

Lake Rippowam

Surface water quality classification: Class B

Morphology Summary:

Characteristic	Units	Value	Source
Surface area	hectares	14	Cedar Eden 2004
Watershed area	hectares	95	EcoLogic 2008 (excl lake)
Volume	mgal	150	Cedar Eden 2004
Elevation	m	144	NYSDEC 2007
Maximum depth	m	6.1	Cedar Eden 2004
Average Depth	m	4.1	Cedar Eden 2004

Lake Inlet: Primary inlet drains wetlands to the west and enters on west shore. Smaller rivulets drain area to the north of the lake.

Lake Outlet: Located at the southeastern end of the lake; outlet flows to Lake Oscaleta.

Recreational impacts: Water quality and aquatic plants were both cited as impacting recreational assessments, although the most significant impacts were associated with poor water clarity and excessive algae growth (NYSDEC 2007). The duration, intensity and composition of periodic algal blooms have not been characterized (Cedar Eden 2002)

Lakeshore Development: Limited to southern shore (Twin Lakes Community built in the 1950's). Northern shore is steeply sloped, forested and undeveloped. Forested wetlands located at eastern and western ends of the lake. (Cedar Eden 2002)

Figure 1 Lake Rippowam Bathymetry

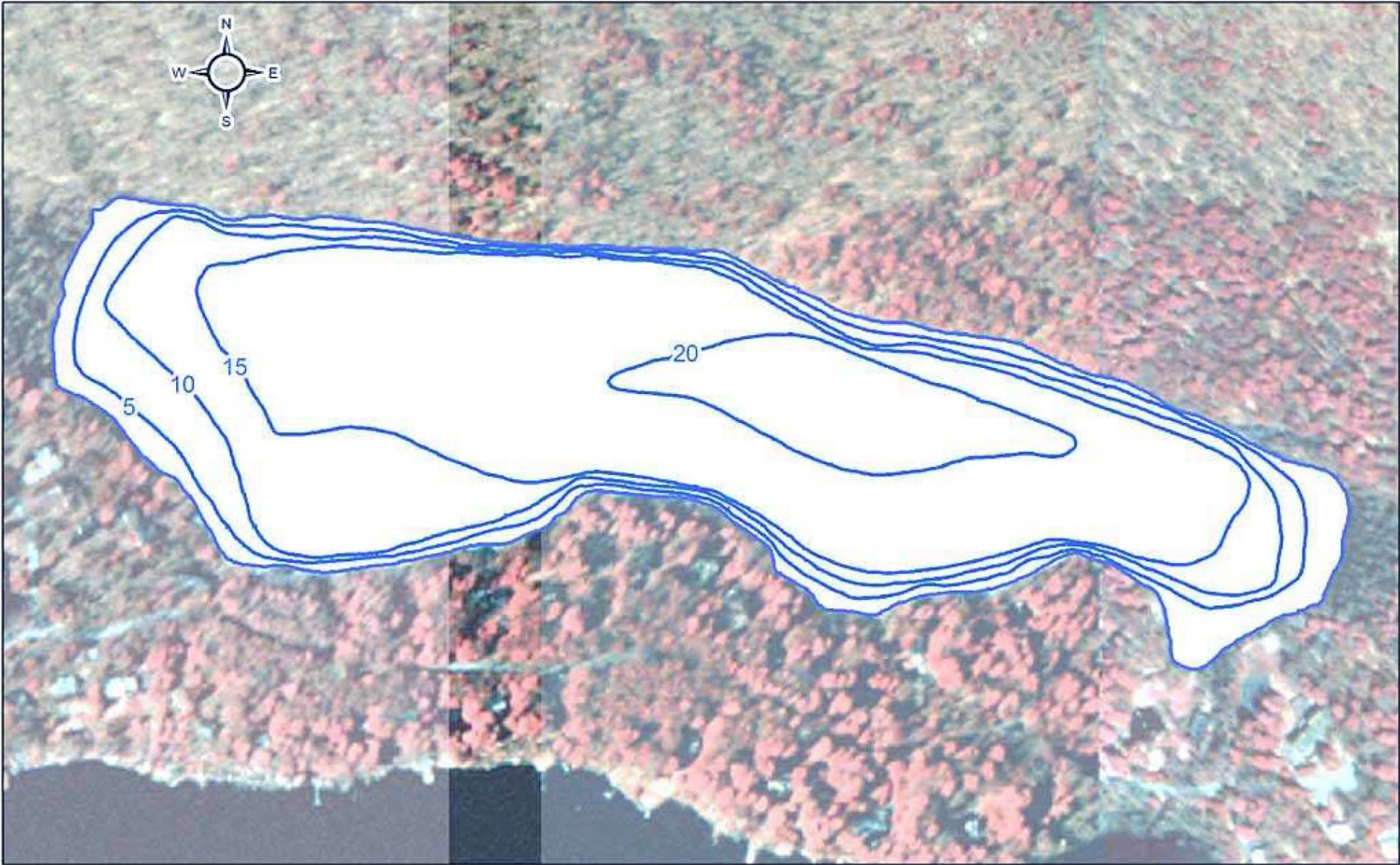
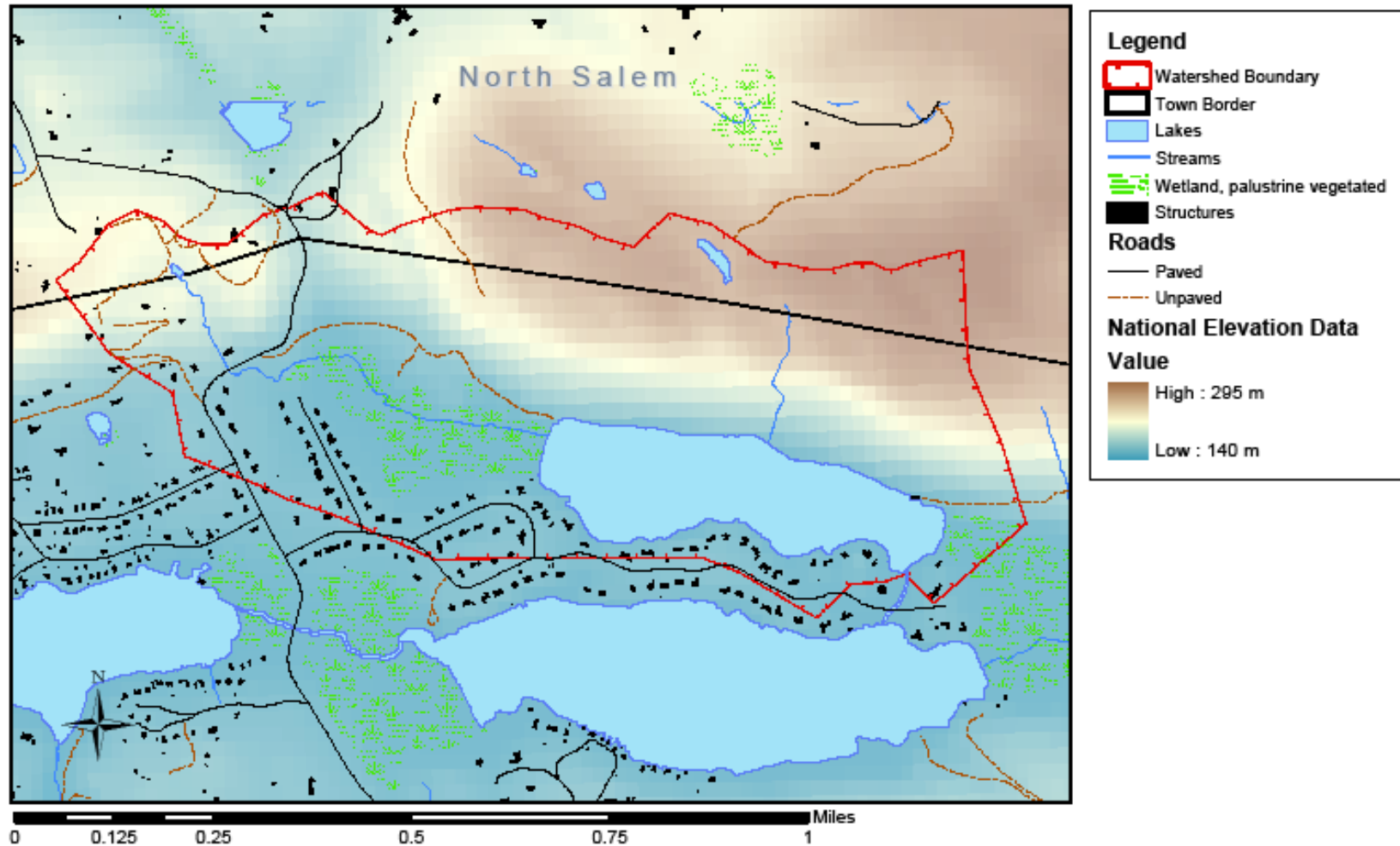


Figure 4.1 Bathymetric map of Lake Rippowam
 Data Source: Field Points by P.Lewis, 5 foot contours by CEE LLC



Figure 2
Lake Rippowam
Topographic and Human Features



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'.
 National Elevation Dataset - U.S. Geological Survey (USGS), EROS Data Center, 1999. On-line at <http://niedata.usgs.net/nied/>.
 Geographic coordinate system. Horizontal datum of NAD83. Vertical datum of NAVD88.



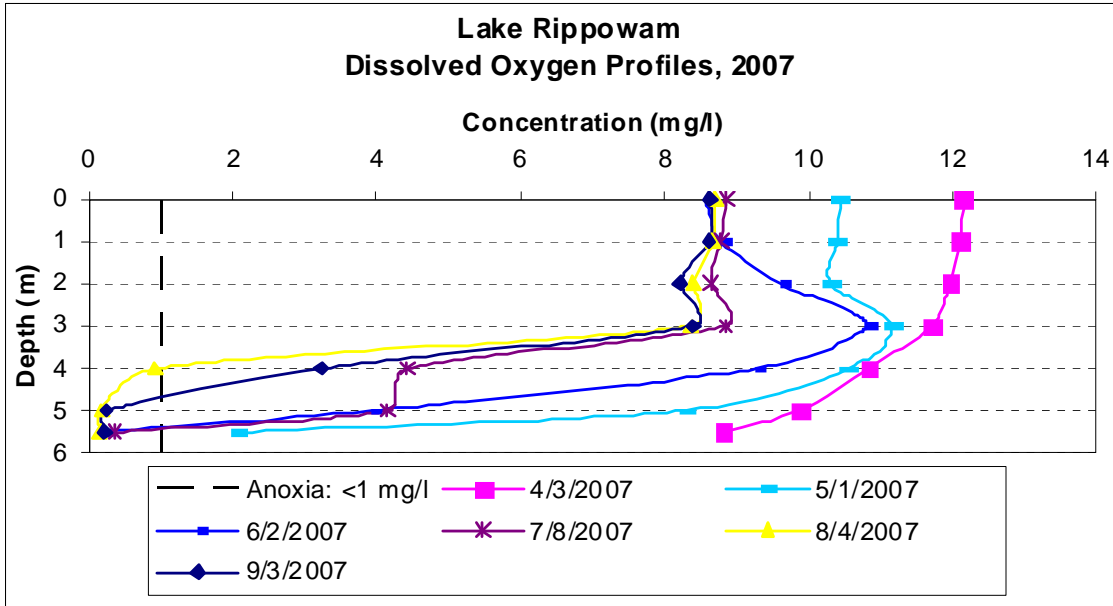
Historical water quality data summary:

Data were collected under the Citizen Statewide Lake Assessment Program (CSLAP), as well as by the Three Lakes Council and other entities over time. Depths ranging from 0 to 5 meters (both upper and lower waters), including some half-meter increment profiles. Table A below summarizes samples collected between January and December of each year; the statistics represent averages of sample results for the time period for all depths, unless otherwise noted. Table B below summarizes samples collected during the summer, defined as the period between June 15 and September 15 each year.

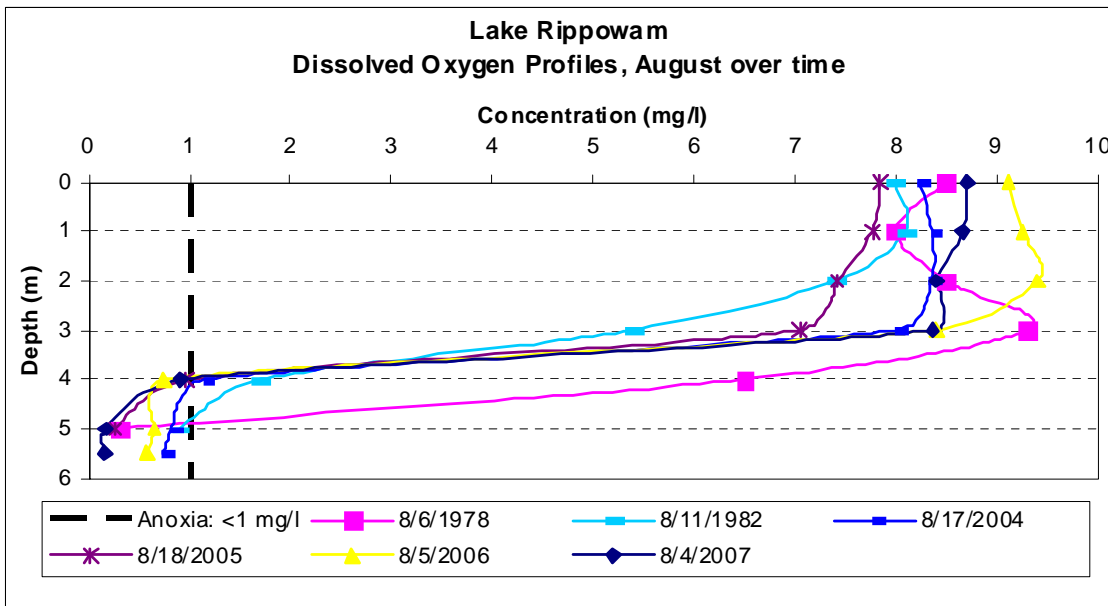
<i>A. Representing samples collected between January and December each year.</i>					
Parameter (units)	Time Period	Number of Samples	Minimum	Maximum	Average
Alkalinity (mg/l)	2002-2007	7	42	54	45
Color (platinum color units)	2006-2007	16	13	41	22.4
Conductivity	2002-2007	37	134.6	287.5	196
pH (std units)	2002-2007	24	7.14	9.4	7.83
Chlorophyll- α (mg/m ³)	1982	3	0.952	4.571	2.752
	2002-2007	40	2.4	38.6	10.15
Phaeophytin- α (mg/m ³)	2003-2006	19	0.005	1.4	0.324
Secchi depth (m)	1978	12	1.83	3.35	2.58
	1980-1983	40	1.80	3.28	2.348
	2002-2007	59	0.50	3.40	2.18
<u>Temperature</u>					
Surface (°C)	1978	26 (0-1 m)	8.6	27	22
	1981-1983	53 (0-1m)	11.2	28.4	22
	2002-2007	112 (0-1.5 m)	6.2	30	21
Depth >5m (°C)	1978	11 (6-7 m)	13.5	17	14.4
	1981-1982	5 (6 m)	10.9	20	14.6
	2002-2007	35 (5.5-6 m)	5.2	19.7	12.3
<u>Dissolved Oxygen</u>					
Surface (mg/l)	1978	26 (0-1 m)	7.2	17	8.9
	1981-1983	53 (0-1 m)	4.5	10.8	7.5
	2002-2007	96 (0-1 m)	6.76	14.39	9.6
Depth >5m (mg/l)	1978	11 (6-7 m)	0	0.6	0.32
	1981-1983	5 (6 m)	0.6	10.2	2.93
	2002-2007	35 (5.5-6 m)	0.01	10.1	2.41
<u>Nutrients:</u>					
<u>Phosphorus</u>					
Upper waters (mg/l)	2002-2007	42 (1.5 m)	0.010	0.058	0.024
Lower waters (mg/l)	2002-2007	26 (4-5 m)	0.020	0.166	0.050
Nitrate N (mg/l)	2003-2007	21	0.0025	0.040	0.0125
Total Kjeldahl Nitrogen (mg/l)	2002-2007	13	0.41	0.98	0.70
Ammonia Nitrogen (mg/l)	2006-2007	16	0.006	0.23	0.047

<i>B. Representing samples collected between June 15 and September 15 each year.</i>					
Parameter (units)	Time Period	Number of Samples	Minimum	Maximum	Average
Chlorophyll- α (mg/m ³)	1982	1	0.952	0.952	0.952
	2002-2007	26	2.4	38.6	8.37
Phaeophytin- α (mg/m ³)	2003-2006	12	0.005	1.2	0.16
Secchi depth (m)	1978	9	2.13	3.35	2.80
	1980-1983	26	1.9	3.28	2.41
	2002-2007	27	0.5	3.35	2.24
<i>Dissolved Oxygen:</i>					
Surface (mg/l) (min depth sampled)	1978	20 (0-1 m)	7.8	9	8.34
	1981-1983	36 (0-1 m)	4.5	9.4	7.05
	2002-2007	40 (0-1 m)	7.21	13.96	8.86
Depth \geq 4 m (mg/l)	1978	11 (6-7 m)	0	0.6	0.318
	1981	1 (6 m)	2.4	2.4	2.4
	2002-2007	15 (5.5 m)	0.06	2.6	0.642
<i>Nutrients</i>					
<i>Phosphorus:</i>					
Surface (mg/l) (min depth sampled)	2002-2007	27 (1.5 m)	0.01	0.058	0.021
	2002-2007	15 (4-5 m)	0.02	0.166	0.052
Nitrate N (mg/l)	2003-2007	15	0.0025	0.03	0.011
Total Kjeldahl Nitrogen (mg/l)	2002-2007	10	0.5159	0.98	0.708
Ammonia Nitrogen (mg/l)	2006-2007	12	0.006	0.15	0.032

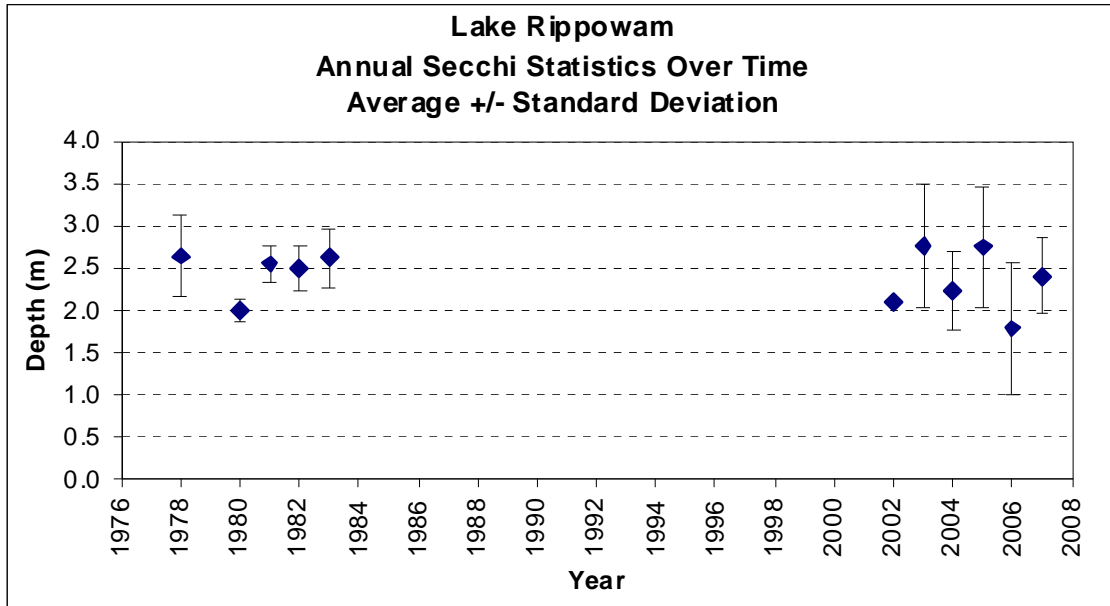
Anoxia: Dissolved oxygen decreases in lower waters, resulting in anoxic conditions from June through September.



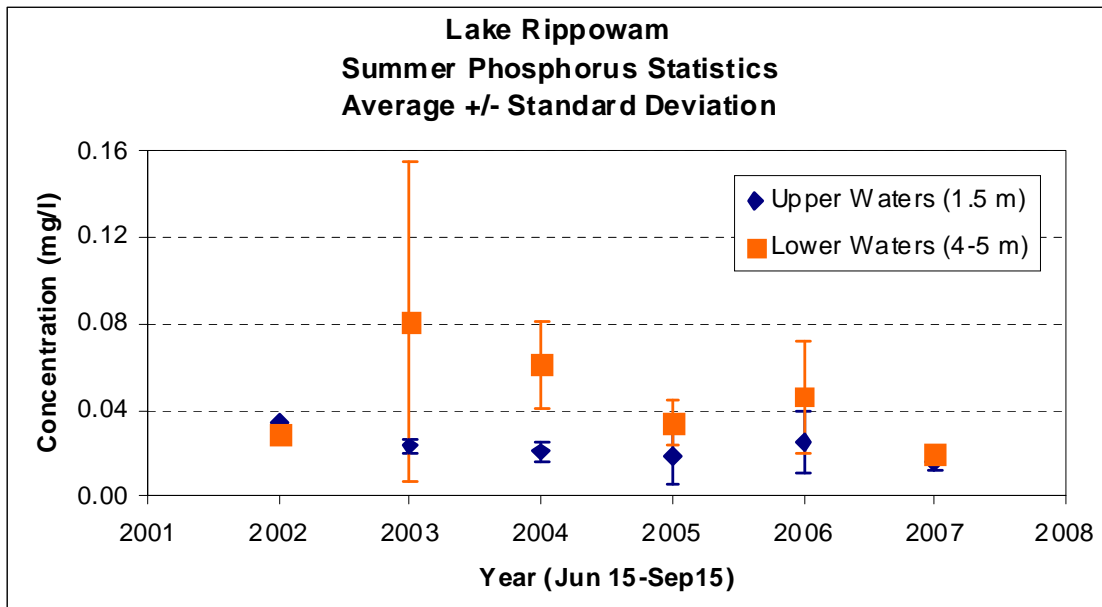
Anoxic conditions in lower waters have been observed in the lake in August from the 1970's to the present.



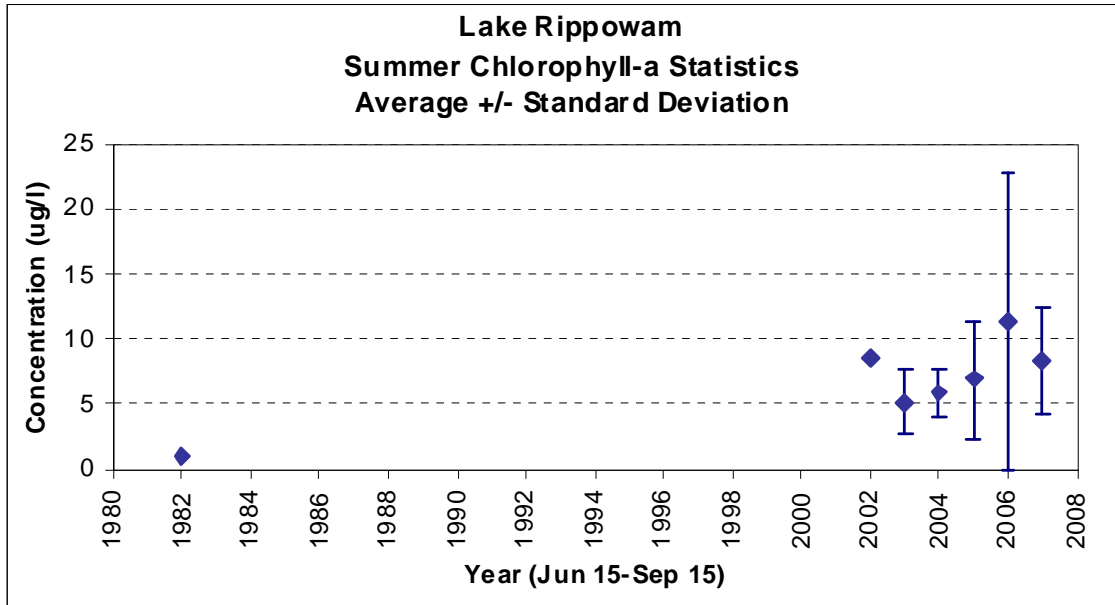
Water Clarity: Averages over time are relatively constant; there is more variability between the annual maximum and minimum in the 2000-2007 period than in the 1980s.



Phosphorus Concentrations: Phosphorus concentrations in the upper waters have been fairly stable since 2003. During the summer months when anoxia occurs in the lower waters (5 meters depth), phosphorus concentrations are elevated, reflecting sediment phosphorus release.



Chlorophyll- α : Chlorophyll- α concentrations are, on average, higher from 2002-2007 than in 1983. The standard deviations show greater variability of the 2006 data from other years.



Trophic Status:

Parameter	Trophic State Indicators (shading indicates match to Lake)				Lake Rippowam*
	Oligotrophic	Mesotrophic	Eutrophic	Hypereutrophic	
Summer average Total Phosphorus, upper waters ($\mu\text{g/l}$)	<10	10-35	35 -100	>100	21
Summer chlorophyll-a, upper waters ($\mu\text{g/l}$)	<2.5	2.5 - 8	8 - 25	>25	8.37
Peak chlorophyll-a ($\mu\text{g/l}$)	<8	8-25	25-75	>75	38.6
Average Secchi disk transparency, m	>6	6-3	3-1.5	<1.5	2.24
Minimum Secchi disk transparency, meters	>3	3-1.5	1.5-0.7	<0.7	0.50
Dissolved oxygen in lower waters (% saturation)	80 - 100	10-80	Less than 10	Zero	8.45

*Data shown are for the period 2002-2007. Summer represents June 15 to September 15. Dissolved oxygen percent saturation calculated using summer data at depths \geq 5 m.

Aquatic Habitat:

- Phytoplankton in 2003 included Golden, Green and Bluegreen groups. June through August the Golden and Green groups dominated (#cells/ml ranged from 7,730-16,296); in September the Bluegreen group was dominant (#cells/ml = 59,870). (Cedar Eden 2004)

- Zooplankton in 2003 were dominated by Cladocerans (*Ceriodaphnia*), accounting for 60% and 76% of the zooplankton communities in June and July, respectively. In September, Cladocerans and Rotifers dominated (45% and 48% of the zooplankton population, respectively). Copepods generally accounted for 12% or less of the population in each sampling event. (Cedar Eden 2004)
- Aquatic Plants in July 2003 were most abundant in the shallow east and west ends, while steep shores prevented vegetation establishment along the north shore. White water lilies (*Nymphaeae* spp) were common in the lake. Eurasian water milfoil (*Myriophyllum spicatum*) was also present in the lake. (Cedar Eden 2004)

List of Aquatic Plants identified in 2003:

Scientific Name	Common Name
<i>Decodon sp.</i>	Three-way sedge
<i>Eleocharis sp.</i>	Spike-rush
<i>Iris spp</i>	Iris
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil
<i>Nuphar sp.</i>	Yellow water lily

Scientific Name	Common Name
<i>Nymphaeae sp.</i>	White water lily
<i>Pontederia cordata</i>	Pickerelweed
<i>Sagittaria sp.</i>	Arrowhead
<i>Scirpus sp.</i>	Bulrush

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

Scientific Name	Common Name
<i>Heracleum mantegazzianum</i>	Giant Hogweed
<i>Wisteria floribunda</i>	Japanese Wisteria, Wisteria
<i>Digitalis grandiflora (D. pupurea)</i>	Yellow Foxglove, Foxglove
<i>Geranium thunbergii</i>	Thunberg's Geranium
<i>Miscanthus sinensis</i>	Chinese Silver Grass, Eulalia
<i>Myriophyllum aquaticum</i>	Parrot-feather, Waterfeather, Brazilian Watermilfoil.
<i>Pinus thunbergiana (P. thunbergii)</i>	Japanese Black Pine
<i>Prunus padus</i>	European Bird Cherry
<i>Veronica beccabunga</i>	European Speedwell

Endangered Species:

- US Fish and Wildlife Service

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

- New York Natural Heritage Program – Town of Lewisboro

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

Water Balance:

USGS Mean Annual (inches/year)		Volume (acre-ft/year)	Water Budget:	
Precipitation (P)	48	143	Inflow to Lake [R+(P-ET)]	191 mgal/year
Evaporation (ET)	22	66	Lake Volume	150 mgal
Runoff (R)	26	507	Flushing Rate	1.3 times/year
			Residence Time	0.79 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	Percent
Open water (all)	32	11	0.30	3.8	29
Developed, open space	19	6.8	0.20	1.5	12
Deciduous forest	182	65	0.07	5.1	38
Evergreen forest	22	7.9	0.20	1.8	13
Mixed forest	0.04	0.01	0.09	0.001	0.01
Pasture/hay	2.4	0.86	0.30	0.29	2.1
Woody wetlands	22	7.9	0.09	0.81	6.1
Total Acres	279	100		13	100

(B) *Septic:* Septic systems serve the communities along the shoreline (Cedar Eden 2002).

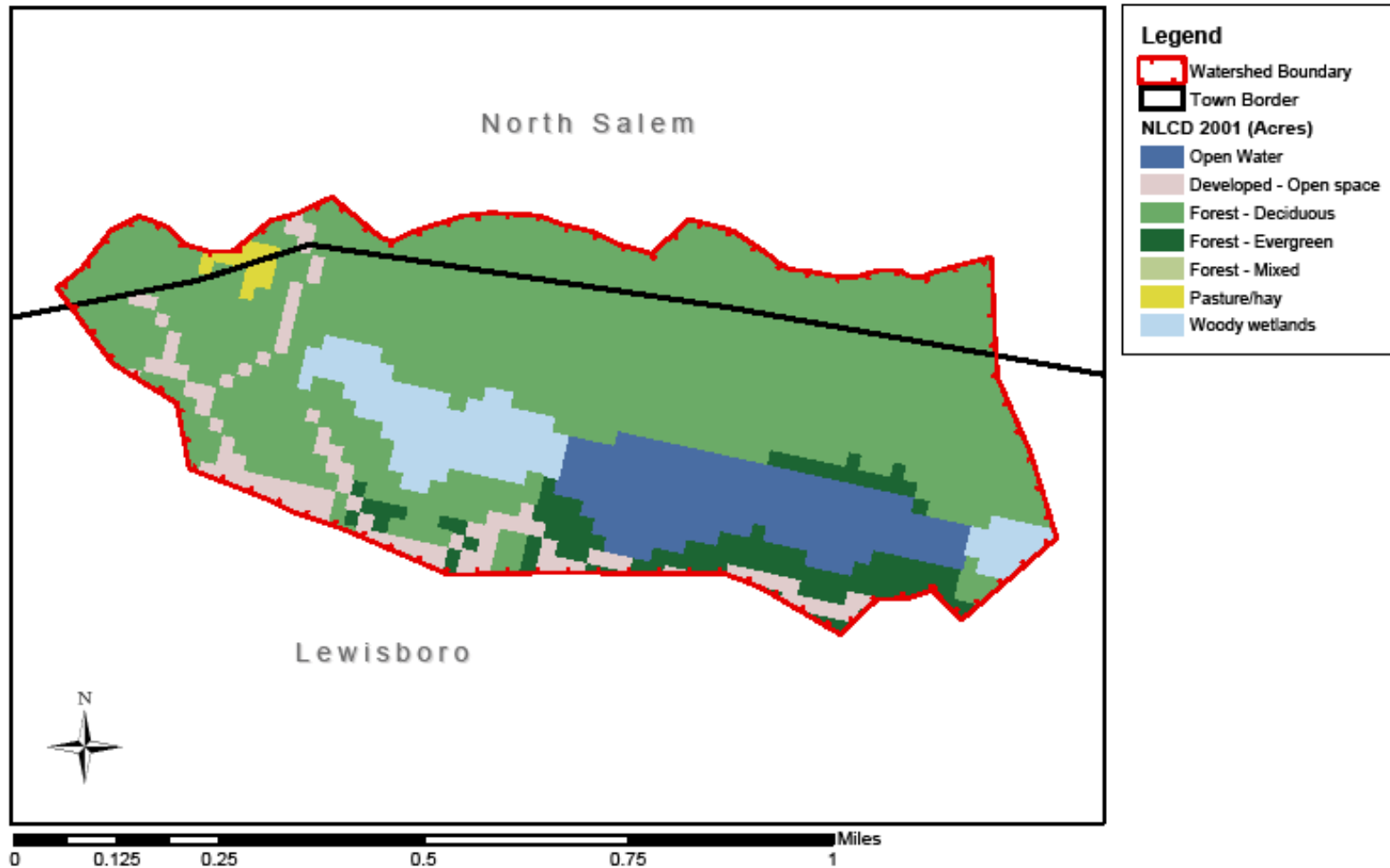
Estimated population on septic by soil suitability class with US 2000 Census household size for 100-meter buffer of surface water.

Class	N Structures	Average Household	Estim Population
Not limited	7	2.5	17
Somewhat limited	21	2.5	53
Very limited	18	2.5	45
Total	46		115

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	16	0.6	10%	1.0
Somewhat limited	50	0.6	30%	9.1
Very limited	43	0.6	60%	15
Failed systems (5%)	5.8	0.6	100%	3.5
Total	115			29

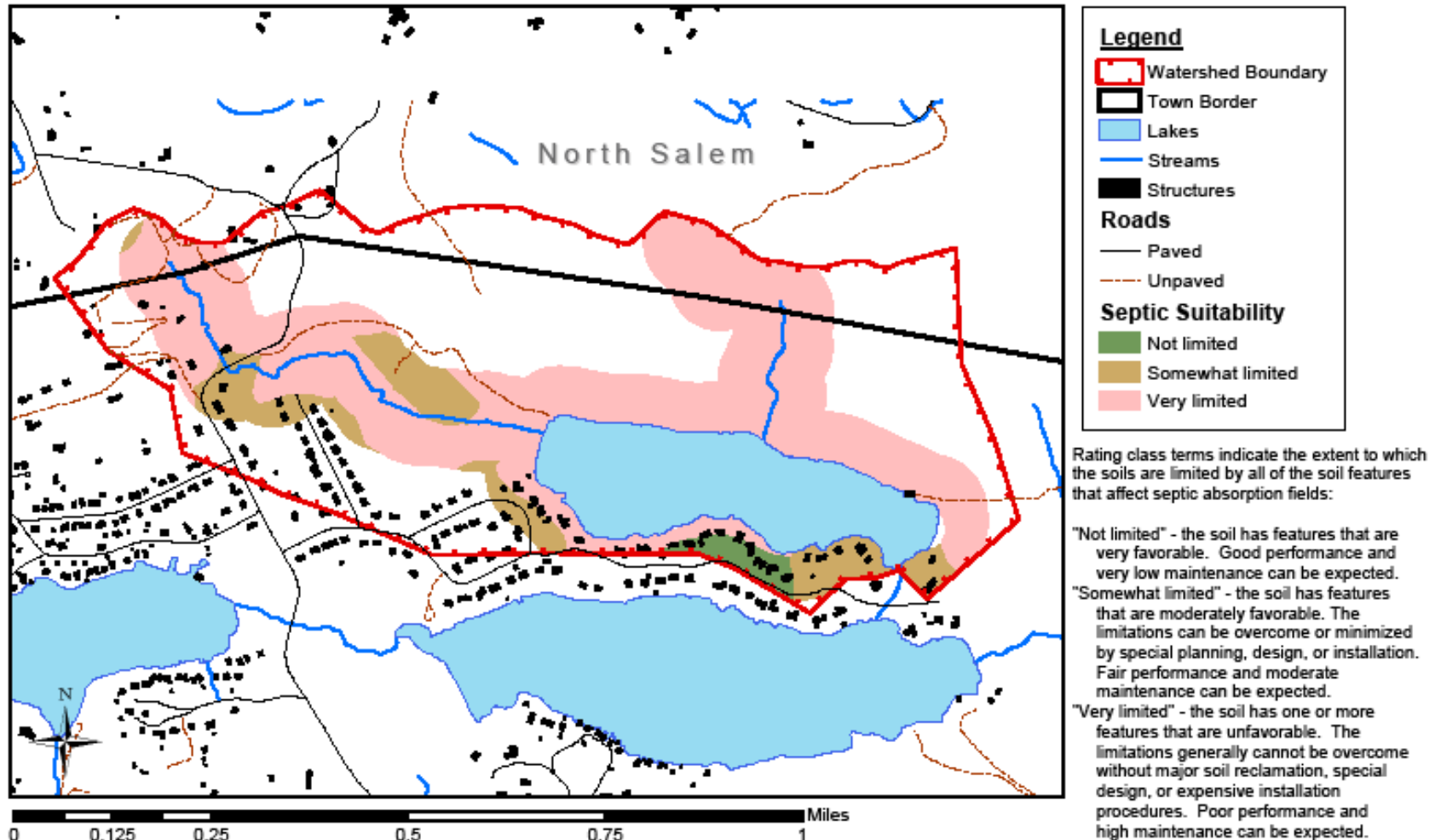
Figure 3
Lake Rippowam
National Land Cover Dataset 2001



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



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.



(C) *Point Sources*: There are no known point sources of phosphorus to the lake.

(D) *Summary of Phosphorus Input to the Lake*:

Source	Input (kg/year)
Watershed Land Cover	13
Point Sources	--
Septic within 100m of surface water	29
Internal sediment loading	0.0049
Total	42

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/m²/year

H = mean depth, m

ρ = flushes per year

Parameter	Units	Result
W'	g/m ² /year	291
H	m	4.1
ρ	flushes per year	0.79
p	ug/l	22
<i>Summer (Jun 15 – Sep 15) average TP</i>		
<i>2002-2007, upper waters:</i>		21

REFERENCES

- Cedar Eden Environmental, LLC. 2006 State of the Lakes: 2004/2005 Water Quality of Lake Rippowam, Lake Oscaleta and Lake Waccabuc. Prepared for The Three Lakes Council, South Salem, NY. April 2006.
- Cedar Eden Environmental, LLC. 2004 Diagnostic-Feasibility Study and Lake & Watershed Management Plan for Lake Rippowam, Lake Oscaleta, and Lake Waccabuc. Prepared for The Three Lakes Council, South Salem, NY. May 2004.
- Cedar Eden Environmental, LLC. 2002 Lake & Watershed Management Recommendations for Lakes Oscaleta, Rippowam and Waccabuc. Prepared for The Three Lakes Council, South Salem, NY. December 2002.
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- New York State Department of Environmental Conservation. 2007. 2006 Interpretive Summary, New York Citizens Statewide Lake Assessment Program (CSLAP) 2006 Annual Report - Lake Rippowam. September 2007. With New York Federation of Lake Associations. Scott A. Kishbaugh, PE.
- US Fish and Wildlife Service. 2007. US Fish and Wildlife Service State Listing. List filtered to species with possible presence in the Town of Lewisboro. Obtained from web site on 11/28/07. Web site: <http://www.fws.gov/northeast/Endangered/>.