Lake Katonah

Surface water quality classification: Class B

Morphology Summary:

Characteristic	Units	Value	Source
Surface area	hectares	7.8 10	NYSDEC 2007 Shapefile
Watershed area	hectares	41	EcoLogic 2008 (excl lake)
Volume	mgal	40.8	EcoLogic 2008
Elevation	m	100	EcoLogic 2008
Maximum depth	m	3.1	EcoLogic 2008
Average Depth	m	1.6	EcoLogic 2008

Lake Inlet: There were no significant inlet streams identified. Numerous natural intermittent channels and stormwater discharges are present.

Lake Outlet: Lake level is controlled by a dam at the northwest shore.

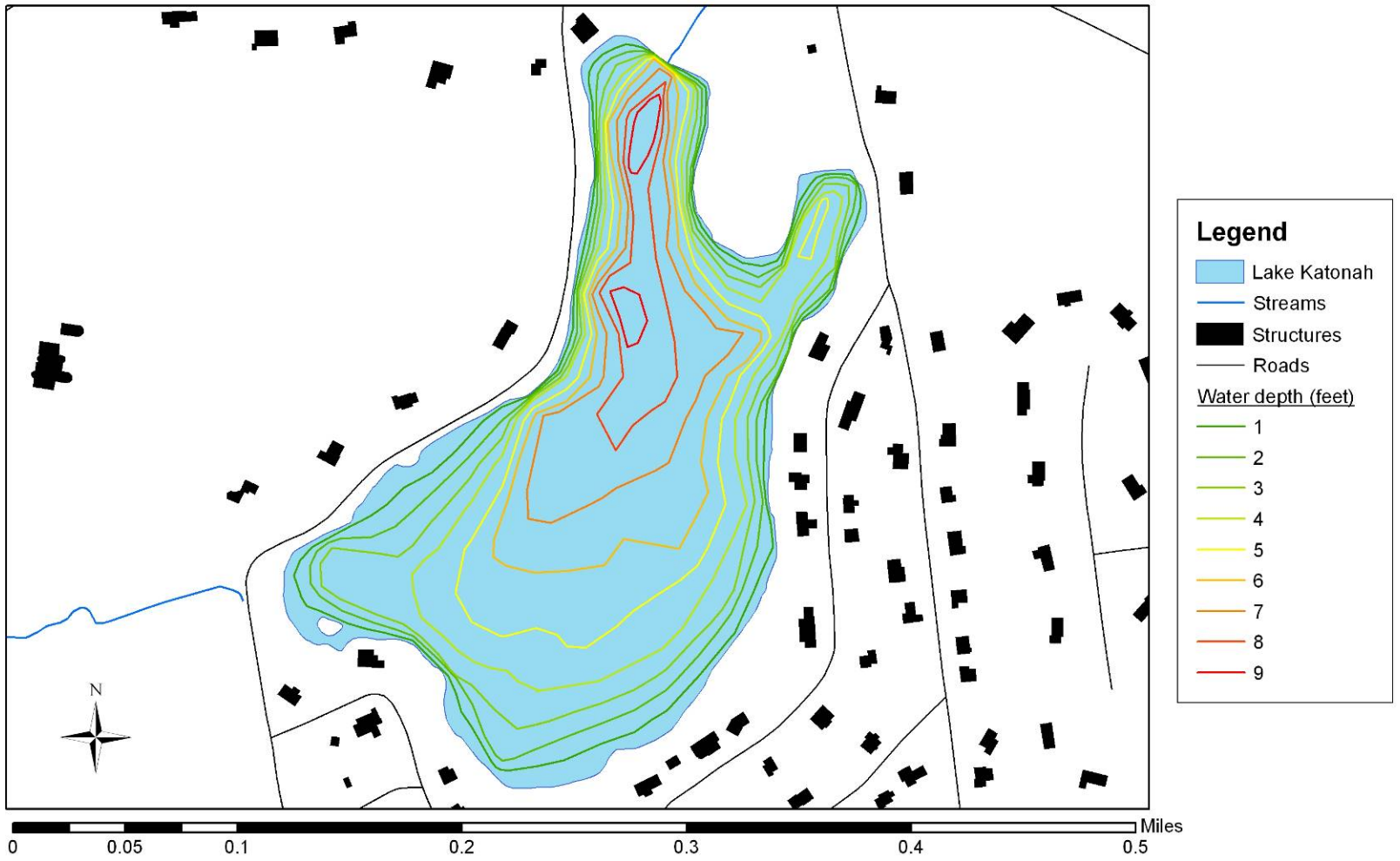
Recreational impacts: Water quality perception improves during the summer, consistent with seasonally decreasing aquatic plant coverage despite seasonally increasing lake productivity (NYSDEC 2008).

Lake Katonah has been described by the CSLAP sampling volunteers as "slightly" impaired during 38% of the CSLAP sampling sessions, and "substantially" impaired 13% of the time. Slightly impaired conditions were associated with excessive weeds during 13% of the sampling sessions and with excessive algae 38% of the time. Substantially

impaired conditions were due to excessive weeds and algae at a frequency of 13% each. (NYSDEC 2008)

Lakeshore Development: Development is predominantly residential, and is most dense to the south and east of the lake.

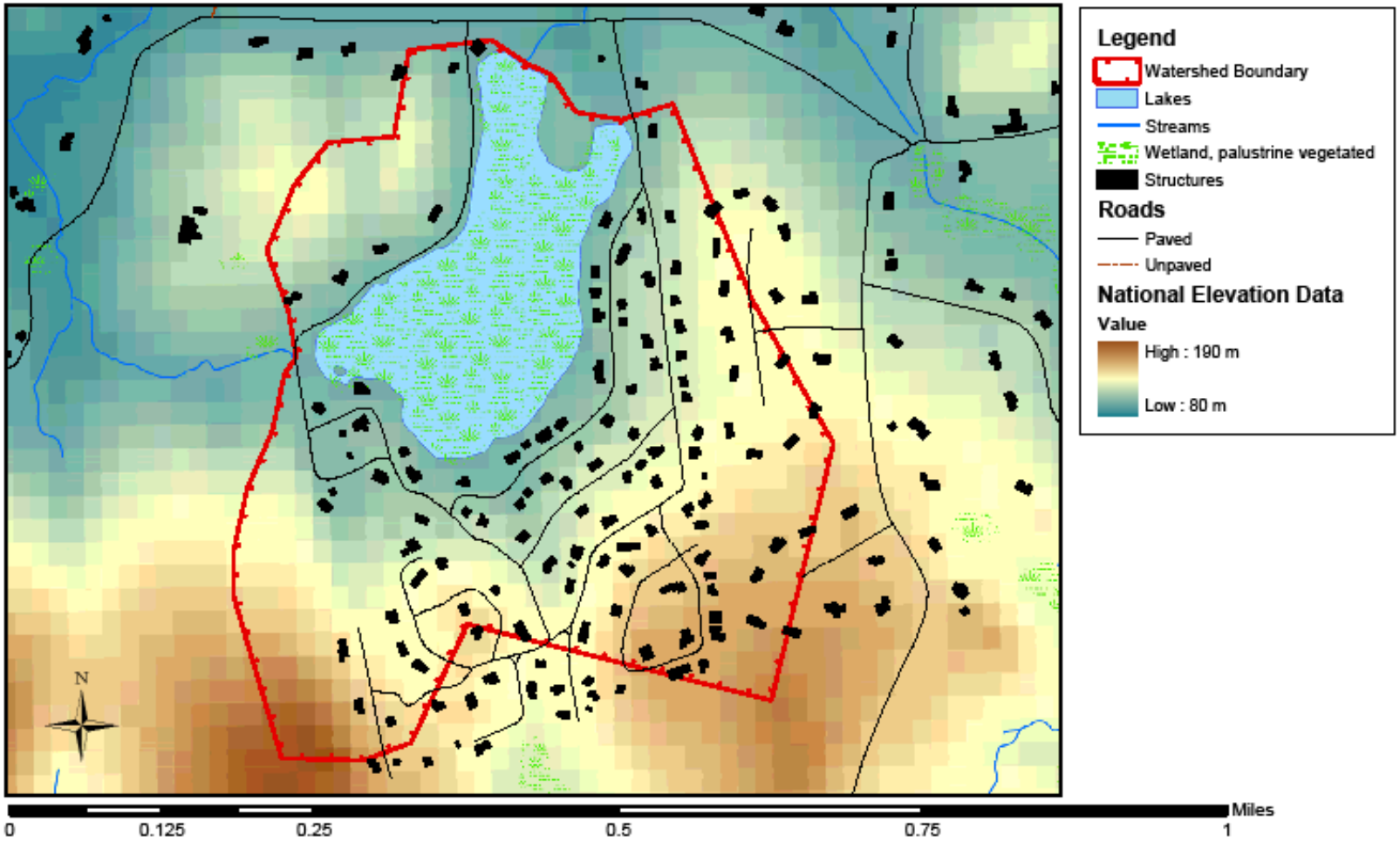
Figure 1
Lake Katonah
Bathymetry August 12, 2008



Sources:
Lakes, Streams, Roads and Structures - On-line at Westchester County web site http://giswww.westchestergov.com/. Municipal planimetric datasets were photogrammetrically derived from the county's 2004 base map project and meet National Map Accuracy Standards at 1"=100'.

Figure 2

Lake Katonah
Topographic and Human Features



Sources:
Lakes, Streams, Roads and Structures - On-line at Westchester County web site http://giswww.westchestergov.com/. Municipal planimetric datasets were photogrammetrically derived from the county's 2004 base map project and meet National Map Accuracy Standards at 1"=100'.
National Elevation Dataset - U.S. Geological Survey (USGS), EROS Data Center, 1999. On-line at http://gisdata.usgs.net/ned/. Geographic coordinate system. Horizontal datum of NAD83. Vertical datum of NAVD88.

Historical water quality data summary: Data were collected under the Citizen Statewide Lake Assessment Program (CSLAP), at depths ranging from 1.0 to 1.5 meters (upper waters only). Table A below summarizes samples collected between January and December of each year. Table B below summarizes samples collected during the summer, defined as the period between June 15 and September 15 each year.

A. Representing samples collected between January and December each year.

Parameter (units)	Time Period	Number of Samples	Minimum	Maximum	Average
Calcium (mg/l)	2006-2007	4	26.28	32.5	28.88
Chlorophyll-α (ug/l)	2006-2007	16	6.29	79.08	34.61
Color (platinum color units)	2006-2007	16	16	45	30.7
Conductivity (umhos/cm; 25°C)	2006-2007	16	335	583.8	469.5
Dissolved Nitrogen (mg/l)	2007	8	0.61	1.24	0.87
NO_3 Nitrates (mg/l)	2006-2007	14	0.0025	0.14	0.028
NH3 Nitrogen (mg/l)	2006-2007	15	0.006	0.558	0.084
Phosphorus (mg/l)	2006-2007	16	0.044	0.158	0.089
Nitrogen:Phosphorus Ratio	2007	8	7.92	20	13.47
pH (std units)	2006-2007	15	7.25	8.5	7.93
Secchi depth (m)	2006-2007	16	0.33	1.6	0.95
Temperature (°C)	2006-2007	16	17.0	28	23.7

B. Representing samples collected between June 15 and September 15 each year.

Parameter (units)	Time Period	Number of Samples	Minimum	Maximum	Average
Chlorophyll-α (ug/l)	2006-2007	11	6.29	79.08	38.18
Dissolved Nitrogen (mg/l)	2007	5	0.71	1.24	0.95
NO_3 Nitrates (mg/l)	2006-2007	9	0.0025	0.14	0.031
NH3 Nitrogen (mg/l)	2006-2007	10	0.006	0.16	0.061
Phosphorus (mg/l)	2006-2007	11	0.046	0.159	0.094
Nitrogen:Phosphorus Ratio	2007	5	9.89	20	14.04
Secchi depth (m)	2006-2007	11	0.5	1.6	0.95

EcoLogic August 2008 water quality data summary:

A. Analytical Results 08/12/2008

Parameter (units)	Surface (0 m)	Depth (2.4 m)
Secchi Transparency (m)	0.6	na
Chlorophyll-a (mg/l)	0.17	na
Alkalinity (mg/l)	60	na
Phosphorus:		
Total Phosphorus (mg/l)	0.092	0.084
Soluble Reactive Phosphorus (mg/l)	0.010[a]	0.0098[a,b]
Nitrogen:		
Nitrate/Nitrite as N (mg/l)	0.037[a]	0.036[a,c]
Total Kjeldahl Nitrogen as N (mg/l)	2.9[a]	2.1[a,b]
Total Nitrogen (mg/l)	2.9	2.1

na – not analyzed
[a]The result of the laboratory control sample was greater than the established limit.
[b]A trace amount of this analyte was found in the laboratory preparation blank.
[c]This analysis was performed beyond the holding time limit by EPA Method 353.1.

B. Field Profiles

Depth ft (m)	Temperature (°C)	pH	Conductivity (us)	DO (mg/L)	DO (% sat)
1 (0.305)	24.7	8.2	651	8.4	108
2 (0.61)	24.2		652	7.9	94.6
3 (0.915)	24.0		653	6.0	71
4 (1.22)	23.9		653	5.6	66
5 (1.525)	23.8		654	5.2	61
6 (1.83)	23.8		654	4.9	57
7 (2.135)	23.7		655	4.6	53
8 (2.44)	23.7		658	4.2	50

Sediment data summary: Composite sample collected August 12, 2008 by EcoLogic.

Parameter	Analytical Method	Result (mg/kg dry wt)
Pesticides/PCBs	EPA 8081/8082	ND
TCL Volatiles	EPA 8260B	
Acetone		0.064
Other VOCs		ND
TCL PAHs	EPA 8270	ND
RCRA Total Metals	EPA 6010	
Arsenic		5.8
Barium		26
Cadmium		0.14
Chromium		2.2*
Copper		110
Lead		8.9
Selenium		0.13
Silver		ND

Parameter	Analytical Method	Result (mg/kg dry wt)
RCRA Mercury	EPA 7471	ND
Total Organic Carbon	EPA 9060	221,000
Total Solids	SM 18-20 2540B	9.9%

ND – non-detect. Analytes reported as less than the method detection limit.
*The result of the laboratory control sample for this analyte was less than the established limit.

Sediment Contaminant Analysis: Interest has been expressed in exploring the feasibility of dredging. A composite sediment sample was collected on August 12, 2008 (EcoLogic, 2008). Results are summarized in Table C, in the context of NYSDEC Screening levels. A complete set of results is attached to the end of this report. (Attachment 2 - 2008 Water Quality and Sediment Sampling Locations and Laboratory Analysis Reports)**.** The NYSDEC screening levels are separated into three Classes: A, B, and C:

- **Class A - No Appreciable Contamination (No Toxicity to aquatic life).**
  If sediment chemistry is found to be at or below the chemical concentrations which define this class, dredging and in-water or riparian placement, at approved locations, can generally proceed.

- **Class B - Moderate Contamination (Chronic Toxicity to aquatic life).**
  Dredging and riparian placement may be conducted with several restrictions. These restrictions may be applied based upon site-specific concerns and knowledge coupled with sediment evaluation.

- **Class C - High Contamination (Acute Toxicity to aquatic life).**
  Class C dredged material is expected to be acutely toxic to aquatic biota and therefore, dredging and disposal requirements may be stringent. When the contaminant levels exceed Class C, it is the responsibility of the applicant to ensure that the dredged material is not a regulated hazardous material as defined in 6NYCRR Part 371. This TOGS does not apply to dredged materials determined to be hazardous.

Table C. Lake Katonah sediment analytical results with NYSDEC Sediment Quality Threshold Values for Dredging, Riparian or In-water Placement. Threshold values are based on known and presumed impacts on aquatic organisms/ecosystem. Results that fall into Class C (high contamination) are highlighted.

Compound	Required Method Detection Limit	Threshold Values			Katonah Results	Threshold Class
		Class A	Class B	Class C		
Metals (mg/kg dry wt) – EPA Method 6010B						
Arsenic	1.0	< 14	14 – 53	> 53	5.8	A
Cadmium	0.5	< 1.2	1.2 - 9.5	> 9.5	0.14	A
Copper*	2.5	< 33	33 – 207	> 207	110	B
Lead	5.0	< 33	33 – 166	> 166	8.9	A
Mercury[+]	0.2	< 0.17	0.17 - 1.6	> 1.6	ND	A
PAHs and Petroleum-Related Compounds (mg/kg dry wt) – EPA Methods 8020, 8021, 8260 and 8270						
Benzene	0.002	< 0.59	0.59 - 2.16	> 2.16	ND	A
Total BTEX*	0.002	< 0.96	0.96 - 5.9	> 5.9	ND	A
Total PAH[1]	0.33	< 4	4 - 35	> 35	ND	A
Pesticides (mg/kg dry wt) – EPA Methods 8081						
Sum of DDT+DDD+DDE[+]	0.029	< 0.003	0.003 - 0.03	> 0.03	ND	A
Mirex*[+]	0.189	< 0.0014	0.0014 - 0.014	> 0.014	na	--
Chlordane*[+]	0.031	< 0.003	0.003 - 0.036	> 0.036	ND	A
Dieldrin	0.019	< 0.11	0.11 -0. 48	> 0.48	ND	A
Chlorinated Hydrocarbons (mg/kg dry wt) – EPA Methods 8082 and 1613B						
PCBs (sum of aroclors)[2]	0.025	< 0.1	0.1 - 1	> 1	ND	A
2,3,7,8-TCDD*[3](sum of toxic equivalency)	0.000002	< 0.0000045	0.0000045 - 0.00005	> 0.00005	na	--

na – not analyzed; ND – not detected

[+]Threshold values lower than the Method Detection Limit are superseded by the Method Detection Limit.

* Indicates case-specific parameter. The analysis and evaluation of these case specific analytes is recommended for those waters known or suspected to have sediment contamination caused by those chemicals. These determinations are made at the discretion of Division staff.

[1]For Sum of PAH, see Appendix E of TOGS 5.1.9. For Lake Katonah, each of the 18 PAH compounds were reported as non-detect (<0.8 mg/kg).

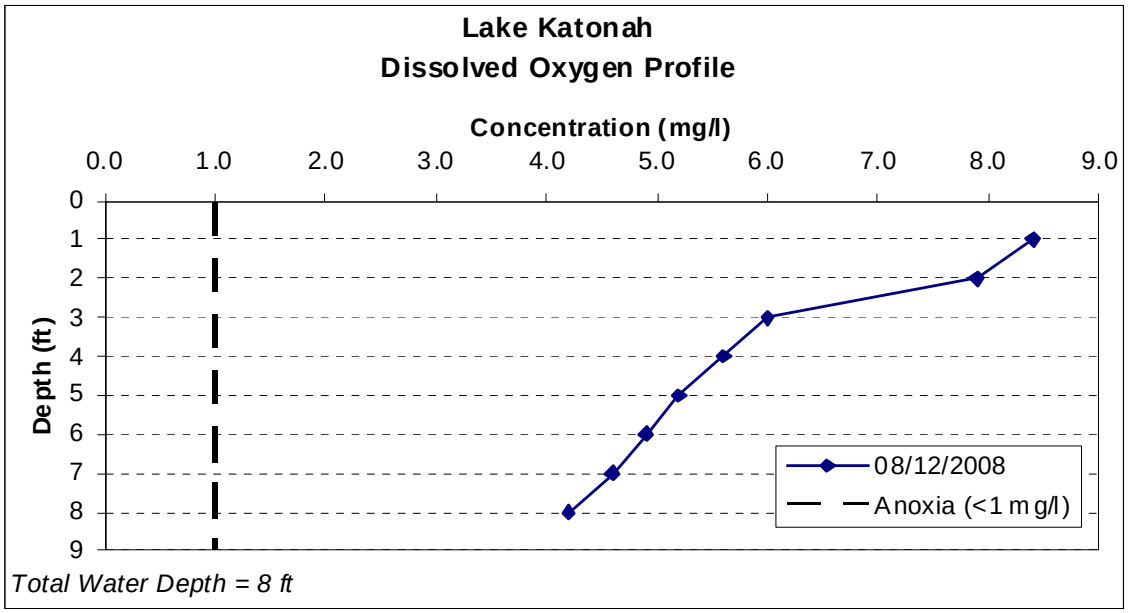
[2]For the sum of the 22 PCB congeners required by the USACE NYD or EPA Region 2, the sum must be multiplied by two to determine the total PCB concentration. On Lake Katonah, seven Aroclors were each reported as <0.2 mg/kg; this value is reported above.

[3]TEQ calculation as per the NATO - 1988 method (see Appendix D of TOGS 5.1.9).

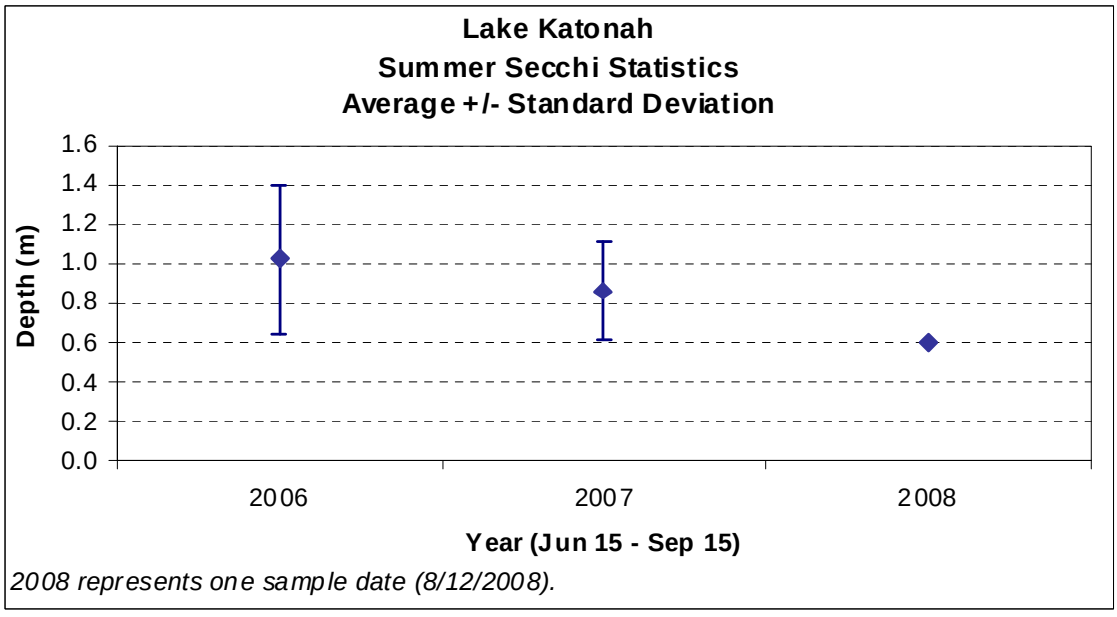
Note: The proposed list of analytes can be augmented with additional site specific parameters of concern. Any additional analytes suggested will require Division approved sediment quality threshold values for the A, B and C classifications.

Source: Table 2, NYSDEC Division of Water, Technical & Operational Guidance Series (TOGS) 5.1.9, "In-Water and Riparian Management of Sediment and Dredged Material", Nov 2004.

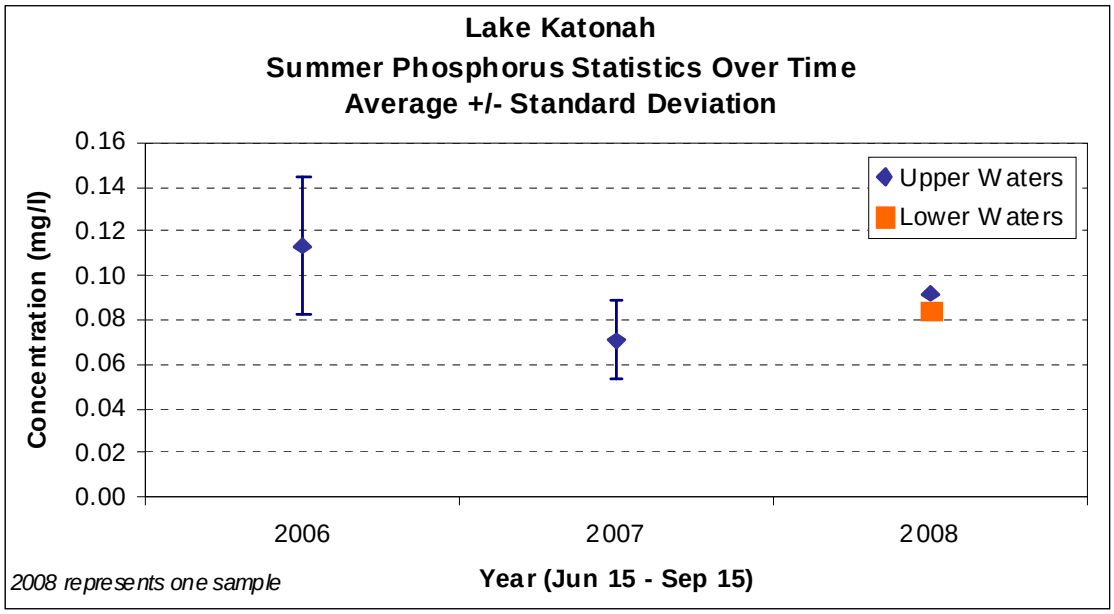
Anoxia: Based on the dissolved oxygen profile collected on August 12, 2008, oxygen levels were depleted in the lower waters, but anoxic conditions (concentrations less than 1 mg/l) were not observed in the lake.



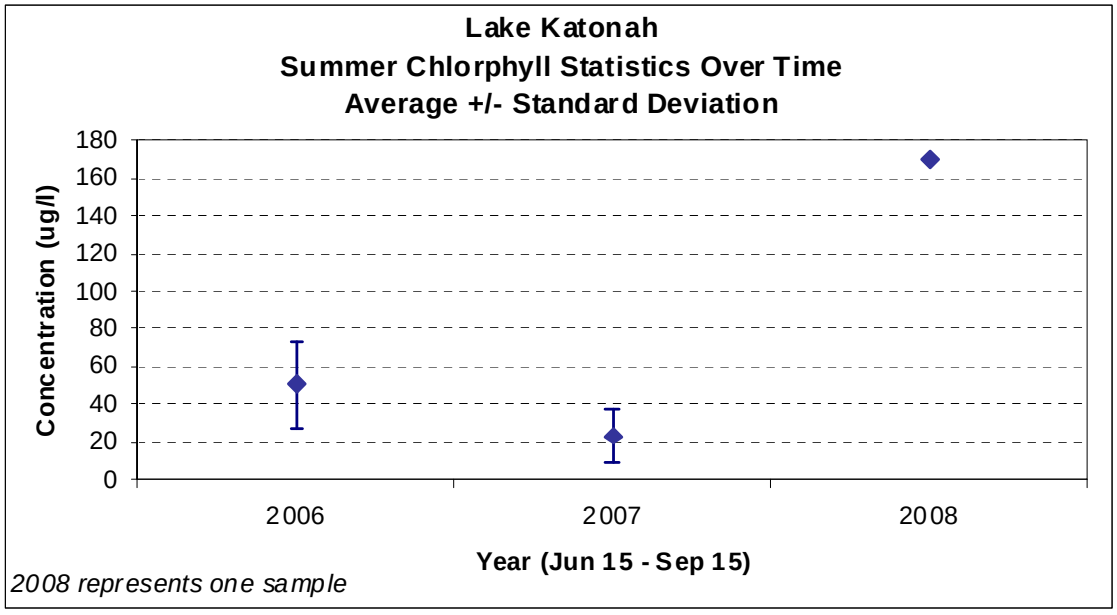
Water Clarity: There are three years of data for Secchi depth measurements.



Phosphorus Concentrations: There are three years of data for phosphorus concentrations during the summer.



Chlorophyll-α: There are three years of Chlorophyll-α data.



Trophic Status:

Parameter	Trophic State (shading indicates match to Lake)				Lake Katonah*
	Oligotrophic	Mesotrophic	Eutrophic	Hypereutrophic	
Summer average Total Phosphorus, upper waters (µg/l)	<10	10-35	35 -100	>100	94
Summer chlorophyll-a, upper waters (µg/l)	<2.5	2.5 - 8	8 - 25	>25	38
Peak chlorophyll-a (µg/l)	<8	8-25	25-75	>75	79
Summer average Secchi disk transparency, m	>6	6-3	3-1.5	<1.5	0.95
Minimum Secchi disk transparency, meters	>3	3-1.5	1.5-0.7	<0.7	0.5
Dissolved oxygen in lower waters (% saturation)	80 - 100	10-80	Less than 10	Zero	50

*Data for the period 2006-2007, except for dissolved oxygen which EcoLogic collected at a depth of 8 feet on 08/12/2008. Summer defined as period June 15 to September 15.

Aquatic Habitat:

- An aquatic macrophyte survey was conducted by Ecologic in August 2008 and found only sporadic sparse macrophyte growth around the lake. Large beds of curly pondweed are apparently present in spring but these are treated annually and were not present during the survey. Habitat for the lakes fish community appears largely limited to woody debris near the shoreline after treatment.

List of Aquatic Plants identified in 2008:

Scientific Name	Common Name
Chara sp.	Muskgrass
Lemna minor	Common duckweed
Najas flexilis	Slender naiad

Scientific Name	Common Name
Potamogeton crispus	Curly pondweed
Zannichellia palustris	Horned pondweed

Invasive Species: Early Detection List for eight regions in New York State, published by the Invasive Species Plant Council of New York State. Obtained on-line (11/29/07). Lower Hudson region list:

Scientific Name	Common Name
Heracleum mantegazzianum	Giant Hogweed
Wisteria floribunda	Japanese Wisteria, Wisteria
Digitalis grandiflora (D. pupurea)	Yellow Foxglove, Foxglove
Geranium thunbergii	Thunberg's Geranium
Miscanthus sinensis	Chinese Silver Grass, Eulalia
Myriophyllum aquaticum	Parrot-feather, Waterfeather, Brazilian Watermilfoil.
Pinus thunbergiana (P. thunbergii)	Japanese Black Pine

Scientific Name	Common Name
Prunus padus	European Bird Cherry
Veronica beccabunga	European Speedwell

Endangered Species:

- US Fish and Wildlife Service

Scientific Name	Common Name	Federal Status
Reptiles		
Clemmys muhlenbergii	Bog Turtle	Threatened, Westchester Co.
Birds		
Haliaeefus leucocephalus	Bald Eagle	Threatened, entire state
Mammals		
Myotis sodalist	Indiana Bat	Endangered, entire state
Felix concolor couguar	Eastern Cougar	Endangered, entire state (probably extinct)
Plants		
Isotria medeoloides	Small Whorled Pogonia	Threatened, entire state
Platanthera leucophea	Eastern Prairie Orchid	Threatened, not relocated in NY
Scirpus ancistrochaetus	Northeastern Bulrush	Endangered, not relocated in NY

- New York Natural Heritage Program – Town of Lewisboro

Scientific Name	Common Name	NY Legal Status
Reptiles		
Glyptemys muhlenbergii (formerly Clemmys muhlenbergii)	Bog Turtle	Endangered
Birds		
Oporornis formosus	Kentucky Warbler	Protected
Butterflies and Skippers		
Satyrium favonius ontario	Northern Oak Hairstreak	Unlisted
Dragonflies and Damselflies		
Enallagma laterale	New England Bluet	Unlisted
Plants		
Asclepias purpurascens	Purple Milkweed	Unlisted
Eleocharis quadrangulata	Angled Spikerush	Endangered

Water Balance:

USGS Mean Annual (inches/year)		Volume (acre-ft/year)
Precipitation (P)	48	99
Evaporation (ET)	22	45
Runoff (R)	26	221

Water Budget:	
Inflow to Lake [R+(P-ET)]	90 mgal/year
Lake Volume	41 mgal
Flushing Rate	2.2 times/year
Residence Time	0.46 year

Phosphorus Budget:

(A) Watershed Land Cover: 2001 National Land Cover Data Set (MRLC). Includes phosphorus export coefficient (kg/ha/year) and estimated phosphorus export.

Description	Watershed (acres)	Cover (%)	Phosphorus Export Coeff	Estim P Export kg/year	Estim P Export Percent
Open water (all)	20	16	0.30	2.5	27
Developed, open space	61	48	0.20	4.9	55
Deciduous forest	39	31	0.07	1.1	12
Evergreen forest	6.9	5.4	0.20	0.56	6.2
Total Acres	**127**	**100**		**9.1**	**100**

(B) Septic: Assumed that communities around the lake are on septic systems.

Estimated population on septic by soil suitability class with US 2000 Census household size for 100-meter buffer of surface water.

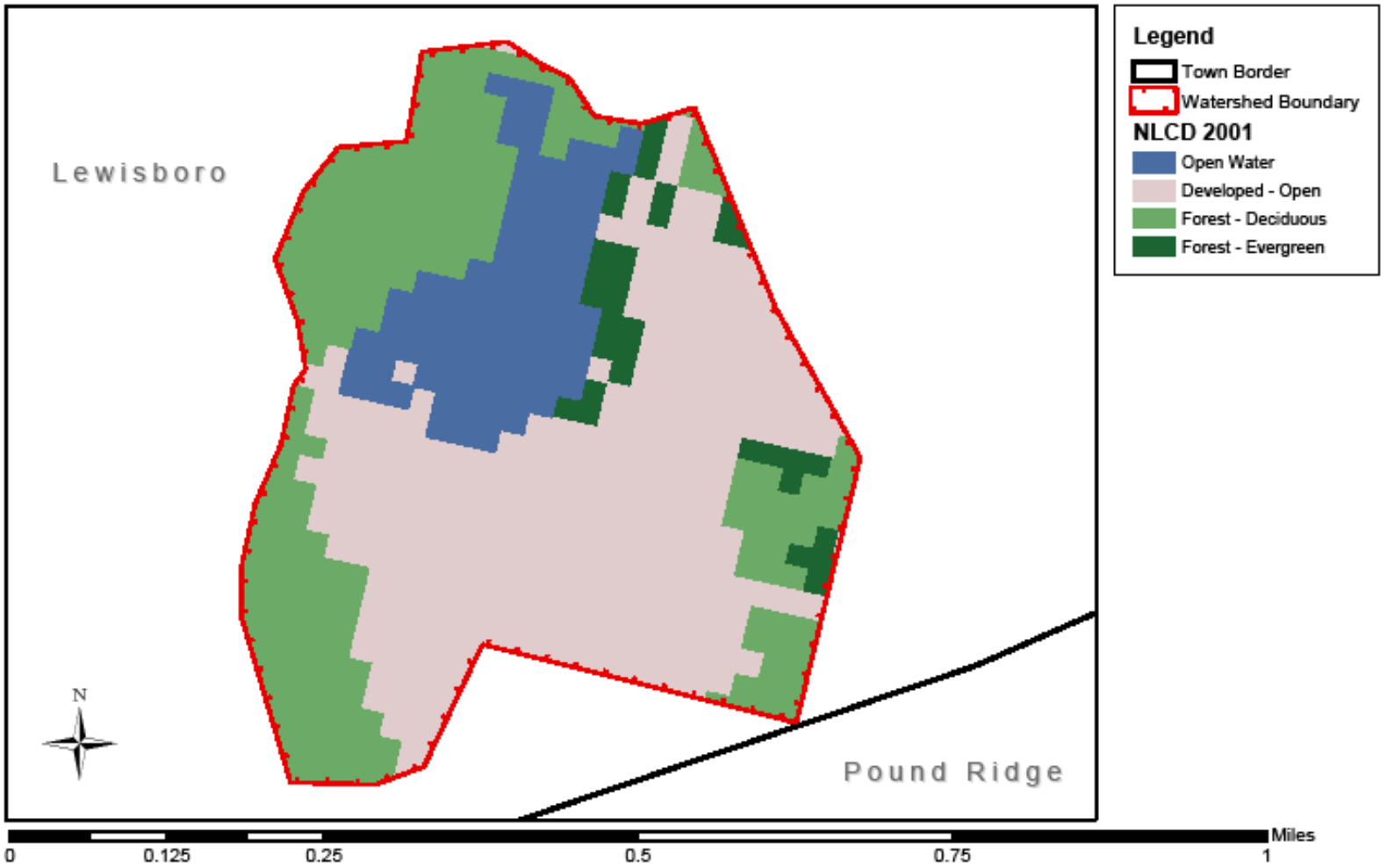
Class	N Structures	Average Household	Estimated Population
Not limited	0	3	0
Somewhat limited	6	3	18
Very limited	38	3	114
Total	**44**		**132**

Estimated phosphorus export by Soil Suitability class for 100-meter buffer of surface water, with failure rate of 5%.

Class	Population	P per cap	Transport	kg/year
Not limited	0	0.6	10%	0
Somewhat limited	17	0.6	30%	3.1
Very limited	108	0.6	60%	39
Failed systems (5%)	7	0.6	100%	4.0
Total	**132**			**46**

Figure 3

Lake Katonah
National Land Cover Dataset 2001

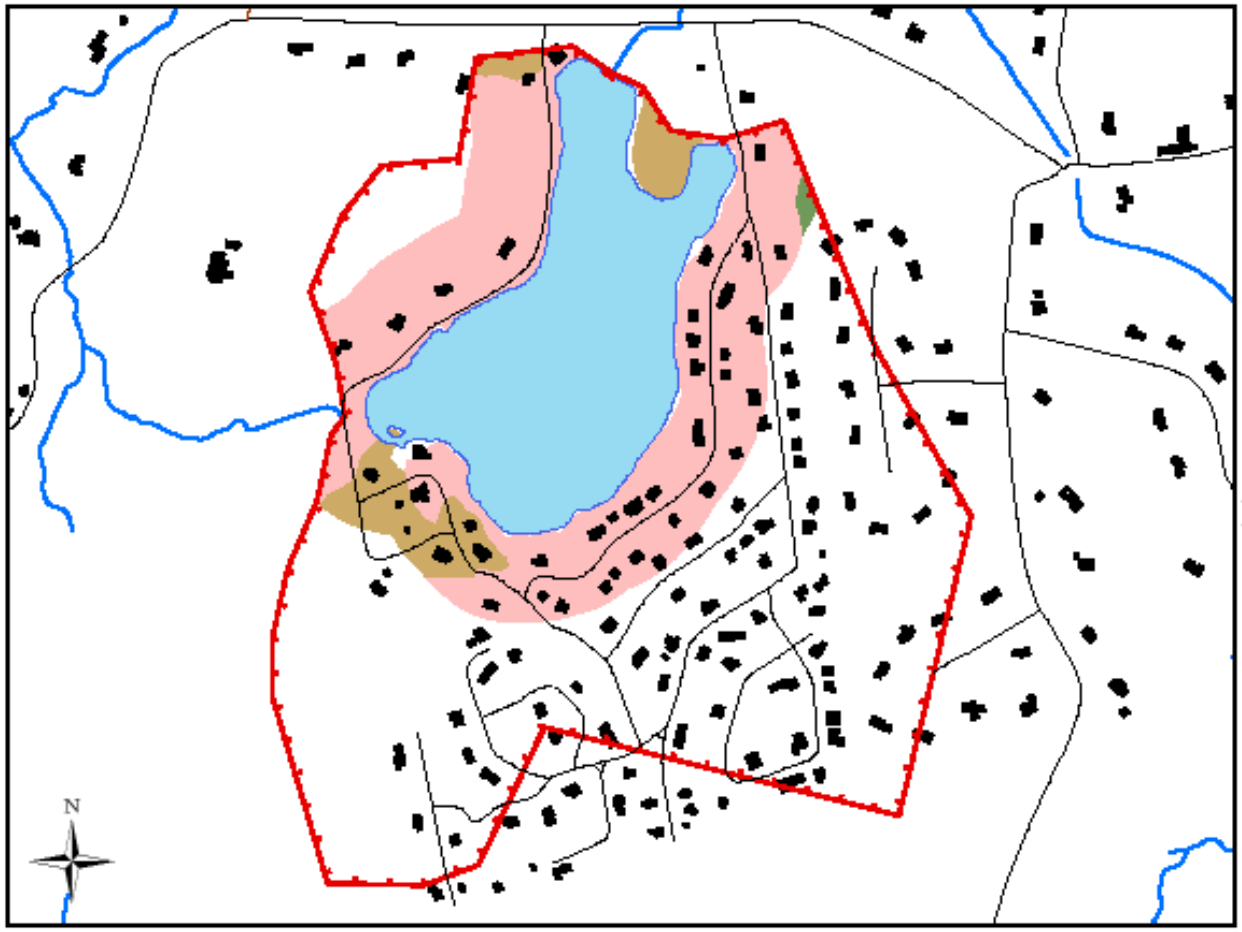


Source:
National Land Cover Database zone 65 Land Cover Layer. On-line at http://www.mrlc.gov
The National Land Cover Database 2001 land cover layer for mapping zone 65 was produced through a cooperative project conducted by the Multi-Resolution Land Characteristics (MRLC) Consortium. Minimum mapping unit = 1 acre. Geo-referenced to Albers Conical Equal Area, with a spheroid of GRS 1980, and Datum of NAD83.

Figure 4

Lake Katonah

Soil Septic Suitability, 100-Meter Stream Buffer Within the Watershed



Legend

- Watershed Boundary
- Lakes
- Streams
- Structures

Roads

- Paved
- Unpaved

Septic Suitability

- Not limited
- Somewhat limited
- Very limited

Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect septic absorption fields:

"Not limited" - the soil has features that are very favorable. Good performance and very low maintenance can be expected.

"Somewhat limited" - the soil has features that are moderately favorable. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.

"Very limited" - the soil has one or more features that are unfavorable. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

0 0.125 0.25 0.5 0.75 1 Miles

Sources:

Lakes, Streams, Wetlands, Roads and Structures - On-line at Westchester County web site http://giswww.westchestergov.com/. Municipal planimetric datasets were photogrammetrically derived from the county's 2004 base map project and meet National Map Accuracy Standards at 1"=100'.

Soil Survey of Westchester County - Compiled by Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. On-line at http://soildatamart.nrcs.usda.gov/. Accessed November 28, 2007. *"Septic tank absorption fields" are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches or between a depth of 24 inches and a restrictive layer is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health.*

EcoLogic

(C) Point Sources: There are no known point sources of phosphorus to Lake Katonah.

(D) Summary of Phosphorus Input to the Lake:

Source	Input (kg/year)
Watershed Land Cover	9.1
Point Sources	0
Septic within 100m of surface water	46
Internal loading (sediment)	0
Total	**55**

Phosphorus Mass Balance: Empirical estimates of net loss from system based on mean depth and water residence time.

$$p = W'/10+H\rho$$

where:

p = summer average in-lake TP concentration, ug/l
W' = areal loading rate, $g/m^2/year$
H = mean depth, m
ρ = flushes per year

Parameter	Units	Result
W'	$g/m^2/year$	549
H	m	1.6
ρ	flushes per year	0.46
p	**ug/l**	**51**
Summer (Jun 15-Sep 15) average TP, 2006-2008, upper waters:		**94 ug/l**

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