



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 7

11201 Renner Boulevard
Lenexa, Kansas 66219

13 JUL 2016

Ms. Sara Parker Pauley, Director
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, Missouri 65102

RE: Approval of TMDL document for Watkins Creek

Dear Ms. Pauley:

This letter responds to the submission from the Missouri Department of Natural Resources, received by the U.S. Environmental Protection Agency, Region 7, on January 7, 2015, for a Total Maximum Daily Load document which contained a TMDL for *Escherichia coli*. Watkins Creek was identified on the 2014 Missouri Section 303(d) List as impaired for *E. coli*. This submission fulfills the Clean Water Act statutory requirement to develop TMDLs for impairments listed on a state's § 303(d) List. The specific impairment (water body segment and pollutant) are:

<u>Water Body Name</u>	<u>WBIDs</u>	<u>Cause</u>
Watkins Creek	MO_1708	<i>Escherichia coli</i>

The EPA has completed its review of the TMDL document with supporting documentation and information. By this letter, the EPA approves the submitted TMDL. Enclosed with this letter is the Region 7 TMDL Decision Document which summarizes the rationale for the EPA's approval of the TMDL. The EPA believes the separate elements of the TMDL described in the enclosed document adequately address the pollutants of concern, taking into consideration seasonal variation and a margin of safety.

Although the EPA does not approve the monitoring or implementation plans submitted by the state, the EPA acknowledges the state's efforts. The EPA understands that the state may use the monitoring plan to gauge the effectiveness of the TMDL and determine if future revisions are necessary or appropriate to meet applicable water quality standards. The EPA recognizes that technical guidance and support are critical to determining the feasibility of achieving the goals outlined in this TMDL document. Therefore, the implementation plan in this TMDL provides information regarding implementation efforts to achieve the loading reductions identified.



The EPA appreciates the thoughtful effort that the MDNR has put into this TMDL. We will continue to cooperate with and assist, as appropriate, in future efforts by the MDNR to develop TMDLs.

Sincerely,



Karen A. Flournoy
Director
Water, Wetlands and Pesticides Division

Enclosure

cc: Mohsen Dkhili, MDNR



EPA Region 7 TMDL Review

TMDL ID: MO_1708

State: MO

Document Name: WATKINS CREEK

Basin(s): UPPER MISSISSIPPI-MERAMEC (CAHOKIA-JOACHIM RIVER BASIN)

HUC(s): 07140101

Water body(ies): WATKINS CR.

Tributary(ies): WATKINS CREEK

Cause(s): BACTERIA

Submittal Date: 1/7/2015

Approved: Yes

Submittal Letter and Total Maximum Daily Load Revisions

The state submittal letter indicates final TMDL(s) for specific pollutant(s) and water(s) were adopted by the state, and submitted to the 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 the EPA, date of receipt of any revisions and the date of original approval if submittal is a revised TMDL document.

The Missouri Department of Natural Resources submitted the TMDL document for Watkins Creek to the U.S. Environmental Protection Agency on January 7, 2015. In response to EPA comments dated February 9, 2015, the MDNR submitted revisions to the TMDL document in an email dated February 17, 2015.

Water Quality Standards Attainment

The targeted pollutant is validated and identified through assessment and data. 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. The TMDL(s) and associated allocations are set at levels adequate to result in attainment of applicable water quality standards [40 CFR § 130.7(c)(1)]. A statement that the WQS will be attained is made.

The 2014 section 303(d) list of impaired waters in Missouri was approved by the U.S. Environmental Protection Agency on August 26, 2014. The 303(d) list includes Watkins Creek, impaired by *Escherichia coli* bacteria, and cites urban runoff and storm sewers as likely sources of the impairment. The TMDL document addresses the Watkins Creek bacteria impairment by establishing a TMDL for *E. coli*. Data analyses conducted to support the listing and TMDL development indicate that *E. coli* bacteria are present in concentrations that result in exceedances of Missouri's water quality criterion for the whole body contact recreation category B designated use.

Data collected from Watkins Creek by the U.S. Geological Survey, the Missouri Department of Natural Resources and the Metropolitan St. Louis Sewer District show exceedances of the state's whole body contact recreation category B criterion of 206 *E. coli* counts per 100 milliliters of water. This assessment is based on the geometric mean of samples collected during the state's recreational season (April 1 through October 31). Bacteria data from Watkins Creek have been collected periodically since 1998. However, for TMDL purposes, only bacteria data collected from Watkins Creek within the last five years (2006 -2010) were used. These data are expected to be the most representative of the stream's current condition. Table 4 in the TMDL document, copied below, summarizes the bacteria data collected from Watkins Creek during the 2006 – 2010 recreation seasons. All available *E. coli* data collected from Watkins Creek, including any data collected outside the recreation season, are contained in Appendix A of the TMDL document.

**Recreation season *E. coli* summary data for Watkins Creek-WBID 1708
(2006 – 2010)***

<i>Year</i>	<i>Sampling Events</i>	<i>Geometric Mean</i>	<i>Criterion</i>	<i>Exceedance‡</i>
2006	2	70.70	206	--
2007	5	28.32	206	No
2008	6	133.34	206	No
2009	12	523.06	206	Yes
2010	5	262.34	206	Yes

* The units for all *E. coli* values are counts/100 mL of water.

‡ Years with fewer than five samples within the recreational season are not assessed against the whole body contact criterion.

Watkin's Creek loading capacity for *E. coli* is identified on the load duration curve developed by the TMDL document. The water quality standard for whole body contact recreation category B at any flow exceedance will be attained per the loading capacity established by the TMDL document. For example at the 75 percent flow exceedance, the loading capacity is 2.97E+09 counts per day.

The TMDL allocations for *E. coli* are set at levels adequate to attain all applicable WQS in Watkins Creek.

Designated Use(s), Applicable Water Quality Standard(s) and Numeric Target(s)

The submittal describes applicable water quality standards, including beneficial uses, applicable numeric and/or narrative criteria, and a numeric target. If the TMDL(s) 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 following designated uses for Watkins Creek are in the Missouri water quality standards at 10 CSR 20-7.031-Table H, and in the Missouri Use Designation Dataset (version 1) described at 10 CSR 20-7.031(1)(P). The MUDD includes the EPA approved use determinations:

- Livestock and wildlife protection
- Irrigation
- Protection and propagation of fish, shellfish and wildlife – warm water habitat
- Human health protection
- Secondary contact recreation
- Whole body contact recreation category B

The whole body contact recreation category B designated use for Watkins Creek is impaired by *E. coli* bacteria. Whole body contact recreation includes activities in which there is direct human contact with surface water that results in complete body submergence, thereby allowing accidental ingestion of the water as well as direct contact with sensitive body organs, such as the eyes, ears and nose. (Category A waters include water bodies that have been established as public swimming areas and waters with documented existing whole body contact recreational uses by the public. Category B applies to waters designated for whole body contact recreation, but are not contained within category A.)

In Missouri's water quality standards at 10 CSR 20-7.031(5)(C) and Table A, specific numeric criteria are given for the protection of the whole body contact recreation use. For category B waters, *E. coli* counts, measured as a geometric mean of at least five samples collected during the recreation season, shall not exceed 206 counts/100 milliliters of water. The state's recreational season is defined in 10 CSR 20-7.031(5)(C) being from April 1 to October 31.

The TMDL established for *E. coli* is protective of all the designated uses for Watkins Creek.

Pollutant(s) of Concern

A statement that the relationship is either directly related to a numeric water quality standard, or established using surrogates and translations to a narrative WQS is included. An explanation and analytical basis for expressing the TMDL(s) through surrogate measures, or by translating a narrative water quality standard to a numeric target is provided (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae). For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and a margin of safety that do not exceed the loading capacity. If the submittal is a revised TMDL document, there are refined relationships linking the load to water quality standard attainment. If there is an increase in the TMDL(s), there is a refined relationship specified to validate that increase (either load allocation or wasteload allocation). This section will compare and validate the change in targeted load between the versions.

Escherichia coli is found in the lower intestines of humans and warm-blooded animals. There are human and animal (such as pets, wildlife and livestock) sources of *E. coli* within the Watkins Creek watershed. In the monitoring and assessment of water quality, the *E. coli* count per 100 milliliter of water is used as an indicator of the potential presence of pathogenic bacteria or viruses in water bodies. Gastrointestinal, respiratory, eye, ear, nose, throat and skin infections may result from pathogen-contaminated water. To address these potential health risks, the TMDL document for Watkins Creek targets instream *E. coli* concentrations and loads. Using a numeric target for *E. coli* enables the use of available data and is consistent with Missouri's water quality standards.

There is a direct link between the *E. coli* TMDL target and the water quality standard using the numeric water quality criterion of 206 counts per 100 milliliters, applicable to Watkins Creek whole body contact recreation category B use. Missouri's water quality standards include the specific numeric *E. coli* water quality criterion of 206 *E. coli* counts per 100 mL of water, calculated as a geometric mean during the recreational season, for waters designated as whole body contact recreation category B. The concentration value of 206 counts/100 mL serves as the numeric target for the TMDL document. This concentration, multiplied by stream flow and a conversion factor, is used to establish a daily load that varies only with stream flows. The loading capacity is calculated using stream flow rates from April 1 to October 31, the water quality criterion and a conversion factor.

$$LC = \text{Flow} \times 206 \text{ counts} / 100 \text{ mL} \times C$$

Loading at or below the TMDL at a given flow exceedance along the load duration curve will result in attaining the state's whole body contact category B water quality criterion. Because the water quality standard for *E. coli* uses a geometric mean concentration, rather than a single sample bacteria concentration, individual bacteria measurements greater than the TMDL target do not in and of themselves result in an excursion of the water quality standard.

The LDC method is useful for identifying and differentiating pollutant loads between storm-driven runoff events and steady base-flow. The LDC provides a visual representation of stream flow conditions in which high pollutant concentrations have been observed, and helps assess critical conditions and estimate the level of pollutant load reductions necessary to meet the surface water quality targets in the stream.

Average daily flow data for Watkins Creek were directly available from May 9, 1997, to April 4, 2011, from the U.S. Geological Survey's gaging station USGS 07001985 Watkins Creek at Bellefontaine Neighbors, Missouri. Flow data from this gage were adjusted to the impaired watershed based on the ratio of the impaired watershed area to the gage drainage area of 5.19 square miles. A detailed discussion of the methods used to develop the bacteria LDC is presented in Appendix B of the TMDL document.

Source Analysis

Important assumptions made in developing the TMDL document, 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. The submittal demonstrates all significant sources have been considered. If this is a revised TMDL document any new sources or removed sources will be specified and explained.

In the absence of a national pollutant discharge elimination system permit, the discharges associated with sources were applied to the load allocation, as opposed to the wasteload allocation for purposes of this TMDL document.

The decision to allocate these sources to the LA does not reflect any determination by the EPA as to whether these discharges are, in fact, unpermitted point source discharges within this watershed. In addition, by establishing these TMDL(s) with some sources treated as LAs, the EPA is not determining that these discharges are exempt from NPDES permitting requirements. If sources of the allocated pollutant in this TMDL document 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 document. Any WLA in addition to that allocated here is not available.

St. Louis County covers an area of 523 square miles, and according to 2010 census data, has a population of 999,021 people. The population of the Watkins Creek watershed is not directly available; however, using U.S. Census Bureau census block data from 2010, the population of the Watkins Creek watershed is estimated to be approximately 17,040. Although portions of the population reside within unincorporated areas of St. Louis County, the U.S. Census Bureau categorizes the entire watershed area as an urban area. The EPA defines this urban area as an entity requiring storm water regulations through municipal separate storm sewer permits.

Land use calculations are based on data from 2000 to 2004 at 30-meter resolution obtained from Thematic Mapper imagery.

Land use in the Watkins Creek watershed

<i>Land Use Type</i>	<i>Acres</i>	<i>Square Miles</i>	<i>Percentage</i>
Impervious	292	0.46	7.00
High-Intensity Urban	28	0.04	0.68
Low-Intensity Urban	2,331	3.64	55.99
Row and Close-grown Crops	25	0.04	0.59
Grassland	753	1.18	18.08
Forest & Woodland	697	1.09	16.73
Herbaceous	2	0.00	0.04
Wetland	23	0.04	0.56
Open Water	14	0.02	0.33
Barren	0	0	0
Total:	4,165	6.51	100

Although the land use dataset categorizes specific areas as impervious, impervious areas exist in all the urban land use categories due to the presence of roads, parking lots, driveways and rooftops. The Metropolitan St. Louis Sewer District, which is a public agency responsible for management of wastewater and some storm water in the watershed, estimates the total imperviousness of the watershed to be approximately 23 percent. This amount of imperviousness in the watershed is significant as stream degradation associated with imperviousness has been shown to first occur at about 10 percent imperviousness and to increase in severity as imperviousness increases.

Following low-intensity urban, the second most abundant land use type in the watershed is grassland, which accounts for 18 percent of the watershed area. Because of the urban nature of the watershed, areas classified as grassland may include golf courses, cemeteries, parks and school playgrounds.

The Bissell Point wastewater treatment facility, permit number MO-0025178, is located about 5.5 miles south of the watershed. Although the treatment facility is located outside the watershed, the presence of the sewerage system infrastructure within the Watkins Creek watershed is a source of bacteria due to sewer overflows. Sanitary

sewer overflows are untreated or partially treated sewage releases from a sanitary sewer system. Overflows could occur for a variety of reasons including blockages, line breaks, sewer defects, lapses in sewer system operation and maintenance, inadequate sewer design and construction, power failures and vandalism. Sanitary sewer overflows can occur during either dry or wet weather and at any point within the collection system, including manholes. Such overflows are unpermitted and are not authorized by the federal Clean Water Act.

Four constructed sanitary sewer overflows are located within the watershed to relieve the sanitary sewers from excessive flow caused by inflow and infiltration of storm water during rainfall-runoff events. A U.S. Geological Survey study of the sources of *E. coli* in other metropolitan St. Louis area streams with similar climatic conditions, land use and bacteria sources as those found in the Watkins Creek watershed estimated that at least one-third of the measured, instream *E. coli* originated from humans. The study also indicated that there is a correlation between *E. coli* counts and the number of upstream sanitary sewer overflows. For these reasons, the constructed sanitary sewer overflows are considered significant potential contributors of *E. coli* to Watkins Creek.

In general, urban runoff has been found to carry high levels of bacteria and can be expected to cause exceedances of water quality criteria for bacteria in streams during and immediately after storm events. *Escherichia coli* contaminated runoff can come from both heavily paved areas and from open areas where soil erosion is common. For these reasons, urban runoff is a significant potential contributor of bacteria to Watkins Creek. As noted in the table copied below, there are two Municipal Separate Storm Sewer System permits in the Watkins Creek watershed. Municipal Separate Storm Sewer System permits authorize the discharge of urban storm water runoff.

Bacterial inputs to streams from urban runoff can be caused by sanitary sewer overflows as discussed previously, but also commonly results from residential and green space runoff carrying domestic and wild animal wastes. Birds, dogs, cats and rodents have been documented as sources of *E. coli* in urban storm water. The USGS study specific to the sources of *E. coli* in metropolitan St. Louis streams found that in addition to the one third of bacteria originating from human sources, 10 percent of the sampled *E. coli* was attributed as being from dogs and 20 percent from geese. Another component of urban runoff is runoff originating from highway corridors. The Federal Highway Administration published research showing that runoff from highway corridors may also contain bacteria. Sources of *E. coli* within highway areas identified in the study include bird droppings, soil and potentially vehicles carrying livestock and stockyard wastes.

In the Watkins Creek watershed, storm water runoff discharged from municipalities is regulated through two MS4 permits. Permit number MO-R040063 regulates MS4 discharges from the Missouri Department of Transportation rights-of-way, and permit number MO-R040005 regulates MS4 discharges from all other areas of the watershed. Bacterial contributions from MS4 permitted entities are precipitation dependent and vary with flow. The significance of any highway contributions of bacteria in the Watkins Creek watershed cannot be quantified in this TMDL document due to insufficient data. Contributions from these systems in the Watkins Creek watershed are expected to be low. Disaggregating the MS4 sources based solely on the area of each MS4 would assume bacterial contributions are equally proportional to the areas of each source, which may not be the case. For these reasons, the MS4 sources of the load cannot be accurately disaggregated. Future bacteria monitoring may provide more specific information regarding each MS4 area's actual contributions, including specific sources and mechanisms of transport, thereby allowing permits to be modified accordingly.

General (MO-G) and storm water (MO-R) permits in the Watkins Creek watershed*

<i>Permit No.</i>	<i>Facility Name</i>	<i>Discharge Type</i>	<i>Receiving Stream</i>	<i>Permit Expires</i>
MO-G350176	Wolco, Inc.	Storm water	Tributary to Watkins Cr.	7/10/2017
MO-R040005	Metropolitan St. Louis Sewer District and co-permittee's Small MS4	Storm water	multiple	6/12/2013
MO-R040063	Missouri Dept. of Transportation Small MS4	Storm water	multiple	6/12/2013
MO-RA00021	Quick Trip #605	Storm water	Tributary to Watkins Cr.	2/7/2017
MO-RA00679	Pier St. Louis	Storm water	Tributary to Watkins Cr.	2/7/2017
MO-RA00873	Family Dollar	Storm water	Tributary to Watkins Cr.	2/7/2017
MO-RA01178	Hazelwood East High School	Storm water	Tributary to Watkins Cr.	2/7/2017

* Permitted dischargers in the Watkins Creek watershed on October 2, 2012. Municipal separate storm sewer systems have multiple outfalls and discharge to multiple receiving streams.

For the non-MS4 storm water permits located in the watershed, the Missouri Department of Natural Resources assumes storm water-related activities are conducted in compliance with all permit conditions, including discharge limitations and monitoring. It is expected that compliance with these permits will result in bacterial loadings at or below applicable targets and these facilities are not expected to contribute to the bacterial impairment of Watkins Creek. If at any time the department determines that the water quality of streams in the watershed is not being adequately protected, the department may require the owner or operator of the permitted facility to obtain a site-specific operating permit per 10 CSR 20-6.010(13)(C).

Typical nonpoint sources of *E. coli* and other pollutants that have the potential to affect water quality are associated with runoff from agricultural lands, unregulated urban storm water, onsite wastewater treatment systems and conditions in riparian corridors.

Storm water runoff from lands used for agricultural purposes is often a source of bacterial loading to water bodies. Activities associated with agricultural land uses that may contribute bacteria to a water body include manure used for fertilizing croplands or pastures, and livestock grazing. As noted in the TMDL document, cropland accounts for less than 1 percent of the entire watershed area, and therefore it is not likely a significant contributor of the bacterial impairment of Watkins Creek.

Bacterial inputs to Watkins Creek from livestock are also likely insignificant. Although 18 percent of the watershed is classified as grassland, much of this area includes golf courses, cemeteries, parks or schoolyards where livestock animals are not likely to be grazing. In most instances, zoning regulations prohibit livestock throughout much of the watershed. However, certain areas, primarily restricted to the northeast portion of the watershed in the unincorporated areas of St. Louis County, are zoned as non-urban areas where dairy farming and domestic animal farming are allowed. These types of farm activities may also occur in areas that are not currently zoned as non-urban areas if the activities existed prior to 1965 when the zoning regulations were established. Despite the fact that pre-existing agricultural livestock practices are allowed, an analysis using U.S. Department of Agriculture 2007 Census of Agriculture data show no livestock numbers within the watershed and

no operations of these types are known to exist. Despite there being no agricultural livestock operations in the watershed, individual residences with private stables housing one to two horses have been observed.

Although livestock sources and animal feeding operations appear to be insignificant or non-existent in the Watkins Creek watershed, any concentrated animal feeding operation that does not obtain an National Pollutant Discharge Elimination System permit must operate as a no discharge operation. Any discharge from an unpermitted Concentrated Animal Feeding Operation is a violation of Section 301 of the Clean Water Act. It is the 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 such as in excess of the 25-year and 24-hour frequency/duration event or are from a man-made conveyance. However, many large CAFOs contend that they do not discharge and therefore are not required to obtain an NPDES permit. It is the 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 likely many animal feeding operations 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.

Animal feeding operations and unpermitted CAFOs are considered under the load allocation because there is currently not enough detailed information to know whether these facilities are required to obtain NPDES permits. This TMDL document does not reflect a determination by the EPA that such a 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 or proposes to discharge 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 the TMDL document as approved.

When properly designed and maintained, onsite wastewater treatment systems (e.g., home septic systems) should not be sources of contamination of surface waters; however, onsite wastewater treatment systems do fail for a variety of reasons. When these systems fail hydraulically (surface breakouts) or hydrogeologically (inadequate soil filtration), there can be adverse impacts to surface water quality. Failing onsite wastewater treatment systems are known to be sources of bacteria, which can reach nearby streams through both surface runoff and groundwater flows, thereby contributing bacteria loads under either wet or dry weather conditions. Onsite wastewater treatment systems may contribute bacteria to Watkins Creek either directly or as a component of MS4-permitted storm water.

The exact number of onsite wastewater treatment systems in the Watkins Creek watershed is unknown, however such systems are known to exist, especially in older areas of the county that were developed prior to the sewerage systems serviced by the Metropolitan St. Louis Sewer District. Although septic system installations and repairs within St. Louis County require a permit, the county database cannot distinguish between work pertaining to onsite wastewater treatment systems and work pertaining to sanitary sewers because they are classified the same. The Metropolitan St. Louis Sewer District maintains parcel and billing information that can be used to estimate the number of parcels in the watershed without a sewer connection. The majority of parcels in the watershed, approximately 89 percent, do have a sewer connection. Non-sewered or suspected non-sewered parcels in the watershed may include parcels with houses or other structures on them as well as parcels comprised entirely of green space. These parcels may have onsite wastewater systems on them. The Metropolitan St. Louis Sewer District confirms that about 3.6 percent of the parcels in the Watkins Creek watershed, approximately 197 parcels, are not connected to a sewer. However, it is not known if any onsite systems exist on these parcels. An additional 7 percent of the parcels in the watershed, approximately 376 parcels, are suspected of not having a sewer connection.

The EPA's Spreadsheet Tool for Estimating Pollutant Loads estimates the failure rate of onsite wastewater treatment systems in St. Louis County as being 39 percent. A more recent study conducted by the Electric Power Research Institute suggests that up to 50 percent of onsite wastewater treatment systems in Missouri may be failing. Despite the lack of specific data showing that onsite wastewater treatment systems are a significant problem in the Watkins Creek watershed, the available failure rate data suggest that onsite wastewater treatment systems in the watershed are potential contributors of bacteria to Watkins Creek either directly or as a component of MS4 storm water. However, due to the overall urban nature of the watershed, the number of onsite wastewater systems in the watershed is expected to be low.

Land uses within the riparian corridor likely contribute to the bacteria impairment of Watkins Creek. An analysis of the riparian corridor includes 30-meters extending out from each side of the stream included in the National Hydrography Dataset, 1 to 24,000-scale flowline. Land classified as low-intensity urban comprises

almost 46 percent of the riparian corridor. Runoff from low-intensity urban areas, such as residential areas, can contribute bacteria loading to a water body from pet or wild animal wastes. Vegetated areas categorized as forest and woodland account for over 37 percent of the Watkins Creek riparian corridor, while grassland accounts for 8 percent. In rural areas of the watershed, grassland areas may contribute higher bacterial loading than forest and woodland areas due to the presence of livestock. However, due to the highly urbanized environment of the Watkins Creek watershed, livestock inputs are not likely to be contributing significantly to the impairment by *E. coli* (and the grassland category of land use in the Watkins Creek watershed includes golf courses, parks, cemeteries and playgrounds).

Land use data for the Watkins Creek watershed riparian buffer, 30-meter

<i>Land Use Category</i>	<i>Acres</i>	<i>Square Miles</i>	<i>Percent</i>
Impervious	10.01	0.02	3.74
High-Intensity Urban	0.22	0.00	0.08
Low-Intensity urban	122.76	0.19	45.92
Row and close-grown crops	0	0	0
Grassland	22.02	0.03	8.24
Forest and woodland	99.41	0.16	37.19
Open water	4.00	0.01	1.50
Barren	0	0	0
Herbaceous	0	0	0
Wetlands	8.9	0.01	3.33
Total:	267.32	0.42	100.00

All known sources of the *E. coli* cause of impairment to Watkins Creek have been considered in the submitted TMDL document.

Allocation - Loading Capacity

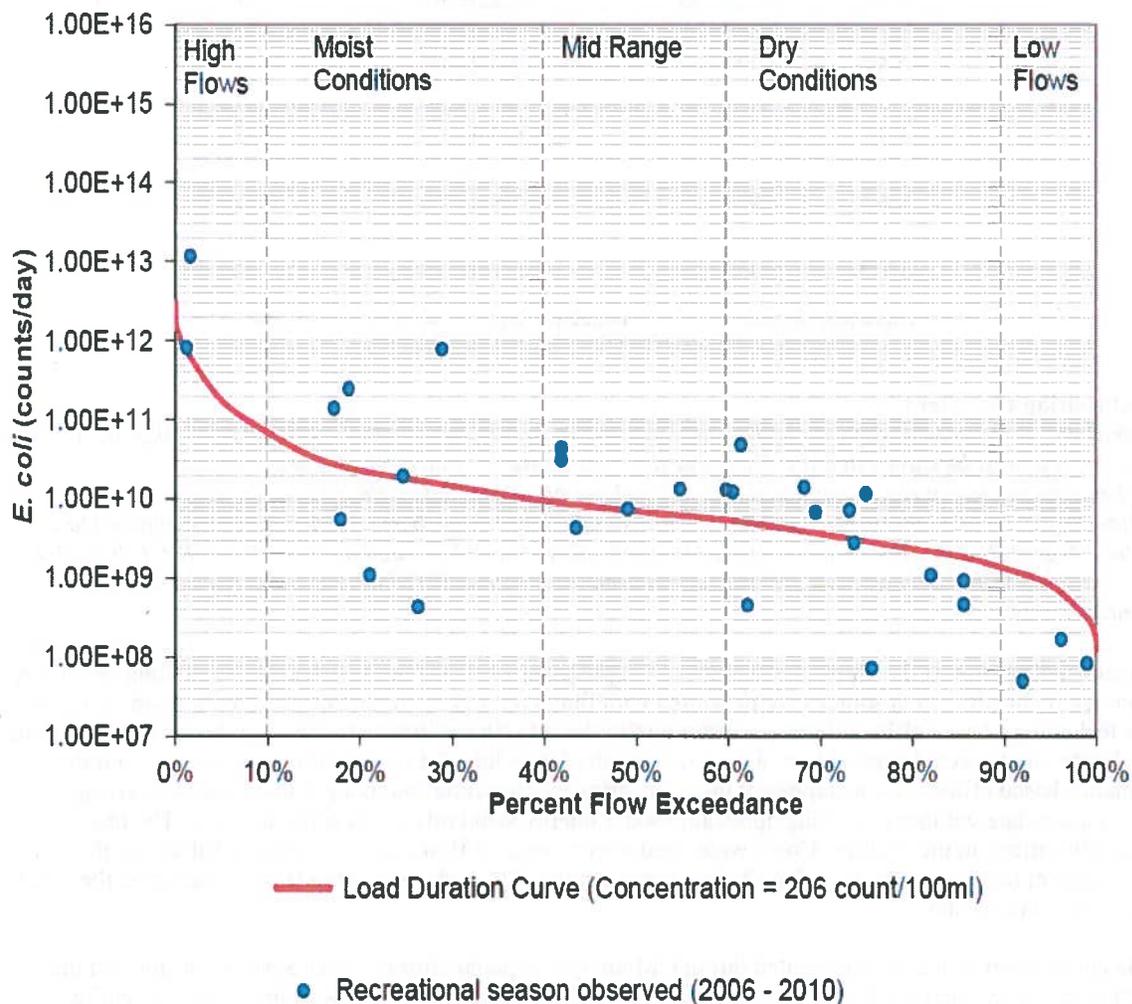
The submittal identifies appropriate loading capacities, wasteload allocations for point sources and load allocations for nonpoint sources. If no point sources are present, the WLA is stated as zero. If no nonpoint sources are present, the LA is stated as zero [40 CFR § 130.2(i)]. If this is a revised TMDL document the change in loading capacity will be documented in this section. All TMDLs must give a daily number. Establishing TMDL "daily" loads consistent with the U.S. Court of Appeals for the D.C. circuit decision in Friends of the Earth, Inc. v. EPA, et al., No. 05-5015, (April 25, 2006).

A TMDL calculates the loading capacity of a water body and allocates that load among the various pollutant sources in the watershed. The loading capacity is the maximum pollutant load that a water body can assimilate and still meet water quality standards. The LC is the sum of the wasteload allocation, load allocation and the margin of safety:

$TMDL = LC = \Sigma WLA + \Sigma LA + MOS$, where ΣWLA is the sum of the wasteload allocations, ΣLA is the sum of the load allocations, and MOS is the margin of safety.

For Watkins Creek, the bacteria TMDL is expressed as *E. coli* counts per day using a load duration curve. To develop the LDC, the TMDL target concentration is multiplied by the flow and a conversion factor to generate

the maximum allowable load at different flows. Figure 10 in the TMDL document, and copied below, is the bacteria TMDL duration curve calculated for Watkins Creek. The y-axis describes bacteria loading as counts per day, which are plotted against the flow duration intervals on the x-axis, which represent the frequency for which a particular flow is met or exceeded. The LDC represents the loading capacity as a solid curve over the range of flows. Bacteria data collected from Watkins Creek during the recreation season are charted as well. Flows in the figure illustrate general base-flow and surface storm water runoff conditions consistent with the EPA guidance on using the LDC method for TMDL development. The table below presents selected TMDL loading capacities and TMDL allocations for Watkins Creek at various flow exceedances along the LDC.



Selected *E. coli* TMDL values for Watkins Creek*

<i>Percentile Flow Exceedance</i>	<i>Flow (cfs)</i>	<i>TMDL (counts/day)</i>	<i>MS4 WLA (counts/day)</i>	<i>LA (counts/day)</i>
95	0.16	8.22E+08	8.22E+08	0
75	0.59	2.97E+09	2.97E+09	0
50	1.38	6.95E+09	6.95E+09	0
25	3.64	1.83E+10	1.83E+10	0
10	13.80	6.95E+10	6.95E+10	0

cfs = cubic feet per second; MS4 = municipal separate storm sewer system;
WLA = wasteload allocation; LA = load allocation

Wasteload Allocation Comment

The submittal lists individual wasteload allocations 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 a water quality standard excursion, the source is contained in a general permit addressed by the TMDL, or extenuating circumstances exist which prevent assignment of individual WLA. 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 revised TMDL document, any differences between the original TMDL(s) WLA and the revised WLA will be documented in this section.

The wasteload allocation is the allowable amount of the pollutant load that can be allocated to existing or future point sources. Typically, point sources are permitted with limits for a given pollutant that are the most stringent of either technology-based effluent limits or water quality-based effluent limits. Technology-based effluent limits are based upon the expected capability of a treatment method to reduce the pollutant to a certain concentration. Water quality-based effluent limits represent the most stringent concentration of a pollutant that a receiving stream can assimilate without exceeding applicable water quality standards at a specific location. The total wasteload allocations in the Watkins Creek watershed over a range of flows are presented in Table 7 of the TMDL document (and copied in the table above). For example, at the fifty percentile flow exceedance, the WLA is 6.95E+09 counts per day.

Since the entire watershed area is regulated through Municipal Separate Storm Sewer System permits and there are no other permitted facilities found to significantly contribute bacteria loads to Watkins Creek, the entire wasteload allocation is allocated to the MS4s in the watershed as an aggregated wasteload allocation. Thus, the WLA is zero for each of the non-MS4 permitted facilities in the watershed. The wasteload allocation in this TMDL do not preclude the establishment of future point sources of potential bacterial loading. Any future point sources and permit limits should be evaluated with respect to the TMDL document or any necessary revisions.

Load Allocation Comment

All nonpoint source loads, natural background and potential for future growth are included. If no nonpoint sources are identified, the load allocation must be given as zero [40 CFR § 130.2(g)]. If this is a revised TMDL document, any differences between the original TMDL(s) LA and the revised LA will be documented in this section.

The load allocation is the allowable amount of the pollutant load that can be assigned to nonpoint sources and includes all existing and future nonpoint sources, as well as natural background contributions. Nonpoint sources identified in this TMDL document to be potential contributors of bacteria include onsite wastewater treatment systems. If functioning properly, these systems should not be contributing to the impaired condition of Watkins Creek. Onsite wastewater treatment systems are assigned a load allocation of zero. Other nonpoint sources are considered minimal for the purposes of this TMDL and therefore no load allocations are assigned for these sources. Thus, the total load allocation for Watkins Creek is zero. No potential future growth of nonpoint sources

are likely in the watershed.

Margin of Safety

The submittal describes explicit and/or implicit margins of safety 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 revised TMDL document, any differences in the MOS will be documented in this section.

A margin of safety is required in the TMDL calculation to account for uncertainties in scientific and technical understanding of water quality in natural systems. The margin of safety is intended to account for such uncertainties in a conservative manner. Based on the EPA guidance, the margin of safety can be achieved through two approaches:

Explicit - Reserve a portion of the loading capacity as a separate term in the TMDL.

Implicit - Incorporate the margin of safety as part of the critical conditions for the wasteload allocation and the load allocation calculations by making conservative assumptions in the analysis.

The margin of safety for this TMDL is implicit due to conservative assumptions in the modeling of this TMDL, the use of multiple years of flow gage data collected under all flow conditions to create a robust TMDL calculation, and the reduced uncertainty of the sources of impairment and their remediation through the Metropolitan St. Louis Sewer District's consent decree. Additionally, bacteria decay rates weren't applied and the direct recreation-season geometric mean was used for estimating the Clean Water Act required daily loading value.

Seasonal Variation and Critical Conditions

The 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 the WQS. If this is a revised TMDL document, any differences in conditions will be documented in this section.

Missouri's water quality criteria for the protection of whole body contact recreation are applicable during the recreational season defined as being from April 1 to October 31. The TMDL load duration curve in Figure 10 of the TMDL document represents stream flow under all conditions and uses flow data collected in all seasons. For this reason, the *E. coli* targets and allocations established in this TMDL document will be protective throughout the recreation season and during flow conditions associated with storm driven flow events, including flows associated with seasonal rain patterns when bacteria loading is more likely. The advantage of a load duration curve approach is that all flow conditions are considered and the constraints associated with using a single-flow critical condition are avoided.

Implementation of the TMDL for *E. coli* during the critical recreational season will result in the year round protection of water quality and meet designated uses.

Public Participation

The submittal describes required public notice and public comment opportunities, and explains how the public comments were considered in the final TMDL(s) [40 CFR § 130.7(c)(1)(ii)].

A 45-day public notice and comment period for this TMDL document was held from June 1 to July 16, 2012. Comments received and the Missouri Department of Natural Resource's responses to those comments will be maintained on file with the department and on the Watkins Creek TMDL record webpage at <http://dnr.mo.gov/env/wpp/tmdl/1708-watkins-cr-record.htm>. In addition to this public notice and comment period, the department hosted a meeting to provide information to the public regarding the TMDL process and the overall goals of this and other bacteria TMDLs developed for impaired streams in St. Louis County. The public meeting was held on September 12, 2012, from 6 pm to 8 pm at the Daniel Boone Branch of the St. Louis County Library at 300 Clarkson Road in Ellisville. The meeting agenda, the department's presentation and an attendance sheet are available online on the Watkins Creek TMDL record webpage.

Due to comments received during the 2012 public comment period and revisions made to the state's water quality standards in 2014, changes to the TMDL were necessary. For this reason, a second public comment period was held for 90 days from May 23, 2014 to August 21, 2014. This public comment period included the Creve Coeur Creek TMDL as well as TMDL documents for Coldwater Creek, Fishpot Creek and Watkins Creek. Due to

requests from the Metropolitan St. Louis Sewer District and members of the Partnership for Tomorrow, this comment period was extended an additional 60 days to October 21, 2014. Members of the Partnership for Tomorrow include the Associated General Contractors of St. Louis, the Home Builders Association of St. Louis and Eastern Missouri, the Missouri Growth Association, the St. Louis Association of Realtors, the St. Louis County of Construction Consumers and the St. Louis Regional Chamber.

During the public comment period, the department met with groups who wanted to share their concerns regarding the TMDL document. The department met twice during the public comment period with the Metropolitan St. Louis Sewer District, once on July 22, 2014, and again on October 2, 2014. The department also met with the Missouri Department of Transportation during the public comment period on June 24, 2014, to discuss their concerns with the TMDL document and again on October 9, 2014 to discuss potential bacteria monitoring and implementation of the TMDL. A third meeting, requested in public comments submitted by the Metropolitan St. Louis Sewer District, was held with the district on December 30, 2014.

Groups that directly received the public notice announcement include the Missouri Clean Water Commission, the Missouri Water Quality Coordinating Committee, the Missouri Department of Conservation, the Missouri Department of Transportation, the St. Louis County Soil and Water Conservation District, St. Louis County Department of Health, St. Louis County Public Works, the University of Missouri Extension, the Greenway Network Inc., the Missouri Coalition for the Environment, the St. Louis County Council, the Metropolitan St. Louis Sewer District, developers of the Watkins Creek watershed management plan, Stream Team volunteers living in or near the watershed, the Missouri Stream Team Watershed Coalition, any affected permitted entities, the four state legislators representing areas within the watershed and any other individual or group who submitted comments during the first public comment period in 2012. For both public comment periods, the department posted the notice, the water body TMDL information sheets and the TMDL document on the department website, making them available to anyone with access to the Internet. Additionally, the department maintains an email distribution list via GovDelivery.com for notifying subscribers regarding significant TMDL updates or activities.

Monitoring Plan for TMDL(s) Under a 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 water quality standards, and a schedule for considering revisions to the TMDL(s) (where a phased approach is used) [40 CFR § 130.7]. If this is a revised TMDL document, monitoring to support the revision will be documented in this section. Although the EPA does not approve the monitoring plan submitted by the state, the EPA acknowledges the state's efforts. The EPA understands that the state may use the monitoring plan to gauge the effectiveness of the TMDLs and determine if future revisions are necessary or appropriate to meet applicable water quality standards.

Regular monitoring of recreational season bacteria counts in Watkins Creek occurred from April 2009 to October 2012 by volunteers trained in Cooperative Stream Investigation as part of the department's Volunteer Water Quality Monitoring Program. This water quality monitoring effort specified that bacteria sampling would be conducted once per month during the seven-month recreational season. No additional monitoring plans are currently scheduled for this water body.

In addition to the data collected as part of the Cooperative Stream Investigation monitoring, the department will also routinely examine water quality data collected by other local, state and federal entities in order to assess the effectiveness of TMDL implementation. These entities may include the U.S. Geological Survey, the EPA, the Missouri Department of Health and Senior Services, the Missouri Department of Conservation, county health departments and the Metropolitan St. Louis Sewer District. In addition, certain quality-assured data collected by universities, municipalities, private companies and other volunteer groups may potentially be considered for monitoring water quality following TMDL implementation.

Reasonable Assurance

Reasonable assurance only applies when less stringent wasteload allocation are assigned based on the assumption that nonpoint source reductions in the load allocation 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 Clean Water Act to develop TMDL implementation plans and the EPA does not approve or disapprove them. However, this TMDL document provides information regarding how point and nonpoint sources can or should be controlled to ensure implementation efforts achieve the loading reductions identified in this TMDL document. The EPA recognizes that technical guidance and support are critical to determining the feasibility of and achieving the goals outlined in this TMDL document. Therefore, the discussion of reduction efforts relating to point and nonpoint sources can be found in the implementation section of the TMDL document, and are briefly described below.

The states have 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 the state should provide reasonable assurance that instream water quality standards 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 wasteload allocations 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 load allocations and point source WLAs do not exceed the WQS-based loading capacity and there is reasonable assurance that the TMDL(s)' allocations can be achieved. Discussion of reduction efforts relating to nonpoint sources can be found in the implementation section of the TMDL document.

Section 303(d)(1)(C) of the federal Clean Water Act requires that TMDLs be established at a level necessary to implement applicable water quality standards. As part of the TMDL process, consideration must be given to the assurances that point and nonpoint source allocations will be achieved and water quality standards attained. Where TMDLs are developed for waters impaired by point sources, reasonable assurance is derived from the National Pollutant Discharge Elimination System, NPDES. The wasteload allocations for MS4s will be implemented through the NPDES MS4 permits with the ultimate goal to employ an iterative process using best management practices (BMPs) to the maximum extent practicable (MEP), assessment, and refocused BMPs to the MEP, leading toward attainment of water quality standards.

The consent decree established as part of the *United States of America and the State of Missouri, and Missouri Coalition for the Environment Foundation v. Metropolitan St. Louis Sewer District*, requires specific eliminations and reductions of point sources in the Metropolitan St. Louis Sewer District's service area, for which Watkins Creek is a part. This court-approved decree will provide an additional reasonable assurance of bacteria reductions in Watkins Creek from point sources over a 23-year period.

Much of the Watkins Creek watershed is serviced by the Metropolitan St. Louis Sewer District's Bissell Point wastewater treatment plant located about 5.5 miles south of Watkins Creek. Due to the availability of this sewer system and a St. Louis County ordinance requiring that a sewer connection to a building be made when a sanitary sewer line is within 200 feet of the property, many onsite wastewater system eliminations have been made. The consent decree also requires the implementation of a supplemental environmental project to decommission some septic tanks and repair or replace laterals to low-income residents within the Metropolitan St. Louis Sewer District's service area. This project could aid in reducing bacteria contributions from onsite wastewater systems within the watershed, however overall reductions are dependent upon availability of funding for this supplemental project. (Any references to the implementation of the supplemental environmental project shall include the following reference: "This project was undertaken in connection with the settlement of an enforcement action, *United States of America and the State of Missouri, and Missouri Coalition for the Environment Foundation v. Metropolitan St. Louis Sewer District*, No. 4:07-CV-1120-CEJ, taken on behalf of the U.S. Environmental Protection Agency, State, and the Coalition under the Clean Water Act".) Progress toward meeting water quality standards in Watkins Creek is expected to be long-term and will primarily be a continuation of current, ongoing or legally required activities, such as the consent decree mentioned above. The MDNR's stated intent for the implementation plan was to not impose any additional activities beyond those already being undertaken to satisfy existing regulations or legal requirements.

Storm water discharges of urban runoff within the entire Watkins Creek watershed are regulated through MS4 permits. For this reason, urban storm water runoff is considered a point source for this TMDL. Although storm water discharges are untreated, small MS4 permit holders must develop, implement, and enforce storm water management plans to reduce the contamination in storm water runoff and prohibit illicit discharges. These plans must include measurable goals, must be reported on annually, and must meet six minimum control measures. These six minimum control measures are public education and outreach, public participation and involvement, illicit discharge detection and elimination, construction site runoff control, post-construction runoff control and pollution prevention. Entities within the Watkins Creek watershed that are regulated under the MS4 permits include the Missouri Department of Transportation and the Metropolitan St. Louis Sewer District and its co-permittee, which in the Watkins Creek watershed include St. Louis County and the municipalities of Black Jack and Bellefontaine Neighbors.

A variety of grants and loans may be available to assist watershed stakeholders with developing and implementing watershed plans, controls and practices to meet the required load allocations in the TMDL document and demonstrate additional reasonable assurance.

