LCI Lake Water Quality Summary

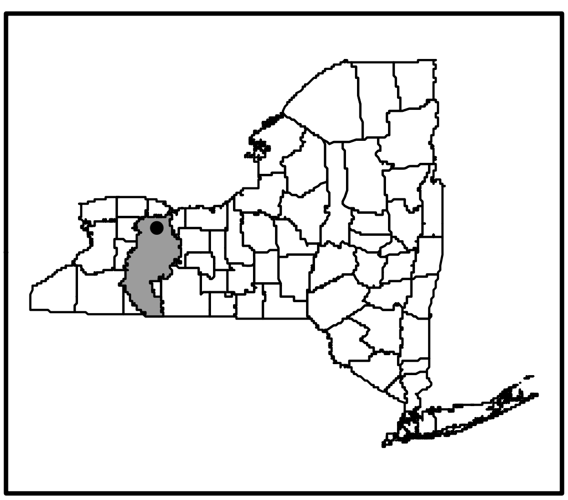
General Information

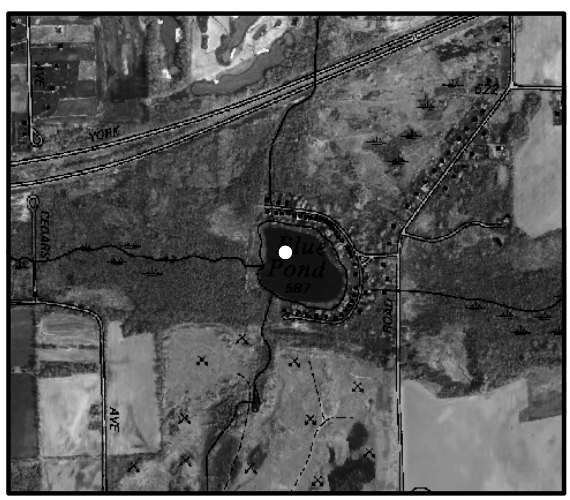
Lake Name: Blue Pond

Location:	Town of Weatland, Monroe County, NY
Basin:	Genesee River Basin
Size:	5.2 hectares (12.8 acres)
Lake Origins:	natural
Major Tributaries:	Mill Creek and a minor unnamed tributary
Lake Tributary to?:	Mill Creek
Water Quality Classification:	B (best intended use: primary contact recreation)
Maximum Sounding Depth:	7.7 meters (25 feet)
Sampling Coordinates:	Latitude: 42.02818, Longitude: -77.82150
Sampling Access Point:	private land (Blue Pond Cottages' Association, Inc.)
Monitoring Program:	Lake Classification and Inventory (LCI) Survey
Sampling Date:	8/3/09, 6/2/10, 7/7/10, 8/5/10, 9/9/10, & 10/27/10
Samplers:	David Newman, Scott Kishbaugh, Steven Finnemore, Lorraine Holdridge, Erik Posner, & Alene Onion NYSDEC Division of Water, Albany
Contact Information:	David Newman, NYSDEC Division of Water djnewman@gw.dec.state.ny.us; 518-402-8201

Lake Map

(sampling location marked with a circle)





Background and Lake Assessment

Blue Pond is a small (12 acre) impoundment on Mill Creek outside of the town of Weatland, Monroe County. The water flows into the pond from Mill Creek and another smaller unnamed tributary and then flows out to Mill Creek. There are about 35 properties that surround the pond, most with private residences. Much of the watershed for Blue Pond is agricultural with a forested buffer along Mill Creek west of the pond. Many of the properties around Blue Pond have manicured lawns that run down to the high water mark of the pond. Blue Pond Cottages Association members boat and fish in the pond, accessing the lake via individual boat docks.

A professor at the University of Buffalo did some work on Blue Pond in 2003 and 2004 evaluating the chemical gradients in the pond related to *Chara*, a native macroalga growing around a shallow rim in the lake. This work showed that there were significant differences in water chemistry parameters between the shallow rim and the open water in the center of the pond (Bové and Stewart 2006).

The pond was included in the New York State DEC Division of Water's 2009 screening (single sampling) Lake Classification and Inventory (LCI) survey of the Genesee River Basin. Inclusion in the survey was based on a "Needs Verification" listing in The 2001 Genesee River Basin Waterbody Inventory and Priority Waterbodies List (WI/PWL). The WI/PWL states:

> Public bathing and other recreational uses (fishing, boating) in Blue Pond may be affected by agricultural runoff, septic system impacts, wildlife and other nonpoint sources in the watershed. Possible inadequate and/or failing on-site septic systems serving homes along the lake shore may be contributing nutrients and/or pathogens to the lake. Conversion of summer cottages to year-round residences coupled with poor site conditions (high water table, small lots) raise concerns. The presence of waterfowl (geese, ducks, heron, loons) are also a concern. (Monroe County WQCC, April 2001)

To further investigate the potential water quality impacts outlined in the WI/PWL, monthly sampling during the summer of 2010 was conducted. An additional water chemistry sample was collected by a lake resident in October of 2010, under the direction of DEC staff, and analyzed through the LCI.

The LCI data found that Blue Pond can generally be characterized as *mesotrophic*, or moderately productive. The average water clarity reading (TSI = 43, typical of *mesotrophic* waterbodies) was expected given the average total phosphorus reading (TSI = 41, typical of *mesotrophic* waterbodies) and the average chlorophyll *a* reading (TSI = 43, typical of *mesotrophic* waterbodies). Data in Bové and Stewart (2006) indicate that in July of 2004 water clarity was much lower than that observed in August of 2009 and lower than the range of values collected in 2010.The LCI data collected in 2009 and 2010 suggest that summer surface water nutrients levels are not supportive of persistent surface water algal blooms in the pond.

The total phosphorus and sulfate readings in the bottom waters were elevated in 2009 and throughout the summer of 2010. Bové and Stewart (2006) observed sub-surface water samples having strong hydrogen sulfide smells as well as having a greenish tint to the sub-surface water samples. They speculated that the green tint may be caused by green sulfur bacteria. Bacterial evaluations were not conducted in the 2003-2004 study or during the LCI, but during the

September 2010 sampling event a subsurface greenish colored bloom was observed. However, this green subsurface bloom also corresponded to a high chlorophyll *a* reading from the bottom waters of the pond.

Total phosphorus levels from the October 2010 (after the pond turned over/ mixed) water sample were over twice the maximum recorded during the summer months. The fall total phosphorus reading exceeds the state's guidance value and may support algal blooms. The fall surface water total phosphorus value fell within the range of values collected from summer bottom water samples, suggesting that the lake may have been well mixed at this time in response to lake destratification. However, it is possible that the large number of water fowl reported to have been on the pond in the fall of 2010 may have also contributed to the high total phosphorus reading.

The water in the pond is uncolored to weakly colored, with an average water clarity reading of 3.5 meters. The only two plant species identified were duckweed (*Lemna minor*) and stonewort (*Chara sp.*). As indicated in Bové and Stewart (2006) *Chara* grew on a shallow rim around most of the pond. A more specific plant specific survey of the pond would be needed to determine if there are any other native or invasive species growing in the pond.

Blue Pond exhibits thermal stratification, in which depth zones (warm water on top, cold water on the bottom during the summer) are establish as in most NYS lakes greater than 6 meters deep. The thermocline was in the 4 to 6 meter range throughout the summer of 2010. Anoxic (lack of oxygen) conditions were observed at or below 5 meters in all summer LCI samples. Summer pH readings indicate alkaline waters, with conductivity readings indicating hard water (high ionic strength). The location of the thermocline, depth of anoxia, and pH and conductivity readings were consistent with Bové and Stewart's (2006) findings. Between the September 9th and October 27th sampling events, the pond destratified, allowing the bottom and surface water layers to mix. This mixing of thermal layers is natural and likely occurs both in the fall and the spring as the water temperatures changes.

Blue Pond appears to be typical of hardwater, weakly colored, alkaline lakes. Other lakes with similar water characteristics often support warmwater fisheries, although fisheries habitat cannot be fully evaluated through this monitoring program. Oxygen deficits in the bottom waters may stress some cold water fish species; however, oxygen rich surface waters appear to stay relatively cool throughout the summer, and may support cold water fish species. This would need to be verified with a fisheries specific survey. Bové and Stewart (2006) indicate that Mill Creek is predominantly spring fed which would explain the cool summer surface water temperatures.

In 2010 phosphorous levels continued to be elevated in the bottom waters. Elevated phosphorous levels are often seen in water bodies experiencing oxygen deficits in the bottom waters. The low oxygen levels allow phosphorus that is chemically bond in the sediments to be released into the water column. There were also elevated levels of ammonia in the bottom waters, with four out of the five summer bottom water samples exceeding the state water quality standards. Elevated ammonia levels in the bottom waters are also typical of water bodies with persistent oxygen deficiencies. Magnesium, sodium and sulfate levels in all six of the LCI surface water samples and all five of the LCI bottom water samples were above the state water quality standards. Iron levels were also elevated in the bottom waters with three of the five LCI samples being above the

DOH guidance values. Chloride levels were high throughout the summer and fall of 2010 and were similar to the August 2009 sample. These chloride levels indicate significant impacts to the pond from road salting and/or runoff through developed areas in the upstream watershed. The magnesium, sodium, sulfate and chloride levels were all consistent with those found by Bové and Stewart (2006), which suggests these are typical for the pond. Arsenic levels were above the laboratory detection limits in both of the samples collected in 2010, although these readings were well below the maximum contaminant level (MCL) established by the federal government as indicative of impaired conditions.

Evaluation of Lake Condition Impacts to Lake Uses

Potable Water (Drinking Water)
Blue Pond is not classified for use as a potable water supply. Although the LCI data are not sufficient to evaluate potable water use, these data suggest that pond water would require substantial treatment to serve as a potable water supply due to the high levels of sodium, magnesium, iron and sulfate, and elevated deepwater ammonia levels.

Contact Recreation (Swimming)
Blue Pond is classified for contact recreation, but it is not known if people from the surrounding area do swim in the pond. Bacteria data are needed to evaluate the safety of Blue Pond for swimming; however, these are not collected through the LCI. The data collected through the LCI did not indicate any water quality parameters that would impact swimming. Water clarity was above the State Department of Health's guidance value of 1.2 meters; however, the work by Bové and Stewart (2006) suggest that at times the water clarity may drop below this guidance value. The reports of large numbers of water fowl on the pond at various times of the year may cause elevated bacteria levels in the pond.

Non-Contact Recreation (Boating and Fishing)
These data did not indicate any water quality related impacts to non-contact recreation.

Aquatic Life
Oxygen deficits in the bottom waters may stress some aquatic life; however, it appears that the oxygen-rich surface waters stay relatively cool throughout the summer. Additional biological studies would need to be conducted to fully evaluate impact to the aquatic life of the pond.

Aesthetics
These data did not indicate any water quality related impacts that would detract from the aesthetic appeal of the pond.

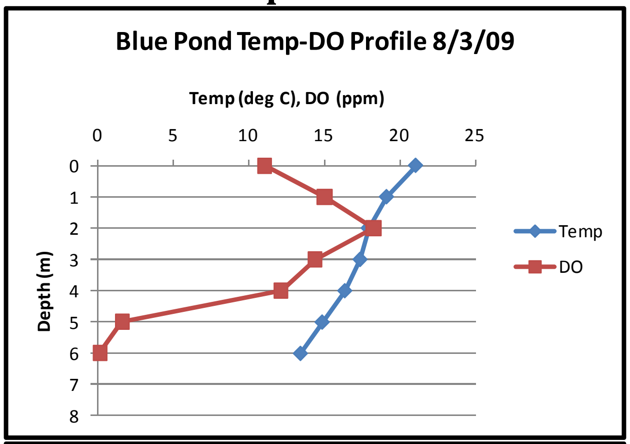
Additional Comments

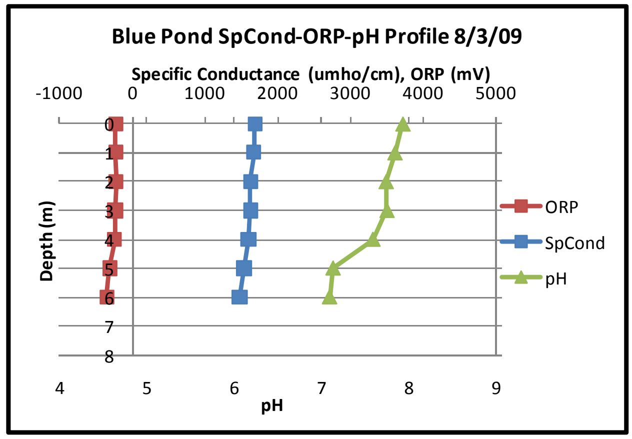
- The 2010 LCI survey helped to confirm the findings of the 2009 survey. With the 2009 readings for almost all parameters falling within the range of values collected in 2010. This would suggest that the water quality conditions found through the LCI are typical for the pond.
- There is some concern from residence who own property on the pond about the number of geese that congregate on the pond especially in the early to late fall where estimates have been as high as several thousand geese. The NYSDEC's Division of Fish, Wildlife and Marine Resources and the U.S. Department of Agriculture's Animal and Plant Health Inspection Service collaborated on a document entitled "When Geese Become a Problem". This document discusses Canada geese, problems associated with them, and management techniques. This document can be accessed at http://www.dec.ny.gov/docs/wildlife_pdf/geeseproblem.pdf. There is also some additional information on the DEC's public website related to *Nuisance Canada Geese*, this information can be accessed at http://www.dec.ny.gov/animals/7003.html.
- The NYS DEC Steam Biomonitoring Unit conducted a survey on Mill Creek less than two miles downstream of Blue Pond. They assessed the invertebrate community as poor, although some declines in invertebrate communities are typical downstream of impoundments. This finding may indicate that the water leaving Blue Pond may not be supportive of a healthy invertebrate community downstream of the pond.
- Periodic surveillance for invasive exotic plant species may help to prevent the establishment and spread of any new invaders, given the escalating problems with exotic aquatic weeds.
- Calcium levels are high in the pond and would support zebra mussels; however, no zebra mussels were observed in the pond. It is not known if this invasive mussel occurs in the pond. Insuring that boats are properly cleaned when they are brought from other waterbodies will help prevent the inadvertent introduction of zebra mussels and other aquatic invaders.

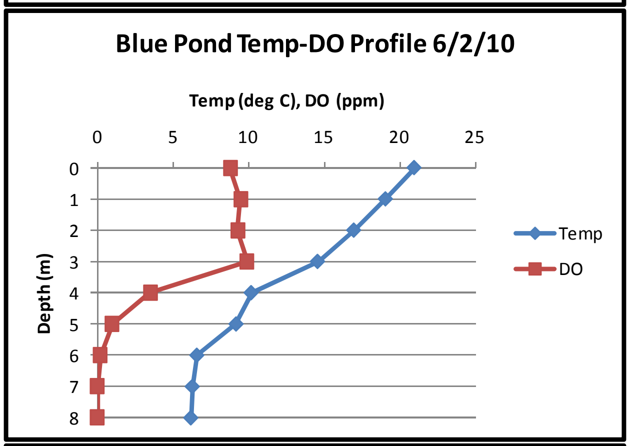
Aquatic Plant IDs

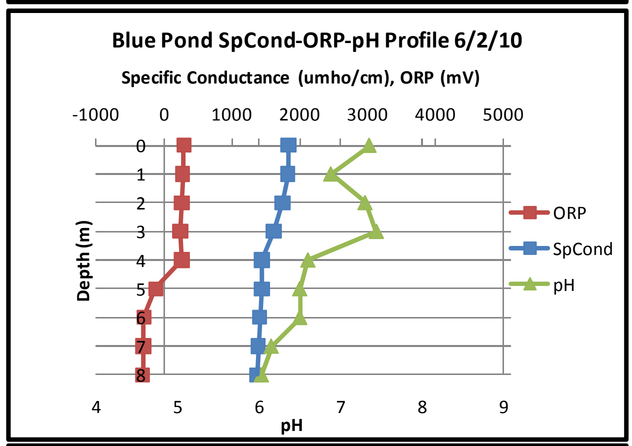
Exotic Plants:	None observed
Native Plants:	*Lemna minor* (duckweed) *Chara sp.* (stonewort)

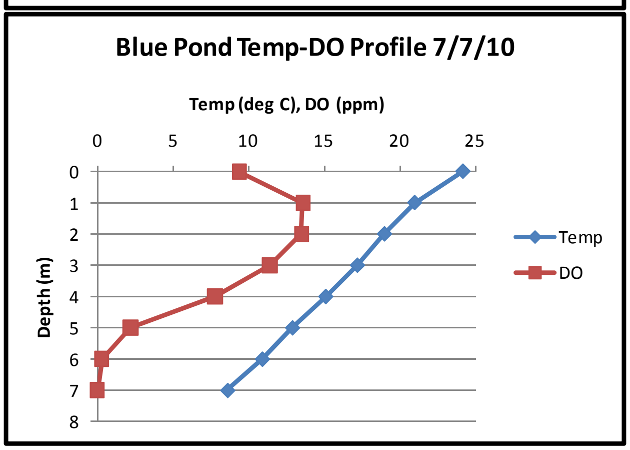
Time Series: Depth Profiles

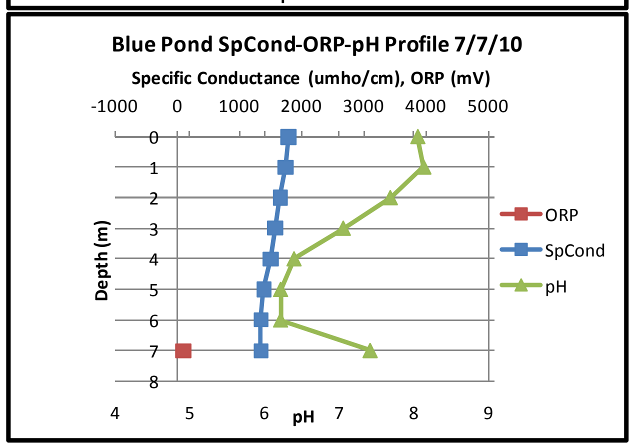


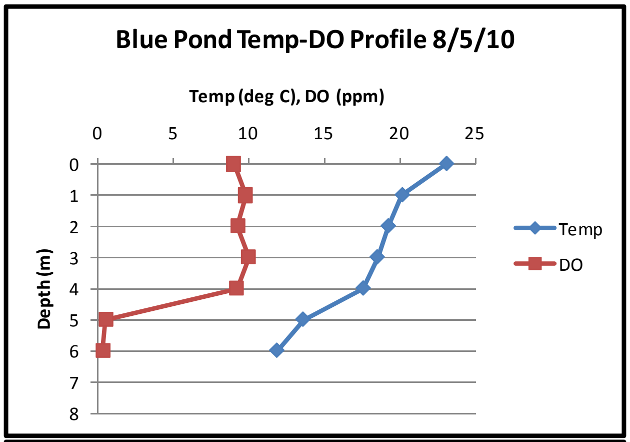


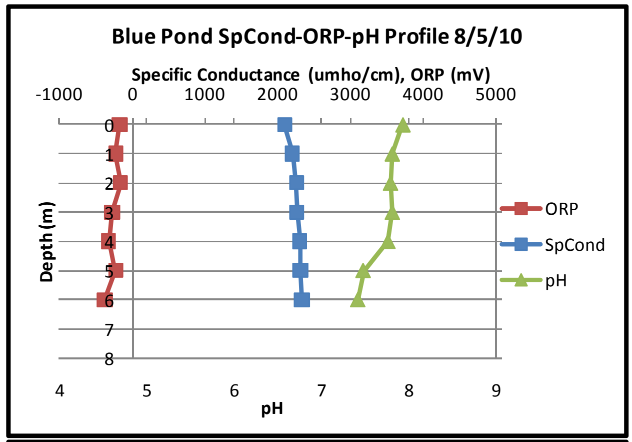


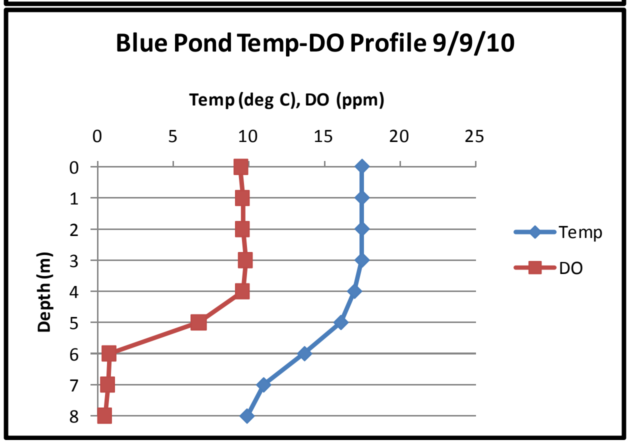


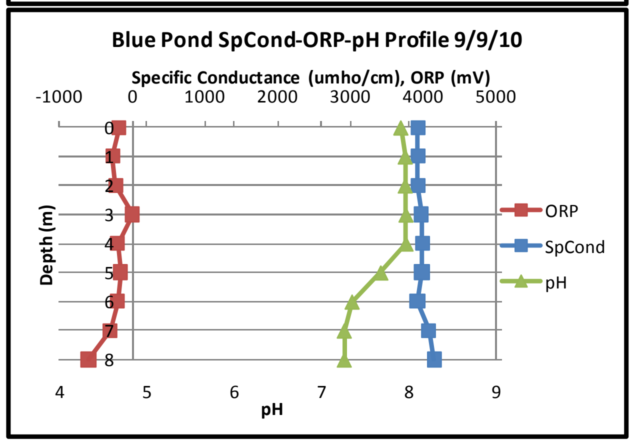




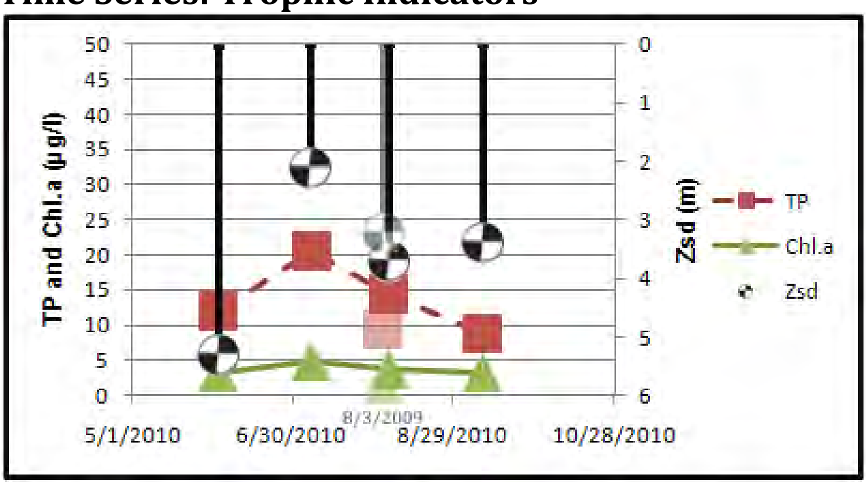








Time Series: Trophic Indicators



WQ Sampling Results

Surface Water Summer Samples

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
SECCHI	meters	5	2.1	3.54	5.3	Mesotrophic	No readings violate DOH guidance value
TSI-Secchi			49.3	43.239	36.0	Mesotrophic	No pertinent water quality standards
TP	mg/l	5	0.0087	0.01304	0.0205	Mesotrophic	20% of readings violate DOH guidelines
TSI-TP			35.3	41.2	47.7	Mesotrophic	No pertinent water quality standards
TSP	mg/l	5	0.0054	0.00608	0.0089	High % soluble Phosphorus	No pertinent water quality standards
NOx	mg/l	5	0.822	0.9778	1.1	Elevated nitrate	No readings violate DOH guidance value
NH4	mg/l	5	ND	0.0194*	0.035	Low ammonia	No readings violate DOH guidance value
TKN	mg/l	5	0.46	0.518	0.62	Intermediate organic nitrogen	No pertinent water quality standards
TN/TP	mg/l	5	181.37	269.37	340.62	Phosphorus Limited	No pertinent water quality standards
CHLA	ug/l	5	2.1	3.4	4.8	Oligotrophic	No pertinent water quality standards
TSI-CHLA			42.0	42.6	46.0	Mesotrophic	No pertinent water quality standards
Alkalinity	mg/l	5	263	274.2	288	Highly Buffered	No pertinent water quality standards
TCOLOR	ptu	5	15	16	20	Weakly Colored	No pertinent water quality standards
TOC	mg/l	5	3.9	4.36	4.8		No pertinent water quality standards
Ca	mg/l	5	386	406.8	427	Strongly Supports Zebra Mussels	No pertinent water quality standards
Fe	mg/l	5	0.0273	0.04058	0.0615		No readings violate DEC water quality standards
Mn	mg/l	5	0.0191	0.02168	0.0253		No readings violate DEC water quality standards
Mg	mg/l	5	40.8	43.24	44.5		100% of readings violate DEC water quality standards
K	mg/l	5	1.78	2.47	3.07		No pertinent water quality standards
Na	mg/l	5	66.2	68.28	71.9		100% of readings violate DEC water quality standards
Cl	mg/l	5	119	124	134	Significant road salt runoff	No readings violate DEC water quality standards
SO4	mg/l	5	773	828.6	863		100% of readings violate DEC water quality standards

This table does not include the October 27, 2010 s surface water sample
* Non-detect values were treated as half the detection limit for the purposes of calculating the average

Bottom Water Summer Samples

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
TP-bottom	mg/l	5	0.0429	0.45266	0.883	Elevated deepwater phosphorus	No pertinent water quality standards
TSP-bottom	mg/l	5	0.0065	0.4325	0.989	High % soluble phosphorus	No pertinent water quality standards
NOx-bottom	mg/l	5	ND	0.127	0.339	No evidence of DO depletion	No readings violate DEC water quality standards
NH4-bottom	mg/l	5	0.207	1.7916	3.43	Evidence of DO depletion	60% of readings violate DEC water quality standards
TKN-bottom	mg/l	5	1.21	2.418	3.72		No pertinent water quality standards
Alk-bottom	mg/l	5	296	327.2	351	Highly Buffered	No pertinent water quality standards
TCOLOR-bottom	ptu	5	35	39.04	50	Highly Colored	No pertinent water quality standards
TOC-bottom	mg/l	5	5	7.64	10.2		No pertinent water quality standards
Ca-bottom	mg/l	5	413	418.6	425		Strongly Supports Zebra Mussels
Fe-bottom	mg/l	5	0.137	0.339	0.622	Taste or odor likely	60% of readings violate DEC water quality standards
Mn-bottom	mg/l	5	0.0989	0.21842	0.332	Taste or odor likely	Reading does not violate water quality standards
Mg-bottom	mg/l	5	41.1	43.84	46.1		100% of readings violate DEC water quality standards
K-bottom	mg/l	5	1.94	2.608	3.19		No pertinent water quality standards
Na-bottom	mg/l	5	66.1	67.98	69.5		100% of readings violate DEC water quality standards
Cl-bottom	mg/l	5	88.7	120.54	133		No readings violate DEC water quality standards
SO4-bottom	mg/l	5	774	817.6	870	May have rotten egg odor	100% of readings violate DEC water quality standards
As-bottom	mg/l	3	ND	0.7	0.818		No readings violate guidance values

Late Fall Surface Sample

	UNITS	Reading	Scientific Classification	Regulatory Comments
TP	mg/l	0.0447	Eutrophic	Sample exceeds guidance value
TSI-TP		58.9	Eutrophic	No pertinent water quality standards
TSP	mg/l	0.043	High % soluble Phosphorus	No pertinent water quality standards
NOx	mg/l	0.505	Elevated nitrate	Reading does not violate guidance
NH4	mg/l	0.203	Potentially high ammonia	Reading does not violate guidance
TKN	mg/l	0.89	Elevated organic nitrogen	No pertinent water quality standards
TN/TP	mg/l	68.66	Phosphorus Limited	No pertinent water quality standards
Alkalinity	mg/l	308	Highly Buffered	No pertinent water quality standards
TCOLOR	ptu	35	Highly Colored	No pertinent water quality standards
TOC	mg/l	6.3		No pertinent water quality standards
Ca	mg/l	395	Strongly Supports Zebra Mussels	No pertinent water quality standards
Fe	mg/l	0.151		Reading does not violate water quality standards
Mn	mg/l	45.4	Taste or odor likely	Reading violates water quality standards
Mg	mg/l	3.38		Reading does not violate water quality standards
K	mg/l	0.0496		No pertinent water quality standards
Na	mg/l	69.2		Reading violates water quality standards
Cl	mg/l	123	Significant road salt runoff	Reading does not violate water quality standards
SO4	mg/l	716		Reading violates water quality standards

Lake Perception

	UNITS	N	MIN	AVG	MAX	Scientific Classification
WQ Assessment	1-5, 1 best	5	1	2.0	3	Not Quite Crystal Clear
Weed Assessment	1-5, 1 best	5	1	2.2	3	Plants Visible Below Surface
Recreational Assessment	1-5, 1 best	5	1	2.0	3	Excellent for Most Uses

References

Bové, G.E. and K.M. Stewart. 2006. *Chara*-induced chemical gradients in Blue Pond, New York, USA. Verh. Internat, Verein. Limnol. 29:1341-45.

Legend Information

General Legend Information

Surface Samples	= integrated sample collected in the first 2 meters of surface water
Bottom Samples	= grab sample collected from a depth of approximately 1 meter from the lake bottom
SECCHI	= Secchi disk water transparency or clarity - measured in meters (m)
TSI-SECCHI	= Trophic State Index calculated from Secchi, = 60 – 14.41*ln(Secchi)

Laboratory Parameters

ND	= Non-Detect, the level of the analyte in question is at or below the laboratory's detection limit
TP	= total phosphorus- milligrams per liter (mg/l) Detection limit = 0.003 mg/l; NYS Guidance Value = 0.020 mg/l
TSI-TP	= Trophic State Index calculated from TP, = 14.42*ln(TP*1000) + 4.15
TSP	= total soluble phosphorus, mg/l Detection limit = 0.003 mg/l; no NYS standard or guidance value
NOx	= nitrate + nitrite nitrogen, mg/l Detection limit = 0.01 mg/l; NYS WQ standard = 10 mg/l
NH4	= total ammonia, mg/l Detection limit = 0.01 mg/l; NYS WQ standard = 2 mg/l
TKN	= total Kjeldahl nitrogen (= organic nitrogen + ammonia), mg/l Detection limit = 0.01 mg/l; no NYS standard or guidance value
TN/TP	= Nitrogen to Phosphorus ratio (molar ratio), = (TKN + NOx)*2.2/TP > 30 suggests phosphorus limitation, < 10 suggests nitrogen limitation
CHLA	= chlorophyll *a*, micrograms per liter (µg/l) or parts per billion (ppb) Detection limit = 2 µg/l; no NYS standard or guidance value
TSI-CHLA	= Trophic State Index calculated from CHLA, = 9.81*ln(CHLA) + 30.6
ALKALINITY	= total alkalinity in mg/l as calcium carbonate Detection limit = 10 mg/l; no NYS standard or guidance value
TCOLOR	= true (filtered or centrifuged) color, platinum color units (ptu) Detection limit = 5 ptu; no NYS standard or guidance value
TOC	= total organic carbon, mg/l Detection limit = 1 mg/l; no NYS standard or guidance value
Ca	= calcium, mg/l Detection limit = 1 mg/l; no NYS standard or guidance value
Fe	= iron, mg/l Detection limit = 0.1 mg/l; NYS standard = 0.3 mg/l
Mn	= manganese, mg/l Detection limit = 0.01 mg/l; NYS standard = 0.3 mg/l
Mg	= magnesium, mg/l Detection limit = 2 mg/l; NYS standard = 35 mg/l
K	= potassium, mg/l Detection limit = 2 mg/l; no NYS standard or guidance value
Na	= sodium, mg/l Detection limit = 2 mg/l; NYS standard = 20 mg/l
Cl	= chloride, mg/l Detection limit = 2 mg/l; NYS standard = 250 mg/l
SO4	= sulfate, mg/l Detection limit = 2 mg/l; NYS standard = 250 mg/l
As	=arsenic, mg/l Detection limit = 0.236mg/l (2010) 3.2 mg/l (2009); NYS standard = 10 mg/l

Field Parameters

Depth	= water depth, meters
Temp	= water temperature, degrees Celsius

D.O.	= dissolved oxygen, in milligrams per liter (mg/l) or parts per million (ppm) NYS standard = 4 mg/l; 5 mg/l for salmonids
pH	= powers of hydrogen, standard pH units (S.U.) Detection limit = 1 S.U.; NYS standard = 6.5 and 8.5
SpCond	= specific conductance, corrected to 25ºC, micromho per centimeter (μmho/cm) Detection limit = 1 μmho/cm; no NYS standard or guidance value
ORP	= Oxygen Reduction Potential, millivolts (MV) Detection limit = -250 mV; no NYS standard or guidance value

Lake Assessment

WQ Assessment	**= water quality assessment**, 5 point scale, 1= crystal clear, 2 = not quite crystal clear, 3 = definite algae greenness, 4 = high algae levels, 5 = severely high algae levels
Weed Assessment	**= weed coverage/density assessment**, 5 point scale, 1 = no plants visible, 2 = plants below surface, 3 = plants at surface, 4 = plants dense at surface, 5 = plants cover surface
Recreational Assessment	**= swimming/aesthetic assessment**, 5 point scale; 1 = could not be nicer, 2 = excellent, 3= slightly impaired, 4 = substantially impaired, 5 = lake not usable