LCI Lake Water Quality Summary

General Information

Lake Name: Foster Lake

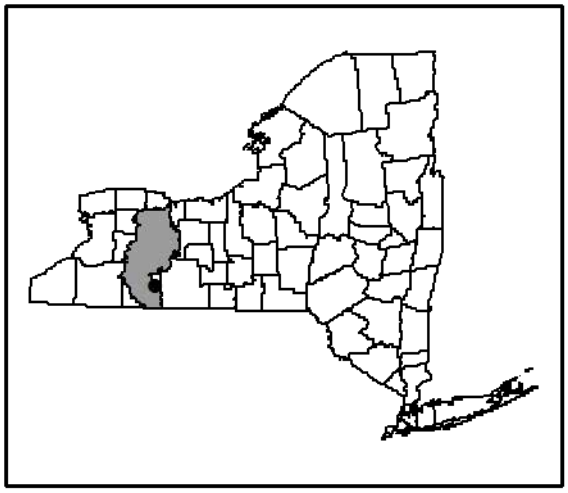
Location: Town of Alfred. Allegany County, NY
Basin: Genesee River Basin
Size: 13.0 hectares (= 32.1 acres)
Lake Origins: man-made
Major Tributaries: none
Lake Tributary to: Vandermark Creek via a minor unnamed tributary
Water Quality Classification: C (best intended use: secondary contact recreation)

Sounding Depth: 4.3 meters (14 feet)
Sampling Coordinates: Latitude: 42.23462, Longitude: -77.82420
Sampling Access Point: Beach operated by Alfred University

Monitoring Program: Lake Classification and Inventory (LCI) Survey
Sampling Date: 8/5/2009, 6/2/2010, 7/6/2010, 8/3/2010, &9/8/2010
Samplers: David Newman, Scott Kishbaugh, Alene Onion, Lorraine Holdridge, & Erik Posner, 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

Foster Lake is a man-made lake that was acquired by Alfred University in 2002. The lake and surrounding land is managed by the university. Currently, students and community members use the lake for swimming from a small beach, as well as boating and fishing. There are also wooded trails and several campsites surrounding the lake. The lake's watershed is almost entirely forested; Alfred University's website indicates that the area around the lake was reforested in the 1950's. Over the last several years bacteria levels in the water column have forced the university to close the lake for swimming during certain portions of the summer.

Foster Lake was screened (single sample) through the NYSDEC Division of Water's Lake Classification and Inventory (LCI) program in the summer of 2009, due to a lack of water quality data in the Division of Water's database. This survey found slightly elevated phosphorus and chlorophyll *a* readings. Due to these findings, Foster Lake was included in the intensive sampling (monthly) of the lakes in the Genesee River Basin during the summer of 2010.

Foster Lake can be characterized as *eutrophic*, or highly productive. The average water clarity reading (TSI = 52, typical of *eutrophic* lakes) was in the expected range given the average total phosphorus reading (TSI = 50, typical of *mesoeutrophic* lakes) but higher than expected given the typical chlorophyll *a* reading (TSI = 61, typical of *eutrophic* lakes). These data indicate that there tends to be slightly elevated levels of phosphorus and chlorophyll *a* (algae) in the lake during the summer months. These elevated levels are leading to reduced water clarity.

During all sampling events the lake was observed to have a slight tea color with hints of yellow and green. The yellow/green is due to elevated chlorophyll *a* (algae), while the tea color is due to weak organic acids (tannic acids) from the watershed soils. Six native and one exotic aquatic plants species were observed to be growing in the lake. The native species included: *Ceratophyllum demersum* (coontail), *Najas flexilis* (slender naiad), *Potamogeton epihydrus* (ribbonleaf pondweed), *Potamogeton zosteriformis* (flatstem pondweed), *Sagittaria sp.* (arrowhead), and *Sparganium sp.* (burr reed). Of these, coontail, slender naiad and the two pondweeds are all submergent species, and arrowhead and burr reed are emergent species. The exotic species *Najas minor* (brittle naiad) was also found to be occurring in the lake (see fact sheet below). None of the above plants were found to be growing at levels that would impact recreational uses of the lake.

Foster Lake exhibited weak thermal stratification, in which depth zones (warm water on top, cold water on the bottom during the summer) are established. Stratification is commonly seen in New York State lakes that are greater than six meters in depth, but does sometimes occur in shallower lakes. An Alfred University professor reports that the lake does stratify in the winter and turn over in the spring. The thermocline in Foster Lake was found between three and four meters during all sampling events except for during the September 2010 sampling event. Dissolved oxygen levels tended to drop to levels that would not support aquatic life in the bottom meter of lake depth. pH levels indicate neutral to alkaline waters, with the pH readings decreasing with depth. Conductivity readings indicate soft water, typical of lakes in forested watersheds.

The water quality characteristics indicate that Foster Lake may support warmwater fisheries. Coldwater fisheries are unlikely to be supported due to the lack of cold water refugia necessary

to protect any salmonids or aquatic life susceptible to high summer temperatures. However, fisheries habitat cannot be fully evaluated though this monitoring program.

Phosphorus levels were found to be elevated during most of the sampling events with low nitrate and ammonia levels. These data indicate that primary production is limited by phosphorus, as in most New York state lakes. Alkalinity was low, indicating that the lake has a low buffering capacity to acidic inputs. Chloride and other ion levels were low, which is typical for lakes with highly forested watersheds.

Evaluation of Lake Condition Impacts to Lake Uses

Potable Water (Drinking Water)

Foster Lake is not classified for use as a potable water supply. Although the LCI data are not sufficient to evaluate potable water use, these data indicate that elevated levels of iron and manganese may *threaten* the use of the lake as a potable water supply.

Contact Recreation (Swimming)

Foster Lake is not classified for primary contact recreation- swimming and bathing being the best intended use. The New York State Water Quality Classification of *Class C* states: water quality shall be suitable for primary contact recreation, although other factors may limit the use for this purpose. The lake does currently support this use when summer conditions allow. Data collected in the past by Alfred University has indicated that at times bacteria levels are above the state water quality standards to protect the safety of swimmers. These findings have lead to the beach to be closed for swimming. The water clarity readings were always above the DOH guidance value of 1.2 meters to protect the safety of swimmers. However, Secchi disk transparency, chlorophyll *a*, and Secchi disk transparency readings are typical of lakes *impaired* for contact recreation. If the university wishes to continue using the lake for swimming, an investigation into the sources of the high bacteria levels may need to be undertaken. Any reduction in phosphorus inputs to the lake may help reduce algae levels and help improve water clarity.

Non-Contact Recreation (Boating and Fishing)

Foster Lake is classified for non-contact recreation. The lake does currently support this use. The recreational assessment of the lake from the lake samplers was typically cited as “excellent for most uses.”

Aquatic Life

The only indicators of stress to aquatic life found during the LCI surveys is the low levels of dissolved oxygen in the bottom meter of the water column. Depressed dissolved oxygen levels may *stress* aquatic life susceptible to high summer temperatures.

Aesthetics

These data indicate that aesthetics may occasionally be *threatened* by elevated algae levels in the lake although it is unlikely that this would detract from non-contact recreational use of the lake and the surrounding land.

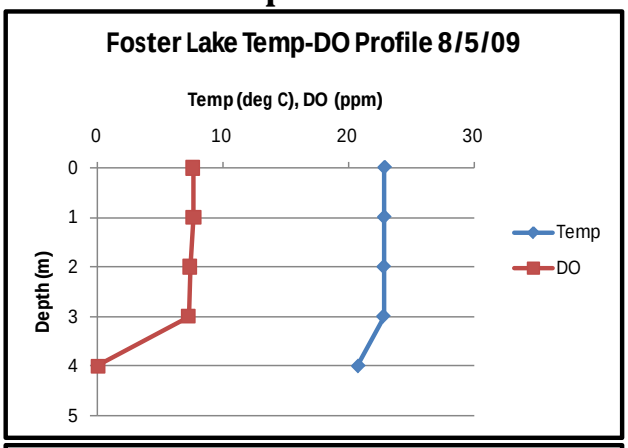
Additional Comments

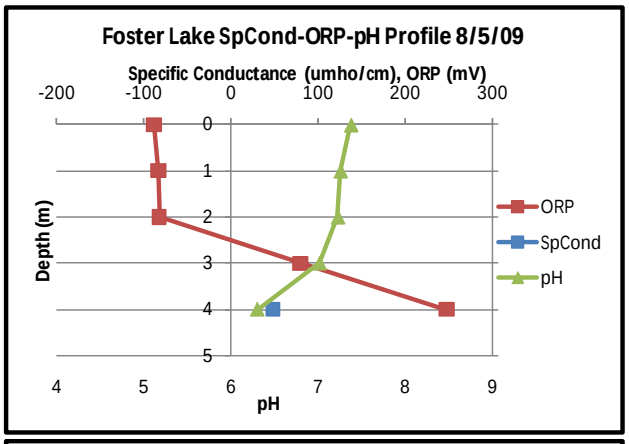
1. Periodic surveillance for invasive exotic plant species may help to prevent the establishment and spread of any new invaders, given the escalating problems with exotic aquatic weeds.
2. Algae identification would determine if the lake may suffer from harmful algal blooms (HADs) and/or the production of algal toxins. This may be conducted through future generation of the LCI.
3. Elevated bacteria levels do not appear to be the result of agricultural or stormwater runoff or failing septic systems, and the remote, heavily forested watershed should minimize bacterial inputs to the lake. This suggests wildlife bacterial sources, which could be better understood by evaluating the fecal coliform to fecal streptococci (FC:FS) ratios. Although these ratios must be applied with caution (http://www.water-research.net/Watershed/bacteria.htm), they can provide some insights as to potential sources for the bacterial contamination. Microbial source tracking may be useful in trying to identify the source of bacterial contamination- the closest laboratory conducting microbial source tracking is Penn State University- http://www.pawatercenter.psu.edu/research_projects/07_08_fame.htm.

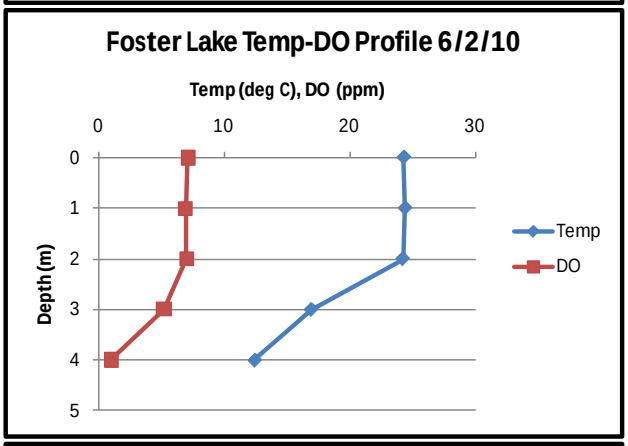
Aquatic Plant IDs

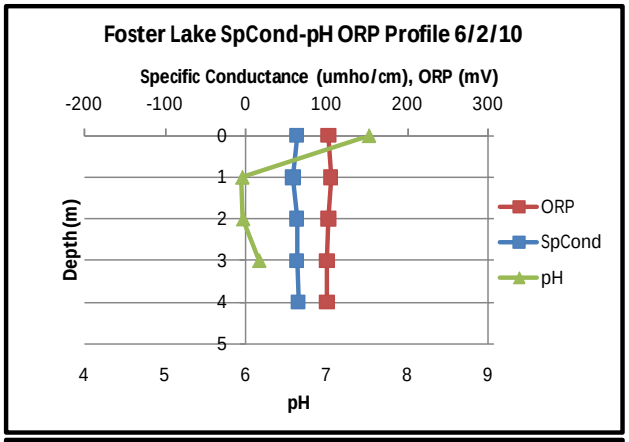
Exotic Plants:	*Najas minor* (brittle naiad)
Native Plants:	*Ceratophyllum demersum* (coontail)
	Najas flexilis (slender naiad)
	Potamogeton epihydrus (ribbonleaf pondweed)
	Potamogeton zosteriformis (flatstem pondweed)
	Sagittaria sp. (arrowhead)
	Sparganium sp. (burr read)

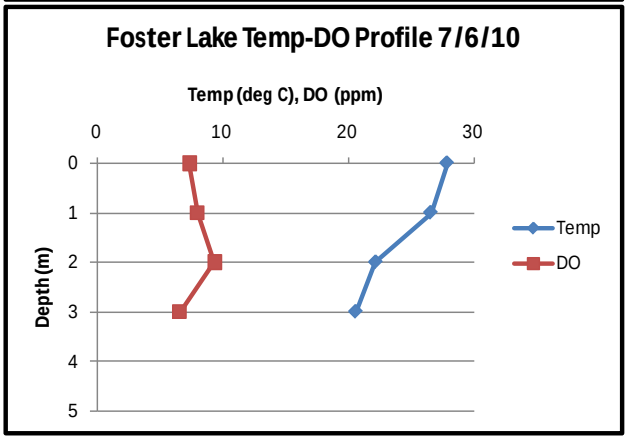
Time Series: Depth Profiles

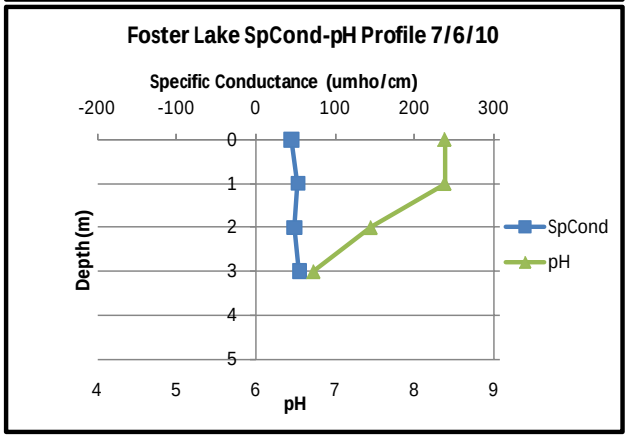


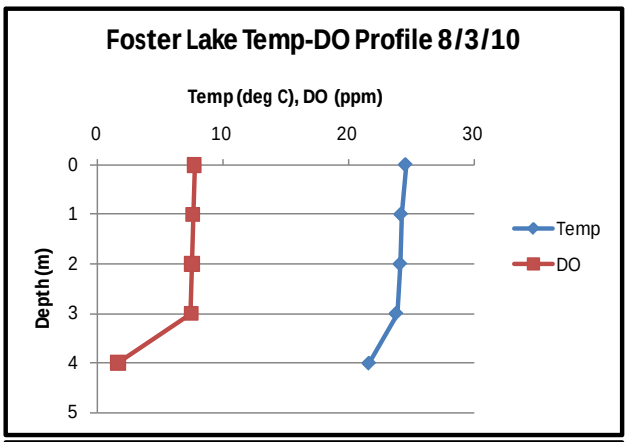


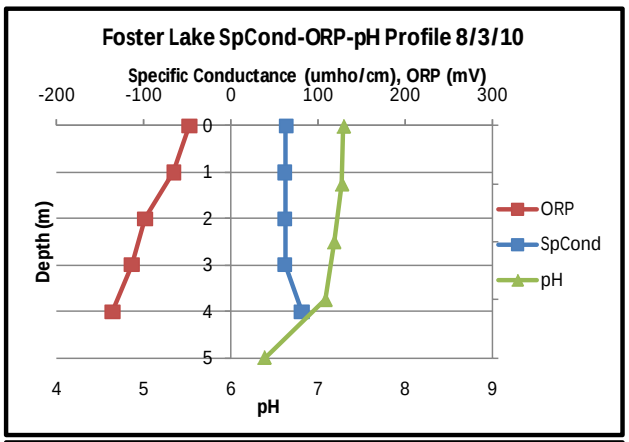


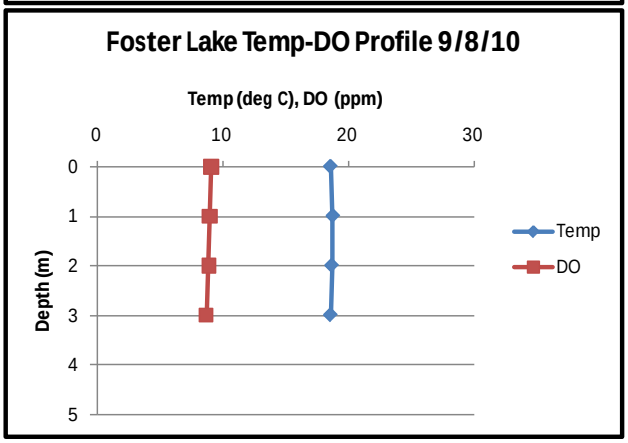


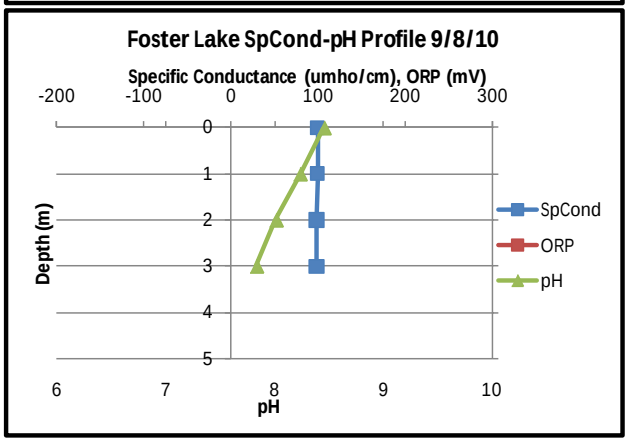




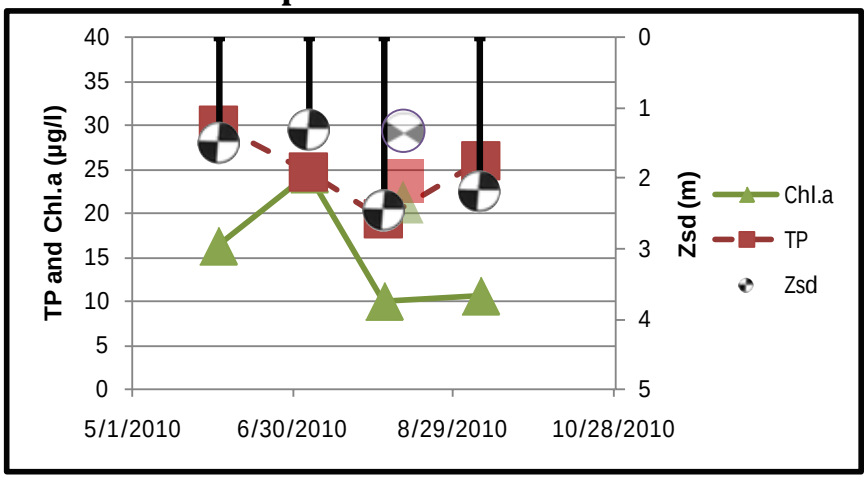








Time Series: Trophic Indicators



* transparent symbols represent the August 5, 2009 data

WQ Sampling Results

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
SECCHI	meters	5	1.3	1.75	2.45	Eutrophic	No readings violate DOH guidance value
TSI-Secchi			56.2	51.9	47.1	Eutrophic	No pertinent water quality standards
TP	mg/l	5	0.0195	0.0248	0.0301	Eutrophic	80% of readings violate water quality standards
TSI-TP			47.0	50.4	53.2	Eutrophic	No pertinent water quality standards
TSP	mg/l	5	0.0064	0.00758	0.0092	High % soluble Phosphorus	No pertinent water quality standards
NOx	mg/l	5	ND	0.00444	0.01	Low nitrate	No readings violate water quality standards
NH4	mg/l	5	ND	0.0086	0.018	Low ammonia	No readings violate water quality standards
TKN	mg/l	5	0.42	0.558	0.73	Intermediate organic nitrogen	No pertinent water quality standards
TN/TP	mg/l	5	30.97	49.01	68.59	Phosphorus Limited	No pertinent water quality standards
CHLA	ug/l	5	10.1	16.64	24.6	Eutrophic	No pertinent water quality standards
TSI-CHLA			53.3	57.60	62.0	Eutrophic	No pertinent water quality standards
Alkalinity	mg/l	5	13.8	18.82	22	Poorly Buffered	No pertinent water quality standards
TCOLOR	ptu	5	10	15	20	Weakly Colored	No pertinent water quality standards
TOC	mg/l	5	4.5	6.46	8.2		No pertinent water quality standards
Ca	mg/l	5	6.47	7.108	7.64	Does Not Support Zebra Mussels	No pertinent water quality standards
Fe	mg/l	5	0.228	0.2452	0.264		No readings violate water quality standards
Mn	mg/l	5	0.0582	0.09636	0.132		No readings violate water quality standards
Mg	mg/l	5	1.73	1.892	2.02		No readings violate water quality standards
K	mg/l	5	0.143	0.505	0.679		No pertinent water quality standards
Na	mg/l	5	1.07	1.19	1.31		No readings violate water quality standards
Cl	mg/l	5	3.5	3.6	3.7	Minor road salt runoff	No readings violate water quality standards
SO4	mg/l	5	3.4	3.98	4.7		No readings violate water quality standards

Lake Perception

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
WQ Assessment	1-5, 1 best	5	2	2.8	4	Definite Algal Greenness	No pertinent water quality standards
Weed Assessment	1-5, 1 best	5	1	1.6	3	Plants Visible Below Surface	No pertinent water quality standards
Recreational Assessment	1-5, 1 best	5	2	2.4	4	Excellent for Most Uses	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(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 = 1.0 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

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

Invasive Species Profile

SPECIES NAME: *Najas minor*

COMMON NAME: slender naiad or brittle naiad or minor naiad

ECOLOGICAL VALUE: see above. *Najas minor* is an exotic species introduced to the Hudson River area from Europe, and has little specific significance as a wildlife food source.

DISTRIBUTION IN UNITED STATES: not native- introduced in the last fifty years along the Hudson River basin, with little regional or national distribution, although in recent years it has become more established in large freshwater lakes, reservoirs, and streams in the southeastern states, the Great Lakes basin. Its range now extends from western New England west to Michigan and Indiana, and south to Florida, Mississippi, and Arkansas. It is found primarily in alkaline waters, and was introduced from Europe.

DISTRIBUTION IN NEW YORK: locally established in brackish and fresh water of river bays and small ponds along the Hudson River (north to Albany), with a few occurrences in the Great Lakes basin and Long Island.

DEGREE OF NUISANCE: while this plant generally does not become abundant to nuisance levels, since it is a non-native species, introduction into otherwise unoccupied sediment can result in prolific growth

COMMENTS: the coloration of this plant range from olive green to reddish. It reproduces by seed and fragmentation. It is characterized by a spiky or coarse (finely toothed) appearance of the leaflets, and rough texture. It is usually, but not always, also characterized by a recurviture of the leaves.

Line drawing: http://de.wikipedia.org/wiki/Bild:Najas_spp_GS253.png