

Total Maximum Daily Load (TMDL) Synopsis

State: Kentucky

Major River Basin: Lower Cumberland River

HUC8: 05130205

Counties: Caldwell, Crittenden, Livingston, and Lyon

Pollutant of Concern: Pathogens

Suspected Sources: Package plant or other permitted small flow discharges, animal feeding operations, agriculture, unknown.

Impaired Waterbodies for Pathogen TMDLs:

Waterbody Name	Impaired Segment (River Miles)	County	GNIS Number	Suspected Sources	Impaired Use
Claylick Creek into Cumberland River	1.9 to 4.8	Livingston	KY489591_01	Agriculture	Primary & Secondary Contact Recreation (nonsupport)
Eddy Creek into Cumberland River	8.4 to 10.5	Lyon	KY491550_01	Unknown	Primary Contact Recreation (nonsupport)
Eddy Creek into Cumberland River	13.0 to 15.7	Caldwell	KY491550_03	Package plant or other permitted small flow discharges	Primary Contact Recreation (nonsupport)
Dry Creek into Eddy Creek	0.0 to 3.6	Caldwell	KY491176_00	Animal Feeding Operations	Primary Contact Recreation (nonsupport)
Ferguson Creek into Cumberland River	0.0 to 1.2	Livingston	KY492034_01	Unknown	Primary Contact Recreation (nonsupport)
Hickory Creek into Cumberland River	0.0 to 3.9	Livingston	KY494122_00	Unknown	Primary Contact Recreation (nonsupport)
Livingston Creek into Cumberland River	4.6 to 7.0	Lyon/Caldwell	KY496913_01	Unknown	Primary Contact Recreation (nonsupport)
Richland Creek into Cumberland River	0.7 to 5.4	Livingston	KY501820_00	Unknown	Primary & Secondary Contact Recreation (nonsupport)
Sandy Creek into Cumberland River	0.0 to 2.3	Livingston	KY502979_00	Unknown	Primary Contact Recreation (nonsupport)
Skinframe Creek into Livingston Creek	0.0 to 4.8	Lyon	KY503607_00	Unknown	Primary Contact Recreation (nonsupport)
Sugar Creek into Cumberland River	2.2 to 6.9	Livingston	KY504655_01	Unknown	Primary Contact Recreation (nonsupport)

Policy and Purpose to Water Quality:

Section 303(d) of the Federal Clean Water Act declares that “each State shall identify those waters within its boundaries for which effluent limitations... are not stringent enough to implement any water quality standard applicable to such waters. The State shall establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters.... Each State shall establish for the waters identified in this subsection, and in accordance with the priority ranking, the total maximum daily load, for those pollutants which the Administrator identifies... for such calculation. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety.”

Kentucky Revised Statute (KRS) 224.70-100 states, “It is hereby declared to be the policy of this Commonwealth... to provide a comprehensive program in the public interest for the prevention, abatement and control of pollution; to provide effective means for the execution and enforcement of such program; and to provide for cooperation with agencies of other states or of the federal government in carrying out these objectives.... the purposes of KRS Chapter 224: to safeguard from pollution the uncontaminated waters of the Commonwealth; to prevent the creation of any new pollution of the waters of the Commonwealth; and to abate any existing pollution.”

Kentucky Water Quality Criteria (WQC) for Fecal Coliform:

Title 401 KAR 5:031 describe the standards used to “protect the surface waters of the Commonwealth, and thus protect water resources.” Fecal coliform bacteria are pathogen indicator organisms. Fecal coliform data are used to indicate the degree of support for primary contact recreation (PCR) use. The stream is assessed as fully supporting the PCR use if the fecal coliform content does not exceed the criterion of 400 colonies per 100 ml in less than 20 percent of samples; it was assessed as partially supporting the PCR use if the criterion was not met in 25-33 percent of samples, and as not supporting the PCR use if the criterion was not met in greater than 33 percent of samples. Streams assessed as either nonsupport or partial support are considered impaired. Secondary contact recreation (SCR) was also assessed following the same method, using the criterion of 2000 colonies per 100 ml. Stream segments were sampled once per month during the primary contact recreation season of May 1 through October 31, 2000.

TMDL Endpoints (i.e., Water Quality Standard/ Fecal Coliform TMDL Target):

The TMDL Target is defined as the WQC minus the Margin of Safety (MOS). The MOS can be an implicit or explicit additional reduction applied to the Waste Load allocation (WLA), Load Allocation (LA) or to both types of sources that accounts for uncertainties in the data or TMDL calculations. The TMDL Target is thus 360 colonies per 100ml (400 col/100ml minus a 10% MOS).

TMDL Equation and Definitions:

A TMDL calculation is performed as follows:

$$WLA + LA + MOS = TMDL$$

Where:

WLA = the Waste Load Allocation, including KPDES-permitted sources such as Sewage Treatment Plants (STPs; aka Wastewater Treatment Plants, WWTPs).

LA = the Load Allocation, including natural background and non-KPDES permitted sources.

MOS = the Margin of Safety, which can be an implicit or explicit additional reduction applied to the WLA, LA or both types of sources that accounts for uncertainties in the data or TMDL calculations. The MOS for these TMDLs was set at 10% to generate an explicit MOS.

TMDL = the maximum load the waterbody can naturally assimilate while still meeting the WQC of 400 colonies per 100 ml at a given flow, in units of colonies per day.

The TMDL calculation must take into account seasonality and other factors that affect the relationship between pollutant inputs and the ability of the stream to meet its designated uses.

TMDL Calculations:

Due to the absence of stream gages or in-stream flow data in the Lower Cumberland Watershed, KDOW used the U.S. Geological Survey's (USGS's) Mean Annual Streamflow (MAF) values. The MAF values were calculated using a three-variable regression equation found in the USGS Water-Resources Investigations Report 02-4206 "Estimating Mean Annual Streamflow of Rural Streams in Kentucky" (http://ky.water.usgs.gov/pubs/wrir_2002_4206.pdf). The MAF values can be found on the Hydrology of Kentucky webpage (<http://kygeonet.ky.gov/kyhydro/main.htm>). Once obtained, major inputs (i.e. WWTP flow, which was set at the facility's design capacity) and withdrawals were integrated to generate a critical flow. The critical flow is then multiplied by the WQC minus the MOS (10%) times the appropriate conversion factors to obtain the TMDL target load.

The TMDL, allocations, and percent reductions for each impaired segment are provided below. Percent reductions are for informational purposes only and are discussed in Appendix A. In addition, pathogen-impaired segments addressed in this document could be converted to an *Escherichia coli* (*E. coli*) daily load by using the WQC for *E. coli* – these calculations are also provided and discussed in Appendix A.

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TMDLs and Allocations:

TMDL ⁽¹⁾	MOS ⁽²⁾	WLA ⁽³⁾		LA	Percent Reduction ⁽⁵⁾
		Wastewater ⁽⁴⁾			
Claylick Creek into Cumberland River RM 1.9-4.8					
5.77×10 ¹¹ col/day	5.77×10 ¹⁰ col/day	0.0 col/day		5.20×10 ¹¹ col/day	89.09%
Eddy Creek into Cumberland River RM 8.4-10.5					
9.32×10 ¹¹ col/day	9.32×10 ¹⁰ col/day	Princeton STP KY0028401	2.377×10 ¹⁰ col/day	8.15×10 ¹¹ col/day	84.35%
		Fontaine Trailer Company KY0022225	1.174×10 ⁸ col/day		
		Total	2.389×10 ¹⁰ col/day		
Eddy Creek into Cumberland River RM 13.0-15.7					
3.48×10 ¹¹ col/day	3.48×10 ¹⁰ col/day	Princeton STP KY0028401	2.377×10 ¹⁰ col/day	2.90×10 ¹¹ col/day	52.63%
		Fontaine Trailer Company KY0022225	1.174×10 ⁸ col/day		
		Total	2.389×10 ¹⁰ col/day		
Dry Creek into Eddy Creek RM 0.0-3.6					
4.38×10 ¹¹ col/day	4.38×10 ¹⁰ col/day	0.0 col/day		3.95×10 ¹¹ col/day	77%
Ferguson Creek into Cumberland River RM 0.0-1.2					
7.63×10 ¹⁰ col/day	7.63×10 ⁹ col/day	0.0 col/day		6.87×10 ¹⁰ col/day	78.82%
Hickory Creek into Cumberland River RM 0.0-3.9					
1.08×10 ¹¹ col/day	1.08×10 ¹⁰ col/day	0.0 col/day		9.69×10 ¹⁰ col/day	92.13%
Livingston Creek into Cumberland River RM 4.6-7.0					
1.37×10 ¹² col/day	1.37×10 ¹¹ col/day	0.0 col/day		1.23×10 ¹² col/day	59.78%
Richland Creek into Cumberland River RM 0.7-5.4					
9.20×10 ¹⁰ col/day	9.20×10 ⁹ col/day	0.0 col/day		8.28×10 ¹⁰ col/day	91.63%
Sandy Creek into Cumberland River RM 0.0-2.3					
3.47×10 ¹¹ col/day	3.47×10 ¹⁰ col/day	Salem STP KY0066541	2.43×10 ⁹ col/day	3.10×10 ¹¹ col/day	96.60%
Skinframe Creek into Livingston Creek RM 0.0-4.8					
5.19×10 ¹¹ col/day	5.19×10 ¹⁰ col/day	0.0 col/day		4.67×10 ¹¹ col/day	71.65%

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TMDL ⁽¹⁾	MOS ⁽²⁾	WLA ⁽³⁾		LA	Percent Reduction ⁽⁵⁾
		Wastewater ⁽⁴⁾			
Sugar Creek into Cumberland River RM 2.2-6.9					
1.29×10 ¹¹ col/day	1.29×10 ¹⁰ col/day	0.0 col/day		1.16×10 ¹¹ col/day	85%

Notes:

- (1). TMDLs are expressed as daily loads of fecal colonies by multiplying the WQC by the mean annual streamflow (MAF) and the appropriate conversion factor. MAF is determined by the USGS. The TMDL is the sum of all components. Daily loads for *E. coli* are provided in Appendix A.
- (2). MOS is explicitly set at 10% of the Water Quality Criterion
- (3). Although Concentrated Animal Feeding Operations (CAFOs) receive allocations within the WLA, there are no permitted CAFOs present in the watersheds of concern. 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 who can discharge during a 24-hour, 25-year or greater storm event.
- (4). Any future KPDES wastewater permitted sources must meet permit limits based on the Water Quality Criterion in 401 KAR 5:031, and must not cause or contribute to an existing impairment. WLA value is based on design flow and acute permit limits and represents the maximum one-day load that can be discharged to the stream segment.
- (5). Overall reduction needed during the 2000 PCR season to achieve the TMDL target of 360 colonies per 100ml. Percent reductions are provided for informational purposes only – see Appendix A.

KPDES Wastewater Discharges to Surface Waters Addressed in these Pathogen TMDLs:

Facility Name	KPDES Permit No.	Design Flow (MGD)	Permit Limit (col/100mL)		WLA
			Monthly Avg.	Max Weekly Avg.	
Sandy Creek into Cumberland River RM 0.0-2.3					
Salem STP	KY0066541	0.16	200	400	2.43×10 ⁹ col/day
Eddy Creek into Cumberland River RM 8.4-10.5					
Princeton STP	KY0028401	1.57	200	400	2.38×10 ¹⁰ col/day
Fontaine Trailer Company	KY0022225	0.0075	200	400	1.17×10 ⁸ col/day
Eddy Creek into Cumberland River RM 13.0-15.7					
Princeton STP	KY0028401	1.57	200	400	2.38×10 ¹⁰ col/day
Fontaine Trailer Company	KY0022225	0.0075	200	400	1.17×10 ⁸ col/day