Final Total Maximum Daily Load for *E. coli*
Three Stream Segments within the North Elkhorn Creek Watershed

Fayette County, Kentucky

North Elkhorn Creek, Fayette County, KDOW

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June 2014

Kentucky Department for Environmental Protection
Division of Water

This report is approved for release

Peter Goodmann, Director
Division of Water

6/17/2014
Date

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GLOSSARY OF ACRONYMS

ADD	Area Development District
AFO	Animal Feeding Operation
AWQA	Agriculture Water Quality Act
BMP	Best Management Practices
BMU	Basin Management Unit
CAFO	Confined Animal Feeding Operation
CFR	Code of Federal Regulations
CPP	Continuing Planning Process
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CSO	Combined Sewer Overflow
DEP	Department of Environmental Protection
DMR	Discharge Monitoring Report
DOC	Division of Conservation
ft^3	Cubic feet
GIS	Geographic Information System
GNIS	Geographic Names Information System
HUC	Hydrologic Unit Code
KAR	Kentucky Administrative Regulations
KDFWR	Kentucky Division of Fish and Wildlife Resources
KDOC	Kentucky Division of Conservation
KDOW	Kentucky Division of Water
KGS	Kentucky Geological Survey
KRS	Kentucky Revised Statutes
KIA	Kentucky Infrastructure Authority
KNDOP	Kentucky No Discharge Operating Permit
KPDES	Kentucky Pollution Discharge Elimination System
L	Liter
LA	Load Allocations
LFUCG	Lexington-Fayette Urban County Government
LTCP	Long Term Control Plan
MAF	Mean Annual Flow
MGD	Million Gallons per Day
MHP	Mobile Home Park
ml	milliliter
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer Systems
NASS	National Agricultural Statistics Service
NHD	National Hydrography Dataset
NLCD	National Landcover Database
NRCS	Natural Resources Conservation Service
NPDES	National Pollution Discharge Elimination System
NPS	Nonpoint Source

NOV	Notice of Violation
OSTDS	On Site Sewage Treatment and Disposal System
PCR	Primary Contact Recreation
PCS	Permit Compliance System
POTW	Publicly Owned Treatment Works
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RM	River Mile
SCR	Secondary Contact Recreation
SOP	Standard Operating Procedures
SSO	Sanitary Sewer Overflow
STP	Sewage Treatment Plant
SWPB	Surface Water Permits Branch
SWS	Sanitary Wastewater System
SWQMP	Storm Water Quality Management Plan
TMDL	Total Maximum Daily Load
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WAH	Warm Water Aquatic Habitat
WBID	Waterbody Identification Number
WBP	Watershed Based Plan
WLA	Waste Load Allocation
WMB	Watershed Management Branch
WQB	Water Quality Branch
WQC	Water Quality Criteria
WQS	Water Quality Standard
WWTP	Wastewater Treatment Plant

Total Maximum Daily Load (TMDL) Synopsis

State: Kentucky
Major River Basin: Kentucky River
USGS HUC8: 05100205
County: Fayette
Pollutant of Concern: Bacteria (*E. coli*)

Table S.1 Impaired Waterbodies Addressed in this TMDL Document

Waterbody Name	County	GNIS Number	Suspected Sources (all segments)	Impaired Use (Support Status)
Upper North Elkhorn Creek of Elkhorn Creek 66.0 to 73.75	Fayette	KY499540_03	Wastewater infrastructure; Municipal Point Source Discharges; Agriculture (grazing-related); Urban Runoff/Storm Sewers; Source Unknown	Primary Contact Recreation (nonsupport)
David Fork of Upper North Elkhorn Creek 0.0 to 1.68		KY490622_01		Primary Contact Recreation (nonsupport)
Unnamed Tributary of Upper North Elkhorn Creek 0.0 to 2.9		KY499540_71.1_01		Primary Contact Recreation (nonsupport)

TMDL Endpoints (i.e., Water Quality Criterion/ *E. coli* TMDL Target):

Title 401, chapter 10 of the Kentucky Administrative Regulations (KAR) describe the water quality standards and criterion to protect the designated uses of the surface waters of the Commonwealth.

The TMDL Target is defined as the water quality criterion (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 the WQC for *E. coli* (240 col/100ml) minus a 10% MOS or 216 colonies per 100ml.

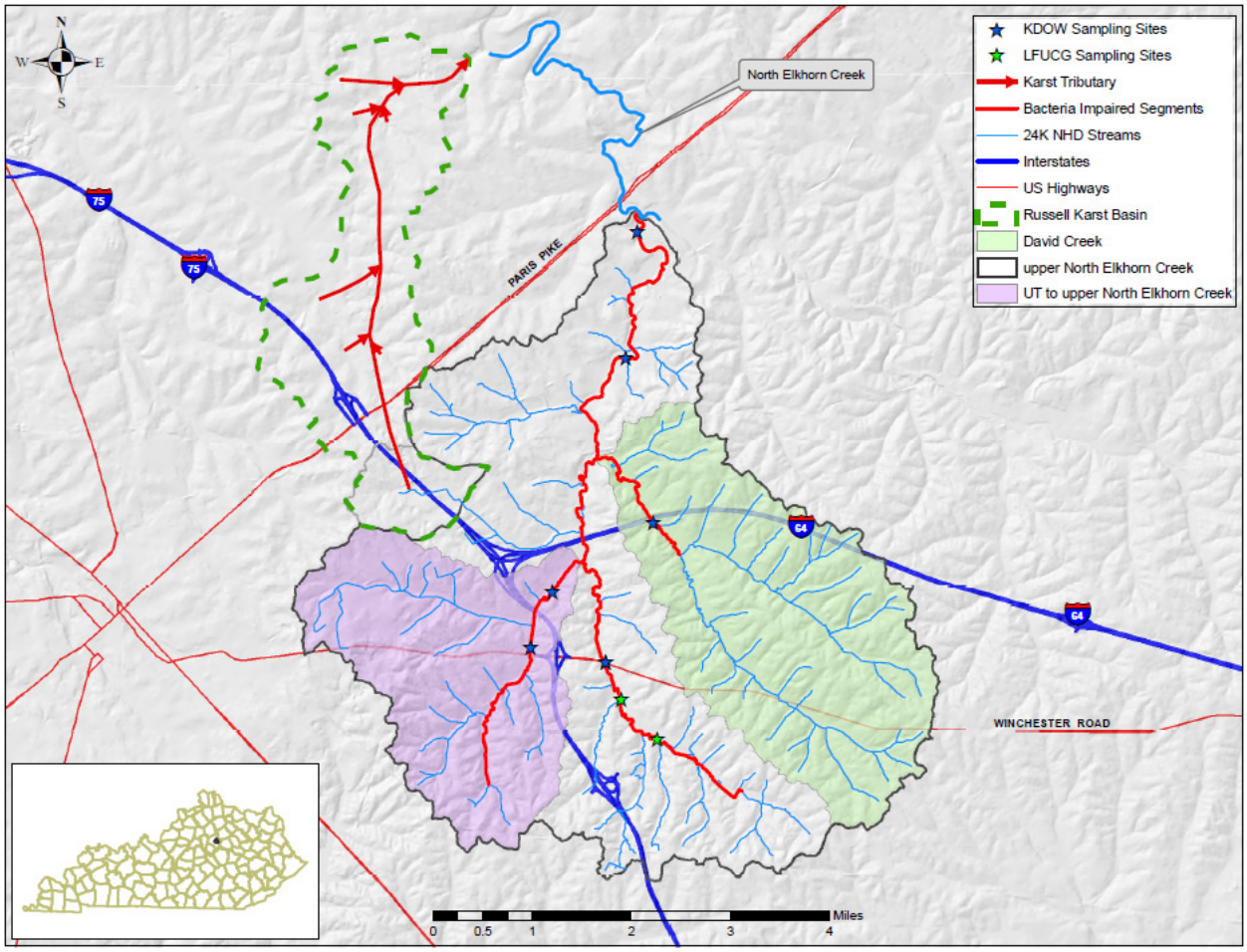

Figure S.1 Location of Bacteria-impaired Segments within the Upper North Elkhorn Creek Watershed

TMDL Equation and Definitions:

A TMDL calculation is performed as follows:

$$TMDL = WLA + LA + MOS$$

The WLA has three components:

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

Where:
TMDL: the WQC, expressed as a load. The WQC is defined in Section 6.0 as an instantaneous concentration of 240 colonies/100 ml for *E. coli* or 400 colonies/100 ml for fecal coliform.
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.
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 SWSs and 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).
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 the 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 water sewer systems (including 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 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.
Percent Reduction: the loading reduction needed to bring the existing condition in line with the TMDL target.
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 per day); it is derived from the calculation of the following components: (28.31685L/f^3 * 86400seconds/day * 1000ml/L)/ (100ml) and is equal to 24,465,758.4.

<u>Calculation Procedure</u>:

1) The MOS, if an explicit value, is calculated and subtracted from the TMDL first, giving the TMDL Target;
2) Percent reductions are calculated to show the difference between Existing Conditions and the TMDL Target;
3) The SWS-WLA is calculated and subtracted from the TMDL Target, leaving the Remainder;
4) The Future Growth-WLA is calculated and subtracted from the Remainder;
5) If there is a MS4 present upstream of the impaired segment, the MS4-WLA is subtracted from the Remainder based on percent developed land cover, leaving the LA.

TMDL Development:

The analytical approach used to develop the TMDLs for the upper North Elkhorn Creek watershed was the load duration curve (LDC). The LDC is a data analysis tool that incorporates hydrology and concentration (number of *E. coli* colonies per 100 ml) to develop existing and maximum allowable loadings across the spectrum of various flow conditions. The LDCs illustrate a critical flow duration zone which is used to determine the site-specific TMDL target load.

Table S.2 *E. coli* TMDL and Critical Flow Zone for each Impaired Segment

Waterbody	Total Maximum Daily Load (col/ day)	Critical Flow Duration Zone
Upper North Elkhorn Creek 66.0 - 73.75	1.04×10^{12}	High
David Fork 0.0 - 1.68	3.31×10^{12}	Mid-Range
UT to Upper North Elkhorn Creek 0.0 - 2.9	3.49×10^{11}	High

Table S.3 Summary of Total Maximum Daily Loads for Each Impaired Segment

Waterbody	TMDL(1) (col/day)	MOS(2) (col/day)	WLA(3) (col/day)			LA (col/day)
			Future Growth	SWS	MS4	
Upper North Elkhorn Creek 66.0 - 73.75	1.04×10^{12}	1.04×10^{11}	4.70×10^{10}	0	5.87×10^{11}	3.05×10^{11}
David Fork 0.0 - 1.68	3.28×10^{10}	3.28×10^{9}	5.91×10^{8}	0	1.02×10^{10}	1.88×10^{10}
UT to Upper North Elkhorn Creek 0.0 - 2.9	3.49×10^{11}	3.49×10^{10}	1.57×10^{10}	0	2.44×10^{10}	5.46×10^{10}

Notes:

(1). TMDLs are expressed as daily loads of *E. coli* colonies by multiplying the WQC by the critical flow and the appropriate conversion factor. The TMDL is the sum of all components.

(2). MOS is an explicit 10% of the TMDL.

(3). Any future KPDES wastewater permitted sources must meet permit limits based on the Water Quality Criterion in 401 KAR 10:031, and must not cause or contribute to an existing impairment. WLA value based on percentage of developed land cover within the MS4 permitted area.

Translation of WLAs into Permit Limits

All KPDES-permitted point sources must meet permit limits based on the Water Quality Standards in 401 KAR 10:031. SWS-WLAs will be translated into KPDES permit limits as an *E. coli* effluent gross limit of 130 colonies/100 ml as a monthly average and 240 colonies/100 ml as a maximum weekly average or as a fecal coliform effluent gross limit of 200 colonies/100 ml as a monthly average and 400 colonies/100 ml as a maximum weekly average.

The MS4-WLA is not a numerical end of pipe limit; it is an instream allocation. The MS4-WLA will be addressed through the MS4 permit and implemented through the Stormwater Quality Management Plan (SWQMP) to the Maximum Extent Practicable (MEP).

1.0 Introduction

Section 303(d) of the Clean Water Act 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 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) 2010) 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.

This TMDL document provides important bacteria allocations and reductions that could assist with developing detailed watershed plans to guide watershed restoration efforts. Watershed Plans for the bacteria impaired North Elkhorn Creek waterbodies should address both KPDES-permitted (point) and non KPDES-permitted (nonpoint) sources of bacteria loadings to the watershed and should build on existing efforts as well as evaluate new approaches. Comprehensive Watershed Plans should consider both voluntary and regulatory approaches in order to meet water quality standards.

2.0 Problem Definition

The Kentucky River Basin, United States Geological Survey (USGS) hydrologic unit code (HUC) 05100205 is located in central Kentucky and spans the length of the state from the Virginia to Indiana border. The area of interest is near the center of the HUC and is completely contained within Fayette County.

North Elkhorn Creek was placed on the 2002 303(d) List of Waters for Kentucky as impaired (non-support) for Primary Contact Recreation (PCR; i.e. swimming) for river miles 66.0 – 73.75 (KDOW 2002). The KDOW added two tributaries, David Fork for river miles 0.0 – 1.68 and Unnamed Tributary to North Elkhorn Creek (at river mile 71.1) for river miles 0.0-2.9, to the 2010 303(d) List of Waters for Kentucky as impaired (non-support) for PCR. All segments are therefore designated first priority based upon their PCR impairment status (see Table 2.1). Data used to assess these waterbodies included *Escherichia coli* (*E. coli)* data collected by the KDOW and Lexington-Fayette Urban County Government (LFUCG), flow data from the United States Geological Survey (USGS), and general watershed data (i.e. geology, land cover, location of KPDES-permitted sources, etc.) analyzed in a geographic information systems (GIS) framework. The suspected sources of bacteria in all three segments are municipal point source discharges, agriculture (grazing-related), and urban runoff/storm sewer overflow as well as unknown sources. The location of the watershed is shown on Figure 2.1.

Table 2.1 Bacteria-impaired Stream Segments in the Upper North Elkhorn Creek Watershed

Waterbody Name	Impaired Segment (River Miles)	County	GNIS Number	Suspected Sources (all segments)	Impaired Use
Upper North Elkhorn Creek of Elkhorn Creek	66.0 to 73.75	Fayette	KY499540_03	Wastewater infrastructure; Municipal Point Source Discharges; Agriculture (grazing-related); Urban Runoff/Storm Sewers; Source Unknown	Primary Contact Recreation (nonsupport)
David Fork of Upper North Elkhorn Creek	0.0 to 1.68	Fayette	KY490622_01		Primary Contact Recreation (nonsupport)
Unnamed Tributary of Upper North Elkhorn Creek	0.0 to 2.9	Fayette	KY499540_71.1_01		Primary Contact Recreation (nonsupport)

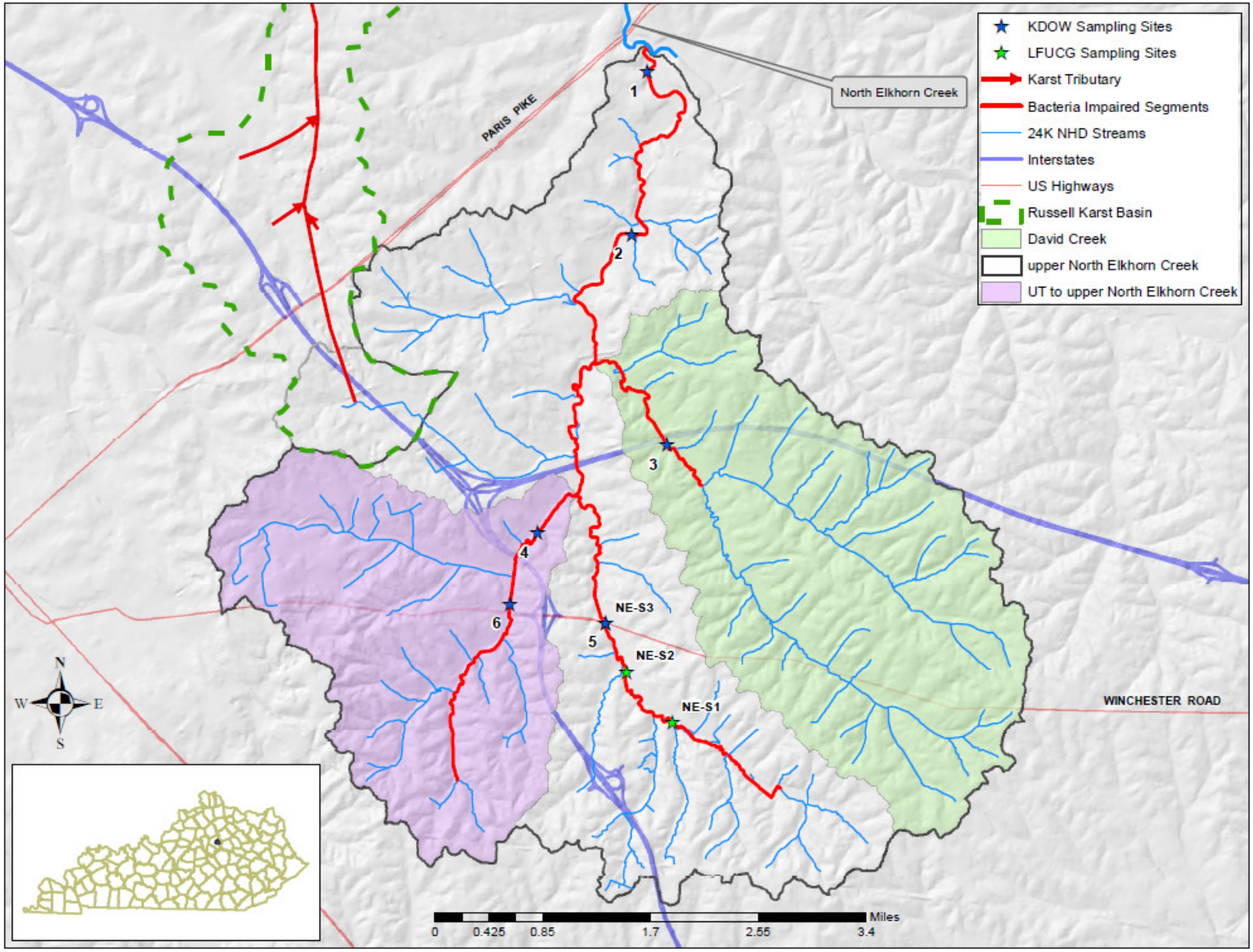

Figure 2.1 Location of Bacteria-impaired Segments within the Upper North Elkhorn Creek Watershed (USGS HUC 05010020-52-80)

3.0 Physical Setting

The upper North Elkhorn Creek watershed (Waterbody ID 499040_05) is located entirely within the northeast corner of Fayette County and drains an area of 24.4 square miles. The watershed lies within the Inner Bluegrass Physiographic Region and Level IV Ecoregion (Woods et al. 2002). All streams generally flow northwest into North Elkhorn Creek then Elkhorn Creek before entering the Kentucky River just north of Frankfort, Kentucky with eventual discharge into the Ohio River near Carrollton, Kentucky.

3.1 Geology

The majority of the upper North Elkhorn Creek watershed is underlain by Lexington Limestone. This major rock unit is found extensively throughout the Inner Bluegrass region and is from the Ordovician age (deposited more than 443 million years ago). Due to the presence of the Lexington Fault System (specifically the Bryan Station Fault zone), younger geologic formations are generally found along and southwest of this area (Figure 3.1). The major members of the Lexington Limestone unit found in the watershed are the Tanglewood, Millersburg, Brannan and Grier. These members occur on the northwestern side of the fault system. The watershed also contains the Garrard Siltstone and Clay's Ferry members from the Upper Ordovician Strata (USGS 1986). These members are generally found along the ridge top near the southern-most border of the watershed and a small portion in the northeast. The city of Lexington is thought to be founded near McConnell Springs, a 'bluehole' natural spring which may have occurred due to the collapse of a series of sinkholes. McConnell Springs is a public park that is located less than four miles east of the upper North Elkhorn watershed (on Old Frankfort Pike inside New Circle Road) and is also underlain by Lexington Limestone – the park is considered a "karst window" providing an opportunity to view several examples of karst features and the surface and groundwater interaction.

Official watershed boundaries may not be accurate in well-developed karst regions. Although groundwater drainage generally follows topographic basin boundaries, this is not always true. Subsurface drainage transfer between surface watersheds in a karst region does occur, which increases or decreases the actual boundaries of an affected stream basin. For example, the Russell karst basin is located in the western area of the watershed Figure 3.1) – surface water in this area enters a swallet and travels underground approximately five miles before emerging as a perennial spring on an unnamed tributary near RM 61.3 of North Elkhorn Creek, completely bypassing the impaired segments. The Russell karst basin removes approximately 545 topographic acres from the upper North Elkhorn watershed and also drains a portion of the neighboring Cane Run watershed. The KDOW and the KGS maintain a Karst Atlas of groundwater tracing data and delineated basins (both as static PDF maps and ArcGIS shape files) that can be downloaded at http://kygeonet.ky.gov - this work is ongoing and data is updated as information becomes available (Blair, KDOW Personal Communication 2008).

Karst topography can create geological hazards such as sudden surface collapse (due to sinkholes), flooding (if a karst pathway becomes clogged with debris or overloaded due to improper surface flow routing), and soil erosion. Karst topography also creates a concern for groundwater and surface water contamination. Areas underlain by karst hydrology can have rapid groundwater flow rates, with complex routes. Storm water and associated pollutants can quickly percolate through soils and sinkholes with little or no filtration or attenuation of the contaminants. Groundwater velocities

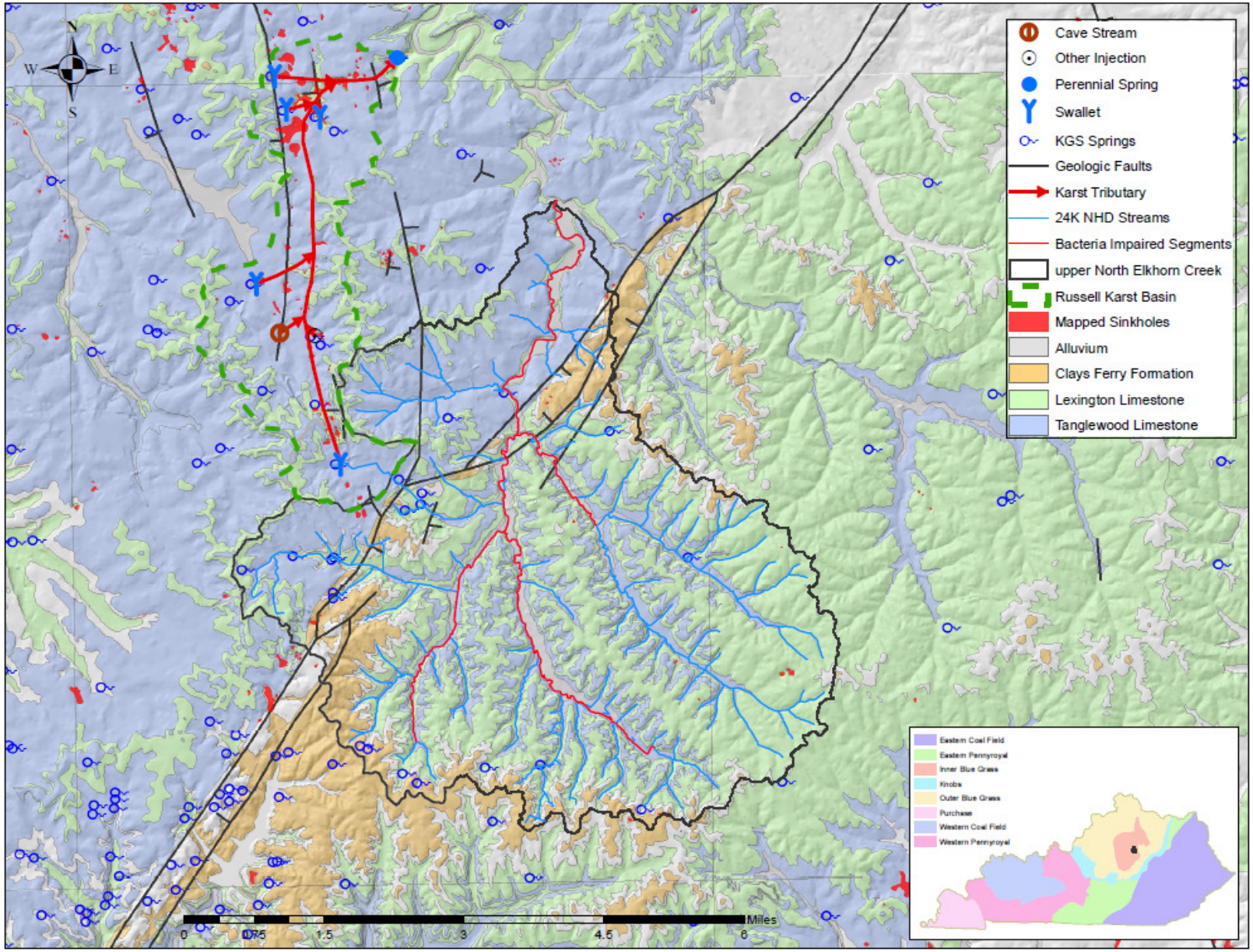

Figure 3.1 Geologic Map of the Upper North Elkhorn Creek Watershed Demonstrating the Presence of Mapped Faults and Karst Features

within conduits are commonly measured in thousands of feet per day instead of the typical rate of inches or feet per year in non-karst systems – the maximum recorded conduit groundwater velocity in Kentucky exceeds 2600 feet per hour (Blair, KDOW Personal Communication 2008). The KGS has developed Generalized Geologic Maps for Land-Use Planning for every county of the State to inform individuals of the general geologic bedrock condition that can affect a site and its intended uses. These pdf maps can be downloaded from their website, (http://kgsweb.uky.edu/download/geology/landuse/lumaps.htm).

Karst pathways can serve as underground tributaries to surface water, and thus can serve as a transport pathway for bacteria to streams. The lack of sunlight, colder temperatures and moist environment of groundwater systems provide the means for bacteria to persist longer before reaching surface streams (Harter 2007). Improper waste management activities (i.e. dumping into sinkholes, poorly installed or failing OSTDSs) or improper best management practices (i.e. lack of buffer strips around sinkholes in agricultural fields) can lead to direct contamination of water supplies. Karst also provides a challenge for nonpoint source pollution management as its pathways have long been regarded as "nature's sewer system" – sinkhole plains, sinking streams, and springs provide a direct connection between surface water and groundwater systems.

As mentioned previously, the Bryan Station Fault Zone is located in the watershed. The presence of faults in a watershed has the potential to influence groundwater/surface water flow - typically, surface water flow will parallel a fracture zone for a distance before sinking off a non-soluble bedrock into a soluble limestone bedrock, near a fault. In the same way, groundwater flow may parallel a fracture zone for a distance before emerging as a spring near the contact (fault) between the soluble limestone and non-soluble bedrock. Further information on the geology of the watershed can be found in Appendix A.

3.2 Soils

The geology of the watershed plays a vital role in the type of soils present. For instance, the Lexington limestone contain minerals (such as phosphorous) – as bedrock weathers, minerals accumulate in soil and act as natural fertilizers. This mineral rich soil fuels the agricultural industry in the area. The two major soil associations found in the watershed are the Maury-McAfee Association and the Lowell-Loradale- Mercer Association. This Maury-McAfee association is dominated by two soil types. The Maury soils comprise about 70 percent of the association and are deep, well drained and rich in phosphate. The McAfee soils are also well drained, but not as deep as the Maury soils and comprise 13 percent of the association. The Lowell-Loradale-Mercer soils are comprised primarily of the Lowell (40%), Loradale (15%) and Mercer (14%) soils. These soils are generally deep and well drained. Appendix A contains additional information and generalized maps of the soils in the watershed.

3.3 Land Cover Distribution

The National Land Cover Dataset (NLCD 2006) was used to determine the land cover within the upper North Elkhorn Creek watershed - results are summarized in Table 3.1. Although upper North Elkhorn Creek is still largely agricultural, a comparison of the 1992 and 2006 NCLD data (Table 3.1) demonstrates that the watershed is becoming more urban as the city of Lexington and its suburbs expand into the rural area. There is also an increase in the amount of pasture land coupled

with a drastic reduction in the amount of row cropping - likely a result of decreased tobacco farming (Figures 3.2 and 3.3). The reported zero values for land cover are correct.

Table 3.1 Summary of Land Cover within the Upper North Elkhorn Creek Watershed; Data Generated Using the 1992 and 2006 NLCD (MRLC)

Land Cover Class	Upper North Elkhorn Creek			
	1992		2006	
	%	Acres	%	Acres
Forest	18.0%	2808.84	8.3%	1300.95
Agriculture (total)	70.0%	10901.97	59.8%	9345.52
Pasture	57.9%	9013.63	58.4%	9119.30
Row Crop	12.1%	1888.35	1.4%	226.22
Developed	11.9%	1850.10	31.5%	4924.96
Natural Grassland	0.0%	0.00	0.1%	8.88
Wetland	0.0%	0.00	0.0%	1.11
Barren	0.1%	16.68	0.0%	1.11
David Fork				
Forest	16.2%	783.05	6.3%	310.84
Agriculture (total)	81.7%	3938.60	83.3%	4121.83
Pasture	69.1%	3330.35	81.5%	4028.72
Row Crop	12.6%	608.25	1.9%	93.12
Developed	2.1%	100.97	10.2%	506.17
Natural Grassland	0.0%	0.00	0.0%	0.00
Wetland	0.0%	0.00	0.0%	1.11
Barren	0.0%	0.00	0.0%	0.00
Unnamed Tributary to Upper North Elkhorn Creek				
Forest	17.4%	598.24	6.3%	234.31
Agriculture (total)	47.7%	1639.27	19.4%	719.10
Pasture	40.0%	1376.17	19.3%	715.11
Row Crop	7.7%	263.09	0.1%	3.99
Developed	34.5%	1186.47	74.1%	2743.83
Natural Grassland	0.0%	0.00	0.0%	0.00
Wetland	0.0%	0.00	0.0%	0.00
Barren	0.4%	13.57	0.0%	0.00

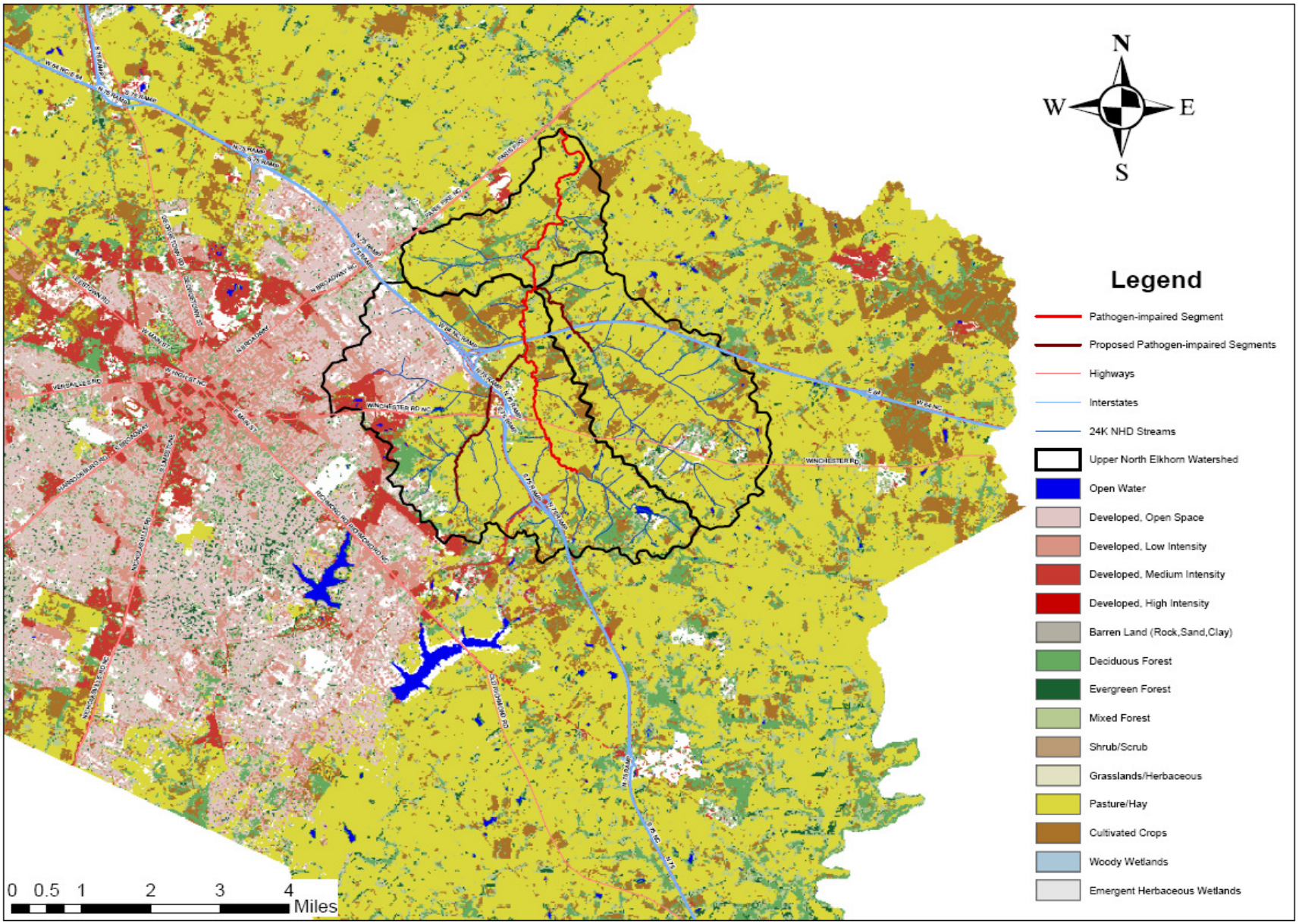

Figure 3.2 Land Cover of the Upper North Elkhorn Creek Watershed (NLCD 1992)

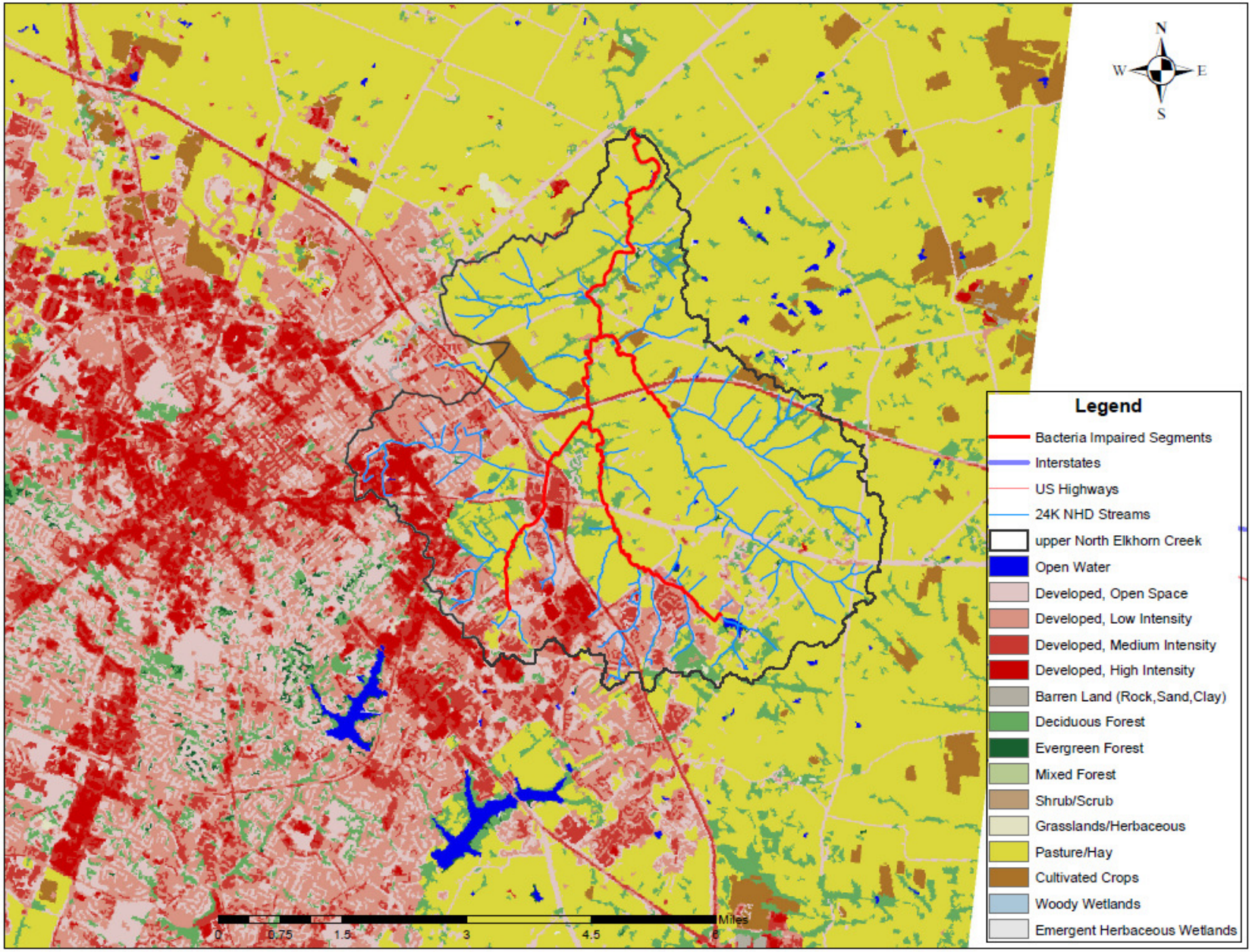

Figure 3.3 Land Cover of the Upper North Elkhorn Creek Watershed (NLCD 2006)

4.0 Water Quality Criterion

Title 401 KAR 10:031 describe the standards used to "protect the surface waters of the Commonwealth, and thus protect water resources." *Escherichia coli* (*E. coli*) bacteria are pathogen indicator organisms. *E. coli* 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 *E. coli* content does not exceed the criterion of 240 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. Stream segments were sampled (and analyzed for *E. coli*) an average of 20 times during the 2005 and 2006 PCR season.

The WQC in 401 KAR 10:031 (Kentucky's Surface Water Standards) for the PCR use are based on both fecal coliform and *E. coli*. Per 401 KAR 10:031:

"The following criteria shall apply to waters designated as primary contact recreation use during the primary contact recreation season of May 1 through October 31: 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."

For these TMDLs, the *E. coli* criterion was applied as the samples were not analyzed for fecal coliform. There are insufficient *E. coli* data to calculate a 5-sample, 30-day geometric mean, so the latter criterion of 240 colonies per 100 ml was used as the WQC in order to calculate the allowable loadings to bring the watershed into compliance with the PCR designated use.

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 *E. Coli* TMDLs will protect the PCR use regardless of whether a segment is impaired for *E. Coli*, fecal coliform, or both). Additionally, because the instantaneous limit is lower for PCR than for SCR (400 colonies/100 ml versus 2000 colonies/100 ml), development of TMDLs for the PCR season also protects segments impaired for the SCR use due to fecal coliform.

5.0 Monitoring

The Kentucky Watershed Management Framework maintains two types of monitoring stations: ambient and rotating watershed stations. Ambient stations are fixed, permanent sample locations located in the downstream and mid-unit reaches of USGS 8-digit HUCs, upstream of major reservoirs and in the downstream reaches of major tributaries. The ambient stations of a watershed management unit are sampled monthly during the year the unit is in the monitoring phase of the watershed cycle. During the other four years of the watershed cycle, sampling frequency is reduced to bimonthly. There are no ambient monitoring stations located in the upper North Elkhorn Creek watershed. Rotating watershed stations are selected for intensive (monthly) sampling for one year during the monitoring portion of the five (5) year watershed cycle. These are usually located at the downstream reaches of USGS 11-digit HUC watersheds, and many were coupled with biological sampling and USGS gaging stations. The KDOW follows water quality sample collection and preservation procedures found in its water quality monitoring Standard Operating Procedure (SOP) manuals, available online (http://water.ky.gov/Pages/SurfaceWaterSOP.aspx). As mentioned previously, waterbodies are identified as first priority for TMDL development if one or more designated uses are identified as nonsupport and second priority if the waterbody partially supports the designated use(s).

5.1 Initial Assessments

Upper North Elkhorn Creek was initially assessed by the KDOW in 1986 during a 'Biological and Water Quality Investigation of the North Elkhorn Creek Drainage'. The KDOW assessed the entire North Elkhorn watershed for the purpose of assigning designated uses and evaluating the habitat, physiochemical, sediment and biological communities, including microbiology. A map included with the report indicates that there was one station located within and one just downstream of the upper North Elkhorn Creek watershed (Figure 5.1). The results of the investigation concluded that the main stem of the Creek supported the WQC for the PCR and SCR designated uses (Table 5.1; KDOW 1992).

Table 5.1 Bacteriological Results from the 1986 KDOW Study on North Elkhorn Creek

Station Number & Location	Date	Fecal Coliform Colonies/100 ml	Fecal Strep Colonies/100 ml	*E. coli* Colonies/ 100 ml
04016015 Downstream of Impaired Segment	06/1986	140	290	-
	10/1986	210	160	140
04016016 At Bryan Station Rd	06/1986	200	300	-
	10/1986	32	250	24

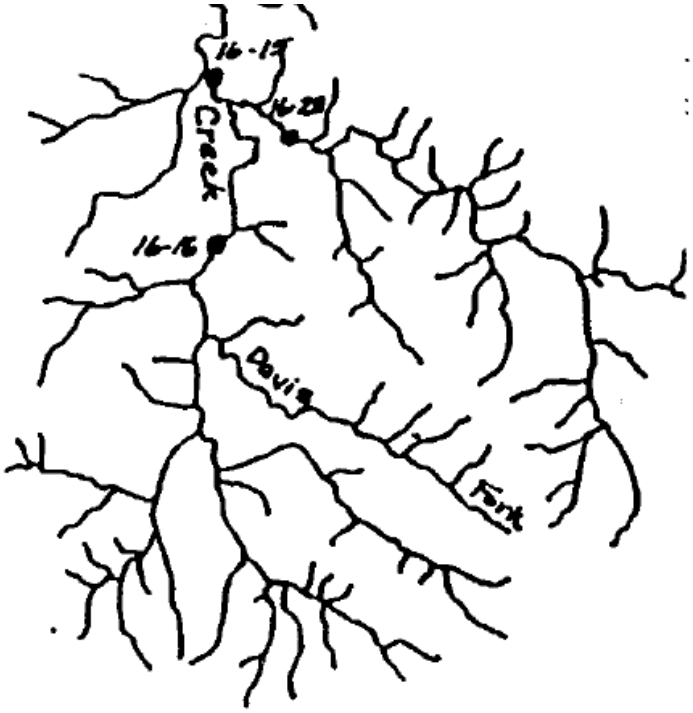

Figure 5.1 1986 KDOW Sample Locations within the Upper North Elkhorn Creek Watershed (KDOW 1992)

5.2 LFUCG Monitoring

The LFUCG collected bacteriological samples within the upper North Elkhorn Creek watershed from 1996 through 2002 during the PCR season (Figure 5.2). Sample results from this time period indicated that Creek no longer supported its PCR designated use (Table 5.2). As a result, the KDOW listed upper North Elkhorn Creek on the 2002 303(d) list from river mile 66.0 to 73.75 as impaired for bacteria – this nonsupport status prompted this subsequent bacteria TMDL development. The LFUCG continues to monitor the upper North Elkhorn Creek watershed for bacteria as part of their KPDES MS4 Stormwater permit (see Table 5.2).

Table 5.2 Bacteria Samples Collected between 1996 and 2012 within the Upper North Elkhorn Creek Watershed by the LFUCG as part of their Stream Monitoring Program

Station ID	Latitude	Longitude	Station Location	Sample Date	*Colonies per 100 ml
NE-S1	38.028551	84.401610	At Bryant Road	10/14/1996	270
				06/18/1997	**1500**
				10/30/1997	**1600**
				06/08/1998	**4100**
				06/25/1999	**15000**
				06/17/2002	**4000**
				8/24/2009	118
				8/29/2009	**326**
				10/2/2009	**1380**
				10/21/2009	75
				6/9/2010	**2420**
				8/20/2010	**296**
				9/16/2010	**3130**
				6/3/2011	238
				6/15/2011	**2420**
				8/31/2011	52
				9/19/2011	**326**
				9/19/2011	**328**
				8/15/2012	<100
				9/17/2012	<100
				10/4/2012	<100
NE-S2	38.034247	84.408267	At Madden Farm	10/14/1996	60
				06/18/1997	**500**
				10/30/1997	**260**
				06/07/1998	**500**
NE-S3	38.040072	84.411033	At Winchester Road	10/15/1996	10
				06/18/1997	110
				10/30/1997	**510**
				07/07/1998	**1200**
				06/25/1999	**>60000**
				06/17/2002	**2100**
				8/24/2009	**461**
				8/29/2009	**291**
				10/2/2009	**5230**
				10/21/2009	63
				6/9/2010	**2420**
				8/20/2010	**1382**
				9/16/2010	<20
				10/26/2010	**31062**
				6/3/2011	**344**
				6/15/2011	**2420**
				8/31/2011	160
				9/19/2011	**980**
				7/13/2012	**>24200**
				8/15/2012	<100
				9/17/2012	**>2420**
				10/4/2012	**300**

- Samples collected prior to 2003 were analyzed for fecal coliform; samples collected after 2009 were analyzed for *E. coli*.
  Exceeds PCR WQC

5.3 KDOW – TMDL Monitoring

The TMDL Section of the KDOW monitored six sites within the upper North Elkhorn Creek watershed from May through October 2005 and again from June through August 2006 (Figure 5.2) as a result of the 2002 303(d) listing. There were an average of 17 samples collected at each site; parameters collected included *E. coli*, pH, dissolved oxygen, specific conductance, temperature and discharge. A brief summary of the results are presented below (Table 5.3) and summarized by station in Section 8.

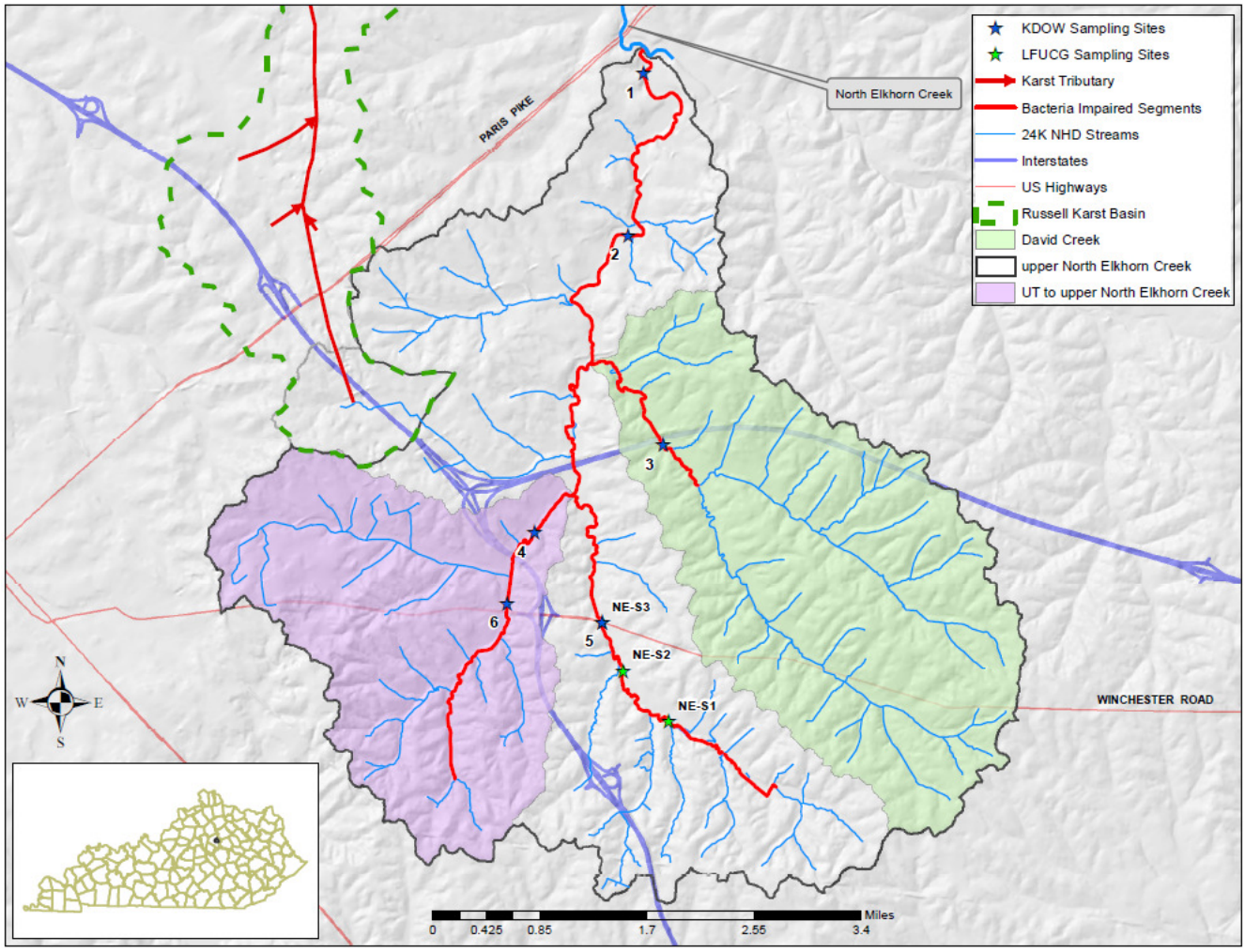

Figure 5.2 LFUCG and KDOW Monitoring Locations within the Upper North Elkhorn Creek Watershed

Table 5.3 KDOW Sample Locations and Bacteriological Data Collected Within the Upper North Elkhorn Creek Watershed during the 2005 and 2006 PCR Seasons

Site ID	Impaired Segment & Location	Drainage Area	Maximum *E. coli* Sample Result (colonies/100ml)	Percent Exceeding PCR Criterion (240 colonies/ 100ml)
01NE	Upper North Elkhorn Creek - At private drive bridge off of Paris Pike (SR27) at Gainsway Farm (38.1032; -84.4037)	24.4	19,860	52.9% (9/ 17)
02NE	Upper North Elkhorn Creek - At SR3367 bridge (38.0846; -84.4065)	22.6	24,200	76.5% (13/ 17)
03NE	David Fork - At private drive bridge off of Royster Rd.; above I-64 overpass (38.0603; -84.4021)	6.8	24,200	94.1% (16/ 17)
04NE	UT North Elkhorn Cr. - At Hume Rd. bridge (38.0504; -84.4206)	5.6	19,860	82.4% (14/ 17)
05NE	Upper North Elkhorn Creek - At Winchester Rd. (US60), East of I-75 (38.0402; -84.4109)	4.1	24,200	87.5% (14/ 16)
06NE	UT North Elkhorn Cr. - Below Winchester Rd. (US60), behind Shell gas station (38.0424; -84.4248)	2.8	9,800	94.1% (16/ 17)

6.0 Source Assessment

For regulatory purposes, the sources of bacteria in a watershed can be placed into two categories: KPDES-permitted and non KPDES-permitted sources. A KPDES-permitted source requires a Kentucky Pollutant Discharge Elimination System (KPDES) discharge permit, a storm water permit, or a Municipal Separate Storm Sewer System (MS4) permit from the KDOW. KPDES discharge permits include wastewater treatment facilities that discharge directly to a stream, facilities discharging storm water, and some agricultural operations (e.g. Concentrated Animal Feeding Operations (CAFOs) with an individual discharge permit). KPDES is not the only permitting program that may affect water quality or quantity within a watershed; other permitting examples include water withdrawal permits, permits to build structures within a floodplain, permits to construct an on-site sewage treatment disposal system (OSTDS), and permits to land apply waste from sewage treatment plants. However, within the framework of the TMDL process a KPDES-permitted source is defined as one regulated under the KPDES program.

Non KPDES-permitted sources include nonpoint sources of pollution. Nonpoint sources of pollution are often caused by runoff from precipitation over and/or through the ground and are correlated to land use.

6.1 KPDES-permitted Sources

KPDES- permitted sources include all sources regulated by the KPDES permitting program. KPDES permit and point source are defined in 401 KAR 10:001. A Wasteload Allocation (WLA) is assigned to KPDES-permitted sources.

6.1.1 Sanitary Wastewater Systems

Information obtained from the Water Resource Information System (WRIS, www.wris.ky.gov) and KDOW Surface Water Permits Branch was used to confirm information associated with wastewater dischargers and their systems. In addition, in October 1999 and March 2000 the Bluegrass Area Development District (BADD) wrote a "Summary of Water Systems" and "Summary of Wastewater Treatment Systems," respectively, as part of the "Strategic Water Resource Development Plan" (SWRDP) compiled and released by the Water Resource Development Commission of the Governor's Office. Information from these reports is for informative purposes only unless confirmed by one of the above mentioned KDOW Branches.

There are no KPDES-permitted wastewater treatment plants (WWTPs) or dischargers within the upper North Elkhorn Creek watershed.

6.1.1.1 Wastewater Infrastructure

There are two permitted wastewater systems that have sanitary sewer collection infrastructure within the upper North Elkhorn Creek watershed but do not discharge to any of its waters. A portion of the Town Branch and West Hickman sewer conveyance system, maintained by the LFUCG, lie within the MS4 area of the watershed – wastewater is treated at one of the respective wastewater treatment plants. According to the LFUCG Division of Water Quality website (and

as reported to the BGADD; http://www.lexingtonky.gov/index.aspx?page=665), the LFUCG maintains nearly 1,400 miles of sewer line, 28,000 manholes, and 81 pump stations within their MS4 boundary. Approximately 12% of the MS4 area lies within the upper North Elkhorn Creek watershed – several pump stations are known to exist here and it could be estimated (assuming an equal distribution) that roughly 168 miles of sewer line and 3,360 manholes are present in the watershed. Recognized problems associated with inflow and infiltration (i.e. illicit connections to the storm sewer system, leaking pipes, rainfall inflow via manhole covers, etc.) could cause the systems to overflow, particularly at times of heavy rainfall, creating a potential source for bacteria. Information from the Division of Water Quality website indicates that sewer system rehabilitation is ongoing; pump station upgrades and construction are complete. Figure 6.1 depicts the sewer conveyance system within the upper North Elkhorn Creek watershed.

6.1.1.2 Wastewater Upgrades and Expansions

The WRIS has been developed through the cooperative efforts of water and wastewater treatment systems and local, regional, and state agencies. It is used by all of these entities, and provides much of the information needed for all aspects of water resource planning--from watershed protection to infrastructure development. This system was used to obtain more detailed information on wastewater systems and any planned upgrades or expansions. Full project profile and system reports can be found in Appendix B.

Sewer lines blanket the MS4 area of the watershed where upgrades and expansions have occurred in the last several years. The two systems mentioned above have several projects on the Clean Water State Revolving Fund List. These projects include sewer line extensions to unserved households, 7,400 GPM pump station construction (and subsequent elimination of four interim pump stations), 13,200 GPM pump station construction (for new service areas and to balance wastewater flow between the two treatment plants, and various stormwater management projects. Many of these projects have been completed in the last year and will help reduce the potential sources of bacteria in the watershed.

6.1.2 Municipal Separate Storm Sewer System Sources

In developed areas, polluted stormwater runoff is often diverted and concentrated into MS4s, where it ultimately discharges to surface waters with little or no treatment.

MS4s are defined in 401 KAR 5:002. EPA has categorized MS4s into three categories: small, medium, and large. The medium and large categories are regulated under the Phase I Storm Water program. Large systems, such as the cities of Lexington and Louisville, have populations in excess of 250,000. Medium systems have populations in excess of 100,000 but less than 250,000; however, there are currently no medium-sized systems in Kentucky. Phase I systems have five-year permitting cycles and have annual reporting requirements. The small MS4 category includes all MS4s not covered under Phase I. Since this category covers a large number of systems, only a select group are regulated under the Phase II rule, either being automatically included based on population (i.e., having a total population over 10,000 or a population per square mile in excess of 1000) or on a case-by-case basis due to the potential to cause adverse impact on surface water. Water quality monitoring is not a requirement of Phase II MS4s, unless

the waterbody has an approved TMDL and the MS4 causes or contributes to the impairment for which the TMDL was written (KDOW 2009). A WLA is assigned to all MS4 permits, including the KYTC, universities and military bases.

The LFUCG MS4 community (KYS000002) covers just over one-third of the watershed in the south/southwest. The Kentucky Transportation Cabinet also has a MS4 permit (KYS000003) and is responsible for stormwater from the pavement and right of way of interstates, parkways, U.S. highways, and state routes within these MS4 boundaries. MS4 permit requirements include development of "a stormwater quality management program that is designed to reduce the discharge of pollutants to the maximum extent practible (MEP). The MEP standard involves applying best management practices that are effective in reducing the discharge of pollutants in stormwater runoff. This requires that the permittee use known, available, and reasonable methods of prevention and control of stormwater discharges." The MS4 community boundaries are illustrated in Figure 6.1 and their respective areas are presented in Table 6.1.

Table 6.1 Percentage of MS4 Area within Upper North Elkhorn Creek

Stream Segment	Total Area (acres)	MS4 Area (acres)	MS4 Area (%)	MS4 WLA (col/day)
Upper North Elkhorn Creek RM 66.0-73.75	15,617.61	6,573.4	42.1%	5.87×10^{11}
David Fork RM 0.0-1.68	4,945.27	290.18	5.9%	1.02×10^{10}
UT to Upper North Elkhorn Creek RM 0.0-2.9	3,700.56	3,463.47	93.6%	2.44×10^{10}

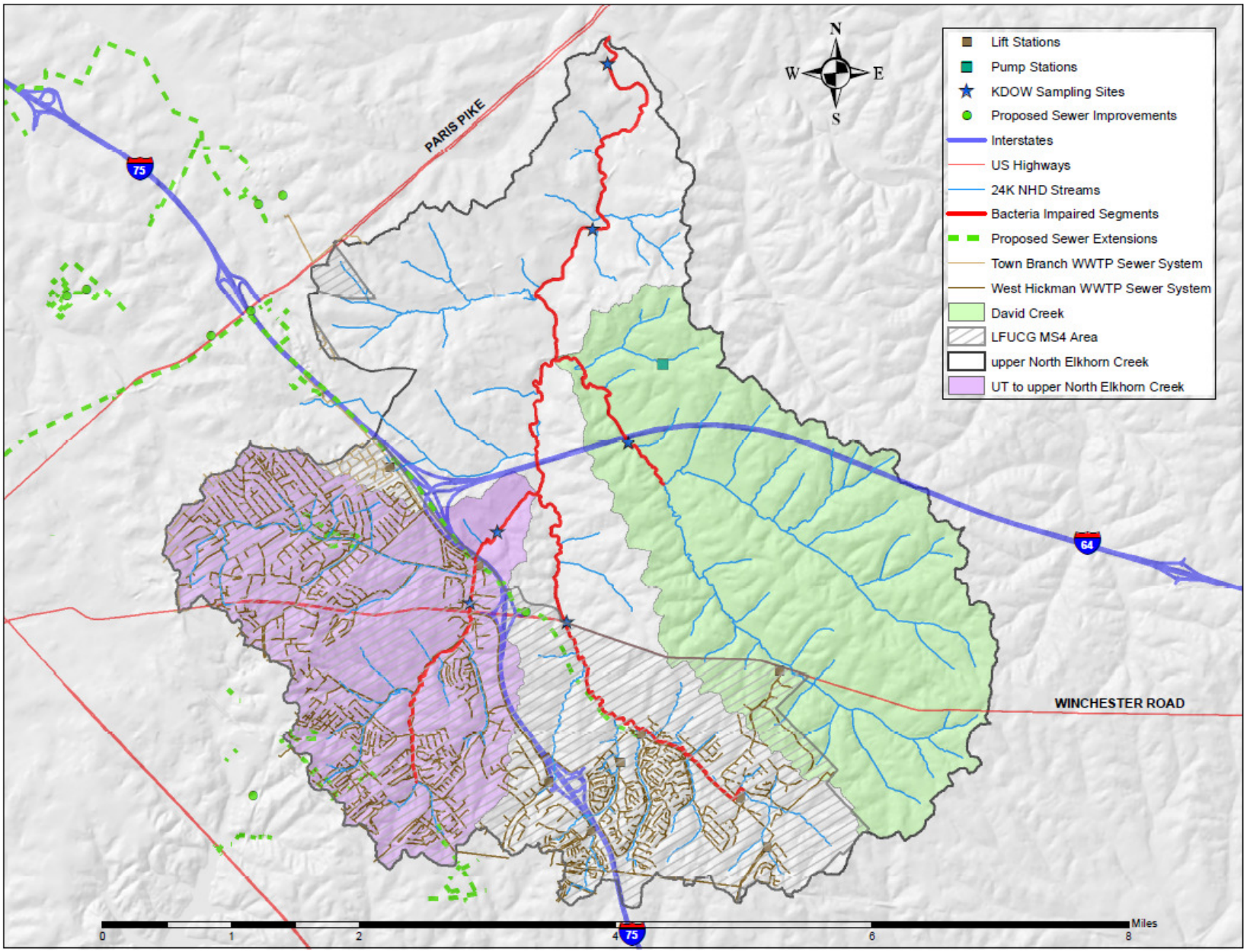

Figure 6.1 Locations of Sewer System Infrastructure and the LFUCG MS4 Area within Upper North Elkhorn Creek

6.1.3 Combined Animal Feeding Operations

Operations that are defined as a CAFO pursuant to 401 KAR 5:002 are required to obtain a KPDES permit. Once defined as a CAFO, the operation can be permitted under a KPDES General Permit or a KPDES Individual Permit depending upon the nature of the operation. Conditions of both types of permits include no discharge to surface waters; however, holders of a KPDES Individual Permit may discharge to surface waters during a 25-year (24-hour) or greater storm event.

There are currently no CAFOs in the upper North Elkhorn Creek watershed.

6.2 Non KPDES-permitted Sources

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. A Load Allocation (LA) is assigned to non KPDES-permitted sources.

Unlike KPDES-permitted sources, non KPDES-permitted sources typically discharge pollutants to surface water in response to rain events (MS4s are a notable exception, as they are a KPDES-permitted source that discharges to surface water in response to rain events through a system of storm drains, curbs, gutters, etc.). Non KPDES-permitted sources for bacteria exist in the watershed and fall into various categories including agriculture, properly functioning OSTDS, failing OSTDS, household pets and natural background, which in the case of bacteria in a rural watershed means wildlife. Straight-pipes are a type of illegal, non KPDES-permitted source that may exist in the watershed, but none are known to exist with certainty.
.
As mentioned in Section 3, this watershed is located in a karst region. The KGS has developed Generalized Geologic Maps for Land-Use Planning (http://www.uky.edu/KGS/) for every county of the State to inform individuals of the general geologic bedrock condition that can affect a site and its intended uses. For example, this watershed is underlain with mostly limestone bedrock – according to the planning guidance, this type of rock carries severe limitations for septic tank disposal systems depending on the amount of soil cover and depth to bedrock. A severe limitation is defined as one that is "difficult to overcome and commonly is not feasible because of the expense involved."

6.2.1 Kentucky No Discharge Operating Permits (KNDOP)

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 Operational Permit (KNDOP) from the KDOW prior to construction and operation. Animal Feeding Operations (AFOs) receive KNDOP permits. 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 the 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.

There are currently no KNDOP-permitted facilities within the upper North Elkhorn Creek watershed.

6.2.2 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 made up of farmers and representatives from various agencies and organizations. The Act requires all 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. More information on the Kentucky AWQA and Water Quality Plans can be found at http://conservation.ky.gov/Pages/AgricultureWaterQuality.aspx.

The USDA National Agricultural Statistics Service (NASS) compiles Census of Agriculture data by County for virtually every facet of U.S. agriculture (USDA 2009). The "Census of Agriculture Act of 1997" (Title 7, United States Code, Section 2204g) directs the Secretary of Agriculture to conduct a census of agriculture on a 5-year cycle collecting data for the years ending in 2 and 7. Selected agricultural data from the 2002 and 2007 Census of Agriculture reports for Fayette County are listed in Table 6.2. These data are based on County-wide data with no assumptions made on a watershed level. The percentage of agricultural types of land cover is calculated for each sub-watershed in Table 3.1 (Section 3.3).

The upper North Elkhorn Creek watershed has a substantial agricultural resource with 59.8% of its land cover devoted to agricultural operations (Figure 3.3). The prevalent threat to streams from agriculture is bacteria loading from animal wastes – it is both a direct and indirect source of bacteria loading to the stream. Livestock often lay in or near the streams in search of shade or drinking water. Livestock with access to streams can have a direct impact on water quality when feces are deposited on stream banks or directly in the stream. Animals grazing in pasture often deposit feces on the land - bacteria that do not decay will runoff into streams during wet weather events. Runoff from pasture land is an indirect source of bacteria since a rainfall event is required to transport the bacteria to the stream. There are considerable numbers of both horses and cattle in the watershed, mostly located in the rural areas north of Interstate 75 (Figure 3.3; Table 6.2). According to the US Census Bureau, there are approximately 283.65 square miles of land in Fayette County – Table 3.1 conveys that there are approximately 9,345 acres or 14.6 square miles of agricultural land cover (most of which is attributed to pasture) within the 24.4 square miles of this watershed. In 2007, the USDA reported that Fayette County had an estimated $382,031 in cash receipts from livestock.

Table 6.2 USDA Agricultural Statistics for Fayette County

Item	Number of Farms		Acreage(a) or Inventory(i)	
	2002	2007	2002	2007
Farms [(1)]	738	810	119,098(a)	135,969
Horses and Ponies	426	498	12,676(i)	14,121(i)
Cattle and Calves	188	202	15,037(i)	16,771(i)
Beef Cows	144	168	(D)	(D)
Milk Cows	2	2	(D)	(D)
Hogs and Pigs	1	4	(D)	22(i)
Any Poultry	11	24	n/a	n/a
Layers 20 weeks old or older	7	21	992(i)	(D)
Broilers & other meat-type chickens sold	n/a	1	n/a	(D)
Corn for grain	34	28	1,919(a)	2,255(a)
Land in Orchards	11	34	17(a)	118(a)
Tobacco	194	78	2,113(a)	2,271(a)
Wheat for grain	16	17	727(a)	1,046(a)
Soybeans for beans	21	18	2,528(a)	1,890(a)
Manure applied as fertilizer [(2)]	151	132	6,751(a)	10,000(a)
Conservation methods utilized	n/a	140	n/a	n/a
Practiced rotational or management-intensive grazing	n/a	194	n/a	n/a
Grazed livestock on a per head or AUM basis	n/a	6	n/a	n/a

[(1)] = A farm is defined as any place from which $1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the census year
[(2)] = 2002 data are based on a sample of farms
n/a = Information not available
(D) = Information withheld to avoid disclosing data for individual farms

The Ohio State University Agricultural Extension Service released a guidance document for the management of livestock manure. The document contains manure characteristics, handling/storage and application procedures and also addresses some of the issues and considerations involved with manure management (James 2006). A similar (though as not detailed) document is available from the North Carolina State University College of Agriculture and Life Sciences (Shaffer 2005). These documents could be used to estimate pathogenic contributions from livestock if it could be determined how much manure actually made it to a stream since it is unrealistic that an animal would be directly contributing to a stream throughout the day. However if Standard Operating Procedures for wastewater collection systems and BMPs are utilized, bacteria contributions to surface waters from livestock should not cause a violation of the WQC. There are no permitted AFO's or CAFO's present in the watershed (Section 6.1.3).

The USDA also estimated (in 2007) that Fayette County had a total of $12,420 in cash receipts from all crops. Though there is less than one square mile of land in this watershed being utilized for row crops, crops may be a source of bacteria if manure is used as a fertilizer. However if BMPs are utilized (as discussed on the KAWQA webpage, http://www.conservation.ky.gov/programs/kawqa/)), bacteria contributions to surface waters should not cause an exceedance of the WQC.

6.2.3 Human Waste Contribution

Human waste disposal is of particular concern in rural areas and increasingly within corporate/MS4 areas. A portion of upper North Elkhorn Creek is serviced by the LFUCG sanitary sewer system. The remaining area must be serviced by an OSTDS (Onsite Sewage Treatment and Disposal Systems) or receives no treatment at all. OSTDS (including septic 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 nutrients (nitrogen and phosphorus), bacteria, and other pollutants to both ground water and surface water.

A type of non KPDES-permitted source that may exist in the upper North Elkhorn watershed is straight-pipes, which are discrete conveyances that discharge sewage, gray water (i.e., water from household sinks, laundry, etc.) and stormwater to the surface waters of the Commonwealth without treatment. Although straight-pipes meet the definition of a point source as defined in 401 KAR 10:002, they are illegal and EPA considers them to be part of the LA as they are a non KPDES-permitted source (see Section 6.3 for further discussion).

The "Strategic Water Resource Development Plan", mentioned in Section 6.1.1, states that 97% of Fayette County is afforded public sewer service with approximately 3,300 households utilizing an OSTDS or not treating their sewage – these estimates are projected to remain constant through 2020. The LFUCG intends to address problems associated with their older system including inflow/infiltration and capacity issues (Kentucky Infrastructure Authority 2000). However the majority of land area in the upper North Elkhorn Creek watershed is not serviced by sewers and there are no package treatment plants - it must be assumed that the households in a large portion of the watershed (northeastern two-thirds) are using OSTDS for human waste disposal or not treating their sewage. Figure 6.1 illustrates the location of sewer lines in the watershed. As mentioned previously, the watershed is located in a karst region and is underlain with limestone bedrock – according to the KGS land-use planning guidance, this type of bedrock carries severe limitations for septic tank disposal systems. A severe limitation is one that is "difficult to overcome and commonly is not feasible because of the expense involved." Figure 6.2 is a karst conceptual model included with Land-Use Planning maps and reprinted with permission from the KGS.

In addition, the USDA Natural Resources Conservation Service (NRCS) publishes county soil surveys and rates the performance of septic tank absorption fields, defined as the area in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Soil ratings are based on soil properties, site features, and the observed performance of the soils - permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of septic tank effluents. Soils in the study area include the Maury-McAfee and the Lowell-Loradale-Mercer Associations. USDA rates these soils as somewhat to very limited for installation of septic tank absorption fields (USDA 2012). Individual images of the dominant soils of the sub-watersheds as well as further soil class descriptions can be found in Appendix A. Based on the soil ratings and prevailing karst formations it is likely many of the septic systems in the watershed are not functioning properly. Failing OSTDS are probable sources of bacteria.

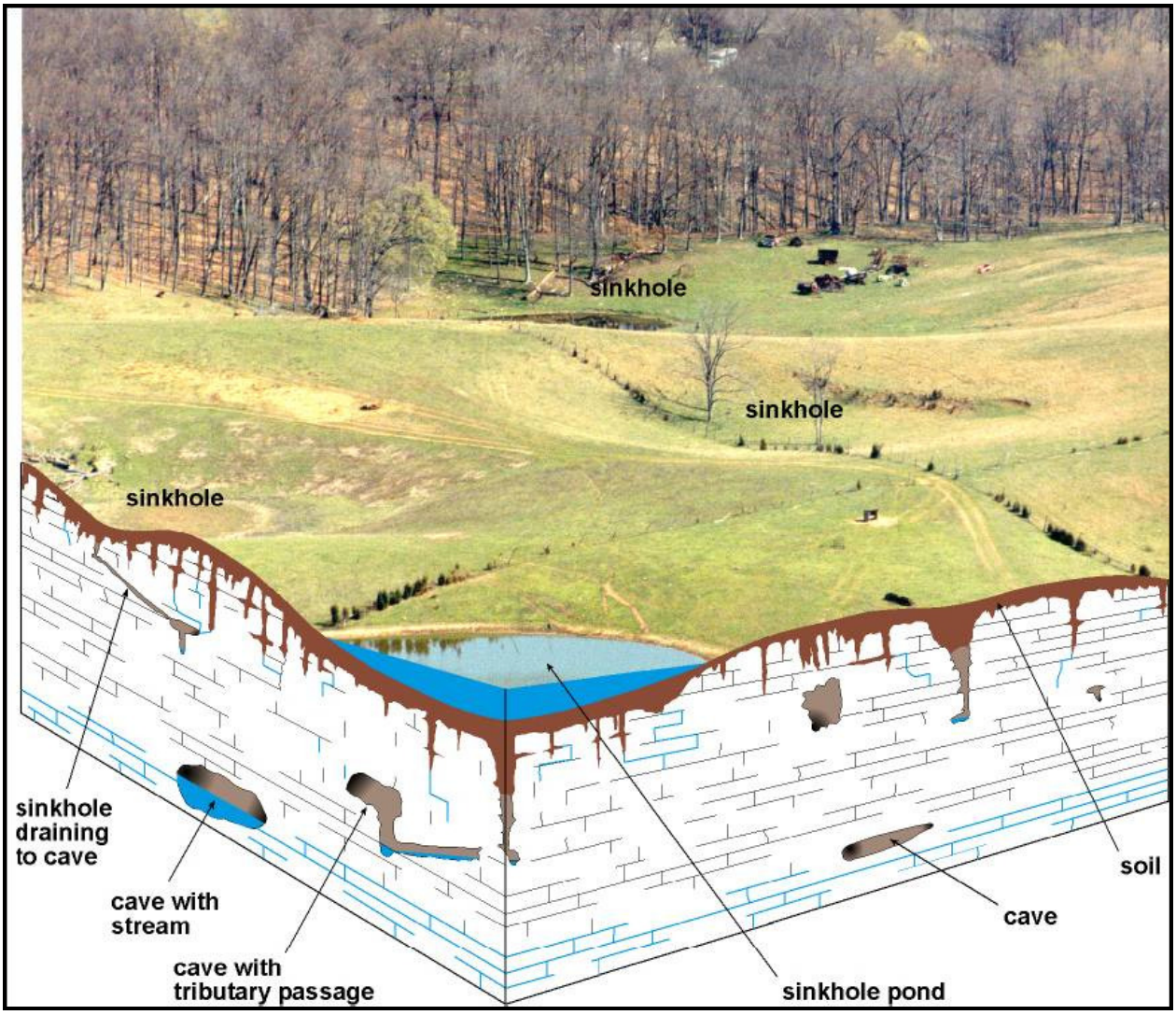

Figure 6.2 A Karst Conceptual Model of the Upper North Elkhorn Creek Watershed Depicting the Correlations Between Surface and Ground Water, Land Cover and Karst Terrains (KGS 2005)

In order to gain a rough estimate of the number of OSTDS present in the watersheds, statistics from the 2010 US Census and KIA were analyzed for the Lexington-Fayette area. Fayette County is 283.65 square miles (or 181,535 acres) and the LFUCG MS4 area is 88.7 square miles (or 56,744 acres). If the 3,300 households utilizing OSTDS or not treating sewage were evenly distributed across the non-MS4 (non-sewered) area of the County, it could be estimated that approximately 239.2 households within the 9,044.2 acres of the upper North Elkhorn watershed are not afforded sewer service (Table 6.3). The watershed area not on sewer service was determined by subtracting the MS4 area from the watershed area (within a GIS framework).

Table 6.3 Estimated Number of Households Operating OSTDS or not Treating Sewage

Watershed/ Stream Name	Watershed Area (not sewered; acres)	MS4 Area (sewered; acres)	Average # of households operating OSTDS or not treating sewage
Upper North Elkhorn Creek	9,044.2	6,573.4	**239.2**
David Fork	4,655.1	290.2	**123.12**
UT to Upper North Elkhorn Creek	237.1	3,463.5	**6.27**

6.2.4 Household Pets

Household pets undoubtedly exist in the upper North Elkhorn Creek watershed - their contribution to the LA is deemed minimal compared to other sources in the rural portions of the watershed. Pet waste may, however, be a larger contributor to bacteria runoff within the MS4/ corporate limits of a city as urban areas tend to have a higher density of households and less permeable surfaces than rural areas.

According to the American Veterinary Medical Association, by the end of 2011, 36.5% of all households (nationally) owned an average 1.6 dogs and 30.4% owned an average 2.1 cats.

6.2.5 Wildlife

Wildlife undoubtedly contributes to bacteria loading in the watershed, however given the higher percentage of urban/residential land use, it is likely not a significant source of bacteria to upper North Elkhorn Creek. The Kentucky Department of Fish and Wildlife Resources estimate deer densities per square mile for all counties of Kentucky (Yancy, Personal Communication, 2008). There are approximately 6 deer per square mile (about 716 total) residing in Fayette County.

Estimates of deer populations are shown for each watershed in Table 6.5. Because the corporate area of the LFUCG encompasses the entire County, the MS4 areas were subtracted from the total watershed area on the assumption that deer remain constant throughout the year and are present (and evenly distributed) on all land classified as agricultural, forested, grasslands, and wetlands. Estimates of numbers of other types of wildlife are not available for Kentucky.

As stated above, although wildlife contributes bacteria to surface water, such contributions represent natural background conditions and receive no reductions within a TMDL. Wildlife such as opossums, raccoons, rats, and birds that reside within the corporate/MS4 boundaries may be a larger contributor to bacteria runoff as urban areas tend to have less permeable surfaces.

Table 6.4 Estimated Deer Populations within Upper North Elkhorn Creek

Sub-watershed Stream Name	Watershed Area (excluding MS4 areas; mi^2)	Estimated Deer Population in Watershed
Upper North Elkhorn Creek	14.1	84.6
UT to Upper North Elkhorn Creek	0.4	2.4
David Fork	7.4	44.4

6.3 Illegal Sources

Both KPDES-permitted and non KPDES-permitted sources can discharge bacteria to surface water illegally - this includes sources which are illegal simply by their existence, such as straight-pipes, as well as legal sources that are operating illegally (e.g., outside of regulations, permit limits or conditions, etc., such as a WWTP bypass). Such sources receive no allocation of any kind in the TMDL process (see Section 8 for TMDL allocations).

In addition to straight-pipes, another illegal source related to human waste disposal is failing OSTDSs, which receive an allocation of zero. Combined Sewer Overflows (CSOs) and Sanitary Sewer Overflows (SSOs) are discharges without a permit and are also illegal sources which receive no allocation.

Another potential illegal source is livestock on farms which 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. Also included are KNDOPs, AFOs and CAFOs not in compliance with the appropriate regulation that cause or contribute to surface water impairment.

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 could be present in the watersheds (e.g., straight-pipes) and sets the allocation for these (and other potential illegal sources) at zero.

7.0 Total Maximum Daily Load

The USEPA defines a TMDL as "a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. Water quality standards are set by States, Territories, and Tribes. They identify the uses for each waterbody, for example, drinking water supply, contact recreation (swimming), and aquatic life support (fishing), and the scientific criteria to support that use. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation must include a margin of safety to ensure that the waterbody can be used for the purposes the State has designated. The calculation must also account for seasonal variation in water quality. The Clean Water Act, section 303, establishes the water quality standards and TMDL programs (USEPA 2008c)."

7.1 TMDL Equation and Definitions

A TMDL calculation is performed as follows:

$$TMDL = MOS + WLA + LA$$

Where:
TMDL: the WQC or the maximum load the waterbody can naturally assimilate while still meeting the WQC of 240 colonies per 100 ml at a given flow, in units of colonies per day.
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 Target: the TMDL minus the MOS.
WLA: the Waste Load Allocation (allowable loadings from KPDES-permitted sources such as SWSs and MS4s.
SWS-WLA: the WLA for KPDES-permitted sanitary wastewater system (SWS) sources, which have discharge limits for bacteria (including wastewater treatment plants, package plants and home units).
Remainder: the TMDL Target minus the WLA
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).
MS4-WLA: the WLA for KPDES-permitted municipal separate storm water sewer systems (including, but not limited to cities, counties, KYTC, universities and military bases).
LA: the Load Allocation, including natural background and non-KPDES permitted sources.
Seasonality: Yearly factors that affect the relationship between pollutant inputs and the ability of the stream to meet its designated uses.
Critical Condition: When the pollutant conditions are expected to be at their worst.
Critical Flow: the flow 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, see Section 7.6.

Percent Reduction: the reduction needed to bring the existing conditions (i.e., the existing non-SWS sources) in line with the Remainder, see Section 7.7.
Load: Concentration * Flow * Conversion Factor in colonies per day
Concentration: colonies per 100 milliliters (col/100ml)
Flow (i.e. stream discharge): cubic feet per second (cfs)
Conversion Factor: the value which converts the product of Concentration and Flow to Load (in units of colonies per day); it is derived from the calculation of the following components: (28.31685L/cf * 86400sec/day * 1000ml/L)/ (100ml) and is equal to 24465758.4.

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. Once a critical flow is obtained, it is then multiplied by the WQC minus the MOS (10%) times the appropriate conversion factors to obtain the TMDL Target load. Allowable loadings from KPDES-permitted sources are then subtracted from the Target load to produce the Remainder. MS4-WLA and Future growth calculations are then performed and subtracted from the Remainder, leaving the LA.

However, regardless of the procedure used to calculate the TMDL, reductions from existing conditions ultimately must be effected within the watershed only until all stream segments meet the PCR use, or until all sources (except wildlife) are discharging in compliance with the WQC. Once the WQC is met, all sources (apart from wildlife) must continue to discharge at a load that meets the WQC.

7.2 Margin of Safety

The MOS can be an implicit (using conservative assumptions) or explicit (a reserved portion) additional reduction applied to the WLA, LA or to both types of sources that accounts for uncertainties in the data or TMDL calculations. For these TMDLs, a 10% explicit MOS (i.e., 10% of the WQC or 24 colonies/100ml) 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:

$$\text{MOS (colonies/day)} = \text{Critical Flow (cfs)} \times \text{24 (colonies/100ml)} \times \text{Conversion Factor 24465758.4}$$

7.3 Waste Load Allocation

The WLA is the portion of the TMDL allocated to KPDES-permitted sources within the watershed. There are currently two KPDES-permitted sources within upper North Elkhorn Creek.

7.3.1 SWS-WLA

The WLA for KPDES-permitted sources discharging to an impaired segment are calculated using their permitted effluent limits for *E. coli* (i.e. the WQC of 240 col/100 ml) and facility design flow (or average daily flow for facilities with comingled waste streams) by means of the following equation:

$$\text{WLA (colonies/day)} = \text{Design Flow or Average Daily Flow (cfs)} \times \text{240 (colonies/100ml)} \times \text{Conversion Factor 24465758.4}$$

The individual SWS-WLAs for each facility that discharges to an impaired segment are summed to create a final SWS-WLA for that segment. There are no SWS KPDES-permitted sources discharging to an impaired segment in upper North Elkhorn Creek.

7.3.2 Remainder

The Remainder is not part of the TMDL however; it is used in the TMDL calculations. It is defined as the TMDL Target load minus the sum of all SWS-WLAs.

7.3.3 Future Growth WLA

A TMDL document will often account for future growth of current or new KPDES-permitted sources in order to avoid having to re-open the TMDL when new sources come online or current ones expand. Future growth is represented by a portion of the Remainder which is set aside (i.e. it is not part of the LA nor is it part of the WLA for current/known sources). It can also include existing storm water sources which are later discovered to discharge the pollutant of concern, even though this fact may not be known at the time the TMDL was written. The loading amount reserved for future growth is determined by using Table 7.1 which assumes that growth occurs more rapidly in a developed area (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 2006 USGS NLCD) than in rural areas. The Future Growth WLA for each impaired segment is shown in Table 7.2 and calculated using the following formula:

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

Table 7.1 Future Growth Matrix

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%

Table 7.2 Future Growth Percentage by Impaired Segment

Waterbody Segment and RMs	Percent Developed Area	Percent of Remainder Set Aside for Future Growth
Upper North Elkhorn Creek, RM 66.0-73.75	31.5%	5%
David Fork, RM 0.0-1.68	10.2%	2%
UT to Upper North Elkhorn Creek, RM 0.0-2.9	74.1%	5%

7.3.4 MS4-WLA

If there is a MS4 within the upstream area of the impaired segment, a MS4-WLA must be calculated. A larger MS4 will not be responsible for other MS4s present within its boundaries (e.g. a City-MS4 is not responsible for a University or KYTC-MS4 within its permitted boundary). The MS4-WLA is calculated using the following equation:

$$\text{Remainder} \times \text{\% of (developed acres in MS4 boundary)/(total acres in subwatershed)} = \text{MS4-WLA}$$

The city of Lexington MS4 community comprises approximately 10.3 square miles of upper North Elkhorn Creek's 24.4 square miles, or 42.2% of the total area. This area includes the Kentucky Transportation Cabinet MS4 that is responsible for stormwater from the pavement and right of way of interstates, parkways, U.S. highways, and state routes within the MS4 boundary. Table 7.3 depicts the percent of MS4 area in each watershed; note that the MS4-WLA is calculated using only the percentage of developed land cover within the MS4 boundary (i.e. areas classified as agriculture, wetlands, forest, barren or natural grasslands according to the 2006 MRLC NLCD were omitted).

Table 7.3 Waste Load Allocations and Percentage of LFCUG MS4 Area for each Impaired Segment of Upper North Elkhorn Creek

Stream Segment	Total Area (acres)	MS4 Area (acres)	MS4 Area (%)	WLA (colonies/day)
North Elkhorn Creek 66.0-73.75	15,617.61	6,573.4	42.1%	5.87×10^{11}
David Fork 0.0-1.68	4,945.27	290.18	5.9%	1.02×10^{10}
UT to North Elkhorn Creek 0.0-2.9	3,700.56	3,463.47	93.6%	2.44×10^{11}

7.4 Load Allocation

The LA is the portion of the TMDL where non KPDES-permitted sources (e.g., nonpoint sources, or those not permitted by KPDES) receive their allocation within the TMDL. Within upper North Elkhorn Creek, these sources can include properly functioning OSTDS (i.e. septic systems), wildlife, household pets and facilities with properly functioning BMPs (e.g. agricultural farms or landfarms for municipal SWS sludge). LAs were calculated using the following equation:

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

The available sampling data were insufficient to apportion the existing loading among the various LA sources; therefore, it is attributed to all LA sources. LAs for each impaired segment are presented in Table 7.4. As discussed in Section 6.3, implementation of these bacteria TMDLs is expected to begin with the elimination of illegal sources such as failing OSTDS and straight-pipes if present in the watershed. In addition, facilities not in compliance with KNDOP regulations or BMP requirements under the AWQA are also illegal and are expected to come into compliance.

Table 7.4 Load Allocations for each Impaired Segment

Impaired Segment	Load Allocation (colonies/day)	Critical Flow Duration Zone
North Elkhorn Creek 66.0-73.75	3.05×10^{11}	High
David Fork 0.0-1.68	1.88×10^{10}	Mid-Range
UT to North Elkhorn Creek 0.0-2.9	5.46×10^{10}	High

7.5 Seasonality

Seasonality is defined as yearly factors such as temporal variations on source behavior and stream loading than can affect the relationship between pollutant inputs and the ability of the stream to meet its designated uses. This TMDL addresses seasonality by only using samples collected within the PCR season (May - October).

7.6 Critical Condition

In order to better understand the relationship between pollutant inputs and the ability of a stream to meet its designated uses, a critical condition is analyzed. The critical condition is established by evaluating the impact of temporal variations on source behavior and stream loading. The critical condition for nonpoint source bacteria loading typically occurs after a runoff event, preceded by an extended dry period - bacteria accumulate on the land surface (during the dry period) and subsequently runoff to streams during wet weather events. The critical condition for point source loading typically occurs during periods of low stream flow when dilution (of effluent) is minimized. The upper North Elkhorn Creek watershed includes both types of source conditions.

Because the LDC method was selected for calculating the bacteria TMDLs, the critical period for each bacteria-impaired stream segment (defined as a flow condition) was determined based on the highest exceedance of all samples collected (Table 7.5).

Table 7.5 Bacteria (*E. coli*) TMDL and Critical Condition for each Impaired Segment

Impaired Segment	Total Maximum Daily Load (colonies/day)	Critical Flow Duration Zone	Existing Conditions, colonies/day	Maximum Exceedance, colonies/100ml
Upper North Elkhorn Creek, RM 66.0-73.75	1.04×10^{12}	High	1.05×10^{14}	24,200
David Fork, RM 0.0-1.68	3.28×10^{10}	Mid-Range	3.31×10^{12}	24,200
UT to Upper North Elkhorn Creek, RM 0.0-2.9	3.49×10^{11}	High	2.89×10^{13}	19,860

8.0 Total Maximum Daily Load

Bacteria TMDLs have been developed using a range of techniques from sophisticated watershed-based computer modeling to qualitative assumptions and a simple mass balance. The analytical approach used to develop the bacteria TMDLs for the Upper North Elkhorn Creek watershed was the load duration curve (LDC). The LDC is a data analysis tool that incorporates hydrology and concentration (number of *E. coli* colonies per 100 ml) to develop existing and maximum allowable loadings across the spectrum of various flow conditions. It is also a graphical illustration of the TMDL which can "provide a representation of the current stream or watershed condition and can depict future watershed land-management scenarios" (EPA 2008).

The best available data from various sources was analyzed and spatial analysis was performed within a GIS framework to obtain sub-watershed level statistics, assess KPDES-permitted and non KPDES-permitted sources, and appropriately allocate TMDL loads. Development of these TMDLs follows the procedures outlined in Kentucky's *Quality Assurance Project Plan (QAPP) for Data Analysis for TMDL Development* and maintains the guidelines set in the *Pathogen Indicator TMDL Standard Operating Procedures* for evaluating the TMDL approach (KDOW 2011).

8.1 TMDLs Calculated as a Daily Load

Federal guidelines of the Clean Water Act require a TMDL to be expressed in terms of a daily load. The *Kentucky Pathogen Indicator TMDL SOP* (KDOW 2011) states, "If there is an appropriate USGS flow gage with which to generate a flow record for the sampling station(s) used in the TMDL, this will be used in conjunction with the [LDC method]… to set the TMDL Target and allocate loads." Because an appropriate USGS gage was available, the LDC approach was used to quantify the existing conditions and determine the critical conditions and allowable loading for the development of this TMDL. The TMDL is represented by a continuous curve on the LDC graph while observed loads (i.e. stream sample data) are point data - points that plot above the curve are exceeding the TMDL and those below are within the TMDL limits.

8.2 Flow Duration Curve

Before a LDC can be developed a flow duration curve (FDC) must be constructed. A FDC is the graphical display of the cumulative frequency distribution of daily flow data in a given time period. This curve relates the measured discharge at a given site and time to the percentage of time the measured flow is equaled or exceeded. The highest discharge events plot on the left side of the curve (since the highest flows are rarely exceeded), while the lowest flows plot on the right side (since they are often exceeded). To construct an accurate FDC a long period of flow data is required. The USGS, in cooperation with the LFUCG, has operated three gages within the upper North Elkhorn Creek watershed since the fall of 1997 (Table 8.1; Figure 8.1). Since the TMDL target and stream sampling was based on the PCR designated use, only flow data collected between May and October were used in the development of the FDC. In order to relate the flows at the USGS gage to the sampling points in the watersheds the area weighting method was used (Equation 8.1). Flows were multiplied by a ratio of the drainage area at the sampling

point to the drainage area at the gage resulting in the area-weighted flow (AWF). USGS Gage 03287590 was used for half of the sites - this gage correlated well to discharge measured in David Fork at site 03NE (R^2 = 0.7676). USGS Gage 03287600 was used for the other half and correlated well to discharge measured in the UT to Upper North Elkhorn Creek at site 04NE (R^2 = 0.5364) and the downstream site (01NE) of Upper North Elkhorn Creek (R^2 = 0.9256).

AWF = Flow * (Area at Sample Site/Area at USGS Gage) **(Equation 8.1)**

Table 8.1 USGS Gages within the Upper North Elkhorn Creek Watershed

Site ID	Description	Drainage Area	Parameters	Beginning Date
03287600	North Elkhorn Cr at Bryant Rd at Montrose, KY	21.5	Gage Height, Discharge, Precipitation	10/1/1997
03287590	North Elkhorn Cr at Winchester Rd near Lexington, KY	4.05	Gage Height, Discharge, Precipitation	10/1/1997
03287580	North Elkhorn Cr at Man O War Blvd near Cadentown, KY	2.2	Gage Height, Discharge	8/10/1997

8.3 Load Duration Curve

To construct the Load Duration Curve the discharge values from the FDC intervals were multiplied by the WQC for *E. coli* (240 colonies/100ml). The acute criterion for *E. coli* was used since there were insufficient data collected to calculate geometric means to compare to the chronic criterion (130 colonies/100 ml as a geometric mean). This line is the TMDL and represents the allowable loading at each flow duration interval. The existing loads were calculated using the in-stream concentration and flow observed by KDOW at the time of sampling. Observed bacteria sample results were converted into loads and plotted against the curve. Samples that exceed the WQC will plot above the curve.

There are many strengths of the LDC method - it can accurately and easily relay information on allowable and existing loads. The curve can be divided into flow zones (High, Moist, Mid-Range, Dry and Low) and be used to graphically determine the critical period based on flow conditions. The critical period can be defined as the flow zone where the most violations of the WQC occur or if violations are distributed equally among the zones, the highest deviation from the curve can be considered the critical period. The LDC also allows for inference of the sources of the pollutant(s). For example, loads that exceed the allowable value in the moist LDC zone would most likely be the result of overland runoff (non KPDES-permitted (nonpoint) sources) – watershed management decisions might include the implementation of BMPs (Best Management Practices; i.e. riparian buffers, etc.) to focus on remediating the overland flow. Likewise, loads that exceed the allowable value in the dry LDC zone could be attributed to KPDES-permitted (point) source discharges, illegal straight-pipes, or farm animals accessing the stream.

TMDLs were calculated for each flow duration zone within the LDC of each bacteria-impaired segment. The LDCs that follow in Section 8.4 show a graphical display of the data relative to the TMDL. The flow values represented at each flow duration zone for each sampling site can be found in Appendix C. Not every zone had a sample (or samples) within it, and not all of the samples showed exceedances of the WQC. Calculation of the TMDL, target loads, and percent

reductions (where applicable) followed the methodology outlined in KDOW's *Pathogen Indicator TMDL Standard Operating Procedures* (KDOW 2011).

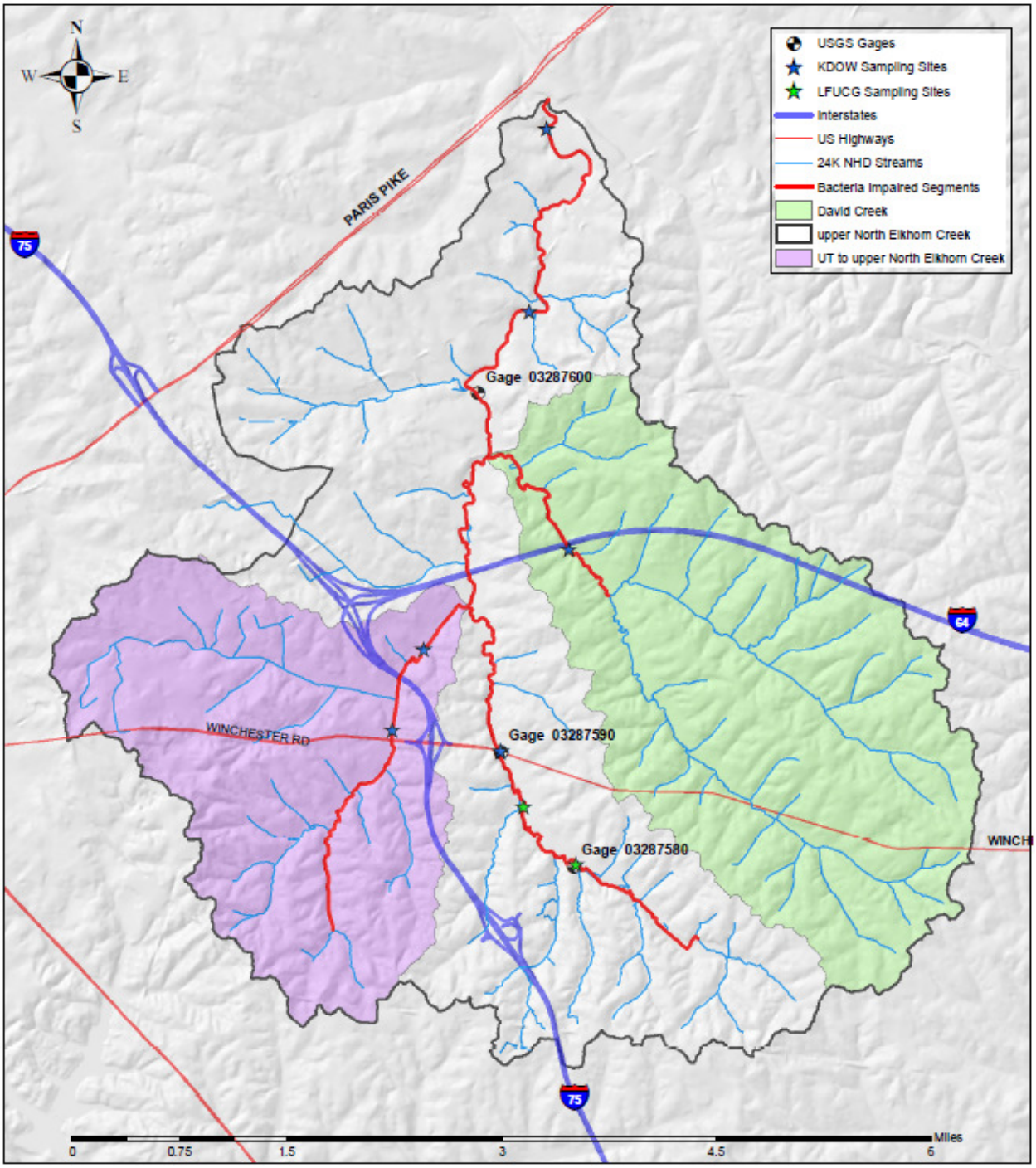

Figure 8.1 Locations of USGS Gaging Stations and KDOW and LFUCG Sample Sites

8.4 Individual Stream Segment Analysis

Data collection and analysis from various sources (including Federal, State and local government and public entities) was carried out for each individually listed stream segment and its associated drainage area. Spatial analysis was also performed within a GIS framework. Most of the data collected for the development of this document can be accessed and downloaded from the Kentucky Geography Network (http://kygeonet.ky.gov).

A brief discussion of each impaired segment is presented below, beginning with the main stem of upper North Elkhorn Creek followed by its tributaries.

8.4.1 TMDL Summary for Upper North Elkhorn Creek

Upper North Elkhorn Creek was originally listed on the 2002 303(d) list from river mile 66.0 to 73.75 as impaired for bacteria as a result of bacteriological monitoring by the LFUCG (see Section 5). The KDOW monitored the watershed for bacteria during the 2005-2006 PCR seasons (Figure 8.2). Exceedance of the WQC was observed in 72% of the samples collected (36 of 50) among the three sites located within the impaired segment – the maximum concentration of all samples was 24,200 colonies per 100 ml (Table 8.2). Bacteria concentrations appear to increase with increased amounts of precipitation which suggests the loading may be caused by non KPDES-permitted sources such as failing OSTDS and farm animals accessing the streams. However the LFUCG MS4 area encompasses just over one-third of the watershed and has a history of infrastructure issues that escalate during wet weather events potentially contributing bacteria loading to the stream.

Table 8.2 E. coli Data Collected for upper North Elkhorn Creek – Sites 1, 2 and 5

Sampling Site	Collection Date	E. coli (colonies/100 ml)	Flow (cfs)
TMDL01NE	5/3/2005	147	26.48
North Elkhorn Cr.	5/10/2005	29	9
off Paris Pike @	5/17/2005	**579**	10.12
Gainsway Farm	5/20/2005	**2400**	118.25
	6/15/2005	**649**	7
	7/14/2005	**1414**	18.75
LAT 38.1036	7/20/2005	**17329**	37.51
LONG -84.4026	7/26/2005	86	2.11
RM 66.2	8/2/2005	145	0.55
	8/25/2005	63	0.71
	8/31/2005	**3650**	236.9
	10/5/2005	190	0.7
	6/8/2006	129	1.675
	7/5/2006	**19860**	234.64
	8/9/2006	100	0.418
	8/21/2006	**4480**	16.57
	8/29/2006	**3448**	9.403
Sampling Site	**Collection Date**	**E. coli (colonies/100 ml)**	**Flow (cfs)**
TMDL02NE	5/3/2005	228	19.32
North Elkhorn Cr.	5/10/2005	**2400**	7.06

Sampling Site	Collection Date	E. coli (colonies/100 ml)	Flow (cfs)
at farm below SR 57 bridge	5/17/2005	**866**	9.86
	5/20/2005	**2400**	75
	6/15/2005	**2400**	6.46
	7/14/2005	**2400**	22.52
LAT 38.0764	7/20/2005	**9208**	33.46
LONG -84.4137	7/26/2005	170	1.84
RM 68.3	8/2/2005	85	0.44
	8/25/2005	**496**	0.35
	8/31/2005	**12030**	220.8
	10/5/2005	160	0.45
	6/8/2006	**248**	1.714
	7/5/2006	**24200**	240.42
	8/9/2006	**500**	0.17
	8/21/2006	**2790**	12.162
	8/29/2006	**3873**	7.5
Sampling Site	**Collection Date**	**E. coli (colonies/100 ml)**	**Flow (cfs)**
TMDL05NE North Elkhorn at US 60	5/3/2005	**461**	3.96
	5/10/2005	**1300**	1.32
	5/17/2005	**770**	2.19
	5/20/2005	**2400**	9.43
	6/15/2005	**2400**	1.62
	7/14/2005	**2400**	3.81
LAT 38.0397	7/20/2005	**2613**	8.59
LONG -84.4109	7/26/2005	216	0.57
RM 72.5	8/2/2005	52	0.23
	8/25/2005	**460**	0.14
	8/31/2005	**4880**	20.8
	10/5/2005	**600**	0.3
	7/5/2006	**24200**	29.86
	8/9/2006	**400**	0.075
	8/21/2006	**1210**	2.227
	8/29/2006	**512**	1.148

Exceedance of WQC

The upper North Elkhorn Creek watershed lies within the city limits of Lexington (approximately seven miles east of the downtown area) and the Fayette County boundary. The stream flows north-northwest to the confluence with South Elkhorn and Elkhorn Creek (aka the "Forks of Elkhorn"), east of Frankfort. Elkhorn Creek flows into the Kentucky River with eventual discharge to the Ohio River near Carrollton. The total drainage area of the watershed includes two sub-watersheds (David Fork and a UT) and is approximately 24.4 square miles (15,617 acres).

The USGS DEM indicates that the watershed descends only 182 feet in elevation from the headwaters to the downstream end of the impaired segment. The only KPDES-permitted source is the LFUCG MS4 area which accounts for 42% of the total area. As of the last Census (2010), there were an estimated 122,075 households and 295,803 people living in Fayette County.

Estimates of the population in the upper North Elkhorn Creek watershed are provided in Table 8.3. Sewer lines cover approximately one-third of the watershed; all other areas rely on OSTDS or do not treat their sewage. The predominant land cover is agriculture (59.8%) followed by developed (31.5%) and forested (8.3%) lands (Table 8.4).

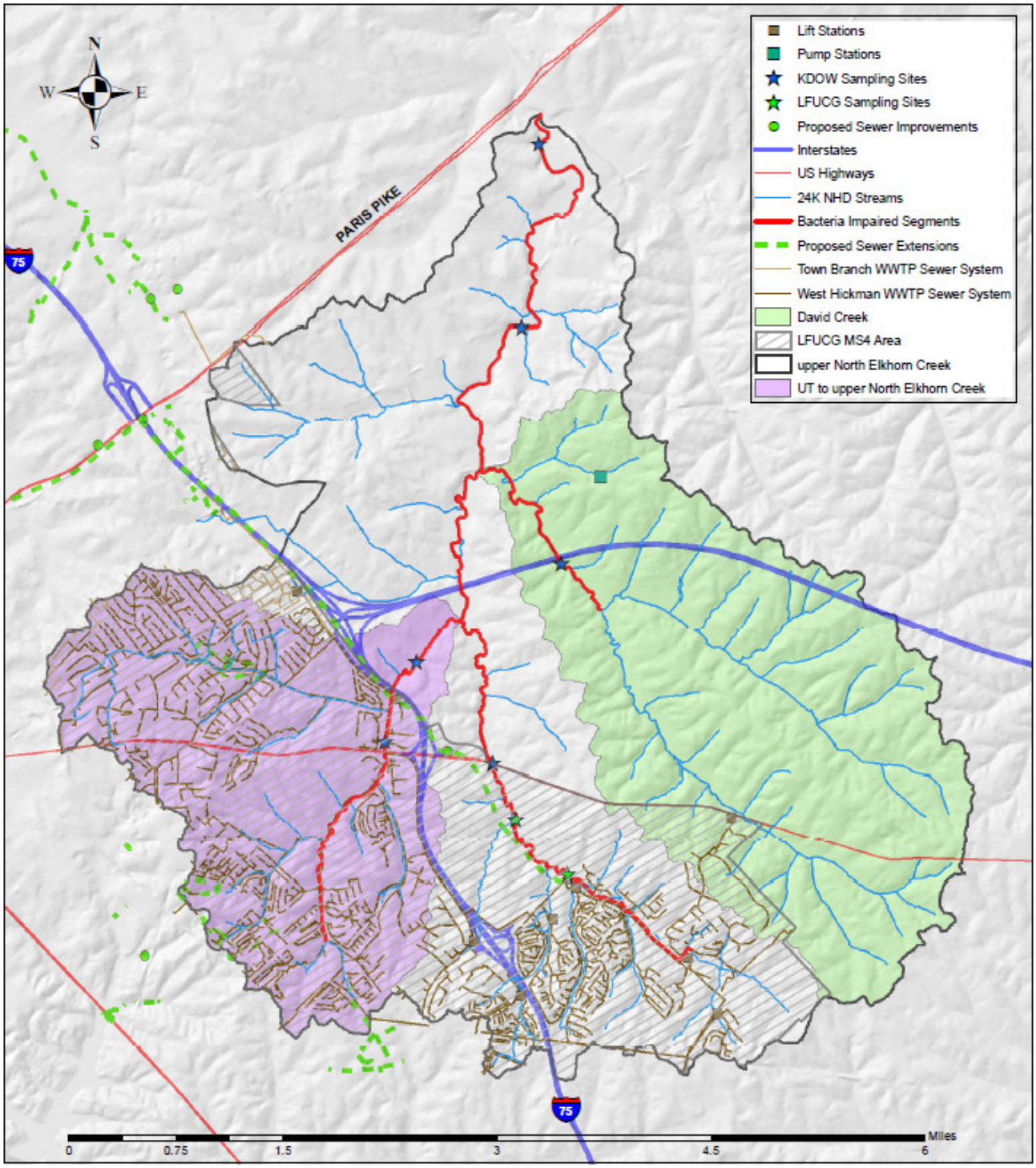

Figure 8.2 KPDES-Permitted Sources and Wastewater Infrastructure within the Upper North Elkhorn Creek Watershed

Table 8.3 Estimated Populations in the Upper North Elkhorn Creek Watershed According to the 2010 US Census

County/ Stream	Watershed Area within County (sq mi)	Persons per Square Mile	Estimated Population in Watershed
Fayette County/ Upper North Elkhorn Creek	24.4	1,042.8	25,444.32

Table 8.4 Land Cover in the Upper North Elkhorn Creek Watershed (NLCD 2006)

Land Cover Class	% of Total Area	Acres	Square Miles
Forest	8.3%	1300.95	2.03
Agriculture (total)	59.8%	9345.52	14.60
Pasture	58.4%	9119.30	14.25
Crop	1.4%	226.22	0.35
Developed	31.5%	4924.96	7.70
Natural Grassland	0.1%	8.88	0.01
Wetland	0.0%	1.11	0.00
Barren	0.0%	1.11	0.00

Three sampling sites were located within the Upper North Elkhorn Creek RM 66.0 to 73.75 impaired segment. The critical condition is the High Flows Zone, as determined by the maximum exceedance (24,200 colonies per 100 ml) recorded at sampling site 5 on 7/5/2006 at a flow of 29.86 cfs, which is the critical flow for this site. However, an exceedance was also found across all other flow zones (Figures 8.3 – 8.5). Therefore, possible sources include failing OSTDS, farm animals accessing the stream, runoff from farm animals and wildlife deposits, and sewer infrastructure issues that escalate during wet weather events.

EPA requires that TMDL allocations be extrapolated from the sampling site to the bottom of the impaired segment represented by the sampling site to account for any additional sources of the pollutant of concern between the site and the bottom of the segment. Upper North Elkhorn Creek has an upstream watershed area at RM 66.0 of 24.4 square miles, and the Upper North Elkhorn Creek sampling site 5 has an upstream watershed area of 4.1 square miles. The Existing Load and TMDL allocations (as reported in Appendix C) were multiplied by the ratio of these areas (24.4/4.1 = 5.951) to generate the final TMDL allocations for the impaired segment.

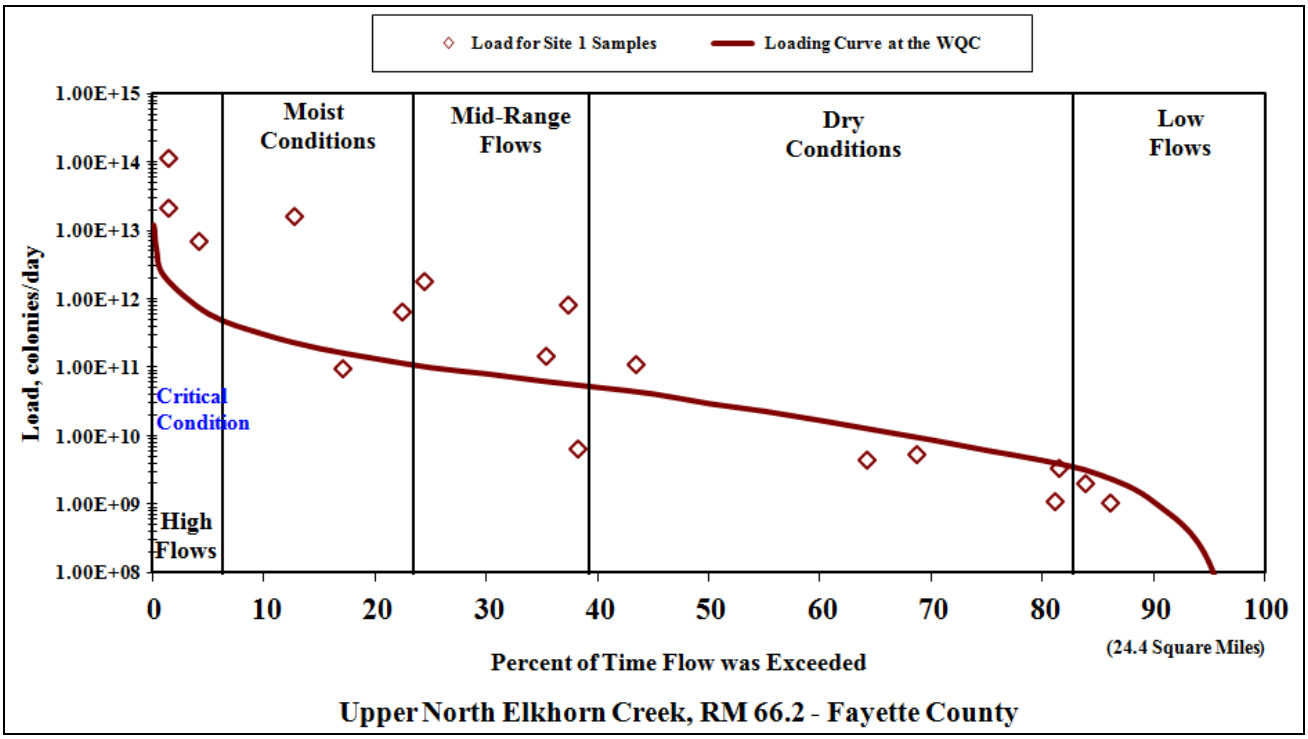

Figure 8.3 LDC for Upper North Elkhorn Creek RM 66.0 to 73.75, Site 1

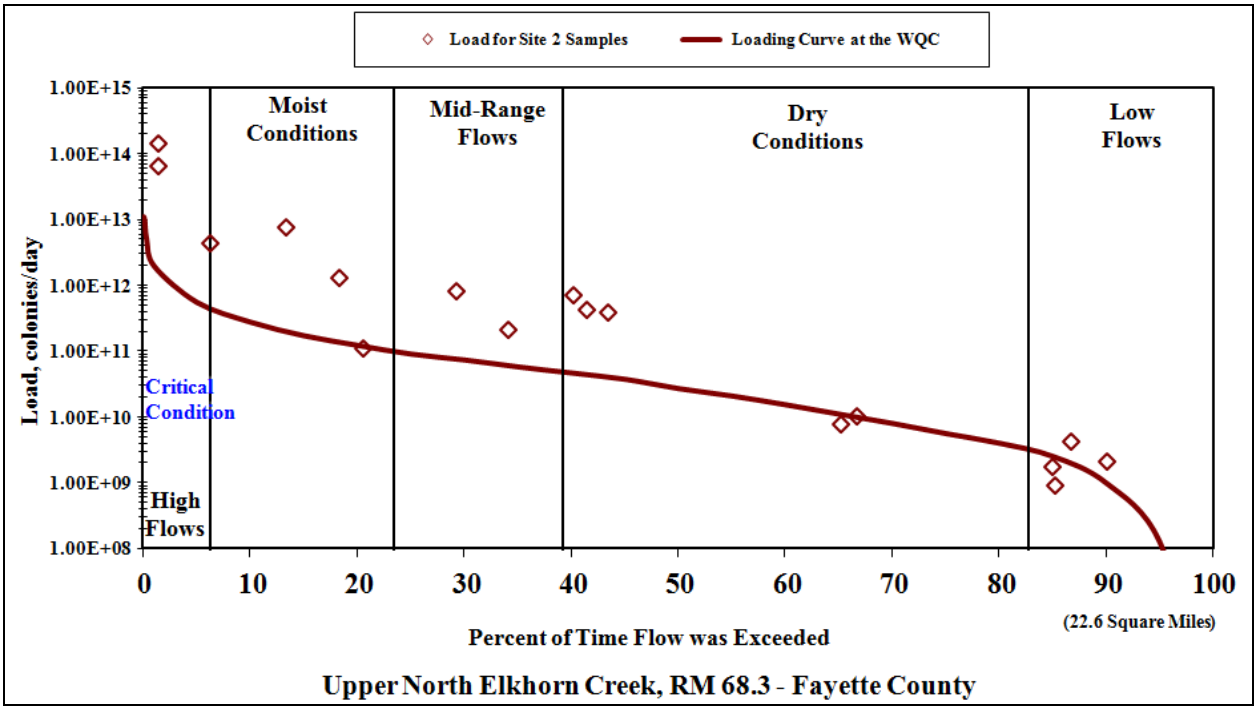

Figure 8.4 LDC for Upper North Elkhorn Creek RM 66.0 to 73.75, Site 2

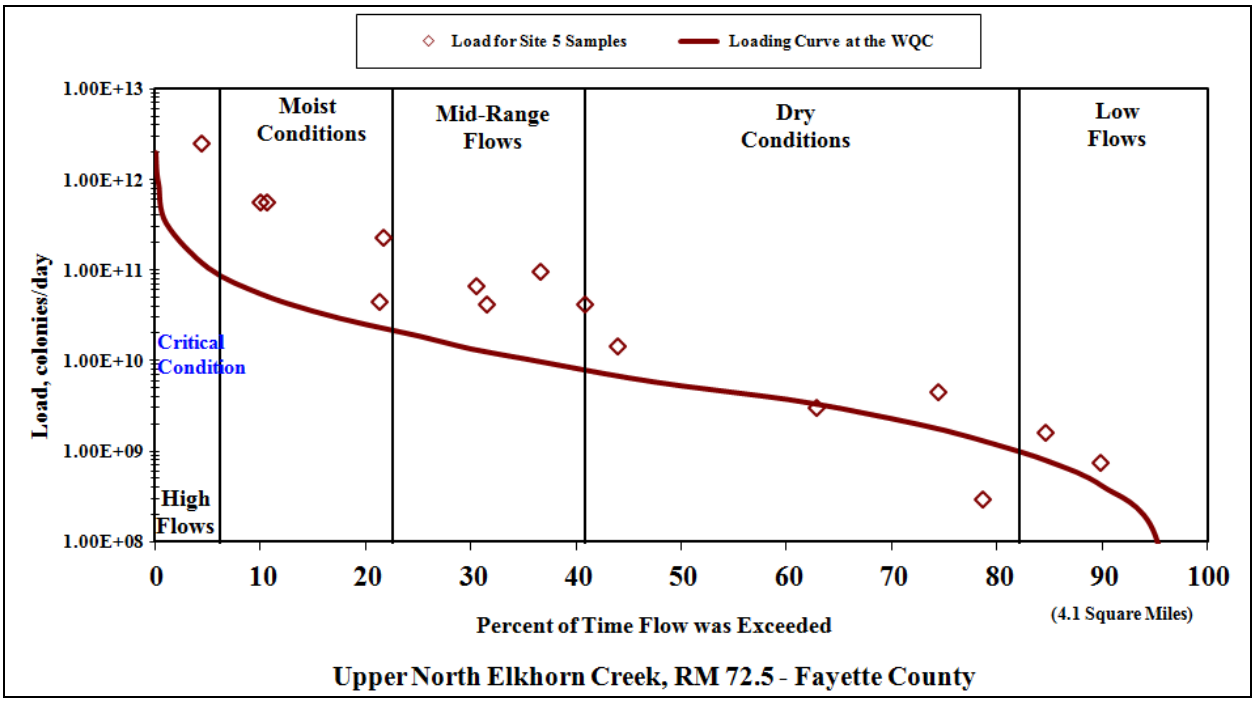

Figure 8.5 LDC for Upper North Elkhorn Creek RM 66.0 to 73.75, Site 5

Based on the LDC analysis and WQC, the critical condition for the 7.75 mile impaired segment of upper North Elkhorn Creek is the high flow duration zone which carries a bacteria TMDL of 1.04×10^{12} colonies per day. According to the data presented, the watershed would have required a 99% reduction in bacteria loading during the 2005-2006 PCR season in order to meet the WQC (Table 8.5). In addition, any future KPDES wastewater permitted sources must meet permit limits based on the WQC in 401 KAR 10:031 and must not cause or contribute to an existing impairment.

Table 8.5 Summary of TMDL Components for Upper North Elkhorn Creek

Existing Load[(1)] (col/day)	TMDL[(1)] (col/day)	Margin of Safety[(2)] (col/day)	SWS-WLA[(3)] (col/day)	MS4-WLA, (col/day)	Future Growth-WLA (col/day)	LA (col/day)
1.05×10^{14}	1.04×10^{12}	1.04×10^{11}	0	5.87×10^{11}	4.70×10^{10}	3.05×10^{11}

Notes:
(1) Existing Load and TMDL calculated using the Critical Flow as defined by the maximum exceedance—see the LDC.
(2) MOS is an explicit 10% of the TMDL.
(3) Any future KPDES-permitted point source must meet permit limits based on the Water Quality Standards in 401 KAR 10:031, and must not cause or contribute to an existing impairment.

8.4.2 TMDL Summary for David Fork

David Fork appeared on the 2010 303(d) List of Impaired Waters from river mile 0.0 to 1.68 as impaired for bacteria as a result of monitoring conducted by the KDOW (TMDL Section) during the 2005-2006 PCR seasons (see Section 5). Exceedance of the WQC was observed in 94% of samples collected (16 of 17) in the watershed – the maximum concentration of all samples was 24,200 colonies per 100 ml. Bacteria concentrations appear to increase with little to no precipitation which suggests the loading may be caused by non KPDES-permitted sources such as failing OSTDS and farm animals accessing the streams (Table 8.6). Though the LFUCG MS4 area covers just 6% of the watershed, their history of infrastructure issues that escalate during wet weather events could potentially contribute bacteria loading to the stream (Figure 8.6).

Table 8.6 E. coli Data Collected for David Fork – Site 3

Sampling Site	Collection Date	E. coli (colonies/100 ml)	Flow (cfs)
TMDL03NE	5/3/2005	**613**	5.08
David Fork off	5/10/2005	**1733**	1.96
Royster Rd.	5/17/2005	**1553**	1.89
	5/20/2005	**2400**	14.93
	6/15/2005	**2400**	0.92
	7/14/2005	**2400**	1.39
LAT 38.0663	7/20/2005	**12033**	7.04
LONG -84.4053	7/26/2005	**428**	0.22
RM 1.3	8/2/2005	**5475**	0.004
	8/25/2005	**10460**	0.003
	8/31/2005	**2990**	17.8
	10/5/2005	20	0.01
	6/8/2006	**1733**	0.318
	7/5/2006	**24200**	4.94
	8/9/2006	**4100**	0.054
	8/21/2006	**2750**	1.342
	8/29/2006	**2755**	0.476

Exceedance of WQC

The headwaters of the David Fork watershed lie within the city limits of Lexington (approximately eight miles east of the downtown area) and the Fayette County boundary. The stream flows northwest to the confluence with upper North Elkhorn Creek with eventual discharge to the Kentucky River near Shallowfield. The total drainage area of the watershed is approximately 7.7 square miles (4,945 acres).

The USGS DEM indicates the difference in elevation from the headwaters to the downstream end of the impaired segment to only be 152 feet. The only KPDES-permitted source is the LFUCG MS4 area; residents living outside of the MS4 area rely on OSTDS or do not treat their sewage. The predominant land cover is agriculture (83.3%) followed by developed (10.2%) and forested (6.3%) lands (Table 8.7).

Table 8.7 Land Cover in the David Fork Watershed (NLCD 2006)

Land Cover Class	% of Total Area	Acres	Square Miles
Forest	6.3%	310.84	0.49
Agriculture (total)	83.3%	4121.83	6.44
Pasture	81.5%	4028.72	6.29
Crop	1.9%	93.12	0.15
Developed	10.2%	506.17	0.79
Natural Grassland	0.0%	0.00	0.00
Wetland	0.0%	1.11	0.00
Barren	0.0%	0.00	0.00

The critical condition for the David Fork RM 0.0 to 1.68 impaired segment is the Mid-Range Flows Zone, as determined by the maximum exceedance (24,200 colonies per 100 ml) recorded at sampling site 3 on 7/5/2006 at a flow of 4.94 cfs, which is the critical flow for this site. No samples were collected during high flows but an exceedance was found across all other flow zones (Figure 8.7). Therefore, possible sources include failing OSTDS, farm animals accessing the stream, runoff from farm animals and wildlife deposits, and infrastructure issues that escalate during wet weather events.

EPA requires that TMDL allocations be extrapolated from the sampling site to the bottom of the impaired segment represented by the sampling site to account for any additional sources of the pollutant of concern between the site and the bottom of the segment. David Fork has an upstream watershed area at RM 0.0 of 7.7 square miles and the David Fork sampling site 3 has an upstream watershed area of 6.8 square miles. The Existing Load and TMDL allocations (as reported in Appendix C) were multiplied by the ratio of these areas (7.7/6.8 = 1.132) to generate the final TMDL allocations for the impaired segment.

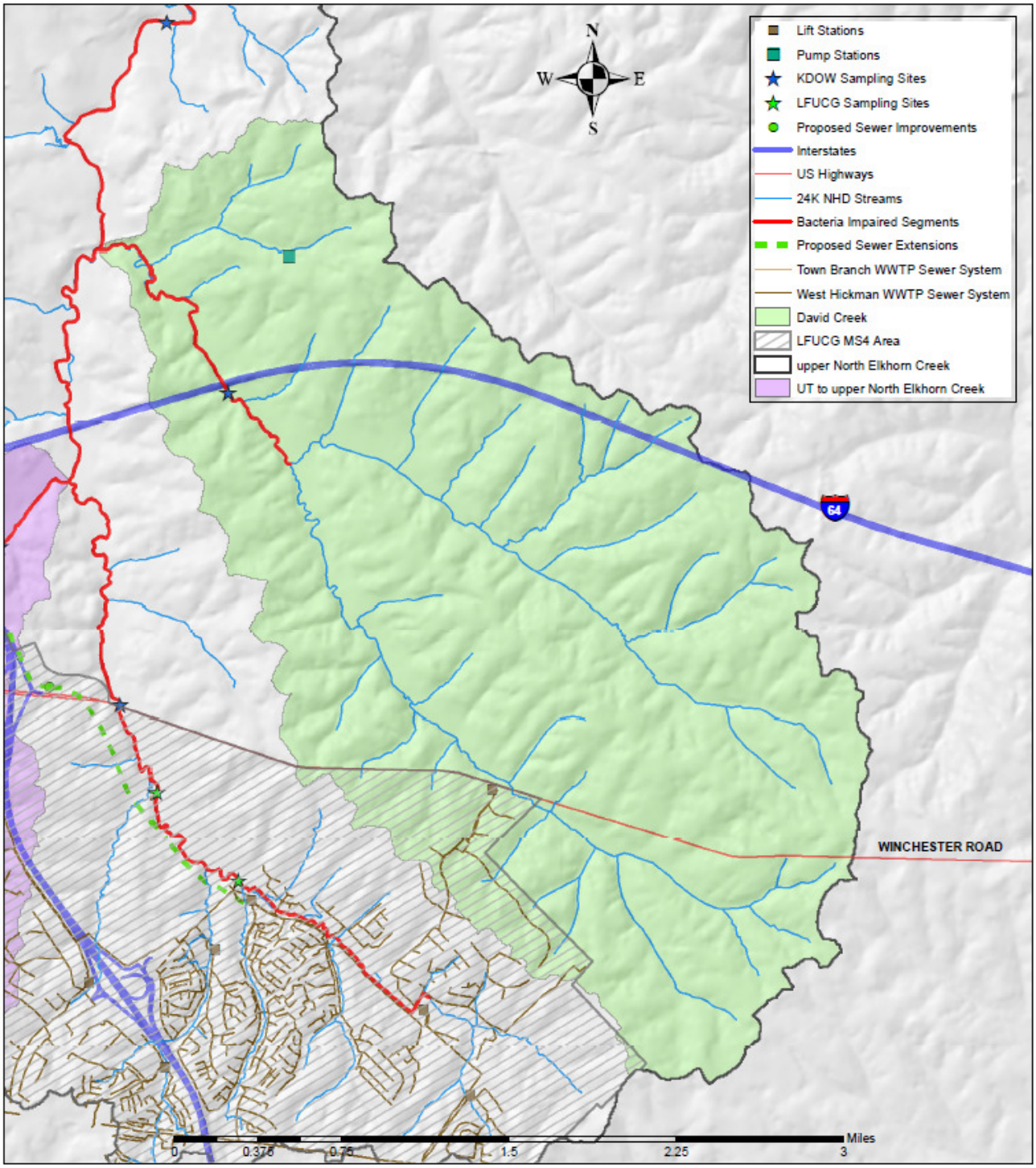

Figure 8.6 KPDES-Permitted Sources and Wastewater Infrastructure within the David Fork Watershed

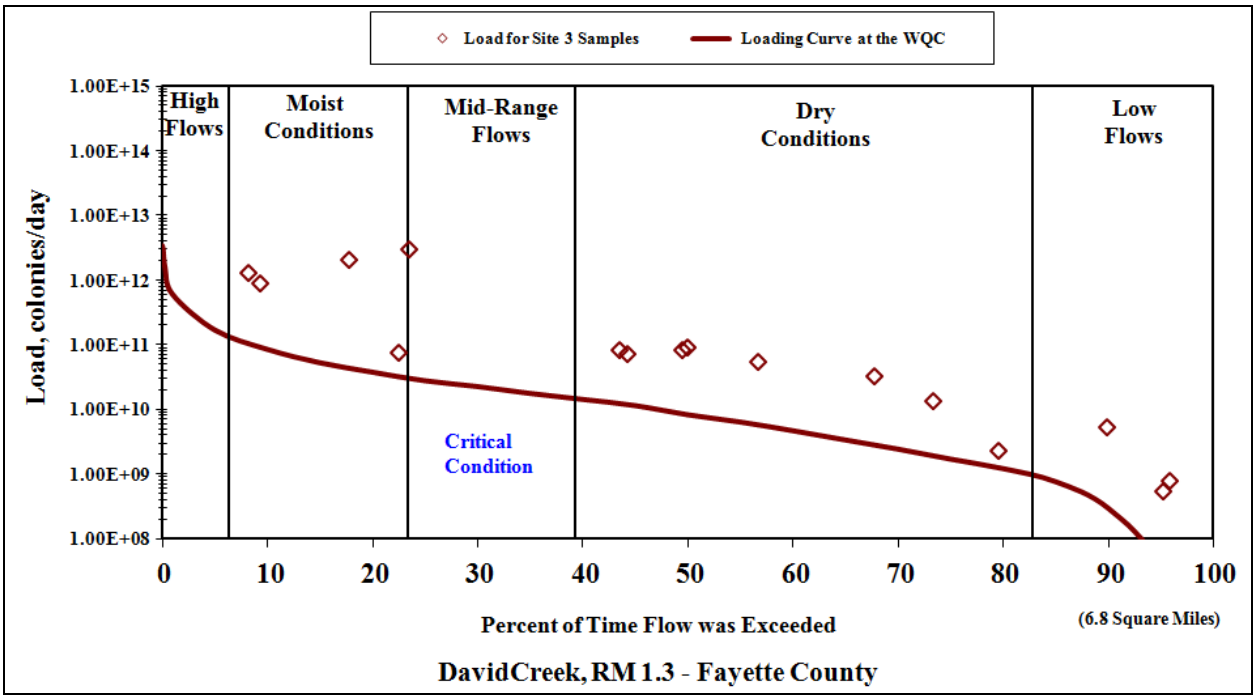

Figure 8.7 LDC for David Fork RM 0.0 to 1.68

Based on the LDC analysis and WQC, the critical condition for the 1.68 mile impaired segment of David Fork is the mid-range flow zone which carries a bacteria TMDL of 3.28×10^{10} colonies per day. According to the data presented, the watershed would have required a 99% reduction in bacteria loading during the 2005-2006 PCR seasons in order to meet the WQC (Table 8.8). In addition, any future KPDES wastewater permitted sources must meet permit limits based on the WQC in 401 KAR 10:031 and must not cause or contribute to an existing impairment.

Table 8.8 Summary of TMDL Components for David Fork

Existing Load[(1)] (col/day)	TMDL[(1)] (col/day)	Margin of Safety[(2)] (col/day)	SWS-WLA[(3)] (col/day)	MS4-WLA, (col/day)	Future Growth-WLA (col/day)	LA (col/day)
3.31×10^{12}	3.28×10^{10}	3.28×10^{9}	0	1.02×10^{10}	5.91×10^{8}	1.88×10^{10}

Notes:
(1) Existing Load and TMDL calculated using the Critical Flow as defined by the maximum exceedance—see the LDC.
(2) MOS is an explicit 10% of the TMDL.
(3) Any future KPDES-permitted point source must meet permit limits based on the Water Quality Standards in 401 KAR 10:031, and must not cause or contribute to an existing impairment.

8.4.3 TMDL Summary for UT to Upper North Elkhorn Creek

The UT to upper North Elkhorn Creek appeared on the 2010 303(d) List of Impaired Waters from river mile 0.0 to 2.9 as impaired for bacteria as a result of monitoring conducted by the KDOW (TMDL Section) during the 2005-2006 PCR season (see Section 5). Exceedance of the WQC was observed in 88% of samples (30 of 34) collected among two sites in the watershed – the maximum concentration of all samples was 19,860 colonies per 100 ml. Bacteria concentrations appear to increase with increased amounts of precipitation which suggests the loading may be caused by non KPDES-permitted sources (Table 8.9). However, the LFUCG MS4 area comprises a vast amount of the watershed (94%) and has a history of infrastructure issues that escalate during wet weather events potentially contributing bacteria loading to the stream (Figure 8.8).

Table 8.9 E. coli Data Collected for UT to North Elkhorn Creek – Sites 4 and 6

Sampling Site	Collection Date	E. coli (colonies/100 ml)	Flow (cfs)
TMDL04NE	5/3/2005	238	2.84
UT Elkhorn Cr.	5/10/2005	**816**	1.46
at Hume Rd.	5/17/2005	**488**	2.05
	5/20/2005	**2400**	18.02
	6/15/2005	**2400**	1.03
	7/14/2005	**1986**	7.46
LAT 38.0499	7/20/2005	**1723**	6.8
LONG -84.4206	7/26/2005	**272**	0.57
RM 0.5	8/2/2005	131	0.34
	8/25/2005	200	0.25
	8/31/2005	**6490**	32.24
	10/5/2005	**440**	0.22
	6/8/2006	**613**	0.728
	7/5/2006	**19860**	58.09
	8/9/2006	**800**	0.224
	8/21/2006	**1560**	3.876
	8/29/2006	**2613**	2.568
Sampling Site	**Collection Date**	**E. coli (colonies/100 ml)**	**Flow (cfs)**
TMDL06NE	5/3/2005	51	2.44
UT North Elkhorn at	5/10/2005	**411**	0.66
US 60; behind Shell	5/17/2005	**488**	11.3
	5/20/2005	**2400**	9.78
	6/15/2005	**2400**	0.3
LAT 38.0424	7/14/2005	**1986**	4.08
LONG -84.4248	7/20/2005	**663**	3.68
RM 1.2	7/26/2005	**985**	0.26
	8/2/2005	**9208**	0.47
	8/25/2005	**1040**	0.15
	8/31/2005	**1050**	18.5
	10/5/2005	**340**	0.15
	6/8/2006	**2400**	0.443
	7/5/2006	**9800**	43.81
	8/9/2006	**600**	0.062

Sampling Site	Collection Date	E. coli (colonies/100 ml)	Flow (cfs)
	8/21/2006	**1320**	2.801
	8/29/2006	**960**	1.148

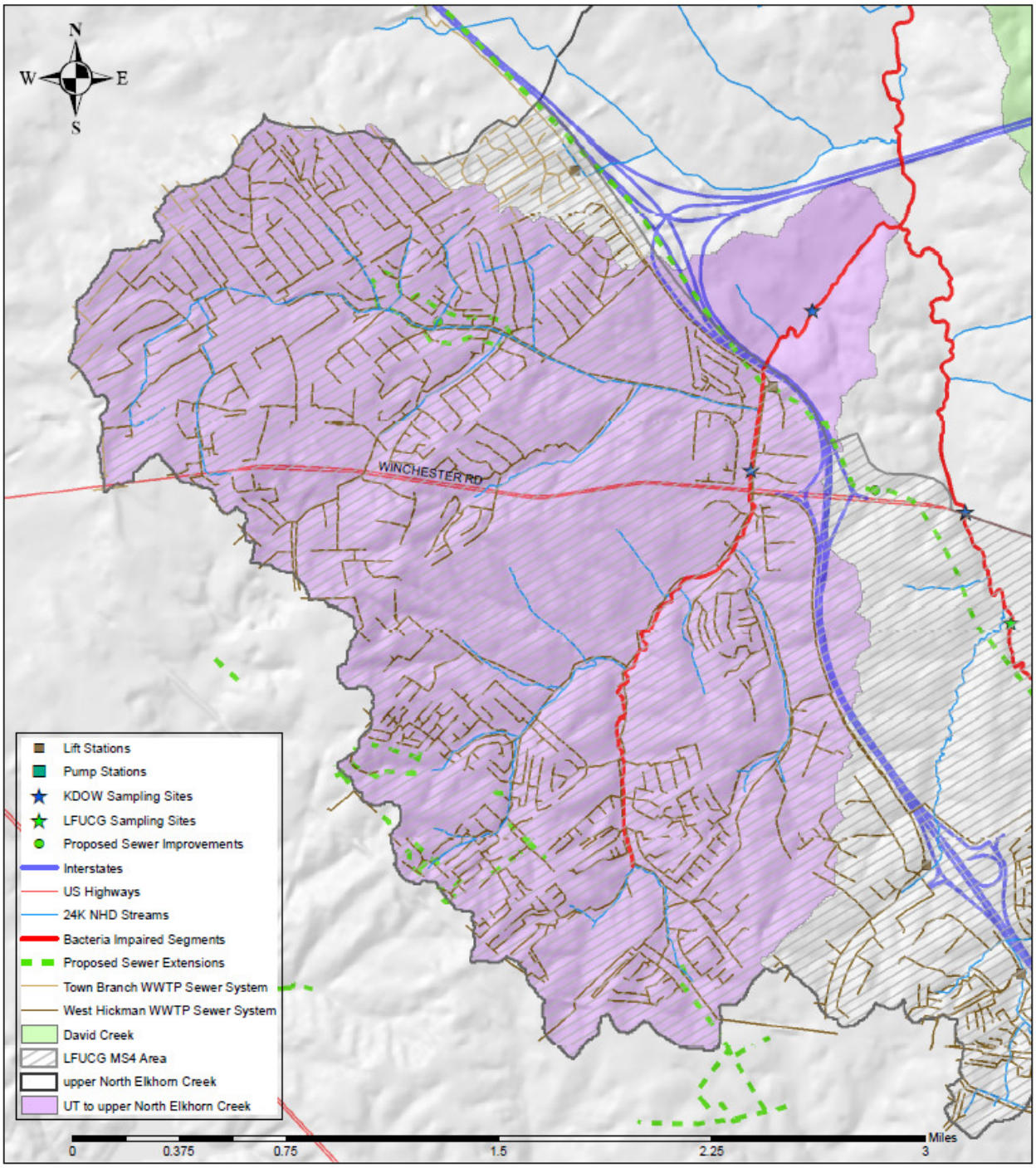

Figure 8.8 KPDES-Permitted Sources and Wastewater Infrastructure within the UT to Upper North Elkhorn Creek Watershed

The headwaters of the UT to upper North Elkhorn Creek watershed lie within the city limits (and MS4 area) of Lexington, just a few miles east of the downtown area. The stream flows north-northeast to the confluence with upper North Elkhorn Creek with eventual discharge to the Kentucky River near Shallowfield. The total drainage area of the watershed is approximately 5.8 square miles (3,700 acres).

The USGS DEM indicates that the watershed drops a mere 150 feet in elevation from the headwaters to the downstream end of the impaired segment. The only KPDES-permitted source is the LFUCG MS4 area which accounts for 94% of the total area; residents living outside of the MS4 area must rely on OSTDS or do not treat their sewage. The predominant land cover is developed land (74.1%) followed by agriculture (19.4%) and forested (6.3%) lands (Table 8.10).

Table 8.10 Land Cover in the UT to Upper North Elkhorn Creek Watershed (NLCD 2006)

Land Cover Class	% of Total Area	Acres	Square Miles
Forest	6.3%	234.31	0.37
Agriculture (total)	19.4%	719.10	1.12
Pasture	19.3%	715.11	1.12
Crop	0.1%	3.99	0.01
Developed	74.1%	2743.83	4.29
Natural Grassland	0.0%	0.00	0.00
Wetland	0.0%	0.00	0.00
Barren	0.0%	0.00	0.00

Two sampling sites were located within the UT to Upper North Elkhorn Creek RM 0.0 to 2.9 impaired segment. The critical condition is the High Flows Zone, as determined by the maximum exceedance (19,860 colonies per 100 ml) recorded at sampling site 4 on 7/5/2006 at a flow of 58.09 cfs, which is the critical flow for this site. However, an exceedance was also found across all other flow zones (Figures 8.9 – 8.10). Therefore, possible sources include sewer infrastructure issues that escalate during wet weather events, runoff from pet and wildlife deposits and failing OSTDS.

EPA requires that TMDL allocations be extrapolated from the sampling site to the bottom of the impaired segment represented by the sampling site to account for any additional sources of the pollutant of concern between the site and the bottom of the segment. UT to Upper North Elkhorn Creek has an upstream watershed area at RM 0.0 of 5.8 square miles, and the UT to Upper North Elkhorn Creek sampling site 4 has an upstream watershed area of 5.7 square miles. The Existing Load and TMDL allocations (as reported in Appendix C) were multiplied by the ratio of these areas (5.8/5.7 = 1.023) to generate the final TMDL allocations for the impaired segment.

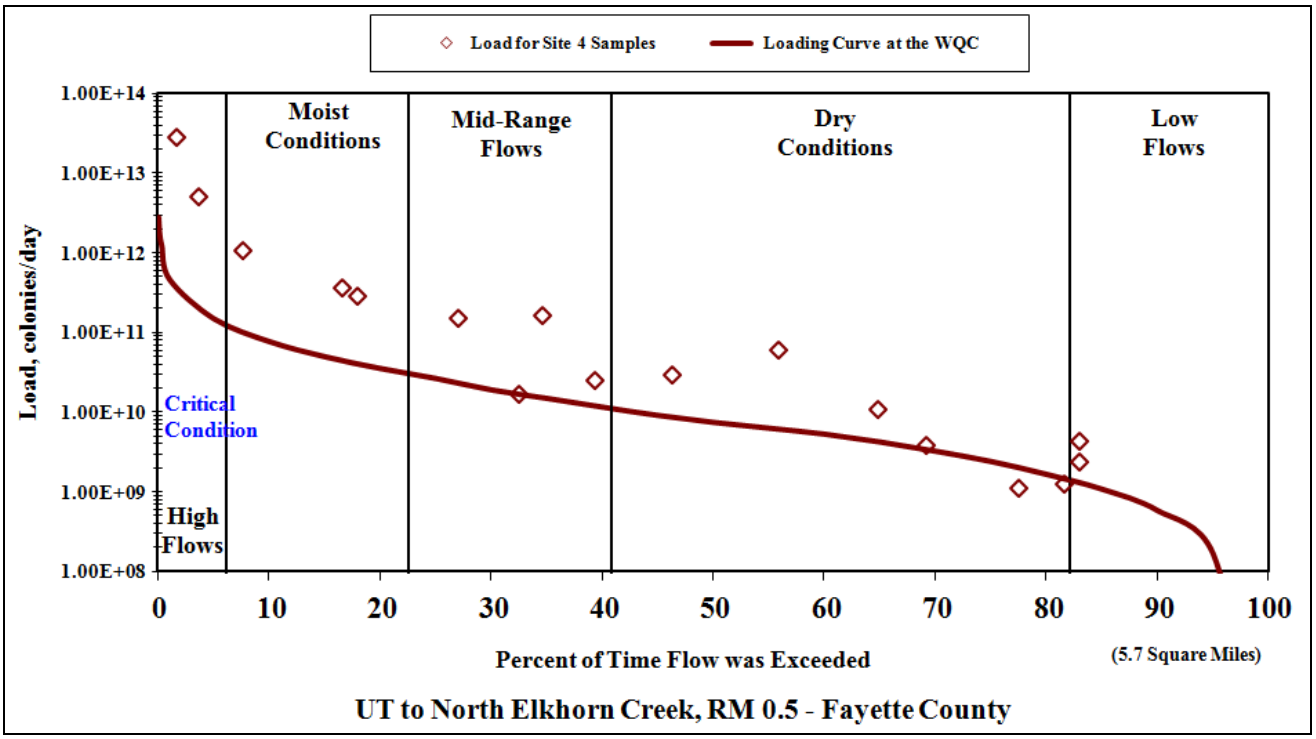

Figure 8.9 LDC for UT to Upper North Elkhorn Creek RM 0.0 to 2.9, Site 4

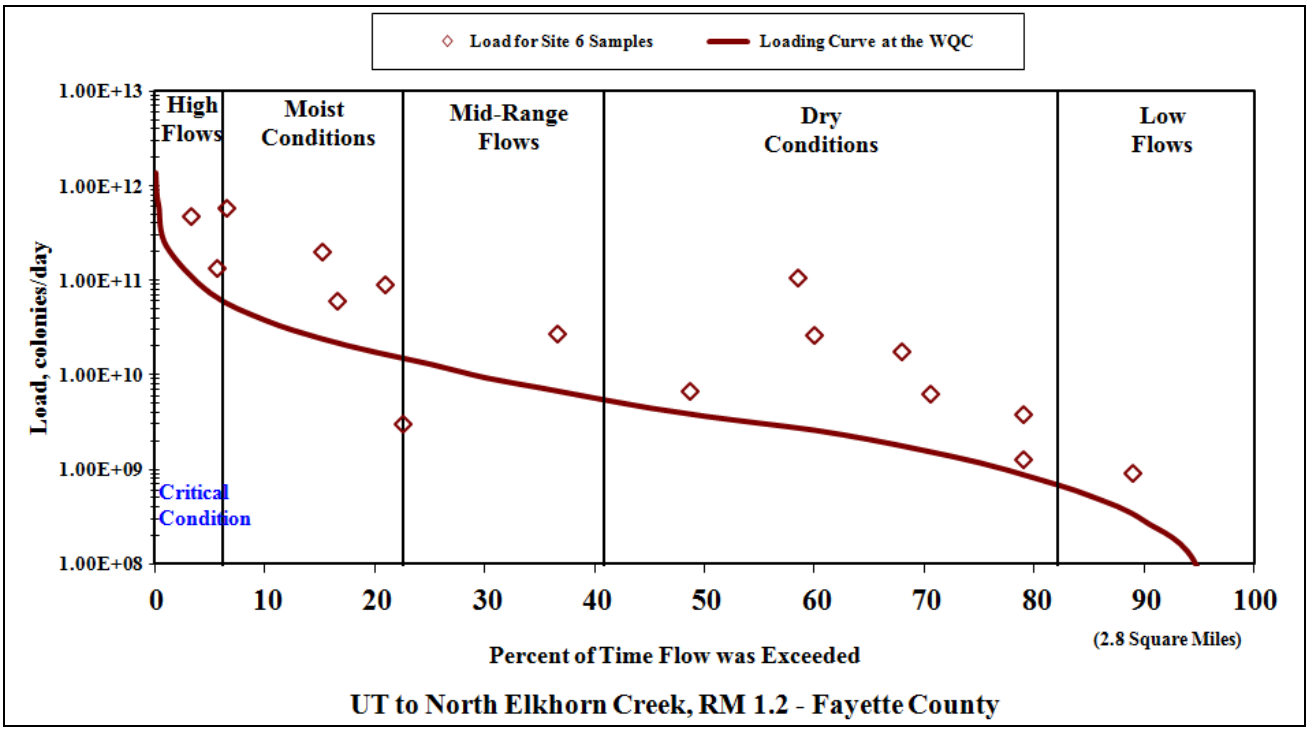

Figure 8.10 LDC for UT to Upper North Elkhorn Creek RM 0.0 to 2.9, Site 6

Based on the LDC analysis and WQC, the critical condition for the 2.9 mile impaired segment of the UT to upper North Elkhorn Creek is the high flow duration zone which carries a bacteria TMDL of 3.49×10^{11} colonies per day. According to the data presented, the watershed would have required a 98.9% reduction in bacteria loading during the 2005-2006 PCR seasons in order to meet the WQC (Table 8.11). In addition, any future KPDES wastewater permitted sources must meet permit limits based on the WQC in 401 KAR 10:031 and must not cause or contribute to an existing impairment.

Table 8.11 Summary of TMDL Components for UT to Upper North Elkhorn Creek

Existing Load[(1)] (col/day)	TMDL[(1)] (col/day)	Margin of Safety[(2)] (col/day)	SWS-WLA[(3)] (col/day)	MS4-WLA, (col/day)	Future Growth-WLA (col/day)	LA (col/day)
2.89×10^{13}	3.49×10^{11}	3.49×10^{10}	0	2.44×10^{10}	1.57×10^{10}	5.46×10^{10}

Notes:
(1) Existing Load and TMDL calculated using the Critical Flow as defined by the maximum exceedance—see the LDC.
(2) MOS is an explicit 10% of the TMDL.
(3) Any future KPDES-permitted point source must meet permit limits based on the Water Quality Standards in 401 KAR 10:031, and must not cause or contribute to an existing impairment.

9.0 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 provide technical support and leadership with 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. At this time, a comprehensive watershed restoration plan for the North Elkhorn Creek watershed has not been developed. This TMDL document provides bacteria allocations and reduction goals that may assist with developing a detailed watershed plan to guide watershed restoration efforts.

A watershed plan for the North Elkhorn Creek watershed should address both point and nonpoint sources of pollution in the watershed and should build on existing efforts as well as evaluate new approaches. Because of the specific landscape and location of the impairments in the North Elkhorn Creek watershed, a watershed plan should incorporate all available restoration and protection mechanisms, including any existing Groundwater Protection Plans, storm water or wastewater KPDES permits. A comprehensive watershed plan should consider both voluntary and regulatory approaches to meet water quality standards.

9.1 Kentucky Watershed Management Framework

A Watershed Management Framework approach to Water Quality Management 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 that involves monitoring, assessment, prioritization, plan development, and plan implementation. As part of the process, a basin coordinator is assigned to each river basin to work with the citizens of the basin to develop a local Watershed Management Team associated with each priority watershed. For more information about the river basins see http://water.ky.gov/watershed/Pages/Basins.aspx.

9.2 Non-Governmental Organizations

There are several Non-Governmental Organizations (NGO) that may be operating in the North Elkhorn Creek watershed that may help to implement the TMDL, particularly with regard to nonpoint source issues. These organizations include Watershed Watch in Kentucky groups and Kentucky Waterways Alliance.

9.2.1 Watershed Watch in Kentucky

Watershed Watch is a citizen's water monitoring effort that relies exclusively 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 measurements are taken annually by Watershed Watch groups. Volunteers collect physical measurements, such as temperature, pH, dissolved oxygen, and conductivity. Stream monitoring may also include macroinvertebrate and habitat assessments. Data from annual monitoring is routinely used to help identify problems in the watershed, and assist with prioritizing streams for restoration and protection activities.

For more information about Watershed Watch see:
http://water.ky.gov/wsw/Pages/default.aspx.

9.2.2 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.

For more information about KWA see:
http://www.kwalliance.org.

10.0 Public Participation

This TMDL document will be published for a 30-day public comment period. A public notice will be sent to all newspapers in the Commonwealth of Kentucky and an advertisement will be purchased in the newspaper of highest circulation published in Fayette County (the Herald-Leader in Lexington, KY). Additionally, the public notice will be distributed electronically through the 'Nonpoint Source Pollution Control' mailing list (http://www.water.ky.gov/sw/nps/Mailing+List.htm) of persons interested in water quality issues as well as the 'Press Release' mailing list maintained by the Governor's Office of media outlets across the Commonwealth.

All comments received during the public notice period will be incorporated into the administrative record for these TMDLs. After consideration of each comment received, suitable revisions will be made to the final TMDL document and responses will be prepared and mailed to each individual or agency participating in the public notice process.

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Appendix A – Additional Information

A.1 Dominant Geologic Formation Descriptions

The Bryan Station Fault Zone of the Lexington Fault System bisects the northwest portion of the watershed (Figure A.1 and A.2). The following Sections provide descriptions of the dominant geologic formations present (at the surface) in the Upper North Elkhorn Creek watershed. These descriptions were taken from the Kentucky Geological Survey's Kentucky Geologic Map Information Service (http://kgsmap.uky.edu/website/KGSGeology/viewer.asp) and can also be found in *The Geology of Kentucky* (USGS 1986).

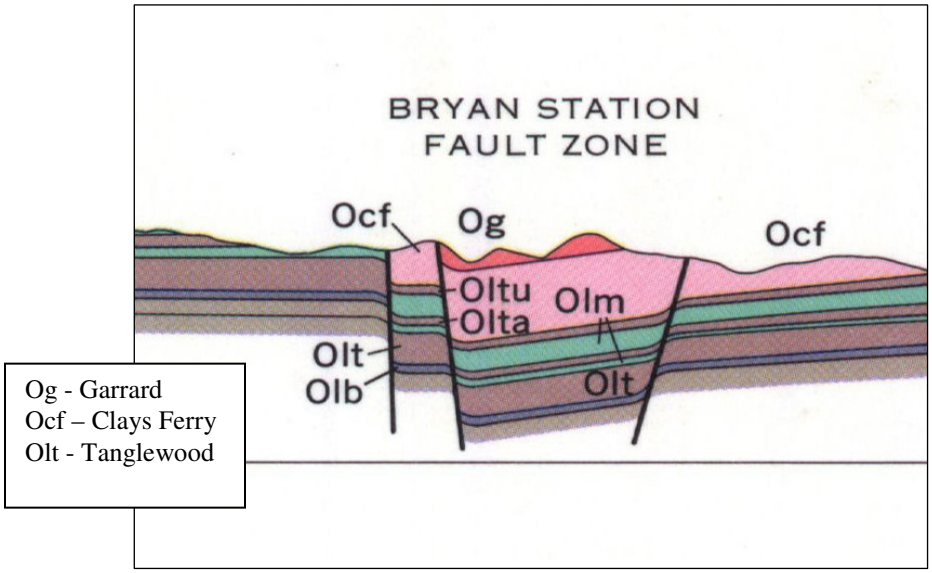

Figure A.1 Stratigraphic Cross Section of the Bryan Station Fault Zone (USGS 1986)

CLAYS FERRY FORMATION
USGS Unit Info: GEOLEX (id: 1093)
Primary Lithology: limestone, shale, and minor siltstone
The Clays Ferry Formation, 90 to 300 ft. thick, is made up of interbedded limestone, shale, and minor siltstone. The limestone and shale occur in about equal amounts, while the siltstone accounts for only a small percentage and is more abundant near the top, especially near the contact with the Garrard Siltstone. The limestone is mostly very fossiliferous and occurs in even beds commonly 2 to 6 in. thick. A small percentage of the limestone is sparsely fossiliferous calcisiltite, mostly near the base. The shale is commonly sparsely fossiliferous and also generally occurs in beds 2 to 6 in thick. The shale beds commonly have sharp contacts with the limestone beds. The Clays Ferry intertongues northward on a small scale with the Kope across a broad zone that trends roughly east-west. The Point Pleasant Tongue of the Clays Ferry Formation is lithologically similar to the main body of the Clays Ferry and extends northward beneath the Kope Formation. It is generally 100 to 130 ft. thick. Both the Clays Ferry and the Kope intertongue in part with the Lexington Limestone.

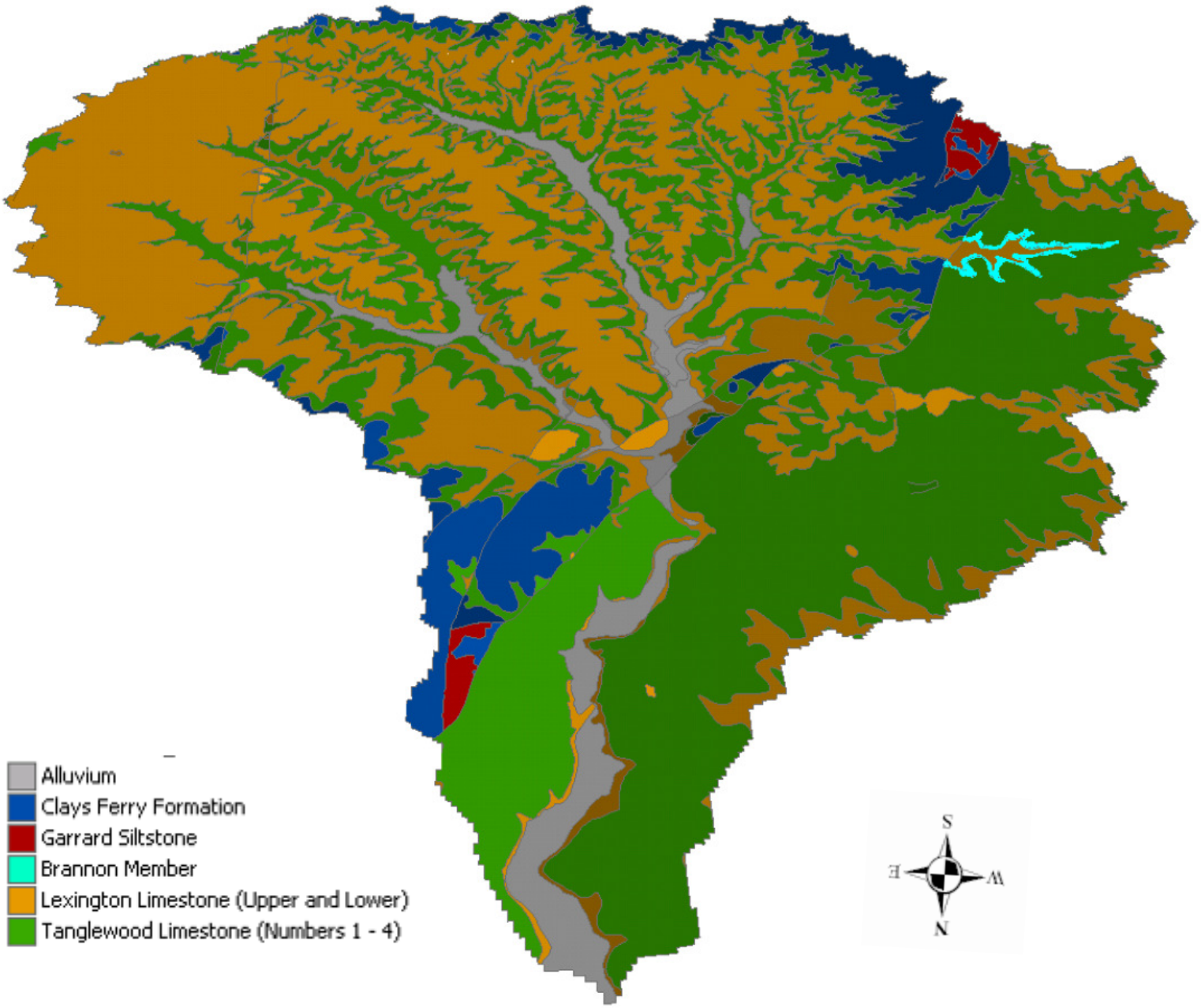

Figure A.2 Geologic Map of Upper North Elkhorn Creek, as Seen from the Mouth of the Watershed

GARRARD SILTSTONE
USGS Unit Info: GEOLEX (id: 1763)
Primary Lithology: siltstone, shale, and limestone
The Garrard Siltstone occurs above the Clays Ferry (locally, the Kope) in the southeastern part of the main outcrop area of the uppermost part of the Clays Ferry. The Garrard Siltstone, which ranges in thickness from 0 to 100 ft., is composed of interbedded siltstone, shale, and limestone. Shale accounts for less than 20 percent, and limestone less than 10 percent. The siltstone is in even beds a few inches to several feet thick which are locally contorted into ball-and-pillow structures. The Kope Formation is composed of interbedded shale (about 60 to 80 percent), limestone (20 to 40 percent), and minor siltstone; it ranges in thickness from 200 to 275 ft. The shale commonly occurs in beds 2 to 5 ft thick and is generally very sparsely fossiliferous. Most of the limestone is fossiliferous and commonly occurs in even beds 2 to 6 in. thick that are in places grouped into sets several feet thick. The limestone beds commonly have sharp contacts with the shale beds.

LEXINGTON LIMESTONE
USGS Unit Info: GEOLEX (id: 2452)
Primary Lithology: fossiliferous limestone
The lithostratigraphy and depositional environments of the Lexington Limestone (Ol) were described by Cressman (1973), and the following discussion has been drawn largely from that account.
The Lexington Limestone consists mostly of very fossiliferous and fossil-fragmental limestone that contrasts strikingly with the micrite-rich, sparingly fossiliferous rocks of the High Bridge Group. The Lexington is more than 320 ft thick along a line that extends from 10 mi. north of Frankfort eastward through Georgetown and Paris. It thins northward from this line to 190 ft. in Pendleton County, westward to about 200 ft in Shelby County, and southward to about 220 ft. near Danville in Boyle County. The thinning results mostly from intertonguing of the upper part of the Lexington with the lower part of the Clays Ferry Formation, as illustrated by the generalized stratigraphic sections of the Lexington Limestone. Intertonguing of the two formations was shown on the geologic quadrangle maps, but the contact is generalized on the State geologic map by necessity of the scale.
Outcrop of the Lexington Limestone in Kentucky is limited to the Inner Bluegrass region. Lateral equivalents of the Lexington in adjacent States have been described by Freeman (1953), Wilson (1949, 1962), and Cressman (1973). The interval in general contains less limestone and more shale to the north and west; the Nashville Group to the south differs principally in a change in facies trends from east-west to north-south (Cressman, 1973, p. 55).
The Lexington Limestone comprises 12 members which are described below. The members are limestone lithofacies, and the relations between them are complex.

BRANNON MEMBER
USGS Unit Info: GEOLEX (id: 605)
Primary Lithology: calcisiltite and shale
The Brannon Member is a distinctive unit of interbedded calcisiltite and shale, as much as 30 ft. thick and in about the middle of the Lexington Limestone, that crops out from Frankfort and Lexington south to and beyond the Kentucky River. Fossils are sparse. On uplands, the Brannon weathers to yield abundant porcelaneous and punky chert fragments. In much of the area the uppermost beds are contorted and display ball-and-pillow structure. North of a line from Frankfort to Lexington, the Brannon passes laterally into calcarenite of the Tanglewood Limestone Member, as shown by the generalized stratigraphic sections of the Lexington Limestone. To the southwest, the Brannon thins as a result of erosion before deposition of the overlying Sulphur Well Member.

TANGLEWOOD LIMESTONE MEMBER
USGS Unit Info: **GEOLEX (id: 4063)**
Primary Lithology: phosphatic calcarenite
The Tanglewood is an extensive irregular body of fossil-fragmental calcarenite that makes up much of the upper part of the Lexington Limestone in the Inner Bluegrass region. The member intertongues with the Clays Ferry Formation and with all other members of the Lexington Limestone except the Curdsville Limestone and Logana Members. The calcarenite is typically well sorted and crossbedded. It contains an average of 2.4 percent P2O5, though the amount varies greatly from bed to bed. The phosphate grains are similar to those in the Grier Limestone Member but have been reworked, rounded, sorted, and concentrated by currents. The Tanglewood was deposited on the shallowest parts of the shelf, where waves and currents could break, abrade, and sort skeletal material, and on bank margins, where tidal currents would have attained maximum velocity.

A.2 Dominant Soil Series Descriptions (USDA-NRCS)

The Maury series consists of deep, well drained, moderately permeable soils formed in silty material and weathered limestone, or old alluvium. These soils are on uplands. Slopes range from 0 to 20 percent. The mean annual precipitation is about 45 inches and the mean annual temperature is about 54 degrees F.
TAXONOMIC CLASS: Fine, mixed, semiactive, mesic Typic Paleudalfs
TYPICAL PEDON: Maury silt loam--cultivated.
GEOGRAPHIC SETTING: Broad ridgetops and gentle side slopes of a karst plain. Slopes range from 0 to 20 percent. These soils formed in 1 to 2 feet of silty loess-like material overlying limestone residuum or old alluvium, typically high in content of phosphate. The underlying limestone is cavernous and some areas have karst topography. Near the type location the average annual air temperature is 54 degrees F. and the average annual precipitation is 45 inches.
DRAINAGE AND PERMEABILITY: Well drained. Runoff is medium to slow and permeability is moderate to moderately rapid.
USE AND VEGETATION: Most areas are used for crops, such as burley tobacco, corn, small grains, and alfalfa and for pasture. Bluegrass and white clover are the most common pasture plants. Native vegetation was dominated by oaks, elm, ash, black walnut, black and honey locust, hackberry, black cherry, and Kentucky coffee tree. Glades of native grasses and canes were reported by early settlers.

The McAfee series consists of moderately deep, well drained soils formed in residuum weathered from limestone on upland ridgetops and side slopes. Permeability is moderately slow. Slopes range from 2 to 50 percent.
TAXONOMIC CLASS: Fine, mixed, active, mesic Mollic Hapludalfs
(Colors are for moist soil unless otherwise stated.)
TYPICAL PEDON: McAfee silty clay loam, in cultivation
GEOGRAPHIC SETTING: McAfee soils are on gently sloping to steep uplands with gradients of 2 to 50 percent. Some areas are karst while others are associated with limestone outcrops. Annual precipitation ranges from 44 to 48 inches with a mean of 45 inches. Temperature ranges from 54 to 57 degrees F. with a mean of 54 degrees.
DRAINAGE AND PERMEABILITY: Well drained with moderately slow permeability. Runoff is medium on slopes less than 5 percent, high on slopes between 5 and 20 percent, and very high on slopes greater than 20 percent.
USE AND VEGETATION: Most areas are used for growing corn, small grains, burley tobacco and hay or as pasture. Original vegetation was hardwoods interspersed with grassy glades. Forests were elm, maple, oak species, ash, hickory, hackberry, redbud, black and honey locust, Kentucky coffee tree, black walnut, Yaupon (Ilex vomitoria) and eastern red cedar.

The Lowell series consists of deep and very deep, well drained soils formed in residuum of limestone interbedded with thin layers of shale on upland ridgetops and sideslopes. Permeability is moderately slow. Slopes range from 2 to 65 percent. Average annual precipitation is 45 inches and the average annual temperature is 54 degrees F.
TAXONOMIC CLASS: Fine, mixed, active, mesic Typic Hapludalfs
TYPICAL PEDON: Lowell silt loam--on a smooth 8 percent slope in pasture.
GEOGRAPHIC SETTING: Lowell soils are on upland ridgetops and sideslopes or footslopes and benches. Slopes range from 2 to 65 percent. These soils formed in residuum, mantled with up to 18 inches of loess in some areas, or slope creep from soils formed in residuum from limestone or interbedded limestone, shale, and siltstone. Mean annual temperature ranges from 53 to 56 degrees F, and the mean annual precipitation ranges from 40 to 52 inches.
DRAINAGE AND PERMEABILITY: Well drained, with moderate or rapid runoff. Permeability is moderately slow.
USE AND VEGETATION: Most areas are used for growing corn, tobacco, hay, or pasture. Native forest has upland oaks, hickory, walnut, ash, hackberry, locusts, redbud, and red cedar as the dominant species.

The Loradale series consists of deep, well drained soils formed in old alluvium residuum from limestone and thin layers of calcareous shale. Permeability is moderately slow. Slopes range from 0 to 12 percent. Average annual precipitation is 46 inches. Average annual temperature is 56 degrees F.
TAXONOMIC CLASS: Fine, mixed, active, mesic Typic Argiudolls
TYPICAL PEDON: Loradale silt loam - cultivated.
GEOGRAPHIC SETTING: Loradale soils are on toeslopes, footslopes, and sideslopes in the uplands and terrace areas. Slopes range from 0 to 12 percent. Some areas are karst. These soils formed in residuum or old alluvium from limestone and thin layers of calcareous shale. Mean annual temperature ranges from 53 to 56 degrees F., and the annual precipitation ranges from 44 to 48 inches.
DRAINAGE AND PERMEABILITY: Well drained. Runoff is medium to slow and permeability is moderately slow.
USE AND VEGETATION: Nearly all areas now are used for crops or pasture. The chief crops are corn, small grains, burley tobacco, and hay. Original vegetation was hardwoods, chiefly overcup and white oak, elm, ash, hackberry, black walnut, black locust, and Kentucky coffee tree. There were many glades of native grasses, sedges, and cane.

The Mercer series consists of deep, moderately, well drained soils formed partly in loess and partly in clayey residuum from phosphatic limestones. Permeability is slow. Slopes range from 0 to 12 percent. Average annual precipitation is 46 inches. Average annual temperature is 55 degrees F.
TAXONOMIC CLASS: Fine-silty, mixed, semiactive, mesic Oxyaquic Fragiudalfs
TYPICAL PEDON: Mercer silt loam - cultivated.
GEOGRAPHIC SETTING: Mercer soils are on ridgetops and side slopes around the head of drains in the uplands. Slopes range from 0 to 12 percent. These soils formed partly in loess or old alluvium and partly in the underlying clayey residuum of phosphatic limestones. Mean annual temperature ranges from 53 to 56 degrees F, and the mean annual precipitation ranges from 45 to 48 inches.
DRAINAGE AND PERMEABILITY: Moderately well drained. Runoff is slow to medium and permeability is slow.
USE AND VEGETATION: Nearly all is cleared and used for corn, small grains, hay and burley tobacco; pasture. Originally hardwoods with grassy glades. Trees were chiefly oaks, beech, ash, elm, maple, locust, and hickory.

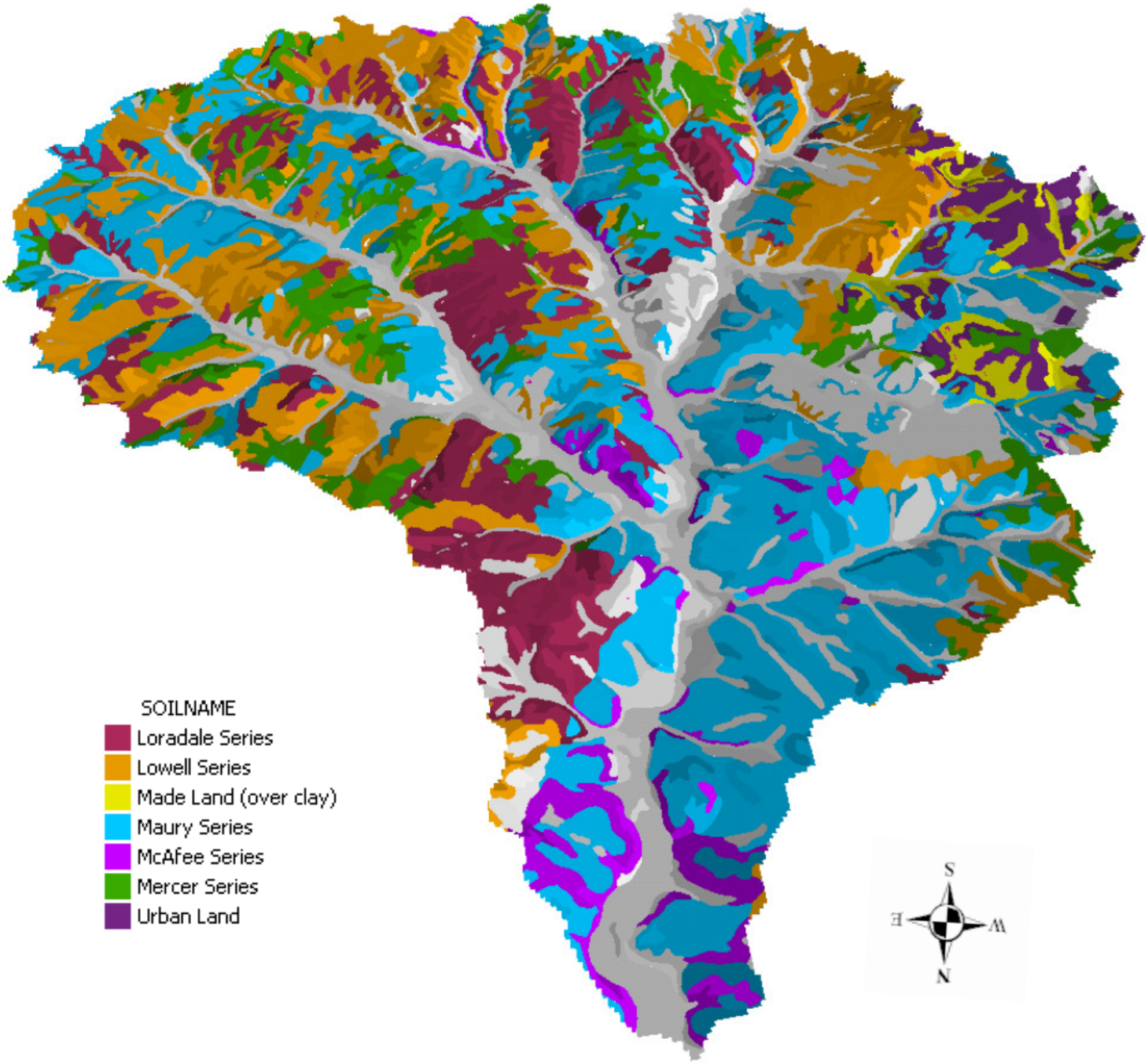

Figure A.3 Soils Map of Upper North Elkhorn Creek, as seen from the Mouth of the Watershed

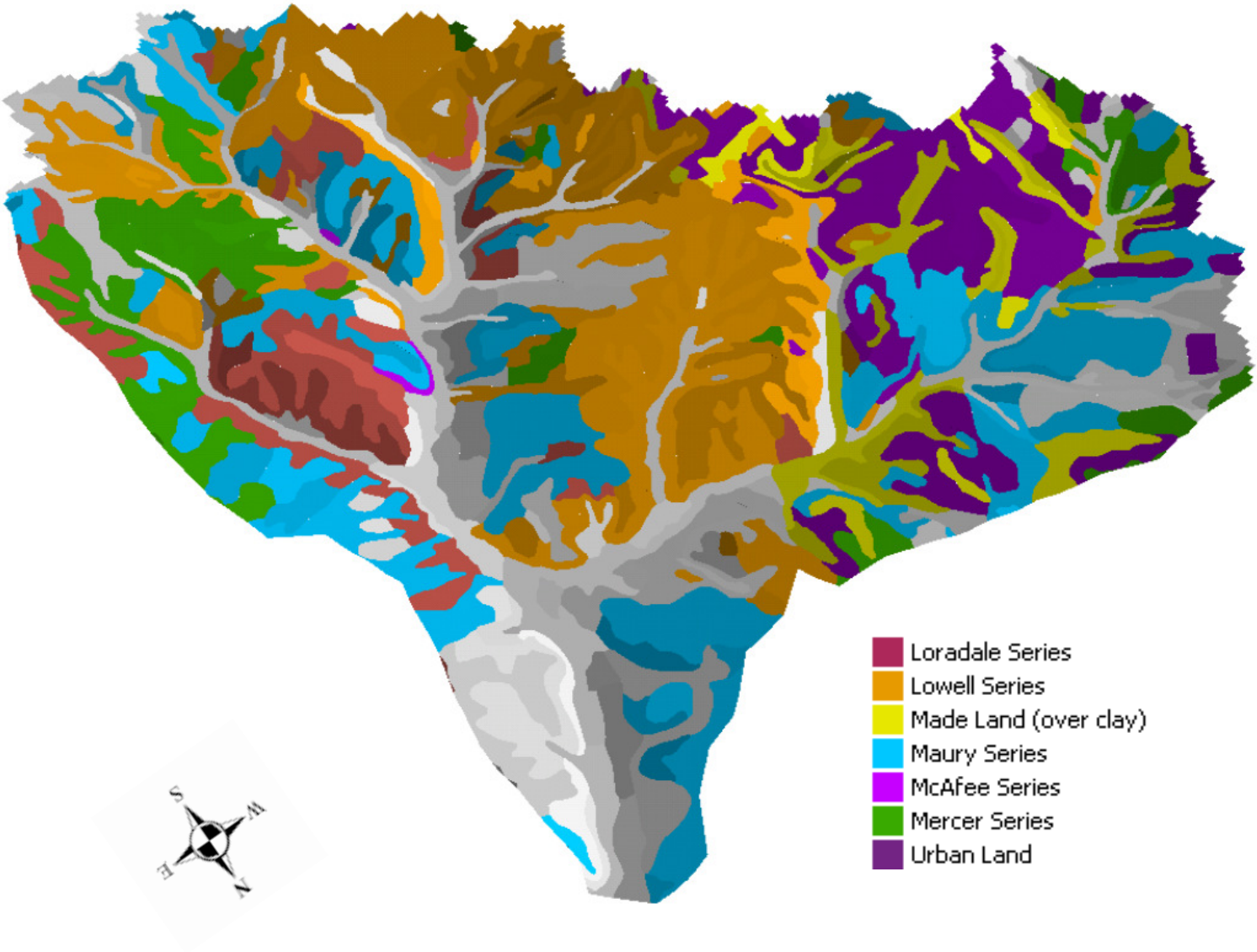

Figure A.4 Soils Map of the UT to Upper North Elkhorn Creek, as seen from the Mouth of the Watershed

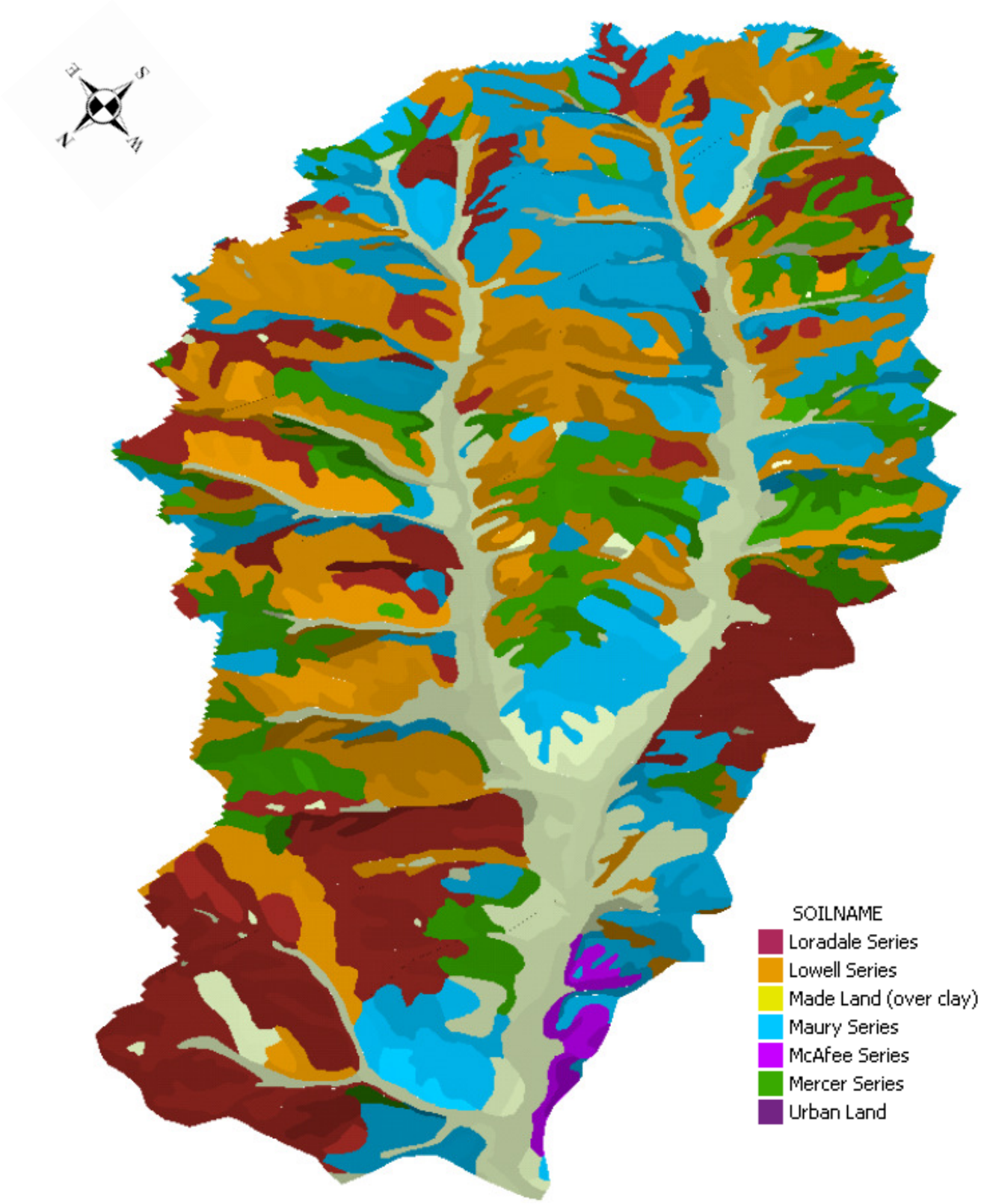

Figure A.5 Soils Map of David Fork, as seen from the Mouth of the Watershed

A.3 Land Cover Analysis

The land cover generated by the 1992 and 2006 NLCD were consolidated for presentation purposes within the report. All forested land (deciduous, evergreen and mixed) and shrubbery was aggregated and reported as one category. Further, all residential land use area was aggregated and reported as one category; developed land. The NLCD returned small but positive values for three types of residential land uses—Developed Open Space, Low-Intensity Residential, and High-Intensity Residential. Developed Open Space is a term applied to differing types of land use, within urban areas it is the designation given to parkland and other green areas. However, in rural watersheds such as the northeastern portion of the Upper North Elkhorn Creek, it denotes residential areas with insufficient density to be classified as Low-Intensity Residential but is mainly composed of single family residences on large lots (James Seay, 2006, Personal Communication). Further descriptions of the NLCD classifications are provided below. Individual NLCD images of the sub-watersheds proceed – to exemplify more surface topography, images oriented North-South have a hillshade effect (topographically higher areas have lighter shading) while images oriented from the mouth of the stream have a 10x vertical exaggeration.

National Land Cover Database Class Descriptions

(Homer et al, 2004)

(11) Open Water - All areas of open water, generally with less than 25% cover of vegetation or soil.

(21) Developed, Open Space - Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes

(22) Developed, Low Intensity - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.

(23) Developed, Medium Intensity - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.

(24) Developed, High Intensity - Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to100 percent of the total cover.

(31) Barren Land (Rock/Sand/Clay) - Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.

(41) Deciduous Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.

(42) Evergreen Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.

(43) Mixed Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.

(52) Shrub/Scrub - Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20 percent of total vegetation. This class includes true shrubs, young trees in an early successional stage, or trees stunted from environmental conditions.

(71) Grassland/Herbaceous - Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.

(81) Pasture/Hay - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.

(82) Cultivated Crops - Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.

(90) Woody Wetlands - Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

(95) Emergent Herbaceous Wetlands - Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Appendix B – WRIS Reports

The following paragraphs explaining the WRIS and WRIS portal were copied from their website in July 2012 and can be accessed at http://kia.ky.gov/wris/.

> The Water Resource Information System (WRIS) has been developed through the cooperative efforts of water and wastewater treatment systems and local, regional, and state agencies. It is used by all these entities, and provides much of the information needed for all aspects of water resource planning--from watershed protection to infrastructure development. The WRIS includes a geographic information system (GIS), and information on water resources, drinking water systems, wastewater treatment systems, project development, emergency response, regulations, and planning.
>
> The WRIS is comprised of strategic plans, water resource maps and publications, systems management information, reporting and regulatory requirements, guidance and training documents, procedural guidance and forms for project implementation and funding, and internet links to support services. Interactive maps in the system support planning and regionalization efforts. The interactive maps also facilitate drought monitoring and response, and rapid response to contamination emergencies. The GIS contains data for water and wastewater treatment facilities, water lines, water sources, storage facilities, sewer lines, and a database of non-spatial systems information. The GIS provides the fundamental data needed for the planning and emergency response activities. Using the GIS infrastructure data in computer models allows for cost-effective analysis of engineering alternatives, and facilitates the efficiencies needed to meet the needs of Kentucky's infrastructure development.

WRIS system reports can be generated using system data accessed via the WRIS portal. Likewise project profile forms can be generated using project profile data accessed via the WRIS portal. There are two permitted wastewater systems that have sanitary sewer collection infrastructure within the upper North Elkhorn Creek watershed but do not discharge to any of its waters. LFUCG operates two sanitary sewer collection systems with the watershed - wastewater is treated at either the Town Branch or West Hickman Wastewater Treatment Plants. Both systems have several projects on the Clean Water State Revolving Fund List. These projects include sewer line extensions to unserved households, 7,400 GPM pump station construction (and subsequent elimination of four interim pump stations), 13,200 GPM pump station construction (for new service areas and to balance wastewater flow between the two treatment plants, and various stormwater management projects. These systems and projects are discussed further in Sections 6 and 8 of the document. The WRIS system reports and project profiles are included below.

WRIS System Data Report

KY0021504 - LFUCG - West Hickman

DOW Permit ID: KY0021504 — Link: EPA PCS Report

DOW Permit Type: WASTE WATER (KPDES) — Link: EPA ECHO Report

DOW Permit Name: Lexington West Hickman STP

WRIS System Name: LFUCG - West Hickman

System Type: KPDES Public Wastewater — Receiving Waters: West Hickman Crk

ADD ID: BGADD — Primary County: Jessamine — Dow Field Office: Frankfort

Permit Dates: Issued: 11.19.2001 — Expired: 12.31.2006 — Inactivated:

SYSTEM CONTACT INFORMATION

Contact: James Worten

Title: Felty

Address Line 1: 645 W Hickman Plant Rd

Address Line 2:

City Nicholasville — State: KY — Zip: 40356

Phone: 859-272-1713 — EMail: mfelty@lexingtonky.gov

Data Source: KENTUCKY INFRASTRUCTURE AUTHORITY — Date Last Modified: 04.25.2013

OWNER ENTITY INFORMATION

DEMOGRAPHIC INFORMATION

Counties Directly Served: 2

	Population	Households
Directly Serviceable:	164,967	76,746
Indirectly Serviceable:		
Total Serviceable:	164,967	76,746

Note: Population counts are based on KIA census block overlay with WRIS mapped features.

County Served	Connection Count	Serviceable Population	Serviceable Households
Fayette	107,457	164,705	76,641
Jessamine	140	262	105
Totals:	107,597	164,967	76,746

System Respondent — ADD WMP — Date

FISCAL ATTRIBUTES

Date Established: 01.01.1972 — Employees: 28

Does this system:

(a) Operate a wastewater treatment facility? Yes

(b) Send wastewater to other systems to be treated? No

(c) Treat wastewater from other systems? No

What is the customer cost per 4,000 gallons of treated water? $21.06

Comments: $21.06 are residential rates
$25.53 are non-residential rates

Date Last Modified: 04.25.2013

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WRIS System Data Report
KY0021504 - LFUCG - West Hickman

DOW Permit ID: KY0021504
Link: EPA PCS Report
Link: EPA ECHO Report
DOW Permit Type: WASTE WATER (KPDES)
DOW Permit Name: Lexington West Hickman STP
WRIS System Name: LFUCG - West Hickman
System Type: KPDES Public Wastewater
Receiving Waters: West Hickman Crk
ADD ID: BGADD
Primary County: Jessamine
Dow Field Office: Frankfort
Permit Dates: Issued: 11.19.2001
Expired: 12.31.2006
Inactivated:

SYSTEM PLANNING

Wastewater Treatment Plants (KIA):

Facility Name	Design Capacity (MGD)	Max Hydr. Capacity (MGD)	Ave. Daily Flow (MGD)
WEST HICKMAN WASTEWATER TREATMENT PLANT	33.870	64.000	15.430

✓ This system has an approved facility plan.

Estimated percentage of facility plan constructed: 100%
Date facility plan last revised or amended: 08.01.1999
Number of manholes in collection system:
Percentage of sewer lines 20 years or older:

DOW Design Capacity (MGD): 33.870
Annual Volume Treated (MG): 8,420.199
KISOP Volume Sent (MG):
Total Annual Volume (MG): 8,420.199

KISOP Customers:
Residential Customers:
Commercial Customers:
Institutional Customers:
Industrial Customers:
Other Customers:
Total Customers:
Comments: West Hickman treats Jessamine South Elkhorn Water District.

Date Last Modified: 04.25.2013

WMP Site Visit - Survey Information:

Site Visit / Survey Date: 11.27.2012
Survey Administrator: SAMANTHA MYERS
Principal Respondent: CASSIE FELTY
Other Respondent(s):
Comments: None.

Date Last Modified: 11.27.2012

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WRIS System Data Report

KY0021504 - LFUCG - West Hickman

DOW Permit ID: KY0021504 — Link: EPA PCS Report

DOW Permit Type: WASTE WATER (KPDES) — Link: EPA ECHO Report

DOW Permit Name: Lexington West Hickman STP

WRIS System Name: LFUCG - West Hickman

System Type: KPDES Public Wastewater — Receiving Waters: West Hickman Crk

ADD ID: BGADD — Primary County: Jessamine — Dow Field Office: Frankfort

Permit Dates: Issued: 11.19.2001 — Expired: 12.31.2006 — Inactivated:

SYSTEM MAINTENANCE

- ○ The management of this system participates in an Area Water Management Planning Council (AWMPC).
- ✓ The management of this system participates in regular training activities.
- ✓ System operator(s) participate in regular training activities.
- ○ This system has an asset management plan.
- ○ This system as a capital improvement plan.
- ○ This system has GIS capabilities.

This system has a policy manual in place containing the following items:

- ✓ Personnel Policies
- ✓ Standard Operating Procedures
- ✓ Operation and Maintenance Procedures
- ✓ Routine Maintenance Program
- ✓ Emergency Operation Procedures
- ✓ Backup Sources

Date of last infiltration analysis: **05.01.2012**

- ○ This system has performed a Sanitary Sewer Evaluation Survey (SSES).
- ✓ This system utilizes standard specifications.
  - Date standard specifications last revised: **01.01.2001**
- ○ This system has periodic service outages.
- ✓ This system experiences problematic weather.
  - Weather: **Flooding during/After storms**
- ✓ This system has localized problems.
  - The following components are associated with locaized problems:
    - Problem location(s): **Around restaurants**
    - Problem diameter(s):
    - Problem Material(s);
    - Problem cause(s):
  - Other problem characteristics:
- ✓ This system has as-built plans (record drawings).
  - Est. degree of accuracy for as-built plans (%):
- ✓ This system uses an on-staff inspector(s) for construction projects.

Date of last infiltration analysis: **05.01.2012**

Maintenance notes for this system:

Date Last Modified: 04.25.2013

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WRIS System Data Report

KY0021504 - LFUCG - West Hickman

The following projects are associated with this system:

PNUM	Applicant	Project Status	Funding Status	Schedule	Project Title	Profile Modified	GIS Modified
SX21067001	Lexington-Fayette Urban County Government	Approved	Partially Funded	0-2 Years	Comprehensive Sanitary Sewer Project - Remaining Unsewered Areas - Phase 1A - Town Branch Wastewater Treatment Plant	03.22.2013	08.09.2010
SX21067003	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	North Elkhorn Diversion Pump Station and Force Main	03.29.2013	05.24.2013
SX21067004	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	South Elkhorn Pump Station and Force Main	03.29.2013	08.04.2010
SX21067006	Lexington-Fayette Urban County Government	Under Construction	Partially Funded	0-2 Years	Expansion Area 2A Class A Pump Station and Trunk Sewer	09.27.2012	02.11.2013
SX21067008	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Comprehensive Sanitary Sewer Project - Remaining Unsewered Areas - Phase 2	03.22.2013	03.21.2013
SX21067012	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	West Hickman Wastewater Treatment Plant Screw Pump Replacement - Phase 2	03.22.2013	10.09.2012
SX21067013	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Comprehensive Sanitary Sewer Project-Remaining Unsewered Areas, Phase 3	03.04.2013	02.11.2013
SX21067015	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	LFUCG-East Hickman Pump Station Expansion and Rehabilitation	03.22.2013	05.24.2013
SX21067017	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Expansion Area 1 - LFUCG	03.05.2013	05.01.2013
SX21067019	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Mint Lane Pump Station - LFUCG	12.13.2012	03.21.2013
SX21067025	Lexington-Fayette Urban County Government	Constructed	Fully Funded	0-2 Years	TRINITY ROAD CULVERT REPLACEMENT-FAYETTE	11.07.2011	07.28.2010
SX21067028	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Woodlake Way Storm Line Repairs	03.19.2013	02.25.2013
SX21067029	Lexington-Fayette Urban County Government	Constructed	Fully Funded	0-2 Years	GETTYSBURG ROAD DRAINAGE REPAIRS	11.07.2011	09.07.2010
SX21067030	Lexington-Fayette Urban County Government	Constructed	Fully Funded	0-2 Years	SHADY LANE DRAINAGE IMPROVEMENTS	11.07.2011	07.28.2010
SX21067033	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	West Hickman WWTP Misc Equip-Fayette	03.19.2013	02.11.2013
SX21067037	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	LFUCG - Eastlake Trunk Sewer Replacement	10.03.2012	09.10.2012
SX21067039	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	LFUCG - Century Hills Trunk Sewer Replacement	04.05.2013	04.05.2013
SX21067040	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	LFUCG - West Hickman Trunk Sewer Replacement - Project A	10.03.2012	09.10.2012
SX21067043	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	LFUCG - Woodhill Trunk Sewer Replacement	10.03.2012	09.10.2012
SX21067048	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	West Hickman WWTP Wet Weather Storage Tanks - Phase 1	01.18.2013	02.11.2013
SX21067053	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	West Hickman Subbasin WH-7 WWS Tank	01.18.2013	01.25.2013
SX21067054	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	West Hickman Main Trunk B	01.18.2013	02.25.2013

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WRIS System Data Report

KY0021491 - LFUCG - Town Branch

DOW Permit ID: KY0021491 — Link: EPA PCS Report

DOW Permit Type: WASTE WATER (KPDES) — Link: EPA ECHO Report

DOW Permit Name: Lexington Town Branch STP

WRIS System Name: LFUCG - Town Branch

System Type: KPDES Public Wastewater — Receiving Waters: Town Br

ADD ID: BGADD — Primary County: Fayette — Dow Field Office: Frankfort

Permit Dates: Issued: 12.03.1998 — Expired: 03.31.2003 — Inactivated:

SYSTEM CONTACT INFORMATION

Contact: Mark Stager

Title: Deputy Director for Administrative Services

Address Line 1: 301 Lisle Industrial Ave

Address Line 2:

City Lexington — State: KY — Zip: 40511

Phone: 859-425-2400 — EMail: mfelty@lexingtonky.gov

Data Source: KENTUCKY INFRASTRUCTURE AUTHORITY — Date Last Modified: 04.25.2013

OWNER ENTITY INFORMATION

Entity Type: City / Municipal Utility — PSC Group ID:

Entity Name: Lexington-Fayette Urban County Government

Web URL:

Office EMail: darenhol@lfucg.com

Office Phone: 859-425-2525 — Toll Free: — Fax:

Mail Address Line 1: 200 E Main St Div of Rev — Phys Address Line 1:

Mail Address Line 2: — Phys Address Line 2:

Mail City, State Zip: Lexington, KY 40507 — Phys City, State Zip:

Contact: Susan Lamb — Manager: Richard Moloney

Contact Title: City Clerk — Manager Title: Public Works Director

Contact EMail: susanl@lexingtonky.gov — Manager EMail: rmoloney@lexingtonky.gov

Contact Phone: 859-258-3240 — Manager Phone: 859-425-2255

Contact Cell: — Manager Cell:

Authorized Official: Jim Gray

Auth. Official Title: Mayor

Auth. Official EMail: mayor@lexingtonky.gov

Auth. Official Phone: 859-258-3100 — Auth. Official Cell:

Data Source: Kentucky Department for Local Government — Date Last Modified: 06.05.2013

DEMOGRAPHIC INFORMATION

Counties Directly Served: 1

	Population	Households
Directly Serviceable:	121,836	54,556
Indirectly Serviceable:	1,615	723
Total Serviceable:	123,451	55,279

Note: Population counts are based on KIA census block overlay with WRIS mapped features.

County Served	Connection Count	Serviceable Population	Serviceable Households
Fayette	107,457	121,836	54,556
Totals:	107,457	121,836	54,556

System Respondent — ADD WMP — Date

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WRIS System Data Report

KY0021491 - LFUCG - Town Branch

DOW Permit ID: KY0021491

Link: EPA PCS Report

DOW Permit Type: WASTE WATER (KPDES)

Link: EPA ECHO Report

DOW Permit Name: Lexington Town Branch STP

WRIS System Name: LFUCG - Town Branch

System Type: KPDES Public Wastewater

Receiving Waters: Town Br

ADD ID: BGADD

Primary County: Fayette

Dow Field Office: Frankfort

Permit Dates: Issued: 12.03.1998

Expired: 03.31.2003

Inactivated:

FISCAL ATTRIBUTES

Date Established: 01.01.1919 Employees: 142

Does this system:

(a) Operate a wastewater treatment facility? Yes

(b) Send wastewater to other systems to be treated? No

(c) Treat wastewater from other systems? Yes

What is the customer cost per 4,000 gallons of treated water? $21.06

Comments: $21.06 is for Schedule A (residential rates)
$25.53 is for Schedule B (non-residential rates)

Date Last Modified: 04.25.2013

This system treats wastewater from the following KISOP customers:

Sender DOW Permit ID	Sender Name	Ann. Vol. (MG)	Serviceable Population	Serviceable Households
KYP000072	Jessamine South Elkhorn Water District		1,615	723
	Totals		1,615	723

- MG = Million Gallons
- KISOP = Kentucky Inter-System Operating Permit

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WRIS System Data Report

KY0021491 - LFUCG - Town Branch

DOW Permit ID: KY0021491
DOW Permit Type: WASTE WATER (KPDES)
DOW Permit Name: Lexington Town Branch STP
WRIS System Name: LFUCG - Town Branch
System Type: KPDES Public Wastewater
Receiving Waters: Town Br
ADD ID: BGADD
Primary County: Fayette
Dow Field Office: Frankfort
Permit Dates: Issued: 12.03.1998
Expired: 03.31.2003
Inactivated:

Link: EPA PCS Report
Link: EPA ECHO Report

SYSTEM PLANNING

Wastewater Treatment Plants (KIA):

Facility Name	Design Capacity (MGD)	Max Hydr. Capacity (MGD)	Ave. Daily Flow (MGD)
TOWN BRANCH WASTEWATER TREATMENT PLANT	30.000	64.000	16.350

✓ This system has an approved facility plan.

Estimated percentage of facility plan constructed: 25%
Date facility plan last revised or amended: 08.01.1999
Number of manholes in collection system: 32,828
Percentage of sewer lines 20 years or older: 35

DOW Design Capacity (MGD): 30.000
Annual Volume Treated (MG): 8,420.199
KISOP Volume Sent (MG):
Total Annual Volume (MG): 8,420.199

KISOP Customers: 1
Residential Customers: 96,216
Commercial Customers: 7,410
Institutional Customers: 295
Industrial Customers: 17
Other Customers:
Total Customers: 103,939
Comments:

Date Last Modified: 05.18.2012

WMP Site Visit - Survey Information:

Site Visit / Survey Date: 04.25.2013
Survey Administrator: Karyn Leverenz
Principal Respondent: Cassie Felty
Other Respondent(s):
Comments: This treatment plant is still awaiting permits from the state. They cannot make changes until they know what their phosphorus will be.

Date Last Modified: 04.25.2013

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WRIS System Data Report

KY0021491 - LFUCG - Town Branch

DOW Permit ID: KY0021491 — Link: EPA PCS Report

DOW Permit Type: WASTE WATER (KPDES) — Link: EPA ECHO Report

DOW Permit Name: Lexington Town Branch STP

WRIS System Name: LFUCG - Town Branch

System Type: KPDES Public Wastewater — Receiving Waters: Town Br

ADD ID: BGADD — Primary County: Fayette — Dow Field Office: Frankfort

Permit Dates: Issued: 12.03.1998 — Expired: 03.31.2003 — Inactivated:

SYSTEM MAINTENANCE

- ○ The management of this system participates in an Area Water Management Planning Council (AWMPC).
- ✓ The management of this system participates in regular training activities.
- ✓ System operator(s) participate in regular training activities.
- ○ This system has an asset management plan.
- ○ This system as a capital improvement plan.
- ○ This system has GIS capabilities.

This system has a policy manual in place containing the following items:

- ✓ Personnel Policies
- ✓ Operation and Maintenance Procedures
- ✓ Emergency Operation Procedures
- ✓ Standard Operating Procedures
- ✓ Routine Maintenance Program
- ✓ Backup Sources

Date of last infiltration analysis: **05.01.2012**

- ○ This system has performed a Sanitary Sewer Evaluation Survey (SSES).
- ✓ This system utilizes standard specifications.
  - Date standard specifications last revised: **01.01.2005**
- ✓ This system has periodic service outages.
  - Cause(s): **Grease in lines**
- ✓ This system experiences problematic weather.
  - Weather: **Periodic flooding during/After storms**
- ✓ This system has localized problems.
  - The following components are associated with locaized problems:
    - Problem location(s): **Around restaurants**
    - Problem diameter(s): **8**
    - Problem Material(s); **Pvc, clay, metal (cast iron)**
    - Problem cause(s):
  - Other problem characteristics:
- ✓ This system has as-built plans (record drawings).
  - Est. degree of accuracy for as-built plans (%): **95%**
- ✓ This system uses an on-staff inspector(s) for construction projects.

Date of last infiltration analysis: **05.01.2012**

Maintenance notes for this system:

Date Last Modified: 05.18.2012

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WRIS System Data Report

KY0021491 - LFUCG - Town Branch

The following projects are associated with this system:

PNUM	Applicant	Project Status	Funding Status	Schedule	Project Title	Profile Modified	GIS Modified
SX21067001	Lexington-Fayette Urban County Government	Approved	Partially Funded	0-2 Years	Comprehensive Sanitary Sewer Project - Remaining Unsewered Areas - Phase 1A - Town Branch Wastewater Treatment Plant	03.22.2013	08.09.2010
SX21067002	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Expansion Area Three Sanitary Sewer Infrastructure	03.22.2013	08.09.2010
SX21067003	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	North Elkhorn Diversion Pump Station and Force Main	03.29.2013	05.24.2013
SX21067005	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Enhanced Solids Process - Town Branch Wastewater Treatment Plant	03.25.2013	02.11.2013
SX21067008	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Comprehensive Sanitary Sewer Project - Remaining Unsewered Areas - Phase 2	03.22.2013	03.21.2013
SX21067014	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	LFUCG Wolf Run Pump Station and Expansion	04.02.2013	05.24.2013
SX21067016	Lexington-Fayette Urban County Government	Constructed	Not Funded	0-2 Years	LFUCG BLUEGRASS AIRPORT PUMP STATION EXPANSION	11.07.2011	08.09.2010
SX21067018	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Lower Cane Run Pump Station - LFUCG	03.19.2013	05.01.2013
SX21067018	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Lower Cane Run Pump Station - LFUCG	03.19.2013	05.01.2013
SX21067020	Lexington-Fayette Urban County Government	Approved	Fully Funded	0-2 Years	Leesway Neighborhood Underserved Areas - Fayette	04.02.2013	08.09.2010
SX21067021	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	LFUCG - Green Acres Neighborhood Project	04.01.2013	02.11.2013
SX21067022	Lexington-Fayette Urban County Government	Constructed	Fully Funded	0-2 Years	TOWN BRANCH WASTEWATER TREATMENT PLANT SCREW PUMP REPLACEMENT-FAYETTE	11.07.2011	07.28.2010
SX21067024	Lexington-Fayette Urban County Government	Constructed	Fully Funded	0-2 Years	Radcliffe Drainage Improvements-Fayette	03.19.2013	08.04.2010
SX21067025	Lexington-Fayette Urban County Government	Constructed	Fully Funded	0-2 Years	TRINITY ROAD CULVERT REPLACEMENT-FAYETTE	11.07.2011	07.28.2010
SX21067028	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Woodlake Way Storm Line Repairs	03.19.2013	02.25.2013
SX21067029	Lexington-Fayette Urban County Government	Constructed	Fully Funded	0-2 Years	GETTYSBURG ROAD DRAINAGE REPAIRS	11.07.2011	09.07.2010
SX21067030	Lexington-Fayette Urban County Government	Constructed	Fully Funded	0-2 Years	SHADY LANE DRAINAGE IMPROVEMENTS	11.07.2011	07.28.2010
SX21067034	Lexington-Fayette Urban County Government	Constructed	Fully Funded	0-2 Years	DOWNTOWN STREETSCAPE GREEN INFRASTUCTURE PROGRAM INITIATIVE	11.07.2011	11.03.2010
SX21067036	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	University of Kentucky Nicholasville Road Flood Mitigation Project	04.01.2013	03.21.2013
SX21067038	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	LFUCG - Bob O Link Trunk Sewer Replacement	06.03.2013	09.10.2012
SX21067041	Lexington-Fayette Urban County Government	Approved	Partially Funded	0-2 Years	LFUCG - Town Branch WWTP Flow Equalization Storage Tanks - Phase I	03.01.2013	04.24.2013
SX21067042	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Wolf Run Flow Equalization Storage Tank	10.03.2012	05.24.2013
SX21067044	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	LFUCG - Wolf Run Trunk Sewer Replacement - Phase A	10.03.2012	09.10.2012
SX21067045	Lexington-Fayette Urban County Government	Approved	Partially Funded	0-2 Years	LFUCG - Anniston - Wickland SW Improvement - Phase 3	04.02.2013	02.25.2013
SX21067046	Lexington-Fayette Urban County Government	Constructed	Fully Funded	0-2 Years	LFUCG - Various Stormwater Management Projects - Phase 1	02.22.2013	12.07.2011
SX21067046	Lexington-Fayette Urban County Government	Constructed	Fully Funded	0-2 Years	LFUCG - Various Stormwater Management Projects - Phase 1	02.22.2013	12.07.2011
SX21067047	Lexington-Fayette Urban County Government	Approved	Partially Funded	0-2 Years	Various Stormwater Management Projects - Phase 2	04.02.2013	03.21.2013

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WRIS System Data Report

KY0021491 - LFUCG - Town Branch

The following projects are associated with this system:

PNUM	Applicant	Project Status	Funding Status	Schedule	Project Title	Profile Modified	GIS Modified
SX21067047	Lexington-Fayette Urban County Government	Approved	Partially Funded	0-2 Years	Various Stormwater Management Projects - Phase 2	04.02.2013	03.21.2013
SX21067049	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Lower Cane Run WWS Tank	01.18.2013	12.14.2012
SX21067050	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Lower Griffin Gate Trunk	01.18.2013	02.25.2013
SX21067051	Lexington-Fayette Urban County Government	Approved	Not Funded	0-2 Years	Lower Cane Run Force Main Extension	01.18.2013	12.14.2012
SX21067052	Lexington-Fayette Urban County Government	Pending	Not Funded	0-2 Years	UK Trunk A	01.18.2013	02.25.2013
SX21113016	Jessamine-South Elkhorn Water District	Withdrawn	Not Funded	0-2 Years	Crosswoods, Unit 3 Sewer Collection System, Jessamine South Elkhorn	02.16.2012	
SX21113018	Jessamine-South Elkhorn Water District	Approved	Not Funded	0-2 Years	Windhaven Drive Sewer Collection System	03.25.2013	08.04.2010

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Clean Water Project Profile

Legal Applicant: **Lexington-Fayette Urban County Government**
Project Title: **Comprehensive Sanitary Sewer Project - Remaining Unsewered Areas - Phase 1A - Town Branch Wastewater Treatment Plant**
Project Number: **SX21067001** View Map
Submitted By: **BGADD**
Funding Status: **Partially Funded**
Primary County: **Fayette**
Project Status: **Approved**
Planning Unit: **Unit 6**
Project Schedule: **0-2 Years**
Multi-County: **No**
E-Clearinghouse SAI: **KY200510191079**
ECH Status: **Endorse With Condition**
Applicant Entity Type: **City / Municipal Utility**
Date Approved (AWMPC): **01-13-2004**

Project Description:

The project provides sanitary sewer service for 252 unserved households in the Lexington-Fayette Urban co. Govn't (LFUCG) Urban service area. The areas included are Bracktown, Cadentown, and wilderness road, which are primarily lower-income and older neighborhoods. Financial assistance is required to provide a cost effective solution to failed on-site septic systems.

Need for Project:
Briefly describe how this project promotes public health or achieves and/or maintains compliance with the Clean Water Act or Safe Drinking Water Act:
Health department complaints filed. Most cost-effective and technically feasible alternative.

Project Alternatives:

Alternate A:
Complete project in phases.

Alternate B:
N/A

Alternate C:
N/A

Legal Applicant:

Entity Type: **City / Municipal Utility**
PSC Group ID:
Entity Name: **Lexington-Fayette Urban County Government**
Web URL:
Office EMail: **darenhol@lfucg.com**
Office Phone: **859-425-2525**
Toll Free:
Fax:

Mail Address Line 1: **200 E Main St Div of Rev**
Phys Address Line 1:
Mail Address Line 2:
Phys Address Line 2:
Mail City, State Zip: **Lexington, KY 40507**
Phys City, State Zip:

Contact: **Susan Lamb**
Manager: **Richard Moloney**
Contact Title: **City Clerk**
Manager Title: **Public Works Director**
Contact EMail: **susanl@lexingtonky.gov**
Manager EMail: **rmoloney@lexingtonky.gov**
Contact Phone: **859-258-3240**
Manager Phone: **859-425-2255**
Contact Cell:
Manager Cell:

Authorized Official: **Jim Gray**
Auth. Official Title: **Mayor**
Auth. Official EMail: **mayor@lexingtonky.gov**
Auth. Official Phone: **859-258-3100**
Auth. Official Cell:
Data Source: **Kentucky Department for Local Government**
Date Last Modified: **06.05.2013**

Print Date:6/5/2013 Kentucky Infrastructure Authority 1 of 8

Clean Water Project Profile

SX21067001 - Lexington-Fayette Urban County Government
Comprehensive Sanitary Sewer Project - Remaining Unsewered Areas - Phase 1A - Town Branch Wastewater Treatment Plant

Project Administrator (PA) Information

Name: **William Bowie Jr.**
Title: **Engineer**
Organization: **Lexington Fayette Urban County Government - Department of Engineering**
Address Line 1: **Deptof Engineering 8th Fl**
Address Line 2: **PO Box 200 E Main Street**
City: **Lexington** State: **KY** Zip: **40507**
Phone: **859-258-3410** Fax: **859-258-3458**

Applicant Contact (AC) Information

Name: **Tiffany Rank**
Title: **Plant Engineer**
Organization: **Lexington Fayette Urban County Government**
Address Line 1: **301 Lisle Industrial Ave**
Address Line 2:
City: **Lexington** State: **KY** Zip: **40511**
Phone: **859-425-2405** Fax:

Project Engineer (PE) Information:

☒ This project requires a licensed Professional Engineer.

License No: **PE 13555**
PE Name: **Joseph Lee Henry**
Phone: **859-223-3999** Fax: **859-223-8917**
E-Mail: **jhenry@grwinc.com**
Firm Name: **GRW Engineers, Inc.**
Addr Line 1: **GRW Engineers**
Addr Line 2: **801 Corporate Dr., Ste. 400**
Addr Line 3:
City: **Lexington** State: **KY** Zip: **40503**
Status: **Current** Disciplinary Actions: **NO**
Issued: **07-21-1983** Expires: **06-30-2013**

Engineering Firm Information:

Permit No: **87**
Firm Name: **GRW Engineers, Inc.**
Phone: **859-223-3999** Fax: **859-223-8917**
Web URL: **http://www.grwinc.com/**
EMail: **rfoster@grwinc.com**
Addr Line 1: **801 Corporate Drive**
Addr Line 2:
City: **Lexington** State: **KY** Zip: **40503**
Status: **Current** Disciplinary Actions: **NO**
Issued: **03-02-1993** Expires: **12-31-2013**

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Clean Water Project Profile

SX21067001 - Lexington-Fayette Urban County Government
Comprehensive Sanitary Sewer Project - Remaining Unsewered Areas - Phase 1A - Town Branch Wastewater Treatment Plant

Project Cost Classification:

Administrative Exp.:	
Legal Exp.:	
Land, Appraisals, Easements:	
Relocation Exp. & Payments:	
Planning:	
Engineering Fees - Design:	
Engineering Fees - Construction:	
Engineering Fees - Inspection:	
Engineering Fees - Other:	
Construction:	**$ 2,300,000**
Equipment:	
Miscellaneous:	
Contingencies:	
Total Project Cost:	**$ 2,300,000**

Construction Cost Categories:

WWTP Secondary Portion:	**$ 0**
WWTP Advanced Portion:	**$ 0**
Inflow & Infiltration Correction:	**$ 0**
Major Sewer Rehabilitation:	**$ 0**
Collector Sewers:	**$ 0**
Interceptor Sewers, including Pump Stations:	**$ 2,300,000**
Combined Sewer Overflow Correction:	**$ 0**
NPS Urban:	**$ 0**
Non-Categorized Cost:	
Total Construction:	**$ 2,300,000**

Total Sustainable Infrastructure Costs:

Note: Total Sustainability Infrastructure Costs are included within construction and other costs reported in this section. This breakout is provided for SRF review purposes.

Project Funding Sources:

Total Project Cost: **$2,300,000**

Total Committed Funding: **$1,400,000**

Funding Gap: **$900,000 (Partially Funded)**

☐ This project will be requesting SRF funding for Federal FY 2014.

Funding Source	Amount	Funding Status	Applicable Date
HB 380 Non-Coal Grant	$1,400,000	Committed	9/5/2007
Total:	$1,400,000		

Detailed Project Schedule:

Environmental Review Status:

RD Approval:

CDBG Approval:

No approval, but Cross-Cutter Scoping Completed:

Construction Permit Application Date:

Construction Permit Application Status:

KPDES Permit Application Date:

KPDES Permit Application Status:

Estimated Bid Date:

Estimated Construction Start Date:

Print Date:6/5/2013 Kentucky Infrastructure Authority 3 of 8

Clean Water Project Profile

SX21067001 - Lexington-Fayette Urban County Government
Comprehensive Sanitary Sewer Project - Remaining Unsewered Areas - Phase 1A - Town Branch Wastewater Treatment Plant

The following systems are beneficiaries of this project:

DOW PERMIT ID	System Name
KY0021491	LFUCG - Town Branch
KY0021504	LFUCG - West Hickman

Project Ranking by AWMPC:

Regional Ranking(s):

Planning Unit Ranking:

Total Points:

Plans and Specifications:

- ☐ Plans and specs have been sent to DOW.
- ☐ Plans and specs have been reviewed by DOW.
- ☐ Plans and specs have been sent to PSC.
- ☐ Plans and specs have been reviewed by PSC.

Demographic Impacts (GIS Census Overlay):

	For Project Area	For Included Systems(s)
Serviceable Population		**286,803**
Serviceable households		**131,302**
Med. Household Income		**$53,099**

New or Improved Service:

	Survey Based	GIS Census Overlay
To Unserved Households	252	
To Underserved Households		
To Total Households	**252**	

Economic Impacts:

Jobs Created	
Jobs Retained	

CW Specific Impacts:

Wastewater Volumes (MGD):

For this project:	
For included system(s):	**128.000**
Reduced by this project:	

Other CW Specific Impacts:

- ☐ This project provides regionalization and/or consolidation of wastewater treatment systems.
- ☐ This project includes an on-site mound, and/or decentralized WW treatment system.
- ☐ This project is necessary to achieve full or partial compliance with a court order, agreed order, or a judicial or administrative concent decree.
- ☐ This project achieves voluntary compliance (violation with no order).
- ☐ This project is consistent with the approved facility plan.
- ☐ This project will have a positive impact on drinking water sources within a 5 mile radius.

Print Date:6/5/2013 Kentucky Infrastructure Authority 4 of 8

Clean Water Project Profile

SX21067001 - Lexington-Fayette Urban County Government
Comprehensive Sanitary Sewer Project - Remaining Unsewered Areas - Phase 1A - Town Branch Wastewater Treatment Plant

Planning Needs:

- ☐ Combined Sewer Overflow (CSO) Correction.
- ☐ Sanitary Sewer Overflow (SSO) Correction.
- ☐ Replacement or Rehabilitation of Aging Infrastructure.
- ☐ New Treatment Plant.
- ☐ New Collector Sewers and Appurtenances.
- ☐ Decentralized Wastewater Treatment Systems.
- ☐ Upgrade to Advanced Treatment.
- ☐ Rehab/Upgrade/Expansion of Existing Treatment Plant.
- ☑ New Interceptor Sewers and Appurtenances.
- ☐ Storm Water Control.
- ☐ Non-Point Source (NPS) Pollution Control.
- ☐ Recycled Water Distribution.
- ☐ Planning.
- ☐ Other (specify):

Project Inventory (Mapped Features):

Point Features:

DOW Permit ID	Count	FeatureType	Purpose	Status	Existing Capacity	Proposed Capacity	Units

Line Features:

DOW Permit ID	Line Type	Purpose	Activity	Size (in.)	Material	Length (LF)
KY0021491	SEWER LINE	INTERCEPTOR	EXTENSION	8.00	PVC	32,357
					Total Length	32,357

Administrative Components:

☐ Planning ☐ Design ☑ Construction ☑ Management

Wastwater Treatment Plants Eliminated:

☐ This project includes the elimination of wastewater treatment plant(s).

Print Date:6/5/2013 Kentucky Infrastructure Authority 5 of 8

Clean Water Project Profile

SX21067001 - Lexington-Fayette Urban County Government
Comprehensive Sanitary Sewer Project - Remaining Unsewered Areas - Phase 1A - Town Branch Wastewater Treatment Plant

Sanitary Sewer Components:

☐ This project includes a new wastewater treatment plant.

Proposed design capacity (MGD): **0.000**

☐ This project includes an expansion of an existing wastewater treatment plant.

Current design capacity (MGD): **0.000**

Current treatment volume (MGD): **0.000**

Proposed design capacity (MGD): **0.000**

☐ This project includes rehabilitation of an existing wastewater treatment plant.

☐ This project includes upgrades to an existing wastewater treatment plant.

☐ This project includes rehabilitation or replacement of aging infractructure.

Total length of replaced infrastructure (LF): **0**

☐ This project includes new collector sewers.

Total length of replaced infrastructure (LF): **0**

☑ This project includes new interceptor sewers.

Total length of new interceptor sewer (LF): **32,357**

☑ This project includes elimination of existing sewer system components.

Number of raw sewage discharges eliminated: **0**

Number of failing septic systems eliminated: **0**

Number of non-failing septic systems eliminated: **150**

Sustainable Infrastructure - Green Infrastructure:

Green stormwater infrastructure includes a wide array of practices at multiple scales that manage wet weather and that maintains and restores natural hydrology by infiltrating, evapotranspiring and harvesting and using stormwater. On a regional scale, green infrastructure is the preservation and restoration of natural landscape features, such as forests, floodplains, and wetlands, coupled with policies such as infill and redevelopment that reduce overall imperviousness in a watershed. On the local scale, green infrastructure consists of site and neighborhood-specific practices, such as:

Component	Cost
☐ Bioretention	$0
☐ Trees	$0
☐ Green Roofs	$0
☐ Permeable Pavement	$0
☐ Cisterns	$0
☐ Constructed Wetlands	$0
☐ Urban Forestry Programs	$0
☐ Downspout Disconnection	$0
☐ Riparian Buffers and Wetlands	$0
☐ Sustainable Landscaping and Site Design	$0
☐ Purchase of land or easements on land for riparian and wetland protection or restoration.	$0
☐ Fencing to divert livestock from streams and stream buffers.*	$0
Total Green Infrastructure Cost:	**$0**

** Indicates a business case may be required for this item.*

There are no Green Infrastructure components specified for this project.

Print Date:6/5/2013 Kentucky Infrastructure Authority 6 of 8

Clean Water Project Profile

Legal Applicant:	**Lexington-Fayette Urban County Government**		
Project Title:	**North Elkhorn Diversion Pump Station and Force Main**		
Project Number:	**SX21067003** View Map	Submitted By:	**BGADD**
Funding Status:	**Not Funded**	Primary County:	**Fayette**
Project Status:	**Approved**	Planning Unit:	**Unit 6**
Project Schedule:	**0-2 Years**	Multi-County:	**No**
E-Clearinghouse SAI:	**KY200510191078**	ECH Status:	**Endorse**
Applicant Entity Type:	**City / Municipal Utility**		
Date Approved (AWMPC):	**11-03-2003**		

Project Description:

Construction of a new 13,200 GPM pump station for the purpose of sewering Urban service area expansion areas and balancing overall system wastewater flows between the two existing wastewater treatment plants. Related facilities would eliminate ssop priority #8 (future. Relieves ssop priorities #7 and #9.

Need for Project:
Briefly describe how this project promotes public health or achieves and/or maintains compliance with the Clean Water Act or Safe Drinking Water Act:
Project is needed to accommodate growth.

Project Alternatives:

Alternate A:
Complete project in phases.

Alternate B:
Construct smaller pump station.

Alternate C:
Do nothing.

Legal Applicant:

Entity Type:	**City / Municipal Utility**	PSC Group ID:	
Entity Name:	**Lexington-Fayette Urban County Government**		
Web URL:			
Office EMail:	**darenhol@lfucg.com**		
Office Phone:	**859-425-2525**	Toll Free:	Fax:
Mail Address Line 1:	**200 E Main St Div of Rev**	Phys Address Line 1:	
Mail Address Line 2:		Phys Address Line 2:	
Mail City, State Zip:	**Lexington, KY 40507**	Phys City, State Zip:	
Contact:	**Susan Lamb**	Manager:	**Richard Moloney**
Contact Title:	**City Clerk**	Manager Title:	**Public Works Director**
Contact EMail:	**susanl@lexingtonky.gov**	Manager EMail:	**rmoloney@lexingtonky.gov**
Contact Phone:	**859-258-3240**	Manager Phone:	**859-425-2255**
Contact Cell:		Manager Cell:	
Authorized Official:	**Jim Gray**		
Auth. Official Title:	**Mayor**		
Auth. Official EMail:	**mayor@lexingtonky.gov**		
Auth. Official Phone:	**859-258-3100**	Auth. Official Cell:	
Data Source:	**Kentucky Department for Local Government**		Date Last Modified: 06.05.2013

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Clean Water Project Profile

SX21067003 - Lexington-Fayette Urban County Government
North Elkhorn Diversion Pump Station and Force Main

Project Administrator (PA) Information

Name: **Charles H Martin**
Title: **Director of Water Quality**
Organization: **Lexington Fayette Urban County Government**
Address Line 1: **125 Lisle Industrial Avenue**
Address Line 2: **Suite 180**
City: **Lexington** State: **KY** Zip: **40511**
Phone: **859-425-2400** Fax:

Applicant Contact (AC) Information

Name: **Tiffany Rank**
Title: **Plant Engineer**
Organization: **Lexington Fayette Urban County Government**
Address Line 1: **301 Lisle Industrial Ave**
Address Line 2:
City: **Lexington** State: **KY** Zip: **40511**
Phone: **859-425-2405** Fax:

Project Engineer (PE) Information:

☒ This project requires a licensed Professional Engineer.

License No: **PE 15332**
PE Name: **Marwan Adel Rayan**
Phone: Fax:
E-Mail:
Firm Name:
Addr Line 1: **City of Lexington**
Addr Line 2: **101 E. Vine Street, 4th Floor**
Addr Line 3:
City: **Lexington** State: **KY** Zip: **40507**
Status: **Current** Disciplinary Actions: **NO**
Issued: **02-09-1988** Expires: **06-30-2014**

Print Date:6/5/2013 Kentucky Infrastructure Authority 2 of 8

Clean Water Project Profile

SX21067003 - Lexington-Fayette Urban County Government
North Elkhorn Diversion Pump Station and Force Main

Project Cost Classification:

Administrative Exp.:	
Legal Exp.:	
Land, Appraisals, Easements:	
Relocation Exp. & Payments:	
Planning:	
Engineering Fees - Design:	
Engineering Fees - Construction:	
Engineering Fees - Inspection:	
Engineering Fees - Other:	
Construction:	**$ 12,000,000**
Equipment:	
Miscellaneous:	
Contingencies:	
Total Project Cost:	**$ 12,000,000**

Construction Cost Categories:

WWTP Secondary Portion:	**$ 0**
WWTP Advanced Portion:	**$ 0**
Inflow & Infiltration Correction:	**$ 0**
Major Sewer Rehabilitation:	**$ 0**
Collector Sewers:	**$ 0**
Interceptor Sewers, including Pump Stations:	**$ 12,000,000**
Combined Sewer Overflow Correction:	**$ 0**
NPS Urban:	**$ 0**
Non-Categorized Cost:	
Total Construction:	**$ 12,000,000**

Total Sustainable Infrastructure Costs:

Note: Total Sustainability Infrastructure Costs are included within construction and other costs reported in this section. This breakout is provided for SRF review purposes.

Project Funding Sources:

Total Project Cost: **$12,000,000**

Total Committed Funding: **$0**

Funding Gap: **$12,000,000 (Not Funded)**

☐ This project will be requesting SRF funding for Federal FY 2014.

Funding Source	Amount	Funding Status	Applicable Date
Local	$12,000,000	Anticipated	N/A
Total:	$12,000,000		

Detailed Project Schedule:

Environmental Review Status:

RD Approval:

CDBG Approval:

No approval, but Cross-Cutter Scoping Completed:

Construction Permit Application Date:

Construction Permit Application Status:

KPDES Permit Application Date:

KPDES Permit Application Status:

Estimated Bid Date:

Estimated Construction Start Date:

Print Date:6/5/2013 Kentucky Infrastructure Authority 3 of 8

Clean Water Project Profile

SX21067003 - Lexington-Fayette Urban County Government
North Elkhorn Diversion Pump Station and Force Main

The following systems are beneficiaries of this project:

DOW PERMIT ID	System Name
KY0021491	LFUCG - Town Branch
KY0021504	LFUCG - West Hickman

Project Ranking by AWMPC:

Regional Ranking(s):

Planning Unit Ranking:

Total Points:

Plans and Specifications:

- ☐ Plans and specs have been sent to DOW.
- ☐ Plans and specs have been reviewed by DOW.
- ☐ Plans and specs have been sent to PSC.
- ☐ Plans and specs have been reviewed by PSC.

Demographic Impacts (GIS Census Overlay):

	For Project Area	For Included Systems(s)
Serviceable Population		**286,803**
Serviceable households		**131,302**
Med. Household Income		**$53,099**

New or Improved Service:

	Survey Based	GIS Census Overlay
To Unserved Households		
To Underserved Households		
To Total Households		

Economic Impacts:

Jobs Created	
Jobs Retained	

CW Specific Impacts:

Wastewater Volumes (MGD):

For this project:	
For included system(s):	**128.000**
Reduced by this project:	

Other CW Specific Impacts:

- ☐ This project provides regionalization and/or consolidation of wastewater treatment systems.
- ☐ This project includes an on-site mound, and/or decentralized WW treatment system.
- ☐ This project is necessary to achieve full or partial compliance with a court order, agreed order, or a judicial or administrative concent decree.
- ☐ This project achieves voluntary compliance (violation with no order).
- ☐ This project is consistent with the approved facility plan.
- ☐ This project will have a positive impact on drinking water sources within a 5 mile radius.

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Clean Water Project Profile

SX21067003 - Lexington-Fayette Urban County Government
North Elkhorn Diversion Pump Station and Force Main

Planning Needs:

- ☐ Combined Sewer Overflow (CSO) Correction.
- ☐ Sanitary Sewer Overflow (SSO) Correction.
- ☐ Replacement or Rehabilitation of Aging Infrastructure.
- ☐ New Treatment Plant.
- ☐ New Collector Sewers and Appurtenances.
- ☐ Decentralized Wastewater Treatment Systems.
- ☐ Upgrade to Advanced Treatment.
- ☐ Rehab/Upgrade/Expansion of Existing Treatment Plant.
- ☑ New Interceptor Sewers and Appurtenances.
- ☐ Storm Water Control.
- ☐ Non-Point Source (NPS) Pollution Control.
- ☐ Recycled Water Distribution.
- ☐ Planning.
- ☐ Other (specify):

Project Inventory (Mapped Features):

Point Features:

DOW Permit ID	Count	FeatureType	Purpose	Status	Existing Capacity	Proposed Capacity	Units
KY0021491	1	LIFTSTATION		NEW		13,200.00	GPM

Line Features:

DOW Permit ID	Line Type	Purpose	Activity	Size (in.)	Material	Length (LF)
KY0021491	SEWER LINE	INTERCEPTOR	EXTENSION	8.00	PVC	39,948
					Total Length	39,948

Administrative Components:

☐ Planning ☑ Design ☑ Construction ☑ Management

Wastwater Treatment Plants Eliminated:

☐ This project includes the elimination of wastewater treatment plant(s).

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Clean Water Project Profile

SX21067003 - Lexington-Fayette Urban County Government
North Elkhorn Diversion Pump Station and Force Main

Sanitary Sewer Components:

☐ This project includes a new wastewater treatment plant.

Proposed design capacity (MGD): **0.000**

☐ This project includes an expansion of an existing wastewater treatment plant.

Current design capacity (MGD): **0.000**

Current treatment volume (MGD): **0.000**

Proposed design capacity (MGD): **0.000**

☐ This project includes rehabilitation of an existing wastewater treatment plant.

☐ This project includes upgrades to an existing wastewater treatment plant.

☐ This project includes rehabilitation or replacement of aging infractructure.

Total length of replaced infrastructure (LF): **0**

☐ This project includes new collector sewers.

Total length of replaced infrastructure (LF): **0**

☑ This project includes new interceptor sewers.

Total length of new interceptor sewer (LF): **39,948**

☐ This project includes elimination of existing sewer system components.

Number of raw sewage discharges eliminated: **0**

Number of failing septic systems eliminated: **0**

Number of non-failing septic systems eliminated: **0**

Sustainable Infrastructure - Green Infrastructure:

Green stormwater infrastructure includes a wide array of practices at multiple scales that manage wet weather and that maintains and restores natural hydrology by infiltrating, evapotranspiring and harvesting and using stormwater. On a regional scale, green infrastructure is the preservation and restoration of natural landscape features, such as forests, floodplains, and wetlands, coupled with policies such as infill and redevelopment that reduce overall imperviousness in a watershed. On the local scale, green infrastructure consists of site and neighborhood-specific practices, such as:

Component	Cost
☐ Bioretention	$0
☐ Trees	$0
☐ Green Roofs	$0
☐ Permeable Pavement	$0
☐ Cisterns	$0
☐ Constructed Wetlands	$0
☐ Urban Forestry Programs	$0
☐ Downspout Disconnection	$0
☐ Riparian Buffers and Wetlands	$0
☐ Sustainable Landscaping and Site Design	$0
☐ Purchase of land or easements on land for riparian and wetland protection or restoration.	$0
☐ Fencing to divert livestock from streams and stream buffers.*	$0
Total Green Infrastructure Cost:	**$0**

** Indicates a business case may be required for this item.*

There are no Green Infrastructure components specified for this project.

Print Date:6/5/2013 Kentucky Infrastructure Authority 6 of 8

Clean Water Project Profile

Legal Applicant:	**Lexington-Fayette Urban County Government**		
Project Title:	**Expansion Area 2A Class A Pump Station and Trunk Sewer**		
Project Number:	**SX21067006** View Map	Submitted By:	**BGADD**
Funding Status:	**Partially Funded**	Primary County:	**Fayette**
Project Status:	**Under Construction**	Planning Unit:	**Unit 6**
Project Schedule:	**0-2 Years**	Multi-County:	**No**
E-Clearinghouse SAI:	**KY200907151407**	ECH Status:	**Endorse With Condition**
Applicant Entity Type:	**City / Municipal Utility**		
Date Approved (AWMPC):	**01-13-2004**		

Project Description:

Expansion area 2A, brought into Lexington's Urban service area in 1996, is experiencing rapid development. This project will design and construct system trunk sewers and a 7,400 GPM class a pump station recommended by the 1999 LFUCG 201 facilities planning study update. The construction of this project will eliminate four (4) existing interim pump stations and allow for planned development in the zoned expansion area of Fayette County.

Need for Project:
Briefly describe how this project promotes public health or achieves and/or maintains compliance with the Clean Water Act or Safe Drinking Water Act:

Provide for the orderly development of Lexington's expansion area 2A, minimizing the quantity of lines and pumps to maintain, thus limiting future I/I and overflow potential.

Project Alternatives:

Alternate A:

Do nothing- allow private development to continue a patchwork of small, temporary pumping factilities, increasing demands on the norht elkhorn force main. An amendment to the 201 plan would be required. "do nothing" is not a suitable alternative.

Alternate B:

Construct a new WWTP in rural Fayette County, farther downstream on north elkhorn creek. This alternate was considered but not adopted or recommended bu the 201 plan. Additional gravity lines would be required to reach the WWTP.

Alternate C:

Do nothing.

Legal Applicant:

Entity Type:	**City / Municipal Utility**	PSC Group ID:	
Entity Name:	**Lexington-Fayette Urban County Government**		
Web URL:			
Office EMail:	**darenhol@lfucg.com**		
Office Phone:	**859-425-2525**	Toll Free:	Fax:
Mail Address Line 1:	**200 E Main St Div of Rev**	Phys Address Line 1:	
Mail Address Line 2:		Phys Address Line 2:	
Mail City, State Zip:	**Lexington, KY 40507**	Phys City, State Zip:	
Contact:	**Susan Lamb**	Manager:	**Richard Moloney**
Contact Title:	**City Clerk**	Manager Title:	**Public Works Director**
Contact EMail:	**susanl@lexingtonky.gov**	Manager EMail:	**rmoloney@lexingtonky.gov**
Contact Phone:	**859-258-3240**	Manager Phone:	**859-425-2255**
Contact Cell:		Manager Cell:	
Authorized Official:	**Jim Gray**		
Auth. Official Title:	**Mayor**		
Auth. Official EMail:	**mayor@lexingtonky.gov**		
Auth. Official Phone:	**859-258-3100**	Auth. Official Cell:	
Data Source:	**Kentucky Department for Local Government**		Date Last Modified: 06.05.2013

Print Date:6/5/2013 Kentucky Infrastructure Authority 1 of 8

Clean Water Project Profile

SX21067006 - Lexington-Fayette Urban County Government
Expansion Area 2A Class A Pump Station and Trunk Sewer

Project Administrator (PA) Information

Name: **LaJoyce Mullins-Williams**
Title: **Project Engineering Coordinator**
Organization: **Division of Water Quality**
Address Line 1: **301 Lisle Industrial Avenue**
Address Line 2:
City: **Lexington** State: **KY** Zip: **40511**
Phone: **859-434-2580** Fax:

Applicant Contact (AC) Information

Name: **Charles H Martin**
Title: **Director of Water Quality**
Organization: **Lexington Fayette Urban County Government**
Address Line 1: **125 Lisle Industrial Avenue**
Address Line 2: **Suite 180**
City: **Lexington** State: **KY** Zip: **40511**
Phone: **859-425-2400** Fax:

Project Engineer (PE) Information:

☒ This project requires a licensed Professional Engineer.

License No: **PE 13555**
PE Name: **Joseph Lee Henry**
Phone: **859-223-3999** Fax: **859-223-8917**
E-Mail: **jhenry@grwinc.com**
Firm Name: **GRW Engineers, Inc.**
Addr Line 1: **GRW Engineers**
Addr Line 2: **801 Corporate Dr., Ste. 400**
Addr Line 3:
City: **Lexington** State: **KY** Zip: **40503**
Status: **Current** Disciplinary Actions: **NO**
Issued: **07-21-1983** Expires: **06-30-2013**

Engineering Firm Information:

Permit No: **87**
Firm Name: **GRW Engineers, Inc.**
Phone: **859-223-3999** Fax: **859-223-8917**
Web URL: **http://www.grwinc.com/**
EMail: **rfoster@grwinc.com**
Addr Line 1: **801 Corporate Drive**
Addr Line 2:
City: **Lexington** State: **KY** Zip: **40503**
Status: **Current** Disciplinary Actions: **NO**
Issued: **03-02-1993** Expires: **12-31-2013**

Print Date:6/5/2013 Kentucky Infrastructure Authority 2 of 8

Clean Water Project Profile

SX21067006 - Lexington-Fayette Urban County Government
Expansion Area 2A Class A Pump Station and Trunk Sewer

Project Cost Classification:

Administrative Exp.:	
Legal Exp.:	
Land, Appraisals, Easements:	**$ 750,000**
Relocation Exp. & Payments:	
Planning:	**$ 20,000**
Engineering Fees - Design:	**$ 225,000**
Engineering Fees - Construction:	**$ 130,000**
Engineering Fees - Inspection:	**$ 200,000**
Engineering Fees - Other:	**$ 95,000**
Construction:	**$ 6,500,000**
Equipment:	
Miscellaneous:	
Contingencies:	**$ 580,000**
Total Project Cost:	**$ 8,500,000**

Construction Cost Categories:

WWTP Secondary Portion:	
WWTP Advanced Portion:	
Inflow & Infiltration Correction:	
Major Sewer Rehabilitation:	
Collector Sewers:	**$ 6,500,000**
Interceptor Sewers, including Pump Stations:	
Combined Sewer Overflow Correction:	
NPS Urban:	
Non-Categorized Cost:	
Total Construction:	**$ 6,500,000**

Total Sustainable Infrastructure Costs:

Note: Total Sustainability Infrastructure Costs are included within construction and other costs reported in this section. This breakout is provided for SRF review purposes.

Project Funding Sources:

Total Project Cost: **$8,500,000**

Total Committed Funding: **$3,100,000**

Funding Gap: **$5,400,000 (Partially Funded)**

☐ This project will be requesting SRF funding for Federal FY 2014.

Funding Source	Amount	Funding Status	Applicable Date
HB 608 Non-Coal Grant	$3,100,000	Committed	8/1/2009
KIA SRF Fund A Loan (CW)	$5,400,000	Anticipated	N/A
Total:	$8,500,000		

Detailed Project Schedule:

Environmental Review Status:

RD Approval:

CDBG Approval:

No approval, but Cross-Cutter Scoping Completed:

Construction Permit Application Date:

Construction Permit Application Status:

KPDES Permit Application Date:

KPDES Permit Application Status:

Estimated Bid Date:

Estimated Construction Start Date: **11-21-2012**

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Clean Water Project Profile

SX21067006 - Lexington-Fayette Urban County Government
Expansion Area 2A Class A Pump Station and Trunk Sewer

The following systems are beneficiaries of this project:

DOW PERMIT ID	System Name
KY0021504	LFUCG - West Hickman

Project Ranking by AWMPC:

Regional Ranking(s):

Planning Unit Ranking:

Total Points:

Plans and Specifications:

- [x] Plans and specs have been sent to DOW. 7/1/2011
- [x] Plans and specs have been reviewed by DOW. 8/1/2011
- [ ] Plans and specs have been sent to PSC.
- [ ] Plans and specs have been reviewed by PSC.

Demographic Impacts (GIS Census Overlay):

	For Project Area	For Included Systems(s)
Serviceable Population		164,967
Serviceable households		76,746
Med. Household Income		$59,551

New or Improved Service:

	Survey Based	GIS Census Overlay
To Unserved Households		
To Underserved Households		
To Total Households		

Economic Impacts:

Jobs Created	
Jobs Retained	

CW Specific Impacts:

Wastewater Volumes (MGD):

For this project:	
For included system(s):	64.000
Reduced by this project:	

Other CW Specific Impacts:

- [x] This project provides regionalization and/or consolidation of wastewater treatment systems.
- [ ] This project includes an on-site mound, and/or decentralized WW treatment system.
- [ ] This project is necessary to achieve full or partial compliance with a court order, agreed order, or a judicial or administrative concent decree.
- [ ] This project achieves voluntary compliance (violation with no order).
- [x] This project is consistent with the approved facility plan.
- [ ] This project will have a positive impact on drinking water sources within a 5 mile radius.

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Clean Water Project Profile

SX21067006 - Lexington-Fayette Urban County Government
Expansion Area 2A Class A Pump Station and Trunk Sewer

Planning Needs:

- ☐ Combined Sewer Overflow (CSO) Correction.
- ☐ Sanitary Sewer Overflow (SSO) Correction.
- ☑ Replacement or Rehabilitation of Aging Infrastructure.
- ☐ New Treatment Plant.
- ☐ New Collector Sewers and Appurtenances.
- ☐ Decentralized Wastewater Treatment Systems.
- ☐ Upgrade to Advanced Treatment.
- ☐ Rehab/Upgrade/Expansion of Existing Treatment Plant.
- ☑ New Interceptor Sewers and Appurtenances.
- ☐ Storm Water Control.
- ☐ Non-Point Source (NPS) Pollution Control.
- ☐ Recycled Water Distribution.
- ☐ Planning.
- ☐ Other (specify):

Project Inventory (Mapped Features):

Point Features:

DOW Permit ID	Count	FeatureType	Purpose	Status	Existing Capacity	Proposed Capacity	Units
KY0021491	1	LIFTSTATION		REHAB		10.50	MGD

Line Features:

DOW Permit ID	Line Type	Purpose	Activity	Size (in.)	Material	Length (LF)
KY0021491	SEWER LINE	INTERCEPTOR	EXTENSION	8.00	DUCTILE IRON	6,631
KY0021491	SEWER LINE	INTERCEPTOR	REHAB - REPLACE PROBLEM LINES	8.00	DUCTILE IRON	1,836
KY0021491	SEWER LINE	INTERCEPTOR	EXTENSION	10.00	DUCTILE IRON	1,641
					Total Length	10,108

Administrative Components:

☑ Planning ☑ Design ☑ Construction ☐ Management

Wastwater Treatment Plants Eliminated:

☐ This project includes the elimination of wastewater treatment plant(s).

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Clean Water Project Profile

SX21067006 - Lexington-Fayette Urban County Government
Expansion Area 2A Class A Pump Station and Trunk Sewer

Sanitary Sewer Components:

☐ This project includes a new wastewater treatment plant.

Proposed design capacity (MGD): **0.000**

☐ This project includes an expansion of an existing wastewater treatment plant.

Current design capacity (MGD): **0.000**

Current treatment volume (MGD): **0.000**

Proposed design capacity (MGD): **0.000**

☐ This project includes rehabilitation of an existing wastewater treatment plant.

☐ This project includes upgrades to an existing wastewater treatment plant.

☑ This project includes rehabilitation or replacement of aging infractructure.

Total length of replaced infrastructure (LF): **1,836**

☐ This project includes new collector sewers.

Total length of replaced infrastructure (LF): **0**

☑ This project includes new interceptor sewers.

Total length of new interceptor sewer (LF): **8,272**

☐ This project includes elimination of existing sewer system components.

Number of raw sewage discharges eliminated: **0**

Number of failing septic systems eliminated: **0**

Number of non-failing septic systems eliminated: **0**

Sustainable Infrastructure - Green Infrastructure:

Green stormwater infrastructure includes a wide array of practices at multiple scales that manage wet weather and that maintains and restores natural hydrology by infiltrating, evapotranspiring and harvesting and using stormwater. On a regional scale, green infrastructure is the preservation and restoration of natural landscape features, such as forests, floodplains, and wetlands, coupled with policies such as infill and redevelopment that reduce overall imperviousness in a watershed. On the local scale, green infrastructure consists of site and neighborhood-specific practices, such as:

	Component	Cost
☒	Bioretention	**$5,000**
☐	Trees	
☐	Green Roofs	
☒	Permeable Pavement	**$45,000**
☐	Cisterns	
☐	Constructed Wetlands	
☐	Urban Forestry Programs	
☐	Downspout Disconnection	
☐	Riparian Buffers and Wetlands	
☐	Sustainable Landscaping and Site Design	
☐	Purchase of land or easements on land for riparian and wetland protection or restoration.	
☐	Fencing to divert livestock from streams and stream buffers.*	
	Total Green Infrastructure Cost:	**$50,000**

** Indicates a business case may be required for this item.*

Project design will include the use of permeable pavement and bioretention.

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Clean Water Project Profile

SX21067006 - Lexington-Fayette Urban County Government
Expansion Area 2A Class A Pump Station and Trunk Sewer

Sustainable Infrastructure - Water Efficiency:

The use of improved technologies and practices to deliver equal or better services with less water. Water efficiency encompasses conservation and reuse efforts, as well as water loss reduction and prevention, to protect water resources for the future. Examples include:

	Component	Cost
☒	Installing or retrofitting water efficient devices such as plumbing fixtures and appliances (toilets, showerheads, urinals).	$5,000
☐	Installing any type of water meter in previously unmetered areas (can include backflow prevention if in conjunction with meter replacement).	
☐	Replacing existing broken/malfunctioning water meters with AMR or smart meters, meters with leak detection, backflow prevention.	
☐	Retrofitting/Adding AMR capabilities or leak equipment to existing meters.	
☐	Developing water audit and conservation plans, which are reasonably expected to result in a capital project.	
☐	Recycling and water reuse projects that replace potable sources with non-potable sources (Gray water, condensate, and wastewater effluent reuse systems, extra treatment or distribution costs associated with water reuse).	
☐	Retrofit or replacement of existing landscape irrigation/agricultural systems to more efficient landscape/agricultural irrigation systems (rain and moisture sensing equipment).	
☐	Water meter replacement with traditional water meters.*	
☐	Projects that result from a water audit or water conservation plan.*	
☐	Storage tank replacement/rehabilitation to reduce water loss.*	
☐	New water efficient landscape/agricultural irrigation system, where there currently is not one.*	
	Total Water Efficiency Cost:	**$5,000**

** Indicates a business case may be required for this item*

Pump station will use water efficient devices.

Sustainable Infrastructure - Energy Efficiency:

Energy efficiency is the use of improved technologies and practices to reduce the energy consumption of water projects, use energy in a more efficient way, and/or produce/utilize renewable energy. Examples include:

	Component	Cost
☐	Renewable energy projects such as wind, solar, geothermal, and micro-hydroelectric, and biogas combined heat and power systems that provide power to a POTW.	
☐	POTW-owned renewable energy projects.	
☐	Collection system infiltration/inflow (I/I) detection equipment.	
☐	POTW energy management planning, including energy assessments, energy audits, optimization studies, and sub-metering of individual processes to determine high energy use areas.	
☒	Projects that achieve a reduction in energy consumption (pumps, motors).*	$175,000
☐	Projects that cost effectively eliminate pumps or pumping stations.*	
☐	I/I correction projects that save energy from pumping and reduced treatment costs.*	
☐	I/I correction where excessive groundwater infiltration is contaminating the influent requiring otherwise unnecessary treatment processes.*	
☐	Replacing old motors with premium energy efficiency motors.*	
☐	Upgrade of POTW lighting to energy efficient sources.*	
☐	SCADA systems where substantial energy savings can be demonstrated.*	
☒	Variable Frequency Drive (VFD) controllers where substantial energy savings can be demonstrated.*	$175,000
	Total Energy Efficiency Cost:	**$350,000**

** Indicates a business case may be required for this item.*

Pump station retrofit will utilize energy efficient pumps and variable frequence drive controllers.

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Clean Water Project Profile

Legal Applicant:	**Lexington-Fayette Urban County Government**		
Project Title:	**Various Stormwater Management Projects - Phase 2**		
Project Number:	**SX21067047** View Map	Submitted By:	**BGADD**
Funding Status:	**Partially Funded**	Primary County:	**Fayette**
Project Status:	**Approved**	Planning Unit:	**Unit 6**
Project Schedule:	**0-2 Years**	Multi-County:	**No**
E-Clearinghouse SAI:	**KY201303140221**	ECH Status:	**Endorse With Condition**
Applicant Entity Type:	**City / Municipal Utility**		
Date Approved (AWMPC):	**12-09-2011**		

Project Description:

From it's existing storm-water priority project list, LFUCG has identified $3,731,640 in storm-water management projects. The project list includes both water quality and water quantity (flooding) control projects. Included in this project list are numerous flood abatement projects. LFUCG's Consent Decree with USEPA and the Commonwealth of Kentucky requires LFUCG to complete $30 million in storm-water flood abatement projects over the next 10 years.

Walhampton - The Walhampton Stormwater Improvement project will mitigate chronic flooding in an older neighborhood near the intersection of Nicholasville Road and Man O War Blvd. The $1,396,000 project cost includes the purchase and demolition of two flood-prone residential structures. The purchase of these structures will be 100% funded by LFUCG capital funds. The loan requested funding is to construct stormwater detention basins and approximately 1,500 linear feet of 30 - 54 inch pipe with various inlet structures.

Rogers Road - This area has an extensive history of flooding. Flooding issues include overland flooding in multiple areas and major street flooding at the intersection of Rogers Rd. and Allen Dr. The solution will include curb inlets, a headwall, multiple manholes and demolition of existing pipe, curb and sidewalk replacement, repaving pipe trenches, site restoration and easements. This project will cost approximately $1,621,000 to complete.

Cardinal-Laramie - will mitigate chronic flooding in an older neighborhood near Clays Mill Road and Lane Allen Road. The project is being constructed in three phases at a total cost of $703,540. Phase 1 includes 118 linear feet of 18-ich storm, a 4x4 box culvert (replacing a failing CMP culvert), 60 linear feet of sanitary pipe and streambank stabilization. The second and third phases will include approxiamtely 700 linear feet of storm sewer replacement with replaced / additional inlets.

Idle Hour - he Idle Hour Stormwater Improvement project will mitigate chronic flooding in the Idle Hour neighborhood upstream from Reservoir #1, which is a potable water source for Kentucky American Water Company. This project is an LFUCG priority stormwater improvement project and is part of LFUCG's commitment for meeting its Consent Decree requirements. This $539,100 project proposes realignment and upsizing of the existing storm sewer system with the installation of approximately 2,200 linear feet of storm water conveyance system ranging from 18-inch to 42-inch diameter piping.

Perimeter Park - The Perimter Park Stormwater Improvement project will mitigate chronic flooding in a commerical area near the intersection of Alumni Drive and New Circle Road. The $45,000 project cost involves the construction of a 15 and 18 inch storm sewer to connect an upstream deten

Need for Project:

Briefly describe how this project promotes public health or achieves and/or maintains compliance with the Clean Water Act or Safe Drinking Water Act:

LFUCG's Consent Decree with USEPA and the Commonwealth of Kentucky requires LFUCG to complete $30 million in stormwater flood abatement projects over the next 10 years.

Project Alternatives:

Alternate A:

Eliminate impervious surfaces upstream from each project area.

Alternate B:

Purchase all properties within the project area.

Alternate C:

Do nothing. Pay fines required by the Consent Decree, ignore the costs associated with damage to public/ private property and continue placing public at risk by allowing flooding within the project areas.

Clean Water Project Profile

SX21067047 - Lexington-Fayette Urban County Government
Various Stormwater Management Projects - Phase 2

Legal Applicant:

Entity Type:	City / Municipal Utility	PSC Group ID:	
Entity Name:	Lexington-Fayette Urban County Government		
Web URL:			
Office EMail:	darenhol@lfucg.com		
Office Phone:	859-425-2525	Toll Free:	Fax:
Mail Address Line 1:	200 E Main St Div of Rev	Phys Address Line 1:	
Mail Address Line 2:		Phys Address Line 2:	
Mail City, State Zip:	Lexington, KY 40507	Phys City, State Zip:	
Contact:	Susan Lamb	Manager:	Richard Moloney
Contact Title:	City Clerk	Manager Title:	Public Works Director
Contact EMail:	susanl@lexingtonky.gov	Manager EMail:	rmoloney@lexingtonky.gov
Contact Phone:	859-258-3240	Manager Phone:	859-425-2255
Contact Cell:		Manager Cell:	
Authorized Official:	Jim Gray		
Auth. Official Title:	Mayor		
Auth. Official EMail:	mayor@lexingtonky.gov		
Auth. Official Phone:	859-258-3100	Auth. Official Cell:	
Data Source:	Kentucky Department for Local Government	Date Last Modified:	06.05.2013

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Clean Water Project Profile

SX21067047 - Lexington-Fayette Urban County Government
Various Stormwater Management Projects - Phase 2

Project Administrator (PA) Information

Name: **Greg Lubeck**
Title: **Program Manager**
Organization: **Lexington Fayette Urban County Government - Division of Water Quality**
Address Line 1: **125 Lisle Industrial Ave.**
Address Line 2: **Suite 180**
City: **Lexington** State: **KY** Zip: **40511**
Phone: **859-258-3446** Fax: **859-254-7787**

Applicant Contact (AC) Information

Name: **Charles H Martin**
Title: **Director of Water Quality**
Organization: **Lexington Fayette Urban County Government**
Address Line 1: **125 Lisle Industrial Avenue**
Address Line 2: **Suite 180**
City: **Lexington** State: **KY** Zip: **40511**
Phone: **859-425-2400** Fax:

Project Engineer (PE) Information:

☐ This project requires a licensed Professional Engineer.

PE Exemption Explanation:

Have not yet procurred an engineer.

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Clean Water Project Profile

SX21067047 - Lexington-Fayette Urban County Government
Various Stormwater Management Projects - Phase 2

Estimated Budget

Project Cost Classification:

Administrative Exp.:	
Legal Exp.:	
Land, Appraisals, Easements:	**$ 138,815**
Relocation Exp. & Payments:	
Planning:	
Engineering Fees - Design:	**$ 369,980**
Engineering Fees - Construction:	
Engineering Fees - Inspection:	
Engineering Fees - Other:	
Construction:	**$ 3,797,845**
Equipment:	
Miscellaneous:	
Contingencies:	
Total Project Cost:	**$ 4,306,640**

Construction Cost Categories:

WWTP Secondary Portion:	
WWTP Advanced Portion:	
Inflow & Infiltration Correction:	
Major Sewer Rehabilitation:	
Collector Sewers:	
Interceptor Sewers, including Pump Stations:	
Combined Sewer Overflow Correction:	
NPS Urban:	
Non-Categorized Cost:	**$ 3,797,845**
Total Construction:	**$ 3,797,845**

Total Sustainable Infrastructure Costs:

Note: Total Sustainability Infrastructure Costs are included within construction and other costs reported in this section. This breakout is provided for SRF review purposes.

Project Funding Sources:

Total Project Cost: **$4,306,640**

Total Committed Funding: **$575,000**

Funding Gap: **$3,731,640 (Partially Funded)**

☐ This project will be requesting SRF funding for Federal FY 2014.

Funding Source	Amount	Funding Status	Applicable Date
KIA SRF Fund A Loan (CW)	$3,731,640	Anticipated	N/A
Local	$575,000	Committed	7/1/2012
Total:	$4,306,640		

Detailed Project Schedule:

Environmental Review Status:	
RD Approval:	
CDBG Approval:	
No approval, but Cross-Cutter Scoping Completed:	
Construction Permit Application Date:	
Construction Permit Application Status:	
KPDES Permit Application Date:	
KPDES Permit Application Status:	
Estimated Bid Date:	**08-18-2013**
Estimated Construction Start Date:	**01-01-2014**

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Clean Water Project Profile

SX21067047 - Lexington-Fayette Urban County Government
Various Stormwater Management Projects - Phase 2

The following systems are beneficiaries of this project:

DOW PERMIT ID	System Name
KY0021491	LFUCG - Town Branch

Project Ranking by AWMPC:

Regional Ranking(s):

Planning Unit Ranking:

Total Points:

Plans and Specifications:

- ☐ Plans and specs have been sent to DOW.
- ☐ Plans and specs have been reviewed by DOW.
- ☐ Plans and specs have been sent to PSC.
- ☐ Plans and specs have been reviewed by PSC.

Demographic Impacts (GIS Census Overlay):

	For Project Area	For Included Systems(s)
Serviceable Population		121,836
Serviceable households		54,556
Med. Household Income		$44,024

New or Improved Service:

	Survey Based	GIS Census Overlay
To Unserved Households		
To Underserved Households		
To Total Households		

Economic Impacts:

Jobs Created	
Jobs Retained	

CW Specific Impacts:

Wastewater Volumes (MGD):

For this project:	
For included system(s):	64.000
Reduced by this project:	

Other CW Specific Impacts:

- ☐ This project provides regionalization and/or consolidation of wastewater treatment systems.
- ☐ This project includes an on-site mound, and/or decentralized WW treatment system.
- ☑ This project is necessary to achieve full or partial compliance with a court order, agreed order, or a judicial or administrative concent decree.
- ☐ This project achieves voluntary compliance (violation with no order).
- ☐ This project is consistent with the approved facility plan.
- ☐ This project will have a positive impact on drinking water sources within a 5 mile radius.

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Clean Water Project Profile

SX21067047 - Lexington-Fayette Urban County Government
Various Stormwater Management Projects - Phase 2

Planning Needs:

- ☐ Combined Sewer Overflow (CSO) Correction.
- ☐ Sanitary Sewer Overflow (SSO) Correction.
- ☑ Replacement or Rehabilitation of Aging Infrastructure.
- ☐ New Treatment Plant.
- ☐ New Collector Sewers and Appurtenances.
- ☐ Decentralized Wastewater Treatment Systems.
- ☐ Upgrade to Advanced Treatment.
- ☐ Rehab/Upgrade/Expansion of Existing Treatment Plant.
- ☐ New Interceptor Sewers and Appurtenances.
- ☑ Storm Water Control.
- ☑ Non-Point Source (NPS) Pollution Control.
- ☐ Recycled Water Distribution.
- ☐ Planning.
- ☐ Other (specify):

Project Inventory (Mapped Features):

Point Features:

DOW Permit ID	Count	FeatureType	Purpose	Status	Existing Capacity	Proposed Capacity	Units
KY0021491	2	STORM SEWER IMPROVEMENTS		NEW			EA
KY0021491	2	STORM SEWER IMPROVEMENTS		REHAB			EA
KY0021504	1	STORM SEWER IMPROVEMENTS		NEW			EA

Line Features:

DOW Permit ID	Line Type	Purpose	Activity	Size (in.)	Material	Length (LF)
KY0021491	SEWER LINE	INTERCEPTOR	REHAB - REPLACE OBSOLETE OR AGING LINES	8.00	UNKNOWN	20,214
KY0021504	SEWER LINE	INTERCEPTOR	REHAB - REPLACE OBSOLETE OR AGING LINES	8.00	UNKNOWN	403
					Total Length	20,617

Administrative Components:

☐ Planning ☑ Design ☑ Construction ☑ Management

Wastwater Treatment Plants Eliminated:

☐ This project includes the elimination of wastewater treatment plant(s).

Clean Water Project Profile

SX21067047 - Lexington-Fayette Urban County Government
Various Stormwater Management Projects - Phase 2

Sanitary Sewer Components:

- ☐ This project includes a new wastewater treatment plant.
  - Proposed design capacity (MGD): **0.000**
- ☐ This project includes an expansion of an existing wastewater treatment plant.
  - Current design capacity (MGD): **0.000**
  - Current treatment volume (MGD): **0.000**
  - Proposed design capacity (MGD): **0.000**
- ☐ This project includes rehabilitation of an existing wastewater treatment plant.
- ☐ This project includes upgrades to an existing wastewater treatment plant.
- ☑ This project includes rehabilitation or replacement of aging infractructure.
  - Total length of replaced infrastructure (LF): **20,617**
- ☐ This project includes new collector sewers.
  - Total length of replaced infrastructure (LF): **0**
- ☐ This project includes new interceptor sewers.
  - Total length of new interceptor sewer (LF): **0**
- ☐ This project includes elimination of existing sewer system components.
  - Number of raw sewage discharges eliminated:
  - Number of failing septic systems eliminated:
  - Number of non-failing septic systems eliminated:

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Clean Water Project Profile

SX21067047 - Lexington-Fayette Urban County Government
Various Stormwater Management Projects - Phase 2

Sustainable Infrastructure - Green Infrastructure:

Green stormwater infrastructure includes a wide array of practices at multiple scales that manage wet weather and that maintains and restores natural hydrology by infiltrating, evapotranspiring and harvesting and using stormwater. On a regional scale, green infrastructure is the preservation and restoration of natural landscape features, such as forests, floodplains, and wetlands, coupled with policies such as infill and redevelopment that reduce overall imperviousness in a watershed. On the local scale, green infrastructure consists of site and neighborhood-specific practices, such as:

	Component	Cost
☒	Bioretention	**$15,000**
☒	Trees	**$15,000**
☐	Green Roofs	
☐	Permeable Pavement	
☐	Cisterns	
☐	Constructed Wetlands	
☐	Urban Forestry Programs	
☐	Downspout Disconnection	
☒	Riparian Buffers and Wetlands	**$10,000**
☐	Sustainable Landscaping and Site Design	
☒	Purchase of land or easements on land for riparian and wetland protection or restoration.	**$10,000**
☐	Fencing to divert livestock from streams and stream buffers.*	
	Total Green Infrastructure Cost:	**$50,000**

** Indicates a business case may be required for this item.*

Bioretention Area/Bioswale is proposed as part of Area 4 of the Cardinal/Laramie storm drainage project. Riparian buffer and easement acquisition is anticipated for the Rogers Road storm drainage project. Trees are expected to be planted as part of most if not all of the proposed various projects.

Sustainable Infrastructure - Water Efficiency:

The use of improved technologies and practices to deliver equal or better services with less water. Water efficiency encompasses conservation and reuse efforts, as well as water loss reduction and prevention, to protect water resources for the future. Examples include:

	Component	Cost
☐	Installing or retrofitting water efficient devices such as plumbing fixtures and appliances (toilets, showerheads, urinals).	
☐	Installing any type of water meter in previously unmetered areas (can include backflow prevention if in conjunction with meter replacement).	
☐	Replacing existing broken/malfunctioning water meters with AMR or smart meters, meters with leak detection, backflow prevention.	
☐	Retrofitting/Adding AMR capabilities or leak equipment to existing meters.	
☐	Developing water audit and conservation plans, which are reasonably expected to result in a capital project.	
☐	Recycling and water reuse projects that replace potable sources with non-potable sources (Gray water, condensate, and wastewater effluent reuse systems, extra treatment or distribution costs associated with water reuse).	
☐	Retrofit or replacement of existing landscape irrigation/agricultural systems to more efficient landscape/agricultural irrigation systems (rain and moisture sensing equipment).	
☐	Water meter replacement with traditional water meters.*	
☐	Projects that result from a water audit or water conservation plan.*	
☐	Storage tank replacement/rehabilitation to reduce water loss.*	
☐	New water efficient landscape/agricultural irrigation system, where there currently is not one.*	
	Total Water Efficiency Cost:	**$0**

** Indicates a business case may be required for this item*

There are no Water Efficiency components specified for this project.

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Clean Water Project Profile

SX21067047 - Lexington-Fayette Urban County Government
Various Stormwater Management Projects - Phase 2

Sustainable Infrastructure - Energy Efficiency:

Energy efficiency is the use of improved technologies and practices to reduce the energy consumption of water projects, use energy in a more efficient way, and/or produce/utilize renewable energy. Examples include:

	Component	Cost
☐	Renewable energy projects such as wind, solar, geothermal, and micro-hydroelectric, and biogas combined heat and power systems that provide power to a POTW.	
☐	POTW-owned renewable energy projects.	
☐	Collection system infiltration/inflow (I/I) detection equipment.	
☐	POTW energy management planning, including energy assessments, energy audits, optimization studies, and sub-metering of individual processes to determine high energy use areas.	
☐	Projects that achieve a reduction in energy consumption (pumps, motors).*	
☐	Projects that cost effectively eliminate pumps or pumping stations.*	
☐	I/I correction projects that save energy from pumping and reduced treatment costs.*	
☐	I/I correction where excessive groundwater infiltration is contaminating the influent requiring otherwise unnecessary treatment processes.*	
☐	Replacing old motors with premium energy efficiency motors.*	
☐	Upgrade of POTW lighting to energy efficient sources.*	
☐	SCADA systems where substantial energy savings can be demonstrated.*	
☐	Variable Frequency Drive (VFD) controllers where substantial energy savings can be demonstrated.*	
	Total Energy Efficiency Cost:	**$0**

** Indicates a business case may be required for this item.*

There are no Energy Efficiency components specified for this project.

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Clean Water Project Profile

SX21067047 - Lexington-Fayette Urban County Government
Various Stormwater Management Projects - Phase 2

Sustainable Infrastructure - Environmentally Innovative Infrastructure:

Environmentally innovative projects include those that demonstrate new and/or innovative approaches to delivering services or managing water resources in a more sustainable way. Examples include:

Component	Cost
☐ Total integrated water resources management planning likely to result in a capital project.	
☐ Utility sustainability plan consistent with EPA's sustainability policy.	
☐ Greenhouse gas inventory or mitigation plan and submission of a GHG inventory to a registry as long as it is being done for an SRF eligible facility.	
☐ Planning activities by a POTW to prepare for adaptation to the long-term effects of climate change and/or extreme weather.	
☐ Construction of US Building Council LEED certified buildings, or renovation of an existing building on POTW facilities.	
☐ Decentralized wastewater treatment solutions to existing deficient or failing onsite wastewater systems.	
☐ Constructed wetlands projects used for municipal wastewater treatment, polishing, and/or effluent disposal.*	
☐ Projects that result from total/integrated water resource management planning consistent with the decision criteria for environmentally innovative projects and that are CWSRF eligible.	
☐ Projects that facilitate adaptation of POTWs to climate change identified by a carbon footprint assessment or climate adaption study.*	
☐ POTW upgrades or retrofits that remove phosphorus for beneficial use, such as biofuel production with algae.*	
☐ Projects that significantly reduce or eliminate the use of chemicals in wastewater treatment.*	
☐ Treatment technologies that significantly reduce the volume of residuals, generation of residuals, or lower the amount of chemicals in the residuals.*	
☐ Educational activities and demonstration projects for water or energy efficiency.*	
☐ Projects that achieve the goals/objectives of utility asset management plans.*	
☐ Sub-surface land application of effluent and other means for groundwater recharge, such as spray irrigation and overland flow.*	
Total Environmentally Innovative Cost:	**$0**

** Indicates a business case may be required for this item.*

There are no Environmentally Innovative components specified for this project.

Sustainable Infrastructure - Asset Management:

If a category is selected, the applicant must provide proof to substantiate claims. The documents must be submitted to Anshu Singh (Anshu.Singh@ky.gov) for CW projects

Component
☐ The system(s) has a Capital Improvement Plan or similar planning document.
☒ The system(s) involved in this project have developed appropriate rate structures to build, operate, and maintain.
☒ The system(s) involved in this project have specifically allocated funds for the rehabilitation and replacement of aging and deteriorating infrastructure.

In 2010, LFUCG initiated a stormwater oriented fee locally identified as the Water Quality Management Fee (WQMF). The purpose of the fee is to provide dedicated funding for the operation, maintenance and capital improvement of the stormwater drainage system in Fayette County.

Lexington's Consent Decree (CD) with USEPA and the Kentucky Division of Water requires this funding in order to maintain MS4 permit obligations and meet the $30 M capital construction obligation described in Appendix K-2 of the CD.

Project Notes:

Date	Notes
03/19/2013	Worked with Cassie Felty and Adam Scott to reconcile this project budget with the project budget from project SX21067045. Both projects were submitted together under the same loan application.

Project Status: Approved Date Approved: 12-09-2011 Date Revised:

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Appendix C – Supporting Data

C.1 LDCs

The following tables depict initial TMDL calculations for all flow zones at all stations, according to KDOW's LDC procedure (KDOW, 2009). Section 8 contains a discussion of how the TMDL calculations at the stations were extrapolated to create the TMDL allocations for each impaired segment (which are the final allocations for this document).

These calculations do not reflect the Future Growth and the MS4-WLA, see Section 7 for the TMDL calculation procedure (i.e., the "LA" value calculated below was subdivided to reflect the LA, Future Growth and MS4-WLA). The critical condition flow zone is highlighted in yellow in each table. Zones marked with an asterisk ("*") had no samples that exceeded the WQC, therefore Existing Conditions could not be calculated.

Table C.1 Upper North Elkhorn Creek - Site 1 TMDL Table by Flow Zone

LDC Zone	Load from Existing Conditions, colonies/day	TMDL (Load at the WQC), colonies/day	MOS, colonies/day	TMDL Target Load (WQC minus MOS), colonies/day	Final Allocation, colonies/day	
					SWS-WLA	LA
High Flows	1.1E+14	1.38E+12	1.38E+11	1.24E+12	0.00E+00	1.24E+12
Moist	1.59E+13	2.20E+11	2.20E+10	1.98E+11	0.00E+00	1.98E+11
Mid-Range	1.82E+12	9.73E+10	9.73E+09	8.76E+10	0.00E+00	8.76E+10
Dry	1.11E+11	4.11E+10	4.11E+09	3.70E+10	0.00E+00	3.70E+10
Low Flows	*	7.86E+08	7.86E+07	7.08E+08	0.00E+00	7.08E+08

Table C.2 Upper North Elkhorn Creek - Site 2 TMDL Table by Flow Zone

LDC Zone	Load from Existing Conditions, colonies/day	TMDL (Load at the WQC), colonies/day	MOS, colonies/day	TMDL Target Load (WQC minus MOS), colonies/day	Final Allocation, colonies/day	
					SWS-WLA	LA
High Flows	1.4E+14	1.41E+12	1.41E+11	1.27E+12	0.00E+00	1.27E+12
Moist	7.54E+12	1.96E+11	1.96E+10	1.77E+11	0.00E+00	1.77E+11
Mid-Range	8.30E+11	7.14E+10	7.14E+09	6.43E+10	0.00E+00	6.43E+10
Dry	7.11E+11	4.40E+10	4.40E+09	3.96E+10	0.00E+00	3.96E+10
Low Flows	2.08E+09	9.98E+08	9.98E+07	8.98E+08	0.00E+00	8.98E+08

Table C.3 Upper North Elkhorn Creek - Site 5 TMDL Table by Flow Zone

LDC Zone	Load from Existing Conditions, colonies/day	TMDL (Load at the WQC), colonies/day	MOS, colonies/day	TMDL Target Load (WQC minus MOS), colonies/day	Final Allocation, colonies/day	
					SWS-WLA	LA
High Flows	1.8E+13	1.75E+11	1.75E+10	1.58E+11	0.00E+00	1.58E+11
Moist	5.49E+11	5.04E+10	5.04E+09	4.54E+10	0.00E+00	4.54E+10
Mid-Range	9.51E+10	9.51E+09	9.51E+08	8.56E+09	0.00E+00	8.56E+09
Dry	4.20E+10	7.75E+09	7.75E+08	6.98E+09	0.00E+00	6.98E+09
Low Flows	1.58E+09	8.22E+08	8.22E+07	7.40E+08	0.00E+00	7.40E+08

Table C.4 UT to Upper North Elkhorn Creek - Site 4 TMDL Table by Flow Zone

LDC Zone	Load from Existing Conditions, colonies/day	TMDL (Load at the WQC), colonies/day	MOS, colonies/day	TMDL Target Load (WQC minus MOS), colonies/day	Final Allocation, colonies/day	
					SWS-WLA	LA
High Flows	2.8E+13	3.41E+11	3.41E+10	3.07E+11	0.00E+00	3.07E+11
Moist	1.06E+12	1.06E+11	1.06E+10	9.52E+10	0.00E+00	9.52E+10
Mid-Range	1.64E+11	1.51E+10	1.51E+09	1.36E+10	0.00E+00	1.36E+10
Dry	6.05E+10	6.05E+09	6.05E+08	5.44E+09	0.00E+00	5.44E+09
Low Flows	4.38E+09	1.32E+09	1.32E+08	1.18E+09	0.00E+00	1.18E+09

Table C.5 UT to Upper North Elkhorn Creek - Site 6 TMDL Table by Flow Zone

LDC Zone	Load from Existing Conditions, colonies/day	TMDL (Load at the WQC), colonies/day	MOS, colonies/day	TMDL Target Load (WQC minus MOS), colonies/day	Final Allocation, colonies/day	
					SWS-WLA	LA
High Flows	1.1E+13	2.57E+11	2.57E+10	2.32E+11	0.00E+00	2.32E+11
Moist	5.74E+11	5.74E+10	5.74E+09	5.17E+10	0.00E+00	5.17E+10
Mid-Range	2.70E+10	6.74E+09	6.74E+08	6.07E+09	0.00E+00	6.07E+09
Dry	1.06E+11	2.76E+09	2.76E+08	2.48E+09	0.00E+00	2.48E+09
Low Flows	9.10E+08	3.64E+08	3.64E+07	3.28E+08	0.00E+00	3.28E+08

Table C.6 David Fork - Site 3 TMDL Table by Flow Zone

LDC Zone	Load from Existing Conditions, colonies/day	TMDL (Load at the WQC), colonies/day	MOS, colonies/day	TMDL Target Load (WQC minus MOS), colonies/day	Final Allocation, colonies/day	
					SWS-WLA	LA
High Flows	*	3.16E+12	3.16E+11	2.85E+12	0	2.85E+12
Moist	2.07E+12	4.13E+10	4.13E+09	3.72E+10	0	3.72E+10
Mid-Range	2.92E+12	2.90E+10	2.90E+09	2.61E+10	0	2.61E+10
Dry	3.21E+10	2.79E+09	2.79E+08	2.52E+09	0	2.52E+09
Low Flows	7.68E+08	1.76E+07	1.76E+06	1.59E+07	0	1.59E+07

C.2 Correlation

A correlation of flows taken between several sites within the Upper North Elkhorn watershed and the USGS Gages was performed while determining the TMDL approach (Figures C.1-C.3). The gages were chosen for use in constructing the LDC because they correlated well with the sites, they were located within the watershed, drainage areas and land use were comparable, and a 10-year period of record was available. In addition, the LDC method allows for analysis of existing and maximum allowable loadings across a spectrum of flow conditions which can "provide a representation of the current stream or watershed condition and can depict future watershed land-management scenarios" (EPA 2008).

In contrast, the Mean Annual Flow (MAF) method does not allow analysis across a spectrum of flow conditions. For example, the MAF for David Fork (taken at the downstream end of the impaired segment) is 9.6 cubic feet per second. This translates to about the 14th percentile of flows taken at the gage used for construction of the LDC for David Fork (Table C.6) – the USGS generally considers this percentile "below normal" since it accounts for less than 25% of the total flows collected at the site during the period in question (i.e. the 1997 through 2012 PCR seasons) and this can be graphically illustrated in Figure C.4.

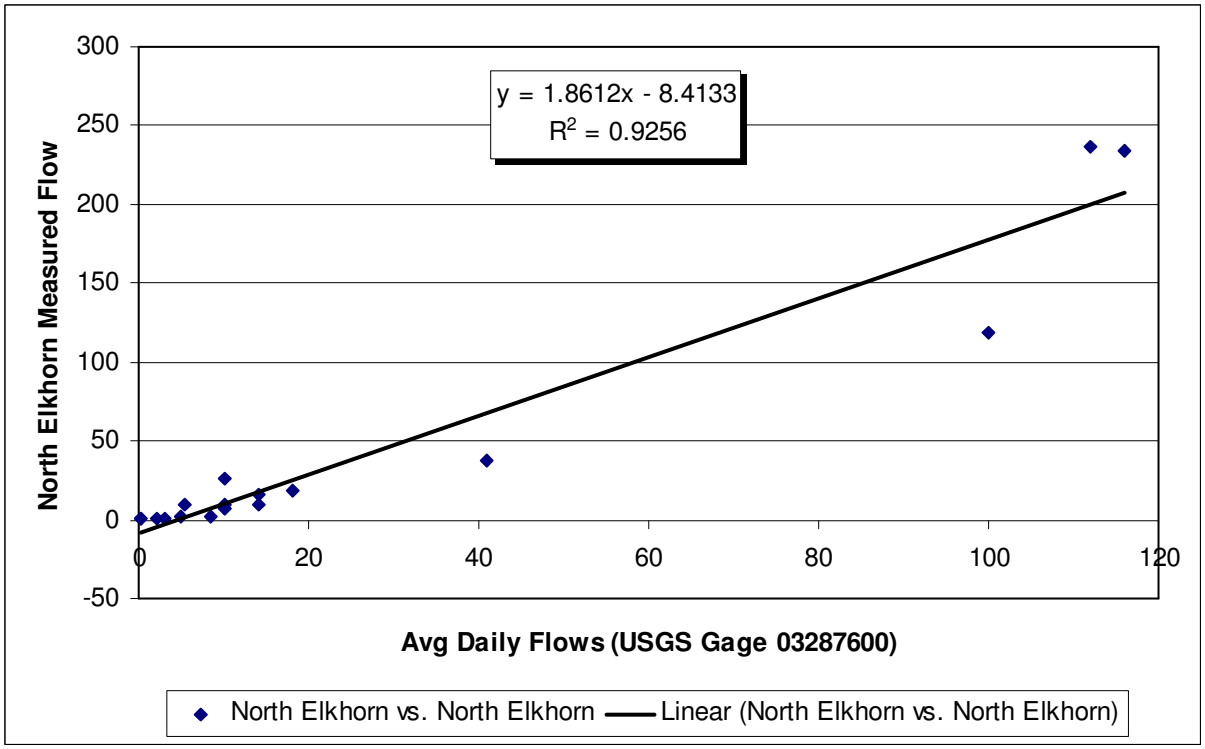

Figure C.1 Correlation between Measured Flows at Site 01NE of Upper North Elkhorn Creek and Average Daily Flows at the USGS Gage

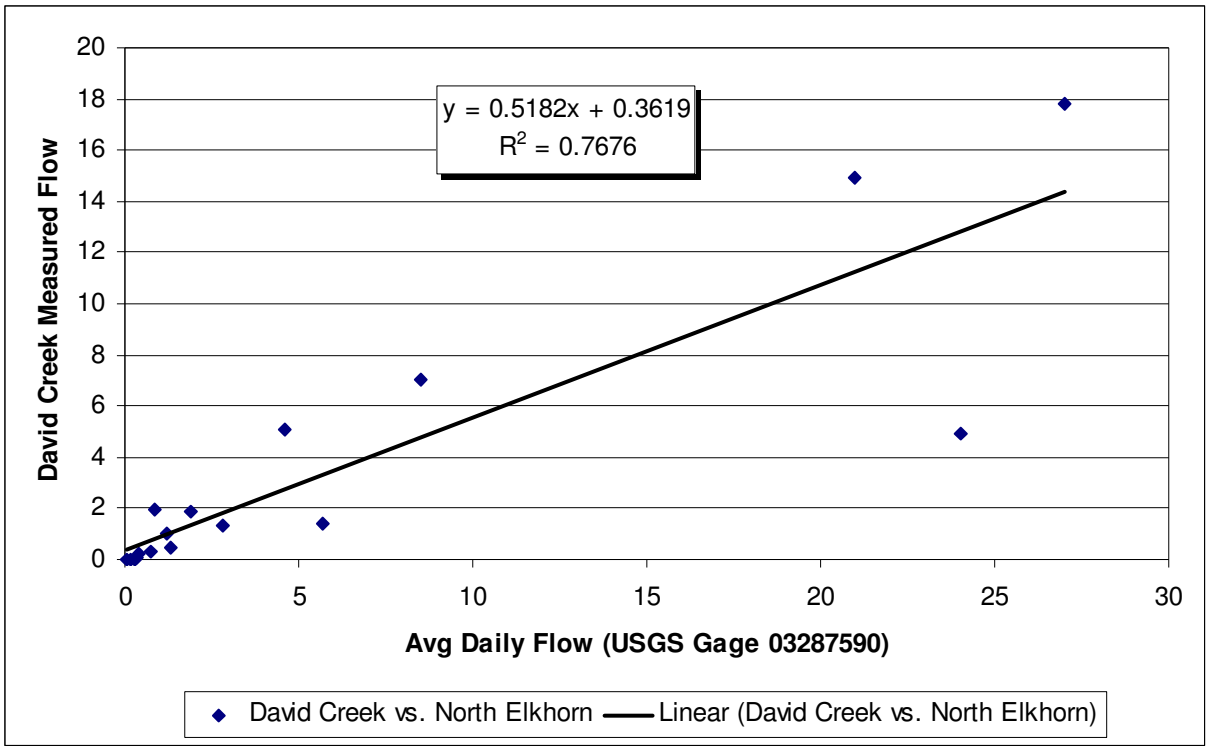

Figure C.2 Correlation between Measured Flows at Site 03NE of David Fork and Average Daily Flows at the USGS Gage

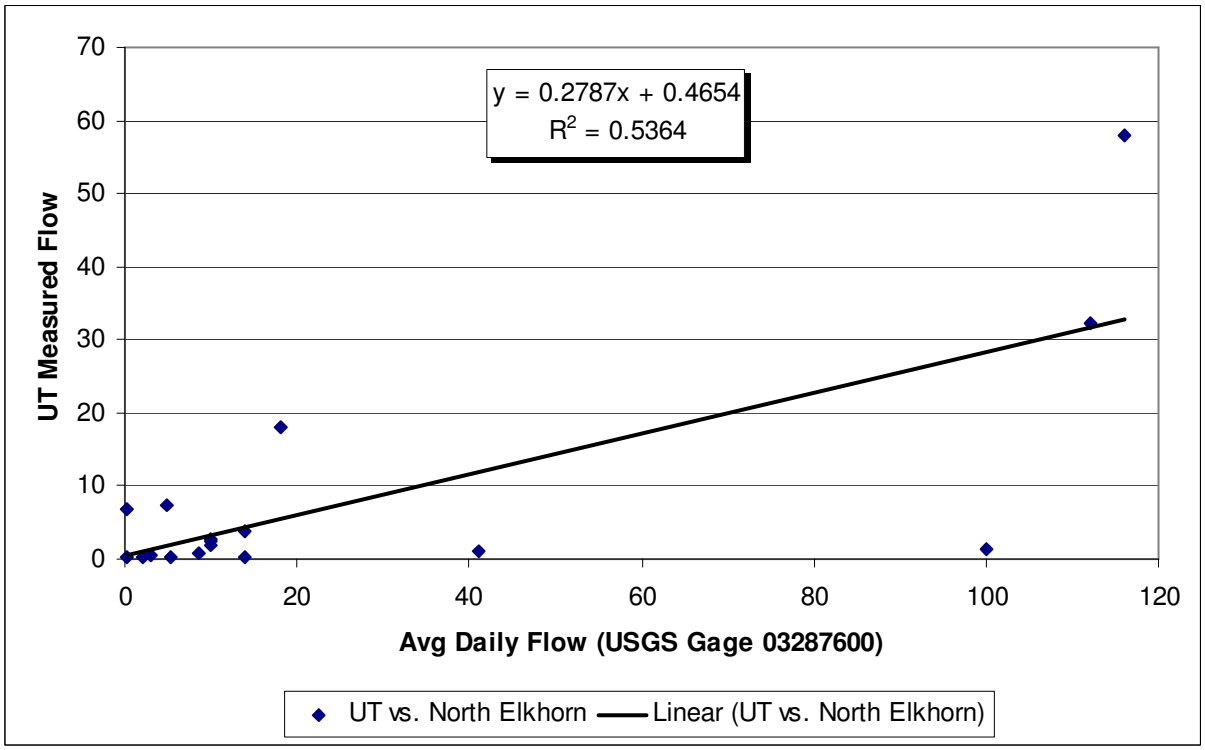

Figure C.3 Correlation between Measured Flows at Site 04NE of UT to Upper North Elkhorn Creek and Average Daily Flows at the USGS Gage

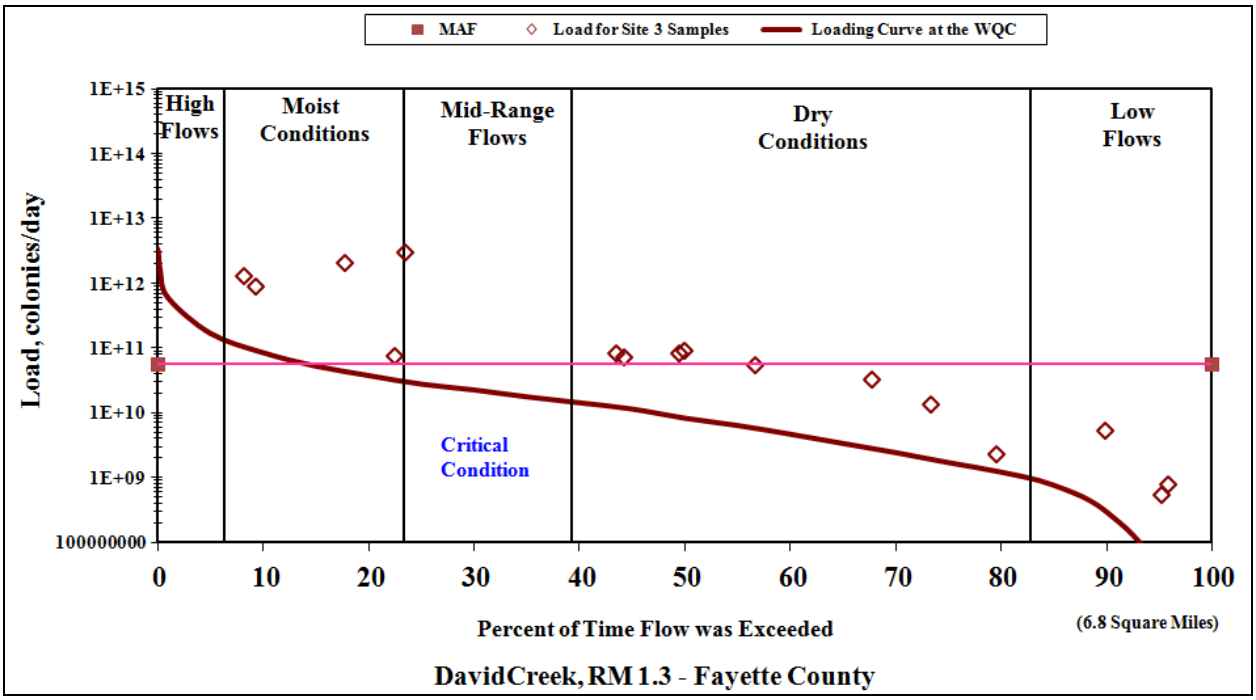

Figure C.4 LDC vs. MAF TMDL Approach for David Creek