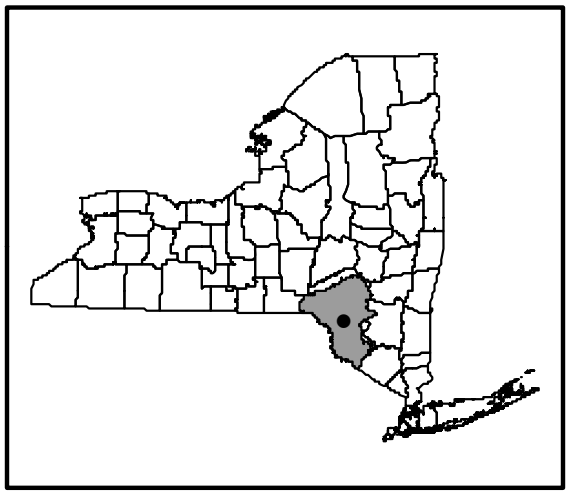
LCI Lake Water Quality Summary

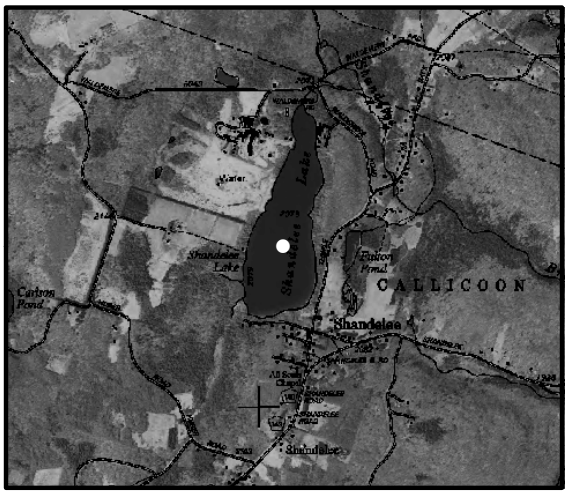
General Information

Lake Name:	**Shandelee Lake**
Location:	Town of Callicoon, Sullivan County, NY
Basin:	Delaware River Basin
Size:	33.7 hectares (83.2 acres)
Lake Origins:	natural
Major Tributaries:	no known inlet
Lake Tributary to?:	Shandelee Brook
Water Quality Classification:	B (best intended use: primary contact recreation)
Sounding Depth:	5.8 meters (19 feet)
Sampling Coordinates:	Latitude: 41.88349, Longitude: -74.87309
Sampling Access Point:	private land (Elizabeth O'Leary)
Monitoring Program:	Lake Classification and Inventory (LCI) Survey
Sampling Date:	July 28, 2009
Samplers:	Scott Kishbaugh, NYSDEC Division of Water, Albany Dan Hayes, NYSDEC Division of Water, Albany
Contact Information:	Scott Kishbaugh, NYSDEC Division of Water sakishba@gw.dec.state.ny.us; 518-402-8282

Lake Map

(sampling location marked with a circle)





Background and Lake Assessment

Shandelee Lake is an approximately 85 acre lake in northern Sullivan County. There are a handful of homes and inns along the north eastern and southern shoreline of the lake and a large facility that was at one time was operated by a religious meditation organization. The remaining near shore land is forested. The lake has a relatively small watershed with no significant inlets; the majority of the watershed is forested with some agricultural land and low density residential housing. The lake is currently used by lake shore residents and guest to the lake shore inns for boating and fishing, although some lake residents may also use the lake for swimming.

Shandelee Lake was included in the NYSDEC Division of Water's 2009 Lake Classification Inventory (LCI) survey in the Delaware River Basin. Inclusion in the LCI's screening year (single sample) was based on a lack of water quality information from the lake in the Division of Water's database. One of the private landowners reports that in the 1970's legal action was taken against the large religious facility regarding pollution of the lake. The specifics regarding this legal case and any remediation action that came from it were not able to be found. Due to a lack of perceived water quality related impairments, the lake is not a candidate for additional monitoring during the summer of 2010.

Shandelee Lake can generally be characterized as *mesoeutrophic*, or moderately to highly productive. The water clarity reading (TSI = 48, typical of *mesoeutrophic* lakes) was within the expected range given the phosphorus reading (TSI = 45, typical of *mesotrophic* lakes), and given the chlorophyll *a* reading (TSI = 50, typical of *mesoeutrophic* lakes). These data suggest that baseline nutrient levels do not support persistent algae blooms, but there may be slightly elevated algae levels in the lake during the summer.

The lake water appeared to be a light tan or tea colored which occurs naturally due to weak organic acids (tannins) found in the watershed. This tannic color was very common among other lakes sampled in the region. *Nuphar sp.* (yellow water lily) and *Nitella sp.* (stonewort) were both observed growing in the lake. Both are native rooted aquatic plant species that were found at many other lakes in sampled in the Delaware River Basin. In addition benthic algae and aquatic moss were also observed to be growing on the lake bottom. Aquatic plants were generally not observed growing near the lake surface, notwithstanding some patches of water lilies. No exotic invasive species were found; however, a more thorough plant specific survey would need to be conducted to completely rule out their occurrence.

Shandelee Lake exhibits thermal stratification, in which depth zones (warm water on top, cold water on the bottom during the summer) are established, as in most NYS lakes great than six meters in depth. The thermocline in the lake was in the three to four meter depth range. The entire hypolimnion (bottom waters) were anoxic (devoid of oxygen) at depths below four meters. However, the deep water nitrate and ammonia levels were low, which may indicate that anoxic conditions are not persistent in the lake. pH readings indicate acidic waters and conductivity readings indicate soft water. The pH reading at the surface was at the state's lower water quality standard; low pH levels were common among the lakes sampled in the northern part of Sullivan County. Soft water was also common throughout the Delaware River Basin and is often associated with slightly depressed pH.

The lake appears to be typical of soft water, weakly colored, acidic lakes. Other lakes with similar water quality characteristics often support warmwater fisheries, although fisheries habitat cannot be fully evaluated through this monitoring program. Coldwater fisheries may not be supported, given the finding of anoxic bottom waters. It is not known if coldwater fish have historically been supported in the lake. Chloride and other ion levels were low, indicating little to no impacts from road salting and/or storm water runoff from developed areas. This is common among lakes in highly forested watersheds. None of the other parameters evaluated through the LCI indicated any water quality problems.

Evaluation of Lake Condition Impacts to Lake Uses

Potable Water (Drinking Water)

Shandelee Lake is not classified for use as a potable water supply. LCI data are not sufficient to evaluate potable water use. All of the parameters evaluated through the LCI fell within the New York State Health's Department's guidelines for potable water use, but bacteria and other water quality monitoring would be needed to evaluate the safety and quality of the lake as a potable water supply.

Contact Recreation (Swimming)

Shandelee Lake is classified for contact recreation-swimming and bathing. It is not known if lake residents currently use the lake for this purpose. Bacteria data are needed to evaluate the safety of the lake for swimming- these data are not collected through the LCI. The data collected through the LCI do not indicate any issues that would prevent the lake from being used for swimming. The water clarity reading was well above the Health Departments guidance value of 1.2 meters for the safety of swimmers.

Non-Contact Recreation (Boating and Fishing)

Boating and fishing are presently supported on the lake. There were no water quality indications that would suggest stressors to either of these uses.

Aquatic Life

The anoxic conditions observed below four meters may stress some aquatic life susceptible to high summer temperatures. Additional biological studies would be needed to fully evaluate stressors to aquatic life.

Aesthetics

There were no water quality indicators that would impact the aesthetics of the lake.

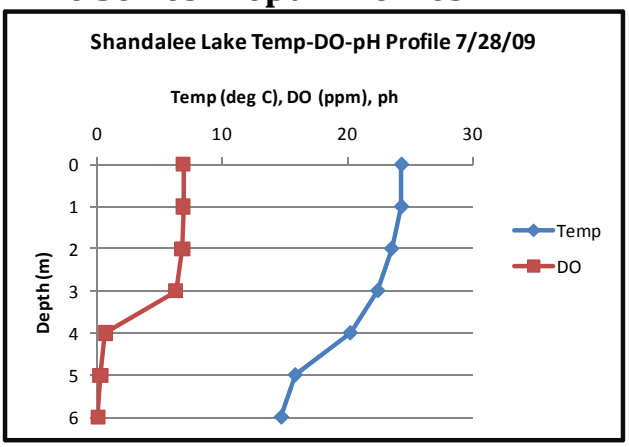
Additional Comments

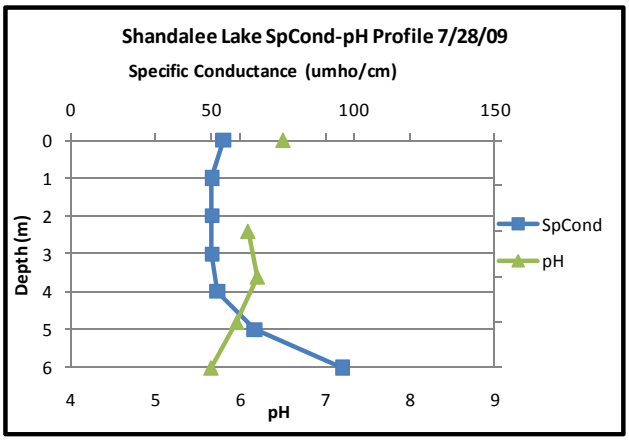
- Periodic surveillance for invasive exotic plant species may help to prevent the establishment and spread of any new invaders, given the escalating problems with exotic aquatic weeds.

Aquatic Plant IDs

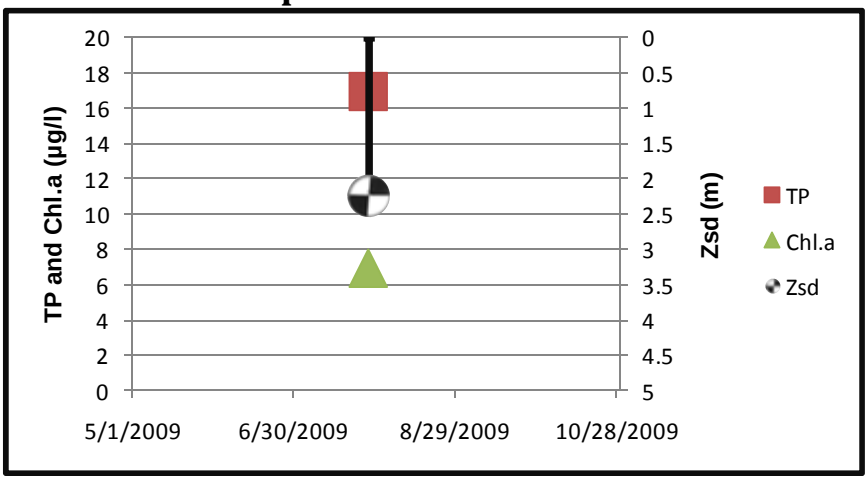
Exotic Plants:	None observed
Native Plants:	*Nuphar sp.* (yellow water lily)
	Nitella sp. (stonewort)
	Unidentified benthic algae
	Unidentified aquatic moss

Time Series: Depth Profiles





Time Series: Trophic Indicators



WQ Sampling Results

Surface Samples

	UNITS	Reading	Scientific Classification	Regulatory Comments
SECCHI	meters	2.25	Mesotrophic	Readings does not violate DOH guidance value
TSI-Secchi		48.3	Mesotrophic	No pertinent water quality standards
TP	mg/l	0.0169	Mesotrophic	Readings does not violate DEC guidance values
TSI-TP		44.9	Mesotrophic	No pertinent water quality standards
TSP	mg/l	0.0101	High % soluble Phosphorus	No pertinent water quality standards
NOx	mg/l	0.0023	Low nitrate	Reading does not violate guidance
NH4	mg/l	0.02	Low ammonia	Reading does not violate guidance
TKN	mg/l	0.33	Low organic nitrogen	No pertinent water quality standards
TN/TP	mg/l	43.26	Phosphorus Limited	No pertinent water quality standards
CHLA	ug/l	6.9	Mesotrophic	No pertinent water quality standards
TSI-CHLA		49.5	Mesotrophic	No pertinent water quality standards
Alkalinity	mg/l	3.4	Poorly Buffered	No pertinent water quality standards
TCOLOR	ptu	20	Weakly Colored	No pertinent water quality standards
TOC	mg/l	5.5		No pertinent water quality standards
Ca	mg/l	3.59	Does Not Support Zebra Mussels	No pertinent water quality standards
Fe	mg/l	0.0873		Reading does not violate water quality standards
Mn	mg/l	0.0367		Reading does not violate water quality standards
Mg	mg/l	0.527		Reading does not violate water quality standards
K	mg/l	0.337		No pertinent water quality standards
Na	mg/l	4.98		Reading does not violate water quality standards
Cl	mg/l	9.3	Minor road salt runoff	Reading does not violate water quality standards
SO4	mg/l	4.3		Reading does not violate water quality standards

Bottom Samples

	UNITS	Reading	Scientific Classification	Regulatory Comments
TP-bottom	mg/l	0.0194		No pertinent water quality standards
TSP-bottom	mg/l	0.0095	High % soluble phosphorus	No pertinent water quality standards
NOx-bottom	mg/l	0.0025	No evidence of DO depletion	Reading does not violate water quality standards
NH4-bottom	mg/l	0.024	No evidence of DO depletion	Reading does not violate water quality standards
TKN-bottom	mg/l	0.32		No pertinent water quality standards
Alk-bottom	mg/l	2.9	Poorly Buffered	No pertinent water quality standards
TCOLOR-bottom	ptu	20	Weakly Colored	No pertinent water quality standards
TOC-bottom	mg/l	5.7		No pertinent water quality standards
Ca-bottom	mg/l	3.79	Does Not Support Zebra Mussels	No pertinent water quality standards
Fe-bottom	mg/l	0.0943		Reading does not violate water quality standards

Bottom Samples (continued)

Mn-bottom	mg/l	0.0401		Reading does not violate water quality standards
Mg-bottom	mg/l	0.567		Reading does not violate water quality standards
K-bottom	mg/l	0.39		
Na-bottom	mg/l	5.21		Reading does not violate water quality standards
Cl-bottom	mg/l	9.3		Reading does not violate water quality standards
SO4-bottom	mg/l	4.4		Reading does not violate 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(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

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