

## LAKE SARAH DIAGNOSTIC STUDY

The Lake Sarah Project was sponsored in the early 1990s by the Commission in cooperation with the cities of Greenfield and Independence, the Lake Sarah Improvement Association, Three Rivers Park District and the Hennepin Conservation District. Funding was provided through a MPCA Clean Water Partnership Grant.

The project was initiated due to the gradual eutrophication of this 552 acre lake. Lake usages are primarily fishing and boating. The recreational uses of Lake Sarah had been impaired due to algal blooms which had occurred for a number of years. The lake fishery had also undergone a change. The Department of Natural Resources (DNR) surveys indicated a significant change in the fish population occurred between 1981 and 1986. 65% of the total area is littoral.

A steering committee was created at the start of the project. The committee met bi-monthly or as needed throughout the project. Their purpose was to oversee the project progress and provide input from a variety of perspectives.

The Project was divided into eight elements – 1) work plan; 2) monitoring plan and Quality Assurance Protection Plan; 3) community information and outreach plan; 4) monitoring; 5) community information and outreach program; 6) data analysis and assessment report; 7) administration; and 8) implementation plan.

Lake samples were collected at two sites. Station #1, where the majority of the samples were collected, was located in the lower basin over the deepest spot in the lake (50 to 60 feet). Station #2 was located in the upper basin over the deepest area in that basin (40 feet).

Stream monitoring was conducted at three sites around the lake. Station #3 was located at the mouth of Dance Hall Creek (aka Rush Creek) as it enters the lake through a 48" corrugated metal pipe. This site is located on the north side of the lake and drains the majority of the watershed. Station #4 was located at Loretto Creek, a small stream entering the southeast end of the easterly bay of the lake. Station #5 is the outlet of the lake, Sarah Creek, located on the northwest end of the western bay. One additional substantial inlet was not monitored. With these sites, 77% of the watershed area runoff was monitored.

The monitoring indicated a high load of phosphorus from the watershed. Loretto contributed 29.3% of the phosphorus load and Dance Hall (Rush) Creek contributed 40.2%. The smaller tributaries and tiles contributed 7.7%. Direct runoff from the area directly around the lake, including septic systems, was estimated to contribute 8.1% of the load. Internal loading from the lake bottom was estimated at 12.3% of the phosphorus load. The lake retains about 89% of the phosphorus that is carried into it.

Groundwater septic system monitoring was conducted on two separate dates with the help of MPCA staff. Samples from the first monitoring were analyzed for cations/anions, total phosphorus, conductivity, redox, pH, alkalinity. The second round of sampling was analyzed for stable isotopes in addition to the parameters analyzed in the first round.

An aquatic macrophyte survey was also conducted, vegetation identified and species and density recorded. An infestation of Eurasian watermilfoil was discovered in the lake during the summer of 1990. In 1991 it was determined that about 10% of the lake surface was covered by emergent vegetation, and submergent plants found in abundance included coontail and sago pondweed.

Rainfall was measured at six sites and snow pack samples were collected from three sites. Water levels fluctuated substantially, mainly due to beaver activity. High water, sometimes causing flooding, and shoreline erosion are problems.

The Lake Sarah watershed drains an area that is primarily agricultural. Most of the agricultural land has been tilled or ditched, causing the loss of many of the type 1 and 2 wetlands. The Project identified eight feedlots within the project

area. Two drained directly to the lake.

Out of 110 homes around the lake, only 100 were served by sanitary sewer. Many of the streets and roads in the project area were not paved.

### **Lake Sarah Implementation Plan**

The Lake Sarah Project goals were based on maintaining and improving the recreational use of the lake. An outcome of the *Lake Sarah Diagnostic Study Report* was the creation of an implementation plan. Developed in 1996, the implementation plan was based upon identification of the two major tributaries as the largest contributors of phosphorus to the lake. Although, in general, individual pollutant sources were not identified through monitoring, a review of land uses and inspections were used to develop the priorities for implementing best management practices in the watershed. Eight priority management areas (PMAs) were identified.

PMA A is located adjacent to Lake Sarah. It is considered a priority management area because of its direct impacts to the lake. Three areas of concern are 1) direct access of cattle to the lake, 2) feedlot runoff, and 3) milk house waste runoff.

PMA B is a 30 acre partially drained wetland just north of Lake Sarah. In 1996 the area currently was used as pasture for cattle, but was proposed for development in the near future.

PMA C is a 48 acre drainage area on the south side of Lake Sarah. It is tiled into the lake and drains primarily farmland and part of an area which was under development.

PMA D is on a tributary to Dance Hall Creek (Rush Creek). It is a feedlot area for cattle and pigs. The creek runs through the feedlot, which is then tiled and ditched to Dance Hall Creek just north of the wetland described in Priority Management Area B.

PMA E is adjacent to Loretto Creek upstream of its entrance to Lake Sarah.

PMA F consists of the corridors along the creeks and ditches draining to Lake Sarah.

PMA G consists of the entire watershed and addresses land management practices.

PMA H consists of Lake Sarah and its shoreline.

The following best management practices (BMPs) to help reduce pollutant loading to Lake Sarah. were considered as part of the Lake Sarah Project Phase II:

Agricultural BMPs, including animal waste management, conservation tillage, contour farming, feedlot runoff management field strips, grassed waterways, livestock exclusion, manure management/ utilization, soil testing, tile inlet filters, and vegetative buffer strips

Other BMPs, including Education, Homeowner Practices, NURP Ponds, Phosphorus Inactivation, Septic System Maintenance, Shoreline Erosion Control, Soil Testing, Streambank Stabilization, Vegetative Buffer Strips and Wetland Restoration.

Administrative Options, including Erosion Control Ordinance, Inspection Program, Shoreland Ordinance and Stormwater Ordinance.

Recommendations were provided by Priority Management Area and included:

PMA A - livestock exclusion and feedlot runoff management.

PMA B - restoration of 30-acre wetland to treat water in Dance Hall Creek.

PMA C - expansion of existing treatment pond to meet NURP standards.

PMA D - livestock exclusion and feedlot runoff management.

PMA E - restoration and enhancement of wetland through which Loretto Creek runs.

PMA F - vegetated buffer strips.

PMA G - conservation tillage, horse stable and backyard livestock management, grassed waterways, tile inlet filters, construction site erosion and sediment control, stormwater management ordinance, education, and wetland restoration.

PMA H - education and homeowner best management practices, erosion control and phosphorus inactivation.