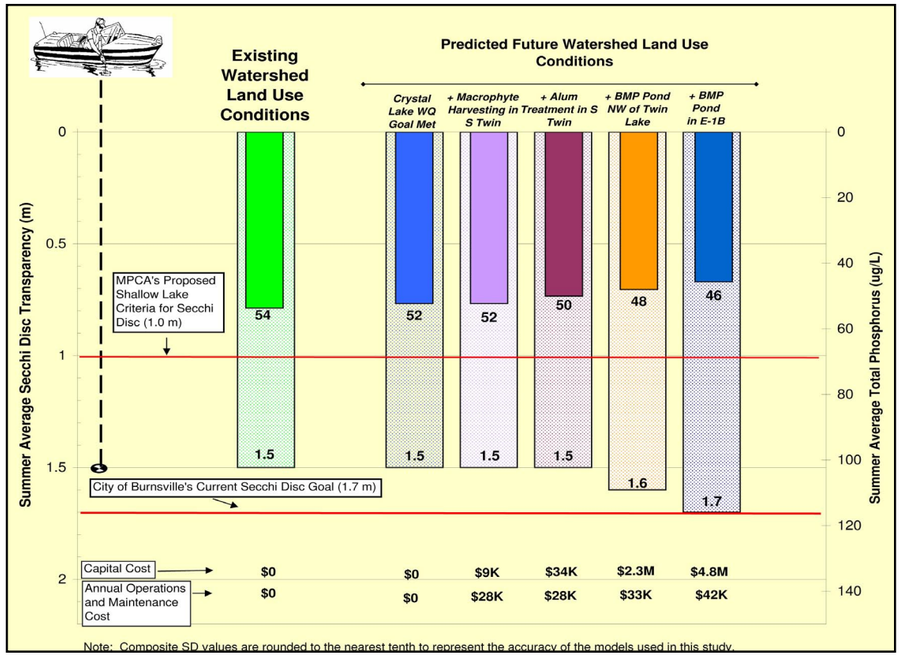
Recommended Management Strategy for Earley Lake

The following figure and table summarize the recommended management strategy for Earley Lake. Several strategies were evaluated based on effectiveness, cost, and feasibility. Input was gathered from the city staff and neighborhood residents as part of the evaluation process. The figure shows current and predicted water quality conditions, both with and without implementation of recommended water quality improvement projects. The table lists elements of the recommended strategy and its cost.

Water Quality Management Strategy



Note: Composite SD values are rounded to the nearest tenth to represent the accuracy of the models used in this study.

Suggested Water Quality Management Strategy and Estimated Implementation Costs

Water Quality Management Strategy Elements[1]	City's Share of the Estimated Capital Cost[2,3] (2007 Dollars)	Annual Operation & Maintenance Cost (2007 Dollars)
Source Reduction Efforts		
Add a Regional Water Quality Treatment Pond at the Southwest Corner of Southcross and Burnhaven Drive (Drainage Area E-1B)	$2,562,000	$9,000
Add a Regional Water Quality Treatment Pond on the Property Northwest of North Twin Lake (To treat runoff from watershed NT-1A and future development in watershed NT-1)	See Twin Lake Management Strategy	See Twin Lake Management Strategy
In-Lake Chemical Treatments		
In-Lake Alum Treatment of South Twin Lake	See Twin Lake Management Strategy	-
In-Lake Mechanical Treatments		
Mechanical Harvesting of Macrophytes in South Twin (Two harvesting events assumed- early summer & late summer)	See Twin Lake Management Strategy	See Twin Lake Management Strategy
Mechanical Harvesting of Macrophytes in Earley Lake (Two harvesting events assumed- early summer & late summer)	-	$18,000
Total	$2,562,000	$27,000

[1] The map on page 3 illustrates the approximate locations of the various water quality management strategies.

[2] Construction costs include estimated engineering fees and a 25% contingency.

[3] Land acquisition costs include estimated land acquisition, easement acquisition, and wetland mitigation costs

Earley Lake Use Attainability Analysis

Project Synopsis

A Use Attainability Analysis (UAA) is a scientific assessment of a water body's physical, chemical, and biological conditions. It uses an outcome-based evaluation and planning process in order to obtain or maintain optimal water quality conditions and achieve beneficial uses, such as swimming, fishing, or wildlife habitat.

During 2006–2007, the City of Burnsville conducted a UAA for Earley and Twin Lakes to address current water quality issues. The UAA includes a water quality analysis and prescription of protective measures for Earley and Twin Lakes and the watershed, based on historical water quality data, the results of intensive lake water quality monitoring, and computer simulations of land use impacts on water quality.

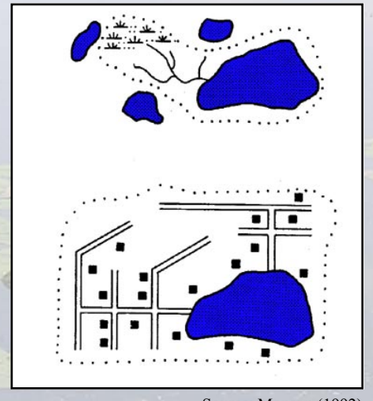
Typical Urban Lake Water Quality Problems

The primary problem in urban lakes is "cultural eutrophication," which is defined as the accelerated increase in concentrations of nutrients, primarily phosphorus and nitrogen, in a lake as a result of human activities in the watershed. Eutrophication is often indicated by increased algal growth, decreased water clarity, and loss of dissolved oxygen in the bottom waters of the lake, which leads to a shift in fish species from desirable game fish to non-game species such as carp and bullhead.

Nuisance algae in lakes results from the excess phosphorus that reaches lakes due to increased stormwater runoff.

The Usual Suspects

These problems typically occur because of watershed urbanization and nonpoint source pollution. Increased urbanization in a watershed leads to more streets, driveways, and rooftops (impervious surfaces). This increased imperviousness results in more stormwater runoff traveling quickly through storm sewers, diminishing the runoff pollutant retention capacity of watershed ponds and wetlands. The increased stormwater runoff carries excess nutrients into lakes and streams as nonpoint source pollution. Increased concentrations of phosphorus in lake waters is the leading cause of algal blooms and decreased water clarity.



Source: Monson (1992)

Before development (top image), stormwater travels slowly through a watershed. After development (bottom image), impervious surfaces are increased, resulting in more stormwater runoff and less filtration of nutrients.

A lake's clarity (transparency) is measured by submerging a black and white patterned disc (a Secchi disc) into the lake. The depth at which the Secchi disc disappears determines the lake's transparency.

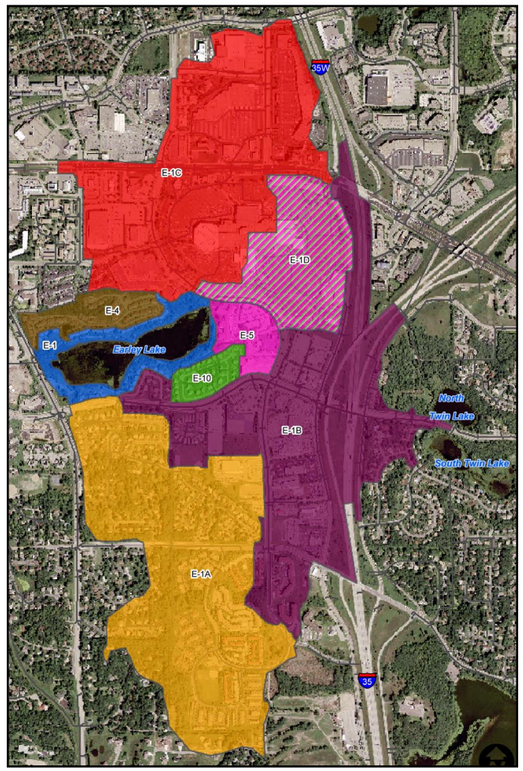
City of BURNSVILLE

Earley Lake Water Quality Problems and Causes

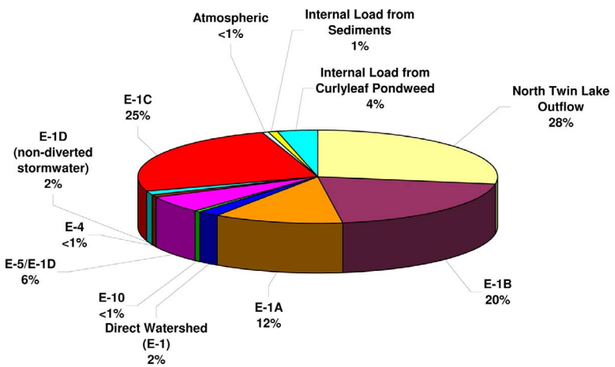
The water quality assessment portion of the UAA determined that Earley Lake suffers from two primary water quality problems: summer algal blooms and excess aquatic plants. The algal blooms are caused by high phosphorus levels, due to poor quality urban stormwater runoff entering the lake. There are four types of problematic lake weeds in Earley Lake. Curlyleaf pondweed, an exotic species, dies back in mid-summer each year, further increasing the lake's phosphorus concentration and algal abundance. Eurasian watermilfoil, another exotic species, and coontail, a native species, can grow in dense areas of Earley Lake, creating access problems. Filamentous green algae grows to nuisance proportions on and around these other species in Earley Lake, creating unsightly mats of slimy, green strands. The following page explains the recommended water management strategy for handling these problems.

Curlyleaf pondweed, one of the four aquatic species that affects recreational use of Earley Lake.

The UAA includes data such as the pie chart to the right, which shows the breakdown of sources of the annual phosphorus load to Earley Lake. See the map below to cross-reference the source/location codes. A similar pie chart for Twin Lake is included in the UAA. In addition to watershed loads, Crystal Lake was found to greatly affect the water quality of Earley and Twin Lakes in wet climatic years.

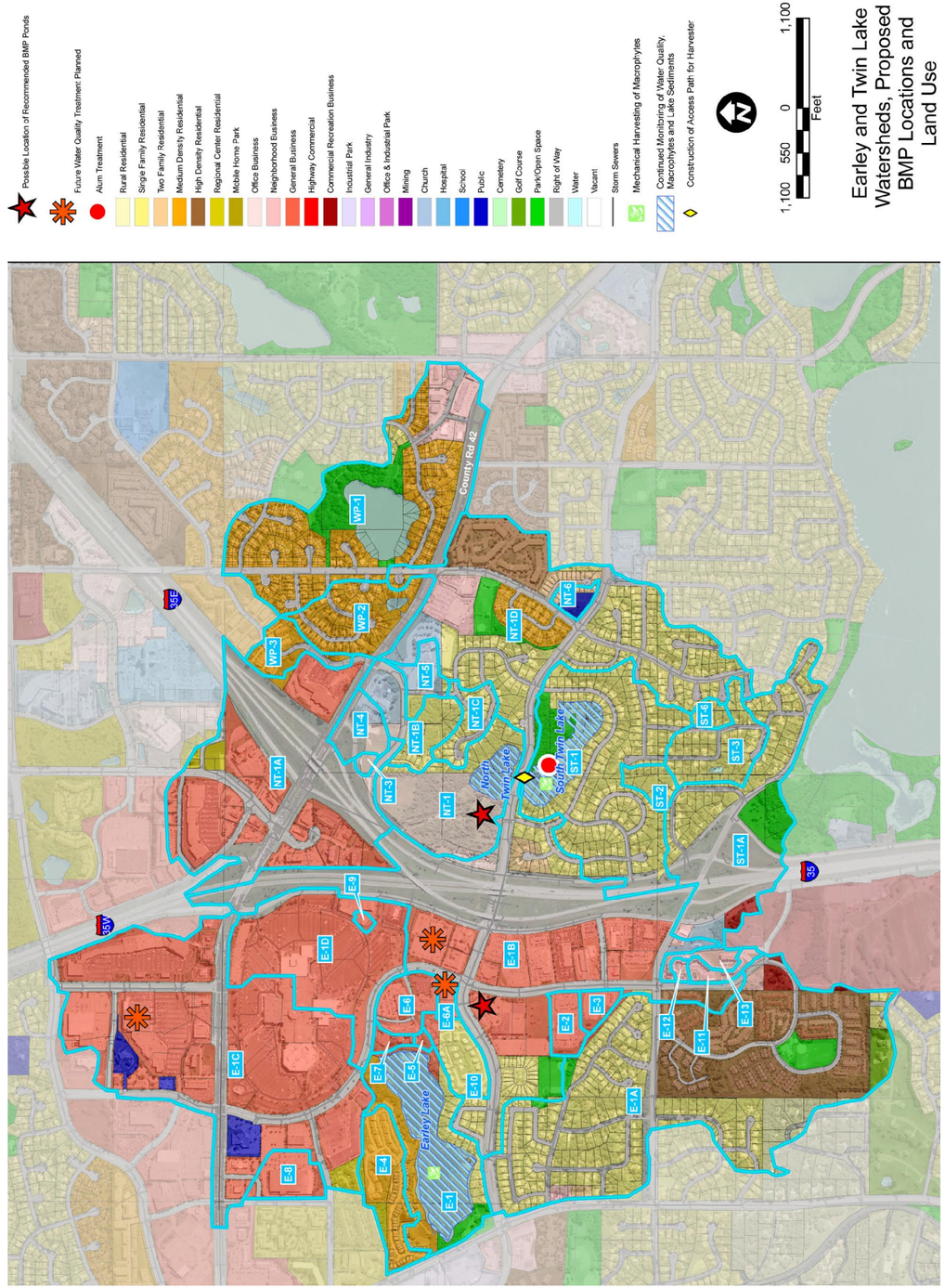


Earley Lake Annual Phosphorus Budget (1069 lbs)
Model Calibration Year (2006) Using Existing Land Use



Investigative Techniques Used in UAA Process

The UAA process included an intensive lakewater quality study, P8 computer simulation modeling of runoff water quality, lake hydrologic and phosphorus budget analyses, and an analysis of the likely water quality improvement benefits of several lake water management strategies. Secchi disc readings were conducted biweekly throughout the open water season as a general indicator of water quality.

Location of Recommended Management Strategy Elements

This map shows the location of the recommended lake water management strategy for improving the water quality of Earley and Twin Lakes.