

appears to be the primary limiting factor. Chlorophyll-to-phosphorus yield was very high. Inorganic turbidity was very low, with very abundant light within the water column.

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 are seen with chlorophyll a concentrations over 12 ug/l and hypereutrophy occurs at levels over 20 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 |

Desired Endpoints of Water Quality at Pierson Park Lake over 2004 - 2008:

In order to improve the trophic condition of the lake 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 2008. Refined endpoints will be developed in 2004 to reflect additional sampling and artificial source assessment and confirmation of impaired status of lake.

3. SOURCE INVENTORY AND ASSESSMENT

Land Use: Phosphorus from animal waste is one contributing factor. Seventy-two percent of land around the lake is grassland. The grazing density is low for this part of the state (11 animal units per square mile).

Another source of phosphorus in Pierson Park Lake is urban fertilizer applications. Land use coverage analysis indicates that 28% of the watershed is urban. Urbanization of the county is projected to decline to the year 2020, so ideally the phosphorus inputs will decrease as well. An annual phosphorus load of 2,160 pounds per year is necessary to correspond to the concentrations seen in the lake.

Background Levels: The lake's carp population is likely resuspending the phosphorus already present in the lake. Some organic pollution may be contributed by wildlife in the park. Geological formations contain small amounts of phosphorus (up to 0.5% of total weight), and may contribute to phosphorus loads.

4. ALLOCATION OF POLLUTION 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: Since this impairment is primarily associated with urban non-point source pollution, there will be no Wasteload Allocation assigned to point sources for nutrients under this TMDL.

Non-Point Sources: Water quality violations are predominantly due to non-point source pollution. Background levels may be attributed to the carp, geological sources, and wildlife waste. The assessment suggests that urban areas and animal waste contribute to the hypereutrophic state of the lake. Given the runoff characteristics of the watershed, overland runoff can easily carry phosphorus into the streams. Generally a Load Allocation of 97 pounds per year, leading to a 95% 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 11 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: This TMDL will be a Low Priority for implementation because Pierson Park Lake is a small lake under municipal jurisdiction and a more detailed source assessments and additional in-lake monitoring of nutrient and algal content is needed.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Lower Kansas Subbasin (HUC 8: 10270104) with a priority ranking of 1 (Highest Priority for restoration work).

Priority HUC 11s: The entire watershed is within HUC 11 (180).

5. IMPLEMENTATION

Desired Implementation Activities

Non-point source controls have a moderate chance of significantly improving water quality at this lake. The lake already has a considerable buffer zone in terms of the park that surrounds it. However, projections indicate that any feasible non-point source improvements will probably not achieve full use support.

Dredging, to improve water depth, is also predicted to fail in achieving full use support. However, projections indicate that non-point source controls plus improving water depth might work together to closely approach a full use situation. This effect would be increased if dredging also allowed any sediment resuspension problems to be resolved. Removal of the rough fish community may be just as useful a management technique.

Implementation Programs Guidance

Until additional assessment of probable non-point sources and in-lake nutrient content is made, no direction can be made to those implementation programs.

Timeframe for Implementation: Additional non-point source pollution reduction practices should be installed within the lake after the year 2004 re-evaluation.

Targeted Participants: Primary participants for implementation will be local park and utility personnel and homeowners within the drainage. A detailed assessment of sources will be conducted by KDHE over 2002-2004.

Milestone for 2004: The year 2004 marks the mid-point of the ten year implementation window for the watershed. At that point in time, additional monitoring data from Station 061801 will be re-examined to confirm the impaired status of the lake. 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 county and city officials.

Reasonable Assurances

Authorities: The following authorities may be used to direct activities in the watershed to reduce pollution.

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 established water quality standards.
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 non-point 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 Kansas-Lower Republican 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 pollution 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 is a Low Priority consideration and should not receive funding until after 2004.

Effectiveness: Effectiveness of corrective actions will depend upon the sources which contribute to the impairment at the lake.

6. MONITORING

KDHE will collect nutrient and chlorophyll a samples from Pierson Park Lake in 2001 and 2003. Additional data, to establish nutrient ratios, source loading and further determine mean summer lake trophic condition, would be of value prior to 2004. If lake impairment is confirmed in 2004, further sampling and evaluation should occur in 2005 and 2007.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the KLR Basin were held March 10, 1999 in Topeka, April 27 in Lawrence and April 29 in Manhattan. 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 Kansas-Lower Republican Basin.

Public Hearing: A Public Hearing on the TMDLs of the Kansas-Lower Republican Basin was held in Topeka on June 3, 1999.

Basin Advisory Committee: The Kansas-Lower Republican Basin Advisory Committee met to discuss the TMDLs in the basin on December 3, 1998; January 14, 1999; February 18, 1999; March 10, 1999; May 20, 1999 and June 3, 1999.

Discussion with Interest Groups: Meetings to discuss TMDLs with interest groups include:
Agriculture: November 10, 1998; December 18, 1998; February 10, 1999; April 10, 1999, May 4, 1999, June 8, 1999 and June 18, 1999.
Municipal: November 12, 1998, January 25, 1999; March 1, 1999; May 10, 1999 and June 16, 1999.
Environmental: November 3, 1998; December 16, 1998; February 13, 1999; March 15, 1999, April 7, 1999 and May 3, 1999.
Conservation Districts: March 16-18, 24-25, 1999

Consideration for 303d Delisting: The lake in this watershed will be evaluated for delisting under Section 303d, based on the monitoring data over the period 1999-2003. Therefore, the decision for delisting will come about in the preparation of the 2004 303d list. Should the lake continue to be listed as impaired in 2004, the next evaluation for delisting will occur with the preparation of the 2008 Section 303d list. Should modifications be made to the applicable water

quality criteria during the ten year implementation period, consideration for delisting, development of desired endpoints of this TMDL and implementation activities will 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 2004.

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