

# LOWER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

**Water Body: Slate Creek W.A.**  
**Water Quality Impairment: Eutrophication Bundled with pH**

## 1. INTRODUCTION AND PROBLEM IDENTIFICATION

**Subbasin:** Middle Arkansas-Slate

**County:** Sumner

**HUC 8:** 11030013

**HUC 11 (HUC 14):** 020 (060)

**Drainage Area:** Approximately 8.86 square miles.

**Conservation Pool:** Area = 26 acres, Maximum Depth = 0.3 meter

**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)).

pH less than 6.5 and greater than 8.5 (KAR 28-16-28e(c)(2)(C))

## 2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

**Level of Eutrophication:** Hypereutrophic, Trophic State Index = 75.13

**Monitoring Sites:** Station 014201 in Slate Creek W.A..

**Period of Record Used:** Three surveys during 1997-1999

**Current Condition:** Slate Creek W.A. has consistently elevated chlorophyll a concentrations. The average concentration is 93.9 ppb, related to a Trophic State Index of 75.13, indicating hypereutrophic conditions. The concentrations have fluctuated over time. The average chlorophyll a concentration was 41.0 ppb in 1997, rose to 131.4 ppb in 1998, and dropped to 109.5 ppb in 1999.

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       |

Total phosphorus concentrations are high, averaging 213.8 ppb. One hundred percent of the samples taken from the wetland were over 100 ppb. The chlorophyll a to total phosphorus yield is very high. The total nitrogen to total phosphorus ratio is 10.3, indicating possible co-limitation. (Phosphorus is more likely to be the primary limiting nutrient, although nitrogen may be co-limiting). Light is not a limiting factor, despite the high inorganic turbidity.

From 1997 to 1999, the pH was high 100 percent of the time. The average pH was 9.08 ranging from 8.88 to 9.30.

**Interim Endpoints of Water Quality (Implied Load Capacity) at Slate Creek W.A. over 2005 - 2010:**

In order to improve the trophic condition of the wetland 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 fully eutrophic conditions by 2009. Achievement of this endpoint should also result in pH values between 6.5 and 8.5. Refined endpoints will be developed in 2005 to reflect additional sampling and artificial source assessment and confirmation of impaired status of wetland.

### 3. SOURCE INVENTORY AND ASSESSMENT

**Land Use:** The primary source of phosphorus within Slate Creek W.A. is probably runoff from agricultural lands where phosphorus has been applied. Land use coverage analysis indicates that 71.6 % of the watershed is cropland. An annual phosphorus load of 4,960 pounds per year is necessary to correspond to the concentrations seen in the wetland.

Phosphorus from animal waste is a contributing factor. Twenty-eight percent of land around the wetland is grassland. The summer and winter grazing densities of livestock are average.

**Background Levels:** Wildlife waste increases the levels of nitrogen and phosphorus in the wetland. Nutrient recycling from the sediments in the wetland is likely contributing available phosphorus to the wetland for algal uptake. Geological formations contain small amounts of phosphorus (up to 0.5% of total weight), and may contribute to phosphorus loads.

### 4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

More detailed assessment of sources and confirmation of the trophic state of the wetland 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 predominantly due to nonpoint source pollutants. Background levels may be attributed to wildlife waste and nutrient recycling. The assessment suggests that cropland and animal waste throughout the watershed contribute to the hypereutrophic state of the wetland. Generally a Load Allocation of 669.6 pounds per year, leading to an 85% 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 74.4 pounds 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 Slate Creek W.A. needs more detailed source assessment and additional in-wetland monitoring of nutrient and algal content, this TMDL will be a Medium Priority for implementation

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

**Priority HUC 11s:** The wetland is within HUC 11 (020).

## **5. IMPLEMENTATION**

### **Desired Implementation Activities**

There is a good potential for nutrient load reductions from best management practice placement in this watershed. Good nonpoint source pollution control will allow a significant reduction in the trophic state of this water body, although it will remain fairly productive of non-phytoplankton life. 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.

Additionally, some lake management might assist in reducing nutrient cycling within the lake.

### **Implementation Programs Guidance**

#### **Fisheries Management-KDWP**

- a. Evaluate in-lake or near-lake potential sources of nutrients to lake.
- b. Apply lake management techniques which may reduce nutrient loading and cycling in lake.

#### **Nonpoint Source Pollution Technical Assistance - KDHE**

- a. Support Section 319 demonstration projects for reduction of sediment runoff from agricultural activities as well as nutrient management.
- b. Provide technical assistance on practices geared to establishment of vegetative buffer strips.
- c. Provide technical assistance on nutrient management in vicinity of streams.

#### **Water Resource Cost Share Program - SCC**

- a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed wetlands.

#### **Nonpoint Source Pollution Control Program - SCC**

- a. Provide sediment control practices to minimize erosion and sediment and nutrient transport.

**Riparian Protection Program - SCC**

- a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation.
- b. Develop riparian restoration projects.
- c. Promote wetland construction to assimilate nutrient loadings.

**Buffer Initiative Program - SCC**

- a. Install grass buffer strips near streams.
- b. Leverage Conservation Reserve Enhancement Program to hold riparian land out of production.

**Extension Outreach and Technical Assistance - Kansas State University**

- a. Educate agricultural producers on sediment, nutrient and pasture management.
- b. Educate livestock producers on livestock waste management and manure applications and nutrient management planning.
- c. Provide technical assistance on livestock waste management systems and nutrient management plans.
- d. Provide technical assistance on buffer strip design and minimizing cropland runoff.
- e. Encourage annual soil testing to determine capacity of field to hold phosphorus.

**Time Frame for Implementation:** Pollution reduction practices should be installed within the lake drainage after 2005. Initial evaluation of nutrient sources to lake and identification of potential management techniques which should occur prior to 2005.

**Targeted Participants:** Primary participants for implementation will be state fisheries managers and agricultural producers within the drainage of the lake. Source assessment would occur over 2000-2005. Initial work in 2005 should include local assessments by conservation district personnel and county extension agents to locate within the lake drainage:

1. Total rowcrop acreage
2. Cultivation alongside lake
3. Drainage alongside or through animal feeding lots
4. Livestock use of riparian areas
5. Fields with manure applications

**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 Slate Creek W.A. should indicate probable sources of nutrients needing implementation.

**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 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.
7. K.S.A. 32-807 authorizes the Kansas Department of Wildlife and Parks to evaluate and manage lake resources or provide assistance to landowners or local governments.

**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 Medium Priority consideration.

**Effectiveness:** Nutrient control has been proven effective through conservation tillage, contour farming, and use of grass waterways and buffer strips. The key to success will be widespread utilization of conservation farming within the watersheds cited in this TMDL.

## 6. MONITORING

KDHE will collect nutrient, pH, and chlorophyll a samples from Slate Creek W.A. in 2000, as a part of an EPA grant project. Additional data, to establish nutrient ratios, source loading and further determine mean summer wetland trophic condition, would be of value prior to 2005. Further sampling and evaluation should occur once before 2005 and once between 2005 and 2010.

## 7. FEEDBACK

**Public Meetings:** Public meetings to discuss TMDLs in the Lower Arkansas Basin were held March 9, 2000 and April 26-27, 2000 in Wichita, Hutchinson, 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 will be 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 implementation needing to occur within the watershed and current condition of the Slate Creek Area.

Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

**Consideration for 303d Delisting:** The river 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 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 after Fiscal Year 2005.

Approved November 13, 2000.