

LOWER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body: Horseshoe Lake
Water Quality Impairment: Eutrophication

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Middle Arkansas-Slate

County: Sedgwick

HUC 8: 11030013

HUC 11 (HUC 14): 010 (040)

Drainage Area: Area within the Wichita Zoo that is immediately adjacent to the lake.

Conservation Pool: Area = 11.4 acres, Maximum Depth = 6 meters

Designated Uses: Secondary Contact Recreation; Expected Aquatic Life Support; Food Procurement; Groundwater Recharge

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 = 67.31

Monitoring Sites: Station 063501 in Horseshoe Lake.

Period of Record Used: One previous survey in 1989

Current Condition: The average, total phosphorus concentration was 120 ppb in 1989. The average chlorophyll a concentration was 42.3 ppb. The chlorophyll a to total phosphorus yield is high. Phosphorus appears to be the primary limiting nutrient. Light is not a limiting factor.

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 12 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 Horseshoe Lake over 2005 - 2009:

In order to improve the trophic condition of the lake from its current hypereutrophic status, 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 lake.

3. SOURCE INVENTORY AND ASSESSMENT

Land Use: Watershed is restricted and has a low to moderate potential for nonpoint source pollution. An annual phosphorus load of 7.7 pounds per year is necessary to correspond to the concentrations seen in the lake.

Human activities in the zoo effect the water quality in the lake. The lake receives an unknown alluvial groundwater interaction.

Background Levels: Waste from wildlife increases the levels of phosphorus in the lake. Trees are present in the park that is adjacent to the lake; leaf litter may be adding to the nutrient load. Small amounts of phosphorus are contributed from the watershed soils. Nitrogen loads may be contributed from the atmosphere.

4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

More detailed assessment of sources and confirmation of the trophic state of the lake must be completed before detailed allocations can be made. The general inventory of sources within the drainage does provide some 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 partially due to nonpoint source pollutants. Background levels may be attributed to wildlife waste and leaf litter. The assessment suggests that human activities in the watershed contribute to the hypereutrophic state of the lake. Generally a Load Allocation of 2 pounds per year, leading to a 71% reduction in phosphorus is necessary to reach the endpoint.

Defined Margin of Safety: The margin of safety provides some hedge against the uncertainty of variable annual phosphorus loads and the chlorophyll a endpoint. Therefore, the margin of safety will be 0.2 pound per year of phosphorus taken from the load capacity to ensure that adequate load reduction occurs to meet the endpoint.

State Water Plan Implementation Priority: Because Horseshoe Lake has unknown groundwater interactions and a more detailed source assessment and additional in-lake monitoring of nutrient and algal content is needed, this TMDL will be a Low Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Middle Arkansas subbasin (HUC 8: 11030013) with a priority ranking of 6 (High Priority for restoration).

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

5. IMPLEMENTATION

Desired Implementation Activities

Given the hydrologic conditions, and the small watershed to work within, little best management practices related activity may be possible.

Implementation Programs Guidance

Until additional assessment of probable sources and in-lake nutrient content is made, no direction can be made to those implementation programs.

Time Frame for Implementation: Pollution reduction practices should be installed within the lake drainage during the years from 2009 to 2013.

Targeted Participants: Primary participants for implementation will be Wichita Zoo employees. A detailed assessment of sources will be conducted by KDHE over 2003-2005.

Milestone for 2005: The year 2005 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, sampled data from Horseshoe 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: Depending upon confirmation of impairment and assessment of probable sources, the primary delivery agents for program participation will be local officials.

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 Lower Arkansas 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 2005.

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

6. MONITORING

Additional data, to establish nutrient ratios, source loading and further determine mean summer lake trophic condition, would be of value prior to 2006. Further sampling and evaluation should occur twice before 2006.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the Lower Arkansas Basin were held March 9 in Wichita, April 26 in Wichita and Hutchinson, and April 27 in Arkansas City and Medicine Lodge. 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 Lower Arkansas Basin.

Public Hearing: A Public Hearing on the TMDLs of the Lower Arkansas Basin was held in Wichita on June 1, 2000.

Basin Advisory Committee: The Lower Arkansas Basin Advisory Committee met to discuss the TMDLs in the basin on September 27, November 8, 1999; January 13, 2000; March 9, 2000.

Discussion with Interest Groups: Meetings to discuss TMDLs with interest groups include:

Agriculture: January 12, February 2 and 29, 2000

Environmental: March 9, 2000

Conservation Districts: November 22, 1999

Industry: December 15, 1999, January 13, February 9 and 22, 2000

Local Environmental Protection Groups: September 30, November 2, December 16, 1999

Milestone Evaluation: In 2005, evaluation will be made as to the degree of impairment which has occurred within the drainage and current condition of Horseshoe Lake. Subsequent decisions will be made regarding implementation approach and follow up of additional implementation.

Consideration for 303d Delisting: Horseshoe Lake will be evaluated for delisting under Section 303d, based on the monitoring data over the period 2005-2009. Therefore, the decision for delisting will come about in the preparation of the 2010 303d list. Should modifications be made to the applicable nutrient criterion 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 after Fiscal Year 2004.

Approved November 13, 2000.