

CIMARRON RIVER BASIN TOTAL MAXIMUM DAILY LOAD
Water Body: Big Basin W. A. (St. Jacob's Well)
Water Quality Impairment: Eutrophication

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Upper Cimarron-Bluff

County: Clark

HUC 8: 11040008

HUC 11 (HUC 14): 020 (060)

Drainage Area: Approximately 11.7 acres (**Figure 1**)

Big Basin W.A. TMDL Reference Map

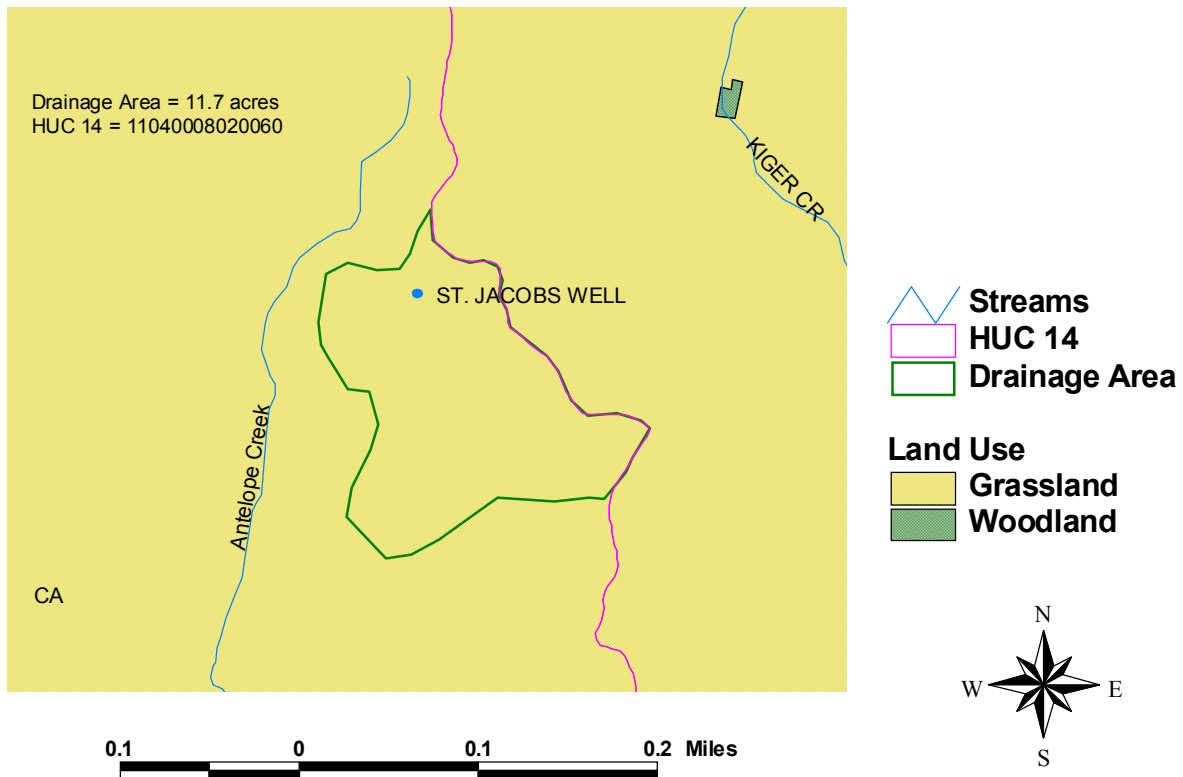


Figure 1

Conservation Pool: Area = 651 square feet, Maximum Depth = 4 meters

Designated Uses: Secondary Contact Recreation; Expected Aquatic Life Support; Food Procurement; Groundwater Recharge; Livestock Watering Use

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

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

Water Quality Standard: 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)).

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Eutrophication: Hypereutrophic; Trophic State Index = 70.95
(Average Chlorophyll a = 61.3 ppb)

Monitoring Sites: Station 060001 in Big Basin W. A..

Period of Record Used: Two surveys during 1989 and 1999

Current Condition: In 1999, Big Basin WA had slightly elevated chlorophyll a concentrations. The average concentration was 22.6 ppb, related to a Trophic State Index of 61.2, indicating very eutrophic conditions. Prior to this, in 1989, the chlorophyll a concentrations averaged 100.0 ppb.

The Trophic State Index of 61 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 are 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 |

Total phosphorus concentrations were elevated in 1989, averaging 224 ppb. (Phosphorus samples were not taken in 1999). Phosphorous appears the most likely limiting factor. To match

the observed total phosphorus concentrations, the total annual phosphorus load needs to be about 0.44 pounds per year. Light is not limiting, despite the presence of highly colored water in 1999. The chlorophyll to total phosphorus ratio is moderate.

Interim Endpoints of Water Quality (Implied Load Capacity) at Big Basin WA over 2005 - 2009:

In order to improve the trophic condition of the wildlife area from its current very eutrophic 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. Refined endpoints will be developed in 2005 to reflect additional sampling and artificial source assessment and confirmation of impaired status of wildlife area.

Big Basin W.A. Drainage Area

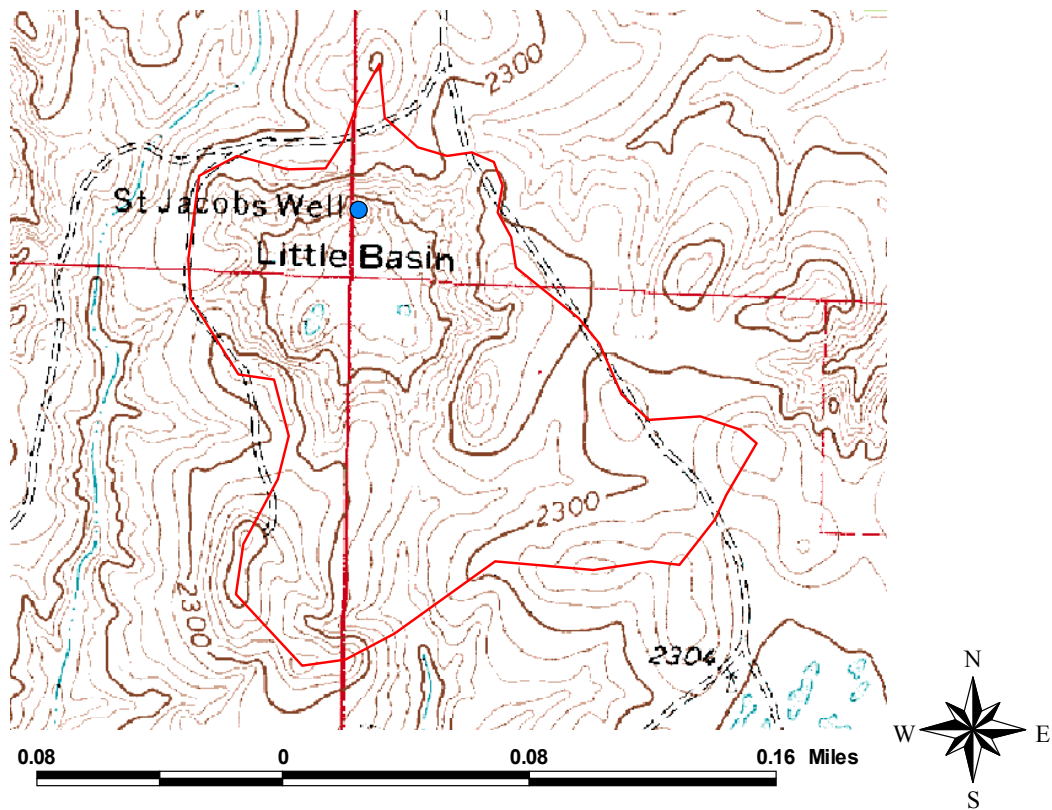


Figure 2

3. SOURCE INVENTORY AND ASSESSMENT

The watershed has a low potential for nonpoint source pollutants. All of the land around the wildlife area is native grassland. A small bison herd is present. They are fenced off from the well yet are allowed to roam around in the drainage area. Their waste may contribute to the phosphorus load. Observation of a nearby holding tank and well indicates the presence of aquatic plants within the holding tank, implying that nutrient loading may be coming from the ground water supply or from atmospheric sources (attached to dust).

Background Levels: St. Jacob's "Well" is a small sinkhole with a deep pool of standing water. The source of water may be from groundwater in the Big Basin formation (Permian rock) or from internal drainage. Several trees are located around the wildlife area. Leaf litter may be contributing to the nutrient levels in Big Basin WA. Atmospheric contributions may come from phosphorus attached to settled dust blowing into the area.

4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

More detailed assessment of sources and confirmation of the trophic state of the wildlife area must be completed before detailed allocations can be made. The general inventory of sources within the drainage does provide some guidance.

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: Water quality violations are natural or non-point in nature. Some drainage from the area may reach the water body. Runoff loads may be due to the herd of bison. There has been a marked decrease in chlorophyll a levels between 1989 and 1999. There is likely a decrease in phosphorus levels as well. Given that the 1989 phosphorus loading amounted to 0.44 pounds per day, the Load Allocation of phosphorus at 0.2 pounds per day in consideration of the more recent conditions.

Defined Margin of Safety: The margin of safety provides some hedge against the uncertainty of loading and the chlorophyll a endpoint. Therefore, the margin of safety will be 0.02 pounds per day.

State Water Plan Implementation Priority: Because Big Basin WA is an Outstanding Natural Resource Water and a wildlife area under state jurisdiction, this TMDL will be a High Priority for implementation

Unified Watershed Assessment Priority Ranking: This watershed lies within the Upper Cimarron-Bluff (HUC 8: 11040008) with a priority ranking of 52 (Low Priority for restoration work).

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

5. IMPLEMENTATION

Desired Implementation Activities

The bison should be kept out of the drainage area leading to the waterbody.

Implementation Programs Guidance

Lands Management - Kansas Department of Wildlife and Parks

- a. Minimize bison use of drainage area leading to waterbody
- b. Install some vegetative buffer strips around water body.

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

Targeted Participants: Primary participants for implementation will be the Department of Wildlife and Parks officials responsible for managing the bison herd and lands.

Milestone for 2005: The year 2005 marks the midpoint of the ten-year implementation window for the wildlife area. At that point in time, milestones should be reached which will have all protection activities planned or implemented in the vicinity of the wildlife area. Additionally, sampled data from the wildlife area should indicate evidence of stable chlorophyll a levels relative to the conditions seen over 1999.

Delivery Agents: The primary delivery agents for program participation will be the Department of Wildlife and Parks.

Reasonable Assurances:

Authorities: The following authorities may be used to direct activities in the wildlife area to provide protection.

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 Cimarron 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.

7. K.S.A. 32-807 authorizes the Kansas Department of Wildlife and Parks to manage lake and wetland resources.

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: By isolating the water body from the bison use in its drainage, the primary source of nutrients should be reduced.

6. MONITORING

KDHE will collect nutrient, pH, dissolved oxygen, and chlorophyll a samples from Big Basin WA in 2000. Additional data, to establish nutrient ratios, source loading and further determine mean summer wildlife area 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 Cimarron Basin were held March 8 and April 25 in Meade. 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 Cimarron Basin.

Public Hearing: A Public Hearing on the TMDLs of the Cimarron Basin was held in Meade on May 30, 2000.

Basin Advisory Committee: The Upper Arkansas Basin Advisory Committee met to discuss the TMDLs in the basin on October 6, 1999; January 11 and 24, 2000; March 8, 2000.

Discussion with Interest Groups: Meetings to discuss TMDLs with interest groups include:
Agriculture: February 28, 2000

Milestone Evaluation: In 2005, evaluation will be made as to the degree of impairment which has occurred within the drainage and current condition of Big Basin WA. Subsequent decisions will be made regarding implementation approach and follow up of additional implementation.

Consideration for 303d Delisting: Big Basin WA 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.