Walloon Lake Profile

2011 Report

What would Michigan be without water? One might as well ask what the Sahara would be without sand or the Himalayas without mountains. Michigan is defined by water and, in fact, the definition of Michigan in some Native American languages literally means water, “big lake” to be precise.

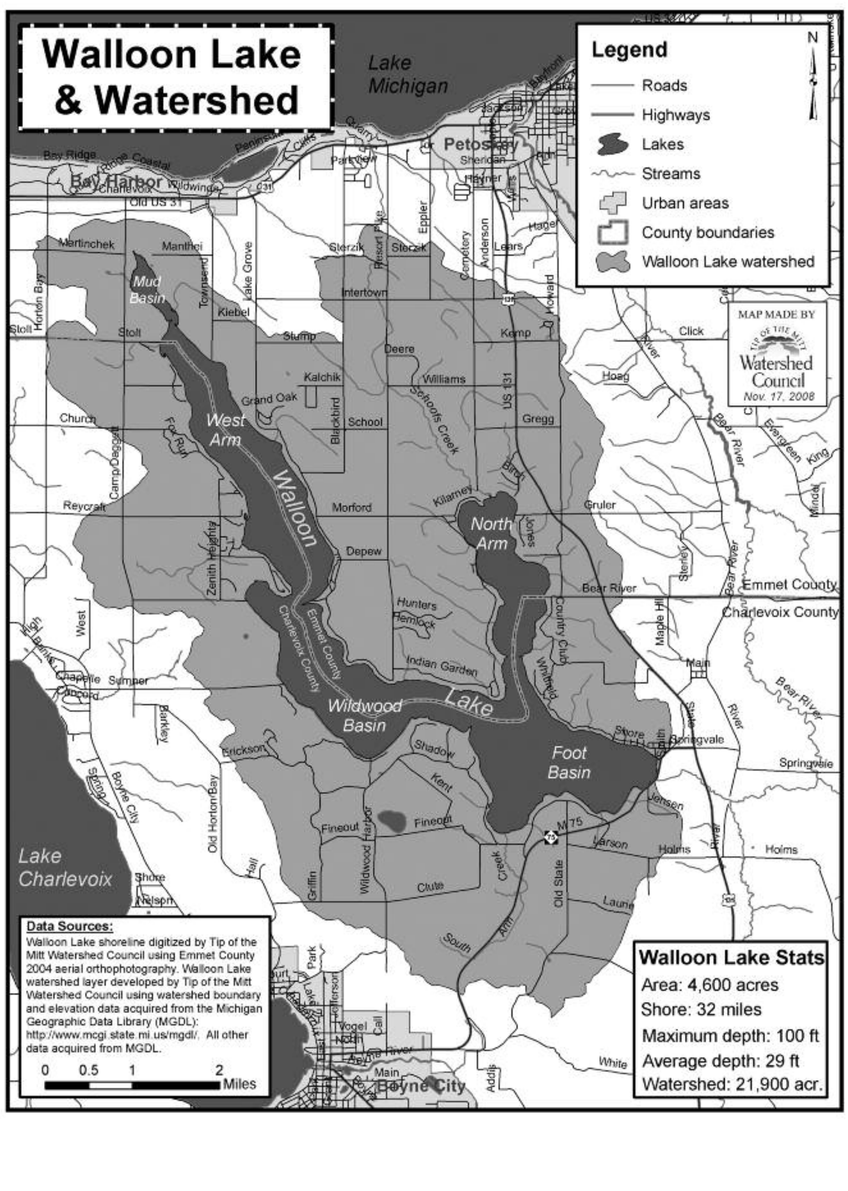
Water formed Michigan, frozen water that is, thousands of feet thick. A series of glaciers advanced and retreated across Michigan over the course of millions of years, creating the present-day landscape of rolling hills and broad plains; dotted with lakes, crisscrossed with rivers, and surrounded by freshwater seas. Glacial scouring and huge ice chunks that were left behind formed thousands of lakes across the landscape, lakes of all shapes and sizes, each unique: each beautiful and special in its own way.

Many people live in or travel through Northern Michigan because of these lakes and the character they lend to the region. Walloon Lake is among the most picturesque and stunning lakes in the world; a true aquatic treasure that is experienced and enjoyed by thousands upon thousands of people annually; generation after generation. The Watershed Council has long recognized the value of Walloon Lake and worked diligently for decades to protect its water quality and preserve its ecosystem integrity.

Lakes throughout Northern Michigan, whether large or small, are monitored by Tip of the Mitt Watershed Council staff and volunteers alike who gather valuable data to keep tabs on the health of our waters. Over 50 lakes and streams in the region are monitored in early spring by staff on an every three year rotation through our Comprehensive Water Quality Monitoring Program. Volunteers supplement the comprehensive program and fill in data gaps by collecting weekly water quality data throughout summer months as part of our Volunteer Lake Monitoring Program.

In addition to monitoring, the Watershed Council works with property owners, associations, local governments, and others on a variety of projects intended to protect lakes throughout Northern Michigan. Projects carried out on these lakes have ranged from lake-wide aquatic plant surveys to individual shoreline property restoration projects. Details about recent projects involving Walloon Lake are included in this report.

We hope you find the information presented in this report both interesting and insightful. If you have any questions, comments, or concerns, please contact Kevin Cronk at Tip of the Mitt Watershed Council at (231) 347-1181 ext. 109 or visit our website at www.watershedcouncil.org/protect.



Comprehensive Water Quality Monitoring

Restoration Ecologist, Jennifer Gelb, uses Kemmerer bottle to collect water sample.

Water Quality Trends in Walloon Lake

Tip of the Mitt Watershed Council has been consistently monitoring the water quality of Northern Michigan lakes for decades as part of the Comprehensive Water Quality Monitoring Program. When the program was launched in 1987, Watershed Council staff monitored a total of 10 lakes. Since then, the program has burgeoned and now, remarkably, includes more than 50 lakes and rivers throughout the tip of the mitt. Over the course of 20+ years of monitoring, we have managed to build an impressively large water quality dataset. This unique, historical dataset is, simply put: invaluable. Data from the program are regularly used by the Watershed Council, lake and stream associations, local governments, regulatory agencies, and others in efforts to protect and improve the water resources that are so important to the region.

Every three years, Watershed Council staff head into the field in the early spring, as soon as ice is out, to monitor lakes and rivers spread across the tip of the mitt. All lakes over 1000 acres and the majority of lakes greater than 100 acres in size, as well as all major rivers, are included in the program. In each of these water bodies, the Watershed Council collects a variety of physical and chemical data, including parameters such as dissolved oxygen, pH, chloride, phosphorus and nitrogen.

Water quality data collected in the field are compiled and used by Watershed Council staff to characterize water bodies, identify specific problems and examine trends over time. One obvious trend found by analyzing data from this program is that chloride (a component of salt) levels have increased significantly in many water bodies during the last 23 years. Why? We need not look any farther than ourselves to find the answer as we use salt in everything from de-icing to cooking.

The following pages contain descriptions of the types of data collected in the program as well as select data from Walloon Lake. We have also included charts to provide a graphic display of trends occurring in the lake. For additional information about the Comprehensive Water Quality Monitoring Program please visit our web site at www.watershedcouncil.org/protect.

Parameters and Results

pH

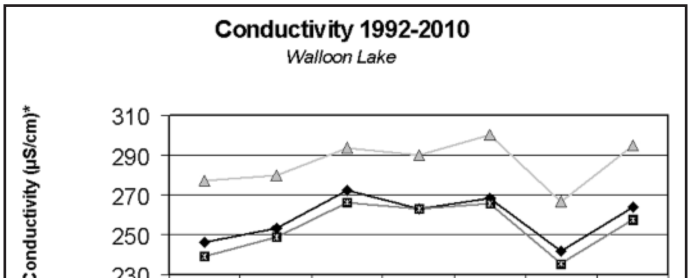
pH values provide a measurement of the acidity or alkalinity of water. Measurements above 7 are alkaline, 7 is considered neutral, and levels below 7 are acidic. When pH is outside the range of 5.5 to 8.5, most aquatic organisms become stressed and populations of some species can become depressed or disappear entirely. State law requires that pH be maintained within a range of 6.5 to 9.0 in all waters of the state. Data collected from Walloon Lake show that pH levels consistently fall within this range, with a minimum of 7.48 (Foot Basin, 1999) and a maximum of 8.63 (Mud Basin, 2009).

Dissolved Oxygen

Oxygen is required by almost all organisms, including those that live in the water. Oxygen dissolves into the water from the atmosphere (especially when there is turbulence) and through photosynthesis of aquatic plants and algae. State law requires that a minimum of 5 to 7 parts per million (PPM) be maintained depending on the lake type. Dissolved oxygen levels recorded in Walloon Lake, from lake surface to bottom, have consistently exceeded State minimums, ranging from 7.7 PPM (North Arm, 1998) to 15.5 PPM (Wildwood Basin, 2010).

Conductivity

Conductivity is a measure of the ability of water to conduct an electric current, which is dependent upon the concentration of charged particles (ions) dissolved in the water. Research shows that conductivity is a good indicator of human impacts on aquatic ecosystems because levels usually increase as population and human activity in the watershed increase. Readings from lakes monitored by the Watershed Council have ranged from 175 to 656 microSiemens (μS), and in Walloon Lake, ranged from a low of 231 μS (Wildwood Basin, 2008) to a high of 336 μS (North Arm, 2009). Data from Walloon Lake show that conductivity levels generally increased during the first decade of monitoring, until dropping considerably (and thus far, inexplicably) in 2007. The most recent data from 2010 show that conductivity levels have returned to the higher levels recorded prior to 2007.



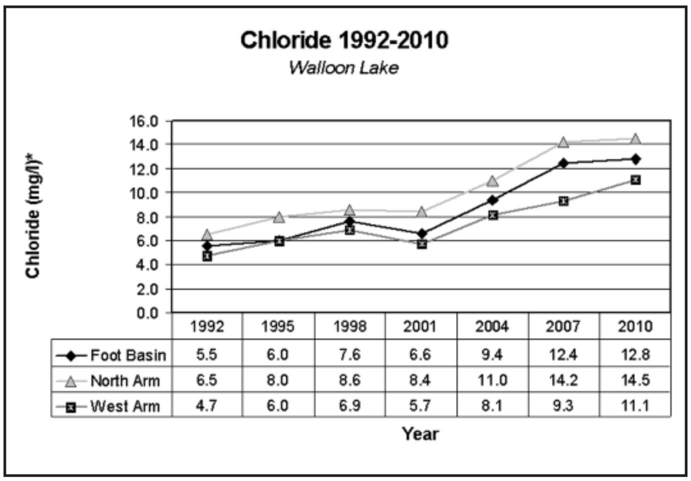
	1992	1995	1998	2001	2004	2007	2010
Foot Basin	246	253	272	263	269	242	264
North Arm	277	280	294	290	300	267	295
West Arm	239	249	266	263	266	236	258

Year

*Unit descriptions: mg/l = parts per million, μg/l = parts per billion, μS = microSiemens per centimeter

Chloride

Chloride, a component of salt, is present naturally at low levels in Northern Michigan surface waters due to the marine origin of the underlying bedrock (typically < 5 PPM). Chloride is a "mobile ion," meaning it is not removed by chemical or biological processes in soil or water. Many products associated with human activities contain chloride (e.g., de-icing salts, water softener salts, fertilizers, and bleach). Although most aquatic organisms are not affected until chloride concentrations exceed 1,000 PPM, increases are indicative of other pollutants associated with humans (such as automotive fluids from roads or nutrients/bacteria from septic systems) reaching our waterways. Chloride concentrations in Walloon Lake have gradually increased from lows of 4-6 PPM in the early 1990s to highs of 11-16 PPM in 2010.



	1992	1995	1998	2001	2004	2007	2010
Foot Basin	5.5	6.0	7.6	6.6	9.4	12.4	12.8
North Arm	6.5	8.0	8.6	8.4	11.0	14.2	14.5
West Arm	4.7	6.0	6.9	5.7	8.1	9.3	11.1

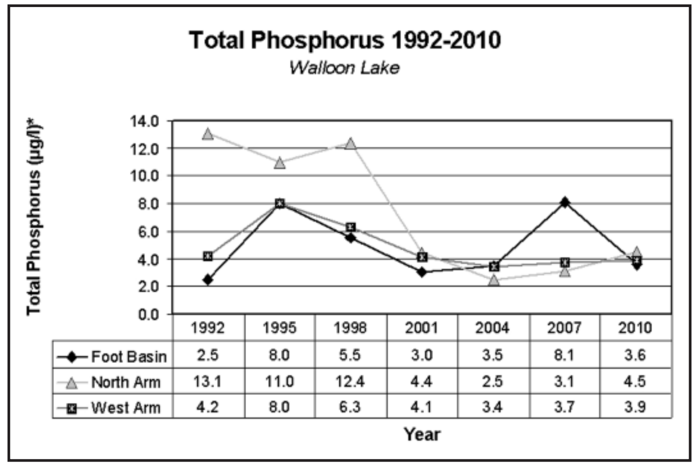
Nutrients

Nutrients are needed by organisms to live, grow, and reproduce; occurring naturally in soils, water, air, plants, and animals. Phosphorus and nitrogen are essential nutrients for plant growth and important for maintaining healthy, vibrant aquatic ecosystems. However, excess nutrients from sources such as fertilizers, faulty septic systems, and stormwater runoff lead to nutrient pollution, which can have negative impacts on our surface waters. In general, nutrient concentrations are highest in small, shallow lakes and lowest in large, deep lakes.

Total Phosphorus

Phosphorus is the most important nutrient for plant productivity in our lakes because it is usually in shortest supply relative to nitrogen and carbon. A water body is considered phosphorus limited if the ratio of nitrogen to phosphorus is greater than 15:1. In fact, most lakes monitored by the Watershed Council are found to be phosphorus limited.

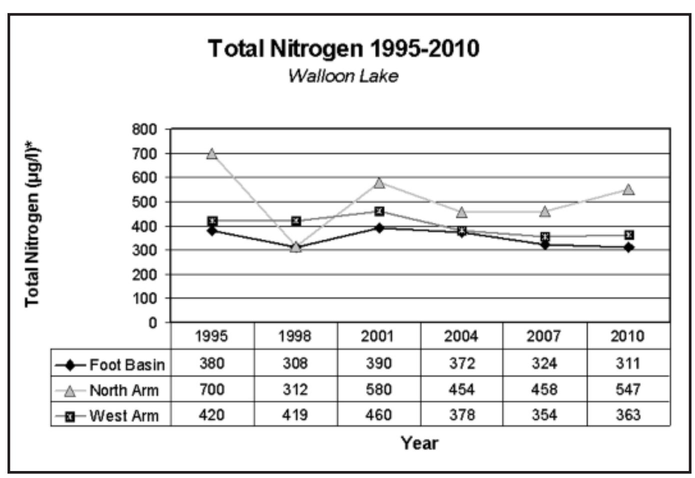
Because of the negative impacts that phosphorus can have on surface waters, legislation has been passed in Michigan to ban phosphorus in soaps, detergents, and fertilizers. Water quality standards for nutrients in surface waters have not been established, but total phosphorus concentrations are usually less than 10 parts per billion (PPB) in the high quality lakes of Northern Michigan. Total phosphorus concentrations in Walloon Lake have ranged from a low of 1.0 PPB (Foot Basin, 2002) to a high of 18.3 PPB (Mud Basin, 2001). Although very low concentrations were recorded in some basins during the first year of monitoring (1992), there has generally been a trend of decreasing phosphorus levels in Walloon Lake over time. This decrease is probably, at least in part, due to the introduction of zebra mussels, which have filtered much of the algae out of the water column and disrupted the natural nutrient cycle in the lake.



	1992	1995	1998	2001	2004	2007	2010
Foot Basin	2.5	8.0	5.5	3.0	3.5	8.1	3.6
North Arm	13.1	11.0	12.4	4.4	2.5	3.1	4.5
West Arm	4.2	8.0	6.3	4.1	3.4	3.7	3.9

Total Nitrogen

Nitrogen is a very abundant element throughout the earth's surface and is a major component of all plant and animal matter. Nitrogen is also generally abundant in our lakes and streams and needed for plant and algae growth. Interestingly, algae have adapted to a wide variety of nitrogen situations in the aquatic environment, some fixating nitrogen directly from the atmosphere to compete in low-nitrogen environments (blue-green algae), while others tend to thrive in nitrogen-rich environments (diatoms). Total nitrogen levels in Walloon Lake have ranged from 195 PPB (Foot Basin, 1998) to 700 PPB (North Arm, 1995). Nitrogen concentrations have remained fairly steady over the duration of monitoring, though somewhat higher in the North Arm than other basins.



	1995	1998	2001	2004	2007	2010
Foot Basin	380	308	390	372	324	311
North Arm	700	312	580	454	458	547
West Arm	420	419	460	378	354	363

*Unit descriptions: mg/l = parts per million, µg/l = parts per billion, µS = microSiemens per centimeter

Comprehensive Water Quality Monitoring Program
How Does Walloon Lake Compare?

Water quality data from the surface of all water bodies monitored in 2010

Water Body	Date	Dissolved Oxygen (mg/l) *	Specific Conductivity (µS)*	pH (units) *	Nitrate-Nitrogen (µg/l) *	Total Nitrogen (µg/l)*	Total Phosphorus (µg/l)*	Chloride (mg/l)*
Bass Lake	4/14/10	11.21	335.3	8.53	11	584	8.8	42.9
Bear River	3/24/10	13.05	283.1	8.30	192	433	16.2	14.3
Bellaire Lake	4/23/10	11.19	315.9	8.29	347	452	3.7	10.7
Ben-way Lake	4/6/10	11.06	358.0	11.32	406	567	6.4	10.8
Birch Lake	4/14/10	11.36	271.6	8.43	3	273	5.7	20.5
Black Lake	4/28/10	10.87	289.3	8.34	27	265	6.8	6.0
Black River	4/15/10	10.54	254.1	8.16	20	308	4.0	4.3
Boyne River	3/26/10	12.71	359.0	8.45	390	626	7.0	11.4
Burt Lake	4/28/10	10.68	297.2	8.32	94	240	3.7	11.5
Charlevoix, Main Basin	4/19/10	12.52	272.7	8.38	343	474	1.4	11.1
Charlevoix, South Arm	4/19/10	11.80	280.8	8.34	427	547	1.3	9.9
Cheboygan River	4/15/10	9.41	285.0	8.35	34	269	2.9	8.5
Clam Lake	4/23/10	10.76	317.6	8.25	322	423	2.7	10.0
Crooked Lake	3/24/10	11.72	252.8	8.51	269	443	8.7	8.7
Crooked River	4/21/10	10.76	293.9	8.50	137	296	4.5	9.4
Deer Lake	3/26/10	11.63	265.4	8.45	53	411	4.6	15.2
Douglas Lake	3/30/10	11.27	214.8	8.25	55	544	7.8	7.3
Elk Lake	4/19/10	12.80	246.7	8.35	193	411	9.6	9.8
Elk River	4/14/10	12.49	261.3	8.51	205	313	2.0	10.0
Ellsworth Lake	3/29/10	10.39	374.8	8.09	404	696	7.0	11.6
Hanley Lake	4/5/10	10.53	367.3	8.27	451	725	3.0	10.9
Huffman Lake	3/26/10	10.66	287.2	8.36	84	248	2.3	4.5
Huron, Duncan Bay	4/22/10	10.85	278.6	8.36	77	322	3.6	9.7
Indian River	4/21/10	11.32	301.4	8.48	75	226	1.6	12.4
Intermediate Lake	4/23/10	10.63	344.8	8.25	363	458	3.2	11.8
Jordan River	3/29/10	10.22	340.5	8.22	1122	1567	8.3	7.1
Lancaster Lake	4/1/10	8.49	276.0	7.72	75	596	6.9	9.1
Larks Lake	3/30/10	11.62	213.0	8.51	76	706	4.8	4.3
Little Sturgeon River	4/21/10	11.36	320.1	8.35	54	228	2.9	14.5
Long Lake	4/15/10	11.17	206.2	8.19	57	355	6.3	9.0
Maple River	4/22/10	10.30	275.9	8.16	308	544	4.5	6.4
Marion Lake	5/10/10	no data	no data	no data	<1	482	9.0	22.2
Michigan, Bay Harbor	5/3/10	11.31	277.0	8.16	284	493	2.2	14.8
Michigan, Grand Traverse Bay	4/28/10	12.40	241.1	8.26	251	360	1.4	11.8
Michigan, Little Traverse Bay	5/10/10	12.03	244.5	8.29	268	373	2.2	12.8
Mullett Lake	4/22/10	11.63	298.0	8.37	56	287	2.7	11.7
Munro Lake	4/1/10	11.55	215.4	8.41	36	1022	13.3	4.9
Nowland Lake	4/14/10	11.09	190.1	8.47	7	583	5.4	6.2
Paradise Lake	4/22/10	10.52	207.2	8.30	8	325	5.0	11.2
Pickerel Lake	3/24/10	11.26	261.6	8.26	183	453	3.1	7.3
Pigeon River	4/21/10	10.09	341.5	8.37	35	233	3.8	6.5
Pine River, Charlevoix	4/14/10	12.42	268.2	8.36	273	349	0.5	11.2
Round Lake (Emmet Cty)	3/30/10	11.95	306.3	8.52	49	739	2.9	25.9
Silver Lake (Wolverine)	4/20/10	10.65	194.4	8.35	26	247	3.3	4.9
Six-mile Lake	3/29/10	10.52	333.5	8.14	279	541	4.4	7.2
Skegemog Lake	4/19/10	10.87	255.8	8.45	186	292	1.4	9.6
Spring Lake	3/24/10	12.46	529.9	8.21	1397	1457	5.3	90.0
St. Clair Lake	3/29/10	10.49	351.0	8.14	260	560	5.4	8.8
Sturgeon River	4/22/10	11.03	374.0	8.33	194	273	1.0	13.9
Susan Lake	3/26/10	12.04	282.7	8.36	111	685	8.0	10.5
Thumb Lake	4/1/10	10.99	200.7	8.22	38	301	10.0	5.1
Torch Lake	4/23/10	12.39	260.3	8.31	270	371	0.7	8.0
Twin Lakes	4/23/10	11.49	259.6	8.32	27	393	9.7	2.2
Walloon, Foot	**4/28/10**	**10.31**	**265.5**	**8.29**	**75**	**316**	**3.2**	**12.8**
Walloon, Mud Basin	**4/28/10**	**9.14**	**296.8**	**8.30**	**25**	**371**	**9.3**	**16.4**
Walloon, North Arm	**4/28/10**	**9.53**	**298.0**	**8.32**	**194**	**529**	**5.3**	**14.5**
Walloon, West Arm	**4/28/10**	**10.66**	**259.8**	**8.29**	**134**	**377**	**3.0**	**11.1**
Walloon, Wildwood Basin	**4/28/10**	**10.29**	**260.6**	**8.32**	**68**	**274**	**3.5**	**12.3**
Wildwood Lake	4/20/10	10.35	295.0	8.38	<1	332	11.9	16.0
Wilson Lake	4/7/10	10.50	358.7	8.28	433	800	5.3	10.7

*Unit descriptions: mg/l = milligrams/liter (parts per million), µg/l = micrograms/liter (parts per billion), µS = microSiemens per centimeter

WALLOON LAKE
Partnerships for Protection

A Long History and Continuing Efforts to Monitor and Protect the Walloon Lake Shoreline

Lake shorelines are the critical interface between land and water; where human activity has the greatest potential for degrading water quality. Developing shoreline properties for residential, commercial or other uses invariably has negative impacts on the lake ecosystem. During the development process, the natural landscape is altered in a variety of ways; vegetation is removed, the terrain is graded, utilities installed, structures are built, and areas are paved. These changes to the landscape and subsequent human activity in the shoreline area have consequences on the aquatic ecosystem. Nutrients from wastes, contaminants from cars and roads, and soils from eroded areas are among some of the pollutants that end up in and negatively impact the lake following shoreline development.

Ten shoreline surveys have been performed on Walloon Lake during the last 30 years. The most recent was completed last year with funding provided by the Walloon Lake Association. During the 2010 survey, Tip of the Mitt Watershed Council staff assessed every property on the lake to document conditions that potentially impact water quality, such as nutrient pollution, erosion, and shoreline alterations.

Results from the 2010 survey indicate that human activity along the Walloon Lake shoreline is likely impacting the lake ecosystem and water quality. Signs of nutrient pollution were noted at nearly half of shoreline properties, approximately 75% had altered shorelines, and erosion was documented at 16% of properties. Relative to other lakes, Walloon Lake had an average percentage of properties with *Cladophora* algae growth and a high percentage of properties with erosion and altered shorelines. Clusters of properties with strong signs of nutrient pollution were scattered throughout the lake, but more prevalent in the North Arm and Foot Basin.

The 2010 shoreline survey results provide another valuable data set that can be used to assist with lake management. Combined with follow-up activities, such as informing property owners of results and performing on-site assessments, problems in shoreline areas that threaten the lake's water quality can be identified and corrected. These solutions are often simple and low cost, such as regular septic system maintenance, proper lawn care practices, and wise land use along the shoreline. Preventing further shoreline degradation can also be achieved through the publicity and education associated with the survey.

During the next few years, the Watershed Council will work closely with the Walloon Lake Association on a variety of follow-up activities to address problems found on the Walloon Lake shoreline. In addition, the Watershed Council will collaborate with the Little Traverse Bay Bands of Odawa Indians (with funding from the Great Lakes Restoration Initiative) to perform another survey of the Walloon Lake shoreline that will focus specifically on greenbelts (i.e., shoreline vegetation). This intensive greenbelt assessment will rate the status of shoreline vegetation at each property on the lake and be used in follow-up activities in 2011 to protect and improve greenbelts throughout the lake. A complete report on the 2010 survey can be downloaded on the Watershed Council web site and results from the greenbelt survey will be available next year.

Results from the 2010 survey indicate that human activity along the Walloon Lake shoreline is likely impacting the lake ecosystem and water quality.

Volunteer Lake Monitoring

Local Volunteers Monitor & Protect Our Lakes

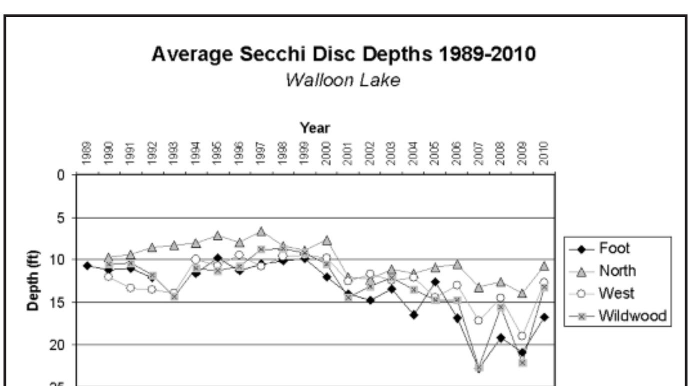
Since 1984, Tip of the Mitt Watershed Council has coordinated the Volunteer Lake Monitoring program (VLM), relying upon hundreds of volunteers to monitor the water quality of dozens of lakes in the northern Lower Peninsula of Michigan. During the most recent summer for which data are available (2010), 51 volunteers monitored water quality at 32 stations on 25 lakes.

Volunteers have monitored water quality in Walloon Lake over 20 years. Volunteers measure water clarity on a weekly basis using a Secchi disc. Every other week volunteers collect water samples to be analyzed for chlorophyll-a. Staff at the Watershed Council process the data and determine Trophic Status Index (TSI) scores to classify the lakes and make comparisons.

A remarkable amount of data has been generated by the VLM program and is available to the public via our web site (www.watershedcouncil.org/protect). This data is essential for discerning short-term changes and long-term trends in the lakes of Northern Michigan. Ultimately, the dedicated effort of volunteers and staff will help improve lake management and protect and enhance the quality of Northern Michigan's waters. The following section summarizes the parameters monitored and results.

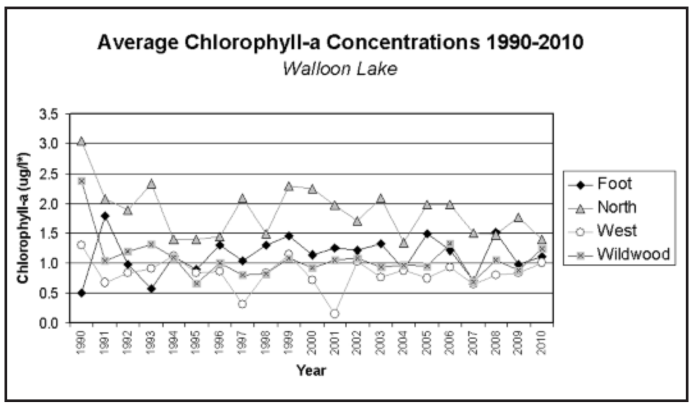
Secchi Disc

The Secchi disc is a weighted disc (eight inches in diameter, painted black and white in alternating quarters) that is used to measure water clarity. The disc is dropped down through the water column and the depth at which it disappears is noted. Using Secchi disc measurements, we are able to determine the relative clarity of water, which is principally determined by the concentration of algae and/or sediment in the water. The clarity of water is a simple and valuable way to assess water quality. Lakes and rivers that are very clear usually contain lower levels of nutrients and sediments and, in most cases, boast high quality waters. Throughout the summer, different algae types bloom at different times, causing clarity to vary greatly. Secchi disc depths have ranged from just a few feet in small inland lakes to over 80 feet in large inland lakes and Great Lakes' bays!



Chlorophyll-a

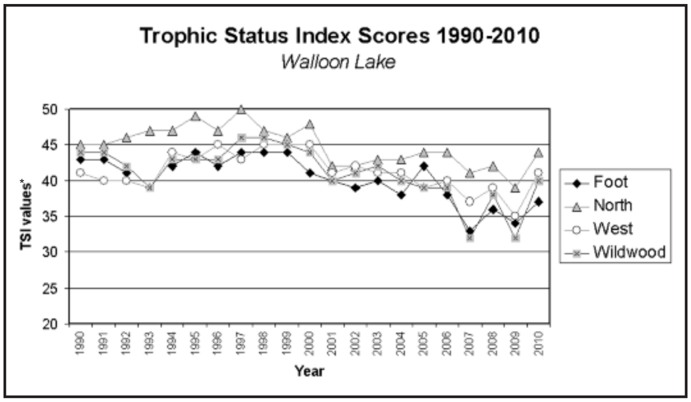
Chlorophyll-a is a pigment found in all green plants, including algae. Water samples collected by volunteers are analyzed for chlorophyll-a to estimate the amount of phytoplankton (minute free-floating algae) in the water column. There is a strong relationship between chlorophyll-a concentrations and Secchi disc depth. Greater amounts of chlorophyll-a indicate greater phytoplankton densities, which reduce water clarity and, thus, the Secchi disc depth as well. So why collect chlorophyll-a data? The chlorophyll-a data provides support for Secchi disc depth data used to determine the productivity of the lake, but it can also help differentiate between turbidity caused by algal blooms versus turbidity caused by other factors such as sedimentation or calcite.



Trophic Status Index

Trophic Status Index (TSI) is a tool developed by Bob Carlson, Ph.D. from Kent State University, to determine the biological productivity of a lake. Formulas developed to calculate the TSI values utilize Secchi disc depth measurements collected by our volunteers and range from 0 to 100. Lower values (0-38) indicate an oligotrophic or low productive system, medium values (39-49) indicate a mesotrophic or moderately productive system, and higher values (50+) indicate a eutrophic or highly productive system. Lakes with greater water clarity and smaller phytoplankton populations would score on the low end of the scale, while lakes with greater turbidity and more phytoplankton would be on the high end.

*Unit descriptions: mg/l = parts per million, µg/l = parts per billion, µS = microSiemens per centimeter



Oligotrophic lakes are characteristically deep, clear, nutrient poor, and with abundant oxygen. On the other end of the spectrum, eutrophic lakes are generally shallow and nutrient rich. A highly productive eutrophic lake could have problems with oxygen depletion whereas the low-productivity oligotrophic lake may have a lackluster fishery. Mesotrophic lakes lie somewhere in between and are moderately productive.

Depending upon variables such as age, depth, and soils, lakes are sometimes naturally eutrophic. However, nutrient and sediment pollution caused by humans can lead to the premature eutrophication of a lake, referred to as “cultural eutrophication”. Cultural eutrophication can affect the fisheries, lead to excessive plant growth, and result in algal blooms that can be both a nuisance and a public health concern.

(2010 TSI Values for all lakes on back page.)

Results from Walloon Lake

Due to its shape, size, and distinct basins, volunteers monitor Walloon Lake water quality in four different locations; in the West Arm, the Wildwood Basin, the Foot Basin, and the North Arm. Only the Mud Basin is not monitored by volunteers. Volunteer monitoring began in the Foot Basin in 1989 and then expanded to the other three sites in 1990. Impressively, all basins have been monitored every year since 1990!

The long-term data from Walloon Lake allow Watershed Council staff to examine changes over time. Average Secchi disc depths in Walloon Lake have increased from an average of approximately 9-12 feet in the early 1990s to around 14-22 feet in 2009, which shows that the water has become much clearer. However, 2010 data show that average Secchi disc depths decreased substantially. Thus far, we have not been able to determine why the trend reversed in 2010 and we anxiously await the 2011 data to see if the change in 2010 was an anomaly or if there is an as-of-yet unidentified factor causing changes in the Walloon Lake ecosystem. Average chlorophyll-a concentrations experienced an initial decrease in the early 1990s, but have since gone up and down without any discernable trends.

These increases in average Secchi disc depths that occurred between 1990 and 2010 are thought to be a repercussion of the introduction of invasive zebra mussels (*Dreissena polymorpha*), which have been present in Walloon Lake for a number of years. Zebra mussels are filter-feeders that prey upon algae and essentially clear the water column. Unfortunately, zebra mussels are not cleaning the water, but rather removing the algae that are the base of the food chain. This loss of primary productivity (i.e., algae) alters the entire food web, ultimately leading to a reduction in top predator fish populations, such as trout or walleye. On a positive note, zebra mussels are reportedly no longer as common as they once were on many large lakes in the area, which indicates that they may have passed their peak and that many of these lake ecosystems are approaching a new equilibrium.

Not surprisingly, data show that the trophic state of Walloon Lake has changed. Trophic status index scores from the first 15 years of monitoring show that Walloon Lake was mesotrophic (moderately productive), but then dropped into the oligotrophic category (low productivity) by 2007 in three of the four basins monitored. Data from the Comprehensive Water Quality Monitoring also attest to this decrease in biological productivity as total phosphorous concentrations have dropped considerably since the early to mid 1990s. Zebra mussels appear to have altered the Walloon Lake food web and reduced its biological productivity, perhaps for the long term. However, data show that water quality remains high, with abundant stores of dissolved oxygen throughout the water column.

Clearly, volunteers are doing an excellent job of monitoring Walloon Lake. Without their dedication and enthusiasm, we would have much less data to assess lake health and fewer eyes on our precious waters. Thus, we can not thank our volunteers enough for the critical roles they play in helping protect the lakes of Northern Michigan. We and the waters of Northern Michigan are eternally grateful! Of course, alternate monitors are always needed, so please consider joining the program to help protect and preserve Walloon Lake.

If you would like to get involved or would like additional information, please contact the program coordinator, Kevin Cronk, at (231) 347-1181 ext. 109 or by e-mailing kevin@watershedcouncil.org.

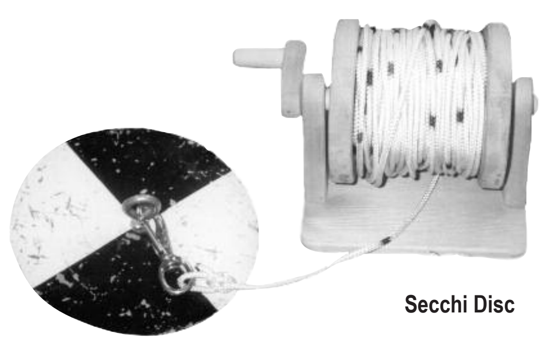
Thank you

Volunteer Lake Monitors on Walloon Lake:

Art Budden • Lori Crothers • Richard Crothers

Mary Anne Newman • Maureen Parker

Bill Stetson • Jack Touran



Secchi Disc

* TSI values range from 0 to 100. Lower values (0-38) indicate an oligotrophic or low productive system, medium values (39-49) indicate a mesotrophic or moderately productive system, and higher values (50+) indicate a eutrophic or highly productive system.

Tip of the Mitt Watershed Council

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Trophic Status Index (TSI) Values for Lakes Monitored in 2010

Lake	TSI*	Lake	TSI*	Lake	TSI*
Bass Lake	44	Lake Charlevoix, South Arm	37	Pickerel Lake	47
Black Lake	41	Huffman Lake	53	Six Mile Lake	45
Burt Lake, Central Basin	37	Lake Marion	39	Thayer Lake	42
Burt Lake, North	37	Lake Michigan, Bay Harbor	26	Thumb Lake	31
Burt Lake, South	37	Lake Michigan, Little Traverse Bay	31	Twin Lake	42
Crooked Lake	46	Long Lake, Cheboygan County	34	Walloon Lake, Foot Basin	37
Douglas Lake - Cheboygan	40	Mullett Lake, Center	38	Walloon Lake, North	44
Douglas Lake - Otsego	43	Mullet Lake, Pigeon Bay	37	Walloon Lake, West Arm	41
Elk Lake	34	Munro Lake	42	Walloon Lake, Wildwood	40
Lake Charlevoix, Main	34	Paradise Lake	46		

* TSI values range from 0 to 100. Lower values (0-38) indicate an oligotrophic or low productive system, medium values (39-49) indicate a mesotrophic or moderately productive system, and higher values (50+) indicate a eutrophic or highly productive system.