



EPA Region 7 TMDL Review

TMDL ID: IA 06-WEM-00445-L_0
Document Name: BLUE LAKE

State: IA

Basin(s): MISSOURI-LITTLE SIOUX
HUC(s): 10230001
Water body(ies): BLUE LAKE
Tributary(ies):
Pollutant(s): ALGAE, TOTAL PHOSPHORUS, TURBIDITY

Submittal Date: 6/2/2008

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.

A letter dated May 28, 2008, received by the U. S. Environmental Protection Agency (EPA) on June 2, 2008, formally submitted this TMDL document for approval. A revised version was submitted by e-mail attachments on June 2, 2008, and October 9, 2008.

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 through the use of a lake response model to target the annual amount of total phosphorus (TP) that Blue Lake can receive to meet its designated uses. To address the identified pollutants (algae and turbidity), the Carlson's Trophic State Indices (TSI) were used to link the concentration of TP to the quantity of algae and turbidity as measured by Secchi Depth (SD). A concentration of TP <59 micrograms per liter (ug/L), was set as a target to achieve TSIs for chlorophyll a (algae) and SD (transparency) of <65; thereby meeting Iowa's narrative WQS. The corresponding concentration values for TP and chlorophyll a are 59 ug/L and 33 ug/L, respectively, and the SD is equivalent to 0.7 meters. The BATHTUB model estimates the yielded TP target concentration of 59 ug/L for Blue Lake. The TMDL will result in a 40% reduction in TP loading.

The annual TP load to Blue Lake consists of external watershed loads (pumpage, ditch overflow, and watershed), internal recycling loads, and atmospheric direct deposition. The targeted TP LC for Blue Lake is 1,114 lbs/year and the daily load is 28.64 lbs/day, 925.60 lbs/year (25.58 lbs/day) externally from the watershed, 77.4 lbs/year (0.22 lbs/day) from internal recycling load. The existing total average load from all sources is estimated to be 2,691 lbs/year. The estimate for the current external watershed load is 2,605 lbs/year, for the internal recycling load is 86 lbs/year. The difference between the existing and target loads is 1,577 lbs/year. The LC for TP is set as a combination of reduction in internal and externally loaded phosphorus.

EPA concurs that meeting the TMDL targets will result in the attainment of WQS in Blue Lake.

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.

The Iowa WQS (IAC 567-61) list the designated uses for Blue Lake as primary contact recreational use (Class A1), aquatic life (Class B(LW)) and human health (Class HH). More recent assessments in 2006 revealed that the Class A1 designated use was assessed (monitored) as "not being supported" due to excessive suspended algae from high phosphorus loading and inorganic turbidity. The Class B(LW) designated use was assessed (evaluated) as "fully supporting." The Class HH fish consumption uses remain "not assessed" due to the lack of recent fish contaminant monitoring.

Iowa does not have numeric water quality criteria for algae or turbidity. For algae and turbidity the impairment is based on narrative standards which state that Blue Lake should be "free from materials attributable to wastewater discharges or agricultural practices producing objectionable color, odor, or other aesthetically objectionable conditions." The criteria for assessing lake algae and turbidity impairment are based on TSI scores for chlorophyll a and SD. The 305(b) assessment impairment thresholds for nuisance conditions are TSI values of 65 for both chlorophyll a and SD, giving a target chlorophyll a concentration of 33 ug/l and a target SD of 0.7 meters. The average annual TP concentration goal for these targets has been estimated at 59 ug/l, using the BATHTUB model.

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.

Carlson's TSI scores were used to define an established linkage between TP concentrations for the reduction of algae and turbidity. The linkage is indicated by a relationship between TP, chlorophyll a, and water SD seen in a group of reference lakes. Phosphorus is the principal nutrient target because of algae's ability to fix atmospheric nitrogen and the overabundance of phosphorus inputs. The TP load to Blue Lake originates entirely from external watershed loads, internal recycling loads, and a small amount of atmospheric direct deposition load on the lake surface. The watershed sources have been linked to impairment using the GWLF/BasinSims model to estimate monthly and annual TP delivery. The internal and atmospheric direct deposition loads are linked by the BATHTUB lake nutrient model to excessive suspended algae. Targeting TP load reductions will also reduce sediment and suspended solid loads.

The TMDL uses the surrogate measure of TSI which links phosphorus concentrations to algal and turbidity conditions. By reducing the concentration of TP <59 ug/L, the TSI for chlorophyll a and SD should be reduced to <65 based on the relationships seen in this lake. A minimum in-lake reduction in TP to meet this goal is 40% which should result in a reduction of 28% for chlorophyll a and an increase in SD of 75%.

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.

Only nonpoint sources influence the TP and sediment loading. There are no permitted point sources in Blue Lake watershed. A significant source of phosphorus loading is external watershed loads (septic tanks and geese).

Following are the six nonpoint sources for Blue Lake: 1) Phosphorus load from residential septic tanks water drains into the lake, which is 73% of the total watershed area, 2) groundwater pumpage into the lake from a well, 3) geese, 4) periodic flooding from McCandless-Cleghorn Ditch during heavy rainfall, 5) phosphorus recycled from lake sediments, and 6) natural background atmospheric direct deposition. All known significant

sources have been identified.

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 goal of this TMDL is to reduce TP loading to achieve an in-lake concentration of <59 ug/L resulting in TSI for SD and chlorophyll a of <65. This will be accomplished with a TP LC of 1,114 lbs/year or 28.64 lbs/day from all sources.

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.

There are no permitted point sources in the Blue Lake watershed. Therefore, the sum of the WLA is 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 TP LA for Blue Lake is the sum of the external watershed load, internal recycling load, and the atmospheric direct deposition load.

Based on the BATHTUB lake nutrient modeling, the internal LA is 77.4 lbs/year (MOS applied) or 0.22 lbs/day; based on the GWLF/BasinSims model, the external LA is 925.6 lbs/year (MOS applied) or 25.58 lbs/day. The annual TP LA is 1,003 lbs/year or 21.7 lbs/day.

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 supplemental pumping, ditch overflow, atmospheric direct deposition, and internal recycle loads is an explicit 10% of the allowable TP loads. The sum of these allowable loads is 518 lbs/year. The MOS is 51.8 lbs/year.

The MOS for the maximum daily allowable load is an explicit 10% reduction in the watershed, supplemental pumping, ditch overflow, and atmospheric direct deposition loads. The allowable daily maximum load based on an average 2-year return storm is 28.64 lbs/day and 10% MOS is 2.84 lbs/day.

The MOS for TP is implicit for the external watershed load based on conservative model assumptions and calculations. A 10% MOS was applied to estimate the allowable loads generated by the GWLF/BasinSims model in the allocation spreadsheet (located in the TMDL).

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.

TSI targets are applied to the growing season when excessive suspended algal blooms and low transparency in the lake is prevalent. The TMDL for algae and turbidity was set for an annual loading of TP that will result in meeting growing season targets (April through September).

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)].

A preliminary meeting with stakeholders and agency staff was held on December 13, 2007, at the U. S. Department of Agriculture Service Center in Onawa, IA. Iowa Department of Natural Resources (IDNR) Watershed Improvement staff toured the state park and the watershed and obtained important information for the development of this report. The state of Iowa owns and operates the state park and immediate lakeshore. An announced public meeting was held on May 7, 2008 in Onawa, IA. This meeting took place during the April 17, 2008 to May 19, 2008, public comment period. IDNR did not receive any written comments on the draft Blue Lake TMDL Water Quality Improvement Plan.

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].

Monitoring similar to that done for the Iowa State University Lake Study and the 2005 and 2006 University Hygienic Laboratory sampling will continue at Blue Lake with three to six samples taken in the growing season. Monitoring that will support analysis and modeling should include the following: 1) Measure the water surface elevation-this can be done by placing an elevation staff in a protected area, reading and recording the levels every day. There do not appear to be any outflow points of concentration that would provide worthwhile discharge information. Determining lake detention time will help calibrate the watershed and lake models and help explain TP and chlorophyll a response to hydrologic conditions, 2) measure overflows from McCandless Cleghorn Ditch and sampling for total and dissolved phosphorus, turbidity, inorganic suspended solids (ISS), and total suspended solids (TSS). This can be sampled at the culvert where the overflow enters the lake, 3) track the supplemental groundwater pumping volume and analyze monthly for phosphorus, suspended solids, dissolved solids, turbidity and iron, 4) sample important water quality variables biweekly to support a mechanistic representation of the lake system, 5) measure precipitation, wind speed, and temperature near the lake, and 6) monitor dissolved oxygen and temperature for improved lake model calibration continuously.

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 point sources in the watershed and reasonable assurances are therefore not required.