

KANSAS-LOWER REPUBLICAN BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Clinton Lake Water Quality Impairment: Eutrophication

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Lower Kansas

Counties: Douglas and Shawnee

HUC 8: 10270104

HUC 11: 010

Drainage Area: Approximately 367 square miles.

Conservation Pool: Elevation 875.5; Volume 125,000 acre-feet

Tributary Arms: Wakarusa River
Deer Creek
Rock Creek

Designated Uses: Primary Contact Recreation; Food Procurement; Domestic Water Supply;
Special Aquatic Life Support

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

Impaired Use: All uses potentially impaired from 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)).

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Use under 1998 303d: Not Supporting Aquatic Life

Monitoring Sites: Station 30001 in Clinton Lake.

Period of Record Used: 1988, 1991, 1994, 1996, 1997, & 1998

Lake Record: 1980-1997 elevations from U.S. Army Corps of Engineers for Clinton Lake.

Current Condition: Lake consistently has elevated chlorophyll a concentrations during summer months, average concentration is 18.1 ppb, related to a Trophic State Index of 59 which is on the border of very eutrophic conditions. Best conditions were seen in 1996 and 1997 when chlorophyll a levels were 10-11 ppb with a TSI of 54, indicative of slightly eutrophic conditions. This was followed by large chlorophyll a concentrations in 1998 of 26 and 37 ppb and a TSI of 64, indicating hyper eutrophic conditions.

Additionally, elevated levels of geosmin, a decomposition product from decaying algae, has affected the taste and odor of the water supply from the lake, occasionally rendering the water unacceptable for use. Total phosphorus data are varied, but tend to be elevated in the lake, averaging 64 ppb and in the Wakarusa river. Thirty three percent of the samples taken from the lake were over 100 ppb and 55% of the samples taken from the river were over 100 ppb. The lake tends to be nitrogen limited, allowing dominance of blue-green algae in summer and fall. Data collected by the Kansas Biological Survey confirm the phosphorus and algae data, noting that the arms of the lake are primary areas of production. Frequency analysis of the pool level at Clinton indicates that water is in the flood pool 60% of the time. A portion of that incursion is management plans to protect fishery spawn. Drawdowns are not very extensive, typically less than three feet. Similarly, use of more than three feet of the flood pool occurred ten percent of the time.

Desired Endpoints of Water Quality at Clinton Lake over 2004 - 2008:

1. Maintain chlorophyll a concentrations at 12 ppb, allowing a slightly eutrophic condition (TSI = 53-54)
2. Reduce proportion of blue green algae in lake to under 10% of phytoplankton
3. Reduce phosphorus loads from Wakarusa drainage by 50-60%
4. Reduce sedimentation within arms of lake.

These TMDL endpoints address the narrative criteria pertaining to nutrients in Clinton, the expectation is achieving this endpoint will reduce the threat of algal populations explosions, particularly of blue-green algae. There is no seasonal variation established under this TMDL since phosphorus retention by the reservoir carries over seasonal loads into the summer productivity season.

These endpoints will be reached as a result of expected reductions in loading from the various sources in the watershed resulting from implementation of corrective actions and Best Management Practices, as directed by this TMDL. Achievement of the endpoints indicate loads are approaching the loading capacity of the lake, water quality standards are attained and full support of the designated uses of the lake has been restored.

3. SOURCE INVENTORY AND ASSESSMENT

The primary source of phosphorus within Clinton Lake is probably runoff from agricultural lands in the Wakarusa Subbasin where phosphorus has been applied. Selection of geographic sources of nutrients is a function of a given watershed's proportion of cropland, its proximity to the lake and its propensity to generate runoff. Land use coverage analysis indicates 28% of the watershed is in cropland. Forty percent of the cropland in subwatershed is within one mile of the streams in the subwatershed. There are a number of small livestock operations in the watershed, a few in proximity to the headwaters of the lake. Grazing density for the watershed is about 30 animal units per square mile. An annual loading of 170 tons per year of phosphorus is necessary to realize the concentrations seen in the lake.

There are also five municipal wastewater dischargers which contribute some phosphorus at low flows. The total of the design flows of those point sources is 0.6 cfs, which is not significant inflow into the lake. Presuming that the point sources influence water quality in flows up to ten times the design flows, the impacts would be seen at flows which are seen 10-15% of the time in the summer and winter.

There are a number of on-site wastewater systems in place in Douglas and Shawnee counties. Both counties are projected to have significant growth through the year 2020, in the range of 75-85% increases over 1990 populations. Inspection and complaint numbers for on-site systems for the two counties are over 200 per year each in 1998 and 1999. Proliferation of on-site systems and the concomittent potential for loading of nutrients is highly probable in the Wakarusa watershed.

Soils in the watershed appear to be low in permeability (average permeability of 0.6"/hr). Under high runoff conditions, 92% of the watershed contributes runoff to the lake, as conditions dry to more moderate conditions, 91% of the watershed continues to experience runoff. Under dry conditions, 71% of the watershed will contribute runoff.

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

Point Sources: Since this impairment is primarily associated with agricultural non-point source pollution, point sources of nutrients will not be emphasized under this TMDL, although future NPDES permits may be conditioned to provide some reduction in phosphorus loading of their effluent. At this point, the Wasteload Allocation will be a reduction of nutrient loadings such that average phosphorus concentrations are below 100 ppb in stream and nitrogen concentrations average below 200 ppb at flows below 10 cfs.

Non-Point Sources: As described in the Source Assessment, the subwatershed has a high proportion of cropland, strong propensity for runoff and is close to the Clinton headwater arms where KBS information indicates a high level of algal production. Estimated loadings of phosphorus need to be reduced by 60% in order to achieve full support of the lake uses, leading to an annual load of 70 tons per year of phosphorus.

Defined Margin of Safety: The margin of safety provides some hedge against the uncertainty of variable annual total phosphorus loads and the endpoint. Therefore, the margin of safety will be 10 tons per year of total phosphorus taken from the load capacity to ensure that adequate load reduction occurs to meet the endpoint.

State Water Plan Implementation Priority: Because this lake has tremendous importance in influencing the water supply and water quality of the Kansas River, the investment made by the state in the conservation storage of the lake and the need to comprehensively package implementation measures to handle multiple impairments in the lake and watershed, this TMDL will be a High Priority for implementation.

Unified Watershed Assessment Priority Ranking: This lake's watershed is in the Lower Kansas Subbasin (HUC8: 10270104). The Unified Watershed Assessment assigned a priority ranking of 1 to the Lower Kansas (Highest Priority for restoration work.)

Priority HUC 11s and Stream Segments: The watershed constitutes a single HUC 11 (010). Priority segments would include the mainstem of the Wakarusa (30,31), Deer Creek (701) and Rock Creek (35)

5. IMPLEMENTATION

Desired Implementation Activities

1. Implement necessary soil sampling to recommend appropriate fertilizer applications on cropland.
2. Maintain necessary conservation tillage and contour farming to minimize cropland erosion.
3. Install necessary grass buffer strips along streams.
4. Reduce activities within riparian areas .
5. Install proper manure storage.
6. Implement nutrient management plans to manage manure application to land.
7. Monitor wastewater discharges for excessive nutrient loadings.

Implementation Programs Guidance

Industrial Program KDHE

- a. Ensure proper permitting and inspection of livestock waste management systems

Municipal Program - KDHE

- a. Ensure proper permitting and operations of municipal wastewater systems to minimize nutrient discharges.

Non-Point 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.
- d. Guide federal programs such as the Environmental Quality Improvement Program, which are dedicated to priority subbasins through the Unified Watershed Assessment, to priority subwatersheds and stream segments within those subbasins identified by this TMDL.

Local Environmental Protection Program - KDHE

- a. Support inspection of on-site wastewater systems to minimize nutrient loadings

Water Resource Cost Share & Non-Point Source Pollution Control Programs - SCC

- a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed wetlands.
- b. Provide sediment control practices to minimize erosion and sediment and nutrient transport
- c. Provide livestock waste management systems for proper manure storage, disposal and land application.
- d. Provide livestock watering sites to reduce use of streams
- e. Repair failing septic systems in proximity to streams
- g. Coordinate with USDA/NRCS Environmental Quality Improvement Program in providing educational, technical and financial assistance to agricultural producers.

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

Timeframe for Implementation: Pollution reduction practices should be installed within the priority subwatersheds and along the priority stream segments during the years 2000-2004, with minor follow up implementation, including other subwatersheds over 2004-2008.

Targeted Participants: Primary participants for implementation will be agricultural producers operating within the drainages of the priority subwatersheds. Implemented activities should be targeted at those areas with greatest potential to impact the lake. Nominally, this would be activities located within one mile of the streams including:

1. Total rowcrop acreage
2. Cultivation alongside stream
3. Drainage alongside or through animal feeding lots
4. Livestock use of riparian areas
5. Fields with manure applications
6. On-site wastewater discharges to stream

Some inventory of local needs should be conducted in 2000 to identify such activities. Such an inventory would be done by local program managers with appropriate assistance by commodity representatives and state program staff in order to direct state assistance programs to the principal activities influencing the quality of the streams in the watershed during the implementation period of this TMDL.

Milestone for 2004: The year 2004 marks the mid-point of the ten year implementation window for the watershed. At that point in time, milestones should be reached which will have at least fifty percent of the producers responsible for the land use activities cited in the local assessment participating in the implementation programs provided by the state. Additionally, sampled data from Clinton Lake should indicate evidence of reduced phosphorus levels in the conservation pool elevations relative to the conditions seen over 1988-1998.

Delivery Agents: The primary delivery agents for program participation will be the 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 pollution.

1. K.S.A. 65-164 and 165 empowers the Secretary of KDHE to regulate the discharge of sewage into the waters of the state.
2. 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.

3. 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.

4. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control non-point source pollution.

5. 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.

6. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan*.

7. The *Kansas Water Plan* and the Kansas-Lower Republican 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 pollution 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 is a **High Priority** consideration.

In State Fiscal Year 1999, the state provided to Douglas and Shawnee counties, \$148,697 of State Water Plan Funds for non-point source pollution reduction. The Commission will decide State Fiscal Year 2000 allocations in May 1999 and is expected to direct similar amounts of funding to the three counties for the next fiscal year

Effectiveness: Nutrient control has been proven effective through conservation tillage, contour farming and use of grass waterways and buffer strips as well as runoff control around animal feeding operations. The key to success will be widespread utilization of conservation farming and waste management within the watersheds cited in this TMDL.

Should participation significantly lag below expectations over the next five years or monitoring indicates lack of progress in improving water quality conditions from those seen over 1990-1998, the state may employ more stringent conditions on agricultural producers in the watershed through establishment of a Critical Water Quality Management Area in order to meet the desired endpoints expressed in this TMDL.

6. MONITORING

KDHE will continue to collect seasonal samples from Clinton Lake twice in the five year period 2000-2004 and three times during 2005-2008. The KBS should be employed to take phytoplankton samples over the period 2004-2008. Additionally, sediment surveys should be conducted, particularly in the three main arms to the lake by 2001 and again in 2008.

Regular monitoring of sites in the drainage will also indicate reductions in phosphorus delivery to streams through management practices. Periodic monitoring of nutrient content of wastewater discharged from treatment systems will be expected under reissued NPDES and state permits.

USGS should complete analysis of SSURGO soil data and 30-m resolution DEM topographic data to evaluate the relative runoff contributing areas within the watershed and provide greater resolution on where implementation activities would be most effective. This analysis should be complete in 2000.

Kansas State should complete its AGNPS analysis of the watershed by 2000 and the results can be used to further target management practices to minimize nutrient inflow to the lake.

Local program management needs to identify its targeted participants of state assistance programs for implementing this TMDL. This information should be collected in 2000 in order to support appropriate implementation projects.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the KLR Basin were held March 10, 1999 in Topeka, April 27 in Lawrence and April 29 in Manhattan. 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 Kansas-Lower Republican Basin.

Public Hearing: A Public Hearing on the TMDLs of the Kansas-Lower Republican Basin was held in Topeka on June 3, 1999.

Basin Advisory Committee: The Kansas-Lower Republican Basin Advisory Committee met to discuss the TMDLs in the basin on December 3, 1998; January 14, 1999; February 18, 1999; March 10, 1999; May 20, 1999 and June 3, 1999.

Discussion with Interest Groups: Meetings to discuss TMDLs with interest groups include:
Agriculture: November 10, 1998; December 18, 1998; February 10, 1999; April 10, 1999, May 4, 1999, June 8, 1999 and June 18, 1999.
Municipal: November 12, 1998, January 25, 1999; March 1, 1999; May 10, 1999 and June 16, 1999.
Environmental: November 3, 1998; December 16, 1998; February 13, 1999; March 15, 1999, April 7, 1999 and May 3, 1999.
Conservation Districts: March 16-18, 24-25, 1999

Milestone Evaluation: In 2004, evaluation will be made as to the degree of implementation which has occurred within the drainage and current condition of the Clinton Lake. Subsequent decisions will be made regarding implementation approach, follow up of additional implementation and implementation in the non-priority subwatersheds.

Consideration for 303d Delisting: Clinton Lake will be evaluated for delisting under Section 303d, based on the monitoring data over the period 2004-2008. Therefore, the decision for delisting will come about in the preparation of the 2008 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 for Fiscal Years 2000-2004.

Approved January 26, 2000.