



EPA Region 7 TMDL Review

TMDL ID: IA 04-UDM-0010_2 **State:** IA
Document Name: DES MOINES RIVER

Basin(s): DES MOINES RIVER, UPPER DES MOINES RIVER BASIN

HUC(s): 07100004, 7100004

Water body(ies): DES MOINES RIVER, DES MOINES RIVER, DES MOINES

Tributary(ies): BEAVER CREEK, BLACK CAT CREEK, BOONE RIVER, BRUSHY CREEK, BUCK CREEK, BUFFALO CREEK, DRAINAGE DITCH 206, EAGLE CREEK, EAST FORK RIVER, JACK CREEK, LINDSEY CREEK, LITTLE EAGLE CREEK, LIZARD CREEK, LYON'S CREEK, OTTER CREEK, PILOT CREEK, PLUM CREEK, PRAIRIE CREEK, WHITE FOX CREEK

Pollutant(s): NITRATE

Submittal Date: 8/18/2009

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 TMDL document for Des Moines River was formally submitted by the Iowa Department of Natural Resources (IDNR) in a letter received by United States Environmental Protection Agency (EPA), Region 7, on August 18, 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 305(b) assessment report indicated that the designated drinking water use was impaired due to nitrate-nitrogen (nitrate) concentrations. The class "C" (drinking water) use was assessed as "not supporting" due to the levels of nitrate exceeding the state WQS and EPA's maximum contaminant level (MCL) of 10 milligrams per liter (mg/L). Concentrations of nitrate exceeded the 10 mg/L WQS approximately 16.4 percent of the time between 1995 and 2006. The LC is 10 mg/L of nitrate. The targeted nitrate concentration is 9.5 mg/L after applying the margin of safety (MOS). The WQS will be attained and the designated use supported once the 9.5 mg/L target is reached.

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 TMDL lists the Iowa standard as:
The applicable WQS for nitrate for class "C" designated use is the EPA MCL of 10 mg/L (IAC chapter 61).
Class "C" waters are to be protected as a raw water source of potable water supply.

Designated uses include:
Drinking water (class C)
Aquatic life (class B(WW-1))
Fish consumption (class HH)
Primary contact recreation (class A1)

The LC is 10 mg/L of nitrate. The target is 9.5 mg/L of nitrate with a MOS of 0.5 mg/L of nitrate, applied. The tier I WLA is 9.46 metric tons of nitrate per day (Mg/day). The tier II WLA is 3.95 Mg/day of nitrate. LA is expressed by load at a percent of flow range. At the 40-50 percent flow range the LA would be 29.6 Mg/day.

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 TMDL was calculated using a load duration curve analysis to assess the relation of measured daily loads to the WQS across a range of flow conditions. This approach was deemed appropriate because nitrate concentrations often vary by flow, tending to increase in concentration as stream flow discharge increases. There is a direct link between standard and target. The numeric standard of 10 mg/L of nitrate is the TMDL target. A five percent MOS (0.5 mg/L of nitrate) was applied to this target.

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.

Land cover in the Des Moines River watershed is predominantly agricultural, consisting of 78.5 percent row crops, 14.3 percent grass, 2.7 percent forest, 2.5 percent urban, and 1.9 percent water and wetlands.

Nitrate concentrations are influenced by both point and nonpoint sources. The point source contribution comes from 74 entities with National Pollution Discharge Elimination System (NPDES) permits in the Iowa portion of the Des Moines River watershed. There are also 17 NPDES permitted entities in the Minnesota portion of the watershed. There are three cities with Municipal Separate Storm Sewer Systems (MS4s). Four permitted facilities are concentrated animal feeding operations (CAFOs). A listing of all permitted and unpermitted facilities, permit numbers (where available) and WLA was given in the TMDL, Tables 3-4, 3-5, 3-6 and also in Appendix B.

Based on the information before us, the state's decision to apply the discharges associated with unpermitted sources to the LA, as opposed to the WLA for purposes of this TMDL is acceptable. The decision to allocate these sources to the LA does not reflect any determination by EPA as to whether these discharges are, in fact, unpermitted point source discharges within this watershed. In addition, by approving these TMDLs with some sources treated as LAs, EPA is not determining that these discharges are exempt from NPDES permitting requirements. If sources of the allocated pollutant in this TMDL are found to be, or become, NPDES-regulated discharges, their loads must be considered as part of the calculated sum of the WLA in this TMDL. WLA in addition to that allocated here is not available.

Sources accounted for, as nonpoint sources of Nitrate, for this TMDL include: contributions from agricultural land (fertilizers, soil mineralization, legume fixation and manure), developed land (urban and residential) and natural sources. Urban and residential contributions include septic systems and turf grass fertilizer. Natural sources include atmospheric deposition and wildlife.

Nonpoint sources of nitrate have been identified as the main cause of the drinking water impairment in the Des Moines River at Des Moines. Soil mineralization and nitrogen fertilizers are the largest sources of nitrogen in the Des Moines River watershed. Point sources, such as wastewater treatment plants (WWTP), urban runoff, and water treatment plants, are also likely contributors to the nitrate loads, but these sources play a less significant role.

Although water treatment plants are required to have an NPDES permit to discharge water into the Des Moines watershed (Iowa portion), only eight facilities have or have applied for an NPDES permit. Of the eight water treatment plants, their permit applications do not specify a nitrogen discharge limit. Available records indicate 55 additional municipal water systems in the Des Moines watershed (Iowa portion). The WLA of nitrogen discharge is required for all water treatment plants in the Des Moines River watershed. The nitrogen WLA for water treatment facilities in the Des Moines River watershed has been allocated as the total capacity for all combined facilities in the basin. The total WLA for water treatment plants in the Iowa portion of the Des Moines River watershed that do not currently have NPDES permits or where permits are pending, is 120.7 pounds per day (lbs/day) or 0.055 Mg/day of nitrate.

Unsewered communities are considered a nonpoint source in this TMDL and as such, their nitrate loads have been allocated in the LA. To accommodate potential nitrogen discharge from future WWTPs, additional waste load capacity is reserved. There are currently 22 unsewered communities in the Des Moines watershed.

NPDES MS4 permits do not assign numeric limits. The TMDL does assign WLA for these cities, which were determined using output from a watershed-based hydrologic model, the area of the city within the sub-basin and the TMDL target concentration. The WLAs are: Grimes is 24 lbs/day of nitrate, Johnston is 100 lbs/day of nitrate, and Des Moines is 255 lbs/day of nitrate.

Point sources associated with WWTPs do not contribute substantially to the nitrate impairment for the Des Moines River at 2nd Avenue. There are no nitrate exceedances at lower flows in the river (flows less than 742 cubic feet per second (cfs), or lowest 30 percent of flows). Lower flows would be the time when impacts from WWTP's are most evident if they were to occur. The lowest flow measured in the Des Moines River at 2nd Avenue with a nitrate load above the TMDL target was 953 cfs. At no time did a nitrate impairment occur when the stream flow was less than 953 cfs. To ensure that low flows in the river are adequately protected from potential point source impacts, a two-tiered system of WLAs was established. Tier 1 waste loads are applied to WWTPs when stream flow in the Des Moines River at 2nd Avenue is greater than 742 cfs. Tier 1 waste loads are set to the maximum daily nitrate load. Tier 2 waste loads are applied when flows are less than 742 cfs. Tier 2 waste loads are set to the average daily nitrate load. Stream flow less than 742 cfs represents the cutoff for the lowest 30 percent of flows. The waste load estimates were conservative and represented the "worst-case"

condition of daily nitrate loads from the WWTP point sources. The waste load estimates assumed that all total kjeldahl nitrogen (TKN) entering the plant was leaving the plant as nitrate, no losses were considered (stream or facility). Should all WWTPs discharge the maximum allowable limit, on the same day, during stream flows greater than 742 cfs, there would not be a nitrate exceedance at the 2nd Avenue intake. Even though nitrate exceedances have not occurred at stream flows less than 742 cfs, establishing the tier 2 waste load provides reasonable assurance for future compliance.

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 TMDL was calculated using a load duration curve analysis to assess the relation of measured daily loads to the WQS across a range of flow conditions. The numeric standard of 10 mg/L of nitrate is the TMDL target. A five percent MOS (0.5 mg/L of nitrate) was applied to this 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 total WLA for WWTPs at tier 1 is 17,906.6 lbs/day. The total WLA for WWTPs at tier 2 is 5,757.7 lbs/day.

The total WLA for NPDES permitted livestock animal feeding operations in the Des Moines River watershed is zero in accordance with IAC Chapter 65.

The sum WLA for the MS4s is 379 lbs/day or 0.172 Mg/day.

The WLA for all water treatment plants (including the permitted ones) is 2,326.5 lbs/day or 1.055 Mg/day of nitrate.

The reserved capacity for unsewered communities is a WLA of 239.8 lbs/day or 0.109 Mg/day of nitrate.

The sum of all WLAs for the Des Moines River at 2nd Avenue at tier 1 is 20,851.9 lbs/day. The sum of all WLAs for the Des Moines River at 2nd Avenue at tier 2 is 8,703 lbs/day.

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.

Nonpoint sources are contributing to the majority of the nitrate impairment in the Des Moines River measured at 2nd Avenue. Because the daily nitrate load varies by flow, the LA will also vary by flow. The LA is set to be the difference between the TMDL target of 10 mg/L of nitrate and the sum of the WLA and the MOS. Nonpoint source nitrate loads require a reduction of 34.4 percent for all daily nitrate loads to be less than the TMDL target of 9.5 mg/L with the MOS applied. An example LA at the 40-50 percent flow range is 29.6 Mg/day of nitrate.

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 is both explicit and implicit in the TMDL. An explicit MOS of five percent (0.5 mg/L) was used for the 10 mg/L TMDL target. The nitrate TMDL target minus the MOS is 9.5 mg/L (10 mg/L - 0.5 mg/L MOS). The MOS is reinforced through conservative assumptions implicit in the representation and modeling of point and nonpoint sources. For example, the point source contributions were calculated using many conservative assumptions that over estimate the point source contributions. The point source loads were based on TKN concentrations, not nitrate, and thus over estimated pollutant discharge concentrations. Estimates based on population do not consider denitrification losses that occur during the treatment process and thus over estimate point source loads. Nonpoint source contributions were calculated using conservative assumptions such as over estimating septic system failure.

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 in nitrate loads in the Des Moines River 2nd Avenue was evaluated using the load duration curve that accounted for seasonal and annual variations in stream flow. Nitrate loads were evaluated by month. Nitrate concentrations exhibit clear seasonality, with higher concentrations occurring during April, May, and June as well as November and December. Seasonal variation was also considered when allocating the WLA for all WWTPs. To ensure that low flows in the river are adequately protected from potential point source impacts, a two-tiered system of WLAs was established. The waste load estimates were conservative and represented the "worst-case" condition of daily nitrate loads from the WWTP point sources.

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)].

In the early stages of the TMDL development, a meeting was held at the Des Moines Botanical Center on December 13, 2006. The draft TMDL document was posted on the IDNR website on June 4, 2009 and comments were accepted until July 6, 2009. A public meeting was held on June 24, 2009 in Johnston, Iowa. IDNR received six comments on the draft TMDL document. The comments and IDNR's response letters are included in Appendix C of the TMDL document.

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].

Several entities conduct water flow and quality monitoring in the Des Moines River. Major ongoing monitoring programs are associated with: United States Geological Survey stream gaging, Des Moines Water Works (Second Avenue), ambient water quality monitoring by IDNR, river monitoring by United States Army Corps of Engineers (through Iowa State University) and ambient water quality monitoring by Agriculture's Clean Water Alliance.

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.

Reasonable assurances for the reduction of nonpoint source loading is given by the availability of technical and financial assistance for conservation practices and watershed improvement grants. Funding made available to local stakeholder groups on an annual basis provides an opportunity for local citizens and landowners to seek their own solutions with technical guidance from state and local government agencies. Increased reductions in nonpoint source loads are not being required in lieu of less stringent WLAs so reasonable assurances are not required.