Office of Water Quality
Total Maximum Daily Load Program

Total Maximum Daily Load for *Escherichia coli* (*E. coli*) West Fork White River (WFWR) Owen County Tributary Watershed - Owen, Greene, and Monroe Counties

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Introduction

Section 303(d) of the Federal Clean Water Act and the United States Environmental Protection Agency's (USEPA's) Water Quality Planning and Management Regulations (Title 40 of the Code of Federal Regulations (CFR), Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for waterbodies that are not meeting Water Quality Standards (WQS). TMDLs provide states a basis for determining the pollutant reductions necessary from both point and nonpoint sources to restore and maintain the quality of their water resources. The purpose of this TMDL is to identify the sources and determine the allowable levels of *E. coli* bacteria that will result in the attainment of the applicable WQS in the WFWR Owen County tributary watershed in Owen, Greene and Monroe Counties in Indiana.

Background

In 1996 Buckhall Creek/Goose Creek tributaries and Jack Creek were listed on the 303(d) lists as impaired for *E. coli*. In 1998 Fall Creek, McCormick's Creek, Spencer tributaries, Mills Creek/Goose Creek Tributaries, and East Fork Fish Creek were listed for *E. coli*. In 2002 Mill Creek – Little Mill Creek, Rattlesnake Creek, Raccoon Creek – Little Raccoon Creek, Raccoon Creek – Lick Creek, Sand Lick Creek, West Fork Creek, and Fish Creek were listed for *E. coli*. In 2004 Big Creek/Limestone Creek Tributaries, East Fish Creek, West Fork Fish Creek, and Fish Creek were listed for *E. coli*. In 2006 Mack Creek was listed for *E. coli*. McCormick's Creek was listed for *E. coli* in 1998 based on a single sample, taken off the listed in 2002, and re-listed in 2004 when additional data was collected.

This TMDL will address approximately 270 square miles of the WFWR Owen County tributary watershed in Owen, Greene and Monroe Counties where recreational uses are impaired by elevated levels of *E. coli* during the recreational season. The WFWR Owen County tributary watershed is located in South Western Indiana (Figure 1). All of the 22 segments of the listed streams for this TMDL are located in the Lower White River Basin in hydrologic unit code (HUC) 05120202. The description of the study area, its topography, and other particulars are as follows:

Waterbody Name	Segment ID	14 Digit HUC 5120202020…	Length (miles)	Impairment
BIG CREEK/LIMESTONE CREEK TRIBUTARYS	INW0221_00	…010	11.28	E. *coli*
MILL CREEK-LITTLE MILL CREEK	INW0222_00	…020	14.60	E. *coli*
FALL CREEK AND OTHER TRIBUTARYS	INW0223_00	…030	3.30	E. *coli*
MCCORMICKS CREEK	INW0223_T1018	…030	7.08	E. *coli*
SPENCER TRIBUTARYS	INW0224_00	…040	5.72	E. *coli*
RATTLESNAKE CREEK	INW0225_00	…050	8.37	E. *coli*
RATTLESNAKE CREEK	INW0225_T1059	…050	3.32	E. *coli*
MILLS CREEK/GOOSE CREEK TRIBUTARYS	INW0226_00	…060	6.42	E. *coli*
RACCOON CREEK-LITTLE RACCOON CREEK	INW0227_00	…070	9.84	E. *coli*
RACCOON CREEK-LICK CREEK	INW0228_00	…080	14.99	E. *coli*

JACK CREEK	INW0229_00	…090	4.93	E. *coli*
EAST FORK FISH CREEK	INW022A_00	…100	4.71	E. *coli*
EAST FORK FISH CREEK	INW022A_T1025	…100	3.45	E. *coli*
WEST FORK FISH CREEK	INW022B_00	…110	4.92	E. *coli*
FISH CREEK	INW022C_00	…120	2.55	E. *coli*
SAND LICK CREEK	INW022C_T1001	…120	4.68	E. *coli*
FISH CREEK	INW022D_00	…130	4.22	E. *coli*
WEST FORK CREEK	INW022D_T1001	…130	2.66	E. *coli*
FISH CREEK-UNNAMED TRIBUTARY	INW022D_T1002	…130	1.91	E. *coli*
FISH CREEK	INW022E_00	…140	5.57	E. *coli*
MACK CREEK	INW022E_T1001	…140	3.32	E. *coli*
BUCKHALL CREEK/GOOSE CREEK TRIBUTARYS	INW022F_00	…150	9.98	E. *coli*

IDEM sampled forty four (44) sites in the WFWR Owen County tributary watershed. Forty three (43) of the forty four (44) samples were collected five (5) times, evenly spaced, within thirty (30) days from May 30, 2006, to June 27, 2006. All forty three (43) violated the geometric mean. The geometric means ranged from 241 MPN/100 ml at site 14 and 1524.19 MPN/100 ml at site 13 (Attachment A).

The TMDL development schedule corresponds with IDEM's basin-rotation water quality monitoring schedule. To take advantage of all available resources for TMDL development, impaired waters are scheduled according to the basin-rotation schedule unless there is a significant reason to deviate from this schedule. Waterbodies could be scheduled based on the following:

1) Waterbodies may be given a high or low priority for TMDL development depending on the specific designated uses that are not being met, or in relation to the magnitude of the impairment.

2) TMDL development of waterbodies where other interested parties, such as local watershed groups, are working on alleviating the water quality problem may be delayed to give these other actions time to have a positive impact on the waterbody. If water quality standards still are not met, then the TMDL process will be initiated.

3) TMDLs that are required due to water quality violations relating to pollutant parameters where no EPA guidance is available may be delayed to give EPA time to develop guidance.

This TMDL was scheduled based on the data available from the basin-rotation schedule, which represents the most accurate and current information available on water quality within waterbodies covered by this TMDL.

Water quality *E. coli* load duration curves were created using IDEM's data. A flow duration interval is described as a percentage. Zero (0) percent corresponds to the highest stream discharge (flood condition) and 100 percent corresponds to the lowest discharge (drought condition). The *E. coli* values at sites 1, 9, 18, 26 and 31 (sample numbers WWL020-0085, WWL020-0077, WWL020-0081, WWL020-0067, and WWL020-0091) were plotted with the corresponding flow duration interval to show the *E. coli* violations of the single-sample maximum standard and geometric mean standard during the recreational season. These sampling sites are located along various tributaries of the WFWR and were sampled in 2006. These sampling sites are representative of the hydrodynamics of the WFWR Owen County tributary watershed (Attachment B).

Numeric Targets

The impaired designated use for the waterbodies in the WFWR Owen County tributary watershed is for total body contact recreational use during the recreational season, April 1st through October 31st.

327 IAC 2-1-6(d) establishes the total body contact recreational use *E. coli* Water Quality Standard (WQS[1]) for all waters in the non-Great Lakes system as follows:

> *E. coli* bacteria, using membrane filter (MF) count, shall not exceed one hundred twenty-five (125) per one hundred (100) milliliters as a geometric mean based on not less than five (5) samples equally spaced over a thirty (30) day period nor exceed two hundred thirty-five (235) per one hundred (100) milliliters in any one (1) sample in a thirty (30) day period.

The sanitary wastewater *E. coli* effluent limits from point sources in the non-Great Lakes system during the recreational season, April 1st through October 31st, are also covered under 327 IAC 2-1-6(d).

For the WFWR Owen County tributary watershed during the recreational season (April 1st through October 31st) the target level is set at the *E. coli* WQS of 125 per one hundred milliliters as a 30-day geometric mean based on not less than five samples equally spaced over a thirty day period.

Source Assessment

Watershed Characterization

The WFWR Owen County tributary watershed ranges over three counties; 80.31 % of the watershed in Owen County, 13.76 % is in Greene County, and 5.93% is in Monroe County. The main stem of this watershed is the WFWR. The portion of the WFWR within this TMDL watershed starts at Gosport and flows south close to Worthington. The major tributaries flowing northwest into the WFWR include; Big Creek, McCormick's Creek, Elliston Creek, McBride Creek, Mills Creek, Raccoon Creek, Jack Creek and Goose Creek. The major tributaries flowing southeast into the WFWR include; Limestone Creek, Mill Creek, Rattlesnake Creek, Goose Creek, Fish Creek, Buckhall Creek, and Clark Creek (Figure 2).

Landuse information was assembled in 1992 using the Gap Analysis Program (GAP). In 1992, approximately 90.95% of the landuse in the WFWR Owen County tributary watershed was forest. The remaining landuse for the WFWR Owen County tributary watershed consisted of approximately 8.43% agriculture, 0.39% wetland, 0.13% water, and .10% urban (Figure 3). Based on observations from our most recent 2006 sampling and 2005 high resolution aerial photographs it appears there has not been a significant change in landuse.

Wildlife is a known source of *E. coli* impairments in waterbodies. Many animals spend time in or around waterbodies. Deer, geese, ducks, raccoons, turkeys, and other animals all create potential sources of *E. coli*. Wildlife contributes to the potential impact of contaminated runoff from animal habitats, such as urban park areas, forest, and cropland.

There are a significant number of homes on septics within the WFWR Owen County tributary watershed. Failing septic tanks are known sources of *E. coli* impairment in waterbodies. Conversations with the staff from the Greene, Monroe, and Owen County Health Departments indicate that septic system failure does occur. No tangible septic failure rate has been established by the Greene County Health Department at

[1] *E. coli* WQS = 125 cfu/100mL or 235 cfu/100mL; 1 cfu (colony forming units)= 1 mpn (most probable number)

this time (Rotman, 2005 Personal Communication); however, the Monroe County Health Department indicates a failure rate of approximately 2-3% from experimental evidence (Cain, 2005 Personal Communication), and the Owen County Health Department indicates an approximate failure rate of 10 to 15 % (Reeves, 2005 Personal Communication).

National Pollutant Discharge Elimination System (NPDES) Permitted Dischargers

There are six (6) NPDES permitted facilities in the WFWR Owen County Tributary watershed (Figure 4, Table 1). Five (5) of the total six (6) permitted discharges have *E. coli* limits in their permits.

- The Uplands Subdivision, McCormick's Creek State Park, Spencer Municipal WWTP, and Timber Ridge Camp WWTP have no recorded violations in the past 5 years that would result in elevated levels of *E. coli* into the receiving streams.
- McCormick's Creek Elementary School violated the hydraulic loading component of their permit. The violation was documented on March 8, 2002. Excessive flows prevent the treatment system from effectively treating the wastewater, and solids were passing through the system and being carried into the receiving stream. This could potentially affect the *E. coli* levels of the receiving stream. A French drain was installed during the spring of 2002 to mitigate the high flow problem. The drain is working and the facility has been in compliance since October 2002.
- All five facilities were in compliance at the time of sampling and are not considered a source of the *E. coli* impairment.

The remaining discharger (Michael and Sons Inc.) does not have *E. coli* or total residual chlorine limits in their permit, therefore, they are not contributing to the sources of *E. coli* in the WFWR Owen County tributary watershed.

Storm Water General Permit Rule 13

There are no municipal separate storm sewer systems (MS4) communities in the WFWR Owen County tributary watershed.

Combined Sewer Overflows (CSO)

There are no CSO communities in the WFWR Owen County tributary watershed.

Confined Feeding Operations and Concentrated Animal Feeding Operations

The removal and disposal of the manure, litter, or processed wastewater that is generated as the result of confined feeding operations falls under the regulations for confined feeding operations (CFOs) and concentrated animal feeding operations (CAFOs). CAFOs are defined as point sources under the Federal NPDES regulations, while CFOs defined under Indiana statute are not considered point sources under the Federal NPDES regulations. There is one (1) CFO in the WFWR Owen County tributary watershed, Baker Farms (Figure 4, Table 2). This CFO is considered a CAFO and has a general permit(s). The CFO and CAFO regulations (327 IAC 16, 327 IAC 15) require operations "not cause or contribute to an impairment of surface waters of the state. Baker Farm violated their CAFO permit in 2001. Contaminated run-off from the feedlot was documented flowing alongside a country road and onto a neighbor's property. Recent inspections indicate this problem has been mitigated, therefore, Baker Farms is not considered a significant source of for the WFWR Owen County tributary watershed.

The animals raised in confined feeding operations produce manure that is stored in pits, lagoons, tanks and other storage devices. The manure is then applied to area fields as fertilizer. When stored and applied

properly, this beneficial re-use of manure provides a natural source for crop nutrition. It also lessens the need for fuel and other natural resources that are used in the production of fertilizer. Confined feeding operations, however, can also pose environmental concerns, including the following:

- Manure can leak or spill from storage pits, lagoons, tanks, etc.
- Improper application of manure can contaminate surface or ground water.
- Manure over-application can adversely impact soil productivity.

There are many smaller livestock operations in the watershed. These operations, due to their small size, are not regulated under the CFO or CAFO regulations. These operations may still have an impact on the water quality and the *E. coli* impairment. No specific information on these small livestock operations is currently available for the WFWR Owen County tributary watershed, however; it is believed that these small livestock operations may be a source of the *E. coli* impairment.

Linkage Analysis and *E. coli* Load Duration Curves and Precipitation Graphs

The linkage between the *E. coli* concentrations in the WFWR Owen County tributary watershed and the potential sources of *E. coli* provides the basis for the development of this TMDL. Analysis of this relationship allows for estimating the total assimilative capacity of the stream and any needed load reductions. Water quality duration curves were created for the sampling sites in the WFWR Owen County tributary watershed that were sampled by IDEM in 2006. A flow duration interval is described as a percentage. Zero (0) percent corresponds to the highest stream discharge (flood condition) and 100 percent corresponds to the lowest discharge (drought condition). These sampling sites are representative of the hydrodynamics of the WFWR Owen County tributary watershed (Attachment B).

To investigate further the potential sources mentioned above, an *E. coli* load duration curve analysis, as outlined in an unpublished paper by Cleland (2002), was developed for each sampling site in the WFWR Owen County tributary watershed. The load duration curve analysis is a relatively new method utilized in TMDL development. The method considers how stream flow conditions relate to a variety of pollutant loadings and their sources (point and non-point).

In order to develop a load duration curve, continuous flow data is required. There are two (2) USGS gages that could be representative for the WFWR Owen County Tributary watershed. One (1) USGS gage (03357000) is located in Spencer, Indiana and the other USGS gage (03360500) is located in Newberry, Indiana. The Spencer gage has not been active since 1971; therefore, the Newberry gage was used for the development of the *E. coli* load duration curve analysis for the WFWR Owen County Tributary watershed TMDL. The Newberry USGS gage (03360500) is located on the White River in Greene County. To confirm the gage is acceptable IDEM ran a regression analysis comparing the Spencer and Newberry gage. This comparison uses a coefficient of determination value, R^2, to indicate the "fit" of the data. The comparison found the coefficient of determination, R^2, to be 0.88. Values near 1 for R^2 indicate a good fit of the data, whereas values near 0 indicate a poor fit of the data. Therefore the Newberry gage was used for the load duration curves for the WFWR Owen County Tributary watershed. The target load curve was created using flow data from 1928 to the present.

The flow data is used to create flow duration curves, which display the cumulative frequency of distribution of the daily flow for the period of record. The flow duration curve relates flow values measured at the monitoring station to the percent of time that those values are met or exceeded. Flows are ranked from extremely low flows, which are exceeded nearly 100 percent of the time, to extremely high flows, which are rarely exceeded. Flow duration curves are then transformed into load duration curves by multiplying the flow values along the curve by applicable water quality criteria values for *E. coli* and

appropriate conversion factors. The load duration curves are conceptually similar to the flow duration curves in that the x-axis represents the flow recurrence interval and the y-axis represents the allowable load of the water quality parameter. The curve representing the allowable load of *E. coli* was calculated using the daily and geometric mean standards of 235 per 100 mL and 125 per 100 mL, respectively. The final step in the development of a load duration curve is to add the water quality pollutant data to the curves. Pollutant loads are estimated from the data as the product of the pollutant concentrations, instantaneous flows measured at the time of sample collection, and appropriate conversion factors. In order to identify the plotting position of each calculated load, the recurrence interval of each instantaneous flow measurement was defined. Water quality pollutant monitoring data are plotted on the same graph as the load duration curve that provides a graphical display of the water quality conditions in the waterbody. The pollutant monitoring data points that are above the target line exceed the water quality standards (WQS); those that fall below the target line meet the WQS (Mississippi DEQ, 2002).

To further investigate sources of pollution, *E. coli*/precipitation graphs have been created (Attachment B). Elevated levels of *E. coli* during rain events indicates *E. coli* contribution due to run-off. The precipitation data was taken from a weather station in Spencer and managed by the Indiana State Climate Office at Purdue University.

Water Quality Duration Curves and Precipitation Graphs

Load duration curves and precipitation graphs were created for all the sampling sites in the WFWR Owen County tributary watershed. However, sampling sites 1, 9, 18, 26, and 31 (sample site numbers WWL020-0085, WWL020-0077, WWL020-0081, WWL020-0067, and WWL020-0091) provides the best description of the sources of *E. coli* to the WFWR Owen County tributary watershed (Figure 2, Attachment B). These sampling sites are part of the data collected specifically for the WFWR Owen County Tributary Watershed TMDL and were collected in 2006.

Site 1(WWL020-0085) is located off of Country Road 650 and represents sources coming from the headwaters of Limestone Creek. The geometric mean value for Site 1 is 984.31 MPN/100mL. The load duration curve shows a relatively constant level of *E. coli* in the stream regardless of the flow. The precipitation graph shows the stream is susceptible to high loads of *E. coli* from run-off. An *E. coli* concentration of 2420 MPN/100mL was recorded on June 19, 2006, after 2.25 inches of rainfall. The stream is consistently in violation of water quality standards even during dry conditions. This indicates point sources may be contributing along with non point sources. If animals have direct access upstream of Site 1 this could contribute to *E. coli* violations at dry and wet conditions.

Site 9 (WWL020-0077) is located off of Country Club Road and represents sources coming from Naans Branch, Mill Creek and Little Mill Creek. The geometric mean value for Site 9 is 425.30 MPN/100mL. The load duration curve shows a spike during mid flow conditions. The precipitation graph shows the stream is susceptible to high loads of *E. coli* from run-off. An *E. coli* concentration of 2420 MPN/100 mL was recorded on June 19, 2006, after 2.25 inches of rainfall. This stream has a much lower average *E. coli* load and run-off affects the stream much more than other sources. Non-point sources are the most likely source of impairment.

Site 18 (WWL020-0081) is located off of Hyden Road and represents sources coming from Rattlesnake Creek. The geometric mean value for Site 17 is 322.97 MPN/100mL. The load duration curve for Site 17 is very similar to Site 9. The precipitation graph shows the stream is susceptible to high loads of *E. coli* from run-off. An *E. coli* concentration of 2420 MPN/100mL was recorded on June 19, 2006, after 2.25 inches of rainfall. During periods of no rain the *E. coli* load is only slightly violating the water quality standard, indicating run-off is the probable source of impairment.

Site 26 (WWL020-0067) is located off of New Hope Road and represents sources coming from Raccoon Creek. The geometric mean value for Site 26 is 389.17 MPN/100mL. An *E. coli* concentration of 172 MPN/100mL was recorded on June 20, 2006, one day after 2.25 inches of rainfall. This is substantially lower than samples taken on June 19, 2006. The rain event may have washed the *E. coli* downstream, leaving a relatively clean stream one day after a rain event. This phenomenon is referred to as "first flush". The high spike during moist flow conditions with no precipitation indicates the tributaries feeding into Raccoon Creek are the main sources of this impairment.

Site 31 (WWL020-0091) is located off of Splinter Ridge Road and represents sources coming from Fish Creek. The geometric mean value for Site 31 is 519.88 MPN/100mL. The precipitation graph shows the stream is susceptible to high loads of *E. coli* from run-off. An *E. coli* concentration of 2420 MPN/100mL was recorded on June 19, 2006, after 2.25 inches of rainfall. The stream is consistently in violation of water quality standards even during dry conditions. This indicates point sources may be contributing along with non point sources. If animals have direct access upstream of Site 31 this could contribute to *E. coli* violations at dry and wet conditions.

While there are point source contributions, compliance with the numeric *E. coli* WQS in the WFWR Owen County tributary watershed most critically depends on controlling of nonpoint sources using best management plans (BMPs). If the *E. coli* inputs are controlled, then total body contact recreation use in WFWR Owen County tributary watershed will be protected.

Source Linkage

The landuse in this watershed is predominately forest. Forested areas comprise 90.95% of the landuse. Agriculture and pasture area comprise of the second highest landuse at 8.43%. Even though agriculture is only 8.43%, it is the dominant use of land adjacent to the streams in the WFWR Owen County tributary watershed. The soils in this sub-watershed necessitate the use of field tiles to drain excess water from the fields. These field tiles then drain to the nearest stream. Field tiles are not themselves sources of *E. coli*, but they can carry *E. coli* from land applied manure, runoff from the fields and pastures, and other sources of *E. coli* not adjacent to the streams. The high *E. coli* value during mid-range to high flow conditions indicates the presence of *E. coli* transportation by field tiles.

There are non-regulated small animal operations in this sub-watershed. Animals located in these smaller animal operations are not as likely to enter a stream during high flow conditions. However, run-off from pasture lands of these smaller animal operations would be shown during high flow. If animals have direct access to a stream this could contribute to *E. coli* violations during dry and wet conditions.

Wildlife is a known source of *E. coli*. The predominant agricultural and forested landuses in this sub-watershed create ideal habitat for wildlife. Wildlife would contribute during all flow conditions with possible spikes in *E. coli* levels during extreme high flow conditions due to runoff or flooding which carries large quantities of *E. coli* at one time.

Five (5) of the total six (6) NPDES permitted facilities in this sub-watershed contain a sanitary component in their discharge. All of the facilities were in compliance during the sampling period and are not considered a significant source of *E. coli*.

There is one CFO is the WFWR Owen County Tributary watershed located near the junction of the White River and Rattlesnake Creek. CFOs and CAFOs could be sources of *E. coli* during high flow conditions on the water quality duration curve. These facilities have the potential to cause a violation of the *E. coli*

water quality standard through land application or a malfunction at the facility. However, this facility was operating in compliance with their permit during the sampling period.

Septic systems are a known source of *E. coli* for this watershed based on information provided to IDEM by the Owen, Greene, and Monroe County Health Departments. The septic systems described by this information would provide a constant source of *E. coli* particularly during low to mid-range flow conditions. According to the water quality duration curve, there are violations of the *E. coli* water quality standard during these flow conditions. Septic systems can also fail during higher flow conditions by leaching to a field tile or other type of pipe that discharges to the stream. Violations of the *E. coli* water quality standard are shown on the water quality duration curves during high flow, but not consistently.

Conclusions

The *E. coli* data has an average single sample maximum violation 83% of the time and a geometric mean violation 100% of the time. There are no ongoing NPDES permit, CFO or CAFO violations. Based on the water quality duration curves, it can be concluded that the majority of sources of *E. coli* in this watershed are nonpoint sources that include small animal operations, wildlife, leaking and failing septic systems.

TMDL Development

The TMDL represents the maximum loading that can be assimilated by the waterbody while still achieving the Waters Quality Standard (WQS). As indicated in the Numeric Targets section of this document, the target for this *E. coli* TMDL is 125 per one hundred milliliters as a geometric mean based on not less than five samples equally spaced over a thirty-day period from April 1 through October 31. Concurrent with the selection of a numeric concentration endpoint, TMDL development also defines the critical conditions that will be used when defining allowable levels. Many TMDLs are designed as the set of environmental conditions that, when addressed by appropriate controls, will ensure attainment of WQS for the pollutant. For example, the critical conditions for the control of point sources in Indiana are given in 327 IAC 5-2-11.1(b). In general, the 7-day average low flow in 10 years (Q7, 10) for a stream is used as the design condition for point source dischargers. However, *E. coli* sources to WFWR Owen County tributary watershed arise from a mixture of dry and wet weather-driven conditions, and there is no single critical condition that would achieve the *E. coli* WQS. For the WFWR Owen County tributary watershed and the contributing sources, there are a number of different allowable loads that will ensure compliance, as long as they are distributed properly throughout the watershed.

For most pollutants, TMDLs are expressed on a mass loading basis (e.g. pounds per day). For *E. coli* indicators, however, mass is not an appropriate measure because *E. coli* is expressed in terms of organism counts (or resulting concentration) (USEPA, 2001). Meeting the Water Quality Standards (WQS) of 125 colony forming unit (cfu) per 100 mL as a geometric mean and 235 cfu/100 mL is the overall goal of the TMDL. The geometric mean *E. coli* WQS allows for the best characterization of the watershed. The geometric mean provides a more reliable measure of *E. coli* concentration because it is less subject to random variation (USEPA, 2004). However, by setting the target to meet the 125 cfu/100 mL geometric mean standard, this TMDL also will meet the 235 cfu/100 mL single day standard. Therefore, this *E. coli* TMDL is concentration-based consistent with 327 IAC 5-2-11.1(b) and 40 CFR, Section 130.2 (i) and the TMDL is equal to the geometric mean *E. coli* WQS for each month of the recreational season (April 1 through October 31).

The Wasteload Allocation and Load Allocations in the TMDL are set at 125 cfu/100mL, which as stated above, also will meet the 235 cfu/100 mL single day standard.

Allocations

TMDLs are comprised of the sum of individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a Margin of Safety (MOS), either implicitly or explicitly, that accounts for uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the equation:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

The term TMDL represents the maximum loading that can be assimilated by the receiving water while still achieving WQS. The overall loading capacity is subsequently allocated into the TMDL components of WLAs for point sources, LAs for nonpoint sources, and the MOS. This *E. coli* TMDL is concentration-based consistent with USEPA regulations at 40 CFR, Section 130.2(i).

Wasteload Allocations

As previously mentioned, there are six (6) permitted dischargers in the WFWR Owen County tributary watershed. Five (5) of the six (6) permitted dischargers have a sanitary component to their discharge. All five (5) of the facilities with a sanitary component already have *E. coli* limits in their permits. The names of these facilities are: The Uplands Subdivision, McCormick's Creek State Park, McCormick's Creek Elementary School, Spencer Municipal WWTP, and Timber Ridge Camp WWTP. The one (1) NPDES facility without a sanitary component in the WFWR Owen County Tributary is Michael & Sons, Inc.

There are no MS4 communities in the WFWR Owen County tributary watershed. Guidelines for MS4 permits and timelines are outlined in Indiana's Municipal Separate Storm Sewer System (MS4) Rule 13 (327 IAC 15-13-10 and 327 IAC 15-13-11).

There are no CSO communities in the WFWR Owen County tributary watershed.

In the event that designated uses and associated water quality criteria applicable to the WFWR Owen County Tributary watershed are revised in accordance with applicable requirements of state and federal law, this TMDL may be revised to be consistent with such revisions.

The WLA for NPDES permits and MS4 communities is set at the WQS of 125 per one hundred milliliters as a geometric mean based on not less than five samples equally spaced over a thirty-day period from April 1st through October 31st. The WLA for CFO's and straight pipes is set at zero (0). Discharge from these sources is not permitted.

Load Allocations

The LA for nonpoint sources is equal to the WQS of 125 per one hundred milliliters as a geometric mean based on not less than five samples equally spaced over a thirty-day period from April 1st through October 31st. The LA will use the geometric mean of each sampling location to determine the reduction necessary to comply with WQS at each site (Attachment C).

Load allocations may be affected by subsequent work in the watershed. There is currently one watershed project, funded by a Section 319 grant, in the WFWR Owen County tributary watershed working on HUCs 05120202020010, 05120202020020, and 05120202020030. The project is managed through the Owen County SWCD. IDEM will continue to work with the watershed coordinators in the surrounding

areas along with local government agencies to encourage interest in watershed projects. It is anticipated that watershed projects will be useful in continuing to define and address the nonpoint sources of *E. coli* in the WFWR Owen County tributary watershed.

Margin of Safety

A Margin of Safety (MOS) was incorporated into this TMDL analysis. The MOS accounts for any uncertainty or lack of knowledge concerning the relationship between pollutant loading and water quality. The MOS can be either implicit (i.e., incorporated into TMDL analysis thorough conservative assumptions) or explicit (i.e., expressed in the TMDL as a portion of the loadings). This TMDL uses an implicit MOS by applying two conservative assumptions. First, no rate of decay for *E. coli* was applied. *E. coli* bacteria have a limited capability of surviving outside of their hosts and therefore, a rate of decay normally would be applied. However, applying a rate of decay could result in a discharge limit that would be greater than the *E. coli* WQS, thus no rate of decay was applied. Second, the *E. coli* WQS was applied to all flow conditions. This adds to the MOS for this TMDL. IDEM determined that applying the *E. coli* WQS of 125 per one hundred milliliters to all flow conditions and with no rate of decay for *E. coli* is a more conservative approach that provides for greater protection of the water quality.

Seasonality

Seasonality in the TMDL is addressed by expressing the TMDL in terms of the *E. coli* WQS for total body contact during the recreational season (April 1st through October 31st) as defined by 327 IAC 2-1-6(d). There is no applicable total body contact *E. coli* WQS during the remainder of the year in Indiana. Because this is a concentration-based TMDL, *E. coli* WQS will be met regardless of flow conditions in the applicable season.

Monitoring

Future *E. coli* monitoring of the WFWR Owen County tributary watershed will take place during IDEM's five-year rotating basin schedule and/or once TMDL implementation methods are in place. Monitoring will be adjusted as needed to assist in continued source identification and elimination. IDEM will monitor at an appropriate frequency to determine if Indiana's 30-day geometric mean value of 125 *E. coli* per one hundred milliliters is being met. When these results indicate that the waterbody is meeting the *E. coli* WQS, the waterbody will then be removed from the 303(d) list.

Reasonable Assurance Activities

Reasonable assurance activities are programs that are in place or will be in place to assist in meeting the WFWR Owen County tributary watershed TMDL allocations and the *E. coli* Water Quality Standard (WQS).

Confined Feeding Operations and Concentrated Animal Feeding Operations

CFO and CAFO are required to manage manure, litter, process wastewater pollutants in a manner that does not cause or contribute to the impairment of *E. coli* WQS.

Watershed Projects

The Owen County SWCD has received a 319 grant to hire a watershed coordinator to work on a detailed watershed management plan. This watershed plan will focus on the north east portion of the WFWR Owen County Tributary watershed (HUCs 05120202020010, 05120202020020, 05120202020030) and will include Limestone Creek, Big Creek, McCormick's Creek, Fall Creek, Naans Branch, Mill Creek and Little Mill Creek.

IDEM has recently hired a Watershed Specialist for this area of the state. The Watershed Specialist will be available to assist stakeholders with starting a watershed group, facilitating planning activities, and serving as a liaison between watershed planning and TMDL activities in the WFWR Owen County Tributary watershed.

TMDLs

A TMDL has been approved for the Middle WFWR. The high *E. coli* levels along the Middle WFWR prompted this TMDL on the tributaries flowing into the WFWR. The findings from the original TMDL are consistent with this TMDL.

Potential Future Activities

Non-point source pollution, which is the primary cause of *E. coli* impairment in this watershed, can be reduced by the implementation of "best management practices" (BMPs). BMPs are practices used in agriculture, forestry, urban land development, and industry to reduce the potential for damage to natural resources from human activities. A BMP may be structural, that is, something that is built or involves changes in landforms or equipment, or it may be managerial, that is, a specific way of using or handling infrastructure or resources. BMPs should be selected based on the goals of a watershed management plan. Livestock owners, farmers, and urban planners, can implement BMPs outside of a watershed management plan, but the success of BMPs would be enhanced if coordinated as part of a watershed management plan. Following are examples of BMPs that may be used to reduce *E. coli* runoff:

Riparian Area Management - Management of riparian areas protects streambanks and river banks with a buffer zone of vegetation, either grasses, legumes, or trees.

Manure Collection and Storage - Collecting, storing, and handling manure in such a way that nutrients or bacteria do not run off into surface waters or leach down into ground water.

Contour Row Crops - Farming with row patterns and field operations aligned at or nearly perpendicular to the slope of the land.

No-Till Farming - No-till is a year-round conservation farming system. In its pure form, no-till does not include any tillage operations either before or after planting. The practice reduces wind and water erosion, catches snow, conserves soil and water, protects water quality, and provides wildlife habitat. No-till helps control soil erosion and improve water quality by maintaining maximum residue plant levels on the soil surface. These plant residues: 1) protect soil particles and applied nutrients and pesticides from detachment by wind and water; 2) increase infiltration; and 3) reduce the speed at which wind and water move over the soil surface.

Manure Nutrient-Testing - If manure application is desired, sampling and chemical analysis of manure should be performed to determine nutrient content for establishing the proper manure application rate in order to avoid over-application and run-off.

Drift Fences - Drift fences (short fences or barriers) can be installed to direct livestock movement. A drift fence parallel to a stream keep animals out and prevents direct input of *E. coli* to the stream.

Pet Clean-up / Education - Education programs for pet owners can improve water quality of runoff from urban areas.

Septic Management/Public Education - Programs for management of septic systems can provide a systematic approach to reducing septic system pollution. Education on proper maintenance of septic systems as well as the need to remove illicit discharges could alleviate some anthropogenic sources of *E. coli*.

Conclusion

The sources of *E. coli* to the WFWR Owen County tributary watershed include both point and nonpoint sources. In order for the WFWR Owen County tributary watershed to achieve Indiana's *E. coli* WQS, the wasteload and load allocations have been set to the *E. coli* WQS of 125 per one hundred milliliters as a geometric mean based on not less than five samples equally spaced over a thirty day from April 1st through October 31st. Achieving the wasteload and load allocations for the WFWR Owen County tributary watershed depends on:

1) Nonpoint sources of *E. coli* being controlled by implementing best management practices in the watershed.
2) CFOs not violating their permits
3) Completion and implementation of the Watershed Management Plan (HUCs 05120202020010, 05120202020020, and 05120202020030)
4) Addressing failing septic systems

The next phase of this TMDL is to identify and support the implementation of activities that will bring the WFWR Owen County tributary watershed in compliance with the *E. coli* WQS. IDEM will continue to work with its existing programs on implementation. In the event that designated uses and associated water quality criteria applicable to the WFWR Owen County tributary watershed are revised in accordance with applicable requirements of state and federal law, the TMDL implementation activities may be revised to be consistent with such revisions. Additionally, IDEM will work with local stakeholder groups to pursue best management practices that will result in improvement of the water quality in the WFWR Owen County tributary watershed.

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Cain, Gary. Monroe County Health Department. Personal Communication 2005.

Cleland, B. 2002 TMDL Development from the "Bottom Up"-Part II. Using Duration Curves to Connect the Pieces. America's Clean Water Foundation.

Mississippi Department of Environmental Quality. 2002. Fecal Coliform TMDL for the Big Sunflower River, Yazoo River Basin.

USEPA. 2001. Protocol for Developing Pathogen TMDLs. United States Environmental Protection Agency, 841-R-00-002.

Reeves, John. Owen County Health Department. Personal Communication 2005

Rotman, Sam. Greene County Health Department. Personal Communication 2005.

Table 1: NPDES Permits in the WFWR Owen County Tributary Watershed

Facilities with E. coli Limits

Permit No.	Facility Name	Receiving Waters
IN0059871	UPLANDS SUBDIVISION, THE	unnamed ditch trib to Elliston Cr. to White River
IN0030201	MC CORMICK'S CREEK STATE PARK	West Fork of White River
IN0060577	MCCORMICK'S CREEK ELEM SCHOOL	McCormick's Creek

Facilities with Total Residual Chlorine Limits

Permit No.	Facility Name	Receiving Waters
none		

Facilities with Total Residual Chlorine Limits and E. coli Limits

Permit No.	Facility Name	Receiving Waters
IN0020192	SPENCER MUNICIPAL WWTP	West Fork of White River
IN0038466	TIMBER RIDGE CAMP WWTP	McBride Branch

Facilities with no Total Residual Chlorine or E. coli Limits

Permit No.	Facility Name	Receiving Waters
IN0061719	MICHAEL & SONS, INC.	unnamed branch of Goose Creek

Table 2: Permitted Confined Feeding Operations in the WFWR Owen County Tributary Watershed

		Approved Animals	
Log Number	**Name**	**Nursery Pigs**	**Growerfinishers**
4742	Baker Farms	500	1000

Table 3: Land Area Distribution for the WFWR Owen County Tibutary TMDL

County	Square Miles	Percent
Owen	216.67	80.31
Greene	37.11	13.76
Monroe	16.00	5.93
Total	*269.78*	*100.00*

Figure 1: WFWR Owen County Tributary Watershed

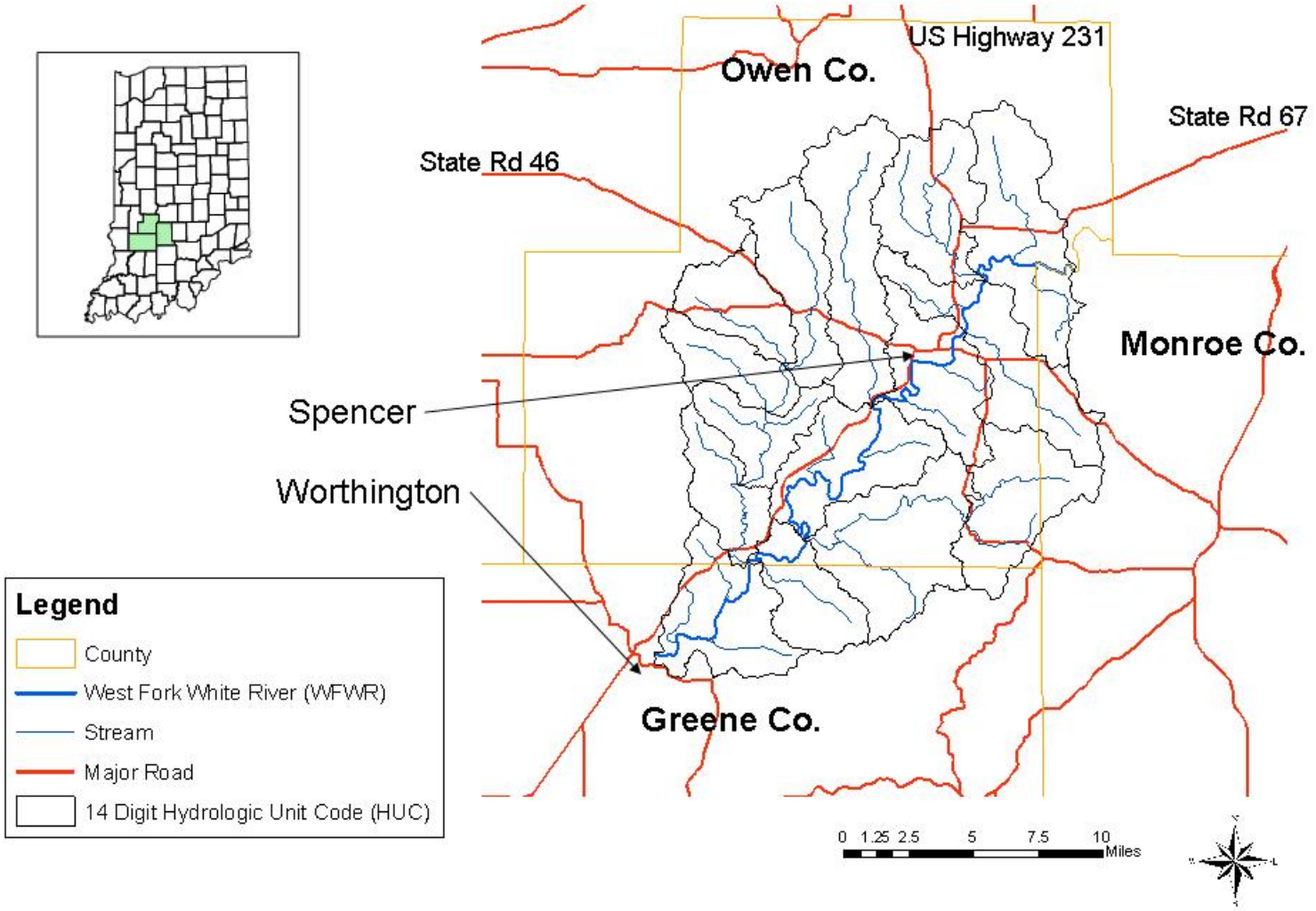


Figure 2: 2006 and 2001 *E. coli* Sample Sites

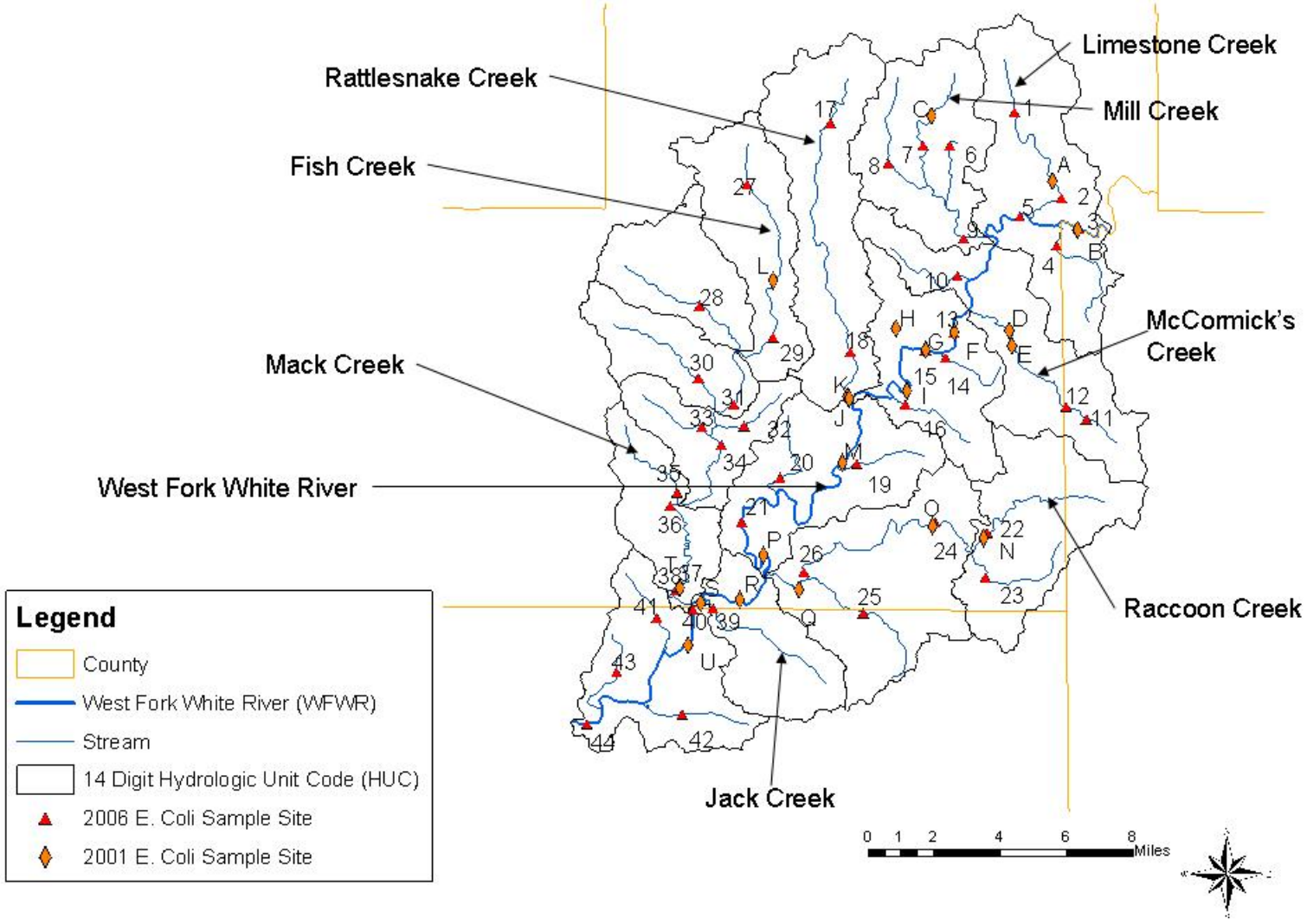


Figure 3: WFWR Owen County Tributary Watershed Landuse

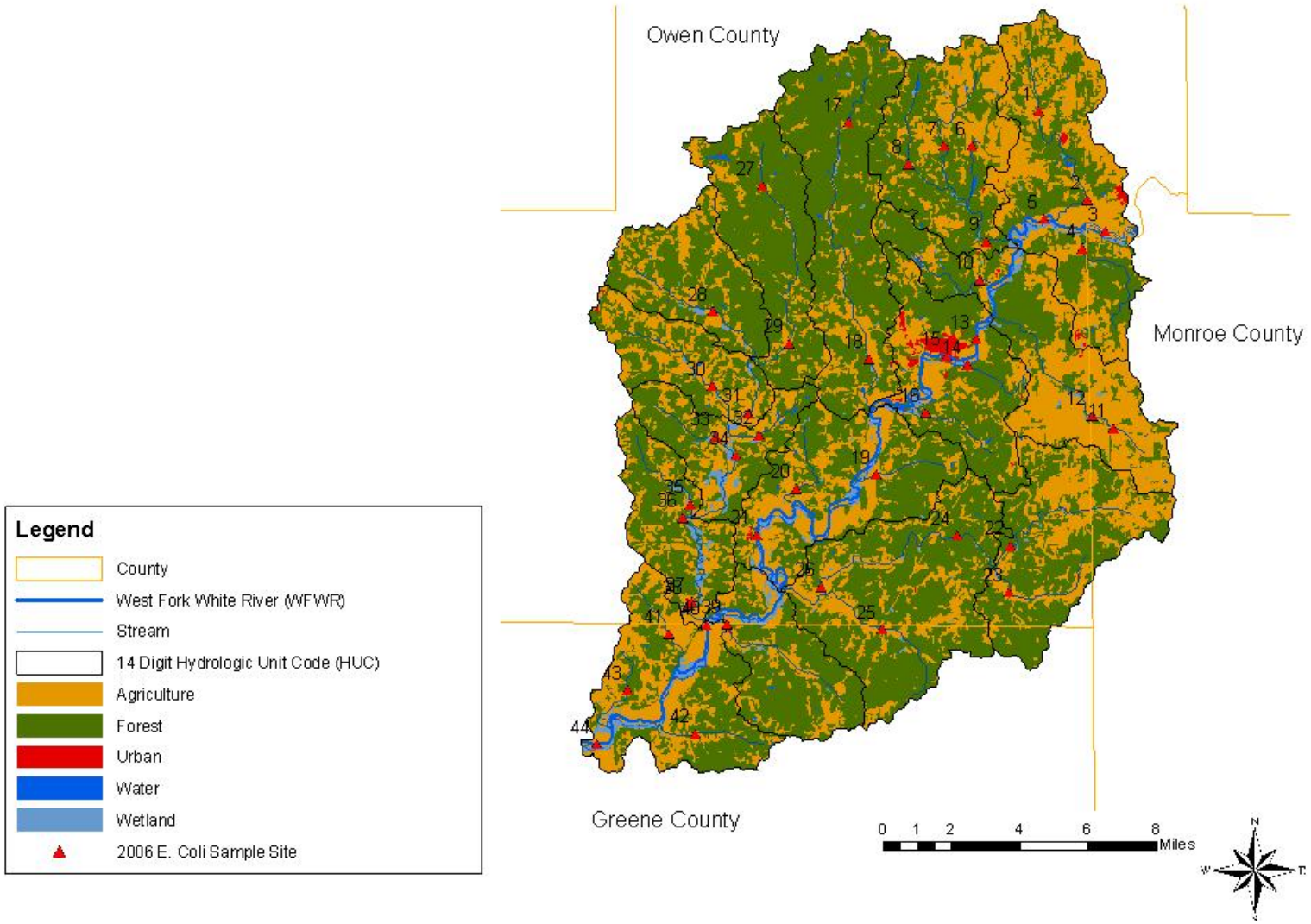
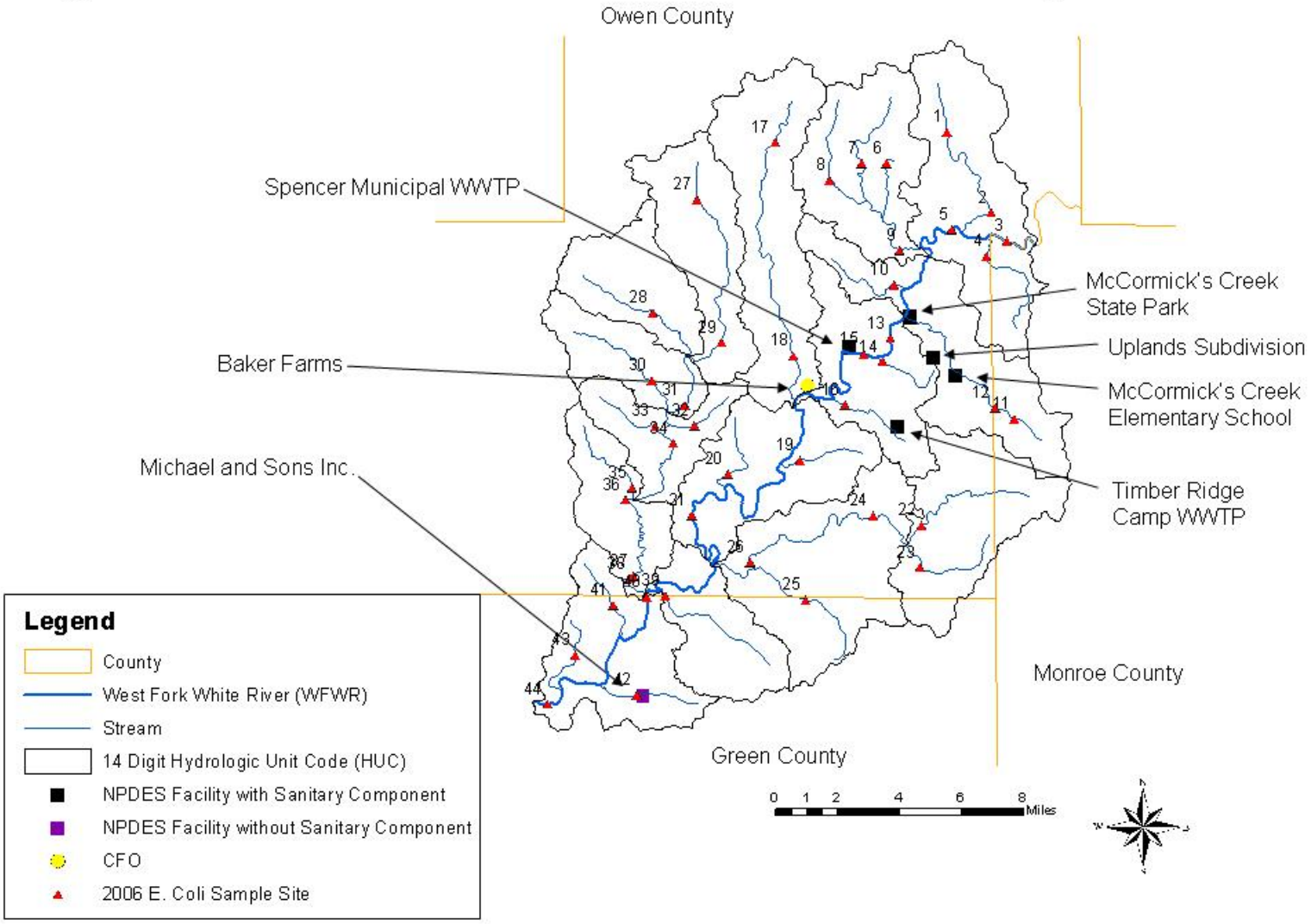


Figure 4: Permitted Facilities in WFWR Owen County Watershed



Attachment A

E. coli Data for WFWR Owen County Tributary watershed TMDL

Site	Project Name	Stream Name	Description	LSITE	Sample Date	*E coli* (MPN/100mL)	GEOMEAN
A	2001 E.coli-Lower WFWR and Eel	Limestone Cr	SR 67	WWL020-0029	8/1/2001	326	321.5
					8/7/2001	194	
					8/14/2001	461	
					8/21/2001	579	
					8/28/2001	204	
B	2001 WF White River White Lick to Buckhall Boat	W Fk White River	Between old and new bridge. Sample from watercraft 39-19-57 86-40-35	WWL020-0032	9/11/2001	2400	1088.2
					9/20/2001	2400	
					9/25/2001	2400	
					10/2/2001	120	
					10/10/2001	920	
C	2001 E.coli-Lower WFWR and Eel	Little Mill Cr	US 231	WWL020-0012	7/31/2001	179	70.2
					8/7/2001	52	
					8/14/2001	56	
					8/21/2001	113	
					8/28/2001	29	
D	2001 E.coli-Lower WFWR and Eel	McCormicks Cr	McCormicks Cr State Park Falls	WWL020-0022	8/1/2001	435	256.6
					8/8/2001	35	
					8/15/2001	1120	
					8/22/2001	308	
					8/29/2001	210	
E	2001 E.coli-Lower WFWR and Eel	McCormicks Cr	Highway 46- U/S of Park	WWL020-0028	8/1/2001	517	439.0
					8/8/2001	613	
					8/15/2001	173	
					8/15/2001	194	
					8/22/2001	435	
					8/29/2001	1553	
F	2001 WF White River White Lick to Buckhall Boat	W Fk White River	BRIDGE. Sample from watercraft 39-17-17 86-44-45	WWL020-0033	9/11/2001	2400	922.4
					9/20/2001	2400	
					9/25/2001	1400	
					10/2/2001	120	
					10/10/2001	690	

Site	Project Name	Stream Name	Description	LSITE	Sample Date	*E coli* (MPN/100mL)	GEOMEAN
G	2001 WF White River White Lick to Buckhall Boat	W Fk White River	SR 43 & 46 Bridge S Edge of Spencer	WWL020-0003	9/11/2001	2400	935.1
					9/20/2001	2400	
					9/25/2001	1700	
					10/2/2001	100	
					10/10/2001	730	
H	2001 E.coli-Lower WFWR and Eel	Rattlesnake Cr	SR 46 W. of Spencer	WWL020-0030	7/31/2001	189	170.1
					8/8/2001	153	
I	2001 WF White River White Lick to Buckhall Boat	W Fk White River	Sample from watercraft 39-15-45 86-46-21	WWL020-0034	9/11/2001	2400	877.8
					9/20/2001	2400	
					9/25/2001	1300	
					10/2/2001	120	
					10/10/2001	580	
J	2001 WF White River White Lick to Buckhall Bridges	Rattlesnake Cr	SR 231	WWL020-0031	9/25/2001	520	299.8
					10/2/2001	370	
					10/10/2001	140	
K	2001 E.coli-Lower WFWR and Eel	Rattlesnake Cr	Cr just west of US 23,1 South of Spencer	WWL020-0004	8/1/2001	687	337.5
					8/15/2001	461	
					8/22/2001	184	
					8/29/2001	222	
L	2001 E.coli-Lower WFWR and Eel	E Fk Fish Cr	Bridge on SR 46, 4.7 Miles Wof Spencer on 425 W.	WWL020-0026	7/31/2001	114	154.0
					8/8/2001	152	
					8/8/2001	142	
					8/15/2001	579	
					8/22/2001	99	
					8/29/2001	162	
					8/29/2001	91	
M	2001 WF White River White Lick to Buckhall Boat	W Fk White River	Sample from watercraft 39-13-52 86-48-32	WWL020-0036	9/11/2001	2400	885.9
					9/20/2001	2400	
					9/25/2001	770	
					10/2/2001	150	
					10/10/2001	820	

Site	Project Name	Stream Name	Description	LSITE	Sample Date	*E coli* (MPN/100mL)	GEOMEAN
N	2001 E.coli-Lower WFWR and Eel	Raccoon Cr	SR 43 at Freeman, IN	WWL020-0018	8/1/2001	1986	1385.9
					8/8/2001	345	
					8/15/2001	1554	
					8/22/2001	1986	
					8/29/2001	2419	
O	2001 E.coli-Lower WFWR and Eel	Raccoon Cr	CR 775 E at New Hope, South east of Freedom	WWL020-0019	8/1/2001	1046	625.2
					8/1/2001	816	
					8/8/2001	411	
					8/15/2001	548	
					8/22/2001	488	
					8/22/2001	517	
					8/29/2001	770	
P	2001 WF White River White Lick to Buckhall Boat	W Fk White River	Sample from watercraft 39-11-27 86-51-12	WWL020-0035	9/11/2001	2400	989.9
					9/20/2001	2400	
					9/25/2001	1500	
					10/2/2001	100	
					10/10/2001	1100	
Q	2001 WF White River White Lick to Buckhall Bridges	Raccoon Cr	Viles Rd S of New Hope	WWL020-0040	9/11/2001	770	354.5
					9/20/2001	1200	
					9/25/2001	370	
					10/2/2001	260	
					10/10/2001	63	
R	2001 WF White River White Lick to Buckhall Boat	W Fk White River	Sample from watercraft 39-10-17 86-52-00	WWL020-0037	9/11/2001	2400	714.8
					9/11/2001	2400	
					9/20/2001	2400	
					9/25/2001	1500	
					10/2/2001	110	
					10/10/2001	190	
					10/10/2001	220	
S	2001 WF White River White Lick to Buckhall Boat	W Fk White River	Sample from watercraft 39-10-12 86-53-19	WWL020-0038	9/11/2001	2400	357.9
					9/20/2001	2400	
					9/25/2001	2000	
					9/25/2001	2400	
					10/2/2001	76	
					10/10/2001	1	

Site	Project Name	Stream Name	Description	LSITE	Sample Date	*E coli* (MPN/100mL)	GEOMEAN
T	2001 WF White River White Lick to Buckhall Bridges	Fish Cr	US 231 South of Spencer. Freedom	WWL020-0008	8/1/2001	866	587.5
					8/8/2001	2419	
					8/14/2001	272	
					8/21/2001	299	
					8/29/2001	411	
T (2)	2001 WF White River White Lick to Buckhall Bridges	Fish Cr	US 231 South of Spencer. Freedom	WWL020-0008	9/11/2001	240	287.1
					9/20/2001	980	
					9/25/2001	290	
					10/2/2001	110	
					10/10/2001	260	
U	2001 WF White River White Lick to Buckhall Boat	W Fk White River	Sample from watercraft 39-09-06 86-53-45	WWL020-0039	9/11/2001	2400	141.8
					9/20/2001	1700	
					10/2/2001	99	
					10/10/2001	1	

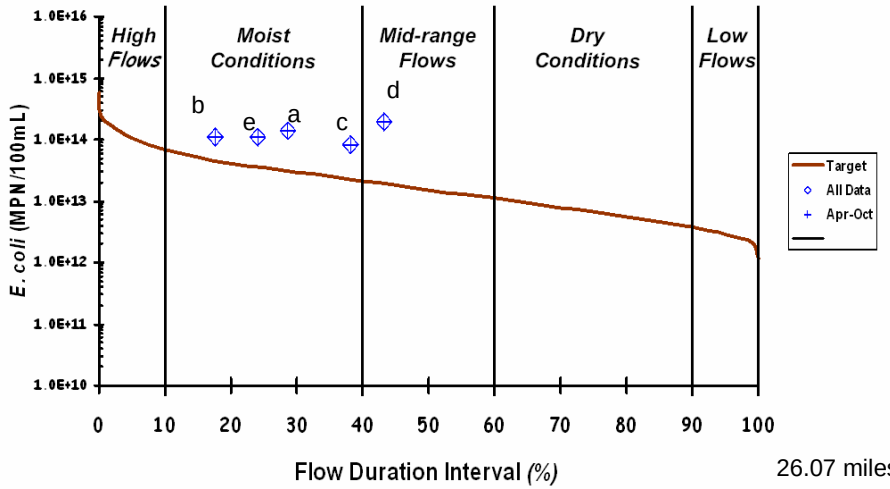
*GEOMEAN's were calculated to give a snapshot of the 2001 *E. coli* water quality. Not all sites have five evenly spaced samples over a 30 day period.

Attachment B

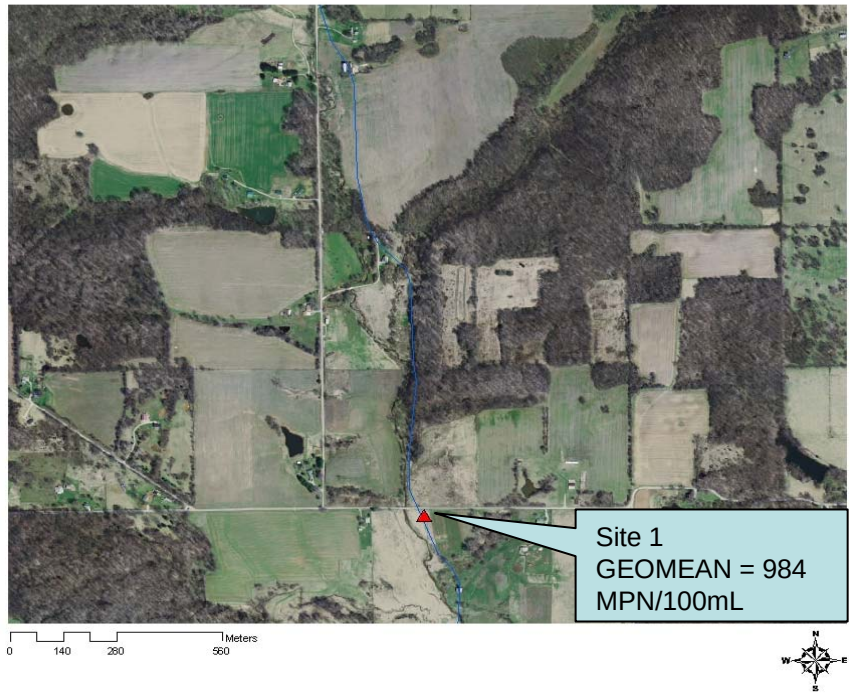
Load Duration Curves and Precipitation Graphs for WFWR Owen County Tributary watershed TMDL

Limestone Creek at Childers Road
Site 1: WWL020-0085

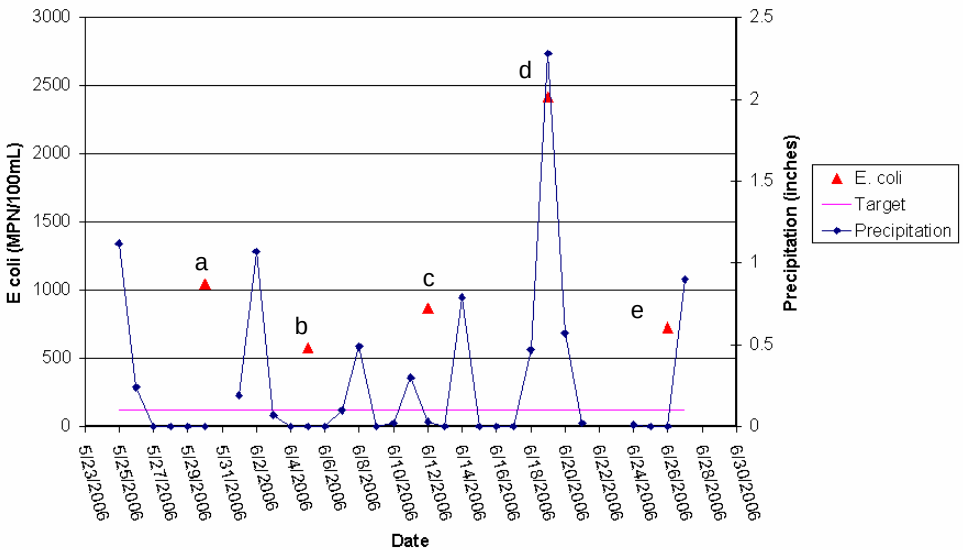
Load Duration Curve



26.07 miles^2



Precipitation



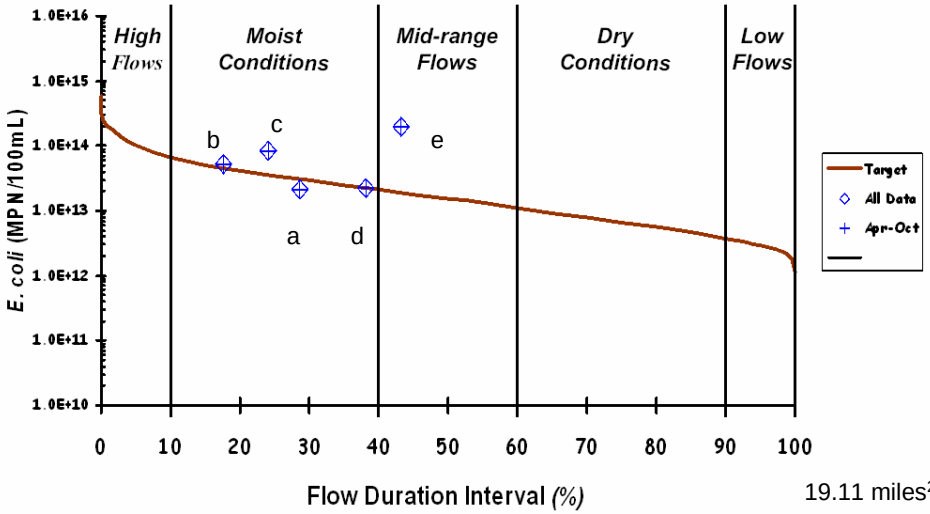
USGS Newberry Flow Gage. Spencer Precipitation Station - State Climate Office

UPSTREAM

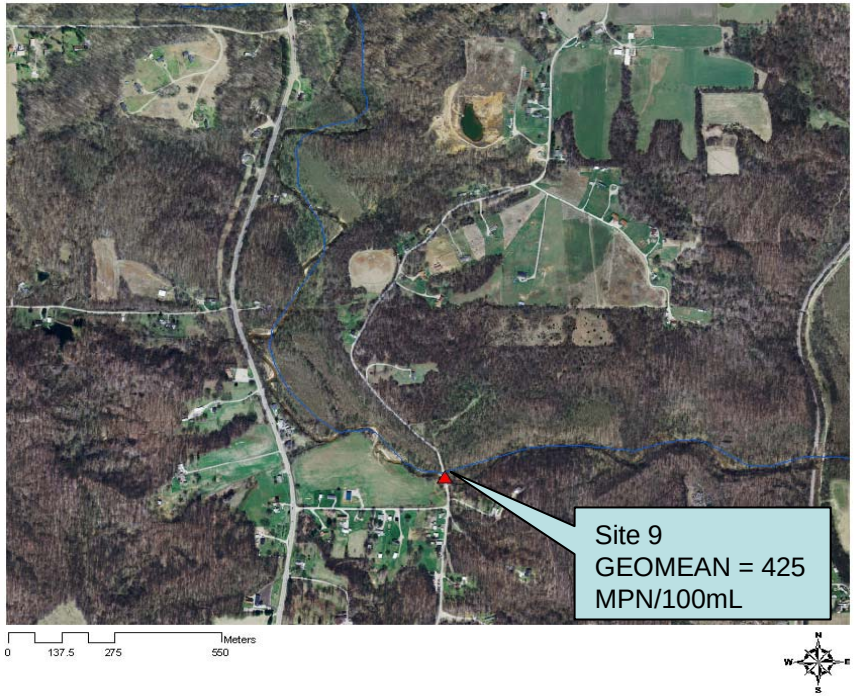
DOWNSTREAM

Mill Creek at Country Club Rd.
Site 9: WWL020-0077

Load Duration Curve



19.11 miles^2



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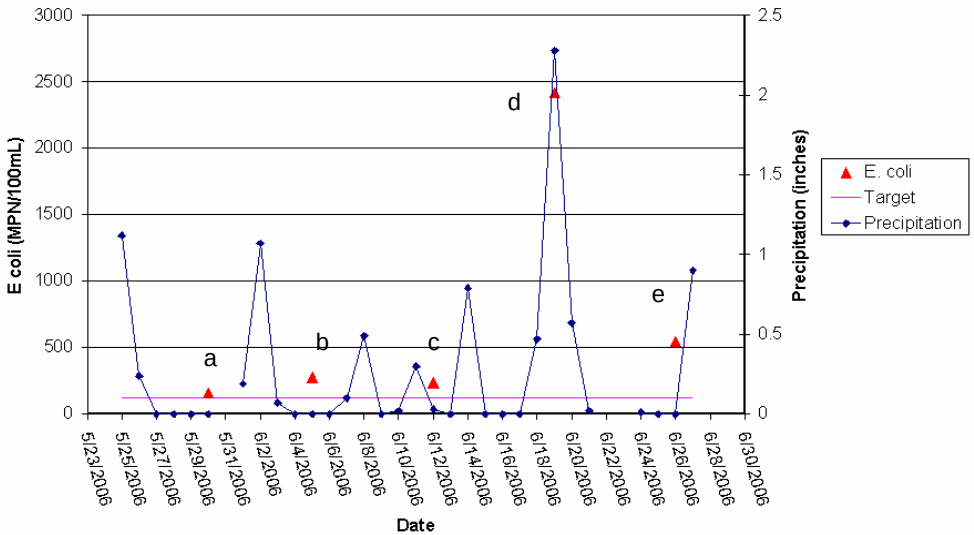


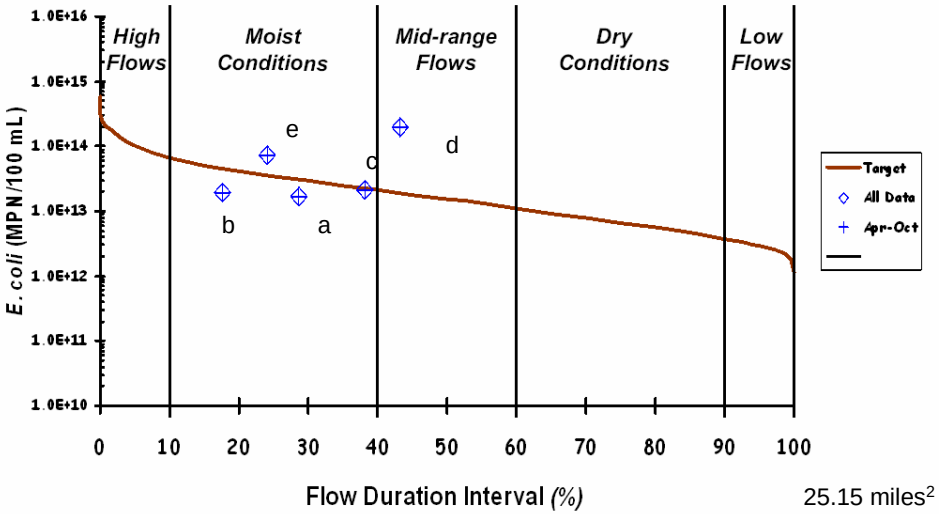
UPSTREAM

DOWNSTREAM

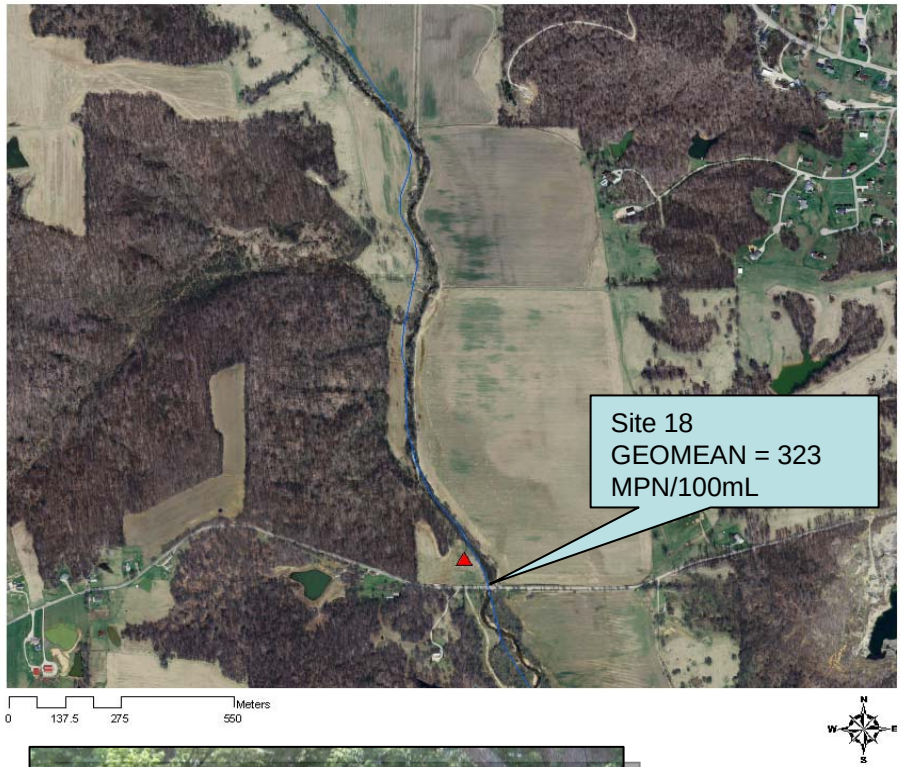
USGS Newberry Flow Gage. Spencer Precipitation Station - State Climate Office

Rattlesnake Creek at Hyden Rd.
Site 18: WWL020-0081

Load Duration Curve



25.15 miles^2



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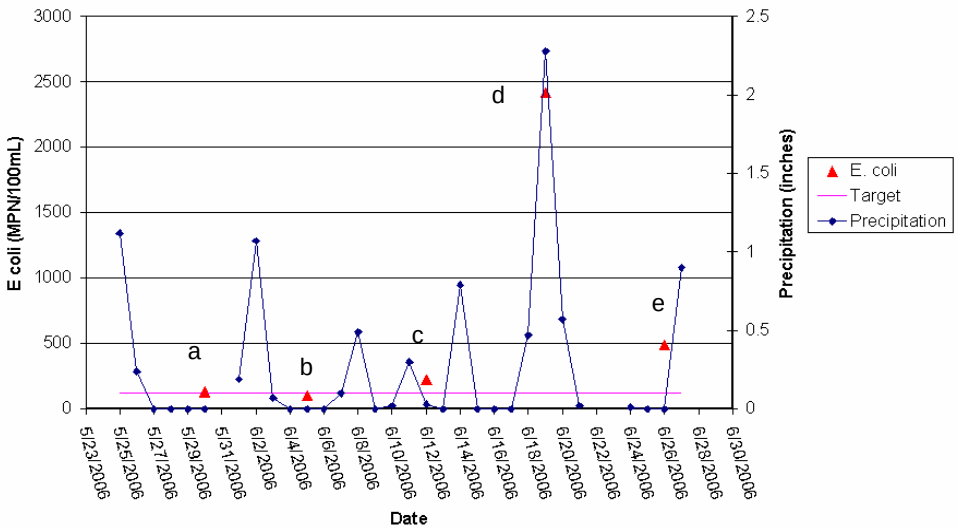


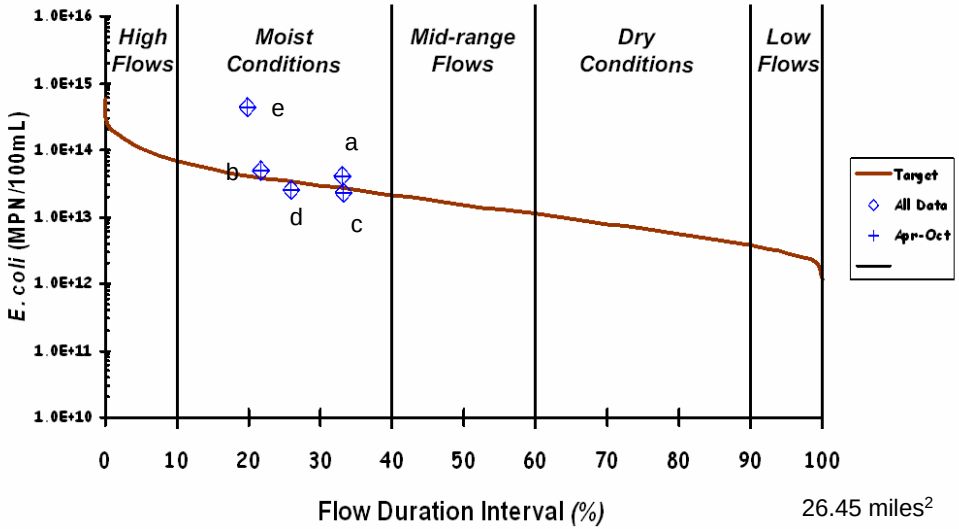
UPSTREAM

DOWNSTREAM

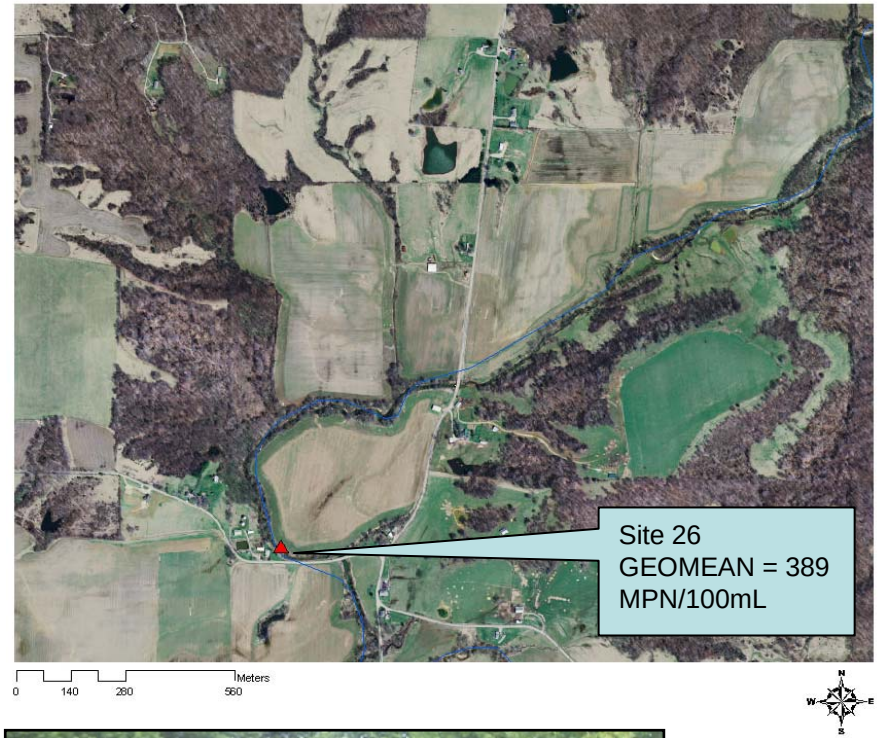
USGS Newberry Flow Gage. Spencer Precipitation Station - State Climate Office

Raccoon Creek at New Hope Rd.
Site 26: WWL020-0067

Load Duration Curve



26.45 miles^2



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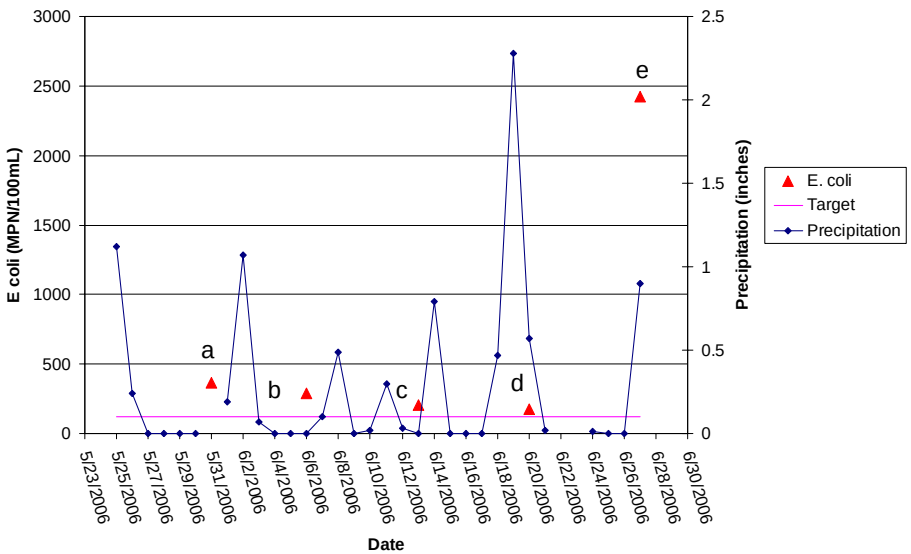


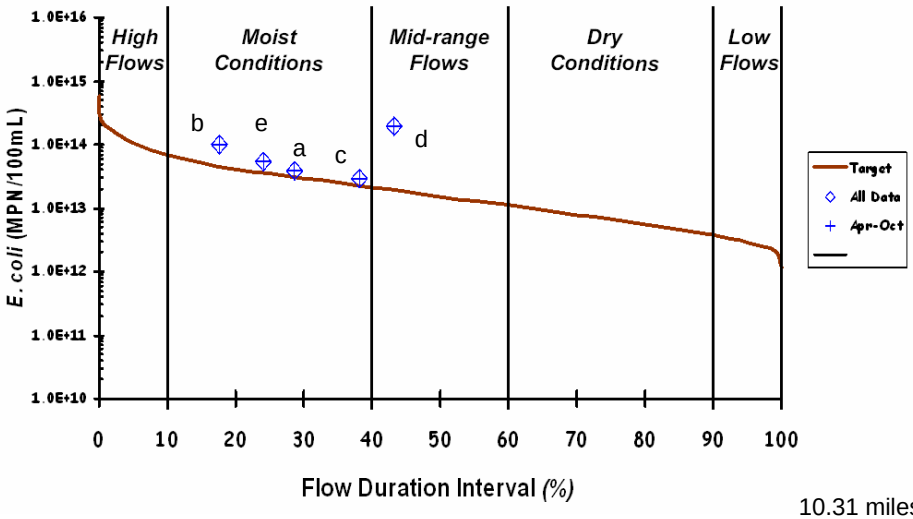
UPSTREAM

DOWNSTREAM

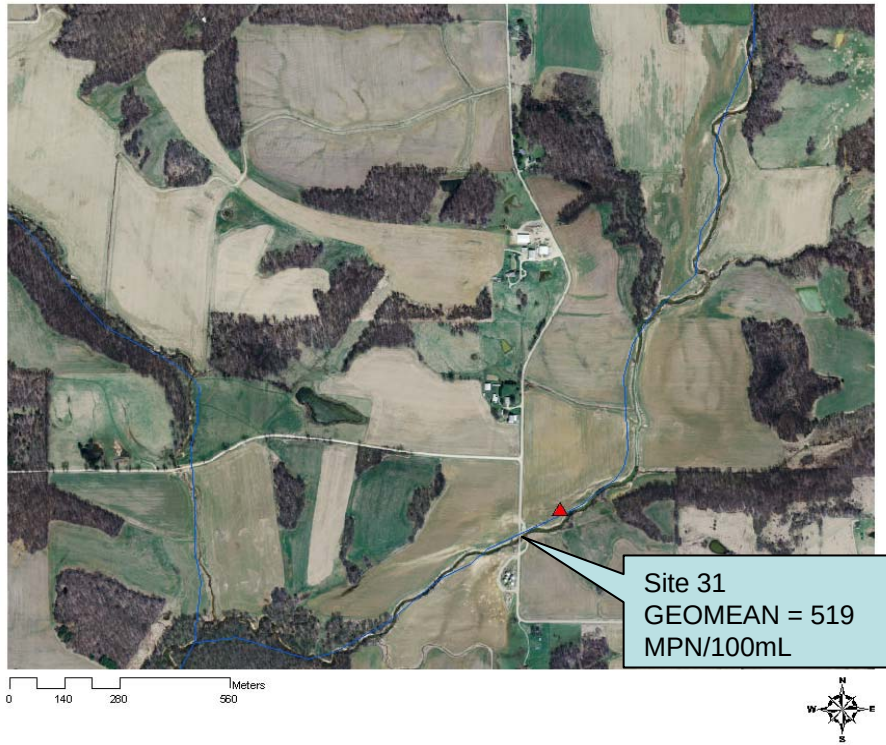
USGS Newberry Flow Gage. Spencer Precipitation Station - State Climate Office

Fish Creek at Splinter Ridge Rd.
Site 31: WWL020-0091

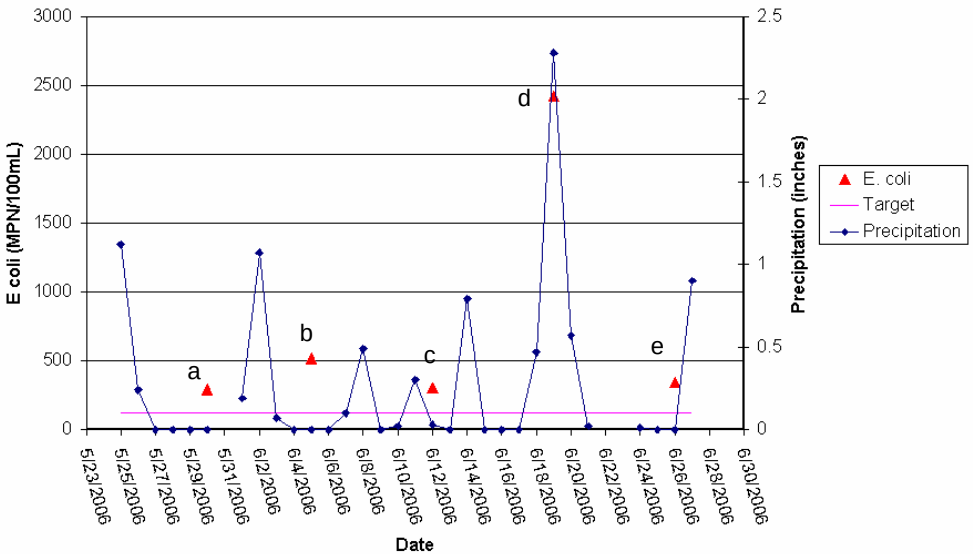
Load Duration Curve



10.31 miles^2



Precipitation



UPSTREAM

DOWNSTREAM

USGS Newberry Flow Gage. Spencer Precipitation Station - State Climate Office

Attachment C

E. coli Load Reductions for WFWR Owen County Tributary watershed TMDL

Load Reductions for the WFWR Owen County Tributary watershed

Site Number	Stream Name	Description	LSITE	GEOMEAN (MPN/100mL)	Overall Site Reduction (%)
1	Limestone Cr	Childers Rd	WWL020-0085	984.31	87.30
2	Limestone Cr	Ramona Rd just W of Gosport	WWL020-0078	287.35	56.50
3	White River	Stinesville Rd	WWL020-0079	532.43	76.52
4	Big Cr	Williams Rd/CR 275 N	WWL020-0080	477.48	73.82
5	White River	River Rd	WWL020-0057	682.07	81.67
6	Mill Cr	Westley Chapel Rd	WWL020-0082	708.01	82.34
7	Little Mill Cr	Rocky Hill Rd	WWL020-0083	670.94	81.37
8	Naans Br	Keeler Rd	WWL020-0084	1038.36	87.96
9	Mill Cr	Country Club Rd	WWL020-0077	425.30	70.61
10	Fall Cr	US 231 N of Spencer	WWL020-0076	466.04	73.18
11	McCormicks Cr	Flatwoods Rd	WWL020-0056	1419.41	91.19
12	McCormicks Cr	County Line Rd	WWL020-0074	1087.46	88.51
13	White River	SR 46 just E of Spencer	WWL020-0075	1524.19	91.80
14	Elliston Cr	River Rd	WWL020-0073	241.49	48.24
15	WFWR	SR43 & 46 Bridge	WWL020-0003	NA*	NA*
16	McBride Br	Pottersville Rd	WWL020-0070	502.16	75.11
17	Rattlesnake Cr	Rattlesnake Rd	WWL020-0086	332.49	62.40
18	Rattlesnake Cr	Hyden Rd	WWL020-0081	322.97	61.30
19	Mills Cr	Pottersville Rd	WWL020-0069	790.02	84.18
20	Goose Cr	Dunn Rd and CR 400 W	WWL020-0059	347.47	64.03
21	White River	CR 590 S Freedoms' New Bridge	WWL020-0068	314.19	60.22
22	Raccoon Cr	White Rd	WWL020-0072	641.61	80.52
23	Little Raccoon Cr	SR 43	WWL020-0071	753.32	83.41
24	Raccoon Creek	Heddings Rd.	WWL020-0054	675.18	81.49
25	Lick Cr	Newark Rd	WWL020-0095	549.42	77.25
26	Raccoon Cr	New Hope Rd	WWL020-0067	389.17	67.88
27	E Fk Fish Cr	Lennox Rd/CR 425N	WWL020-0093	287.39	56.51

28	W Fk Fish Cr	Valdalia Rd	WWL020-0094	527.60	76.31
29	E Fk Fish Cr	Patricksburg Rd	WWL020-0092	605.88	79.37
30	Sand Lick Cr	Hoot Rd	WWL020-0090	588.31	78.75
31	Fish Cr	Splinter Ridge Rd	WWL020-0091	519.88	75.96
32	Unnamed Trib to Fish Cr	Stuzt Rd	WWL020-0089	498.98	74.95
33	West Fork Cr	Hoot Rd.	WWL020-0088	458.85	72.76
34	Fish Cr	Goose Cr Rd	WWL020-0087	445.78	71.96
35	Mack Cr	Sassafrass Rd	WWL020-0066	625.46	80.01
36	Fish Creek	CR 550 S.	WWL020-0055	312.18	59.96
37	Fish Cr	US 231	WWL020-0065	319.47	60.87
38	Fish Creek	SR 231	WWL020-0058	407.23	69.30
39	Jack Cr	CR 850 S, just inside Owen Co line	WWL020-0064	346.93	63.97
40	White River	CR 990 N (Farmer's Ferry Rd), just aft confl w/Fish Cr	WWL020-0063	346.06	63.88
41	Buckhall Cr	CR 990 N (Farmer's Ferry Rd)West Side of White	WWL020-0062	1198.53	89.57
42	Goose Cr	CR 675 N	WWL020-0061	863.50	85.52
43	Clark Cr	CR 800 N	WWL020-0060	529.14	76.38
44	White River	SR 157 William Prior Memorial Bridge	WWL020-0096	450.83	72.27
*A GEOMEAN was not calculated at Site 15. There was not five samples.					