

UPPER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body: Ford County Lake

Water Quality Impairment: Eutrophication Bundled with Dissolved Oxygen & pH

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Buckner

County: Ford

HUC 8: 11030006

HUC 11 (HUC 14): 020 (040)

Drainage Area: Approximately 13.4 square miles. **(Figure 1)**

Conservation Pool: Area 29.6 acres, Maximum Depth = 4.5 meters

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

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)).

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

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

Ford County State Fishing Lake TMDL Reference Map

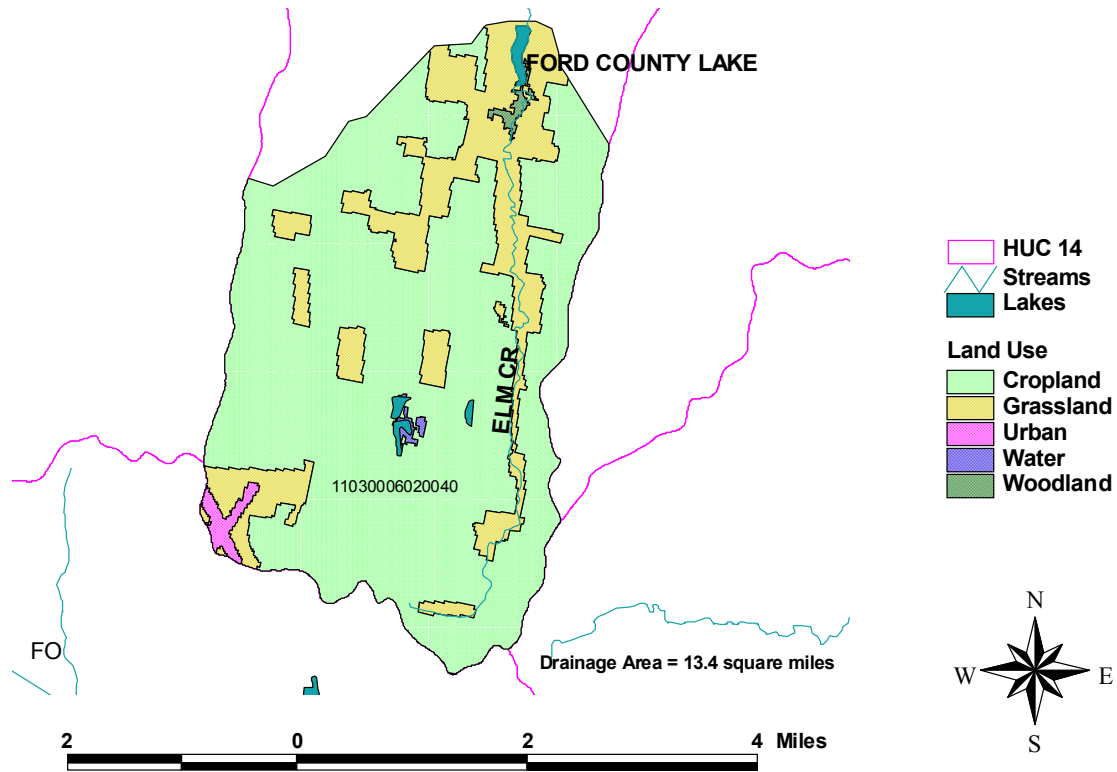


Figure 1

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Eutrophication: Hypereutrophic, Trophic State Index = 64.87

Monitoring Sites: Station 070801 in Ford County Lake

Period of Record Used: Three surveys during 1994-1999; Clean Lakes Program study in the mid-1980s.

Current Condition: Ford County Lake has elevated chlorophyll a concentrations. The average concentration is 33.0 ppb, related to a Trophic State Index of 64.87, indicating hypereutrophic conditions.

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: \geq 64

Total phosphorus concentrations are consistently high, averaging 336 ppb. One hundred percent of the samples taken from the lake were over 100 ppb. The chlorophyll a to total phosphorus yield is low. The total nitrogen to total phosphorus ratio is 4.2, indicating that nitrogen is the primary limiting factor. Before 1999, ammonia and nitrate concentrations have been below the detectable limit. The ammonia concentration averaged 45.3 ppb, and the nitrate concentration averaged 72.5 ppb in 1999. Light is not limiting, despite moderate inorganic turbidity.

Ford County Lake	Date	Depth (ft)	Dissolved Oxygen (mg/L)	pH (Sample taken at surface)
070801	15-Aug-94	1.64	9.700	9.13
070801	15-Aug-94	1.64	10.000	9.11
070801	18-Jun-96	0	16.500	9.07
070801	18-Jun-96	1.64	16.500	9.12
070801	18-Jun-96	3.28	16.500	8.94
070801	18-Jun-96	6.56	3.000	8.87
070801	18-Jun-96	9.84	0.200	
070801	28-Jun-99	0	8.600	8.99
070801	28-Jun-99	1.64	8.600	8.99
070801	28-Jun-99	3.28	8.600	9.29
070801	28-Jun-99	6.56	8.600	8.70
070801	28-Jun-99	9.84	7.200	
070801	28-Jun-99	13.12	0.200	
070801	28-Jun-99	14.76	0.200	

The dissolved oxygen concentrations decreased with increased depth. (See above table). At the surface, the average concentration was 12.6 mg/L, a sufficient amount of dissolved oxygen for aquatic life support. However, near the bottom of the lake, the concentration approaches zero mg/L.

From 1994 to 1999, the pH was high 100 percent of the time. The average pH was 9.02 ranging from 8.70 to 9.29.

Interim Endpoints of Water Quality (Implied Load Capacity) at Ford County Lake over 2005 - 2010:

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 fully eutrophic conditions by 2010. Achievement of this endpoint should also result in higher concentrations of dissolved oxygen (>5 mg/L) in the water column of the lake as well as pH values between 6.5 and 8.5. Refined endpoints will be developed in 2005 to reflect additional sampling, source inventory, source control and evaluation of opportunities to reduce impairment of the lake.

3. SOURCE INVENTORY AND ASSESSMENT

Land Use: The watershed has a high potential for nonpoint source pollutants. An annual phosphorus load of 639 pounds per year is necessary to correspond to the concentrations seen in the lake. The annual nitrogen load is 9,590 lb/yr.

The primary source of phosphorus within Ford County Lake is probably runoff from agricultural lands where phosphorus has been applied. Land use coverage analysis indicates that 77.6% of the watershed is cropland. A total of 20,845 tons of fertilizer was bought in Ford County in 1998. One point two percent of this county lies within the watershed. Assuming an even distribution, about 257 tons of fertilizer were bought and used in the watershed in 1998.

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

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 up to 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, 35 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 most of the watershed .

Background Levels: Wildlife waste increases the levels of nitrogen and phosphorus in the lake. A large grove of trees is located on the south side of Ford County Lake; leaf litter may be adding to the nutrient load. 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 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 predominantly due to nonpoint source pollutants. Background levels may be attributed to wildlife waste and leaf litter. The assessment suggests that cropland throughout the watershed contribute to the hypereutrophic state of the lake. Generally a Load Allocation of 230.1 pounds per year, leading to a 60% reduction in available phosphorus is necessary to reach the endpoint. The Load Allocation for nitrogen is 4,067 pounds per year, resulting in a 52.9% reduction.

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 25.6 pounds per year of total phosphorus and 452 pounds per year of nitrogen taken from the load capacity to ensure that adequate load reduction occurs to meet the endpoint.

State Water Plan Implementation Priority: Because Ford County Lake has pH and dissolved oxygen issues tied to nutrients and is one of the few functioning lakes in the Upper Arkansas Basin, this TMDL will be a High Priority for implementation

Unified Watershed Assessment Priority Ranking: This watershed lies within the Buckner Creek Subbasin (HUC 8: 11030006) with a priority ranking of 28 (Medium Priority for restoration work).

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

5. IMPLEMENTATION

Desired Implementation Activities

There is potential for nonpoint source control through the use of Best Management Practices. The Clean Lakes Program project was to have pursued such Best Management Practices, but the process was never vigorous. (Likewise, the lake was to have been dredged, with the addition of a sediment pond at the upper end. What appears to have been built was a set of “sediment piers” designed to only slow down the flow of silt into the lake proper). Some potential exists for reducing the level of nutrient pollutants coming into Ford County Lake. 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, lake management can be employed to reduce sedimentation in lake and associated in-lake nutrient inputs.

Implementation Programs Guidance

Fisheries Management -KDWP

- a. Assist evaluation in-lake or near-lake potential sources of nutrients to lake.
- b. Advise county on applicable 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 lake watershed.

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 before 2005. Evaluation of nutrient sources to lake and identification of potential management techniques should occur prior to 2005.

Targeted Participants: Primary participants for implementation will be county and state fisheries managers in and around Ford County and agricultural producers within the drainage of the lake. 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, assessments should be underway to determine sources to be targeted.

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 Upper 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 manage lake resources.

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 High 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

Additional data, to establish nutrient ratios, source loading and further determine mean summer lake trophic condition, would be of value prior to 2005. Further sampling and evaluation should occur once before 2005 and twice between 2005 and 2010.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the Upper Arkansas Basin were held March 8 and April 24 in Garden City and April 25 in Great Bend. 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 Upper Arkansas Basin.

Public Hearing: A Public Hearing on the TMDLs of the Upper Arkansas Basin was held in Garden City on May 31, 2000.

Basin Advisory Committee: The Upper Arkansas Basin Advisory Committee met to discuss the

TMDLs in the basin on October 6, 1999; January 11 and 24, 2000; March 8, 2000;

Discussion with Interest Groups: Meetings to discuss TMDLs with interest groups include:
Associated Ditches of Kansas: October 6, 1999; January 28, 2000; March 8, 2000; and
April 24, 2000.
Agriculture: February 28, 2000
Environmental: March 9, 2000

Milestone Evaluation: In 2005, evaluation will be made as to the sources of impairment which has occurred within the drainage and current condition of Ford County Lake. Subsequent decisions will be made regarding implementation approach and follow up assessments of source contribution and possible management techniques.

Consideration for 303d Delisting: Ford County 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 during Fiscal Year 2001-2005.

Approved September 11, 2000