

## MISSOURI RIVER BASIN TOTAL MAXIMUM DAILY LOAD

### Water Body: Sabetha City Lake Water Quality Impairment: Eutrophication

**Subbasin:** South Fork Big Nemaha      **County:** Nemaha

**HUC 8:** 10240007      **HUC 11 (HUC 14):** 010 (040)

**Drainage Area:** Approximately 8.8 square miles.

**Conservation Pool:** Area = 81.9 acres, Mean Depth = 0.8 meter

**Designated Uses:** Secondary Contact Recreation; Expected Aquatic Life Support; Drinking Water; Food Procurement; Industrial Water Supply

**1998 303d Listing:** Table 4 - Water Quality Limited Lakes

**Impaired Use:** All uses are impaired to a degree by eutrophication

**Water Quality Standard:** Nutrients - Narrative: The introduction of plant nutrients into streams, lakes, or wetlands from artificial sources shall be controlled to prevent the accelerated succession or replacement of aquatic biota or the production of undesirable quantities or kinds of aquatic life. (KAR 28-16-28e(c)(2)(B)).

The introduction of plant nutrients into surface waters designated for primary or secondary contact recreational use shall be controlled to prevent the development of objectionable concentrations of algae or algal by-products or nuisance growths of submersed, floating, or emergent aquatic vegetation. (KAR 28-16-28e(c)(7)(A)).

## 2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

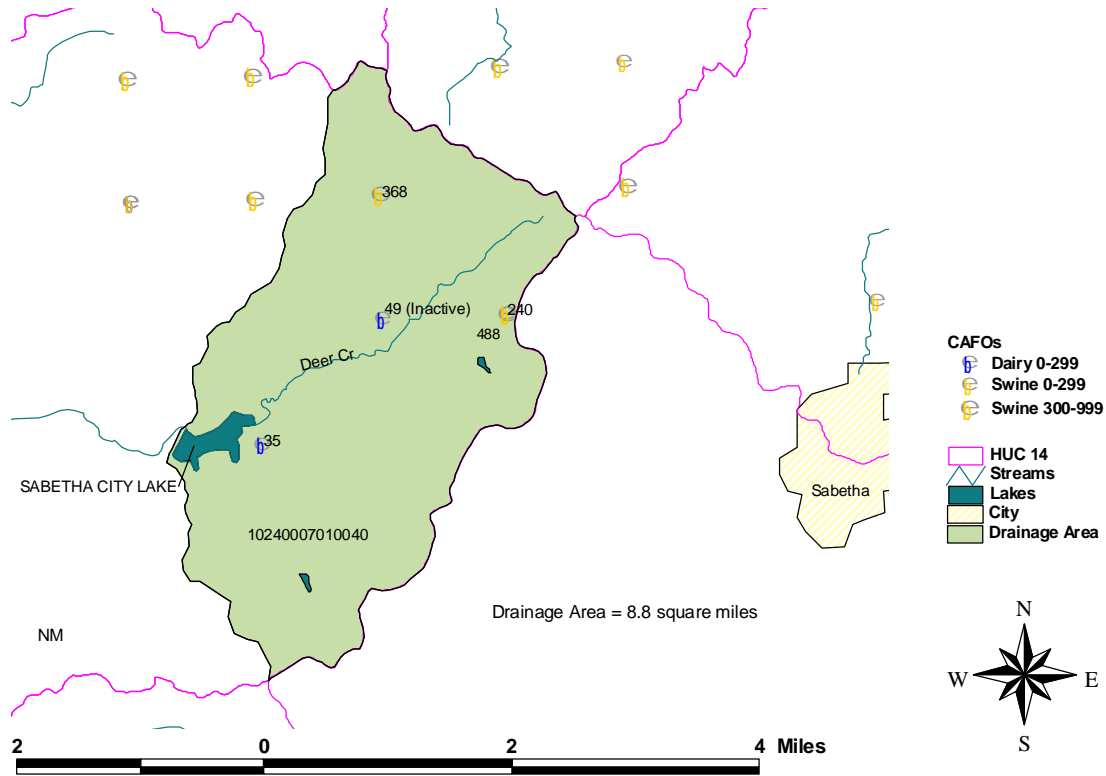
**Level of Eutrophication:** Hypereutrophic, Trophic State Index = 68.80

**Monitoring Sites:** Station 011501 in Sabetha City Lake. (Figure 1)

**Period of Record Used:** One survey in 1989.

Figure 1

## Sabetha City Lake TMDL Reference Map



### Current Condition:

At the time of the 1989 survey, Sabetha City Lake had elevated chlorophyll a concentrations averaging 49.3 ppb. This relates to a Trophic State Index of 68.80, indicating hypereutrophic conditions. The total phosphorus concentrations were high, averaging 200.0 ppb. The chlorophyll a to total phosphorus yield was moderate.

The Trophic State Index is derived from the chlorophyll a concentration. Trophic state assessments of potential algal productivity were made based on chlorophyll a concentrations, nutrient levels and values of the Carlson Trophic State Index (TSI). Generally, some degree of eutrophic conditions is seen with chlorophyll a concentrations over 7 ug/l and hypereutrophy occurs at levels over 30 ug/L. The Carlson TSI, derives from the chlorophyll concentrations and scales the trophic state as follows:

- |                       |                 |
|-----------------------|-----------------|
| 1. Oligotrophic       | TSI < 40        |
| 2. Mesotrophic        | TSI: 40 - 49.99 |
| 3. Slightly Eutrophic | TSI: 50 - 54.99 |
| 4. Fully Eutrophic    | TSI: 55 - 59.99 |
| 5. Very Eutrophic     | TSI: 60 - 63.99 |
| 6. Hypereutrophic     | TSI: \$ 64      |

**Interim Endpoints of Water Quality (Implied Load Capacity) at Sabetha City Lake over 2005 - 2009:**

The desired endpoint will be summer chlorophyll a concentrations at or below 20 ug/l, corresponding to a trophic state of eutrophic conditions by 2009. Refined endpoints will be developed in 2005 to reflect additional sampling and artificial source assessment and confirmation of impaired status of the lake.

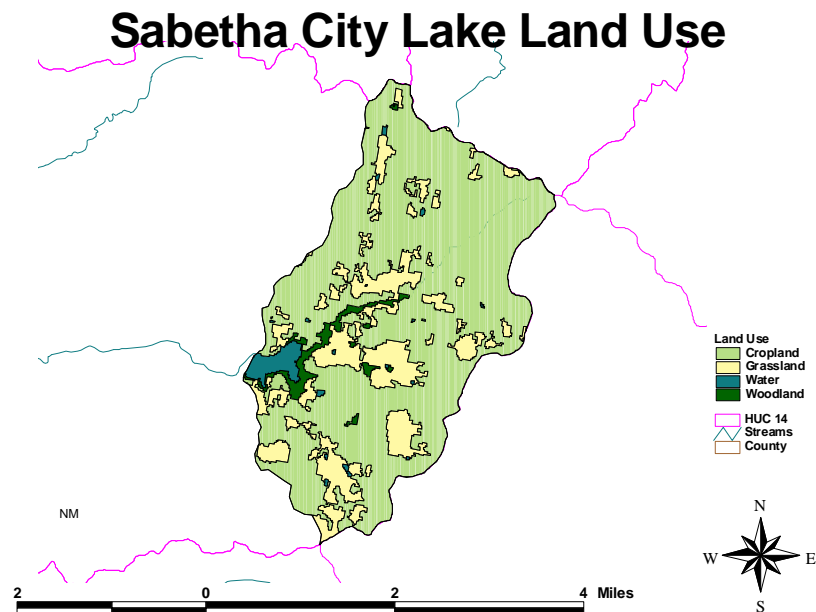
**3. SOURCE INVENTORY AND ASSESSMENT**

**Land Use:** The watershed around Sabetha City Lake has a moderate to high potential for nonpoint source pollutants. An annual phosphorus load of 14,296.7 pounds per year is necessary to correspond to the concentrations seen in the lake.

The primary source of phosphorus within Sabetha City Lake is probably runoff from agricultural lands where phosphorus has been applied. Land use coverage analysis indicates that 76.4% of the watershed is cropland (Figure 2).

In 1999, 34,036 tons of fertilizer were sold in Nemaha County. Since the watershed takes up approximately 1.24% of Nemaha County, 422 tons of fertilizer were bought and potentially used with the watershed.

Phosphorus from animal waste is a secondary contributing factor. Nineteen percent of land around the lake is grassland;



**Figure 2**

the grazing density of livestock is moderate. There are one dairy and three swine facilities with a total of 1,131 animal units in the watershed. Another dairy within the watershed is inactive.

The population in the watershed is low (9.12 people per square mile). By 2020, the population of Sabetha is anticipated to grow 10.0%.

**Contributing Runoff:** The watershed's average soil permeability is 0.4 inches/hour according to NRCS STATSGO data base. About 95.5% of the watershed produces runoff even under relative low (1.5"/hr) potential runoff conditions. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. As the watersheds' soil profiles become saturated, excess overland flow is produced. Generally, storms producing less than 0.5"/hr of rain will generate runoff from only 89.0% of this watershed, chiefly along the stream channels.

**Background Levels:** Two percent of land in the watershed is woodland; leaf litter may be contributing to the nutrient loading. The nutrient recycling, atmospheric deposition, and geological formations (i.e., soil and bedrock) may contribute to phosphorus loads.

#### **4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY**

Phosphorus is the limiting nutrient in Sabetha City Lake and allocated under this TMDL. The general inventory of sources within the drainage does provide guidance as to areas of load reduction.

**Point Sources:** A current Wasteload Allocation of zero is established by this TMDL because of the lack of point sources in the watershed. Should future point sources be proposed in the watershed and discharge into the impaired segments, the current Wasteload allocation will be revised by adjusting current load allocations to account for the presence and impact of these new point source dischargers.

**Nonpoint Sources:** Water quality violations are predominantly due to nonpoint source pollutants. Background levels may be attributed to nutrient recycling and leaf litter. The assessment suggests that cropland and animal waste contribute to the elevated total phosphorus concentrations in the lake. Generally a Load Allocation of 2,999.7 pounds of total phosphorus per year, leading to a 76.7% reduction, is necessary to reach the endpoint.

**Defined Margin of Safety:** The margin of safety provides some hedge against the uncertainty of variable annual total phosphorus loads and the chlorophyll a endpoint. Therefore, the margin of safety will be 333.3 pounds of total phosphorus per year taken from the load capacity subtracted to compensate for the lack of knowledge about the relationship between the allocated loadings and the resulting water quality.

**State Water Plan Implementation Priority:** Because more data is needed to determine the trophic state of the lake, the Sabetha City Lake TMDL will be a Low Priority for implementation.

**Unified Watershed Assessment Priority Ranking:** This watershed lies within the South Fork Big Nemaha (HUC 8: 10240007) with a priority ranking of 9 (High Priority for restoration).

**Priority HUC 11s:** The watershed is within HUC 11 (010).

## **5. IMPLEMENTATION**

### **Desired Implementation Activities**

There is a good potential for reducing pollutant loads to this lake through the use of best management practices. Some of the recommended agricultural practices are as follows:

1. Implement soil sampling to recommend appropriate fertilizer applications on cropland.
2. Maintain conservation tillage and contour farming to minimize cropland erosion.
3. Install grass buffer strips along streams.
4. Reduce activities within riparian areas.
5. Implement nutrient management plans to manage manure application to land.

### **Implementation Programs Guidance**

Until the 2006 assessment of the continuation of monitoring is made, no direction can be made to those implementation programs.

**Time Frame for Implementation:** Continued monitoring over the years from 2001 to 2005.

**Targeted Participants:** Primary participants for implementation will be the City of Sabetha agricultural producers within the drainage of the lake. A detailed assessment of sources will be conducted by KDHE over 2002-2005.

**Milestone for 2006:** The year 2006 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, sampled data from Sabetha City Lake will be reexamined to confirm the impaired status of the lake. Should the case of impairment remain, source assessment, allocation and implementation activities will ensue.

**Delivery Agents:** The primary delivery agents for program participation will be the Kansas Department of Wildlife and Parks, conservation districts for programs of the State Conservation Commission, and the Natural Resources Conservation Service. Producer outreach and awareness will be delivered by Kansas State Extension.

**Reasonable Assurances:**

**Authorities:** The following authorities may be used to direct activities in the watershed to reduce pollutants.

1. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.
2. K.S.A. 2-1915 empowers the State Conservation Commission to develop programs to assist the protection, conservation and management of soil and water resources in the state, including riparian areas.
3. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control nonpoint source pollution.
4. K.S.A. 82a-901, et seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.
5. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan*.
6. The *Kansas Water Plan* and the Missouri Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority in implementation.

**Funding:** The State Water Plan Fund annually generates \$16-18 million and is the primary funding mechanism for implementing water quality protection and pollutant reduction activities in the state through the *Kansas Water Plan*. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watersheds and water resources of highest priority. Typically, the state allocates at least 50% of the fund to programs supporting water quality protection. This watershed and its TMDL are a Low Priority consideration and should not receive funding until after 2006.

**Effectiveness:** Effectiveness of corrective actions will depend upon the sources which contribute to the impairment at the lake.

**6. MONITORING**

Further sampling and evaluation should occur twice before 2005.

## 7. FEEDBACK

**Public Meeting:** A public meeting to discuss TMDLs in the Missouri Basin was held February 28, 2001 in Atchison. An active Internet Web site was established at <http://www.kdhe.state.ks.us/tmdl/> to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Missouri Basin.

**Public Hearing:** A Public Hearing on the TMDLs of the Missouri Basin was held in Hiawatha on May 29, 2001.

**Basin Advisory Committee:** The Missouri Basin Advisory Committee met to discuss the TMDLs in the basin on October 4, 2000, February 28 and May 29, 2001.

**Milestone Evaluation:** In 2006, evaluation will be made as to the degree of impairment which has occurred within the drainage and current condition of Sabetha City Lake. Subsequent decisions will be made regarding implementation approach and follow up of additional implementation.

**Consideration for 303d Delisting:** The lake will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2005-2009. Therefore, the decision for delisting will come about in the preparation of the 2010 303(d) list. Should modifications be made to the applicable water quality criteria during the ten-year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

**Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process:** Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2002 which will emphasize revision of the Water Quality Management Plan. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in *Kansas Water Plan* implementation decisions under the State Water Planning Process for Fiscal Years 2002-2006.

### Bibliography

Carney, C. Edward 1999, *Requested information on the two TMDL "review themes" you received from EPA which relate to lakes* [Memorandum] 5 Aug. 1999

Liscek, Bonnie C. 2001, *Reference for Determining Limitation/Co-Limitation of Nutrients* [Memorandum] 18 Jun. 2001

Stiles, Thomas C. 1999, *Rationale and Reference to Selected TMDL Issues* [Memorandum] 6 Aug. 1999