



**Monitoring Sites:** Station 591 near Hardtner

**Period of Record Used:** 1990 to 2000

**Flow Record:** Salt Fork Arkansas River near Alma, OK (USGS Station 07148400)

**Long Term Flow Conditions:** Median Flow = 65 cfs

**Current Conditions:** Sulfate concentrations have ranged from 337.8 mg/l to 1,395.2 mg/l over the period of record. Overall, the average sulfate concentration was 695 mg/l. Concentrations at flows less than median flow (65 cfs) averaged 729 mg/l, while those at higher flows averaged 668 mg/l. There is a strong natural background concentration of sulfate in the Salt Fork Arkansas River.

Excursions were seen in all three seasons and are outlined in Table 1. All samples, regardless of season, exceeded the water supply criterion. This would represent a baseline condition of non-support of the impaired designated use.

**Table 1**  
**NUMBER OF SAMPLES OVER SULFATE STANDARD OF 250mg/L BY FLOW**

Station	Season	0 to 10%	10 to 25%	25 to 50%	50 to 75%	75 to 90%	90 to 100%	Cum Freq.
Salt Fork Arkansas R nr Hardtner (591)	Spring	2	7	7	7	2	0	25/25 = 100%
	Summer	1	2	3	1	5	2	14/14 = 100%
	Winter	0	3	7	8	0	0	18/18 = 100%

**Desired Endpoints of Water Quality (Implied Load Capacity) at Site 591 over 2005 - 2010:**

The ultimate endpoint for this TMDL will be to achieve the Kansas Water Quality Standards fully supporting Drinking Water Use. This TMDL will, however, be phased. The current standard of 250 mg/L of sulfate was used to establish the TMDL. However, the Salt Fork Arkansas River is subject to loading of sulfate from underlying Permian geologic formation and their high gypsum content in the watershed. As such, the stream has elevated sulfate levels from this natural source, with a tendency to increase loading with flow. This natural background of sulfate at high flows, consistently above 250 mg/L, makes achievement of the existing criterion impossible.

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 stream. 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 tentative endpoint has been developed based on currently available information and

is 729 mg/L from data collected over 1990-2000 at flows equal to or less than median flow. The Phase Two TMDL will be based on the future standard.

Seasonal variation has been incorporated in this TMDL through the documentation of the seasonal consistency of elevated sulfate 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

**Background:** The primary cause of the sulfate impairment of the Salt Fork Arkansas River in Comanche and Barber County is natural dissolution of gypsum (hydrated calcium sulfate) in the bedrock outcropping and underlying alluvial aquifer sediments in the watershed. Bedrock outcropping and underlying alluvial sediments of the uppermost watershed of the Salt Fork of the Arkansas River consists primarily of shales, siltstones, and sandstones of the Lower Cretaceous System. Most of the Cretaceous bedrock that would affect the quality of runoff and groundwater discharge to the tributaries of the river is the Kiowa Shale and Cheyenne Sandstone. Gypsum, in the mineral form known as selenite, occurs in these formations. The selenite is present in different parts of the Cheyenne Sandstone and is common throughout the Kiowa Shale.

Additionally, the bedrock outcropping and alluvial sediments underlying most of the Salt Fork watershed consists primarily of shales, siltstones, and sandstones of the Permian System. These include strata in the Upper Permian and upper part of the Lower Permian Series, including the Dog Creek Shale, Blaine Formation, Flowerpot Shale, Cedar Hills Sandstone, and Salt Plain Formation, all of which contain gypsum beds, veins, or cement. The Blaine Formation contains gypsum beds of great enough thickness that they are mined in Barber County. The prevalence of gypsum at or near the land surface in Barber County and southeast Comanche counties contributes substantial amounts of sulfate to runoff and ground-water discharge to streams as a result of natural dissolution of the mineral. Gypsum is a very soluble mineral and can lead to sulfate concentrations of nearly 2,000 mg/L when dissolved to saturation in water of low chloride content and concentrations substantially exceeding 2,000 mg/L in water with appreciable chloride content.

There are no municipal NPDES sites located within the watershed. Any anthropogenic sulfate sources or hydrologic modifications increasing the sulfate concentration would be minor in comparison with the natural sulfate source in the watershed.

**Irrigation Return Flows:** Aggravation or impairment associated with irrigation return flows in this watershed is negligible. Only center pivot or center pivot with drop-nozzle irrigation is utilized within the Salt Fork Arkansas River subbasin and these diversions are primarily located in the northern third of the watershed immediately west of the Nescatunga Creek in HUC 14s 11060002020030 and 11060002020040. This small, localized source of groundwater supply, formed within a bedrock low, is the Belleville/Meade/Grand Island formation. Return flows, if any, via groundwater discharge to Nescatunga Creek from those diversions would be low in

sulfate because of the low sulfate content of the source of supply and is confirmed by samples (water quality site 623, unimpaired by sulfate or chloride) taken on Nescatunga Creek (sulfate average of 72 mg/l and chloride average of 14 mg/L).

#### **4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY**

The source assessment has ascertained that natural sulfate loading within the watershed generally is responsible for the excursions seen at Hardtner.

**Point Sources:** A Wasteload Allocation of zero will be established by this TMDL because of the lack of point sources along the segment. 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.

**Non-Point Sources:** This sulfate load is background geologic in nature. The Load Allocation based on the existing standard will be 3.1 tons per day at five cfs and 39.5 tons per day at the median flow. This allocation increases to 8.8 tons per day at five cfs and 115 tons per day at median flow if the elevated background concentration becomes the applicable criteria. The Load Allocation is intended to reduce the number of excursions over the applicable water quality criterion.

**Defined Margin of Safety:** The Margin of Safety provides some hedge against the uncertainty of loading and the sulfate endpoint and will be ten percent of the applicable sulfate load, or 0.3 tons per day at five cfs and 4.4 tons per day at median flow. Again, the Margin of Safety increases to 1 ton per day at five cfs and 13 tons per day if the elevated background concentration becomes the applicable criteria.

**State Water Plan Implementation Priority:** Because it appears this watershed's sulfate load is predominately natural, this TMDL will be a Low Priority for implementation.

**Unified Watershed Assessment Priority Ranking:** This watershed lies within the Upper Salt Fork Arkansas subbasin (HUC 8: 11060002) with a priority ranking of 41 (Medium Priority for restoration).

**Priority HUC 11s:** Because of the natural geologic contribution of this impairment, no priority subwatersheds or stream segments will be identified..

#### **5. IMPLEMENTATION**

##### **Desired Implementation Activities**

1. Monitor any anthropogenic contributions of sulfate loading to river.

2. Establish alternative background criterion
3. Assess likelihood of river being used for domestic uses.

## **Implementation Programs Guidance**

### **Non-Point Source Pollution Technical Assistance - KDHE**

- a. Evaluate any potential anthropogenic activities which might contribute sulfate to the river as part of an overall Watershed Restoration and Protection Strategy.

### **Water Quality Standards and Assessment - KDHE**

- a. Establish background levels of sulfate for the river and recommend an alternative water quality criterion.

### **Use Attainability Analysis - KDHE**

- a. Consult with Division of Water Resources on locating existing or future domestic points of diversion on the Salt Fork of the Arkansas River for drinking water purposes.

**Time Frame for Implementation:** Development of a background level-based water quality standard should be accomplished with the 2002 water quality standards revision.

**Targeted Participants:** Primary participants for implementation will be KDHE.

**Milestone for 2006:** The year 2006 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, additional monitoring data from Salt Fork Arkansas River will be reexamined 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:** The primary delivery agents for program participation will be the Kansas Department of Health and Environment.

## **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-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.

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

5. The *Kansas Water Plan* and the Lower 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.

**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 Low Priority consideration and should not receive funding .

**Effectiveness:** Minimal control can be exerted on natural contributions to loading.

## 6. MONITORING

KDHE will continue to collect bimonthly samples at Station 591, including sulfate 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 numeric criterion based on background concentrations.

## 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:

Agriculture: January 12, February 2 and 29, 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 drainage and current condition of Salt Fork Arkansas River. Subsequent decisions will be made regarding implementation approach and follow up of additional implementation.

**Consideration for 303(d) Delisting:** Salt Fork Arkansas River will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2001-2005. Therefore, the decision for delisting will come about in the preparation of the 2006 303(d) list. Should modifications be made to the 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