



EPA Region 7 TMDL Review

TMDL ID: KS-VE-03-LM023001
Document Name: BIG HILL LAKE

State: KS

Basin(s): VERDIGRIS BASIN
HUC(s): 11070103
Water body(ies): BIG HILL LAKE
Tributary(ies):

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.

This TMDL was formally submitted in a letter format from the Kansas Department of Health and Environment (KDHE) to the United States Environmental Protection Agency (EPA) which was received March 13, 2009. Revisions addressing EPA comments was received by email attachment April 15, 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 TMDL identifies eutrophication as the impairment to Big Hill Lake and phosphorous as the limiting nutrient in the main basin of the lake. Phosphorus and nitrogen will both be allocated with load reductions focused on phosphorous. Allocations will be made for nitrogen to ensure loads do not increase. Phosphorus and nitrogen are key nutrient contributors to eutrophication. The reduction and monitoring of these nutrients will decrease the amount of algal growth within the water body and will decrease eutrophication within the lake. Chlorophyll *a* (chl_a) is used as a surrogate measure linking algal growth to phosphorus, nitrogen, and eutrophication. The indicated target for chl_a should assist in the achievement of all desired endpoints.

The LC identified in the submittal is 64,508 lbs/yr, or 402 lbs/day for total phosphorus (TP), and 2,919 lbs/yr, or 12.4 lbs/day for total nitrogen (TN). A 25 percent reduction of TP is needed to achieve a desired endpoint of summer chl_a levels maintained below 10 micrograms per liter (µg/L). A Secchi disk depth greater than 1.6 meters within the main basin of the lake is required.

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.

Big Hill Lake's eutrophication impairment is 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. 28-16-28e(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)).

Assigned beneficial uses for Big Hill Lake are: Primary Contact Recreation (A); Expected Aquatic Life Support; Domestic Water Supply; Food Procurement; Industrial Water Supply; Irrigation Use; and Livestock Watering Use. The submittal states that all designated uses are impaired by eutrophication.

Numeric criteria for phosphorus are derived through the use of BATHTUB. BATHTUB is an empirical receiving water quality model, that was developed by the U.S. Army Corps of Engineers. BATHTUB is commonly used to address TMDL-related issues associated with morphometrically complex lakes and reservoirs. Clean Air Status and Trends Network (CASTNET) was used to obtain atmospheric TN. Phosphorus and nitrogen are key contributors to the eutrophication impairment within the Lake. The reduction of phosphorus and nitrogen will decrease the amount of algae present within the water body. The numeric target criteria for Big Hill Lake indicates summer chla concentrations below 10 µg/L with reductions focused on phosphorus and a Secchi disk depth of greater than 1.6 meters within in the main basin.

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 submittal uses a chla target of 10 µg/L as a statewide goal for lakes serving as public water supplies, as well as to ensure the long-term protection to fully support Primary Contact Recreation. This target will also ensure long-term protection to fully support Primary Contact Recreation within the lake. A Secchi disk depth greater than 1.6 meters would be achieved if this target is met.

Phosphorus and nitrogen are key contributors to eutrophication within the lake. The reduction and monitoring of these nutrients will decrease the amount of algal growth within the water body and will result in the decrease of eutrophication within the lake. Chla was used as a surrogate measure to determine the amount of nuisance algal growth within the water body. The indicated target for chla will assist in the achievement of all desired endpoints. A Secchi disk depth target greater than 1.6 meters was used to determine water clarity and presence of algae.

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 for Big Hill Lake includes 52 percent pasture, 22 percent cropland, and 11 percent forest. The remaining land use of this watershed is comprised of 5 percent open water, 4 percent developed open space, 1 percent developed low-high density, 3 percent grassland, and 1 percent woody wetlands.

Although there aren't any permitted or registered confined animal feeding operations (CAFOs) located within the watershed, there are smaller animal feeding operations with less than 300 animal units that may be operating within the watershed. Nutrients within the Big Hill Lake watershed may be attributed to fertilizer or manure applications to the agricultural lands being utilized for pasture, hay, or cropland production. There are no National Pollution Discharge Elimination System (NPDES)-permitted facilities within this watershed.

Big Hill Lake watershed is a rural agricultural area, and it is assumed that all of the rural residences within the watershed are not connected to public sewer systems. Failing septic systems is stated to significantly contribute to nutrient loadings into Big Hill Lake. An excessive amount of nutrient loading will aggravate eutrophication problems.

The mean soil permeability is given as 0.86 inch/hr and about 53 percent of the watershed has a permeability value of less than 0.57 inch/hr that contributes to runoff during extremely low rainfall intensity events. As a result, runoff is primarily generated as infiltration excess with intense rainfall.

Natural background sources are identified as leaf litter, wastes from wildlife, atmospheric and geological formations which could contribute to nutrient loads.

EPA agrees the 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 Big Hill Lake is 64,508 lbs/yr, or 402 lbs/day TP, and 2,919 lbs/yr, or 12.4 lbs/day TN. A 25 percent reduction of phosphorus is needed to achieve desirable endpoints.

EPA agrees this is an appropriate LC.

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.

Due to lack of point sources in the watershed, a WLA of zero was assigned for nitrogen and phosphorus.

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 for phosphorus is 2,385 lbs/yr, or 10.13 lbs/day TP, and 48,245 lbs/yr, or 301 lbs/day TN. TP air deposition accounts for 242 lbs/yr, or 1.03 lbs/day. TN air deposition is 9,813 lbs/yr, or 61 lbs/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 was explicitly set at 10 percent of the original calculated TP and TN load allocations. For phosphorus the MOS is set at 292 lbs/yr, or 1.24 lbs/day. For nitrogen the MOS is 6,450 lbs/yr, or 40 lbs/day.

EPA agrees these are appropriate explicit 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.

The TMDL stated that Big Hill Lake has a tendency to have higher chla concentrations during drier conditions and are closely related to hydrologic conditions and nutrient flux from the watershed. Therefore, the submittal has incorporated seasonal variation as a result of the peak algal growth that occurs during the summer months.

Seasonality and 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. A public hearing on the TMDLs of this basin was held on July 23, 2008 in Neodesha. The Verdigris Basin Advisory Committee met to discuss these TMDLs on September 25, 2007 in Eureka; February 27, 2008 in Independence, and on July 23, 2008 in Neodesha.

An active Internet Web site was established at <http://www.kdheks.gov/tmdl/index.htm> to convey information to the public on the general establishment of TMDLs in the Verdigris Basin TMDLs and these specific TMDLs.

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 its three year sampling schedule in order to assess the trophic state of Big Hill Lake. Based on the sampling results, the improved state of the lake will be evaluated in 2016. More intensive sampling will be conducted over the period 2016-2018 to assess progress in this TMDL's implementation if impairment 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.

The WLA for this TMDL is zero, no reasonable assurances are required. The submittal lists numerous potential state authorities to regulate point and nonpoint source pollutants in the watershed.