EPA Region 7 TMDL Review

TMDL ID: 2814 **Water Body ID:** 2814
Water Body Name: Main Ditch
Tributary: Main Ditch
Pollutant: Biochemical Oxygen Demand (BOD), Volatile Suspended Solids (VSS), Low Dissolved Oxygen (DO)
State: Missouri **HUC:** 11010007-070005
BASIN: Pike Creek (Lower Black River Basin)
Submittal Date: November 10, 2005
Approved: Yes

Submittal Letter

State submittal letter indicates final TMDL(s) 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.

Letter dated November 10, 2005, was received by EPA November 16, 2005, formally submitting this TMDL for approval under Section 303(d).

Water Quality Standards Attainment

The water body's loading capacity 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.

The loading capacity for Biological Oxygen Demand (BOD), Volatile Suspended Solid (VSS), and Ammonia are identified, and were determined using the QUAL2E water quality model. High BOD, and VSS cause low DO in the receiving stream, which eliminates many aquatic organisms that require high levels of oxygen to survive.

BOD loading resulting in violations of the dissolved oxygen (DO) criterion were modeled based upon meeting 5.0 mg/L DO in Main Ditch which, upon implementation of the WLA concentration-based permit limits, should result in attainment of both narrative and numeric water quality standards (WQS) for the protection of the Warm water Aquatic Life designated use.
If EPA approves the "site-specific criteria" revision, the TMDL can be reopened and the allocations revised to reflect the WQS change in regard to the "site specific DO criteria". In addition to BOD, VSS, and Low DO the city's NPDES permit must be reissued with the Waste Load Allocation (WLA) derived permit limit concentration identified in the TMDL for BOD, VSS, and Ammonia.

Numeric Target(s)

Submittal describes applicable water quality standards, 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.

All WQS, criteria, and beneficial uses have been described. BOD and Ammonia are the parameters modeled to determine the impact the WWTP will cause low DO levels in Main Ditch; seasonal Ammonia criteria were targeted using temperature and pH per the MO WQS. The VSS criteria is narrative, therefore in this TMDL, the targeted value was derived using best professional judgment due to the fact there is no immediate upstream VSS data which would assist in targeting a natural background concentration.

Numeric Target(s) and 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 that do not exceed the load capacity.

The water quality model QUAL2E generated the numeric link between DO, and BOD and Ammonia. Seasonal Ammonia criteria were targeted using temperature and pH per the MO WQS. VSS was not simulated in the model. Its WLA was derived through statistical calculations of available data. The 25th percentile value of all VSS data is 2.499. Since the detection level for this pollutant is 5 mg/L, a no detection measurement is reported in the database as 2.499 to allow numerical computation. The 2.499 equals the detection level value (5) divided by 2 minus 1 plus 0.099 [no-detection = 5/2-1+0.099]. The 99 at the end, is a flag to indicate no detection. The VSS target was conservatively set to 5 mg/L.

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, non point and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered.

Land use and soils are described as well as the history of the area. The sole source of the impairment is Poplar Bluff Waste Water Treatment Facility (WWTF); NPDES permit number MO-0043648. Main Ditch is on the 2002-303(d) list due to high BOD, VSS, and low DO.

Point Source Poplar Bluff WWTF is the only discharger in the impaired segment's watershed. The current permit has a design flow of 1.9 million gallons per day (MGD) (about 4.5 cubic feet per second [ft^3/S]) and contains the following effluent limits: BOD_5 30/45 mg/L monthly weekly averages respectively, TSS 80/120 mg/L, NH3 10 mg/L, and a pH>=6 standard units. This permit expired July 30, 2003. The monthly DMRs summary for the period of January 1999 to March 2004 is presented in Table 1a. These reports show that the median lagoon discharge is 8ft^3/s, the average is 10ft^3/s and its upper 95th confidence interval is 10.5 ft^3/s. This is about twice the design flow. BOD_5 is the amount of oxygen used to decompose the organic matter present in a water sample in a five-day period. The discharge in this calculation is the overall monthly average of all flows reported for April through October (10ft^3/s).

Non Point Source in this watershed consists of runoff from agricultural fields during rain events. Main ditch receives discharge from the Poplar Bluff WWTF (lagoon system) and from many irrigation drainage pipes. The flow and water quality from these drainage pipes are variable and difficult to quantify accurately. The drainage pipes discharge during wet season, rain events and during the dry season, when farmers irrigate their crops. The emphasis is to model the dry season because it is the critical period for aquatic life survival. Any runoff due to irrigation waters alone is conceptually represented in the model as a point source. These pipes are not regulated or permitted under the NPDES system. All significant sources have been considered at this time.

Allocation

Submittal identifies appropriate wasteload allocations for point, and load allocations for nonpoint sources. If no point sources are present the wasteload allocation is zero. If no nonpoint sources are present, the load allocation is zero.

Allocations of Main Ditch, receives discharge from the Poplar Bluff WWTF (lagoon system) and from many irrigation drainage pipes. The flow and water quality from these drainage pipes are variable and difficult to quantify accurately.

The QUAL2E model was calibrated to the simulation of flow, velocity, BOD, DO organic nitrogen, Ammonia nitrogen, nitrate and nitrite nitrogen, within the range of measured data for these parameters. The WLA's for BOD, VSS, and Ammonia-N were derived from adjusting the plant discharge in the model to the full design flow of 4.5 cfs. Because Main Ditch is a Class C stream at the outfall, lagoon effluent qualifies for a mixing zone as allowed in Missouri WQS (MO 10CSR 20-7.031(4)(A) 5.B. (II)(a)), therefore, a mixing zone applies to this TMDL. An additional test was done with the model with the application of winter conditions. The WLA concentrations are identified and will be incorporated in Poplar Bluff Waster Water Treatment Plant NPDES permit in the next permit reissurance.

WLA Comment

Waste load allocations (WLAs) for the city near poplar Bluff WWTP are as follows:

The facility has been operating above capacity in the last five years as indicated in the DMR data, the modeling simulation results are based on an average actual flow of $10ft^3/s$.

Load of 20 mg/L BOD-equivalent to 1079 lb/day of CBOD, (the old NPDES permit maximum daily limits were 45 mg/L BOD and monthly average limit 30 mg/L BOD).

Load of 5 mg/L VSS-equivalent to 270 lb/day, (the old NPDES permit maximum daily limits were 80 mg/L and average monthly limit of 120 mg/L TSS).

NH3-N (Ammonia as Nitrogen) is seasonal based upon summer and winter:
Summer: 1.7 mg/L NH3-N and 67 lb/day
Winter: 2.8 mg/L NH3-N and 110.60 lb/day

LA Comment

The load allocation (LA) is the maximum allowable amount of the pollutant that can be assigned to non-point sources. Because of the timing of data collection, only discharge from the irrigation pipes is represented. The LA contribution is relatively small when compared to that of the lagoon system. The LA's for non-point source are as follows: CBOD-69 lb/day, NH3-N-18 LB/day, and VSS-94 lb/day

Margin of Safety

Submittal describes explicit and/or implicit margin of safety for each pollutant. 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.

The MOS is implicit based upon the model assumptions and calculations. The limits for BOD, VSS, AND NH3-N were derived from QUAL2E simulation that considered a background DO concentration of 1mg/L instead of the lowest recorded levels of 4.3, 3.6, and 2.8 mg/L for August 2000, July 2002, and August 2002 respectively.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s).

Seasonal variation is taken into consideration for ammonia as nitrogen and a separate limit calculated for each summer and winter. Otherwise, the WWTP NPDES permit limits apply year long.

Public Participation

Submittal describes public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s).

The Missouri Department of Natural Resources (MDNR) placed this TMDL on public notice from August 5, 2005 to September 4, 2005, on MDNR's state website. Groups which received the public notice announcement include the Missouri Clean Water Commission, the Water Quality Coordinating Committee, the TMDL Policy Advisory Committee, Stream Team volunteers in the watershed (21 people) the appropriate legislators, Senator Robert Mayer, Representative Gayle Kingery, Representative Mike Dethrow, and Representative Otto Bean and others that routinely receive the public notice of Missouri State Operating Permits.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies the 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).

Periodic effluent and stream monitoring is required in Poplar Bluff WWTP permit and requires samples be taken from stream monitoring sites for the following parameters; DO, pH, Temperature, Ammonia, BOD and VSS will validate the adequacy of this calculation. In addition, low flow stream survey and biological assessment shall be performed one to two years following treatment facility construction TMDL implementation to properly link stream water quality and biocriteria to the proposed effluent limits and BMP activities in the watershed. MDNR routinely (about every five to seven years) monitors small streams that receive wastewater effluent from facilities that discharge at least 1 MGD.

Reasonable assurance

Reasonable assurance only applies when reductions in nonpoint source loading is required to meet the prescribed waste load allocations.

The Waste Load Allocations are set to meet quality standards; no reasonable assurances are required of the Load Allocation. MDNR will work with the City of Popular Bluff to discuss treatment plant upgrades and funding options and will issue a permit reflective of the water quality standards that must be met.