

# LOWER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

**Water Body: Quivira Big Salt Marsh**  
**Water Quality Impairment: Eutrophication Bundled with pH**

## 1. INTRODUCTION AND PROBLEM IDENTIFICATION

**Subbasin:** Rattlesnake

**County:** Stafford and Reno

**HUC 8:** 11030009

**HUC 11 (HUC 14s):** 040 (040, 050)

**Drainage Area:** Approximately 101.9 square miles. **(Figure 1)**

**Conservation Pool:** Area = 1,367 acres, Maximum Depth = approximately 1 meter

**Designated Uses:** Secondary Contact Recreation, Special Aquatic Life Support, and Food Procurement

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

**Impaired Use:** All uses are impaired to a degree by eutrophication

**Water Quality Standard:** Nutrients - Narrative: The introduction of plant nutrients into streams, lakes, or wetlands from artificial sources shall be controlled to prevent the accelerated succession or replacement of aquatic biota or the production of undesirable quantities or kinds of aquatic life. (KAR 28-16-28e(c)(2)(B)).

The introduction of plant nutrients into surface waters designated for primary or secondary contact recreational use shall be controlled to prevent the development of objectionable concentrations of algae or algal by-products or nuisance growths of submersed, floating, or emergent aquatic vegetation. (KAR 28-16-28e(c)(7)(A)).

pH less than 6.5 and greater than 8.5 (KAR 28-16-28e(c)(2)(C))

# Quivira Big Salt Marsh

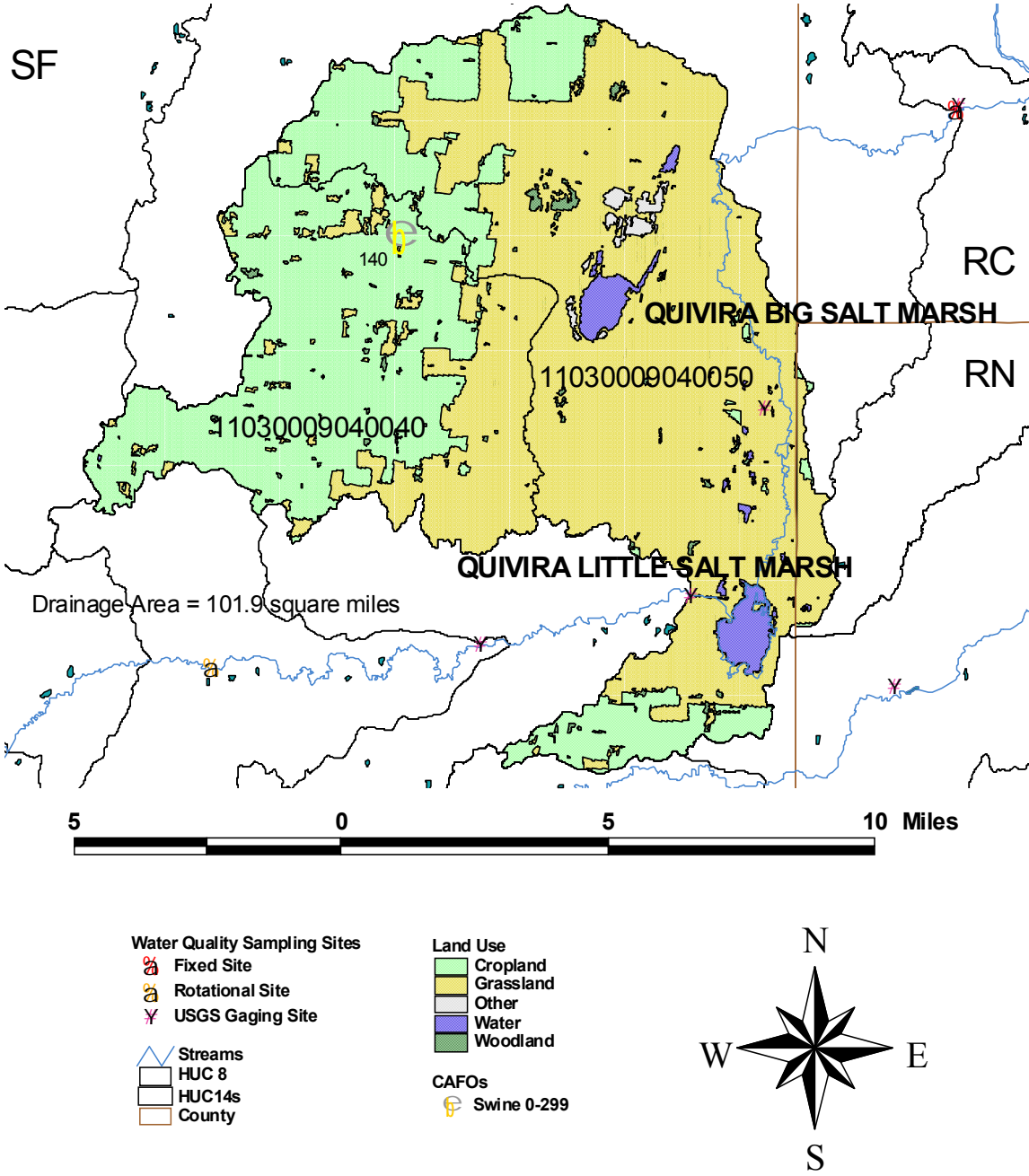


Figure 1

## 2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

**Level of Eutrophication:** Hypereutrophic, Trophic State Index = 79.47

**Monitoring Sites:** Station 050601 in Quivira Big Salt Marsh.

**Period of Record Used:** Six surveys during 1988-1999.

**Current Condition:** Quivira Big Salt Marsh has elevated chlorophyll a concentrations averaging 146.2 ppb. This relates to a Trophic State Index of 79.47, indicating hypereutrophic conditions. The chlorophyll a concentration has fluctuated over time. During the 1988 and 1991 surveys, the average concentration was 24.1 ppb. The highest concentrations (averaging 383.5 ppb) were seen in 1994. In the 1997 through 1999 surveys, the average chlorophyll a concentration dropped to 148.6 ppb.

The Trophic State Index of 79 is derived from the chlorophyll a concentration. Trophic state assessments of potential algal productivity were made based on chlorophyll a concentrations, nutrient levels and values of the Carlson Trophic State Index (TSI). Generally, some degree of eutrophic conditions is seen with chlorophyll a concentrations over 12 ug/l and hypereutrophy occurs at levels over 30 ug/l. The Carlson TSI, derives from the chlorophyll concentrations and scales the trophic state as follows:

- |                       |                 |
|-----------------------|-----------------|
| 1. Oligotrophic       | TSI < 40        |
| 2. Mesotrophic        | TSI: 40 - 49.99 |
| 3. Slightly Eutrophic | TSI: 50 - 54.99 |
| 4. Fully Eutrophic    | TSI: 55 - 59.99 |
| 5. Very Eutrophic     | TSI: 60 - 63.99 |
| 6. Hypereutrophic     | TSI: ≥ 64       |

The total phosphorus concentrations are high, averaging 264 ppb. Eighty-three percent of the samples are over 100 ppb. The total nitrogen to total phosphorus ratio is 16.2, indicating that phosphorus is the primary limiting factor. The chlorophyll a to total phosphorus yield is high. Despite moderate to high turbidity in the marsh, light is not indicated to be a limiting factor.

From 1988 to 1999, the pH was high 83 percent of the time. The average pH was 8.96 ranging from 7.94 to 9.90. High pH problems relate directly to the high trophic state.

### **Interim Endpoints of Water Quality (Implied Load Capacity) at Quivira Big Salt Marsh over 2005 - 2009:**

In order to improve the trophic condition of the marsh from its current hypereutrophic status, the desired endpoint will be summer chlorophyll a concentrations at or below 20 ug/l, corresponding to a trophic state of eutrophic conditions by 2009. Achievement of this endpoint should also result in pH values between 6.5 and 8.5. Refined endpoints will be developed in 2005 to reflect additional sampling and artificial source assessment and confirmation of impaired status of marsh.

### 3. SOURCE INVENTORY AND ASSESSMENT

**Land Use:** Quivira Big Salt Marsh has a high potential for nonpoint source pollutants. An annual phosphorus load of 6,548 pounds per year is necessary to correspond to the concentrations seen in the marsh.

Animal waste adds to the phosphorus load going into Quivira Big Salt Marsh. Fifty-eight percent of land around the marsh is grassland. The summer grazing density of livestock is high, and the winter grazing density is average. One confined animal feeding operation (140 animal units of swine) is located within the watershed.

A source of phosphorus within Quivira Big Salt Marsh is probably runoff from agricultural lands where phosphorus has been applied. Land use coverage analysis indicates that 37.6% of the watershed is cropland; the majority of that cropland lies within Stafford County. In 1998, 32,301 tons of fertilizer were sold in Stafford County. Assuming that the drainage area of Quivira Big Salt Marsh covers 13 percent of the county, then 4,185 tons of fertilizer were bought and potentially used with the watershed.

**Background Levels:** Waterfowl, shorebirds, sandhill cranes, bald eagles, whooping cranes, and Mississippi kites travel through the Quivira National Wildlife Refuge during their migration. Their waste, as well as waste from numerous other types of wildlife, increases the levels of phosphorus in the marsh.

Seven hundred and thirty-seven acres of woodland are located around Quivira Big Salt Marsh; leaf litter may be adding to the nutrient load. There is the potential for wind and carp to resuspend bottom sediments in this marsh. Nutrient recycling from the sediments in the marsh is likely contributing available phosphorus to the marsh for algal uptake. Geological formations contain small amounts of phosphorus (up to 0.5% of total weight), and may contribute to phosphorus loads.

### 4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

More detailed assessment of sources and confirmation of the trophic state of the marsh must be completed before detailed allocations can be made. The general inventory of sources within the drainage does provide some guidance as to areas of load reduction.

**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:** The assessment suggests that cropland and animal waste contribute to the hypereutrophic state of the marsh. Water quality violations are partially due to migratory birds. Generally a Load Allocation of 1,178.5 pounds per year, leading to an 80% reduction in available phosphorus is necessary to reach the endpoint.

**Defined Margin of Safety:** The margin of safety provides some hedge against the uncertainty of variable annual total phosphorus loads and the chlorophyll a endpoint. Therefore, the margin of safety will be 131.0 pounds per year of total phosphorus taken from the load capacity to ensure that adequate load reduction occurs to meet the endpoint.

**State Water Plan Implementation Priority:** Because Quivira Big Salt Marsh is an outstanding national resource water, this TMDL will be a High Priority for implementation.

**Unified Watershed Assessment Priority Ranking:** This watershed lies within the Rattlesnake (HUC 8: 11030009) with a priority ranking of 18 ( High Priority for restoration).

**Priority HUC 11s:** The entire watershed is within HUC 11 (040).

## **5. IMPLEMENTATION**

### **Desired Implementation Activities**

It is not very likely that this water body can be brought to such a low trophic state as to fully support all beneficial uses. However, a significant reduction in nonpoint source loads can be achieved, with some improvement in the percent of the year that might see impairments occurring. Some of the recommended agricultural practices are as follows:

1. Implement soil sampling to recommend appropriate fertilizer applications on cropland.
2. Maintain conservation tillage and contour farming to minimize cropland erosion.
3. Install grass buffer strips along streams.
4. Reduce activities within riparian areas.
5. Implement nutrient management plans to manage manure application to land.

Additionally, continued water management at Quivera may lead to decreased nutrient cycling.

### **Implementation Programs Guidance**

#### **Nonpoint Source Pollution Technical Assistance - KDHE**

- a. Support Section 319 demonstration projects for reduction of sediment runoff from agricultural activities as well as nutrient management.
- b. Provide technical assistance on practices geared to establishment of vegetative buffer strips.
- c. Provide technical assistance on nutrient management in vicinity of streams.

#### **Water Resource Cost Share Program - SCC**

- a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed wetlands.

**Nonpoint Source Pollution Control Program - SCC**

- a. Provide sediment control practices to minimize erosion and sediment and nutrient transport.

**Riparian Protection Program - SCC**

- a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation.
- b. Develop riparian restoration projects.
- c. Promote wetland construction to assimilate nutrient loadings.

**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 agricultural producers on sediment, nutrient and pasture management.
- b. Educate livestock producers on livestock waste management and manure applications and nutrient management planning.
- c. Provide technical assistance on livestock waste management systems and nutrient management plans.
- d. Provide technical assistance on buffer strip design and minimizing cropland runoff.
- e. Encourage annual soil testing to determine capacity of field to hold phosphorus.

**Subbasin Water Management - Division of Water Resources**

- a. Continue to work with Groundwater Management District No. 5 and U.S. Fish and Wildlife Service to implement the Rattlesnake Creek Subbasin Management Plan to provide water to the Quivera wetland complex.

**Time Frame for Implementation:** Pollutant reduction practices should be installed within the priority subwatersheds during the years 2001-2005, with minor follow up implementation, including other subwatersheds over 2005-2009.

**Targeted Participants:** Primary participants for implementation will be public lands managers for Quivera and agricultural producers within the drainage of the marsh. Initial work in 2005 should include local assessments by conservation district personnel and county extension agents to locate within the marsh drainage:

1. Total row crop acreage
2. Cultivation alongside marsh
3. Drainage alongside or through animal feeding lots
4. Livestock use of riparian areas
5. Fields with manure applications

**Milestone for 2005:** The year 2005 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, sampled data from Quivira Big Salt Marsh should indicate evidence of reduced phosphorus levels in the conservation pool elevations relative to the conditions seen over 1988-1999.

**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.

**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 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 High Priority consideration.

**Effectiveness:** Nutrient control has been proven effective through conservation tillage, contour farming and use of grass waterways and buffer strips. The key to success will be widespread utilization of conservation farming within the watersheds cited in this TMDL.

## 6. MONITORING

KDHE will collect nutrient, pH, dissolved oxygen, and chlorophyll a samples from Quivira Big Salt Marsh in 2000. Additional data, to establish nutrient ratios, source loading and further determine mean summer marsh trophic condition, would be of value prior to 2005. Further sampling and evaluation should occur once before 2005 and twice between 2005 and 2010.

## 7. FEEDBACK

**Public Meetings:** Public meetings to discuss TMDLs in the Lower Arkansas Basin were held March 9 in Wichita, April 26 in Wichita and Hutchinson, and April 27 in 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 Basin.

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

**Basin Advisory Committee:** The Lower Arkansas Basin Advisory Committee met to discuss the TMDLs in the basin on September 27, November 8, 1999; January 13, 2000; March 9, 2000 and June 1, 2000

**Discussion with Interest Groups:** Meetings to discuss TMDLs with interest groups include:  
Ground Water Management District No. 5: August 10, September 9, 1999 and May 11, 2000.  
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 2005, evaluation will be made as to the degree of impairment which has occurred within the drainage and current condition of Quivira Big Salt Marsh. Subsequent decisions will be made regarding implementation approach, follow up of additional implementation and implementation in the nonpriority subwatersheds.



**Consideration for 303d Delisting:** Quivira Big Salt Marsh will be evaluated for delisting under Section 303d, based on the monitoring data over the period 2005-2009. Therefore, the decision for delisting will come about in the preparation of the 2010 303d list. Should modifications be made to the applicable nutrient 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 during Fiscal Years 2001-2005.

Approved September 11, 2000.