

KANSAS-LOWER REPUBLICAN BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Tuttle Creek Lake
Water Quality Impairment: Alachlor

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasins: Lower Big Blue
& Lower Little Blue

Counties: Marshall, Nemaha, Washington, and
Republic

HUC 8s: 10270205 & 10270207

HUC 11s: 10270205: 035, 044, 050, 060, 070, 080,
090, 100, 110, 120, 130, 140, 150, 160, 169
10270207: 031, 074, 083, 090, 100

Drainage Area: Approximately 9,628 square miles.

Conservation Pool: Elevation 1075'; Volume 335,000 acre-feet

Tributary Arms: Big Blue River
Little Blue River
Black Vermillion River
Fancy Creek

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

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

Impaired Use: Domestic Water Supply is impaired from Alachlor

Water Quality Standard: Alachlor: 2 $\mu\text{g/l}$ (ppb) (KAR 28-16-28e(c)(3)(A))

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Use under 303d: Not Supporting Domestic Water
Supply

Monitoring Sites: Station 61201 in Tuttle Creek Lake.

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

Lake Record: 1968-1997 elevations from U.S. Army Corps of Engineers for Tuttle Creek Lake.

Current Condition: Lake consistently has elevated pesticides, occasional detects of alachlor above the 2 ppb criterion were noted in June of 1991 (2.7 ppb) and 1994(2.7 and 3.0 ppb). Summer samples taken in 1996-1998 detected alachlor below the water quality standard(.88, 1.3 and 1.2 ppb). The excursion in water quality occurred while the pool was above 1075'. Numerous samples taken by the Corps of Engineers in 1996 and 1997 showed alachlor levels above 2 ppb from June to early September.

Concentrations of Alachlor at Surface of Water in Tuttle Creek Lake above the Dam (ug/l)

Year	April	May	June	July	August	September
1996	---	---	4.9	4.2	3.1	0.1
1997	0.4	0.6	3.3	2.2	3.8	2.3

Spring of 1996 was marked by tremendous runoff entering the lake, more modest runoff was seen in 1997. Samples taken from permanent stations in the Tuttle Creek drainage had rare incidence of excursions above the 2 ppb criterion in streamflow, typically 2-3 samples of 3-3.5 ppb. Biweekly samples taken in the Black Vermillion River Watershed had more indications of elevated alachlor levels in smaller streams over 1996-1998. Without fail, excursions occurred in May and June. Alachlor levels declined to detection limits from July onward. These data hint that alachlor persists longer in the lake than atrazine relative to their respective water quality criteria.

The historic frequency of the pool level at Tuttle Creek Lake was analyzed for the period of 1968-1997. The conservation pool at 1075' msl was reached or exceeded 65% of the time over those 30 years. The lake rarely had drawdowns of three or more feet. The pool at the lake has been managed for fishery spawn support and waterfowl migration by holding water in the lower three feet of the flood pool in spring and fall. Pool levels exceeded 1978' msl 30% of the time. Seasonal runoff was usually controlled by detention in the lower seven feet of the flood control pool (1082' msl), a level which was exceeded only ten percent of the time.

The lake can be divided into three zones: a managed pool at or below 1078' msl where a majority of the designated uses would occur; a seasonal flood pool between 1078' and 1082' msl which reflected upstream watershed conditions and a critical flood pool over 1082' msl which detains extreme high flow events.

Examination of lake data indicated that most excursions from the 2 ppb standard occurred in the managed conservation pool or lower three feet of the flood pool. Computing the permissible mass of alachlor in the lake at elevations 1078' to 1069' results in values of 0.92 T/D to 0.64 T/D. The high end of this mass should be exceeded less than 30% of the time.

A margin of safety may be taken as the reduction of permissible mass in the lake to the level exceeded 90% of the time. This corresponds to 0.70 T/D and is associated with the typical level of drawdown seen at the lake (down to 1072'). Therefore, the desired endpoints defining good water quality at Tuttle Creek Lake assigned to the managed pool delineated for the lake.

Desired Endpoints of Water Quality at Tuttle Creek Lake over 2004 - 2008

1. Alachlor mass in the managed pool below 1078' should remain below 0.70 tons/day
2. Alachlor mass in the flood pool above 1078' should remain at or below 0.92 tons/day.

These endpoints will ensure that alachlor levels in the lake will remain below 2 ppb with no more than one exceedence in three years. 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 within the loading capacity of the lake, water quality standards are attained with minimal excursions and full support of the designated uses of the lake has been restored.

3. SOURCE INVENTORY AND ASSESSMENT

The primary source of alachlor entering Tuttle Creek Lake is springtime runoff off of croplands in the Big and Little Blue River Basins. Alachlor has been widely used since the 1960's for selective control of broadleaf and grass weeds in corn, sorghum and soybeans. Because of its high solubility in water, alachlor is susceptible to removal from cropland during overland runoff events. Within Marshall and Nemaha counties, a high percentage of the cropland is planted with sorghum and soybeans with substantially smaller acreage in corn. The persistent appearance of alachlor in late spring runoff may reflect later applications on sorghum and soybean cropland than done for atrazine on corn. Alachlor is not used to the extent that atrazine is to control grasses and broadleaves.

Selection of primary sources of alachlor 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 large percentages of cropland in subwatersheds of the Big Blue River Subbasin (HUC8=10270205), particularly along the Big Blue River itself and the Black Vermillion River. Sixty-five to seventy percent of the subwatersheds are cropland. Subwatersheds of the Little Blue River Subbasin (HUC8=10270207) are about half cropland, with a greater proportion of grassland than the watersheds to the east. The subwatersheds of the Little Blue which are closer to the headwater of Tuttle Creek Lake have a higher proportion of cropland.

Soils in the eastern subwatersheds appear less permeable (average permeability of 0.4"/hr to 0.6"/hr) while those of the Little Blue Subbasin are more permeable (0.7"/hr to 0.9"/hr). Consequently, runoff contributions tend to be generated from the Big Blue River or Black Vermillion drainages rather than from the western side of the drainage area. Under wet conditions or intense storms, the whole basin contributes runoff. Under moderate or lower conditions, a higher proportion of the eastern watersheds generate runoff than the western watersheds.

The following table summarizes these three characteristics for the subwatersheds above Tuttle Creek which are most likely to have contributions of alachlor loading into the lake. The recommended subwatershed targets are indicated by bold type. Targets are emphasized in the Big Blue River and Black Vermillion Subbasins, close to the headwaters of the lake.

CHARACTERISTICS OF TARGETED SUBWATERSHEDS FOR ATRAZINE TMDL						
				% of Watershed w/Runoff		
HUC 11	Description	%Cropland	Avg. Perm	High	Mod	Low
10270205035	Mission-Murdock	65%	0.6"	97	93	51
10270205044	Hrshoe Crk-Big Blue	65%	0.6"	97	93	51
10270205050	Spring Creek	66%	0.6"	97	93	51
10270205090	N.Fork Black Vermillion	70%	0.4"	99	99	92
10270205100	Black Vermillion	65%	0.4"	99	99	92
10270205070	Robidoux Creek	54%	0.4"	99	99	92
10270205080	Marshall Co-Minor Strms	62%	0.4"	99	99	92
10270207090	Lower Little Blue	52%	0.8"	91	83	12
10270207100	Coon-Camp Crks	56%	0.8"	91	83	12
10270207083	Mill Creek	54%	0.9"	89	54	13
10270205140	Fancy Creek	44%	0.7"	91	83	12

Analysis of tributary data in the Black Vermillion watershed indicates the May-June seasonal pattern of water quality standard violations relative toalachlor. Average concentrations during runoff events are over 3 ppb, particularly in the tributaries feeding into the North Fork of the Black Vermillion River. Those tributaries tend to drain extensive cropland areas.

Governor's Water Quality Initiative Data		
Site	Number of Samples Over 2 ppb	Average of those Samples
128	5	5.1 ppb
129	1	3.6 ppb
130	3	4.5 ppb
131	2	3.8 ppb
132	3	6.8 ppb
133	4	6.8 ppb
134	6	5.4 ppb
141	3	2.9 ppb

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

Point Sources: Since this pollutant is associated with agricultural non-point source pollution, there will be no Wasteload Allocation assigned to point sources for alachlor under this TMDL.

Non-Point Sources: As described in the Source Assessment, the subwatersheds with high proportion of cropland, strong propensity for runoff and in proximity to the Tuttle Creek headwaters are targeted for implementing this TMDL. The Load Allocation will involve eliminating excessive alachlor loads from the Big Blue River and the Black Vermillion River watershed such that the endpoint loads are reached, accounting for the margin of safety.

Defined Margin of Safety: The margin of safety will be taken as the reduction of permissible mass in the lake to the level exceeded 90% of the time. This corresponds to 0.70 T/D and reduces the permissible load at the top of the managed pool (1078') by 0.22 T/D.

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 watersheds encompass both the Lower Big Blue Subbasin (HUC8: 10270205) and the Lower Little Blue Subbasin (HUC8: 10270207). The Unified Watershed Assessment assigned a priority ranking of 2 to the Lower Big Blue and 10 to the Lower Little Blue subbasins (Both Highest Priority for restoration work.)

Priority HUC 11s and Stream Segments: Because of their high proportion of cropland, proximity to the lake and ability to generate runoff, the following subwatersheds are highest priority:

Big Blue River	Subbasin	Priority Stream Segments
10270205044	Horseshoe Crk-Big Blue	17, 18, 20, 21, 26
10270205050	Spring Creek	19
10270205090	N.Fork Black Vermillion	15
10270205100	Black Vermillion	13, 14

Focus should be made on the smaller tributaries feeding into the main stream segments listed for each of those subwatersheds as well as cropland adjacent to the main stream.

5. IMPLEMENTATION

Desired Implementation Activities

1. Implement proper mix of pesticide use best management practices, including incorporation, application timing, banding, alternative weed control and buffer zones
2. Implement necessary storage and handling site best management practices
3. Install necessary grass buffer strips along streams.
4. Increase label compliance by applicators
5. Evaluate the usage of alachlor in the vicinity of Tuttle Creek Lake and the Blue Basin in Kansas.

Implementation Programs Guidance

Non-Point Source Pollution Technical Assistance - KDHE

- a. Support Section 319 demonstration projects for reduction of alachlor runoff from sorghum, soybean and corn cropland.
- b. Provide technical assistance on practices geared to establishment of vegetative buffer strips.
- c. 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.

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

- a. Provide pesticide management areas for storage, mixing and handling.
- b. Provide pesticide management practices to minimize pesticide spillage

Riparian Protection Program - SCC

- a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation.
- b. Develop riparian restoration projects in cropland areas

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 sorghum and soybean producers on pesticide management
- b. Provide technical assistance on buffer strip design and minimizing cropland runoff and construction of pesticide handling pads

Pesticide Management Program - KDA

- a. Implement pesticide bulk containment regulations
- b. Increase label compliance by pesticide applicators
- c. Evaluate usage of alachlor in the watersheds adjacent to Tuttle Creek Lake and the Big Blue River.
- d. Continue basin pesticide education efforts through Kansas State and commodity associations

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 sorghum, soybean and corn producers operating within the drainages of the Big Blue River and the Black Vermillion River. Implemented activities should be targeted at those areas with greatest potential to impact the stream. Nominally, this would be activities located within one mile of the streams including:

1. Total corn, sorghum and soybean acreage
2. Applications of alachlor
3. Location of tile drain outlets draining into streams.
4. Location of pesticide storage, mixing and handling sites
5. Cultivated riparian areas
6. Number of pesticide applicators

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 midpoint of the ten-year implementation window for the watershed. At that point in time, milestones should be reached which will have at least eighty 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 Tuttle Creek should indicate evidence of reduced alachlor levels at non-critical pool elevations in July - September relative to the conditions seen over 1994-1998.

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 and agricultural interest groups such as Kansas Corn Growers Association and Kansas Grain Sorghum Growers Association and the Kansas Soybean Growers Association.

Reasonable Assurances:

Authorities: The following authorities may be used to direct activities in the watershed to reduce pollution.

1. K.S.A. 2-2439 empowers the Secretary of Agriculture to oversee pesticide management, registration and use in the state.
2. K.S.A. 2-2472 empowers the Secretary of Agriculture to establish Pesticide Management Areas to protect public health, safety and welfare and the natural resources of the state from pesticide pollution.

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.
8. The Federal Insecticide, Fungicide and Rodenticide Act authorizes the state to initiate the process of making label changes on the use, application and provision of environmental protection of pesticides.

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. However, costs are likely to be associated with monitoring in the lake and watershed. Most pesticide application management practices can be made without cost-share considerations.

In State Fiscal Year 1999, the state provided to Washington, Marshall and Nemaha counties, \$446,662 of State Water Plan Funds for non-point source pollution reduction, which included \$5600 for buffer strip installation. The Commission will decide State Fiscal Year 2000 allocations in May 1999 and is expected to direct similar amounts of funding to the two counties for the next fiscal year

Effectiveness: Pesticide management has proven to be effective in reducing atrazine levels in Perry Lake. Many voluntary approaches were promoted through the Pesticide Management Area established on the Delaware River Subbasin. Most of those producers raised corn. The key to effectiveness will be equivalent participation by sorghum and soybean producers in the Tuttle Creek drainage area.

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 Pesticide Management Area in order to meet the desired endpoints expressed in this TMDL.

6. MONITORING

KDHE will continue to collect seasonal samples from Tuttle Creek Lake twice in the five-year period 2000-2004. The Corps of Engineers should continue to sample for pesticides within the lake over April to September. Over the period 2004-2008, monthly samples will be collected over April to September from specified pool level conditions. Two thirds of the samples should be taken at elevations below 1078'. Samples taken at elevations above 1078' should be restricted to April to July. Elevations should be fairly stable for a week prior to sampling.

Survey data should be collected to pinpoint the locations where alachlor is extensively applied in the watershed. Kansas State University should continue to collect grab and runoff samples within the drainage area, particularly at Frankfort, Barnes and Marysville. Additionally, two to three years of biweekly sampling for alachlor need to be taken over Spring at Stations 128-134 and 141 on the two main forks of the river above Frankfort. These samples will be compared to the sampling data of 1996-1998 collected as part of Governor's Water Quality Initiative. The intensive sampling should occur over 2006-2007 and as resources allow, 2008.

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

Task Force: A special task force to examine the issues of establishing a TMDL on Tuttle Creek met on November 9, 1998; January 5, 1999 and February 15, 1999. Additionally, subcommittees met to discuss implementation, biological impacts, municipal impacts and data analysis.

Blue River Compact: The water quality committee of the Compact and the Compact Administration met on May 7 and May 23, 1999 to discuss this TMDL.

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 Tuttle Creek 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: Tuttle Creek 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.