

LOWER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Rattlesnake Creek Water Quality Impairment: Chloride

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Rattlesnake **Counties:** Rice, Stafford, Pawnee, Edwards, and Kiowa

HUC 8: 11030009

HUC 11s (HUC 14s): **010** (010, 020, 030, 040, 050, 060, and 070) *unimpaired*
 020 (010, 020, 060, and 070)
 030 (010, 020, 030, 040, 050, 060, 070, and 080)
 040 (010, 020, 030, 050, 060, and 070)

Drainage Area: 727.1 mi² (+ 370.8 mi² *unimpaired*)

Main Stem Segments: WQLS: 1 and 3; starting at confluence with Arkansas River and traveling upstream to Trousedale.

Tributary Segments: WQLS: Wildhorse Creek (2)
 Little Wildhorse Creek (6)
 Bear Creek (8)
 Spring Creek (7)

Designated Uses: Special Aquatic Life Support; Primary Contact Recreation; Domestic Water Supply; Food Procurement; Ground Water Recharge; Industrial Water Supply Use; Irrigation Use; Livestock Watering Use for Main Stem Segments
 Expected Aquatic Life Support on Tributary Segments

1998 303(d) Listing: Table 1 - Predominant Point Source and Non-point Source Impact

Impaired Use: Domestic Water Supply and Special Aquatic Life Support

Water Quality Standard: 250 mg/l for Domestic Water Supply (KAR 28-16-28e(c)(3)(A))

In stream segments where background concentrations of naturally occurring substances, including chlorides and sulfates, exceed the water quality criteria listed in Table 1a of KAR 28-16-28e(d), at ambient flow, the existing water quality shall be maintained, and the newly established numeric criteria shall be the background concentration, as

defined in KAR 28-16-28b(e). Background concentrations shall be established using the methods outlined in the “Kansas implementation procedures: surface water,” dated June 1, 1999... (KAR 28-16-28e(b)(9)).

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Use under 1998 303(d): Not Supporting Domestic Water Supply

Monitoring Sites: Station 030 near Raymond; Station 660 near Hudson

Period of Record Used: 1985 to 1999 (030); 1992 and 1996 (660)

Flow Record: Rattlesnake Creek near Zenith (USGS Station 07142575; 1973 to 1998) and Rattlesnake Creek near Raymond (USGS Station 07142620; 1973 to 1998)

Long Term Flow Conditions: Median Flow = 29 cfs (Station 07142575); 24 cfs (Station 07142620), 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 examined from the Raymond and Zenith Gaging Stations 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 75-99% range. Load curves were established for the chloride 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 tons of chloride 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 for both water quality sampling sites. Eighty three percent of Spring samples from water quality site 660 and 100% of water quality site 030 were over the criteria. 100% of Summer-Fall samples were over the criterion for both sites. 100% of Winter samples were over the criterion both sites. Overall 91% of the samples at site 660 were over the criteria. 100% of the sample at site 030 were over the criteria. This would represent a baseline condition of non-support of the impaired designated use for both sites.

NUMBER OF SAMPLES OVER CHLORIDE STANDARD OF 250 mg/L BY FLOW AND SEASON

Station	Season	0 to 10%	10 to 25%	25 to 50%	50 to 75%	75 to 90%	90 to 100%	Cum Freq.
Raymond (030)	Spring	2	3	11	12	11	8	47/47 = 100%
	Summer	2	4	4	3	3	2	18/18 = 100%
	Winter	3	4	11	14	4	4	40/40 = 100%

Station	Season	0 to 10%	10 to 25%	25 to 50%	50 to 75%	75 to 90%	90 to 100%	Cum Freq.
Hudson (660)	Spring	0	0	1	1	0	3	5/6 = 83%
	Summer	0	0	1	1	0	0	2/2 = 100%
	Winter	0	0	1	0	2	0	3/3 = 100%

Samples taken by Groundwater Management District No. 5 over 1992-1999 along Rattlesnake Creek indicate fresh water (< 250 mg/l) along Segment 3 down to approximately 2 miles downstream from the confluence of Wild Horse Creek. Immediately downstream from that point, chloride levels jump from an average of 109 mg/l to 912 mg/l.

Desired Endpoints of Water Quality (Implied Load Capacity) at Sites 660 and 030 over 2005 - 2010:

The ultimate endpoint for this TMDL will be to achieve the Kansas Water Quality Standards fully supporting the stream's designated uses, including Domestic Water Supply. This TMDL will, however, be phased. The current domestic water supply standard of 250 mg/L of chloride was used to establish a load duration curved on the TMDL curve.

Kansas Implementation Procedures for Surface Water allow for a numerical criterion based on natural background to be established using the mean concentration of in stream measurements gathered when stream flow was less than the median flow on the creek. A minimum of five data points is needed to determine the background concentration. The specific stream criteria to supplant the general standard will be developed concurrent with Phase One of this TMDL following the appropriate administrative and technical Water Quality Standards processes. Meanwhile, a Phase Two endpoint has been developed for the upper half of Stream Segment 1 (above the Little Salt Marsh in Quivira National Wildlife Refuge (QNWR)) based on currently available information and is 1,400 mg/L from data collected over 1992 and 1996 at site 660 for flows equal to or less than 29 cfs. The Phase Two endpoint for the lower half of Segment 1, which lies below the Little Salt Marsh in QNWR, is 3,660 mg/L from data collected over 1985-1999 at site 030 for flows equal to or less than 24 cfs. The Phase Two TMDL will be based on the future standard.

The endpoint for Segment 3 and the upstream tributaries will be 250 mg/l because of the freshwater supplied by the Big Bend Prairie Aquifer to the creek and lack of any mineral intrusion.

Seasonal variation has been incorporated in this TMDL through the documentation of the seasonal consistency of elevated chloride levels. 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

Groundwater from the Permian geologic formations underlying the eastern portion of the Rattlesnake Creek watershed has a naturally high level of chloride. As the baseflow component from the western watershed decreases or interacts with the upwelling ground water east of St. John, the chloride concentrations along Segment 1 increase substantially. The predominant source of the chloride in the surface water can be attributed to this natural contribution from Permian ground water in the baseflow. Reductions in freshwater baseflows upstream of Highway 281, evapotranspiration from the creek and in Quivira National Wildlife Refuge further increases the concentration at downstream locations of Segment 1.

Additional flow and chloride data from the 1990s provided by the Big Bend Groundwater Management District #5 substantiates this assessment. The water in Rattlesnake Creek does not receive a chloride load of any significance until downstream of highway 281 (near the confluence of Wild Horse Creek and Rattlesnake Creek). Chloride criteria violations do not appear to occur upstream of highway 281, including below the outfall of St. John.

Some additional loading might be associated with brine from oil fields in the area. Additional monitoring will be required to determine the relative contribution of these sources.

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

Additional assessment will be necessary to ascertain the amount of natural chloride loading within the watershed. The following can be anticipated:

Point Sources: There is one point source above the monitoring location(s), St. John. The Wasteload Allocation based on a 0.316 cfs design flow shall be 384 pounds per day of chloride at the 7Q10 of 1 cfs. Since Segment 3 has low chloride content, the 250 mg/l endpoint will be applicable regardless of development of elevated background concentrations on Segment 1.

The State and Groundwater Management District No. 5 are implementing a Rattlesnake Creek Subbasin Management Plan which will work toward water use reduction over a 12 year period and attempt to rebalance available water supply with demand. One aspect of the plan is flow augmentation along Rattlesnake Creek to supply the Quivira Wildlife Refuge with water during

autumn migratory season. If such a plan is implemented, the discharges to the creek will be subject to NPDES permitting and fall under the Wasteload Allocation of this TMDL, particularly if the augmentation water is taken from the ground water east of St. John, which will be elevated in chloride. If this plan develops and new discharges enter into the impaired segment, 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.

Non-Point Sources: The vast majority of chloride load is background in nature. The Load Allocation based on the existing standard will be 1,350 pounds per day at one cfs. This allocation increases to 3.8 tons per day at one cfs if the elevated background concentration in the upper half of Segment 1 becomes the applicable criteria and 9.9 tons per day at one cfs if the elevated background concentration in the lower half of Segment 1 becomes the criteria. At median flows, the upper half of Segment 1 would have a load allocation of 110 tons per day, while the lower half would have 237 tons per day.

Defined Margin of Safety: The Margin of Safety will be ten percent of the applicable sulfate wasteload, or 43 pounds tons per day at 1 cfs. Again, the Margin of Safety will remain in place despite incorporation of background concentrations or increases in available flow.

State Water Plan Implementation Priority: Because this watershed's chloride load is predominately natural in source this TMDL will be a Low Priority for implementation, except as relates to implementation of water use reduction activities under the Rattlesnake Creek Subbasin Management Plan.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Rattlesnake Subbasin (HUC 8: 11030009) with a priority ranking of 15 (High Priority for restoration work).

Priority HUC 11s and Stream Segments: Based on monitoring data from Groundwater Management District No. 5, Segment 1 will be the priority stream segment of concern for this TMDL.

5. IMPLEMENTATION

Desired Implementation Activities

1. Establish appropriate background concentrations
2. Remediate brine discharges to streams
3. Reestablish freshwater baseflows to reduce chloride concentrations along Rattlesnake Creek.

Implementation Programs Guidance

Water Quality Standards and Assessment - KDHE

- a. Establish background levels of chloride for Rattlesnake Creek.

Industrial Programs - KDHE

- a. Establish appropriate permit limits for any discharges to Rattlesnake Creek made for flow augmentation to ensure that chloride levels are not overloaded in the stream, at Quivira or into the Arkansas River.

Conservation Program - Kansas Corporation Commission

- a. Inventory, inspect and maintain any brine transport lines crossing streams within the watershed.
- b. Ensure oil and gas extraction activities have spill prevention and appropriate brine storage practices in place.
- c. Remediate by extraction and deep injection any brine disposal areas found to be contributing to elevated chloride conditions within the watershed.

Rattlesnake Creek Subbasin Water Resources Management Program - KDA

- a. Implement Rattlesnake Creek Management Plan to improve stream flow in Rattlesnake Creek, especially upstream of Highway 281 and to reduce the possibility of induced saltwater movement to the creek by upwelling of the salt/fresh water interface from groundwater withdrawals near the stream.

Timeframe for Implementation: Continued monitoring over the years 2001-2005. Development of a background level- based water quality standard should be accomplished with the 2002 water quality standards. Implementation of the Rattlesnake Creek Subbasin Management Plan will occur over 2000 - 2012.

Targeted Participants: Primary participants for implementation will be oil and gas operators within the watershed. Implementation 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. Brine Disposal Areas
2. Active leases for oil and gas extraction
3. Historic oil and gas lease areas no longer in production

Additionally, the Groundwater Management District and irrigators in the area will be participating in the water management of the regional aquifer which will have impacts on the quantity and quality of water in Segment 1.

Milestone for 2005: The year 2005 marks the mid-point of the ten year implementation window for the watershed. At that point in time, additional monitoring data from Stations 660 and 030 will be re-examined to confirm the impaired status of the river and the suggested background concentration. Should the case of impairment remain, source assessment, allocation and implementation activities will ensue

Delivery Agents: Depending upon confirmation of impairment and assessment of probable sources, the primary delivery agents for program participation will be the Kansas Department of Health and Environment, the Kansas Corporation Commission, the Kansas Water Office, the Kansas Department of Agriculture, and Big Bend GMD #5.

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. 82a-706. Empowers the chief engineer of the Division of Water Resources, KDA, to enforce and administer the laws of this state pertaining to the beneficial use of water and shall control, conserve, regulate, allot and aid in the distribution of the water resources of the state for the benefits and beneficial uses of all of its inhabitants in accordance with the rights of priority of appropriation.
4. K.S.A. 2-1915 empowers the Kansas Corporation Commission to develop programs to permit oil and gas activities, including the remediation of sites impacted by past operations.
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 Lower Arkansas River 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. Beyond implementation activities associated with the Rattlesnake Creek Subbasin Management Plan, this TMDL is a Low Priority consideration and should not receive funding.

Effectiveness: Minimal control can be exerted on natural contributions to loading. Controls on oil and gas lease activities are effective in containing spills and preventing them from reaching water resources. Conservation and water use reduction activities will yield increased streamflows over the long term after recharge of the system by natural rainfall/runoff events.

6. MONITORING

KDHE will continue to collect bimonthly samples at Station 030 and in 2000 and 2004 at rotational Station 660, including chloride samples over each of the three defined seasons. Based on that sampling, the status of 303(d) listing will be evaluated in 2006 including application of a numeric criteria based on background concentrations. Should impaired status remain, the desired endpoints under this TMDL will be refined and direct more intensive sampling will need to be conducted under specified seasonal flow conditions over the period 2005-2009.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the Lower Arkansas River Basin were held March 9, 2000 and April 26-27, in Hutchinson, Wichita, Arkansas City and Medicine Lodge. 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 Lower Arkansas River Basin. A draft of this TMDL has been maintained on the website since June 1, 2000 and modifications to the original draft have been available to the public for viewing and review up to the date of submitting this TMDL to EPA.

Public Hearing: A Public Hearing on the original draft of these TMDLs of the Lower Arkansas River Basin was held in Wichita on June 1, 2000.

Basin Advisory Committee: The Lower Arkansas River Basin Advisory Committee met to discuss the TMDLs in the basin on September 27, and November 8, 1999; January 13 and March 9, 2000. The Committee recommended approval of the Basin Plan which set high priority TMDLs in the basin, thereby, delegating medium and low priority status to this and subsequent TMDLs for the basin. The Kansas Water Authority approved the Basin Plan on July 11, 2000.

Discussion with Interest Groups: Meetings to discuss TMDLs with interest groups include:
Sedgwick County Technical Advisory Group: August 8, October 14, November 15, 1999 and January 20, 2000.
Agriculture: January 12, February 2 and 19, 2000.
Environmental: March 9, 2000.

Conservation Districts: November 22, 1999.

Industry: December 15, 1999, January 13, February 9 and 22, 2000.

Local Environmental Protection Groups: September 30, November 2, December 16, 1999.

Milestone Evaluation: In 2006, evaluation will be made as to the degree of impairment which has occurred within the watershed and current condition of Rattlesnake Creek. Subsequent decisions will be made regarding implementation approach and follow up on additional implementation in subwatersheds.

Consideration for 303(d) Delisting: Rattlesnake Creek will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2000-2005. Therefore, the decision for delisting will come about in the preparation of the 2006 303(d) list. Should modifications be made to applicable 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 2005.

Approved July 27, 2001.