



EPA Region 7 TMDL Review

TMDL ID: KS-VE-02-LM023001
Document Name: FALL RIVER LAKE

State: KS

Basin(s): VERDIGRIS BASIN
HUC(s): 11070102
Water body(ies): FALL RIVER LAKE
Tributary(ies):

Pollutant(s): DISSOLVED OXYGEN, EUTROPHICATION, SEDIMENT/SILTATION,
TOTAL NITROGEN, TOTAL PHOSPHORUS

Submittal Date: 3/13/2009

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 (KDHE) to the United States Environmental Agency (EPA) in a letter format received on March 13, 2009.

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 LC has been established as 35,573 kilograms per year (kg/yr) total phosphorus (TP), and 261,476 kg/yr total nitrogen (TN). Sediment is linked through Total Suspended Solids (TSS) clarity to address the siltation pollutant within this submittal. The LC for TSS is 198,000 tons/yr, or 1,455 tons/day.

Eutrophication is a result of increased TN and TP nutrient loadings into the water body. In eutrophication impairments, chlorophyll *a* (chl_a) concentrations are used as a surrogate measure to measure algal growth and as a parameter for WQS. The submittal recognizes a numeric target for summer chl_a concentrations to be established below 10 micrograms per liter (µg/L), preferably 9.5 µg/L with reductions focused on TN and TP. The chl_a target of 10 µg/L is a statewide goal for Federal lakes and lakes serving as public water supplies. This target was set to ensure long-term protection of the Primary Contact Recreation use within the lake. The required reductions to achieve the desired endpoints are 15 percent TP (50 percent for ultimate TP TMDL), 10 percent TN and 40 percent for TSS.

Siltation is a result of suspended sediment into the water body and is also known to increase turbidity. To assist with the improvement of water column quality and the siltation impairment, the desired endpoint should result in an increase of the average transparency of the lake to 0.70 meters, as measured by the Secchi disk depth within the main basin of Fall River Lake. When the desired endpoint for siltation is achieved, this will result in the decrease of sediment loading into Fall River Lake. The submittal uses TSS as a surrogate measure for sediment to assess water quality conditions. A 42 percent reduction of TSS is required to achieve a Secchi depth of 0.70 meters.

The long-term endpoint will be to maintain ambient phosphorus concentrations in the lake below 35 µg/L. Dissolved Oxygen (DO) levels should exceed 5 milligrams per liter (mg/L) throughout the entire water column.

EPA agrees that attainment of the LCs should result in the attainment of WQS.

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.

Fall River Lake's impairments are addressed through a narrative nutrient WQS. The KS WQS states that:

- 1) "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." (K.A.R. 28-16-28(e)(2)(A));
- 2) "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." (K.A.R. 28-16-28e(c)(7)(A);
- 3) "Suspended solids added to surface waters by artificial sources shall not interfere with the behavior, reproduction, physical habitat or other factors related to the survival and propagation of aquatic or semi-aquatic or terrestrial wildlife." (K.A.R. 28-16-28e(c)(2)(B)); and
- 4) "The concentration of Dissolved Oxygen in surface waters shall not be lowered by the influence of artificial sources or pollution." Dissolved Oxygen (DO): 5 milligrams per liter (mg/L) (K.A.R. 28-16-28e(d) Table 1g).

Designated uses for Fall River Lake are Primary Contact Recreation (A); Expected Aquatic Life Support; Domestic Water Supply; Food Procurement; Ground Water Recharge; Industrial Water Supply; Irrigation Use; and Livestock Watering Use. The submittal states that all uses are impaired to a degree by eutrophication.

Numeric criteria for TP and TN were derived through the use of the BATHTUB water quality model. BATHTUB is an empirical receiving water quality model that was developed by the United States Corp of Engineers used to address TMDL-related issues associated with morphometrically complex lakes and reservoirs.

Eutrophication is a result of increased TN and TP nutrient loadings into the water body. In eutrophication impairments, chl_a concentrations are used as a surrogate measure to measure algal growth and as a parameter for WQS. The submittal recognizes a numeric target for summer chl_a concentrations to be established below 10 µg/L, preferably 9.5 µg/l with reductions focused on TN and TP. The chl_a target of 10 µg/L is a statewide goal for Federal lakes and lakes serving as public water supplies. This target was set to ensure long-term protection of the Primary Contact Recreation use within the lake. The required reductions to achieve the desired endpoints are 15 percent TP (50 percent for ultimate TP TMDL), 10 percent TN, and 40 percent for TSS.

Siltation is a result of suspended sediment into the water body and is also known to increase turbidity. To assist with the improvement of water column quality and the siltation impairment, the desired endpoint should result in an increase of the average transparency of the lake to 0.70 meters, as measured by the Secchi disk depth within the main basin of Fall River Lake. When the desired endpoint for siltation is achieved, this will result in the decrease of sediment loading into Fall River Lake. The submittal uses TSS as a surrogate measure for sediment to assess water quality conditions. A 42 percent reduction of TSS is required to achieve a Secchi depth of 0.70 meters.

The long-term endpoint will be to maintain ambient phosphorus concentrations in the lake below 35 µg/L due to existing phosphorous levels that may trigger algal blooms once light limitations lessen. Dissolved Oxygen (DO) levels should exceed 5 mg/L throughout the entire water column.

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.

Pollutants of concern for Fall River Lake are eutrophication, siltation, and DO. Eutrophication is an increase in nutrients, specifically TP and TN, within the natural habitat or an ecosystem. This is normally a result of stormwater runoff, effluent discharge, and many other factors. TN and TP are the targeted pollutants of this submittal because these two pollutants are present within loadings discharged into water bodies. Sediment is also considered in the submittal to account for the siltation component of this TMDL. Sediment is silt that has been suspended into this water body as a result of erosion from silt loam soils, stream channel stability, wind, and boating activities. Chla concentrations are monitored and targeted throughout this submittal because chla is a useful parameter for determining the biological productivity of a water body. Increased levels of TN and TP within the water body will cause an abundance of algal growth. The siltation impairment is linked through clarity to a TSS concentration of 17.4 mg/L, and a Secchi depth of 0.7 meters.

The submittal states that a numeric target for chla concentrations is below 10 µg/L, with reductions focused on TN and TP. This target was set to ensure protection to support all designated uses. The desired endpoint to increase the average transparency to 0.70 meters was established to address siltation. DO should exceed 5 mg/L for the entire water column of the lake.

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 land use distribution within this watershed is predominantly 87 percent grasslands and pasture that covers the scenic Flint Hills. The remaining land use is comprised of 6.7 percent forest, water, and wetlands; 3.6 percent developed land and barren ground; and 2.8 percent croplands. There are nine permitted or certified confined animal feedlot operations (A-VEGW-B001, A-VEGW-BA06, A-VEGW-BA01, A-VEGW-B004, A-VEGW-BA07, A-VEGW-BA05, A-VEGW-MA11, A-VEGW-BA11, A-VEGW-M002) that are located adjacent to stream corridors. Waste management systems have been established within all of the permitted livestock facilities to assist with the minimization of runoff entering their facility, as well as to detain runoff emanating from their operations. The submittal also states that none of the facilities exceeds the 1,000 animal unit threshold for Federal National Pollution Discharge Elimination System (NPDES) permitting. According to 2006-2007 Kansas Agricultural Farm Facts, there are 77,000 head of cattle in Greenwood County, with Greenwood ranked second in the state for pasture acreage. Therefore, the high proportion of grassland and pasture are assumed to support a large number of smaller animal feeding operations that are not registered and close to streams, particularly during over-wintering.

There are five NPDES-permitted facilities within the Fall River Lake watershed. Out of the five, only one facility, the City of Eureka, continuously discharges into the watershed. The submittal also states that Fall River Lake uses a lagoon system resulting in monitoring being limited to biological oxygen demand, TSS, ammonia, pH, and fecal coliform bacteria. The current capacity of the wastewater system appears to be adequate for the current population estimate of 2,607 in 2007. The watershed of Climax is the only other town that was incorporated. Climax has a population of 60 and also does not have a wastewater system. Another potential source are the concrete and quarry operations. They have not discharged since 2004 and are designed to conserve on-site water for re-use and dust suspension. These facilities and the non-overflowing lagoon at the Family Camp are stated to only discharge under extreme precipitation events or occurrences of limited frequency and duration. All non-discharging lagoon systems are prohibited from discharging into surface waters and if waters within the lagoon approach two feet of the top of the lagoon dikes, KDHE should be notified immediately. Discharges are only allowed if an alternative method is not available or if it is necessary to protect public safety or property and will prevent damage to the facility.

NPDES Facilities

Facility	NPDES#
CMC-Eureka	KSG110079
Harshman-Braden Quarry	KS0098892
Martin-Marietta-Eureka Quarry	KS0095311
Flint Hills Family Camp	C-VE16-NO01
City of Eureka	KS0083178

On-site septic systems do not impose a significant impact or threat to the condition of the Fall River Lake watershed. As a result of the past census results, only one-third of the residents of Greenwood County rely on septic systems. In regards to stream channel stability, geomorphic studies have shown that over half of the first, second, and third order streams in the Upper Fall River Lake watershed were lost due to inundation and impoundment. As a result, this implies that diminished sediment supplies from the tributaries could induce main channel erosion along Fall River while the flowing river looks for an equilibrium with its transporting sediment load. Another potential source loading into the lake are three soil types: silt loam soils, reading soils, and chase soils. This is stated as a potential source because of the possibility for fertilization for agricultural production and proximity to flows eroding and transporting nutrients into the lake. The contribution of runoff poses potential source loading into the Fall River Lake. As a result, runoff is primarily generated as infiltration excess during rainfall intensities greater than soil permeability.

Natural background sources include leaf decomposition, waste, atmospheric deposition, and seepage from geological formations. The wind and boating activities may influence the suspension of sediment and nutrients within the lake.

EPA agrees this submittal considers all known sources.

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.

The LC for Fall River Lake is 35,573 kilograms per year (kg/yr) TP and 261,476 kg/yr TN. Sediment is linked through TSS clarity to address the siltation pollutant within this submittal. The LC for TSS is 198,000 tons/yr, or 1,455 tons/day.

The City of Eureka is the only discharging NPDES facility within the watershed. The City of Eureka has a WLA of 795 kg/yr, 2.2 kg/day TP, and 2,750 kg/yr, or 7.5 kg/day TN. The WLA for TSS is 35 tons/yr, 0.1 tons/day. The remaining four NPDES facilities receive a WLA of zero because they do not discharge or involve activities that is likely to discharge nutrients.

The LA to reduce TP and TN to 9.5 µg/L chl a is 34,684 kg/yr, or 962 kg/day TP. TN allocations are 252,125 kg/yr, or 6,940 kg/day TN with atmospheric deposition accounting for 6,601 kg/yr, or 18.1 kg/day. To further reduce the TP to reach 35 µg/L within the lake, the LA is 20,818 kg/yr, or 569.5 kg/day TP.

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.

The City of Eureka (KS0083178), the only discharging permit within the watershed, is the only NPDES facility within the watershed that requires a WLA for TN, TP, and, TSS. The WLA for the City of Eureka is 795 kg/yr, or 2.2 kg/day TP and 2,750 kg/yr, or 7.5 kg/day TN. The WLA for TSS is 35 tons/yr, or 0.1 tons/day.

All other operations are either non-discharging or involve activities that are unlikely to discharge nutrients. These facilities have a WLA of zero.

EPA agrees this is an appropriate WLA.

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.

The LA to reduce TP and TN by 16 percent to 9.5 µg/L chl a is 34,684 kg/yr, or 962 kg/day TP. Atmospheric deposition accounts for 94 kg/yr, 0.3 kg/day TP. TN allocations are 252,125 kg/yr, or 6,940 kg/day TN with atmospheric deposition accounting for 6,601 kg/yr, or 18.1 kg/day. To further reduce TP by 50 percent to reach 35 µg/L within the lake, the LA is 20,818 kg/yr, or 569.5 kg/day TP.

The LA for TSS is 197,965 tons/yr, or 1,455.7 tons/day.

EPA agrees this is an appropriate LA.

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 MOS for TP and TN were implicitly set because load reductions are aimed to achieve a chl_a concentration of 9.5 µg/L which is below the 10 µg/L endpoint demarcating adequate and problematic trophic conditions. Additionally, the TMDL focuses on the direct implementation to continue to reduce in-lake phosphorus levels to mitigate against the threat of algal blooms re-emerging as lake clarity improves with reductions in sediment loading. The indicated load reductions were rounded down from the modeled results to create a margin for water quality.

The MOS for siltation was also implicitly set based on the assumption that the vast reduction in long-term phosphorus loading will correspond to a reduction in sediment loading beyond what is necessary to maintain the integrity of the conservation storage in Fall River Lake.

EPA agrees this is an appropriate MOS.

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.

Seasonal variation has been accounted for in this TMDL due to peaks of algal growth that occur in the summer months. The summer months are indicated as the months of May-September.

Seasonality and any critical conditions have been addressed in the submittal.

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)].

Public meetings to discuss TMDLs in the Verdigris Basin have been held since 2002. To convey information to the public on the general establishment of TMDLs in the Verdigris Basin and these specific TMDLs, an active internet website was established at <http://www.kdheks.gov/tmdl/index/htm>.

On September 25, 2007 the Verdigris Basin Advisory Committee met in Eureka to discuss these TMDLs. Meetings were also held on February 27, 2008 in Independence, and July 23, 2008 in Neodesha.

A public hearing on these Verdigris Basin TMDLs was held on July 23, 2008 in Neodesha. The record for this TMDL remained open until October 31, 2008, due to delays in its public release.

The original drafts of the TMDL documents were revised based on comments received throughout the 2008 public notice period. All comments were considered.

EPA agrees the TMDL received the opportunity for meaningful public input.

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].

KDHE will continue to monitor its 3-year sampling schedule to assess the trophic state of Fall River Lake. Evaluation on the improved status of the lake will be based upon these results. This evaluation will be performed in 2016. The desired endpoints under this TMDL will be refined. More intensive sampling will be conducted over the period 2016-2018 to assess progress in implementation if impairment status continues.

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.

There are no reasonable assurances needed because allocations were set to meet WQS. The submittal lists reasonable assurances that include numerous authorities and funding through the Kansas Water Plan.
