



EPA Region 7 TMDL Review

TMDL ID: KS-NE-02-L-12100 **State:** KS
Document Name: MARION LAKE (RESERVOIR)
Basin(s): NEOSHO BASIN
HUC(s): 11070202
Water body(ies): MARION CO LAKE, MARION LAKE
Tributary(ies): DRY CREEK, FRENCH CREEK, NORTH COTTONWOOD RIVER, PERRY CREEK
Pollutant(s): EUTROPHICATION, 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.

The Kansas Department of Health and Environment (KDHE) formally submitted eight TMDL documents in a letter received by the United States Environmental Protection Agency (EPA) on March 13, 2009. The Marion Lake (Reservoir) submittal is a phase 2 (revised) TMDL. The original (phase 1) TMDL was approved by EPA on January 6, 2005.

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 is set using a lake eutrophication model (BATHTUB) to target the annual amount of total nitrogen (TN) and total phosphorus (TP) loads that Marion Lake can receive and meet its designated uses. To address the identified pollutant (eutrophication), an initial chlorophyll *a* (chl_a) concentration of below 12 micrograms per liter (ug/L) by 2014 was used to link the concentration of TN and TP to the level of eutrophication. The Primary Contact Recreation Use targets chl_a concentrations of 12 ug/L as an endpoint to attain this designated use. To further limit impairment to all designated uses, a chl_a concentration of below 10 ug/L by 2016 will be targeted. The Carlson's Trophic State Index (TSI) is derived from chl_a concentrations and provides a scale of eutrophication levels.

EPA agrees this is an appropriate translator for this TMDL. The desired endpoints under this TMDL will be refined based on additional monitoring and evaluation. Because lake conditions represent responses to environmental loads occurring over an extended period of time, expression of the load as an average annual value is the preferred approach found in current scientific limnological literature.

Table 3 of the TMDL document lists the LCs as 1,115,824 pounds/year (lbs/yr) TN, and 29,619 lbs/yr for TP, to achieve a chl_a concentration below 10 ug/L. This is a 19 percent TN, and a 20 percent TP reduction in load from the current conditions.

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.

Kansas Surface WQS state 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. 28-16-28e(c)(2)(A)); and
- 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)).

Beneficial uses:

Primary Contact Recreation
Expected Aquatic Life Support
Drinking Water
Ground Water Recharge
Industrial Water Supply
Food Procurement
Irrigation
Livestock Watering

*The submittal states that all uses are impaired to a degree by eutrophication.

The translation of the narrative standards using numeric nitrogen and phosphorus targets was derived through the use of models. The models included the Generalized Watershed Loading Function (GWLF) and BATHTUB, an empirical receiving water quality model that was developed by the United States Army Corps of Engineers (USACE), which has been commonly applied to address many TMDLs relating to issues associated with morphometrically complex lakes and reservoirs.

The desired end point for this TMDL will be to maintain the growing seasons chla concentration below 10 ug/L by 2016. Table 3 of the TMDL lists the LC for each parameter.

Parameter	LC
Total Nitrogen (lbs/yr)	115,824
Total Phosphorus (lbs/yr)	29,619
Total Nitrogen (ug/L)	550
Total Phosphorus (ug/L)	48
Chlorophyll <i>a</i> (ug/L)	<10

lbs/yr = pounds per year ug/L = micrograms per liter

The state of Kansas does not have numeric criterion for nutrients in their WQS. Marion Lake exceeded the narrative WQS which states that "water shall be free from" aesthetically objectionable conditions. High turbidity negatively affects the development of a phytoplankton community. Nutrient availability remains high but is not fully translated into algal productivity due to light limitations. Trophic state assessments of potential algal productivity were made based on chla, nutrient levels (TN and TP), and values from the TSI which effectively links TN, TP, and chla to the narrative 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.

A lake eutrophication model (BATHTUB), suggests that a load reduction of nutrients (TN and TP) is required to reach the chla endpoint representing the narrative WQS. Using the GWLF and BATHTUB models; LCs of 115,824 lbs/yr TN and 29,619 lbs/yr for TP were derived, in order to translate the narrative standards as chla concentration below 10 ug/L. This reduction in TP and TN loading is an established link in the reduction of chla concentrations. Chla concentrations are linked to eutrophication through trophic indices, and Kansas state eutrophication TMDL targets of 12 ug/L chla for primary contact recreational lakes, 20 ug/L for secondary contact recreation lakes, and 10 ug/L for federal lakes and lakes serving as water supplies. The chla target was set at a concentration below 10 ug/L.

The phase 2 TMDL uses an expanded data set to make more refined loading and LC estimates. The chla target decreases from 12 ug/L to 10 ug/L. The phase 2 TMDL uses improved modeling techniques with current monitoring data, as well as better sourcing information. The TMDL still targets phosphorous as a translator and has added a refined nitrogen target, over what the original phase 1 TMDL required.

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.

Within this watershed, there are four National Pollution Discharge Elimination System (NPDES) permitted municipal wastewater treatment plants (Canton KS0098426, Durham KSJ000350, Lehigh KS0026417, and Marion County S.D. #1 KSJ000348) in the headwaters of the watershed. Two are non-overflowing lagoon systems. Non-overflowing lagoons are prohibited from discharging and would only contribute TP and ammonia load under extreme precipitation events.

There are 38 registered confined animal feedlot operations (CAFOs and AFOs) that are either certified or permitted. All of the permitted livestock facilities have waste management systems designed to minimize runoff entering their operation or detaining runoff emanating from their facilities.

Land use in the watershed includes: grassland is 40 percent, of which pasture/hay accounts for about 2 percent; cultivated cropland occupies around 43 percent; woody and deciduous forests cover 3 percent; and urban area is less than 1 percent.

Because of moderate grazing density of the livestock operations throughout the watershed and the dominant watershed land use of grassland, animal waste from both confined and unconfined feeding sites poses a potential source of phosphorous loading into Marion Lake.

Nonpoint source loading includes runoff due to intense storms and low soil permeability averages, urban fertilizers, and failing septic systems. Urban fertilizer with stormwater runoff is considered a minor contributing nutrient factor due to low urban land use in the watershed. Failing septic systems may be a minor source of nutrients.

Natural background sources are identified as leaf litter, atmospheric deposition, and geological formations which may contribute to nutrient load.

The phase 2 TMDL provides greater detail on the sourcing for the CAFOs and AFOs, the watershed soil permeability, and the NPDES permits (including design flow), than the original phase 1 TMDL.

All known potential 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.

The LC is 115,824 lbs/yr TN, and 29,619 lbs/yr TP. The WLA is 3,183 lbs/yr TN, and 909 lbs/yr TP. The LA is 101,059 lbs/yr TN and 25,748 lbs/yr TP.

The LC for the original phase 1 TMDL was 33,527 lbs/yr TP. TN was not allocated. The current phase 2 (revised) TMDL has LCs set for 115,824 lbs/yr TN, and 29,619 lbs/yr TP. The phase 2 TMDL displays a more refined LC. It shows a decrease in TP and sets a numeric value for TN. The chla target decreases from 12 ug/L to 10 ug/L and the phase 2 TMDL uses improved modeling techniques with current monitoring data, as well as better sourcing information. The TMDL still targets phosphorous as a translator and has added a refined nitrogen target.

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 WLA for TN is 21.3 lbs/day. $((3,183 * 2.44)/365)$

The WLA for TP is 5.65 lbs/day. $((909 * 2.27)/365)$

(see Appendix E within the TMDL for documentation of conversion assumptions)

The WLA for the original phase 1 TMDL was 1,782 lbs/yr TP. No reduction in TN or TP were required. The current phase 2 TMDL sets the WLA for 3,183 lbs/yr TN, and 909 lbs/yr TP. The phase 2 TMDL displays a more refined WLA. It shows a decrease in TP and sets a numeric value for TN.

There are four NPDES permitted facilities within this watershed.

Facility	Permit number	WLA TN (lbs/day)	WLA TP (lbs/day)
Canton MWTP	KS0098426	6.99	2.00
Durham MWTP	KSJ000350	0	0
Lehigh MWTP	KS0096873	1.74	0.50
Marion Co. SD #1	KSJ000348	0	0
Totals		8.73	2.50

All 38 registered CAFOs and AFOs have a WLA of zero.

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 for TN is 674 lbs/day.

The LA for TP is 160 lbs/day.

The LA for the original phase 1 TMDL was 28,392 lbs/yr TP and no reduction in TN was required. The current phase 2 TMDL has LAs set for 101,302 lbs/yr TN, and 25,748 lbs/yr TP. The phase 2 TMDL displays a more refined LA. The chla target decreases from 12 ug/L to 10 ug/L, and the phase 2 TMDL uses improved modeling techniques with current monitoring data, as well as better sourcing information. The TMDL still targets phosphorous as a translator and has added a refined nitrogen target.

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 explicit MOS is set at ten percent of the total nutrient loads (TN and TP) from the watershed. This translates to 77.27 lbs/day TN and 18.46 lbs/day TP.

The MOS for the original phase 1 TMDL was 3,353 lbs/yr TP set to ensure that the endpoint was reached. The current phase 2 TMDL has 11,582 lbs/yr TN, and 2,962 lbs/yr TP. The phase 2 TMDL displays a more refined 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.

This TMDL was developed based on chla contributions to generalized lake conditions. The annual targets should result in WQS attainment regardless of the season. Seasonal variation has been incorporated in this TMDL since the peaks of algal growth occur in the summer months (May-September).

Seasonal variation is considered in the document "Lake and Wetlands Monitoring Program - 2005 annual report" by C. Edward Carney dated 2006, and included by reference in all Kansas eutrophication TMDLs. The reference discusses sampling during times representative of "normal" summer conditions.

Seasonal variation and critical conditions are accounted for by conducting seasonal sampling and by considering the magnitude of runoff which is chiefly generated when the rainfall rate is greater than the rate at which rain can infiltrate the soil.

No significant differences in seasonal variation and critical conditions were found between the phase 1 and phase 2 documents.

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)].

On July 24, 2008, public hearings on the TMDL for the Neosho Basin were held in Burlington at the Coffey County Courthouse.

The Neosho Basin Advisory Committee met to discuss the Neosho Basin TMDLs on September 27, 2007 at the Schermerhorn Nature Center (Galena), February 28, 2008 in Burlington (in the Coffey County Courthouse), and on May 15, 2008 at the Emporia City Library. Public meetings to discuss these TMDLs were also held at the aforementioned locations and dates, as well as on December 8, 2006 in Columbus.

An active website was established to convey information to the public on the specific TMDLs for the Neosho Basin, at <http://www.kdhe.state.ks.us/tmdl>.

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

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].

Future lake sampling is scheduled to occur at least three times between 2008 and 2015. Monitoring of the tributary levels of nutrients during runoff events will assist direct abatement efforts toward major contributors. Tracking of nutrient loads from the existing municipal lagoons will be used to confirm their small contribution to the lake.

Monitoring between phase 1 and phase 2 TMDLs occurred at Station LM020001, where seven surveys were taken from 1987-2005. Stream chemistry was monitored at two stations (636 and 676) between 1993-2005. The Tulsa District of the USACE measured inflow at the dam between 1995-2006. Chla concentrations were measured during the growing seasons from 1987-2006.

The phase 2 submittal documents that the water body was monitored between submittals.

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.

The WLAs are set to meet WQS, so no reasonable assurances are required. The submittal lists reasonable assurances that include numerous authorities and funding through the Kansas Water Plan. Kansas has identified several federal, state, local, and non-government organizations that may be included in the implementation process.