

LOWER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body: Lake Afton
Water Quality Impairment: Eutrophication

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Ninnescah

County: Sedgwick

HUC 8: 11030016

HUC 11 (HUC 14): 010 (020)

Drainage Area: Approximately 10.3 square miles. **(Figure 1)**

Conservation Pool: Area = 207 acres, Maximum Depth = 6 meters

Designated Uses: Primary and Secondary Contact Recreation; Expected Aquatic Life Support; 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)).

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Eutrophication: Very Eutrophic, Trophic State Index = 62.33

Monitoring Sites: Station 049201 in Lake Afton.

Period of Record Used: Three surveys during 1987-1996.

Lake Afton TMDL Reference Map

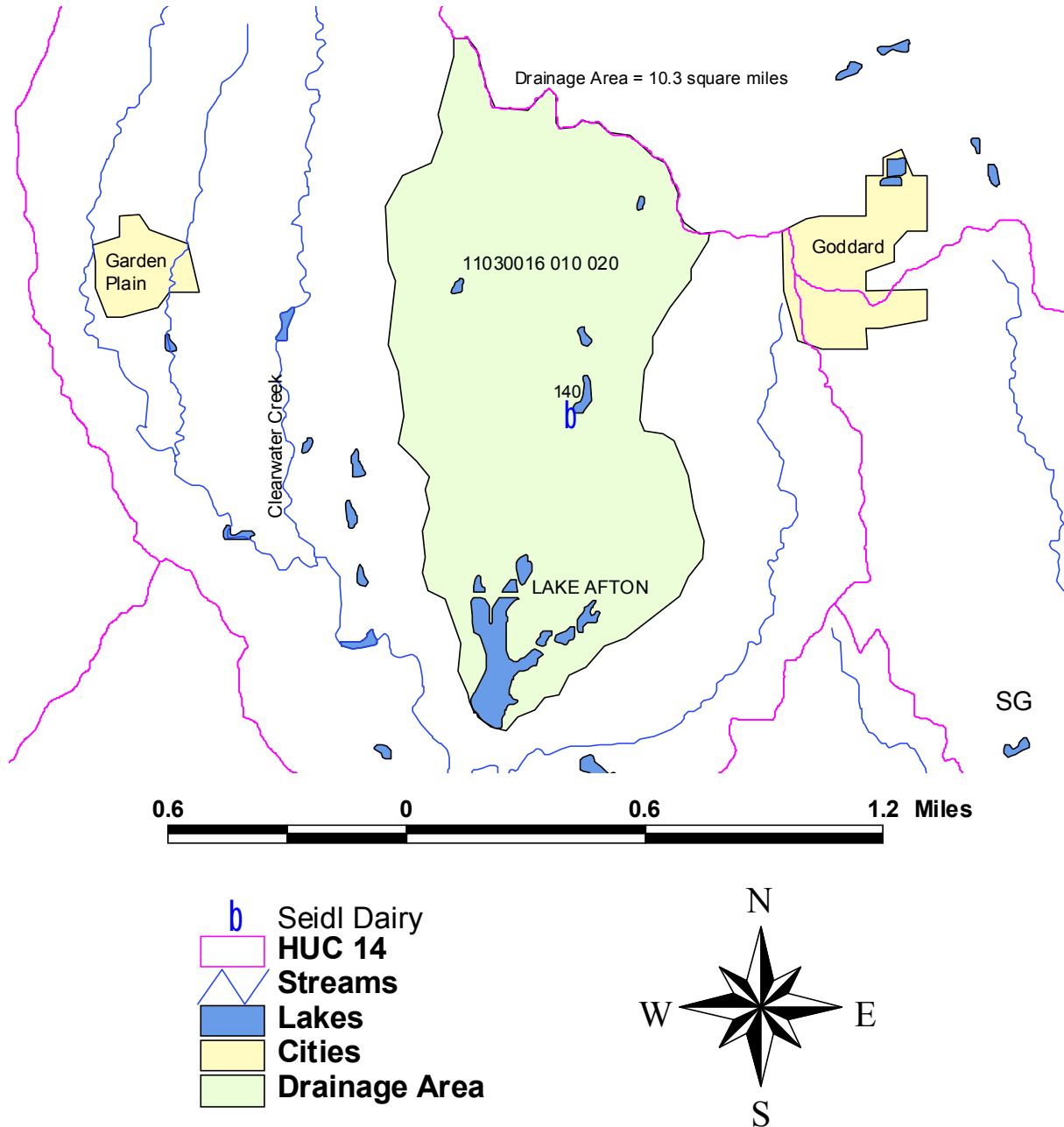


Figure 1

Current Condition: Lake Afton has elevated chlorophyll a concentrations averaging 25.5 ppb. This relates to a Trophic State Index of 62.33, indicating very eutrophic conditions. The chlorophyll a concentration has increased over time. The average concentration was 17.1 ppb in 1987 and rose to 41.9 ppb by 1996.

The Trophic State Index 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 114 ppb. Sixty-four percent of the samples are over 100 ppb. The chlorophyll a to total phosphorus yield is moderate, suggesting some phosphorus limitation is possible. Co-limitation by phosphorus and nitrogen is probable. (The total nitrogen to total phosphorus ratio is 4.5, indicating increase nitrogen importance). Light is not indicated as a limiting factor, despite moderate inorganic turbidity.

Interim Endpoints of Water Quality (Implied Load Capacity) at Lake Afton over 2005 - 2009:

In order to improve the trophic condition of the lake from its current very eutrophic status, the desired endpoint will be summer chlorophyll a concentrations at or below 12 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 lake.

3. SOURCE INVENTORY AND ASSESSMENT

Land Use: Lake Afton has a moderate to high potential for nonpoint source pollutants. An annual phosphorus load of 5,732 pounds per year is necessary to correspond to the concentrations seen in the lake. The annual nitrogen load is 17,086 lb/yr (**Figure 2.**)

The primary source of phosphorus within Lake Afton is probably runoff from agricultural lands where phosphorus has been applied. Land use coverage analysis indicates that 80.4% of the watershed is cropland. In Sedgwick County, 47,335 tons of fertilizer were sold in Sedgwick County in 1998. Assuming that the drainage area of Lake Afton covers 1.03% of the county, then 487.6 tons of fertilizer were bought and potentially used with the watershed.

Phosphorus from animal waste is a contributing factor. Fifteen percent of land around the lake is grassland; the grazing density of livestock is high in the summer and average in the fall.

Lake Afton Land Use

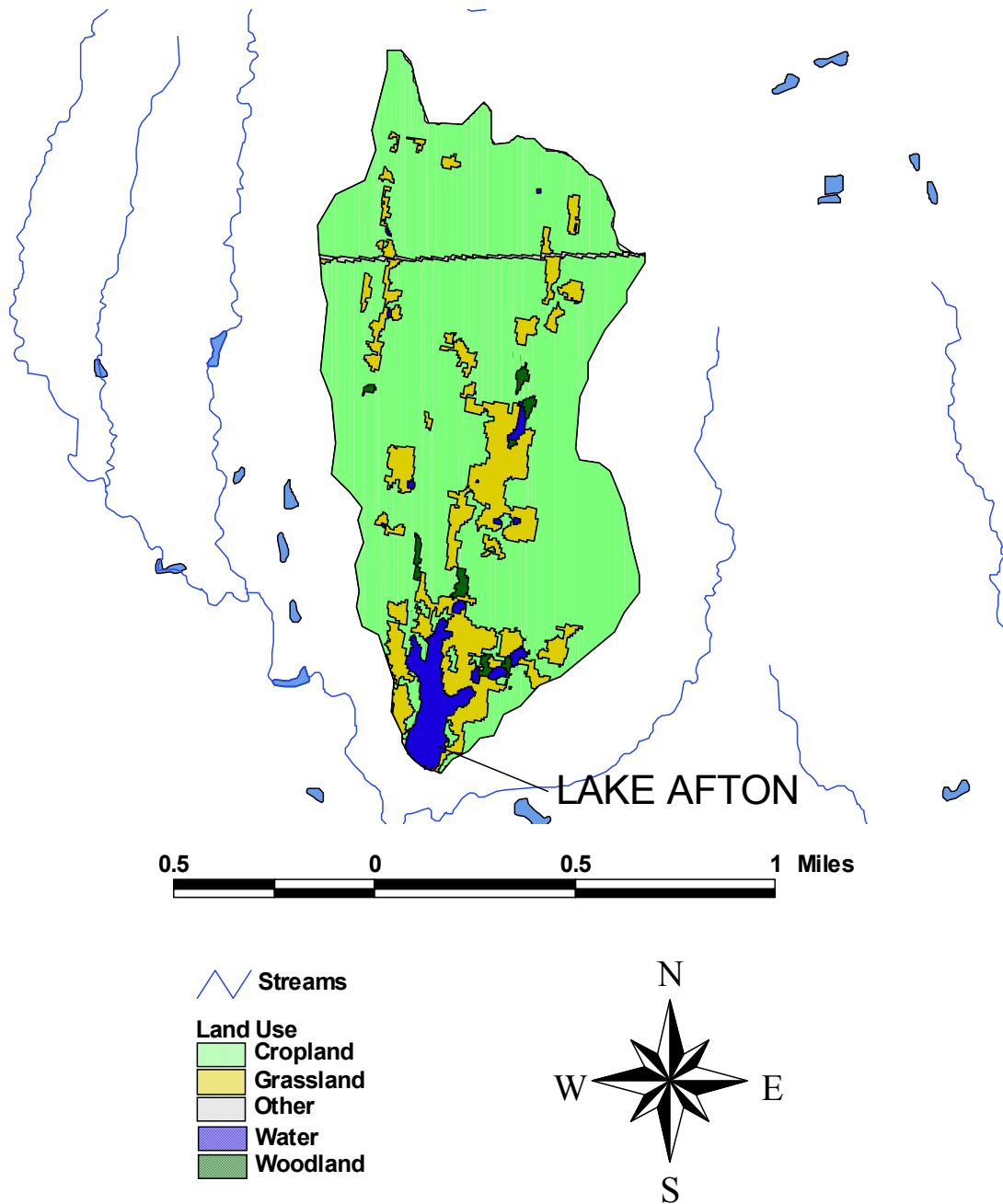


Figure 2

Livestock Waste Management Systems: One dairy operation is permitted within the watershed, accounting for a potential of up to 140 animal units. All permitted livestock facilities have waste management systems designed to minimize runoff entering their operations or detaining runoff emanating from their areas. Such systems are designed for the 25 year, 24 hour rainfall/runoff event, which would be indicative of flow durations well under 10 percent of the time. The actual number of animal units on site is variable, but typically less than permitted numbers. Tracking the excursions from the water quality standards to flow conditions at the tributary stations indicates that most excursions are related to ongoing runoff or the aftermath of a runoff event placing waste in the stream.

Contributing Runoff: The watershed has an average soil permeability of about 2 inches/hour according to NRCS STATSGO data base. Runoff would be produced from storms one to two hours in duration, having a recurrence interval of five, ten or twenty five years and storms of three hours in duration, having a recurrence interval of twenty-five years. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. Generally, 80 percent of the watershed would generate runoff under dryer conditions or smaller storms. Moderate or wet conditions or larger storms would see runoff contributed from about 90 percent of the watershed respectively.

Background Levels: There is the potential for carp resuspending bottom sediments in this lake. Nutrient recycling from the sediments in the lake is likely contributing available phosphorus to the lake 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 lake 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: Water quality violations are predominantly due to nonpoint source pollutants. Background levels may be attributed to nutrient recycling. The assessment suggests that cropland and animal waste contribute to the very eutrophic state of the lake. Given the runoff characteristics of the watershed, overland runoff can easily carry phosphorus into the lake. Generally a Load Allocation of 1290 pounds per year, leading to a 75% reduction in available phosphorus is necessary to reach the endpoint. The Load Allocation for nitrogen is 12,153 pounds per year, resulting in a 21.0% reduction.

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 143 pounds per year of total phosphorus and 1,350 pounds per year of nitrogen taken from the load capacity to ensure that adequate load reduction occurs to meet the endpoint.

State Water Plan Implementation Priority: Because a more detailed source assessment and additional in-lake monitoring of nutrient and algal content is needed, this TMDL will be a High Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Ninescah (HUC 8: 11030016), a Category II watershed indicating need for protecting existing water quality.

Priority HUC 11: Since the HUC 8 and HUC 11 watersheds overlie one another, the priority area will be the north sub-drainage of the HUC entering into Lake Afton.

5. IMPLEMENTATION

Desired Implementation Activities

There is a good potential for nonpoint source pollutant controls to achieve full support of beneficial uses. Pursuit of agricultural Best Management Practices is recommended, as well as an assessment of the magnitude of the carp population within the fishery. 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, lake management can be employed to reduce sedimentation in lake and associated in-lake nutrient inputs.

Implementation Programs Guidance

Fisheries Management - KDWP

- a. Assist evaluation in-lake or near-lake potential sources of nutrients to lake.
- b. Advise county on application lake management techniques which may reduce nutrient loading and cycling in lake.

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.

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 county and state fisheries managers in Sedgwick County and agricultural producers within the drainage of the lake. Initial work in 2005 should include local assessments by conservation district personnel and county extension agents to locate within the lake drainage:

- 1. Total row crop acreage
- 2. Cultivation alongside lake
- 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 Lake Afton should indicate evidence of reduced phosphorus levels in the conservation pool elevations relative to the conditions seen over 1987-1996.

Delivery Agents: The primary delivery agents for program participation will be Sedgwick County, 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. Lake management consultations will be made by the Kansas Department of Wildlife and Parks.

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.
7. K.S.A. 32-807 authorizes the Kansas Department of Wildlife and Parks to manage lake 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 lake and its watershed and TMDL is 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 Lake Afton in 2000. Additional data, to establish nutrient ratios, source loading and further determine mean summer lake 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, 2000 and April 26-27, 2000 in Wichita, Hutchinson, 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:
Sedgwick County Technical Advisory Group: August 8, October 14, and November 15, 1999 and January 20, April 27, and May 25, 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 implementation which has occurred within the watershed and current condition of the Lake Afton. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

Consideration for 303d Delisting: The river 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 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 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 for Fiscal Years 2001-2005.

Approved September 11, 2000.