Proposed Draft Total Maximum Daily Load for *E. coli*
11 Stream Segments within the Laurel and Little Laurel River Watersheds, Laurel County, Kentucky

Photo of Laurel River into Cumberland River (KDOW)

August 2012

Commonwealth of Kentucky

Steven L. Beshear, Governor

Energy and Environment Cabinet
Len Peters, Secretary

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August 2012

Kentucky Department for Environmental Protection

Division of Water

Frankfort, Kentucky

This report has been approved for release

_____
Sandra L. Gruzesky, Director
Division of Water

_____
Date

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LIST OF ACRONYMS

AC/TC	Ratio of Atypical Coliform to Typical Coliform Bacteria
AWQA	Agricultural Water Quality Authority
AWQP	Agricultural Water Quality Plan
BMP	Best Management Practices
CAFO	Concentrated Animal Feeding Operation
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
cfu	Colony Forming Units
CPP	Continuing Planning Process
CWA	Clean Water Act

DMR	Discharge Monitoring Report
DWS	Drinking Water Supply
EPA	United States Environmental Protection Agency
GM	Geometric Mean
GNIS	Geographic Names Information System
HUC	Hydrologic Unit Code
KAR	Kentucky Administrative Regulations
KDEP	Kentucky Department for Environmental Protection
KDOW	Kentucky Division of Water
KEEC	Kentucky Energy and Environment Cabinet
KGS	Kentucky Geological Survey
KNDOP	Kentucky No-Discharge Operating Permit
KPDES	Kentucky Pollution Discharge Elimination System
LA	Load Allocations
mgd	Million Gallons per Day
ml	Milliliter
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer Systems
NGO	Non-Governmental Organization
NHD	National Hydrography Dataset
OSTDS	On Site Sewage Treatment and Disposal System
PCR	Primary Contact Recreation
PRIDE	Personal Responsibility in a Desirable Environment
RAILL	Restoration Activities in the Little Laurel River
RM	River Mile
SDWA	Safe Drinking Water Act
SSA	Sanitary Sewer Assessment
SSO	Sanitary Sewer Overflow
STP	Sewage Treatment Plant
SWS	Sanitary Wastewater System
TMDL	Total Maximum Daily Load
UCRWW	Upper Cumberland River Watershed Watch
USDA	United States Department of Agriculture
USGS	United States Geological Survey

UT	Unnamed Tributary
WBP	Watershed Based Plan
WLA	Wasteload Allocation
WMB	Watershed Management Branch
WQC	Water Quality Criteria
WWTP	Wastewater Treatment Plant

TMDL SYNOPSIS

S.1 Impaired Waterbodies

State: Kentucky
Major River Basin: Tennessee, Mississippi, Cumberland River Basin
USGS HUC8: 05130101
Counties: Laurel
Pollutant of Concern: *E. coli*, Fecal Coliform
Impaired Use: Primary Contact Recreation
Suspected Sources: Non-Point Source, Source Unknown, Municipal (Urbanized High Density Area), Municipal Point Source Discharges, Sanitary Sewer Overflows (Collection System Failures)

Table S.1 Impaired Waterbodies Addressed in this TMDL Document

Waterbody, Segment	GNIS[1] Number	County	Support Status	Pollutant	Suspected Source(s)
Laurel River 26.35 to 33.95	KY513263_03	Laurel	Nonsupport	*E. coli*	Non-Point Source
Lick Creek 0.0 to 3.65	KY513397_01	Laurel	Nonsupport	*E. coli*	Source Unknown
Little Laurel River 0.0 to 8.4	KY513497_01	Laurel	Partial Support	*E. coli*	Source Unknown
Little Laurel River 8.4 to 12.7	KY513497_02	Laurel	Nonsupport	*E. coli*	Source Unknown
Little Laurel River 12.7 to 14.8	KY513497_03	Laurel	Nonsupport	Fecal Coliform	Source Unknown
Little Laurel River 14.8 to 23.0	KY513497_04	Laurel	Nonsupport	*E. coli*	Source Unknown
Sallys Branch 0.0 to 2.90	KY515184_01	Laurel	Nonsupport	*E. coli*	Source Unknown
Sampson Branch 0.0 to 4.70	KY515208_01	Laurel	Nonsupport	*E. coli*	Source Unknown
UT of Little Laurel River at 16.05 RM[2] 0.0 to 1.4	KY513497-16.05_01	Laurel	Nonsupport	*E. coli*	Municipal (Urbanized High Density Area)
Whitley Branch 0.0 to 1.0	KY516339_01	Laurel	Nonsupport	*E. coli*	Municipal Point Source Discharges

Waterbody, Segment	GNIS[1] Number	County	Support Status	Pollutant	Suspected Source(s)
Whitley Branch 1.1 to 2.6	KY516339_02	Laurel	Nonsupport	Fecal Coliform	Sanitary Sewer Overflows (Collection System Failures)

[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, Segment	GNIS[1] Number	TMDL Target
Laurel River 26.35 to 33.95	KY513263_03	216 *E. coli* colonies/100ml which must be met in at least 80% of all observations within a 30-day period during the Primary Contact Recreational season of May through October. This is based on the 240 colonies/100ml instantaneous Water Quality Criterion, incorporating an explicit Margin of Safety of 10%.
Lick Creek 0.0 to 3.65	KY513397_01	
Little Laurel River 0.0 to 8.4	KY513497_01	
Little Laurel River 8.4 to 12.7	KY513497_02	
Little Laurel River 12.7 to 14.8	KY513497_03	
Little Laurel River 14.8 to 23.0	KY513497_04	
Sallys Branch 0.0 to 2.90	KY515184_01	
Sampson Branch 0.00 to 4.70	KY515208_01	
UT of Little Laurel River at 16.05 RM[2] 0.0 to 1.4	KY513497-16.05_01	
Whitley Branch 0.0 to 1.0	KY516339_01	
Whitley Branch 1.1 to 2.6	KY516339_02	

[1] GNIS = Geographic Names Information System.
[2] RM = River Mile.

S.3 TMDL Equation and Calculations

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

$$TMDL = WLA + LA + MOS$$
(Equation S.1)

The WLA has three components:

$$WLA = SWS\text{-}WLA + MS4\text{-}WLA + Future\ Growth\text{-}WLA$$
(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 both implicit and explicit.
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: (28.31685L/ft^3 * 86400seconds/day * 1000ml/L)/(100ml) 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 within Laurel and Little Laurel River watersheds have SWS-WLAs as described in Table S.4.

Table S.3 Final TMDL Allocations

Waterbody, Segment, GNIS ID	TMDL (*E. coli* colonies/ day) (1)	MOS (*E. coli* colonies/ day)	SWS-WLA (*E. coli* colonies/ day) (2)	Future Growth-WLA (*E. coli* colonies/ day)	LA (*E. coli* colonies/ day)
Laurel River 26.35 to 33.95 KY513263_03	4.95E+11	4.95E+10	8.99E+07	4.45E+09	4.41E+11
Lick Creek 0.0 to 3.65 KY513397_01	4.99E+10	4.99E+09	0.00E+00	8.98E+08	4.40E+10
Little Laurel River 0.0 to 8.4 KY513497_01	4.14E+11	4.14E+10	4.55E+10	1.63E+10	3.10E+11
Little Laurel River 8.4 to 12.7 KY513497_02	2.60E+11	2.60E+10	4.55E+10	9.42E+09	1.79E+11
Little Laurel River 12.7 to 14.8 KY513497_03	2.22E+11	2.22E+10	4.55E+10	7.70E+09	1.46E+11
Little Laurel River 14.8 to 23.0 KY513497_04	1.40E+11	1.40E+10	4.54E+07	5.05E+09	1.21E+11
Sallys Branch 0.0 to 2.90 KY515184_01	2.17E+10	2.17E+09	0.00E+00	5.87E+08	1.90E+10
Sampson Branch 0.0 to 4.70 KY515208_01	5.23E+10	5.23E+09	0.00E+00	2.35E+09	4.47E+10
UT(3) of Little Laurel River at 16.05 RM(4) 0.0 to 1.4 KY513497-16.05_01	1.82E+10	1.82E+09	0.00E+00	8.19E+08	1.56E+10

Waterbody, Segment, GNIS ID	TMDL (*E. coli* colonies/ day) [1]	MOS (*E. coli* colonies/ day)	SWS-WLA (*E. coli* colonies/ day) [2]	Future Growth-WLA (*E. coli* colonies/ day)	LA (*E. coli* colonies/ day)
Whitley Branch 0.0 to 1.0 KY516339_01	6.71E+10	6.71E+09	4.54E+10	7.51E+08	1.43E+10
Whitley Branch 1.1 to 2.6 KY516339_02	1.70E+10	1.70E+09	0.00E+00	7.66E+08	1.46E+10

(1) The TMDL applies only during the May through October Primary Contact Recreational season, as described in 401 KAR 10:031.

(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 *E. coli* Water Quality Criterion (WQC) of 240 colonies/100ml 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;* Cornerstone Christian School and Johnson Elementary report in terms of *E. coli* but the London STP reports in terms of fecal coliform. However, it was necessary to report the WLA for all SWSs in terms of *E. coli* so their allocations were consistent with the monitoring protocol used to develop the TMDL. Although the WLA is in terms of *E. coli*, this does not change the permit limits for any given facility; facilities permitted in terms of fecal coliform should continue to report in those units.

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) UT = Unnamed Tributary.

(4) RM = River Mile.

Table S.4 Sanitary Wastewater Systems

Facility	KPDES Permit	Receiving Waterbody	Design Discharge (mgd[1])	Permit Limit (*E. coli* colonies/ 100ml)	WLA (*E. coli* colonies/ day)	Latitude	Longitude
Cornerstone Christian School	KY0026581	UT to Laurel River at 27.9, near mouth	0.0099	240	4.55E+10	37.019722	-84.073056
London STP[2]	KY0021270	Whitley Branch at RM 1.0	5.0	240	4.55E+10	37.105000	-84.069722
Johnson Elementary School	KY0026557	RM 1.0 of the UT to Little Laurel River at RM 19.7	0.005	240	4.54E+07	37.158709	-84.051250

[1] mgd = millions of gallons per day.
[2] STP = sewage treatment plant.

S.4 Translation of WLAs into Permit Limits

WLAs for Sanitary Wastewater Systems (SWSs) were given in Table S.4. SWS-WLAs will be translated into KPDES 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.

There are currently no Municipal Separate Storm Sewer Systems (MS4s) in the watershed. Future MS4-WLAs will be addressed through the KDOW storm water permitting program.

1.0 INTRODUCTION

Section 303(d) of the Clean Water Act (CWA) requires states to identify waterbodies within their boundaries that have been assessed and are not currently meeting their designated uses (401 KAR 10:026 and 10:031) and that require the development of a Total Maximum Daily Load (TMDL). States must establish a priority ranking for such waters, taking into account their intended uses and the severity of the pollutant. Section 303(d) also requires that states provide a list of this information called the 303(d) list. This list is submitted to the U.S. Environmental Protection Agency (EPA) during even-numbered years and each submittal replaces the previous list. The 2010-303(d) information for Kentucky can be found in the *2010 Integrated Report to Congress on the Condition of Water Resources in Kentucky Volume II. 303(d) List of Surface Waters* (Kentucky Division of Water (KDOW), 2011a) and can be obtained at: http://water.ky.gov.

States are also required to develop TMDLs for the pollutants that cause each waterbody to fail to meet its designated uses. The TMDL process establishes the allowable amount (i.e., load) of the pollutant the waterbody can naturally assimilate while continuing to meet the Water Quality Criteria (WQC) for each designated use. The pollutant load must be established at a level necessary to implement the applicable WQC with seasonal variations and a Margin of Safety (MOS) that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality. This load is then divided among different sources of the pollutant in a watershed. Information from EPA on TMDLs can be found at: http://www.epa.gov/owow/tmdl.

1.1 Location

The Laurel and Little Laurel River watersheds are located in Laurel County, Kentucky. The area of both watersheds is 103.50 square miles. Major roads that traverse the watershed include I-75 and the Hal Rodgers Parkway, see Figure 1.1. The corporate boundaries of the city of London largely lie within the Little Laurel River watershed, approximately at the intersection of US25 and the Hal Rogers Parkway. The Laurel and Little Laurel River watersheds are located within the United States Geological Survey (USGS) Hydrologic Unit Code 11 (HUC11) 05130101450.

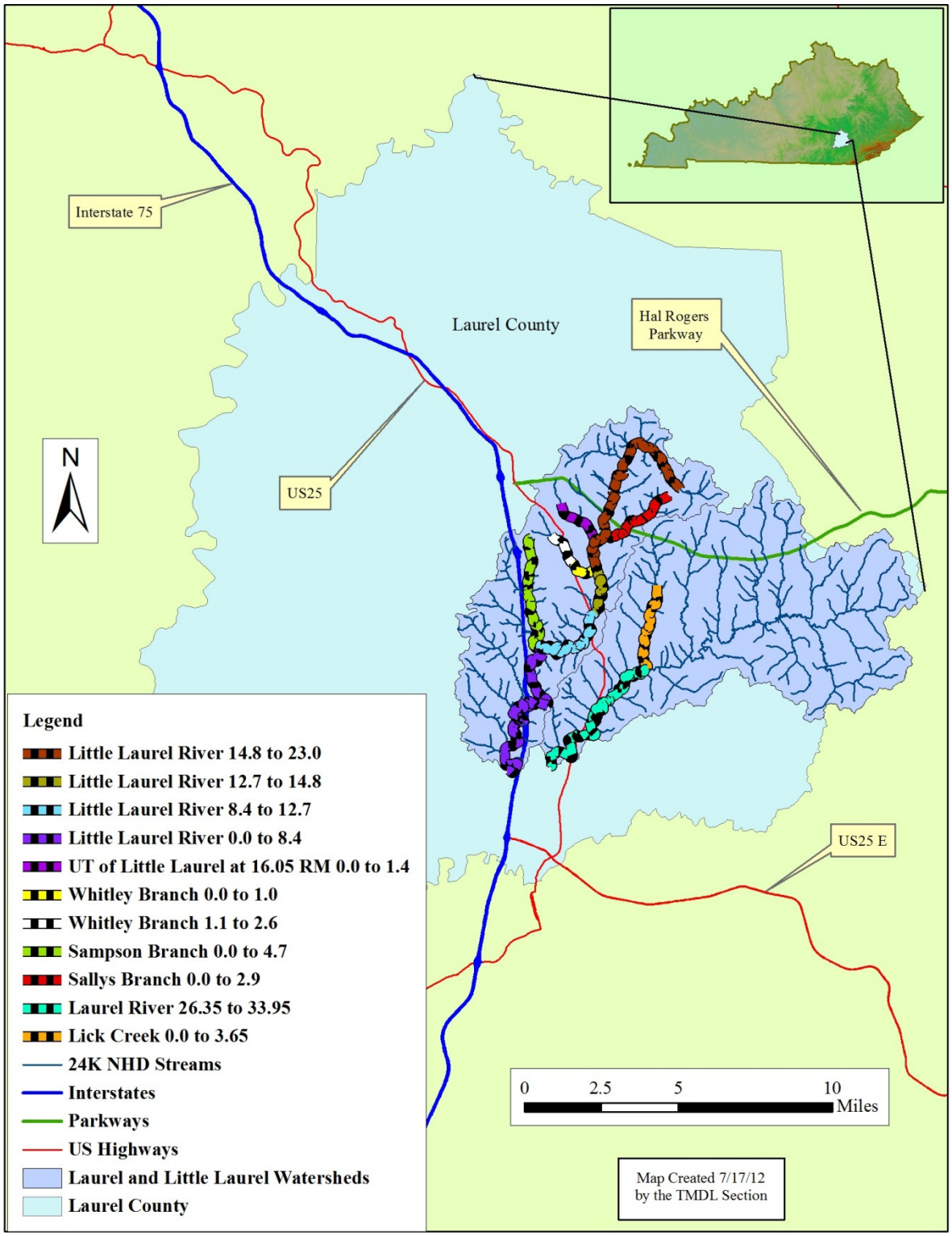

Figure 1.1 Location of Laurel and Little Laurel River Watersheds

2.0 PROBLEM DEFINITION

2.1 Impaired Segments

Laurel River 12.7 to 14.8 was listed as impaired for the Primary Contact Recreation (PCR) designated use due to pathogens on the Kentucky Division of Water's (KDOW's) 1996 303(d) list of impaired waters that require a TMDL. The term 'pathogens' is a designation for pathogen indicators, which for the sake of brevity may be referred to simply as pathogens (KDOW, 2011b), or bacteria. Since that time, the listing was changed from pathogens to fecal coliform, and further segments in the Little Laurel River watershed have been added to subsequent 303(d) lists. Additional segments that have not yet been 303(d)-listed were also found to be impaired based on data submitted with this report, see Table 2.1 and Figure 2.1.

Table 2.1 All Impaired Waterbodies Addressed in this TMDL Document

Waterbody and Segment (GNIS[1] Number)	Listing Year[2]	County	Support Status	Use Impairment(s)	Suspected Source(s)
Laurel River 26.35 to 33.95 KY513263_03	N/A	Laurel	PCR (Nonsupport)	*E. coli*	Non-Point Source
Lick Creek 0.0 to 3.65 KY513397_01	N/A	Laurel	PCR (Nonsupport)	*E. coli*	Source Unknown
Little Laurel River 0.0 to 8.4 KY513497_01	2006	Laurel	PCR (Partial Support)	*E. coli*	Source Unknown
Little Laurel River 8.4 to 12.7 KY513497_02	1998	Laurel	PCR (Nonsupport)	*E. coli*	Source Unknown
Little Laurel River 12.7 to 14.8 KY513497_03	1996	Laurel	PCR (Nonsupport)	Fecal Coliform	Source Unknown
Little Laurel River 14.8 to 23.0 KY513497_04	1998	Laurel	PCR (Nonsupport)	*E. coli*	Source Unknown
Sallys Branch 0.0 to 2.9 KY515184_01	N/A	Laurel	PCR (Nonsupport)	*E. coli*	Source Unknown

Waterbody and Segment (GNIS[1] Number)	Listing Year[2]	County	Support Status	Use Impairment(s)	Suspected Source(s)
Sampson Branch 0.0 to 4.7 KY515208_01	N/A	Laurel	PCR (Nonsupport)	*E. coli*	Source Unknown
UT of Little Laurel River 0.0 to 1.4 KY513497-16.05_01	N/A	Laurel	PCR (Nonsupport)	*E. coli*	Municipal (Urbanized High Density Area)
Whitley Branch 0.0 to 1.0 KY516339_01[3]	N/A	Laurel	PCR (Nonsupport)	*E. coli*	Municipal Point Source Discharges
Whitley Branch 1.1 to 2.6 KY516339_02	1996	Laurel	PCR (Nonsupport)	Fecal Coliform	Sanitary Sewer Overflows (Collection System Failures)

(1) GNIS = Geographic Names Information System.

(2) Waterbodies with a Listing Year of N/A (i.e., 'Not Applicable') have not yet been listed on the 303(d); they were found to be impaired by sampling submitted with this study. This TMDL report constitutes the public notice required to list these waterbodies as impaired. Upon approval of this TMDL, they will be listed in Category 4A of Kentucky's Integrated Report, Approved TMDLs.

(3) Whitley Branch 0.0 to 1.0 was listed for pathogens on the 2004 303(d) list, but was delisted in 2008. However, it was found to be impaired and require a TMDL by sampling conducted for this study. It therefore receives TMDL allocations within this document.

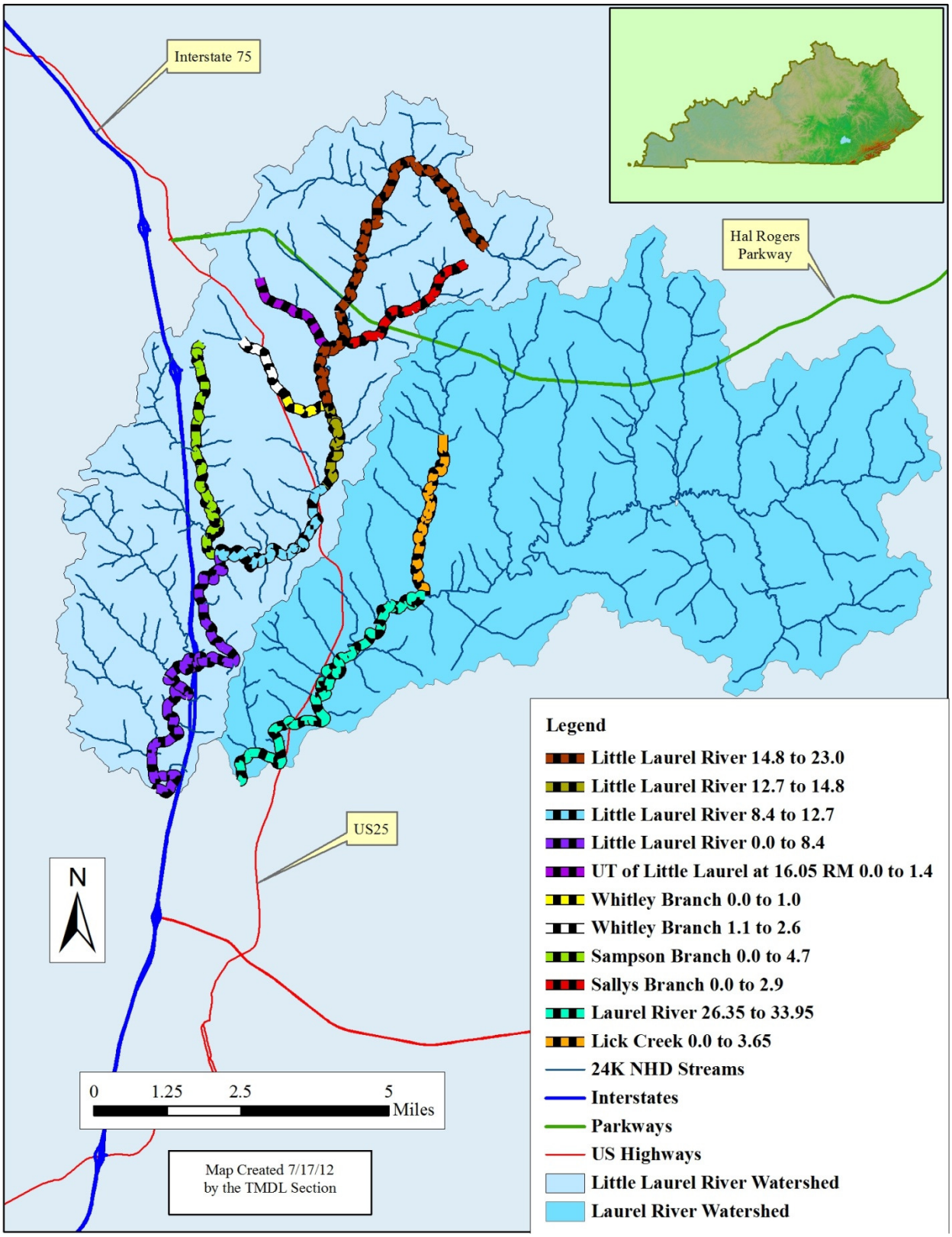

Figure 2.1 Bacteria-Impaired Streams in the Laurel and Little Laurel River Watersheds

2.2 Target Identification

The goal of the TMDL process is to achieve pollutant loading within the assimilative capacity of the impaired waterbody under study that allows it to meet its designated use (i.e., PCR). KDOW currently uses fecal coliform and *Escherichia coli* (*E. coli*) as indicators of the likelihood of bacteria impairment. The PCR Water Quality Criteria (WQCs) are in effect from May 1 through October 31. For this designated use, 401 KAR 10:031 Section 7(1)(a) states that:

[The] Fecal coliform content or Escherichia coli content shall not exceed 200 colonies per 100 ml or 130 colonies per 100 ml respectively as a geometric mean based on not less than five (5) samples taken during a thirty (30) day period. Content also shall not exceed 400 colonies per 100 ml in twenty (20) percent or more of all samples taken during a thirty (30) day period for fecal coliform or 240 colonies per 100 ml for Escherichia coli. These limits shall be applicable during the recreation season of May 1 through October 31.

While some impaired segments were initially listed for fecal coliform, these data are not available due to recordkeeping issues, and most segments were resampled for *E. coli* by the TMDL Section, therefore the TMDL is reported in terms of *E. coli*. The instream *E. coli* WQC for this TMDL is an instantaneous maximum of 240 colonies/100ml (which also may be written as colony forming units, or cfu/100ml), which shall not be exceeded in 20% or more of all samples taken within a 30-day period.

Because Kentucky has a dual standard for the PCR designated use, development of TMDLs using the *E. coli* criterion are sufficient to provide TMDLs for fecal coliform-listed segments and vice versa (i.e., development of fecal coliform TMDLs will protect for the PCR use regardless of whether a segment is impaired for *E. coli*, fecal coliform, or both). Likewise, Kentucky Pollutant Discharge Elimination System (KPDES) permit holders who are permitted to discharge bacteria into the surface waters of the Commonwealth may be given discharge limits in units of fecal coliform or *E. coli*, either of which protect the PCR use and allow the facility to meet the requirements of 401 KAR 10:031.

2.3 Monitoring in the Laurel and Little Laurel Watersheds

The KDOW TMDL Section sampled streams for *E. coli* in the Laurel and Little Laurel River watersheds for this report from 5/3/2007 through 10/23/2007. Additionally, prior data from site UCTMDL01 exists (one data point), which was sampled for fecal coliform on 8/1/2000, and data from site CRW014 exists from 2005 and 2010 (fecal coliform was sampled in 2005, and *E. coli* was sampled in 2010). Other fecal coliform data from the late 1990s has been lost. Figure 2.2 shows KDOW sampling sites; only the last four digits of the 2007 *E. coli* stations were used to label those stations. The sites are listed in Table 2.2. 3rd Rock, Inc. sampled streams in the watershed in 2005 and 2006 for their Corbin City Reservoir Watershed Plan (3rd Rock, 2007). Figure 2.3 shows 3rd Rock fecal coliform sampling stations on bacteria-impaired segments, these stations are also listed in Table 2.3; for a list of all 3rd Rock stations and sampling data, see the Corbin City Reservoir Watershed Plan and attachments.

Table 2.2 DOW *E. coli* Sampling Stations

Site	Longitude	Latitude	Location	RM	Impaired Segment
DOW02026002	-84.027777	37.054750	at KY229	34.0	Laurel River 26.35 to 33.95
DOW02036003	-84.026900	37.056510	at Smith Brewer Road (CR1177)	0.2	Lick Creek 0.00 to 3.65
DOW02046004	-84.000490	37.064180	at KY1189	0.3	None: Insufficient Data to Assess
DOW02056005	-83.998800	37.059510	at KY830	36.1	None: Insufficient Data to Assess
DOW02066006	-83.972590	37.073100	off private drive	40.3	None: Insufficient Data to Assess
DOW02076007	-83.962120	37.082080	at KY80	0.5	None: Insufficient Data to Assess
DOW02086008	-83.960720	37.076680	off private drive; above Little Sandy Creek	41.6	None: Insufficient Data to Assess
DOW02097001	-84.111427	37.017466	at KY552	1.5	Little Laurel River 0.0 to 8.4
DOW02107005	-84.091540	37.059518	at Pine Grove School Road (CR1231)	7.8	Little Laurel River 0.0 to 8.4
DOW02117006	-84.090914	37.065768	off Dogwood Springs Road	0.1	Sampson Branch 0.0 to 4.70
DOW02127007	-84.059518	37.080445	at US25	12.5	Little Laurel River 8.4 to 12.7
DOW02137008	-84.056365	37.101718	off KY229; near mouth	0.1	Whitley Branch 0.0 to 1.0
DOW02147009	-84.055830	37.102780	at KY229	14.8	Little Laurel River 14.8 to 23.0
DOW02157010	-84.056683	37.117143	at KY192	0.08	UT of Little Laurel River at 16.05 RM 0.0 to 1.4
DOW02167011	-84.047450	37.117041	off KY80	0.2	Sallys Branch 0.00 to 2.90
DOW02177012	-84.045359	37.138777	off KY472	18.3	Little Laurel River 14.8 to 23.0
UCTMDL01	-84.055800	37.102900	at KY1006 Bridge	12.7	Little Laurel River 12.7 to 14.8
CRW014	-84.048300	37.042000	Near Lily, at Happy Hollow Road	31.6	Laurel River 26.35 to 33.95

Table 2.3 3rd Rock Fecal Coliform Sampling Stations

Site	Longitude	Latitude	RM	Impaired Segment
2A	-84.111328	37.016791	1.4	Little Laurel River 0.0 to 8.4
12A	-84.059629	37.080487	12.5	Little Laurel River 8.4 to 12.7
17A	-84.055778	37.102723	14.8	Little Laurel River 14.8 to 23.0
19A	-84.056766	37.117110	0.1	UT of Little Laurel River at 16.05 RM 0.0 to 1.4
24A	-84.038748	37.147217	19.3	Little Laurel River 14.8 to 23.0
25A	-84.014101	37.149527	22.15	Little Laurel River 14.8 to 23.0
10B	-84.027348	37.054612	33.9	Laurel River 26.35 to 33.95
Laurel River	-84.068801	37.024155	28.5	Laurel River 26.35 to 33.95
WWTP	-84.066021	37.101171	0.7	Whitley Branch 0.0 to 1.0

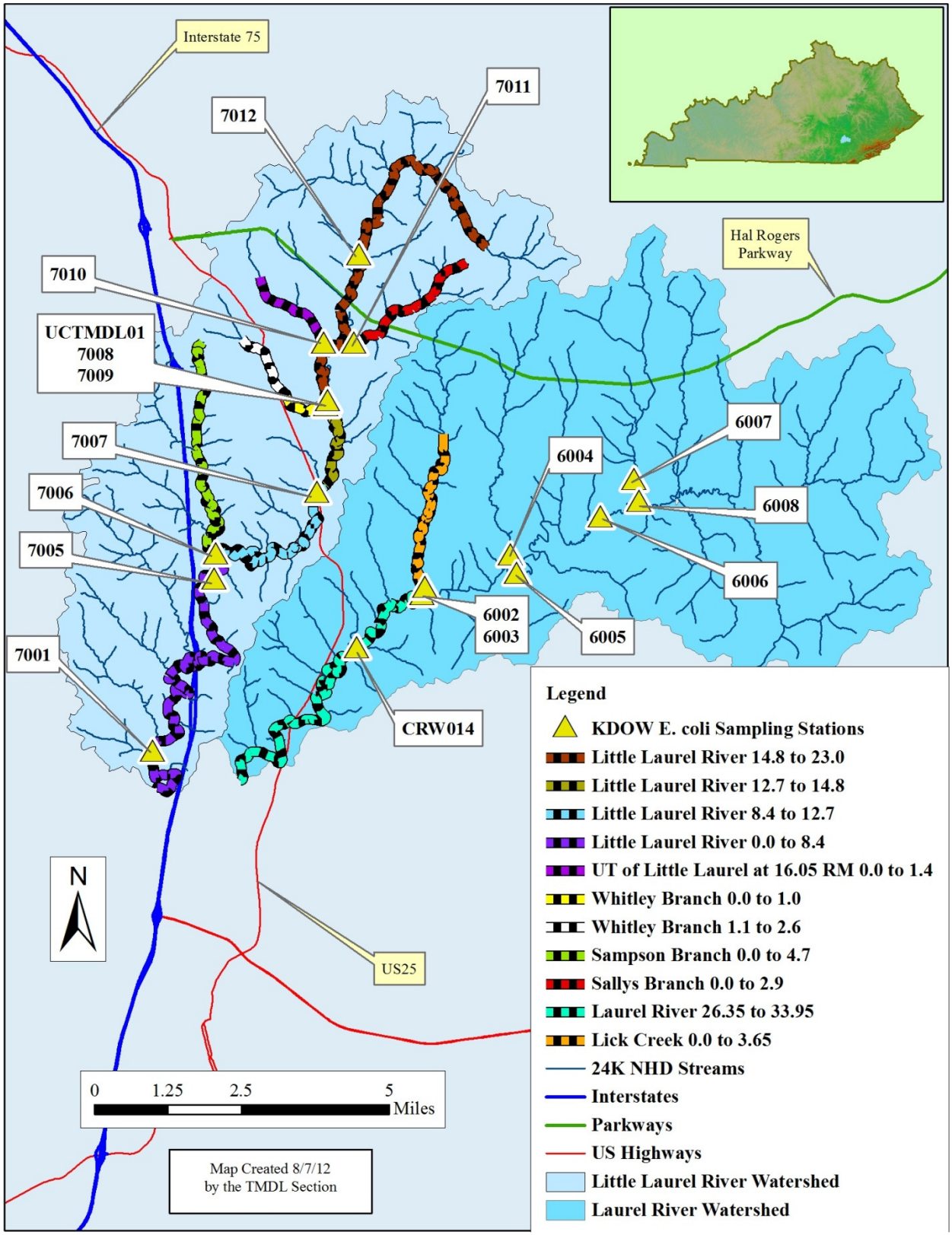

Figure 2.2 KDOW Sampling Stations

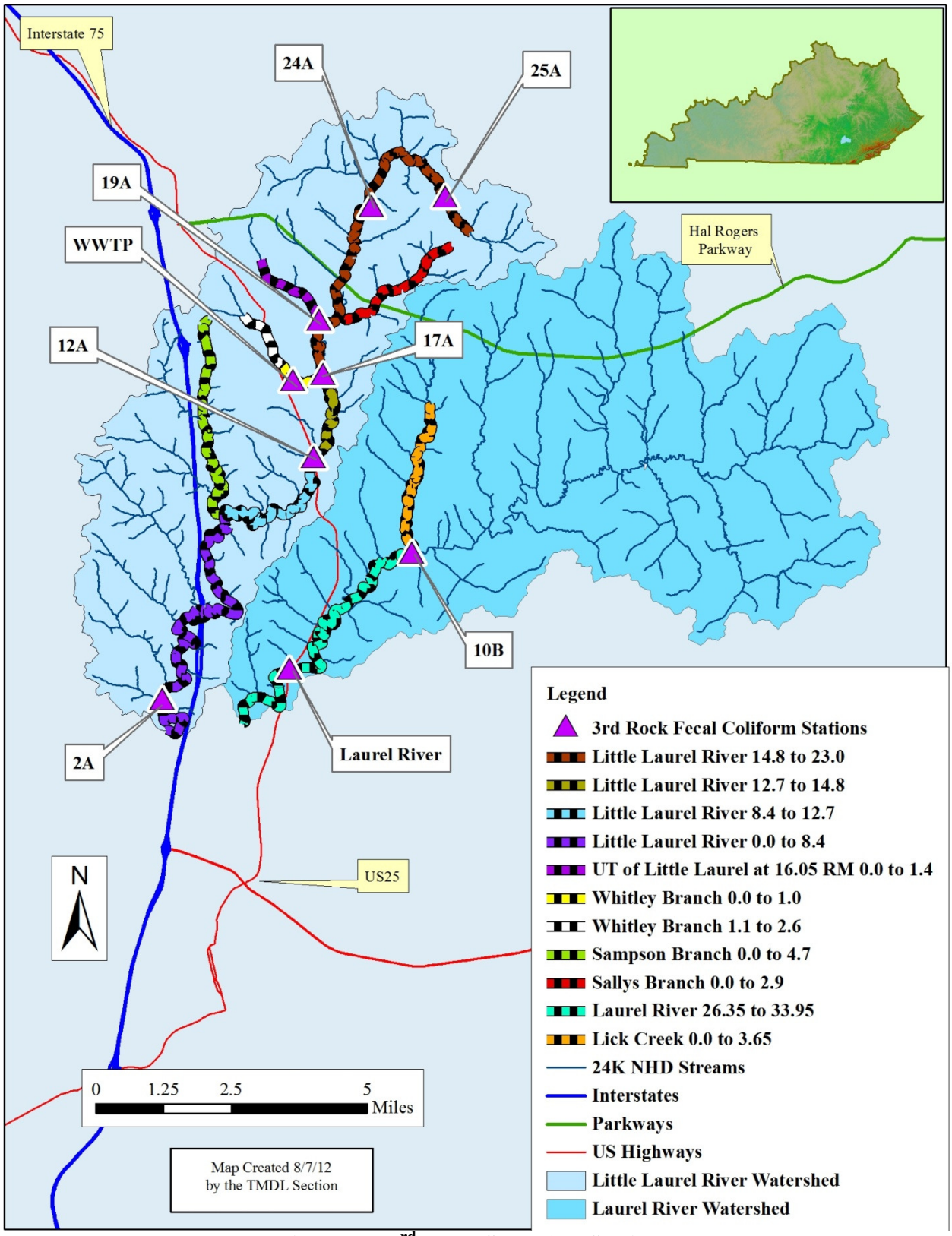

Figure 2.3 3rd Rock Sampling Stations

3.0 SOURCE ASSESSMENT

3.1 Wasteload Allocation

The Wasteload Allocation (WLA) is the portion of the TMDL allocated to KPDES-permitted sources within the watersheds. Facilities holding Kentucky Pollutant Discharge Elimination System (KPDES) permits to discharge bacteria to the waters of the Commonwealth can include Sanitary Wastewater Systems (SWSs) include all facilities with KPDES-permitted discharge limit for bacteria, including Wastewater Treatment Plants (WWTPs), Sewage Treatment Plants (STPs), package plants and home units. Other types of KPDES-permitted sources include Municipal Separate Storm Sewer Systems (MS4s), which are communities that receive storm water permits based on population. There are currently no MS4s in the Laurel or Little Laurel River watersheds.

3.1.1 Sanitary Wastewater Systems

There are three active SWS facilities in the Laurel and Little Laurel watersheds; Cornerstone Christian Church (KY0026581), Johnson Elementary School (KY0026557) and the London Sewage Treatment Plant (STP, KY0021270), although Johnson Elementary's permit expired on January 31st, 2012 and has not yet been renewed, see Table 3.1 and Figure 3.1. Cornerstone Christian discharges to a UT of Laurel River at RM 27.9 near the UT's mouth and Johnson Elementary discharges to RM 1.0 of a UT Of Little Laurel River at RM 19.7. The London STP discharges to Whitley Branch of Little Laurel River at RM 1.0. Cornerstone Christian and Johnson Elementary are currently permitted in terms of *E. coli*, and the London WWTP is permitted in terms of fecal coliform. However, the SWS-WLA for all facilities is reported in terms of *E. coli* so their WLAs match the units of the monitoring plan used to develop the TMDL, although London WWTP should still report DMR data in terms of fecal coliform. See Appendix A for DMR data reported from these facilities since 2007.

The SWS-WLA was calculated using the following equation, which requires the design flows of the SWS in million gallons per day (mgd) to be converted to cfs, which was done by multiplying the flow in mgd by the figure 1.547:

$$\underset{\text{(colonies/100ml)}}{240} \times \underset{\text{(cfs)}}{\text{Design Flow}} \times \underset{24{,}465{,}758.4}{\text{Conversion Factor}} = \text{WLA (colonies/day)}$$

(Equation 1)

SWSs are also responsible for their collection systems: The locations of sanitary sewer lines and lift stations within the Laurel and Little Laurel watersheds are shown in Figure 3.2 (KIA, 2012a, 2012b). This collection system serves the London STP. The London collection system has documented releases of sewage, known as Sanitary Sewer Overflows (SSOs, 3rd Rock, 2007). London has made improvements in its sewage infrastructure since 2007, but further work is needed in the area of capacity management, operation and maintenance (CMOM, Personal Communication, Gary Levy, 8/6/12). Any discharge from London's collection systems is an illegal source and thus receives an allocation of zero. See Section 3.3, Illegal Sources, for further discussion.

Table 3.1 Sanitary Wastewater Systems

Facility	KPDES Permit	Receiving Waterbody	Design Discharge (mgd[1])	Design Discharge (cfs[2])	Permit Limit (*E. coli* colonies/ 100ml) [3]	Latitude	Longitude
Cornerstone Christian School	KY0026581	UT to Laurel River at 27.9, near mouth	0.0099	0.015	240	37.019722	-84.073056
London STP	KY0021270	Whitley Branch at RM 1.0	5.0	7.74	240	37.105000	-84.069722
Johnson Elementary School	KY0026557	RM 1.0 of the UT to Little Laurel River at RM 19.7	0.005	0.008	240	37.158709	-84.051250

[1] mgd = millions of gallons per day.
[2] cfs = cubic feet per second.
[3] All Sanitary Wastewater System (SWS) facilities received WLAs in terms of *E. coli*; Johnson Elementary and Cornerstone Christian School report in terms of *E. coli* but the London STP reports in terms of fecal coliform. However, it was necessary to report the WLA for all SWSs in terms of *E. coli* so their allocations were consistent with the monitoring protocol used to develop the TMDL. Although the WLA is in terms of *E. coli*, this does not change the permit limits for any given facility; facilities permitted in terms of fecal coliform should continue to report in those units.

3.2 Load Allocation

Non KPDES-permitted sources include all sources not permitted by the KPDES permitting program and are often associated with land use. The loads to surface water from non-KPDES permitted sources are regulated by laws such as the Kentucky Agricultural Water Quality Act (AWQA, KRS 224.71-100 through 224.71-145, i.e., implementation of individual agriculture water quality plans and corrective measures), the federal Clean Water Act (i.e., the TMDL process) and 401 KAR 5:037 (Groundwater Protection Plans (GPPs)), among others. Unlike KPDES-permitted sources, non KPDES-permitted sources typically discharge pollutants to surface water in response to rain events. A Load Allocation (LA) is assigned to non KPDES-permitted sources. The LA is calculated using the following equation:

$$\text{Remainder} - \text{Future Growth WLA} - \text{Sum of MS4-WLAs} = \text{LA}$$

(Equation 2)

The available sampling data were insufficient to apportion the existing loading among the various LA sources; therefore, it is attributed to all LA sources. Sources are discussed individually below.

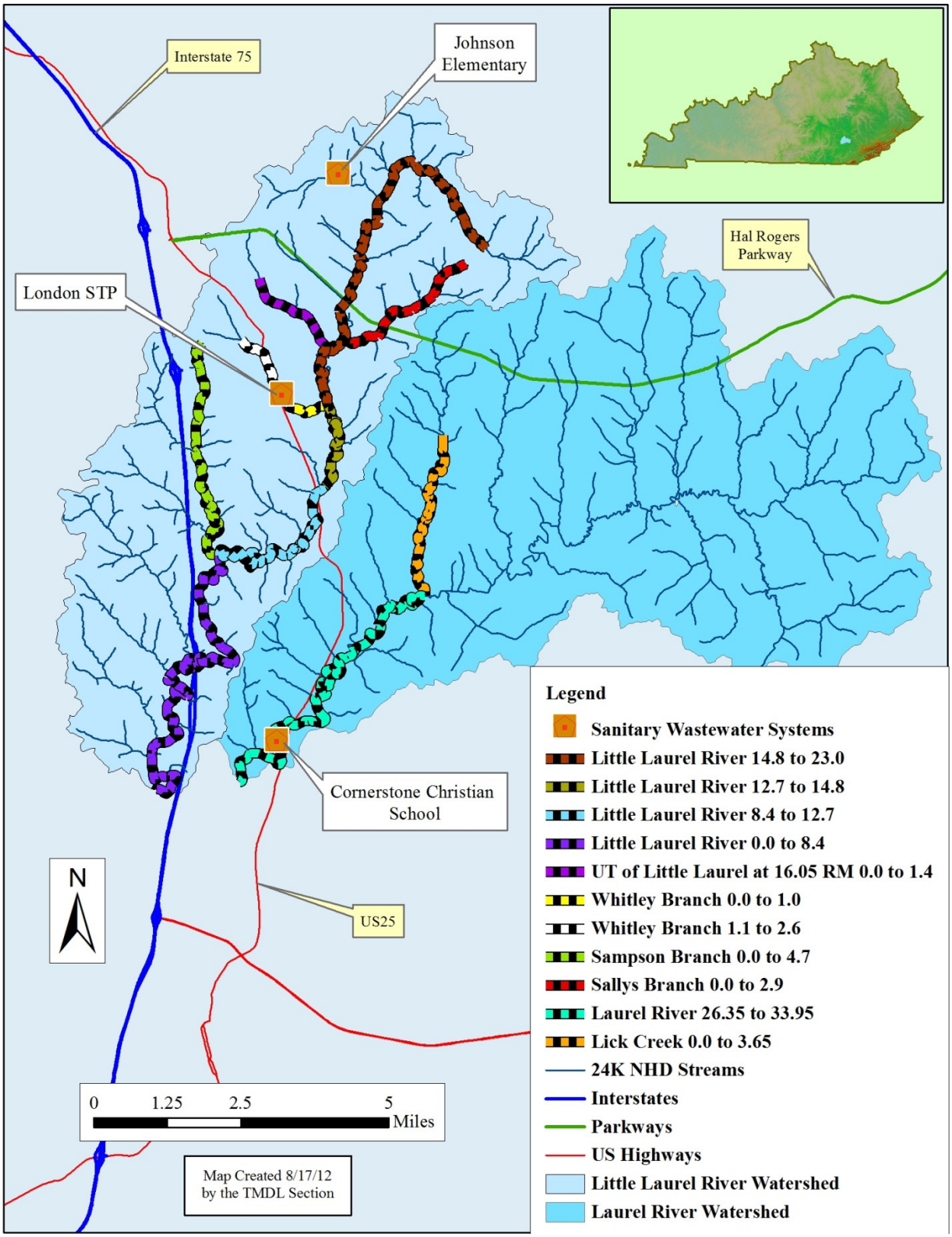

Figure 3.1 Sanitary Wastewater Systems

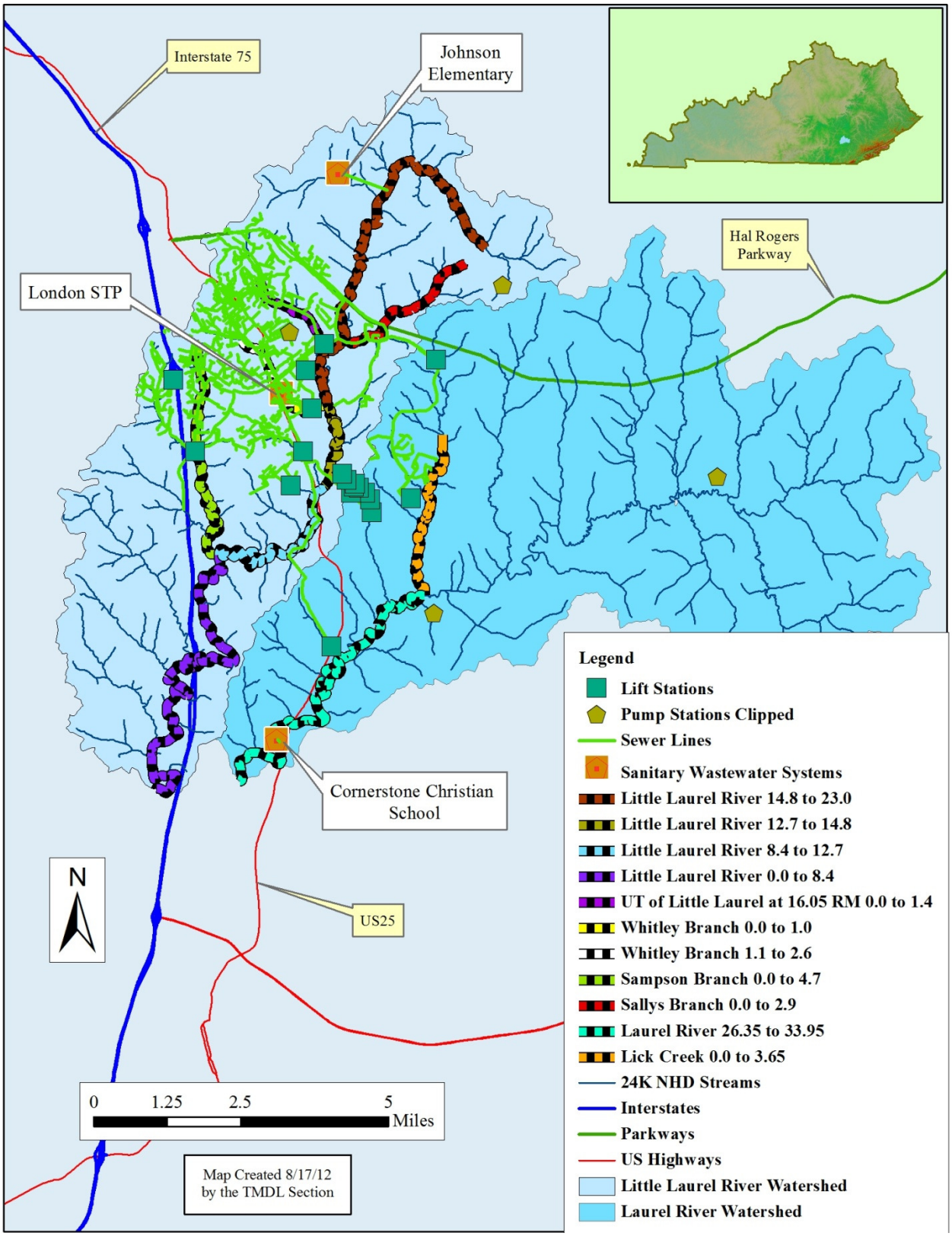

Figure 3.2 Sewer Lines, Lift Stations and Pump Stations

3.2.1 Wildlife

Wildlife are sources of bacteria in surface water, especially in rural areas. No numerical analysis of wildlife was conducted for this report.

3.2.2 Kentucky No Discharge Operating Permits

As stated in 401 KAR 5:005, facilities with agricultural waste handling systems or that dispose of their effluent by spray irrigation but do not discharge to surface waters are required to obtain a Kentucky No Discharge Operating Permit (KNDOP) from KDOW prior to construction and operation. Animal Feeding Operations (AFOs) receive KNDOP permits, see Section 3.2.3 for further information. These operations handle liquid waste in a storage component of the operation (e.g., lagoon, pit, or tank) and may land apply the waste via spray irrigation or injection to cropped acreages. Land application of the waste that results in runoff to a stream is prohibited. Facilities that handle animal waste as a liquid are required to submit a Short Form B, construction plans, and a Comprehensive Nutrient Management Plan to KDOW. Also included in KNDOP requirements are golf courses that land apply treated wastewater via spray irrigation, typically from a holding pond; some industrial operations also spray-irrigate.

3.2.3 Agriculture

The Kentucky AWQA was passed by the 1994 General Assembly. The law focuses on the protection of surface water and groundwater resources from agricultural and silvicultural activities. The Act created the Kentucky Agriculture Water Quality Authority (KAWQA), a 15-member peer group comprising farmers and representatives from various agencies and organizations. The Act requires farms greater than 10 acres in size to adhere to the Best Management Practices (BMPs) specified in the Kentucky Agriculture Water Quality Plan. Specific BMPs have been designated for all operations.

Landcover in the watershed is categorized in Table 3.2; this table includes agricultural landcover, the data are from the 2001 National Landcover Database (USGS, 2003). Landcover is also shown in Figure 3.3. Animal Feeding Operations (AFOs) are shown in Figure 3.4.

Table 3.2 Landcover in Laurel and Little Laurel Watersheds

Landcover	% of Total Area	Square Miles
Forest	34.3%	35.50
Agriculture (total)	38.0%	39.38
Pasture	38.0%	39.36
Row Crop	0.0%	0.02
Developed	18.2%	18.83
Natural Grassland	7.6%	7.91
Wetland	0.0%	0.01
Barren	1.6%	1.64

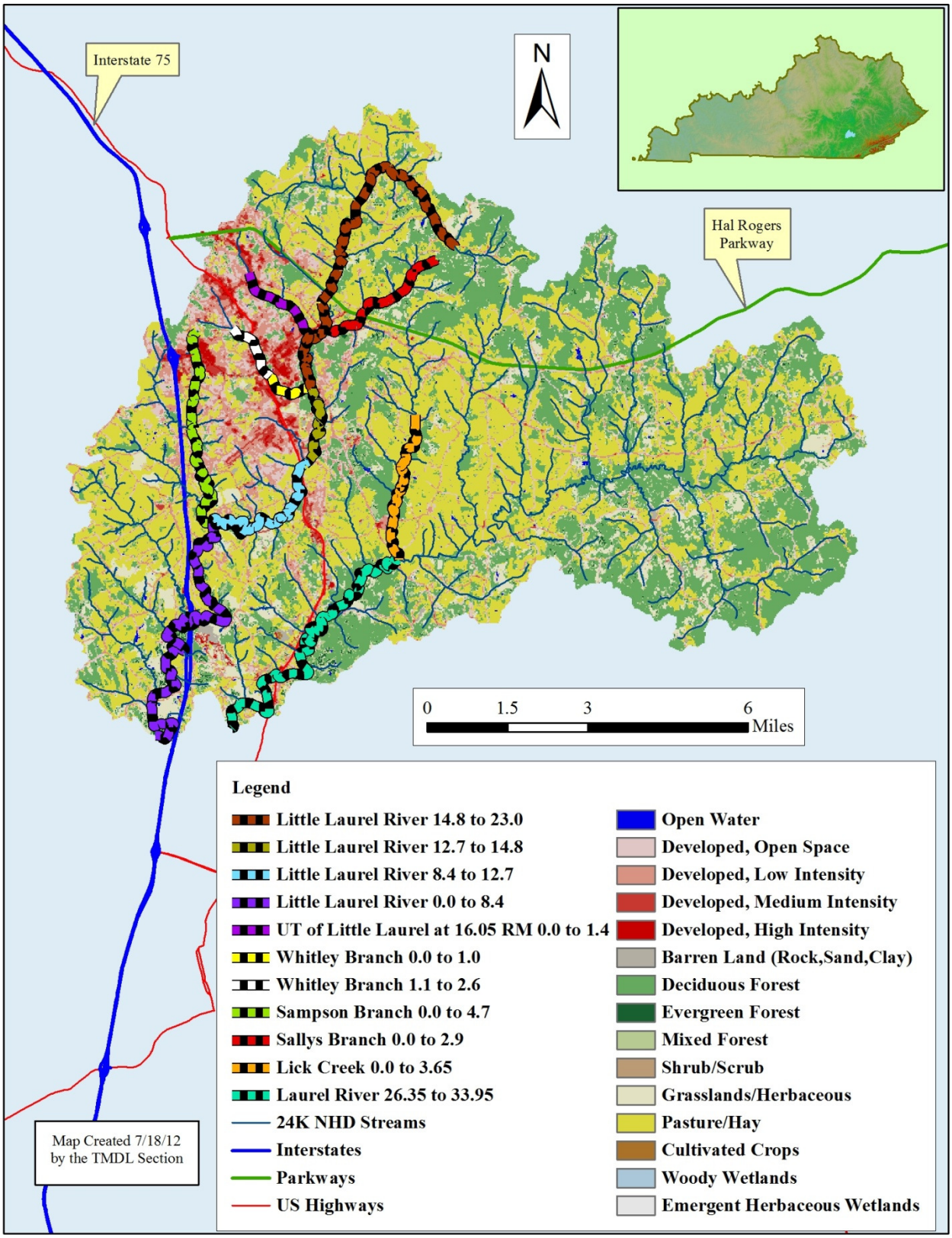

Figure 3.3 Landcover

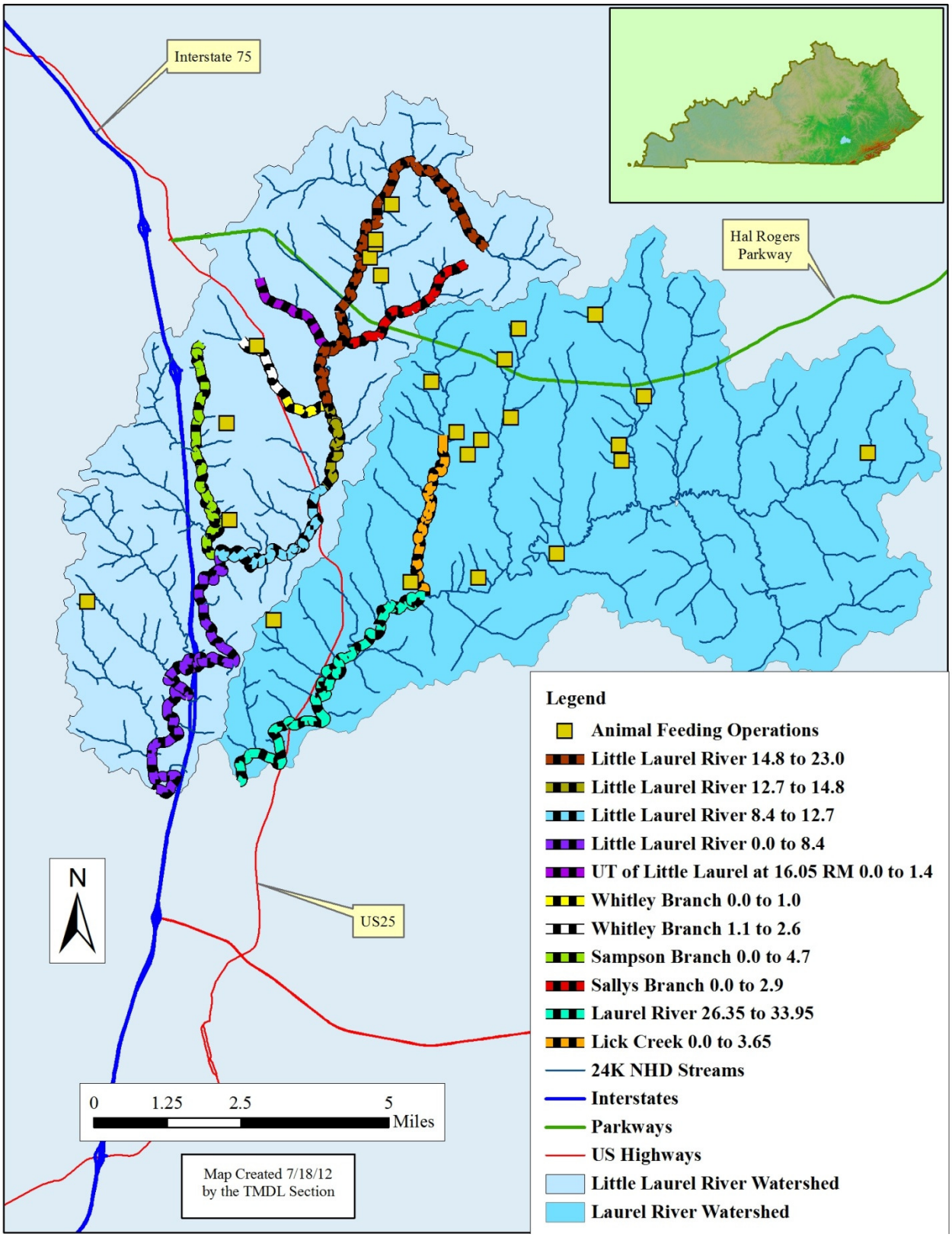

Figure 3.4 Animal Feeding Operations

3.2.4 Human Waste

Human waste disposal is of particular concern in rural areas. Areas not served by sewers either employ On Site Sewage Treatment and Disposal Systems (OSTDSs) or do not treat their sewage. OSTDSs, including septic tank systems, are commonly used in areas where providing a centralized sewage collection and treatment system is not cost-effective or practical. When properly sited, designed, constructed, maintained, and operated, septic systems are an effective means of disposing and treating domestic waste. The effluent from a well-functioning OSTDS is comparable to secondarily treated wastewater from a sewage treatment plant. When not functioning properly, they can be a source of *E. coli* (or fecal coliform) to both groundwater and surface water, see Section 3.3, Illegal Sources, for further discussion of failing OSTDSs. Another type of non KPDES-permitted source that may exist in the watershed is straight-pipes, which are discrete conveyances that discharge sewage, gray water (i.e., water from household sinks, laundry, etc.), and storm water to the surface waters of the Commonwealth without treatment.

In order to explore the effect of soil permeability on the function of OSTDSs, KDOW examined the SSURGO soil maps of the watershed (USDA/NRCS 2008). Soil types within the watershed include the Latham silt loam, the Whitley silt loam, the Morehead silt loam, the Stendal silt loam, the Shelocta-Latham silt loams, the Lily and Steinsburg silt loams, which are somewhat limited to very limited in terms of septic field absorption capability. This increases the likelihood that failing OSTDSs are a significant source of bacteria in the watershed.

3.2.5 Household Pets

Although household pets undoubtedly exist in this watershed, their contribution to the LA is deemed to be minimal compared to other sources in rural areas. Pet waste may, however, be a larger contributor to bacteria runoff in areas where there is a higher density of households and more impermeable surfaces.

3.3 Illegal Sources

Both KPDES-permitted and non KPDES-permitted sources can discharge bacteria to surface water illegally. This includes sources that are illegal simply by their existence, such as straight-pipes and SSOs, which receive no allocation. There may also be legal sources that are operating illegally (e.g., outside of regulations, permit limits or conditions, etc.), such as WWTP bypasses or a failing OSTDSs, which receive no allocation above that of a properly functioning system.

Another potential illegal source is livestock on farms that have no BMPs (as required under the AWQA) as well as farms where BMPs are present but are insufficient or failing in a manner that causes or contributes to surface water impairment; such farms receive no allocation above that of a farm with properly installed and functioning BMPs. Also included are KNDOPs, AFOs and CAFOs not in compliance with the appropriate regulations that cause or contribute to a surface water impairment.

As stated, due to the soil characteristics of the watershed, failing septic systems are expected to be contributors to surface water fecal coliform pollution. Straight pipes are likely present within the watershed. The City of London has remaining SSO problems.

KDOW expects implementation of these TMDLs to begin with the elimination of illegal sources. This is intended to prevent legally operating sources from having to effect reductions in order to accommodate the pollutant loading of illegal sources. Note this Section of the TMDL is not intended to summarize the universe of potential illegal sources that may discharge pollutants into surface waters, nor does it attempt to summarize the universe of legal sources that may be operating illegally. Instead, it gives examples of illegal sources known to be present or that are likely present in the watersheds (e.g., straight pipes).

4.0 TMDL METHOD

4.1 TMDL Definitions and Equation

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

$$TMDL = WLA + LA + MOS$$
(Equation 3)

The WLA has three components:

$$WLA = SWS\text{-}WLA + MS4\text{-}WLA + Future\ Growth\text{-}WLA$$
(Equation 4)

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 both implicit and explicit.
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: (28.31685L/ft^3 * 86400seconds/day * 1000ml/L)/(100ml) 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.

4.2 TMDL Components

Federal guidelines of the Clean Water Act require that TMDLs consider seasonality, are written for a critical condition, include a MOS as appropriate and are expressed as a daily load. KDOW also calculates a Future Growth-WLA.

4.2.1 Seasonality.

This TMDL considers seasonality because it only applies during the PCR season of May through October.

4.2.2 Critical Condition.

The critical condition or critical flow for streams impaired by nonpoint sources generally occurs during periods of wet weather and high surface runoff (especially with an antecedent dry period that allows pollutant buildup prior to the runoff event), while the critical condition for streams impaired by point sources generally occurs during periods of dry weather and low surface runoff when low stream flow allows for only minimal or zero dilution of the point source's effluent.

Because bacteria inputs are attributed to both point and nonpoint sources in the watershed, and due to the limited amount of flow data available, particularly the absence of USGS stream gages or in-stream flow data, the critical condition for this TMDL is the Adjusted Mean Annual Flow (AMAF). The AMAF is calculated by first determining the Mean Annual Flow (MAF). USGS has generated MAF values for streams across Kentucky, which were calculated using the 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 the MAF was obtained the design flows of all SWS inputs within or above each impaired segment were added to generate the AMAF, which is as the critical condition or critical flow for that impaired segment.

4.2.3 Margin of Safety.

There are two methods for incorporating a MOS in the TMDL analysis: implicitly include the MOS using conservative assumptions, or explicitly designate a (numerical) portion of the TMDL as the MOS and divide the remainder of the allowable load (i.e., the TMDL Target load) between the LA and WLA. For this TMDL, a 10% explicit MOS (i.e., 10% of the WQC, or {XX} colonies/100ml, but expressed as a load where possible) was reserved to address uncertainties involving loading from non-SWS sources. SWS sources have an implicit MOS based on the fact that they seldom operate at their design flow. The explicit MOS load was calculated using the following equation:

$$\underset{\text{(colonies/100ml)}}{24} \times \underset{\text{(cfs)}}{\text{Critical Flow}} \times \underset{24{,}465{,}758.4}{\text{Conversion Factor}} = \text{MOS (colonies/day)}$$

(Equation 5)

4.2.4 TMDL Method.

TMDLs must be expressed in terms of a daily load. KDOW developed TMDLs for Laurel and Little Laurel Rivers using the *E. coli* instantaneous WQC and the critical flow, or AMAF. The critical flow (i.e., the AMAF) was multiplied by the WQC minus the MOS (10%) times the appropriate conversion factor to obtain the TMDL Target (i.e., the allowable daily load).

4.2.5 Remainder

The Remainder is not part of the TMDL; however, it is used in the TMDL calculations. It is calculated as the Target Load (i.e., the TMDL minus the MOS) minus the sum of all individual SWS-WLAs.

4.2.5 Future Growth-WLA.

Because the WLA must include all KPDES-permitted sources, often a TMDL will anticipate future growth of these sources (i.e., an increase in the number of WLA sources or in the loading per discharger) in order to avoid having to re-open the TMDL and change the WLA when new sources begin discharging. It can also include existing storm water sources that are later discovered to discharge the pollutant of concern, even though this fact was not known at the time the TMDL was written. Future growth is represented by a portion of the Remainder that is set aside (i.e., is not part of the LA nor is it part of the WLA for current/known sources). Of course, any and all of the sources mentioned above must meet the WQC and KDOW's permitting requirements. The amount reserved for future growth is determined using Table 4.1, which assumes that growth occurs more rapidly in developed areas (which is determined by the sum of developed open space, developed low intensity, developed medium intensity and developed high intensity areas as defined by the USGS NLCD) than in rural areas:

Table 4.1 Future Growth

Percent Developed Area in the Subwatershed	Future Growth WLA Percentage
≥25%	5%
≥20% – <25%	4%
≥15% – <20%	3%
≥10% – <15%	2%
≥5% – <10%	1%
<5%	0.5%

The Future Growth WLA is calculated using the following formula:

$$\text{Remainder} \times \text{Future Growth-WLA percentage} = \text{Future Growth-WLA}$$

(Equation 6)

5.0 IMPAIRED SEGMENTS SAMPLING DATA AND TMDL DETERMINATION

For each impaired segment, the available sampling data, landcover information, and TMDL allocations were determined and are presented in tabular format.

5.1 Laurel River

5.1.1 Laurel River 26.3 to 33.95

This subwatershed comprises 59.29 square miles. Sampling data, landcover values, and TMDL calculations follow. Cornerstone Christian School discharges to a UT to this segment.

Table 5.1 Sampling Data, Laurel River 26.3 to 33.95

Site	Collection Date	*E. coli* (colonies/ 100 ml)	Exceedance	Discharge[1] (cfs)
DOW02026002	5/9/2007	817	**Yes**	65.4 E
Laurel River at KY229	5/22/2007	210	No	4.912
37.05475, -84.02777	6/12/2007	276	**Yes**	3.96 E
RM 33.9	6/27/2007	185	No	0.197
	7/18/2007	80	No	0.048 E
	8/15/2007	41	No	0.153 E
	8/30/2007	5	No	1.769
	9/13/2007	257	**Yes**	0.017
	9/26/2007	13	No	0.282
	10/16/2007	10	No	0.126
	10/23/2007	110	No	0.0252 E
Site	**Collection Date**	**Fecal Coliform (colonies/ 100 ml)**	**Exceedance**	**Discharge[1] (cfs)**
CRW014	8/1/2000	64	No	N/A
Laurel River near Lilly	5/5/2005	18	No	N/A
Happy Hollow Road	6/5/2005	127	No	N/A
37.04200, -84.04830	7/5/2005	30	No	N/A
RM 31.6	8/5/2005	8	No	N/A
	9/5/2005	41	No	N/A
	10/5/2005	46	No	N/A

Site	Collection Date	*E. coli* (colonies/100 ml)	Exceedance	Discharge[1] (cfs)
CRW014	5/10/2010	866	**Yes**	N/A
Laurel River near Lilly	6/10/2010	91	No	N/A
Happy Hollow Road	7/10/2010	106	No	N/A
37.04200, -84.04830	8/10/2010	276	**Yes**	N/A
RM 31.6	9/10/2010	300	**Yes**	N/A
	10/10/2010	105	No	N/A
Site	**Collection Date**	**Fecal Coliform (colonies/100 ml)**	**Exceedance**	**Discharge[1] (cfs)**
10B	11/11/2005	500	**Yes**	N/A
37.054612, -84.027348				
RM 33.9				
Site	**Collection Date**	**Fecal Coliform (colonies/100 ml)**	**Exceedance**	**Discharge[1] (cfs)**
Laurel River	1/27/2006	120	No	N/A
37.024155, -84.068801	3/1/2006	30	No	N/A
28.5				

[1] D = duplicate sample
[2] E= estimated discharge. N/A = no discharge recorded.

Table 5.2 Landcover Data, Laurel River 26.3 to 33.95

Landcover	% of Total Area	Square Miles
Forest	42.0%	24.88
Agriculture (total)	38.7%	22.92
Pasture	38.6%	22.91
Row Crop	0.0%	0.01
Developed	9.7%	5.78
Natural Grassland	7.9%	4.68
Wetland	0.0%	0.00
Barren	1.5%	0.90

Table 5.3 MAF Data, Laurel River 26.3 to 33.95

Waterbody & Segment	MAF, cfs	SWS Flow, cfs	Adjusted MAF, cfs
Laurel River 26.35 to 33.95	84.3	0.015	84.32

Table 5.4 TMDL Allocations, Laurel River 26.3 to 33.95

Waterbody & Segment	TMDL (*E. coli* colonies/ day)	MOS (*E. coli* colonies/day)	SWS-WLA (*E. coli* colonies/ day)	Future Growth %	Future Growth-WLA (*E. coli* colonies/day)	LA (*E. coli* colonies/day)
Laurel River 26.35 to 33.95	4.95E+11	4.95E+10	8.99E+07	1%	4.45E+09	4.41E+11

5.1.2 Lick Creek 0.0 to 3.65

This subwatershed comprises 5.95 square miles. Sampling data, landcover values, and TMDL calculations follow.

Table 5.5 Sampling Data, Lick Creek 0.0 to 3.65

Site	Collection Date	*E. coli* [(1)] (colonies/100 ml)	Exceedance	Discharge[(2)] (cfs)
DOW02026003	5/9/2007	817	**Yes**	5.833
Lick Creek at Smith	5/22/2007	290	**Yes**	0.583
Brewer Road	5/22/2007	388 D	**Yes**	N/A
37.05651, -84.02690	6/12/2007	1047	**Yes**	0.077 E
RM 0.15	6/27/2007	548	**Yes**	0.05
	7/18/2007	345	**Yes**	0.019
	8/15/2007	1300	**Yes**	0.006
	8/30/2007	365	**Yes**	0.004 E
	9/13/2007	1117	**Yes**	0.012 E
	10/23/2007	1170	**Yes**	0.017

[(1)] D = duplicate sample
[(2)] E= estimated discharge. N/A = no discharge recorded.

Table 5.6 Landcover Data, Lick Creek 0.0 to 3.65

Landcover	% of Total Area	Square Miles
Forest	35.4%	2.11
Agriculture (total)	47.3%	2.82
Pasture	47.3%	2.82
Row Crop	0.0%	0.00
Developed	11.9%	0.71
Natural Grassland	3.7%	0.22
Wetland	0.0%	0.00
Barren	1.2%	0.07

Table 5.7 MAF Data, Lick Creek 0.0 to 3.65

Waterbody & Segment	MAF, cfs	SWS Flow, cfs	Adjusted MAF, cfs
Lick Creek 0.0 to 3.65	8.5	0	8.5

Table 5.8 TMDL Allocations, Lick Creek 0.0 to 3.65

Waterbody & Segment	TMDL (*E. coli* colonies/ day)	MOS (*E. coli* colonies/day)	SWS-WLA (*E. coli* colonies/ day)	Future Growth %	Future Growth-WLA (*E. coli* colonies/day)	LA (*E. coli* colonies/day)
Lick Creek 0.0 to 3.65	4.99E+10	4.99E+09	0.00E+00	2%	8.98E+08	4.40E+10

5.2 Little Laurel River

5.2.1 Little Laurel River 0.0 to 8.4

This subwatershed comprises 44.16 square miles. Sampling data, landcover values, and TMDL calculations follow. The London SWS discharges above this segment.

Table 5.9 Sampling Data, Little Laurel River 0.0 to 8.4

Site	Collection Date	*E. coli* (1) (colonies/100 ml)	Exceedance	Discharge(2) (cfs)
DOW02027001	5/3/2007	>2400	**Yes**	306.78 E
Little Laurel River at KY552	5/29/2007	52	No	4.962

Site	Collection Date	*E. coli* [1] (colonies/100 ml)	Exceedance	Discharge[2] (cfs)
37.017466, -84.111427	6/7/2007	200	No	5.837
RM 1.5	6/19/2007	26	No	3.24
	7/10/2007	86	No	18.93
	8/7/2007	62	No	2.862
	8/21/2007	24	No	2.094
	9/6/2007	57	No	1.893
	9/20/2007	79	No	2.389
	10/9/2007	4352	**Yes**	2.319
	10/23/2007	400	**Yes**	2.345
Site	**Collection Date**	***E. coli* [1] (colonies/100 ml)**	**Exceedance**	**Discharge[2] (cfs)**
DOW02027005	5/3/2007	>2400	**Yes**	439.98 E
Little Laurel River at Pine	5/29/2007	145	No	5.677
Grove School Road	6/7/2007	171	No	3.903
37.059518, -84.091540	6/7/2007	256 D	**Yes**	N/A
RM 7.8	6/19/2007	83	No	2.398
	7/10/2007	866	**Yes**	2.137
	8/7/2007	33	No	1.445
	8/21/2007	75	No	1.214
	9/6/2007	105	No	2.576
	9/20/2007	770	**Yes**	2.487
	10/9/2007	624	**Yes**	1.177
Site	**Collection Date**	**Fecal Coliform (colonies/100 ml)**	**Exceedance**	**Discharge[2] (cfs)**
2A	1/27/2006	440	**Yes**	N/A
37.016791, -84.111328	3/1/2006	10	No	N/A
RM 1.4				

[1] D = duplicate sample. A ">" symbol means the sample exceeded the amount shown, but the actual number is not known.
[2] E= estimated discharge. N/A = no discharge recorded.

Table 5.10 Landcover Data, Little Laurel River 0.0 to 8.4

Landcover	% of Total Area	Square Miles
Forest	24.0%	10.58
Agriculture (total)	37.3%	16.46
Pasture	37.3%	16.45
Row Crop	0.0%	0.01
Developed	29.6%	13.05
Natural Grassland	7.3%	3.23
Wetland	0.0%	0.00
Barren	1.7%	0.73

Table 5.11 MAF Data, Little Laurel River 0.0 to 8.4

Waterbody & Segment	MAF, cfs	SWS Flow, cfs	Adjusted MAF, cfs
Little Laurel River 0.0 to 8.4	62.7	7.74	70.44

Table 5.12 TMDL Allocations, Little Laurel River 0.0 to 8.4

Waterbody & Segment	TMDL (*E. coli* colonies/ day)	MOS (*E. coli* colonies/day)	SWS-WLA (*E. coli* colonies/ day)	Future Growth %	Future Growth-WLA (*E. coli* colonies/day)	LA (*E. coli* colonies/day)
Little Laurel River 0.0 to 8.4	4.14E+11	4.14E+10	4.55E+10	5%	1.63E+10	3.10E+11

5.2.2 Little Laurel River 8.4 to 12.7

This subwatershed comprises 25.74 square miles. Sampling data, landcover values, and TMDL calculations follow. The London SWS discharges above this segment.

Table 5.13 Sampling Data, Little Laurel River 8.4 to 12.7

Site	Collection Date	*E. coli* (1) (colonies/100 ml)	Exceedance	Discharge(2) (cfs)
DOW02027007	5/3/2007	>2400	**Yes**	101.85 E
Little Laurel River at U.S.25	5/3/2007	>2400 D	**Yes**	N/A
37.080445, -84.059518	5/29/2007	1187	**Yes**	3.147

Site	Collection Date	*E. coli* [1] (colonies/100 ml)	Exceedance	Discharge[2] (cfs)
RM 12.50	6/7/2007	3076	**Yes**	2.517
	6/19/2007	172	**No**	3.063
	7/10/2007	980	**Yes**	2.196
	8/7/2007	488	**Yes**	2.544
	8/21/2007	172	No	2.06
	9/6/2007	115	No	2.411
	9/20/2007	687	**Yes**	2.284
	10/9/2007	624	**Yes**	2.447
	10/23/2007	1920	**Yes**	34.36
Site	**Collection Date**	**Fecal Coliform (colonies/100 ml)**	**Exceedance**	**Discharge[2] (cfs)**
12A	5/2005	800	**Yes**	N/A
37.080487, -84.059629	11/14/2005	3200	**Yes**	N/A
RM 12.5				

[1] D = duplicate sample. A ">" symbol means the sample exceeded the amount shown, but the actual number is not known.
[2] E= estimated discharge. N/A = no discharge recorded.

Table 5.14 Landcover Data, Little Laurel River 8.4 to 12.7

Landcover	% of Total Area	Square Miles
Forest	25.8%	6.64
Agriculture (total)	32.6%	8.39
Pasture	32.6%	8.38
Row Crop	0.0%	0.00
Developed	34.1%	8.78
Natural Grassland	5.8%	1.49
Wetland	0.0%	0.00
Barren	1.6%	0.40

Table 5.15 MAF Data, Little Laurel River 8.4 to 12.7

Waterbody & Segment	MAF, cfs	SWS Flow, cfs	Adjusted MAF, cfs
Little Laurel River 8.4 to 12.7	36.5	7.74	44.24

Table 5.16 TMDL Allocations, Little Laurel River 8.4 to 12.7

Waterbody & Segment	TMDL (*E. coli* colonies/ day)	MOS (*E. coli* colonies/day)	SWS-WLA (*E. coli* colonies/ day)	Future Growth %	Future Growth-WLA (*E. coli* colonies/day)	LA (*E. coli* colonies/day)
Little Laurel River 8.4 to 12.7	2.60E+11	2.60E+10	4.55E+10	5%	9.42E+09	1.79E+11

5.2.3 Little Laurel River 12.7 to 14.8

This subwatershed comprises 21.16 square miles. Sampling data, landcover values, and TMDL calculations follow. The London SWS discharges to Whitley Branch, which flows into this segment.

Table 5.17 Sampling Data, Little Laurel River 12.7 to 14.8

Site	Collection Date	Fecal Coliform[1] (colonies/100 ml)	Exceedance	Discharge[2] (cfs)
UCTMDL01	8/1/2000	TNTC	**Yes**	N/A
Little Laurel River at KY1006 Bridge				
37.102900, -84.055800				
RM 12.7				

[1] TNTC = too numerous to count.
[2] N/A = no discharge recorded.

Table 5.18 Landcover Data, Little Laurel River 12.7 to 14.8

Landcover	% of Total Area	Square Miles
Forest	28.8%	6.10
Agriculture (total)	33.0%	6.98
Pasture	32.9%	6.98
Row Crop	0.0%	0.00
Developed	30.7%	6.51
Natural Grassland	5.8%	1.24
Wetland	0.0%	0.00
Barren	1.5%	0.32

Table 5.19 MAF Data, Little Laurel River 12.7 to 14.8

Waterbody & Segment	MAF, cfs	SWS Flow, cfs	Adjusted MAF, cfs
Little Laurel River 12.7 to 14.8	30	7.74	37.74

Table 5.20 TMDL Allocations, Little Laurel River 12.7 to 14.8

Waterbody & Segment	TMDL (*E. coli* colonies/ day)	MOS (*E. coli* colonies/day)	SWS-WLA (*E. coli* colonies/ day)	Future Growth %	Future Growth-WLA (*E. coli* colonies/day)	LA (*E. coli* colonies/day)
Little Laurel River 12.7 to 14.8	2.22E+11	2.22E+10	4.55E+10	5%	7.70E+09	1.46E+11

5.2.4 Little Laurel River 14.8 to 23.0

This subwatershed comprises 16.91 square miles. Sampling data, landcover values, and TMDL calculations follow.

Table 5.21 Sampling Data, Little Laurel River 14.8 to 23.0

Site	Collection Date	*E. coli* (1) (colonies/100 ml)	Exceedance	Discharge(2) (cfs)
DOW02027009	5/3/2007	>2400	**Yes**	218.41 E
Little Laurel River at KY229	5/29/2007	573	**Yes**	0.518

Site	Collection Date	*E. coli* [1] (colonies/100 ml)	Exceedance	Discharge[2] (cfs)
37.10278, -84.055830	6/7/2007	41	No	0.245
RM 14.8	7/10/2007	23	No	0.085
	7/10/2007	18 D	No	N/A
	10/9/2007	92	No	0.018
Site	**Collection Date**	***E. coli* [1] (colonies/100 ml)**	**Exceedance**	**Discharge[2] (cfs)**
DOW02027012	5/3/2007	>2400	**Yes**	50.433 E
Little Laurel River off KY472	5/29/2007	6488	**Yes**	0.283
37.138777, -84.045359				
RM 18.30				
Site	**Collection Date**	**Fecal Coliform[1] (colonies/100 ml)**	**Exceedance**	**Discharge[2] (cfs)**
17A	11/11/2005	500	**Yes**	N/A
37.102723, -84.055778	11/14/2005	3200	**Yes**	N/A
RM 14.8				
Site	**Collection Date**	**Fecal Coliform[1] (colonies/100 ml)**	**Exceedance**	**Discharge[2] (cfs)**
24A	5/2005	1800	**Yes**	N/A
37.147217, -84.038748				
RM 19.3				
Site	**Collection Date**	**Fecal Coliform[1] (colonies/100 ml)**	**Exceedance**	**Discharge[2] (cfs)**
25A	11/14/2005	2900	**Yes**	N/A
37.149527, -84.014101				
RM 22.15				

[1] D = duplicate sample. A ">" symbol means the sample exceeded the amount shown, but the actual number is not known.
[2] E= estimated discharge. N/A = no discharge recorded.

Table 5.22 Landcover Data, Little Laurel River 14.8 to 23.0

Landcover	% of Total Area	Square Miles
Forest	30.6%	5.17
Agriculture (total)	38.5%	6.51
Pasture	38.5%	6.51
Row Crop	0.0%	0.00
Developed	23.1%	3.91
Natural Grassland	6.0%	1.02
Wetland	0.0%	0.00
Barren	1.6%	0.27

Table 5.23 MAF Data, Little Laurel River 14.8 to 23.0

Waterbody & Segment	MAF, cfs	SWS Flow, cfs	Adjusted MAF, cfs
Little Laurel River 14.8 to 23.0	23.9	0.0077	23.9

Table 5.24 TMDL Allocations, Little Laurel River 14.8 to 23.0

Waterbody & Segment	TMDL (*E. coli* colonies/ day)	MOS (*E. coli* colonies/day)	SWS-WLA (*E. coli* colonies/ day)	Future Growth %	Future Growth-WLA (*E. coli* colonies/day)	LA (*E. coli* colonies/day)
Little Laurel River 14.8 to 23.0	1.40E+11	1.40E+10	4.54E+07	4%	5.05E+09	1.21E+11

5.2.5 Sallys Branch 0.0 to 2.9

This subwatershed comprises 2.80 square miles. Sampling data, landcover values, and TMDL calculations follow.

Table 5.25 Sampling Data, Sallys Branch 0.0 to 2.9

Site	Collection Date	*E. coli* (1) (colonies/100 ml)	Exceedance	Discharge(2) (cfs)
DOW02027011	5/3/2007	>2400	**Yes**	9.873 E
Sally Branch off KY80	5/29/2007	241	**Yes**	0.14

Site	Collection Date	*E. coli* [1] (colonies/100 ml)	Exceedance	Discharge[2] (cfs)
37.117041, -84.047450	6/7/2007	158	No	0.019
RM 0.2	7/10/2007	88	No	0.045
	9/20/2007	249	**Yes**	0.019

[1] A ">" symbol means the sample exceeded the amount shown, but the actual number is not known.
[2] E= estimated discharge.

Table 5.26 Landcover Data, Sallys Branch 0.0 to 2.9

Landcover	% of Total Area	Square Miles
Forest	32.5%	0.91
Agriculture (total)	39.9%	1.12
Pasture	39.9%	1.12
Row Crop	0.0%	0.00
Developed	17.1%	0.48
Natural Grassland	8.2%	0.23
Wetland	0.0%	0.00
Barren	2.1%	0.06

Table 5.27 MAF Data, Sallys Branch 0.0 to 2.9

Waterbody & Segment	MAF, cfs	SWS Flow, cfs	Adjusted MAF, cfs
Sallys Branch 0.0 to 2.90	3.7	N/A	3.7

Table 5.28 TMDL Allocations, Sallys Branch 0.0 to 2.9

Waterbody & Segment	TMDL (*E. coli* colonies/ day)	MOS (*E. coli* colonies/day)	SWS-WLA (*E. coli* colonies/ day)	Future Growth %	Future Growth-WLA (*E. coli* colonies/day)	LA (*E. coli* colonies/day)
Sallys Branch 0.0 to 2.90	2.17E+10	2.17E+09	0.00E+00	3%	5.87E+08	1.90E+10

5.2.6 Sampson Branch 0.0 to 4.7

This subwatershed comprises 6.36 square miles. Sampling data, landcover values, and TMDL calculations follow.

Table 5.29 Sampling Data, Sampson Branch 0.0 to 4.7

Site	Collection Date	*E. coli* [1] (colonies/100 ml)	Exceedance	Discharge[2] (cfs)
DOW02027006	5/3/2007	>2400	**Yes**	17.43 E
Sampson Branch off Dogwood	5/29/2007	480	**Yes**	0.545
Springs Road	6/7/2007	520	**Yes**	0.48
37.065768, -84.090914	6/19/2007	201	No	0.096
RM 0.10	6/19/2007	387 D	**Yes**	N/A
	7/10/2007	291	**Yes**	0.587
	8/7/2007	24	No	0.077
	9/20/2007	35	No	0.012
	10/9/2007	1421	**Yes**	0.207

[1] D = duplicate sample. A ">" symbol means the sample exceeded the amount shown, but the actual number is not known.
[2] E= estimated discharge. N/A = no discharge recorded.

Table 5.30 Landcover Data, Sampson Branch 0.0 to 4.7

Landcover	% of Total Area	Square Miles
Forest	11.4%	0.72
Agriculture (total)	39.3%	2.50
Pasture	39.3%	2.50
Row Crop	0.1%	0.00
Developed	41.0%	2.61
Natural Grassland	6.3%	0.40
Wetland	0.0%	0.00
Barren	1.6%	0.10

Table 5.31 MAF Data, Sampson Branch 0.0 to 4.7

Waterbody & Segment	MAF, cfs	SWS Flow, cfs	Adjusted MAF, cfs
Sampson Branch 0.0 to 4.70	8.9	N/A	8.9

Table 5.32 TMDL Allocations, Sampson Branch 0.0 to 4.7

Waterbody & Segment	TMDL (*E. coli* colonies/ day)	MOS (*E. coli* colonies/day)	SWS-WLA (*E. coli* colonies/ day)	Future Growth %	Future Growth-WLA (*E. coli* colonies/day)	LA (*E. coli* colonies/day)
Sampson Branch 0.0 to 4.70	5.23E+10	5.23E+09	0.00E+00	5%	2.35E+09	4.47E+10

5.2.7 UT to Little Laurel River 0.0 to 1.4

This subwatershed comprises 2.21 square miles. Sampling data, landcover values, and TMDL calculations follow.

Table 5.33 Sampling Data, UT to Little Laurel River 0.0 to 1.4

Site	Collection Date	*E. coli* [(1)] (colonies/100 ml)	Exceedance	Discharge[(2)] (cfs)
DOW02027010	5/3/2007	>2400	**Yes**	3.561
UT Little Laurel River at TLC	5/29/2007	2359	**Yes**	0.021 E
37.117143, -84.056683	6/7/2007	548	**Yes**	0.027
RM 0.08	7/10/2007	2420	**Yes**	0.017 E
	8/7/2007	107	No	0.069 E
	8/7/2007	110 D	No	N/A
Site	**Collection Date and Time**	**Fecal Coliform[(1)] (colonies/100 ml)**	**Exceedance**	**Discharge[(2)] (cfs)**
19A	5/2005	430	**Yes**	N/A
37.11711, -84.056766	11/11/2005 8:09:00 AM	200	No	N/A
RM 0.1	11/11/2005 8:21:00 AM	100	No	N/A

[(1)] D = duplicate sample. A ">" symbol means the sample exceeded the amount shown, but the actual number is not known.
[(2)] E= estimated discharge. N/A = no discharge recorded.

Table 5.34 Landcover Data, UT to Little Laurel River 0.0 to 1.4

Landcover	% of Total Area	Square Miles
Forest	13.6%	0.30
Agriculture (total)	14.3%	0.32
Pasture	14.2%	0.32
Row Crop	0.1%	0.00
Developed	68.4%	1.51
Natural Grassland	1.8%	0.04
Wetland	0.0%	0.00
Barren	1.5%	0.03

Table 5.35 MAF Data, UT to Little Laurel River 0.0 to 1.4

Waterbody & Segment	MAF, cfs	SWS Flow, cfs	Adjusted MAF, cfs
UT of Little Laurel River at 16.05 RM 0.0 to 1.4	3.1	N/A	3.1

Table 5.36 TMDL Allocations, UT to Little Laurel River 0.0 to 1.4

Waterbody & Segment	TMDL (*E. coli* colonies/ day)	MOS (*E. coli* colonies/day)	SWS-WLA (*E. coli* colonies/ day)	Future Growth %	Future Growth-WLA (*E. coli* colonies/day)	LA (*E. coli* colonies/day)
UT of Little Laurel River at 16.05 RM 0.0 to 1.4	1.82E+10	1.82E+09	0.00E+00	5%	8.19E+08	1.56E+10

5.2.8 Whitley Branch 0.0 to 1.0

This subwatershed comprises 2.61 square miles. Sampling data, landcover values, and TMDL calculations follow. The London SWS discharges to this segment.

Table 5.37 Sampling Data, Whitley Branch 0.0 to 1.0

Site	Collection Date	*E. coli*[1] (colonies/100 ml)	Exceedance	Discharge[2] (cfs)
DOW02027008	5/3/2007	1987	**Yes**	6.5
Whitley Branch of Little Laurel River	5/29/2007	158	No	2.994
37.101718, -84.056365	5/29/2007	295 D	**Yes**	N/A
RM 0.10	6/7/2007	132	No	4.083
	7/10/2007	308	**Yes**	1.683
	8/7/2007	387	**Yes**	3.607
	8/21/2008	517	**Yes**	0.432
	9/6/2007	210	No	4.63
	9/20/2007	326	**Yes**	3.693
	10/9/2007	3681	**Yes**	4.767
Site	**Collection Date**	**Fecal Coliform[1] (colonies/100 ml)**	**Exceedance**	**Discharge[2] (cfs)**
WWTP	11/14/2005	3600	**Yes**	N/A
37.101171, -84.066021				
RM 0.7				

[1] D = duplicate sample.
[2] N/A = no discharge recorded.

Table 5.38 Landcover Data, Whitley Branch 0.0 to 1.0

Landcover	% of Total Area	Square Miles
Forest	10.5%	0.27
Agriculture (total)	9.3%	0.24
Pasture	9.3%	0.24
Row Crop	0.0%	0.00
Developed	76.5%	1.99
Natural Grassland	2.3%	0.06
Wetland	0.0%	0.00
Barren	1.4%	0.04

Table 5.39 MAF Data, Whitley Branch 0.0 to 1.0

Waterbody & Segment	MAF, cfs	SWS Flow, cfs	Adjusted MAF, cfs
Whitley Branch 0.0 to 1.0	3.7	7.74	11.44

Table 5.40 TMDL Allocations, Whitley Branch 0.0 to 1.0

Waterbody & Segment	TMDL (*E. coli* colonies/ day)	MOS (*E. coli* colonies/day)	SWS-WLA (*E. coli* colonies/ day)	Future Growth %	Future Growth-WLA (*E. coli* colonies/day)	LA (*E. coli* colonies/day)
Whitley Branch 0.0 to 1.0	6.71E+10	6.71E+09	4.54E+10	5%	7.51E+08	1.43E+10

5.2.9 Whitley Branch 1.1 to 2.6

This subwatershed comprises 2.01 square miles. The sampling data used to list Whitley Branch 1.1 to 2.6 has been lost. It is recommended that this segment be resampled prior to TMDL implementation.

Table 5.41 Landcover Data, Whitley Branch 1.1 to 2.6

Landcover	% of Total Area	Square Miles
Forest	10.9%	0.22
Agriculture (total)	9.1%	0.18
Pasture	9.1%	0.18
Row Crop	0.0%	0.00
Developed	77.8%	1.56
Natural Grassland	1.5%	0.03
Wetland	0.0%	0.00
Barren	0.6%	0.01

Table 5.42 MAF Data, Whitley Branch 1.1 to 2.6

Waterbody & Segment	MAF, cfs	SWS Flow, cfs	Adjusted MAF, cfs
Whitley Branch 1.1 to 2.6	2.9	N/A	2.9

Table 5.43 TMDL Allocations, Whitley Branch 1.1 to 2.6

Waterbody & Segment	TMDL (*E. coli* colonies/ day)	MOS (*E. coli* colonies/day)	SWS-WLA (*E. coli* colonies/ day)	Future Growth %	Future Growth-WLA (*E. coli* colonies/day)	LA (*E. coli* colonies/day)
Whitley Branch 1.1 to 2.6	1.70E+10	1.70E+09	0.00E+00	5%	7.66E+08	1.46E+10

5.3 TMDL Summary

Table 5.44 organizes the previously presented TMDL allocation information into a single table.

Table 5.44 TMDL Summary Table

Waterbody, Segment, GNIS ID	TMDL (*E. coli* colonies/ day) (1)	MOS (*E. coli* colonies/ day)	SWS-WLA (*E. coli* colonies/ day) (2)	Future Growth-WLA (*E. coli* colonies/ day)	LA (*E. coli* colonies/ day)
Laurel River 26.35 to 33.95 KY513263_03	4.95E+11	4.95E+10	8.99E+07	4.45E+09	4.41E+11
Lick Creek 0.0 to 3.65 KY513397_01	4.99E+10	4.99E+09	0.00E+00	8.98E+08	4.40E+10
Little Laurel River 0.0 to 8.4 KY513497_01	4.14E+11	4.14E+10	4.55E+10	1.63E+10	3.10E+11
Little Laurel River 8.4 to 12.7 KY513497_02	2.60E+11	2.60E+10	4.55E+10	9.42E+09	1.79E+11
Little Laurel River 12.7 to 14.8 KY513497_03	2.22E+11	2.22E+10	4.55E+10	7.70E+09	1.46E+11
Little Laurel River 14.8 to 23.0 KY513497_04	1.40E+11	1.40E+10	4.54E+07	5.05E+09	1.21E+11
Sallys Branch 0.0 to 2.90 KY515184_01	2.17E+10	2.17E+09	0.00E+00	5.87E+08	1.90E+10

Waterbody, Segment, GNIS ID	TMDL (*E. coli* colonies/ day) [1]	MOS (*E. coli* colonies/ day)	SWS-WLA (*E. coli* colonies/ day) [2]	Future Growth-WLA (*E. coli* colonies/ day)	LA (*E. coli* colonies/ day)
Sampson Branch 0.0 to 4.70 KY515208_01	5.23E+10	5.23E+09	0.00E+00	2.35E+09	4.47E+10
UT[3] of Little Laurel River at 16.05 RM[4] 0.0 to 1.4 KY513497-16.05_01	1.82E+10	1.82E+09	0.00E+00	8.19E+08	1.56E+10
Whitley Branch 0.0 to 1.0 KY516339_01	6.71E+10	6.71E+09	4.54E+10	7.51E+08	1.43E+10
Whitley Branch 1.1 to 2.6 KY516339_02	1.70E+10	1.70E+09	0.00E+00	7.66E+08	1.46E+10

(1) The TMDL applies only during the May through October Primary Contact Recreational season, as described in 401 KAR 10:031.

(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 *E. coli* Water Quality Criterion (WQC) of 240 colonies/100ml 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;* Cornerstone Christian School and Johnson Elementary report in terms of *E. coli* but the London STP reports in terms of fecal coliform. However, it was necessary to report the WLA for all SWSs in terms of *E. coli* so their allocations were consistent with the monitoring protocol used to develop the TMDL. Although the WLA is in terms of *E. coli*, this does not change the permit limits for any given facility; facilities permitted in terms of fecal coliform should continue to report in those units.

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) UT = Unnamed Tributary.

(4) RM = River Mile.

6.0 IMPLEMENTATION

Section 303(e) of the Clean Water Act and 40 CFR Part 130, Section 130.5, require states to have a continuing planning process (CPP) composed of several parts specified in the Act and the regulation. The CPP provides an outline of agency programs and the available authority to address water issues. Under the CPP umbrella, the Watershed Management Branch of KDOW will be available to provide assistance with technical support for developing and implementing watershed plans to address water quality and quantity problems and threats. Developing watershed plans enables more effective targeting of limited restoration funds and resources, thus improving environmental benefit, protection and recovery.

Watershed plans provide an integrative approach for identifying and describing how, when, who and what actions should be taken in order to meet water quality standards. As a product of the

prioritization process of the watershed management framework, in 2004 3rd Rock Consultants received funding through a Clean Water Act Section 319(h) Nonpoint Source Implementation grant. 3rd Rock developed a watershed plan for the Corbin City Reservoir (including the Laurel and Little River watersheds), which was accepted in 2007. The watershed plan for the Corbin City Reservoir addresses both point and nonpoint sources of pollution in the watershed and builds on existing efforts as well as offering new approaches. Based on sampling data, land use information, local knowledge, and confirmation of local support, several areas were identified for implementation of water quality improvement projects. This TMDL provides bacteria allocations that may be different than those outlined in the watershed plan. The plan should be revised to incorporate the information presented in the TMDL and the strategy of restoration efforts updated.

3rd Rock and the City of London received additional 319(h) funding in 2007 and 2011 for implementation of the watershed plan. With the 2007 funding they completed the Levi Jackson stormwater wetland, installed a residential rain garden, conducted additional streambank erosion evaluations and in 2008 they developed a local group to guide implementation efforts. The group is named RAILL which stands for Restoration Action Initiative in the Little Laurel River, see http://www.raill.org/index.html. The additional funding awarded in 2011 will be used for stream and wetland restoration on the Kentucky Heritage Land Trust property along Whitley Branch and stream restoration on the UT of the Little Laurel, also referred to as Town Branch. Both sites will include interpretive signage and provide multiple educational opportunities. The RAILL group will continue to provide oversight and assistance with the implementation.

6.1 Kentucky Watershed Management Framework

A Watershed Management Framework approach to Water Quality Management (WQM) was adopted by the KDOW in 1998. The plan divides Kentucky's major drainage basins into five groups of basins which are cycled through a five year staggered process which involves monitoring, assessment, prioritization, plan development, and plan implementation. The major basin that the Laurel River watershed lies within is the Upper Cumberland River basin. The first phase of the process for the Upper Cumberland River basin began in 1999 and in 2002 the Laurel River watershed was listed as a high priority watershed using the watershed management framework process. For more information about the Upper Cumberland River basin see: http://water.ky.gov/watershed/Pages/UpperCumberlandRiverBasin.aspx.

6.2 Non-Governmental Organizations

There are several Non-Governmental Organizations (NGO) operating in the Laurel and Little River watersheds that may help to implement the TMDL, particularly with regard to nonpoint source issues. These organizations include the Upper Cumberland River Watershed Watch and Kentucky Waterways Alliance.

6.2.1 Upper Cumberland River Watershed Watch

The Upper Cumberland River Watershed Watch (UCRWW) is a citizen's water monitoring effort that relies on volunteers to provide administration, training, and volunteer and equipment coordination. The volunteers measure basic parameters of stream health to determine whether

streams meet important "uses" under the Clean Water Act including aquatic life, human recreation, and drinking water.

Several water quality parameters have been monitored by UCRWW. One time each year, water samples are collected from one site on in the Laurel and Little River watersheds. Eight other sites have been sampled in the past, but are no longer being monitored. Volunteers collect physical measurements, such as temperature, pH, dissolved oxygen, and conductivity. Stream monitoring also includes macroinvertebrate and habitat assessments. Once annually, water samples are tested for bacteria (*E. coli*), although fecal coliform data were collected in the past. Data from annual monitoring is routinely used to help identify problems in the watershed, and assist with prioritizing streams for restoration and protection activities. Due to the distance between this watershed and the laboratory used by UCRWW, sometimes data are not reported for a given sampling event because the sample holding time would have been exceeded (Personal Communication, Jo Ann Palmer, August 7th, 2012). See Appendix B for a list of UCRWW stations, a map showing the station locations, and bacteria results from 2002 to the present.

6.2.2 Kentucky Waterways Alliance

The formation of Kentucky Waterways Alliance (KWA) was the result of a series of meetings sponsored by the Kentucky Environmental Quality Commission. The KWA has a mission to protect and restore Kentucky's waterways and their watersheds through alliances for watershed stewardship. This includes strengthening community and governmental stewardship for the restoration and preservation of Kentucky's water resources. The Alliance promotes networking, communication and mutual support among groups, government agencies, and businesses working on waterway issues.

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APPENDIX A: DMR DATA

This Appendix contains Discharge Monitoring Report (DMR) data from the London STP, Cornerstone Christian School and Johnson Elementary from 1/1/2007 through 8/6/12 (ICIS, 2012, TEMPO 2012). Numeric permit limit violations are yellow-shaded (London reported two numeric violations during this time period, Cornerstone Christian zero, and Johnson Elementary reported eight). London reports DMR observations monthly, and Cornerstone Christian and Johnson Elementary report quarterly. Cornerstone Christian School switched from reporting in terms of fecal coliform to reporting in terms of *E. coli* during June of 2009. Both weekly average values (which must meet the geometric mean WQC) and monthly average values (which must meet the instantaneous WQC) are reported, see the "Limit Value" column of the table to determine which WQC the reported concentration was compared to.

London STP Fecal Coliform Results				
Monitoring	Period	DMR Value	Limit Value	Limit Units
1/1/2007	01/31/2007	5	200	Number per 100 Milliliters
1/1/2007	01/31/2007	83	400	Number per 100 Milliliters
2/1/2007	02/28/2007	12	200	Number per 100 Milliliters
2/1/2007	02/28/2007	51	400	Number per 100 Milliliters
3/1/2007	03/31/2007	2	200	Number per 100 Milliliters
3/1/2007	03/31/2007	3	400	Number per 100 Milliliters
4/1/2007	04/30/2007	5	200	Number per 100 Milliliters
4/1/2007	04/30/2007	23	400	Number per 100 Milliliters
5/1/2007	05/31/2007	5	200	Number per 100 Milliliters
5/1/2007	05/31/2007	15	400	Number per 100 Milliliters
6/1/2007	06/30/2007	7	200	Number per 100 Milliliters
6/1/2007	06/30/2007	11	400	Number per 100 Milliliters
7/1/2007	07/31/2007	22	200	Number per 100 Milliliters
7/1/2007	07/31/2007	65	400	Number per 100 Milliliters
8/1/2007	08/31/2007	10	200	Number per 100 Milliliters
8/1/2007	08/31/2007	31	400	Number per 100 Milliliters
9/1/2007	09/30/2007	10	200	Number per 100 Milliliters
9/1/2007	09/30/2007	31	400	Number per 100 Milliliters

London STP Fecal Coliform Results				
Monitoring	Period	DMR Value	Limit Value	Limit Units
10/1/2007	10/31/2007	13	200	Number per 100 Milliliters
10/1/2007	10/31/2007	29	400	Number per 100 Milliliters
11/1/2007	11/30/2007	32	200	Number per 100 Milliliters
11/1/2007	11/30/2007	164	400	Number per 100 Milliliters
12/1/2007	12/31/2007	6	200	Number per 100 Milliliters
12/1/2007	12/31/2007	21	400	Number per 100 Milliliters
1/1/2008	01/31/2008	11	200	Number per 100 Milliliters
1/1/2008	01/31/2008	23	400	Number per 100 Milliliters
2/1/2008	02/29/2008	9	200	Number per 100 Milliliters
2/1/2008	02/29/2008	31	400	Number per 100 Milliliters
3/1/2008	03/31/2008	3	200	Number per 100 Milliliters
3/1/2008	03/31/2008	33	400	Number per 100 Milliliters
4/1/2008	04/30/2008	3	200	Number per 100 Milliliters
4/1/2008	04/30/2008	19	400	Number per 100 Milliliters
5/1/2008	05/31/2008	6	200	Number per 100 Milliliters
5/1/2008	05/31/2008	10	400	Number per 100 Milliliters
6/1/2008	06/30/2008	1	200	Number per 100 Milliliters
6/1/2008	06/30/2008	3	400	Number per 100 Milliliters
7/1/2008	07/31/2008	3	200	Number per 100 Milliliters
7/1/2008	07/31/2008	7	400	Number per 100 Milliliters
8/1/2008	08/31/2008	4	200	Number per 100 Milliliters
8/1/2008	08/31/2008	19	400	Number per 100 Milliliters
9/1/2008	09/30/2008	4	200	Number per 100 Milliliters
9/1/2008	09/30/2008	4	400	Number per 100 Milliliters
10/1/2008	10/31/2008	10	200	Number per 100 Milliliters
10/1/2008	10/31/2008	26	400	Number per 100 Milliliters

London STP Fecal Coliform Results				
Monitoring	Period	DMR Value	Limit Value	Limit Units
11/1/2008	11/30/2008	4	200	Number per 100 Milliliters
11/1/2008	11/30/2008	9	400	Number per 100 Milliliters
12/1/2008	12/31/2008	19	200	Number per 100 Milliliters
12/1/2008	12/31/2008	75	400	Number per 100 Milliliters
1/1/2009	01/31/2009	6	200	Number per 100 Milliliters
1/1/2009	01/31/2009	33	400	Number per 100 Milliliters
2/1/2009	02/28/2009	4	200	Number per 100 Milliliters
2/1/2009	02/28/2009	16	400	Number per 100 Milliliters
3/1/2009	03/31/2009	10	200	Number per 100 Milliliters
3/1/2009	03/31/2009	16	400	Number per 100 Milliliters
4/1/2009	04/30/2009	24	200	Number per 100 Milliliters
4/1/2009	04/30/2009	115	400	Number per 100 Milliliters
5/1/2009	05/31/2009	13	200	Number per 100 Milliliters
5/1/2009	05/31/2009	346	400	Number per 100 Milliliters
6/1/2009	06/30/2009	6	200	Number per 100 Milliliters
6/1/2009	06/30/2009	59	400	Number per 100 Milliliters
7/1/2009	07/31/2009	3	200	Number per 100 Milliliters
7/1/2009	07/31/2009	10	400	Number per 100 Milliliters
8/1/2009	08/31/2009	26	200	Number per 100 Milliliters
8/1/2009	08/31/2009	71	400	Number per 100 Milliliters
9/1/2009	09/30/2009	10	200	Number per 100 Milliliters
9/1/2009	09/30/2009	14	400	Number per 100 Milliliters
10/1/2009	10/31/2009	8	200	Number per 100 Milliliters
10/1/2009	10/31/2009	26	400	Number per 100 Milliliters
11/1/2009	11/30/2009	16	200	Number per 100 Milliliters
11/1/2009	11/30/2009	104	400	Number per 100 Milliliters

London STP Fecal Coliform Results				
Monitoring	Period	DMR Value	Limit Value	Limit Units
12/1/2009	12/31/2009	130	200	Number per 100 Milliliters
12/1/2009	12/31/2009	498	400	Number per 100 Milliliters
1/1/2010	01/31/2010	134	200	Number per 100 Milliliters
1/1/2010	01/31/2010	509	400	Number per 100 Milliliters
2/1/2010	02/28/2010	36	200	Number per 100 Milliliters
2/1/2010	02/28/2010	61	400	Number per 100 Milliliters
3/1/2010	03/31/2010	16	200	Number per 100 Milliliters
3/1/2010	03/31/2010	41	400	Number per 100 Milliliters
4/1/2010	04/30/2010	2	200	Number per 100 Milliliters
4/1/2010	04/30/2010	6	400	Number per 100 Milliliters
5/1/2010	05/31/2010	2	200	Number per 100 Milliliters
5/1/2010	05/31/2010	8	400	Number per 100 Milliliters
6/1/2010	06/30/2010	21	200	Number per 100 Milliliters
6/1/2010	06/30/2010	46	400	Number per 100 Milliliters
7/1/2010	07/31/2010	40	200	Number per 100 Milliliters
7/1/2010	07/31/2010	80	400	Number per 100 Milliliters
8/1/2010	08/31/2010	25	200	Number per 100 Milliliters
8/1/2010	08/31/2010	49	400	Number per 100 Milliliters
9/1/2010	09/30/2010	12	200	Number per 100 Milliliters
9/1/2010	09/30/2010	24	400	Number per 100 Milliliters
10/1/2010	10/31/2010	13	200	Number per 100 Milliliters
10/1/2010	10/31/2010	41	400	Number per 100 Milliliters
11/1/2010	11/30/2010	7	200	Number per 100 Milliliters
11/1/2010	11/30/2010	8	400	Number per 100 Milliliters
12/1/2010	12/31/2010	6	200	Number per 100 Milliliters
12/1/2010	12/31/2010	18	400	Number per 100 Milliliters

London STP Fecal Coliform Results				
Monitoring	Period	DMR Value	Limit Value	Limit Units
1/1/2011	01/31/2011	3	200	Number per 100 Milliliters
1/1/2011	01/31/2011	28	400	Number per 100 Milliliters
2/1/2011	02/28/2011	19	200	Number per 100 Milliliters
2/1/2011	02/28/2011	64	400	Number per 100 Milliliters
3/1/2011	03/31/2011	8	200	Number per 100 Milliliters
3/1/2011	03/31/2011	19	400	Number per 100 Milliliters
4/1/2011	04/30/2011	5	200	Number per 100 Milliliters
4/1/2011	04/30/2011	10	400	Number per 100 Milliliters
5/1/2011	05/31/2011	5	200	Number per 100 Milliliters
5/1/2011	05/31/2011	11	400	Number per 100 Milliliters
6/1/2011	06/30/2011	4	200	Number per 100 Milliliters
6/1/2011	06/30/2011	22	400	Number per 100 Milliliters
7/1/2011	07/31/2011	6	200	Number per 100 Milliliters
7/1/2011	07/31/2011	20	400	Number per 100 Milliliters
8/1/2011	08/31/2011	5	200	Number per 100 Milliliters
8/1/2011	08/31/2011	10	400	Number per 100 Milliliters
9/1/2011	09/30/2011	20	200	Number per 100 Milliliters
9/1/2011	09/30/2011	92	400	Number per 100 Milliliters
10/1/2011	10/31/2011	3	200	Number per 100 Milliliters
10/1/2011	10/31/2011	12	400	Number per 100 Milliliters
11/1/2011	11/30/2011	9	200	Number per 100 Milliliters
11/1/2011	11/30/2011	21	400	Number per 100 Milliliters
12/1/2011	12/31/2011	5	200	Number per 100 Milliliters
12/1/2011	12/31/2011	10	400	Number per 100 Milliliters
1/1/2012	01/31/2012	8	200	Number per 100 Milliliters
1/1/2012	01/31/2012	21	400	Number per 100 Milliliters

London STP Fecal Coliform Results				
Monitoring	Period	DMR Value	Limit Value	Limit Units
2/1/2012	02/29/2012	4	200	Number per 100 Milliliters
2/1/2012	02/29/2012	9	400	Number per 100 Milliliters
3/1/2012	03/31/2012	7	200	Number per 100 Milliliters
3/1/2012	03/31/2012	10	400	Number per 100 Milliliters
4/1/2012	04/30/2012	11	200	Number per 100 Milliliters
4/1/2012	04/30/2012	24	400	Number per 100 Milliliters
5/1/2012	05/31/2012	12	200	Number per 100 Milliliters
5/1/2012	05/31/2012	44	400	Number per 100 Milliliters
6/1/2012	06/30/2012	11	200	Number per 100 Milliliters
6/1/2012	06/30/2012	80	400	Number per 100 Milliliters
7/1/2012	07/31/2012	Not Received	200	Number per 100 Milliliters
7/1/2012	07/31/2012	Not Received	400	Number per 100 Milliliters

Cornerstone Christian School				
Monitoring	Period	DMR Value	Limit Value	Limit Units
Fecal Coliform Results				
1/1/2007	3/31/2007	<10	200	Number per 100 Milliliters
1/1/2007	3/31/2007	<10	400	Number per 100 Milliliters
4/1/2007	6/30/2007	<10	200	Number per 100 Milliliters
4/1/2007	6/30/2007	<10	400	Number per 100 Milliliters
7/1/2007	9/30/2007	<10	200	Number per 100 Milliliters
7/1/2007	9/30/2007	<10	400	Number per 100 Milliliters
10/1/2007	12/31/2007	<10	200	Number per 100 Milliliters
10/1/2007	12/31/2007	<10	400	Number per 100 Milliliters
1/1/2008	3/31/2008	<10	200	Number per 100 Milliliters
1/1/2008	3/31/2008	<10	400	Number per 100 Milliliters
4/1/2008	6/30/2008	<10	200	Number per 100 Milliliters
4/1/2008	6/30/2008	<10	400	Number per 100 Milliliters
7/1/2008	9/30/2008	<10	200	Number per 100 Milliliters
7/1/2008	9/30/2008	<10	400	Number per 100 Milliliters
10/1/2008	12/31/2008	10	200	Number per 100 Milliliters

Cornerstone Christian School				
Monitoring	**Period**	**DMR Value**	**Limit Value**	**Limit Units**
10/1/2008	12/31/2008	10	400	Number per 100 Milliliters
1/1/2009	3/31/2009	<10	200	Number per 100 Milliliters
1/1/2009	3/31/2009	<10	400	Number per 100 Milliliters
***E. coli* Results**				
6/1/2009	6/30/2009	6	130	Number per 100 Milliliters
6/1/2009	6/30/2009	6	240	Number per 100 Milliliters
7/1/2009	9/30/2009	1	130	Number per 100 Milliliters
7/1/2009	9/30/2009	1	240	Number per 100 Milliliters
10/1/2009	12/31/2009	1	130	Number per 100 Milliliters
10/1/2009	12/31/2009	1	240	Number per 100 Milliliters
1/1/2010	3/31/2010	1	130	Number per 100 Milliliters
1/1/2010	3/31/2010	1	240	Number per 100 Milliliters
4/1/2010	6/30/2010	1	130	Number per 100 Milliliters
4/1/2010	6/30/2010	1	240	Number per 100 Milliliters
7/1/2010	9/30/2010	No discharge	130	Number per 100 Milliliters
7/1/2010	9/30/2010	No discharge	240	Number per 100 Milliliters
10/1/2010	12/31/2010	No discharge	130	Number per 100 Milliliters
10/1/2010	12/31/2010	No discharge	240	Number per 100 Milliliters
1/1/2011	3/31/2011	Not Received	130	Number per 100 Milliliters
1/1/2011	3/31/2011	Not Received	240	Number per 100 Milliliters
4/1/2011	6/30/2011	Not Received	130	Number per 100 Milliliters
4/1/2011	6/30/2011	Not Received	240	Number per 100 Milliliters
7/1/2011	9/30/2011	Not Received	130	Number per 100 Milliliters
7/1/2011	9/30/2011	Not Received	240	Number per 100 Milliliters
10/1/2011	12/31/2011	Not Received	130	Number per 100 Milliliters
10/1/2011	12/31/2011	Not Received	240	Number per 100 Milliliters
1/1/2012	3/31/2012	Not Received	130	Number per 100 Milliliters
1/1/2012	3/31/2012	Not Received	240	Number per 100 Milliliters
4/1/2012	6/30/2012	Not Received	130	Number per 100 Milliliters
4/1/2012	6/30/2012	Not Received	240	Number per 100 Milliliters

Johnson Elementary School *E. coli* Results				
Monitoring	**Period**	**DMR Value**	**Limit Value**	**Limit Units**
1/1/2007	3/31/2007	< 1	130	Number per 100 Milliliters
1/1/2007	3/31/2007	< 1	240	Number per 100 Milliliters
4/1/2007	6/30/2007	< 1	130	Number per 100 Milliliters
4/1/2007	6/30/2007	< 1	240	Number per 100 Milliliters
7/1/2007	9/30/2007	6	130	Number per 100 Milliliters
7/1/2007	9/30/2007	180	240	Number per 100 Milliliters
10/1/2007	12/31/2007	Not Received	130	Number per 100 Milliliters
10/1/2007	12/31/2007	Not Received	240	Number per 100 Milliliters
1/1/2008	3/31/2008	4	130	Number per 100 Milliliters
1/1/2008	3/31/2008	23	240	Number per 100 Milliliters
4/1/2008	6/30/2008	Not Received	130	Number per 100 Milliliters
4/1/2008	6/30/2008	Not Received	240	Number per 100 Milliliters
7/1/2008	9/30/2008	< 1	130	Number per 100 Milliliters
7/1/2008	9/30/2008	< 1	240	Number per 100 Milliliters
10/1/2008	12/31/2008	2	130	Number per 100 Milliliters
10/1/2008	12/31/2008	6	240	Number per 100 Milliliters
1/1/2009	3/31/2009	> 9	130	Number per 100 Milliliters
1/1/2009	3/31/2009	> 800	240	Number per 100 Milliliters
4/1/2009	6/30/2009	3	130	Number per 100 Milliliters
4/1/2009	6/30/2009	13	240	Number per 100 Milliliters
7/1/2009	9/30/2009	1	130	Number per 100 Milliliters
7/1/2009	9/30/2009	3	240	Number per 100 Milliliters
10/1/2009	12/31/2009	30	130	Number per 100 Milliliters
10/1/2009	12/31/2009	2420	240	Number per 100 Milliliters
1/1/2010	3/31/2010	12	130	Number per 100 Milliliters
1/1/2010	3/31/2010	1300	240	Number per 100 Milliliters
4/1/2010	6/30/2010	151	130	Number per 100 Milliliters
4/1/2010	6/30/2010	1986	240	Number per 100 Milliliters
7/1/2010	9/30/2010	Not Received	130	Number per 100 Milliliters
7/1/2010	9/30/2010	Not Received	240	Number per 100 Milliliters
10/1/2010	12/31/2010	180	130	Number per 100 Milliliters
10/1/2010	12/31/2010	2420	240	Number per 100 Milliliters
1/1/2011	3/31/2011	1	130	Number per 100 Milliliters
1/1/2011	3/31/2011	1	240	Number per 100 Milliliters

Johnson Elementary School *E. coli* Results				
Monitoring	**Period**	**DMR Value**	**Limit Value**	**Limit Units**
4/1/2011	6/30/2011	1	130	Number per 100 Milliliters
4/1/2011	6/30/2011	1	240	Number per 100 Milliliters
7/1/2011	9/30/2011	2	130	Number per 100 Milliliters
7/1/2011	9/30/2011	13	240	Number per 100 Milliliters
10/1/2011	12/31/2011	13	130	Number per 100 Milliliters
10/1/2011	12/31/2011	2420	240	Number per 100 Milliliters
1/1/2012	3/31/2012	2	130	Number per 100 Milliliters
1/1/2012	3/31/2012	2	240	Number per 100 Milliliters

APPENDIX B: UPPER CUMBERLAND RIVER WATERSHED WATCH DATA

The Upper Cumberland Chapter of KRWW collects *E. coli* and fecal coliform data in the Laurel and Little Laurel River watersheds (http://www.uppercumberlandriver.org/index.php?option=com_content&view=article&id=4&Itemid=12). Table B.1 lists KRWW's sampling station locations, and a map showing KRWW's sampling stations is included as Figure B.1. The figure and table refer to the Historic Id, not the Site Id for sampling locations. Also, Table B.2 shows the bacteria data collected since 2002 (KRWW, 2012).

Table B.1 Upper Cumberland River Watershed Watch Sampling Station Locations

Site Id	Historic Id	Stream	Impaired Segment	River Mile	Location	Latitude	Longitude
2508	U48	Little Laurel River	Little Laurel River 8.4 to 12.7	9.8	Riverbend Subdivision off Lily Road, 4 miles south of London	37.06298	-84.07972
2536	U82	Little Laurel River	Little Laurel River 0.0 to 8.4	0.3	Just above city dam	37.00764	-84.10678
2540	U86	Laurel River	Laurel River 26.35 to 33.95	27.0	Upstream Corbin City Lake	37.01673	-84.08059
2754	U351	Laurel River	None	36.2	2636 Rough Creek Rd.	37.0594	-83.9971

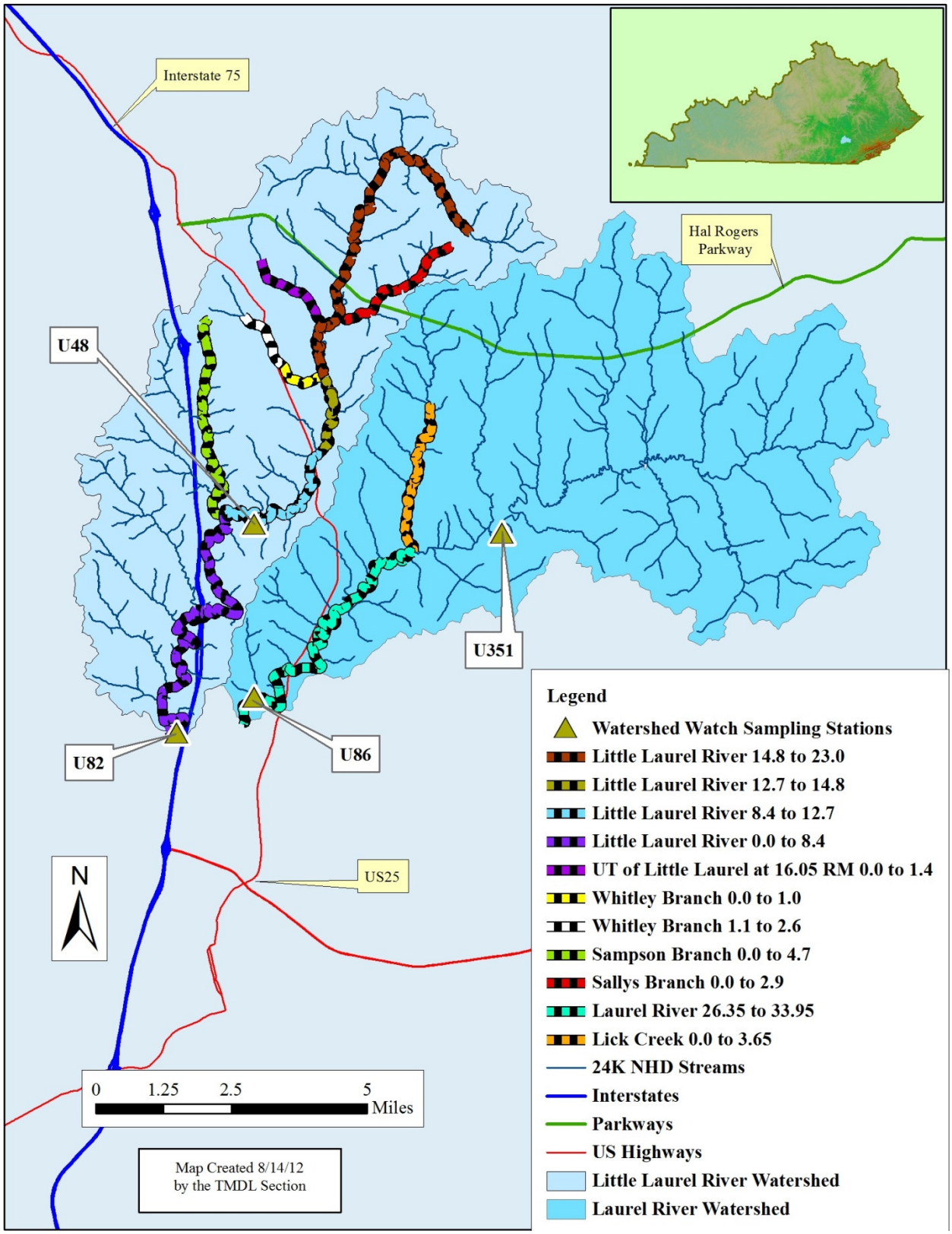

Figure B.1 Upper Cumberland River Watershed Watch Sampling Stations

Table B.2 Upper Cumberland River Watershed Watch Bacteria Data

Station Name	Historic Name	Sample Date	Analyte	Results[(1)]	Units
2508	U48	4/27/2002	Fecal Coliform	3000	colonies/100 ml
2508	U48	7/26/2002	Fecal Coliform	>60000	colonies/100 ml
2536	U82	4/27/2002	Fecal Coliform	4500	colonies/100 ml
2536	U82	9/14/2002	Fecal Coliform	20	colonies/100 ml
2536	U82	5/10/2003	Fecal Coliform	60000	colonies/100 ml
2536	U82	7/12/2003	Fecal Coliform	530	colonies/100 ml
2536	U82	5/8/2004	Fecal Coliform	200	colonies/100 ml
2536	U82	7/24/2004	Fecal Coliform	<20	colonies/100 ml
2540	U86	4/27/2002	Fecal Coliform	2200	colonies/100 ml
2540	U86	7/27/2002	Fecal Coliform	1700	colonies/100 ml
2540	U86	7/12/2003	Fecal Coliform	510	colonies/100 ml
2540	U86	5/8/2004	Fecal Coliform	800	colonies/100 ml
2540	U86	7/24/2004	Fecal Coliform	<20	colonies/100 ml
2540	U86	7/9/2005	*E. coli*	<20	colonies/100 ml
2540	U86	9/10/2005	*E. coli*	<20	colonies/100 ml
2540	U86	Jul-06	*E. coli*	720	colonies/100 ml
2540	U86	5/3/2007	*E. coli*	13734	colonies/100 ml
2540	U86	7/7/2007	*E. coli*	<20	colonies/100 ml
2540	U86	8/15/2007	*E. coli*	152	colonies/100 ml
2754	U351	4/29/2006	*E. coli*	196	colonies/100 ml

(1) The "<" and ">" are the less than and greater than symbols, respectively, indicating a non-detect in the case of the less than symbol, and a number that exceeds the value shown but whose exact value is unknown in the case of the greater than symbol.