

KANSAS-LOWER REPUBLICAN BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Vermillion Creek Water Quality Impairment: Fecal Coliform Bacteria

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Middle Kansas

County: Pottawatomie and Nemaha

HUC 8: 10270102

HUC 11s: 030 and 040.

Drainage Area: 343.5 sq. mi.

Main Stem Segments: 15, 16, 17, and 18 starting at confluence with Kansas River, headwaters in Nemaha County near Corning.

Tributary Segments: Indian Creek (20)
Pomeroy Creek (59)
Adams Creek (53)
Spring Creek (54)
Jim Creek (52)

Designated Uses: Segments 16, 17, and 18 of Main Stem support Primary and Secondary Contact Recreation and all other designated uses.
Segment 15 of Main Stem and Adams Creek support Expected Aquatic Life Support; Secondary Contact Recreation and Food Procurement.
Indian Creek supports all designated uses except Primary Contact Recreation.
Pomeroy Creek, Jim Creek and Spring Creek support Expected Aquatic Life Support & Secondary Contact Recreation.

1998 303d Listing: Table 1 - Predominant Point and Non-point Source Impacts

Impaired Use: Primary Contact Recreation Use on Main Stem (segments 16, 17, and 18); Secondary Contact Recreation on Main Stem segment 15 and other tributaries.

Water Quality Standard: Fecal Coliform Bacteria: 2000 colonies per 100 ml for Secondary (KAR 28-16-28e(7)(C)); 900 colonies per 100 ml for Primary (KAR 28-16-28e(7)(B))
Classified streams may be excluded from applying these criteria when streamflow exceeds flow that is surpassed 10% of the time ((KAR 28-16-28c(c)(2))

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Use under 303d: Not Supporting Secondary Contact Recreation.

Monitoring Sites: Station 520 (permanent site) near Louisville and Station 681 (rotational site) near Onaga.

Period of Record Used: 1990 to 1998

Flow Record: Vermillion Creek flow was calculated using seasonal regression (19 years of average daily streamflow) from Vermillion Creek near Wamego (USGS Station 06888000) on Mill Creek at Paxico (USGS Station 06888500) expanded to 30 years of average daily streamflow.

Long Term Flow Conditions: 10% High Flow Exclusion = 275 cfs, 7Q10 = 1 cfs

Current Conditions: Since loading capacity varies as a function of the flow present in the stream, this TMDL represents a continuum of desired loads over all flow conditions, rather than fixed at a single value. Flow duration data were estimated from the Wamego Gaging Station for each of the three defined seasons: Spring (Apr-Jun), Summer-Fall (Jul-Oct) and Winter (Nov-Mar). High flows and runoff equate to lower flow durations, baseflow and point source influences generally occur in the 85-99% range. Load curves were established for both Primary Contact Recreation and Secondary Contact Recreation criterion by multiplying the flow values along the curve by the applicable water quality criterion and converting the units to derive a load duration curve of colonies of bacteria per day. These load curves represent the TMDL since any point along the curve represents water quality at the standard at that flow. Historic excursions from WQS are seen as plotted points above the load curves. Water quality standards are met for those points plotting below the applicable load duration curves.

Excursions were seen in all three seasons. Twenty nine percent of Spring samples and 29% of Summer-Fall samples were over the primary criterion. Nine percent of Winter samples were over the secondary criterion. Overall 20% of the samples were over the criteria. This would represent a baseline condition of partial support of the impaired designated use.

PERCENT OF SAMPLES OVER WATER QUALITY STANDARDS BY FLOW AND SEASON

STREAM NAME	I M P A I R M E N T	S E A S O N	MAGNITUDE	DURATION					F R E Q U E N C Y	Current Condition of Water Quality at Site 520 Over 1990-1998
				0 TO 10%	10 TO 30%	30 TO 60%	60 TO 90%	90 TO 100 %		
VERMILLION CREEK	F C B	S	900-2000	0	0	0	0	0	4/14= 29%	9/45=20% Exceedance
			> 2000	0	0	0	14	0		
			> 2 X 2000	14	0	0	0	0		
		S F	900-2000	0	0	0	7	0	4/14= 29%	
			> 2000	0	0	7	0	0		
			> 2 X 2000	7	7	0	0	0		
		W	> 2000	0	0	0	0	0	1/17= 6%	
			> 2 X 2000	6	0	0	0	0		

Data collected at the Onaga station (681) in 1994 and 1998 had no excursions over the seasonally appropriate criteria in nine samples.

Desired Endpoints of Water Quality (Implied Load Capacity) at Site 520 over 2004 - 2008:

Overall, the endpoint of this TMDL will be to reduce the percent of samples over the applicable criteria from 20% to less than 10% for samples taken at flows below the high flow exclusion over the monitoring period of 2004-2008. This TMDL endpoint meets water quality standards as measured and determined by Kansas Water Quality Assessment protocols. These assessment protocols are similar to those used to cite the stream segments in this watershed as impaired on the Kansas 1998 Section 303d list.

Seasonal variation in endpoints is accounted for by TMDL curves established for each season and will be evaluated based on monitoring data from 2004-2008. Monitoring data plotting below the applicable seasonal TMDL curves will indicate attainment of the water quality standards. As with the overall endpoint, the manner of evaluation of the seasonal endpoints is consistent with the assessment protocols used to establish the case for impairment in these streams.

1. Less than 10 % of samples taken in Spring exceed primary criterion at flows under 275 cfs with no samples exceeding the criterion at flows under 55 cfs.
2. Less than 10% of samples taken in Summer or Fall exceed the primary criterion at flows under 275 cfs with no samples exceeding the criterion at flows under 10 cfs.

3. Less than 10% of samples taken in Winter exceed secondary criterion at flows under 275 cfs.

These endpoints will be reached as a result of expected, though unspecified, 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 stream, water quality standards are attained and full support of the designated uses of the stream has been restored.

3. SOURCE INVENTORY AND ASSESSMENT

NPDES: There are three NPDES permitted wastewater dischargers within the watershed.

MUNICIPALITY	STREAM REACH	SEGMENT	DESIGN FLOW	# CELLS	DETENTION TIME
Corning	Vermillion Cr.	18	0.024 mgd	3	> 120 days
Havensville	Spring Cr.	48	0.02 mgd	3	> 120 days
Onaga	Vermillion Cr.	17 via 43	0.06 mgd	3	> 120 days

Population projections for all municipalities to the year 2020 indicate small increases in population. Projections for associated future water use and resulting wastewater appear to be under design flows for the Corning and Havensville systems. Water use projection for Onaga indicate that design flows of the system may be exceeded by wastewater supply by 2020. At design flows, the contributions from these three systems make up 8% of the flow which was exceeded during the Summer-Fall season 90% of the time. The Summer-Fall season is the only one where water quality excursions occurred at relatively low flow conditions. The excursions from the water quality standards appear to occur under medium and high flow conditions in all seasons, indicating that point sources have little impact in watershed.

Livestock Waste Management Systems: 20 operations are registered, certified or permitted within the watershed. Most of these facilities are located in either the lower half of the watershed or near the watershed boundary. These operations are mostly swine (52% of animal units), or cattle/beef (41% of animal units). Animal units for the watershed total 6,734. Permitted facilities have systems (these facilities account for 84% of the animal units in the watershed) designed for the 25 year, 24 hour rainfall/runoff event, which would be indicative of flow durations well under 10 percent of the time. The actual number of animal units on site is variable, but typically less than permitted numbers.

Land Use: Most of the watershed is grassland (62% of the area) or cropland (29% of the area). Grazing density of livestock is moderately high for the watershed (42-44 animal units/sq. mi.). Cropland above the primary water quality monitoring site (Station 520) is restricted to areas adjacent to watercourses and the upper reaches of the watershed.

On-Site Waste Systems: While the population density in the watershed is low, a number of residents within Pottawatomie and Nemaha Counties are in rural settings without sewer service, relying instead on on-site systems.. Rural population for Pottawatomie County is projected to increase. Failing on-site waste systems can contribute bacteria loadings. In FY 1998, 180 inspections or investigation of complaints on failing on site systems were investigated in Pottawatomie County. In the first three quarters of Fiscal Year 1999, 145 such visits have been made on on-site systems in the county. The sporadic excursion from the water quality standards seems to indicate a lack of persistent loadings from such systems on any grand scale. Nonetheless, on-site systems are expected to increase over time within the watershed.

Contributing Runoff: The watershed has an average soil permeability of 0.6 inches/hour according to NRCS STATSGO data base. Runoff would be produced from storms one to three hours in duration, having a recurrence interval of five or ten years and from storms of one to six hours in duration having a recurrence interval of 25 years. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. Generally, 79 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 95 or 97 percent of the watershed respectively.

Background Levels: Some fecal bacteria counts may be associated with environmental background levels, including contributions from wildlife, but it is likely that the density of animals such as deer is fairly dispersed across the watershed resulting in minimal loading to the streams below the levels necessary to violate the water quality standards.

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

The nature of bacteria loading is too dynamic to assign fixed allocations for wasteloads and non-point loads. Instead, allocation decisions will be made which reflect the expected reduction of bacteria loading under defined flow conditions. These flow conditions will be defined by the presumed ability of point or non-point sources to be the dominant influence on stream water quality. Therefore, the allocation of wasteloads and loads will be made by demarcating the seasonal TMDL curves at a particular flow duration level. Flows lower than that designated flow will represent conditions which are the responsibility of point sources to maintain water quality standards, those flows greater than the designated flow are the responsibility of non-point sources up to the high flow exclusion value.

Point Sources: Within the watershed all municipal facilities rely on lagoon systems for wastewater detention and long holding times to minimize the release of fecal bacteria to receiving streams. The point sources are responsible to maintain their lagoons in proper working condition and appropriate detention volume to handle anticipated wasteloads of their respective populations. Ongoing inspections and monitoring of the lagoons will be made to ensure that minimal contributions have been made by these sources.

The Wasteload Allocation is defined at the flow condition where the sum of the design flows represent more than 10% of the flow or the 7Q10, whichever is greater, thereby exerting influence on the water quality of the stream. For Vermillion Creek at this location, that flow condition would be flows of 0-1.6 cfs. Such flows have been exceeded 92-99% of the time during the three seasons. Future NPDES and state permits will be conditioned such that discharges from permitted facilities will not cause violations of the applicable bacteria criteria at this low flow. The critical period will be the Summer-Fall, when flows of 1.6 cfs were exceeded 92% of the time.

Non-Point Sources: Based on the assessment of sources, the distribution of excursions from water quality standards and the relationship of those excursions to flow conditions, non-point sources are seen as the primary cause of water quality violations. Background levels might be represented by the low loads plotting below each of the seasonal curves. Fourteen of the 20 livestock facilities (accounting for 84% of the animal units in the watershed) rely on lagoon systems for wastewater detention and long holding times to minimize the release of fecal bacteria to receiving streams. The previous assessment suggests that activities in proximity to the stream may be contributing to the bacteria violations. These activities would include livestock in small family operations and on pastureland along the streams, as well as potentially failing on-site waste systems. Given the runoff characteristics of the watershed, overland runoff can easily carry waste material into streams.

Activities to reduce fecal pollution should be directed toward the smaller, unpermitted livestock operations and rural homesteads and farmsteads in the watershed. The Load Allocation assigns responsibility for maintaining water quality below the TMDL curve over flow conditions bracketed by the low flow of 1.6 cfs demarcating point source influence and the high flow exclusion of 275 cfs. These flows are exceeded 20-99% of the time during the Spring, 6-92% of the time over the Summer and Fall and 8-98% of the time during the Winter. Best Management Practices will be directed toward those activities such that there will be minimal violation of the applicable bacteria criteria at higher flows.

Defined Margin of Safety: Because there will not be a traditional load allocation made for fecal bacteria, the margin of safety will be framed around the desired endpoints of the applicable water quality standards. Therefore, evaluation of achieving the endpoints should use values set 100 counts less than the applicable criteria (800 colonies for primary contact recreation; 1900 colonies for secondary contact recreation) to mark full support of the recreation designated use of the streams in this watershed. By this definition, the margin of safety is 100 colonies per 100 ml and would be represented by a parallel line lying below each seasonal TMDL curve by a distance corresponding to loads associated with 100 colonies per 100 ml.

State Water Plan Implementation Priority: This TMDL will be a High Priority for implementation because Vermillion Creek is a tributary watershed influencing the quality of the main stem of Kansas River above Topeka.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Middle Kansas Subbasin (HUC 8: 10270102) with a priority ranking of 4 (Highest Priority for restoration work).

Priority HUC 11s and Stream Segments: Because the lower subwatershed (040) probably has greater concentration of livestock operations than the upper (030), and because data from the upstream Onaga station did not reveal excursions from the water quality standards, the lower subwatershed (040) should be the priority focus of implementation while the Upper Vermillion Creek (030) subwatershed is considered during follow-up efforts. Activities should be directed to the portion of the subwatershed which contains the mainstem segments 16 and 17 of Vermillion Creek.

5. IMPLEMENTATION

Desired Implementation Activities

1. Renew necessary state and federal permits and monitor permitted facilities for permit compliance
2. Install necessary proper manure and livestock waste storage
3. Install necessary grass buffer strips along streams.
4. Install necessary pasture management practices, including proper stock density on grasslands
5. Remove feeding sites in proximity to streams
6. Reduce livestock use of riparian areas
7. Insure proper on-site waste system operations in proximity to main streams.

Implementation Programs Guidance

NPDES and State Permits - KDHE

- a. Municipal permits for facilities in the watershed will be renewed after 2000 maintaining existing operations of the lagoon systems.
- b. Livestock permitted facilities will be inspected for integrity of applied pollution prevention technologies.
- c. Registered livestock facilities with less than 300 animal units will apply pollution prevention technologies.
- d. Manure management plans will be implemented.

Non-Point Source Pollution Technical Assistance - KDHE

- a. Support Section 319 demonstration projects for pollution reduction from livestock operations in watershed.
- b. Provide technical assistance on practices geared to small livestock operations which minimize impact to stream resources.
- 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 alternative water supplies to small livestock operations
- b. Develop improved grazing management plans
- c. Reduce grazing density on pasturelands
- d. Install livestock waste management systems for manure storage
- e. Implement manure management plans
- f. Install replacement on-site waste systems
- g. Coordinate with USDA/NRCS Environmental Quality Improvement Program in providing educational, technical and financial assistance to agricultural producers.

Riparian Protection Program - SCC

- a. Design feeding areas away from streams
- b. Develop riparian restoration projects

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 livestock producers on riparian and waste management techniques.
- b. Provide technical assistance on livestock waste management design.
- c. Continue Section 319 demonstration projects on livestock management.

Kansas Center for Agriculture Resources and the Environment - Kansas State University

- a. Complete research on identifying sources of fecal coliform bacteria and evaluating effectiveness of Best Management Practices on reducing bacteria contamination.

Agricultural Outreach - KDA

- a. Provide information on livestock management to commodity advocacy groups.
- b. Support Kansas State outreach efforts.

Local Environmental Protection Program - KDHE

- a. Inspect on-site waste systems within one mile of main tributary streams.

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

Targeted Participants: Primary participants for implementation will be small livestock producers operating without need of permits within the priority subwatershed. 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. Facilities without water quality controls
2. Unpermitted permanent feeding/holding areas
3. Sites where drainage runs through or adjacent livestock areas
4. Sites where livestock have full access to stream and stream is primary water supply
5. Grazed acreage, overstocked acreage and acreage with poor range condition
6. Poor riparian sites
7. Near stream feeding sites
8. Failing on-site waste systems

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 two-thirds of the landowners responsible for the activities identified locally for assistance participating in the implementation programs provided by the state. Additionally, sampled data from Stations 520 and 681 should indicate evidence of reduced bacteria levels at moderate to low flow conditions relative to the conditions seen over 1990-1998.

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 Farm Bureau, Kansas Livestock Association, the Kansas Pork Producers Council and the Kansas Dairy Association. On-site waste system inspections will be performed by Local Environmental Protection Program personnel for Pottawatomie County.

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.A.R. 28-16-69 to -71 implements water quality protection by KDHE through the establishment and administration of critical water quality management areas on a watershed basis.

4. 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.

5. 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.

6. 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.

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

8. 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 Pottawatomie County, \$80,400 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 county for the next fiscal year

Effectiveness: Non-point source controls for livestock waste have been shown to be effective in reducing pollution in locales such as the Herrington Lake watershed.. The key to effectiveness is participation within a finite subwatershed to direct resources to the activities influencing water quality. The milestones established under this TMDL are intended to gauge the level of participation in those programs implementing 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 in order to meet the desired endpoints expressed in this TMDL. The state has the authority to impose conditions on activities with a significant potential to pollute the waters of the state under K.S.A. 65-171. If overall water quality conditions in the watershed deteriorate, a Critical Water Quality Management Area may be proposed for the watershed, in response.

6. MONITORING

KDHE will continue to collect bimonthly samples at Station 520, including fecal coliform samples over each of the three defined seasons. During the evaluation period determining achievement of the desired endpoints of this TMDL over the period 2004-2008, more intensive sampling will need to be conducted under specified seasonal flow conditions. In Spring, at least 10 samples should be taken at flow conditions below 275 cfs, with half taken below 55 cfs. In Summer and Fall, 20 samples need to be taken below flows of 275 cfs, a majority of which will be collected at flows less than 10 cfs. In Winter 10 samples need to be taken at flows below 275 cfs. Use of the real time flow data available at the Paxico stream gaging station can direct sampling efforts.

Monitoring of bacteria levels in effluent will be a condition of NPDES and state permits for facilities using lagoons as the method of wastewater treatment. This monitoring will continually assess the functionality of the lagoon systems in reducing bacteria levels in the effluent released to the streams.

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.

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 watershed and current condition of Vermillion Creek. Subsequent decisions will be made regarding implementation approach, follow up of additional implementation and implementation in the non-priority subwatershed.

Consideration for 303d Delisting: The streams in this watershed 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.