

SMOKY HILL/SALINE RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body: Sheridan Wildlife Area Water Quality Impairment: pH

Subbasin: Upper Saline

County: Sheridan and Gove

HUC 8: 10260009

HUC 11 (HUC 14): 020 (040)

Ecoregion: Central Great Plains, Rolling Plains and Breaks (27b)

Drainage Area: Approximately 0.2 square mile

Conservation Pool: Area = 0.3 acre
Maximum Depth = 2.0 meters (6.6 feet)
Mean Depth = 0.8 meter (3 feet)
Retention Time = 0.66 year (7.9 months)

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

Authority: State (Kansas Department of Wildlife and Parks)

2002 303(d) Listing: Smoky Hill/Saline River Basin Lakes

Impaired Use: Expected Aquatic Life Support

Water Quality Standard: Artificial sources of pollution shall not cause the pH of any surface water outside of a zone of initial dilution to be below 6.5 and above 8.5 (KAR 28-16-28e(c)(2)(C))

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Monitoring Sites: Station 014501 in Sheridan WA (Figure 1).

Period of Record Used: Four surveys during 1997 - 2000.

Current Condition:

Over the four years that surveys were taken, the pH level was high 62.5% of the time. The

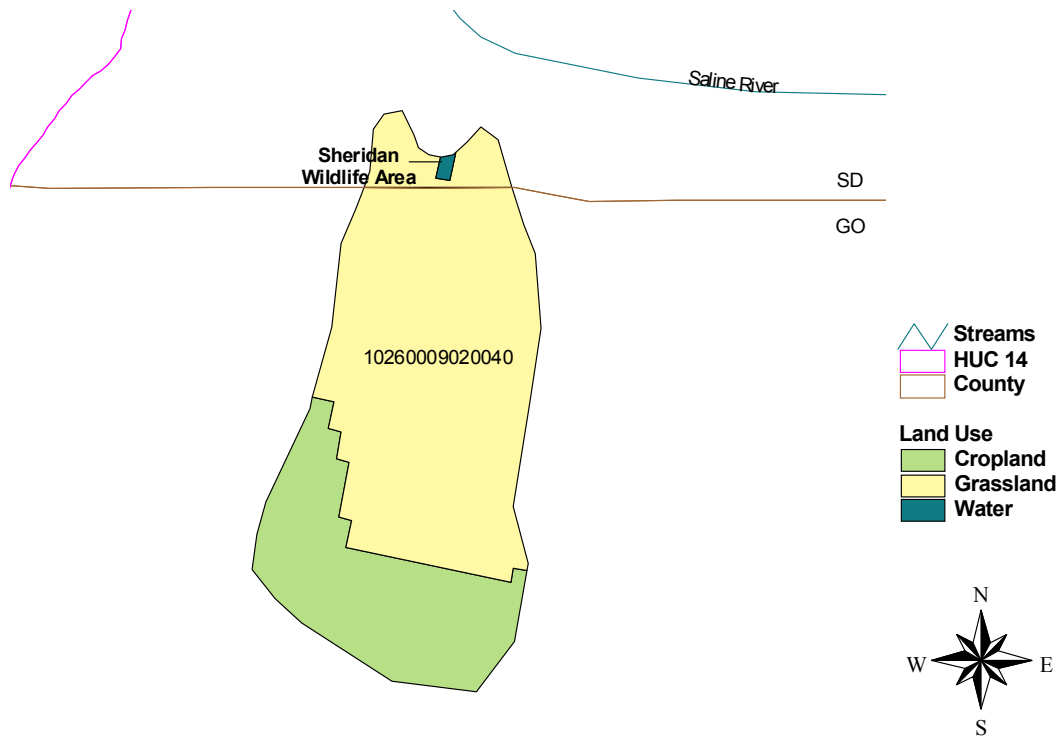
average pH was 8.38 ranging from 7.43 to 8.95 (Appendix A). The highest levels were seen in the summer of 2000. (See the table below). High pH problems relate directly to the large macrophyte community present in the wetland.

pH data from the KDHE Lake Monitoring Program

Site Name	Date	Field pH
LM014501	8/12/97	8.34
LM014501	8/12/97	8.54
LM014501	8/25/98	8.74
LM014501	8/25/98	8.88
LM014501	8/17/99	7.43
LM014501	8/17/99	7.44
LM014501	8/15/00	8.69
LM014501	8/15/00	8.95

Figure 1

Sheridan Wildlife Area TMDL Reference Map



Eutrophication is not a concern for Sheridan WA. Based on the four monitoring visits, Sheridan WA had an average chlorophyll a concentration of 4.4 $\mu\text{g/L}$, a Total Phosphorus concentration of 37 $\mu\text{g/L}$, a Total Kjeldahl Nitrogen concentration of 0.59 mg/L , and a nitrate concentration of 0.13 mg/L . The Secchi disc depth equaled the water column depth. Light was indicated to be the

primary limiting factor due to clay turbidity (Appendix B). Phosphorus and nitrogen were not limiting nutrients.

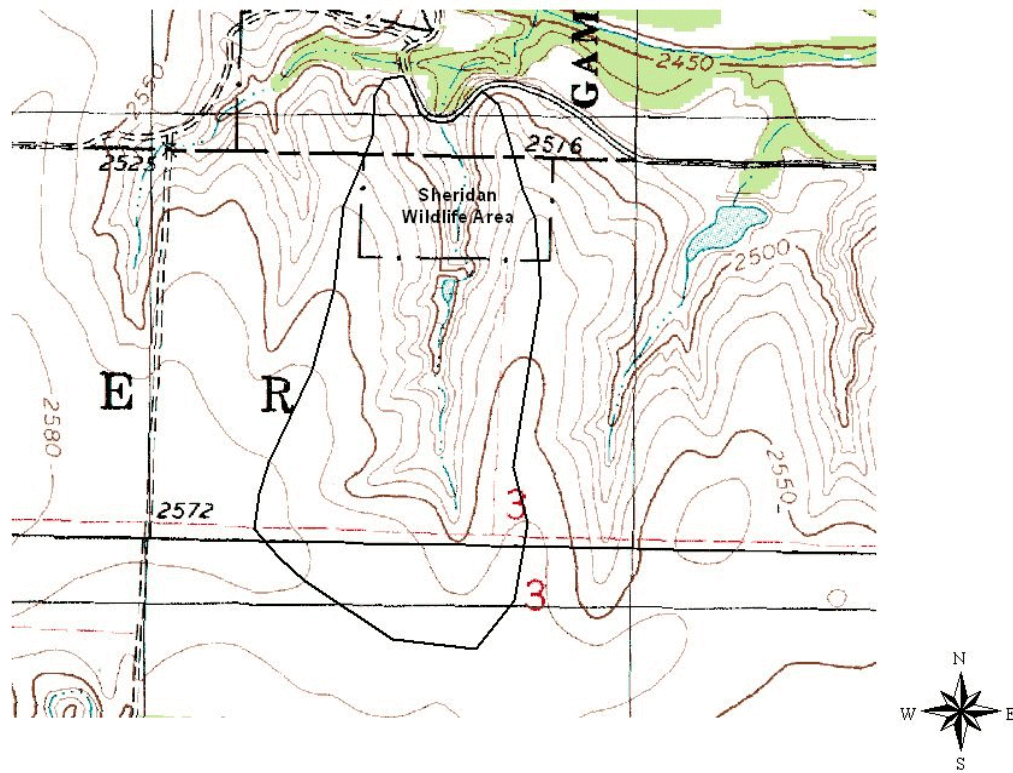
Interim Endpoints of Water Quality (Implied Load Capacity) at Sheridan WA over 2008 - 2012:

The desired endpoint will be to have pH samples fall between 6.5 and 8.5. Refined endpoints will be developed in 2008 to reflect additional sampling and artificial source assessment and confirmation of impaired status of wetland.

Parameter	Current Condition	TMDL	Percent Change
pH	8.38	> 6.5, <8.5	0 %

Figure 2

Sheridan Wildlife Area



3. SOURCE INVENTORY AND ASSESSMENT

The current levels of nutrients entering the wetland are not significantly impacting the eutrophication level. Grassland (69% of the land use) surrounds and buffers Sheridan WA.

The pH impairment is caused by an abundance of macrophytes in the wetland. Levels of pH typically rise above 8.5 under vigorous photosynthesis. Photosynthesis drives the biological system by converting carbon dioxide and water through sunlight into sugar and oxygen. An additional end-product from the photosynthesis process are hydroxyl ions, stripped of hydrogen atoms in the production of glucose. Therefore, not only is carbon dioxide taken up from the water column, where it tends to form carbonic acid with disassociated hydrogen ions, but the addition of the hydroxyl ions in combination with bicarbonate ions in the water column raises pH levels. Explosive primary productivity driven by photosynthesis and results in pH rises above the desired 8.5 level.

Reducing the macrophyte community would have detrimental effects on the wetland ecosystem and wildlife habitat. Therefore, the macrophyte community should be left intact.

4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

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: Phase One of this TMDL requires 0% change because Sheridan WA is attaining the water quality standard for pH and the wetland is fully functioning with an abundance of macrophytes. Phase Two involves the possible development of site specific criteria for pH based on the monitoring data from 2004 to 2008, if elevated pH values are detected.

Defined Margin of Safety: The margin of safety is implicit, by not allowing for artificial sources to raise the pH above 8.5 or drop below 6.5.

State Water Plan Implementation Priority: Because the impairment is due to the macrophyte community, this TMDL will be a Low Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Upper Saline (HUC 8: 10260009) with a priority ranking of 39 (Medium Priority for restoration).

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

5. IMPLEMENTATION

Desired Implementation Activities

1. Prevent anthropogenic sources of nutrients from entering the wetland.
2. Monitor the Total Phosphorus and Total Nitrogen concentrations in the wetland.

Implementation Programs Guidance

Nonpoint Source Pollution Technical Assistance - KDHE

- a. Develop a Watershed Restoration and Protection Strategy for HUC 10260009.

Time Frame for Implementation: Continued monitoring over the years from 2003 to 2008.

Targeted Participants: Primary participants for implementation will be state and county officials responsible for managing the wetland.

Milestone for 2008: The year 2008 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, sampled data from Sheridan WA will be reexamined to confirm the impaired status of the wetland. 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 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 Smoky Hill/Saline 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: Effectiveness of corrective actions will depend upon the sources which contribute to the impairment at the lake.

6. MONITORING

Further assessment should occur before 2008. The monitoring data collected during the assessment period will be used to determine if site specific criteria for pH should be developed for the wetland.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the Smoky Hill/Saline Basin were held January 7 and March 5, 2003 in Hays. 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 Smoky Hill/Saline Basin.

Public Hearing: A Public Hearing on the TMDLs of the Smoky Hill/Saline Basin was held in Hays on June 2, 2003.

Basin Advisory Committee: The Smoky Hill/Saline Basin Advisory Committee met to discuss the TMDLs in the basin on October 3, 2002, January 7, March 5, and June 2, 2003.

Milestone Evaluation: In 2008, evaluation will be made as to the degree of impairment which has occurred within the watershed and current condition of Sheridan WA. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

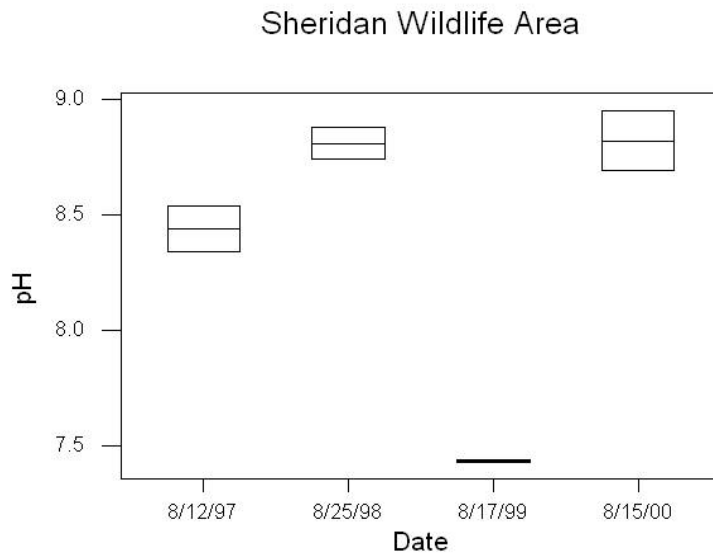
Consideration for 303(d) Delisting: The lake will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2008-2012. Therefore, the decision for delisting will come about in the preparation of the 2012 303(d) list. Should modifications be made to the applicable water 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 2004 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 2004-2008.

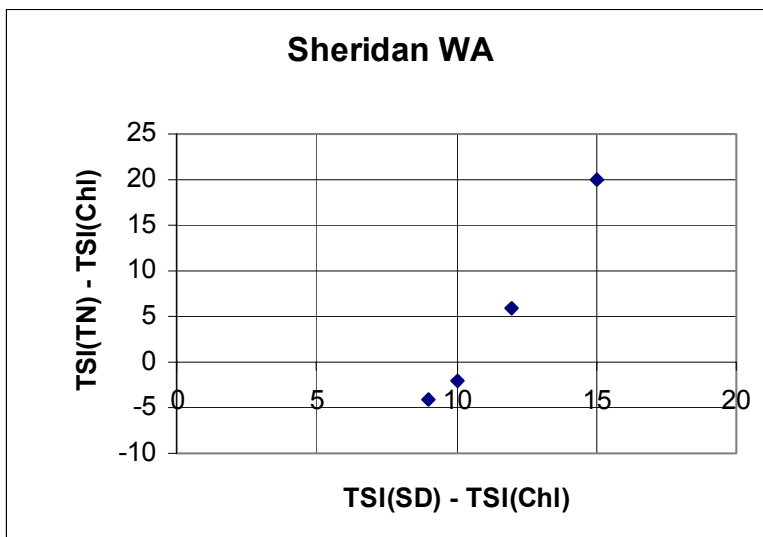
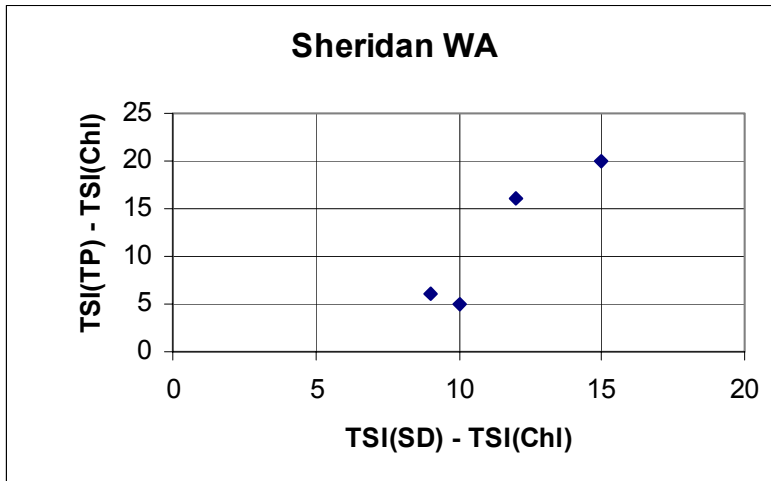
Bibliography

Liscek, Bonnie C. Methodology Used in Kansas Lake TMDLs [web page] Jul. 2001;
<http://www.kdhe.state.ks.us/tmdl/eutro.htm> [Accessed 30 September 2002].

Appendix A - Boxplots



Appendix B - Trophic State Index Plots



The Trophic State Index plots indicate that light is the primary limiting factor, due to clay turbidity. This is inferred by examining the relationship between the TSI(SD) - TSI(Chl) versus TSI(TP)-TSI(Chl) and TSI(TN)-TSI(Chl). The deviation of chlorophyll from the sediment load indicates the degree of light penetration, while the difference between chlorophyll and phosphorus/nitrogen indicates the level of phosphorus/nitrogen limitation. Therefore, if the final plot is in the first quadrant, it shows that the transparency of the water is impaired due to the presence of small particles, and that phosphorus/nitrogen does not limit algae growth. The positive slope of the graph also indicates a correlation between phosphorus/nitrogen and transparency which is found when phosphorus is bound to non algal particles.

Approved Sep. 30, 2003