



## EPA Region 7 TMDL Review

**TMDL ID:** IA 05-PLA-00335-L\_0

**State:** IA

**Document Name:** LAKE OF THREE FIRES

**Basin(s):** SOUTHERN IOWA RIVER BASIN

**HUC(s):** 10240013

**Water body(ies):** LAKE OF THREE FIRES

**Tributary(ies):** UNNAMED INTERMITTENT STREAMS

**Pollutant(s):** E. COLI

**Submittal Date:** 4/13/2010

**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 submitted for approval by the Iowa Department of Natural Resources (IDNR) in a letter dated April 13, 2010, and received by the U.S. Environmental Protection Agency (EPA) on April 19, 2010. A conference call was made to discuss modeling issues on December 15, 2010. A revised version of the TMDL was submitted by email on December 28, 2010. A final revised TMDL was submitted by email on January 4, 2011.

### 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.*

Lake of Three Fires is impaired based on the results of monitoring for the indicator bacteria (*Escherichia coli* [*E. coli*]) - (1) the geometric means (geomeans) of 13 thirty-day periods during the summer recreation seasons of 2004, 2005 and 2006 exceeded the Iowa WQS of 126 *E. coli* organisms per 100 milliliters (ml) and (2) the percentage of samples exceeding Iowa's single sample maximum (SSM) criterion (235 *E. coli* organisms per 100 ml) was significantly greater than 10 percent in the 2004 recreation season (29 percent). The LC is expressed with a load duration curve (LDC), which uses stream discharge and a WQS target to define the LC at all percentiles of flow exceedance (or recurrence). The LCs for both geomean and SSM values for each of the individual impaired segments are given in the table as follows. These LCs will result in the achievement of WQS in the targeted water body.

Water Body ID	Flow Condition (percent recurrence)	LC (Geomean) (organisms/day)	LC (SSM) (organisms/day)
IA 05-PLA-00335-L_0	High Flow (0-10)	6.3E+10	1.2E+11
	Moist (10-40)	2.7E+10	5.0E+10
	Mid-Range (40-60)	1.4E+10	2.5E+10
	Dry (60-90)	4.9E+09	9.2E+09
	Low Flow (90-100)	6.2E+08	1.2E+09

### 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 WQS for the impaired lake covered by this TMDL is given in the table below.

Water Body ID	Designated Uses	Impaired Use	<i>E. coli</i> Criteria
IA 05-PLA-00335-L_0	Class A1, Class B(LW), Class C, Class HH	Class A1	126 organisms/100 ml (Geomean) 235 organisms/100 ml (SSM)  Primary Contact Recreation Period: March 15 to November 15

Lake of Three Fires has been on the Iowa 303(d) List for impaired Class A1 (primary contact recreation) use since 2006.

### 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 WQS for *E. coli* bacteria are set, based on both the geometric mean (geomean) of 126 *E. coli* organisms per 100 ml and the SSM concentration of 235 *E. coli* organisms per 100 ml; these are direct measures. The point source WLA in this TMDL is given as zero pounds per day (lb/day) because there are no permitted facilities located in the watershed. The LA is set at the remainder of the TMDL loading curve after removing allowances for the WLA and MOS.

Nonpoint sources (including natural sources) have been identified to be contributing to the bacteria loads being delivered to Lake of Three Fires. During the summer recreation seasons from 2004 to 2006 there were 13 excursions to the bacteria geometric mean criterion; 8 of 10 geometric means were exceeded in 2004, 0 of 8 geometric means were exceeded in 2005 and 5 of 23 geometric means were exceeded in 2006. In addition, the percentage of samples exceeding Iowa's SSM criterion was significantly greater than 10 percent in the 2004 recreation season (29 percent) while the percentages of samples exceeding the SSM in 2005 (17 percent) and 2006 (11 percent) were not significantly greater than 10 percent.

One of the IDNR's assessment methods of evaluating pathogen indicator criteria is that if 10 percent or more of samples exceed the *E. coli* criterion then the water body is considered not supporting recreational use. To estimate existing bacteria loads, the 90th percentile of observed bacteria concentrations within each flow condition determined by a LDC is multiplied by the median flow for each condition. The EPA Bacteria Indicator Tool (BIT) model is used to estimate the maximum bacteria load available for wash off by land use. However, only a fraction of the bacteria available for wash off is actually delivered to the lake. This fraction delivered by precipitation is the existing load during runoff conditions. To meet the SSM standards, there are two flow conditions that require a load reduction; 85 percent reduction at the high flow condition and 41 percent reduction at the moist flow condition. To meet the geomean standards, bacteria load reductions required are 92 percent at the high flow condition, 69 percent at the moist condition, 13 percent at the mid-range flow condition, 41 percent at the dry flow condition and 10 percent at the low flow condition.

### 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 two types of bacteria sources that are evaluated for TMDL development are point and nonpoint sources. Point sources are permitted discharges that are usually municipal wastewater treatment facilities. The second category is nonpoint sources that include all other discharges. Nonpoint sources are usually of a diffuse nature such as runoff from agricultural areas.

There are no permitted point sources in the Lake of Three Fires watershed. The state park has a relatively new wastewater collection and treatment system that discharges downstream of the lake. Construction was completed and it began operation in 2000. The facility includes a two-celled aerated lagoon and two lift stations that receive wastewater from six cabins, two bath houses, a dump station and the park ranger's house. This facility is not a bacteria source since wastewater is collected, treated and discharged downstream of the lake.

Though there are no concentrated animal feeding operation (CAFO) sites identified in the watershed, any CAFO that does not obtain a National Pollutant Discharge Elimination System (NPDES) permit must operate as a no discharge operation. Any discharge from an unpermitted CAFO is a violation of Section 301. It is EPA's position that all CAFOs should obtain an NPDES permit because it provides clarity of compliance requirements, authorization to discharge when the discharges are the result of large precipitation events (e.g., in excess of 25-year and 24-hour frequency/duration) or are from a man-made conveyance. However, many large CAFOs (mostly the poultry and swine sectors) contend that they do not discharge and therefore are not required to obtain an NPDES permit. It is EPA's opinion that many of the "no discharge" CAFOs may not have adequate land application area to ensure the agronomic uptake of land applied waste or are not designed, constructed, operated or maintained so that they will not discharge. Furthermore, there are many animal feeding operations (AFOs) that meet the definition of a medium CAFO (i.e., discharge via a man-made conveyance) but are unpermitted and have not limited their impact on waters by applying Best Professional Judgment to effluent reductions, pursuant to a permit.

AFOs and unpermitted CAFOs are considered under the LA because there is currently not enough detailed information to know whether these facilities are required to obtain NPDES permits. This TMDL does not reflect a determination by EPA that such facility does not meet the definition of a CAFO nor that the facility does not need to obtain a permit. To the contrary, a CAFO that discharges has a duty to obtain a permit. If it is determined that any such operation is a CAFO that discharges, any future WLA assigned to the facility must not result in an exceedance of the sum of the WLAs in this TMDL as approved.

In the absence of a NPDES permit, the discharges associated with sources were applied to the LA, as opposed to the WLA for purposes of this TMDL. 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 establishing this TMDL 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 WLAs in this TMDL. WLA in addition to that allocated here is not available.

Nonpoint sources of *E. coli* in the lake and watershed originate from the feces of warm blooded animals. In Lake of Three Fires the sources are (1) wildlife (primarily geese and deer in the park), (2) horses on the park trails and in the equestrian campground, (3) grazing animals in pastures, (4) cattle manure directly deposited in tributary streams, (5) land application of manure and (6) faulty septic tank systems in the watershed. These six nonpoint source categories listed above have been evaluated for their potential for lake bacteria contamination. These assessments have been integrated into the source model (i.e., BIT) that quantifies bacteria sources and their potential to contribute to the impairment.

The Lake of Three Fires watershed is divided into two subwatersheds to characterize potential bacteria sources. The first is the area near the lake and is designated as the Lakeshore subwatershed. It is the forested land use and most of it is contained in the state park. The Lakeshore subwatershed is 681 acres; the bacteria sources are wildlife and horses in the state park. The second subwatershed is the Three Fires subwatershed and consists of 2,843 acres of land and 102 acres of water (ponds, settling basins, streams). The total watershed area for this subwatershed is 2,945 acres. The sources here are primarily grazing cattle on pastureland and wildlife on all land uses. The detailed source evaluations for these subwatersheds can be found in Appendix D.

All known 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.

LCs were given for Lake of Three Fires, which were carefully addressed in this TMDL document. WLAs were set at zero because there are no NPDES facilities located in the watershed. LAs were calculated as the difference between the TMDL and the WLA + MOS. The MOS is an explicit load of 10 percent of the TMDL load. The LCs for the impaired lake are given in the table shown below.

Water Body ID	Flow Condition (% recurrence)	<i>E. coli</i> bacteria (Geomean) (organisms/day)	<i>E. coli</i> bacteria (SSM) (organisms/day)
IA 05-PLA-00335-L_0	High Flow, 0-10	6.3E+10	1.2E+11
	Moist, 10-40	2.7E+10	5.0E+10
	Mid-Range, 40-60	1.4E+10	2.5E+10
	Dry, 60-90	4.9E+09	9.2E+09
	Low Flow, 90-100	6.2E+08	1.2E+09

### 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 Lake of Three Fires watershed. The state park has a relatively new wastewater collection and treatment system that discharges downstream of the lake. Construction was completed and it began operation in 2000. The new facility includes a two-celled aerated lagoon and two lift stations that receive wastewater from six cabins, two bath houses, a dump station, and the park ranger's house. This facility is not a bacteria source since wastewater is collected, treated and discharged downstream of the lake. For this TMDL, the WLA is zero 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.

The LA is set by  $LA = TMDL - WLA - MOS$ . The LAs for the impaired lake are given in the table shown below.

Lake ID	Flow Condition (% recurrence)	<i>E. coli</i> bacteria (Geomean) (organisms/day)	<i>E. coli</i> bacteria (SSM) (organisms/day)
IA 05-PLA-00335-L_0	High Flow, 0-10	5.7E+10	1.1E+11
	Moist, 10-40	2.4E+10	4.5E+10
	Mid-Range, 40-60	1.2E+10	2.3E+10
	Dry, 60-90	4.4E+09	8.3E+09
	Low Flow, 90-100	5.5E+08	1.0E+09

### 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.

This bacteria TMDL has an explicit MOS of 10 percent for both the geometric mean (126 *E. coli* organisms/100 ml) and the single sample maximum (235 *E. coli* organisms/100 ml) targets during the primary contact recreation period from March 15 to November 15. The MOS for the impaired lake are given in the table shown below.

Lake ID	Flow Condition (% recurrence)	<i>E. coli</i> bacteria (Geomean) (organisms/day)	<i>E. coli</i> bacteria (SSM) (organisms/day)
IA 05-PLA-00335-L_0	High Flow, 0-10	6.3E+09	1.2E+10
	Moist, 10-40	2.7E+09	5.0E+09
	Mid-Range, 40-60	1.4E+09	2.5E+09
	Dry, 60-90	4.9E+08	9.2E+08
	Low Flow, 90-100	6.2E+07	1.2E+08

### 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.*

Seasonality and any critical conditions have been addressed in the submittal. This TMDL was developed using the LDC analysis and BIT model, based on the Iowa WQS primary contact recreation period from March 15 to November 15. Five flow conditions, including the critical low flows, were addressed in the LDC analysis. Because the primary contact recreation season was incorporated in the analysis, this TMDL has also evaluated the seasonal variability of bacteria loads.

### 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 involvement is important in the TMDL process since it is the land owners, tenants and citizens who directly manage land and live in the watershed that will determine Lake of Three Fires water quality. During the development of this TMDL, efforts were made to ensure local stakeholder involvement.

Two public meetings (November 3, 2009 and March 15, 2010) were held to gather public/stakeholder comments and suggestions for the development of this TMDL. The meeting at Bedford Fire Station on March 15, 2010, was well attended with most people concerned with the horse trails. The IDNR staff discussed and explained the importance of establishing this TMDL. The draft TMDL was available on IDNR's Website during the public notice period from February 15 to March 29, 2010. During this period, one written comment was received and addressed through written communications.

EPA agrees there has been opportunity for meaningful public input to this TMDL.

### 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].*

Existing Lake of Three Fires monitoring consists of two programs supported by IDNR. In one program, the University of Iowa Hygienic Lab (UHL) collects three to six samples between April and October. These samples are analyzed for nutrients, suspended solids, temperature, pH, chlorophyll and transparency. The other effort is the beach monitoring program in which samples are collected weekly at the park's beach and analyzed for *E. coli*.

These two monitoring efforts provide the information used in the water quality assessment and currently form the foundation of Lake of Three Fires monitoring activities. This data is sufficient to assess lake water quality because, over time it can determine impairments. However, evaluation of pollutant sources, the impacts of implemented best management practices (BMPs), and water quality trends may require a comprehensive watershed monitoring coupled with detailed lake sampling.

### 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.*

States are not required under Section 303(d) of the CWA to develop TMDL implementation plans and EPA does not approve or disapprove them. However, IDNR included an implementation plan in this TMDL to provide information regarding how point and nonpoint sources can or should be controlled to ensure implementation efforts achieve the loading reductions identified in this TMDL. EPA recognizes that technical guidance and support are critical to determining the feasibility of and achieving the goals outlined in this TMDL. Therefore, discussion of reduction efforts relating to point and nonpoint sources can be found in the implementation section of the TMDL, and are briefly described below.

IDNR has the authority to issue and enforce state operating permits. Inclusion of effluent limits into a state operating permit and requiring that effluent and instream monitoring be reported to IDNR should provide reasonable assurance that instream WQS will be met. Section 301(b)(1)(C) requires that point source permits have effluent limits as stringent as necessary to meet WQS. However, for WLAs to serve that purpose, they must themselves be stringent enough so that (in conjunction with the water body's other loadings) they meet WQS. This generally occurs when the TMDL's combined nonpoint source LAs and point source WLAs do not exceed the WQS-based LC and there is reasonable assurance that the TMDL's allocations can be achieved.

Funding assistance for controlling nonpoint sources of bacteria loads are available, such as the Clean Water Act Section 319 grants. These grants will be used for implementing BMPs to reduce nonpoint bacteria sources. Some management practices can be identified for implementation. The primary focus needs to be on nearby sources in the Lakeshore sub-watershed. These sources include geese on the beach and nearby locations, deer throughout the forested park and horses in the equestrian campground and on park trails. Reductions in these loads will require changes in the way wildlife and horse manure are managed. BMPs for reducing pathogen indicators in the Lakeshore sub-watershed include: (1) reduce the geese numbers and time spent on and near the lake, especially the beach area; (2) remove goose feces from the beach area daily and remove it outside of the watershed; (3) reduce the deer population in the park; (4) slow down the runoff from the equestrian campground with detention basins in drainage ways; (5) remove horse manure from the equestrian campground outside of the watershed daily and (6) limit horses on trails near the lake and remove trail manure daily outside of the watershed.

There are other bacteria sources in the Three Fires subwatershed but distance, time, sedimentation basins, ponds, and wetlands dampen their impacts. These sources include the continuous septic tank, cattle in the streams, pasture and manure application that are available for washoff during rainy seasons. BMPs for reducing pathogen indicators in the Three Fires subwatershed include: (1) limit livestock access to waterways in pastures and provide alternate watering sources; (2) control manure in runoff using incorporation or subsurface application to physically separate fecal material from surface runoff; (3) place buffer strips along tributaries to slow and divert runoff and (4) repair or replace improperly connected and malfunctioning septic tank systems.

Below are objectives and a suggested schedule to reduce *E. coli* in Lake of Three Fires.

1. Identify, assess and rank the potential sources within a quarter mile of the lakeshore. Select BMPs for each source. Complete by May 2011.
2. Begin implementation of the BMPs by priority ranking for the sources identified in step 1. Reduce the identified source pathogen loading 25 percent by May 2012.
3. In 2012, begin the process of identifying, assessing and ranking watershed bacteria sources and selecting BMPs outward from the tributary streams in quarter-mile increments every year.