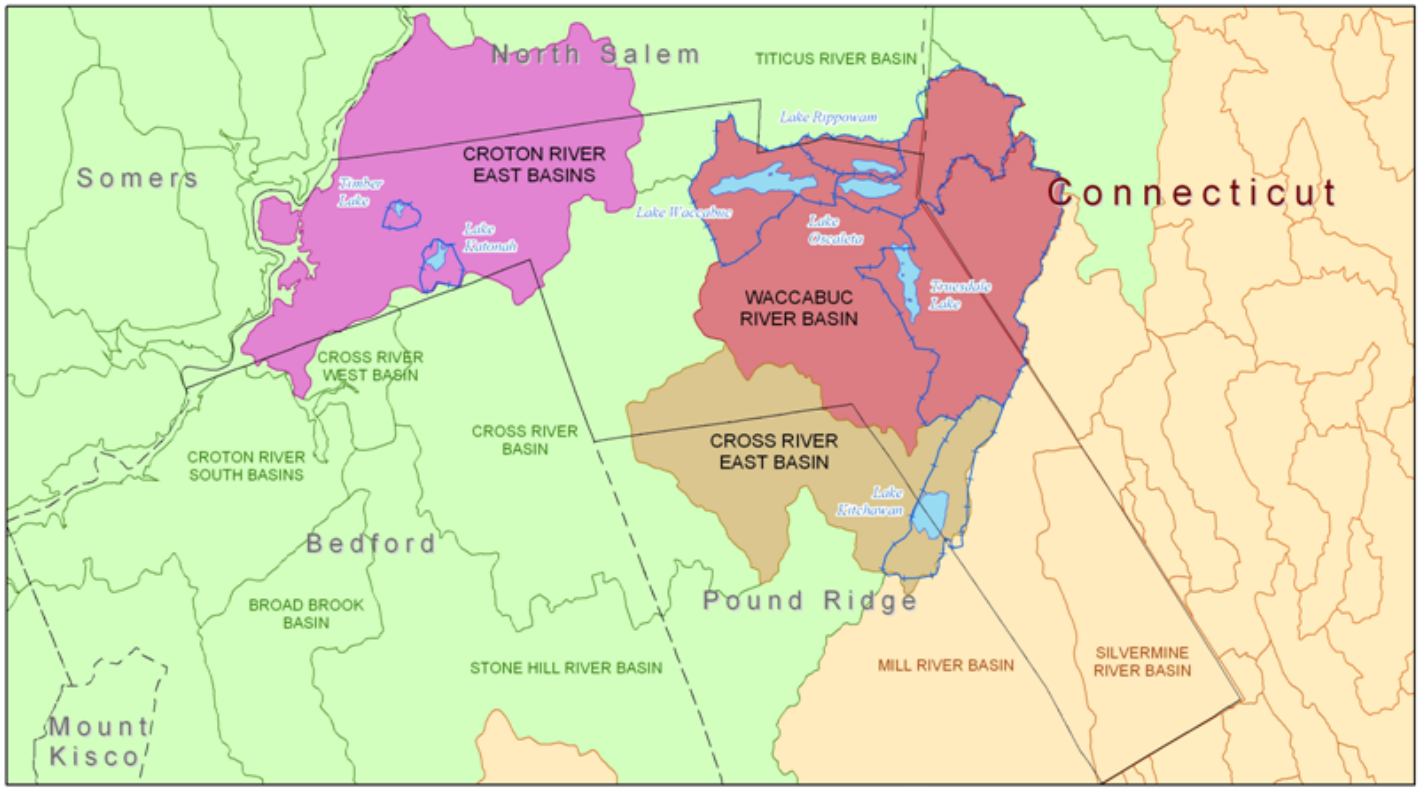
EXECUTIVE SUMMARY



Town-wide Comprehensive Lakes Management Plan

Town of Lewisboro, New York

Edward Brancati, Town Supervisor

EXECUTIVE SUMMARY

FEBRUARY 6, 2009

EcoLogic

Town of Lewisboro
Town-wide Comprehensive Lakes Management Plan
Executive Summary – prepared by EcoLogic, LLC

Introduction

In August 2007, EcoLogic entered into an agreement with the Town of Lewisboro to develop a planning document outlining management of the lakes and watershed areas within the Town. Four specific objectives were cited:

- Create a central repository of natural resource data, statistics, and testing data for each of the lakes in the Town;
- Summarize each lake's water quality and environmental concerns;
- Recommend the most logical, environmentally sound, and cost-effective sequence of projects to improve and maintain water quality throughout the Town;
- Synthesize and collate all the studies on each of the lakes.

The resulting document – *Town-wide Comprehensive Lakes Management Plan* - summarizes the water quality and aquatic habitat conditions of seven lakes in the Town of Lewisboro, and recommends measures for their protection and restoration. That document is composed of ten sections:

1. Introduction
2. Environmental Setting
3. Lake Fact Sheets
4. Water Quality – Current Conditions
5. Reductions in Phosphorus Needed To Meet State Guidance Targets
6. Town-Wide Management Options
7. Recommended Strategies
8. Potential Funding Sources
9. Priority Actions for the Town of Lewisboro
10. References

This Executive Summary provides an overview of the main report. The reader is urged to read the full report for additional information and discussion that can only be found there.

Eutrophication and Trophic State

Eutrophication is the term that describes both the process and the effects of enrichment of surface water systems (including lakes, estuaries, and reservoirs), and it is a major water quality issue. Aquatic systems become increasingly enriched with plant nutrients, organic matter, and silt, resulting in increased biomass of algae and plants, reduced water clarity, and ultimately, a reduction in volume. Aesthetic quality and habitat conditions are degraded, and surface waters may lose suitability for recreational uses and water supply as eutrophication proceeds. The composition and abundance of the aquatic biota may be altered.

While eutrophication is a natural process, it can be greatly accelerated by human activities. Excessive nutrient inputs from human activities include nonpoint sources such as on-site wastewater disposal systems (septics) and point sources such as outfalls of wastewater treatment facilities. Water resources managers focus on identifying and controlling the sources of nutrients, organic material, and silt to aquatic ecosystems in an effort to slow down the eutrophication process.

A *limiting nutrient* is a nutrient that is essential for algal growth, the lack of which inhibits or eliminates growth of algal biomass. Phosphorus is most often the limiting nutrient for primary productivity and algal biomass in inland lakes of the Northeast. Once phosphorus is exhausted, the algal community stops growing. If more phosphorus is added, algal growth will continue. This finding has focused lake restoration and management techniques on controlling the concentration of phosphorus and has led to significant improvements in many systems.

Eutrophication occurs along a continuum. Lakes progress from a nutrient-poor, clear water state (*oligotrophic*) through an intermediate state of biological productivity (*mesotrophic*) and eventually to a nutrient rich condition of high biological productivity (*eutrophic*). *Hypereutrophic* lakes are turbid lakes with very high biological productivity. Lakes may exist in a trophic equilibrium for decades or centuries. When human activities accelerate the eutrophication process, it is termed *cultural eutrophication*.

Limnologists and lake managers have developed guidelines to define the transition between trophic states based on four indicators: phosphorus concentration, water clarity, chlorophyll-a concentration, and deep water dissolved oxygen concentrations. Assigning a lake to one trophic state requires professional judgment that considers the cumulative evidence of water quality conditions and the level of productivity.

Trophic State of Seven Lewisboro Lakes

The available water quality and aquatic habitat data collected in recent years indicate that the seven Lewisboro Lakes are in various stages of eutrophication. While the data for some lakes are somewhat limited, representing few sampling points, they still provide a basis for making an assessment of trophic state using the four indicators described above.

Mesotrophic: Moderately productive	Eutrophic: Highly productive	Hypereutrophic: Very highly productive
Rippowam	Oscaleta	Katonah
Kitchawan	Waccabuc	
	Truesdale	
	Timber	

Phosphorus Loading to Seven Lewisboro Lakes

Two important relationships have been quantified for many aquatic systems:

(1) the relationship between watershed activities and loading (quantity of material that enters a lake over a defined period; for example kilograms of phosphorous per year), and

(2) the relationship between loading and resultant water quality conditions.

For the first relationship, scientists, engineers, and planners have quantified nutrient runoff based on land use and population density. For the second relationship, limnologists have determined the physical and hydrologic features (such as depth and water residence time) that contribute to a lake's assimilative capacity. These two relationships form the basis for defining an acceptable loading to aquatic systems to meet water quality objectives. Standard limnological methods have been developed to quantify the relationship between external loading and in-lake concentration as a function of mean depth and water residence time. These standard methods were developed based on empirical observations of a large number of lakes, with defined inlets and outlets.

The phosphorus budget for the Lewisboro Lakes is based on existing data describing water quality conditions in the Lewisboro Lakes, and land use and vegetative cover data throughout the watershed. Several measures were taken into account:

- Water balance (volume in and volume out)
- Land cover types in the watersheds
- Septic contributions
- Point sources
- Internal loading from sediments

Phosphorus loading to the Lewisboro Lakes occurs through several mechanisms:

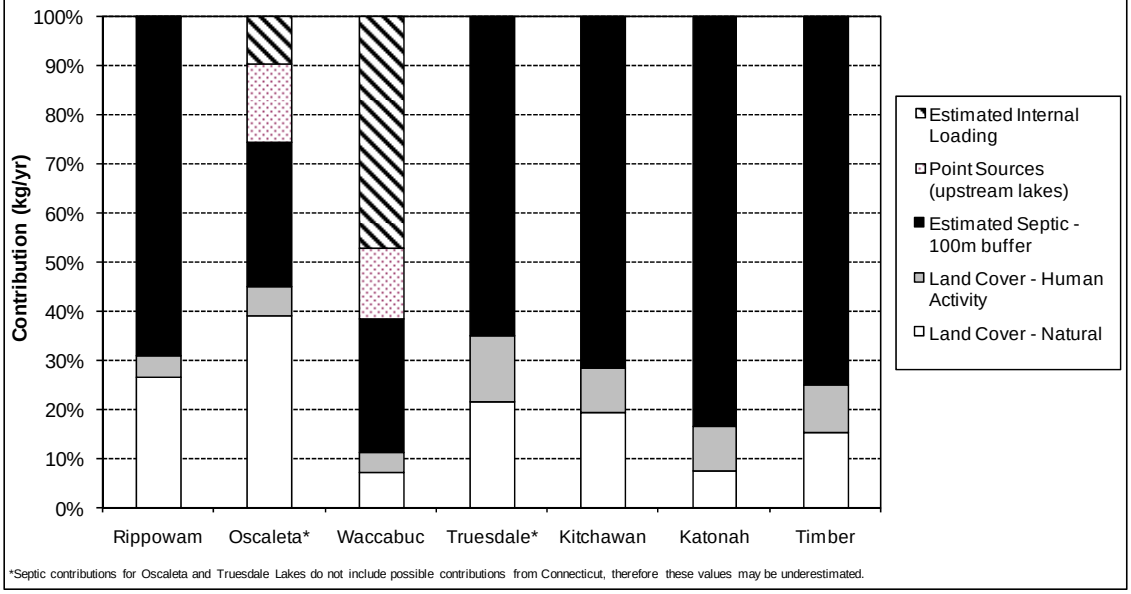
- Phosphorus carried in runoff from surrounding watershed; the amount of phosphorus runoff varies by land cover type;
- Phosphorus from septic systems that have failed, septic systems located in poor soils that allow phosphorus to migrate to surface water, or those that are located close to a lake.
- Phosphorus from point sources; outlets of other lakes are considered point sources for the purpose of this analysis.

The phosphorus loading for each of the Lewisboro Lakes is summarized in **Figure 1**. It is clear from this analysis that contributions from on-site wastewater disposal systems represent the primary source of phosphorus, with the exceptions of Lakes Oscaleta and Waccabuc.

Phosphorus Reduction Targets

The lakes in Lewisboro can be placed into three groups; those that are in the beginning stages of eutrophication (Rippowam, and Kitchawan), those that are currently in a eutrophic state (Oscaleta, Truesdale, Timber and Waccabuc), and those that are hypereutrophic (Katonah). Those in the beginning stages of eutrophication would likely see some improvements with relatively moderate reductions in phosphorus loading. The eutrophic lakes will require more intensive efforts before improvements are realized. Lake Katonah's phosphorus concentrations are extreme and a large reduction in phosphorus loading would be required before significant improvements are realized.

Figure 1
Phosphorus Loading Estimate, Lewisboro Lakes



*Septic contributions for Oscaleta and Truesdale Lakes do not include possible contributions from Connecticut, therefore these values may be underestimated.

In order to quantify the necessary reductions in loading to improve water quality, an in-lake target concentration is needed. New York State has a narrative standard for phosphorus: *"None in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages."* A target concentration of 20 ug/l was adopted as a guidance

value for phosphorus to protect recreational quality; this is measured as a summer average mid-lake sample at 1 m depth. This concentration was selected based on a statistical analysis relating perceived water quality impairment for recreational use to total phosphorus concentration.

Reduction targets for the Lewisboro Lakes were estimated using the target concentration of 20 ug/l total phosphorus concentration (**Table 1**). For lakes with phosphorus levels near 20 ug/l concentration (Oscaleta, Rippowam, Waccabuc, and Kitchawan) this target may be achievable with a focused effort to reduce phosphorus loading. Even greater effort to reduce phosphorus loading will be required to meet the target concentration for the lakes presently exhibiting higher concentrations (Timber, Truesdale, and Katonah).

Estimated reductions in external phosphorus loading for two management scenarios were also calculated (**Table 1**). In the first scenario, best management practices were applied to reduce runoff load from developed lands by 50%; in the second scenario, sanitary sewers were installed to eliminate the phosphorus contribution from on-site wastewater disposal systems. Clearly, unless the contribution from on-site wastewater disposal systems is addressed, approaching the 20 ug/l guidance concentration for phosphorus in most lakes is unlikely.

Table 1. Estimated percent reduction needed to approach state guidance targets in relation to estimated load reductions from BMPs in watershed and elimination of on-site wastewater disposal systems.

	Estimated Percent Reduction in Phosphorus Loading		
Lake	*Needed to meet 20 ug/l target concentration*	*Achieved with 50% decrease in runoff loading from developed areas*	*Achieved with installation of sanitary sewers*
Oscaleta	9%	6%	29%
Rippowam	27%	4%	68%
Waccabuc	28%	4%	27%
Kitchawan	46%	9%	72%
Timber	52%	10%	75%
Truesdale	63%	13%	65%
Katonah	82%	9%	84%

Town-wide Management Options

Existing data show that phosphorus is the primary nutrient supporting algae and weed growth in the Lewisboro Lakes, and that phosphorus enrichment adversely affects recreational quality. The phosphorus loading estimates indicate that on-site wastewater disposal systems represent the most significant cultural source of phosphorus; non-point runoff from residential development is a secondary source. In addition, some of the deeper lakes exhibit anoxic conditions that allow phosphorus stored in sediments to enter the water column. Since the highest proportion of phosphorus entering most of the lakes originates from wastewater, strategies for mitigating loading should focus primarily on this source, with secondary efforts directed at storm water runoff from developed areas. The importance of phosphorus released from sediment in deeper lakes needs to be explored further.

The town has three general management options to consider:

- *Do nothing* - It is predicted that if no actions are taken, water quality conditions in the seven lakes will gradually deteriorate over time.

- *Actions to maintain/slightly improve current water quality conditions* - Under this option, net loading of nutrients is maintained over time. This option is most warranted in those lakes experiencing only minor levels of eutrophication: Lakes Waccabuc, Rippowam, Oscaleta, and Kitchawan.

- *Actions to substantially improve water quality conditions* - Under this option, improved water quality conditions are noticeable to lake residents. This will require stronger measures to reduce, rather than maintain, nutrient loading and erosion. This option is most warranted in those lakes that are currently either in a stable eutrophic state (Truesdale and Timber) or a stable hypereutrophic state (Katonah).

Greater levels of phosphorus reduction are associated with greater levels of effort, cost, and control over development in the watersheds. Although there are many options available to decrease phosphorus loading, effective solutions must be tailored to reflect the most significant sources and consider the nature of the watersheds.

Townwide Recommended Strategies

Strategy	Recommendations to the Town of Lewisboro
Reduce phosphorus migration from on-site wastewater disposal systems	• Work with an engineering firm to conduct a feasibility/cost-benefit analysis for installing sewers in the watersheds of each lake. Priority watersheds (those with the highest phosphorus levels): Katonah, Truesdale, and Timber. • Where sewers are not installed, institute a septic inspection and maintenance program. Inspect systems every five years and pump systems biennially. • Initiate a public education campaign aimed at informing residents of the importance of proper septic maintenance and upkeep. • Consider a ban on sale and use of phosphate containing dishwasher detergents within the watershed. • Offer financial incentives to homeowners who convert to new technologies designed to reduce impact from septic systems.
Management of stormwater runoff	• Continue to identify stormwater discharge points and drains. • Expand funding of stormwater management BMPs, such as catch basins. • Reinstate the practice of picking up and disposing of leaves and yard waste as these are a source of organic matter to the lakes • Storm drain structure sumps and catch basins should be routinely cleaned of accumulated sediment. • Form watershed tax districts to provide a dedicated funding source for upgrades to the Towns stormwater management program.
Development / land acquisition	• Consider adopting a moratorium on new construction of homes in affected watersheds until a sewer feasibility study is completed. • Pass an ordinance that prohibits new septic constructed in areas of the watersheds that are within 100 meters of a waterbody that is hydrologically connected to one of the Town's lakes. • Identify and acquire key parcels of open space. Place high priority for acquisition of properties in riparian areas.
Fertilizer restrictions	• Introduce a local law restricting application of phosphorus as a fertilizer. • Fertilizers containing phosphorus should not be used on lawns and turf within 100m of a lake or waterbody hydrologically connected to one of the lakes.
Canadian geese controls	• Continue with the goose egg oiling program on the Three Lakes and Truesdale Lake, and consider implementing a similar program on the other Town lakes. • On lakes where goose populations become large, implement a volunteer goose harassment program designed to deter geese from staying on the lakes for long periods.
Education/ Involvement	• In collaboration with the Lake Associations, convene a public forum to discuss lake ecology, the range of current water quality conditions in the seven lakes, and potential mitigating measures. • In collaboration with the Lake Associations, prepare an annual Lewisboro Lakes Report Card to enhance public understanding of water quality conditions and contributing factors.

Priority Actions for the Town of Lewisboro

Actions recommended for 2009:

- Convene a public educational forum to discuss current water quality and habitat conditions of the lakes of Lewisboro. Solicit public input on the desired future for the lakes (overall and for individual lakes). Major topics include:
    - The eutrophication process
    - How have conditions changed in recent decades
    - What can be done
    - Why each lake may require slightly different strategies based on physical characteristics, current conditions, and desired use
    - How will a wastewater facility affect the lakes
    - What are the costs and benefits associated with alternatives
- Continue and expand the annual lakes monitoring program to improve baseline data and gather data needed to apply for permits and funding for implementation of control measures. The recommended monitoring plan would collect water the standard CSLAP variables monthly from May to October in all lakes. Stratified lakes would include a near bottom water sample analyzed for phosphorus.
- Prepare an annual Lewisboro Lakes Report Card to enhance public understanding of water quality conditions and contributing factors.
- Convene technical committee (or select consultant) to initiate detailed planning, cost estimating, and identify funding sources for construction regional wastewater treatment facilities to serve the Town of Lewisboro Lakes watersheds.
- Propose creation of watershed tax districts to help fund stormwater management.
- Propose an initiative program to encourage the use of "green" technologies as they relate to onsite waste water treatment.
- Propose a moratorium on septic system construction in lake watersheds until decision is made on wastewater treatment facilities.
- Introduce a local law prohibiting septic system construction within 100 meters of a waterbody hydrologically connected to one of the Towns lakes.

Actions recommended for 2010-2011:

- Propose a local law requiring periodic inspection, maintenance, and pumping of individual on-site wastewater treatment systems if wastewater facility option not initiated. The frequency can be linked to distance to lakes and hydrologically connected waterbodies, with more stringent requirements within a defined buffer zone.
- If wastewater facilities are not approved, propose an ordinance that prohibits any septic system construction within 100 meters of a waterbody that is hydrologically connected to one of the Towns lakes.
- Continue to convene periodic public educational forums that focus on current conditions and what needs to be done.
- Continue the expanded annual lakes monitoring program and Lewisboro Lakes Report Card