

TMDL SYNOPSIS**S.1 Impaired Waterbodies****State:** Kentucky**Major River Basin:** Kentucky River**USGS HUC8:** 05100205**Counties:** Fayette and Scott**Pollutant of Concern:** Fecal Coliform, *E. coli***Impaired Use:** Primary Contact Recreation, Secondary Contact Recreation**Suspected Sources:** Livestock (Grazing or Feeding Operations), Managed Pasture Grazing, Package Plant or Other Permitted Small Flows Discharges, Unspecified Urban Stormwater**Table S.1 Impaired Waterbodies Addressed in this TMDL Document**

Waterbody and Segment (GNIS⁽¹⁾ Number)	County	Support Status	Pollutant	Suspected Source(s)
Cane Run 0.0 to 3.0 (KY488799_01)	Scott	PCR (Nonsupport), SCR (Partial Support)	Fecal Coliform	Livestock (Grazing or Feeding Operations), Managed Pasture Grazing, Package Plant or Other Permitted Small Flows Discharges, Unspecified Urban Stormwater
Cane Run 3.0 to 9.6 (KY488799_02)	Scott	PCR (Nonsupport)	Fecal Coliform	Livestock (Grazing or Feeding Operations), Package Plant or Other Permitted Small Flows Discharges
Cane Run 9.6 to 17.4 (KY488799_03)	Fayette	PCR (Nonsupport), SCR (Nonsupport)	Fecal Coliform	Livestock (Grazing or Feeding Operations), Unspecified Urban Stormwater
UT to Cane Run at 6.13 RM ⁽²⁾ 0.0 to 3.5 (KY488799-6.13_01)	Scott	PCR (Nonsupport)	Fecal Coliform	Livestock (Grazing or Feeding Operations)
UT to Cane Run at 10.8 RM 0.0 to 2.4 (KY488799-10.8_01)	Scott	PCR (Nonsupport)	<i>E. coli</i>	Livestock (Grazing or Feeding Operations)

Waterbody and Segment (GNIS ⁽¹⁾ Number)	County	Support Status	Pollutant	Suspected Source(s)
UT to Cane Run at 12.9 RM 0.0 to 2.1 (KY488799-12.9_01)	Scott	PCR (Nonsupport)	<i>E. coli</i>	Agriculture, Unspecified Urban Stormwater
UT to Cane Run at 15.6 RM 0.0 to 0.9 (KY488799-15.6_01)	Scott	PCR (Nonsupport)	<i>E. coli</i>	Unspecified Urban Stormwater

⁽¹⁾ GNIS = Geographic Names Information System.

⁽²⁾ RM = River Mile.

S.2 TMDL Target (Numeric or Narrative)

Table S.2 TMDL Targets by Impaired Waterbody

Waterbody and River Mile (GNIS ⁽¹⁾ Number)	TMDL Target ⁽³⁾
Cane Run 0.0 to 3.0 (KY488799_01)	180 fecal coliform colonies/100ml expressed as a 30-day geometric mean as well as 360 colonies/100ml which must be met in at least 80% of all observations within a 30-day period (incorporating an implicit Margin of Safety)
Cane Run 3.0 to 9.6 (KY488799_02)	
Cane Run 9.6 to 17.4 (KY488799_03)	
UT to Cane Run at 6.13 RM ⁽²⁾ 0.0 to 3.5 (KY488799-6.13_01)	
UT to Cane Run at 10.8 RM 0.0 to 2.4 (KY488799-10.8_01) ⁽⁴⁾	
UT to Cane Run at 12.9 RM 0.0 to 2.1 (KY488799-12.9_01) ⁽⁴⁾	
UT to Cane Run at 15.6 RM 0.0 to 0.9 (KY488799-15.6_01) ⁽⁴⁾	

⁽¹⁾ GNIS = Geographic Names Information System.

⁽²⁾ RM = River Mile.

⁽³⁾ The TMDL Targets reflect the fecal coliform WQCs minus an implicit MOS.

⁽⁴⁾ Segments impaired for *E. coli* received allocations in terms of fecal coliform because the model was calibrated using fecal coliform data, and Kentucky has a dual standard for both fecal coliform and *E. coli* as shown in Section 2.1, thus development of TMDLs using the fecal coliform criterion are sufficient to provide TMDLs for *E. coli*-listed segments and vice versa.

S.3 TMDL Equation and Calculations:

According to EPA (1991), a TMDL calculation is performed as follows:

$$\text{TMDL} = \text{WLA} + \text{LA} + \text{MOS}$$

(Equation S.1)

The WLA has three components:

$$\text{WLA} = \text{SWS-WLA} + \text{MS4-WLA} + \text{Future Growth-WLA}$$

(Equation S.2)

Definitions:

TMDL: the WQC, expressed as a load.

MOS: the Margin of Safety, which can be an implicit or explicit additional reduction applied to sources of pollutants that accounts for uncertainties in the relationship between effluent limits and water quality. For this report, the MOS is implicit.

TMDL Target: the TMDL minus the MOS.

WLA: the Wasteload Allocation, which is the allowable loading of pollutants into the stream from KPDES-permitted sources, such as Sanitary Wastewater Systems (SWSs) and Municipal Separate Storm Sewer Systems (MS4s).

SWS-WLA: the WLA for KPDES-permitted sources which have discharge limits for pathogen indicators (including wastewater treatment plants, package plants and home units, which are referred to as Sanitary Wastewater Systems, or SWSs).

Future Growth-WLA: the allowable loading for future KPDES-permitted sources, including new SWSs, expansion of existing SWSs, new storm water sources, and growth of existing storm water sources (such as MS4s). Also includes the allocation for KPDES-permitted sources that existed but were not known at the time the TMDL was written.

Remainder: the TMDL minus the MOS and minus the SWS-WLA (also equal to Future Growth-WLA plus the MS4-WLA and the LA).

MS4-WLA: the WLA for KPDES-permitted Municipal Separate Storm Sewer Systems (MS4 permittees can include cities, counties, roads and right-of-ways owned by the Kentucky Transportation Cabinet (KYTC), universities and military bases).

LA: the Load Allocation, which is the allowable loading of pollutants into the stream from sources not permitted by KPDES and from natural background.

Seasonality: yearly factors that affect the relationship between pollutant inputs and the ability of the stream to meet its designated uses.

Critical Condition: the time period when the pollutant conditions are expected to be at their worst.

Critical Flow: the flow(s) used to calculate the TMDL as a load.

Existing Conditions: the load that exists in the watershed at the time of TMDL development (i.e., sampling) and is causing the impairment.

Load: concentration * flow * conversion factor.

Concentration: colonies per 100 milliliters (colonies/100ml).

Flow (i.e., stream discharge): cubic feet per second (cfs).

Conversion Factor: the value that converts the product of concentration and flow to load (in units of colonies/day); it is derived from the calculation of the following components: $(28.31685\text{L}/\text{ft}^3 * 86400\text{seconds}/\text{day} * 1000\text{ml}/\text{L})/(100\text{ml})$ and is equal to 24,465,758.4.

Calculation Procedure:

- 1) The MOS, if an explicit value, is calculated and subtracted from the TMDL first, giving the TMDL Target;
- 2) The SWS-WLA is calculated and subtracted from the TMDL Target, leaving the Remainder;
- 3) The Future Growth-WLA is calculated and subtracted from the Remainder;
- 4) If there is a MS4 present upstream of the impaired segment, the MS4-WLA is subtracted from the Remainder based on percent developed landcover within the MS4 permitted boundary, leaving the LA.

TMDL calculations for individual impaired waterbodies are shown in Table S.3. SWSs with discharges to Cane Run have SWS-WLAs as described in Table S.4.

Table S.3 Final TMDL Allocations

Subwatershed	TMDL (fecal coliform colonies/day) ⁽¹⁾	SWS-WLA (fecal coliform colonies/day) ⁽²⁾	MS4 Permittee	MS4-WLA (fecal coliform colonies/day) ⁽³⁾	Future Growth-WLA (fecal coliform colonies/day)	LA (fecal coliform colonies/day)
Cane Run 0.0 to 3.0	2.17E+12	0	Georgetown/ KYTC	2.83E+08	4.35E+10	2.12E+12
Cane Run 3.0 to 9.6	4.91E+12	0	Lexington/ Georgetown/ KYTC	1.98E+09	1.48E+11	4.76E+12
UT ⁽⁴⁾ to Cane Run at 6.13 RM ⁽⁵⁾ 0.0 to 3.5	1.36E+12	5.68E+08	None	0.00E+00	4.08E+10	1.32E+12
Cane Run 9.6 to 17.4	2.23E+12	0	Lexington/ KYTC	1.29E+10	1.11E+11	2.10E+12
UT to Cane Run at 10.8 RM 0.0 to 2.4	1.19E+12	0	Lexington/ KYTC	6.43E+07	2.38E+10	1.17E+12
UT to Cane Run at 12.9 RM 0.0 to 2.1	4.79E+11	0	Lexington/ KYTC	1.58E+09	2.40E+10	4.53E+11

Subwatershed	TMDL (fecal coliform colonies/day) ⁽¹⁾	SWS-WLA (fecal coliform colonies/day) ⁽²⁾	MS4 Permittee	MS4-WLA (fecal coliform colonies/day) ⁽³⁾	Future Growth-WLA (fecal coliform colonies/day)	LA (fecal coliform colonies/day)
UT to Cane Run at 15.6 RM 0.0 to 0.9	1.40E+11	0	Lexington/ KYTC	7.01E+09	7.00E+09	1.26E+11

⁽¹⁾ In the event that compliance with the WQC is determined using *E. coli* concentrations as opposed to fecal coliform concentrations, the final fecal coliform allocations can be converted to *E. coli* by multiplying by the figure (240/400) for instantaneous values, or by the figure (130/200) for the 30-day geometric mean value, assuming 5 or more samples are taken within a 30-day period. Note that these relationships only demonstrate how to convert the TMDL allocations from terms of fecal coliform to terms of *E. coli* based on the relationship between the fecal coliform WQC and the *E. coli* WQC: The actual relationship between fecal coliform and *E. coli* instream has been defined in Section 2.2.4.1 of the Modeling Report based on sampling data. However, the relationship given in Section 2.2.4.1 of the Modeling Report is an estimate, and will not be used to convert *E. coli* to fecal coliform (or vice versa) to demonstrate compliance.

The TMDL is defined as the sum of the Wasteload Allocations (WLAs), Load Allocations (LAs) and a Margin of Safety (MOS, which in this case is implicit). However, sources of bacteria change over time and the output of existing sources changes with time. Allocation shifts can be made between the sources within the WLA, and between sources within the LA after the TMDL is approved, but not between the LA and WLA without TMDL revision, public notice and EPA approval.

⁽²⁾ WLAs for the Sanitary Wastewater Systems (SWSs, e.g., Wastewater Treatment Plants (WWTPs)) discharging to a listed segment are equal to their permit limit times their design flow. These values were derived using the fecal coliform Water Quality Criterion (WQC) of 200 colonies/100ml calculated as a geometric mean using 5 or more samples collected within a 30-day period so the allocated load is in units of colonies/day. See Table S.4 for allocations for individual SWSs. According to 401 KAR 10:031, individual SWSs may be permitted to discharge either fecal coliform or *E. coli*; currently all SWSs in the Cane Run watershed are permitted in terms of *E. coli*. However, the SWSs were modeled as discharging fecal coliform so their output was consistent with the monitoring protocol used to develop the TMDL.

Although Concentrated Animal Feeding Operations (CAFOs) receive their allocations within the WLA, there are no permitted CAFOs present in the watershed. Any future CAFO cannot legally discharge to surface water, and therefore receives a WLA of zero. The only exception is holders of a CAFO Individual Permit can discharge during a 25-year or greater storm event.

⁽³⁾ Municipal Separate Storm Sewer Systems (MS4s) receiving aggregated MS4-WLAs include the City of Lexington (Permit Number KYS000002), the City of Georgetown (Permit Number KYG200040) and the Kentucky Transportation Cabinet (KYTC, Permit Number KYS000003).

⁽⁴⁾ UT = Unnamed Tributary.

⁽⁵⁾ RM = River Mile.

Table S.4 SWS-WLAs

Facility	KPDES Permit	Receiving Waterbody	Design Discharge (mgd ⁽¹⁾)	Permit Limit (fecal coliform colonies/100ml) ⁽²⁾	Wasteload Allocation (fecal coliform colonies/day)
Spindletop MHP	KY0081213	UT to Cane Run at 6.13 RM 0.0 to 3.5	0.030	200	2.27E+08
Ponderosa MHP	KY0081221	UT to Cane Run at 6.13 RM 0.0 to 3.5	0.016	200	1.21E+08
Maple Grove MHP	KY0083321	UT to Cane Run at 6.13 RM 0.0 to 3.5	0.029	200	2.20E+08

⁽¹⁾ mgd = millions of gallons per day.

⁽²⁾ While all Sanitary Wastewater System (SWS) facilities were modeled as discharging fecal coliform at the monthly geometric mean of 200 colonies/100ml, since the TMDL was begun in 2002 KDOW has been in the process of switching active permit holders from reporting in terms of fecal coliform to instead reporting in terms of *E. coli* when their permits became due for reissuance, therefore all facilities in the Cane Run watershed now report in terms of *E. coli*. However, it was necessary to report the WLA for all SWSs in terms of fecal coliform so their allocations were consistent with the monitoring protocol used to develop the TMDL. Although the WLA is in terms of fecal coliform, this does not change the permit limits for any given facility.

S.4 Translation of WLAs into Permit Limits

Draft S.4 Translation of WLAs into Permit Limits

WLAs for Sanitary Wastewater Systems (SWSs) were given in Table S.3. SWS-WLAs will be translated into KPDES SWS permit limits as an *E. coli* effluent gross limit of 130 colonies/100ml as a monthly average and 240 colonies/100ml as a maximum weekly average or as a fecal coliform effluent gross limit of 200 colonies/100ml as a monthly average and 400 colonies/100ml as a maximum weekly average.

KPDES permits for Municipal Separate Storm Sewer Systems (MS4) must also contain conditions that are consistent with the MS4-WLA [40 CFR 122.44(d)(1)(vii)(B)]. Because of the varying flow conditions associated with MS4 discharges and the fact that the MS4-WLA was set under a single modeling scenario, permit conditions should provide for an adaptive iterative approach via Best Management Practices (BMPs) outlined in the Stormwater Quality Management Plan (SWQMP) and implemented to the Maximum Extent Practicable (MEP).

Because MS4 loading inputs vary over time and with flow, the MS4-WLA values shown in the TMDL Summary Tables represent only one possible allocation scenario. The computed MS4-WLA should be viewed in this broader context of varying load and varying flow when evaluating the MS4's fractional contribution to total in-stream bacteria concentration. Consideration of stream assimilative capacity, use of pollutant trading or offset scenarios, MS4

pollutant load input variations for dry and wet weather, and BMP implementation and performance are some of the variables to consider when setting compliance goals.

The MS4 permit requires that upon completion of a TMDL for a receiving water to which the MS4 discharges, the SWQMP must be revised to identify specific, measureable, and enforceable actions to be taken, in the context of MEP, in the MS4's effort to attain the MS4-WLA identified in the TMDL.

While not all MS4 permits within the watershed currently call for monitoring as a requirement of the MS4 permittee based on an approved TMDL, KDOW plans to issue future MS4 permits in watersheds with approved TMDLs that will require MS4s to develop and implement a monitoring program to measure the effectiveness of the actions taken toward meeting the MS4-WLA and to direct the MS4 to adaptive management approaches to implementing the TMDL; all permits will provide that actions taken by the MS4 toward meeting the MS4-WLA must meet the standard of MEP. Accordingly, future MS4 permit conditions should require the permittee to propose, as part of its SWQMP, structural and/or non-structural BMPs to attain MS4-WLA to the MEP. The SWQMP shall also include an adaptive, iterative approach that can be evaluated over multiple MS4 permit terms to ensure reasonable progress toward achieving the MS4-WLA.