

LCI Lake Water Quality Summary

General Information

Lake Name:

Tomahawk Lake

Location:

Town of Blooming Grove, Orange County

Basin:

Lower Hudson River Basin

Size:

~70 hectares (~175 acres)

Lake Origins:

Dam built in 1929

Tributaries:

Cromline Creek

Watershed Area:

29 square miles

Lake Tributary to:

Cromline Creek

Water Quality Classification:

B (best intended use: contact recreation)

Sounding Depth:

4 meters (12 feet)

Sampling Coordinates:

41.4164, -74.2185

Sampling Access Point:

Tomahawk Lake Association Beach

Monitoring Program:

Lake Classification and Inventory (LCI) Survey

Sampling Date:

August 2, 2012

Samplers:

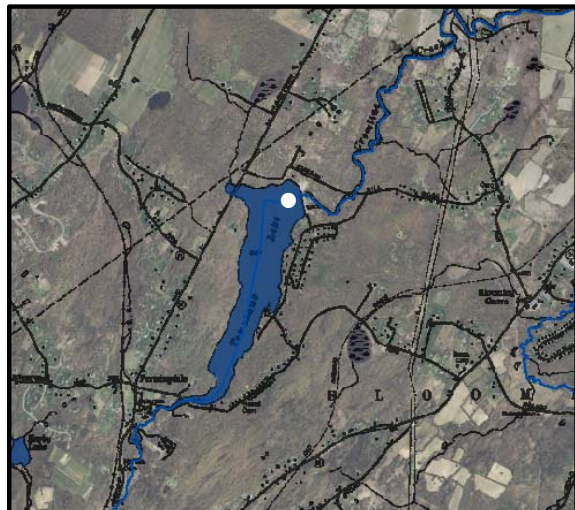
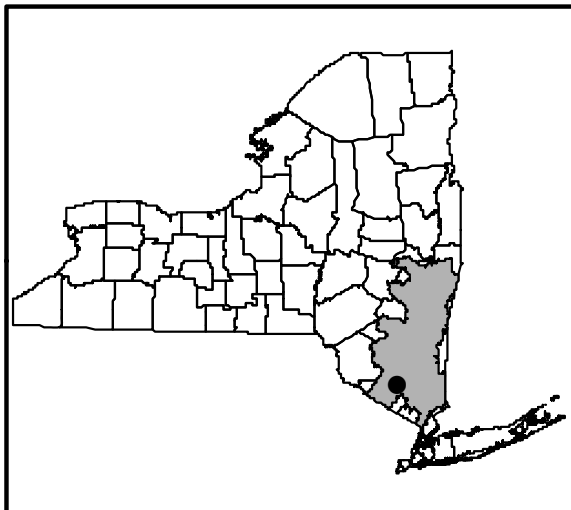
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Lake Map

(sampling location marked with a circle)



Background and Lake Assessment

Tomahawk Lake is a privately owned, moderately sized lake in the town of Blooming Grove, Orange County. The lake is owned by the local homeowners association, which has a community recreation area that includes a small beach/swimming area. Public access/use of the lake is limited to shoreline fishing from two roadways that cross over small portions of the lake.

Much of the lake's shoreline is forested with only a small number of homes along the eastern shore of the lake and the beach and recreation area at the north end of the lake. The lake's greater watershed is comprised of a mix land covers which includes forest and other natural lands (>65% by area), including Goose Pond Mountain State Park, agricultural lands (~12%), and developed areas (~12%). Much of the development is low intensity however there are a few built up areas including the Route 17 corridor, suburban developments near Walton Lake and built up areas near the town of Chester.

Tomahawk Lake was included in the 2012 screening (single samples) of lakes and ponds within the Lower Hudson River Basin. The lake was included in this monitoring effort due to a lack of water quality data in the DEC's water quality database. Due to finding elevated levels phosphorus levels and the occurrence of a blue-green algae, the lake is a candidate for additional monitoring during the summer of 2013. This additional sampling will include monthly sampling of the lake.

Based on data from the single sampling event, in early August of 2012, Tomahawk Lake can be characterized as *eutrophic*, or highly productive. The water clarity reading (TSI = 58, typical of *eutrophic* lakes) was in the expected range, given the phosphorus (TSI = 65, typical of *eutrophic* lakes). A sample for chlorophyll a was collected, but due to a shipping error this sample was not able to be analyzed. The trophic indicators show that baseline nutrient levels may support high levels of algae production in the lake. A blue-green algae bloom was observed during the sampling event. The bloom was most apparent along the shoreline near the beach but was also visible in open water areas of the lake. The lake was visited by DEC staff at the end of August, at which time the algae bloom had dissipated. Blue-green algae blooms can produce toxins that are harmful to humans and other animals. More information on blue-green algal blooms can be found on the New York State DEC's website at <http://www.dec.ny.gov/chemical/77140.html>.

Like most shallow waterbodies, Tomahawk Lake does not exhibit thermal stratification, in which depth zones (warm water on top, cold water on the bottom during the summer) are established during the summer. Dissolved oxygen levels were low at 1 meter below the surface and deeper. This reduced oxygen level is likely due to high rates of algae decomposition. pH readings were found to be above the New York State Water Quality Standard of 8.5. It is common for highly productive waterbodies to experience elevated pH readings.

Tomahawk Lake appears to be typical of alkaline, hard water, shallow lakes in the Lower Hudson River Basin. Other waterbodies, with similar water quality characteristics, often support warm water fish species. Due to the shallow nature of the lake it is unlikely that the lake supports cold water fish species.

Both water chestnut and Eurasian watermilfoil are known to occur in Tomahawk Lake. Both of these aquatic plants are considered to be invasive species as they can form dense stands and crowd and shade out native plant species. The Lake association has used aquatic herbicides in the past to control the growth of water chestnut.

Evaluation of Lake Condition Impacts to Lake Uses

Contact Recreation (Swimming)

Tomahawk Lake is classified for contact recreation, including swimming and bathing. The lake association does have a private swimming beach that members use during the summer months. Bacteria data would be needed to evaluate the safety of Tomahawk Lake for swimming; these are not collected through the LCI. Data collected through the LCI, indicate that swimming may be stressed by low water clarity and the occurrence of potentially harmful algal blooms.

Non-Contact Recreation (Boating and Fishing)

The data collected through the LCI indicated that boating and fishing may be *stressed* by the occurrence of aquatic invasive plant species.

Aquatic Life

The high pH level found in the lake may *stress* some species aquatic life in the lake. The high pH level can also increase the toxicity of other substances in the water column. The occurrence of invasive plant species may also *threaten* the native aquatic life within the lake.

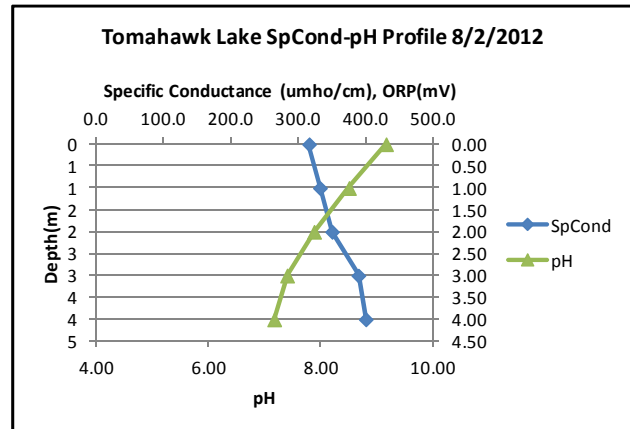
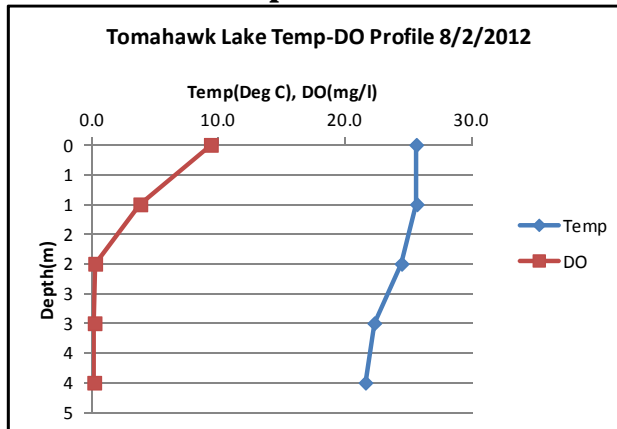
Aesthetics

The aesthetics of the lake may be *stressed* by the occurrence of algal blooms.

Additional Comments

- 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 species.
- People and pets should avoid contact with water that is discolored or has scums on the surface. Colors can include shades of green, blue-green, yellow, brown or red. If contact does occur, wash with soap and water or rinse thoroughly with clean water to remove algae. More information on harmful algal blooms is available at <http://www.dec.ny.gov/chemical/77118.html>.

Time Series: Depth Profiles



WQ Sampling Results

Surface Samples

	UNITS	Reading	Scientific Classification	Regulatory Comments
SECCHI	meters	1.09	Eutrophic	Reading violates DOH guidelines
TSI-Secchi		58.8	Eutrophic	No pertinent water quality standards
TP	mg/l	0.0721	Eutrophic	Sample exceeds guidance value
TSI-TP		65.8	Eutrophic	No pertinent water quality standards
TSP	mg/l	0.0138	Little available phosphorus	No pertinent water quality standards
NOx	mg/l	0.0353	Low nitrate	Reading does not violate guidance
NH4	mg/l	0.122	Potentially high ammonia	Reading does not violate guidance
TKN	mg/l	1.08	Elevated organic nitrogen	No pertinent water quality standards
TN/TP	mg/l	34.03	Phosphorus Limited	No pertinent water quality standards
Alkalinity	mg/l	73.7	Moderately Buffered	No pertinent water quality standards
TCOLOR	ptu	37	Highly Colored	No pertinent water quality standards
TOC	mg/l	8.1		No pertinent water quality standards
Ca	mg/l	27.9	Minimally Supports Zebra Mussels	No pertinent water quality standards
Fe	mg/l	0.245		Reading does not violate water quality standards
Mn	mg/l	0.097		Reading does not violate water quality standards
Mg	mg/l	5.96		Reading does not violate water quality standards
K	mg/l	1.53		No pertinent water quality standards
Na	mg/l	30.9		Reading violates water quality guidance value
Cl	mg/l	52.6	Significant road salt runoff	Reading does not violate water quality standards
SO4	mg/l	10.6		Reading does not violate water quality standards
Si	mg/l	5.59		No pertinent water quality standards

Lake Perception

	UNITS	Reading	Scientific Classification	Regulatory Comments
WQ Assessment	1-5, 1 best	4	High Algae Levels	No pertinent water quality standards
Weed Assessment	1-5, 1 best	2	Plants Visible Below Surface	No pertinent water quality standards
Recreational Assessment	1-5, 1 best	4	Substantially Impaired	No pertinent water quality standards

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, = $60 - 14.41 * \ln(\text{Secchi})$

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, = $14.42 * \ln(\text{TP} * 1000) + 4.15$
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), = $(\text{TKN} + \text{NOx}) * 2.2 / \text{TP}$ > 30 suggests phosphorus limitation, < 10 suggests nitrogen limitation
CHLA	= chlorophyll <i>a</i> , micrograms per liter ($\mu\text{g/l}$) or parts per billion (ppb) Detection limit = 2 $\mu\text{g/l}$; no NYS standard or guidance value
TSI-CHLA	= Trophic State Index calculated from CHLA, = $9.81 * \ln(\text{CHLA}) + 30.6$
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 = 1.0 mg/l
Mn	= manganese, mg/l

Mg	Detection limit = 0.01 mg/l; NYS standard = 0.3 mg/l = magnesium, mg/l
K	Detection limit = 2 mg/l; NYS standard = 35 mg/l = potassium, mg/l
Na	Detection limit = 2 mg/l; no NYS standard or guidance value = sodium, mg/l
Cl	Detection limit = 2 mg/l; NYS standard = 250 mg/l = chloride, mg/l
SO4	Detection limit = 2 mg/l; NYS standard = 250 mg/l = sulfate, mg/l
Si	Detection limit = 0.01mg/l; no NYS standard or guidance value = dissolved silica, 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 25°C, 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