EPA Region 7 TMDL Review

TMDL ID: KS-KR-16-LM015001 **State:** KS

Document Name: LOVEWELL LAKE

Basin(s): KANSAS-LOWER REPUBLICAN
HUC(s): 10250016
Water body(ies): LOVEWELL LAKE
Tributary(ies): WHITE ROCK CREEK
Pollutant(s): EUTROPHICATION, PH, TOTAL NITROGEN, TOTAL PHOSPHORUS

Submittal Date: 10/5/2011 **Approved:** Yes

Submittal Letter

State submittal letter indicates final Total Maximum Daily Load(s) (TMDL) for specific pollutant(s)/water(s) were adopted by the state, and submitted to EPA for approval under section 303(d) of the Clean Water Act [40 CFR § 130.7(c)(1)]. Include date submitted letter was received by EPA, date of receipt of any revisions, and the date of original approval if submittal is a phase II TMDL.

This TMDL was formally submitted by the Kansas Department of Health and Environment to the U.S. Environmental Protection Agency on October 5, 2011. Revisions to this document were received by email on October 20, November 4, November 29 and December 6, 2011.

Water Quality Standards Attainment

The water body's loading capacity (LC) for the applicable pollutant is identified and the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources is described. TMDL and associated allocations are set at levels adequate to result in attainment of applicable water quality standards (WQS) [40 CFR § 130.7(c)(1)]. A statement that WQS will be attained is made.

The Carlson Trophic State Indices for chlorophyll *a*, Secchi depth and total phosphorus in Lovewell Lake show a state of hypereutrophy for at least one of the three parameters each year Lovewell Lake samples were collected and analyzed. Conditions showed slight improvement in 2004 and 2007 but Trophic State Index values for all three parameters reached a state of hypereutrophy in 2010.

Excessive nutrients are not being controlled and are impairing aquatic life, domestic water supply and contributing to objectionable algal blooms that contribute to the eutrophication and impairment of contact recreation within Lovewell Lake. The level of eutrophication is hypereutrophic. The Trophic State Index is derived from the chlorophyll *a* concentration. Trophic state assessments of potential algal productivity were made based on chlorophyll *a*, nutrient levels and values of the Carlson Trophic State Index. In Kansas lakes, some degree of eutrophic conditions is seen with chlorophyll *a* over 12 micrograms per liter; hypereutrophy occurs at levels over 30 µg/L. Chlorophyll *a* concentrations sharply rose to 45.7 µg/L in 2001 and remained above 35.0 µg/L through 2010. Lovewell Lake currently has chlorophyll *a* concentrations averaging 33.0 µg/L, with a corresponding Trophic State Index value of 64.9.

A water quality standard excursion for pH was observed once in 2001 with a value of 8.55. In 2001, the chlorophyll *a* and phosphorus concentrations were high at 45.9 µg/L and 239 µg/L, respectively. This influenced the pH within the lake as increasing algal communities within a lake commonly leads to an increase in the level of pH due to photosynthesis. Algae draws available carbon dioxide out of water, causing the pH to increase. During daylight, algae and underwater plants remove carbon dioxide from the water as part of the sunlight-driven process of photosynthesis. So during the day, underwater photosynthesis usually exceeds respiration, and the pH rises as carbon dioxide is extracted from the water. With higher productivity, more carbon

dioxide is removed and the shift in pH becomes more pronounced

The trophic indicator values within Lovewell Lake do not meet any of the statewide or Central Great Plains benchmarks. The nutrient benchmarks were derived from 47-58 lakes and reservoirs, based on the data collected between 1985-2002.

Median trophic indicator values of Lovewell Lake in comparison with draft nutrient benchmarks in Kansas.

Trophic Indicator	Lovewell Lake	Statewide Benchmark
Secchi depth (cm)	70.0	129
total nitrogen (µg/l)	1009	625
total phosphorus (µg/l)	77.5	23
chlorophyll *a* (µg/l)	35	8

cm = centimeters

The blooms of blue-green algae are a major issue for Lovewell Lake. The intense episodic algal blooms required the KDHE to issue public health advisories instructing the public to avoid contact with the water, avoid consuming fish or shellfish from the lake and to avoid watering livestock from the irrigation canals during the summer of 2010.

Lovewell Lake stores water from White Rock Creek and diversions from the Republican River by way of the Courtland Canal. The Courtland Canal is operated by the Kansas Bostwick Irrigation District No. 2 and supplies water for irrigation to 12,800 acres in Kansas above Lovewell Lake and 25,150 acres below Lovewell Lake. Water is released from Harlan County Lake in Nebraska and flows down the Republican River where it is diverted at the Superior-Courtland Diversion Dam to the Courtland Canal, which transports the release to Lovewell Lake for storage. The Courtland Canal then distributes Lovewell releases downstream for irrigation. Total average inflow to Lovewell was split between flow from White Rock Creek (32,157 acre-feet average flow) and the Courtland Canal (29,912 acre-feet average flow) while the average discharge from Lovewell Lake to the Courtland Canal (36,878 acre-feet average flow) was nearly three times that of the average discharge to White Rock Creek (12,337 acre-feet average flow) highlighting Lovewell Lake's role as an irrigation storage facility. The mean annual discharge for the period of record is 49,215 acre-feet per year and the average computed mean inflow for the lake is 60,069 acre feet per year.

The TMDL endpoint will be to maintain summer chlorophyll *a* average concentrations below 10 µg/L, with the reductions focused on nutrients entering the lake. The chlorophyll *a* endpoint of 10 µg/L is the statewide goal for Federal Lakes and lakes serving as Public Water Supplies, which will also ensure long-term protection to fully support primary contact recreation within the lake. Total phosphorus and total nitrogen concentrations entering the lake must be reduced by 79 percent for White Rock Creek and the Courtland Canal.

Pollutants	Loading Capacity
total phosphorus	94.5 pounds per day
total phosphorus	0.0297 milligrams per liter
total nitrogen	615 lbs/day
total nitrogen	0.396 mg/L
chlorophyll *a*	10 ug/L

Phosphorus in water exists in two main forms: dissolved (soluble) and particulate (attached to or a component of particulate matter). Ortho-phosphorus is a dissolved form of phosphorus and is readily available to algae and aquatic plants. Nitrogen is very common and found in many forms in the environment. Inorganic forms include nitrate (NO3), nitrite (NO2), ammonia (NH3) and nitrogen gas (N2). Organic nitrogen is found in the cells of all living things and is a component of proteins, peptides and amino acids. Total nitrogen is a measurement of all forms of nitrogen in a water sample.

Ortho-phosphorus must be reduced by 94 percent and 91 percent and inorganic nitrogen must be reduced by 91 percent and 90 percent in White Rock Creek and the Courtland Canal, respectively. Reductions at the inflows to Lovewell Lake will result in a 78 percent reduction of total phosphorus, 69 percent reduction of total nitrogen and a 70 percent reduction of chlorophyll *a* within the lake. The reduction of chlorophyll *a* will lower photosynthesis rates within Lovewell Lake as higher photosynthesis rates cause pH levels to rise over 8.5. With reduced nutrient

loads, trophic conditions in the lake will improve, leading the pH level to stabilize and remain in the 6.5 to 8.5 range prescribed by the Kansas Surface Water Quality Standards. Achievement of all endpoints and targets listed would indicate loads are within the loading capacity of the lake, the water quality standards are attained and full support of the designated uses of the lake has been achieved.

Numeric Target(s)

Submittal describes applicable WQS, including beneficial uses, applicable numeric and/or narrative criteria. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, site specific if possible, was developed from a narrative criterion and a description of the process used to derive the target is included in the submittal.

Designated Uses:
primary contact recreation class A
expected aquatic life support
domestic water supply
food procurement
ground water recharge
industrial water supply
irrigation use
livestock watering use

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

Water Quality Criteria:
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)(A)).

The introduction of plant nutrients into surface waters designated for domestic water supply use shall be controlled to prevent interference with the production of drinking water (K.A.R. 28-16-28e(c)(3)(A)).

The pH range outside the zone of initial dilution: 6.5-8.5 (K.A.R 28-16-28e(d), Table 1g).

The loading capacity for total nitrogen is 615 pounds per day. The LC for total phosphorus is 94.5 lb/day. Attaining these LCs should ensure the desired endpoint will be maintained for summer chlorophyll *a* average concentrations below 10 micrograms per liter, with the reductions focused on nutrients (TN and TP) entering the lake. With reduced nutrient loads, trophic conditions in the lake will improve leading the pH level to stabilize and remain in the 6.5 to 8.5 range prescribed by the Kansas Surface Water Quality Standards.

Pollutant(s) of concern

An explanation and analytical basis for expressing the TMDL through surrogate measures (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae) is provided, if applicable. For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and margin of safety (MOS) that do not exceed the LC. If submittal is a phase II TMDL there are refined relationships linking the load to WQS attainment. If there is an increase in the TMDL there is a refined relationship specified to validate the increase in TMDL (either load allocation (LA) or waste load allocation (WLA)). This section will compare and validate the change in targeted load between the versions.

The lake model used for the development of the TMDL document was BATHTUB. BATHTUB is an empirical receiving water quality model, that was developed by the U.S. Army Corps of Engineers and has been commonly applied in the nation to address many TMDLs relating to issues associated with morphometrically complex lakes and reservoirs.

Atmospheric total nitrogen was obtained from the Clean Air Status and Trends Network-CASTNET. The CASTNET station from the Konza Prairie (KS) was used to estimate the atmospheric total nitrogen concentration for the model. Total phosphorus atmospheric loading was estimated using the 1983 study of Rast and Lee.

The Spreadsheet Tool for Estimating Pollutant Load, STEPL, was used to identify priority HUC12s within the watershed. STEPL is a simple watershed model that provides both agricultural and urban annual average sediment and nutrient simulations as well as implementation evaluation of best management practices.

A link was established translating the eutrophication and pH impairments to numeric total nitrogen and total phosphorus targets. Objectionable algal blooms contribute to the eutrophication and impairment within Lovewell Lake. The level of eutrophication is hypereutrophic. In Kansas lakes, some degree of eutrophic condition is seen with chlorophyll *a* over 12 parts per billion; hypereutrophy occurs at levels over 30 ppb. Lovewell Lake has chlorophyll *a* concentrations averaging 33.0 micrograms per liter. The Carlson Trophic State Indices for chlorophyll *a*, Secchi depth and total phosphorus in Lovewell Lake shows a state of hypereutrophy for at least one of the three parameters each year Lovewell Lake samples were collected and analyzed. TSI values for all three parameters reached a state of hypereutrophy in 2010. An increasing supply of nutrients, especially phosphorus and possibly nitrogen, will often result in higher growth of blue-green algae because they possess certain adaptations that enable them to out compete true algae. Several of the blue-green algae species possess gas vacuoles that allow them to move within the water column vertically. This selective advantage allows for some species to move within the water column to avoid predation and reach optimal primary productivity. A comparison of nutrients and chlorophyll *a* concentrations to the ratio of the inflow shows chlorophyll *a* concentrations increase as the 90 day to 30 day inflow ratio increases. This correlation indicates algae blooms in Lovewell Lake are stimulated by the nutrient loading that occurs during the first 60 days of the 90 day period. In order to improve the trophic condition of Lovewell Lake from its current hypertrophic status, the desired endpoint will be to maintain summer chlorophyll *a* average concentrations below 10 µg/L, with the reductions focused on nutrients (TN and TP) entering the lake. The reduction of chlorophyll *a* will lower photosynthesis rates within Lovewell Lake. Achievement of the endpoint indicates loads are within the loading capacity of the lake, the water quality standards are attained, and full support of the designated uses of the lake has been achieved.

The blooms of blue-green algae are a major issue for Lovewell Lake and the intense episodic algal blooms required the KDHE to issue public health advisories during the summer of 2010. Algal communities can be reduced through nutrient reduction leading to pH concentrations that fall within the water quality standard of 6.5 to 8.5. With reduced nutrient loads, trophic conditions in the lake will improve leading the pH level to stabilize and remain in the 6.5 to 8.5 range prescribed by the Kansas Surface Water Quality Standards.

Source Analysis

Important assumptions made in developing the TMDL, such as assumed distribution of land use in the watershed, population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources, are described. Point, nonpoint and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered. If this is a phase II TMDL any new sources or removed sources will be specified and explained.

The predominant land uses in the Lovewell Lake watershed are 50 percent grassland and 39 percent cultivated cropland. Together they account for 89 percent of the total land area in the watershed. Approximately 4.5 percent of the land is deciduous forest, and open water and wetlands account for 2.5 percent. Developed areas, such as residential, commercial and industrial land as well as roads, makes up about 4 percent of the watershed.

There are two national pollutant discharge elimination system permitted facilities in the Lovewell Lake watershed. Both facilities are non-overflowing lagoon systems that are prohibited from discharging and would only contribute a phosphorus load under extreme precipitation or flooding events. Such events would not occur at a frequency or for duration sufficient to cause impairment in the watershed.

Discharging Facility	NPDES Permit #	Type	Expiration Date
Burr Oak wastewater treatment plant	KSJ000380	2 Cell Lagoon Non-Overflowing	April 30, 2014
Global Country World of Peace	KSJ000651	1 Cell Lagoon Non-Overflowing	September 30, 2014

There are 11 active concentrated animal feeding operations within the Lovewell Lake watershed amounting to 2,975 head of cattle and 1,400 head of swine. All of these livestock facilities have waste management systems designed to minimize runoff entering their operation or detaining runoff emanating from their facilities. They are designed to retain a 25-year, 24-hour rainfall/runoff event as well as an anticipated two weeks of normal wastewater from their operations. Typically, this rainfall event coincides with stream flow occurring less than 1-5 percent of the time.

Permit Number	Animal Total
A-LRSM-BA01	500
A-LRSM-BA02	400
A-LRJW-B004	600
A-LRJW-B003	500
N-LRJW-6621	100
A-LRJW-BA05	400
A-LRJW-BA10	300
A-LRSM-M001	175
N-LRJW-4927	100
A-LRJW-S008	950
A-SOSM-SA02	350

As of January 1, 2011, Jewell County had a livestock inventory of 35,000 head of cattle and 3,100 head of hogs while Smith County had an inventory of 32,000 head of cattle and 6,400 head of hogs.

Any CAFO that does not obtain an NPDES permit must operate as a no discharge operation. Any discharge from an unpermitted CAFO is a violation of Section 301. It is the EPA's position that all CAFOs should obtain an NPDES permit because it provides clarity of compliance requirements, authorization to discharge when the discharges are the result of large precipitation events (e.g., in excess of 25-year and 24-hour frequency/duration) or are from a man-made conveyance.

Permitted CAFOs identified in this TMDL are part of the assigned WLA. Animal feeding operations and unpermitted CAFOs are considered under the LA because there is currently not enough detailed information to know whether these facilities are required to obtain NPDES permits. This TMDL does not reflect a determination by the EPA that such facility does not meet the definition of a CAFO nor that the facility does not need to obtain a permit. To the contrary, a CAFO that discharges has a duty to obtain a permit. If it is determined that any such operation is a CAFO that discharges, any future WLA assigned to the facility must not result in an exceedance of the sum of the WLAs in this TMDL as approved.

According to the Kansas Department of Agriculture, in 2010 there were 18,448 tons of total fertilizer applied in Jewell County contributing 6,320 tons of nitrogen and 562 tons of P_2O_5 (commonly referred to as phosphoric acid) which accounted for 0.70 percent of the fertilizer applied in Kansas in 2010. Smith County reported the application of 30,156 tons of total fertilizer contributing 12,252 tons of nitrogen and 3,811 tons of P_2O_5, which accounted for 1.1 percent of the fertilizer applied in Kansas in 2010.

In the absence of an NPDES permit, the discharges associated with sources were applied to the load allocation, as opposed to the wasteload allocation for purposes of this TMDL. The decision to allocate these sources to the LA does not reflect any determination by the EPA as to whether these discharges are, in fact, unpermitted point source discharges within this watershed. In addition, by establishing these TMDLs with some sources treated as LAs, the EPA is not determining that these discharges are exempt from NPDES permitting requirements. If sources of the allocated pollutant in this TMDL are found to be, or become, NPDES-regulated discharges, their loads must be considered as part of the calculated sum of the WLAs in this TMDL. The WLA in addition to that allocated here is not available.

The general inventory of sources within the drainage area of the lake indicates load reductions should be focused on nonpoint source runoff contributions attributed to smaller livestock facilities and fertilizer applicators.

There are 115 and 210 unique points of diversion in Jewell and Smith Counties, respectively. The majority of the points of diversion are located outside of this watershed and likely have little effect on nutrient concentration in the Lovewell Lake watershed.

The Lovewell Lake watershed is a rural agricultural area that falls into both Jewell and Smith counties and includes the city of Burr Oak with a population 265. Not all of the rural residences in the watershed are connected to public sewer systems; failing on-site septic systems may contribute nutrient loadings and aggravate eutrophication problems. According to the 2000 census data from the U.S. Census Bureau, the population within the watershed is approximately 1,516 people. Projections predict a population decrease of 8 percent by 2020 and a decrease of nearly 25 percent by 2040.

The watershed of Lovewell Lake has a mean soil permeability value of 1.23 inches per hour, 78 percent of the Lovewell Lake watershed is categorized as having a low soil permeability value of 1.29 inches/hour. As the watersheds' soil profiles become saturated, excess overland flow is produced.

Undissolved nutrients bound to suspended solids in the inflow to Lovewell Lake are potentially significant sources of nutrients that may endure in the sediment layer until they are removed by dredging. These internal nutrient loads can undergo remineralization and resuspension and may be a continuing source of nutrients in Lovewell Lake.

Deciduous forest is about 5 percent of the land cover in the watershed; background levels may be attributed to nutrient recycling and leaf litter. The assessment suggests that runoff transporting nutrient loads associated with animal wastes and cultivated crops where fertilizer has been applied, including pasture and hay, contribute to the hypereutrophic condition of the lake. Atmospheric and geological formations (i.e., soil and bedrock) may also contribute to the nutrient loads.

All known sources have been considered.

Allocation - Loading Capacity

Submittal identifies appropriate WLA for point, and load allocations for nonpoint sources. If no point sources are present the WLA is stated as zero. If no nonpoint sources are present, the LA is stated as zero [40 CFR § 130.2 (i)]. If this is a phase II TMDL the change in LC will be documented in this section.

Description	Allocations - pounds per day
total phosphorus loading capacity	94.5
total phosphorus atmospheric load	2.17
total phosphorus nonpoint source load allocation	82.88
total phosphorus wasteload allocation	0
total phosphorus margin of safety	9.45
total nitrogen loading capacity	615
total nitrogen atmospheric load	122
total nitrogen nonpoint source LA	431.5
total nitrogen wasteload allocation	0
total nitrogen margin of safety	61.5

The pH is set at the standard of 6.5 - 8.5. Reductions in phosphorus and nitrogen will lead to meeting the pH endpoint of 6.5 to 8.5 by reducing the rate of photosynthesis.

WLA Comment

Submittal lists individual WLAs for each identified point source [40 CFR § 130.2(h)]. If a WLA is not assigned it must be shown that the discharge does not cause or contribute to WQS excursions, the source is contained in a general permit addressed by the TMDL, or extenuating circumstances exist which prevent assignment of individual WLAs. Any such exceptions must be explained to a satisfactory degree. If a WLA of zero is assigned to any facility it must be stated as such [40 CFR § 130.2(i)]. If this is a phase II TMDL any differences in phase I and phase II WLAs will be documented in this section.

All permitted point source dischargers into the Lovewell Lake watershed are non-discharging and unlikely to contribute to the impairment. A wasteload allocation of zero for total nitrogen and total phosphorus was set for this TMDL.

LA Comment

Includes all nonpoint sources loads, natural background, and potential for future growth. If no nonpoint sources are identified the LA must be given as zero [40 CFR § 130.2(g)]. If this is a phase II TMDL any differences in phase I and phase II LAs will be documented in this section.

Nonpoint sources are the main contributor for the nutrient impairment in Lovewell Lake.

Description	Load Allocations - pounds per day
total phosphorus atmospheric load	2.17
total phosphorus nonpoint source LA	82.88
total nitrogen atmospheric load	122
total nitrogen nonpoint source LA	431.5

With reduced nutrient loads, trophic conditions in the lake will improve leading the pH level to stabilize and remain in the 6.5 to 8.5 range prescribed by the Kansas Surface Water Quality Standards.

Margin of Safety

Submittal describes explicit and/or implicit MOS for each pollutant [40 CFR § 130.7(c)(1)]. If the MOS is implicit, the conservative assumptions in the analysis for the MOS are described. If the MOS is explicit, the loadings set aside for the MOS are identified and a rationale for selecting the value for the MOS is provided. If this is a phase II TMDL any differences in MOS will be documented in this section.

The margin of safety provides some hedge against the uncertainty of variable annual total phosphorus and total nitrogen loads and the chlorophyll *a* endpoint. Therefore, the MOS is explicitly set at 10 percent of the original calculated total phosphorus and total nitrogen loading capacities, which compensates for the uncertainty about the relationship between the allocated loadings and the resulting water quality. The MOS is 9.45 pounds per day total phosphorus and 61.5 lbs/day total nitrogen.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s) [40 CFR § 130.7(c)(1)]. Critical conditions are factors such as flow or temperature which may lead to the excursion of WQS. If this is a phase II TMDL any differences in conditions will be documented in this section.

According to the 2007 survey of Lovewell Lake, algal communities, based on both cell count and biovolume, were dominated by blue-green algae. An increasing supply of nutrients, especially phosphorus and possibly nitrogen, will often result in higher growth of blue-green algae because they possess certain adaptations that enable them to out compete true algae. Several of the blue-green algae species possess gas vacuoles that allow them to move within the water column vertically. This selective advantage allows for some species to move within the water column to avoid predation and reach optimal primary productivity. Their movement within the water column may influence chlorophyll *a* levels within the lake at various depths during the diel cycle. It has been known that the blooms of blue-green algae are a major issue for Lovewell Lake and the intense episodic algal blooms required the KDHE to issue public health advisories instructing the public to avoid contact with the water, avoid consuming fish or shellfish from the lake and to avoid watering livestock from the irrigation canals during the summer of 2010.

Seasonal variation has been incorporated in this TMDL since the peaks of algal growth occur in the summer months.

Public Participation

Submittal describes required public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s) [40 CFR § 130.7(c)(1)(ii)].

An active Internet Website was established at www.kdheks.gov/tmdl/ to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Kansas-Lower Republican Basin. A Public Hearing on this TMDL document was held on August 31, 2011, in Topeka to receive comments on these TMDLs. The Kansas-Lower Republican Basin Advisory Committee met to discuss the TMDLs in the basin on September 30, 2010, in Lawrence, March 17, 2011, in Manhattan, June 16, 2011, in Lawrence and September 29, 2011, in Topeka. Currently, no active watershed restoration and protection strategy group is working in the Lovewell Lake watershed. No comments were received for this TMDL document.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies a monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of WQS, and a schedule for considering revisions to the TMDL(s) (where phased approach is used) [40 CFR § 130.7].

The KDHE will continue its 3-year sampling schedule in order to assess the trophic state of Lovewell Lake. Based on the sampling results, the 303(d) listing will be evaluated in 2020. Should impairment status continue, the desired endpoints under this TMDL document will be refined and more intensive sampling will be conducted over the period 2015-2020 to assess progress in this implementation.

Reasonable Assurance

Reasonable assurance only applies when less stringent WLAs are assigned based on the assumption of nonpoint source reductions in the LA will be met [40 CFR § 130.2(i)]. This section can also contain statements made by the state concerning the state's authority to control pollutant loads.

States are not required under Section 303(d) of the Clean Water Act to develop TMDL implementation plans and the EPA does not approve or disapprove them. However, the KDHE included an implementation plan in this TMDL document to provide information regarding how point and nonpoint sources can or should be controlled to ensure implementation efforts achieve the loading reductions identified in this document. The EPA recognizes that technical guidance and support are critical to determining the feasibility of and achieving the goals outlined in this TMDL document. Therefore, discussion of reduction efforts relating to point and nonpoint sources can be found in the implementation section of the TMDL document, and are briefly described below.

The KDHE has the authority to issue and enforce state operating permits. Inclusion of effluent limits into a state operating permit and requiring that effluent and instream monitoring be reported to the KDHE should provide reasonable assurance that instream water quality standards will be met. Section 301(b)(1)(C) requires that point source permits have effluent limits as stringent as necessary to meet WQS. However, for wasteload allocations to serve that purpose, they must themselves be stringent enough so that (in conjunction with the water body's other loadings) they meet WQS. This generally occurs when the TMDL's combined nonpoint source load allocations and point source WLAs do not exceed the WQS-based loading capacity and there is reasonable assurance that the TMDL's allocations can be achieved. Discussion of reduction efforts relating to nonpoint sources can be found in the implementation section of the TMDL document.

Immediate actions by the stakeholders within the Lovewell Lake watershed are very likely to improve the trophic status of the lake. Because the KDHE issued public health advisories due to blue-green algae blooms in the summer of 2010 urging the public to avoid contact with the water in Lovewell Lake which is used for primary contact recreation, these TMDLs will be a high priority implementation.

The Spreadsheet Tool for Estimating Pollutant Load was used to identify priority Hydrologic Unit Codes, HUC 12s within the watershed. STEPL is a simple watershed model that provides both agricultural and urban annual average sediment and nutrient simulations as well as implementation evaluation of best management practices. Preliminary STEPL results for phosphorus and nitrogen indicate initial priorities should focus on the top three HUC 12 subwatersheds listed in Table 12 of the TMDL document.

There is a very good potential that agricultural BMPs will improve the condition of Lovewell Lake. Some of the recommended agricultural practices are as follows:

- Implement soil sampling to recommend appropriate fertilizer applications on cultivated cropland.
- Maintain conservation tillage and contour farming to minimize cropland erosion.
- Promote and adopt continuous no-till cultivation to increase the amount of water infiltration and minimize cropland soil erosion and nutrient transports.
- Install grass buffer strips along streams and drainage channels in the watershed.
- Reduce activities within riparian areas.
- Implement nutrient management plans to manage manure land applications and runoff potential.
- Adequately manage fertilizer utilization in the watershed and implement runoff control measures.
- Use state-supported Kansas-Lower Republican Basin watershed restoration and protection strategy process to coordinate load reduction of nutrients to the lake.

The KDHE will:

- Support Section 319 project activities conducted under the WRAPS program for Lovewell Lake, including demonstration projects and outreach efforts dealing with erosion and sediment control and nutrient management.
- Provide technical assistance on practices geared to the establishment of vegetative buffer strips.

- Provide technical assistance on nutrient management in the vicinity of streams.
- Incorporate the provisions of this TMDL document into WRAPS documents relating to Lovewell Lake.

The Kansas Department of Agriculture, Division of Conservation will:

- Establish, protect or re-establish natural riparian systems, including vegetative filter strips and streambank vegetation.
- Develop riparian restoration projects.
- Promote wetland construction to assimilate nutrient loadings.
- Install grass buffer strips near streams.
- Leverage Conservation Reserve Enhancement Program to hold riparian land out of production.
- Apply conservation farming practices and/or erosion control structures, including no-till, terraces and contours, sediment control basins and constructed wetlands.
- Provide sediment control practices to minimize erosion and sediment and nutrient transport.
- Re-evaluate nonpoint source pollution control methods.

The Kansas State University will:

- Educate agricultural producers on sediment, nutrient and pasture management.
- Educate livestock producers on livestock waste management and manure applications and nutrient management planning.
- Provide technical assistance on livestock waste management systems and nutrient management planning.
- Provide technical assistance on buffer strip design and minimizing cropland runoff.
- Encourage annual soil testing to determine capacity of field to hold nutrients.
- Support outreach efforts by Middle Republican WRAPS projects and continue to educate residents, landowners and watershed stakeholders about nonpoint source pollution.

Initial implementation will proceed over the years from 2011-2015. Additional implementation may be required during 2016-2020 to achieve the endpoints of this TMDL document.

Primary participants for implementation will be agricultural producers and stakeholders within the Lovewell Lake watershed. A detailed assessment of sources conducted during 2011-2012 should include local assessments by conservation district personnel and county extension agents to survey, locate and assess the following within the lake drainage area:

- Total row crop acreage and fertilizer application rates,
- Cultivation alongside lake,
- Livestock use of riparian areas,
- Fields with manure applications.

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 percent of the fund to programs supporting water quality protection. Additionally, $2 million has been allocated between the State Water Plan Fund and the EPA 319 funds to support implementation of Watershed Restoration and Protection Strategies. This watershed and its TMDLs are a high priority consideration for funding.

Nutrient control has been proven effective through conservation tillage, contour farming and use of grass waterways and buffer strips. In addition, the proper implementation of comprehensive livestock waste management plans has proven effective at reducing nutrient runoff associated with livestock facilities. The key to success will be widespread use of conservation farming and proper livestock waste management within the watershed cited in this TMDL document.