SHELBYVILLE LAKE

WATER QUALITY

REPORT

for

1998

U.S. ARMY CORPS OF ENGINEERS, ST. LOUIS DISTRICT
ENVIRONMENTAL QUALITY SECTION - Water Quality

Ted Postol, Section Chief
Tori Foerste, Environmental Engineer
Donna Zoeller, Environmental Technician
Ron Frerker, Chemist

Table of Contents

LIST OF APPENDICES

LIST OF TABLES

LIST OF GRAPHS

WATER QUALITY MONITORING PROGRAM

Shelbyville Lake, Shelbyville, IL

1.0 GENERAL OVERVIEW

Shelbyville Lake is within the Kaskaskia River basin in central Illinois. The lake serves as a heavy recreational usage lake. The land surrounding the lake is used predominately for agriculture. Surrounding communities have existing industrial/commercial operations and residents which discharge wastewater into municipal wastewater treatment plants which ultimately discharge treated water into the Kaskaskia River basin. Agricultural runoff and municipal wastewater treatment facilities are the primary potential source of pollution into the Shelbyville Lake watershed. Additional sources are marinas, recreational watercraft discharges and wildlife fecal material runoff.

Water quality monitoring was conducted during 1998 to assure the safe conditions for human recreation, wildlife and aquatic life was maintained and managed within the lake system. The 1998 water quality monitoring program began in March and continued through October. Monitoring was conducted every other month for a total of four sampling/analysis events. Six sampling stations are sampled during each sampling event. The locations of the six sampling stations are depicted in the lake map in Appendix A.

2.0 WATER QUALITY ASSESSMENT CRITERIA

The water quality assessment criteria is based upon the State of Illinois regulatory limits for certain contaminants and generally accepted criteria for sustaining adequate aquatic plant and animal growth. The sampling and analysis conducted for Lake Shelbyville reflects the minimal set of parameters needed to indicate the current status of water quality for the lake system.

The following parameters were analyzed in FY98 sampling at Shelbyville Lake: alkalinity, total organic carbon (TOC), iron, manganese, ammonia-nitrogen, nitrate-nitrogen, orthophosphate, total phosphate, silica, total suspended solids (TSS), total volatile suspended solids (TVSS), fecal coliform and fecal streptococcus bacteria, pH, temperature, dissolved oxygen, specific conductance, oxidation-reduction potential (ORP), chlorophyll, pheophytin-a, atrazine and alachlor.

The Illinois Environmental Protection Agency in Title 35, Subtitle B, C, and D classify water quality criteria based on end usage. Subpart B contains regulations for general use water, while subpart C and D delineate those for public and food processing water and secondary contact and indigenous aquatic life standards, respectively. These standards are used to determine the aquatic water quality of the lake. Table 2.1 provides a listing of the regulatory limits for the parameters analyzed where a limit has been established.

TABLE 2.1 State of Illinois Water Quality Standards	
PARAMETER	**LIMIT**
Alkalinity	≥ 20 mg/l
Ammonia Nitrogen	15 mg/l
Nitrate-Nitrogen	10 mg/l
Iron	1.0 mg/l
Manganese	0.05 mg/l
Phosphorous as Phosphate	0.05 mg/l
Fecal Coliform	< 200 colonies/100 ml
Chloride, Chronic	230 mg/l
Chloride, Acute	860 mg/l
pH	Range: 6.5 to 9.0
DO	> 5.0 mg/l
Atrazine	0.003 mg/l (Drinking Water Standard)
Alachlor	0.002 mg/l (Drinking Water Standard)

Monitoring of the alkalinity provides the measurement of the buffering capacity of lake water as well as the effect on the toxicity of certain pollutants in the water (i.e., algae blooms and decay). Ammonia nitrogen is monitored so that the effects on fish spawning, hatching, growth rate and pathologic changes in gills, liver and kidney tissue can be related to the detected levels of ammonia nitrogen. Nitrate-nitrogen degrades to nitrite or produces ammonia which has a detrimental effect on aquatic life and therefore is monitored to assure levels are below the regulatory "safe" limit. The metals manganese and iron are nutrients for both plants and animals. Phosphate as analyzed as phosphorus is monitored due to the potential for uptake by nuisance algae. Levels of phosphate can indicate the potential for rapid growth of algae (algae bloom) which can cause serious oxygen depletion during the algae decay process. Serious oxygen depletion has a major effect on aquatic life. Photosynethic activity can be hindered by the levels of total suspended solids. Total suspended solids concentrations which cause the photosynethic activity to be reduced by more than 10% from the seasonably established norm, would have a detrimental effect on aquatic life. Silica, chlorophyll and pheophytin-a are monitored to provide indicators of algae growth and therefore potential oxygen depletion activity. Total volatile solids indicate the presence of organics in suspension and therefore additional demand levels of oxygen. Fecal coliform bacteria is monitored for the protection of human health as it relates to full body contact of lake waters. Chloride, pH and dissolved oxygen are monitored for the protection of aquatic life. Atrazine and Alachlor herbicides are commonly used agricultural chemicals which can be readily transported by rainfall runoff. Both compounds are suspected of causing cancer and therefore are monitored for the protection of human and aquatic health.

3.0 SPECIAL STUDIES

The collection of sediments at all lake sites was continued in 1998. This study is being conducted to establish baseline levels. Presently, there are no regulations for sediments. The composition of sediments vary for different areas. The data may provide supplemental information as to the relative amount of contaminants transported by sediments versus contaminants dissolved in the water column. This study will provide useful information into what contaminants bottom fish and other aquatic life are ingesting. It would also give an indication into what reactions take place during lake turnover. Lake turnover can have an effect on the oxidizing of metals. Trend analysis of this data will be performed every five years. The parameters analyzed include: fourteen (14) priority pollutant metals, total phosphate (TPO_4), Kjeldahl nitrogen, nitrate-N (NO_3), total solids, total organic carbon (TOC), chlorinated pesticides and PCB's. The results for chlorinated pesticides and PCB analysis were below the detectable limits for 1998.

4.0 WATER QUALITY MONITORING RESULTS

The laboratory analytical results for water samples are summarized in Table C-1, Appendix C. Analytical results of detected levels are plotted in graphical form on Graphs C-1a through C-1h, Appendix C.

Field collected analytical results are summarized in Table D-1 through D-4, Appendix D. A graphical presentation of field results are presented in Graphs D-1a through D-4, Appendix D.

Laboratory results for sediment samples are summarized in Table E-1, Appendix E.

5.0 SUMMARY OF MONITORING RESULTS

The seasonal change brought on a gradual lake stratification during the summer months. The stratification was less dramatic than previous years and therefore overall sudden detrimental water quality changes such as algae blooms and dramatic dissolved oxygen reductions were not experienced in the lake system.

Bacteria levels were elevated in the early spring and could be attributed to surface water runoff carrying additional wildlife wastes into the lake during a time of seasonably increasing temperatures. Bacteria levels decreased to within acceptable limits throughout the remainder of the year.

Iron was seen at slightly elevated levels within the lake waters but no evidence exists that demonstrate the levels are detrimental to the overall lake system at this time.

The 1998 phosphate results demonstrate that levels are above the required standard. The increased levels of phosphate in combination with nitrogen and other lake conditions such as temperature, pH and stagnant lake conditions can lead to increased algae growth.

The resulting detrimental effects of algae toxins and oxygen depletion could result in health problems for fish and land animals utilizing the water supply. None of these effects were apparent in 1998.

Atrazine was detected at a level above the regulatory limit for drinking water standards. The slightly elevated levels are a concern since the lake is a supplier to several surrounding communities. Treatment of water for the removal of atrazine is an expensive process and therefore elimination of the contaminant prior to water supply intake is the most cost effective approach. Management of agricultural application of the compound along with runoff management could reduce the influx into the lake system and therefore reduce the requirements for pretreatment of drinking water supplies originating from the lake.

The monitoring program for Shelbyville Lake during FY98 revealed a good water quality when compared to limits established by the Illinois Environmental Protection Agency (IEPA) for general use, secondary contact and indigenous aquatic life. Herbicide contamination and other agricultural nutrient runoffs are primary concerns for the lake water quality. Better land management practices, erosion control and buffering zones are methods to reduce these contaminants from entering the lake. The St. Louis District personnel will continue working with lake personnel, area communities and agencies in implementation of educational and implementation planning to bring about the use of better management techniques which will improve the lake water quality.

6.0 PLANNED 1999 STUDIES

A new sampling plan has been proposed for FY99. This plan involves an extensive trend analysis of the contaminants entering Shelbyville Lake. The sampling sites include 7, 9, 2, 1, the golf course site, and a new site at Asa Creek near the sewage treatment plant. The combination of these sites will effectively represent the incoming contaminants and their effects on the lake.

St. Louis District plans to investigate the current herbicide usage practices within the surrounding area of the lake. Herbicide contamination from agricultural use is one of the primary environmental concerns for the lake water quality. Herbicide contamination has been detected during FY98 and previous years at low levels. Upon determination of current herbicide usage practices, the St. Louis District plans to perform sediment sampling at the normal lake sampling sites and tributaries to determine if recent agricultural run off is impacting the lake conditions.