off the east basin. Whitewood Lake elevation is 851 feet above sea level. The Huron River flows through both basins. There are no islands in the lake.

The size of the watershed, which is the land area that contributes water to the lake, but does not include the lake, is large, 243,138 acres. The drainage area, which includes the lake and the watershed, is 243,200 acres. The watershed to lake ratio is large, 3922 to 1. Because of this the basins flush rapidly, 0.007 years or about once every 2 or 3 days, on an average.

The longitude and latitude of the 50-foot deep hole is 83° 52.601W and 42° 26.004N.

THE SAMPLE STATIONS

The locations of the four in-lake sample stations are shown as circles on the hydrographic map of the lake.



THE SAMPLE DATES

WQI limnologists took three or four spring surface samples for water quality testing plus Secchi disk readings at the sites shown on the map June 9, 1996, May 12, 1997, April 19, 1998, April 25, 1999, April 15, 2000, May 13, 2001, April 15, 2002, April 28, 2003, April 16, 2004, April 18, 2005, April 19, 2006, April 21, 2007, April 18, 2008, April 18, 2009 and April 20, 2010.

WQI limnologists collected three or four late summer surface samples for water quality testing at the stations shown on the map August 7, 1996, August 25, 1997, August 10, 1998, August 28, 1999, August 4, 2000, August 3, 2001, August 2, 2002, August 1, 2003, August 2, 2004, August 3, 2005, August 1, 2006, August 1, 2007, August 1, 2008, August 3, 2009 and August 2, 2010.

Bottom sediment samples were collected at three stations in 1996 and four stations in 2005. Upstream, the Huron River and Davis Creek were sampled 11 times June 2005 through April 2006. And Davis Creek was sampled 12 times May 2009 to April 2010.

THE ANALYSES

The tests performed on the samples included total phosphorus, total nitrate nitrogen, total alkalinity, pH, conductivity, chlorophyll a, Secchi disk depth, temperature, and dissolved oxygen.

Temperature, dissolved oxygen and Secchi disk depths were measured in the field. Chlorophyll a, phosphorus, nitrate nitrogen, alkalinity, pH and conductivity tests were performed at the Water Quality Investigators laboratory in Dexter, Michigan. All test procedures followed those outlined in APHA's *Standard Methods for the Examination of Water and Wastewater* (1985).

THE TEST RESULTS

The results of the tests are found in the text, in the tables at the end of this report and on the enclosed atlas pages.

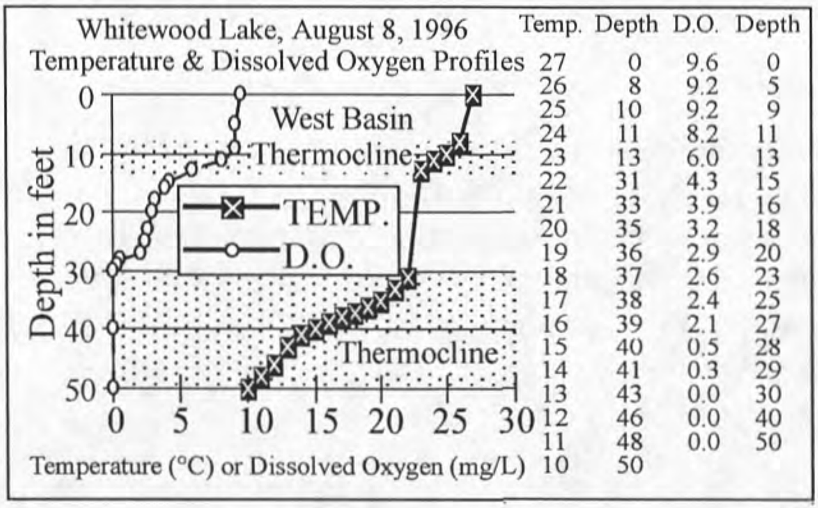
TEMPERATURE AND DISSOLVED OXYGEN

Temperature exerts a wide variety of influences on most lakes, such as the separation of layers of water (stratification), solubility of gasses and biological activity. In spring temperature generally doesn't need to be determined because we've found temperatures are low and dissolved oxygen is near saturation at that time.

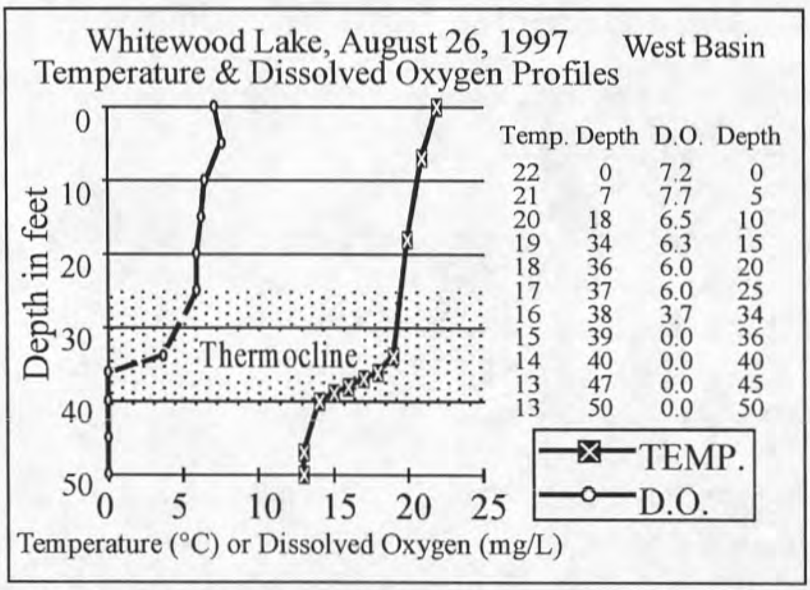
Dissolved oxygen is the test most often selected by lake scientists as being important. Besides providing oxygen for aquatic organisms, in natural lakes oxygen is involved the capture and release of various chemicals, such as iron and phosphorus. In spring top to bottom dissolved oxygen concentrations were not measured. On the other hand, top to bottom dissolved oxygen and temperature profile data were collected in both basins when they were sampled in late summer.

THE WEST BASIN

1996



Temp.	Depth	D.O.	Depth
27	0	9.6	0
26	8	9.2	5
25	10	9.2	9
24	11	8.2	11
23	13	6.0	13
22	31	4.3	15
21	33	3.9	16
20	35	3.2	18
19	36	2.9	20
18	37	2.6	23
17	38	2.4	25
16	39	2.1	27
15	40	0.5	28
14	41	0.3	29
13	43	0.0	30
12	46	0.0	40
11	48	0.0	50
10	50		



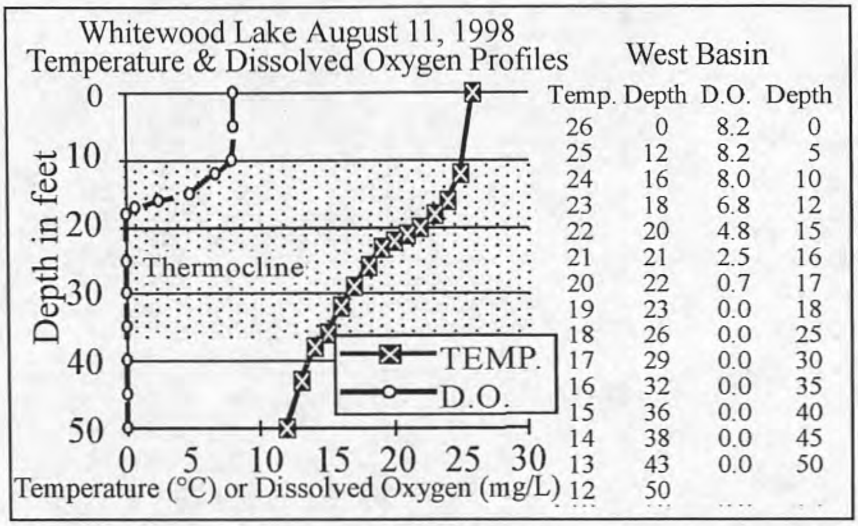
Temp.	Depth	D.O.	Depth
22	0	7.2	0
21	7	7.7	5
20	18	6.5	10
19	34	6.3	15
18	36	6.0	20
17	37	6.0	25
16	38	3.7	34
15	39	0.0	36
14	40	0.0	40
13	47	0.0	45
13	50	0.0	50

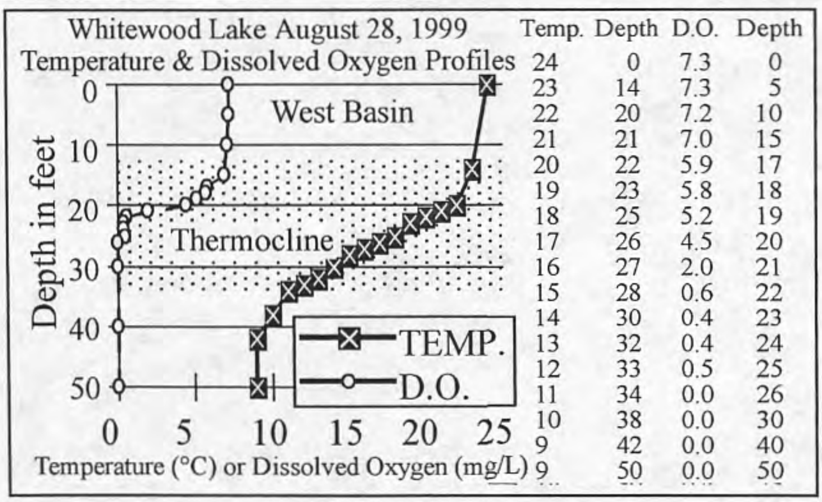
In late summer 1996, the west basin formed two thermoclines (where the temperature changes rapidly with depth and shown shaded on the graphs), a five foot thick one from 8 to 13 feet, and a second one 20 feet thick from 30 to 50 feet, which was the bottom of the lake. Dissolved oxygen was plentiful above ten feet and started to decrease below 10 feet. The basin ran out of dissolved oxygen at 30 feet. That condition remained to the bottom. The hypsographic (depth-area) graph shows about 45 percent of this basin is deeper than 30 feet.

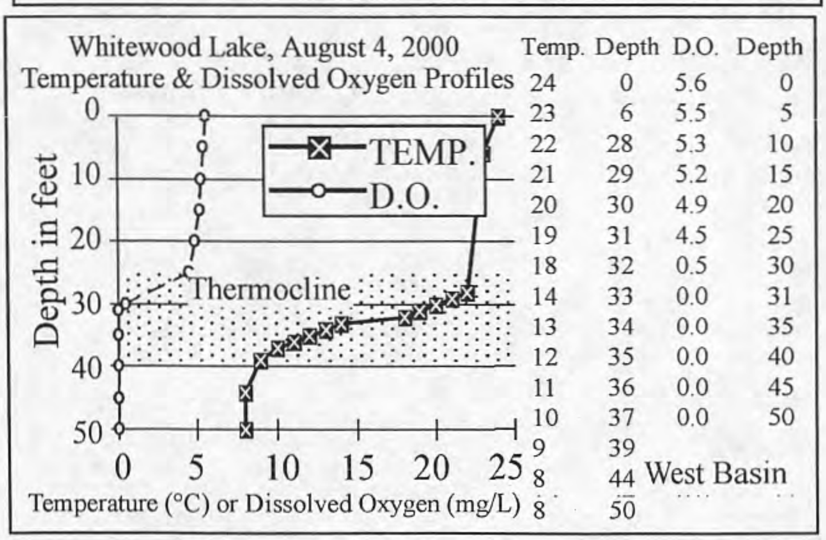
1997

In late summer 1997, the west basin formed a 15-foot-thick thermocline from 25 to 40 feet. Dissolved oxygen was plentiful above 25 feet, and started to drop below that depth. The basin ran out of dissolved oxygen at

36 feet. That condition remained to the bottom. About 30% of the basin is deeper than 36 feet.







1998

In late summer 1998, the west basin formed a 27-foot-thick thermocline from 10 to 37 feet. Dissolved oxygen was plentiful above 10 feet and started to decrease below that depth. The basin ran out of dissolved oxygen at 18 feet, and that condition remained to the bottom. About 68 percent of the basin is deeper than 18 feet.

1999

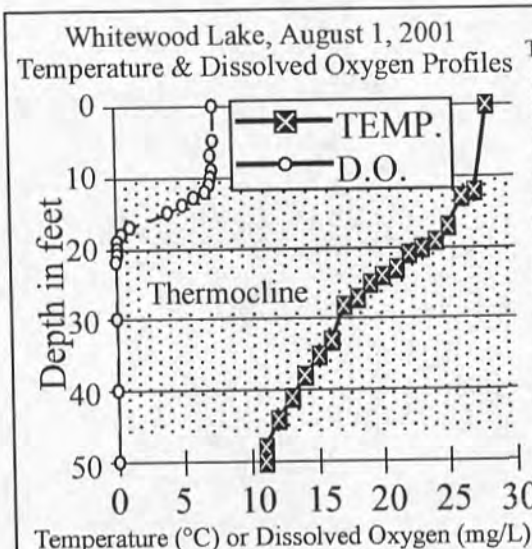
In late summer 1999, the west basin formed a 20-foot-thick thermocline from 14 to 34 feet. Dissolved oxygen was plentiful above the thermocline. The basin ran out of dissolved oxygen at 26 feet. That condition remained to the bottom. About 53 percent of the lake is deeper than 26 feet.

2000

In late summer 2000, the west basin formed a 15-foot-thick thermocline from 25 to 40 feet. Dissolved oxygen was present, but low (5.6 milligrams per liter or less) above the thermocline. The basin ran out of dissolved oxygen at 31 feet. That condition remained to the bottom. About 42 percent of the lake is deeper than 31 feet.

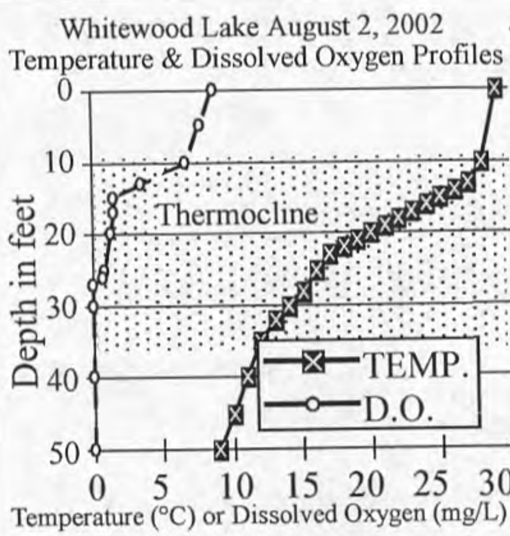
2001

In late summer 2001, the west basin formed a 36-foot-thick thermocline from 10 to 46 feet.



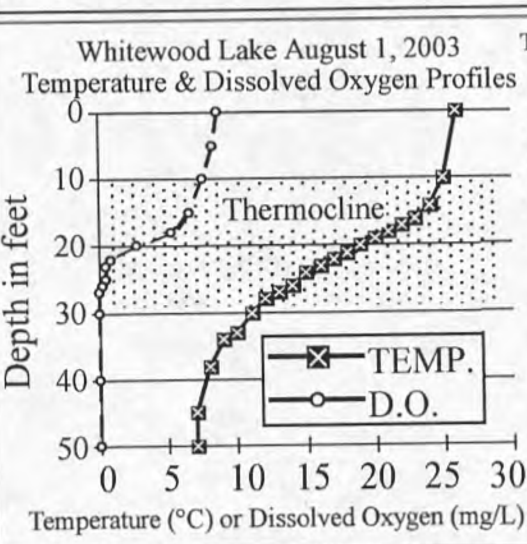
West Basin

Temp.	Depth	D.O.	Depth
28	0	7.5	0
27	12	7.5	5
26	13	7.3	7
25	17	7.4	9
24	19	7.3	10
23	20	7.2	11
22	21	6.8	12
21	23	6.0	13
20	24	5.1	14
19	25	4.0	15
18	27	1.1	17
17	28	0.4	18
16	33	0.1	19
15	35	0.1	20
14	38	0.1	21
13	41	0.0	22
12	44	0.0	30
11	48	0.0	40
11	50	0.0	50



Temp.	Depth	D.O.	Depth
29	0	8.9	0
28	10	7.9	5
27	13	6.8	10
26	14	3.6	13
25	15	1.6	15
24	16	1.5	17
23	17	1.3	20
22	18	0.8	25
21	19	0.7	26
20	20	0.0	27
19	21	0.0	30
18	22	0.0	40
17	23	0.0	50
16	25		
15	28		
14	30		
13	32		
12	35		
11	40		
10	45		
9	50		

West Basin



Temp.	Depth	D.O.	Depth
26	0	8.7	0
25	10	8.4	5
24	14	7.6	10
23	16	6.7	15
22	17	5.3	18
21	18	2.8	20
20	19	0.8	22
19	20	0.5	23
18	21	0.5	25
17	22	0.3	26
16	23	0.0	27
15	24	0.0	30
14	26	0.0	40
13	27	0.0	50
12	28		
11	30		
10	33		
9	34		
8	38		
7	45		
7	50		

West Basin

Dissolved oxygen was plentiful above the thermocline.

The basin ran out of dissolved oxygen at 22 feet. That condition remained to the bottom. About 60 percent of the basin is deeper than 22 feet.

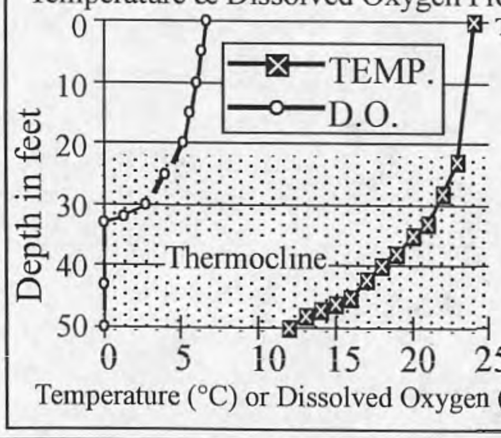
2002

In late summer 2002, the west basin formed a 26-foot-thick thermocline from 10 to 36 feet. Dissolved oxygen was plentiful above the thermocline. The basin ran out of dissolved oxygen at 27 feet. That condition remained to the bottom. About 52 percent of the basin is deeper than 27 feet.

2003

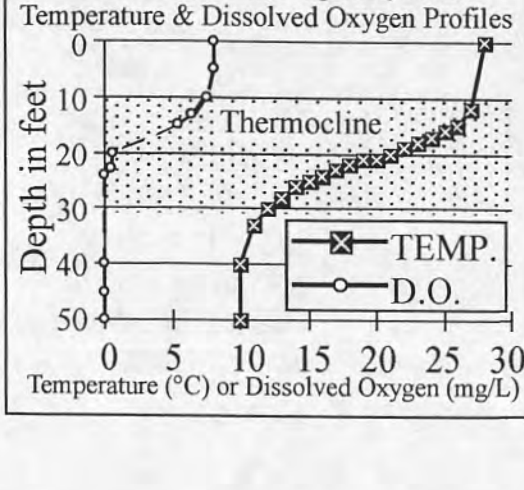
In late summer 2003, the west basin formed a 20-foot-thick thermocline from 10 to 30 feet. Dissolved oxygen was plentiful above the thermocline. The basin ran out of dissolved oxygen at 27 feet. That condition remained to the bottom. About 52 percent of the basin is deeper than 27 feet.

Whitewood Lake August 2, 2004 West Basin
Temperature & Dissolved Oxygen Profiles



Temp.	Depth	D.O.	Depth
24	0	6.7	0
23	23	6.4	5
22	28	6.0	10
21	33	5.6	15
20	35	5.2	20
19	38	4.0	25
18	40	2.7	30
17	42	1.3	32
16	45	0.0	33
15	46	0.0	43
14	47	0.0	50
13	48		
12	50		

Whitewood Lake, August 3, 2005
Temperature & Dissolved Oxygen Profiles



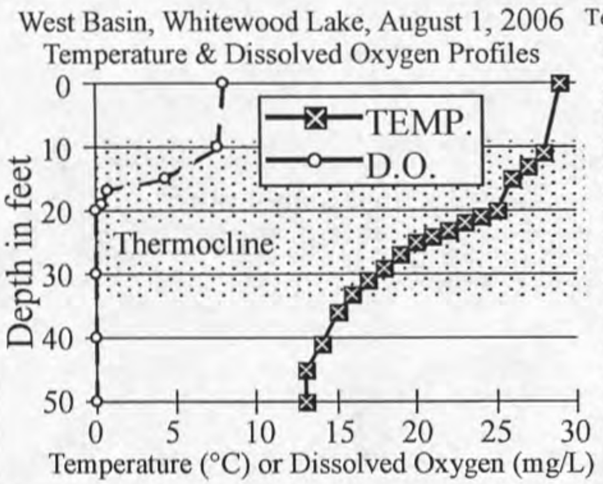
Temp.	Depth	D.O.	Depth
28	0	8.1	0
27	12	8.1	5
26	15	7.6	10
25	16	6.5	13
23	18	5.4	15
21	20	0.6	20
19	21	0.5	23
18	22	0.0	24
16	24	0.0	40
15	25	0.0	50
14	26	0.0	45
13	28	0.0	50
12	30		
11	33	West Basin	
10	40		
10	50		

2004

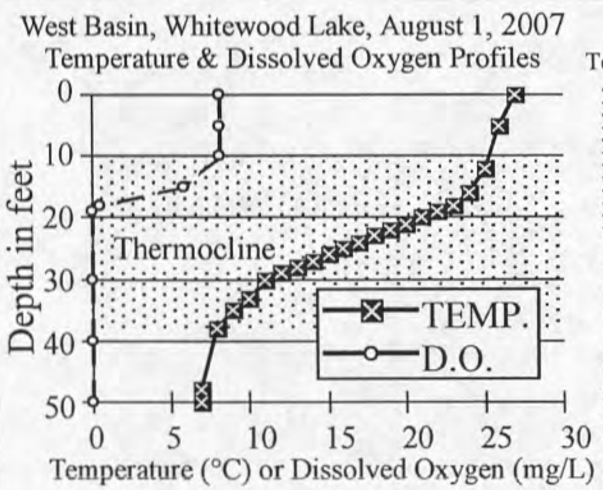
In late summer 2004, the west basin formed a 30-foot-thick thermocline from 20 to 50 feet. Dissolved oxygen was adequate above the thermocline. The basin ran out of dissolved oxygen at 33 feet. That condition remained to the bottom.

About 37 percent of the basin is deeper than 33 feet.

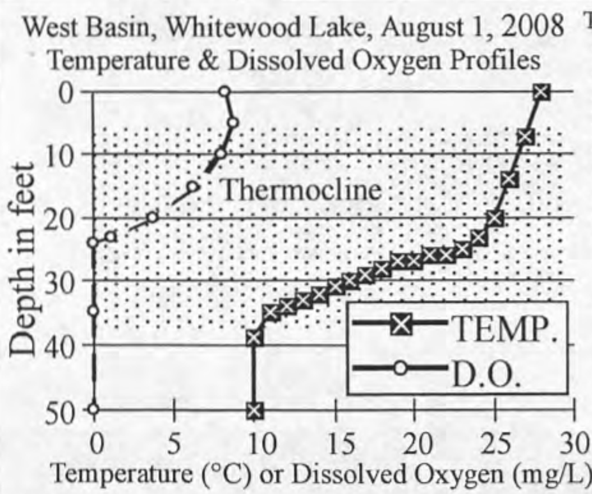
2005



Temp.	Depth	D.O.	Depth
29	0	8.1	0
28	11	7.7	10
27	13	4.4	15
26	15	0.8	17
25	20	0.4	19
24	21	0.0	20
23	22	0.0	30
22	23	0.0	40
21	24	0.0	50
20	25		
19	27		
18	29		
17	31		
16	33		
15	36		
14	41		
13	45		
13	50		



Temp.	Depth	D.O.	Depth
27	0	8.2	0
26	5	8.2	5
25	12	8.2	10
24	16	6.0	15
23	18	0.5	18
21	20	0.0	19
19	22	0.0	30
17	24	0.0	40
15	26	0.0	50
13	28		
11	30		
10	33		
9	35		
8	38		
7	48		
7	50		



Temp.	Depth	D.O.	Depth
28	0	8.3	0
27	7	8.8	5
26	14	8.1	10
25	20	6.3	15
24	23	3.8	20
23	25	1.1	23
22	26	0.0	24
20	27	0.0	35
18	28	0.0	50
17	29		
16	30		
15	31		
14	32		
13	33		
12	34		
11	35		
10	39		
10	50		

In late summer 2005, the west basin formed a 20-foot-thick thermocline from 10 to 30 feet. Dissolved oxygen was plentiful above the thermocline. The basin ran out of dissolved oxygen at 24 feet. That condition remained to the bottom.

About 60 percent of the basin is deeper than 24 feet.

2006

In late summer 2006 the west basin formed a 23-foot-thick thermocline from 10 to 33 feet. Dissolved oxygen supplies were adequate above 10 feet. Below that depth dissolved oxygen concentrations started to decrease, and were zero at 20 feet. That condition remained to the bottom. About 62 percent of the basin is deeper than 20 feet.

2007

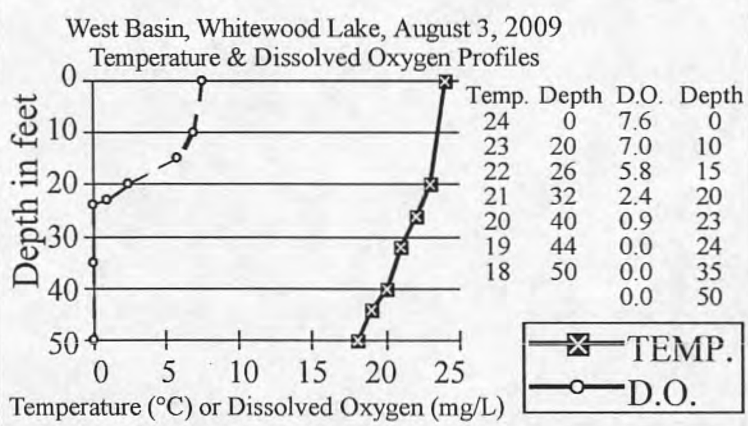
In late summer 2007 the west basin formed a 28-foot-thick thermocline from 10 to 38 feet. Dissolved oxygen was plentiful above 10 feet and started to decrease below that depth. It was zero at 19 feet, and that condition remained to the bottom.

2008

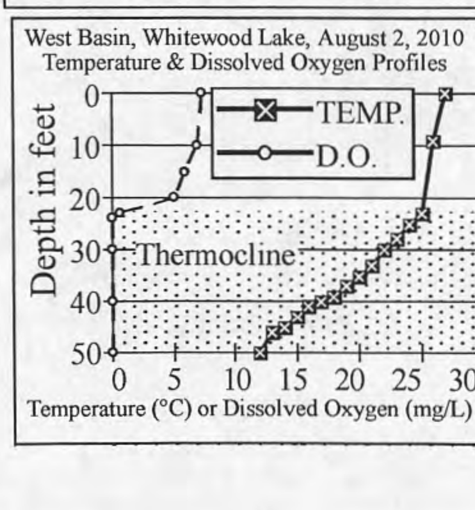
In late summer 2008 the west basin formed a 30-foot thick thermocline from 5 to 35 feet. Dissolved oxygen supplies were plentiful above the thermocline and reached zero at 24 feet. About 56 percent of this basin is deeper than 24 feet.

2009

In late summer 2009 a most unusual condition occurred in the west basin in late summer in that the basin did not form a thermocline. The surface temperature was 24 degrees C and the bottom temperature was 18 degrees C, but the temperature just gradually changed from top to bottom. Even so, dissolved oxygen, which was adequate but low in the top 15 feet, dropped to zero at 24 feet, and that condition remained to the bottom.



Temp.	Depth	D.O.	Depth
24	0	7.6	0
23	20	7.0	10
22	26	5.8	15
21	32	2.4	20
20	40	0.9	23
19	44	0.0	24
18	50	0.0	35
		0.0	50

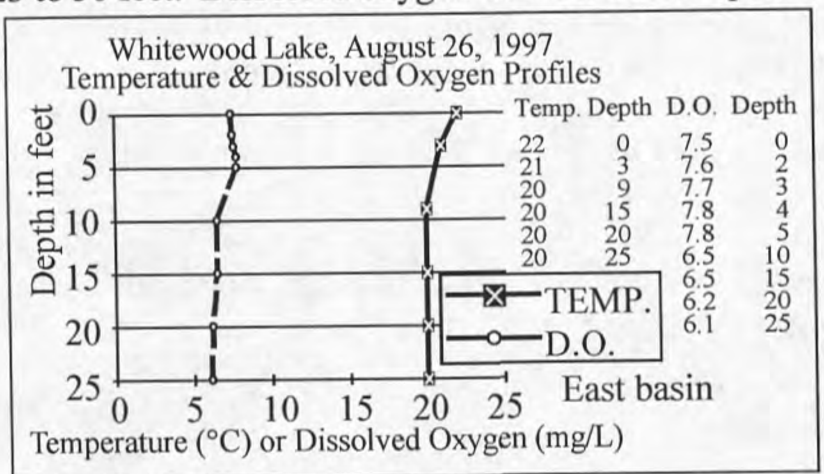


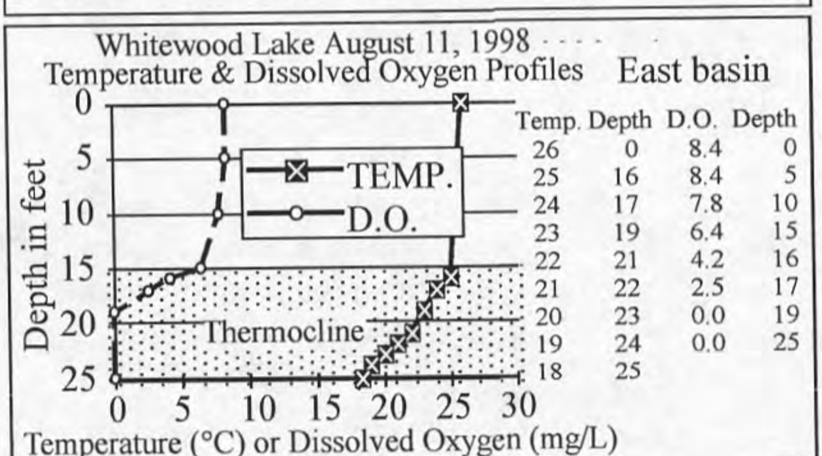
Temp.	Depth	D.O.	Depth
27	0	7.4	0
26	9	6.9	10
25	23	5.9	15
24	25	5.0	20
23	28	0.6	23
22	30	0.0	24
21	33	0.0	30
20	35	0.0	40
19	37	0.0	50
18	39		
17	40		
16	41		
15	43		
14	45		
13	46		
12	50		

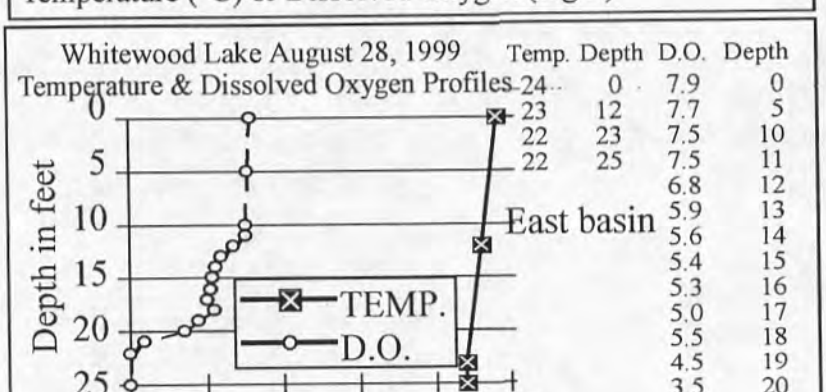
This is interesting because it indicates a lake can run out of dissolved oxygen even if it is not stratified in summer.

2010

In late summer 2010 the west basin formed a 27-foot thick thermocline from 23 to 50 feet. Dissolved oxygen was low but adequate above 20 feet. The basin ran out of dissolved oxygen at 24 feet and that condition remained to the bottom. Late summer temperature and dissolved oxygen profiles show that no pattern is emerging in the west basin regarding the depth the lake runs out of dissolved oxygen. That's a plus.







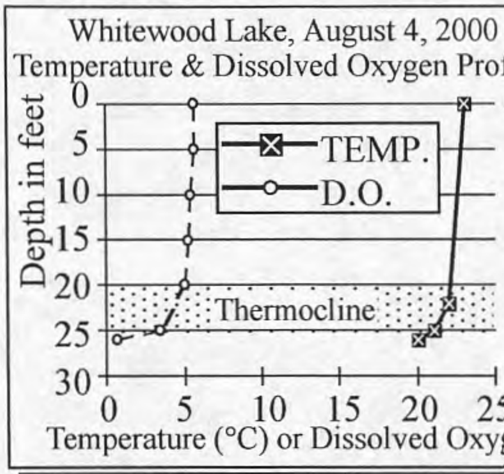
THE EAST BASIN

1997

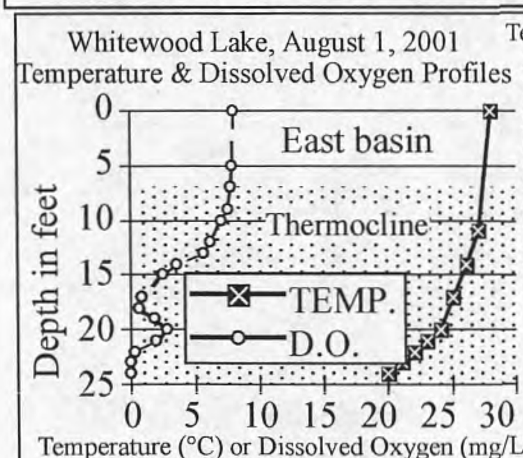
In late summer 1997, the east basin did not form a thermocline. Temperature was essentially uniform top to bottom. Since there was no stratification of layers of water in the lake, dissolved oxygen was also uniformly mixed through the entire water column.

1998

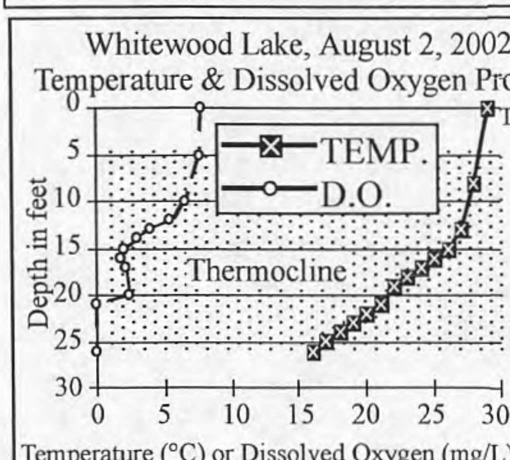
In late summer 1998 the east basin formed a ten-foot-thick thermocline from 15 to 25 feet. Above the thermocline, dissolved oxygen was plentiful. The basin ran out of dissolved oxygen at 19 feet and that condition remained to the bottom. About 48 percent of the basin is deeper than 19 feet.



Temp.	Depth	D.O.	Depth
23	0	5.6	0
22	22	5.6	5
21	25	5.4	10
20	26	5.2	15
		5.0	20
		3.4	25
		0.7	26



Temp.	Depth	D.O.	Depth
28	0	8.0	0
27	11	7.9	5
26	14	7.8	7
25	17	7.6	9
24	20	7.0	10
23	21	6.2	12
22	22	5.7	13
21	23	3.5	14
20	24	2.5	15
		0.9	17
		0.6	18
		1.8	19
		2.8	20
		1.9	21
		0.3	22
		0.0	23
		0.0	24



Temp.	Depth	D.O.	Depth
29	0	7.8	0
28	8	7.6	5
27	13	6.6	10
26	15	5.4	12
25	16	4.0	13
24	17	3.0	14
23	18	2.0	15
22	19	1.8	16
21	21	2.1	17
20	22	2.4	20
19	23	0.0	21
18	24	0.0	26
17	25		
16	26		

1999

In late summer 1999, no thermocline formed in the east basin. Temperature was essentially uniform top to bottom. Dissolved oxygen was plentiful above 10 feet. From that depth the dissolved oxygen concentration gradually decreased. It was zero at 22 feet and that condition remained to the bottom. About 30 percent of the basin is deeper than 22 feet.

2000

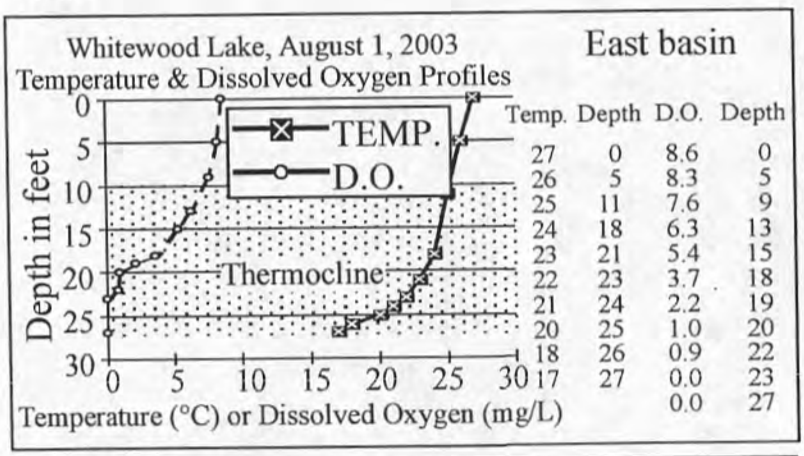
In late summer 2000, the east basin formed a

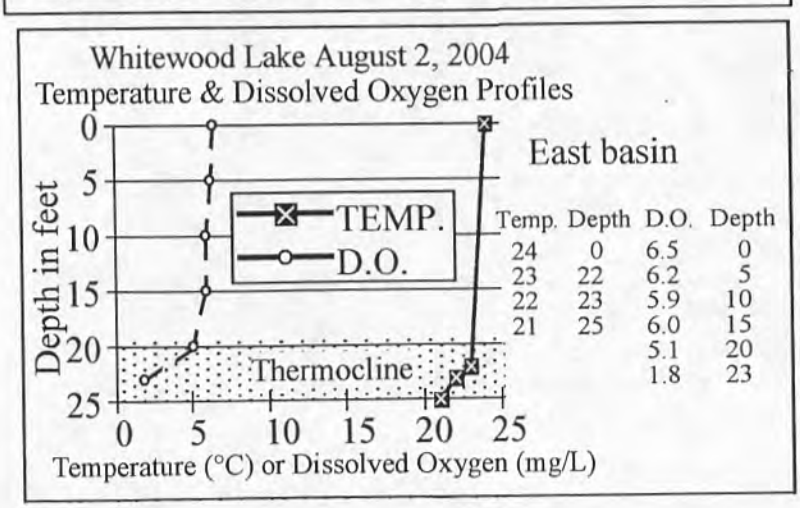
6-foot-thick thermocline from 20 to 26 feet (the bottom of the basin). The dissolved oxygen concentrations were low from the surface to 20 feet (less than 6 milligrams per liter). At 20 feet the dissolved oxygen concentration started to decrease. It reached 0.7 milligrams per liter at 26 feet, the bottom of the basin.

2001

In late summer 2001, the east basin formed a 16-foot-thick thermocline from 9 to 25 feet. In this case, dissolved oxygen concentration did a better job of defining the thermocline than did temperature. Dissolved oxygen was plentiful above 10 feet. From that depth the dissolved oxygen concentration gradually decreased to a low of 0.6 milligrams per liter at 18 feet. There was a small peak of dissolved oxygen at 20 feet, probably the result of an algal bloom which settled there. It was zero at 23 feet and that condition remained to the bottom. About 25 percent of the lake is deeper than 23 feet.

2002





In late summer 2002, the east basin formed a 21-foot-thick thermocline from 5 to 26 feet. Dissolved oxygen concentration again did a better job of defining the thermocline than did temperature. Dissolved oxygen was plentiful above 10 feet. From that depth the dissolved oxygen concentration gradually decreased to a low of 1.8 milligrams per liter at 16 feet, then increased to 2.4 mg/L at 20 feet. Dissolved oxygen was zero at 21 feet and that condition remained to the bottom.

2003

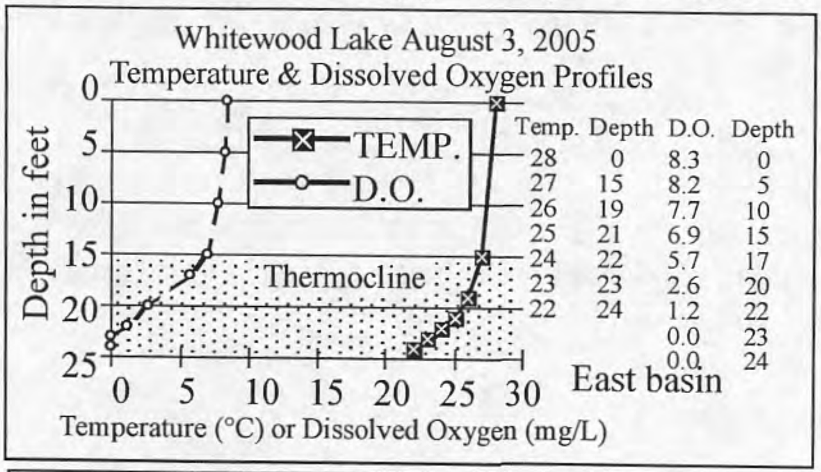
In late summer 2003, the east basin formed a 17-foot-thick thermocline from 10 to 27 feet. Dissolved oxygen was plentiful above 10 feet. From that depth the dissolved oxygen concentration gradually decreased to zero at 23 feet and that condition remained to the bottom.

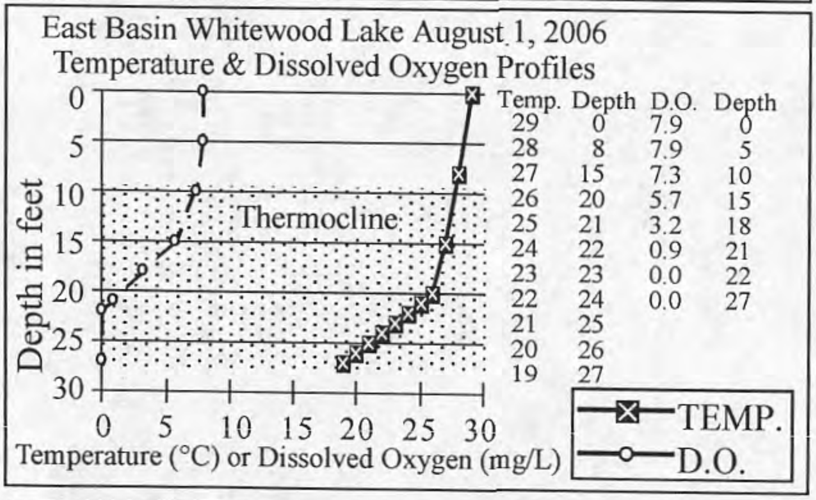
2004

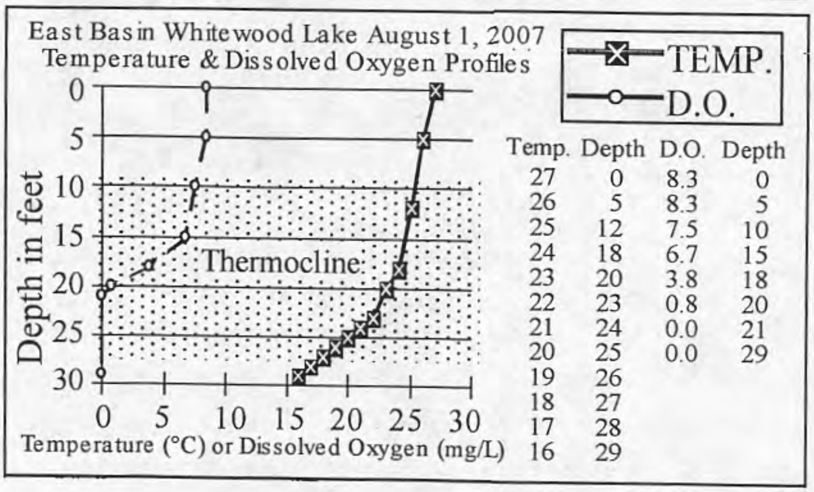
In late summer 2004, the east basin formed a 5-foot-thick thermocline from 20 to 25 feet. Dissolved oxygen was low but adequate above 20 feet. From that depth the dissolved oxygen concentration gradually decreased to 1.8 mg/L at 23 feet.

2005

In late summer 2005 the east basin formed a 10-foot thick thermocline from 15 to 25 feet.







Dissolved oxygen was plentiful above 15 feet. This year the basin ran out of dissolved oxygen near the bottom, at 23 feet.

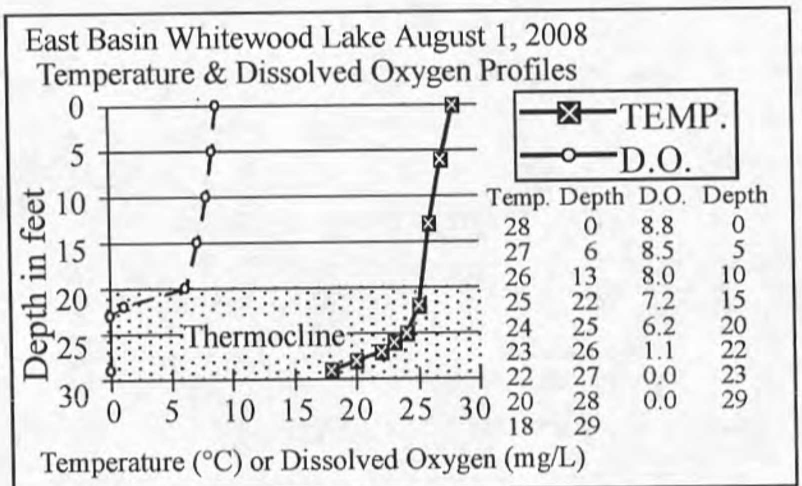
2006

In late summer 2006 the east basin formed a 17-foot thick thermocline from 10 to 27 feet. Dissolved oxygen was plentiful above 13 feet. This year the basin ran out of dissolved oxygen at 22 feet.

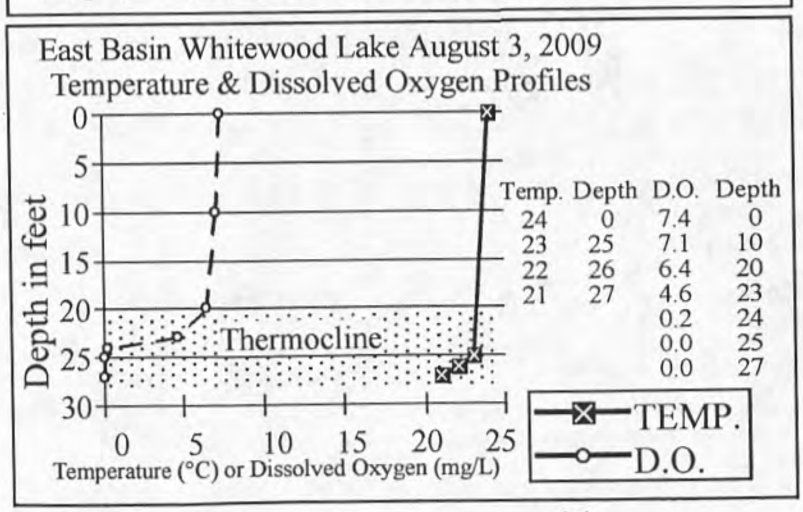
2007

In late summer 2007 the east basin formed an 18-foot thick thermocline from 10 to 28 feet. Dissolved oxygen was plentiful above 10 feet. This year the basin ran out of dissolved oxygen at 21 feet.

2008



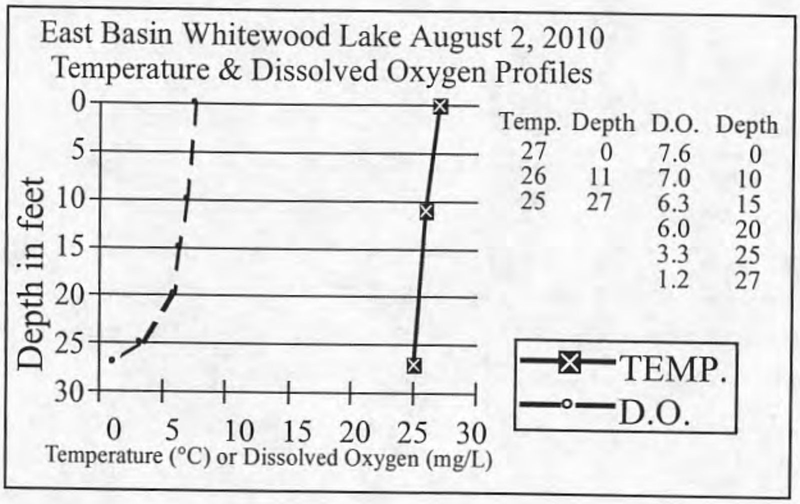
In late summer 2008 the east basin formed an 8-foot thick thermocline from 20 to 28 feet. Dissolved oxygen was plentiful above 20 feet. This year the basin ran out of dissolved oxygen at 23 feet. About 25 percent of the east basin is deeper than 23 feet.



2009

In late summer 2009 the east basin formed a 7-foot thick thermocline from 20 to 27 feet. Dissolved oxygen was low but adequate above 20 feet. This year the basin ran out of dissolved oxygen at 25 feet. About 12 percent of the east basin is deeper than 25 feet.

2010



In late summer 2010 the east basin temperature was 27 at the surface and 25 and the bottom, so a thermocline did not form. Dissolved oxygen was adequate to support fish life to 24 feet. This basin did not run out of dissolved oxygen at any depth in 2010.

The data show this basin has unusually variable temperature and dissolved oxygen conditions, probably the result of the high flushing rate.

A NOTE ABOUT THE REMAINING GRAPHS

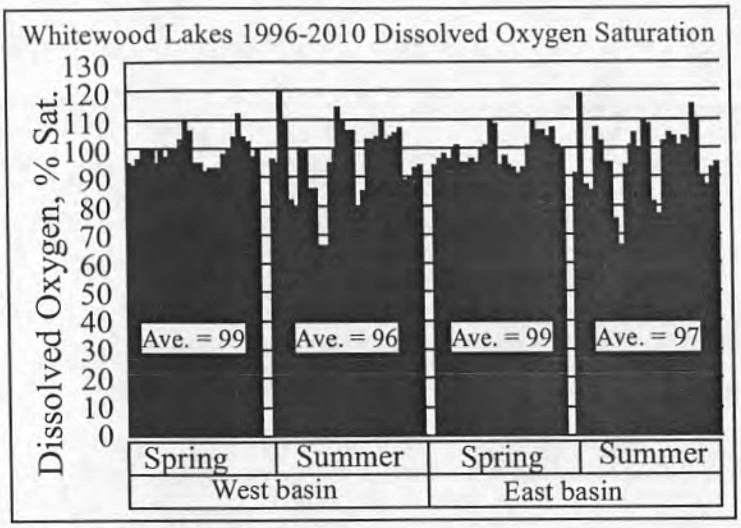
The graphs below are sorted first by spring and summer then by east and west basin, then by date. The purpose is to see if there are any differences in the spring and summer data between the two basins. Averages for each data set are also shown on the bars.

DISSOLVED OXYGEN, PERCENT SATURATION

Because the amount of dissolved oxygen a water can hold is temperature dependent, with cold water holding more than warm water, percent saturation is often a better way to determine if surface oxygen supplies are adequate. Best is near 100 percent.

The graph shows the saturation of dissolved oxygen is usually less than 100 percent, especially in summer, There are however, occasional higher values.

These data should indicate the lake does not have a lot of plants and algae, because plants and algae often create supersaturated conditions in lakes.

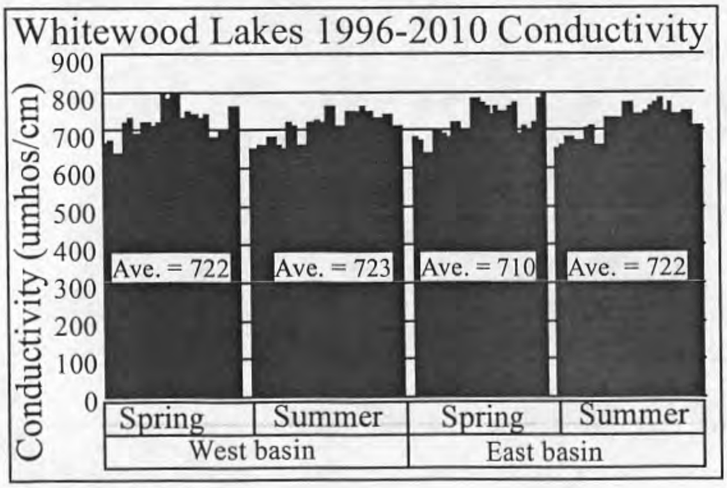


However the high flushing rate may be keeping these high dissolved oxygen concentrations in check. The graph does not show any large differences between the spring and summer data in either basin, although summer values vary more.

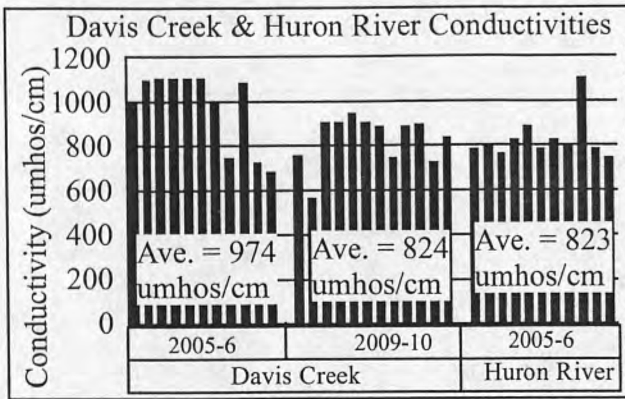
CONDUCTIVITY

Conductivity, measured with a meter, detects the capacity of a water to conduct an electric current. More importantly however, it measures the amount of materials dissolved in the water (salts), since only dissolved materials will permit an electric current to flow. Theoretically, pure water will not conduct an electric current.

It is the perception of the experts that poor quality water has more dissolved materials than good quality water. I agree. Lower is usually better. The graph shows spring and summer conductivities ranged from 640 to 800 micromhos per centimeter, which is high for a Michigan inland lake.



The graph shows spring conductivities in both basins formed the same hump seen in both Base and Portage Lake conductivity data. However, the summer data in both basins do not show this same trend. They show steadily increasing conductivities, which are probably coming from upstream sources.

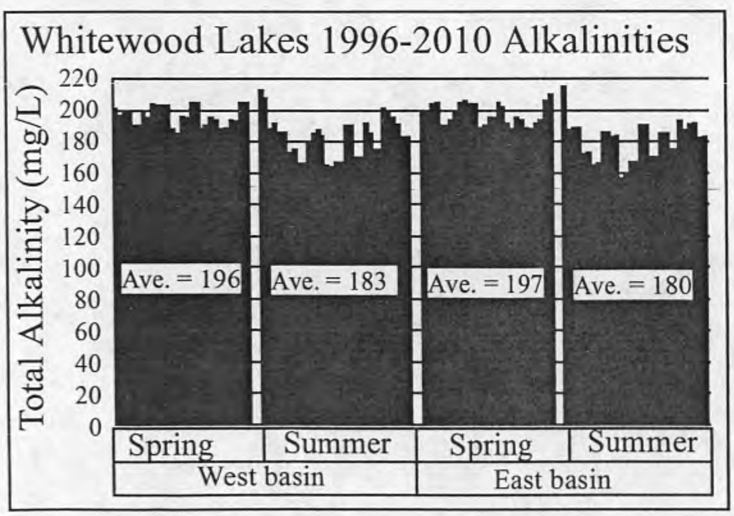


Davis Cr.		5/28/09	750	Huron R.	
6/30/05	1000	6/29/09	560	6/30/05	780
7/29/05	1090	7/31/09	900	7/29/05	790
8/29/05	1100	8/28/09	900	8/29/05	760
9/27/05	1100	9/23/09	940	9/27/05	820
10/24/05	1100	10/21/09	900	10/24/05	880
11/30/05	1100	11/23/09	880	11/30/05	780
12/27/05	1000	12/26/09	740	12/27/05	820
1/27/06.	740	1/23/10	880	1/27/06.	800
2/28/06.	1080	3/9/10	890	2/28/06.	1100
3/30/06.	720	3/31/10	720	3/30/06.	780
4/19/06.	680	4/20/10	830	4/19/06.	740

The graph shows the conductivities of the 2005-6 Davis Creek samples were higher than Whitewood Lake, while the conductivities of the Huron River samples were about the same as Whitewood Lake. The 2009-10 Davis Creek conductivities were considerably lower than the 2005-6 conductivities, and about the same as the Huron River. This is a plus.

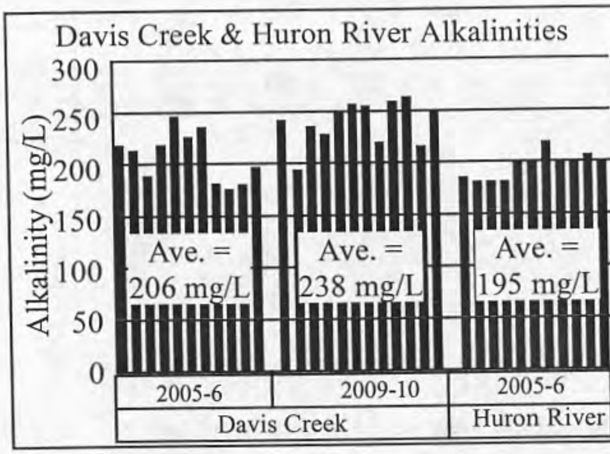
TOTAL ALKALINITY

Alkalinity measures carbonates and bicarbonates in water. Soft water lakes have alkalinities below 75 milligrams per liter. Moderately hard water lakes have alkalinities between 75 and 150 milligrams per liter. Hard water lakes have alkalinities above 150 milligrams per liter.



The alkalinity of Whitewood Lake(s) ranges from 157 to 215 milligrams per liter. This indicates the lake is a hard water lake, not surprising given the Huron River flows through both basins. The graph shows summer alkalinities are lower than spring alkalinities, which is normal and expected. The graph does not show any specific trend in either basin.

Hard water lakes are tougher than soft water lakes because they have the ability to precipitate some phosphorus to the bottom sediments as calcium phosphate. Soft water lakes lack this ability.

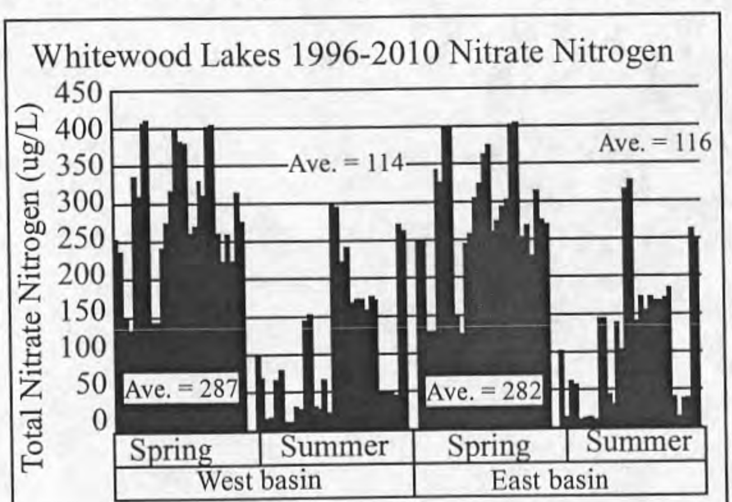


Davis Cr.				Huron R.	
6/30/05	217	5/28/09	241	6/30/05	184
7/29/05	212	6/29/09	193	7/29/05	180
8/29/05	188	7/31/09	235	8/29/05	180
9/27/05	217	8/28/09	227	9/27/05	180
10/24/05	245	9/23/09	250	10/24/05	200
11/30/05	225	10/21/09	256	11/30/05	200
12/27/05	235	11/23/09	254	12/27/05	218
1/27/06.	180	12/26/09	219	1/27/06.	200
2/28/06.	175	1/23/10	258	2/28/06.	200
3/30/06.	179	3/9/10	263	3/30/06.	205
4/19/06.	196	3/31/10	215	4/19/06.	198
		4/20/10	250		

The alkalinities of the Davis Creek samples in the 2005-6 are slightly higher than the Huron River, and for some reason, the 2009-10 alkalinities in the Davis Creek samples are quite a bit higher than the Huron River. This is not a problem. It's just interesting because the alkalinity of a stream shouldn't change much as time passes. Huron River alkalinities are about the same as Whitewood Lake samples, not surprising given the Huron River flows through both basins.

NITRATE NITROGEN

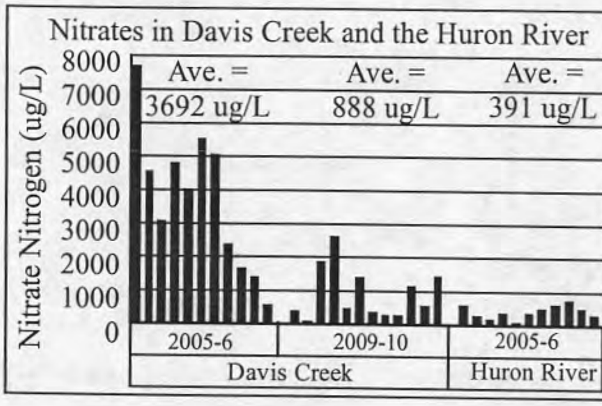
Most Michigan inland lakes have spring nitrate nitrogen concentrations around 200 micrograms per liter (or parts per billion). Summer nitrate nitrogen concentrations are generally much lower, in the 10 to 40 micrograms per liter range.



The graph shows spring nitrate nitrogen concentrations are higher than summer nitrates, and range from 69 micrograms per liter to a high of 410 micrograms per liter in both basins.

Summer values are variable; sometimes low (less than 100 ug/L) and sometimes higher than 300 ug/L. The amount of variation is unusual.

The graph seems to show nitrates are generally increasing in both basins in both spring and summer. That is not a plus.



Davis Creek				Huron River	
6/30/05	7700	5/28/09	370	6/30/05	581
7/29/05	4532	6/29/09	47	7/29/05	256
8/29/05	3060	7/31/09	1845	8/29/05	160
9/27/05	4800	8/28/09	2600	9/27/05	344
10/24/05	4007	9/23/09	450	10/24/05	55
11/30/05	5527	10/21/09	1375	11/30/05	352
12/27/05	5061	11/23/09	350	12/27/05	470
1/27/06	2368	12/26/09	263	1/27/06	611
2/28/06	1632	1/23/10	250	2/28/06	726
3/30/06	1376	3/9/10	1122	3/30/06	458
4/19/06	549	3/31/10	548	4/19/06	288
5/28/09	370	4/20/10	1438		

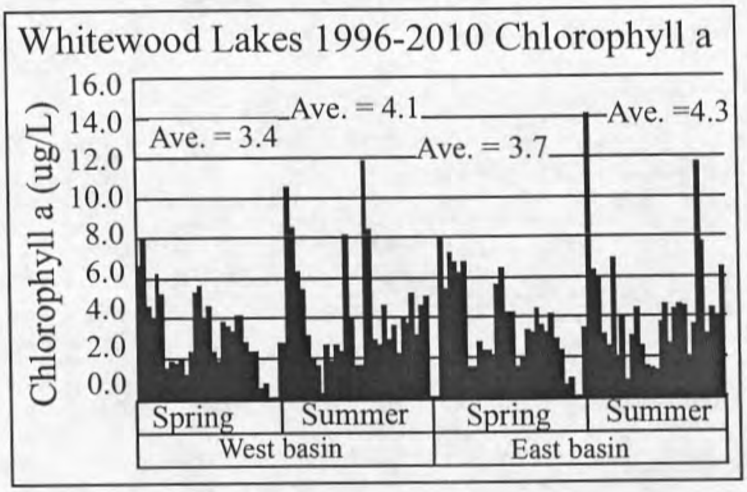
Good news here. The graph shows nitrate concentrations in the 2005-6 Davis Creek samples were about ten times higher than the Huron River samples, averaging 3692 ug/L. However the 2009-10 Davis Creek nitrates were considerably lower (average 888 ug/L). I suspect the source of these nitrates in Davis Creek is the Northfield Township sewage treatment plant. And the data indicates nitrates in the creek are lower by a factor of about 4, which is a real plus.

The DNR does not feel nitrates are a problem. In fact, they encourage nitrate production at sewage treatment plants.

I feel nitrates are a problem because although limiting the amount of phosphorus in the water may control algal communities in lakes, that is not the case with aquatic plants. Since aquatic plants have roots, and the bottom sediments of most lakes have plenty of phosphorus, the plants can get their phosphorus from the bottom sediments. Hence controlling phosphorus does little to limit aquatic plant growth. Therefore nitrogen needs to be controlled, because the aquatic plants get their nitrogen from the water, just like the algae do.

CHLOROPHYLL A

Chlorophyll a, reported in micrograms per liter (or parts per billion) generally gives an estimate of algal densities. Best is less than 1 microgram per liter.



The chlorophyll graph shows not a lot of difference between the spring and summer data of both basins. It shows chlorophyll concentrations are above 2 ug/L most of the time, and sometimes above 5 ug/L. Spring chlorophylls average 3.4 ug/L in the west basin and 3.7 in the east basin. These are essentially the same. In summer west basin chlorophylls average 4.1 ug/L while the east basin chlorophylls average 4.3 ug/L. Again, these are essentially the same.

The graph does not show any specific trend in either basin in either spring or summer, although summer values appear to be higher than spring values, but just by a bit.

pH (Hydrogen ion concentration) (no graph)

Lakes with extensive plant communities often have high summer pH values (greater than 9) because the plants use the carbonates in the water as a carbon source. This causes a decrease in the buffering capacity of the water and allows the pH to increase.

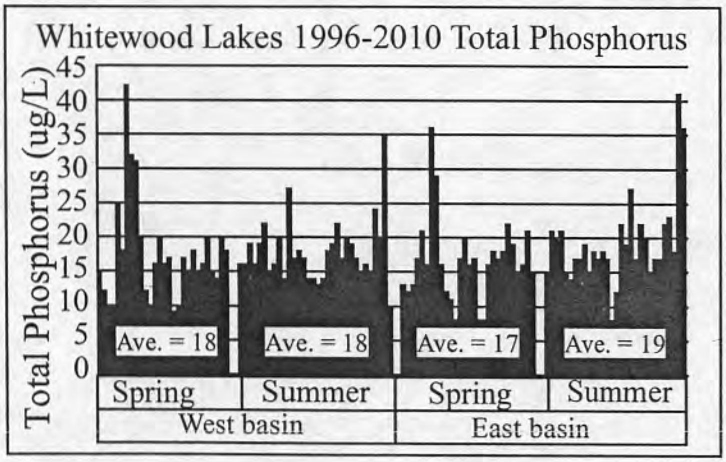
The pH values of Whitewood Lake range from 7.4 to 8.4 which are normal for a lake with a river flowing through it.

TOTAL PHOSPHORUS

Although there are several forms of phosphorus found in lakes, the experts selected total phosphorus as being most important. This is probably because all forms of phosphorus can be converted to the other forms. Currently, most lake scientists feel phosphorus, which is measured in parts per billion (1 part per billion is one second in 31 years) or micrograms per liter (ug/L), is the one nutrient which might be controlled. If its addition to lake water could be limited, the lake might not become covered with the algal communities so often found in eutrophic lakes.

However, based on our studies of many Michigan inland lakes, we've found many lakes were phosphorus limited in spring (so don't add phosphorus) and nitrate limited in summer (so don't add nitrogen). 10 parts per billion is considered a low concentration of phosphorus in a lake and 50 parts per billion is considered a high value in a lake by many limnologists.

The total phosphorus graph shows Whitewood Lake had phosphorus concentrations ranging from 8 to 37 micrograms per liter. Best is below 10 micrograms per liter.

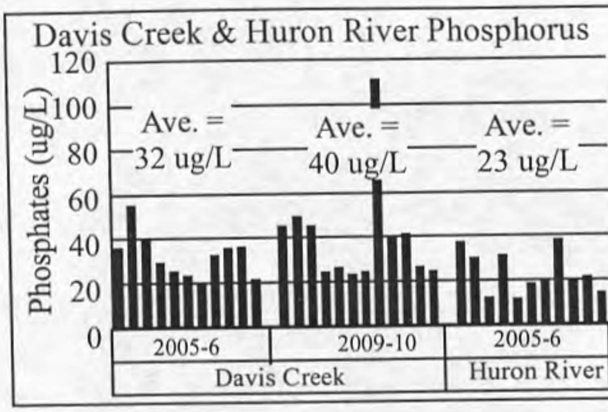


The graph shows there is not a lot of difference between the phosphorus concentrations of the two basins in either spring or summer.

The graph shows most of the time, phosphorus concentrations are less than 20 ug/l. Once they start exceeding that value, if other nutrients are present in sufficient quantities, plants and algae will grow to nuisance levels.

More importantly, the graph does not show phosphorus is increasing in either spring or summer in either basin although 2010 summer phosphorus was high in the east basin, 37 and 42 ug/L.

The graph shows the 2005-6 Davis Creek average phosphorus concentration is 32 ug/L and the average 2009-10 Davis Creek phosphorus concentration is 40 ug/L (but that's influenced by a single high 111 ug/L value) while the average Huron River phosphorus concentration is 23 ug/L. Both are higher than the average Whitewood Lake phosphorus concentration of 18 ug/L.



Davis Cr.		5/28/09	45	Huron R.	
6/30/05	36	6/29/09	49	6/30/05	37
7/29/05	55	7/31/09	45	7/29/05	30
8/29/05	40	8/28/09	24	8/29/05	12
9/27/05	29	9/23/09	26	9/27/05	31
10/24/05	25	10/21/09	23	10/24/05	11
11/30/05	23	11/23/09	24	11/30/05	18
12/27/05	20	12/26/09	111	12/27/05	19
1/27/06.	32	1/23/10	39	1/27/06.	38
2/28/06.	35	3/9/10	41	2/28/06.	20
3/30/06.	36	3/31/10	26	3/30/06.	21
4/19/06.	21	4/20/10	24	4/19/06.	14

During both sample periods, Davis Creek had a phosphorus concentration about 50 percent higher than the Huron River. That's not a plus for the lakes.

It is a real plus that the Portage, Base and Whitewood Board passed a resolution recommending no fertilizers, containing either phosphorus or nitrogen be used on lands within four hundred feet of the lakes, or from streams that feed the lakes. If residents heed this policy, the quality of their lakes should improve.

SECCHI DISK TRANSPARENCY (originally Secchi's disk)

In 1865, Angelo Secchi, the Pope's astronomer in Rome, Italy devised a 20 centimeter (8 inch) white disk for studying the transparency of the water in the Mediterranean Sea. Later an American limnologist (lake scientist) named Whipple divided the disk into black and white quadrants which many are familiar with today.

The Secchi disk transparency is a lake test widely used and accepted by limnologists. The experts generally felt the greater the Secchi disk depth, the better quality the water. However, one Canadian scientist pointed out acid lakes have very deep Secchi disk readings. Most lakes in southeast Michigan have Secchi disk transparencies of less than ten feet. On the other hand, Elizabeth Lake in Oakland County had 34 foot Secchi disk readings in summer 1996, evidently caused by a zebra mussel invasion a couple of years earlier.

Most limnology texts recommend the following: to take a Secchi disk transparency reading, lower the disk into the water on the shaded side of an anchored boat to a point where it disappears. Then raise it to a point where it's visible. The average of these two readings is the Secchi disk transparency depth.

We do it slightly differently. We lower the disk on the shaded side of an anchored boat until the disk disappears, and note the depth, then report the depth to the next deepest foot. For example if the disk disappears at six and a half feet, we report the Secchi disk depth as 7 feet. The reason we do this is that some suggest using a water telescope (a device that works like an underwater mask and eliminates water roughness) to view the disk as it disappears. Since we don't use this device, we compensate for it by noting the slightly deeper depth.

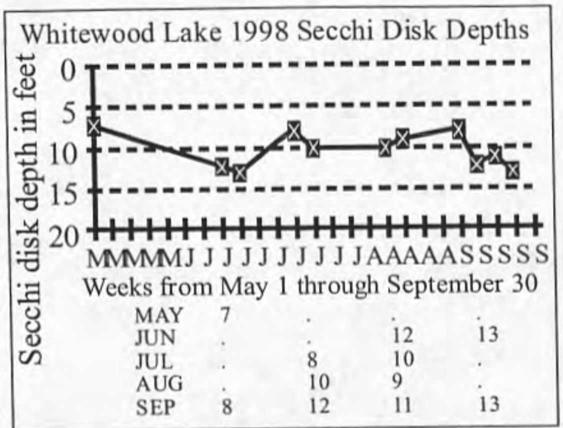
We feel it is only necessary to report Secchi disk measurements to the closest foot. Secchi disk measurements should be taken between 10 AM and 4 PM. Rough water will give slightly shallower readings than smooth water. Sunny days will give slightly deeper readings than cloudy days. However, roughness influences the visibility of the disk more than sunny or cloudy days. Furthermore, it's been reported that most adults can see the Secchi disk disappear at about the same depth, but grand-children see it disappear 3-4 feet deeper than grand-parents.

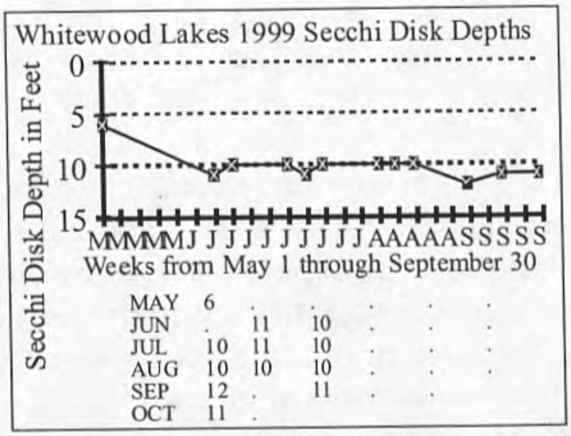
If there are sample sites where the lake is too shallow and the disk is visible when resting on the bottom, the reading should be taken at a nearby deeper site. Since the sampling procedure is designed to obtain "representative samples" moving the boat to an area where a Secchi disk transparency reading can be properly taken is appropriate. In the case of Secchi disk readings, this procedure is more valid than reporting the disk is visible on the lake bottom.

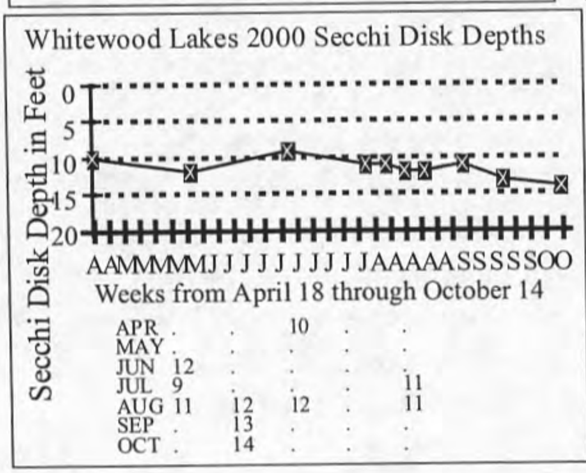
WHITEWOOD LAKES SECCHI DISK DATA

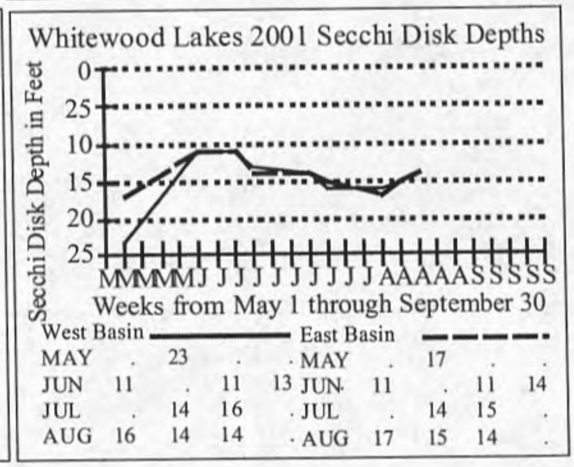
1998

The graph of 1998 Secchi disk data shows 7 foot readings in early May increasing to 14 feet the end of June, then decreasing to between 8 and 12 feet through the summer, ending up at 13 feet the end of September.









1999

The graph of 1999 Secchi disk data shows 6 feet in early May, increasing to 10 to 12 feet the remainder of the warm months. In other words after an initial shallow reading, the clarity of the lakes hardly changed when the water was warm.

2000

The graph shows the clarity of the water was in the 10 to 12 foot range for most of the summer, increasing to 14 feet in October.

2001

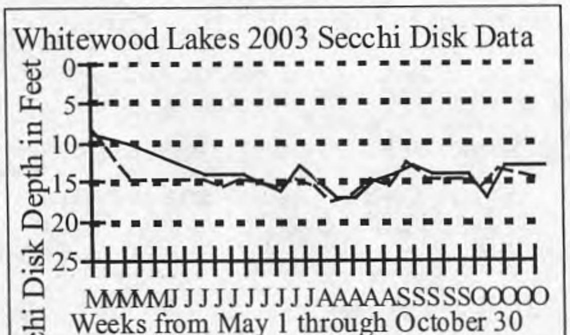
Jerry and Stacy Porman did a good job taking Secchi disk readings in both basins of Whitewood Lake in 2001. The graph shows their data.

The graph shows in May, the clarity of the west basin was better (23 feet) than the east basin (17 feet). After that, the Secchi disk readings in both basins were similar. The graph shows Secchi disk readings are shallowest in June, about 11 feet. From that point on, they gradually increased to 14 to 17 feet in July and August.

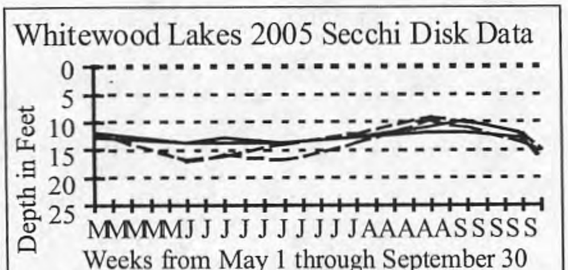
2003

Jerry and Stacy Porman collected Secchi disk data in 2003 from both basins. The graph shows their data from both basins, stacked.

The graph shows little change in water clarity between spring when the water is cold, and summer when it is warm. This is probably due to the high flushing rate.

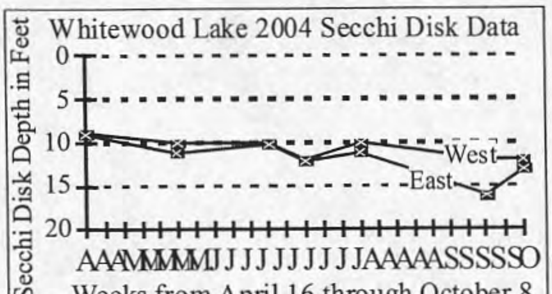


West ------						East ———					
MAY	8 .	14	.	.		MAY	9 .	10	.	.	
JUN	. 14	15	14	.		JUN	. 14	14	14	.	
JUL	15 14	15	17	16		JUL	16 13	15	17	17	
AUG	14 15	12	14	.		AUG	15 14	13	14	.	
SEP	14 15	13	.	.		SEP	14 17	13	.		
OCT	. .	.	.	14		OCT	. .	.	.	13	

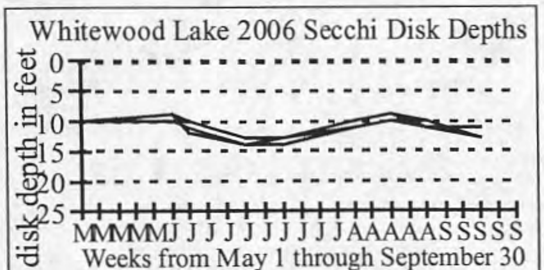


Station 1 -----						Station 3 ———					
MAY	12 .	.	.	.		MAY	13 .	.	.	.	
JUN	17 .	16	.	.		JUN	14 .	13	.	.	
JUL	14 .	.	.	12		JUL	14 .	.	.	13	
AUG	. .	.	9	.		AUG	. .	.	12	.	
SEP	10 .	.	12	15		SEP	12 .	.	13	16	

Station 2 -----						Station 4 ———					
MAY	12 .	.	.	.		MAY	12 .	.	.	.	
JUN	17 .	16	.	.		JUN	14 .	14	.	.	
JUL	17 .	.	.	14		JUL	14 .	.	.	13	
AUG	. .	.	10	.		AUG	. .	.	11	.	
SEP	11 .	.	14	15		SEP	10 .	.	12	16	



West						East					
APR	9	.	.	.		APR	9	.	.	.	.
JUN	11	.	.	.		JUN	10	.	.	.	.
JUL 10	.	12	.	.		JUL 10	.	12	.	.	
AUG	11	.	.	.		AUG	10	.	.	.	.
SEP.	.	16	.	13		SEP.	.	12	.	12	



	M1	J1	J2	J5	J2	A1	A3	A5	S3
Station 1	10	9	12	14	14	11	10	10	13
Station 2	10	9	10	13	13	11	10	11	11
Station 3	10	10	10	13	13	10	9	11	13
Station 4	10	10	11	14	13	10	9	10	13

2004

Jerry and Stacy Porman again collected Secchi disk data in 2004 in both basins of Whitewood Lake. The graph shows their data.

The graph shows three things. First, there is not a lot of difference between the clarity of the water in east and west basins, two; the clarity didn't change much between spring and summer, and three, in late summer the east basin was a bit clearer than the west basin.

2005

The Pormans collected Whitewood Lake Secchi disk data at all four stations in 2005. The graph shows the four data sets, stacked. The west basin data are represented by dashes, and the east basin data are represented by solid lines.

The graph shows the west basin had slightly deeper readings than the east basin in June and July, and slightly shallower readings in August. But all in all, the graph shows the clarity doesn't change much between spring and summer in either basin.

2006

The Pormans collected 2006 Secchi disk data at all four stations on a regular basis through the warm months.

The graph shows little difference between the four stations. It also shows little variation between spring, when the water is cold, and summer when the water is warm.

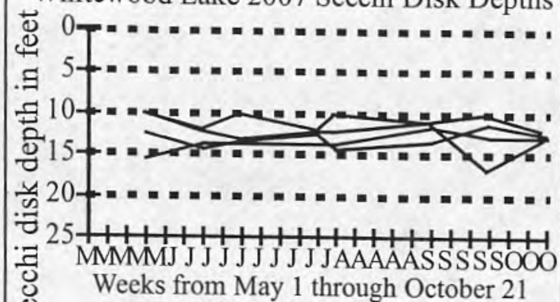
2007

Porman's 2007 data shows more variation between the four stations this year. However, the graph is essentially a straight line, indicating the clarity of the lake didn't change much as the water warmed from spring to summer.

2008

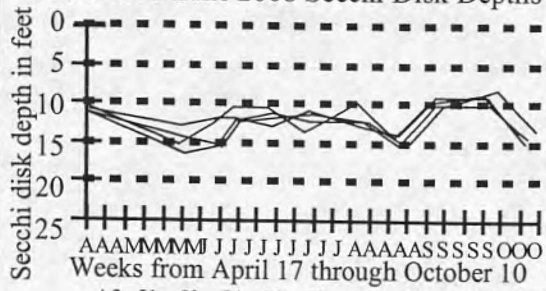
Porman's 2008 data shows little variation between the four stations this year.

Whitewood Lake 2007 Secchi Disk Depths



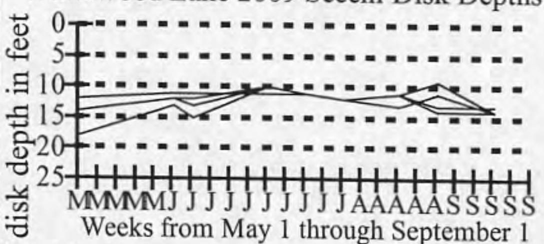
	M4	J2	J4	J3	J4	A4	S2	O3
Station 1	16	14	14	14	14	12	13	13
Station 2	13	15	14	13	15	14	12	13
Station 3	11	13	14	13	13	12	18	14
Station 4	11	13	11	13	11	12	11	13

Whitewood Lake 2008 Secchi Disk Depths



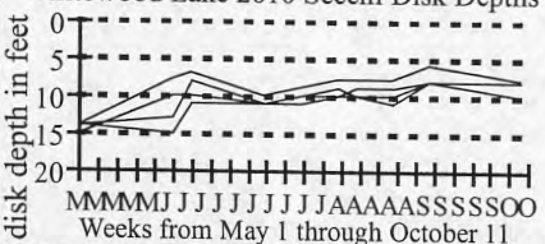
	A3	J1	J3	J4	J1	J3	A1	A3	A5	S3	O2
Station 1	11	16	15	12	---	11	12	15	10	8	13
Station 2	11	14	15	12	11	12	12	15	10	10	14
Station 3	11	13	12	12	13	11	13	14	9	9	15
Station 4	11	16	13	11	11	14	10	15	10	9	14

Whitewood Lake 2009 Secchi Disk Depths



Station 1	M1	J1	J2	J1	J3	J5	A3	A5	S3
Station 2	14	12	12	10	11	12	13	11	14
	14	12	13	10	11	12	11	9	14
Station 3	18	13	15	10	11	12	11	13	13
Station 4	12	11	11	11	11	12	11	14	14

Whitewood Lake 2010 Secchi Disk Depths



Station 1	M1	J1	J2	J1	J3	J5	A1	A3	A5	O2
Station 2	14	15	11	11	10	9	10	11	8	10
	14	13	8	11	10	10	10	10	8	8
Station 3	15	10	10	11	11	10	9	9	8	8
Station 4	15	9	8	11	10	9	9	9	7	9

And the lines on the graph are essentially a straight line, indicating the clarity of the lake didn't change much as the water warmed from spring to summer. This is probably because of the high flushing rate.

2009

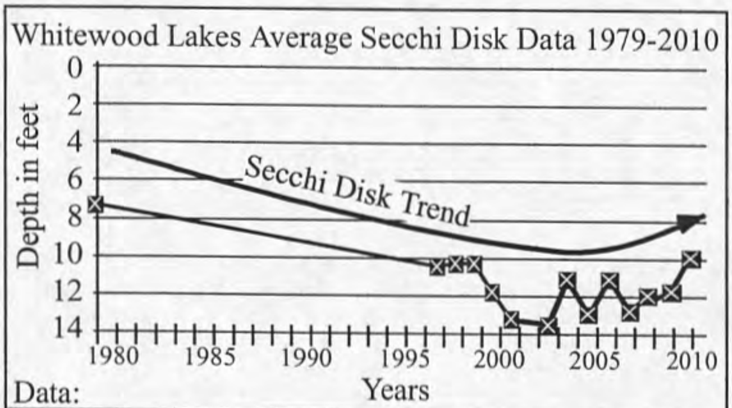
Porman's 2009 data shows the variation between the four stations ranged from 10 to 18 feet, but were mostly in the 10 to 15 foot range.

The lines on the graph are essentially a straight line, indicating the clarity of the lake didn't change much as the water warmed from spring to summer.

2010

The 2010 data for all four stations shows deepest readings in early spring, 14 and 15 feet, decreasing in June to 7 to 11 feet. The remainder of the warm months readings were in the 7 to 11 foot range.

THE SECCHI DISK TREND GRAPH



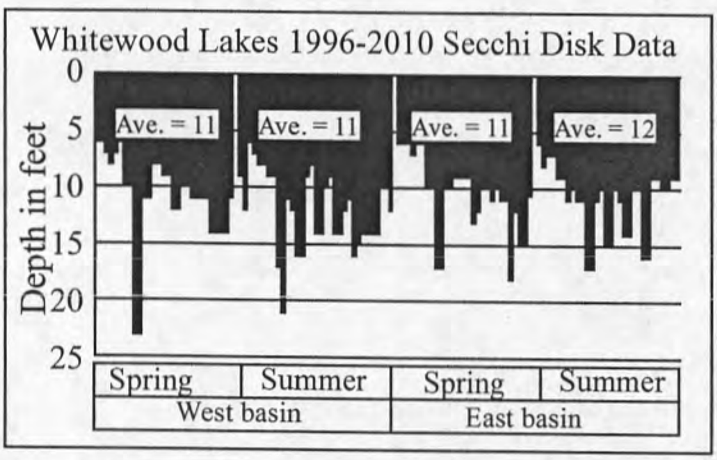
Data:

1979	1997	1998	1999	2000	2001	2003	2004	2005	2006	2007	2008	2009	2010
7.3	10.4	10.3	10.3	11.8	13.2	13.5	11.2	13.3	11.2	12.9	12.1	11.8	10.0

Since we have average Secchi disk data from 1979, plus 1997 through 2010, we were able to construct a Secchi disk trend graph. The graph shows Whitewood Lake was getting clearer through 2003. Since then, the clarity has gradually decreased. Let's hope this trend doesn't continue.

It would be better if we had more data from the 1980s and early 1990s.

SECCHI DISK READINGS TAKEN WITH THE SAMPLES



The graph shows the Secchi disk readings taken with the spring and summer samples. It shows the clarity of the water in the west basin is getting better in both spring and summer. In the east basin that appears to be true in spring but not in summer.

The graph shows the west basin had the deepest readings, 23 feet in spring. The graph also shows the average Secchi disk readings for both basins is about the same, 11 or 12 feet.

THE LAKE WATER QUALITY INDEX

The Lake Water Quality Index used in this study to define the water quality of Whitewood Lake was developed for two reasons. First, there was no agreement among lake scientists regarding which tests should be used to define the water quality of lakes, and second, there was no agreement among lake scientists regarding what the results of various tests meant in terms of lake water quality.

Development of the index used two questionnaires sent to a panel of 555 lake scientists who were members of the American Society of Limnology and Oceanography. The panel was specifically selected because they were chemists and biologists with advanced degrees who studied lake water quality.

The first questionnaire asked the scientists to select tests they felt should be used to define lake water quality. The tests most often selected by the panel became the index parameters (or tests). They were:

Dissolved oxygen (percent saturation)
Total phosphorus
Chlorophyll a
Secchi disk depth
Total nitrate nitrogen
Total alkalinity
Temperature
Conductivity
pH

The second questionnaire, sent out after the first was returned, asked the scientists what the results of the tests they selected as good indicators of lake water quality meant.

After the responses to the second questionnaire were returned and tabulated, the nine parameters and the accompanying rating curves were combined into a Lake Water Quality Index.

The index ranges from 1 to 100 and rates lakes about the same way professors rate students: 90-100=A, 80-90=B, 70-80=C, 60-70=D, and below 60 = E. The lake with the highest LWQI was Long Lake in Grand Traverse County, with a spring LQWI of 100. The lowest was 16 at an Ottawa County lake.

THE LAKE WATER QUALITY INDEX CALCULATION SHEETS

The Lake Water Quality Index calculation sheets which follow were developed to show graphically what the results of the nine different lake water quality tests mean in terms of lake water quality.

HOW TO READ THE LAKE WATER QUALITY INDEX CALCULATION SHEETS.

Listed across the top of the calculation sheets are the tests selected by the panel of experts as being good indicators of lake water quality. The results of the tests are entered into the square boxes immediately under the names of the tests.

The figures which look like thermometers are actually graphs which convert the test results (the numbers found outside the thermometer) to a uniform 1-100 lake water quality rating (found inside the thermometer).

The calculation sheet permits calculation of the Lake Water Quality Index, using the results of all nine lake water quality tests.

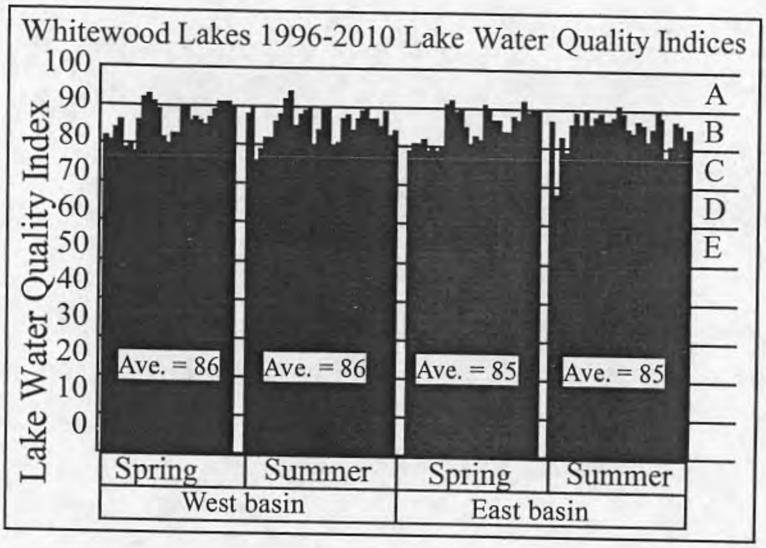
The position of the red lines across the thermometer indicates how the results of each test compare in terms of lake water quality. Test results indicating excellent water quality are indicated by red lines near the top of the thermometer. Test results indicating poor water quality are indicated by red lines lower on the thermometer. And the lower the red line on the thermometer, the greater the water quality problem. A glance at the top of the calculation sheet indicates the test and the actual test results.

The thermometer rating scales also allow you to determine what test results would be considered excellent in terms of lake water quality. They are the numbers found outside the thermometer near the top.

The index is shown three different ways, as a number between 1 and 100 in the circle marked LWQI, and by a color and position on the sheet edge scale. The purpose of the sheet edge scale is to review quickly large numbers of lakes or test sites within a lake, and determine how the water quality of the various lakes, or test sites within a lake compare.

THE 1996-2010 WHITEWOOD LAKES WATER QUALITY INDICES

The graph shows the Lake Water Quality Indices for Whitewood Lake ranges from a low of 68 to a high of 94. It shows most of the time the Lake Water Quality Indices are in the 80s, or B range with a few in the 90s (A range).



The graph also seems to show spring values are lower than summer values in both basins, but not by a lot. On the other hand, the average LWQIs for the four stations are 85 or 86, indicating not a lot of difference.

THE LAKE WATER QUALITY INDEX

CALCULATION SHEETS

Because the Lake Water Quality Indices were relatively uniform in both basins in spring 2010 (91 90 90 90), one Lake Water Quality Index calculation sheet is included in this report for those four surface samples, using averaged data.

In summer 2010, the Lake Water Quality Indices in both basins were relatively uniform, (83 84 83 81) so an additional LWQI calculation sheet is included, using averaged data.

In the report marked MASTER, all 8 of the 2010 Lake Water Quality Index calculation sheets are included. That is the only difference between the MASTER and the rest of the reports.

BOTTOM SEDIMENTS

Many times bottom sediments tell us more about what is happening in a lake than the water quality tests do. That's because bottom sediments provide sort of a history of what's been happening in a lake, while water testing just provides a snapshot.

Bottom sediments are collected with a Pederson dredge, transferred to pint freezer containers and allowed to air dry. Once they are dry, the (usually) shrunken block of material is measured to determine volume, then ground, placed in porcelain dishes, dried at 100 degrees C, weighed, burned at 550 degrees C, and weighed again. Color after air-drying and after burning is also noted.

Bottom sediments almost always come up from the lake bottom black, and many people consider these black sediments "muck". However that's not usually the case.

The bottom sediments are black because no oxygen penetrates them, so the decomposition processes which occur use sulfur rather than oxygen, and in this process, they produce iron sulfides, which are black. However once the sediments are exposed to air, they usually turn some other color.

If the sediments remain black after air drying it usually means they are less than about 65 percent mineral (or more than 35% organic material). Sediments also remain black if they are from soft water lakes, but there's a reason for that.

If the sediments turn gray after air drying it usually means they are made up primarily of carbonates. This is what we usually see in moderately hard water and hard water lakes.

If the sediments turn tan, it usually means they are made up primarily of clays. Further evidence of this occurs when we burn the sediments at 550 degrees C.

We determine how much bottom sediments shrink when they air dry because this information is useful when considering dredging a lake. Normal shrinkage after air-drying is in the range of 50 to 80 percent. However sands and gravels don't shrink at all. Excessive shrinkage is more than 95 percent. In other words, there is only five percent or less of the material remaining after air-drying.

If the gray bottom sediments remain gray after burning they are considered carbonates, and the loss of material during this process is considered organic material. The results are expressed in the percentage of minerals in the bottom sediments.

If the tan bottom sediments turn red after burning, it means the lake is filling with clay. Clay enters the lake from near-lake activities such as road building, home building or farming. Usually clay is not a material that makes up the bottom sediments of most inland lakes.

Highly organic sediments that remained black after air drying usually turn tan after burning, but the mineral content is usually quite low.

I consider high quality bottom sediments from natural lakes to be above 85 percent mineral. And I consider bottom sediments less than 50 percent mineral to be muck.

WHITEWOOD LAKE BOTTOM SEDIMENTS

Three bottom sediment samples (Stations 1, 2 & 3) were collected from Whitewood Lake in 1996. Four were collected from the lake in 2005. The graph shows the data.

STATION 1

In 1996 the sediment sample from Station 1 collected in 50 feet of water was black when recovered, turned gray and shrunk 68 percent after air drying. It remained gray after burning at 550 degrees C, and was 83 percent mineral.

In 2005 the sediment sample from Station 1 collected in 50 feet of water was black when recovered, turned gray and shrunk 68 percent after air-drying. It remained gray after burning at 550 degrees C, and was 74 percent mineral.

STATION 2

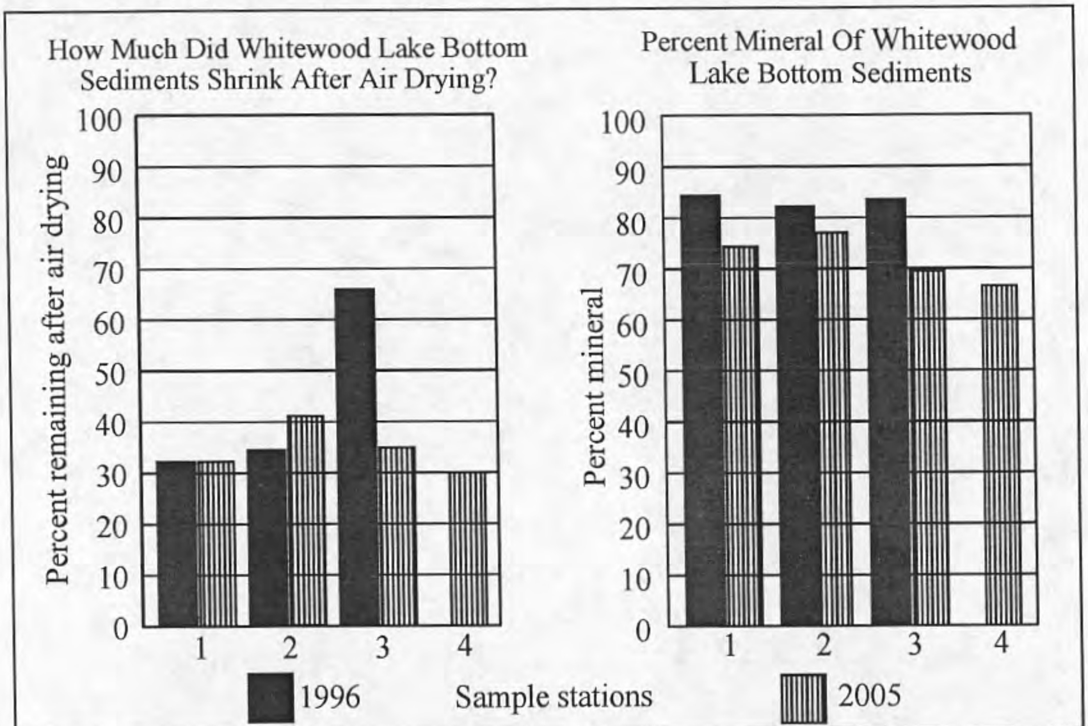
In 1996 the sediment sample from Station 2 collected in 31 feet of water was black when recovered, turned gray and shrunk 65 percent after air-drying. It remained gray after burning at 550 degrees C, and was 82 percent mineral.

In 2005 the sediment sample from Station 2 collected in 40 feet of water was black when recovered, turned gray and shrunk 59 percent after air-drying. It remained gray after burning at 550 degrees C, and was 77 percent mineral.

STATION 3

In 1996 the sediment sample from Station 3 collected in 19 feet of water was black when recovered, turned gray and shrunk 35 percent after air-drying. It remained gray after burning at 550 degrees C, and was 84 percent mineral.

In 2005 the sediment sample from Station 3 collected in 20 feet of water was black when recovered, turned gray and shrunk 65 percent after air-drying. It remained gray after burning at 550 degrees C, and was 70 percent mineral.



Characteristics of Whitewood Lake Bottom Sediments (1996 & 2005)					
Sample I.D.	Percent Shrinkage	Percent Mineral	Dried at 100°C Color & Description	Color after burning at 550°C	Depth of water (feet)
1-1996	68	83	Gray, smooth	Gray	50
1-2005	68	74	Gray	Gray	50
2-1996	65	82	Gray, smooth	Gray	31
2-2005	59	77	Gray	Gray	40
3-1996	35	84	Gray, smooth	Gray	19
3-2005	65	70	Gray	Gray	20
4-2005	70	67	Gray	Gray	24
Average mineral content of bottom sediments 1996 = 83%, 2005 = 72%.					

STATION 4

A bottom sediment sample was not collected from Station 4 in 1996

In 2005 the sediment sample from Station 4 collected in 24 feet of water was black when recovered, turned gray and shrunk 70 percent after air-drying. It remained gray after burning at 550 degrees C, and was 67 percent mineral.

All of the samples shrunk a normal amount, indicating the bottom sediments of Whitewood Lake are fairly well consolidated, and not easily mixed into the water column by wind and wave, or boat action.

All sediments turned gray after air drying, indicating they are primarily carbonates and bicarbonates. This is not surprising given the high alkalinity of the lake. Carbonates are what Michigan inland lakes are normally filling with.

After burning at 550 degrees C, all sediment samples remained gray. If they had turned red, it would have indicated clay was being washed into the lake from near-shore activities such as home building or road building activities.

The three 1996 bottom sediment samples ranged from 82 to 84 percent mineral, and averaged 83 percent mineral.

The four 2005 bottom sediment samples ranged from 67 to 77 percent mineral, and averaged 72 percent mineral.

These data indicate Whitewood Lake is continuing to accumulate organic material in the bottom sediments at a rate faster than it can decompose it.

Wallace E Fusilier

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Consulting Limnologist
Water Quality Investigators
Dexter, Michigan
May 2011

Surface Lake Water Quality Data

Date	Sample Station Number	Temperature °C	Dissolved Oxygen (mg/L)	Dissolved Oxygen Percent Saturation	Chlorophyll a ug/L	Secchi Disk Depth (feet)	Total Nitrate Nitrogen ug/L	Alkalinity mg/L	pH	Conductivity umhos per cm at 25°C	Total Phosphorus ug/L	Lake Water Quality Index	Grade
6/9/96	1	21	8.6	96	2.7	9	96	213	8.2	650	16	88	B
6/9/96	2	22	8.4	95	2.7	12	69	208	8.2	650	16	90	A
6/9/96	3	21	8.2	91	3.4	6	101	215	8.2	650	15	87	B
8/7/96	1	27	9.6	120	10.5	6	15	188	8.3	660	19	76	C
8/7/96	2	27	8.7	109	8.5	7	17	192	8.3	660	16	79	C
8/7/96	3	27	9.5	119	14.1	8	13	187	8.3	660	21	68	D
5/12/97	1	13	10.1	95	6.6	6	252	201	8.2	665	15	82	B
5/12/97	2	12	10.2	94	7.9	6	236	197	8.2	670	12	81	B
5/12/97	3	12	10.2	94	7.9	6	247	198	8.2	680	13	79	C
5/12/97	4	13	10.2	96	5.4	6	247	200	8.2	670	12	81	B
8/25/97	1	22	7.2	82	6.3	8	65	186	8.2	680	19	82	B
8/25/97	2	22	7.0	80	5.4	8	79	186	8.2	680	22	82	B
8/25/97	3	21	7.8	87	6.3	7	61	189	8.2	680	20	83	B
8/25/97	4	22	7.5	85	6.0	7	57	189	8.2	680	21	79	C
4/19/98	1	13	10.2	96	4.6	7	149	200	8.3	640	10	84	B
4/19/98	2	13	10.5	99	4.0	8	132	200	8.3	640	10	86	B
4/19/98	3	13	10.4	98	7.2	6	127	204	8.3	640	13	81	B
4/19/98	4	13	10.2	96	6.7	7	127	205	8.3	640	17	82	B
8/10/98	1	26	8.2	100	3.1	9	11	173	8.5	660	15	86	B
8/10/98	2	26	8.2	100	1.9	9	10	175	8.5	650	16	88	B
8/10/98	3	26	8.8	107	3.1	9	11	172	8.5	670	15	86	B
8/10/98	4	26	8.4	102	2.5	9	12	173	8.5	670	14	89	B
4/25/99	1	13	10.6	100	6.2	7	336	190	8.3	720	25	79	C
4/25/99	2	13	10.5	99	5.2	6	309	190	8.3	730	18	80	B
4/25/99	3	13	10.5	99	6.2	6	341	190	8.3	700	21	79	C
4/25/99	4	14	10.5	101	6.7	6	325	190	8.3	700	16	80	B
8/28/99	1	24	7.3	86	1.6	17	29	166	7.9	720	20	92	A
8/28/99	2	24	7.3	86	0.2	21	27	166	7.9	710	14	94	A
8/28/99	3	24	8.1	95	6.9	11	14	165	8.0	705	17	86	B
8/28/99	4	24	7.9	95	1.9	10	11	166	8.0	710	17	90	A
4/15/00	1	11	10.6	95	1.5	10	406	198	8.2	690	30	78	C
4/15/00	2	12	10.8	100	1.8	10	410	195	8.3	690	32	86	B
4/15/00	3	11	10.6	95	1.5	10	396	194	8.3	690	36	79	C
4/15/00	4	11	10.6	95	1.5	10	396	200	8.3	680	29	80	B
8/4/00	1	24	5.6	66	2.6	11	144	180	8.0	660	27	85	B
8/4/00	2	24	5.6	66	1.8	12	151	185	8.1	660	17	88	B
8/4/00	3	24	6.4	75	4.0	11	144	186	8.0	660	19	86	B
8/4/00	4	23	6.4	66	0.8	11	144	186	7.9	660	15	88	B
5/13/01	1	20	8.9	97	1.7	23	142	204	8.2	720	31	92	A
5/13/01	2	20	9.1	99	2.0	23	142	203	8.3	720	20	93	A
5/13/01	3	20	8.8	96	2.7	17	147	205	8.2	720	16	91	A
5/13/01	4	20	8.7	95	2.3	17	125	206	8.2	720	12	92	A
8/3/01	1	28	7.5	95	2.6	16	29	187	7.9	720	18	89	B
8/3/01	2	28	7.8	99	2.3	16	27	184	7.8	720	17	90	A
8/3/01	3	28	7.4	94	3.0	17	43	183	7.8	730	18	89	B
8/3/01	4	28	8.0	101	4.4	17	29	184	7.8	730	17	87	B
4/15/02	1	14	10.3	99	1.2	11	241	203	8.2	710	12	91	A
4/15/02	2	14	10.7	103	2.3	11	273	203	8.3	720	10	89	B
4/15/02	3	14	10.4	100	2.3	10	244	204	8.2	700	11	89	B
4/15/02	4	14	10.5	101	2.1	10	257	204	8.2	695	8	90	A
8/2/02	1	29	8.9	114	8.1	9	66	165	7.5	725	14	80	B
8/2/02	2	29	8.6	110	4.0	8	22	164	7.6	720	14	84	B
8/2/02	3	29	8.2	105	2.5	11	138	157	7.4	730	18	87	B
8/2/02	4	29	7.8	100	1.5	10	102	158	7.4	730	17	88	B
4/28/03	1	15	11.3	110	5.3	8	317	188	8.3	800	16	82	B
4/28/03	2	15	10.8	106	5.6	38	396	185	8.3	780	20	80	B
4/28/03	3	16	10.9	109	5.6	9	305	189	8.3	780	17	85	B
4/28/03	4	15	11.0	108	6.4	9	324	190	8.3	780	20	81	B
8/1/03	1	26	8.7	106	1.6	14	299	167	8.4	760	13	90	A
8/1/03	2	26	8.7	106	1.6	14	294	167	8.4	760	14	90	A
8/1/03	3	26	8.9	109	1.4	15	315	167	8.3	770	8	91	A
8/1/03	4	27	8.6	108	1.3	15	326	167	8.3	770	12	89	B

Lake Water Quality Data

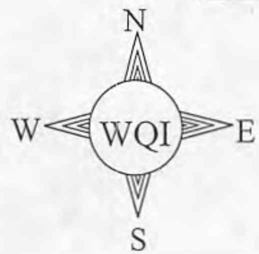
Date	Sample Station Number	Temperature °C	Dissolved Oxygen (mg/L)	Dissolved Oxygen Percent Saturation	Chlorophyll a ug/L	Secchi Disk Depth (feet)	Total Nitrate Nitrogen ug/L	Alkalinity mg/L	pH	Conductivity umhos per cm at 25°C	Total Phosphorus ug/L	Lake Water Quality Index	Grade
4/16/04	1	11	10.6	95	3.9	9	381	196	8.2	800	16	83	B
4/16/04	2	11	10.6	95	4.6	9	378	195	8.2	800	17	83	B
4/16/04	3	11	10.5	94	4.2	9	363	195	8.2	770	16	83	B
4/16/04	4	11	10.8	97	4.2	9	375	195	8.3	760	17	82	B
8/2/04	1	24	6.7	79	11.8	10	221	190	8.0	710	18	80	B
8/2/04	2	25	7.1	85	8.4	9	241	190	8.0	710	19	81	B
8/2/04	3	24	6.9	81	3.7	10	139	190	7.9	740	22	85	B
8/2/04	4	24	6.5	77	4.6	11	172	190	8.0	740	19	84	B
4/18/05	1	15	9.4	92	2.3	12	260	205	8.1	730	9	90	A
4/18/05	2	16	9.3	93	1.8	12	269	205	8.1	750	10	90	A
4/18/05	3	16	9.4	94	1.5	13	260	205	8.2	740	8	91	A
4/18/05	4	16	9.3	93	2.0	12	273	202	8.1	760	8	90	A
8/3/05	1	28	8.1	103	2.9	14	168	170	8.1	750	22	87	B
8/3/05	2	28	8.1	103	2.6	14	172	170	8.1	750	17	88	B
8/3/05	3	28	8.0	102	2.6	14	155	170	8.1	750	27	87	B
8/3/05	4	28	8.3	105	4.3	14	172	170	8.1	760	17	86	B
4/19/06	1	14	9.7	93	3.8	10	329	188	8.1	740	17	86	B
4/19/06	2	14	9.7	93	3.6	10	311	190	8.0	740	15	87	B
4/19/06	3	14	9.5	91	3.3	10	293	192	8.0	750	16	87	B
4/19/06	4	14	9.7	93	3.2	10	302	188	8.1	750	18	87	B
8/1/06	1	29	8.1	104	4.6	12	173	192	8.3	750	20	84	B
8/1/06	2	29	8.5	109	2.9	11	158	185	8.4	760	19	87	B
8/1/06	3	29	8.1	104	4.6	10	168	185	8.3	770	22	82	B
8/1/06	4	29	7.9	101	4.5	10	168	185	8.3	780	20	85	B
4/21/07	1	11	10.9	98	3.3	11	401	195	8.2	730	18	86	B
4/21/07	2	12	10.8	100	4.1	11	404	194	8.2	740	15	85	B
4/21/07	3	12	10.9	101	4.4	11	401	195	8.2	760	17	84	B
4/21/07	4	13	11.7	110	3.6	10	404	194	8.2	770	18	84	B
8/1/07	1	27	8.2	103	3.6	16	175	175	8.2	750	17	89	B
8/1/07	2	27	8.4	104	2.2	15	171	175	8.3	750	15	90	A
8/1/07	3	27	8.4	104	1.9	16	171	175	8.3	750	15	90	A
8/1/07	4	27	8.3	103	3.6	16	184	175	8.2	770	17	88	B
4/18/08	1	12	11.2	104	4.1	11	260	188	7.8	680	16	87	B
4/18/08	2	14	11.7	112	2.8	11	223	189	7.9	680	20	89	B
4/18/08	3	13	11.2	106	3.2	11	253	189	7.9	690	22	88	B
4/18/08	4	13	11.2	106	4.1	11	267	188	7.9	710	19	87	B
8/1/08	1	28	8.3	105	4.0	14	47	201	8.2	730	16	87	B
8/1/08	2	28	8.5	107	3.7	14	50	200	8.2	730	15	87	B
8/1/08	3	28	9.1	115	11.7	9	40	193	8.2	740	17	78	C
8/1/08	4	28	8.8	110	7.7	9	13	187	8.2	740	22	81	B
4/18/09	1	12	11.2	104	2.3	14	258	194	8.1	700	15	91	A
4/18/09	2	11	11.3	102	2.3	14	223	193	8.1	700	14	91	A
4/18/09	3	12	11.2	104	2.9	18	227	192	8.1	700	15	92	A
4/18/09	4	12	11.5	107	2.3	12	314	194	8.0	720	16	89	B
8/3/09	1	27	7.6	89	5.2	14	48	195	8.0	740	24	85	B
8/3/09	2	24	7.7	90	3.1	14	44	191	8.0	740	20	89	B
8/3/09	3	24	7.7	90	3.1	10	37	191	8.0	750	23	87	B
8/3/09	4	24	7.4	87	4.4	10	39	192	8.0	750	18	86	B
4/20/10	1	13	10.3	97	0.5	14	313	205	8.2	760	20	91	A
4/20/10	2	14	10.3	99	0.7	14	275	205	8.1	760	18	90	A
4/20/10	3	14	10.5	101	0.6	15	275	206	8.2	780	21	90	A
4/20/10	4	14	10.4	100	0.9	15	269	210	8.2	800	15	90	A
8/2/10	1	27	7.4	93	4.6	10	270	183	8.2	710	35	83	B
8/2/10	2	27	7.5	94	5.0	10	262	183	8.2	710	10	84	B
8/2/10	3	26	7.4	93	4.0	9	262	182	8.1	710	41	83	B
8/2/10	4	27	7.6	95	6.4	9	246	183	8.1	710	36	85	B

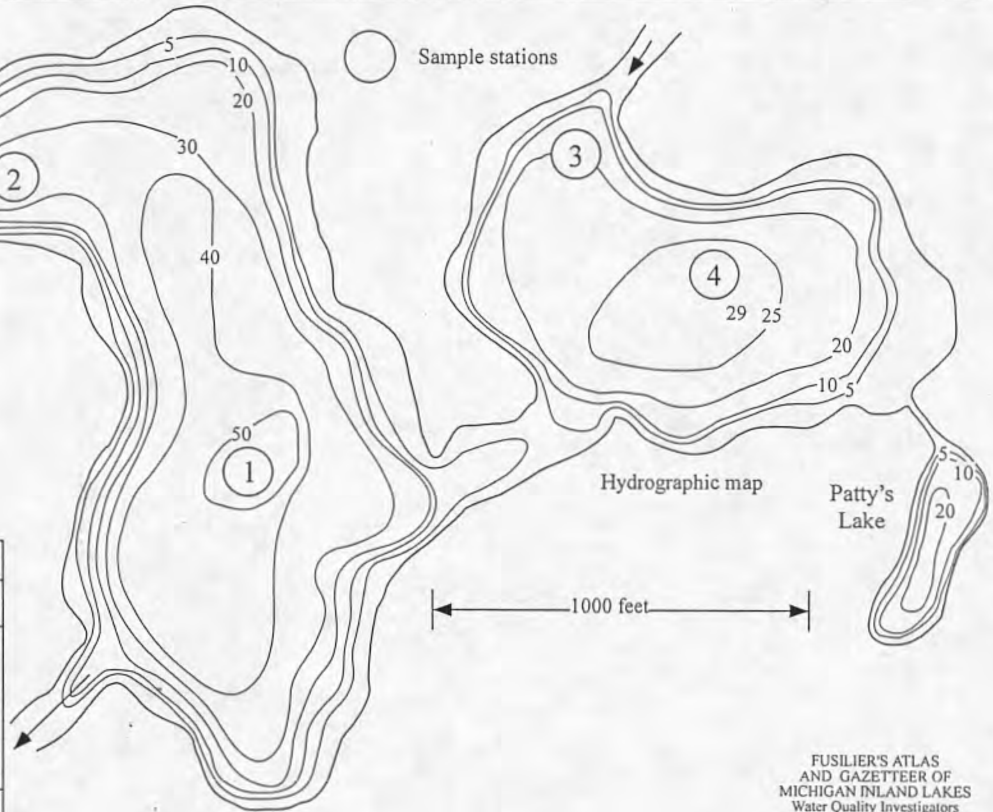
Lake Water Quality Data

Date	Sample Station Number	Temperature °C	Dissolved Oxygen (mg/L)	Dissolved Oxygen Percent Saturation	Chlorophyll a ug/L	Secchi Disk Depth (feet)	Total Nitrate Nitrogen ug/L	Alkalinity mg/L	pH	Conductivity umhos per cm at 25°C	Total Phosphorus ug/L	Lake Water Quality Index	Grade
8/28/99	Patty's	25	7.8	93	1.7	11	68	150	8.1	595	17	92	A
4/15/00	Patty's	14	10.7	103	1.8	10	83	188	8.2	590	51	86	B
8/4/00	Patty's	25	8.1	95	2.9	8	13	185	8.0	550	13	89	B
5/13/01	Patty's	20	9.0	98	2.9	12	33	188	8.2	580	19	91	A
8/3/01	Patty's	28	8.4	106	3.5	8	16	159	8.0	530	17	86	B
4/15/02	Patty's	18	9.5	100	5.0	7	46	186	8.2	570	8	86	B
8/2/02	Patty's	26	8.6	105	2.2	8	47	140	8.4	680	5	89	B
4/28/03	Patty's	18	9.7	102	1.2	9	69	167	8.1	700	16	90	A
8/1/03	Patty's	26	8.6	105	2.7	8	47	140	8.4	680	5	89	B
4/16/04	Patty's	13	10.3	97	4.6	7	26	180	8.2	680	11	85	B
8/2/04	Patty's	27	6.2	78	2.6	7	32	201	8.0	630	23	84	B
4/18/05	Patty's	18	8.8	93	4.1	7	53	202	8.1	620	15	86	B
8/3/05	Patty's	29	7.9	99	3.1	8	31	158	8.1	620	27	84	B
4/19/06	Patty's	16	10.2	102	13.8	8	68	172	8.1	780	15	79	C
8/1/06	Patty's	29	7.8	100	2.4	8	16	178	8.4	570	16	87	B
4/21/07	Patty's	16	11.4	114	10.4	6	41	204	8.2	600	27	78	C
8/1/07	Patty's	27	8.0	100	2.5	9	48	166	8.3	570	24	88	B
6/30/05	Huron R.	---	---	---	---	---	581	184	8.1	780	37	---	---
7/29/05	Huron R.	---	---	---	---	---	256	180	7.9	790	30	---	---
8/29/05	Huron R.	---	---	---	---	---	160	180	8.2	760	12	---	---
9/27/05	Huron R.	---	---	---	---	---	344	180	8.0	820	31	---	---
10/24/05	Huron R.	---	---	---	---	---	55	200	8.1	880	11	---	---
11/30/05	Huron R.	---	---	---	---	---	352	200	8.1	780	18	---	---
12/27/05	Huron R.	---	---	---	---	---	470	218	8.1	820	19	---	---
1/27/06	Huron R.	---	---	---	---	---	611	200	8.0	800	38	---	---
2/28/06	Huron R.	---	---	---	---	---	726	200	8.0	1100	20	---	---
3/30/06	Huron R.	---	---	---	---	---	458	205	8.1	780	21	---	---
4/19/06	Huron R.	---	---	---	---	---	288	198	8.1	740	14	---	---
6/30/05	Davis Cr.	---	---	---	---	---	7700	217	7.9	1000	36	---	---
7/29/05	Davis Cr.	---	---	---	---	---	4532	212	7.8	1090	55	---	---
8/29/05	Davis Cr.	---	---	---	---	---	3060	188	7.9	1100	40	---	---
9/27/05	Davis Cr.	---	---	---	---	---	4800	217	7.8	1100	29	---	---
10/24/05	Davis Cr.	---	---	---	---	---	4007	245	7.8	1100	25	---	---
11/30/05	Davis Cr.	---	---	---	---	---	5527	225	7.9	1100	23	---	---
12/27/05	Davis Cr.	---	---	---	---	---	5061	235	7.8	1000	20	---	---
1/27/06	Davis Cr.	---	---	---	---	---	2368	180	7.7	740	32	---	---
2/28/06	Davis Cr.	---	---	---	---	---	1632	175	7.8	1080	35	---	---
3/30/06	Davis Cr.	---	---	---	---	---	1376	179	7.8	720	36	---	---
4/19/06	Davis Cr.	---	---	---	---	---	549	196	7.9	680	21	---	---
5/28/09	Davis Cr.	---	---	---	---	---	370	241	7.9	750	45	---	---
6/29/09	Davis Cr.	---	---	---	---	---	47	193	7.8	560	49	---	---
7/31/09	Davis Cr.	---	---	---	---	---	1845	235	7.9	900	45	---	---
8/28/09	Davis Cr.	---	---	---	---	---	2600	227	7.9	900	24	---	---
9/23/09	Davis Cr.	---	---	---	---	---	450	250	7.8	940	26	---	---
10/21/09	Davis Cr.	---	---	---	---	---	1375	256	7.8	900	23	---	---
11/23/09	Davis Cr.	---	---	---	---	---	350	254	7.9	880	24	---	---
12/26/09	Davis Cr.	---	---	---	---	---	263	219	7.7	740	111	---	---
1/23/10	Davis Cr.	---	---	---	---	---	250	258	7.8	880	39	---	---
3/9/10	Davis Cr.	---	---	---	---	---	1122	263	8.0	890	41	---	---
3/31/10	Davis Cr.	---	---	---	---	---	548	215	8.0	720	26	---	---
4/20/10	Davis Cr.	---	---	---	---	---	1438	250	8.2	830	24	---	---

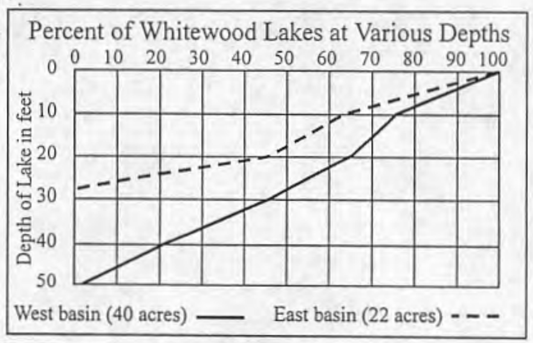
TABLE OF LAKE DATA

Lake Name	Whitewood Lake
or	Whiteford Lake
County	Livingston
U.S.G.S. Map	Hamburg
and	Pinckney
Type of lake	Natural, kettle
River basin	Huron
Lake area (acres)	62
East basin	22
West basin	40
Maximum depth (feet)	
East basin	29
West basin	50
Mean depth (feet)	
East basin	14.9
West basin	26.0
Lake volume (acre feet)	1369
East basin	328
West basin	1041
Shoreline length (feet)	12299
Watershed area (acres)	243138
Drainage area (acres)	243200
Watershed to lake ratio	3922
Flushing rate	0.007 years
Elevation	851
Longest dimension (feet)	2966
Lake Water Quality Indices	
Spring 1996	88 90 87
Summer 1996	76 79 68
Spring 1997	82 81 79 81
Summer 1997	82 82 83 79
Spring 1998	84 86 81 82
Summer 1998	86 88 86 87
Spring 1999	79 80 79 80
Summer 1999	92 94 86 90 92
Spring 2000	78 86 79 80 86
Summer 2000	85 88 86 88 89
Spring 2001	92 93 91 92 91
Summer 2001	89 90 89 87 86
Spring 2002	91 89 89 90
Summer 2002	80 84 87 88
Spring 2003	82 80 85 81
Summer 2003	90 90 91 89
Spring 2004	83 83 83 82
Summer 2004	80 81 85 84
Spring 2005	90 90 91 90
Summer 2005	87 88 87 86
Spring 2006	86 87 87 87
Summer 2006	84 87 82 85
Spring 2007	86 85 84 84
Summer 2007	89 90 90 88
Spring 2008	87 89 88 87
Summer 2008	87 87 78 81
Spring 2009	91 91 92 89
Summer 2009	85 89 87 86
Spring 2010	91 90 90 90
Summer 2010	83 84 83 81
Bottom Sediments, % mineral	
1996	83 82 84
2005	74 77 70 67
Latitude	42° 26.004N
Longitude	83° 52.601W
Official Lake Monitors	Jerry & Stacy Porman





Whitewood Lakes Contour Areas & Volumes	
Area of various contours	Volume in acre feet
East Basin	
Surface area = 22 acres	179
10 foot = 13.821 acres	119
20 foot = 9.992 acres	30
25-29 foot = 2.123 acres	
Basin volume = 328 acre feet	
West Basin	
Surface area = 40 acres	351
10 foot = 30.268 acres	282
20 foot = 26.154 acres	224
30 foot = 18.587 acres	136
40 foot = 8.592 acres	48
50 foot = 1.042 acres	
Basin volume = 1041 acre feet	
Lake volume = 1369 acre feet	

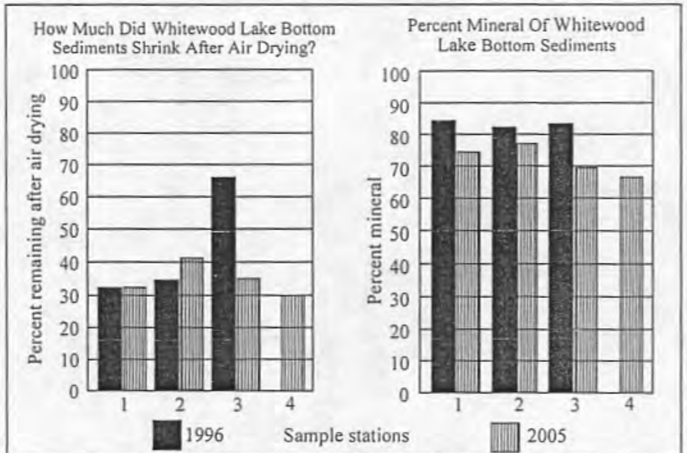


FUSILIER'S ATLAS
AND GAZETTEER OF
MICHIGAN INLAND LAKES
Water Quality Investigators
9200 Dexter Chelsea Road
Dexter, Michigan 48130
(734) 426-8972

Whitewood Lakes
Section 32
Hamburg Township
T1N R5E
Livingston County

Surface Lake Water Quality Data

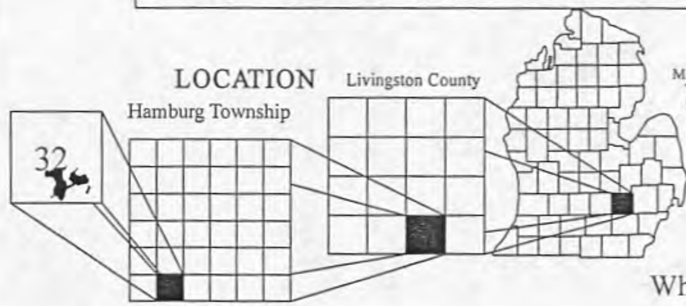
Date	Sample Station Number	Temperature °C	Dissolved Oxygen (mg/L)	Dissolved Oxygen Percent Saturation	Chlorophyll a ug/L	Secchi Disk Depth (feet)	Total Nitrate Nitrogen ug/L	Alkalinity mg/L	pH	Conductivity umhos per cm at 25°C	Total Phosphorus ug/L	Lake Water Quality Index	Grade
6/9/96	1	21	8.6	96	2.7	9	96	213	8.2	650	16	88	B
6/9/96	2	22	8.4	95	2.7	12	69	208	8.2	650	16	90	A
6/9/96	3	21	8.2	91	3.4	6	101	215	8.2	650	15	87	B
8/7/96	1	27	9.6	120	10.5	6	15	188	8.3	660	19	76	C
8/7/96	2	27	8.7	109	8.5	7	17	192	8.3	660	16	79	C
8/7/96	3	27	9.5	119	14.1	8	13	187	8.3	660	21	68	D
5/12/97	1	13	10.1	95	6.6	6	252	201	8.2	665	15	82	B
5/12/97	2	12	10.2	94	7.9	6	236	197	8.2	670	12	81	B
5/12/97	3	12	10.2	94	7.9	6	247	198	8.2	680	13	79	C
5/12/97	4	13	10.2	96	5.4	6	247	200	8.2	670	12	81	B
8/25/97	1	22	7.2	82	6.3	8	65	186	8.2	680	19	82	B
8/25/97	2	22	7.0	80	5.4	8	79	186	8.2	680	22	82	B
8/25/97	3	21	7.8	87	6.3	7	61	189	8.2	680	20	83	B
8/25/97	4	22	7.5	85	6.0	7	57	189	8.2	680	21	79	C
4/19/98	1	13	10.2	96	4.6	7	149	200	8.3	640	10	84	B
4/19/98	2	13	10.5	99	4.0	8	132	200	8.3	640	10	86	B
4/19/98	3	13	10.4	98	7.2	6	127	204	8.3	640	13	81	B
4/19/98	4	13	10.2	96	6.7	7	127	205	8.3	640	17	82	B
8/10/98	1	26	8.2	100	3.1	9	11	173	8.5	660	15	86	B
8/10/98	2	26	8.2	100	1.9	9	10	175	8.5	650	16	88	B
8/10/98	3	26	8.8	107	3.1	9	11	172	8.5	670	15	86	B
8/10/98	4	26	8.4	102	2.5	9	12	173	8.5	670	14	89	B
4/25/99	1	13	10.6	100	6.2	7	336	190	8.3	720	25	79	C
4/25/99	2	13	10.5	99	5.2	6	309	190	8.3	730	18	80	B
4/25/99	3	13	10.5	99	6.2	6	341	190	8.3	700	21	79	C
4/25/99	4	14	10.5	101	6.7	6	325	190	8.3	700	16	80	B
8/28/99	1	24	7.3	86	1.6	17	29	166	7.9	720	20	92	A
8/28/99	2	24	7.3	86	0.2	21	27	166	7.9	710	14	94	A
8/28/99	3	24	8.1	95	6.9	11	14	165	8.0	705	17	86	B
8/28/99	4	24	7.9	95	1.9	10	11	166	8.0	710	17	90	A
4/15/00	1	11	10.6	95	1.5	10	406	198	8.2	690	30	78	C
4/15/00	2	12	10.8	100	1.8	10	410	195	8.3	690	32	86	B
4/15/00	3	11	10.6	95	1.5	10	396	194	8.3	690	36	79	C
4/15/00	4	11	10.6	95	1.5	10	396	200	8.3	680	29	80	B
8/4/00	1	24	5.6	66	2.6	11	144	180	8.0	660	27	85	B
8/4/00	2	24	5.6	66	1.8	12	151	185	8.1	660	17	88	B
8/4/00	3	24	6.4	75	4.0	11	144	186	8.0	660	19	86	B
8/4/00	4	23	6.4	66	0.8	11	144	186	7.9	660	15	88	B
5/13/01	1	20	8.9	97	1.7	23	142	204	8.2	720	31	92	A
5/13/01	2	20	9.1	99	2.0	23	142	203	8.3	720	20	93	A
5/13/01	3	20	8.8	96	2.7	17	147	205	8.2	720	16	91	A
5/13/01	4	20	8.7	95	2.3	17	125	206	8.2	720	12	92	A
8/3/01	1	28	7.5	95	2.6	16	29	187	7.9	720	18	89	B
8/3/01	2	28	7.8	99	2.3	16	27	184	7.8	720	17	90	A
8/3/01	3	28	7.4	94	3.0	17	43	183	7.8	730	18	89	B
8/3/01	4	28	8.0	101	4.4	17	29	184	7.8	730	17	87	B
4/15/02	1	14	10.3	99	1.2	11	241	203	8.2	710	12	91	A
4/15/02	2	14	10.7	103	2.3	11	273	203	8.3	720	10	89	B
4/15/02	3	14	10.4	100	2.3	10	244	204	8.2	700	11	89	B
4/15/02	4	14	10.5	101	2.1	10	257	204	8.2	695	8	90	A
8/2/02	1	29	8.9	114	8.1	9	66	165	7.5	725	14	80	B
8/2/02	2	29	8.6	110	4.0	8	22	164	7.6	720	14	84	B
8/2/02	3	29	8.2	105	2.5	11	138	157	7.4	730	18	87	B
8/2/02	4	29	7.8	100	1.5	10	102	158	7.4	730	17	88	B
4/28/03	1	15	11.3	110	5.3	8	317	188	8.3	800	16	82	B
4/28/03	2	15	10.8	106	5.6	38	396	185	8.3	780	20	80	B
4/28/03	3	16	10.9	109	5.6	9	305	189	8.3	780	17	85	B
4/28/03	4	15	11.0	108	6.4	9	324	190	8.3	780	20	81	B
8/1/03	1	26	8.7	106	1.6	14	299	167	8.4	760	13	90	A
8/1/03	2	26	8.7	106	1.6	14	294	167	8.4	760	14	90	A
8/1/03	3	26	8.9	109	1.4	15	315	167	8.3	770	8	91	A
8/1/03	4	27	8.6	108	1.3	15	326	167	8.3	770	12	89	B



Characteristics of Whitewood Lake Bottom Sediments (1996 & 2005)

Sample I.D.	Percent Shrinkage	Percent Mineral	Dried at 100°C Color & Description	Color after burning at 550°C	Depth of water (feet)
1-1996	68	83	Gray, smooth	Gray	50
1-2005	68	74	Gray	Gray	50
2-1996	65	82	Gray, smooth	Gray	31
2-2005	59	77	Gray	Gray	40
3-1996	35	84	Gray, smooth	Gray	19
3-2005	65	70	Gray	Gray	20
4-2005	70	67	Gray	Gray	24

Average mineral content of bottom sediments 1996 = 83%, 2005 = 72%.



FUSILIER'S ATLAS AND GAZETTEER OF MICHIGAN INLAND LAKES
Water Quality Investigators
9200 Dexter Chelsea Road
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(734) 426-8972

Whitewood Lakes
Section 32
Hamburg Township
T1N R5E
Livingston County

Lake Water Quality Data

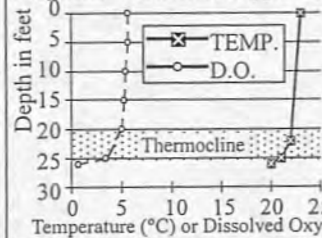
Date	Sample Station Number	Temperature °C	Dissolved Oxygen (mg/L)	Dissolved Oxygen Percent Saturation	Chlorophyll a ug/L	Secchi Disk Depth (feet)	Total Nitrate Nitrogen ug/L	Alkalinity mg/L	pH	Conductivity umhos per cm at 25°C	Total Phosphorus ug/L	Lake Water Quality Index	Grade
4/16/04	1	11	10.6	95	3.9	9	381	196	8.2	800	16	83	B
4/16/04	2	11	10.6	95	4.6	9	378	195	8.2	800	17	83	B
4/16/04	3	11	10.5	94	4.2	9	363	195	8.2	770	16	83	B
4/16/04	4	11	10.8	97	4.2	9	375	195	8.3	760	17	82	B
8/2/04	1	24	6.7	79	11.8	10	221	190	8.0	710	18	80	B
8/2/04	2	25	7.1	85	8.4	9	241	190	8.0	710	19	81	B
8/2/04	3	24	6.9	81	3.7	10	139	190	7.9	740	22	85	B
8/2/04	4	24	6.5	77	4.6	11	172	190	8.0	740	19	84	B
4/18/05	1	15	9.4	92	2.3	12	260	205	8.1	730	9	90	A
4/18/05	2	16	9.3	93	1.8	12	269	205	8.1	750	10	90	A
4/18/05	3	16	9.4	94	1.5	13	260	205	8.2	740	8	91	A
4/18/05	4	16	9.3	93	2.0	12	273	202	8.1	760	8	90	A
8/3/05	1	28	8.1	103	2.9	14	168	170	8.1	750	22	87	B
8/3/05	2	28	8.1	103	2.6	14	172	170	8.1	750	17	88	B
8/3/05	3	28	8.0	102	2.6	14	155	170	8.1	750	27	87	B
8/3/05	4	28	8.3	105	4.3	14	172	170	8.1	760	17	86	B
4/19/06	1	14	9.7	93	3.8	10	329	188	8.1	740	17	86	B
4/19/06	2	14	9.7	93	3.6	10	311	190	8.0	740	15	87	B
4/19/06	3	14	9.5	91	3.3	10	293	192	8.0	750	16	87	B
4/19/06	4	14	9.7	93	3.2	10	302	188	8.1	750	18	87	B
8/1/06	1	29	8.1	104	4.6	12	173	192	8.3	750	20	84	B
8/1/06	2	29	8.5	109	2.9	11	158	185	8.4	760	19	87	B
8/1/06	3	29	8.1	104	4.6	10	168	185	8.3	770	22	82	B
8/1/06	4	29	7.9	101	4.5	10	168	185	8.3	780	20	85	B
4/21/07	1	11	10.9	98	3.3	11	401	195	8.2	730	18	86	B
4/21/07	2	12	10.8	100	4.1	11	404	194	8.2	740	15	85	B
4/21/07	3	12	10.9	101	4.4	11	401	195	8.2	760	17	84	B
4/21/07	4	13	11.7	110	3.6	10	404	194	8.2	770	18	84	B
8/1/07	1	27	8.2	103	3.6	16	175	175	8.2	750	17	89	B
8/1/07	2	27	8.4	104	2.2	15	171	175	8.3	750	15	90	A
8/1/07	3	27	8.4	104	1.9	16	171	175	8.3	750	15	90	A
8/1/07	4	27	8.3	103	3.6	16	184	175	8.2	770	17	88	B
4/18/08	1	12	11.2	104	4.1	11	260	188	7.8	680	16	87	B
4/18/08	2	14	11.7	112	2.8	11	223	189	7.9	680	20	89	B
4/18/08	3	13	11.2	106	3.2	11	253	189	7.9	690	22	88	B
4/18/08	4	13	11.2	106	4.1	11	267	188	7.9	710	19	87	B
8/1/08	1	28	8.3	105	4.0	14	47	201	8.2	730	16	87	B
8/1/08	2	28	8.5	107	3.7	14	50	200	8.2	730	15	87	B
8/1/08	3	28	9.1	115	11.7	9	40	193	8.2	740	17	78	C
8/1/08	4	28	8.8	110	7.7	9	13	187	8.2	740	22	81	B
4/18/09	1	12	11.2	104	2.3	14	258	194	8.1	700	15	91	A
4/18/09	2	11	11.3	102	2.3	14	223	193	8.1	700	14	91	A
4/18/09	3	12	11.2	104	2.9	18	227	192	8.1	700	15	92	A
4/18/09	4	12	11.5	107	2.3	12	314	194	8.0	720	16	89	B
8/3/09	1	27	7.6	89	5.2	14	48	195	8.0	740	24	85	B
8/3/09	2	24	7.7	90	3.1	14	44	191	8.0	740	20	89	B
8/3/09	3	24	7.7	90	3.1	10	37	191	8.0	750	23	87	B
8/3/09	4	24	7.4	87	4.4	10	39	192	8.0	750	18	86	B
4/20/10	1	13	10.3	97	0.5	14	313	205	8.2	760	20	91	A
4/20/10	2	14	10.3	99	0.7	14	275	205	8.1	760	18	90	A
4/20/10	3	14	10.5	101	0.6	15	275	206	8.2	780	21	90	A
4/20/10	4	14	10.4	100	0.9	15	269	210	8.2	800	15	90	A
8/2/10	1	27	7.4	93	4.6	10	270	183	8.2	710	35	83	B
8/2/10	2	27	7.5	94	5.0	10	262	183	8.2	710	10	84	B
8/2/10	3	26	7.4	93	4.0	9	262	182	8.1	710	41	83	B
8/2/10	4	27	7.6	95	6.4	9	246	183	8.1	710	36	85	B

Lake Water Quality Data

Date	Sample Station Number	Temperature °C	Dissolved Oxygen (mg/L)	Dissolved Oxygen Percent Saturation	Chlorophyll a ug/L	Secchi Disk Depth (feet)	Total Nitrate Nitrogen ug/L	Alkalinity mg/L	pH	Conductivity umhos per cm at 25°C	Total Phosphorus ug/L	Lake Water Quality Index	Grade
8/28/99	Patty's	25	7.8	93	1.7	11	68	150	8.1	595	17	92	A
4/15/00	Patty's	14	10.7	103	1.8	10	83	188	8.2	590	51	86	B
8/4/00	Patty's	25	8.1	95	2.9	8	13	185	8.0	550	13	89	B
5/13/01	Patty's	20	9.0	98	2.9	12	33	188	8.2	580	19	91	A
8/3/01	Patty's	28	8.4	106	3.5	8	16	159	8.0	530	17	86	B
4/15/02	Patty's	18	9.5	100	5.0	7	46	186	8.2	570	8	86	B
8/2/02	Patty's	26	8.6	105	2.2	8	47	140	8.4	680	5	89	B
4/28/03	Patty's	18	9.7	102	1.2	9	69	167	8.1	700	16	90	A
8/1/03	Patty's	26	8.6	105	2.7	8	47	140	8.4	680	5	89	B
4/16/04	Patty's	13	10.3	97	4.6	7	26	180	8.2	680	11	85	B
8/2/04	Patty's	27	6.2	78	2.6	7	32	201	8.0	630	23	84	B
4/18/05	Patty's	18	8.8	93	4.1	7	53	202	8.1	620	15	86	B
8/3/05	Patty's	29	7.9	99	3.1	8	31	158	8.1	620	27	84	B
4/19/06	Patty's	16	10.2	102	13.8	8	68	172	8.1	780	15	79	C
8/1/06	Patty's	29	7.8	100	2.4	8	16	178	8.4	570	16	87	B
4/21/07	Patty's	16	11.4	114	10.4	6	41	204	8.2	600	27	78	C
8/1/07	Patty's	27	8.0	100	2.5	9	48	166	8.3	570	24	88	B
6/30/05	Huron R.	---	---	---	---	---	581	184	8.1	780	37	---	---
7/29/05	Huron R.	---	---	---	---	---	256	180	7.9	790	30	---	---
8/29/05	Huron R.	---	---	---	---	---	160	180	8.2	760	12	---	---
9/27/05	Huron R.	---	---	---	---	---	344	180	8.0	820	31	---	---
10/24/05	Huron R.	---	---	---	---	---	55	200	8.1	880	11	---	---
11/30/05	Huron R.	---	---	---	---	---	352	200	8.1	780	18	---	---
12/27/05	Huron R.	---	---	---	---	---	470	218	8.1	820	19	---	---
1/27/06	Huron R.	---	---	---	---	---	611	200	8.0	800	38	---	---
2/28/06	Huron R.	---	---	---	---	---	726	200	8.0	1100	20	---	---
3/30/06	Huron R.	---	---	---	---	---	458	205	8.1	780	21	---	---
4/19/06	Huron R.	---	---	---	---	---	288	198	8.1	740	14	---	---
6/30/05	Davis Cr.	---	---	---	---	---	7700	217	7.9	1000	36	---	---
7/29/05	Davis Cr.	---	---	---	---	---	4532	212	7.8	1090	55	---	---
8/29/05	Davis Cr.	---	---	---	---	---	3060	188	7.9	1100	40	---	---
9/27/05	Davis Cr.	---	---	---	---	---	4800	217	7.8	1100	29	---	---
10/24/05	Davis Cr.	---	---	---	---	---	4007	245	7.8	1100	25	---	---
11/30/05	Davis Cr.	---	---	---	---	---	5527	225	7.9	1100	23	---	---
12/27/05	Davis Cr.	---	---	---	---	---	5061	235	7.8	1000	20	---	---
1/27/06	Davis Cr.	---	---	---	---	---	2368	180	7.7	740	32	---	---
2/28/06	Davis Cr.	---	---	---	---	---	1632	175	7.8	1080	35	---	---
3/30/06	Davis Cr.	---	---	---	---	---	1376	179	7.8	720	36	---	---
4/19/06	Davis Cr.	---	---	---	---	---	549	196	7.9	680	21	---	---
5/28/09	Davis Cr.	---	---	---	---	---	370	241	7.9	750	45	---	---
6/29/09	Davis Cr.	---	---	---	---	---	47	193	7.8	560	49	---	---
7/31/09	Davis Cr.	---	---	---	---	---	1845	235	7.9	900	45	---	---
8/28/09	Davis Cr.	---	---	---	---	---	2600	227	7.9	900	24	---	---
9/23/09	Davis Cr.	---	---	---	---	---	450	250	7.8	940	26	---	---
10/21/09	Davis Cr.	---	---	---	---	---	1375	256	7.8	900	23	---	---
11/23/09	Davis Cr.	---	---	---	---	---	350	254	7.9	880	24	---	---
12/26/09	Davis Cr.	---	---	---	---	---	263	219	7.7	740	111	---	---
1/23/10	Davis Cr.	---	---	---	---	---	250	258	7.8	880	39	---	---
3/9/10	Davis Cr.	---	---	---	---	---	1122	263	8.0	890	41	---	---
3/31/10	Davis Cr.	---	---	---	---	---	548	215	8.0	720	26	---	---
4/20/10	Davis Cr.	---	---	---	---	---	1438	250	8.2	830	24	---	---

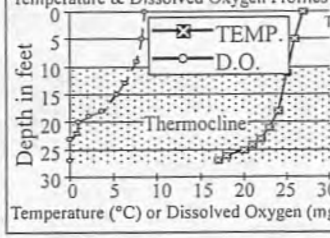
FUSILIER'S ATLAS
AND GAZETTEER OF
MICHIGAN INLAND LAKES
Water Quality Investigators
9200 Dexter Chelsea Road
Dexter, Michigan 48130
(734) 426-8972

Whitewood Lake, August 4, 2000
Temperature & Dissolved Oxygen Profiles
East basin



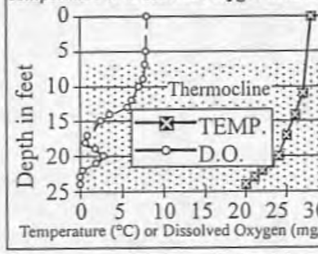
Temp.	Depth	D.O.	Depth
23	0	5.6	0
22	22	5.6	5
21	25	5.4	10
20	26	5.2	15
		5.0	20
		3.4	25
		0.7	26

Whitewood Lake, August 1, 2003
Temperature & Dissolved Oxygen Profiles
East basin



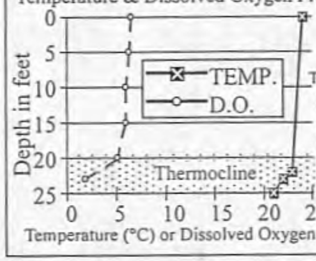
Temp.	Depth	D.O.	Depth
27	0	8.6	0
26	5	8.3	5
25	11	7.6	9
24	18	6.3	13
23	21	5.4	15
22	23	3.7	18
21	24	2.2	19
20	25	1.0	20
18	26	0.9	22
17	27	0.0	23
		0.0	27

Whitewood Lake, August 1, 2001
Temperature & Dissolved Oxygen Profiles
East basin



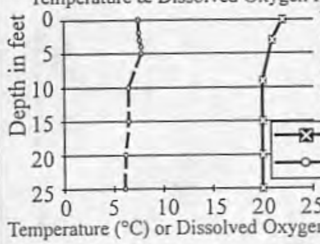
Temp.	Depth	D.O.	Depth
28	0	8.0	0
27	11	7.9	5
26	14	7.8	7
25	17	7.6	9
24	20	7.0	10
23	21	6.2	12
22	22	5.7	13
21	23	3.5	14
20	24	2.5	15
		0.9	17.
		0.6	18
		1.8	19
		2.8	20
		1.9	21
		0.3	22
		0.0	23
		0.0	24

Whitewood Lake August 2, 2004
Temperature & Dissolved Oxygen Profiles
East basin



Temp.	Depth	D.O.	Depth
24	0	6.5	0
23	22	6.2	5
22	23	5.9	10
21	25	6.0	15
		5.1	20
		1.8	23

Whitewood Lake, August 26, 1997
Temperature & Dissolved Oxygen Profiles
East basin



Temp.	Depth	D.O.	Depth
22	0	7.5	0
21	3	7.6	2
20	9	7.7	3
20	15	7.8	4
20	20	7.8	5
20	25	6.5	10
		6.5	15
		6.2	20
		6.1	25

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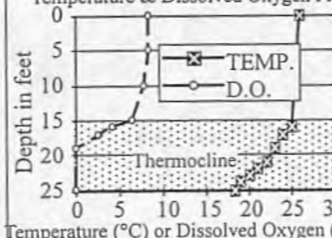
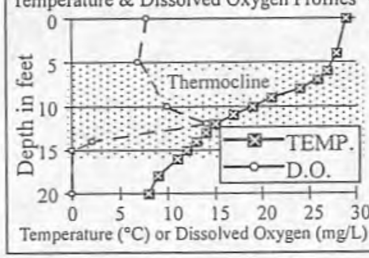
Whitewood Lake August 11, 1998
Temperature & Dissolved Oxygen Profiles
East basin



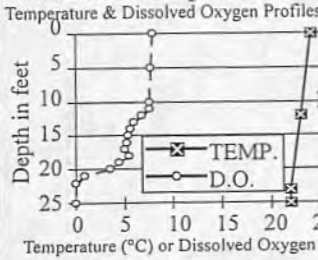
Temp.	Depth	D.O.	Depth
26	0	8.4	0
25	16	8.4	5
24	17	7.8	10
23	19	6.4	15
22	21	4.2	16
21	22	2.5	17
20	23	0.0	19
19	24	0.0	25
18	25		

Patty's Lake August 1, 2006
Temperature & Dissolved Oxygen Profiles



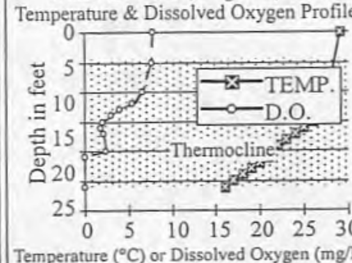
Temp.	Depth	D.O.	Depth
29	0	7.8	0
28	4	6.9	5
27	6	10.0	10
26	7	14.2	12
24	8	2.1	14
21	9	0.0	15
19	10	0.0	20
17	11		
15	12		
14	13		
13	14		
12	15		
11	16		
9	18		
8	20		

Whitewood Lake August 28, 1999
Temperature & Dissolved Oxygen Profiles
East basin



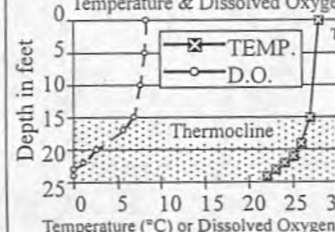
Temp.	Depth	D.O.	Depth
24	0	7.9	0
23	12	7.7	5
22	23	7.5	10
22	25	7.5	11
		6.8	12
		5.9	13
		5.6	14
		5.4	15
		5.3	16
		5.0	17
		5.5	18
		4.5	19
		3.5	20
		0.9	21
		0.0	22
		0.0	25

Whitewood Lake, August 2, 2002
Temperature & Dissolved Oxygen Profiles
East basin



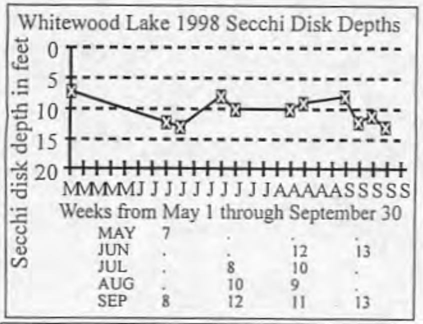
Temp.	Depth	D.O.	Depth
29	0	7.8	0
28	8	7.6	5
27	13	6.6	10
26	15	5.4	12
25	16	4.0	13
24	17	3.0	14
23	18	2.0	15
22	19	1.8	16
21	21	2.1	17
20	22	2.4	20
19	23	0.0	21
18	24	0.0	26
17	25		
16	26		

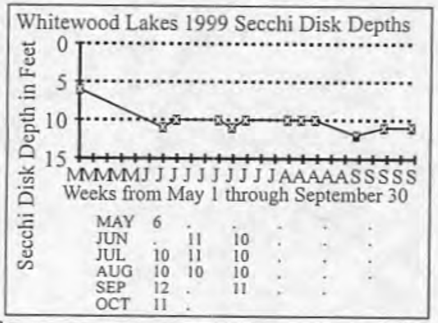
Whitewood Lake August 3, 2005
Temperature & Dissolved Oxygen Profiles
East basin

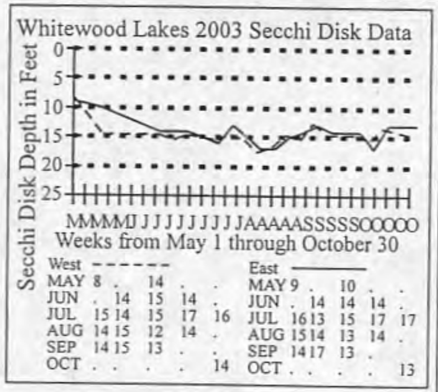


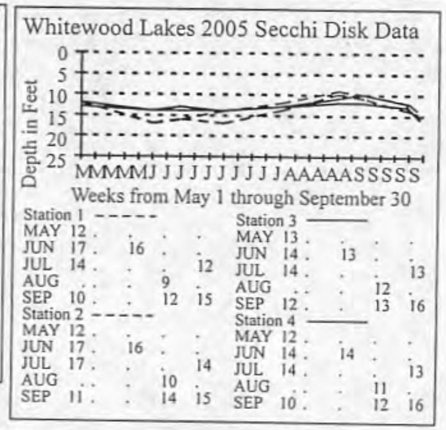
Temp.	Depth	D.O.	Depth
28	0	8.3	0
27	15	8.2	5
26	19	7.7	10
25	21	6.9	15
24	22	5.7	17
23	23	2.6	20
22	24	1.2	22
		0.0	23
		0.0	24

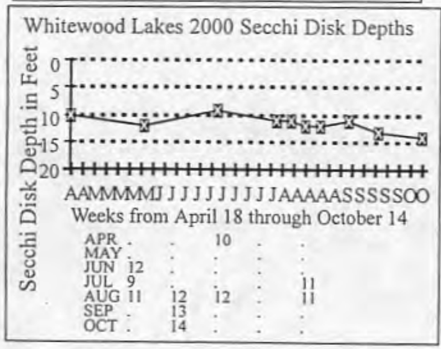
Whitewood Lakes
Section 32
Hamburg Township
T1N R5E
Livingston County

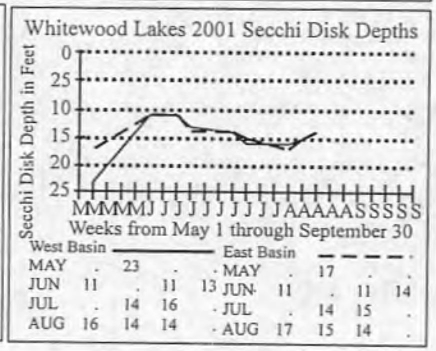


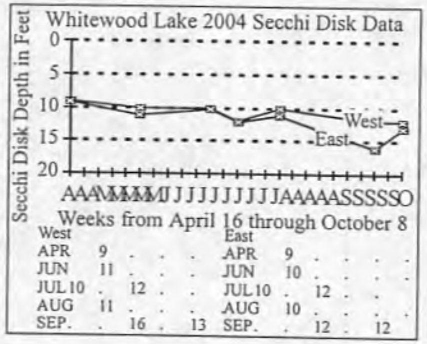


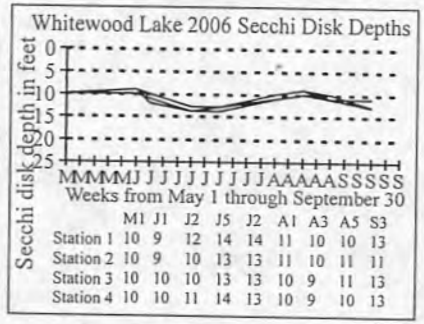












FUSILIER'S ATLAS AND GAZETTEER OF MICHIGAN INLAND LAKES
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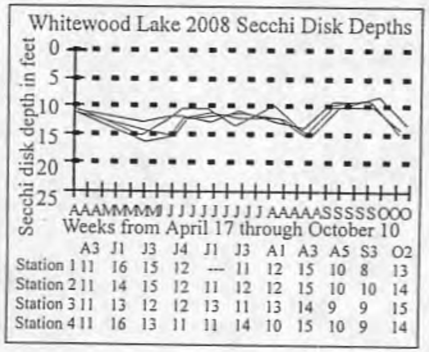
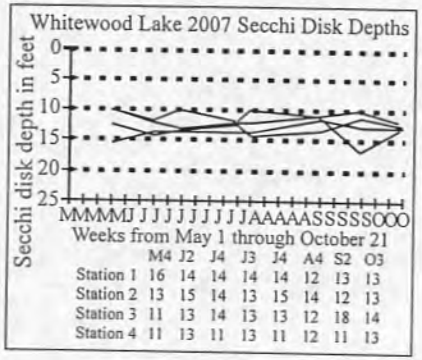
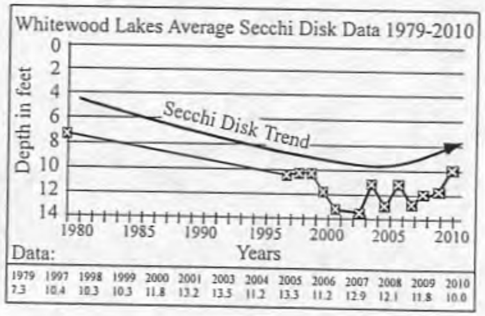
(734) 426-8972

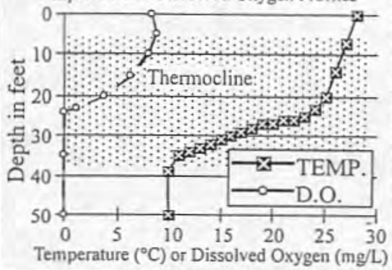
Whitewood Lakes
Section 32
Hamburg Township
T1N R5E
Livingston County





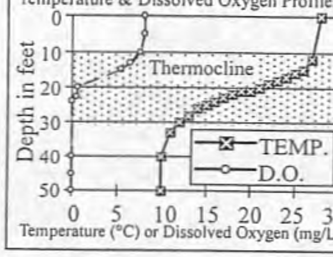


West Basin, Whitewood Lake, August 1, 2008
Temperature & Dissolved Oxygen Profiles



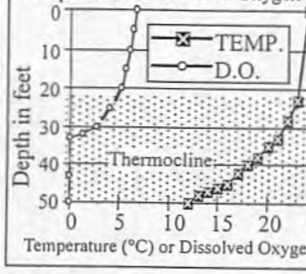
Temp.	Depth	D.O.	Depth
28	0	8.3	0
27	7	8.8	5
26	14	8.1	10
25	20	6.3	15
24	23	3.8	20
23	25	1.1	23
22	26	0.0	24
20	27	0.0	35
18	28	0.0	50
17	29		
16	30		
15	31		
14	32		
13	33		
12	34		
11	35		
10	39		
10	50		

Whitewood Lake, August 3, 2005
Temperature & Dissolved Oxygen Profiles



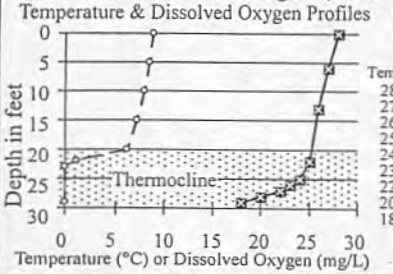
Temp.	Depth	D.O.	Depth
28	0	8.1	0
27	12	8.1	5
26	15	7.6	10
25	16	6.5	13
23	18	5.4	15
21	20	0.6	20
19	21	0.5	23
18	22	0.0	24
16	24	0.0	40
15	25	0.0	50
14	26	0.0	45
13	28	0.0	50
12	30		
11	33	West Basin	
10	40		
10	50		

Whitewood Lake August 2, 2004 — West Basin
Temperature & Dissolved Oxygen Profiles



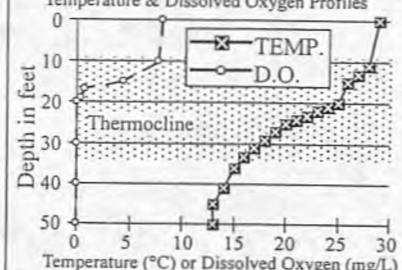
Temp.	Depth	D.O.	Depth
24	0	6.7	0
23	23	6.4	5
22	28	6.0	10
21	33	5.6	15
20	35	5.2	20
19	38	4.0	25
18	40	2.7	30
17	42	1.3	32
16	45	0.0	33
15	46	0.0	43
14	47	0.0	50
13	48		
12	50		

East Basin Whitewood Lake August 1, 2008
Temperature & Dissolved Oxygen Profiles



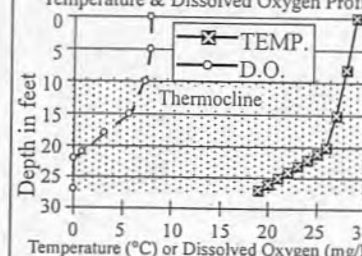
Temp.	Depth	D.O.	Depth
28	0	8.8	0
27	6	8.5	5
26	13	8.0	10
25	22	7.2	15
24	25	6.2	20
23	26	1.1	22
22	27	0.0	23
20	28	0.0	29
18	29		

West Basin, Whitewood Lake, August 1, 2006
Temperature & Dissolved Oxygen Profiles



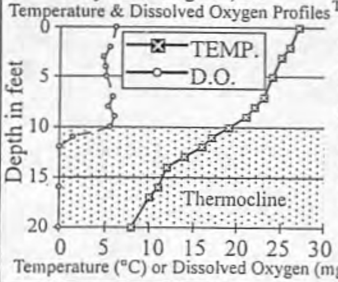
Temp.	Depth	D.O.	Depth
29	0	8.1	0
28	11	7.7	10
27	13	4.4	15
26	15	0.8	17
25	20	0.4	19
24	21	0.0	20
23	22	0.0	30
22	23	0.0	40
21	24	0.0	50
20	25		
19	27		
18	29		
17	31		
16	33		
15	36		
14	41		
13	45		
13	50		

East Basin Whitewood Lake August 1, 2006
Temperature & Dissolved Oxygen Profiles



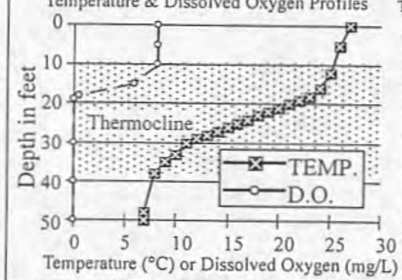
Temp.	Depth	D.O.	Depth
29	0	7.9	0
28	8	7.9	5
27	15	7.3	10
26	20	5.7	15
25	21	3.2	18
24	22	0.9	21
23	23	0.0	22
22	24	0.0	27
21	25		
20	26		
19	27		

Patty's Lake August 2, 2004
Temperature & Dissolved Oxygen Profiles



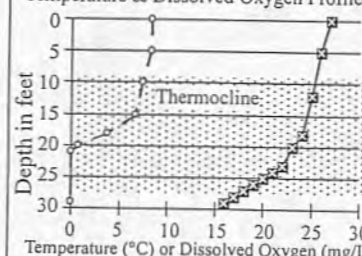
Temp.	Depth	D.O.	Depth
27	0	6.2	0
26	2	5.6	2
25	3	4.8	3
24	5	5.1	4
23	7	5.2	5
22	8	5.9	7
21	9	5.4	8
19	10	6.1	9
17	11	5.6	10
16	12	1.5	11
14	13	0.0	12
12	14	0.0	16
11	16	0.0	20
10	17		
8	20		

West Basin, Whitewood Lake, August 1, 2007
Temperature & Dissolved Oxygen Profiles



Temp.	Depth	D.O.	Depth
27	0	8.2	0
26	5	8.2	5
25	12	8.2	10
24	16	6.0	15
23	18	0.5	18
21	20	0.0	19
19	22	0.0	30
17	24	0.0	40
15	26	0.0	50
13	28		
11	30		
10	33		
9	35		
8	38		
7	48		
7	50		

East Basin Whitewood Lake August 1, 2007
Temperature & Dissolved Oxygen Profiles



Temp.	Depth	D.O.	Depth
27	0	8.3	0
26	5	8.3	5
25	12	7.5	10
24	18	6.7	15
23	20	3.8	18
22	23	0.8	20
21	24	0.0	21
20	25	0.0	29
19	26		
18	27		
17	28		
16	29		

Whitewood Lakes
Section 32
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Livingston County

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9200 Dexter Chelsea Road
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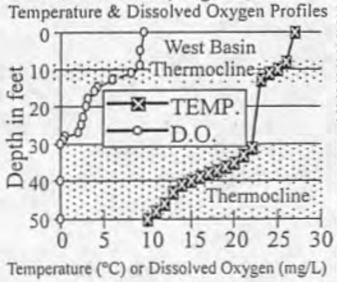
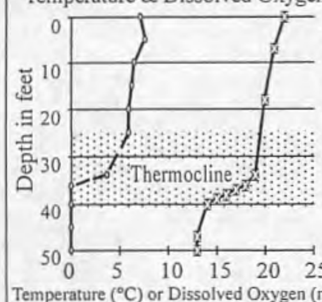
(734) 426-8972

Whitewood Lake, August 8, 1996
Temperature & Dissolved Oxygen Profiles



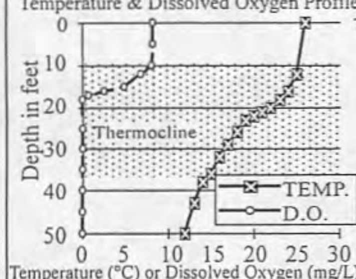
Temp.	Depth	D.O.	Depth
27	0	9.6	0
26	8	9.2	5
25	10	9.2	9
24	11	8.2	11
23	13	6.0	13
22	31	4.3	15
21	33	3.9	16
20	35	3.2	18
19	36	2.9	20
18	37	2.6	23
17	38	2.4	25
16	39	2.1	27
15	40	0.5	28
14	41	0.3	29
13	43	0.0	30
12	46	0.0	40
11	48	0.0	50
10	50		

Whitewood Lake, August 26, 1997
West Basin
Temperature & Dissolved Oxygen Profiles



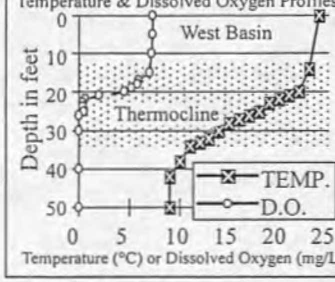
Temp.	Depth	D.O.	Depth
22	0	7.2	0
21	7	7.7	5
20	18	6.5	10
19	34	6.3	15
18	36	6.0	20
17	37	6.0	25
16	38	3.7	34
15	39	0.0	36
14	40	0.0	40
13	47	0.0	45
13	50	0.0	50

Whitewood Lake August 11, 1998
Temperature & Dissolved Oxygen Profiles
West Basin



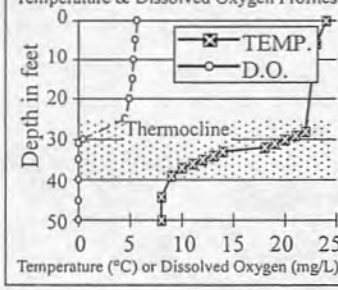
Temp.	Depth	D.O.	Depth
26	0	8.2	0
25	12	8.2	5
24	16	8.0	10
23	18	6.8	12
22	20	4.8	15
21	21	2.5	16
20	22	0.7	17
19	23	0.0	18
18	26	0.0	25
17	29	0.0	30
16	32	0.0	35
15	36	0.0	40
14	38	0.0	45
13	43	0.0	50
12	50		

Whitewood Lake August 28, 1999
Temperature & Dissolved Oxygen Profiles



Temp.	Depth	D.O.	Depth
24	0	7.3	0
23	14	7.3	5
22	20	7.2	10
21	21	7.0	15
20	22	5.9	17
19	23	5.8	18
18	25	5.2	19
17	26	4.5	20
16	27	2.0	21
15	28	0.6	22
14	30	0.4	23
13	32	0.4	24
12	33	0.5	25
11	34	0.0	26
10	38	0.0	30
9	42	0.0	40
9	50	0.0	50

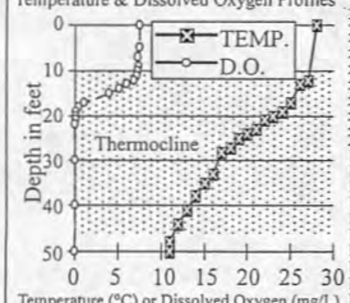
Whitewood Lake, August 4, 2000
Temperature & Dissolved Oxygen Profiles



Temp.	Depth	D.O.	Depth
24	0	5.6	0
23	6	5.5	5
22	28	5.3	10
21	29	5.2	15
20	30	4.9	20
19	31	4.5	25
18	32	0.5	30
14	33	0.0	31
13	34	0.0	35
12	35	0.0	40
11	36	0.0	45
10	37	0.0	50
9	39		
8	44		
8	50		

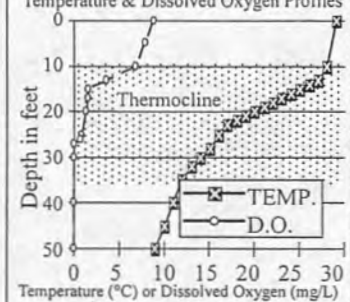
West Basin

Whitewood Lake, August 1, 2001
Temperature & Dissolved Oxygen Profiles
West Basin



Temp.	Depth	D.O.	Depth
28	0	7.5	0
27	12	7.5	5
26	13	7.3	7
25	17	7.4	9
24	19	7.3	10
23	20	7.2	11
22	21	6.8	12
21	23	6.0	13
20	24	5.1	14
19	25	4.0	15
18	27	1.1	17
17	28	0.4	18
16	33	0.1	19
15	35	0.1	20
14	38	0.1	21
13	41	0.0	22
12	44	0.0	30
11	48	0.0	40
11	50	0.0	50

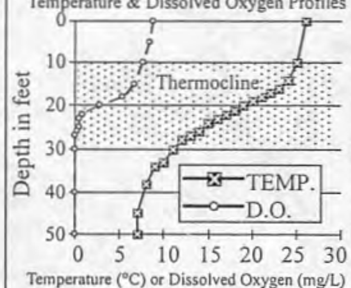
Whitewood Lake August 2, 2002
Temperature & Dissolved Oxygen Profiles



Temp.	Depth	D.O.	Depth
29	0	8.9	0
28	10	7.9	5
27	13	6.8	10
26	14	3.6	13
25	15	1.6	15
24	16	1.5	17
23	17	1.3	20
22	18	0.8	25
21	19	0.7	26
20	20	0.0	27
19	21	0.0	30
18	22	0.0	40
17	23	0.0	50
16	25		
15	28		
14	30		
13	32		
12	35		
11	40		
10	45		
9	50		

West Basin

Whitewood Lake August 1, 2003
Temperature & Dissolved Oxygen Profiles



Temp.	Depth	D.O.	Depth
26	0	8.7	0
25	10	8.4	5
24	14	7.6	10
23	16	6.7	15
22	17	5.3	18
21	18	2.8	20
20	19	0.8	22
19	20	0.5	23
18	21	0.5	25
17	22	0.3	26
16	23	0.0	27
15	24	0.0	30
14	26	0.0	40
13	27	0.0	50
12	28		
11	30		
10	33		
9	34		
8	38		
7	45		
7	50		

West Basin

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Section 32
Hamburg Township
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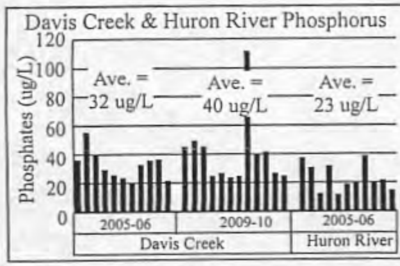
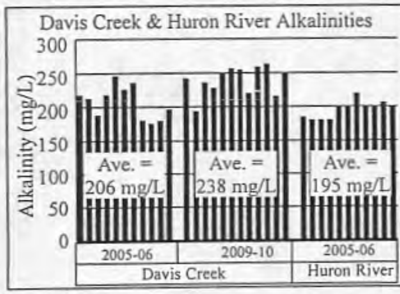
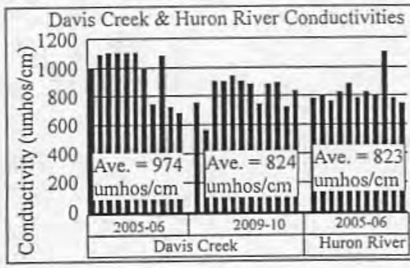
Livingston County



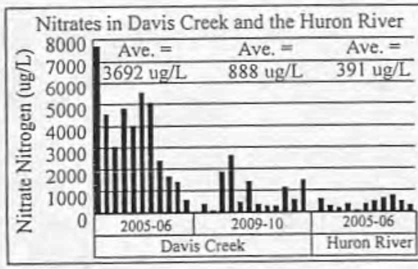
Davis Cr.		5/28/09	45	Huron R.	
6/30/05	36	6/29/09	49	6/30/05	37
7/29/05	55	7/31/09	45	7/29/05	30
8/29/05	40	8/28/09	24	8/29/05	12
9/27/05	29	9/23/09	26	9/27/05	31
10/24/05	25	10/21/09	23	10/24/05	11
11/30/05	23	11/23/09	24	11/30/05	18
12/27/05	20	12/26/09	111	12/27/05	19
1/27/06.	32	1/23/10	39	1/27/06.	38
2/28/06.	35	3/9/10	41	2/28/06.	20
3/30/06.	36	3/31/10	26	3/30/06.	21
4/19/06.	21	4/20/10	24	4/19/06.	14



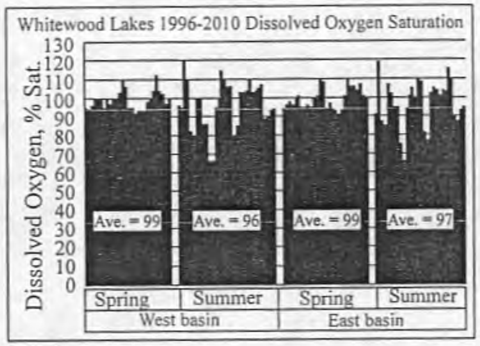
Davis Cr.				Huron R.	
6/30/05	217	5/28/09	241	6/30/05	184
7/29/05	212	6/29/09	193	7/29/05	180
8/29/05	188	7/31/09	235	8/29/05	180
9/27/05	217	8/28/09	227	9/27/05	180
10/24/05	245	9/23/09	250	10/24/05	200
11/30/05	225	10/21/09	256	11/30/05	200
12/27/05	235	11/23/09	254	12/27/05	218
1/27/06.	180	12/26/09	219	1/27/06.	200
2/28/06.	175	1/23/10	258	2/28/06.	200
3/30/06.	179	3/9/10	263	3/30/06.	205
4/19/06.	196	3/31/10	215	4/19/06.	198
		4/20/10	250		

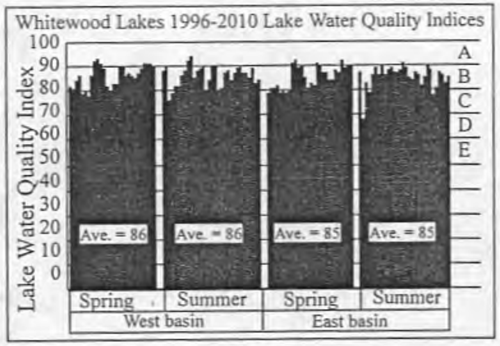


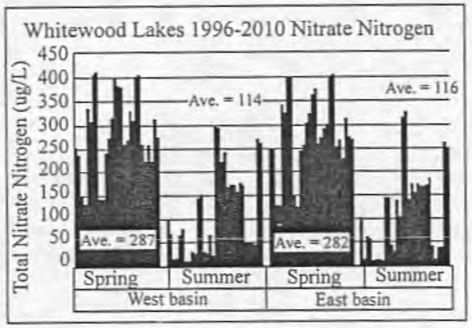
Davis Cr.		5/28/09	750	Huron R.	
6/30/05	1000	6/29/09	560	6/30/05	780
7/29/05	1090	7/31/09	900	7/29/05	790
8/29/05	1100	8/28/09	900	8/29/05	760
9/27/05	1100	9/23/09	940	9/27/05	820
10/24/05	1100	10/21/09	900	10/24/05	880
11/30/05	1100	11/23/09	880	11/30/05	780
12/27/05	1000	12/26/09	740	12/27/05	820
1/27/06.	740	1/23/10	880	1/27/06.	800
2/28/06.	1080	3/9/10	890	2/28/06.	1100
3/30/06.	720	3/31/10	720	3/30/06.	780
4/19/06.	680	4/20/10	830	4/19/06.	740

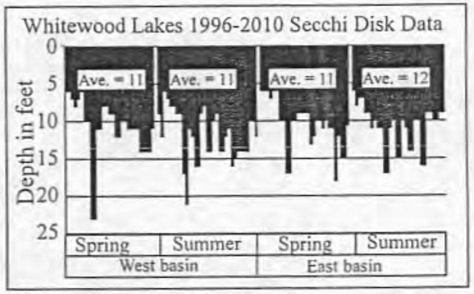


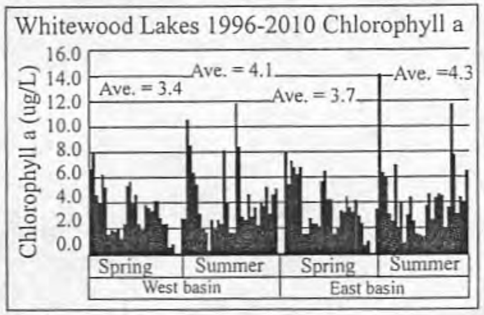
Davis Creek				Huron River	
6/30/05	7700	5/28/09	370	6/30/05	581
7/29/05	4532	6/29/09	47	7/29/05	256
8/29/05	3060	7/31/09	1845	8/29/05	160
9/27/05	4800	8/28/09	2600	9/27/05	344
10/24/05	4007	9/23/09	450	10/24/05	55
11/30/05	5527	10/21/09	1375	11/30/05	352
12/27/05	5061	11/23/09	350	12/27/05	470
1/27/06	2368	12/26/09	263	1/27/06	611
2/28/06	1632	1/23/10	250	2/28/06	726
3/30/06	1376	3/9/10	1122	3/30/06	458
4/19/06	549	3/31/10	548	4/19/06	288
5/28/09	370	4/20/10	1438		

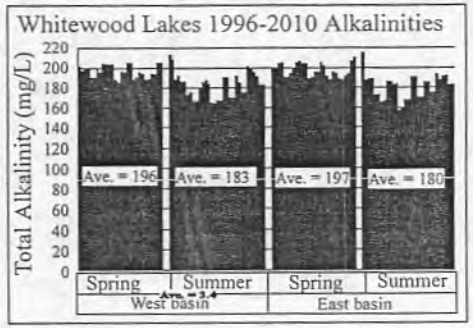












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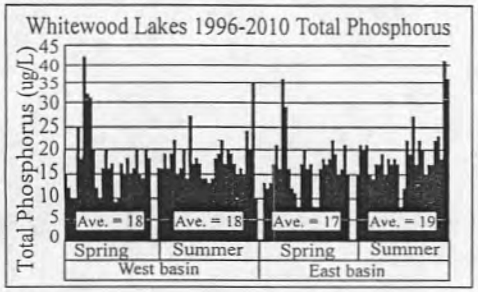

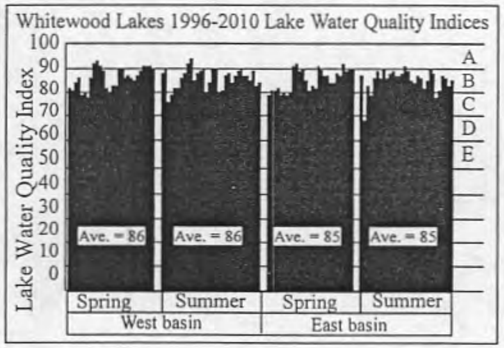

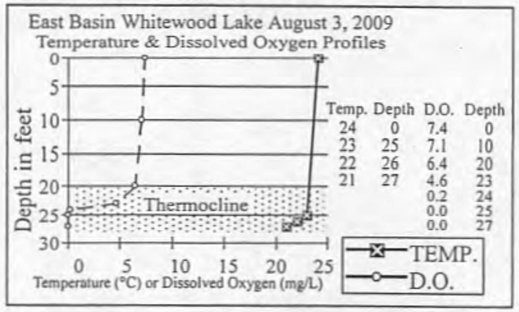

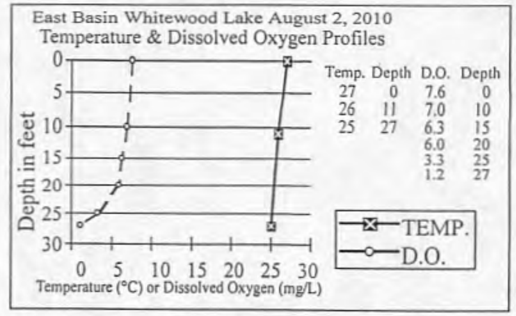

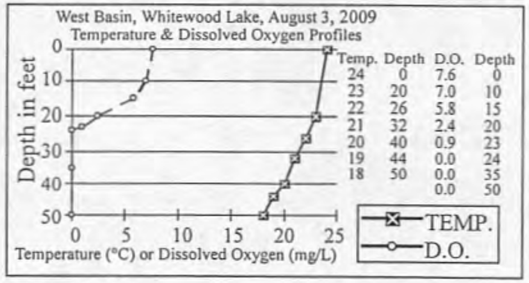

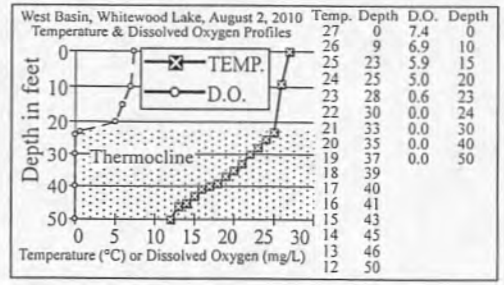

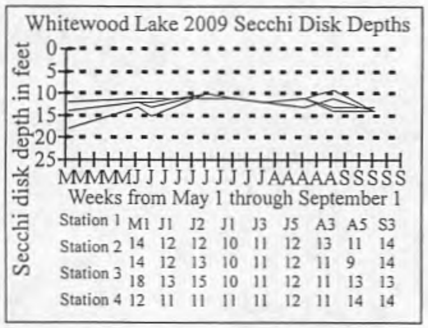

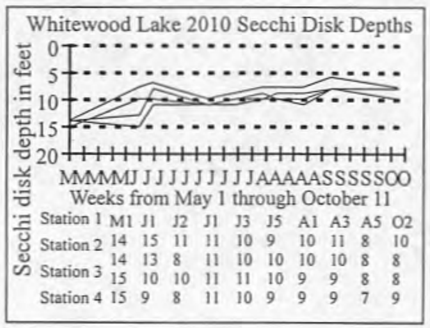

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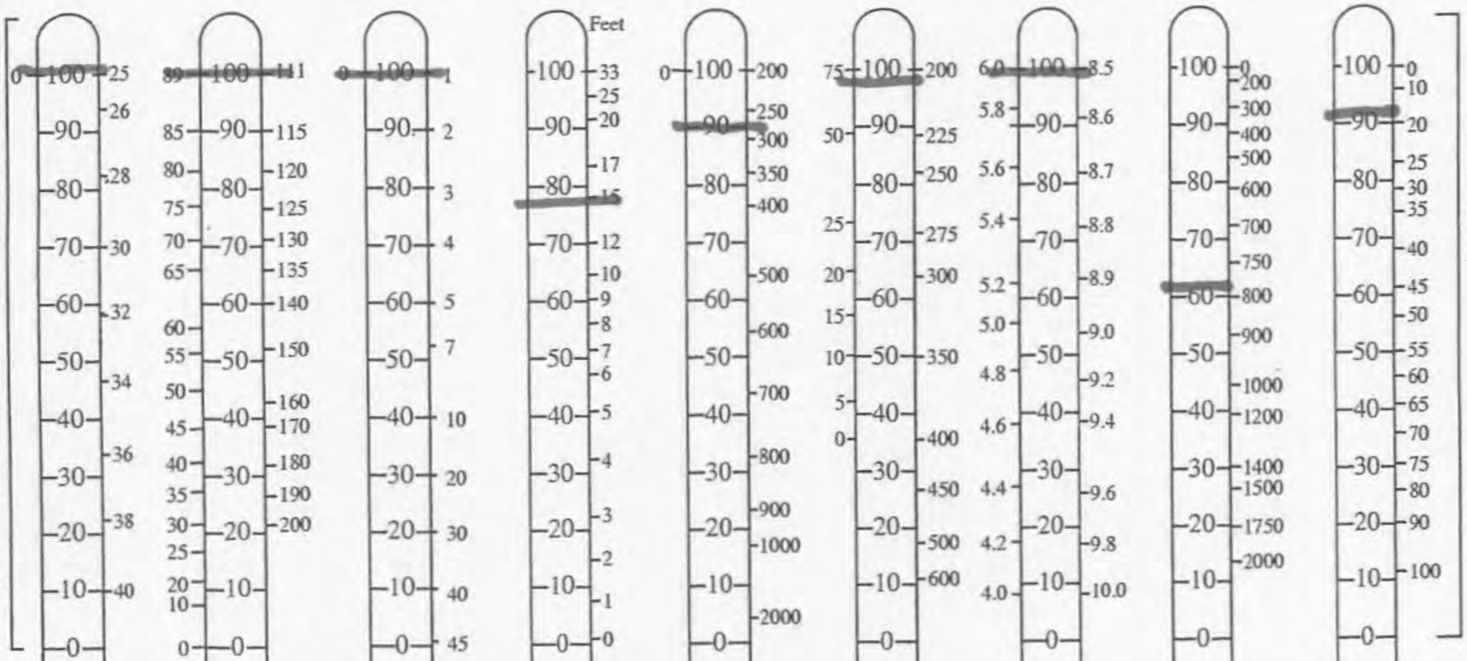
CALCULATION SHEET FOR THE UNWEIGHTED MULTIPLICATIVE LAKE WATER QUALITY INDEX

W. Fusilier, Ph.D.

QUALITY RATING CURVES

(Individual Quality Ratings never exceed 100)

Temperature in degrees C	Dissolved Oxygen, % Saturation	Chlorophyll a ug/L	Secchi Disk Depth in feet	Nitrate-N ug/L	Alkalinity mg/L	pH S. U.	Specific Conductivity umhos/cm@ 25C	Total Phosphorus ug/L
14°	10.4/10.4 100	0.7	15'	283	207	8.2	775	19



9√	100	X	100	X	106	X	78	X	90	X	99	X	100	X	61	X	91	=	90

Watershed to lake ratio	3914
Flushing rate	.007 years
Drainage Basin	Huron
Drainage Area	243200
Lake Volume	1371
County	Livingston
Township	Hamburg
Analyst	WQI
Lake Depth	50'
Lake Area	62

LWQI 90

SET THE PARAMETER QUALITY RATING AT 1 IF THE EXTERNAL EXTREME VALUE RANGE IS EXCEEDED

LAKE WATER QUALITY INDEX

0–15	15–25	25–35	35–45	45–55	55–65	65–75	75–85	85–100
Red	Red Orange	Orange	Orange Yellow	Yellow	Yellow green	Green	Blue Green	Blue

DATE 20 April 2010

STATION AVE 1-4

LAKE Whitewood

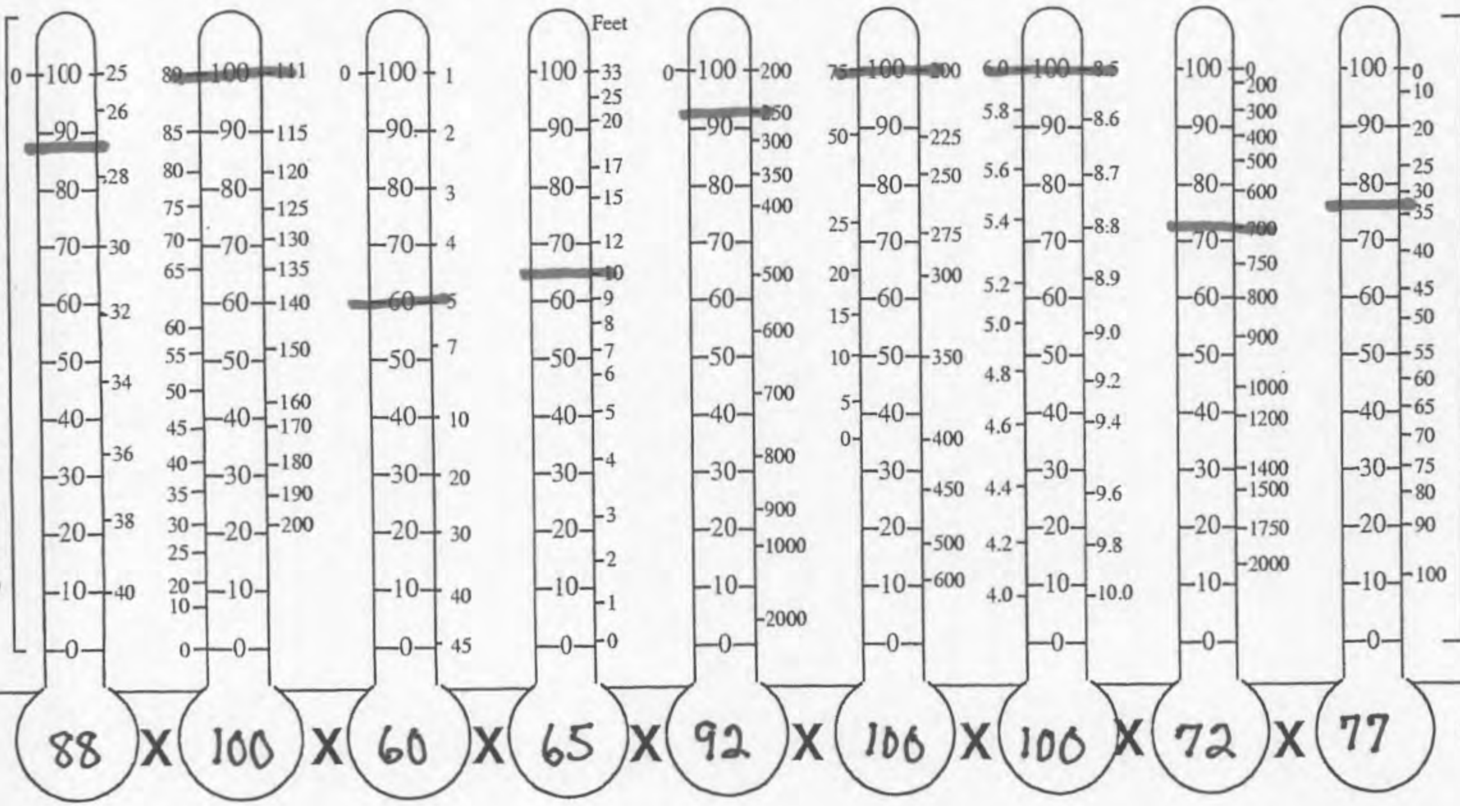
CALCULATION SHEET FOR THE UNWEIGHTED MULTIPLICATIVE LAKE WATER QUALITY INDEX

W. Fusilier, Ph.D.

QUALITY RATING CURVES

(Individual Quality Ratings never exceed 100)

Parameter	Value	Quality Rating
Temperature in degrees C	27°	88
Dissolved Oxygen, % Saturation	75/8.0 93	100
Chlorophyll a ug/L	5.0	60
Secchi Disk Depth in feet	10'	65
Nitrate-N ug/L	260	92
Alkalinity mg/L	183	100
pH S. U.	8.2	100
Specific Conductivity umhos/cm@ 25C	710	72
Total Phosphorus ug/L	32	77



$\sqrt[9]{88 \times 100 \times 60 \times 65 \times 92 \times 100 \times 100 \times 72 \times 77} = 82$

LWQI 82

3914 Watershed to lake ratio

.007 years Flushing rate

Huron Drainage Basin

243200 Drainage Area

1371 Lake Volume

Livingston County

Hamburg Township

WQI Analyst

50' Lake Depth

62 Lake Area

SET THE PARAMETER QUALITY RATING AT 1 IF THE EXTERNAL EXTREME VALUE RANGE IS EXCEEDED

LAKE WATER QUALITY INDEX

0–15	15–25	25–35	35–45	45–55	55–65	65–75	75–85	85–100
Red	Red Orange	Orange	Orange Yellow	Yellow	Yellow green	Green	Blue Green	Blue

DATE 2 August 2010

STATION AVE 1-4

LAKE Whitewood