

KANSAS-LOWER REPUBLICAN BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Lake Jewell Water Quality Impairment: Eutrophication

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Lower Republican **County:** Jewell

HUC 8: 10250017 **HUC 11:** 020

Drainage Area: Approximately 15.1 square miles.

Conservation Pool: Area 7 acres, Maximum Depth 1.0 meter.

Designated Uses: Secondary Contact Recreation; Aquatic Life Support

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

Impaired Use: Both 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)).

Dissolved Oxygen: 5 mg/L (KAR 28-16-28e(c)(2)(A))

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Use (for Dissolved Oxygen) under 303d: Not Supporting

Level of Eutrophication: Very Eutrophic - Trophic State Index = 61

Monitoring Sites: Station 062901 in Lake Jewell.

Period of Record Used: One previous survey on August 10, 1994. There had been no significant rain for 1-2 weeks prior to the survey, with the month slightly below normal for precipitation. The survey should be reasonably representative of mean summer condition.

Current Condition: The lake has an elevated chlorophyll a concentration (38.1 ppb), indicative of very eutrophic conditions. Total phosphorus concentration (310 ppb) is elevated. Nitrogen appears to be the primary limiting factor. The survey found high ammonia levels at the surface of the lake. There is moderate to high inorganic turbidity, but no deficiency of light in the water column. Nutrients are of primary importance, but chlorophyll-to-phosphorus yield is low.

The Trophic State Index of 61 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 are seen with chlorophyll a concentrations over 12 ug/l and hypereutrophy occurs at levels over 20 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 |

Low dissolved oxygen is a severe problem, with oxygen at the surface near zero (0.1 mg/L), and insufficient for aquatic life support. (See attached table). This is very unusual for Kansas, and strongly indicates the level of organic enrichment.

The abundance of aquatic plants, although high, should not be a major concern. These plants may actually compete with algae and provide some benefit in this case. While they may be a nuisance for some fishermen, their benefits are believed to far exceed the impact on recreational uses.

Interim Endpoints of Water Quality (Implied Load Capacity) at Lake Jewell over 2004 - 2008:

In order to improve the trophic condition of the lake from its current very eutrophic 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 2008. Achievement of this endpoint should also result in higher concentrations of dissolved oxygen in the water column of the lake as well as manageable coverage of macrophytes. Refined endpoints will be developed in 2004 to reflect additional sampling and artificial source assessment and confirmation of impaired status of lake.

3. SOURCE INVENTORY AND ASSESSMENT

Land Use: The primary source of phosphorus within Lake Jewell is probably runoff from agricultural lands where phosphorus has been applied. Land use coverage analysis indicates 58% of the watershed is cropland. An annual phosphorus load of 5,445 pounds per year is necessary to correspond to the concentrations seen in the lake.

Phosphorus from animal waste is another contributing factor. Forty percent of land around the lake is grassland. Grazing density of livestock is moderate for the watershed (29 -31 animal units/sq. mi.). Feedlots are present around the lake as well.

Contributing Runoff: The watershed has an average soil permeability of 1.1 inches/hour according to NRCS STATSGO data base. Runoff would be produced from storms one to two hours in duration, having a recurrence interval of five, ten or twenty five years and storms of three hours in duration, having a recurrence interval of twenty five years. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. Generally, 12 percent of the watershed would generate runoff under dryer conditions or smaller storms. Moderate or wet conditions or larger storms would see runoff contributed from 36 or 85 percent of the watershed respectively.

Background Levels: Nutrient recycling from the sediments in the lake is likely contributing available phosphorus to the lake 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 POLLUTION 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: Since this impairment is primarily associated with agricultural non-point source pollution, there will be no Wasteload Allocation assigned to point sources for nutrients under this TMDL.

Non-Point Sources: Water quality violations are predominantly due to non-point source pollution. Background levels may be attributed to geological sources. The assessment suggests that cropland throughout the watershed contribute to the very eutrophic state of the lake. Given the runoff characteristics of the watershed, overland runoff can easily carry phosphorus into the lake. Generally a Load Allocation of 882 pounds per year, leading to a 82% reduction in available phosphorus 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 98 pounds 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 Lake Jewell is a small lake under state jurisdiction and a more detailed source assessments and additional in-lake monitoring of nutrient and algal content is needed and impacts on dissolved oxygen conditions, this TMDL will be a Medium Priority for implementation

Unified Watershed Assessment Priority Ranking: This watershed lies within the Lower Republican Subbasin (HUC 8: 10250017) with a priority ranking of 22 (Medium Priority for restoration work).

Priority HUC 11s: The entire watershed is within HUC 11 (020).

5. IMPLEMENTATION

Desired Implementation Activities

Despite the fact that the lake appears to be nitrogen limited, phosphorus controls might still be easier to implement. However, given the large drainage/lake condition, it may not be possible to significantly improve water quality through watershed BMPs alone. (Projections show abundant ability to reduce nutrient inputs from the watershed, but the results still show a lake with poor water quality). 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. Install proper manure storage
6. Implement nutrient management plans to manage manure application to land
7. Monitor on site wastewater discharges for excessive phosphorus loadings

Implementation Programs Guidance

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.

Local Environmental Protection Program - KDHE

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

Water Resource Cost Share Program - SCC

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

Non-Point Source Pollution Control Program - SCC

- a. Provide sediment control practices to minimize erosion and sediment and nutrient transport.
- b. Provide livestock waste management systems for proper manure storage, disposal and land application.
- c. Provide livestock watering sites to reduce use of streams.
- d. Repair failing septic systems in proximity to streams.

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 lake drainage after the year 2004.

Targeted Participants: Primary participants for implementation will be agricultural producers within the drainages of the lake. Initial work in 2004 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
6. On-site wastewater discharges to stream

County Local Environment Protection staff will conduct the inspection of on-site wastewater systems. Based on the local assessment, implementation activities should focus participation within those areas with greatest potential for impact on stream resources.

Milestone for 2004: The year 2004 marks the mid-point of the ten year implementation window for the watershed. At that point in time, sampled data from Lake Jewell 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 Medium Priority consideration and should not receive funding until after 2004.

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.

6. MONITORING

KDHE will collect nutrient, pH, dissolved oxygen and chlorophyll a samples from Lake Jewell in 2001 and 2003. Additional data, to establish nutrient ratios, source loading and further determine mean summer lake trophic condition, would be of value prior to 2004. Further sampling and evaluation should occur in 2005 and 2007.

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 impairment which has occurred within the drainage and current condition of Lake Jewell. Subsequent decisions will be made regarding implementation approach, follow up of additional implementation and implementation in the non-priority subwatersheds.

Consideration for 303d Delisting: Lake Jewell 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 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 January 26, 2000.