NEOSHO RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body: Olpe City Lake
Water Quality Impairment: Siltation

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Neosho Headwaters

County: Lyon

HUC 8: 11070201

HUC 11 (HUC 14): **040** (030)

Ecoregion: Flint Hills (28)

Drainage Area: Approximately 1.6 square miles

Conservation Pool: Area = 85 acres
Maximum Depth = 5.0 meters (16 feet)
Mean Depth = 2.0 meters (6.6 feet)
Retention Time = 1.0 years (12 months)

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

Authority: Kansas Department of Wildlife and Parks

2002 303(d) Listing: Neosho Basin Lakes

Impaired Use: Expected Aquatic Life Support and Primary and Secondary Contact Recreation

Water Quality Standard: Suspended solids - Narrative: Suspended solids added to surface waters by artificial sources shall not interfere with the behavior, reproduction, physical habitat or other factor related to the survival and propagation of aquatic or semi-aquatic or terrestrial wildlife. (KAR 28-16-28e(c)(2)(D)).

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Monitoring Sites: Station 041001 in Olpe City Lake (Figures 1 & 2).

Period of Record Used: Four surveys in 1989 - 2002.

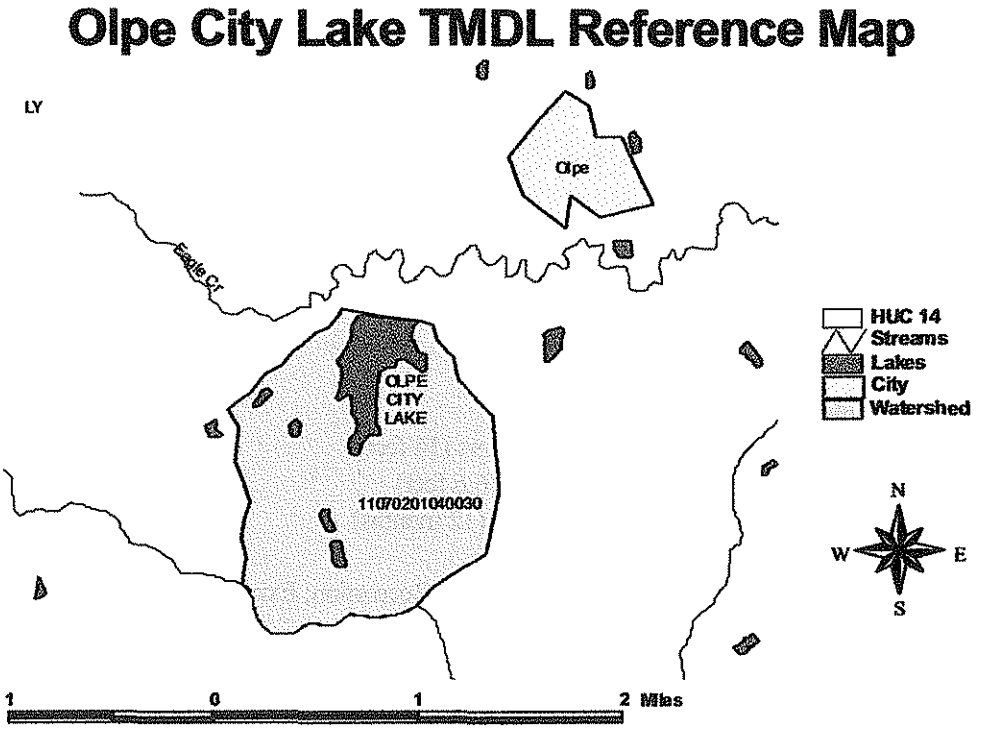


Figure 1

Current Condition: Surface water in Olpe City Lake has high turbidity, dominated by inorganic materials because the lake receives a steady inflow of silt. The lake is light limited (Appendix B). The chlorophyll a concentration is dependent on the amount of turbidity in Olpe City Lake (Figure 3). The transparency (Secchi Disc depth) is 0.45 meter, the average turbidity is 43.7 formazin turbidity units, and the average total suspended solid concentration is 28 mg/L (Appendix A). Lakes are considered to have a siltation problem if they meet the following criteria: chronically turbid, trophic state index plots indicate light limitation, and Secchi Disc Depth less than 0.5 meters. The concentrations over time are as follows:

Average Concentrations in Olpe City Lake

Date	Secchi Disc Depth (m)	Chlorophyll a (ug/L)	Total Suspended Solids (mg/L)	Turbidity (Formazin Turbidity Units)
6/17/1989	0.65	14.7		
8/19/1991	0.50	28.6	24.0	19.9
6/8/1998	0.20	10.7	38.0	68.0
7/15/2002	0.46	18.5	21.3	43.3

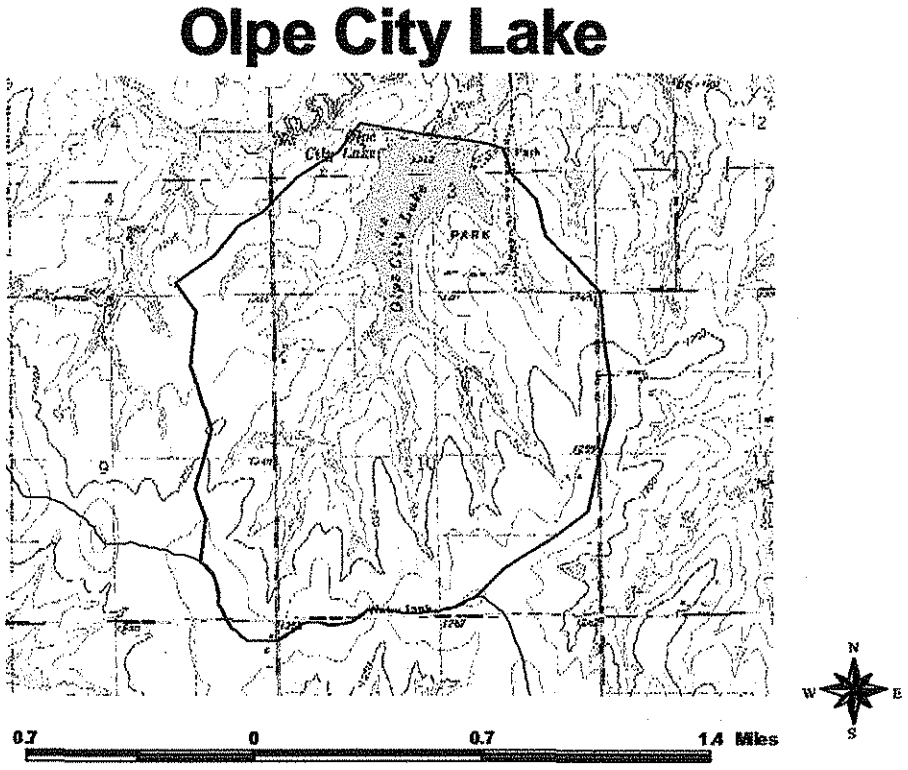
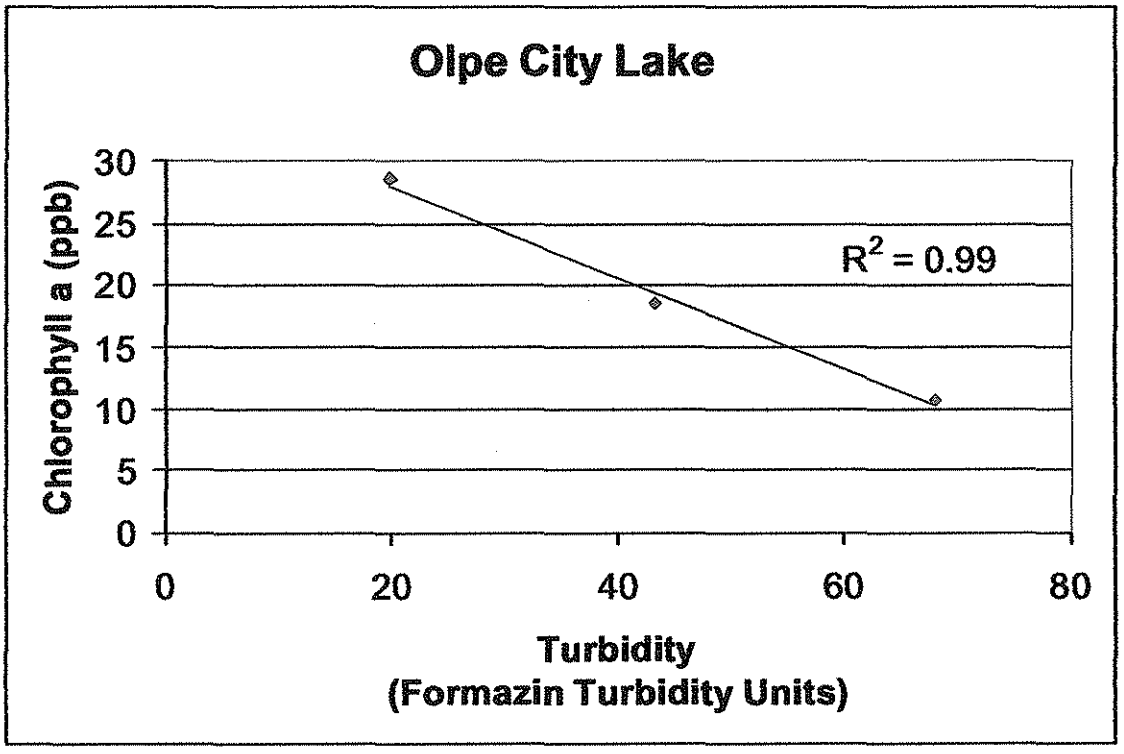


Figure 2

Figure 3



Interim Endpoints of Water Quality (Implied Load Capacity) at Olpe City Lake over 2007 - 2011:

In order to improve the quality of the water column, the endpoint for Olpe City Lake will be an increase in average transparency as measured by Secchi Disc Depth greater than 0.5 meter. The current turbidity impairment impedes primary productivity and dampens the support of aquatic life within the lake. However, a concomitant reduction in phosphorus loading must accompany any reduction in sediment loads and accompanying siltation. Much of the phosphorus entering Olpe City Lake is attached to sediment. In reducing sediment loads, the associated phosphorus loads should also be reduced, reflected in reduced in-lake total phosphorus concentrations. Modeling with CNET predicts that reduction of phosphorus levels, as specified in the Olpe City Lake Eutrophication TMDL, should allow Secchi Disc depths to reach 0.5 meter. This increased clarity will boost biological productivity in the lake without causing the inception of excessive eutrophic conditions.

Additionally, sediment accumulation in the lake reduces the reservoir volume, and limits accessibility to portions of the lake which have silted in. Additionally, accumulated sediment contributes to recycling contributes to recycling of nutrients within the lake. Therefore, reduction of the turbidity improves the quality of the lake and extends the utility as a water supply and recreation facility.

This TMDL endpoint meets water quality standards as measured and determined by Kansas Water Quality Assessment protocols. When the Secchi Disc depth is increased to 0.5 meter, the turbidity will be reduced to a level that encourages primary productivity and the support of aquatic life within the lake. The primary and secondary contact recreation uses will be supported because with less sediment accumulation a greater portion of the lake can still be used for recreation. These assessment protocols are similar to those used to cite the stream segments in this watershed as impaired on the Kansas 2002 Section 303(d) list.

Seasonal variation in the endpoint is not established by this TMDL. This endpoint can be reached as a result of expected reductions in loading from the various sources in the watershed resulting from implementation of corrective actions and Best Management Practices, as directed by this TMDL. Achievement of the endpoints indicates loads are within the loading capacity of the stream, water quality standards are attained and full support of the designated uses of the stream has been restored, therefore the narrative water quality standard pertaining to suspended solids would be attained.

Current Condition and Reductions for Olpe City Lake

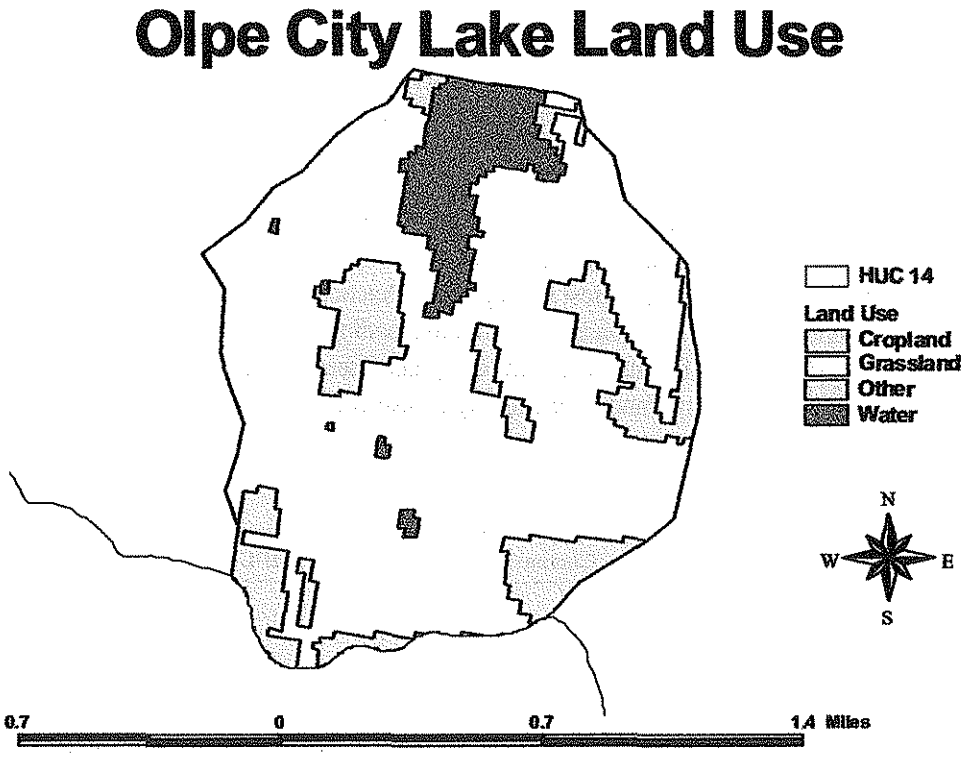
Parameter	Current Condition	TMDL	Percent Reduction
Turbidity (Formazin Turbidity Units)	**43.7**	**20.0**	**54 %**
Secchi Disc Depth (m)	**0.45**	**> 0.50**	**11 % Increase**

3. SOURCE INVENTORY AND ASSESSMENT

Land Use: The siltation impairment is most likely due to cropland that is adjacent to the streams that drain into Olpe City Lake. Soil from exposed land runs-off into the lake, increasing the turbidity and concentration of total suspended solids and decreasing the transparency. Land use coverage analysis indicates that 17% of the watershed is cropland, and 74% is grassland (Figure 4). More woodland and grassland are needed around the streams to prevent erosion.

Background Levels: Wind Mixing and carp may cause some resuspension of sediment. Background levels of total suspended solids come from geological sources. Sediment becomes suspended during high flow events as soil along the banks is eroded.

Figure 4



4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

The load capacity of Olpe City Lake is 20.0 formazin turbidity units. When the turbidity is reduced as specified in this TMDL, the clarity of the lake will improve. Reducing the phosphorus loading, as detailed in the Olpe City Lake Eutrophication TMDL, will insure that the algal community will not increase as the clarity improves. More detailed assessment of sources and confirmation of the siltation impairment 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: Siltation loading comes predominantly from nonpoint source pollution. Given the runoff characteristics of the watershed, overland runoff can easily carry sediment into the streams. The Load Allocation within the lake is turbidity levels not to exceed 18.0 formazin turbidity units, a 54% reduction from current condition.

Defined Margin of Safety: The margin of safety provides some hedge against the uncertainty of the Secchi disc depth endpoint. Therefore, the margin of safety will be 2.0 formazin turbidity units (10%) taken from the load capacity to ensure that adequate load reduction occurs to meet the endpoint.

State Water Plan Implementation Priority: Because the Kansas Department of Wildlife and Parks is renovating the lake, the Olpe City Lake TMDL will be a High Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Neosho Headwaters (HUC 8: 11070201) with a priority ranking of 38 (Medium Priority for restoration).

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

5. IMPLEMENTATION

Desired Implementation Activities

There is some potential that agricultural best management practices will improve the water quality in Olpe City Lake. Some of the recommended agricultural practices are as follows:

1. Maintain conservation tillage and contour farming to minimize cropland erosion.
2. Install grass buffer strips along streams.
3. Reduce activities within riparian areas.

Implementation Programs Guidance

Fisheries Management - KDWP

a. Assist evaluation in-lake or near-lake potential sources of sediment to lake.

b. Use applicable lake management techniques which may reduce sediment 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.

Water Resource Cost Share and Nonpoint Source Pollution Control Program - SCC

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

b. 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.

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. Provide technical assistance on buffer strip design and minimizing cropland runoff.
c. Continue to educate residents and landowners about nonpoint source pollution.

Time Frame for Implementation: Pollutant reduction practices should be installed within the priority subwatersheds before 2007, with minor followup implementation, including other subwatersheds over 2007-2011.

Targeted Participants: Primary participants for implementation will be agricultural producers within the drainage of the lake. Initial work in before 2007 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 2007: The year 2007 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, sampled data from Olpe City Lake should indicate evidence of reduced sediment levels in the conservation pool elevations relative to the conditions seen over 1989-2002.

Delivery Agents: The primary delivery agents for program participation will be the Kansas Department of Wildlife and Parks and 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 Neosho 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 and should not receive funding until after 2007.

Effectiveness: Sediment 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

Additional data, to establish nutrient ratios, source loading and further determine mean summer lake trophic condition, would be of value prior to 2007. Further sampling and evaluation should occur once before 2007, and twice after 2007.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the Neosho Basin were held January 9, 2002 in Burlington and March 4, 2002 in Council Grove. 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 Neosho Basin.

Public Hearing: Public Hearings on the TMDLs of the Neosho Basin were held in Burlington and Parsons on June 3, 2002.

Basin Advisory Committee: The Neosho Basin Advisory Committee met to discuss the TMDLs in the basin on October 2, 2001, January 9, March 4, June 3, 2002, and July 30, 2004..

Discussion with Interest Groups: Meetings to discuss TMDLs with interest groups include:
Kansas Farm Bureau: February 26 in Parsons and February 27 in Council Grove

Milestone Evaluation: In 2007, evaluation will be made as to the degree of impairment which has occurred within the watershed and current condition of Olpe City Lake. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

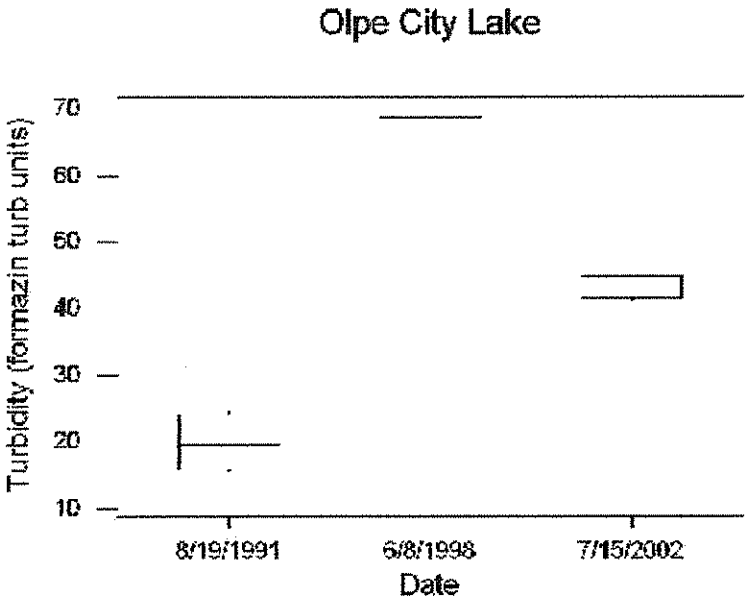
Consideration for 303(d) Delisting: The lake will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2007-2011. Therefore, the decision for delisting will come about in the preparation of the 2012 303(d) list. Should modifications be made to the applicable water quality criteria during the ten-year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

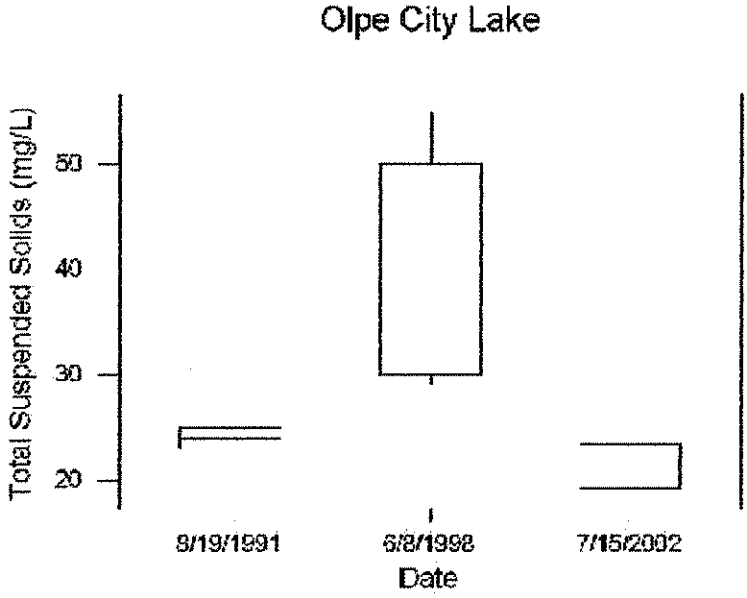
Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process: Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2003 which will emphasize revision of the Water Quality Management Plan. At that 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 2003-2007.

Bibliography

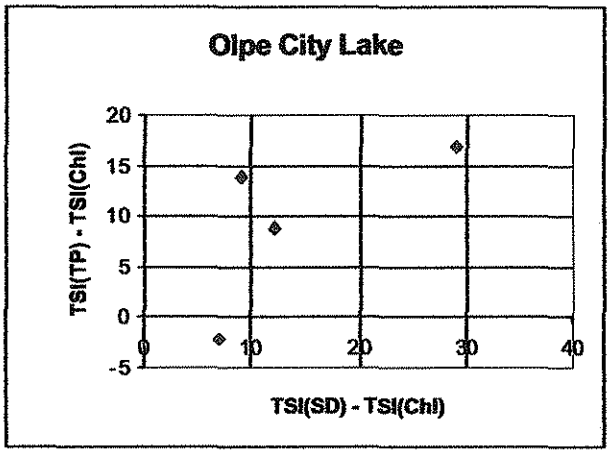
Liscek, Bonnie C. Methodology Used in Kansas Lake TMDLs [web page] Jul. 2001;
http://www.kdhe.state.ks.us/tmdl/eutro.htm [Accessed 17 May 2002].

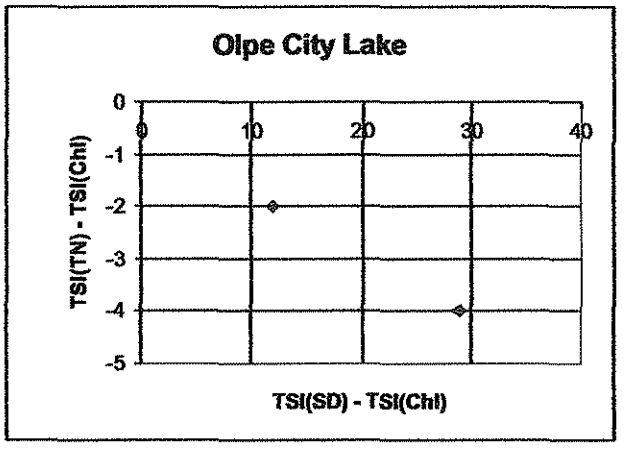
Appendix A–Boxplots





Appendix B - Trophic State Index Plot





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) and TSI(TP)-TSI(Chl) or 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, or chlorophyll and nitrogen indicates the level of phosphorus or 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 does not limit algae growth. The positive slope of the graph also indicates a correlation between phosphorus and transparency which is found when phosphorus is bound to non algal particles. The points in the fourth quadrant of the TSI(TN)-TSI(Chl) graph indicate that nitrogen may be a secondary contributing factor.

09/08/04