



Minnesota  
Pollution  
Control  
Agency

# Crystal, Keller, and Lee Lakes Total Maximum Daily Load and Earley Lake Water Quality Assessment: Excess Nutrients

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**C**ystal, Keller, Lee, and Earley Lakes were listed on the Minnesota Pollution Control Agency (MPCA's) 303(d) Impaired Waters List in 2002 as impaired for aquatic recreation due to excess nutrients (phosphorus). As part of Clean Water Act requirements, a Total Maximum Daily Load (TMDL) report must be completed for each impaired waterbody. Excess phosphorus from stormwater runoff creates poor water quality conditions and causes summer algal blooms, which limit lake recreational activities such as swimming. Based on the most recent ten years of water quality data, Earley Lake is now meeting State water quality standards and will be removed from the Impaired Waters List.

## Crystal, Keller, Lee, and Earley Lakes

Crystal, Keller, Lee, and Earley Lakes are located in the southern Twin Cities Metropolitan Area in the Cities of Burnsville, Lakeville, and Apple Valley, Minnesota. The lakes are between 19 and 292 acres in size. The lakes combined watershed is approximately 5,000 acres which is part of the Black Dog Watershed Management Organization. The land area is almost completely developed and the main land uses are low density residential, highway, and commercial development. Recreational opportunities vary with each lake. Crystal Lake provides a public beach and boat landing for swimming, fishing, water skiing and aesthetic viewing. Keller



Lake is used for fishing, canoeing, and wildlife viewing, and Lee and Earley Lakes provide wildlife observation and aesthetic viewing.

The main objectives of this project are to determine the sources of the excess nutrients to these lakes and to estimate the reductions that are needed in order for Crystal, Keller, and Lee Lakes to meet the appropriate water quality standards and to improve water quality in Earley Lake. The end product of this project will be a Crystal, Keller, and Lee Lakes TMDL Report, Earley Lake Water Quality Assessment, and Implementation Plan.

## Total Maximum Daily Load background

The federal Clean Water Act requires states to adopt water quality standards to protect waterbodies from pollution. The MPCA has developed water quality standards, and these standards are outlined in Minn. R. ch. 7050. When waterbodies fail to meet the state standards, they

become listed on the 303(d) Impaired Waters List, requiring the completion of a TMDL study that establishes the pollutant reduction goals needed to restore the waters.

### Water quality standards and lake data

The MPCA's North Central Hardwood Forest (NCHF) Ecoregion *shallow* lake standards as applied to Keller, Lee, and Earley Lakes are  $\leq 60$   $\mu\text{g/L}$  (micrograms per liter) total phosphorus (TP),  $\leq 20$   $\mu\text{g/L}$  chlorophyll-a (chl-a), and  $\geq 1.0$  meter (m) secchi transparency (secchi) for Class 2B recreational waters. *Deep* lake standards as applied to Crystal Lake are  $\leq 40$   $\mu\text{g/L}$  TP,  $\leq 14$   $\mu\text{g/L}$  chl-a, and  $\geq 1.4$  m secchi. The lakes' growing season averages from 1999 through 2008 are:

- Keller Lake: 84  $\mu\text{g/L}$  TP, 29  $\mu\text{g/L}$  chl-a, and 1.2 m secchi
- Lee Lake: 66  $\mu\text{g/L}$  TP, 24  $\mu\text{g/L}$  chl-a, and 1.3 m secchi
- Earley Lake: 51  $\mu\text{g/L}$  TP, 13  $\mu\text{g/L}$  chl-a, and 1.5 m secchi
- Crystal Lake: 42  $\mu\text{g/L}$  TP, 25  $\mu\text{g/L}$  chl-a, and 1.7 m secchi

### Pollution sources

Crystal, Keller, Lee, and Earley Lakes each receive excess phosphorus loading from watershed and internal (in-lake) sources. Phosphorus in stormwater is a result of transporting fertilizers, sediments, and organic material such as leaves and grass clippings to lakes. Internal loading from a combination of curly-leaf pondweed dieback and sediment release of phosphorus is also a source of nutrients in the lakes. Phosphorus has built up in the sediments of these lakes after years of high phosphorus loads from stormwater runoff. This excess phosphorus is released into the water column when lake sediment is re-suspended by wind mixing or rough fish activity, dissolved oxygen levels are low, or pH levels are high. Phosphorus is also released when the heavy growths of the non-native invasive aquatic plant, curly-leaf pondweed, dies back in early to mid-summer.

### Pollution reductions needed

Listed below are the reductions in phosphorus loading to the lakes in order to meet water quality standards. The Waste Load Allocation (WLA) refers to watershed loading of phosphorus to the lake and the Load Allocation (LA) refers to phosphorus reductions needed from in-lake sources.

- Crystal Lake requires a 4 percent WLA reduction and 41 percent LA reduction.
- Keller Lake requires a 52 percent WLA reduction and 77 percent LA reduction.
- Lee Lake requires a 31 percent WLA reduction and 51 percent LA reduction.

### Implementation

Strategies will be developed to restore water quality in these lakes as part of a separate Implementation Plan. These may include activities such as street sweeping, public outreach and education, retrofitting or adding stormwater treatment projects, incorporating low impact development designs, managing aquatic plants and fisheries, and inactivating sediment phosphorus sources.

### For more information

The Crystal, Keller, and Lee Lakes TMDL Report and Earley Lake Water Quality Assessment along with the associated Implementation Plan are being prepared for the Black Dog Watershed Management Organization and MPCA by Barr Engineering.

For more information about this project, view the Web page at [www.pca.state.mn.us/water/tmdl/project-cklelakes-nutrients.html](http://www.pca.state.mn.us/water/tmdl/project-cklelakes-nutrients.html) or contact:

Minnesota Pollution Control Agency  
520 Lafayette Road North  
St. Paul, MN 55155  
651-296-6300 or 1-800-657-3864.

For general TMDL information, browse MPCA's Impaired Waters Web pages at [www.pca.state.mn.us/water/tmdl/index.html](http://www.pca.state.mn.us/water/tmdl/index.html).