Eric J. Holcomb
Governor

Bruno L. Pigott
Commissioner

March 11, 2020

Thomas R. Short
Acting Division Director, Water Division
U.S. Environmental Protection Agency
R5, W15-J
77 West Jackson Boulevard
Chicago, IL 60604-3507

Dear Mr. Short,

The TMDL accompanying this letter is the Revised TMDL submission for the Southern Whitewater River Watershed Total Maximum Daily Load (TMDL) report approved by U.S. EPA on September 30, 2015. During IDEM's internal permit renewal and review process, it was discovered that the Lake Santee Regional Waste and Water District WWTP (IN0060704) was assigned a Wasteload Allocation (WLA) that was miscalculated for total phosphorus. The WLA was calculated based on the 0.3 mg/L TMDL target value rather than the intended permit limit of 1.0 mg/L. The permit limit value is consistent with IDEM's current permitting approach for assigning total phosphorus limits to facilities as monitoring data has indicated that, when in compliance, the in-stream target (0.3 mg/L) is typically met. Therefore, IDEM has made revisions to the 2015 TMDL report to update the relevant WLAs and summary tables. IDEM has proposed to re-allocate the Load Allocations (LAs) for the Righthand Fork Salt Creek (050800030502) subwatershed in order to accommodate the increased WLAs as this is consistent with the original intentions of the TMDL report. These adjustments allow for the overall TMDL to be met across all flow regimes, therefore IDEM believes the revised allocations continue to be protective of relevant water quality criteria. A 30-day public comment period on the revised document was initiated on February 5, 2020 and ended on March 6, 2020. IDEM received no public comments regarding this notice.

Revisions to the 2015 report:

- Section 4.2.1.1: Updated language to state more clearly that 1.0 mg/L was used to establish total phosphorus permit limits for relevant facilities.

- Section 11.3.2 (Table 84): Updated total phosphorus WLAs for Lake Santee WWTP from 0.25 lbs/day to 0.83 lbs/day based on recalculated 1.0 mg/L permit limit. Recalculated LAs for Righthand Fork Salt Creek subwatershed to accommodate increase in WLAs. The original and revised tables are included as an attachment to this letter.

Please direct any questions or comments on the Revised TMDL for the Southern Whitewater River Watershed to Angie Brown at 317-308-3102.

Sincerely,

Angela M Brown

Angie Brown, Section Chief
Watershed Planning and Restoration Section
Office of Water Quality

Cc: David Werbach, U.S. EPA Region 5
Paul Proto, U.S. EPA Region 5

Attachment 1: Original and revised versions for **Table 84: Summary of Righthand Fork Salt Creek Subwatershed Characteristics.**

Original table from the 2015 Southern Whitewater River TMDL report:

Righthand Fork Salt Creek (050800030502)					
Drainage Area (sq. mi.): 45.76					
TMDL Sample Sites: GMW-05-0014 (T3), GMW-05-0011 (T4), GMW-05-0007 (T6), GMW-05-0003 (P12)					
Listed Segments: ING0352_01, ING0352_T1001, ING0352_T1002, ING0352_T1003, ING0352_T1004, ING0352_T1005, ING0352_T1006					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10 %**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90-100%**
Bacteria TMDL (billions of bacteria/day)	**650.7**	**213.30**	**96.01**	**44.57**	**20.93**
Wasteload Allocation (WLA): Total	**0.89**	**0.89**	**0.89**	**0.89**	**0.89**
Lake Santee Regional Waste and Water District WWTP (IN0060704) 0.1 MGD	**0.89**	**0.89**	**0.89**	**0.89**	**0.89**
Load Allocation (LA)	**586.40**	**191.61**	**85.72**	**39.36**	**17.99**
Margin Of Safety (MOS) (5%)	**32.5**	**10.7**	**4.8**	**2.2**	**1.05**
Future Growth (5%)	**30.9**	**10.1**	**4.6**	**2.1**	**1.0**
Drainage Area (sq. mi.): 5.482					
TMDL Sample Sites: GMW-05-0011 (T4)					
Listed Segments: ING0352_T1006					
Flow Regime TMDL analysis for Total Phosphorus (pounds/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10 %**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90-100%**
Total Phosphorus TMDL (pounds/day)	**35.5**	**11.76**	**5.41**	**2.62**	**1.34**
Wasteload Allocation (WLA): Total	**0.25**	**0.25**	**0.25**	**0.25**	**0.25**
Lake Santee Regional Waste and Water District WWTP (IN0060704) 0.1 MGD	**0.25**	**0.25**	**0.25**	**0.25**	**0.25**
Load Allocation (LA)	**31.77**	**10.37**	**4.63**	**2.12**	**0.96**
Margin Of Safety (MOS) (5%)	**1.80**	**0.59**	**0.27**	**0.13**	**0.07**
Future Growth (5%)	**1.68**	**0.56**	**0.26**	**0.12**	**0.06**

Revised table showing updated calculations to the 2015 Southern Whitewater River TMDL report:

Righthand Fork Salt Creek (050800030502)					
Drainage Area (sq. mi.): 45.76					
TMDL Sample Sites: GMW-05-0014 (T3), GMW-05-0011 (T4), GMW-05-0007 (T6), GMW-05-0003 (P12)					
Listed Segments: ING0352_01, ING0352_T1001, ING0352_T1002, ING0352_T1003, ING0352_T1004, ING0352_T1005, ING0352_T1006					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10 %**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90-100%**
Bacteria TMDL (billions of bacteria/day)	**650.7**	**213.30**	**96.01**	**44.57**	**20.93**
Wasteload Allocation (WLA): Total	**0.89**	**0.89**	**0.89**	**0.89**	**0.89**
Lake Santee Regional Waste and Water District WWTP (IN0060704) 0.1 MGD	**0.89**	**0.89**	**0.89**	**0.89**	**0.89**
Load Allocation (LA)	**586.40**	**191.61**	**85.72**	**39.36**	**17.99**
Margin Of Safety (MOS) (5%)	**32.5**	**10.7**	**4.8**	**2.2**	**1.05**
Future Growth (5%)	**30.9**	**10.1**	**4.6**	**2.1**	**1.0**
Drainage Area (sq. mi.): 5.482					
TMDL Sample Sites: GMW-05-0011 (T4)					
Listed Segments: ING0352_T1006					
Flow Regime TMDL analysis for Total Phosphorus (pounds/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10 %**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90-100%**
Total Phosphorus TMDL (pounds/day)	**35.5**	**11.76**	**5.41**	**2.62**	**1.34**
Wasteload Allocation (WLA): Total	**0.83**	**0.83**	**0.83**	**0.83**	**0.83**
Lake Santee Regional Waste and Water District WWTP (IN0060704) 0.1 MGD	**0.83**	**0.83**	**0.83**	**0.83**	**0.83**
Load Allocation (LA)	**31.19**	**9.79**	**4.05**	**1.54**	**0.38**
Margin Of Safety (MOS) (5%)	**1.80**	**0.59**	**0.27**	**0.13**	**0.07**
Future Growth (5%)	**1.68**	**0.56**	**0.26**	**0.12**	**0.06**

Note: Rows highlighted in yellow have been revised based upon updated calculations. WLAs for Lake Santee Regional Waste and Water District WWTP were increased from 0.25 lbs/day to 0.83 lbs/day. LAs were reduced by 0.58 lbs/day.

Total Maximum Daily Load Report for the Southern Whitewater River Watershed

Revised Final Draft

February 5, 2020

Prepared for

U.S. Environmental Protection Agency Region 5

Prepared by

Indiana Department of Environmental Management

Contents

Tables

Figures

1.0 EXECUTIVE SUMMARY

The Southern Whitewater River watershed (HUC: 0508000305, 0508000306, 0508000308) is located in southeastern Indiana along the Ohio state border. The watershed has a surface area of 412 square miles and drains a total of 1,370 square miles. The Salt Creek watershed (0508000305) is located farthest west and originates near Buena Vista, Indiana before flowing east until the confluence with Whitewater River. The Whitewater River continues flowing east through Pipe Creek watershed (0508000306) before the confluence with East Fork Whitewater River from the north. Whitewater River then flows southeast as it travels through Whitewater River watershed (0508000308), entering Ohio near West Harrison, Indiana and ultimately entering the Ohio River through the Great Miami River west of Cincinnati. The mainstem Whitewater River is classified as a State Outstanding Resource and while few impairments exist currently, it is crucial to protect the condition of this aquatic resource to prevent future degradation. While this document covers the Southern Whitewater River watershed in its entirety, Salt Creek, Pipe Creek and Whitewater River watersheds will be discussed separately throughout the document.

The Clean Water Act (CWA) and U.S. Environmental Protection Agency (USEPA) regulations require that states develop Total Maximum Daily Loads (TMDLs) for waters on the Section 303(d) impaired waters list. A TMDL is the total amount of a pollutant that can be assimilated by the receiving water while still achieving water quality standards. TMDLs are composed of the sum of individual wasteload allocations (WLAs) for regulated sources and load allocations (LAs) for sources that are not directly regulated. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this is defined by the equation:

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

This TMDL has been developed for nutrients and sediment impaired biological communities and *E. coli* in the Southern Whitewater River watershed.

After IDEM identifies a waterbody as having an impairment and places the waterbody on Indiana's Section 303(d) list of impaired waters, IDEM implements a sampling plan to determine the extent and the magnitude of the impairment. The next task is to reassess the waterbodies using new sampling data and to examine the watershed as a whole. The reassessment data helps IDEM identify the area of concern for TMDL development. As a result of the reassessment for the Southern Whitewater River watershed, the pollutants and the impaired segments for which TMDLs were developed differ from the pollutants and impaired segments appearing on the Draft 2014 Section 303(d) list for the following reasons:

- Sampling performed by the Indiana Department of Environmental Management in 2013 and 2014 generated new water quality data that were not available at the time the Draft 2012 Section 303(d) list was developed.

Data used for the TMDL analysis were collected from 33 stream sites (T1-T33) by IDEM between November 2013 and October 2014. Twelve additional sites (P1-P12) were sampled between April 2014 and October 2014 as part of the IDEM probabilistic monitoring program. This data, although not specifically targeted through the TMDL monitoring design, was also used in reassessing the watershed. All available IDEM historical data was also used in supporting the results described in the TMDL document.

Potential sources of *E. coli*, nutrients and sediment in the watershed include regulated point sources such as waste water treatment plants (WWTPs), leaking or failing septic systems, industrial facilities and construction activities. Point sources are regulated through the National Pollutant Discharge Elimination System (NPDES). Potential nonpoint sources of *E. coli*, nutrients and sediment in the watershed include unregulated urban storm water, agricultural runoff, forested runoff and confined feeding operations (CFOs). Determining the specific reasons for high levels of *E. coli*, nutrients and sediment within any waterbody is challenging. There are many potential sources and the pollutants are inherently variable. Specific sources of each impaired waterbody should be further evaluated during follow-up implementation activities.

Determining the specific reasons for high *E. coli* counts in any given waterbody is challenging. There are many potential sources and *E. coli* counts are inherently variable. Within the Southern Whitewater River watershed, subwatersheds with agricultural land uses, confined feeding operations, and narrow riparian buffers surrounding streams also have the highest average *E. coli* counts. It is therefore possible that these characteristics are contributing to the elevated *E. coli* counts. However, other factors could also explain this correlation, such as steep terrain surrounding many of the streams causing runoff to enter the streams much faster carrying with it potential sources. Many of the subwatersheds are headwater streams and those subwatersheds also tend to experience smaller flows and thus have less dilution. Specific sources of *E. coli* to each impaired waterbody should be further evaluated during follow-up implementation activities.

Within the Southern Whitewater River watershed, subwatersheds with agricultural lands and wastewater treatment plants also have the highest total phosphorus loads. It is therefore possible that there are point sources, as well as, nonpoint sources contributing to elevated phosphorus loads. However, other factors could also explain this correlation, such as nutrient management practices, precipitation events and lake eutrophication contributing to downstream surface water. Specific sources of total phosphorus to each impaired waterbody should be further evaluated during follow-up implementation activities.

Within the Southern Whitewater River watershed, subwatersheds with narrow riparian buffers and steep terrain also have the highest total suspended solid (TSS) loads. It is therefore likely that high TSS loads coincide with rainfall events in these subwatersheds. However, other factors could also explain elevated levels of TSS, such as unknown illicit dischargers, permit violations or cattle access to streams.

Various subwatersheds in the Southern Whitewater River watershed have impaired biotic communities (IBC). Biological communities include fish and aquatic invertebrates, such as insects. These in-stream organisms are indicators of the cumulative effects of activities that affect water quality conditions over time. An IBC listing on Indiana's 303(d) list, suggests that one or more of the aquatic biological communities are unhealthy as determined by IDEM's monitoring data. IBC is not a source of impairment but a symptom of other sources. To address these impairments in the Southern Whitewater River watershed, nutrients (total nitrogen (TN) and total phosphorus (TP)) and total suspended solids (TSS) have been identified as pollutants for TMDL development.

An important step in the TMDL process is the allocation of the allowable loads to individual point sources as well as sources that are not directly regulated. The Southern Whitewater River watershed TMDL includes these allocations, which are presented for each of the 172 Assessment Unit IDs (AUIDs) located in the twenty 12-digit hydrologic unit code (HUC) subwatersheds.

There are five permitted WWTPs and four permitted industrial facilities located in the Southern Whitewater River watershed. Of these facilities, 2 have been found to be in violation of their permit limits for *E. coli*, nutrients and sediment. Although 2 NPDES facilities have been found to be in violation of their permit limits for *E. coli*, nutrients and sediment, the majority of the time discharge effluent from these facilities meets water quality standards.

There are several types of nonpoint sources located in the Southern Whitewater River watershed, including land use runoff, animal feeding operations, livestock with direct access to the stream, and wildlife. Although Indiana does not have a permitting program for nonpoint sources, many nonpoint sources are addressed through voluntary programs intended to reduce pollutant loads, minimize flow, and improve water quality.

This TMDL report identifies which locations could most benefit from focus on implementation activities. These areas throughout the Southern Whitewater River watershed are referred to as potential priority implementation areas (PPIAs). It also provides recommendations on the types of implementation activities, including best management practices (BMPs) that key implementation partners in the Southern Whitewater River watershed can consider to achieve the pollutant load reductions calculated for each subwatershed. PPIAs can help watershed stakeholders identify critical areas and select BMPs in the Southern Whitewater River watershed through a watershed management planning process. Tables 1, 2 and 3 present the PPIAs and associated BMP recommendations identified having a high likely degree of effectiveness to achieve the *E. coli*, nutrients and sediment load reductions allocated to sources in each subwatershed. These subwatershed rankings are based on the results of the Recovery Potential Tool (RPT), while the implementation activities are recommended based on potential point and nonpoint sources of pollution in the subwatershed.

Table 1 PPIAs and Recommended BMPs in the Salt Creek Watershed to Achieve Pollutant Load Reductions by Subwatershed

Subwatershed	PPIA Rank	Implementation Action
Fremont Branch (050800030505)	1	Outreach and education and training
		Filter Strips
		Grazing land management
Bull Fork (050800030503)	2	Filter Strips
		Riparian forested/herbaceous buffers
		Grazing land management
Little Salt Creek (050800030504)	3	Cover crops
		Riparian forested/herbaceous buffers
		Grazing land management
Righthand Fork Salt Creek (050800030502)	4	Comprehensive Nutrient Management Plan
		Conservation tillage/residue management
		Heavy Use Area Pad
Headwaters Salt Creek (050800030501)	5	Comprehensive Nutrient Management Plan
		Conservation tillage/residue management
		Heavy Use Area Pad

Table 2 PPIAs and Recommended BMPs in the Pipe Creek Watershed to Achieve Pollutant Load Reductions by Subwatershed

Subwatershed	PPIA Rank	Implementation Action
Yellow Bank Creek (050800030605)	1	Outreach and education and training
		System replacement
		Nutrient Management Plan
Walnut Fork (050800030604)	2	Outreach and education and training
		Filter strips

Subwatershed	PPIA Rank	Implementation Action
		Nutrient Management Plan
Clear Fork (050800030602)	3	Outreach and education and training
		Conservation tillage/residue management
		System replacement
Headwaters Pipe Creek (050800030601)	4	Outreach and education and training
		Conservation tillage/residue management
		System replacement
Duck Creek (050800030603)	5	Outreach and education and training
		Nutrient Management Plan
		Filter strips

Table 3 PPIAs and Recommended BMPs in the Whitewater River Watershed to Achieve Pollutant Load Reductions by Subwatershed

Subwatershed	PPIA Rank	Implementation Action
Jameson Creek (050800030810)	1	Not enough information to prioritize
Johnson Fork (050800030806)	2	Outreach and education and training
		Riparian forested/herbaceous buffers
		Constructed Wetland
Blackburn Creek (050800030805)	3	Outreach and education and training
		Riparian forested/herbaceous buffers
		Constructed Wetland
Little Cedar Creek (050800030804)	4	Riparian forested/herbaceous buffers
		Outreach and education and training
		Grazing land management
Wolf Creek (050800030802)	5	Riparian forested/herbaceous buffers
		Outreach and education and training
		Grazing land management
Big Cedar Creek (050800030803)	6	Outreach and education and training
		Nutrient Management Plan
		Filter strips
Headwaters Blue Creek (050800030801)	7	Manure handling, storage, treatment, and disposal
		Outreach and education and training
		Filter strips
Howard Creek (050800030808)	8	Manure handling, storage, treatment, and disposal
		Nutrient Management Plan
		Filter strips
Headwaters Dry Fork Whitewater River (050800030807)	9	Manure handling, storage, treatment, and disposal
		Nutrient Management Plan
		Filter strips
Lee Creek	10	Not enough information to prioritize

Public participation is an important and required component of the TMDL development process. The following public meetings and public comment periods have been held to further develop this project:

- Two TMDL public kickoff meetings were held on October 29, 2013. The first meeting was held at 2:00 PM (EST) at the Franklin County Government Center, 1010 Franklin Avenue, Brookville, IN 47012. The second kickoff meeting was held at 6:00 PM (EST) at the Batesville Middle School, 201 N. Mulberry Street, Batesville, IN 47006. IDEM described the TMDL program and provided a summary of the available data and the proposed sampling approach at both meetings.
- A Southern Whitewater River Monitoring Field Day was held on June 16, 2014 from 10:00 AM – 12:00 PM (EST). This event was held at the Brookville City Park along the East Fork Whitewater River. At this event, participants learned more about sampling methods from IDEM and Hoosier Riverwatch staff in the watershed. Field procedures for fish & macroinvertebrate collection, habitat assessment and water chemistry were demonstrated. Live wells and voucher specimens were on hand for observation.
- A Draft TMDL meeting was held at the Franklin County Government Center- Commissioners Room; 1010 Franklin Ave. Brookville, IN at 2:00 PM and Batesville Middle School- Commons; 201 Mulberry St. Batesville IN 6:00 PM on August 6, 2015 during which IDEM describes the TMDL program and provided an overview of the draft TMDL results. A representative from the Whitewater River Watershed Project will also provide information on current and future activities.

2.0 INTRODUCTION

This section of the Total Maximum Daily Load (TMDL) provides an overview of the Southern Whitewater River watershed location and the regulatory requirements that have led to the development of this TMDL to address impairments in the Southern Whitewater River watershed.

The Southern Whitewater River watershed (0508000305, 0508000306, 0508000308), shown in Figure 1, is located in southeastern Indiana along the Ohio state border. The watershed has a surface area of 412 square miles and drains a total of 1,370 square miles. The Salt Creek watershed (0508000305) is located farthest west and originates near Buena Vista, Indiana before flowing east until the confluence with Whitewater River. The Whitewater River continues flowing east through Pipe Creek watershed (0508000306) before the confluence with East Fork Whitewater River from the north. Whitewater River then flows southeast as it travels through Whitewater River watershed (0508000308), entering Ohio near West Harrison, Indiana and ultimately entering the Ohio River through the Great Miami River west of Cincinnati. Land use throughout the watershed is predominantly forested land. The Southern Whitewater River Watershed is primarily in Franklin County with Fayette, Rush, Decatur, Ripley and Dearborn Counties also having smaller portions of the watershed. The Righthand Fork Salt Creek subwatershed is also a source of drinking water for the community surrounding Lake Santee.

The Clean Water Act (CWA) and U.S. Environmental Protection Agency (USEPA) regulations require that states develop TMDLs for waters on the Section 303(d) lists. USEPA defines a TMDL as the sum of the individual wasteload allocations (WLA) for point sources and load allocations (LA) for nonpoint sources, and a margin of safety (MOS) such that the capacity of the waterbody to assimilate pollutant loadings is not exceeded.

The overall goals and objectives of the TMDL study for the Southern Whitewater River watershed are:

- Assess the water quality of the impaired waterbodies and identify key issues associated with the impairments and potential pollutant sources.
- Determine current loads of pollutants to the impaired waterbodies.
- Use the best available science and available data to determine the total maximum daily load the waterbodies can receive while fully supporting the impaired designated use(s).
- If current loads exceed the maximum allowable loads, determine the load reduction that is needed.
- Inform and involve the public throughout the project to ensure that key concerns are addressed and the best available information is used.
- Identify potential priority implementation areas (PPIAs) that watershed stakeholders can use to identify critical areas
- Recommend activities for purposes of TMDL implementation.
- Submit a final TMDL report to the U.S. Environmental Protection Agency (USEPA) for review and approval.

Watershed stakeholders and partners can use the final approved TMDL report to craft a watershed management plan (WMP) that meets both USEPA’s nine minimum elements under the CWA Section 319 Nonpoint Source Program, as well as the additional requirements under IDEM’s 2009 WMP Checklist.

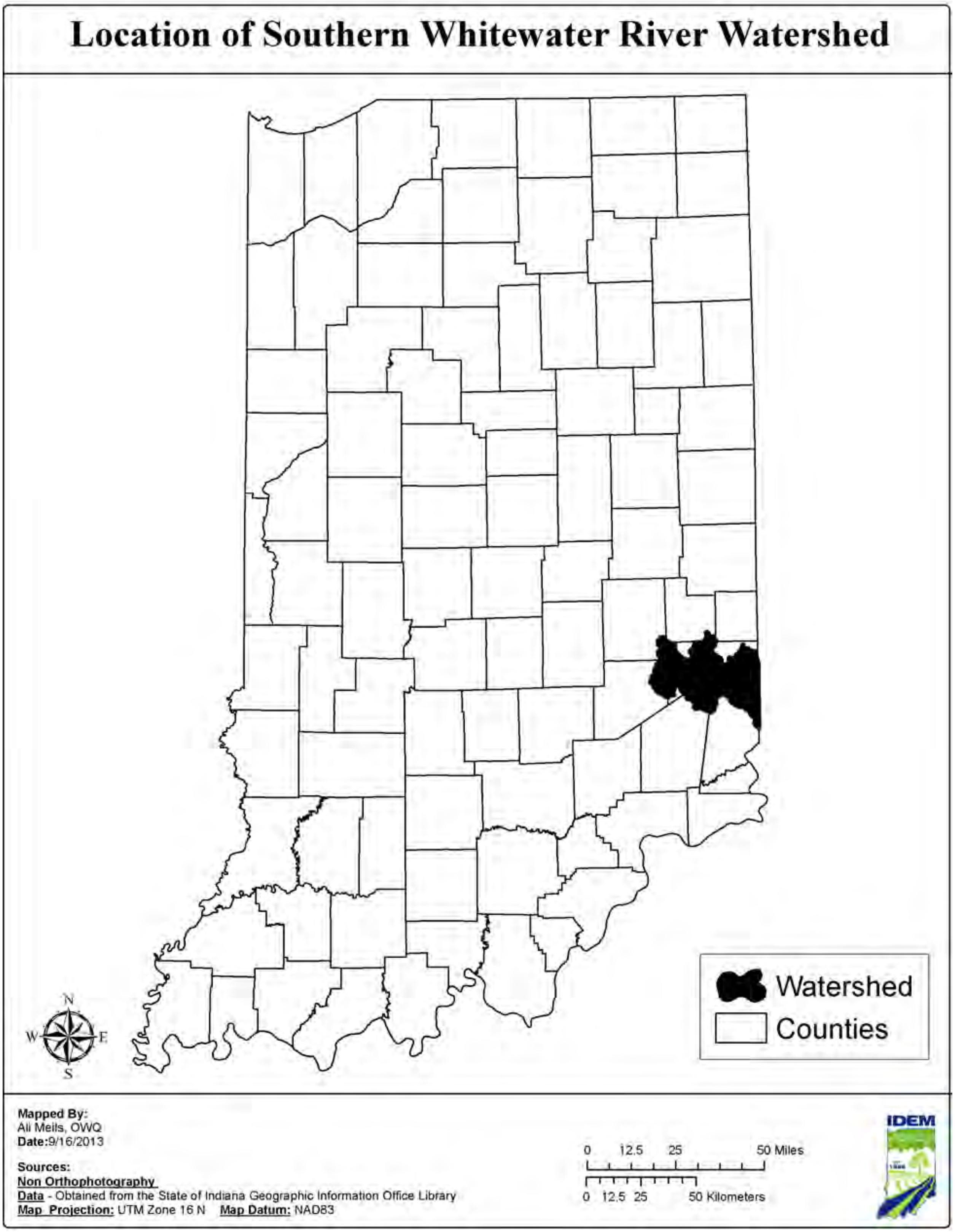


Figure 1 Location of the Southern Whitewater River Watershed

2.1 Water Quality Standards

Under the Clean Water Act (CWA), every state must adopt water quality standards to protect, maintain, and improve the quality of the nation's surface waters. These standards represent a level of water quality that will support the CWA's goal of "swimmable/fishable" waters. Water quality standards consist of three different components:

- **Designated uses** reflect how the water can potentially be used by humans and how well it supports a biological community. Examples of designated uses include aquatic life support, drinking water supply, and full body contact recreation. Every waterbody in Indiana has a designated use or uses; however, not all uses apply to all waters. The Southern Whitewater River Watershed TMDLs focus on protecting the designated aquatic life support, drinking water supply, and full body contact recreational uses of the waterbodies.
- Criteria express the condition of the water that is necessary to support the designated uses. **Numeric criteria** represent the concentration of a pollutant that can be in the water and still protect the designated use of the waterbody. **Narrative criteria** are the general water quality criteria that apply to all surface waters. Numeric criteria for *E. coli*, nutrients and sediment were used as the basis of the Southern Whitewater River Watershed TMDLs.
- Antidegradation policies protect existing uses and provide extra protection for high-quality or unique waters.

The water quality standards in Indiana pertaining to *E. coli*, nutrients and sediment are described below.

E. coli is an indicator of the possible presence of pathogenic organisms (e.g., enterococcal *E. coli*, viruses, and protozoa) which may cause human illness. The direct monitoring of these pathogens is difficult; therefore, *E. coli* is used as an indicator of potential fecal contamination. *E. coli* is a sub-group of fecal coliform, the presence of *E. coli* in a water sample indicates recent fecal contamination is likely. Concentrations are typically reported as the count of organisms in 100 milliliters of water (count/100 mL) and may vary at a particular site depending on the baseline *E. coli* level already in the river, inputs from other sources, dilution due to precipitation events, and die-off or multiplication of the organism within the river water and sediments.

The numeric *E. coli* criteria associated with protecting the recreational use are described below.

> *"The criteria in this subsection are to be used to evaluate waters for full body contact recreational uses, to establish wastewater treatment requirements, and to establish effluent limits during the recreational season, which is defined as the months of April through October, inclusive. E. coli bacteria, 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. . . However, a single sample shall be used for making beach notification and closure decisions."* [Source: Indiana Administrative Code Title 327 Water Pollution Control Board. Article 2. Section 1-6(a).]

The term nutrients refers to the various forms of nitrogen and phosphorus found in a waterbody. Both nitrogen and phosphorus are necessary for aquatic life, and both elements are needed at some level in a waterbody to sustain life. The natural amount of nutrients in a waterbody varies depending on the type of system. A pristine mountain spring might have little to almost no nutrients, whereas a lowland, mature stream flowing through wetland areas might have naturally high nutrient concentrations. Streams draining larger areas are also expected to have higher nutrient concentrations.

Nutrients generally do not pose a direct threat to the designated uses of a waterbody. However, excess nutrients can cause an undesirable abundance of plant and algae growth, a process is called eutrophication. Eutrophication can have many effects on a stream. One possible effect is low dissolved oxygen concentrations caused by excessive plant respiration and/or decay. Ammonia, which is toxic to fish at high concentrations, can be released from decaying organic matter when eutrophication occurs. For these reasons, excessive nutrients can result in the non-attainment of biocriteria and impairment of the designated use.

Like most states, Indiana has not yet adopted numeric water quality criteria for nutrients. The relevant narrative criteria that apply to the TMDLs presented in this report state the following:

> *"All surface waters at all times and at all places, including waters within the mixing zone, shall meet the minimum conditions of being free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges that do any of the following:" [327 IAC 2-1-6. Sec. 6. (a)(1)]…*
>
> *(a)re in concentrations or combinations that will cause or contribute to the growth of aquatic plants or algae to such degree as to create a nuisance, be unsightly, or otherwise impair the designated uses." [327 IAC 2-1-6. Sec. 6. (a) (1)(D)]*
>
> *(a)re in amounts sufficient to be acutely toxic to, or to otherwise severely injure or kill, aquatic life, other animals, plants, or humans." [327 IAC 2-1-6. Sec. 6. (a) (1)(E)]*

IDEM has not yet adopted numeric water quality criteria for total suspended solids (TSS). The relevant narrative criteria that apply to the TMDLs presented in this report state the following:

> *"All surface waters at all times and at all places, including waters within the mixing zone, shall meet the minimum conditions of being free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges that do any of the following:" [327 IAC 2-1-6. Sec. 6. (a)(1)]…*
>
> *(a)re in concentrations or combinations that will cause or contribute to the growth of aquatic plants or algae to such degree as to create a nuisance, be unsightly, or otherwise impair the designated uses." [327 IAC 2-1-6. Sec. 6. (a) (1)(D)]*
>
> *(a)re in amounts sufficient to be acutely toxic to, or to otherwise severely injure or kill, aquatic life, other animals, plants, or humans." [327 IAC 2-1-6. Sec. 6. (a) (1)(E)]*

In addition, the narrative biological criterion [327 IAC 2-1-3(2)] states the following:

> *"All waters, except those designated as limited use, will be capable of supporting a well-balanced, warm water aquatic community."*

The water quality regulatory definition of a "well-balanced aquatic community" is "*an aquatic community which is diverse in species composition, contains several different trophic levels, and is not composed mainly of pollution tolerant species*" [327 IAC 2-1-9(59)].

Table 4 presents the criteria associated with the fish community Warm Water Index of Biotic Integrity (IBI) and benthic aquatic macroinvertebrate community Index of Biotic Integrity (mIBI) that indicates whether a watershed is fully supporting or not supporting the aquatic life use.

Table 4 Aquatic Life Use Support Criteria for Biological Communities

Biotic Index		Integrity Class	Corresponding Integrity Class	Attributes
Fish community Warm Water Index of Biotic Integrity (IBI) Scores (Range of possible scores is 0-60)	Fully Supporting IBI ≥ 36	Excellent	53-60	Comparable to "least impacted" conditions, exceptional assemblage of species
		Good	45-52	Decreased species richness (intolerant species in particular), sensitive species present
		Fair	36-44	Intolerant and sensitive species absent, skewed trophic structure
	Not Supporting IBI < 36	Poor	23-35	Many expected species absent or rare, tolerant species dominant
		Very Poor	12-22	Few species and individuals present, tolerant species dominant
		No Organisms	0	No fish captured during sampling.
Benthic aquatic macroinvertebrate community Index of Biotic Integrity (mIBI) Scores Multihabitat MHAB methods (Range of possible scores is 12-60)	Fully Supporting mIBI ≥ 36	Excellent	53-60	Comparable to "least impacted" conditions, exceptional assemblage of species
		Good	45-52	Decreased species richness (intolerant species in particular), sensitive species present
		Fair	36-44	Intolerant and sensitive species absent, skewed trophic structure
	Not Supporting mIBI < 36	Poor	23-35	Many expected species absent or rare, tolerant species dominant
		Very Poor	12-22	Few species and individuals present, tolerant species dominant
		No Organisms	< 12	No macroinvertebrates captured during sampling.

2.2 TMDL Target Values

Target values are needed for the development of TMDLs because of the need to calculate allowable daily loads. For parameters that have numeric criteria, such as *E. coli*, the target equals the numeric criteria. For parameters that do not have numeric criteria, target values must be identified from some other source. The target values used to develop the Southern Whitewater River Watershed TMDL are presented below.

2.2.1 *E. coli*

The Southern Whitewater River TMDL *E. coli* target is: from April 1 through October 31, *E. coli* shall not exceed **235 cfu/100 mL**. For *E. coli* TMDLs, allocations were calculated based upon the **235 cfu/100 mL** portion of the criteria. U.S. EPA believes this target value is protective of both portions of the criteria. The U.S. EPA report, "*An Approach for Using Load Duration Curves in the Development of TMDLs*" (U.S. EPA, 2007) describes how the monthly geometric mean (in this case, 125 cfu/100 mL for *E. coli*) is likely to be met when the single sample maximum value (in this case, 235 cfu/100 mL for *E. coli*) is used to develop the loading capacity. The process calculates the daily maximum bacteria value that is possible to observe and still attain the monthly geometric mean. If the single sample maximum is set as a never-to-be surpassed value then it becomes the maximum value that can be observed, and all other bacteria values would have to be less than the maximum, i.e., 235 cfu/100 mL. U.S. EPA notes that whichever portion of the criteria is used to determine the allocations, both the monthly geometric mean and single sample maximum will be used to assess the extent of implementation by point and nonpoint sources.

2.2.2 IBC TMDLs

The following sections describe the TMDL target values used for nutrients and TSS when developing an IBC TMDL.

2.2.2.1 Nutrients

Although Indiana has not yet adopted numeric water quality criteria for nutrients, IDEM has identified the following nutrient benchmarks that are used to assess potential nutrient impairments:

- Total phosphorus should not exceed 0.30 mg/L (USEPA's nationwide 1986 Quality Criteria for Waters also known as the *Gold Book*).
- Total nitrogen should not exceed 10.0 mg/L (Indiana Drinking Water Standard).

The total phosphorus (0.30 mg/L) and total nitrogen (10.0 mg/L) values were used as TMDL targets during the development of the Southern Whitewater River Watershed TMDL. IDEM has determined that meeting these targets will result in achieving the narrative biological criterion by improving water quality and promoting a well-balanced aquatic community.

2.2.2.2 Total Suspended Solids (TSS)

Although Indiana has not yet adopted numeric water quality criteria for TSS, IDEM has identified target values based on the U.S. EPA recommendation for excellent fisheries. A target of 25.0 mg/L for total suspended solids has been identified as a protective concentration for fisheries (Waters, T.F., 1995). A target value of 25.0 mg/L TSS was therefore used as the TSS TMDL target value to ensure protection of biological communities and the supporting habitat in the Whitewater River and its tributaries to protect the State Outstanding Resource Waters. IDEM has determined that meeting the TSS target will result in achieving the narrative biological criterion by improving water quality and promoting a well-balanced aquatic community.

Various subwatersheds in the Southern Whitewater River watershed have impaired biological communities (IBC). Biological communities include fish and aquatic invertebrates, such as insects. These in-stream organisms are indicators of the cumulative effects of activities that affect water quality conditions over time. An IBC listing on Indiana's 303(d) list, means IDEM's monitoring data shows one or both of the aquatic communities are not as healthy as they should be. IBC is not a source of impairment but a symptom of other sources. To address these impairments in the Southern Whitewater River watershed, TSS and TP have been identified as pollutants for TMDL development.

Several subwatersheds in the Southern Whitewater River watershed have dissolved oxygen impairments. Dissolved oxygen is not a source of impairment but a symptom of other sources. To address these impairments in the Southern Whitewater River watershed, phosphorus and TSS, where applicable, have been identified as a pollutant for TMDL development.

2.3 Listing Information

The Southern Whitewater River watershed and a number of tributaries are listed as impaired for *E. coli*, and IBC's (nutrients and sediment) on Indiana's Impaired Waters List, as shown in Figure 2**Error! Reference source not found.**. IDEM identifies the Southern Whitewater River watershed and its tributaries using a watershed numbering system developed by USGS, NRCS, and the U.S. Water Resources Council referred to as hydrologic unit codes (HUCs). HUCs are a way of identifying watersheds in a nested arrangement from largest (i.e., those with shorter HUCs) to smallest (i.e., those with longer HUCs). (For more information on HUCs, go to http://www.in.gov/idem/nps/2422.htm.)

A total of 85 AUIDs within the Southern Whitewater River watershed will be cited as impaired for *E. coli*, nutrients, biological communities, dissolved oxygen, PCBs or mercury on the Indiana 2016 303(d) list. These impaired segments account for approximately 584 miles of *E. coli* impairments, 35 miles of nutrient impairments, 99 miles of IBC impairments, 87 miles of DO impairments, 62 miles of PCB impairments, and 34 miles of mercury impairments. The listings and causes of impairment have been adjusted as a result of reassessment data.

Table 6 presents listing information for the Southern Whitewater River watershed, including a comparison of the updated listings with the 2012 listings and associated causes of impairments addressed by the TMDLs. The reassessment data used in updating the listings for the Southern Whitewater River watershed are available in Appendix B.

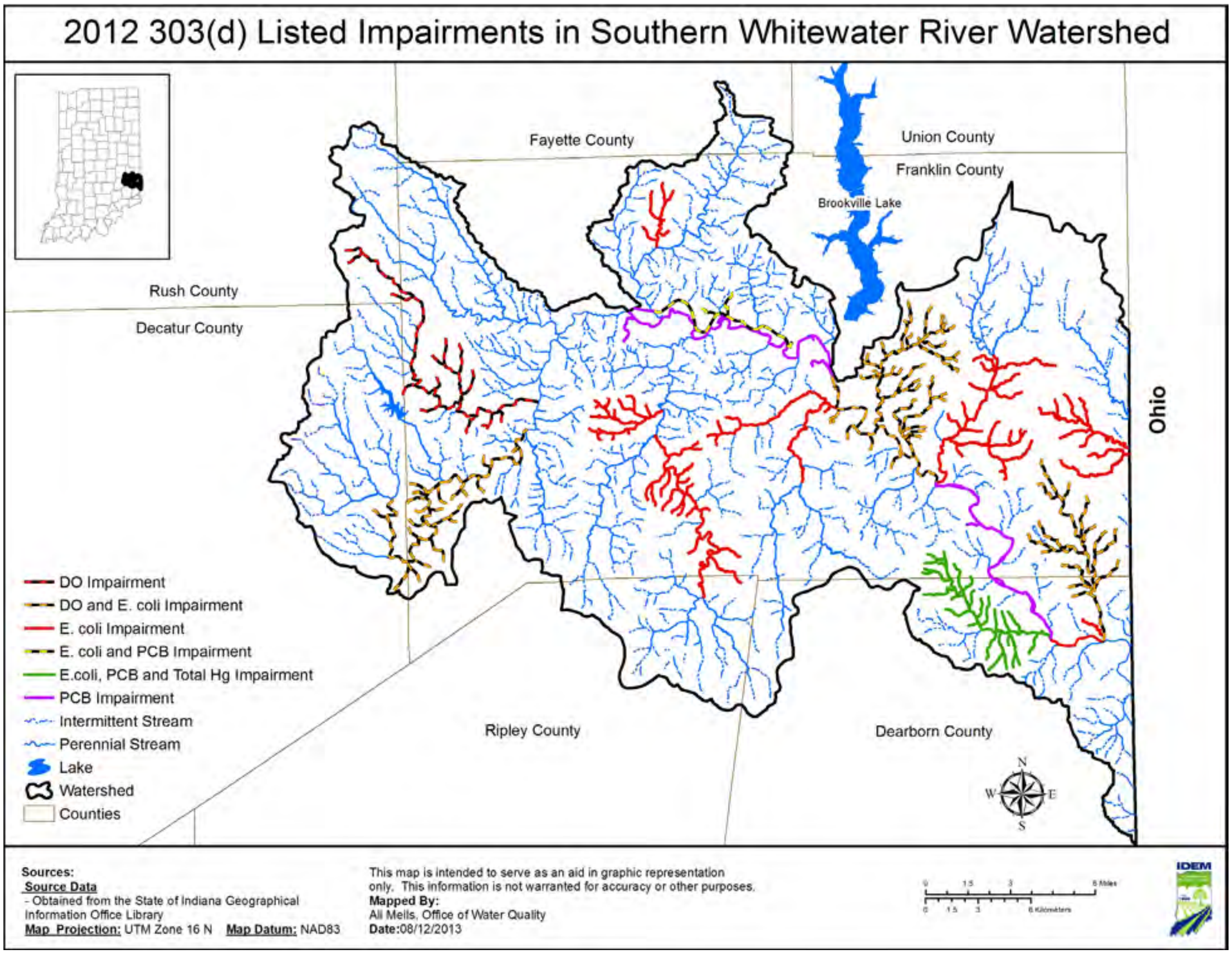


Figure 2 Streams Listed on the 2012 Section 303(d) List in the Southern Whitewater River Watershed

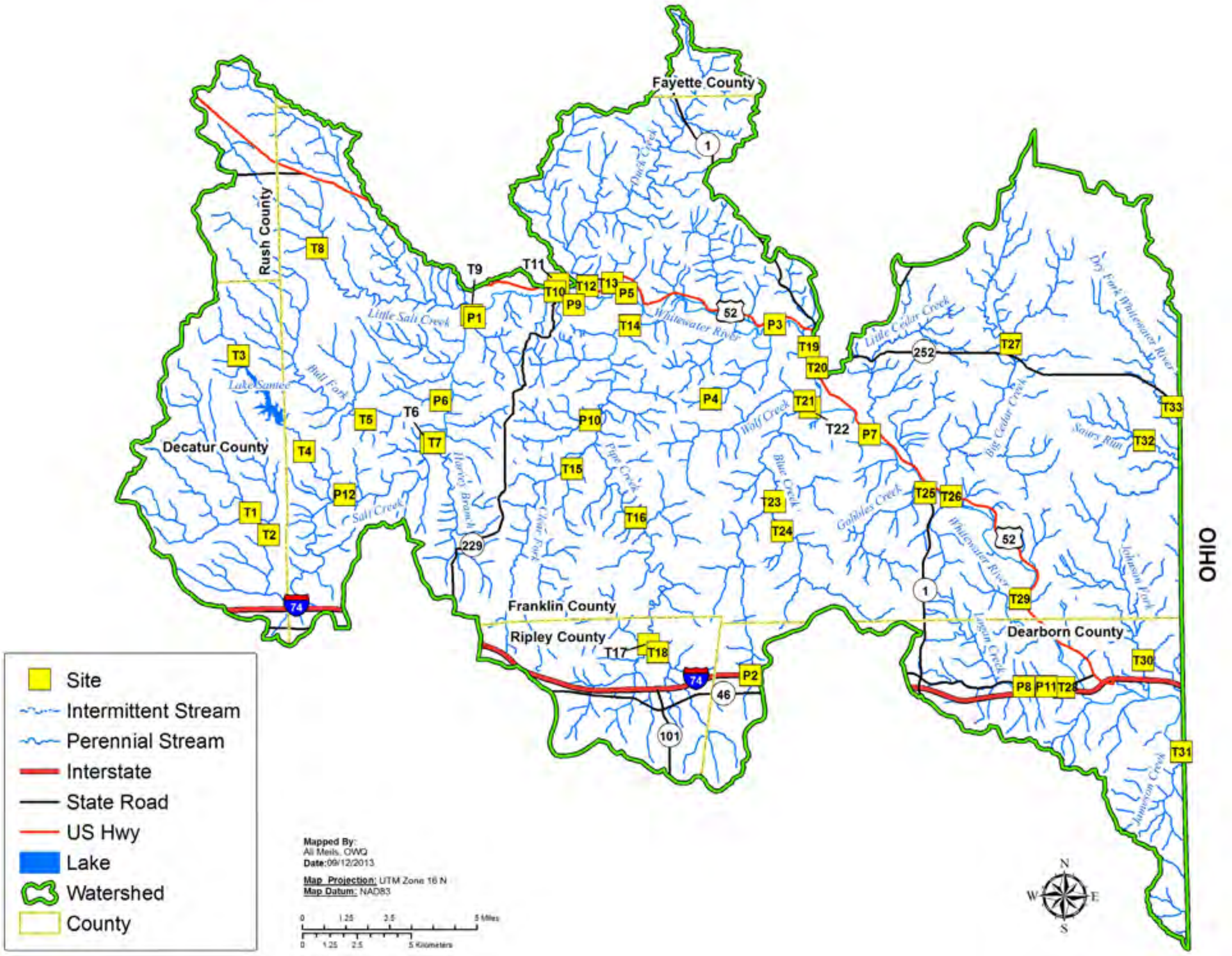


Figure 3 Sampling Locations in 2013 Southern Whitewater River Watershed TMDL

Table 5 Southern Whitewater River Sampling Site Information

Site #	L-Site #	Stream Name	Road Name	AUID 2012
T1	GMW050-0023	Tributary of Salt Creek	CR 150 N	ING0351_T1002
T2	GMW-05-0006	Salt Creek	CR 50 N	ING352_01
T3	GMW-05-0014	Righthand Fork Salt Creek	E CR 550 N	ING0352_T1003
T4	GMW-05-0011	Righthand Fork Salt Creek	Hamburg Rd	ING0352_T1006
T5	GMW-05-0009	Bull Fork	Bullfork Rd	ING353_02
T6	GMW-05-0007	Salt Creek	Rail Fence Rd	ING352_01
T7	GMW-05-0012	Harvey Branch	Rail Fence Rd	ING0355_T1002
T8	GMW-05-0015	South Fork Little Salt Creek	Chapel Rd	ING0354_T1003
T9	GMW-05-0008	Little Salt Creek	Stipps Hill Rd	ING0354_02
T10	GMW-05-0010	Salt Creek	SR 229	ING0355_01
T11	GMW-04-0018	Whitewater River	US 52	ING0348_03
T12	GMW-06-0019	Duck Creek	US 52	ING0363_02
T13	GMW-06-0022	Whitewater Canal	Unnamed Rd	ING0362_01
T14	GMW-06-0015	Pipe Creek	Silver Creek Rd	ING0364_02
T15	GMW-06-0013	Clear Fork	Schwegman Rd	ING0362_02
T16	GMW-06-0020	Pipe Creek	St. Marys Rd	ING0364_01
T17	GMW-06-0014	Tributary of Pipe Creek	St. Marys Rd	ING0361_T1005
T18	GMW060-0027	Pipe Creek	Pipe Creek Rd	ING0361_02
T19	GMW-06-0012	Whitewater River	Saint Mary Rd	ING0365_01
T20	GMW-07-0026	East Fork Whitewater River	US 52	ING037H_01
T21	GMW-08-0026	Wolf Creek	Blue Creek Rd	ING0382_02
T22	GMW080-0003	Blue Creek	Highland Center Rd	ING0382_01
T23	GMW-08-0014	Blue Creek	Blue Creek Rd	ING0382_01
T24	GMW-08-0022	East Fork Blue Creek	Blue Creek Rd	ING0381_02
T25	GMW-08-0015	Whitewater River	SR 1	ING0384_01
T26	GMW-08-0016	Big Cedar Creek	US 52	ING0383_02
T27	GMW-08-0024	Big Cedar Creek	Big Cedar Rd	ING0380_01
T28	GMW-08-0019	Logan Creek	SR 46	ING0386_T1001
T29	GMW-08-0030	Whitewater River	St. Peters Rd	ING0385_01
T30	GMW-08-0018	Johnson Fork	Johnson Fork Rd	ING0386_02
T31	GMW-08-0021	Whitewater River	Jamison Rd	ING038A_01
T32	GMW-08-0027	Sours Run	Drewersburg Rd	ING0388_01
T33	GMW-08-0020	Dry Fork Whitewater	Dickson Rd	ING0387_02

		River		
P1	GMW-05-0001	Little Salt Creek	Stipps Hill Rd	ING0354_02
P2	GMW-08-0001	Blue Creek	County Line Rd	ING0364_01
P3	GMW-06-0002	Whitewater River	St. Mary Rd	ING0365_01
P4	GMW-06-0003	McCartys Run	St. Mary Rd	ING0365_T1003
P5	GMW-06-0004	Whitewater River	Silver Creek Rd	ING0365_01
P6	GMW-05-0002	Bull Fork	Bullfork Rd	ING0353_02
P7	GMW-08-0013	Whitewater River	River Rd	ING0384_01
P8	GMW-08-0003	Logan Creek	Covered Bridge Rd	ING0386_T1001
P9	GMW-06-0005	Whitewater River	Pennington Rd	ING0365_01
P10	GMW-06-0006	Walnut Fork	Walnut Fork Rd	ING0364_T1003
P11	GMW-08-0005	Logan Creek	Higher Ground Lane	ING0386_T1001
P12	GMW-05-0003	Salt Creek	Giesting Rd	ING0352_01

Understanding Table 5:

- *Column 1: Site #.* Lists the site number that corresponds to the site location in Figure 3.
- *Column 2: L-Site #* .Provides the site number from the IDEM AIMS database.
- *Column 3: Stream Name*. Identifies the stream name that the site is located on.
- *Column 4: Road Name.* Identifies the road name at which the site is located or the nearest road crossing.
- *Column 5: AUID 2012.* Identifies the AUID given to waterbodies within the 12-digit HUC subwatershed for purposes of the Section 303(d) listing assessment process.

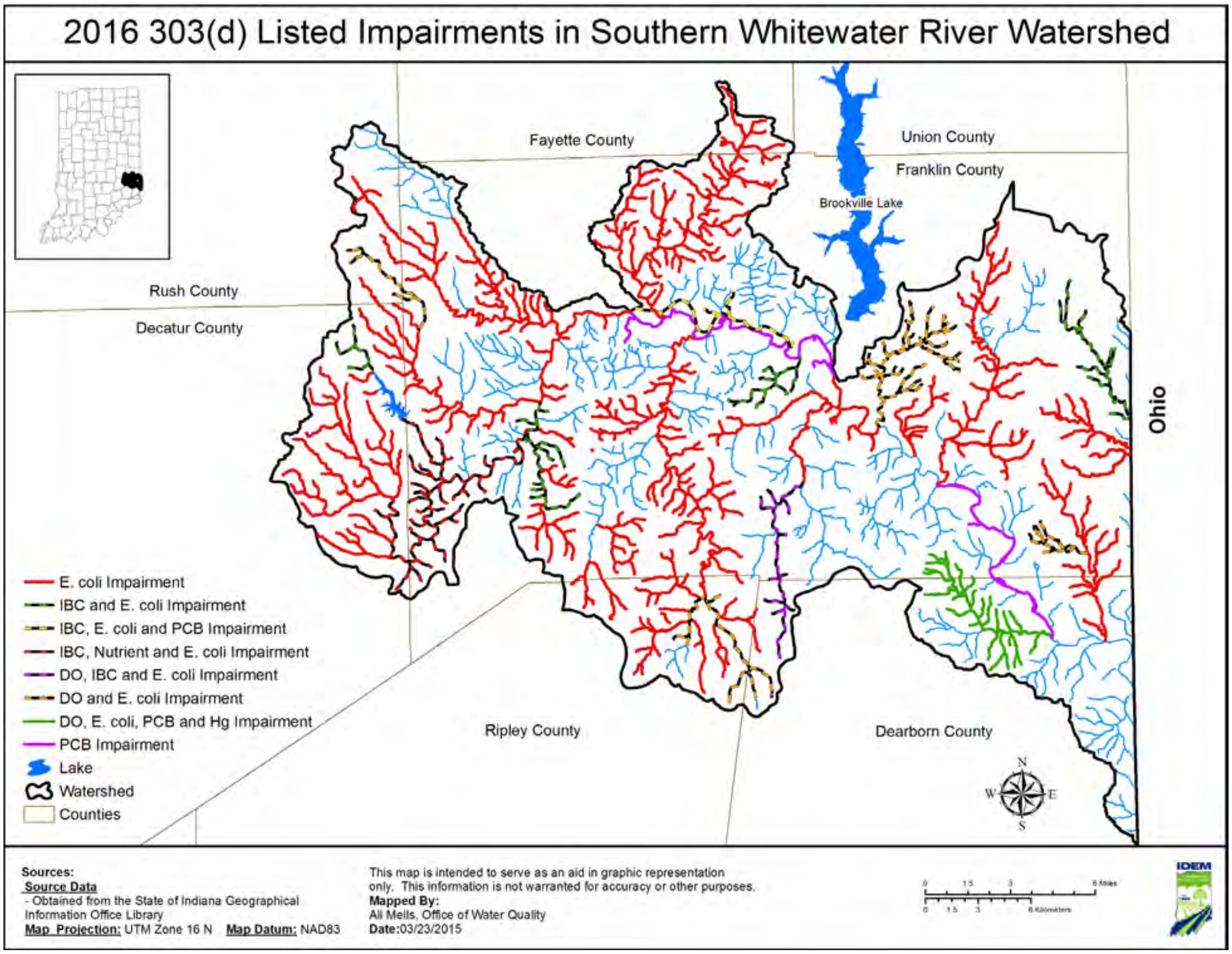


Figure 4 Streams Listed on the Draft 2016 Section 303(d) List in the Southern Whitewater River Watershed

Table 6 Section 303(d) List Information for the Southern Whitewater River Watershed for 2012 and 2016.

Watershed (10-digit HUC)	Subwatershed (12-digit HUC)	Previous AUID	Draft 2012 Section 303(d) Listed Impairment	New AUID	Updated Impairments to be Listed in on 4A in 2016	Number of TMDLs in 2015
Salt Creek (0508000305)	**Headwaters Salt Creek (050800030501)**	ING0351_00		ING0351_01	E. coli	E. coli-1
				ING0351_T1001	E. coli	E. coli-1
		New		ING0351_T1002	E. coli	E. coli-1
		New		ING0351_T1003	E. coli	E. coli-1
	Righthand Fork (050800030502)	ING0353_00	DO, *E. coli*	ING0352_01	E. coli, IBC, Nutrients	E. coli-1
		ING0352_00	DO, *E. coli*			
		New		ING0352_01A		
		ING0353_P1024		ING0352_P1001		
		New		ING0352_T1001	E. coli	E. coli-1
		New		ING0352_T1002	E. coli	E. coli-1
		New		ING0352_T1003	E. coli, IBC	E. coli-1
		New		ING0352_T1004	E. coli	E. coli-1
		New		ING0352_T1005	E. coli	E. coli-1
		ING0353_00		ING0352_T1006	E. coli, IBC, Nutrients	E. coli-1 TP-1 TN-1
		New		ING0352_T1007		
		New		ING0352_T1008		
		New		ING0352_T1009		
		New		ING0352_T1010		
		New		ING0352_T1011		
	Bull Fork (050800030503)	ING0355_00	DO	ING0353_01	E. coli, DO	E. coli-1
				ING0353_02	E. coli	E. coli-1
		New		ING0353_02A		
		New		ING0353_T1001	E. coli	E. coli-1
		New		ING0353_T1002	E. coli	E. coli-1
		New		ING0353_T1003	E. coli	E. coli-1
		New		ING0353_T1004	E. coli	E. coli-1
		New		ING0353_T1005	E. coli	E. coli-1
		ING0355_00	DO	ING0353_T1006		
		New		ING0353_T1007	E. coli	E. coli-1
		New		ING0353_T1008		
	Little Salt Creek (050800030504)	ING0357_00		ING0354_01		
				ING0354_02	E. coli	E. coli-1
		New		ING0354_T1001		
		ING0357_T1001		ING0354_T1002	E. coli	E. coli-1
				ING0354_T1003	E. coli	E. coli-1
		New		ING0354_T1004	E. coli	E. coli-1
		New		ING0354_T1005		

	Fremont Branch (050800030505)	ING0358_00 ING0356_00		ING0355_01	E. coli	E. coli-1, TSS-1
		ING0354_00		ING0355_T1001	E. coli	E. coli-1
				ING0355_T1002	E. coli, IBC	E. coli-1
		New		ING0355_T1003	E. coli	E. coli-1
		New		ING0355_T1004	E. coli	E. coli-1
		New		ING0355_T1005		
		ING0356_00		ING0355_T1006		
		New		ING0355_T1007		
		ING0356_00		ING0355_T1008		
		New		ING0355_T1009		
		New		ING0355_T1010		
Pipe Creek (0508000306)	Headwaters Pipe Creek (050800030601)	ING0363_00		ING0361_02	E. coli, DO (4C)	E. coli-1
		ING0363_P1026		ING0361_P1001		
		ING0363_P1025		ING0361_P1002		
		New		ING0361_T1003	E. coli	E. coli-1
		New		ING0361_T1004	E. coli	E. coli-1
		ING0363_00		ING0361_T1005	E. coli, DO	E. coli-1
		New		ING0361_T1005A		
		New		ING0361_T1005B		
		New		ING0361_T1005 C		
		New		ING0361_T1006	E. coli	E. coli-1
		New		ING0361_T1006A	E. coli	E. coli-1
		New		ING0361_T1007	E. coli	E. coli-1
		New		ING0361_T1008	E. coli	E. coli-1
		New		ING0361_T1009	E. coli	E. coli-1
	Clear Fork (050800030602)	ING0365_00		ING0362_02		
		New		ING0362_02A	E. coli	E. coli-1
		New		ING0362_T1002	E. coli	E. coli-1
		New		ING0362_T1003	E. coli	E. coli-1
		New		ING0362_T1004	E. coli	E. coli-1
		New		ING0362_T1005		
		New		ING0362_T1006		
	Duck Creek (050800030603)	ING0361_00		ING0363_01	E. coli	E. coli-1
		ING0361_01 ING0362_T1001		ING0363_02	E. coli	E. coli-1
		New		ING0363_T1001	E. coli	E. coli-1
		New		ING0363_T1002	E. coli	E. coli-1
		New		ING0363_T1003	E. coli	E. coli-1
		New		ING0363_T1004	E. coli	E. coli-1
		New		ING0363_T1005	E. coli	E. coli-1
		New		ING0363_T1006	E. coli	E. coli-1
		New		ING0363_T1007	E. coli	E. coli-1
		ING0361_T1001		ING0363_T1008	E. coli	E. coli-1

		New		ING0363_T1009	E. coli	E. coli-1
		ING0361_T1002		ING0363_T1010	E. coli	E. coli-1
	Walnut Fork (050800030604)	ING0364_00	*E. coli*	ING0364_01	E. coli	E. coli-1
		ING0366_00		ING0364_02	E. coli	E. coli-1
		New		ING0364_T1001	E. coli	E. coli-1
		New		ING0364_T1002	E. coli	E. coli-1
		ING0366_T1002	*E. coli*	ING0364_T1003	E. coli	E. coli-1
		New		ING0364_T1004		
		New		ING0364_T1005		
		ING0366_T1001		ING0364_T1006		
		New		ING0364_T1007		
		New		ING0364_T1008		
	Yellow Bank Creek (050800030605)	ING0362_00 ING0367_00 ING0368_00	PCBs	ING0365_01	PCBs	TSS-1
		ING0362_01 ING0367_00 ING0368_00	*E. coli*, PCBs	ING0365_02 ING0362_01	E. coli, IBC, PCBs (ING0362_01 only)	E. coli-1
		New		ING0365_T1001		
		ING0368_00		ING0365_T1002		
		ING0368_00		ING0365_T1003	E. coli, IBC	E. coli-1
		ING0368_00		ING0365_T1004		
		New		ING0365_T1005		
		New		ING0365_T1006		
		New		ING0365_T1007		
		ING0367_00		ING0365_T1008		
		New		ING0365_T1009		
Whitewater River (0508000308)	**Headwaters Blue Creek (050800030801)**	ING0381_00		ING0381_01	E. coli, DO, IBC	E. coli-1
		ING0382_00		ING0381_02		
		New		ING0381_T1001		
		New		ING0381_T1002		
		New		ING0381_T1003		
		New		ING0381_T1004		
	Wolf Creek-Blue Creek (050800030802)	ING0382_01 ING0383_00	*E. coli*	ING0382_01	E. coli, IBC	E. coli-1
		ING0384_T1001	*E. coli*	ING0382_02	E. coli	E. coli-1
		New		ING0382_T1001		
		New		ING0382_T1002		
		New		ING0382_T1003		
		New		ING0382_T1004		
		New		ING0382_T1005		
		New		ING0382_T1006		
		New		ING0382_T1007		
		New		ING0382_T1008		
		New		ING0382_T1009		

	Big Cedar Creek (050800030803)	ING0387_00 ING0387_T1001 ING0387_T1002 ING0387_T1003		ING0383_01	E. coli	E. coli-1
		ING0388_00	*E. coli*	ING0383_02	E. coli	E. coli-1
		ING0387_T1004		ING0383_T1001		
		ING0387_01		ING0383_T1002		
		ING0388_T1001	*E. coli*	ING0383_T1003	E. coli	E. coli-1
		ING0388_T1002	*E. coli*	ING0383_T1004	E. coli	E. coli-1
		ING0388_T1003	*E. coli*	ING0383_T1005	E. coli	E. coli-1
		ING0388_T1004		ING0383_T1006		
	Little Cedar Creek (050800030804)	ING0384_00 ING0385_00 ING0386_00	DO, *E. coli*	ING0384_01	E. coli	E. coli-1 TSS-1
		ING0385_00	DO, *E. coli*	ING0384_T1001	E. coli, DO	E. coli-1
		ING0386_00		ING0384_T1002		
		ING0386_T1043 ING0386_00	DO, *E. coli*	ING0384_T1003	E. coli	E. coli-1
		ING0386_00		ING0384_T1004		
	Blackburn Creek (050800030805)	ING0389_T1019 ING0389_T1020	PCBs	ING0385_01	PCBs	TSS-1
		ING0389_T1009		ING0385_01A		
		ING0389_T1002 ING0389_T1003		ING0385_T1001		
		ING0389_T1001		ING0385_T1002		
		New		ING0385_T1003		
		ING0389_T1005		ING0385_T1004		
		ING0389_T1006		ING0385_T1005		
		ING0389_T1007		ING0385_T1006		
		ING0389_T1008		ING0385_T1007		
		New		ING0385_T1008		
		New		ING0385_T1009		
		ING0389_T1010		ING0385_T1010		
	Johnson Fork (050800030806)	ING038B_T1021 ING038A_T1041	*E. coli*	ING0386_01		TSS-1
		ING038B_00	DO, *E. coli*	ING0386_02	E. coli	E. coli-1
		ING038A_00 ING038A_T1001 ING038A_T1002 ING038A_T1003 ING038A_T1004 ING038A_T1006 ING038A_T1007 ING038A_T1008	*E. coli,* PCBs, Hg	ING0386_T1001	E. coli, DO, IBC, PCBs, Hg	E. coli-1
		ING038A_T1005		ING0386_T1002	E. coli	E. coli-1
		ING038A_T1009		ING0386_T1003		
		ING038C_00		ING0386_T1004		
		New		ING0386_T1005		
		ING038B_00	DO, *E. coli*	ING0386_T1006	E. coli, DO (4C)	E. coli-1
		New		ING0386_T1006A	E. coli, DO (4C)	E. coli-1

		ING038B_00	DO, *E. coli*	ING0386_T1007	E. coli	E. coli-1
		ING038B_00	*E. coli*	ING0386_T1008	E. coli	E. coli-1
	Headwaters Dry Fork Whitewater River (050800030807)	ING038D_00		ING0387_02	E. coli, IBC	E. coli-1
				ING0387_03		
	Howard Creek (050800030808)	ING038E_00	*E. coli*	ING0388_01	E. coli	E. coli-1
		New		ING0388_P1001		
		ING038E_00	*E. coli*	ING0388_T1005	E. coli	E. coli-1
		New		ING0388_T1006		
		ING038E_00	*E. coli*	ING0388_T1007	E. coli	E. coli-1
		ING038F_00		ING0388_T1008		
	Lee Creek (050800030809)	ING038G_00		ING0389_01		
	Jameson Creek (050800030810)	ING038C_T1022		ING038A_01		TSS-1
		New		ING038A_01A		
		New		ING038A_P1001		
		ING038C_00		ING038A_T1010		
				ING038A_T1011		
		ING038H_00		ING038A_T1012		

Understanding Table 6***:***

- *Column 1: Watershed (10-digit HUC).* Lists the subwatersheds at the 10-digit HUC scale that were part of the initial assessment for the Southern Whitewater River watershed.
- *Column 2: Subwatershed (12-digit HUC).* Shows the name of the subwatershed at the 12-digit HUC scale. The subwatershed found in this second column is the appropriate scale for what the IDEM's WMP Checklist defines as a subwatershed for the purposes of watershed management planning.
- *Column 3: Previous AUID.* Identifies the AUID given to waterbodies within the 12-digit HUC subwatershed for purposes of the 2008 Section 303(d) listing assessment process.
- *Column 4: 2012 Section 303(d) Listed Impairment.* Identifies the cause of impairment associated with the 2012 Section 303(d) listing.
- *Column 5: New AUID.* Provides the updated AUIDs associated with each 12-digit HUC subwatershed. Look for these AUIDs used throughout this report to present detailed analysis of sources, load allocations, and recommended implementation activities in PPIAs.
- *Column 6: Updated Impairment to be Listed on 4A in 2016.* Provides the updated causes of impairment if new data and information are available.

2.4 Priority Ranking Discussion

The Southern Whitewater River Watershed TMDL was prioritized to be completed at this time based on local interest in addressing water quality, IDEM's interest in conducting baseline water quality monitoring for local planning, and a competitive Section 319 application from the local partners to develop a watershed management plan, and implementation management measures, including BMPs.

3.0 DESCRIPTION OF THE SALT CREEK WATERSHED

This section of the TMDL report contains a brief characterization of the Salt Creek watershed to provide a better understanding of the historic and current conditions of the watershed that affect water quality and contribute to *E.coli* and nutrient impairments. Understanding the natural and human factors affecting the watershed will assist in selecting and tailoring appropriate and feasible implementation activities to achieve water quality standards.

The Salt Creek watershed (0508000305), shown in Figure 5, is located farthest west in the Southern Whitewater River watershed. The watershed comprises 117 square miles and also drains a total of 117 square miles. The tributaries of Salt Creek watershed originate in Rush and Decatur counties and flow east into Franklin County. Salt Creek then flows north before its confluence with Whitewater River. Land use throughout the watershed is predominantly forested land. The Salt Creek Watershed is also a source of drinking water for the community surrounding Lake Santee.

There are a number of existing impairments in the Salt Creek watershed from the Draft 2012 303(d) List of Impaired Waters (Figure 5). In the Salt Creek watershed there are approximately 53 stream miles on the Draft 2012 303(d) List of Impaired Waters. The listings and causes of impairment have been adjusted as a result of reassessment data collected at 13 sampling locations in the watershed (Figures 3). Within the Salt Creek watershed a total of 28 assessment unit IDs (AUIDs) are cited as impaired for *E. coli* (193 stream miles), nutrients (35 stream miles), or biological communities (51 stream miles) on the Indiana's Draft 2016 303(d) list (Figure 7). These impaired segments account for approximately 193 stream miles. Table 3 presents listing information for the Salt Creek watershed, including a comparison of the updated listings with the 2012 listings and associated causes of impairments addressed by the TMDLs. The reassessment data used in updating the listings for the Salt Creek watershed are available in Appendix B.

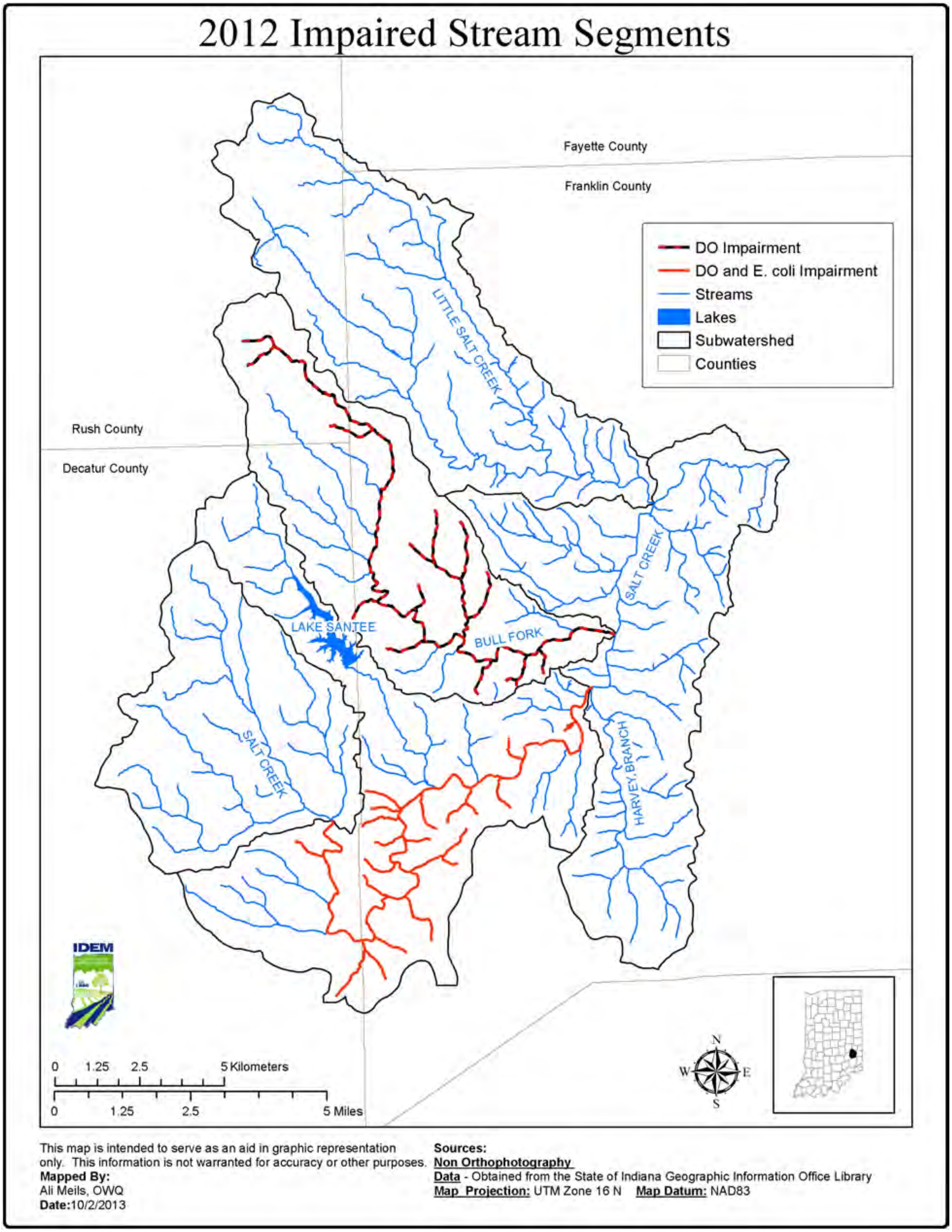


Figure 5 Streams Listed on the Draft 2012 Section 303(d) List in the Salt Creek Watershed

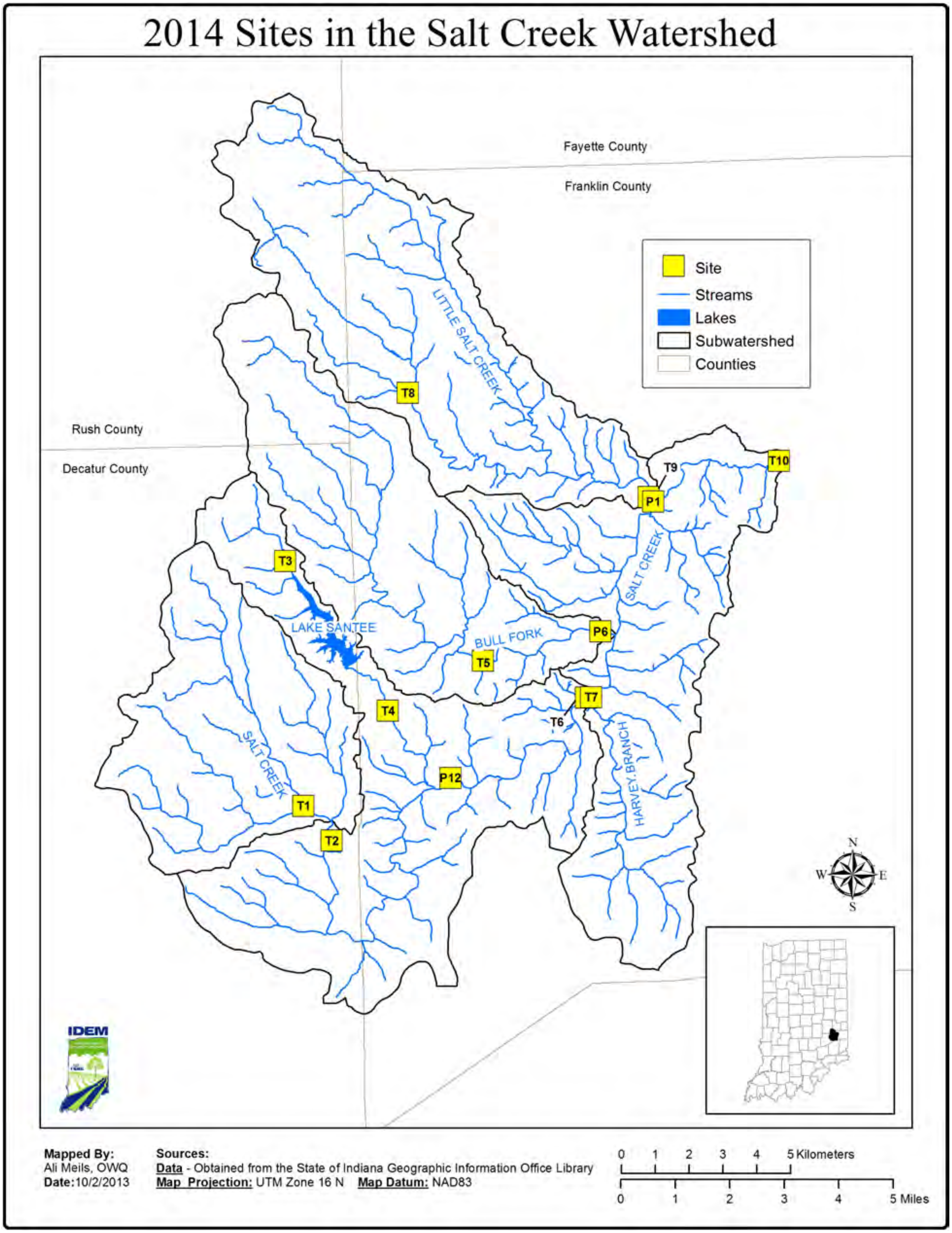


Figure 6 Sampling Locations in 2014 Salt Creek Watershed

Table 7 Salt Creek Sampling Site Information

Site #	Station #	Stream Name	Road Name	AUID 2012
T1	GMW050-0023	Tributary of Salt Creek	CR 150 N	ING0351_T1002
T2	GMW-05-0006	Salt Creek	CR 50 N	ING0352_01
T3	GMW-05-0014	Righthand Fork Salt Creek	E CR 550 N	ING0352_T1003
T4	GMW-05-0011	Righthand Fork Salt Creek	Hamburg Road	ING0352_T1006
T5	GMW-05-0009	Bull Fork	Bullfork Road	ING0353_02
T6	GMW-05-0007	Salt Creek	Rail Fence Road	ING0352_01
T7	GMW-05-0012	Harvey Branch	Rail Fence Road	ING0355_T1002
T8	GMW-05-0015	South Fork Little Salt Creek	Chapel Road	ING0354_T1003
T9	GMW-05-0008	Little Salt Creek	Stipps Hill Road	ING0354_02
T10	GMW-05-0010	Salt Creek	SR 229	ING0355_01
P1	GMW-05-0001	Little Salt Creek	Stipps Hill Rd	ING0354_02
P6	GMW-05-0002	Bull Fork	Bullfork Rd	ING0353_02
P12	GMW-05-0003	Salt Creek	Giesting Rd	ING0352_01

Understanding Table 7:

- *Column 1: Site #.* Lists the site number that corresponds to the site location in Figure 3.
- *Column 2: Station #* .Provides the IDEM site identification number for the location.
- *Column 3: Stream Name*. Identifies the Stream Name where the site is located.
- *Column 4: Road Name.* Identifies the Road Name where the site is located.
- *Column 5: AUID 2012.* Identifies the AUID given to waterbodies within the 12-digit HUC subwatershed for purposes of the 2016 Section 303(d) listing assessment process.

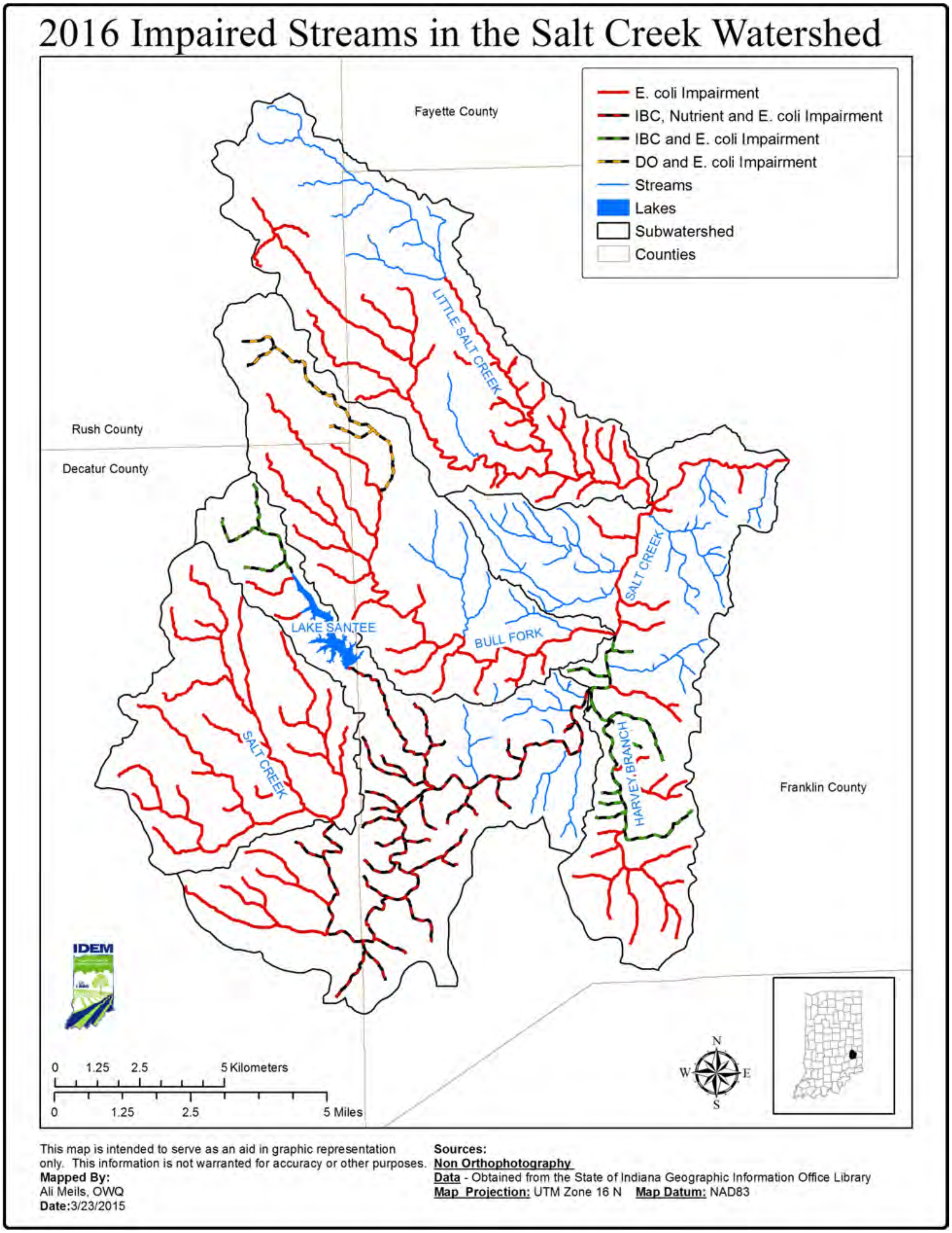


Figure 7 Streams Listed on the Draft 2016 Section 303(d) List in the Salt Creek Watershed

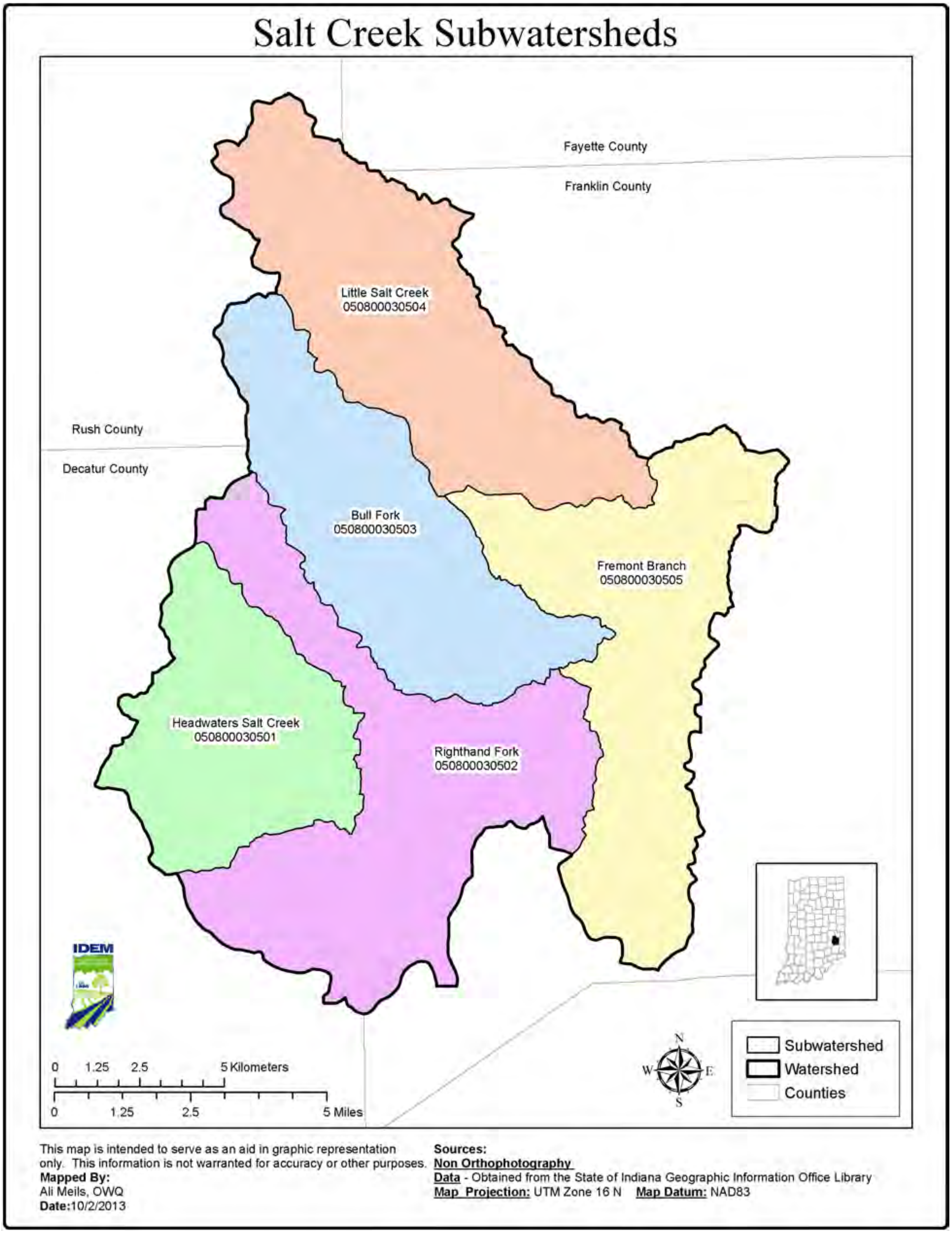


Figure 8 Subwatersheds (12-Digit HUCs) in the Salt Creek Watershed

3.1 Land Use

Land use patterns provide important clues to the potential sources of *E. coli*, nutrients and sediment in a watershed. Land use information for the Salt Creek watershed is available from the USDA, National Agriculture Statistics Service (NASS), and 2012 Indiana Cropland Data Layer. The Cropland Data Layer (CDL) categorizes the land use for each 30 meters by 30 meters parcel of land in the watershed based on satellite imagery from circa 2012. Figure 9 displays the spatial distribution of the land uses and the data are summarized in Table 8.

Land use in the Salt Creek watershed is primarily forested, comprising 50 percent of the Salt Creek watershed. Undeveloped forested land is ideal for riparian areas around waterbodies. The topography of the watershed may play a greater role in pollutants reaching the stream than the forested land use areas. Approximately 30 percent of the land is agriculture and 5 percent is developed. Agricultural lands can be significant sources of TSS, nutrients and *E. coli* if they are fertilized with manure and other inorganic fertilizers. The remaining land categories represent less than 15 percent of the total land area.

The Salt Creek watershed has a diverse network of streams. Tributaries include Little Salt Creek, Bull Fork, Righthand Fork Salt Creek, Fremont Branch and Harvey Branch among others. Many of these tributaries are shown in Figure 6 and Figure 7. The Salt Creek watershed is comprised of fast flowing headwater streams, surrounded by forested riparian areas. The smaller headwater streams along the northern and western edge are impacted by agricultural practices, however the majority of the watershed has little silt with a cobble and gravel substrate. They are fast flowing streams based on the topography of the land. The variegate darter (*Etheostoma variatum*) is an Indiana State Endangered fish species that is found in Whitewater River along the mainstem. Salt Creek is the only known tributary to Whitewater River where the Variegate Darters are also found. The Variegate Darter is restricted to the Ohio River drainage and are only found in the Whitewater River watershed in Indiana. They are an indicator of good water quality and are abundant in high quality streams. They are found in medium to large streams and rivers with swift flowing riffles with gravel, cobble or boulders on the stream bottom. Additional information on state endangered, threatened and rare species can be found on the DNR website (http://www.in.gov/dnr/naturepreserve/4666.htm). No Variegate Darters were collected in the Salt Creek watershed during IDEMs sampling in 2014. A reduction in the TSS target was implemented in the area where the Variegate Darters have been found a more detailed discussion of this is found in Section 13 of this document

Table 8 Land Use of Salt Creek Watershed

Land Use	Watershed Area Acres	Watershed Area Square Miles	Watershed Percent
Agricultural Lands	22,088.70	34.51	29.40
Developed Land	3,651.28	5.71	4.87
Forested Land	37,886.96	59.20	50.44
Pasture/Hay	10,173.23	15.90	13.55
Shrub/Scrub	869.79	1.36	1.16
Wetlands	2.45	0.01	0.01
Open Water	426.55	0.67	0.57
TOTAL	**75,098.96**	**117.36**	**100**

Understanding Table 8: The predominant land use types in the Salt Creek watershed can indicate potential sources of *E. coli*, nutrient and sediment loadings. Different types of land uses are characterized by different types of hydrology. For example, developed lands are characterized by impervious surfaces that increase the potential of storm water events during high flow periods delivering *E. coli*, nutrients and sediment to downstream streams and rivers. Forested land and wetlands allow water to infiltrate slowly thus reducing the risks of polluted water to running off into waterbodies. In addition to differences in hydrology, land use types are associated with different types of activities that could contribute *E. coli*, nutrients and sediment to the watershed. Understanding types of land uses will help identify the type of implementation approaches that watershed stakeholders can use to achieve *E. coli*, nutrient and sediment load reductions.

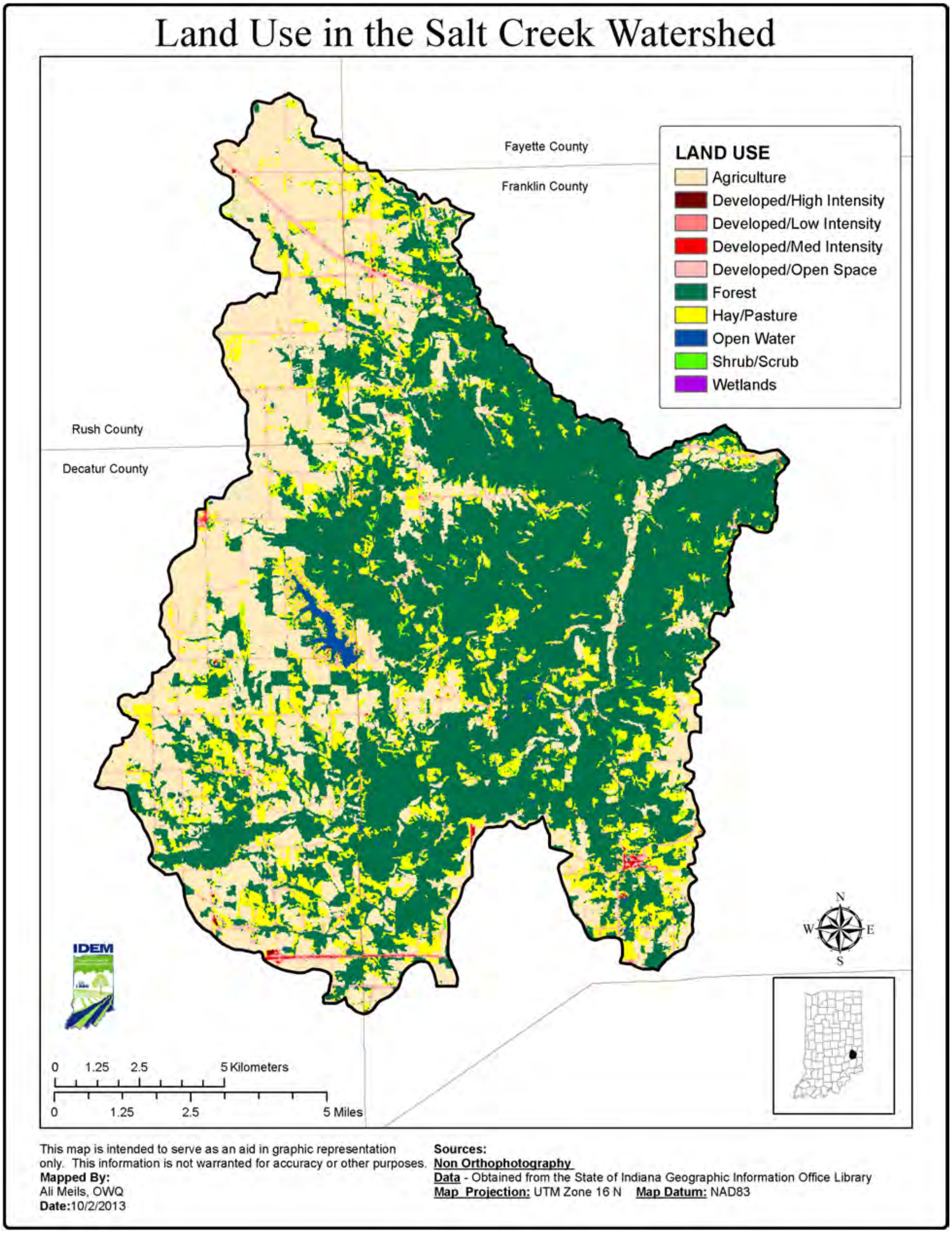


Figure 9 Land Use in the Salt Creek Watershed

3.2 Cropland

Land use patterns provide important clues to the potential sources of *E. coli*, nutrients and sediment in a watershed. Land use information for the Salt Creek watershed is available from the USDA, National Agriculture Statistics Service (NASS), and Indiana Cropland Data Layer. These data categorize the land use for each 30 meters by 30 meters parcel of land in the watershed based on satellite imagery from 2012. Figure 910 displays the spatial distribution of the cropland and the data are summarized in Table 8.

Land use in the Salt Creek watershed is primarily forested, comprising approximately 50 percent of the Salt Creek watershed. However there is a significant portion of the watershed that is agricultural (30 percent). Corn and soybean crops are not typically associated with high *E. coli*, nutrient and sediment, loads, unless they have been fertilized with manure. Approximately 94 percent of the cropland is corn or soybean.

Table 9 Crop Land of Salt Creek Watershed

Crop Data	Watershed		
	Area		Percent
	Acres	Square Miles	
Corn	11635.03	18.18	50.87
Soybean	9916.14	15.49	43.35
Alfalfa and other Hay	989.43	1.55	4.32
Double Crop Winter Wheat/corn or Soybeans	328.69	0.51	1.44
Double Crop Soybeans/Oats	1.33	<0.01	<0.01
Pop or Orn Corn	0.67	<0.01	<0.01
Tomatoes	0.44	<0.01	<0.01
Rye	0.44	<0.01	<0.01
TOTAL	22,872.17	35.73	100

Understanding Table 9: The predominant cropland types in the Salt Creek watershed can indicate potential sources of *E. coli*, nutrient and sediment loadings. Cropland use in the Salt Creek watershed is primarily corn and soybean. Understanding types of cropland will help identify the type of implementation approaches that watershed stakeholders use to achieve *E. coli*, nutrient and sediment load reductions.

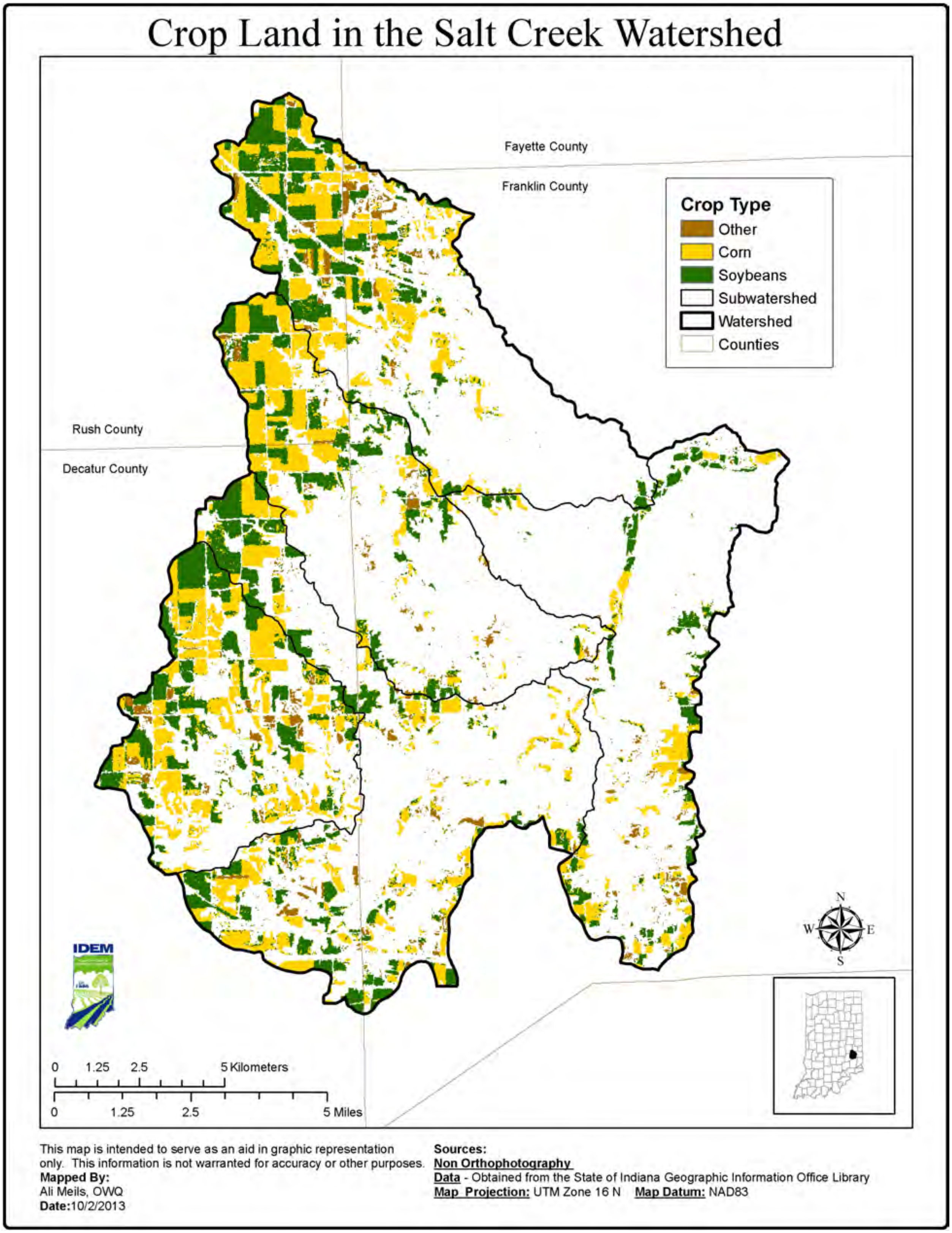


Figure 10 Crop Land of Salt Creek Watershed

3.3 Human Population

Counties with land located in the Salt Creek watershed include Rush, Fayette, Decatur and Franklin counties. Major cities and towns with jurisdiction at least partially within the Salt Creek watershed include Oldenburg and Batesville. Unincorporated towns in the watershed include Andersonville, Clarksburg, and Buena Vista. U.S. Census data for each county during the past three decades are provided in Table 10. Cities and towns are labeled in Figure 11.

Table 10 Population Data for Counties in the Salt Creek Watershed

County	1990	2000	2010
Rush	18,159	18,261	17,392
Fayette	26,065	25,588	24,277
Decatur	23,673	24,555	25,740
Franklin	19,580	22,151	23,087
TOTAL	***87,477***	***90,555***	***90,496***

Source: U.S. Census Bureau.

Understanding Table 10. Water quality is linked to population growth because a growing population often leads to more development, translating into more houses, roads, and infrastructure to support more people. Table 10 provides information that shows how population has changed in each of the counties located in the Salt Creek watershed over time. In addition, understanding population trends can help watershed stakeholders to anticipate where pressures might increase in the future and where action now could help prevent further water quality degradation.

Estimates of population within Salt Creek watershed are based on US Census data (2010) and the percentage of the total county and urban area that is within the watershed (Table 11). Based on this analysis, the estimated population of the watershed is 8,700 with approximately 93 percent of the population classified as rural residents and seven percent classified as urban residents. Figure 12 indicates population density within the Salt Creek watershed.

Table 11 Estimated Population in the Salt Creek Watershed

County	2010 Population	Total Estimated Watershed Population	Percent of Total Watershed Population	Non-urban Population	Urban Population
Rush	17,392	473	5.43	473	0
Fayette	24,277	35	0.40	35	0
Decatur	25,740	2,223	25.49	2,203	20
Franklin	23,087	5,990	68.68	5,401	589
TOTAL	***90,496***	**8,721**	**100**	**8,112**	**609**

Understanding Table 11: Problems associated with impervious surfaces, riparian habitat, storm water flows, and wastewater inputs are where the greatest population is concentrated. Non-urban populations are more likely to suffer from failing septic systems, agricultural runoff, and poor riparian habitat. Comparing information in Table 10 with Table 11 can provide an understanding of how population might change and which counties are experiencing the most growth and shifts in urban and non-urban population.

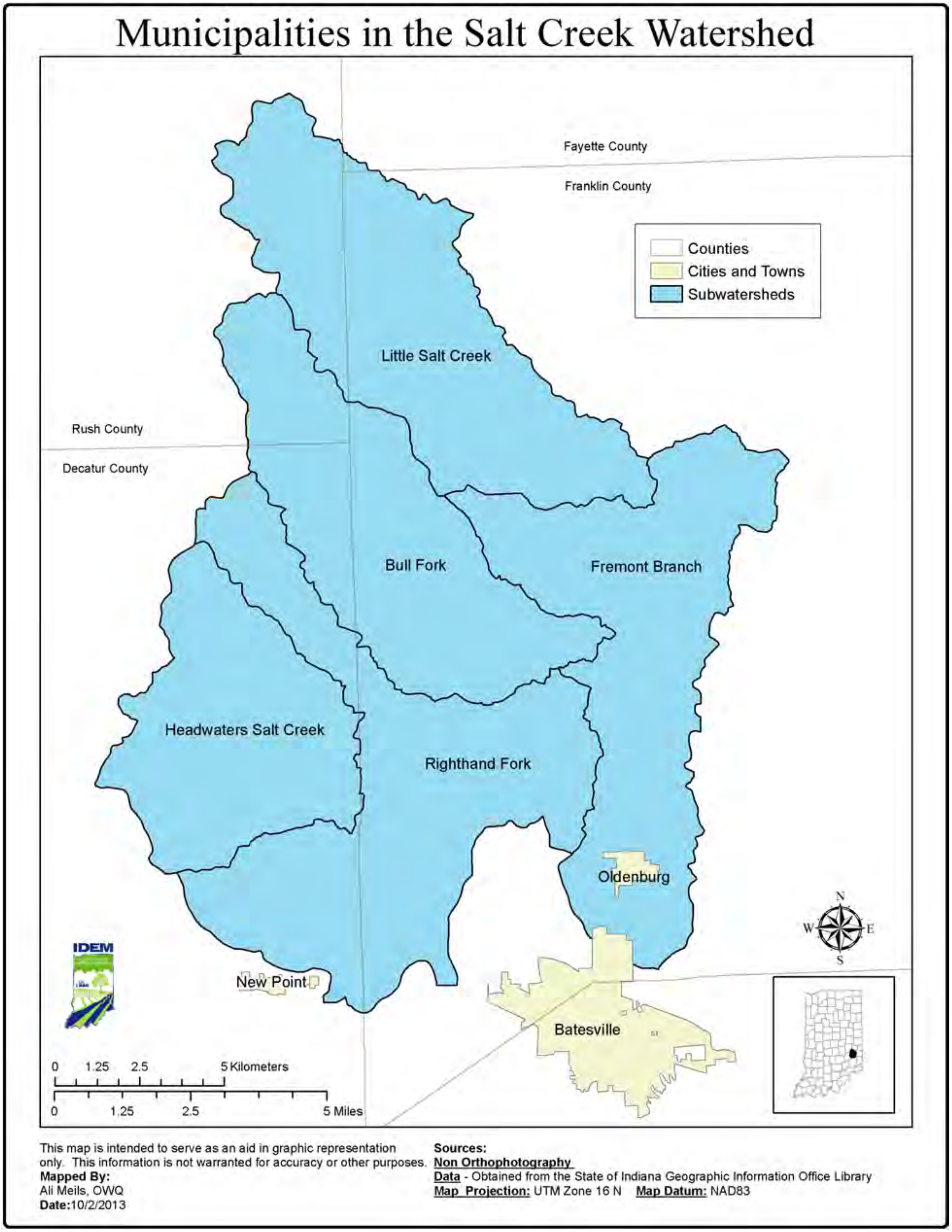


Figure 11 Municipalities in the Salt Creek Watershed

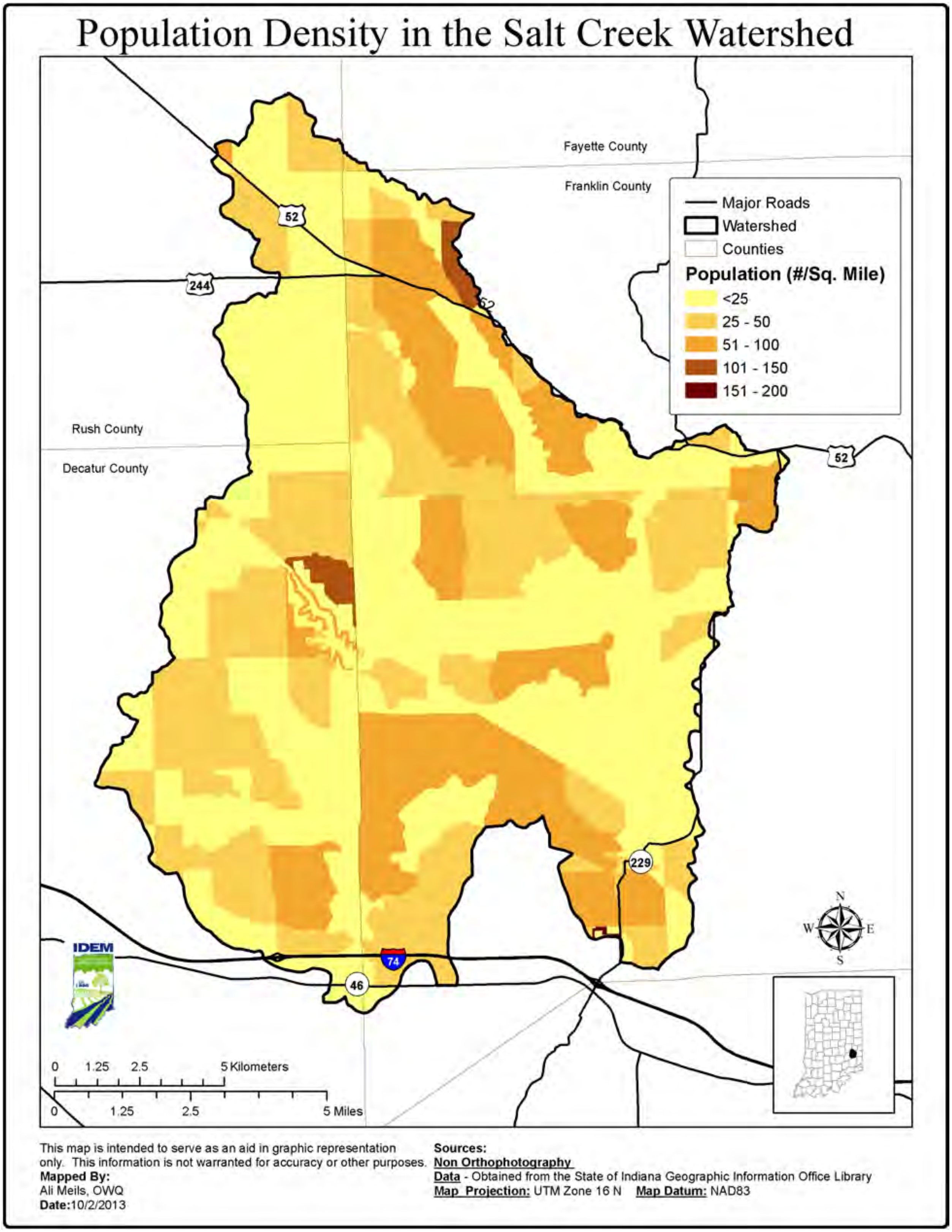


Figure 12 Population Density in the Salt Creek Watershed

3.4 Topography and Geology

Topographic and geologic features of a watershed play a role in defining a watershed's drainage pattern. Information concerning the topography and geology within the Salt Creek watershed is available from the Indiana Geologic Survey (IGS). The majority of Salt Creek watershed is located in the Eastern Corn Belt Plain (ECBP) ecoregion with the eastern part of the watershed located in the Interior Plateau (IP) ecoregion. The ECBP is characterized by extensive cropland agriculture with some natural forest cover and gently rolling glacial till plains dissected by moraines, kames and outwash plains. The IP ecoregion includes a till plain of low topographic relief formed from Illinoian glacial drift materials, rolling to modestly or deeply dissected basin terrain. Layers of sandstone, siltstone, shale and limestone underlie much of the Interior Plateau. Limestone outcrops are common, as are areas pitted with limestone sinks. Elevations in the watershed range from 670 feet to 1090 feet. The landscape changes from gentle slopes in the north and western portions of the watershed to steeper slopes as you move east through the watershed. Figure 13 shows the topography of the Salt Creek watershed. National Elevation Data (NED) is available from the USGS National Map seamless server (http://seamless.usgs.gov/website/seamless/viewer.htm). The steep slopes within the watershed produce rapid flows of water which often causes heavy erosion along the banks and more opportunity for pollutants to enter the streams through runoff.

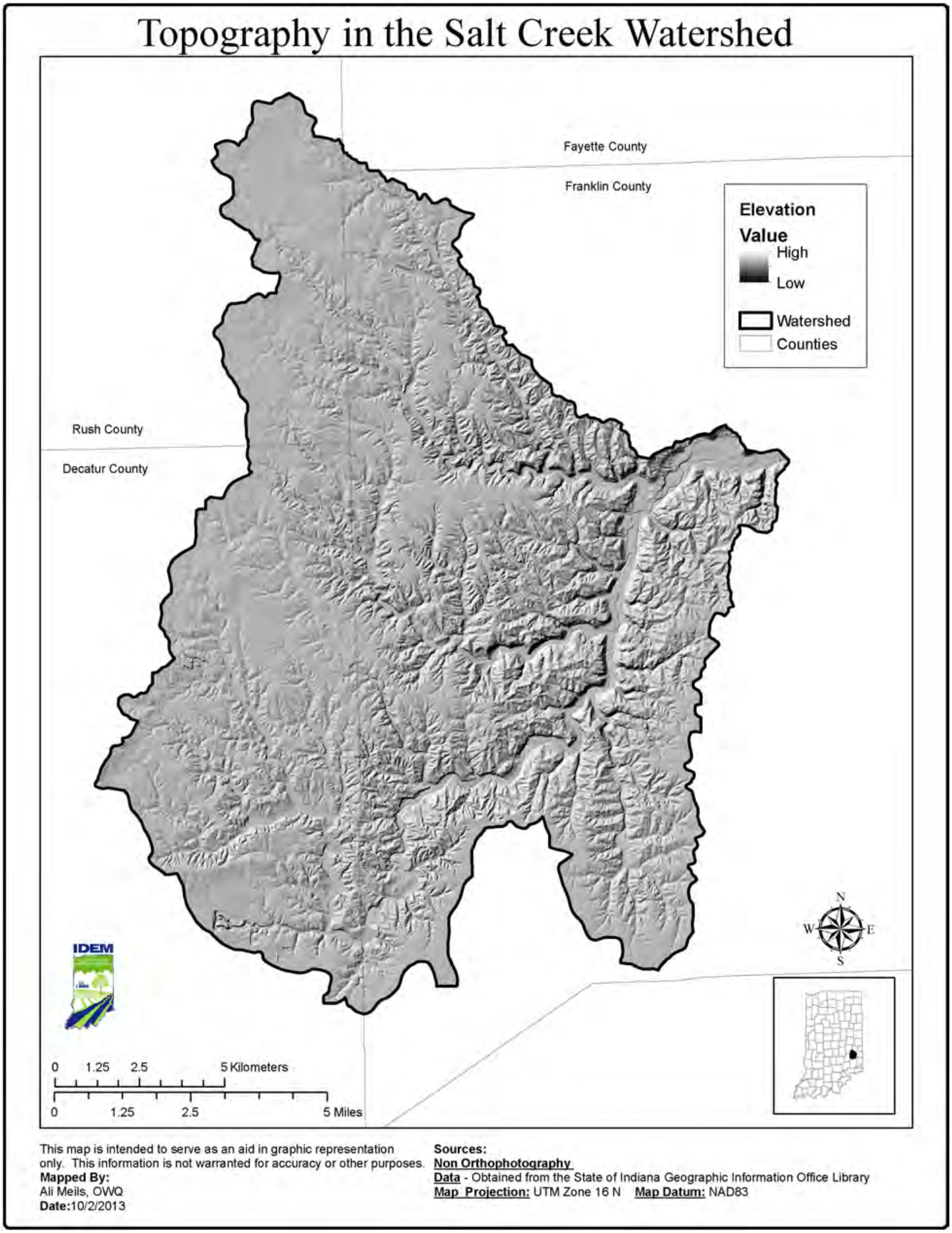


Figure 13 Topography of the Salt Creek Watershed

The entire bedrock surface of Indiana consists of sedimentary rocks. The major kinds of sedimentary rock in Indiana include limestone, dolomite, shale, sandstone, and siltstone. The northern two-thirds of Indiana are composed of glacial deposits containing groundwater. These glacial aquifers exist where sand and gravel bodies are present within clay-rich glacial till (sediment deposited by ice) or in alluvial, coastal, and glacial outwash deposits. Groundwater availability is much different in the southern unglaciated part of Indiana. There are few unconsolidated deposits above the bedrock surface, and the voids in bedrock (other than karst dissolution features) are seldom sufficiently interconnected to yield useful amounts of groundwater. Water supplies in southern Indiana usually come from reservoirs, such as Lake Santee, in lieu of water wells.

Based on information gathered in the Atlas of Hydrogeologic Terrains and Settings of Indiana 1995, the Salt Creek watershed is sensitive to ground water pollution through surface water. Hydrogeologic settings help to interpret the occurrence, movement, and sensitivity to contamination of ground water in relation to the surface and subsurface environment. Generally the Salt Creek watershed is located in the bottomlands of southern Indiana, which are often associated with large bedrock valleys and significant quantities of late glacial till outwash. These outwash deposits are the major ground water resources for the entire southern part of the state. They are characterized by shallow water table conditions and are consequently zones of significant interaction between surface water and ground water.

Specifically, the outwash in the Southern Whitewater River valley constitutes the primary source of ground water in this part of the state, as suitable aquifers are generally sparse in the adjoining uplands. Most of the valley bottom is in floodplain, so water table depths are typically between 5 and 15 feet. A considerable amount of ground water is transmitted down-valley within the outwash and interacts with the river at frequent meanders that cut across the aquifer. The valley as a whole is generally a ground water discharge area, although it is unlikely that there is an appreciable volume of actual discharge to this segment of the valley in view of the poor water-transmitting properties of the surrounding bedrock and till. Overall characteristics indicate that ground water beneath the valley floor is likely to be relatively sensitive to contamination, and that finding replacement water sources would be difficult should contamination affect a part of the aquifer. This should be of special concern since there is currently one surface drinking water source known in the Salt Creek watershed. All other drinking water sources are ground water sources.

While the topography and geology of the watershed can have an effect on hydrology, it is also likely that soil characteristics will play a role in affecting hydrologic processes.

3.5 Soils

There are different soil characteristics that can affect the health of the watershed. These characteristics include soil drainage, septic tank suitability, soil saturation, and soil erodibility.

3.5.1 Soil Drainage

The hydrologic soil group classification is a means for categorizing soils by similar infiltration and runoff characteristics during periods of prolonged wetting. The Natural Resources Conservation Service (NRCS) has defined four hydrologic groups for soils, described in Table 12 (NRCS, 2001). Data for the Salt Creek watershed were obtained from the Soil Survey Geographic (SSURGO) database. Downloaded data were summarized based on the major hydrologic group in the surface layers of the map unit and are displayed in Figure 14.

The majority of the watershed is covered by group C soils (76%) and group B soils (23%). Group A and D make up the remaining 1% of the watershed.

Table 12 Hydrologic Soil Groups

Hydrologic Soils Group	Description
A	Soils with high infiltrations rates. Usually deep, well drained sands or gravels. Little runoff.
B	Soils with moderate infiltration rates. Usually moderately deep, moderately well drained soils.
C	Soils with slow infiltration rates. Soils with finer textures and slow water movement.
D	Soils with very slow infiltration rates. Soils with high clay content and poor drainage. High amounts of runoff.

Understanding Table 12: Typically, clay soils that are poorly drained have lower infiltration rates, while well-drained sandy soils have the greatest infiltration rates. Soil infiltration rates can affect *E. coli*, nutrients and sediment loading within a watershed. During high flows, areas with low soil infiltration capacity can flood and therefore discharge high *E. coli*, nutrients and sediment loads to nearby waterways. In contrast, soils with high infiltration rates can slow the movement of *E. coli*, nutrients and sediment to streams.

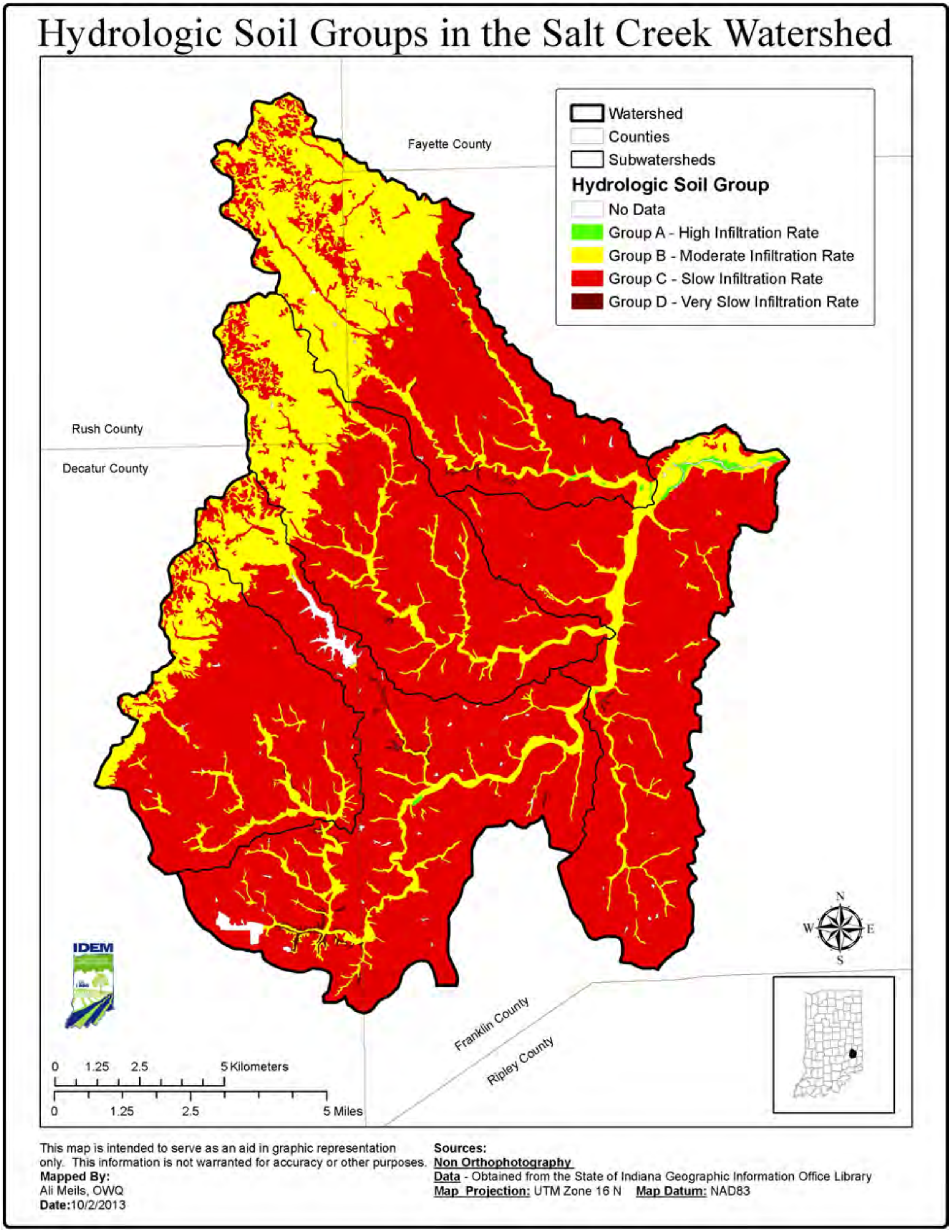


Figure 14 Hydrologic Soil Groups in the Salt Creek Watershed

3.5.2 Septic Tank Suitability

Septic systems require soil characteristics and geology that allow gradual seepage of wastewater into the surrounding soils. Seasonal high water tables, shallow compact till and coarse soils present limitations for septic systems. While system design can often overcome these limitations (i.e., perimeter drains, mound systems or pressure distribution), sometimes the soil characteristics prove to be unsuitable for any type of traditional septic system.

Heavy clay soils require larger (and therefore more expensive) absorption fields; while sandier, well-drained soils are often suitable for smaller, more affordable gravity-flow trench systems.

The septic system is considered failing when the system exhibits one or more of the following:

1. The system refuses to accept sewage at the rate of design application thereby interfering with the normal use of plumbing fixtures

2. Effluent discharge exceeds the absorptive capacity of the soil, resulting in ponding, seepage, or other discharge of the effluent to the ground surface or to surface waters

3. Effluent is discharged from the system causing contamination of a potable water supply, ground water, or surface water

Figure 15 shows ratings that indicate the extent to which the soils are suitable for septic systems within the Salt Creek watershed. Only that part of the soil between depths of 24 and 60 inches is evaluated for septic system suitability. The ratings are based on the soil properties that affect absorption of the effluent, construction, maintenance of the system, and public health.

Soils labeled “very limited” indicate that the soil has at least one feature that is unfavorable for septic systems. Approximately 99 percent of the Salt Creek watershed is considered “very limited” in terms of soil suitability for septic systems. These limitations generally cannot be overcome without major soil reclamation or expensive installation designs. Approximately one percent of the soils within the Salt Creek watershed have “somewhat limited” septic suitability or are “not rated,” meaning these soils have not been assigned a rating class because it is not industry standard to install a septic system in these geographic locations. There are no soils in the Salt Creek watershed that are designated “not limited,” meaning that the soil type is suitable for septic systems.

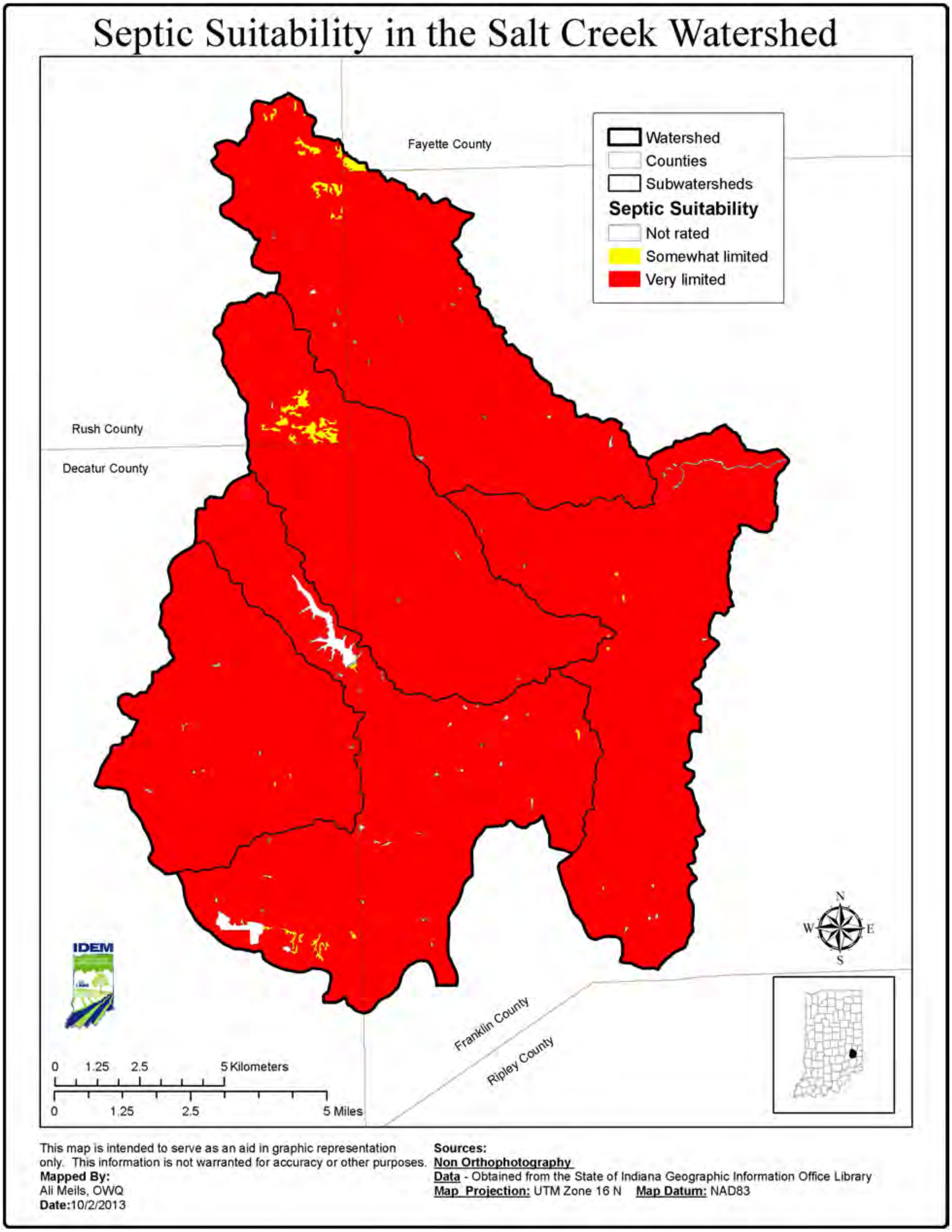


Figure 15 Suitability of Soils for Septic Systems in the Salt Creek Watershed

3.5.3 Soil Saturation

Soils that remain saturated or inundated with water for a sufficient length of time become hydric through a series of chemical, physical, and biological processes. Once a soil takes on hydric characteristics, it retains those characteristics even after the soil is drained. Hydric soils have been identified in the Salt Creek watershed and are important in consideration of wetland restoration activities. Approximately 4,063 acres or 5 percent of the Salt Creek watershed area contains soils that are considered hydric, as shown in Table 13. However, a large majority of these soils have been drained for either agricultural production or urban development and would no longer support a wetland. The location of remaining hydric soils, as shown in Figure 16, can be used to consider possible locations of wetland creation or enhancement. There are many components in addition to soil type that must be considered before moving forward with wetland design and creation. In the Salt Creek watershed, Franklin County has the most acreage of hydric soils. Areas within these counties might contain opportunities for wetland restoration activities that could help address water quality impairments. Additional information on wetlands can be found on the IDEM website (http://www.in.gov/idem/wetlands).

Table 13 Hydric Soils by County in the Salt Creek Watershed

County	Symbol	Hydric Soil Type	Acres	Total Percent
Decatur	Cm	Clermont silt loam	991.96	68.74
	Cy	Cyclone silt loam	421.97	29.24
	Mr	Milford silty clay	4.74	0.33
	So	Sloan silt loam	24.34	1.69
		Total	**1,443.01**	**100**
Fayette		**Total**	**0**	**0**
Franklin	Cm	Cobbsfork silt loam	1,451.51	94.28
	Cy	Cyclone silt loam	57.38	3.73
	Mr	Milford silty clay loam	30.61	1.99
		Total	**1,539.50**	**100**
Rush	Cy	Cyclone silty clay loam	1,080.75	100
		Total	**1,080.75**	**100**

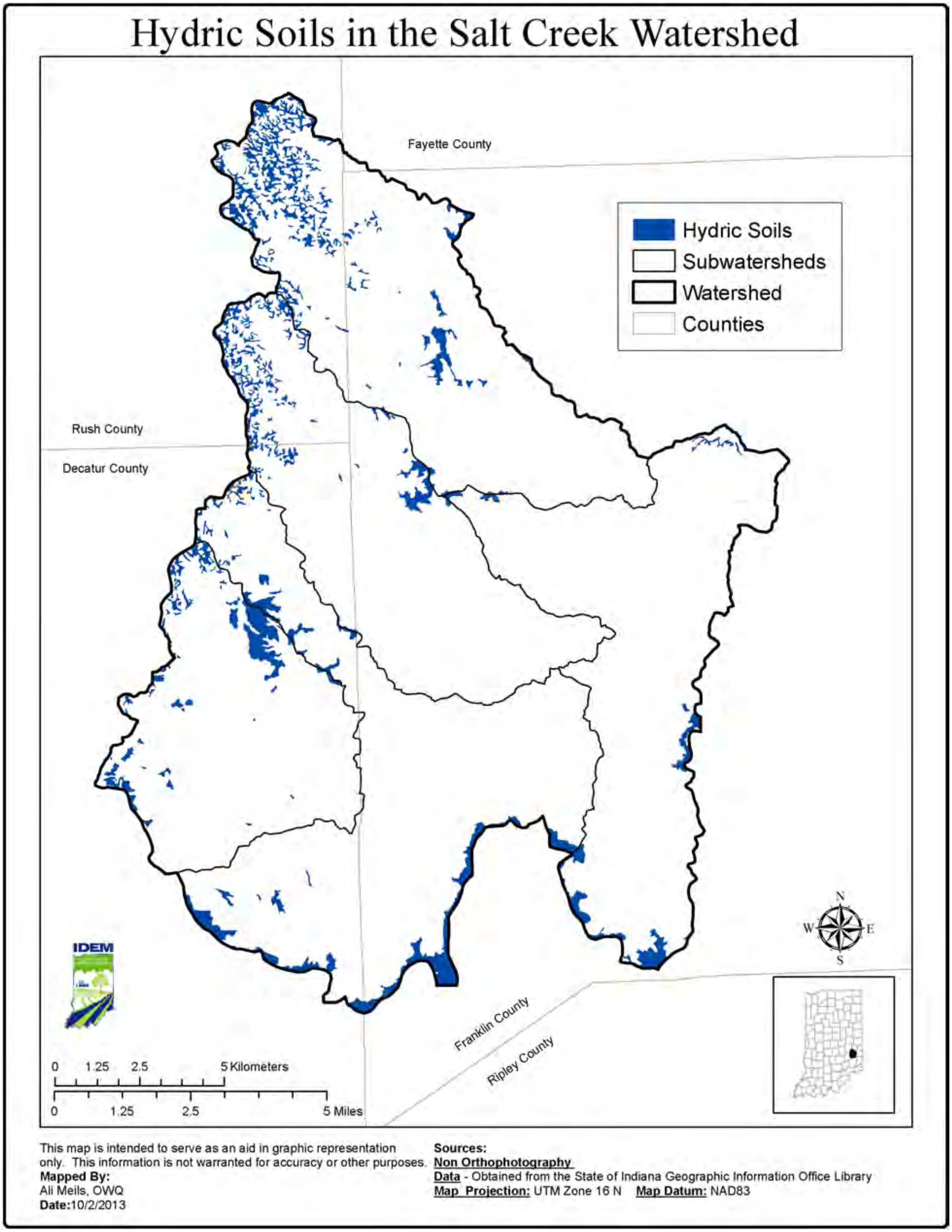


Figure 16 Hydric Soils in the Salt Creek Watershed

Data on hydric soils by county is available from NRCS at http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/use/hydric/.Agencies such as the USGS and U.S. Fish and Wildlife Service (USFWS) estimate that Indiana has lost approximately 85 percent of the state's original wetlands. (See http://www.in.gov/dnr/fishwild/files/partner.pdf and http://water.usgs.gov/nwsum/WSP2425/state_highlights_summary.html) Currently, the Salt Creek watershed contains approximately 970 acres of wetlands or 1.3 percent of the total surface area USFWS, 2003).

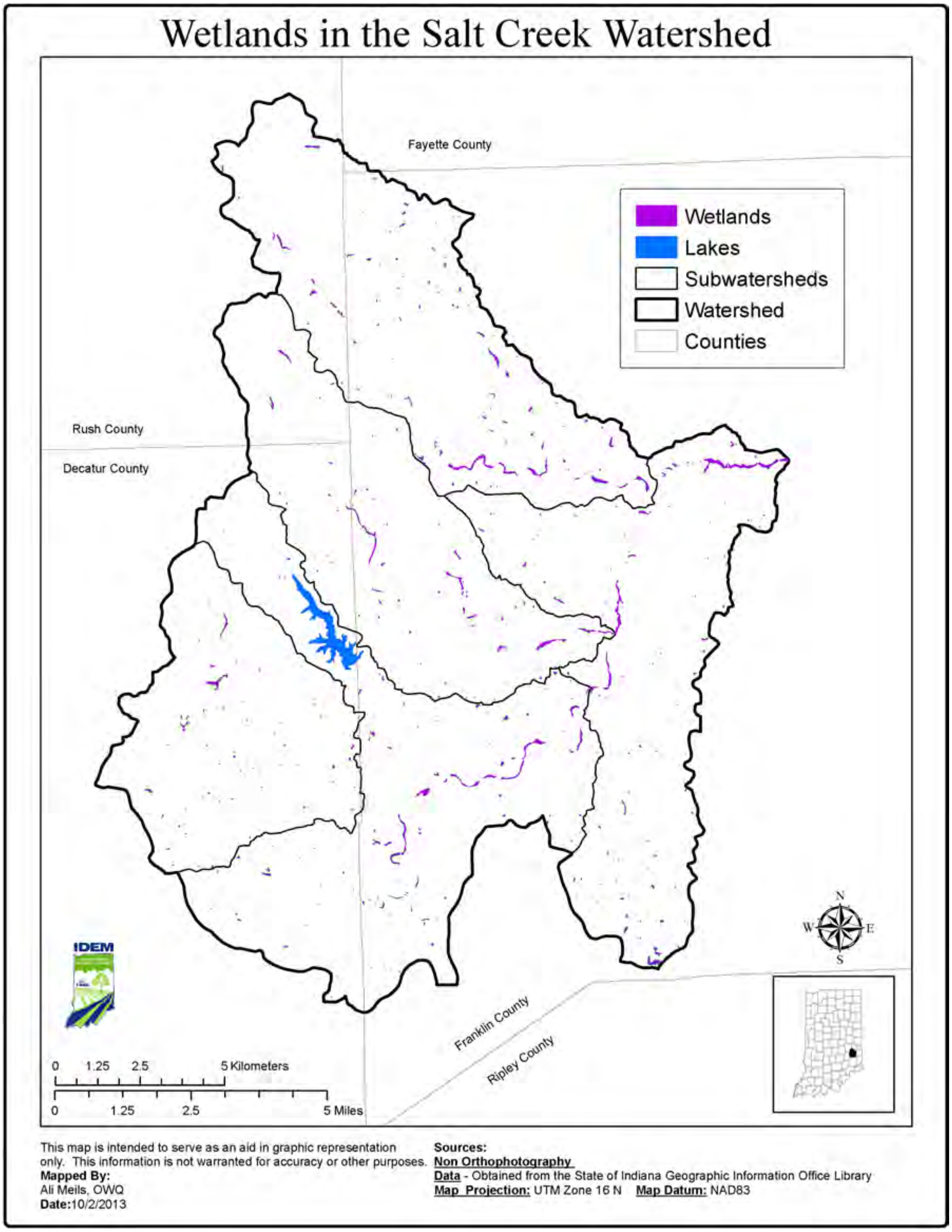


Figure 17: Wetlands in the Salt Creek Watershed

Figure 17 shows estimated locations of wetlands as defined by the USFWS's National Wetland Inventory (NWI). Wetland data for Indiana is available from the U.S. Fish and Wildlife Service's NWI at < http://www.fws.gov/wetlands/Data/Web-Map-Services.html>. Aerial photograph interpretation techniques were used to compile the NWI. The NWI was not intended to produce maps that show exact wetland boundaries comparable to boundaries derived from ground surveys, and boundaries are generalized in most cases. The wetland information used in Section 3.1 was from the Multi-Resolution Land Characteristics Consortium (MRLCC) dataset and is based on soil types, whereas, aerial photography interpretation techniques were used to compile the NWI. Therefore the estimate of the current extent of wetlands in the Salt Creek watershed from the NWI may not agree with those listed in Section 3.1, which are based upon the MRLCC dataset. Wetland areas act to buffer wide variations in flow conditions that result from storm events. They also allow water to infiltrate slowly thus reducing the risks of contaminated water runoff into waterbodies.

Changes to the natural drainage patterns of a watershed are referred to as hydromodification. Historically, drain tiles have been used throughout Indiana to drain marsh or wetlands and make it either habitable or tillable for agricultural purposes. While tile drainage is understood to be pervasive – estimated at thousands of miles in Indiana – it is extremely challenging to quantify on a watershed basis because these tiles were established by varying authorities including County Courts, County Commissioners, or County Drainage Boards (see http://boonecounty.in.gov/Default.aspx?tabid=167). Records were not kept by private landowners as to the location and quantity of these tiles.

In addition to tile drainage, regulated drains are another form of hydromodification. A regulated drain is a drain which was established through either a Circuit Court or Commissioners Court of the County prior to January 1, 1966 or by the County Drainage Board since that time. Regulated drains can be an open ditch, a tile drain, or a combination of both. The County Drainage Board can construct, maintain, reconstruct or vacate a regulated drain. In the Salt Creek watershed, there are approximately 1 mile of tile drains and 1 mile of open ditches under the jurisdiction of the Rush County Drainage Board all other county information is unavailable.

3.5.4 Soil Erodibility

Although erosion is a natural process within stream ecosystems, excessive erosion negatively impacts the health of watersheds. Erosion increases sedimentation of the streambeds, which impacts the quality of habitat for fish and other organisms. Erosion also impacts water quality as it increases nutrients and decreases water clarity. As water flows over land and enters the stream as runoff, it carries pollutants and other nutrients that are attached to the sediment. Sediment suspended in the water blocks light needed by plants for photosynthesis and clogs respiratory surfaces of aquatic organisms.

The NRCS maintains a list of highly erodible lands (HEL) units for each county based upon the potential of soil units to erode from the land. HELs are especially susceptible to the erosional forces of wind and water. Wind erosion is common in flat areas where vegetation is sparse or where soil is loose, dry, and finely granulated. Wind erosion damages land and natural vegetation by removing productive top soil from one place and depositing it in another. The classification for HELs is based upon an erodibility index for a soil, which is determined by dividing the potential average annual rate of erosion by the soil unit's soil loss tolerance (T) value, which is the maximum annual rate of erosion that could occur without causing a decline in long-term productivity. The soil types and acreages in the Salt Creek watershed are listed by county in Table 14. HELs and potential HELs in the Salt Creek watershed are mapped in Figure 18. The data used to create Figure 18 was collected from the NRCS offices of Decatur, Franklin, Fayette and Rush Counties. A total of 36,545 acres or 49 percent of the Salt Creek watershed is considered highly erodible or potentially highly erodible. Rainfall within the Salt Creek watershed is moderately heavy with an annual average of 43 inches. This rainfall and climate data specific to the watershed is available from the National Climatic Data Center (http://www.ncdc.noaa.gov/oa/ncdc.html). Heavy rainfall increases flow rates within streams as the volume and velocity of water moving through the stream channels increases. Velocity of water also increases as streambank steepness increases. When comparing the HEL map to the landuse map it seems much of the HEL is agricultural land. Best management practices, such as cover crops, should be used to prevent bare soil from being exposed to the elements furthering the loss of sediments. On the other hand, when comparing the HEL map to the topography map, it appears these areas are also the flattest areas in the watershed which is helping prevent sediment erosion.

Table 14 HEL/Potential HEL Total Acres in the Counties in the Salt Creek Watershed

County	Symbol	HEL/Potential HEL Soil Types	Acres	Total Percent
Decatur	AvA, AvB	Avonburg silt loam	3,367.65	24.70
	Cg	Chagrin loam	454.68	3.33
	Ch	Chagrin variant silt loam	52.90	0.39
	CkB2	Cincinnati silt loam	361.74	2.65
	Cm	Clermont silt loam	991.96	7.27
	CnG	Corydon-Rock outcrop complex	144.92	1.06
	Cy	Cyclone silt loam	421.97	3.09
	FcA, FcB	Fincastle silt loam	721.47	5.29
	GrC2	Grayford-Ryker silt loam	60.75	0.45
	Lb	Lobdell silt loam	685.09	5.02
	MeA, MeB2	Martinsville loam	27.87	0.20
	MmB2	Miami silt loam	101.53	0.74
	Mr	Milford silty clay	4.74	0.03
	Or	Orrville silt loam	1,145.29	8.40
	RsB2	Rossmoyne silt loam	3,053.57	22.40
	RuB	Russell silt loam	761.94	5.59
	So	Sloan silt loam	24.34	0.18
	Ud	Udorthents-Pits complex	133.37	0.98
	WmB	Williamstown silt loam	159.94	1.17
	XnA, XnB	Xenia silt loam	962.23	7.06
		Total	**13,637.95**	**100**
Fayette	RsB1, RsC2	Russell silt loam	36.21	67.49
	RtB3, RtC3, RtD3	Russell soils	14.22	26.51
	XeB1	Xenia silt loam	3.22	6.0
		Total	**53.65**	**100**
Franklin	AlA, AlB	Alvin sandy loam	351.21	1.91
	AvA	Avonburg silt loam	3,566.46	19.40
	CkB2	Cincinnati silt loam	3,328.98	18.11
	Cm	Cobbsfork silt loam	1,451.51	7.89
	Cy	Cyclone silt loam	57.38	0.31
	Db	Dearborn loam	601.22	3.27
	ElB	Eldean loam	6.75	0.04
	FcB	Fincastle silt loam	132.99	0.72

County	Symbol	HEL/Potential HEL Soil Types	Acres	Total Percent
	GD, GE	Gessie loam	1,164.96	6.34
	Ht	Holton silt loam	724.84	3.94
	MmB2	Miami silt loam	363.39	1.98
	Mr	Milford silty clay loam	30.61	0.17
	Mt, Mx	Moundhaven sandy loam	138.44	0.75
	OcA, OcB2	Ockley loam	166.40	0.91
	Og	Oldenburg silt loam	764.47	4.16
	PrC	Princeton fine sandy loam	45.91	0.25
	Rm	Ross silt loam	12.60	0.07
	RsA, RsB2	Rossmoyne silt loam	2,995.98	16.30
	RuB2	Russell silt loam	428.45	2.33
	UaB	Uniontown silt loam	45.08	0.25
	WeB2	Weisburg silt loam	132.41	0.72
	WmB	Williamstown silt loam	21.98	0.12
	Wn	Wirt loam	1,277.65	6.95
	WoB	Woolper silty clay loam	57.78	0.31
	XnA, XnB2	Xenia silt loam	518.32	2.82
		Total	**18,385.77**	**100**
Rush	MoC3, MoD3	Miami clay loam	1,080.75	24.19
	MmD, MmB2	Miami silt loam	1,363.22	30.51
	RuB	Russell silt loam	293.32	6.56
	WwB2	Williamstown silt loam	260.41	5.83
	XeB	Xenia silt loam	1,470.33	32.91
		Total	**4,468.03**	**100**

Understanding Table 14: In the Salt Creek watershed, Franklin County has the most acreage of HEL/potential HEL soils. Areas within these counties might contribute to water quality impairments associated with excessive erosion, including IBC/TSS, and might contain opportunities for restoration to decrease erosion.

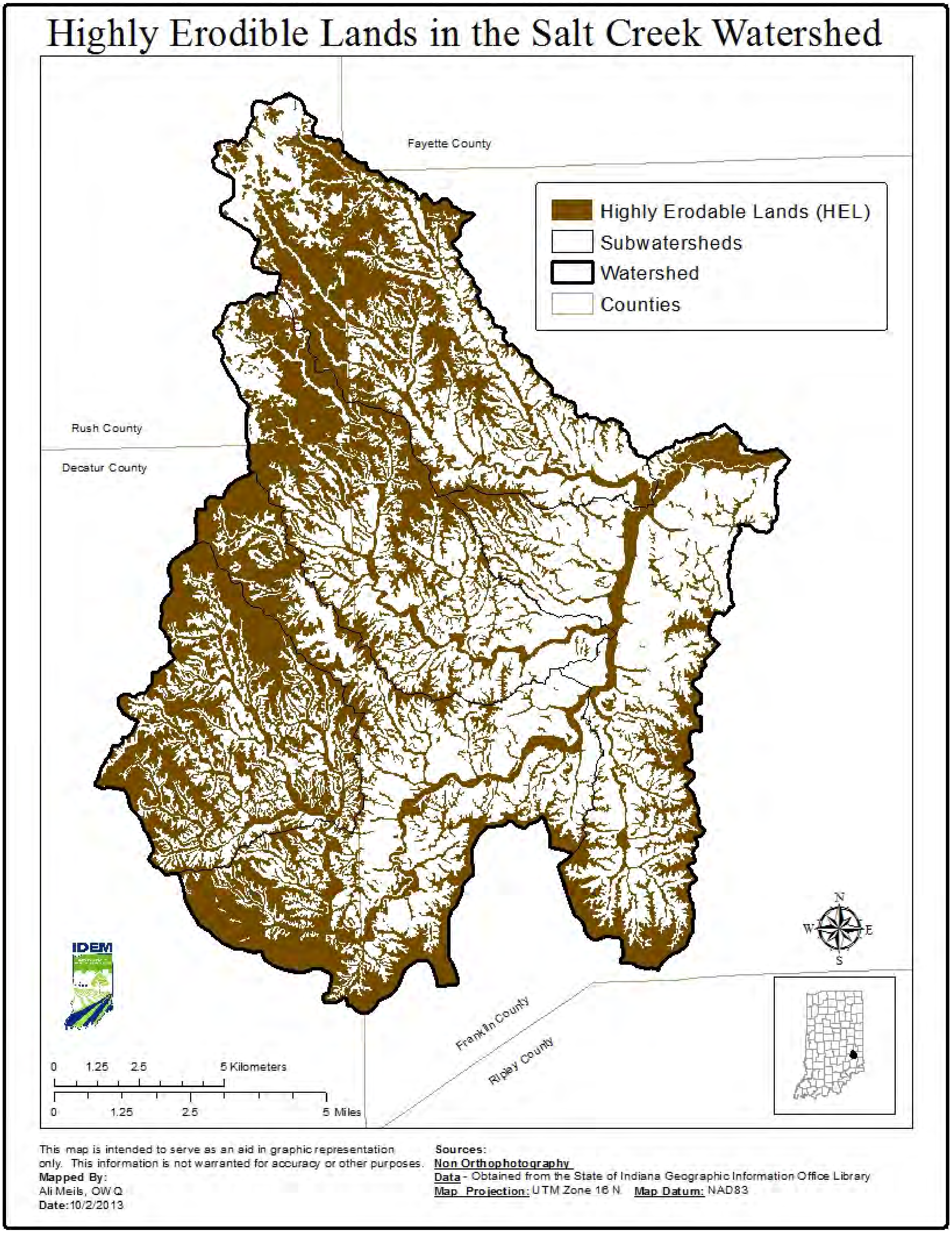


Figure 18 HEL/Potential HEL Soils in the Salt Creek Watershed

The Indiana State Department of Agriculture (ISDA) tracks trends in conservation and cropland through annual county tillage transects. Data collected through the tillage transect help determine adoption of conservation practices and estimate the average annual soil loss from Indiana's agricultural lands. The latest figures for the counties in the Salt Creek watershed are shown in Table 15. Tillage practices captured in ISDA's tillage transect include No-Till, Mulch-Till, Reduced-Till and conventional tillage practices. ISDA defines No-Till as any direct seeding system including site preparation, with minimal soil disturbance. Mulch-Till is any tillage system leaving greater than 30 percent residue cover after planting, excluding no-till. Reduced-Till is a tillage system leaving 16 percent to 30 percent residue cover after planting. Conventional-Till is any tillage system leaving less than 30 percent residue cover after planting.

Table 15 County Tillage Transect Data from 2009 to 2013 in the Salt Creek Watershed

Crop	Tillage Practice	Decatur			Fayette			Franklin			Rush		
		2009	2011	2013	2009	2011	2013	2009	2011	2013	2009	2011	2013
Corn	% No-Till	33	24	27	22	39	40	19	23	21	19	33	19
	% Mulch-Till	18	18	16	7	21	11	15	15	14	19	37	40
	% Reduced-Till	14	18	28	18	31	19	33	43	54	36	20	35
	% Conventional-Till	36	39	29	53	9	30	33	19	11	26	10	6
Soybeans	% No-Till	71	61	64	69	53	46	70	50	62	65	82	63
	% Mulch-Till	15	18	18	15	39	32	11	32	22	15	13	26
	% Reduced-Till	6	10	13	10	6	16	7	14	14	14	3	10
	% Conventional-Till	7	10	6	5	2	6	13	3	2	6	2	1

Understanding Table 15: According to Table 15, No-Till practices for soybeans are predominant in all counties in the Salt Creek watershed. There has been a reduction in conventional tillage practices for corn in both Franklin and Rush counties since 2009.

3.6 Climate and Precipitation

Climate varies in Indiana depending on latitude, topography, soil types, and lakes. Information on Indiana's climate is available through sources including the Indiana State Climate Office at Purdue University (http://climate.agry.purdue.edu/climate/narrative.asp).

Climate data from Station 121030 located in Brookville were used for climate analysis of the Salt Creek watershed. Monthly data from 1948 - 2013 were available at the time of analysis. In general, the climate of the region has hot, humid summers and cold winters. From 1948 to 2013, the average winter temperature in Brookville was 32°F and the average summer temperature was 85°F. The average growing season (consecutive days with low temperatures greater than or equal to 32 degrees) is 183 days.

Examination of precipitation patterns is also a key component of watershed characterization because of the impact of runoff on water quality. From 1948 to 2013, the annual average precipitation in Brookville at Station 121030 was approximately 43 inches, including approximately 15.5 inches of snowfall.

Rainfall intensity and timing affect watershed response to precipitation. This information is important in evaluating the effects of storm water on the Salt Creek watershed. Using data from 121030 during 1948 to 2013, 52 percent of the measureable precipitation events were very low intensity (i.e., less than 0.2 inches), while 8 percent of the measurable precipitation events were greater than one inch.

Knowing when precipitation events occur helps in the linkage analysis, which correlates flow conditions to pollutant concentrations and loads. Data indicates that the wet weather season in the Salt Creek watershed occurs between the months of April and May. Precipitation/ Rainfall graphs can be found for all sampling sites in Appendix B.

3.7 Summary

The information presented helps to provide a better comprehensive understanding of the conditions and characteristics in the Salt Creek watershed that, when coupled with the sources, affect both water quality and water quantity. In summary, the predominant land uses in the Salt Creek watershed of forested and agricultural lands serve as indicators as to the type of sources that are likely to contribute to water quality impairments in the Salt Creek watershed. Human population, which is greatest in Franklin and Decatur counties in the Salt Creek watershed, indicates where more infrastructure related pressures on water quality might exist. The subsections on topography and geology, as well as soils, provide information on the natural features that affect hydrology in the Salt Creek watershed. These features interact with land use activities and human population to create pressures on both water quality and quantity in the Salt Creek watershed. Lastly, the subsection on climate and precipitation provides information on water quantity and the factors that influence flow, which ultimately affects the influence of storm water on the watershed. Collectively, this information plays an important role in understanding the sources that contribute to water quality impairment during TMDL development and crafting the linkage analysis that connects the observed water quality impairment to what has caused that impairment.

4.0 SOURCE ASSESSMENT

This section presents information concerning IDEM's segmentation process as it applies to the Salt Creek watershed in order to present a source assessment specific to the Salt Creek watershed as well as summaries of significant sources of *E. coli*, nutrients and sediment for each subwatershed within the Salt Creek watershed.

4.1 Understanding Subwatersheds and Assessment Units

As briefly discussed in Section 2.3, the Salt Creek watershed contains five 12-digit HUC subwatersheds. Examining subwatersheds enables a closer examination of key factors that affect water quality. The subwatersheds include:

- Headwaters Salt Creek (050800030501)
- Righthand Fork Salt Creek (050800030502)
- Bull Fork (050800030503)
- Little Salt Creek (050800030504)
- Fremont Branch (050800030505)

Within each 12-digit HUC subwatershed, IDEM has identified several Assessment Unit (AUIDs), which represent individual stream segments. Through the process of segmenting subwatersheds into AUIDs, IDEM identifies streams reaches and stream networks that are representative for the purposes of assessment. In practice, this process leads to grouping tributary streams into smaller catchment basins of similar hydrology, land use, and other characteristics such that all tributaries within the catchment basin can be expected to have similar potential water quality impacts. Catchment basins, as defined by the aforementioned factors and are typically very small, which significantly reduces the variability in the water quality expected from one stream or stream reach to another. Given this, all tributaries within a catchment basin are assigned a single AUID. Grouping tributary systems into smaller catchment basins also allows for better characterization of the larger watershed and more localized recommendations for implementation activities. Variability within the larger watershed will be accounted for by the differing AUIDs assigned to the different catchment basins.

Table 16 contains the AUIDs in the subwatersheds of the Salt Creek watershed and the associated drainage area. Subsequent sections of the TMDL report organize information by subwatershed (if applicable) and AUID.

Table 16 Assessment Units in Salt Creek Watershed

Name of Subwatershed	Surface Area (sq. miles)	Percent Surface Area	Current AUID (2014)	Length (mi)	Drainage area (sq. miles)
Headwaters Salt Creek (050800030501)	17.35	14.76	ING0351_01	8.10	17.32
			ING0351_T1001	4.33	
			ING0351_T1002	14.04	
			ING0351_T1003	7.88	
Righthand Fork (050800030502)	28.45	24.25	ING0352_01	28.15	45.76
			ING0352_01A	0.38	
			ING0352_P1001	2.46	
			ING0352_T1001	2.86	
			ING0352_T1002	5.15	

Name of Subwatershed	Surface Area (sq. miles)	Percent Surface Area	Current AUID (2014)	Length (mi)	Drainage area (sq. miles)
			ING0352_T1003	4.05	
			ING0352_T1004	1.17	
			ING0352_T1005	0.53	
			ING0352_T1006	7.17	
			ING0352_T1007	2.37	
			ING0352_T1008	2.23	
			ING0352_T1009	2.13	
			ING0352_T1010	2.35	
			ING0352_T1011	1.08	
Bull Fork (050800030503)	21.57	18.38	ING0353_01	6.56	21.56
			ING0353_02	13.01	
			ING0353_02A	0.36	
			ING0353_T1001	1.56	
			ING0353_T1002	3.70	
			ING0353_T1003	5.25	
			ING0353_T1004	1.18	
			ING0353_T1005	1.07	
			ING0353_T1006	5.74	
			ING0353_T1007	1.08	
			ING0353_T1008	2.18	
Little Salt Creek (050800030504)	25.14	21.42	ING0354_01	10.92	25.13
			ING0354_02	20.43	
			ING0354_T1001	2.57	
			ING0354_T1002	9.48	
			ING0354_T1003	6.81	
			ING0354_T1004	4.07	
			ING0354_T1005	1.92	
Fremont Branch (050800030505)	24.87	21.19	ING0355_01	10.16	117.36
			ING0355_T1001	9.26	
			ING0355_T1002	11.49	
			ING0355_T1003	3.08	
			ING0355_T1004	1.84	
			ING0355_T1005	3.71	
			ING0355_T1006	5.50	
			ING0355_T1007	8.37	
			ING0355_T1008	7.43	
			ING0355_T1009	2.35	
			ING0355_T1010	1.71	

Understanding Table 16: Land area helps IDEM to define the pollutant load reductions needed for each AUID in each 12-digit HUC subwatershed that comprises the Salt Creek watershed. Information in each column is as follows:

- *Column 1: Name of Subwatershed.* Lists the name of the subwatersheds.

- *Column 2: Surface Area.* Indicates the total surface area for each subwatershed.
- *Column 3: Percent Surface Area.* Indicates the percent of the total surface area, providing a relative understanding of the portion of each subwatershed in the Salt Creek watershed.
- *Column 4: Current AUID.* Provides the updated AUIDs associated with each subwatershed.
- *Column 5: Length.* Quantifies the length of each AUID stream segment.
- *Column 6: Drainage Area.* Quantifies the area the subwatershed drains.

IDEM bases percent load reductions on the drainage area for each AUID in the 12-digit HUC subwatersheds. The information contained in this table is the foundation for the technical calculations found in this report. This table will help watershed stakeholders look at the smaller segments within the Salt Creek watershed and understand the smaller areas contributing to the impaired waterbody, helping to quantify the geographic scale that influences source characterization and areas for implementation.

4.2 Source Assessment by Subwatershed

This section summarizes the available information on significant point and nonpoint sources of *E. coli*, nutrients and sediment in the five subwatersheds of the Salt Creek watershed.

The term “point source” refers to any discernible, confined and discrete conveyance, such as a pipe, ditch, channel, tunnel or conduit, by which pollutants are transported to a waterbody. It also includes vessels or other floating craft from which pollutants are or may be discharged. By law, the term “point source” also includes: concentrated animal feeding operations (CAFO) which are places where animals are confined and fed; storm water runoff from Municipal Separate Storm Sewer Systems (MS4s), construction site of one acre or more of land disturbance, and specific categories of industrial activities that convey storm water; and illicitly connected “straight pipe” discharges of household waste. Permitted point sources are regulated through the NPDES.

Nonpoint sources include all other categories not classified as point sources. In urban areas, nonpoint sources can include leaking or faulty septic systems, runoff from lawn fertilizer applications, pet waste, storm water runoff (outside of MS4 communities), and other sources. In rural areas, nonpoint sources can include runoff from cropland, pastures and animal feeding operations and inputs from streambank erosion, leaking or failing septic systems, and wildlife.

4.2.1 Salt Creek Subwatershed Summary

This section of the report presents the available information on the sources of *E. coli*, nutrients and sediment in the Salt Creek subwatersheds.

Table 17 Land Use in the Headwaters Salt Creek Subwatersheds

Subwatershed	Area	Land Use							Total
		Agriculture	Developed	Forest	Hay/ Pasture	Shrub	Open Water	Wetlands	
Headwaters Salt Creek	Acres	5258	538	3387	1807	76	24	<1	11,090
	Sq. Mi.	8	1	5	3	<1	<1	<1	17
	Percent	47	5	31	16	1	<1	<1	100
Righthand Fork Salt Creek	Acres	5,118	1,144	8,674	2,781	187	305	1	18,210
	Sq. Mi.	8	2	14	4	<1	<1	<1	28
	Percent	28	6	48	15	1	2	<1	100
Bull Fork	Acres	3923	470	7,553	1,625	216	17	0	13,804
	Sq. Mi.	6	1	12	3	<1	<1	0	22
	Percent	28	3	55	12	2	<1	0	100
Little Salt Creek	Acres	5,694	828	7,542	1,777	36	206	1	16,084
	Sq. Mi.	9	1	12	3	<1	<1	<1	25
	Percent	36	5	48	11	<1	1	<1	100
Fremont Branch	Acres	2,133	649	10,730	2,169	185	45	0	15,911
	Sq. Mi.	3	1	17	3	<1	<1	0	24
	Percent	14	4	67	14	1	<1	0	100

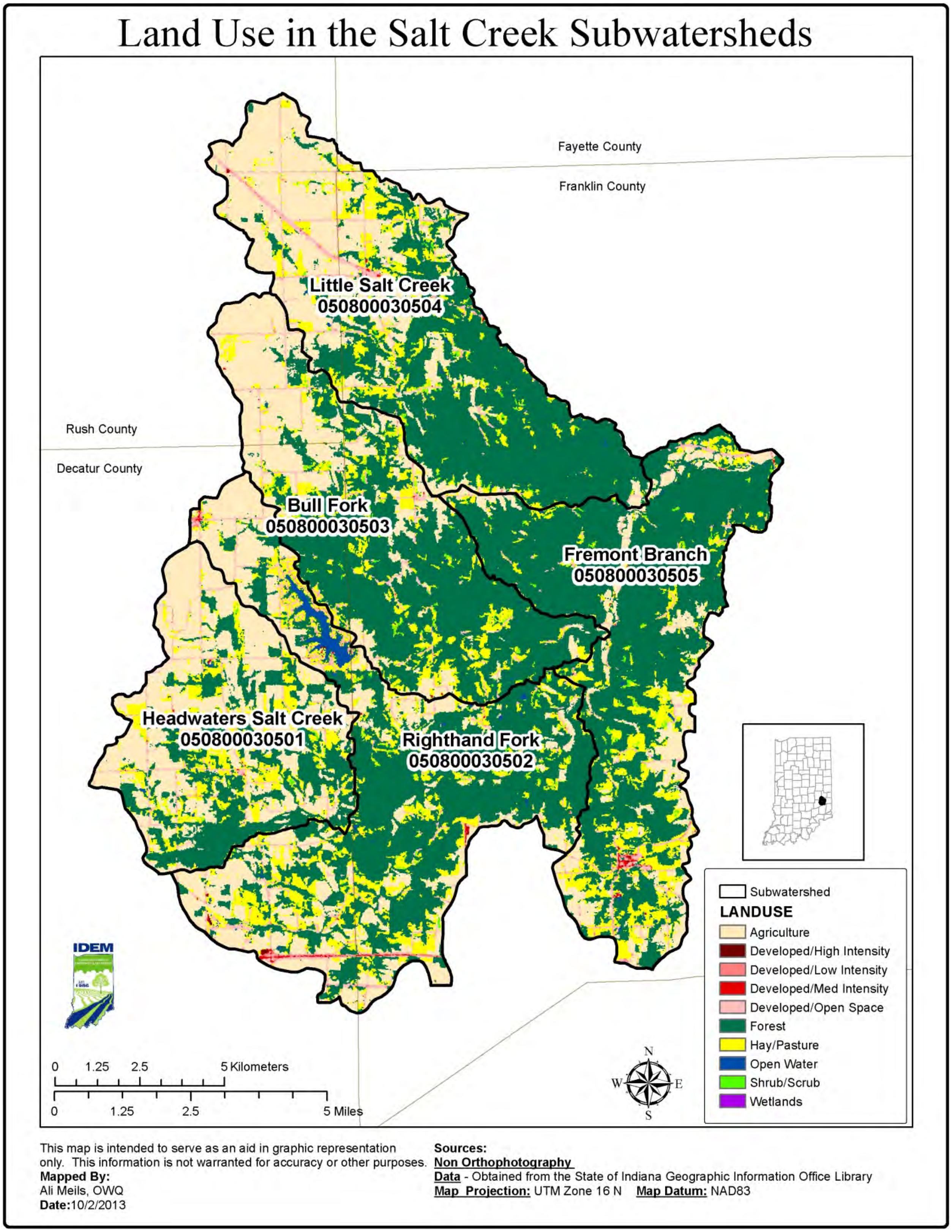


Figure 19 Land Use in the Salt Creek Subwatersheds

4.2.1.1 Point Sources

The State of Indiana regulates the direct discharge of pollutants to waters of the State through the National Pollutant Discharge Elimination System (NPDES) Permit Program. The permits issued place limits on the amount of pollutants that may be discharged to surface waters by each facility. These limits are set at levels protective of both aquatic life in the waters which receive the discharge and protective of human health. This section summarizes the potential point sources of *E. coli*, nutrients and sediment in the Salt Creek watershed, as regulated through the National Pollutant Discharge Elimination System (NPDES) Program.

Municipal Facilities

A municipal facility, or wastewater treatment plant (WWTP), is designed to remove biological or chemical waste products from water, thereby permitting the treated water to be used for other purposes. Some of the functions of a WWTP include agricultural wastewater treatment, sewage treatment and industrial wastewater treatment. WWTPs are critical for maintaining public sanitation and a healthy environment.

Municipal facilities in Indiana are required to disinfect their effluent during the recreational season (April 1 to October 31).Table 18 contains the maximum design flow for the active facilities.

Treated municipal sewage is a point source of nutrients. WWTPs may release water with elevated concentrations of nutrients into streams. As discussed in Section 2.2, the target value for total phosphorus is 0.30 mg/L and the target value for total nitrogen is 10 mg/L. These target values are used to establish potential permit limits. Phosphorus is interpreted as an average in the NPDES permits. Monitoring data has shown that, when in compliance with a permit limit of 1.0 mg/L, the in-stream TMDL target is typically met. As such, WWTPs were given WLAs based on a 1.0 mg/L total phosphorus permit limit.

Flows used to calculate nutrient loads from each treatment plant are estimated based on current flow data from data monitoring reports (DMR) or design flows from the facility permits when actual flow data is not available. Nutrient concentrations used to calculate nutrient loads from each treatment plant are based on known technological limitations of the facilities (literature values for facilities with similar treatment levels).

The TMDL target value for TSS is set at the WWTP's permit effluent limit for TSS. Therefore, a target of 30 mg/L for total suspended solids TSS has been identified as a permit limit for NPDES facilities.

There are two WWTP dischargers that discharge wastewater containing *E. coli*, nutrients and sediment within the Salt Creek watershed (Figure 20). These facilities are as follows: Lake Santee Regional Waste and Water District WWTP and Oldenburg WWTP. Summaries of the WWTP permits within the Salt Creek watershed are described below.

Table 18 NPDES Permitted Wastewater Treatment Plants Discharging within the Salt Creek Subwatersheds

Subwatershed	Facility Name	Permit Number	AUID	Receiving Stream	Maximum Design Flow (MGD)
Headwaters Salt Creek	NA	NA	NA	NA	NA
Righthand Fork Salt Creek	Lake Santee Regional Waste and Water District Wastewater Treatment Plant	IN0060704	ING0352_T1006	Righthand Fork	0.1
Bull Fork	NA	NA	NA	NA	NA
Little Salt Creek	NA	NA	NA	NA	NA
Fremont Branch	Oldenburg WWTP	IN0023973	ING0355_T1001	Harvey Branch	0.15

The Lake Santee Regional Waste and Water District WWTP operates a Class I extended aeration treatment facility consisting of nitrification, two final clarifiers, an aerobic digester, ultraviolet light disinfection, post aeration and influent and effluent flow meters. The collection system is comprised of 100% separate sanitary sewers by design with no overflow or bypass points. Final solids are land applied under Land Application Permit INLA000663. Effluent from the plant impacts a small portion of Righthand Fork Salt Creek downstream of Lake Santee, approximately three miles upstream of the confluence with Salt Creek.

The Town of Oldenburg WWTP operates a Class I extended aeration treatment facility consisting of a flow meter, an oxidation ditch, two secondary clarifiers (although only one in use), and effluent chlorination/dechlorination. Liquid sludge is stored in one of the two aerobic digesters and then dewatered by a sludge dewatering bagger system. Bags of sludge are then hauled to a landfill by a private contractor. The collection system is comprised of 100% separate sanitary sewers by design with one sanitary sewer overflow (SSO). Oldenburg WWTP was granted a construction permit in 2011 to update the facility. The plans indicate the construction of a flow equalization pump station and a flow equalization tank to collect excess wet weather flow when the influent flows exceed the capacity of the raw sewage pump station. This 500,000 gallon tank should reduce or eliminate SSO events. An additional secondary clarifier and digester upgrades are included in the construction plans. Effluent from the plant impacts the headwaters of Harvey Branch, approximately three miles upstream of the confluence with Salt Creek. A notice on noncompliance was issued to the facility in January 2014 for an ammonia nitrogen violation and as of September of 2014 the facility remains in violation according to the EPA.

Table 19 presents a summary of permit compliance for WWTP NPDES facilities in the Salt Creek watershed for the five year period between 2009 and 2014. It presents the date of the facility's last inspection and findings from the inspection (i.e., compliance or violation for facility maintenance). The table also presents the total number of violations in the five year period for the NPDES permitted parameters. According to Table 19, there have been seven NPDES facility inspections resulting in potential problems or violations in the five year period. Overall, there are a total of ten permit violations for the NPDES permitted parameters in the Salt Creek watershed.

Table 19 Summary of WWTP Inspections and Permit Compliance in the Salt Creek Subwatersheds for the Five Year Period Ending September 30, 2014

Subwatershed	Facility Name	Permit Number	AUID	Date of Last Inspection and Findings	Violations from 4/2009 through 9/2014				
					Month	Year	Parameter	Type	# Violations
Headwaters Salt Creek	NA	NA	NA	NA	NA				
Righthand Fork Salt Creek	Lake Santee Regional Waste and Water District Wastewater Treatment Plant	IN0060704	ING0352_T1006	07/13/2009: Potential problems observed 07/06/2011: No violations observed 02/13/2013: Potential problems observed 10/29/2013: No Violations observed	Dec April	2010 2013	TSS TSS	Max Wk Avg Max Wk Avg	1 1
Bull Fork	NA	NA	NA	NA	NA				
Little Salt Creek	NA	NA	NA	NA	NA				
Fremont Branch	Oldenburg WWTP	IN0023973	ING0355_T1001	01/06/2010: Potential problems observed 09/27/2011: Potential problems observed 03/08/2012: Potential problems observed 02/19/2013: Potential problems observed 01/08/2014: Violations observed	April May April April April Dec April Jan	2010 2010 2011 2011 2011 2011 2012 2104	*E. coli* *E. coli* BOD *E. coli* TSS Ammonia Ammonia Ammonia	Daily Max Daily Max Max Wk Avg Daily Max Max Wk Avg Max Wk Avg Max Wk Avg Max Wk Avg	1 1 1 1 1 1 1 1

Sanitary Sewer Overflows

Sanitary sewer overflows (SSOs) are unintentional and illegal discharges of raw sewage from municipal sanitary sewers. SSOs discharge *E. coli* to waterbodies and may occur due to:

- Severe weather resulting in of excessive runoff of storm water into sewer lines
- Vandalism
- Improper operation and maintenance
- Malfunction of lift stations
- Electrical power failures

Overflows in the sanitary sewer system or in a sanitary portion of a combined sewer system are expressly prohibited from discharging at any time. Should any release from the sanitary sewer system occur, the permittee is required to notify the Enforcement Section of the Office of Water Quality orally within 24 hours and in writing within five days of the event in accordance with the requirements in Part II.C.2.b of the permit. The correspondence shall include the duration and cause of discharge as well as the remediation action taken to eliminate it.

One permitted facility with one SSO location was identified in the Salt Creek watershed. (Table 20). The Town of Oldenburg WWTP operates a Class I extended aeration treatment facility. The collection system is comprised of 100% separate sanitary sewers by design with one sanitary sewer overflow (SSO).

Table 20 Sanitary Sewer Overflows in the Salt Creek Subwatersheds

Subwatershed	Facility Name	Permit #	Type	AUID
Headwaters Salt Creek	NA	NA	NA	NA
Righthand Fork Salt Creek	NA	NA	NA	NA
Bull Fork	NA	NA	NA	NA
Little Salt Creek	NA	NA	NA	NA
Fremont Branch	Oldenburg WWTP	IN0023973	SSO – Influent Structure NA	ING0355_T1001

Industrial Facilities

Industrial facilities with NPDES permits produce wastewater generated through producing a product. Wastewater discharges from industrial sources may contain pollutants at levels that could affect the quality of receiving waters. The NPDES permit program establishes specific requirements for dischargers from industrial sources. If the industrial facility discharges wastewater directly to a surface water then it requires an individual or general NPDES permit. A general permit, or permit-by-rule, is a “one size fits all” type of activity-specific permit. The general permit rule (327 IAC 15-1 through 15-4) covers the following activities: coal mining, coal processing, and reclamation activities, noncontact cooling water, petroleum products terminals, groundwater petroleum remediation systems, hydrostatic testing of commercial pipelines, and sand, gravel and stone operations. In contrast, individual permits are tailored to the specific activities of the facility and may regulate a number of additional pollutants other than those described under the general permits.

There is one industrial facility with a general NPDES permit within the Salt Creek watershed. Based on the industrial activities and the regulated parameters within the specific permits there is only one active industrial facility that discharges wastewater within the Salt Creek watershed. This facility is the New Point Quarry. Summaries of the industrial permits within the Salt Creek watershed are described below.

Table 21A NPDES Permitted Industrial Facilities in the Salt Creek Subwatersheds

Subwatershed	Facility Name	Permit Number	AUID	Receiving Stream	Maximum Design Flow (MGD)
Headwaters Salt Creek	NA	NA	NA	NA	NA
Righthand Fork Salt Creek	New Point Quarry	ING490006	ING0352_T1002	Salt Creek	NA
Bull Fork	NA	NA	NA	NA	NA
Little Salt Creek	NA	NA	NA	NA	NA
Fremont Branch	NA	NA	NA	NA	NA

New Point Quarry is engaged in sand, gravel, dimension stone or crushed stone operations. They have been granted a general permit allowing processed wastewater from sand and gravel operations to be discharged to an unnamed tributary of Salt Creek. The effluent consists of ground and rain water necessary to dewater the quarry.

Table 21B presents a summary of permit compliance for industrial NPDES facilities in the Salt Creek watershed for the three year period between 2009 and 2014. It presents the date of the facility's last inspection and findings from the inspection (i.e., compliance or violation for facility maintenance). The table also presents the total number of violations in the five year period for all parameters. According to Table 21B, there have been two NPDES industrial facility inspection in the five year period. Overall, there are no permit violations in the Salt Creek watershed.

Table 21B Summary of Inspections and Permit Compliance for Industrial Facilities in the Salt Creek Subwatersheds for the Five Year Period Ending in September 30, 2014

Subwatershed	Facility Name	Permit Number	AUID	Date of Last Inspection and Findings	Violations from 4/2009 through 9/2014
Headwaters Salt Creek	NA	NA	NA	NA	NA
Righthand Fork Salt Creek	New Point Quarry	ING490006	ING0352_T1002	12/17/2009: No violations observed 01/10/2012: No violations observed	NA
Bull Fork	NA	NA	NA	NA	NA
Little Salt Creek	NA	NA	NA	NA	NA
Fremont Branch	NA	NA	NA	NA	NA

Industrial Storm Water

Depending on the type of industrial facility operated more than one NPDES program may apply. Some industrial facilities require an additional permit under the storm water program which will be discussed in this section.

Industrial storm water permits are required for facilities where activities of the industrial operation are exposed to storm water and run-off is discharged though a point source to waters of the state. The general permit 327 IAC 15-6 (Rule 6) applies to specific categories of industrial activities that must obtain permit coverage. Determination of applicable industrial activities is based on a facility's Standard Industrial Classification (SIC) Code(s) or facility activities included in the listed narrative descriptions within the rule. Under certain circumstances, a facility may require an individual storm water permit. This permit is typically required only if a regulated industrial activity category has established effluent limitations or IDEM determines the storm water discharge will significantly lower water quality. There are two Industrial storm water permits within Salt Creek watershed: Batesville Aviation Service LLC and Roman Nobb Incorporated. Industrial storm water permits in the Salt Creek watershed are shown in Figure 22.

These facility must develop and implement a Storm Water Pollution Prevention Plan (SWP3), and submit a completed SWP3 Checklist Form certifying to IDEM that such a plan is in place. The SWP3 is used to identify potential and actual storm water pollutant sources, and to determine best management practices and measures that will minimize the pollutants transported in storm water run-off. The SWP3 itself must be retained at the facility, and made available for review during any on-site inspection. Periodically, the plan must be reviewed, and revised if changes at the facility alter conditions that could affect run-off.

Table 20C NPDES Industrial Storm Water Permits in the Salt Creek Subwatersheds

Subwatershed	Facility Name	Permit Number	AUID	Receiving Stream	Estimated Acreage
Headwaters Salt Creek	NA	NA	NA	NA	NA
Righthand Fork Salt Creek	Batesville Aviation Services LLC	INR800261	ING0352_01	Salt Creek	0.023
Bull Fork	NA	NA	NA	NA	NA
Little Salt Creek	NA	NA	NA	NA	NA
Fremont Branch	Roman Nobbe Incorporated	INR210213 INR00R065	ING0355_T1001	Harvey Branch	0.056

Construction Storm Water

Storm water run-off associated with construction activity is regulated under 327 IAC 15-5 which is commonly known as Rule 5. Rule 5 is a performance-based regulation designed to reduce pollutants that are associated with construction and/or land disturbing activities.

The requirements of Rule 5 now apply to all persons who are involved in construction activity (which includes clearing, grading, excavation and other land disturbing activities) that results in the disturbance of one (1) acre or more of total land area. If the land disturbing activity results in the disturbance of less than one (1) acre of total land area, but is part of a larger common plan of development or sale, the project is still subject to storm water permitting.

In Indiana most construction projects subject to Rule 5 are administered through a general permit. A general permit is a permit by rule, and as such it is not "issued" in the same manner as an individual NPDES permit would be issued. Rather, Rule 5 was "conditionally issued" to all future "project site owners" at the time that the rule was adopted by the Indiana Water Pollution Control Board. The permit conditions within Rule 5 apply universally to all "project site owners" who are eligible to operate under the rule.

Rule 5 requires the development of a Construction Plan and an integral part of the Construction Plan is a SWP3. The SWP3 addresses several issues. First, the plan outlines how erosion and sedimentation will be controlled on the project site to minimize the discharge of sediment off-site or to a water of the state. Second, the plan addresses other pollutants that may be associated with construction activity. This can include disposal of building materials, management of fueling operations, etc. Finally, the plan should also address pollutants that will be associated with the post construction land use. It is the responsibility of the project site owner to implement the storm water pollution prevention plan. In addition, it is critical that the site is monitored during the construction process and in field modifications are made to address the discharge of sediment and other pollutants from the project site. This may require modification of the plan and field changes on the project site, as necessary, to prevent pollutants, including sediment, from leaving the project site.

If an adverse environmental impact from a project site is evident, a Rule 5 permit or, in more significant situations, an individual storm water permit may be required. An individual storm water permit is typically required only if IDEM determines the discharge will significantly lower water quality. If an individual storm water permit is required, notice will be given to the project site owner. The acreage numbers in Table 23 were calculated by using an area weighted approach with using the past five years of permitted construction sites in Rush, Decatur, Franklin and Fayette counties.

Table 21 Permitted Construction Acreage in the Salt Creek Subwatersheds

Subwatershed	Estimated Construction Acreage
Headwaters Salt Creek	1.72
Righthand Fork Salt Creek	2.09
Bull Fork	1.55
Little Salt Creek	1.71
Fremont Branch	1.35

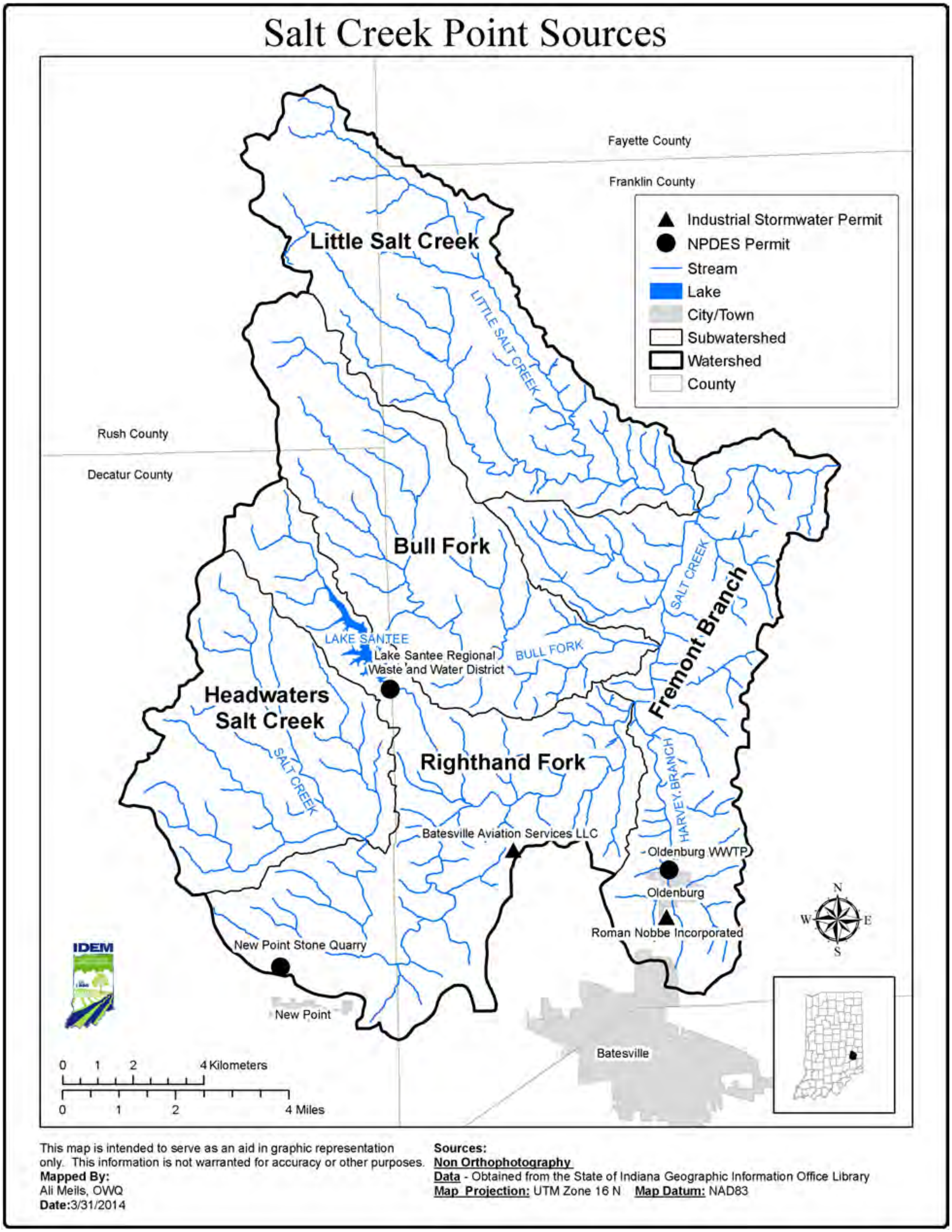


Figure 22 Point Sources in the Salt Creek Watershed

Illicitly Connected "Straight Pipe" Systems

Some household wastes within Indiana and potentially within the Salt Creek watershed directly discharge to a stream or are illegally connected directly to tile-drainage pipes in rural areas, providing a direct source of pollutants such as *E. coli*, nutrients, and TSS to the stream (these systems are sometimes referred to as "straight pipe" discharges).

Nonpoint Sources

This section summarizes the potential nonpoint sources of *E. coli*, nutrients and sediment in the Salt Creek watershed that are not regulated through the National Pollutant Discharge Elimination System (NPDES) Program.

Cropland

Croplands can be a source of *E. coli*, sediments, and nutrients. Accumulation of nutrients and *E. coli* on cropland occurs from decomposition of residual crop material, fertilization with chemical (e.g., anhydrous ammonia) and manure fertilizers, inorganic fertilizers, wildlife excreta, irrigation water, and application of waste products from municipal and industrial wastewater treatment facilities. The majority of nutrient loading from cropland occurs from fertilization with commercial and manure fertilizers (USEPA, 2003). Use of manure for nitrogen supplementation often results in excessive phosphorus loads relative to crop requirements (USEPA, 2003).

Watershed specific data are not available for field specific crops. However, county-wide data available from the National Agricultural Statistic Service (NASS) were downloaded and area weighted to estimate crop acreage in the subwatersheds. The area of the county within the subwatersheds is divided by the area of the entire county and multiplied by the total acreage of crops in the county based on the NASS survey. This is done for each county in the subwatersheds and summed to get an area weighted estimate of cropland with the watershed. The 2012 NASS statistics was used in the analysis as shown in Table 24.

Table 22 Major Cash Crop Acreage in the Salt Creek watershed

Crop	Total Acreage in County			
	Decatur	Fayette	Franklin	Rush
Corn	85,300	38,100	39,600	110,000
Soybean	75,100	35,700	35,800	103,000
Winter Wheat	4,600	1,600	1,800	3,700

Subwatershed Area (mi²)	Crop	Total Acreage	Percentage of Subwatershed Crop Acreage
Headwaters Salt Creek (17.32 mi²)	Corn	2,861.05	55.39
	Soybean	2,264.60	43.85
	Winter Wheat	39.36	0.76
	Total	**5,165.01**	**100**
Righthand Fork Salt Creek (28.44 mi²)	Corn	3,483.07	51.42
	Soybean	3,123.25	46.11

	Winter Wheat	167.50	2.47
	Total	**6,773.82**	**100**
Bull Fork (21.56 mi²)	Corn	3,440.78	51.21
	Soybean	3,128.36	46.56
	Winter Wheat	149.76	2.23
	Total	**6,718.90**	**100**
Little Salt Creek (25.13 mi²)	Corn	3,803.05	51.01
	Soybean	3,503.45	46.99
	Winter Wheat	149.14	2.00
	Total	**7,455.64**	**100**
Fremont Branch (24.86 mi²)	Corn	2,514.6	51.30
	Soybean	2,273.3	46.37
	Winter Wheat	114.30	2.33
	Total	**4,902.2**	**100**

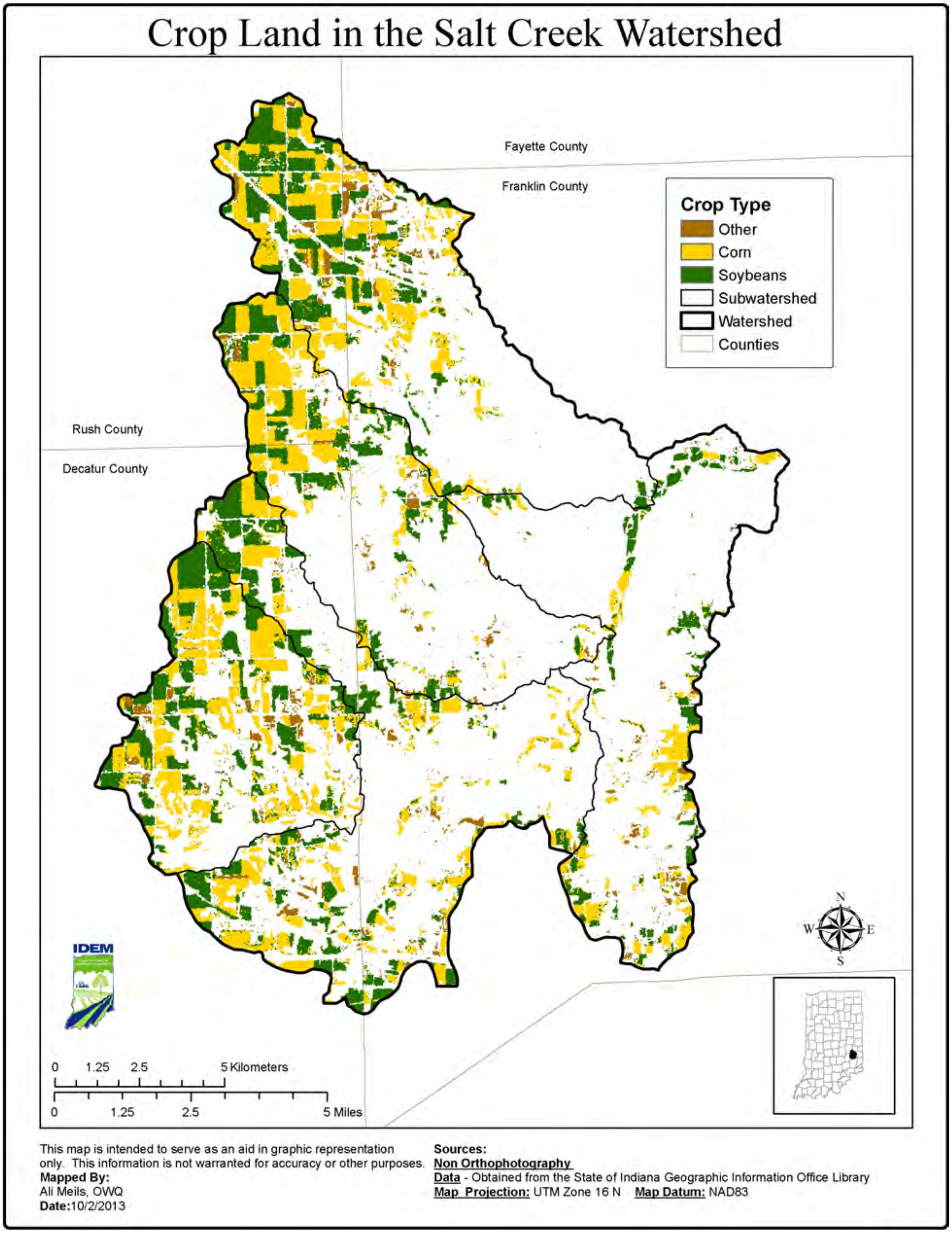


Figure 23 Major Cash Crop Agriculture in the Salt Creek Subwatersheds

Pastures and Livestock Operations

Runoff from pastures and livestock operations can be potential agricultural sources of *E. coli*, nutrients, and sediment. For example, animals grazing in pasturelands deposit manure directly upon the land surface and, even though a pasture may be relatively large and animal densities low, the manure will often be concentrated near the feeding and watering areas in the field. These areas can quickly become barren of plant cover, increasing the possibility of erosion and contaminated runoff during a storm event.

Livestock are potential source of *E. coli*, sediment and nutrients to streams, particularly when direct access is not restricted and/or where feeding structures are located adjacent to riparian areas. Watershed specific data are not available for livestock populations. However, county-wide data available from the National Agricultural Statistic Service were downloaded and area weighted to estimate animal population in the subwatersheds. The area of the county within the subwatersheds is divided by the area of the entire county and multiplied by the total number of animals in the county based on the NASS survey. This is done for each county in the subwatersheds and summed to get an area weighted estimate of animals with the subwatersheds. There are an estimated 11,823 animal units in the Salt Creek watershed and the animal unit density is 100 animal units per square mile as shown in Table 24.

Table 23 Animal Unit Density in the Salt Creek Subwatersheds

	Hogs and Pigs	**Cattle and Calves**	**Sheep and Goats**	**Horses and Ponies**	**Poultry**
Number of Animals in One Animal Unit	2.5	1	10	0.5	250
Total Number of Head in County					
Decatur	179,324	11,479	1,302	389	399
Fayette	12,730	6,470	884	315	416
Franklin	19,941	12,323	842	581	1,015
Rush	133,430	14,388	1,408	510	646
Total Number of Animal Units in Subwatersheds					
	Headwaters Salt Creek	Righthand Fork Salt Creek	Bull Fork	Little Salt Creek	Fremont Branch
Hogs and Pigs	3,300	1,700*	1,086	1,333	507
Cattle and Calves	528	893	550	820	782
Sheep and Goats	2	4	2	4	3
Horses and Ponies	36	80	48	71	74
Poultry	0	0	0	0	0
Total	**3,866**	**2,677**	**1,686**	**2,228**	**1,366**
Animal Unit Density (animal units/mi²)	**223**	**94**	**78**	**89**	**55**

*Numbers adjusted based on known CFO farms in the subwatershed.

Confined Feeding Operations (CFOs)

A CFO is an agricultural operation where animals are kept and raised in confined situations. It is a lot or facility (other than an aquatic animal production facility) where the following conditions are met:

- Animals have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and
- Crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.
- The number of animal present meets the requirements for the state permitting action.

Confined feeding operations that are not classified as CAFOs are known as confined feeding operations (CFOs) in Indiana. Non-CAFO animal feeding operations are considered nonpoint sources by USEPA. CAFOs have federal permits and fall under the jurisdiction of the NPDES program, as described in Section 6.2.1.1. Indiana's CFOs have state-issued permits but are not under the jurisdiction of the federal NPDES program and are therefore categorized as nonpoint sources for the purposes of this TMDL. CFO permits are "no discharge" permits. Therefore it is prohibited for these facilities to discharge to any water of the State.

The CFO regulations (327 IAC 19, 327 IAC 15-16) require that operations "not cause or contribute to an impairment of surface waters of the state". IDEM regulates these confined feeding operations under IC 13-18-10, the Confined Feeding Control Law. The rules at 327 IAC 19, which implement the statute regulating confined feeding operations, were effective on July 1, 2012. The rule at 327 IAC 15-16, which regulates concentrated animal feeding operations and incorporates by reference the federal NPDES CAFO regulations, became effective on July 1, 2012.

Like CAFOs, the animals raised in CFOs 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. CFOs, however, can also be potential sources of TSS, total nitrogen, total phosphorus, and *E. coli* due to 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 or improper application can adversely impact soil productivity.

There are eight CFOs in the Salt Creek watershed as shown in Table 47 and Figure 24.

Table 24 CFOs in the Salt Creek Subwatersheds

Subwatershed	Operation Name	Farm ID	AUID	Animal Type and Number
Headwaters Salt Creek	Geis Farms	4803	ING0351_T1002	1680 Nursery Pigs 1620 Finishers 780 Sows
	Geis Farms	6282	ING0351_T1002	200 Nursery Pigs 1000 Finishers 100 Sows
	Jeffrey Berkemeier	6503	ING0351_01	2000 Finishers
	Flodder Site	6517	ING0351_T1003	2300 Finishers
	Ricke Livestock Home Farm	954	ING0351_T1002	1200 Nursery Pigs; 1200 Finishers
Righthand Fork Salt Creek	Philip & Don Kramer	4480	ING0352_T1005	1000 Nursery Pigs 2300 Finishers 95 Sows
	RJR Farms Inc.	6137	ING0352_T1003	180 Nursery Pigs 860 Finishers 136 Sows 80 Beef Cattle
	Dale O. Thie	6163	ING0352_01	230 Nursery Pigs 690 Finishers 20 beef Cattle
	D & S Volk Farming Inc.	4021	ING0352_T1002	1600 Nursery Pigs; 3850 Finishers
Bull Fork	NA	NA	NA	NA
Little Salt Creek	NA	NA	NA	NA
Fremont Branch	Steinfort Farms	3711	ING0355_T1001	180 Nursery Pigs; 730 Finishers; 54 Sows

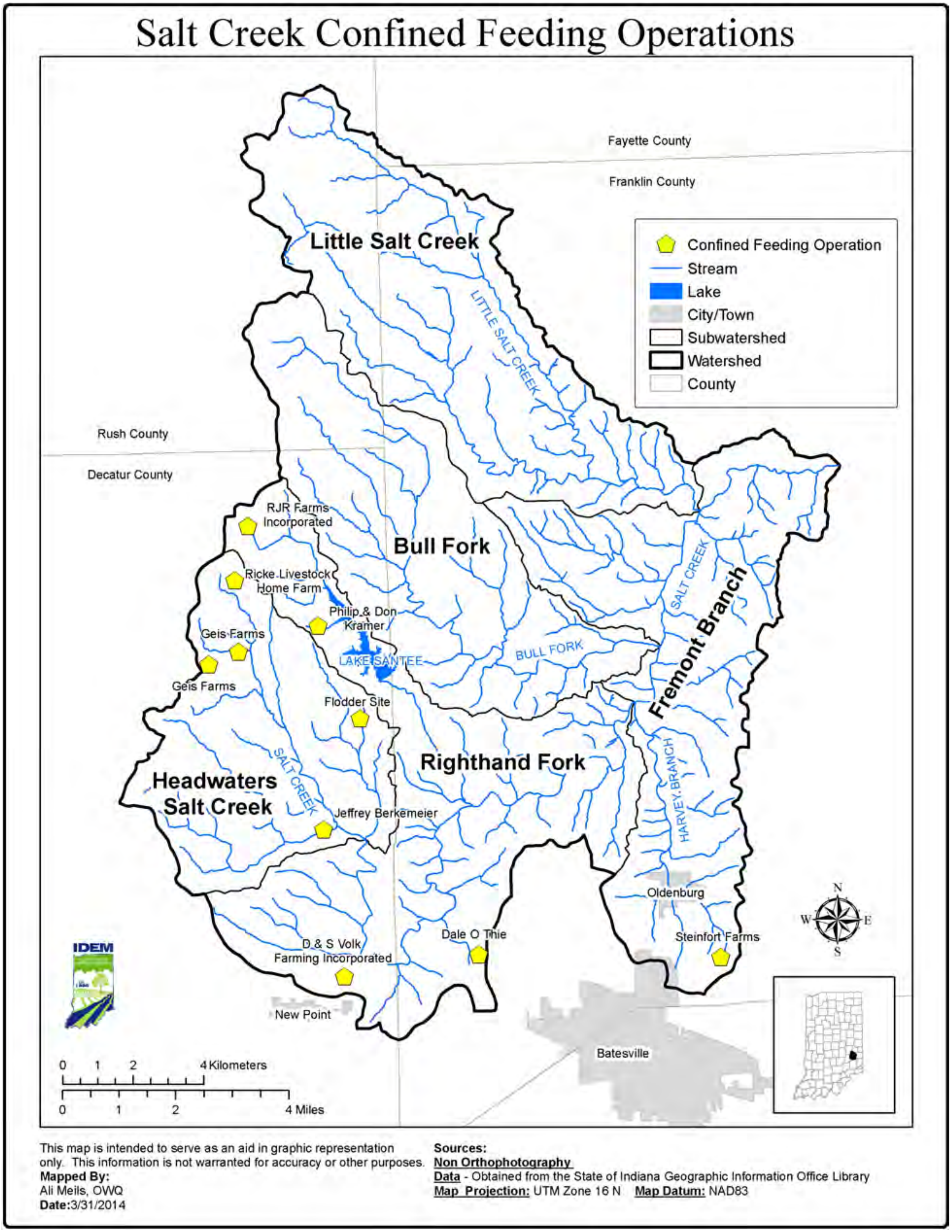


Figure 24 Confined Feeding Operations in the Salt Creek Subwatersheds

Streambank Erosion

Streambank erosion is potentially a significant source of TSS in the Salt Creek watershed. Streambank erosion is a natural process but can be accelerated due to a variety of human activities:

Vegetation located adjacent to streams flowing through crop or pasture fields is often removed to promote drainage or cattle access to water. The loss of vegetation makes the streambanks more susceptible to erosion due to the loss of plant roots.

Extensive areas of agricultural tiles promote much quicker delivery of rainfall into streams than would occur without subsurface drainage, which could potentially contribute to streambank erosion due to high velocities and shear stress.

The creation of impervious surfaces (e.g., streets, rooftops, driveways, parking lots) can also lead to rapid runoff of rainfall and higher stream velocities that might cause streambank erosion.

Onsite Wastewater Treatment Systems

Onsite wastewater treatment systems (e.g., septic systems) that are properly designed and maintained should not serve as a source of contamination to surface waters. However, onsite systems do fail for a variety of reasons. Common soil-type limitations which contribute to failure are: seasonal water tables, compact glacial till, bedrock, coarse sand and gravel outwash and fragipan. When these septic systems fail hydraulically (surface breakouts) or hydrogeologically (inadequate soil filtration) there can be adverse effects to surface waters due to *E. coli,* nitrate + nitrite, and total phosphorus (Horsely and Witten, 1996). Septic systems contain all the water discharged from homes and business and can be significant sources of pathogens and nutrients.

The Indiana State Department of Health (ISDH) regulates (410 IAC 6-8.3) through the local health departments the residential onsite sewage disposal program. Onsite sewage disposal systems (i.e., septic systems) are those, which do not result in an off-lot discharge of treated effluent, typically consisting of a septic tank to settle out and digest sewage solids, followed by a system of perforated piping to distribute the treated wastewater for absorption into the soil. More than 800,000 onsite sewage disposal systems are currently used in Indiana. Local health departments issue more than 15,000 permits per year for new systems, and about 6,000 permits for repairs.

410 IAC 6-8.3-52 General sewage disposal requirements

Sec. 52. (a) No person shall throw, run, drain, seep, or otherwise dispose into any of the surface waters or ground waters of this state, or cause, permit, or suffer to be thrown, run, drained, allowed to seep, or otherwise disposed into such waters, any organic or inorganic matter from a dwelling or residential onsite sewage system that would cause or contribute to a health hazard or water pollution.
(b) The: (1) design; (2) construction; (3) installation; (4) location; (5) maintenance; and (6) operation; of residential onsite sewage systems shall comply with the provisions of this rule.

410 IAC 6-8.3-55 Violations; permit denial and revocation

Sec. 55. (a) Should a residential onsite sewage system fail, the failure shall be corrected by the owner within the time limit set by the health officer. (b) If any component of a residential onsite sewage system is found to be: (1) defective; (2) malfunctioning; or (3) in need of service; the health officer may require the repair, replacement, or service of that component. The repair, replacement, or service shall be conducted within the time limit set by the health officer. (c) Any person found to be violating this rule may be served by the health officer with a written order stating the nature of the violation and providing a time limit for satisfactory correction thereof.

A comprehensive database of septic systems within the Southern Whitewater River watershed is not available; therefore, the rural population of each subwatershed was calculated to obtain a general representation of the number of systems. The US Census provides the total number of people within a county as well as the total urban and rural population of the county. Subwatershed population is estimated by dividing the subwatershed area by the total county area and multiplying it by the county census population. It is assumed that the numbers of septic systems in the subwatersheds are directly proportional to rural population density. An additional estimate of septic systems can be made using the 1990 US Census, as that is the last Census that inventoried how household wastewater is disposed. The rural households in the Salt Creek subwatersheds are shown in Table 49, along with a calculated density (total rural households divided by total area). The rural household density can be used to compare the different subwatersheds within the Salt Creek watershed.

It should also be noted that hydrologic soil group A and B soils have good infiltration rates and have less risk for failing septic systems due to this factor. Group C and D soils have slow infiltration rates with finer textures and slow water movement.

Table 25 Hydrologic Soil Groups in the Salt Creek Subwatersheds

Subwatershed	Hydrologic Soil Group			
	A	B	C	D
Headwaters Salt Creek	0	17.48%	82.46%	0.06%
Righthand Fork Salt Creek	0.06%	14.34%	84.38%	1.22%
Bull Fork	0	30.36%	69.56%	0.08%
Little Salt Creek	0.15%	42.81%	56.63%	0.41%
Fremont Branch	0.77%	10.62%	88.53%	0.08%

Table 26. Rural Population Density in the Salt Creek Subwatersheds

Subwatershed	**County**	**Area of County in Subwatershed (mi^2)**	**County Households in Subwatershed**	**Urban Households**	**Rural Households**	**Rural Household Density (Houses/mi^2)**
Headwaters Salt Creek	Decatur	17.29	315	0	315	**20**
	Franklin	0.03	30	0	30	
	Total	17.32	345	0	345	
Righthand Fork Salt Creek	Decatur	4.74	744	0	744	**40**
	Franklin	23.70	402	0	402	
	Total	28.44	1,146	0	1,146	
Bull Fork	Decatur	3.95	137	0	137	**20**
	Franklin	13.11	246	0	0246	
	Rush	4.50	38	0	038	
	Total	21.56	421	0	421	
Little Salt Creek	Fayette	0.10	17	0	17	**30**
	Franklin	17.6	633	0	633	
	Rush	7.43	113	0	113	
	Total	25.13	763	0	763	
Fremont Branch	Franklin	24.86	1,294	566	728	**29**
	Total	24.86	1,294	566	728	

Urban Storm Water

In areas not covered under the NPDES MS4 program, storm water runoff from developed areas is not regulated under a permit and is therefore a nonpoint source. Runoff from urban areas can carry a variety of pollutants originating from a variety of sources. Typically urban sources of nutrients are fertilizer application to lawns and pet waste, which is also a source of *E. coli*. Depending on the amount of developed, impervious land in a watershed, urban nonpoint source inputs can result in localized or widespread water quality degradation. The percent and distribution of developed land in the Headwaters Salt Creek watershed is discussed in Section 4.2.1. However, inputs from urban sources are difficult to quantify. Estimates can be made of pet populations and residential areas that might receive fertilizer treatment. These estimates provide insight into the potential of urban nonpoint sources as important sources of nutrients, sediment and *E. coli* in the Salt Creek watershed.

Dog and cat populations were estimated for the Salt Creek subwatersheds using statistics reported in the *2007 U.S. Pet Ownership & Demographics Sourcebook*[1]. Specifically, the *Sourcebook* reports that on average 37.2 percent of households own dogs and 32.4 percent of households own cats. Typically, the average number of pets per household is 1.7 dogs and 2.2 cats. However, pets are likely only a significant source of *E. coli* and nutrients in population centers (i.e., cities and towns). The estimates of domestic pets in cities and towns in the watershed are presented in Table 28 and are based on the average number of pets per household multiplied by the households in the urban areas of the subwatersheds.

Table 27 Estimated Pet Populations in the Cities and Towns in the Salt Creek Watershed

Subwatershed	City/Town	Households in 2010	Estimated Number of Cats	Estimated Number of Dogs
Headwaters Salt Creek	NA	NA	NA	NA
Righthand Fork Salt Creek	NA	NA	NA	NA
Bull Fork	NA	NA	NA	NA
Little Salt Creek	NA	NA	NA	NA
Fremont Branch	Oldenburg	362	796	615
	Batesville	204	449	347
	Total	566	1,245	962

Wildlife

The Indiana Department of Natural Resources (IDNR) is the primary entity responsible for monitoring wildlife populations and habitats throughout Indiana. Wildlife such as deer, geese, ducks, etc. can be sources of *E. coli*. Little information exist surrounding feces depositional patterns of wildlife and a direct inventory of wildlife populations is generally not available. However, based on the *Bacteria Source Load Calculator* developed by the Center for TMDL and Watershed Studies, bacteria production by animal type is estimated as well as their preferred habitat. Higher concentrations of wildlife in the habitats described in Table 29 could contribute *E. coli* and nutrients to the watershed, particularly during high flow conditions or flooding events.

[1] http://www.avma.org/reference/marketstats/sourcebook.asp

Table 28 Bacteria Source Load by species

Wildlife Type	*E. coli* Production Rate (cfu/day – animal)	Habitat
Deer	1.86×10^8	Entire Watershed
Raccoon	2.65×10^7	Low density on forests in rural areas; high density on forest near a permanent water source or near cropland
Muskrat	1.33×10^7	Near ditch, medium sized stream, pond or lake edge
Goose	4.25×10^8	Near main streams and impoundments
Duck	1.27×10^9	Near main streams and impoundments
Beaver	2.00×10^5	Near streams and impoundments in forest and pastures

Managed lands include natural and recreation areas which are owned or managed by the Indiana Department of Natural Resources, federal agencies, local agencies, non-profit organizations, and conservation easements. Classified lands are public or private lands containing areas supporting growth of native or planted trees, native or planted grasses, wetlands or other acceptable types of cover that have been set aside for managed production of timber, wildlife habitat and watershed protection. These natural areas provide ideal habitat for wildlife. Some of the more common wildlife often found in natural areas include white-tailed deer, raccoon, muskrat, fowl and beaver. While wildlife is known to contribute *E.coli* and nutrients to the surface waters, natural areas provide economic, ecological and social benefits and should be preserved and protected. Management practices such as reducing impervious surfaces, native vegetation plantings, wetland creation and riparian buffers will help in reducing stormwater runoff transporting pollutants to the streams. Figure 25 shows the managed lands within the Salt Creek watershed. There are 6,282 acres of managed and classified lands in the Salt Creek watershed.

Table 29 Managed Land and Classified Land in the Salt Creek Watershed

Managed Lands			
Subwatershed	**Unit Name**	**Manager**	**Area (acres)**
Fremont Branch	Kaufman Tract Forest Legacy Area	Private Landowner	245
		Total	245

Classified Lands (Acres)						
Subwatershed	**Grassland**	**Woodland**	**Shrubland**	**Wetland**	**Other**	**Total**
Headwaters Salt Creek	0	633.90	0	0	0	633.90
Righthand Fork	21.1	1475.76	17.7	2.8	38	1,555.36
Bull Fork	37.05	909.52	13.9	0	0	960.47
Little Salt Creek	4	469.57	13.35	1.5	0	488.42
Fremont Branch	37.54	2,275.43	84.66	1	0	2,398.63

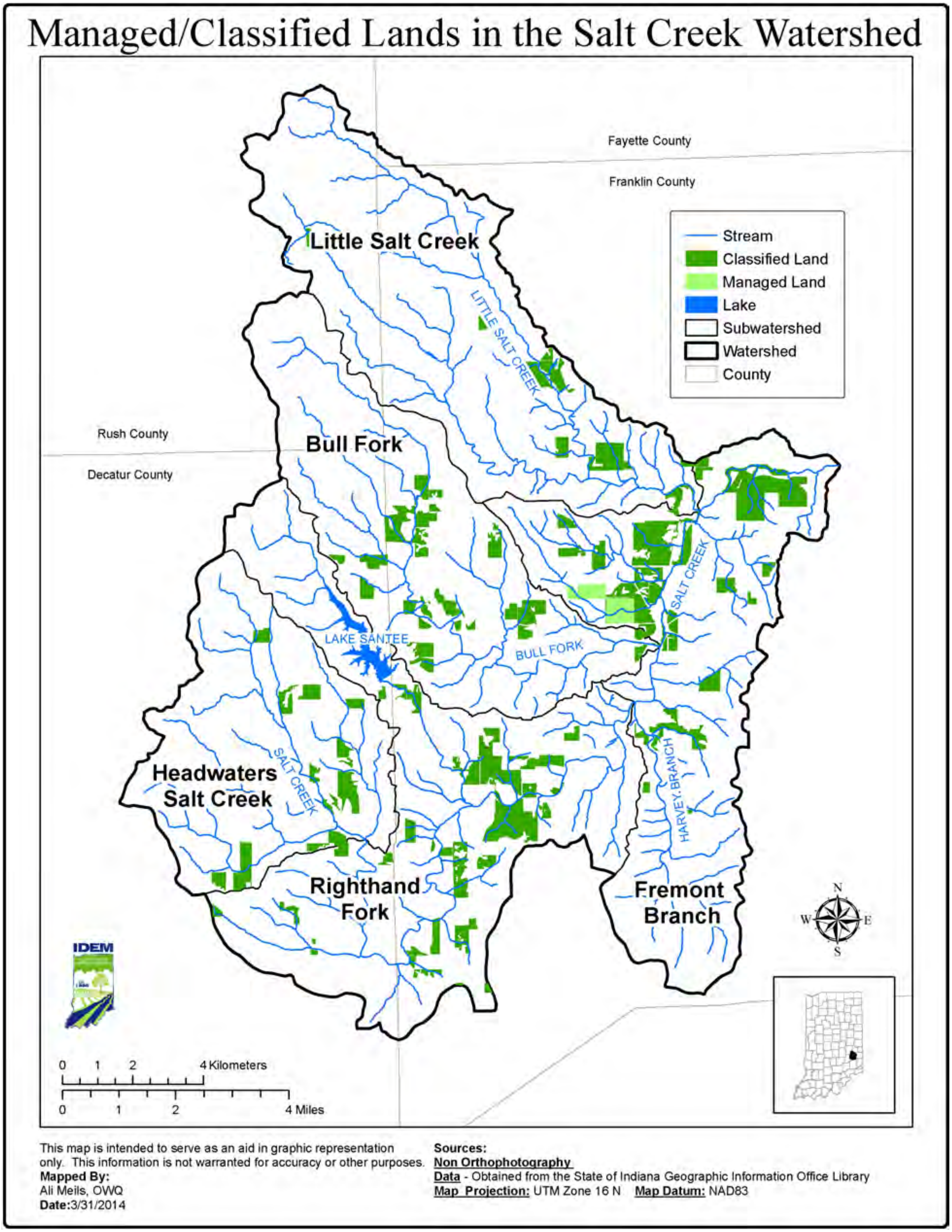


Figure 25 Managed Lands in the Salt Creek Watershed

5.0 DESCRIPTION OF THE PIPE CREEK WATERSHED

This section of the TMDL report contains a brief characterization of the Pipe Creek watershed to provide a better understanding of the historic and current conditions of the watershed that affect water quality and contribute to the *E. coli*, nutrients and sediment impairment. Understanding the natural and human factors affecting the watershed will assist in selecting and tailoring appropriate and feasible implementation activities to achieve water quality standards.

The Pipe Creek watershed (HUC 0508000306) is located in the middle of the Southern Whitewater River watershed. The watershed covers 118 square miles and drains a total of 842 square miles. Whitewater River flows through the middle of the watershed in Franklin County. The tributaries flowing into the Whitewater River from the north include Duck Creek, Little Duck Creek and Yellow Bank River. The tributaries flowing into Whitewater River from the south include Pipe Creek, Clear Fork, Walnut Fork, Snail Creek, and McCartys Run. The watershed encompasses parts of Fayette, Franklin, Dearborn and Ripley counties. The Pipe Creek watershed is mostly rural with portions of the Town of Brookville in the eastern part of the watershed and portions of the Town of Sunman and City of Batesville in the southern part of the watershed. Land use throughout the watershed is predominantly forested land.

There are a number of existing impairments in the Pipe Creek watershed from the approved Draft 2012 303(d) List of Impaired Waters (Figure 26). The listings and causes of impairment have been adjusted as a result of reassessment data collected at 13 sampling locations in the watershed (Figures 27). Within the Pipe Creek watershed a total of 34 assessment unit IDs (AUIDs) are cited as impaired for *E. coli* (189 stream miles), biological communities (17 stream miles), dissolved oxygen (11 stream miles), or PCBs (25 stream miles) on the Indiana's Draft 2016 303(d) list (Figure 28). These impaired segments account for approximately 205 stream miles. Table 31 presents listing information for the Pipe Creek watershed, including a comparison of the updated listings with the 2012 listings and associated causes of impairments addressed by the TMDLs. The reassessment data used in updating the listings for the Pipe Creek watershed are available in Appendix A.

IDEM identifies the Pipe Creek watershed and its tributaries using a watershed numbering system developed by United States Geological Survey (USGS), Natural Resource Conservation Service (NRCS), and the U.S. Water Resources Council referred to as hydrologic unit codes (HUCs). HUCs are a way of identifying watersheds in a nested arrangement from largest (i.e., those with shorter HUCs) to smallest (i.e., those with longer HUCs). (For more information on HUCs, go to http://www.in.gov/idem/nps/2422.htm.) Figure 29 shows the 12-digit HUCs located in the Pipe Creek watershed.

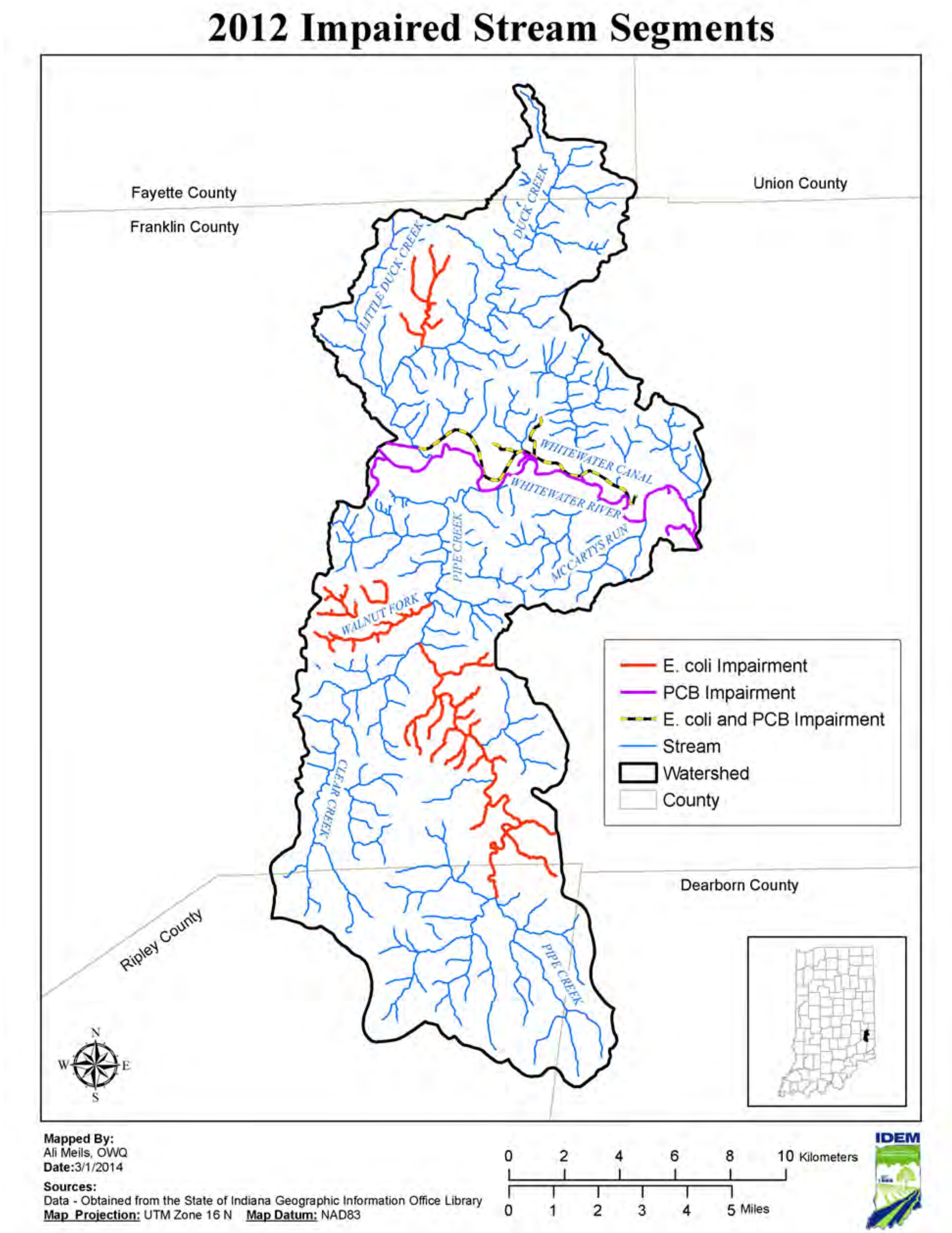


Figure 26 Streams Listed on the Draft 2012 Section 303(d) List in the Pipe Creek Watershed

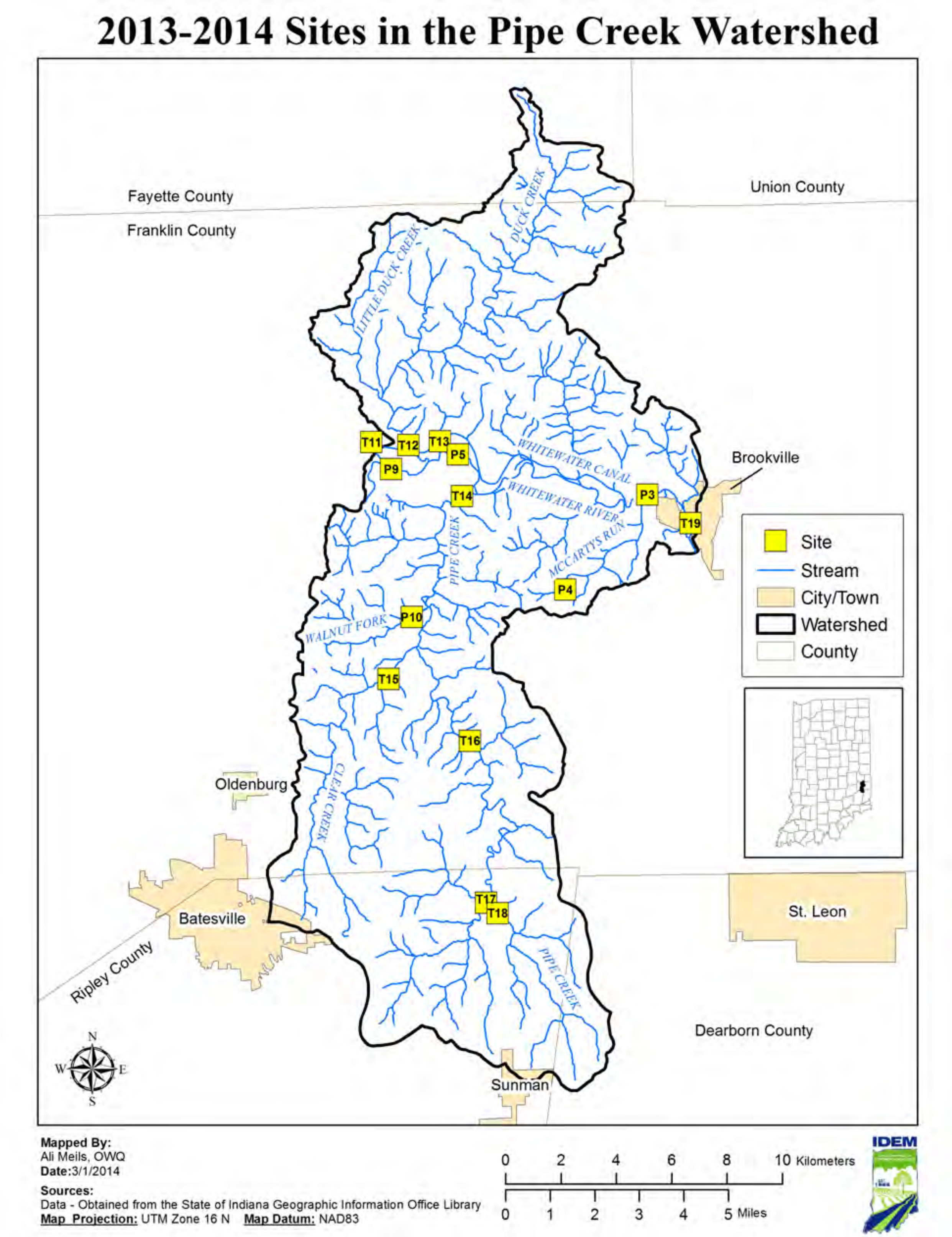


Figure 27 2013 Sampling Locations in the Pipe Creek Watershed

Table 30 Pipe Creek Sampling Site Information

Site #	L-Site #	Stream Name	Road Name	AUID 2012
T11*	GMW-04-0018	Whitewater River	US 52	ING0348_03
T12	GMW-06-0019	Duck Creek	US 52	ING0363_02
T13	GMW-06-0022	Whitewater Canal	Unnamed Road	ING0362_01
T14	GMW-06-0015	Pipe Creek	Silver Creek Road	ING0364_01
T15	GMW-06-0013	Clear Fork	Schwegman Road	ING0362_02
T16	GMW-06-0020	Pipe Creek	St. Marys Road	ING0364_01
T17	GMW-06-0014	Tributary of Pipe Creek	St Marys Road	ING0361_T1005
T18	GMW060-0027	Pipe Creek	Pipe Creek Road	ING0361_02
T19	GMW-06-0012	Whitewater River	Saint Mary Road	ING0365_01
P3	GMW-06-0002	Whitewater River	Saint Mary Road	ING0365_01
P4	GMW-06-0003	McCartys Run	Saint Mary Road	ING0365_T1003
P5	GMW-06-0004	Whitewater River	Silver Creek Road	ING0365_01
P9	GMW-06-0005	Whitewater River	Pennington Road	ING0365_01
P10	GMW-06-0006	Walnut Fork	Walnut Fork Road	ING0364_T1003

*****This site is not located within the boundaries of the watershed but the data will be used to account for load contributions from the West Fork Whitewater River before it flows through the study area.

Understanding Table 31:

- *Column 1: Site #.* Lists the site number that corresponds to the site location in Figure 31.
- *Column 2: Station #.* Provides the IDEM site identification number.
- *Column 3: Stream Name*. Identifies the Stream Name where the site is located.
- *Column 4: Road Name.* Identifies the Road Name where the site is located.
- *Column 5 AUID 2012.* Identifies the AUID given to waterbodies within the 12-digit HUC subwatershed for purposes of the 2014 Section 303(d) listing assessment process.

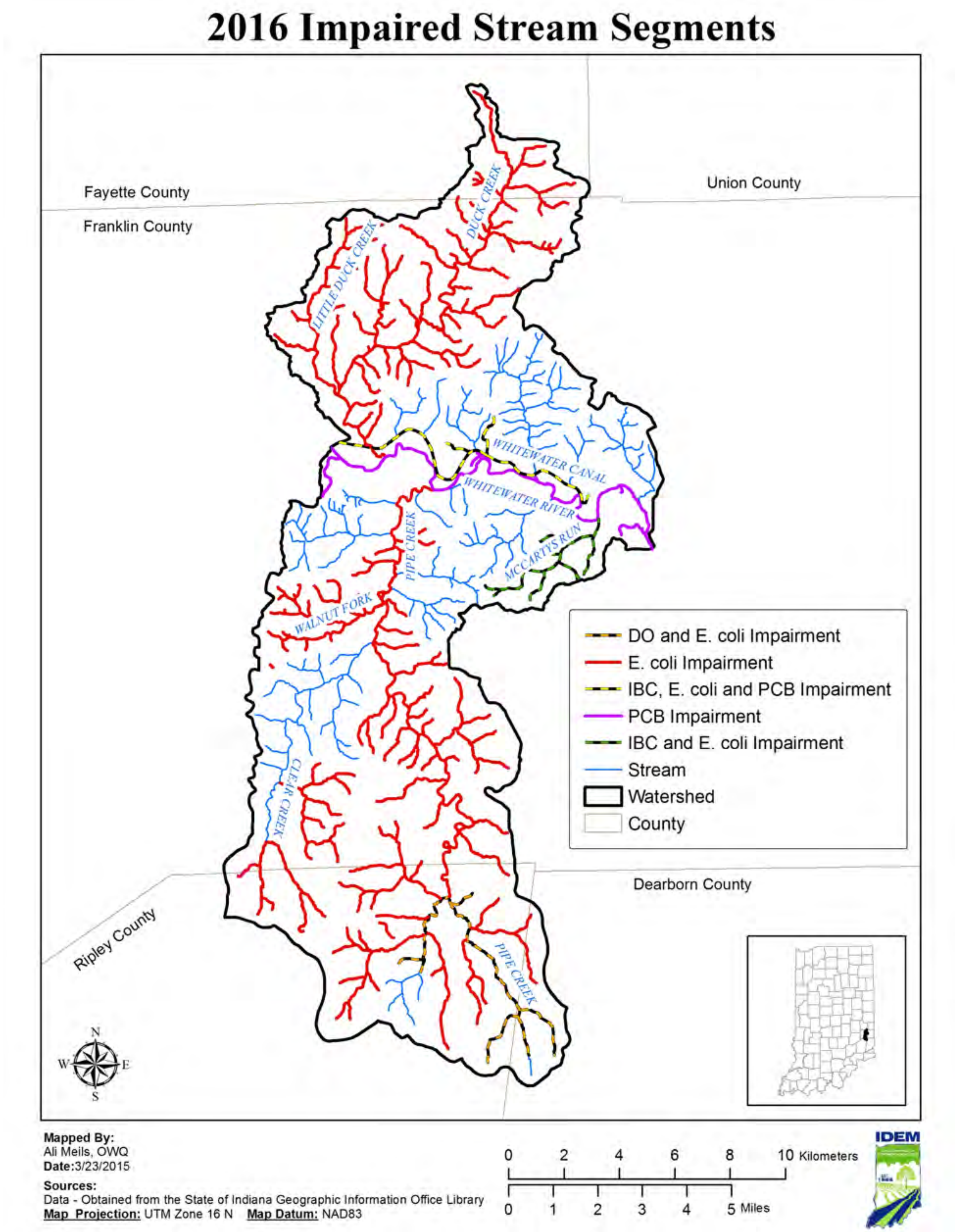


Figure 28 Streams Listed on the Draft 2016 Section 303(d) List in the Pipe Creek Watershed

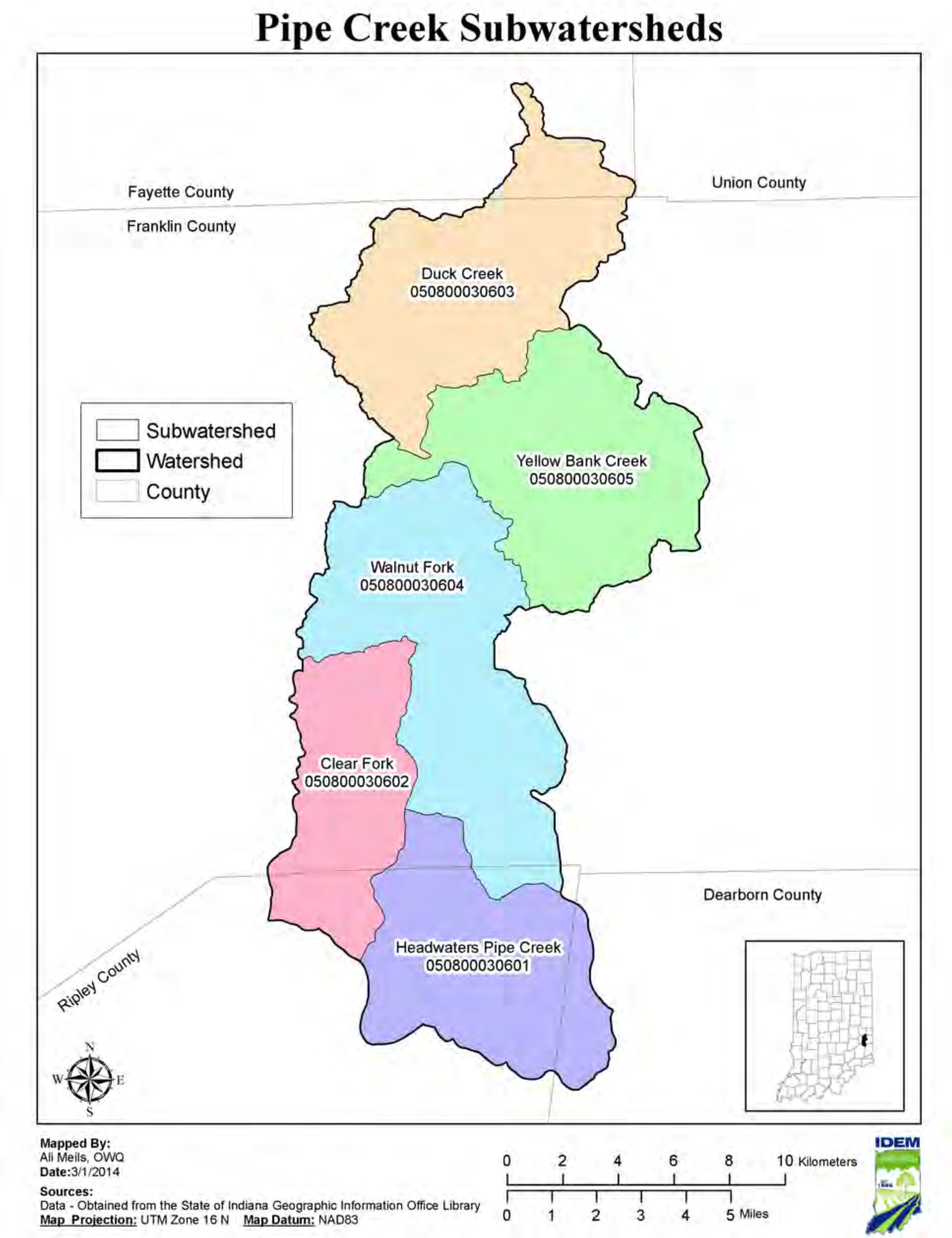


Figure 29 Subwatersheds (12-Digit HUCs) in the Pipe Creek Watershed

5.1 Land Use

Land use patterns provide important clues to the potential sources of *E. coli*, nutrients and sediment in a watershed. Land use information for the Pipe Creek watershed is available from the National Agricultural Statistics Service (NASS), which is part of the United States Department of Agriculture (USDA). The Cropland Data Layer (CDL) categorizes the land use for each 30 meters by 30 meters parcel of land in the watershed based on satellite imagery from circa 2012. Figure 9 displays the spatial distribution of the land uses and the data are summarized in Table 8.

Land use in the Pipe Creek watershed is primarily forested land, comprising 59 percent of the Pipe Creek watershed. Approximately 19 percent of the land is cropland and 15 percent is pasture lands. Pasture land and agricultural practices represent 34 percent of the watershed and indicate the presence of animal feedlots and potentially the application of manure on fields, both uses can be significant sources of *E. coli*, nutrients and sediment. There is a low percentage of developed land in the watershed but those areas surrounding the Town of Brookville and Batesville have increased levels of impervious surfaces that can be significant sources of *E. coli* and sediment.

The Pipe Creek watershed has a diverse network of streams. Tributaries include Pipe Creek, Duck Creek, Walnut Fork, Yellow Bank among others. The headwaters of the watershed have more agricultural land uses with narrow riparian buffers surrounding the streams, but landscape becomes steep and forested moving closer to the mainstem Whitewater River. Agricultural fields in the area are drained using tiles because otherwise it would be too wet to farm and there are a few legal drains in the watershed. Pipe Creek has very sandy substrates with much more substrate embeddedness than the Salt Creek watershed. Salt Creek tributaries tended to be dominated by cobble and gravel substrates, with little embeddedness. The Variegate Darter (*Etheostoma variatum*) is an Indiana State Endangered fish species that is found in Whitewater River along the mainstem only. The Variegate Darter is restricted to the Ohio River drainage and are only found in the Whitewater River watershed in Indiana. They are an indicator of good water quality and are abundant in high quality streams. They are found in medium to large streams and rivers with swift flowing riffles with gravel, cobble or boulders on the stream bottom. Additional information on state endangered, threatened and rare species can be found on the DNR website (http://www.in.gov/dnr/naturepreserve/4666.htm).

Table 31 Land Use of Pipe Creek Watershed

Land Use	Watershed		
	Area		Percent
	Acres	Square Miles	
Agricultural Lands	14,792.37	23.11	19.43
Developed Land	3,513.84	5.49	4.62
Forested Land	45,193.75	70.62	59.40
Pasture/Hay	11,521.16	18.00	15.14
Shrub/Scrub	648.06	1.01	0.85
Wetlands	3.56	0.01	0.01
Open Water	415.66	0.65	0.55
TOTAL	**76,088.40**	**118.89**	**100**

Understanding Table 8: The predominant land use types in the Pipe Creek watershed can indicate potential sources of *E. coli*, nutrients and sediment loadings. Different types of land uses are characterized by different types of hydrology. For example, developed lands are characterized by impervious surfaces that increase the potential of storm water events during high flow periods delivering *E. coli*, nutrients and sediment to downstream streams and rivers. Forested land and wetlands allow water to infiltrate slowly thus reducing the risks of polluted water to running off into waterbodies. In addition to differences in hydrology, land use types are associated with different types of activities that could contribute *E. coli*, nutrients and sediment to the watershed. Understanding types of land uses will help identify the type of implementation approaches that watershed stakeholders can use to achieve *E. coli*, nutrients and sediment load reductions.

5.2 Crop Land

Land use patterns provide important clues to the potential sources of *E.coli*, nutrients and sediment in a watershed. Land use information for the Pipe Creek watershed is available from the MRLCC. These data categorize the land use for each 30 meters by 30 meters parcel of land in the watershed based on satellite imagery from 2012. Figure 9 displays the spatial distribution of the cropland and the data are summarized in Table 8.

Land use in the Pipe Creek watershed is primarily forested, comprising approximately 59 percent of the Pipe Creek watershed. However there is a significant portion of the watershed that is agricultural (19 percent). Corn and soybean crops are not typically associated with high *E.coli*, nutrients and sediment loads, unless they have been fertilized with manure. Approximately 92 percent of the crop land is corn or soybean.

Table 32 Crop Land of Pipe Creek Watershed

	Watershed		
	Area		
Crop Data	Acres	Square Miles	Percent
Corn	7618.36	11.90	48.74
Soybean	6758.13	10.56	43.23
Alfalfa and other Hay	840.65	1.31	5.38
Double Crop Winter Wheat/Corn or Soybeans	247.52	0.38	1.58
Winter Wheat	162.57	0.25	1.04
Tobacco	3.78	0.01	<0.01
Pop or Orn Corn	1.11	<0.01	<0.01
Dry Beans	0.67	<0.01	<0.01
Rye	0.22	<0.01	<0.01
TOTAL	15,633.01	24.41	100

Understanding Table 5: The predominant cropland types in the Pipe Creek watershed can indicate potential sources of *E.coli*, nutrients and sediment loadings. Crop land use in the Pipe Creek watershed is primarily corn and soybean. Understanding types of cropland will help identify the type of implementation approaches that watershed stakeholders use to achieve *E.coli*, nutrients and sediment load reductions.

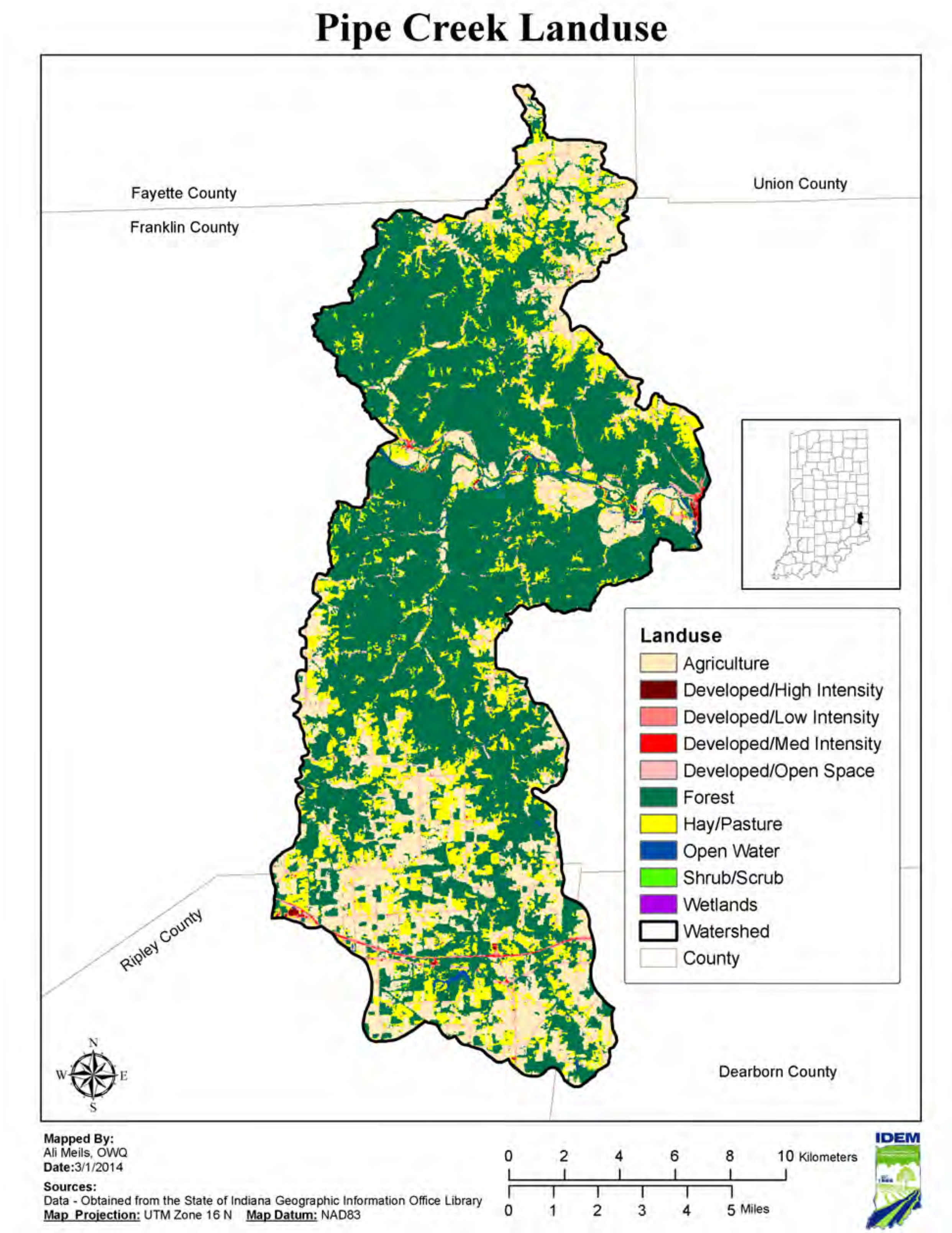


Figure 30 Land Use in the Pipe Creek Watershed

5.3 Human Population

Counties with land located in the Pipe Creek watershed include Dearborn, Fayette, Franklin, Ripley and Union. Major incorporated and unincorporated cities and towns with jurisdiction at least partially within the Pipe Creek watershed include Metamora, Saint Marys, Blooming Grove, Penntown, Oak Forest, and portions of Batesville, Sunman and Brookville. U.S. Census data for each county during the past three decades are provided in Table 34. Cities and towns are labeled in Figure 1131.

Table 33 Population Data for Counties in the Pipe Creek Watershed

County	1990	2000	2010
Dearborn	38,835	46,109	50,047
Fayette	26,015	25,588	24,277
Franklin	19,580	22,151	23,087
Ripley	24,616	26,523	28,818
TOTAL	***109,046***	***120,371***	***126,229***

Source: U.S. Census Bureau.

Understanding Table 34***:*** Water quality is linked to population growth because a growing population often leads to more development, translating into more houses, roads, and infrastructure to support more people. Table 35 provides information that shows how population has changed in each of the counties located in the Pipe Creek watershed over time. In addition, understanding population trends can help watershed stakeholders to anticipate where pressures might increase in the future and where action now could help prevent further water quality degradation.

Estimates of population within Pipe Creek watershed are based on US Census data (2010) and the percentage of the total county and urban area that is within the watershed (Table 11). Based on this analysis, the estimated population of the watershed is 9,059 with approximately 84 percent of the population classified as rural residents and 16 percent classified as urban residents. Figure 12 indicates population density within the Pipe Creek watershed.

Table 34 Estimated Population in the Pipe Creek Watershed

County	2010 Population	Total Estimated Watershed Population	Percent of Total Watershed Population	Rural Population	Urban Population
Dearborn	50,047	441	4.86	441	0
Fayette	24,277	431	4.76	431	0
Franklin	23,087	6,162	68.02	5,356	806
Ripley	28,818	2,025	22.36	1,389	636
TOTAL	***126,229***	***9,059***	***100***	***7,617***	***1,442***

Understanding Table 11: Understanding where the greatest population is concentrated within the Pipe Creek watershed will help watershed stakeholders understand where different types of water quality pressures might currently exist.

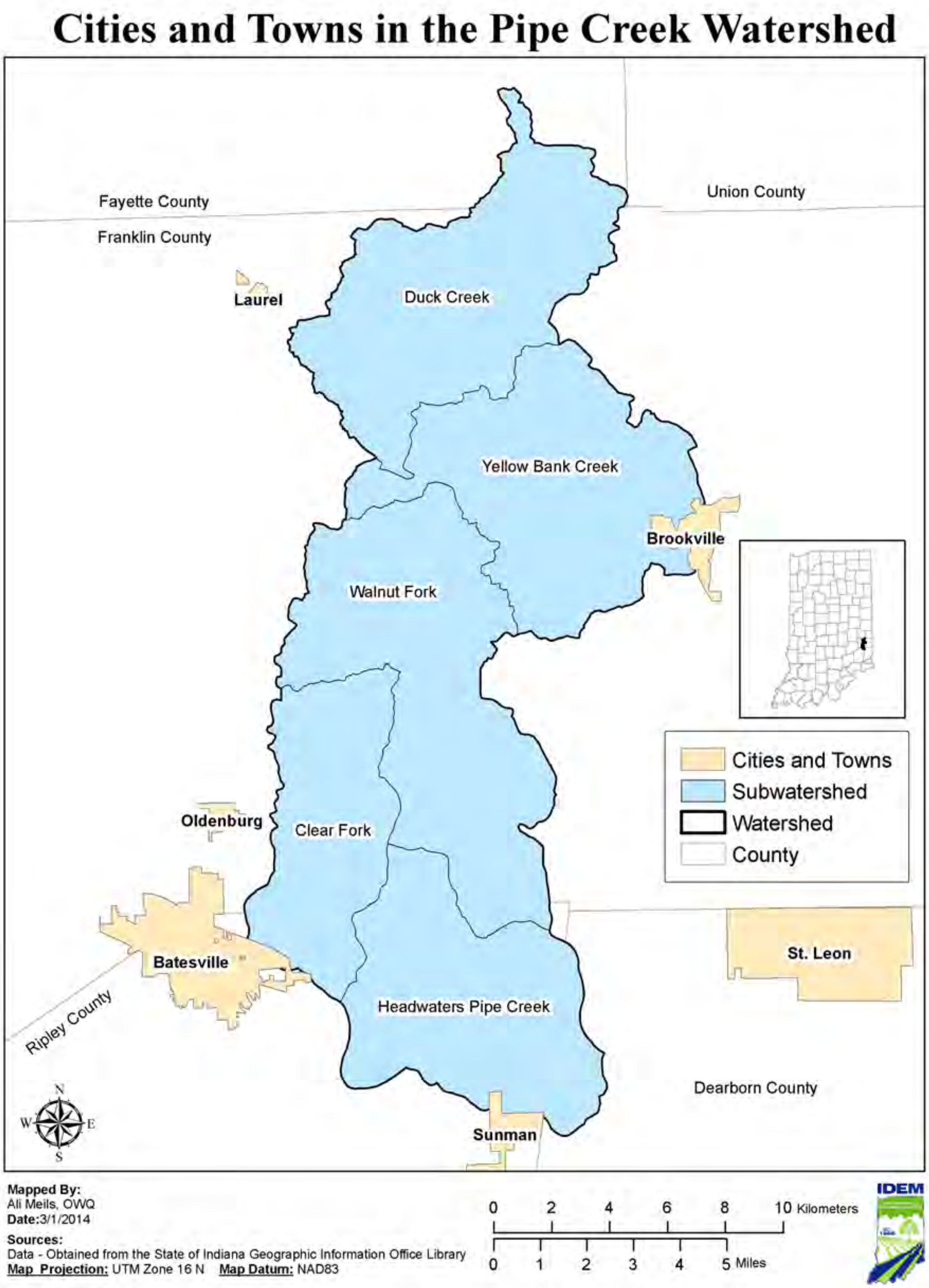


Figure 31 Municipalities in the Pipe Creek Watershed

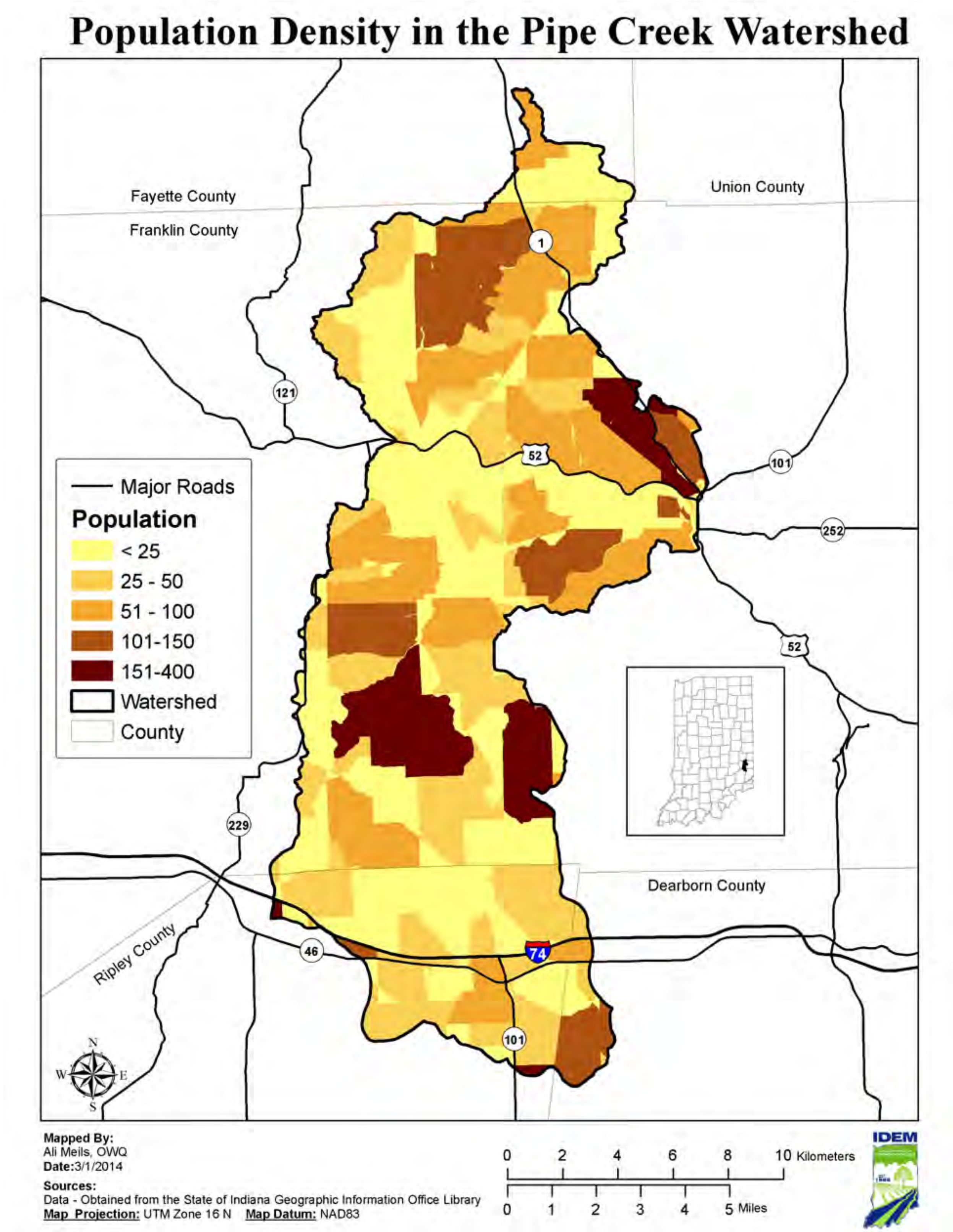


Figure 32 Population Density in the Pipe Creek Watershed

5.4 Topography and Geology

Topographic and geologic features of a watershed play a role in defining a watershed's drainage pattern. Information concerning the topography and geology within the Pipe Creek watershed is available from the Indiana Geologic Survey (IGS). The majority of Pipe Creek watershed is located in the Eastern Corn Belt Plain (ECBP) ecoregion with a part of the Interior Plateau (IP) dissecting the watershed through the center. The ECBP is characterized by extensive cropland agriculture with some natural forest cover and gently rolling glacial till plains dissected by moraines, kames and outwash plains. The IP ecoregion includes a till plain of low topographic relief formed from Illinoian glacial drift materials, rolling to modestly or deeply dissected basin terrain. Layers of sandstone, siltstone, shale and limestone underlie much of the Interior Plateau. Limestone outcrops are common, as are areas pitted with limestone sinks. Elevations in the watershed range from 610 feet to 1060 feet. Figure 13 shows the topography of the Pipe Creek watershed. National Elevation Data (NED) is available from the USGS National Map seamless server (http://seamless.usgs.gov/website/seamless/viewer.htm).

Based on information gathered in the Atlas of Hydrogeologic Terrains and Settings of Indiana, the Pipe Creek watershed is sensitive to ground water pollution through surface water. Hydrogeologic settings help to interpret the occurrence, movement, and sensitivity to contamination of ground water in relation to the surface and subsurface environment. Generally, the Pipe Creek watershed is located in the bottomlands of southern Indiana, which are often associated with large bedrock valleys and significant quantities of late glacial till outwash. These outwash deposits are the major ground water resources for the entire southern part of the state. They are characterized by shallow water table conditions and are consequently also zones of significant interaction between surface water and ground water.

Specifically, the outwash in the Southern Whitewater River valley constitutes the primary source of ground water in this part of the state, as suitable aquifers are generally sparse in the adjoining uplands. Most of the valley bottom is in floodplain, so water table depths are typically between 5 and 15 feet. A considerable amount of ground water is transmitted down-valley within the outwash and interacts with the river at frequent meanders that cut across the aquifer. The valley as a whole is generally a ground water discharge area, although it is unlikely that there is an appreciable volume of actual discharge to this segment of the valley in view of the poor water-transmitting properties of the surrounding bedrock and till. Overall characteristics indicate that ground water beneath the valley floor is likely to be relatively sensitive to contamination, and that finding replacement water sources would be difficult should contamination affect a part of the aquifer. This should be of special concern since there is currently one surface drinking water source known in the Salt Creek watershed. All other drinking water sources are ground water sources.

While the topography of the watershed can have an effect on hydrology, it is also likely that soil characteristics will play a role in affecting hydrologic processes.

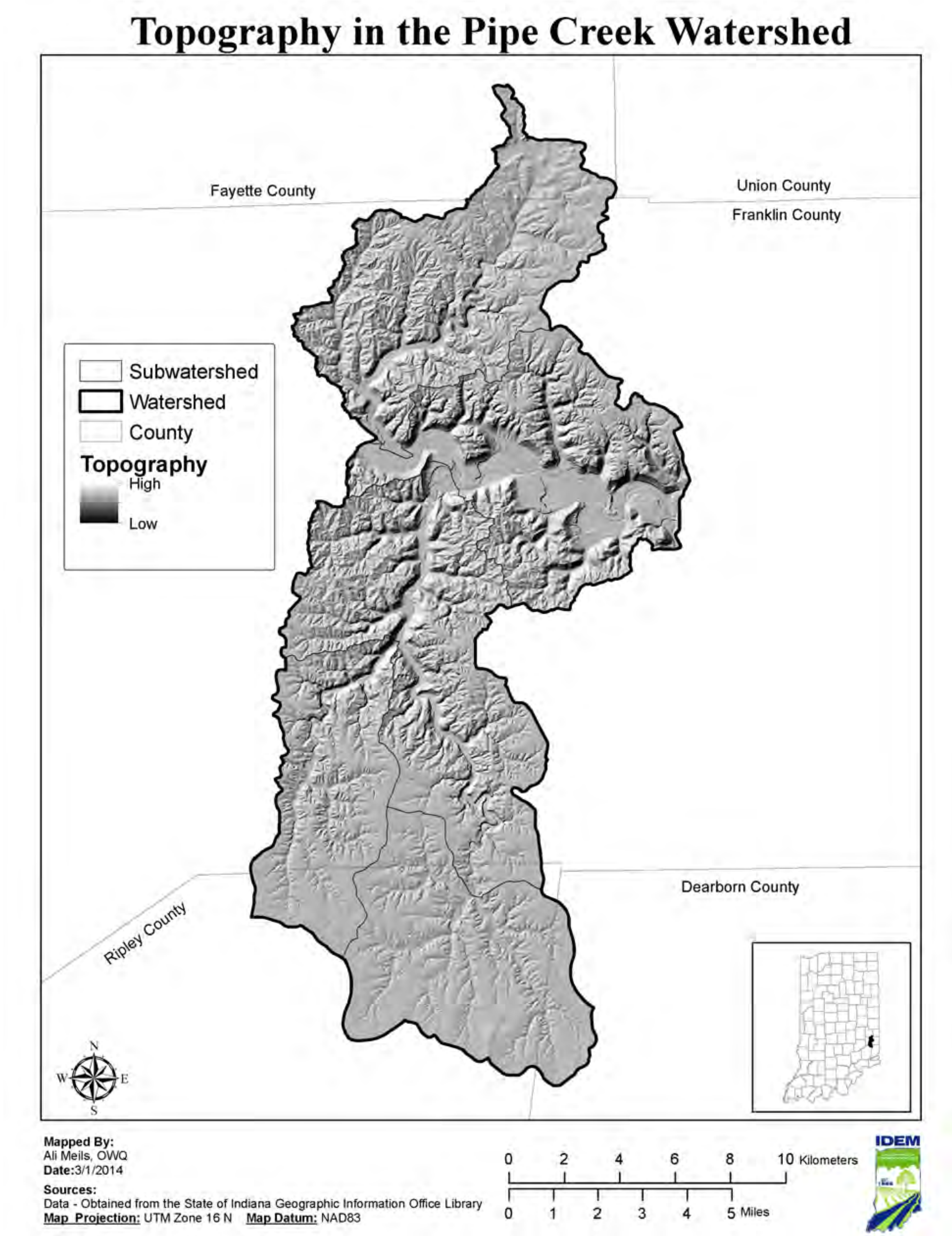


Figure 33 Topography of the Pipe Creek Watershed

5.5 Soils

There are different soil characteristics that can affect the health of the watershed. These characteristics include soil drainage, septic tank suitability, soil saturation, and soil erodibility.

5.5.1 Soil Drainage

The hydrologic soil group classification is a means for categorizing soils by similar infiltration and runoff characteristics during periods of prolonged wetting. The NRCS has defined four hydrologic groups for soils, described in Table 12 (NRCS, 2001). Data for the Pipe Creek watershed were obtained from the Soil Survey Geographic (SSURGO) database. Downloaded data were summarized based on the major hydrologic group in the surface layers of the map unit and are displayed in Figure 14.

The majority of the watershed is covered by type C soils (79%) followed by type B soils (19%), type A soils (1%) and less than one percent type D soils.

Table 35 Hydrologic Soil Groups

Hydrologic Soils Group	Description
A	Soils with high infiltrations rates. Usually deep, well drained sands or gravels. Little runoff.
B	Soils with moderate infiltration rates. Usually moderately deep, moderately well drained soils.
C	Soils with slow infiltration rates. Soils with finer textures and slow water movement.
D	Soils with very slow infiltration rates. Soils with high clay content and poor drainage. High amounts of runoff.

Understanding Table 12: Typically, clay soils that are poorly drained have lower infiltration rates, while well-drained sandy soils have the greatest infiltration rates. Soil infiltration rates can affect *E. coli*, nutrients and sediment loading within a watershed. During high flows, areas with low soil infiltration capacity can flood and therefore discharge high *E. coli*, nutrients and sediment loads to nearby waterways. In contrast, soils with high infiltration rates can slow the movement of *E. coli*, nutrients and sediment to streams.

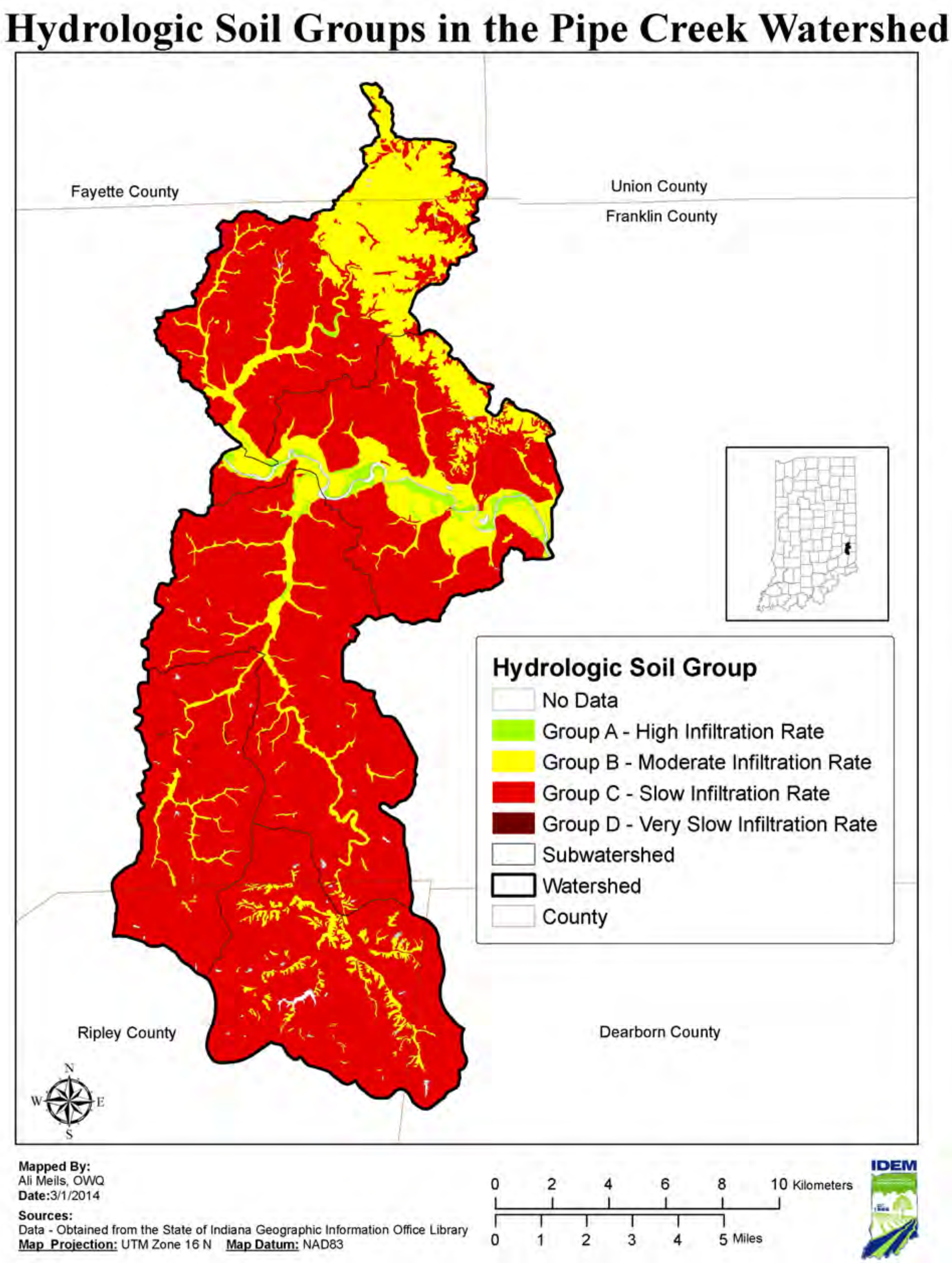


Figure 34 Hydrologic Soil Groups in the Pipe Creek Watershed

5.5.2 Septic Tank Suitability

Septic systems require soil characteristics and geology that allow gradual seepage of wastewater into the surrounding soils. Seasonal high water tables, shallow compact till and coarse soils present limitations for septic systems. While system design can often overcome these limitations (i.e., perimeter drains, mound systems or pressure distribution), sometimes the soil characteristics prove to be unsuitable for any type of traditional septic system.

Heavy clay soils require larger (and therefore more expensive) absorption fields; while sandier, well-drained soils are often suitable for smaller, more affordable gravity-flow trench systems.

The septic system is considered failing when the system exhibits one or more of the following:

1. The system refuses to accept sewage at the rate of design application thereby interfering with the normal use of plumbing fixtures

2. Effluent discharge exceeds the absorptive capacity of the soil, resulting in ponding, seepage, or other discharge of the effluent to the ground surface or to surface waters

3. Effluent is discharged from the system causing contamination of a potable water supply, ground water, or surface water.

Figure 15 shows ratings that indicate the extent to which the soils are suitable for septic systems within the Pipe Creek watershed. Only that part of the soil between depths of 24 and 60 inches is evaluated for septic system suitability. The ratings are based on the soil properties that affect absorption of the effluent, construction, maintenance of the system, and public health.

Soils labeled “very limited” indicate that the soil has at least one feature that is unfavorable for septic systems. Approximately 98 percent of the Pipe Creek watershed is considered “very limited” in terms of soil suitability for septic systems. These limitations generally cannot be overcome without major soil reclamation or expensive installation designs. Less than one percent of the soils within the Pipe Creek watershed are “not rated,” meaning these soils have not been assigned a rating class because it is not industry standard to install a septic system in these geographic locations and less than one percent of the soils in the Pipe Creek watershed are designated “not limited,” meaning that the soil type is suitable for septic systems.

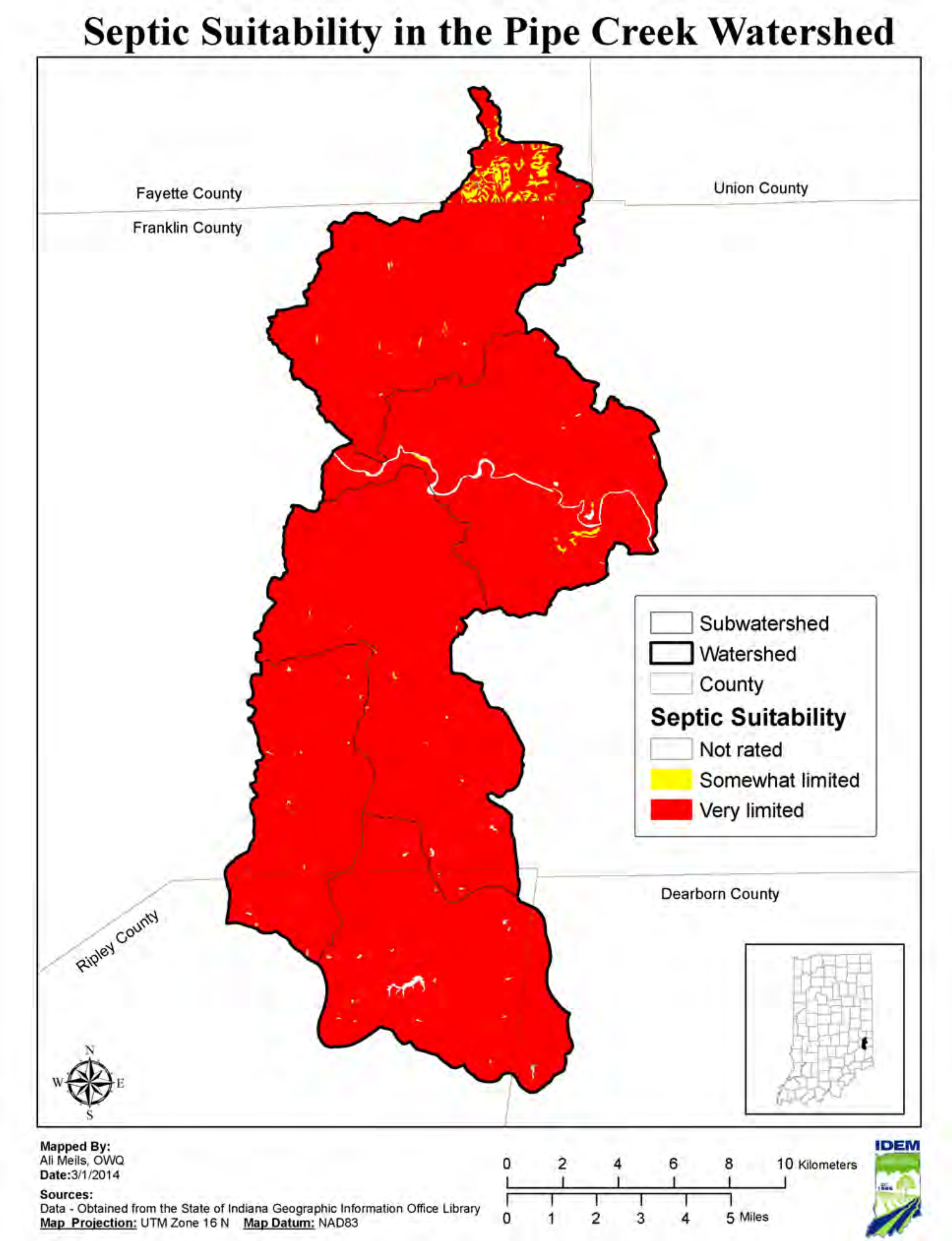


Figure 35 Suitability of Soils for Septic Systems in the Pipe Creek Watershed

5.5.3 Soil Saturation

Soils that remain saturated or inundated with water for a sufficient length of time become hydric through a series of chemical, physical, and biological processes. Once a soil takes on hydric characteristics, it retains those characteristics even after the soil is drained. Hydric soils have been identified in the Pipe Creek watershed and are important in consideration of wetland restoration activities. Approximately 3,693 acres or five percent of the Pipe Creek watershed area contains soils that are considered hydric, as shown in Table 13. However, a large majority of these soils have been drained for either agricultural production or urban development and would no longer support a wetland. The location of remaining hydric soils, as shown in Figure 16, can be used to consider possible locations of wetland creation or enhancement. There are many components in addition to soil type that must be considered before moving forward with wetland design and creation. Additional information on wetlands can be found on the IDEM website (http://www.in.gov/idem/4138.htm).

Table 13 Hydric Soils by County in the Pipe Creek Watershed

County	Map Symbol	Hydric Soil Type	Acres	Total Percent
Dearborn	Ct	Clermont silt loam	594.78	100
		Total	**594.78**	**100**
Fayette	Co	Cope silt loam	61.29	43.60
	We	Westland silt loam	79.27	56.40
		Total	**140.56**	**100**
Franklin	Cm	Cobbsfork silt loam	790.18	93.73
	Cy	Cyclone silt loam	52.85	6.27
		Total	**843.03**	**100**
Ripley	Cm	Cobbsfork silt loam	2,115.28	100
		Total	**2,115.28**	**100**

Understanding Table 13: In the Pipe Creek watershed, Ripley County has the most acreage of hydric soils. Areas within these counties might contain opportunities for wetland restoration activities that could help address water quality impairments.

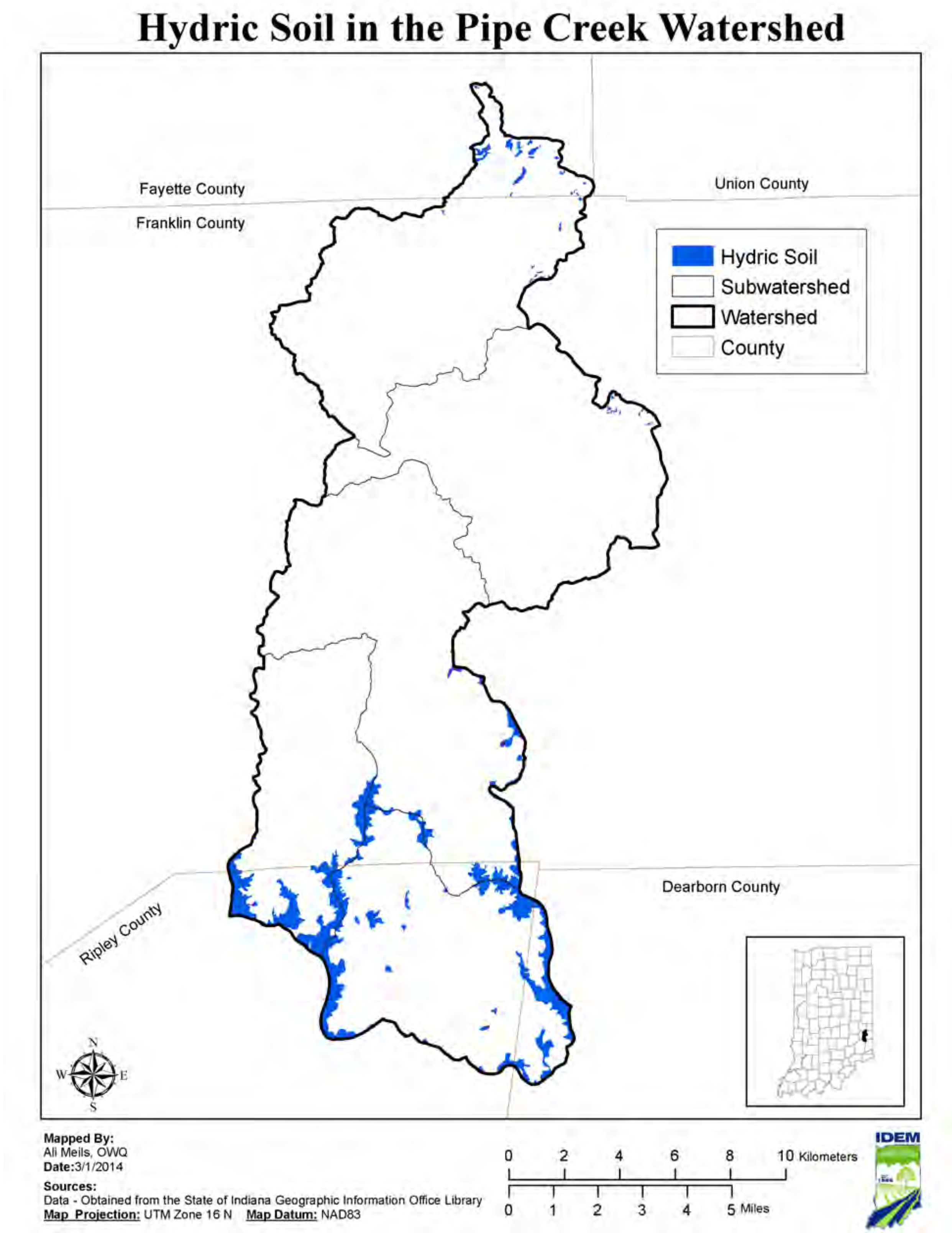


Figure 36 Hydric Soils in the Pipe Creek Watershed

Wetland areas act to buffer wide variations in flow conditions that result from storm events. They also allow water to infiltrate slowly thus reducing the risks of contaminated water runoff into waterbodies. Agencies such as the USGS and U.S. Fish and Wildlife Service (USFWS) estimate that Indiana has lost approximately 85 percent of the state's original wetlands. (See http://www.in.gov/dnr/fishwild/files/partner.pdf and http://water.usgs.gov/nwsum/WSP2425/state_highlights_summary.html) Currently, the Pipe Creek watershed contains approximately 1,281 acres of wetlands or 1.5 percent of the total surface area (USFWS, 2003). Figure 37 Locations of Wetlands in Pipe Creek Watershed shows estimated locations of wetlands as defined by the USFWS's National Wetland Inventory (NWI). Wetland data for Indiana is available from the U.S. Fish and Wildlife Service's NWI at < http://www.fws.gov/wetlands/Data/Web-Map-Services.html>. The NWI was not intended to produce maps that show exact wetland boundaries comparable to boundaries derived from ground surveys, and boundaries are generalized in most cases. The wetland information is from the MRLCC dataset and is based on soil types, whereas, aerial photography interpretation techniques were used to compile the NWI. Therefore the estimate of the current extent of wetlands in the Pipe Creek watershed from the NWI may not agree with those based upon the MRLCC dataset.

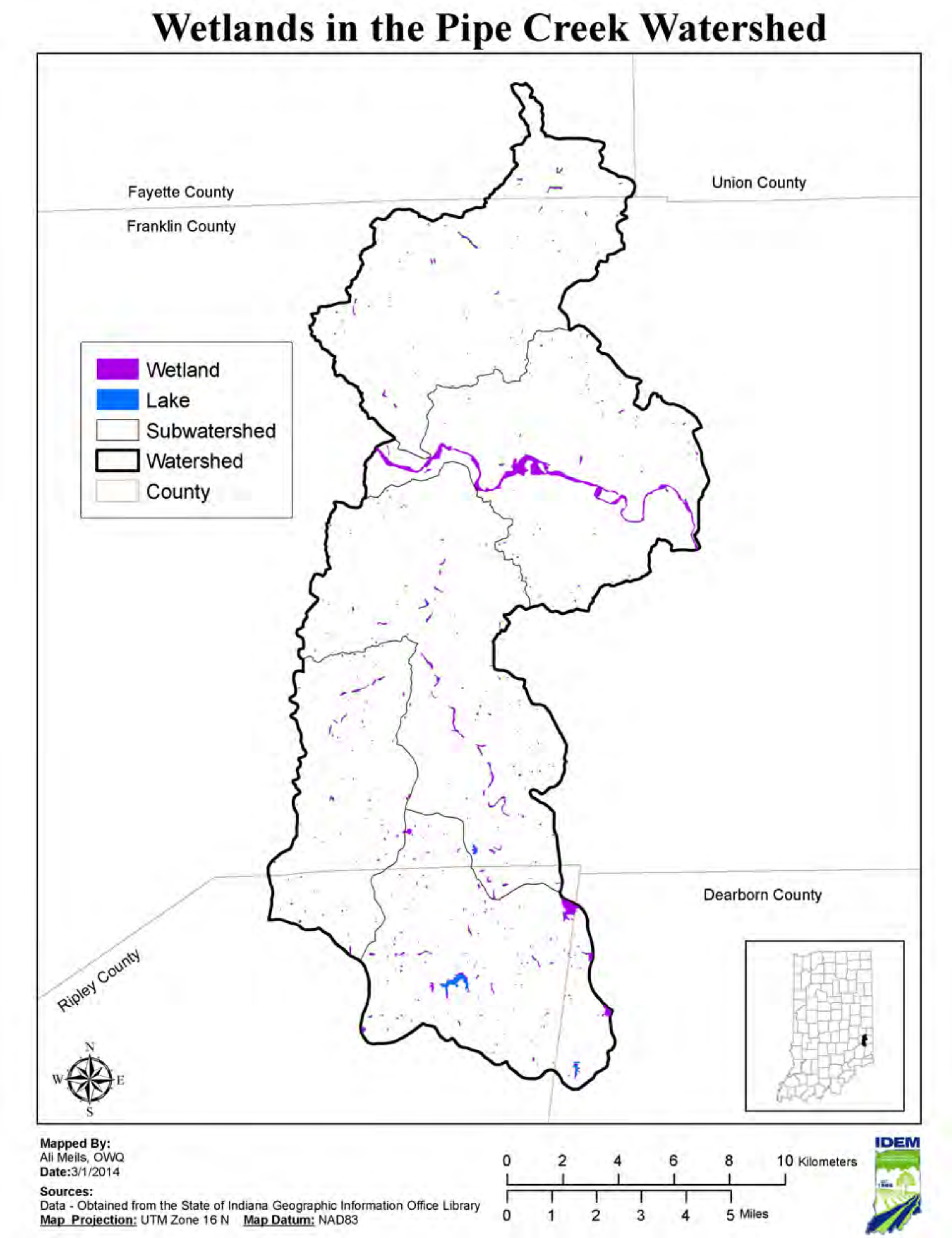


Figure 37 Locations of Wetlands in Pipe Creek Watershed

Changes to the natural drainage patterns of a watershed are referred to as hydromodifications. Historically, drain tiles have been used throughout Indiana to drain marsh or wetlands and make it either habitable or tillable for agricultural purposes. While tile drainage is understood to be pervasive – estimated at thousands of miles in Indiana – it is extremely challenging to quantify on a watershed basis because these tiles were established by varying authorities including County Courts, County Commissioners, or County Drainage Boards. Records were not kept by private landowners as to the location and quantity of these tiles.

In addition to tile drainage, regulated drains are another form of hydromodification. A regulated drain is a drain which was established through either a Circuit Court or Commissioners Court of the County prior to January 1, 1966 or by the County Drainage Board since that time. Regulated drains can be an open ditch, a tile drain, or a combination of both. The Drainage Board can construct, maintain, reconstruct or vacate a regulated drain.

5.5.4 Soil Erodibility

Although erosion is a natural process within stream ecosystems, excessive erosion negatively impacts the health of watersheds. Erosion increases sedimentation of the streambeds, which impacts the quality of habitat for fish and other organisms. Erosion also impacts water quality as it increases nutrients and decreases water clarity. As water flows over land and enters the stream as runoff, it carries pollutants and other nutrients that are attached to the sediment. Sediment suspended in the water blocks light needed by plants for photosynthesis and clogs respiratory surfaces of aquatic organisms.

The NRCS maintains a list of highly erodible lands (HEL) units for each county based upon the potential of soil units to erode from the land. HELs are especially susceptible to the erosional forces of wind and water. Wind erosion is common in flat areas where vegetation is sparse or where soil is loose, dry, and finely granulated. Wind erosion damages land and natural vegetation by removing productive top soil from one place and depositing it in another. The classification for HELs is based upon an erodibility index for a soil, which is determined by dividing the potential average annual rate of erosion by the soil unit's soil loss tolerance (T) value, which is the maximum annual rate of erosion that could occur without causing a decline in long-term productivity. The soil types and acreages in the Pipe Creek watershed are listed by county in Table 14. HELs and potential HELs in the Pipe Creek watershed are mapped in Figure 38. The data used to create Figure 38 was collected from the NRCS offices of Dearborn, Fayette, Franklin and Ripley counties. A total of 30,239 acres or 40 percent of the Pipe Creek watershed is considered highly erodible or potentially highly erodible. Rainfall within the Pipe Creek watershed is moderately heavy with an annual average of 43 inches. This rainfall and climate data specific to the watershed is available from the National Climatic Data Center (http://www.ncdc.noaa.gov/oa/ncdc.html). Heavy rainfall increases flow rates within streams as the volume and velocity of water moving through the stream channels increases. Velocity of water also increases as streambank steepness increases.

Table 14 HEL/Potential HEL Total Acres in the Counties in the Pipe Creek Watershed

County	Map Symbol	HEL/Potential HEL Soil Types	Acres
Dearborn	BaA	Bartle silt loam	3.41
	BeD2, BeD3, BeE	Bonnell silt loam	88.32
	CnB2, CnC2, CnC3	Cincinnati silt loam	273.95
	EdE3	Eden flaggy silty clay loam	11.12
	RoB2	Rossmoyne silt loam	300.68
	SwC2, SwC3	Switzerland silt loam	13.53
	WbB2, WbC2, WbC3	Weisburg silt loam	58.72
		Total	**749.73**
Fayette	CcB2, CcC2	Cincinnati silt loam	5.94
	FeB2	Fincastle and Crosby silt loams	9.30
	FcB1, FcB2	Fincastle silt loam	11.39
	FtD2, FtE2	Fox and Rodman loams	11.02
	FnB1, FnB2, FnD2	Fox silt loam	31.17
	Gv	Gravel Pits	2.31
	HeF1, HeF2, HeG2	Hennepin loam	48.25
	MmD2	Miami silt loam	10.85
	MsD3, MsE3	Miami soils	12.11
	ReB2	Reesville silt loam	1.56
	RuB1, RuB2, RuC2	Russell and Miami silt loams	157.07
	RvB3, RvC3	Russell and Miami soils	68.98
	RsB1, RsB2, RsC1, RsC2, RsD1, RsD2, RsE2	Russell silt loam	707.40
	RtB3, RtC3, RtD3, RtE3	Russell soils	433.60
	WhB	Whitaker silt loam	14.00
	XnB1, XnB2	Xenia and Celina silt loams	76.66
	XeB1, XeB2	Xenia silt loam	44.37
		Total	**1,645.98**
Franklin	AlB	Alvin sandy loam	545.98
	AvA	Avonburg silt loam	2,751.71
	CkB2	Cincinnati silt loam	3,001.70
	Cm	Cobbsfork silt loam	790.19
	Cy	Cyclone silt loam	52.85
	Db	Dearborn loam	1414.48
	ElA, ElB	Eldean loam	453.17
	FfA	Fincastle-Reesville silt loams	33.26
	FcB	Fincastle silt loam	920.27
	Gd, Ge	Gessie loam	2,201.03
	Ht	Holton silt loam	245.49

	MmB2	Miami silt loam	373.59
	Mt, Mx	Moundhaven sandy loam	735.01
	OcA, OcB2	Ockley loam	616.23
	Og	Oldenburg silt loam	417.18
	Pg	Gravel pits	21.96
	PrC	Princeton fine sandy loam	170.34
	Rm	Ross silt loam	100.83
	RsA, RsB2	Rossmoyne silt loam	3,064.73
	RuB2	Russell silt loam	823.43
	UaB	Uniontown silt loam	83.59
	WmB	Williamstown silt loam	25.04
	Wn	Wirt loam	469.16
	WoB	Woolper silty clay loam	253.14
	XnA, XnB2	Xenia silt loam	644.34
		Total	**20,208.70**
Ripley	AvB2	Avonburg silt loam	330.45
	BeD3, BeE	Bonnell silt loam	5.24
	CbE	Carmel silt loam	7.63
	CcB2, CcC2, CcC3, CcD2	Cincinnati silt loam	2,743.40
	EdE	Eden flaggy silty clay loam	19.38
	HkE	Hickory loam	1,019.52
	HkD2, HkD3	Hickory silt loam	1,683.16
	PeB2	Pekin silt loam	4.60
	RoB2	Rossmoyne silt loam	1,805.44
	SwC2, SwD2	Switzerland silt loam	15.88
		Total	**7,634.70**

Understanding Table 14: In the Pipe Creek watershed, Franklin County has the most acreage of HEL/potential HEL soils. Areas within these counties might contribute to water quality impairments associated with excessive erosion, including IBC/TSS, and might contain opportunities for restoration to decrease erosion.

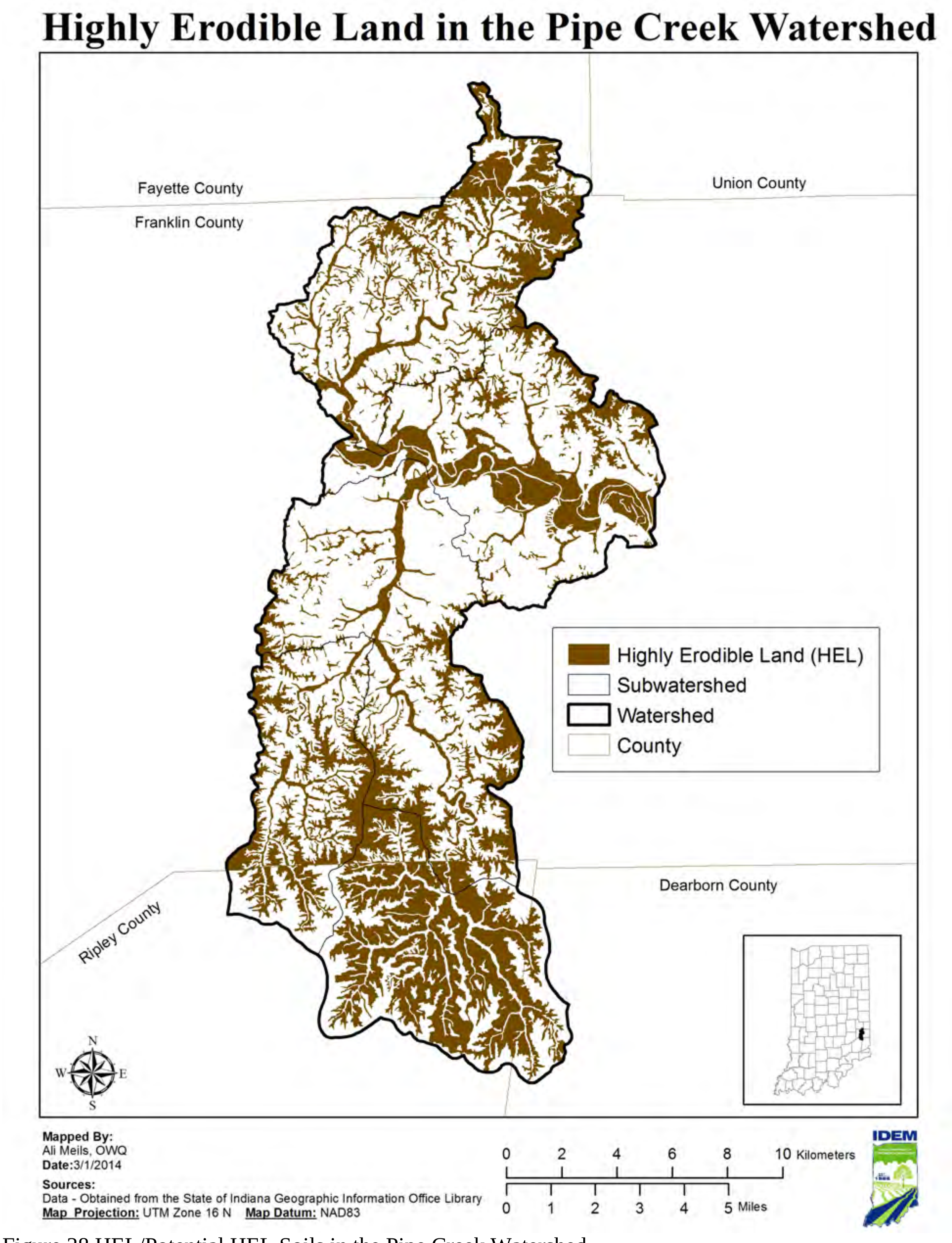


Figure 38 HEL/Potential HEL Soils in the Pipe Creek Watershed

The Indiana State Department of Agriculture (ISDA) tracks trends in conservation and cropland through annual county tillage transects. Data collected through the tillage transect help determine adoption of conservation practices and estimate the average annual soil loss from Indiana's agricultural lands. The latest figures for the counties in the Pipe Creek watershed are shown in Table 15. Tillage practices captured in ISDA's tillage transect include No-Till, Mulch-Till, and conventional tillage practices. ISDA defines No-Till as any direct seeding system including site preparation, with minimal soil disturbance. Mulch-Till is any tillage system leaving greater than 30 percent residue cover after planting, excluding no-till. Reduced tillage is a tillage system leaving 16 percent to 30 percent residue cover after planting. Conventional tillage is any tillage system leaving less than 30 percent residue cover after planting.

Table 36 County Tillage Transect Data from 2009 to 2013 in the Pipe Creek Watershed

Crop	Tillage Practice	Dearborn			Fayette			Franklin			Ripley		
		2009	2011	2013	2009	2011	2013	2009	2011	2013	2009	2011	2013
Corn	No-Till	38	46	39	22	39	40	19	23	21	33	45	36
	Mulch-Till	18	21	6	7	21	11	15	15	14	18	8	10
	Reduced-Till	9	32	13	18	31	19	33	43	54	0	0	0
	Conventional-Till	35	0	42	53	9	30	33	19	11	49	47	53
Soybean	No-Till	75	88	71	69	53	46	70	50	62	76	76	55
	Mulch-Till	4	0	0	15	39	32	11	32	22	17	14	22
	Reduced-Till	8	6	13	10	6	16	7	14	14	0	0	0
	Conventional-Till	13	6	16	5	2	6	13	3	2	7	10	23

Understanding Table 36***:*** According to Table 36, No-Till practices for soybeans are predominant in all counties in the Pipe Creek watershed. There has been a reduction in conventional tillage practices for corn in both Fayette and Franklin County since 2009.

5.6 Climate and Precipitation

Climate varies in Indiana depending on latitude, topography, soil types, and lakes. Information on Indiana's climate is available through sources including the Indiana State Climate Office at Purdue University (http://climate.agry.purdue.edu/climate/narrative.asp).

Climate data from Station 121030 located in Brookville were used for climate analysis of the Pipe Creek watershed. Monthly data from 1948-2013 were available at the time of analysis. In general, the climate of the region has hot, humid summers and cold winters. From 1948 to 2013, the average winter temperature in Brookville was 32°F and the average summer temperature was 85°F. The average growing season (consecutive days with low temperatures greater than or equal to 32 degrees) is 183 days.

Examination of precipitation patterns is also a key component of watershed characterization because of the impact of runoff on water quality. From 1948 to 2013, the annual average precipitation in Brookville at Station 121030 was approximately 43 inches, including approximately 15.5 inches of snowfall. More detailed discussions on precipitation data during sampling periods are presented in a later Section.

Rainfall intensity and timing affect watershed response to precipitation. This information is important in evaluating the effects of storm water on the Pipe Creek watershed. Using data from 121030 during 1948 to 2013, 52 percent of the measureable precipitation events were very low intensity (i.e., less than 0.2 inches), while 8 percent of the measurable precipitation events were greater than one inch.

Knowing when precipitation events occur helps in the linkage analysis, which correlates flow conditions to pollutant concentrations and loads. Data indicates that the wet weather season in the Pipe Creek watershed occurs between the months of April and May.

5.7 Summary

The information presented in Section 5 helps to provide a better comprehensive understanding of the conditions and characteristics in the Pipe Creek watershed that, when coupled with the sources presented, affect both water quality and water quantity. In summary, the predominant land uses in the Pipe Creek watershed of forested lands and agricultural lands serve as indicators as to the type of sources that are likely to contribute to water quality impairments in the Pipe Creek watershed. Human population, which is greatest in Franklin and Ripley counties in the Pipe Creek watershed, indicates where more infrastructure related pressures on water quality might exist. The subsections on topography and geology, as well as soils, provide information on the natural features that affect hydrology in the Pipe Creek watershed. These features interact with land use activities and human population to create pressures on both water quality and quantity in the Pipe Creek watershed. Lastly, the subsection on climate and precipitation provides information on water quantity and the factors that influence flow, which ultimately affects the influence of stormwater on the watershed. Collectively, this information plays an important role in understanding the sources that contribute to water quality impairment during TMDL development and crafting the linkage analysis that connects the observed water quality impairment to what has caused that impairment.

6.0 SOURCE ASSESSMENT

This section presents information concerning IDEM's segmentation process as it applies to the Pipe Creek watershed in order to present a source assessment specific to the Pipe Creek watershed as well as summaries of significant sources of *E. coli*, nutrients and sediment for each subwatershed within the Pipe Creek watershed.

6.1 Understanding Subwatersheds and Assessment Units

As briefly discussed in Section 5, the Pipe Creek watershed contains five 12-digit HUC subwatersheds. Examining subwatersheds enables a closer examination of key factors that affect water quality. The subwatersheds include:

- Headwaters Pipe Creek (050800030601)
- Clear Fork (050800030602)
- Duck Creek (050800030603)
- Walnut Fork (050800030604)
- Yellow Bank Creek (050800030605)

Within each 12-digit HUC subwatershed, IDEM has identified several AUIDs, which represent individual stream segments. Through the process of segmenting subwatersheds into AUIDs, IDEM identifies streams reaches and stream networks that are representative for the purposes of assessment. In practice, this process leads to grouping tributary streams into smaller catchment basins of similar hydrology, land use, and other characteristics such that all tributaries within the catchment basin can be expected to have similar potential water quality impacts. Catchment basins, as defined by the aforementioned factors and are typically very small, which significantly reduces the variability in the water quality expected from one stream or stream reach to another. Given this, all tributaries within a catchment basin are assigned a single AUID. Grouping tributary systems into smaller catchment basins also allows for better characterization of the larger watershed and more localized recommendations for implementation activities. Variability within the larger watershed will be accounted for by the differing AUIDs assigned to the different catchment basins.

Table 16 contains the AUIDs in the subwatersheds of the Pipe Creek watershed and the associated drainage area. Subsequent sections of the TMDL report organize information by subwatershed (if applicable) and AUID.

Table 37 Assessment Units in Pipe Creek Watershed

Name of Subwatershed	Surface Area (sq.miles)	Percent of Total Surface Area	Current AUID 2012	Length (mi)	Drainage Area (sq. miles)
Headwaters Pipe Creek (050800030601)	21.73	18.28	ING0361_02	8.29	18.28
			ING0361_P1001	0.45	
			ING0361_P1002	1.15	
			ING0361_T1003	3.04	
			ING0361_T1004	4.00	
			ING0361_T1005	2.90	
			ING0361_T1005A	0.26	
			ING0361_T1005B	1.39	
			ING0361_T1005C	0.34	

Name of Subwatershed	Surface Area (sq.miles)	Percent of Total Surface Area	Current AUID 2012	Length (mi)	Drainage Area (sq. miles)
			ING0361_T1006	6.83	
			ING0361_T1006A	0.56	
			ING0361_T1007	3.29	
			ING0361_T1008	0.69	
			ING0361_T1009	7.43	
Clear Fork (050800030602)	15.80	13.30	ING0362_01	0.76	13.30
			ING0362_02	12.47	
			ING0362_02A	0.13	
			ING0362_T1002	2.91	
			ING0362_T1003	3.47	
			ING0362_T1004	8.14	
			ING0362_T1005	3.65	
			ING0362_T1006	1.79	
Duck Creek (050800030603)	25.74	21.65	ING0363_01	9.61	21.65
			ING0363_02	7.75	
			ING0363_T1001	3.07	
			ING0363_T1002	2.76	
			ING0363_T1003	1.82	
			ING0363_T1004	3.32	
			ING0363_T1005	1.62	
			ING0363_T1006	2.81	
			ING0363_T1007	2.21	
			ING0363_T1008	6.11	
			ING0363_T1009	1.81	
			ING0363_T1010	10.82	
Walnut Fork (050800030604)	29.67	24.96	ING0364_01	23.77	56.54
			ING0364_02	12.02	
			ING0364_T1001	1.93	
			ING0364_T1002	5.54	
			ING0364_T1003	10.91	
			ING0364_T1004	4.64	
			ING0364_T1005	3.91	
			ING0364_T1006	9.77	
			ING0364_T1007	1.90	
			ING0364_T1008	1.31	
Yellow Bank Creek (050800030605)	25.92	21.81	ING0365_01	15.47	842.10
			ING0365_02	8.41	
			ING0365_T1001	1.63	
			ING0365_T1002	7.49	
			ING0365_T1003	7.82	
			ING0365_T1004	7.10	
			ING0365_T1005	2.13	
			ING0365_T1006	1.54	

Name of Subwatershed	Surface Area (sq.miles)	Percent of Total Surface Area	Current AUID 2012	Length (mi)	Drainage Area (sq. miles)
			ING0365_T1007	3.97	
			ING0365_T1008	16.79	
			ING0365_T1009	2.30	

Understanding Table 16: Land area helps IDEM to define the pollutant load reductions needed for each AU in each 12-digit HUC subwatershed that comprises the Pipe Creek watershed. Information in each column is as follows:

- *Column 1: Name of Subwatershed.* Lists the name of the subwatersheds.
- *Column 2: Surface Area.* Indicates the total surface area for each subwatershed.
- *Column 3: Percent of Total Drainage Area.* Indicates the percent of the total surface area, providing a relative understanding of the portion of each subwatershed in the Pipe Creek watershed.
- *Column 4: Current AUID*. Provides the updated AUIDs associated with each subwatershed.
- *Column 5: Length.* Quantifies the length of each AUID stream segment.
- *Column 6: Drainage Area.* Quantifies the area the subwatershed drains.

IDEM bases percent load reductions on the drainage area for each AUID in the 12-digit HUC subwatersheds. The information contained in this table is the foundation for the technical calculations found in this report. This table will help watershed stakeholders look at the smaller segments within the Pipe Creek watershed and understand the smaller areas contributing to the impaired waterbody, helping to quantify the geographic scale that influences source characterization and areas for implementation.

6.2 Source Assessment by Subwatershed

This section summarizes the available information on significant point and nonpoint sources of *E. coli*, nutrients and sediment in the five subwatersheds of the Pipe Creek watershed.

The term "point source" refers to any discernible, confined and discrete conveyance, such as a pipe, ditch, channel, tunnel or conduit, by which pollutants are transported to a waterbody. It also includes vessels or other floating craft from which pollutants are or may be discharged. By law, the term "point source" also includes: concentrated animal feeding operations (CAFO) which are places where animals are confined and fed; storm water runoff from Municipal Separate Storm Sewer Systems (MS4s), construction site of one acre or more of land disturbance, and specific categories of industrial activities that convey storm water; and illicitly connected "straight pipe" discharges of household waste. Permitted point sources are regulated through the NPDES.

Nonpoint sources include all other categories not classified as point sources. In urban areas, nonpoint sources can include leaking or faulty septic systems, runoff from lawn fertilizer applications, pet waste, storm water runoff (outside of MS4 communities), and other sources. In rural areas, nonpoint sources can include runoff from cropland, pastures and animal feeding operations and inputs from streambank erosion, leaking or failing septic systems, and wildlife.

6.2.1 Pipe Creek Subwatershed Summary

This section of the report presents the available information on the sources of *E. coli*, nutrients and sediment in the Pipe Creek subwatersheds.

Table 38 Land Use in the Pipe Creek Subwatersheds

Subwatershed	Area	Land Use							Total
		Agriculture	Developed	Forest	Hay/ Pasture	Shrub	Open Water	Wetlands	
Headwaters Pipe Creek	Acres	4,748	962	5,151	2,882	43	116	<1	13,902
	Sq. Mi.	7	2	8	5	<1	<1	<1	22
	Percent	34	7	37	21	<1	1	<1	100
Clear Fork	Acres	2655	628	4766	1982	44	40	0	10,115
	Sq. Mi.	4	1	8	3	<1	<1	0	16
	Percent	26	6	47	20	<1	<1	0	100
Duck Creek	Acres	3,318	596	10,277	2,010	256	17	1	16,475
	Sq. Mi.	5	1	16	3	<1	<1	<1	25
	Percent	20	4	62	12	2	<1	<1	100
Walnut Fork	Acres	2,052	555	13,662	2,514	148	61	<1	18,992
	Sq. Mi.	3	1	21	4	<1	<1	<1	29
	Percent	11	3	72	13	1	<1	<1	100
Yellow Bank Creek	Acres	1,991	779	11,349	2,134	157	181	1	16,592
	Sq. Mi.	3	1	18	3	<1	<1	<1	25
	Percent	12	5	68	13	1	1	<1	100

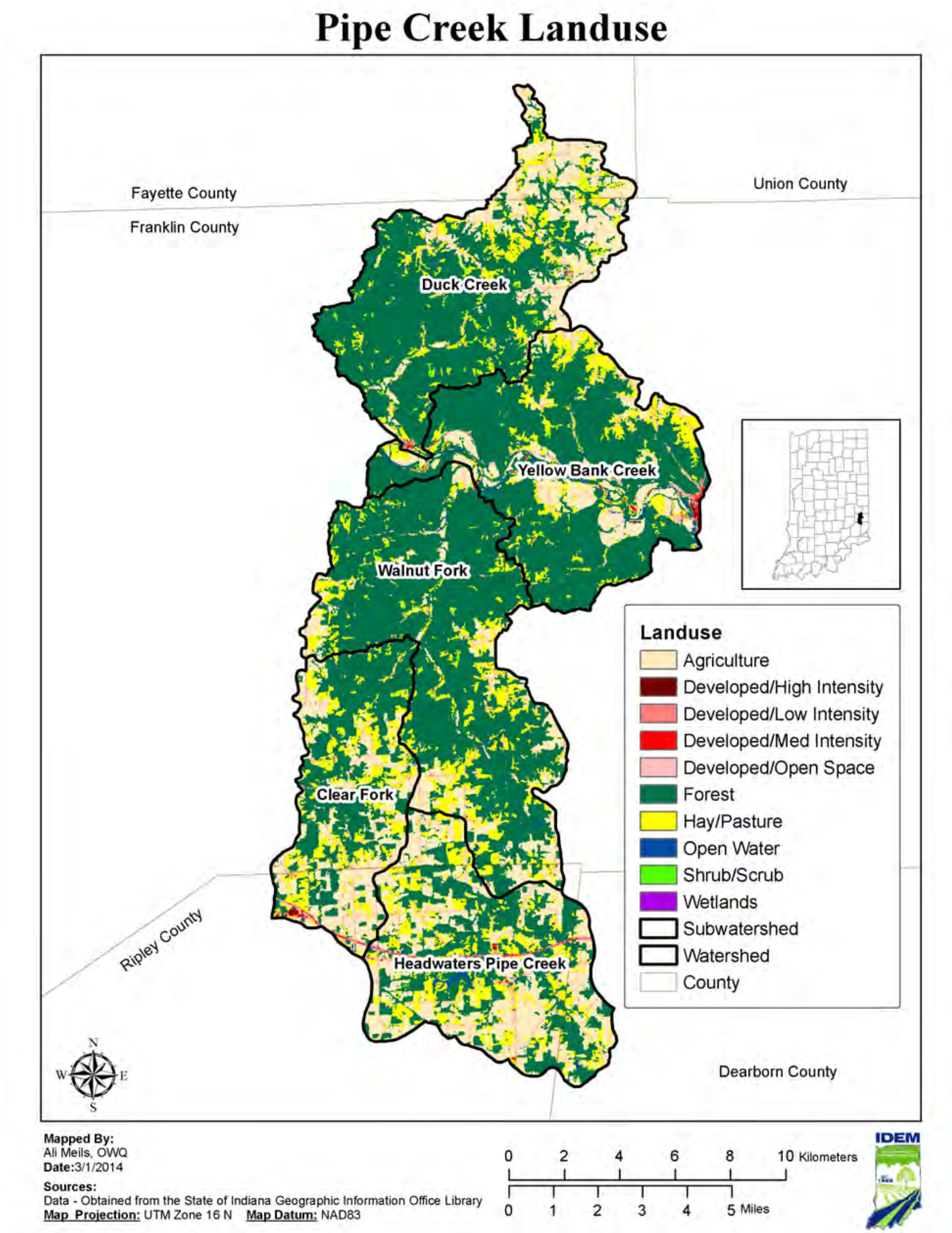


Figure 39 Land use in the Pipe Creek Subwatersheds

6.2.1.1 Point Sources

The State of Indiana regulates the direct discharge of pollutants to waters of the State through the National Pollutant Discharge Elimination System (NPDES) Permit Program. The permits issued place limits on the amount of pollutants that may be discharged to surface waters by each facility. These limits are set at levels protective of both aquatic life in the waters which receive the discharge and protective of human health. This section summarizes the potential point sources of *E. coli*, nutrients and sediment in the Pipe Creek watershed, as regulated through the National Pollutant Discharge Elimination System (NPDES) Program.

Municipal Facilities

A municipal facility, or wastewater treatment plant (WWTP), is designed to remove biological or chemical waste products from water, thereby permitting the treated water to be used for other purposes. Some of the functions of a WWTP include agricultural wastewater treatment, sewage treatment and industrial wastewater treatment. WWTPs are critical for maintaining public sanitation and a healthy environment.

Municipal facilities in Indiana are required to disinfect their effluent during the recreational season (April 1 to October 31). IDEM does not require disinfection for waste-stabilization lagoons as long as *E. coli* limits from the permit are met utilizing the lagoon's retention time. Table 42 contains the maximum design flow for the active facilities.

Treated municipal sewage is a point source of nutrients. WWTPs may release water with elevated concentrations of nutrients into streams. As discussed in Section 2.2, the target value for total phosphorus is 0.30 mg/L and the target value for total nitrogen is 10 mg/L. These target values are used to establish potential permit limits.

Flows used to calculate nutrient loads from each treatment plant are estimated based on current flow data from discharge monitoring reports (DMR) or design flows from the facility permits when actual flow data is not available. Nutrient concentrations used to calculate nutrient loads from each treatment plant are based on known technological limitations of the facilities (literature values for facilities with similar treatment levels). Because the phosphorus loads from these NPDES facilities had to be estimated, it is recommended that effluent monitoring be added to the WWTP permits. Additional in-stream monitoring should also be performed.

The TMDL target value for TSS is set at the WWTP's permit effluent limit for TSS. Therefore, a target of 30 mg/L for total suspended solids TSS has been identified as a permit limit for NPDES facilities.

There are no known facilities contributing polluted runoff containing *E. coli*, nutrients and sediment within the Pipe Creek watershed. The Metamora Regional Sewer District Wastewater Treatment Plant is listed in this Section but is located outside the project area (Figure 40 and Table 42). This facility information will be used to calculate pollutant loadings entering the stream from the West Fork Whitewater River and could potentially impact the mainstem Whitewater River downstream. A summary of the WWTP permit is described below.

Table 39 NPDES Permitted Wastewater Treatment Plants Discharging within the Pipe Creek Subwatersheds

Subwatershed	Facility Name	Permit Number	AUID	Receiving Stream	Maximum Design Flow (MGD)
Headwaters Pipe Creek	NA	NA	NA	NA	NA
Clear Fork	NA	NA	NA	NA	NA
Duck Creek	NA	NA	NA	NA	NA
Walnut Fork	NA	NA	NA	NA	NA
Yellow Bank Creek	NA	NA	NA	NA	NA
**	Metamora RSD WWTP	IN0062391	ING0348_03	West Fork Whitewater River	0.06

** Site is located outside the Pipe Creek watershed but data will be used to calculate pollutant contributions from West Fork Whitewater River.

The Metamora Regional Sewer District WWTP is a Class 1 extended aeration treatment facility consisting of a lift station, headworks with fine screens, a flow equalization basin, two aeration tanks, a final clarifier, ultraviolet light disinfection, an effluent flow meter and post aeration. Sludge facilities include an aerobic sludge holding talk with final solids hauled off site by a licensed contractor. The collection system is comprised of 100% separate sanitary sewers by design with no overflow or bypass points. There have been six notices of noncompliance issued to the facility in the last five years. Based on this information, in April of 2014, IDEM revoked the wastewater operator certification of the WWTP manager. A new plant operator is currently managing the WWTP.

Table 40 presents a summary of permit compliance for WWTP NPDES facilities in the Pipe Creek watershed for the five year period between 2009 and 2014. It presents the date of the facility's last inspection and findings from the inspection (i.e., compliance or violation for facility maintenance). The table also presents the total number of violations in the five year period for the NPDES permitted parameters. According to Table 42, there have been five NPDES facility inspections resulting in violations in the five year period. Overall, there are a total of four permit violations for the NPDES permitted parameters in the Pipe Creek watershed.

Table 40 Summary of WWTP Inspections and Permit Compliance in the Pipe Creek Subwatersheds for the Five Year Period Ending September 30, 2014

Subwatershed	Facility Name	Permit Number	AUID	Date of Last Inspection and Findings	Violations from 4/2009 through 9/2014				
					Month	Year	Parameter	Type	# Violations
Headwaters Pipe Creek	NA	NA	NA	NA	NA				
Clear Fork	NA	NA	NA	NA	NA				
Duck Creek	NA	NA	NA	NA	NA				
Walnut Fork	NA	NA	NA	NA	NA				
Yellow Bank Creek	NA	NA	NA	NA	NA				
**	Metamora RSD WWTP	IN0062391	ING0348_03	08/12/2010: Potential problems observed 09/14/2010: Potential problems observed 09/30/2010: Potential problems observed 01/13/2011: Violations observed 08/11/2011: Violations observed 06/15/2012: No violations observed 08/20/2012: No violations observed 01/10/2013: Violations observed 07/10/2013: Violations observed 06/12/2014: Violations observed	Dec Dec Jan Oct	2009 2009 2010 2010	TSS TSS TSS TSS	Mo Avg Max Wk Avg Max Wk Avg Mo Avg	1 1 1 1

** Site is located outside the Pipe Creek watershed but data will be used to calculate pollutant contributions from West Fork Whitewater River.

Industrial Facilities

Industrial facilities with NPDES permits produce wastewater generated through producing a product. Wastewater discharges from industrial sources may contain pollutants at levels that could affect the quality of receiving waters. The NPDES permit program establishes specific requirements for dischargers from industrial sources. If the industrial facility discharges wastewater directly to a surface water then it requires an individual or general NPDES permit. A general permit, or permit-by-rule, is a "one size fits all" type of activity-specific permit. The general permit rule (327 IAC 15-1 through 15-4) covers the following activities: coal mining, coal processing, and reclamation activities, noncontact cooling water, petroleum products terminals, groundwater petroleum remediation systems, hydrostatic testing of commercial pipelines, and sand, gravel and stone operations. In contrast, individual permits are tailored to the specific activities of the facility and may regulate a number of additional pollutants other than those described under the general permits.

There is one industrial facility with a NPDES permits within the Pipe Creek watershed (Table XX). Based on the industrial activities and the regulated parameters within the specific permits the facility does not discharge wastewater within the Pipe Creek watershed. A summary of the industrial permit within the Pipe Creek watershed are described below.

Figure 41 NPDES Permitted Industrial Facilities in the Pipe Creek Subwatersheds

Subwatershed	Facility Name	Permit Number	AUID	Receiving Stream	Maximum Design Flow (MGD)
Headwaters Pipe Creek	NA	NA	NA	NA	NA
Clear Fork	NA	NA	NA	NA	NA
Duck Creek	NA	NA	NA	NA	NA
Walnut Fork	NA	NA	NA	NA	NA
Yellow Bank Creek	Owens Corning Roofing & Asphalt LLC	INP000122	NA	NA	0.064

Owens Corning Roofing and Asphalt LLC manufacture residential roofing products. The manufacturing process includes coating fiberglass mats with hot filled asphalt and cooling of product with water. Part of the water evaporates and is exhausted to the atmosphere. The remainder of the water flows to settling pits where solids settle out and the overflow water discharges to the city sewer through a weir. The company retains a pretreatment permit which covers the discharge from the facility into the Brookville Publicly Owned Treatment Works. There is no direct discharge into a stream.

Table 42 presents a summary of permit compliance for industrial NPDES facilities in the Pipe Creek watershed for the five year period between 2009 and 2014. It presents the date of the facility's last inspection and findings from the inspection (i.e., compliance or violation for facility maintenance). According to the table, there have been no NPDES industrial facility inspections resulting in violations in the five year period.

Table 42 Summary of Inspections and Permit Compliance for Industrial Facilities in the Pipe Creek Watershed for the Five Year Period Ending September 30, 2014

Subwatershed	Facility Name	Permit Number	AUID	Date of Last Inspection and Findings	Violations from 4/2009 through 9/2014
Headwaters Pipe Creek	NA	NA	NA	NA	NA
Clear Fork	NA	NA	NA	NA	NA
Duck Creek	NA	NA	NA	NA	NA
Walnut Fork	NA	NA	NA	NA	NA
Yellow Bank Creek	Owens Corning Roofing & Asphalt LLC	INP000122	NA	6/9/2011: No violations observed 6/28/2013: No violations observed 8/14/2014: No violations observed	NA

Industrial Storm Water

Depending on the type of industrial facility operated more than one NPDES program may apply. Some industrial facilities require an additional permit under the storm water program which will be discussed in this section.

Industrial storm water permits are required for facilities where activities of the industrial operation are exposed to storm water and run-off is discharged though a point source to waters of the state. The general permit 327 IAC 15-6 (Rule 6) applies to specific categories of industrial activities that must obtain permit coverage. Determination of applicable industrial activities is based on a facility's Standard Industrial Classification (SIC) Code(s) or facility activities included in the listed narrative descriptions within the rule. Under certain circumstances, a facility may require an individual storm water permit. This permit is typically required only if a regulated industrial activity category has established effluent limitations or IDEM determines the storm water discharge will significantly lower water quality. Industrial storm water permits in the Pipe Creek watershed are shown in Figure 40.

The facility must develop and implement a Storm Water Pollution Prevention Plan (SWP3), and submit a completed SWP3 Checklist Form certifying to IDEM that such a plan is in place. The SWP3 is used to identify potential and actual storm water pollutant sources, and to determine best management practices and measures that will minimize the pollutants transported in storm water run-off. The SWP3 itself must be retained at the facility, and made available for review during any on-site inspection. Periodically, the plan must be reviewed, and revised if changes at the facility alter conditions that could affect run-off.

Table 43 NPDES Industrial Storm Water Permits in the Pipe Creek Subwatersheds

Subwatershed	Facility Name	Permit Number	AUID	Receiving Stream	Area (Sq. Mi.)
Headwaters Pipe Creek	Paul H Rohe Company Incorporated	INR700041	ING0361_T1007	Tributary to Pipe Creek	0.032
	Taylor Corporation McPhersons Division	INR14X065	ING0361_02	Pipe Creek	0.016
Clear Fork	Virtus Incorporated	INRX00251	ING0362_T1002	Tributary to Clear Creek	0.007
	General Electric Lighting Large Order Center	INR800268	ING0362_T1002	Tributary to Clear Creek	0.052
Duck Creek	None	NA	NA	NA	NA
Walnut Fork	Cummins & Sons	INR00C218 INR600241	ING0364_T1006 ING0364_T1007	Trace Branch Tributary to Pipe Creek	0.013
Yellow Bank Creek	Owens Corning	INR700015	ING0365_01	Whitewater River	0.045

Construction Storm Water

Storm water run-off associated with construction activity is regulated under 327 IAC 15-5 which is commonly known as Rule 5. Rule 5 is a performance-based regulation designed to reduce pollutants that are associated with construction and/or land disturbing activities.

The requirements of Rule 5 now apply to all persons who are involved in construction activity (which includes clearing, grading, excavation and other land disturbing activities) that results in the disturbance of one (1) acre or more of total land area. If the land disturbing activity results in the disturbance of less than one (1) acre of total land area, but is part of a larger common plan of development or sale, the project is still subject to storm water permitting.

In Indiana most construction projects subject to Rule 5 are administered through a general permit. A general permit is a permit by rule, and as such it is not "issued" in the same manner as an individual NPDES permit would be issued. Rather, Rule 5 was "conditionally issued" to all future "project site owners" at the time that the rule was adopted by the Indiana Water Pollution Control Board. The permit conditions within Rule 5 apply universally to all "project site owners" who are eligible to operate under the rule.

Rule 5 requires the development of a Construction Plan and an integral part of the Construction Plan is a SWP3. The SWP3 addresses several issues. First, the plan outlines how erosion and sedimentation will be controlled on the project site to minimize the discharge of sediment off-site or to a water of the state. Second, the plan addresses other pollutants that may be associated with construction activity. This can include disposal of building materials, management of fueling operations, etc. Finally, the plan should also address pollutants that will be associated with the post construction land use. It is the responsibility of the project site owner to implement the storm water pollution prevention plan. In addition, it is critical that the site is monitored during the construction process and in field modifications are made to address the discharge of sediment and other pollutants from the project site. This may require modification of the plan and field changes on the project site, as necessary, to prevent pollutants, including sediment, from leaving the project site.

If an adverse environmental impact from a project site is evident, a Rule 5 permit or, in more significant situations, an individual storm water permit may be required. An individual storm water permit is typically required only if IDEM determines the discharge will significantly lower water quality. If an individual storm water permit is required, notice will be given to the project site owner. The acreage numbers in Table 47 were calculated by using an area weighted approach with using the past five years of permitted construction sites in Fayette, Franklin, Dearborn and Ripley counties.

Table 44 Permitted Construction Acreage in the Pipe Creek Subwatersheds

Subwatershed	Estimated Construction Acreage
Headwaters Pipe Creek	2.45
Clear Fork	0.96
Duck Creek	1.40
Walnut Fork	1.64
Yellow Bank Creek	1.40

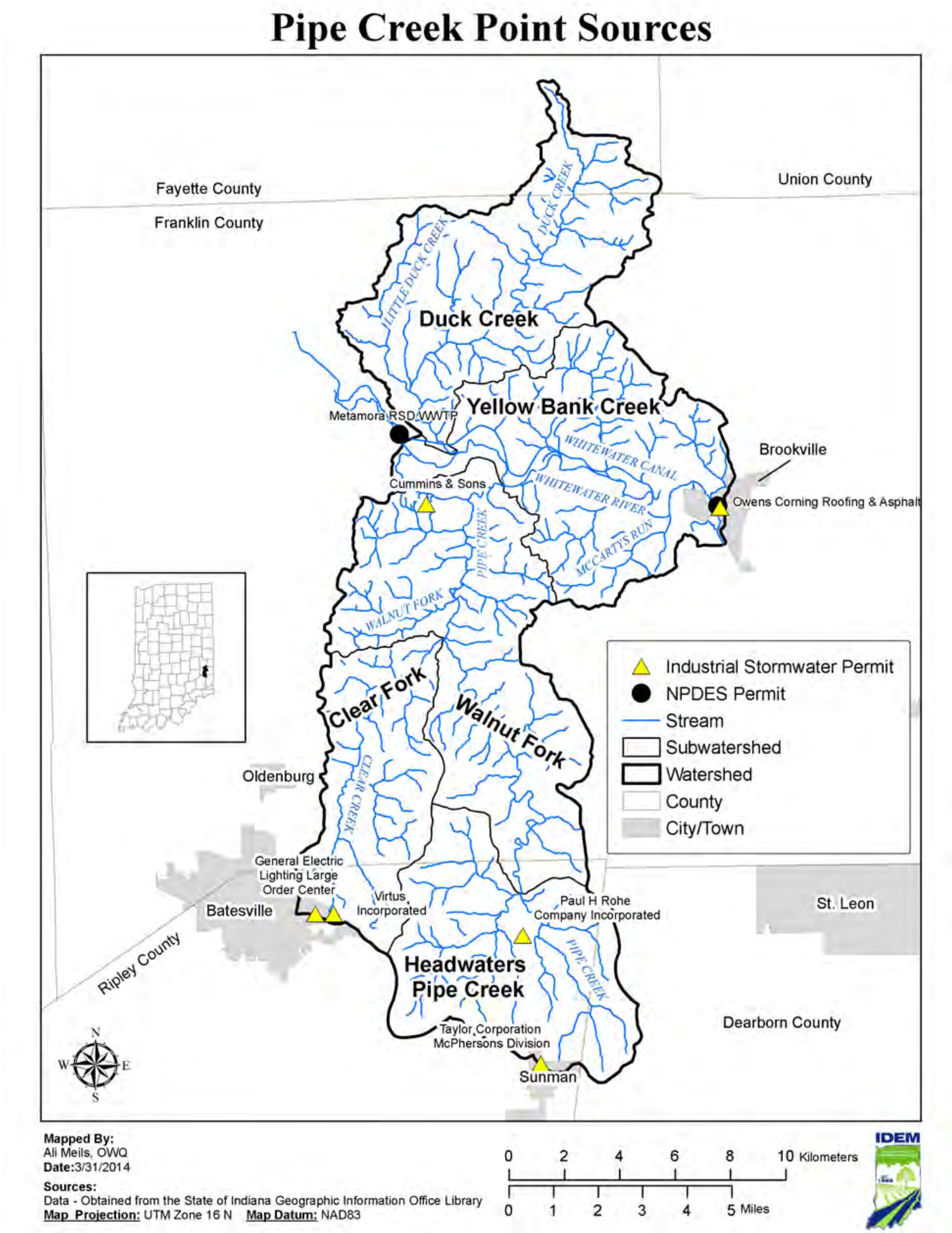


Figure 40 Point Sources in the Pipe Creek Watershed

Illicitly Connected "Straight Pipe" Systems

Some household wastes within Indiana and potentially within the Pipe Creek watershed directly discharge to a stream or are illegally connected directly to tile-drainage pipes in rural areas, providing a direct source of pollutants such as *E. coli*, nutrients, and TSS to the stream (these systems are sometimes referred to as "straight pipe" discharges).

Nonpoint Sources

This section summarizes the potential nonpoint sources of *E. coli*, nutrients and sediment in the Pipe Creek watershed that are not regulated through the National Pollutant Discharge Elimination System (NPDES) Program.

Cropland

Croplands can be a source of *E. coli*, sediments, and nutrients. Accumulation of nutrients and *E. coli* on cropland occurs from decomposition of residual crop material, fertilization with chemical (e.g., anyhdrous ammonia) and manure fertilizers, inorganic fertilizers, wildlife excreta, irrigation water, and application of waste products from municipal and industrial wastewater treatment facilities. The majority of nutrient loading from cropland occurs from fertilization with commercial and manure fertilizers (USEPA, 2003). Use of manure for nitrogen supplementation often results in excessive phosphorus loads relative to crop requirements (USEPA, 2003).

Watershed specific data are not available for field specific crops. However, county-wide data available from the National Agricultural Statistic Service (NASS) were downloaded and area weighted to estimate crop acreage in the subwatersheds. The area of the county within the subwatersheds is divided by the area of the entire county and multiplied by the total acreage of crops in the county based on the NASS survey. This is done for each county in the subwatersheds and summed to get an area weighted estimate of cropland with the watershed. The 2012 NASS statistics was used in the analysis as shown in Table 48.

Table 45 Major Cash Crop Acreage in the Pipe Creek watershed

Crop	Total Acreage in County			
	Dearborn	Fayette	Franklin	Ripley
Corn	9,300	38,100	39,600	48400
Soybean	9,600	35,700	35,800	55600
Winter Wheat	NA	1,600	1,800	NA

Subwatershed Area (mi²)	Crop	Total Acreage	Percentage of Subwatershed Crop Acreage
Headwaters Pipe Creek (21.73 mi²)	Corn	2106	47
	Soybean	2365	53
	Winter Wheat	8	<1
	Total	**4479**	**100**

Clear Fork (15.80 mi²)	Corn	1623	50
	Soybean	1557	48
	Winter Wheat	57	2
	Total	**3237**	**100**
Duck Creek (25.74 mi²)	Corn	2876	51
	Soybean	2621	47
	Winter Wheat	129	2
	Total	**5626**	**100**
Walnut Fork (29.67mi²)	Corn	3010	51
	Soybean	2748	47
	Winter Wheat	132	2
	Total	**5890**	**100**
Yellow Bank Creek (25.92 mi²)	Corn	2624	51
	Soybean	2372	46
	Winter Wheat	119	3
	Total	**5115**	**100**

Pastures and Livestock Operations

Runoff from pastures and livestock operations can be potential agricultural sources of *E. coli*, nutrients, and TSS. For example, animals grazing in pasturelands deposit manure directly upon the land surface and, even though a pasture may be relatively large and animal densities low, the manure will often be concentrated near the feeding and watering areas in the field. These areas can quickly become barren of plant cover, increasing the possibility of erosion and contaminated runoff during a storm event.

Livestock are a potential source of *E. coli*, nutrients, and stream bank erosion in streams, particularly when direct access is not restricted and/or where feeding structures are located adjacent to riparian areas. Watershed specific data are not available for livestock populations. However, county-wide data available from the National Agricultural Statistic Service were downloaded and area weighted to estimate animal population in the subwatersheds. The area of the county within the subwatersheds is divided by the area of the entire county and multiplied by the total number of animals in the county based on the NASS survey. This is done for each county in the subwatersheds and summed to get an area weighted estimate of animals with the subwatersheds. There are an estimated 6,339 animal units in the Pipe Creek watershed and the animal unit density is 53 animal units per square mile as shown in Table 46.

Table 46 Animal Unit Density in the Pipe Creek Subwatersheds

	Hogs and Pigs	Cattle and Calves	Sheep and Goats	Horses and Ponies	Poultry
Number of Animals in One Animal Unit	2.5	1	10	0.5	250
Total Number of Head in County					
Dearborn	342	7,133	619	568	777
Fayette	12,730	6,470	884	315	416
Franklin	19,941	12,323	842	581	1,015
Ripley	32,591	9,474	1,268	593	915
Total Number of Animal Units in Subwatersheds					
	Headwaters Pipe Creek	Clear Fork	Duck Creek	Walnut Fork	Yellow Bank Creek
Hogs and Pigs	531	352	537	614	528
Cattle and Calves	415	463	806	924	816
Sheep and Goats	21	2	4	4	3
Horses and Ponies	50	46	76	88	77
Poultry	0	0	0	0	0
Total	**999**	**863**	**1423**	**1630**	**1424**
Animal Unit Density (animal units/mi²)	**46**	**55**	**55**	**55**	**55**

Confined Feeding Operations (CFOs)

A CFO is an agricultural operation where animals are kept and raised in confined situations. It is a lot or facility (other than an aquatic animal production facility) where the following conditions are met:

Animals have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and

Crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.

The number of animal present meets the requirements for the state permitting action.

Confined feeding operations that are not classified as CAFOs are known as confined feeding operations (CFOs) in Indiana. Non-CAFO animal feeding operations are considered nonpoint sources by USEPA. CAFOs have federal permits and fall under the jurisdiction of the NPDES program, as described in Section 6.2.1.1. Indiana’s CFOs have state-issued permits but are not under the jurisdiction of the federal NPDES program and are therefore categorized as nonpoint sources for the purposes of this TMDL. CFO permits are “no discharge” permits. Therefore it is prohibited for these facilities to discharge to any water of the State.

The CFO regulations (327 IAC 19, 327 IAC 15-16) require that operations “not cause or contribute to an impairment of surface waters of the state”. IDEM regulates these confined feeding operations under IC 13-18-10, the Confined Feeding Control Law. The rules at 327 IAC 19, which implement the statute regulating confined feeding operations, were effective on July 1, 2012. The rule at 327 IAC 15-16, which regulates concentrated animal feeding operations and incorporates by reference the federal NPDES CAFO regulations, became effective on July 1, 2012.

Like CAFOs, the animals raised in CFOs 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. CFOs, however, can also be potential sources of TSS, total nitrogen, total phosphorus, and *E. coli* due to the following:

Manure can leak or spill from storage pits, lagoons, tanks, etc.

Improper application of manure can contaminate surface or ground water.

Manure overapplication or improper application can adversely impact soil productivity.

There are five CFOs in the Pipe Creek watershed as shown in Table 47.

Table 47 CFOs in the Pipe Creek Subwatersheds

Subwatershed	Operation Name	Farm ID	AUID	Animal Type and Number
Headwaters Pipe Creek	Brent Sarringhaus	4764	ING0361_T1006	240 Nursery Pigs 720 Finishers 74 Sows
Clear Fork	D & L Werner Farms	6328	ING0362_02	400 Nursery Pigs 810 Finishers 104 Sows 48 Beef Cattle
Duck Creek	NA	NA	NA	NA
Walnut Fork	Kopp Land & Livestock	4481	ING0364_01	600 Beef Cattle
	Joe Schwegman Farm	4635	ING0364_01	200 Nursery Pigs 700 Finishers 125 Sows 25 Beef Cattle
Yellow Bank Creek	Alan Vanmeter	4121	ING0363_T1004	270 Nursery Pigs 1000 Finishers 124 Sows

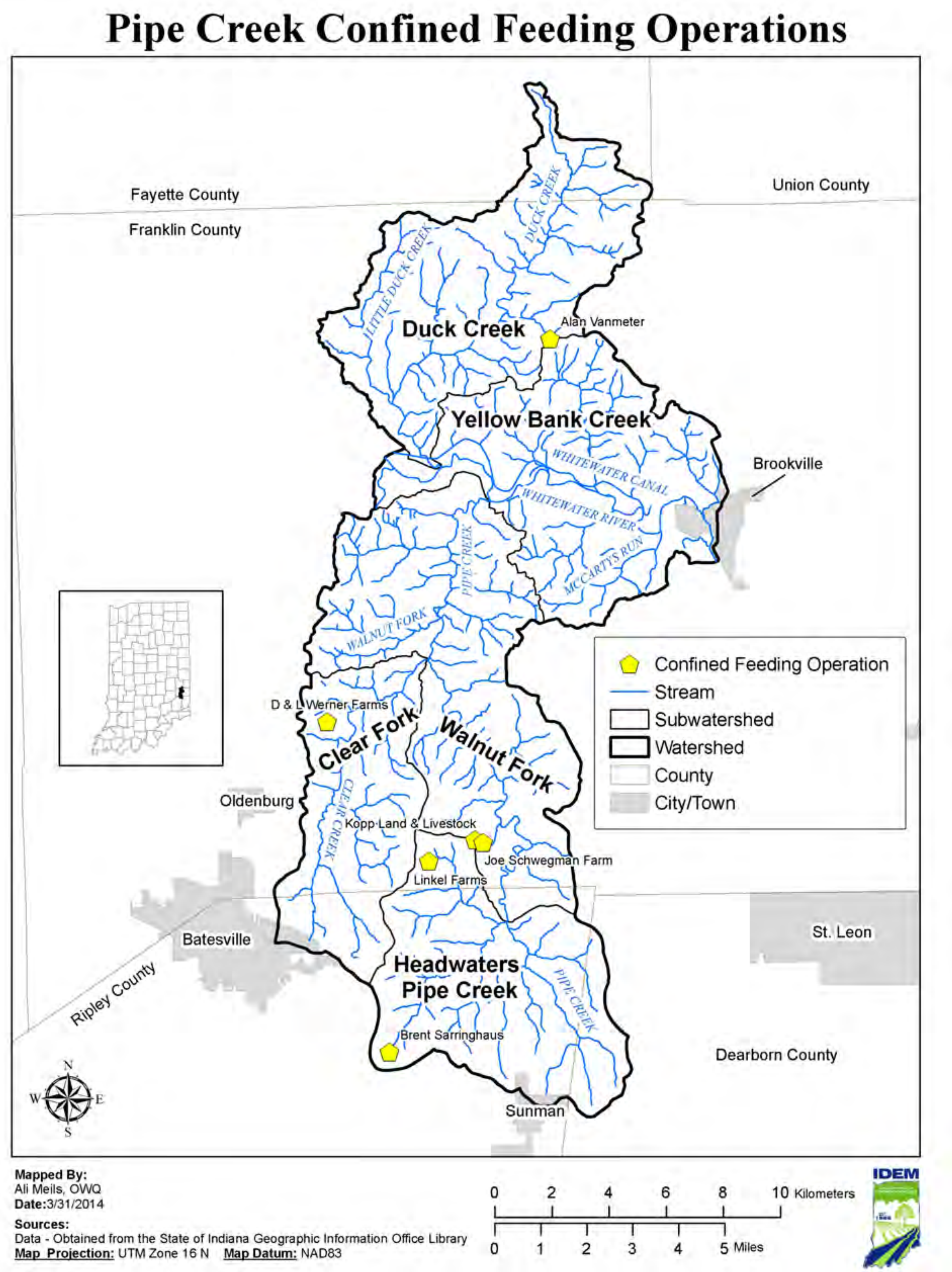


Figure 41 Confined Feeding Operations in the Pipe Creek Subwatersheds

Streambank Erosion

Streambank erosion is potentially a significant source of TSS in the Pipe Creek watershed. Streambank erosion is a natural process but can be accelerated due to a variety of human activities:

Vegetation located adjacent to streams flowing through crop or pasture fields is often removed to promote drainage or cattle access to water. The loss of vegetation makes the streambanks more susceptible to erosion due to the loss of plant roots.

Extensive areas of agricultural tiles promote much quicker delivery of rainfall into streams than would occur without subsurface drainage, which could potentially contribute to streambank erosion due to high velocities and shear stress.

The creation of impervious surfaces (e.g., streets, rooftops, driveways, parking lots) can also lead to rapid runoff of rainfall and higher stream velocities that might cause streambank erosion.

Onsite Wastewater Treatment Systems

Onsite wastewater treatment systems (e.g., septic systems) that are properly designed and maintained should not serve as a source of contamination to surface waters. However, onsite systems do fail for a variety of reasons. Common soil-type limitations which contribute to failure are: seasonal water tables, compact glacial till, bedrock, coarse sand and gravel outwash and fragipan. When these septic systems fail hydraulically (surface breakouts) or hydrogeologically (inadequate soil filtration) there can be adverse effects to surface waters due to *E. coli,* nitrate + nitrite, and total phosphorus (Horsely and Witten, 1996). Septic systems contain all the water discharged from homes and business and can be significant sources of pathogens and nutrients.

The Indiana State Department of Health (ISDH) regulates (410 IAC 6-8.3) through the local health departments the residential onsite sewage disposal program. Onsite sewage disposal systems (i.e., septic systems) are those, which do not result in an off-lot discharge of treated effluent, typically consisting of a septic tank to settle out and digest sewage solids, followed by a system of perforated piping to distribute the treated wastewater for absorption into the soil. More than 800,000 onsite sewage disposal systems are currently used in Indiana. Local health departments issue more than 15,000 permits per year for new systems, and about 6,000 permits for repairs.

410 IAC 6-8.3-52 General sewage disposal requirements

Sec. 52. (a) No person shall throw, run, drain, seep, or otherwise dispose into any of the surface waters or ground waters of this state, or cause, permit, or suffer to be thrown, run, drained, allowed to seep, or otherwise disposed into such waters, any organic or inorganic matter from a dwelling or residential onsite sewage system that would cause or contribute to a health hazard or water pollution.
(b) The: (1) design; (2) construction; (3) installation; (4) location; (5) maintenance; and (6) operation; of residential onsite sewage systems shall comply with the provisions of this rule.

410 IAC 6-8.3-55 Violations; permit denial and revocation

Sec. 55. (a) Should a residential onsite sewage system fail, the failure shall be corrected by the owner within the time limit set by the health officer. (b) If any component of a residential onsite sewage system is found to be: (1) defective; (2) malfunctioning; or (3) in need of service; the health officer may require the repair, replacement, or service of that component. The repair, replacement, or service shall be conducted within the time limit set by the health officer. (c) Any person found to be violating this rule may be served by the health officer with a written order stating the nature of the violation and providing a time limit for satisfactory correction thereof.

A comprehensive database of septic systems within the Southern Whitewater River watershed is not available; therefore, the rural population of each subwatershed was calculated to obtain a general representation of the number of systems. The US Census provides the total number of people within a county as well as the total urban and rural population of the county. Subwatershed population is estimated by dividing the subwatershed area by the total county area and multiplying it by the county census population. It is assumed that the numbers of septic systems in the subwatersheds are directly proportional to rural population density. An additional estimate of septic systems can be made using the 1990 US Census, as that is the last Census that inventoried how household wastewater is disposed. The rural households in the Pipe Creek subwatersheds are shown in Table 49, along with a calculated density (total rural households divided by total area). The rural household density can be used to compare the different subwatersheds within the Pipe Creek watershed.

It should also be noted that hydrologic soil group A and B soils have good infiltration rates and have less risk for failing septic systems due to this factor. Group C and D soils have slow infiltration rates with finer textures and slow water movement. Table 51 illustrates the hydrologic soil groups for the Pipe Creek subwatersheds.

Table 48 Hydrologic Soil Groups in the Pipe Creek Subwatersheds

Subwatershed	Hydrologic Soil Group			
	A	B	C	D
Headwaters Pipe Creek	0	1,167.36	14,375.35	0
Clear Fork	0	682.99	12,417.96	23.00
Duck Creek	98.62	7,261.35	11,133.94	0
Walnut Fork	87.68	1,778.32	20,441.32	2.42
Yellow Bank Creek	877.40	6,017.39	12,314.44	0

Table 49 Rural Population Density in the Pipe Creek Subwatersheds

Subwatershed	County	Area of County in Subwatershed (mi^2)	County Households in Subwatershed	Urban Households	Rural Households	Rural Household Density (Houses/mi^2)
Headwaters Pipe Creek	Dearborn	2.92	126	0	126	**29**
	Franklin	1.74	46	0	46	
	Ripley	17.07	459	5	454	
	Total	21.73	631	5	626	
Clear Fork	Franklin	12.41	199	0	199	**26**
	Ripley	3.39	302	95	207	
	Total	15.80	501	95	406	
Duck Creek	Fayette	3.57	51	0	51	**22**
	Franklin	22.17	517	0	517	
	Total	25.74	568	0	568	
Walnut Fork	Franklin	28.66	498	0	498	**18**
	Ripley	1.01	24	0	24	
	Total	29.67	522	0	522	
Yellow Bank Creek	Franklin	25.92	1,076	280	796	**31**
	Total	25.92	1,076	280	796	

Urban Storm Water

In areas not covered under the NPDES MS4 program, storm water runoff from developed areas is not regulated under a permit and is therefore a nonpoint source. Runoff from urban areas can carry a variety of pollutants originating from a variety of sources. Typically urban sources of nutrients are fertilizer application to lawns and pet waste, which is also a source of *E. coli*. Depending on the amount of developed, impervious land in a watershed, urban nonpoint source inputs can result in localized or widespread water quality degradation. The percent and distribution of developed land in the Headwaters Pipe Creek watershed is discussed in Section 4.2.1. However, inputs from urban sources are difficult to quantify. Estimates can be made of pet populations and residential areas that might receive fertilizer treatment. These estimates provide insight into the potential of urban nonpoint sources as important sources of nutrients or *E. coli* in the Pipe Creek watershed.

Dog and cat populations were estimated for the Pipe Creek subwatersheds using statistics reported in the *2007 U.S. Pet Ownership & Demographics Sourcebook*[1]. Specifically, the *Sourcebook* reports that on average 37.2 percent of households own dogs and 32.4 percent of households own cats. Typically, the average number of pets per household is 1.7 dogs and 2.2 cats. However, pets are likely only a significant source of *E. coli* and nutrients in population centers (i.e., cities and towns). The estimates of domestic pets in cities and towns in the watershed are presented in Table 51 and are based on the average number of pets per household multiplied by the households in the urban areas of the subwatersheds.

Table 50 Estimated Pet Populations in the Cities and Towns in the Pipe Creek Watershed

Subwatershed	City/Town	Households in 2010	Estimated Number of Cats	Estimated Number of Dogs
Headwaters Pipe Creek	Sunman	5	11	9
Clear Fork	Batesville	95	209	162
Duck Creek	NA	NA	NA	NA
Walnut Fork	NA	NA	NA	NA
Yellow Bank Creek	Brookville	280	616	476
	Total	380	836	647

Wildlife

The Indiana Department of Natural Resources (IDNR) is the primary entity responsible for monitoring wildlife populations and habitats throughout Indiana. Wildlife such as deer, geese, ducks, etc. can be sources of *E. coli*. Little information exist surrounding feces depositional patterns of wildlife and a direct inventory of wildlife populations is generally not available. However, based on the *Bacteria Source Load Calculator* developed by the Center for TMDL and Watershed Studies, bacteria production by animal type is estimated as well as their preferred habitat. Higher concentrations of wildlife in the habitats described in Table 54 could contribute *E. coli* and nutrients to the watershed, particularly during high flow conditions or flooding events.

Table 51 Bacteria Source Load by species

Wildlife Type	*E. coli* Production Rate (cfu/day – animal)	Habitat
Deer	1.86×10^8	Entire Watershed
Raccoon	2.65×10^7	Low density on forests in rural areas; high density on forest near a permanent water source or near cropland
Muskrat	1.33×10^7	Near ditch, medium sized stream, pond or lake edge
Goose	4.25×10^8	Near main streams and impoundments
Duck	1.27×10^9	Near main streams and impoundments
Beaver	2.00×10^5	Near streams and impoundments in forest and pastures

[1] http://www.avma.org/reference/marketstats/sourcebook.asp

Managed lands include natural and recreation areas which are owned or managed by the Indiana Department of Natural Resources, federal agencies, local agencies, non-profit organizations, and conservation easements. Classified lands are public or private lands containing areas supporting growth of native or planted trees, native or planted grasses, wetlands or other acceptable types of cover that have been set aside for managed production of timber, wildlife habitat and watershed protection. These natural areas provide ideal habitat for wildlife. Some of the more common wildlife often found in natural areas include white-tailed deer, raccoon, muskrat, fowl and beaver. While wildlife is known to contribute *E.coli* and nutrients to the surface waters, natural areas provide economic, ecological and social benefits and should be preserved and protected. Management practices such as reducing impervious surfaces, native vegetation plantings, wetland creation and riparian buffers will help in reducing stormwater runoff transporting pollutants to the streams. Figure 42 shows the managed lands within the Pipe Creek watershed. There are 5,269 acres of managed and classified lands in the Pipe Creek watershed.

Table 52 Managed Land and Classified Land in the Pipe Creek Watershed

Managed Lands						
Subwatershed	**Unit Name**			**Manager**		**Area (acres)**
Yellow Bank Creek/Duck Creek	Whitewater Canal State Historic Site			Indiana State Museum and Historical Sites Corporation		250
					Total	250
Classified Lands (Acres)						
Subwatershed	**Grassland**	**Woodland**	**Shrubland**	**Wetland**	**Other**	**Total**
Headwaters Pipe Creek	0	526.03	14.59	0	0	540.62
Clear Fork	2	512.14	1.32	3.2	33.18	551.84
Duck Creek	131.1	852.39	36.5	0.5	0.57	1,021.06
Walnut Fork	37.38	1428.13	25	6.65	0	1,497.16
Yellow Bank Creek	22.48	1245.02	101.83	36.17	2.89	1,408.39
					Total	5,019.07

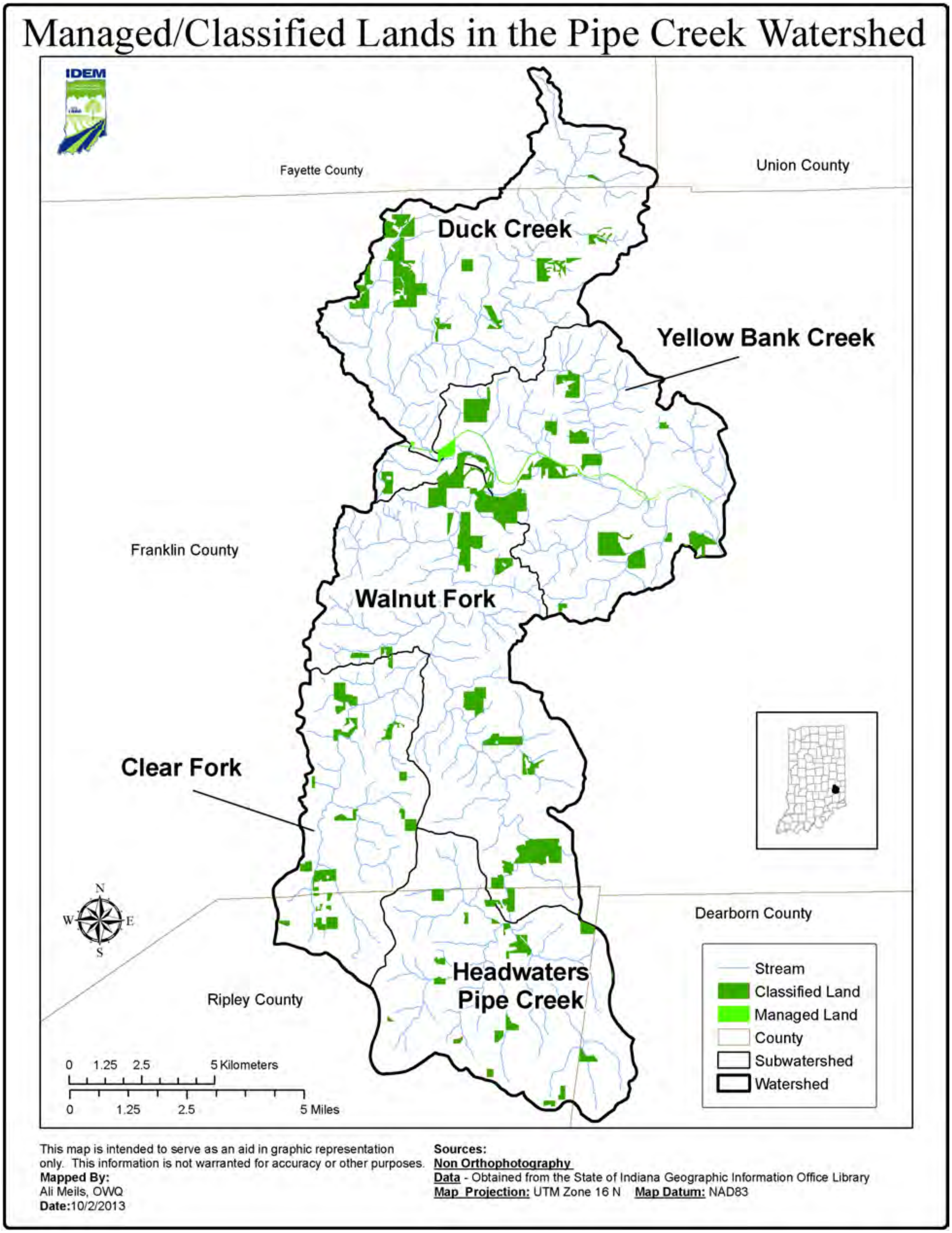


Figure 42 Managed Lands in the Pipe Creek Watershed

7.0 DESCRIPTION OF THE WHITEWATER RIVER WATERSHED

This section of the TMDL report contains a brief characterization of the Whitewater River watershed to provide a better understanding of the historic and current conditions of the watershed that affect water quality and contribute to the *E. coli*, nutrients and sediment impairment. Understanding the natural and human factors affecting the watershed will assist in selecting and tailoring appropriate and feasible implementation activities to achieve water quality standards.

The Whitewater River watershed (0508000308), shown in Figure 43, is located on the east side of the Southern Whitewater River watershed along the state border with Ohio. The watershed comprises 175 square miles and drains a total of 1,370 square miles. The Whitewater River watershed originates near Brookville just downstream of the confluence with the East Branch Whitewater River (downstream of Brookville Reservoir). Whitewater River flows southeast through Franklin and Dearborn counties before flowing into Ohio where it ultimately empties into the Ohio River near Cincinnati, Ohio. Land use throughout the watershed is predominantly forested land. The Whitewater River is not a source of drinking water in the watershed.

There are a number of existing impairments in the Whitewater River watershed from Indiana's Draft 2012 303(d) List of Impaired Waters (Figure 43). The listings and causes of impairment have been adjusted as a result of reassessment data collected at 17 sampling locations in the watershed (Figures 44). Within the Whitewater River watershed a total of 23 assessment unit IDs (AUIDs) are cited as impaired for *E. coli* (205 stream miles), biological communities (31 stream miles), dissolved oxygen (70 stream miles), PCBs (38 stream miles), and mercury (34 stream miles) on the Indiana's Draft 2016 303(d) list (Figure 45). These impaired segments account for approximately 214 miles. Table 56 presents listing information for the Whitewater River watershed, including a comparison of the updated listings with the 2012 listings and associated causes of impairments addressed by the TMDLs. The reassessment data used in updating the listings for the Whitewater River watershed are available in Appendix A.

IDEM identifies the Whitewater River watershed and its tributaries using a watershed numbering system developed by United States Geological Survey (USGS), Natural Resource Conservation Service (NRCS), and the U.S. Water Resources Council referred to as hydrologic unit codes (HUCs). HUCs are a way of identifying watersheds in a nested arrangement from largest (i.e., those with shorter HUCs) to smallest (i.e., those with longer HUCs). (For more information on HUCs, go to http://www.in.gov/idem/nps/2422.htm.) Table 56 shows the 12-digit HUCs located in the Whitewater River watershed.

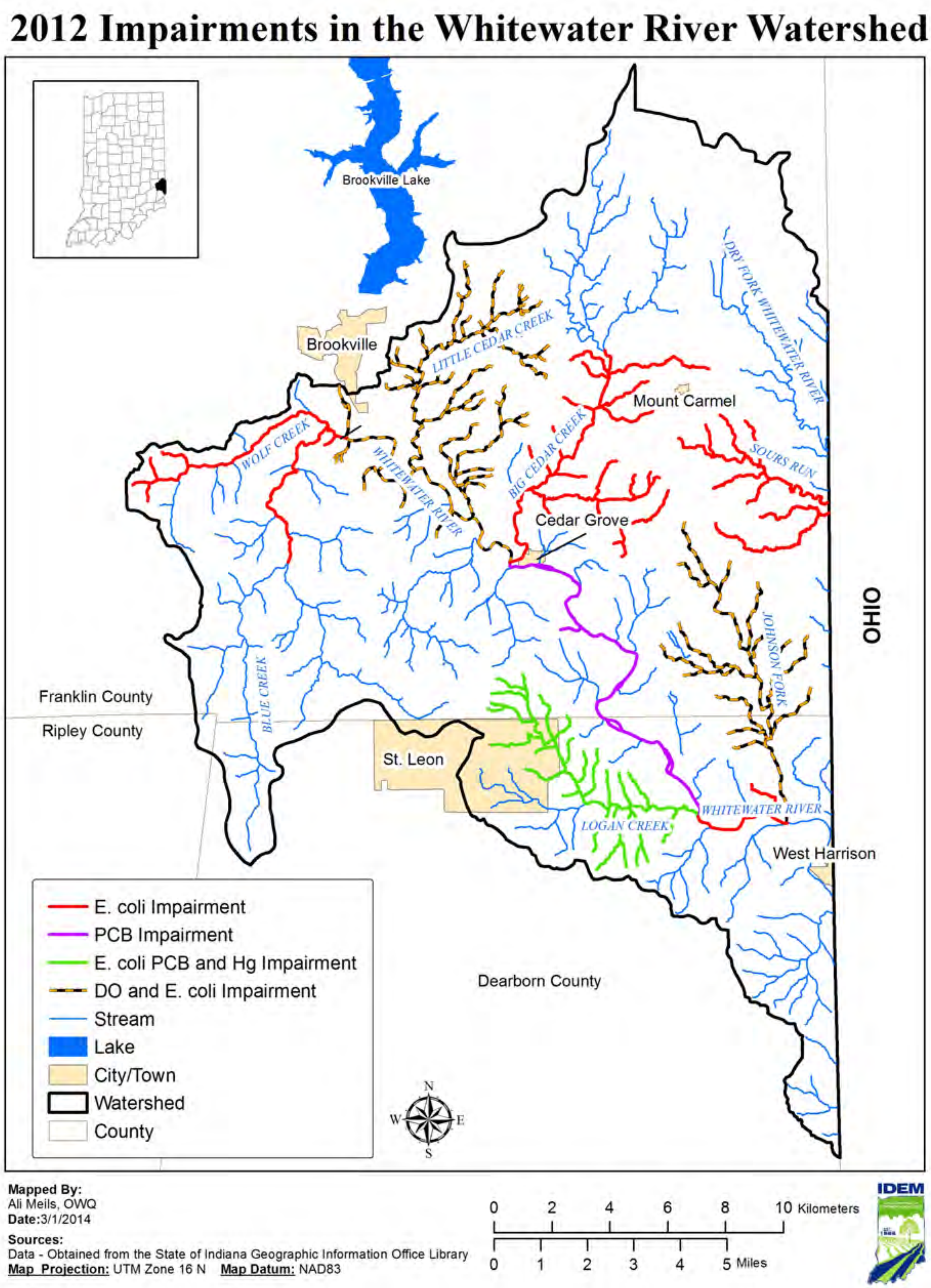


Figure 43 Streams Listed on the Draft 2012 Section 303(d) List in the Whitewater River Watershed

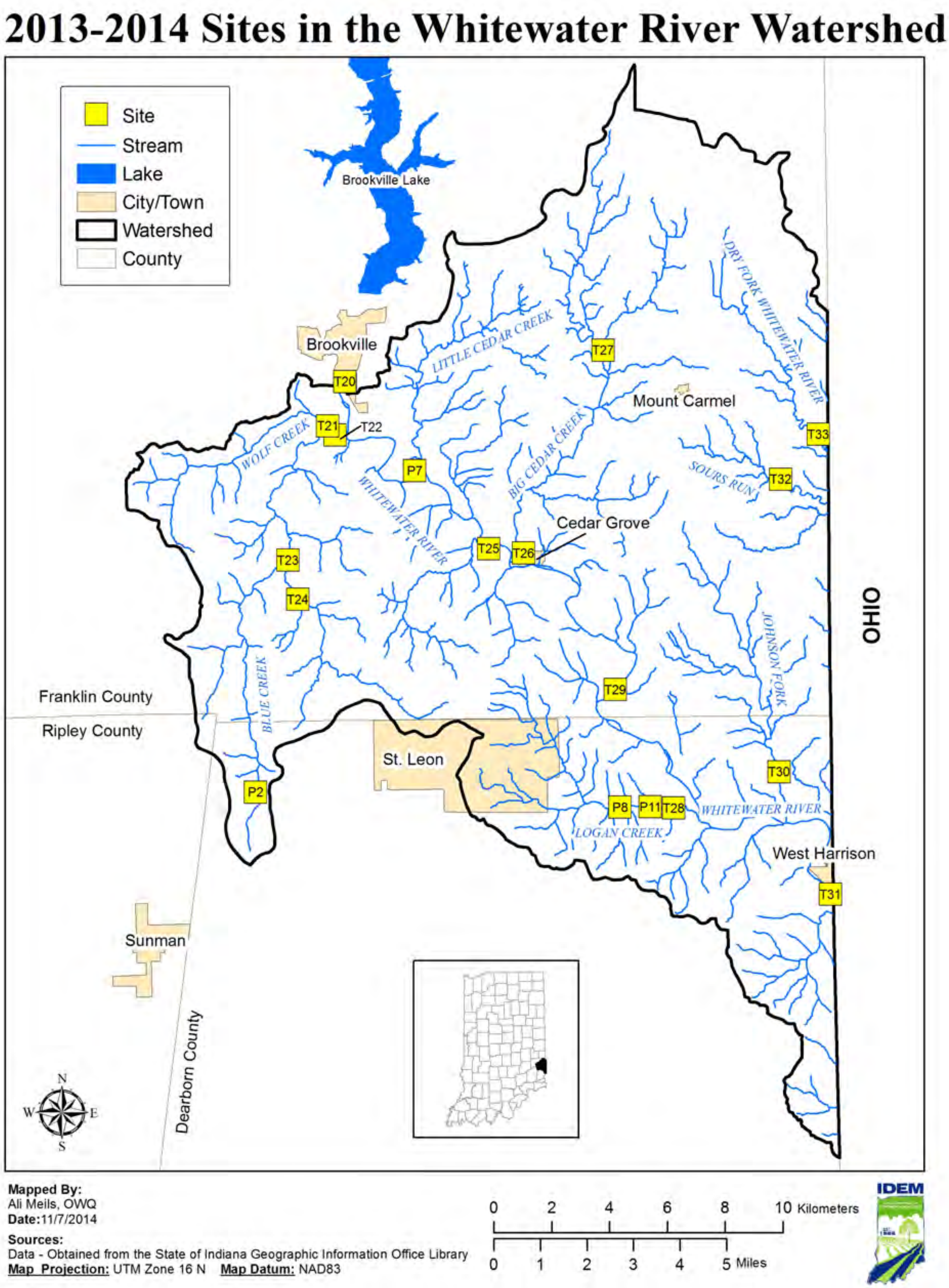


Figure 44 Sampling Locations in Whitewater River Watershed Study

Table 53 Whitewater River Watershed Sampling Site Information

Site #	Station #	Stream Name	Road Name	AUID 2012
T20*	GMW-07-0026	East Fork Whitewater River	US 52	ING037H_01
T21	GMW-08-0026	Wolf Creek	Blue Creek Rd	ING0382_02
T22	GMW080-0003	Blue Creek	Highland Center Rd	ING0382_01
T23	GMW-08-0014	Blue Creek	Blue Creek Rd	ING0382_01
T24	GMW-08-0022	East Fork Blue Creek	Blue Creek Rd	ING0381_02
T25	GMW-08-0015	Whitewater River	SR 1	ING0384_01
T26	GMW-08-0016	Big Cedar Creek	US 52	ING0383_02
T27	GMW-08-0024	Big Cedar Creek	Big Cedar Rd	ING0380_01
T28	GMW-08-0019	Logan Creek	SR 46	ING0386_T1001
T29	GMW-08-0030	Whitewater River	St. Peters Rd	ING0385_01
T30	GMW-08-0018	Johnson Fork	Johnson Fork Rd	ING0386_02
T31	GMW-08-0021	Whitewater River	Jamison Rd	ING038A_01
T32	GMW-08-0027	Sours Run	Drewersburg Rd	ING0388_01
T33	GMW-08-0020	Dry Fork Whitewater River	Dickson Rd	ING0387_02
P2	GMW-08-0001	Blue Creek	County Line Rd	ING0364_01
P7	GMW-08-0013	Whitewater River	River Rd	ING0384_01
P8	GMW-08-0003	Logan Creek	Covered Bridge Rd	ING0386_T1001
P11	GMW-08-0005	Logan Creek	Higher Ground Lane	ING0386_T1001

*****This site is not located within the boundaries of the watershed but the data will be used to account for load contributions from East Fork Whitewater River before it joins the West Fork Whitewater River.

Understanding Table 56:

- *Column 1: Site #*. Lists the site number that corresponds to the site location in Figure 56.
- *Column 2: Station #* .Provides the IDEM identification number.
- *Column 3: Stream Name*. Identifies the Stream Name where the site is located.
- *Column 4: Road Name.* Identifies the Road Name where the site is located.
- *Column 5: AUID 2012.* Identifies the AUID given to waterbodies within the 12-digit HUC subwatershed for purposes of the 2014 Section 303(d) listing assessment process.

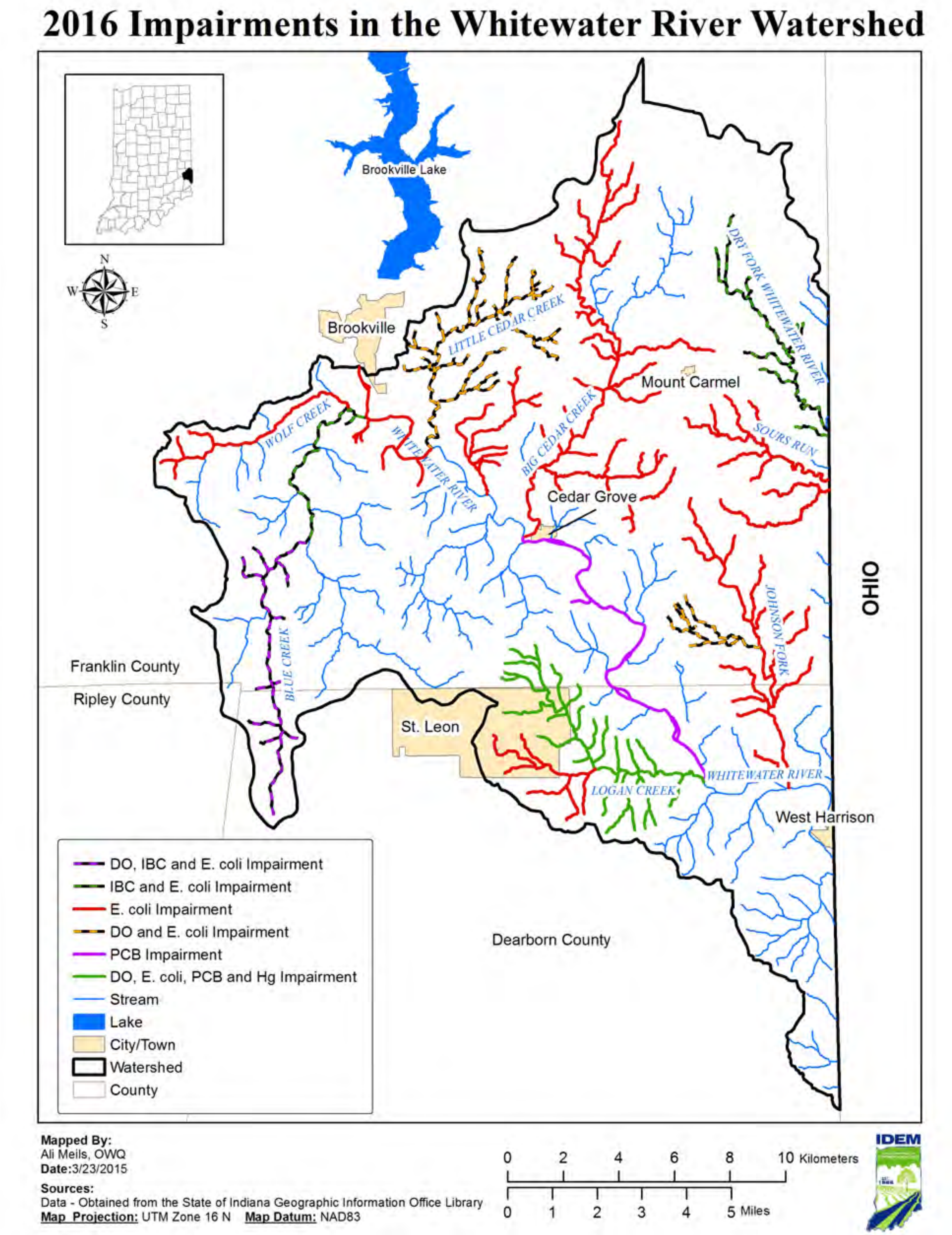


Figure 45 Streams Listed on the Draft 2016 Section 303(d) List in the Whitewater River Watershed

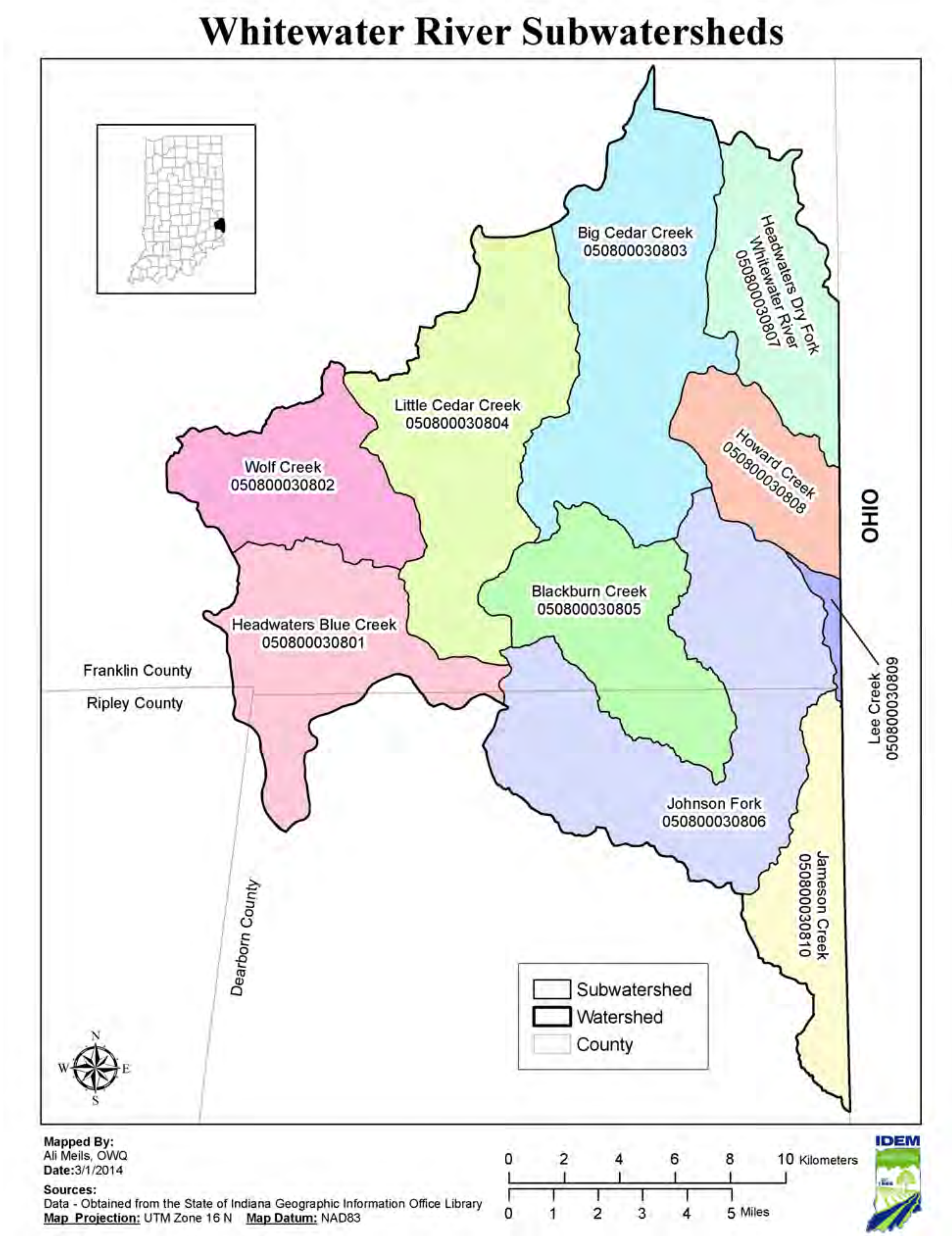


Figure 46 Subwatersheds (12-Digit HUCs) in the Whitewater River Watershed

7.1 Land Use

Land use patterns provide important clues to the potential sources of *E. coli*, nutrients and sediment in a watershed. Land use information for the Whitewater River watershed is available from the National Agricultural Statistics Service (NASS), which is part of the United States Department of Agriculture (USDA). The Cropland Data Layer (CDL) categorizes the land use for each 30 meters by 30 meters parcel of land in the watershed based on satellite imagery from circa 2012. 47 displays the spatial distribution of the land uses and the data are summarized in 57.

Land use in the Whitewater River watershed is primarily forested land, comprising 43 percent of the Whitewater River watershed. Approximately 29 percent of the land is agricultural and 20 percent is pasture and hay fields. Pasture lands and agriculture represent nearly half of the watershed and indicates the presence of animal feedlots and agricultural practices (ex. manure application) that can be significant sources of *E. coli*, nutrients and sediment. Overall there is a low percentage of developed land in the watershed. However as you get closer to the Ohio State line there are increased developed areas due to the proximity to Cincinnati, Ohio. This increase in developed lands is an indicator of high levels of impervious surfaces that can be significant sources of *E. coli*, nutrients and sediment.

The Whitewater River watershed has a diverse network of streams. Tributaries include the Big Cedar Creek, Little Cedar Creek, Jameson Creek, Logan Creek, Johnson Fork, Blue Creek, Dry Fork, Gobles Creek, and Wolf Creek among others. Many of these tributaries are shown in Figure 44. The natural topography of the watershed allows stream channels to maintain natural meandering for the most part. The high gradient streams often dry up in the summer months creating isolated pools which can often lower dissolved oxygen and impact biological communities. While this is problematic for biological communities it can also be understood as a natural condition that cannot be addressed through management efforts. The Variegate Darter (*Etheostoma variatum*) is an Indiana State Endangered fish species that is found in Whitewater River along the mainstem only. The Variegate Darter is restricted to the Ohio River drainage and are only found in the Whitewater River watershed in Indiana. They are an indicator of good water quality and are abundant in high quality streams. They are found in medium to large streams and rivers with swift flowing riffles with gravel, cobble or boulders on the stream bottom. Additional information on state endangered, threatened and rare species can be found on the DNR website (http://www.in.gov/dnr/naturepreserve/4666.htm).

Table 54 Land Use of Whitewater River Watershed

Land Use	Watershed Area Acres	Watershed Area Square Miles	Watershed Percent
Agricultural Lands	32,996.50	51.56	29.42
Developed Land	6,727.22	10.51	6.00
Forested Land	48,942.21	76.47	43.63
Pasture/Hay	22,299.75	34.85	19.88
Grasslands and Shrubs	568.22	0.89	0.51
Wetlands	9.12	0.01	0
Open Water	627.60	0.98	0.56
TOTAL	**112,170.62**	**175.27**	**100**

Understanding Table 8: The predominant land use types in the Whitewater River watershed can indicate potential sources of *E. coli*, nutrients and sediment loadings. Different types of land uses are characterized by different types of hydrology. For example, developed lands are characterized by impervious surfaces that increase the potential of storm water events during high flow periods delivering *E. coli*, nutrients and sediment to downstream streams and rivers. Forested land and wetlands allow water to infiltrate slowly thus reducing the risks of polluted water to running off into waterbodies. In addition to differences in hydrology, land use types are associated with different types of activities that could contribute *E. coli*, nutrients and sediment to the watershed. Understanding types of land uses will help identify the type of implementation approaches that watershed stakeholders can use to achieve *E. coli*, nutrients and sediment load reductions.

7.2 Crop Land

Land use patterns provide important clues to the potential sources of *E.coli*, nutrients and sediments in a watershed. Land use information for the Whitewater River watershed is available from the Multi-Resolution Land Characteristics Consortium (MRLCC). These data categorize the land use for each 30 meters by 30 meters parcel of land in the watershed based on satellite imagery from 2012. Figure 97 displays the spatial distribution of the cropland and the data are summarized in Table 8.

Land use in the Whitewater River watershed is primarily forested, comprising approximately 43 percent of the Whitewater River watershed. However there is a significant portion of the watershed that is agricultural (29 percent). Corn and soybean crops are not typically associated with high *E. coli* loads, unless they have been fertilized with manure. Approximately 96 percent of the cropland is corn or soybean.

Table 55 Crop Land of Whitewater River Watershed

Crop Data	Watershed		
	Area		Percent
	Acres	Square Miles	
Corn	17380.82	27.16	51.37
Soybean	15212.25	23.77	44.96
Alfalfa and other Hay	1027.46	1.6	3.04
Double Crop Winter Wheat/Corn or Soybeans	213.28	0.33	0.63
Pop or Orn Corn	0.44	<0.01	<0.01
Watermelons	0.22	<0.01	<0.01
Pumpkins	0.22	<0.01	<0.01
Double Crop Soybeans/Oats	0.22	<0.01	<0.01
TOTAL	33834.47	52.86	100

Understanding Table 58: The predominant cropland types in the Whitewater River watershed can indicate potential sources of *E.coli*, nutrient and sediment loadings. Cropland use in the Whitewater River watershed is primarily corn and soybean. Understanding types of cropland will help identify the type of implementation approaches that watershed stakeholders use to achieve *E.coli*, nutrient and sediment load reductions.

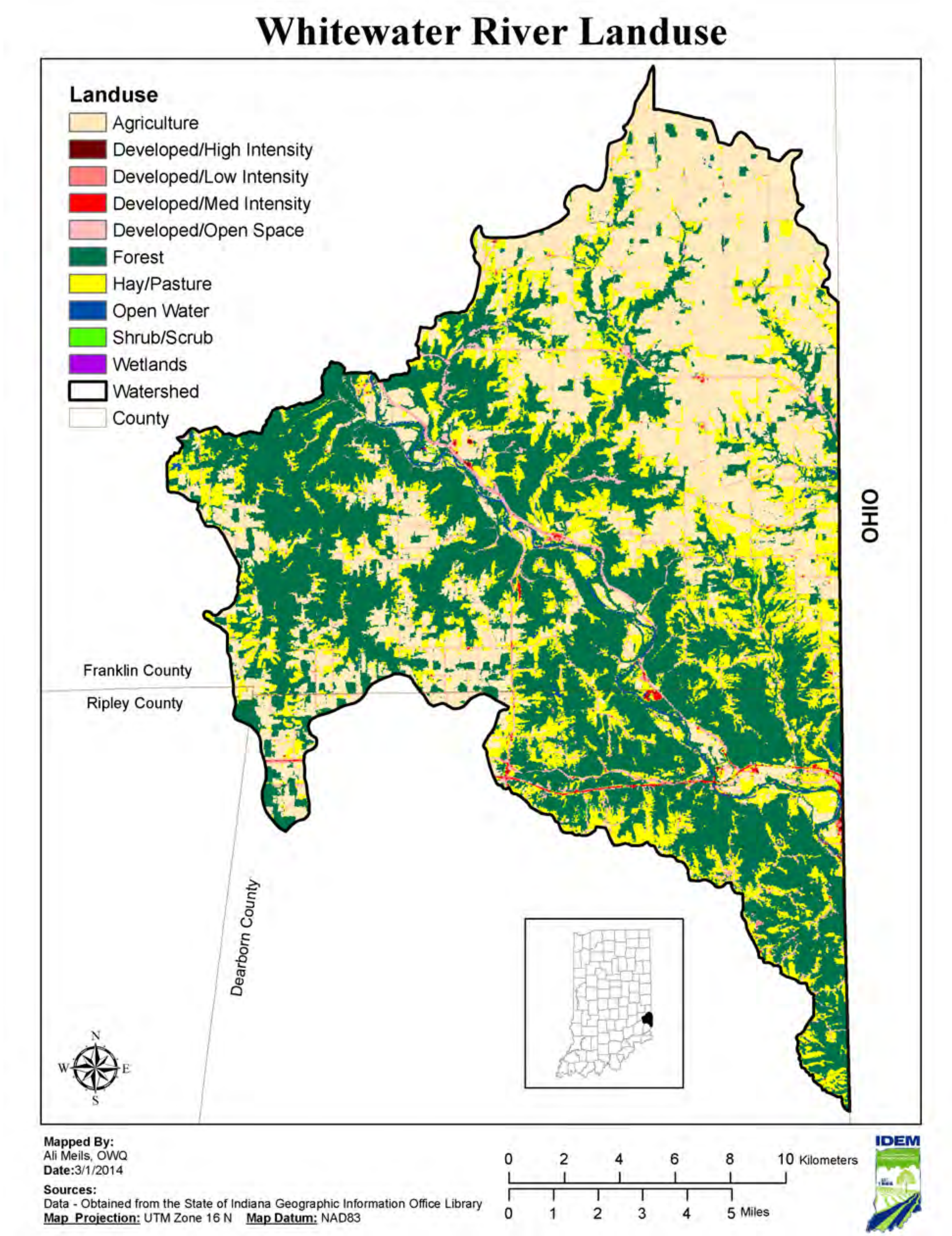


Figure 47 Land Use in the Whitewater River Watershed

7.3 Human Population

Counties with land located in the Whitewater River watershed include Dearborn, Franklin and Ripley. Major cities and towns with jurisdiction at least partially within the Whitewater River watershed include Hidden Valley, Brookville, Bright, Mount Carmel, Cedar Grove, St. Leon, and West Harrison. United States census data for each county during the past three decades are provided in Table 59. Cities and towns are labeled in Figure 48.

Table 56 Population Data for Counties in the Whitewater River Watershed

County	1990	2000	2010
Dearborn	38,835	46,109	50,047
Franklin	19,580	22,151	23,087
Ripley	24,616	26,523	28,818
TOTAL	***83,031***	***94,783***	***101,952***

Source: U.S. Census Bureau.

Understanding Table 59: Water quality is linked to population growth because a growing population often leads to more development, translating into more houses, roads, and infrastructure to support more people. Table 59 provides information that shows how population has changed in each of the counties located in the Whitewater River watershed over time. In addition, understanding population trends can help watershed stakeholders to anticipate where pressures might increase in the future and where action now could help prevent further water quality degradation. Census data illustrates that population in Dearborn County has increased nearly 30 percent in the last two decades. This is likely due to Whitewater River watersheds proximity to Cincinnati, Ohio.

Estimates of population within Whitewater River watershed are based on US Census data 2010 and the percentage of the total county and urban area that is within the watershed (Table 11). Based on this analysis, the estimated population of the watershed is 16,614 with approximately 84 percent of the population classified as rural residents and 16 percent classified as urban residents. Figure 49 indicates population density within the Whitewater River watershed.

Table 57 Estimated Population in the Whitewater River Watershed

County	2010 Population	Total Estimated Watershed Population	Percent of Total Watershed Population	Non-urban Population	Urban Population
Dearborn	50,047	8,909	53.62	6,506	2,403
Franklin	23,087	7,672	46.18	7,336	336
Ripley	28,818	33	0.20	33	0
TOTAL	***101,952***	***16,614***	***100***	***13,875***	***2,739***

Understanding Table 110: Understanding where the greatest population is concentrated within the Whitewater River watershed will help watershed stakeholders understand where different types of water quality pressures might currently exist. In general, watersheds with large urban populations are more likely to have problems associated with lots of impervious surfaces, poor riparian habitat, flashy storm water flows, and large wastewater inputs. Alternatively, watersheds with mostly a non-urban population are more likely to suffer problems from failing septic systems, agricultural runoff, and other types of poor riparian habitat (e.g., channelized streams).

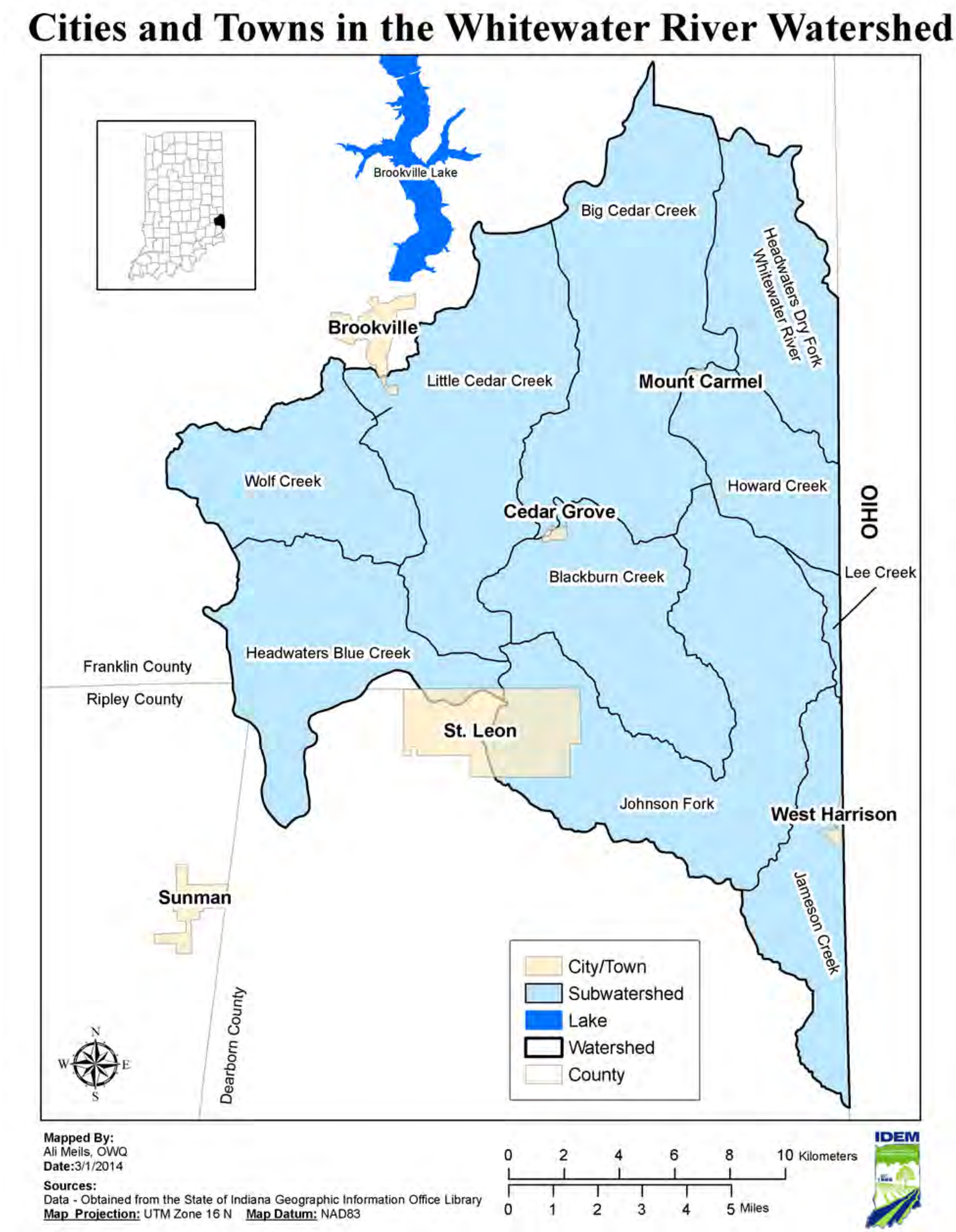


Figure 48 Municipalities in the Whitewater River Watershed

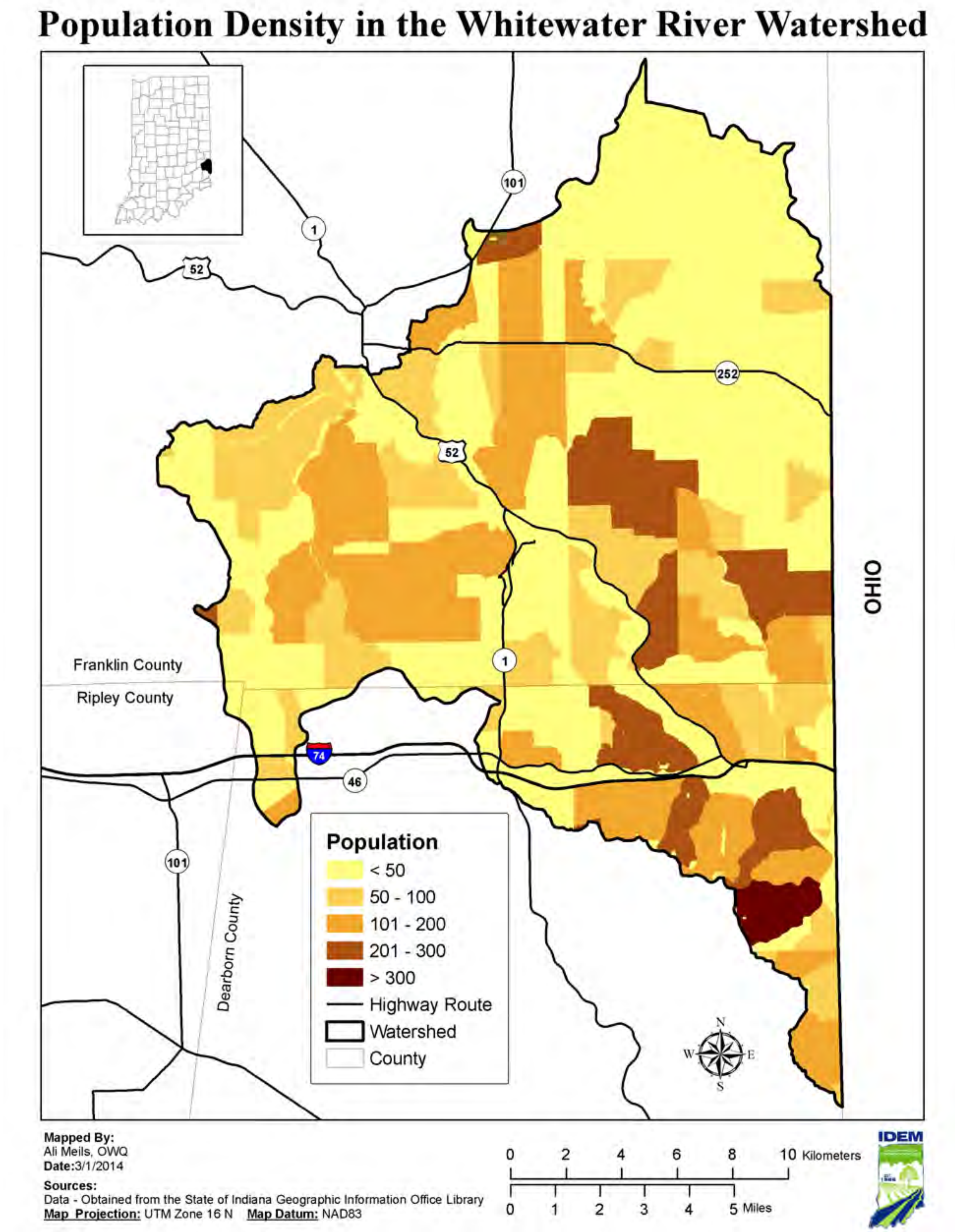


Figure 49 Population Density in the Whitewater River Watershed

7.4 Topography and Geology

Topographic and geologic features of a watershed play a role in defining a watershed's drainage pattern. Information concerning the topography and geology within the Whitewater River watershed is available from the Indiana Geologic Survey (IGS). The Whitewater River watershed originates in Franklin County near Brookville and travels southwest through Franklin and Dearborn Counties, eventually flowing into Ohio before discharging in the Ohio River. Portions of Whitewater River watershed are located in the Eastern Corn Belt Plain (ECBP) and the Interior Plateau (IP) physiographic regions. The ECBP is characterized by extensive cropland agriculture with some natural forest cover and gently rolling glacial till plains dissected by moraines, kames and outwash plains. The IP ecoregion, which encompasses the area around the mainstem, includes a till plain of low topographic relief formed from Illinoian glacial drift materials, rolling to modestly or deeply dissected basin terrain. Layers of sandstone, siltstone, shale and limestone underlie much of the Interior Plateau. Limestone outcrops are common, as are areas pitted with limestone sinks. Figure 13 shows the topography of the Whitewater River watershed. National Elevation Data (NED) is available from the USGS National Map seamless server (http://seamless.usgs.gov/website/seamless/viewer.htm).

Based on information gathered in the Atlas of Hydrogeologic Terrains and Settings of Indiana, the Whitewater River watershed is sensitive to ground water pollution through surface water. Hydrogeologic settings help to interpret the occurrence, movement, and sensitivity to contamination of ground water in relation to the surface and subsurface environment. Generally the Whitewater River watershed is located in the bottomlands of southern Indiana, which are often associated with large bedrock valleys and significant quantities of late glacial till outwash. These outwash deposits are the major ground water resources for the entire southern part of the state. They are characterized by shallow water table conditions and are consequently also zones of significant interaction between surface water and ground water.

Specifically, the outwash in the Southern Whitewater River valley constitutes the primary source of ground water in this part of the state, as suitable aquifers are generally sparse in the adjoining uplands. Most of the valley bottom is in floodplain, so water table depths are typically between 5 and 15 feet. A considerable amount of ground water is transmitted down-valley within the outwash and interacts with the river at frequent meanders that cut across the aquifer. The valley as a whole is generally a ground water discharge area, although it is unlikely that there is an appreciable volume of actual discharge to this segment of the valley in view of the poor water-transmitting properties of the surrounding bedrock and till. Overall characteristics indicate that ground water beneath the valley floor is likely to be relatively sensitive to contamination, and that finding replacement water sources would be difficult should contamination affect a part of the aquifer. There is currently no surface drinking water source known in the Whitewater River Subwatershed.

While the topography of the watershed can have an effect on hydrology, it is also likely that soil characteristics will play a role in affecting hydrologic processes.

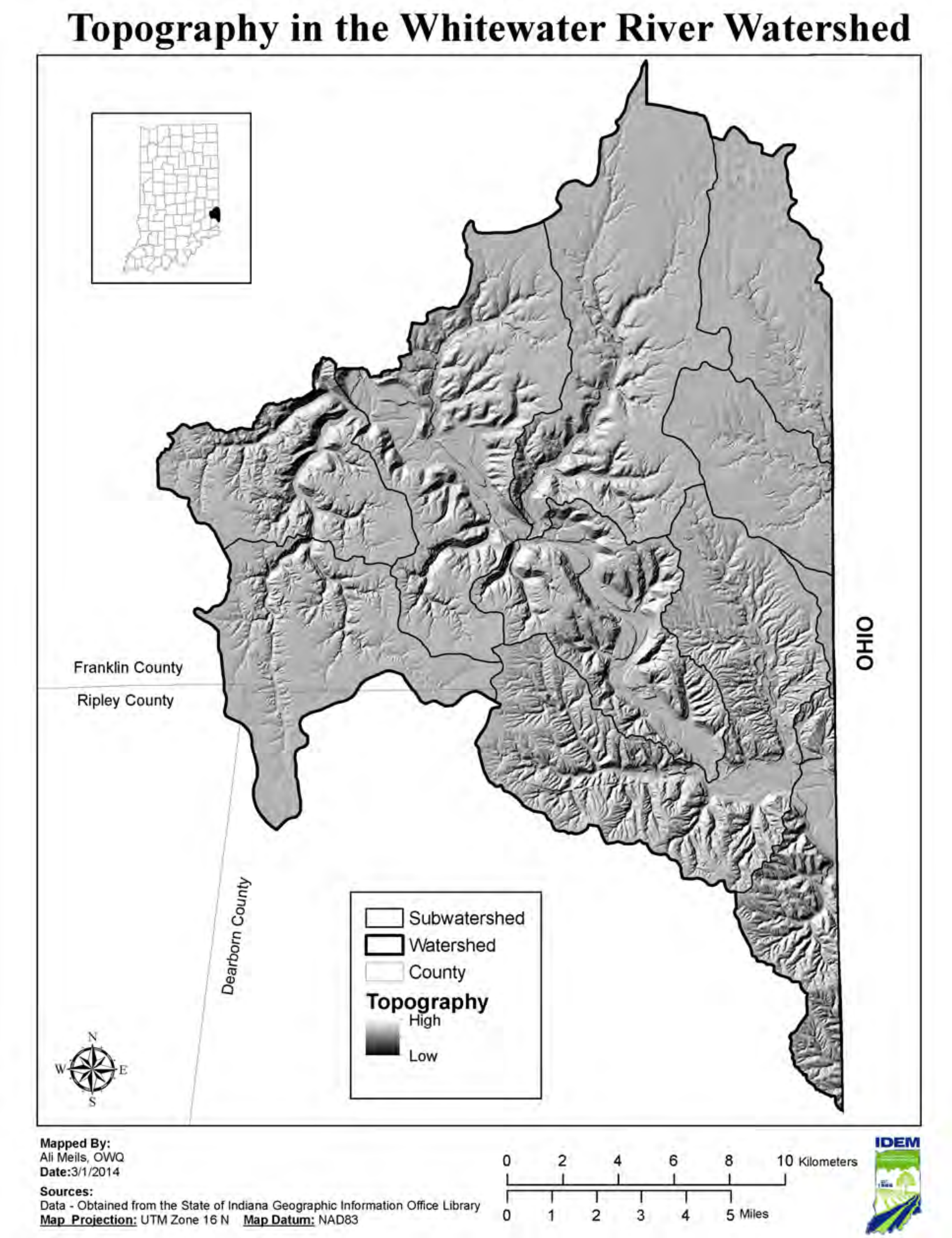


Figure 50 Topography of the Whitewater River Watershed

7.5 Soils

There are different soil characteristics that can affect the health of the watershed. These characteristics include soil drainage, septic tank suitability, soil saturation, and soil erodibility.

7.5.1 Soil Drainage

The hydrologic soil group classification is a means for categorizing soils by similar infiltration and runoff characteristics during periods of prolonged wetting. The NRCS has defined four hydrologic groups for soils, described in Table 12 (NRCS, 2001). Data for the Whitewater River watershed were obtained from the Soil Survey Geographic (SSURGO) database. Downloaded data were summarized based on the major hydrologic group in the surface layers of the map unit and are displayed in Figure 1451.

The majority of the watershed is covered by soil group C soils (60%) followed by soil group B (39%), soil group A (1%) and there are no group D soils in the watershed.

Table 58 Hydrologic Soil Groups

Hydrologic Soils Group	Description
A	Soils with high infiltrations rates. Usually deep, well drained sands or gravels. Little runoff.
B	Soils with moderate infiltration rates. Usually moderately deep, moderately well drained soils.
C	Soils with slow infiltration rates. Soils with finer textures and slow water movement.
D	Soils with very slow infiltration rates. Soils with high clay content and poor drainage. High amounts of runoff.

Understanding **Table 61:** Typically, clay soils that are poorly drained have lower infiltration rates, while well-drained sandy soils have the greatest infiltration rates. Soil infiltration rates can affect *E. coli*, nutrients and sediment loading within a watershed. During high flows, areas with low soil infiltration capacity can flood and therefore discharge high *E. coli*, nutrients and sediment loads to nearby waterways. In contrast, soils with high infiltration rates can slow the movement of *E. coli*, nutrients and sediment to streams.

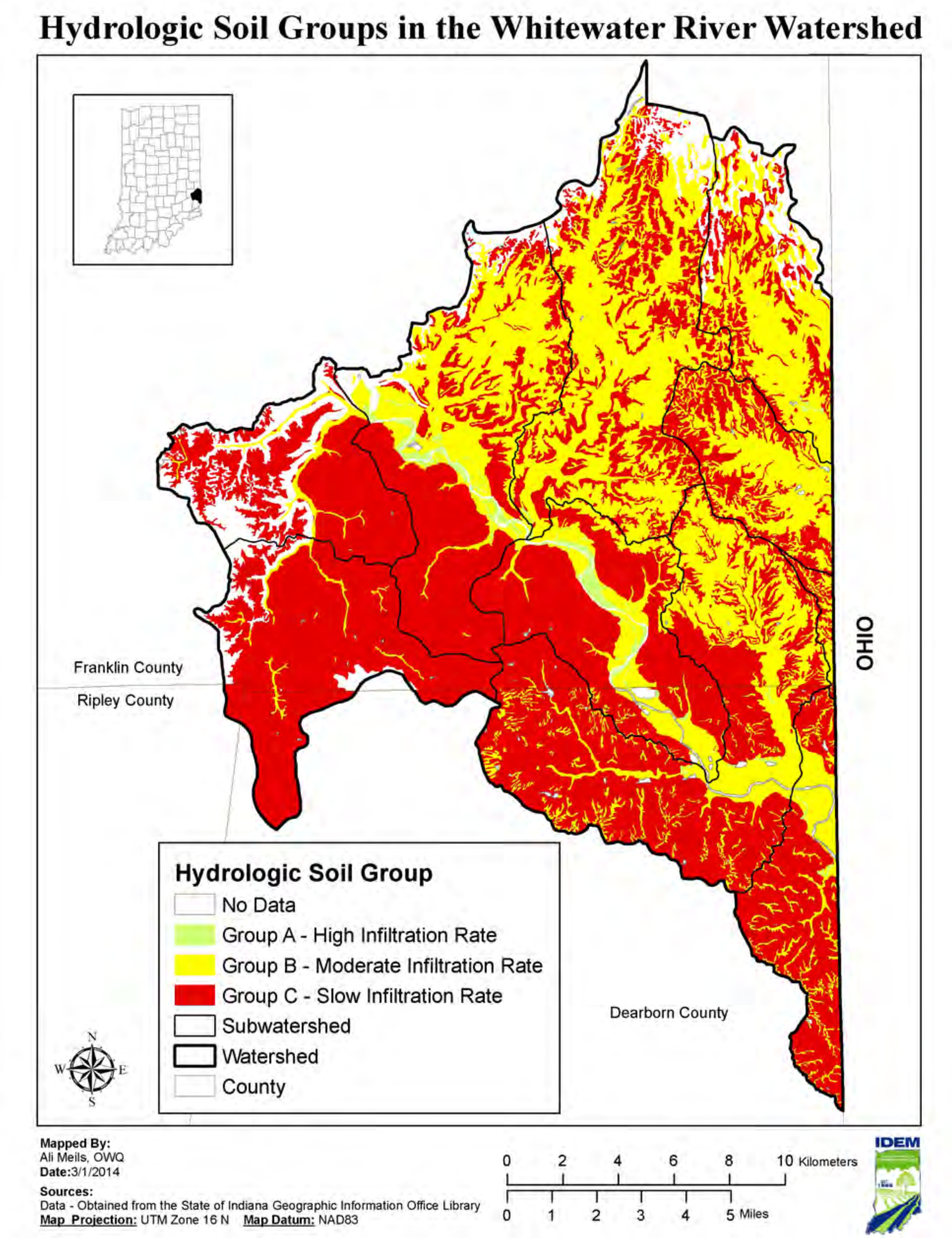


Figure 51 Hydrologic Soil Groups in the Whitewater River Watershed

7.5.2 Septic Tank Suitability

Septic systems require soil characteristics and geology that allow gradual seepage of wastewater into the surrounding soils. Seasonal high water tables, shallow compact till and coarse soils present limitations for septic systems. While system design can often overcome these limitations (i.e., perimeter drains, mound systems or pressure distribution), sometimes the soil characteristics prove to be unsuitable for any type of traditional septic system.

Heavy clay soils require larger (and therefore more expensive) absorption fields; while sandier, well-drained soils are often suitable for smaller, more affordable gravity-flow trench systems.

The septic system is considered failing when the system exhibits one or more of the following:

1. The system refuses to accept sewage at the rate of design application thereby interfering with the normal use of plumbing fixtures

2. Effluent discharge exceeds the absorptive capacity of the soil, resulting in ponding, seepage, or other discharge of the effluent to the ground surface or to surface waters

3. Effluent is discharged from the system causing contamination of a potable water supply, ground water, or surface water.

Figure 52 shows ratings that indicate the extent to which the soils are suitable for septic systems within the Whitewater River watershed. Only that part of the soil between depths of 24 and 60 inches is evaluated for septic system suitability. The ratings are based on the soil properties that affect absorption of the effluent, construction, maintenance of the system, and public health.

Soils labeled “very limited” indicate that the soil has at least one feature that is unfavorable for septic systems. Approximately 99 percent of the Whitewater River watershed is considered “very limited” in terms of soil suitability for septic systems. These limitations generally cannot be overcome without major soil reclamation, special design or expensive installation procedures. Less than one percent of the soils within the Whitewater River watershed are designated as “somewhat limited” or “not rated.” “Somewhat limited” means that the soil has features that are moderately favorable for septic systems. The limitations can be overcome or minimized by special planning, design or installation. “Not rated,” means these soils have not been assigned a rating class because it is not industry standard to install a septic system in these geographic locations. There are no soils in the Whitewater River watershed designated as “not limited,” meaning that the soil type is suitable for septic systems.

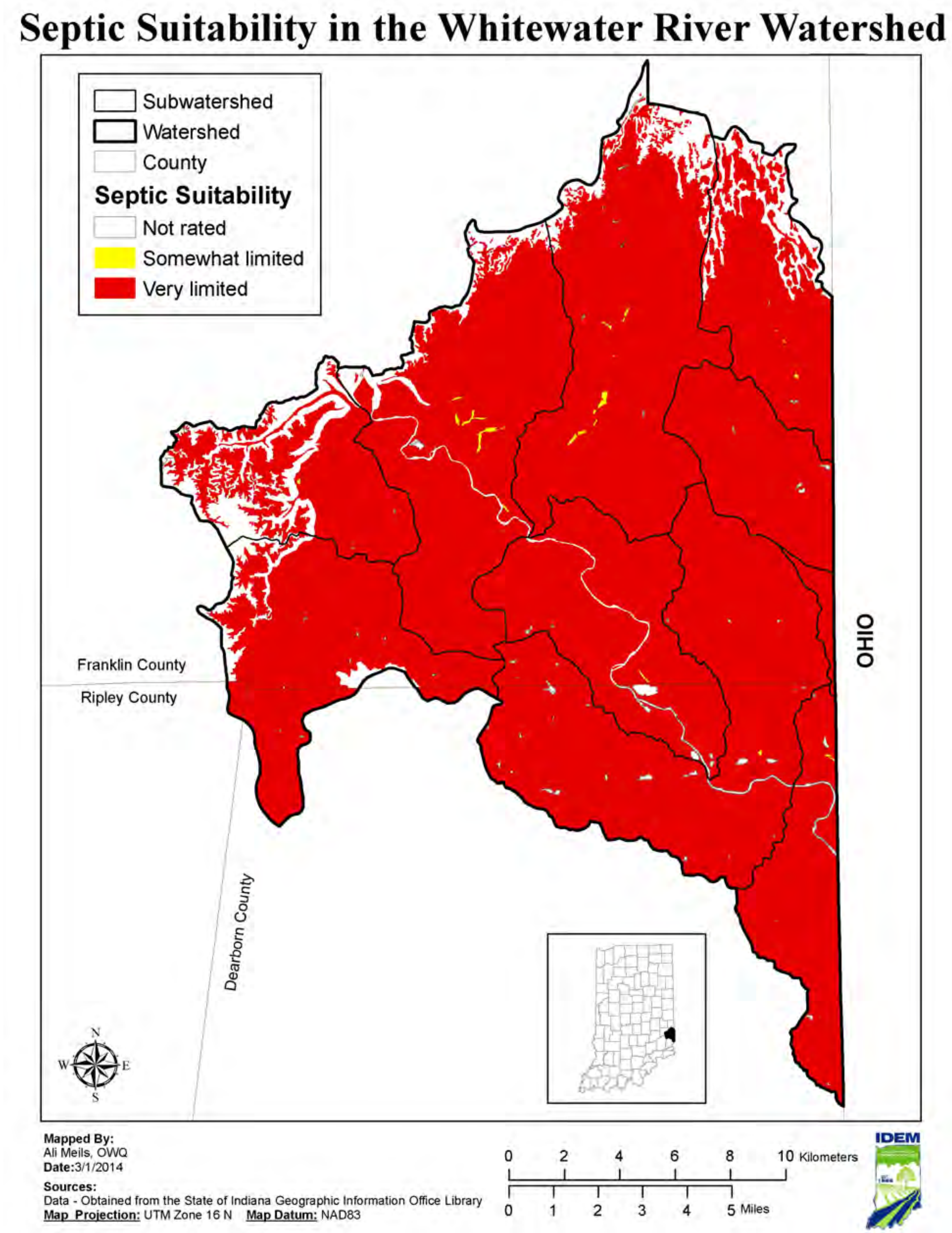


Figure 52 Suitability of Soils for Septic Systems in the Whitewater River Watershed

7.5.3 Soil Saturation

Soils that remain saturated or inundated with water for a sufficient length of time become hydric through a series of chemical, physical, and biological processes. Once a soil takes on hydric characteristics, it retains those characteristics even after the soil is drained. Hydric soils have been identified in the Whitewater River watershed and are important in consideration of wetland restoration activities. Approximately 8,500 acres or eight percent of the Whitewater River watershed area contains soils that are considered hydric, as shown in Table 13. However, a large majority of these soils have been drained for either agricultural production or urban development and would no longer support a wetland. The location of remaining hydric soils, as shown in Figure 16, can be used to consider possible locations of wetland creation or enhancement. There are many components in addition to soil type that must be considered before moving forward with wetland design and creation. Additional information on wetlands can be found on the IDEM website (http://www.in.gov/idem/4138.htm).

Table 59 Hydric Soils by County in the Whitewater River Watershed

County	Map Symbol	Hydric Soil Type	Acres	Total Percent
Dearborn	Ct	Clermont silt loam	1,248.49	100
		Total	**1,248.49**	**100**
Franklin	Cm	Cobbsfork silt loam	2,197.43	31.00
	Cy	Cyclone silt loam	4,825.53	68.08
	Mr	Milford silty clay loam	65.27	0.92
		Total	**7,088.23**	**100**
Ripley	Cm	Cobbsfork silt loam	172.28	100
		Total	**172.28**	**100**

***Understanding* Table 62:** In the Whitewater River watershed, Franklin County has the most acreage of hydric soils. Areas within these counties might contain opportunities for wetland restoration activities that could help address water quality impairments.

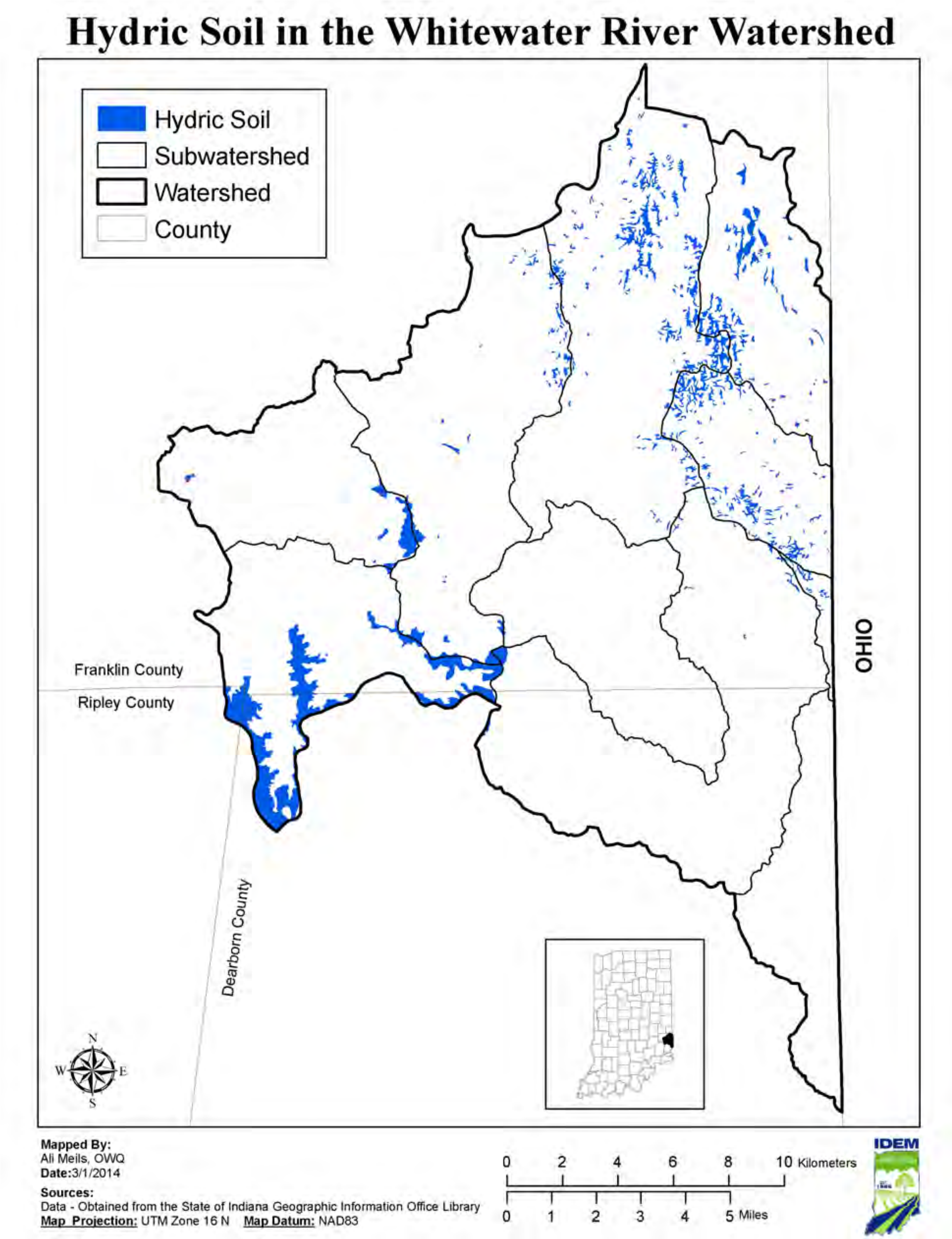


Figure 53 Hydric Soils in the Whitewater River Watershed

Wetland areas act to buffer wide variations in flow conditions that result from storm events. They also allow water to infiltrate slowly thus reducing the risks of contaminated water runoff into waterbodies. Agencies such as the USGS and U.S. Fish and Wildlife Service (USFWS) estimate that Indiana has lost approximately 85 percent of the state's original wetlands. (See http://www.in.gov/dnr/fishwild/files/partner.pdf and http://water.usgs.gov/nwsum/WSP2425/state_highlights_summary.html) Currently, the Whitewater River watershed contains approximately 2,889 acres of wetlands or two and a half percent of the total surface area (USFWS, 2003). **Error! Reference source not found.** shows estimated locations of wetlands as defined by the USFWS's National Wetland Inventory (NWI). Wetland data for Indiana is available from the U.S. Fish and Wildlife Service's NWI at < http://www.fws.gov/wetlands/Data/Web-Map-Services.html>. The NWI was not intended to produce maps that show exact wetland boundaries comparable to boundaries derived from ground surveys, and boundaries are generalized in most cases. The wetland information used in Section 3.1 was from the MRLCC dataset and is based on soil types, whereas, aerial photography interpretation techniques were used to compile the NWI. Therefore the estimate of the current extent of wetlands in the Whitewater River watershed from the NWI may not agree with those listed in Section 3.1, which are based upon the MRLCC dataset.

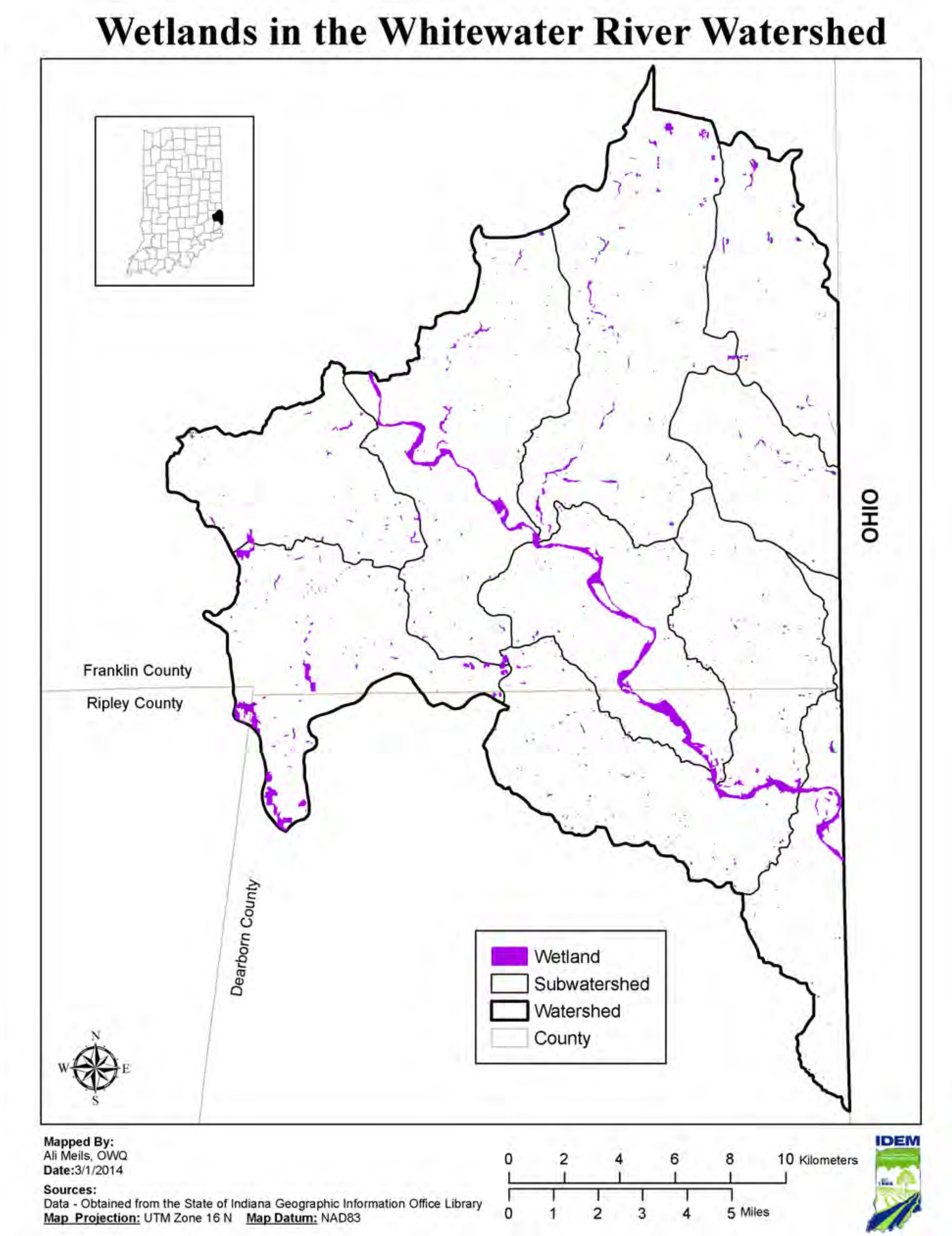


Figure 54 Locations of Wetlands in Whitewater River Watershed

Changes to the natural drainage patterns of a watershed are referred to as hydromodifications. Historically, drain tiles have been used throughout Indiana to drain marsh or wetlands and make it either habitable or tillable for agricultural purposes. While tile drainage is understood to be pervasive – estimated at thousands of miles in Indiana – it is extremely challenging to quantify on a watershed basis because these tiles were established by varying authorities including County Courts, County Commissioners, or County Drainage Boards (see http://boonecounty.in.gov/Default.aspx?tabid=167). Records were not kept by private landowners as to the location and quantity of these tiles.

In addition to tile drainage, regulated drains are another form of hydromodification. A regulated drain is a drain which was established through either a Circuit Court or Commissioners Court of the County prior to January 1, 1966 or by the County Drainage Board since that time. Regulated drains can be an open ditch, a tile drain, or a combination of both. The County Drainage Board can construct, maintain, reconstruct or vacate a regulated drain.

7.5.4 Soil Erodibility

Although erosion is a natural process within stream ecosystems, excessive erosion negatively impacts the health of watersheds. Erosion increases sedimentation of the streambeds, which impacts the quality of habitat for fish and other organisms. Erosion also impacts water quality as it increases nutrients and decreases water clarity. As water flows over land and enters the stream as runoff, it carries pollutants and other nutrients that are attached to the sediment. Sediment suspended in the water blocks light needed by plants for photosynthesis and clogs respiratory surfaces of aquatic organisms.

The NRCS maintains a list of highly erodible lands (HEL) units for each county based upon the potential of soil units to erode from the land. HELs are especially susceptible to the erosional forces of wind and water. Wind erosion is common in flat areas where vegetation is sparse or where soil is loose, dry, and finely granulated. Wind erosion damages land and natural vegetation by removing productive top soil from one place and depositing it in another. The classification for HELs is based upon an erodibility index for a soil, which is determined by dividing the potential average annual rate of erosion by the soil unit's soil loss tolerance (T) value, which is the maximum annual rate of erosion that could occur without causing a decline in long-term productivity. The soil types and acreages in the Whitewater River watershed are listed by county in Table 14. HELs and potential HELs in the Whitewater River watershed are mapped in

Figure 18. The data used to create Figure 18 was collected from the NRCS offices of Dearborn, Franklin and Ripley counties. A total of 76,103 acres or 68 percent of the Whitewater River watershed is considered highly erodible or potentially highly erodible. Rainfall within the Whitewater River watershed is moderately heavy with an annual average of 43 inches. This rainfall and climate data specific to the watershed is available from the National Climatic Data Center (http://www.ncdc.noaa.gov/oa/ncdc.html). Heavy rainfall increases flow rates within streams as the volume and velocity of water moving through the stream channels increases. Velocity of water also increases as streambank steepness increases.

Table 60 HEL/Potential HEL Total Acres in the Counties in the Whitewater River Watershed

County	Map Symbol	HEL/Potential HEL Soil Types	Acres
Dearborn	BaA	Bartle silt loam	8.25
	BeD2, BeD3, BeE, BeC2, BeC3	Bonnell silt loam	549.14
	CaC2, CaD2, CaE2,	Carmel silt loam	862.85
	CcC3, CcD3, CcE3	Carmel silty clay loam	1,707.29
	CnB2, CnC2, CnC3	Cincinnati silt loam	567.85
	EdE3	Eden flaggy silty clay loam	1,971.50
	EdF	Eden flaggy silty clay	7,158.07
	EcE2	Eden silty clay loam	1,125.64
	EkC2	Elkinsville silt loam	6.70
	FoB2	Fox silt loam	227.83
	HcG	Hennepin loam	191.27
	MaF2, MaB2	Markland silt loam	169.58
	MbD3	Markland silty clay loam	6.79
	PaD2, PaE2	Pate silty clay loam	732.56
	Pg	Gravel pits	103.65
	RdG	Rodman sandy loam	126.89
	RoB2	Rossmoyne silt loam	452.12
	RxB	Russell-Fincastle silt loam	161.25
	SwB2, SwC2, SwC3, SwD2	Switzerland silt loam	2,241.35
	Ud	Udorthents, loamy	82.44
	WbB2, WbC2, WbC3	Weisburg silt loam	1,188.07
		Total	**19,641.09**
Franklin	AlB	Alvin sandy loam	163.30
	AvA	Avonburg silt loam	4006.79
	BpD3	Bonnell clay loam	950.70
	BnF	Bonnell loam	281.53
	BoC2, BoD2, BoE2	Bonnell silt loam	2,176.63
	BrC3	Bonnell silty clay loam	89.07
	CbC2	Carmel silt loam	2,397.39
	CkB2, CkC2, CkC3	Cincinnati silt loam	4,302.78
	EbE2	Eden flaggy silty clay	3,563.23
	EdG	Eden very flaggy silty clay	10,423.71
	EeD2	Edenton silt loam	378.90
	ElB	Eldean loam	439.52
	FxC3	Fox complex	141.89
	HeG	Hennepin loam	1,447.07
	MoC3, MoD3	Miami clay loam	6,082.15
	MmB2, MmC2	Miami silt loam	4,871.84

	OcA	Ockley loam	547.39
	Pg	Gravel pits	21.89
	PrC	Princeton fine sandy loam	37.76
	RkF	Rodman gravelly coarse sandy loam	302.35
	RsB2	Rossmoyne silt loam	3,008.15
	RuB2	Russell silt loam	3,174.80
	SdB	Sidell silt loam	95.80
	UaB	Uniontown silt loam	142.83
	WeB2	Weisburg silt loam	573.27
	WoB	Woolper silty clay loam	372.99
	WrB, WrC2	Wynn silt loam	605.51
	WyC3	Wynn silty clay loam	809.32
	XnB2	Xenia silt loam	5,031.57
		Total	**56,440.13**
Ripley	AvB2	Avonburg silt loam	9.77
	CcC2	Cincinnati silt loam	8.45
	RoB2	Rossmoyne silt loam	4.10
		Total	**22.32**

Understanding Table 14: In the Whitewater River watershed, Franklin County has the most acreage of HEL/potential HEL soils. Areas within these counties might contribute to water quality impairments associated with excessive erosion, including IBC/TSS, and might contain opportunities for restoration to decrease erosion.

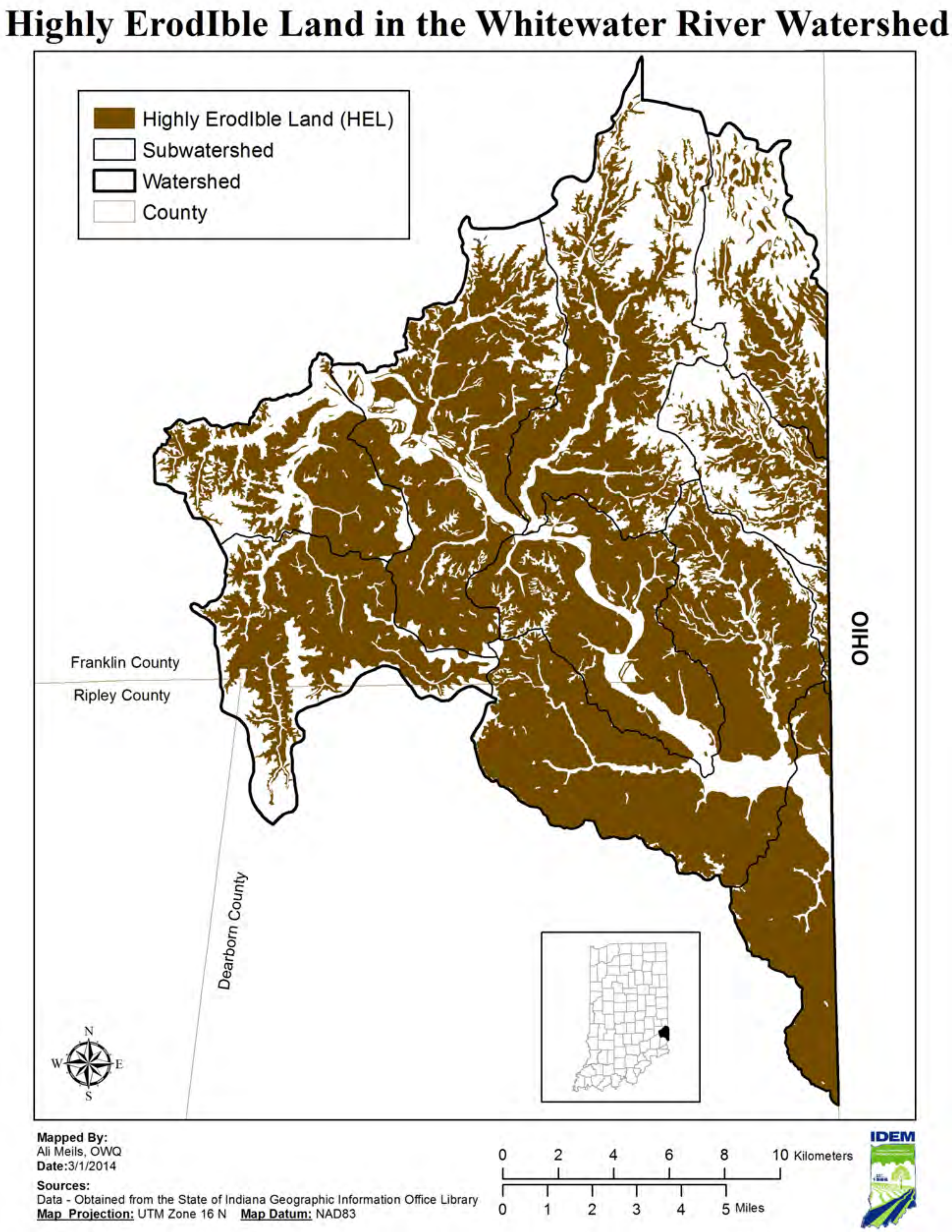


Figure 55 HEL/Potential HEL Soils in the Whitewater River Watershed

The Indiana State Department of Agriculture (ISDA) tracks trends in conservation and cropland through annual county tillage transects. Data collected through the tillage transect help determine adoption of conservation practices and estimate the average annual soil loss from Indiana's agricultural lands. The latest figures for the counties in the Whitewater River watershed are shown in Table 15. Tillage practices captured in ISDA's tillage transect include No-Till, Mulch Till, and conventional tillage practices. ISDA defines No-Till as any direct seeding system including site preparation, with minimal soil disturbance. Mulch Till is any tillage system leaving greater than 30 percent residue cover after planting, excluding no-till. Reduces tillage is an tillage system leaving 16 percent to 30 percent residue cover after planting. Conventional tillage is any tillage system leaving less than 30 percent residue cover after planting.

Table 61 County Tillage Transect Data from 2009 to 2013 in the Whitewater River Watershed

Crop	Tillage Practice	Dearborn			Franklin			Ripley		
		2009	2011	2013	2009	2011	2013	2009	2011	2013
Corn	% No-Till	38	46	39	19	23	21	33	45	36
	% Mulch-Till	18	21	6	15	15	14	18	8	10
	% Reduced-Till	9	32	13	33	43	54	0	0	0
	% Conventional-Till	35	0	42	33	19	11	49	47	53
Soybeans	% No-Till	75	88	71	70	50	62	76	76	55
	% Mulch-Till	4	0	0	11	32	22	17	14	22
	% Reduced-Till	8	6	13	7	14	14	0	0	0
	% Conventional-Till	13	6	16	13	3	2	7	10	23

Understanding Table 15: According to Table 15, No-Till practices for soybeans are predominant in all counties in the Whitewater River watershed. There has been a reduction in conventional tillage practices for corn in Franklin County since 2009.

7.6 Climate and Precipitation

Climate varies in Indiana depending on latitude, topography, soil types, and lakes. Information on Indiana's climate is available through sources including the Indiana State Climate Office at Purdue University (http://climate.agry.purdue.edu/climate/narrative.asp).

Climate data from Station 121030 located in Brookville were used for climate analysis of the Whitewater River watershed. Monthly data from 1948-2013 were available at the time of analysis. In general, the climate of the region has hot, humid summers and cold winters. From 1948 to 2013, the average winter temperature in Brookville was 32°F and the average summer temperature was 85°F. The average growing season (consecutive days with low temperatures greater than or equal to 32 degrees) is 183 days.

Examination of precipitation patterns is also a key component of watershed characterization because of the impact of runoff on water quality. From 1948 to 2013, the annual average precipitation in Brookville at Station 121030 was approximately 43 inches, including approximately 15.5 inches of snowfall. More detailed discussions on precipitation data during sampling periods are presented in Section 0.

Rainfall intensity and timing affect watershed response to precipitation. This information is important in evaluating the effects of storm water on the Whitewater River watershed. Using data from 121030 during 1948 to 2013, 52 percent of the measureable precipitation events were very low intensity (i.e., less than 0.2 inches), while eight percent of the measurable precipitation events were greater than one inch.

Knowing when precipitation events occur helps in the linkage analysis (Section 0), which correlates flow conditions to pollutant concentrations and loads. Data indicates that the wet weather season in the Whitewater River watershed occurs between the months of April and May.

7.7 Summary

The information presented in Section 7 helps to provide a better comprehensive understanding of the conditions and characteristics in the Whitewater River watershed that, when coupled with the sources, affect both water quality and water quantity. In summary, the predominant land uses in the Whitewater River watershed of forested and agricultural lands serve as indicators as to the type of sources that are likely to contribute to water quality impairments in the Whitewater River watershed. Human population, which is greatest in Dearborn County in the Whitewater River watershed, indicates where more infrastructure related pressures on water quality might exist. The subsections on topography and geology, as well as soils, provide information on the natural features that affect hydrology in the Whitewater River watershed. These features interact with land use activities and human population to create pressures on both water quality and quantity in the Whitewater River watershed. Lastly, the subsection on climate and precipitation provides information on water quantity and the factors that influence flow, which ultimately affects the influence of storm water on the watershed. Collectively, this information plays an important role in understanding the sources that contribute to water quality impairment during TMDL development and crafting the linkage analysis that connects the observed water quality impairment to what has caused that impairment.

8.0 SOURCE ASSESSMENT

This section presents information concerning IDEM's segmentation process as it applies to the Whitewater River watershed in order to present a source assessment specific to the Whitewater River watershed as well as summaries of significant sources of *E. coli*, nutrients and sediment for each subwatershed within the Whitewater River watershed.

8.1 Understanding Subwatersheds and Assessment Units

As briefly discussed in Section 2.3, the Whitewater River watershed contains ten 12-digit HUC subwatersheds. Examining subwatersheds enables a closer examination of key factors that affect water quality. The subwatersheds include:

- Headwaters Blue Creek (050800030801)
- Wolf Creek (050800030802)
- Big Cedar Creek (050800030803)
- Little Cedar Creek (050800030804)
- Blackburn Creek (050800030805)
- Johnson Fork (050800030806)
- Headwaters Dry Fork Whitewater River (050800030807)
- Howard Creek (050800030808)
- Lee Creek (050800030809)
- Jameson Creek (050800030810)

Within each 12-digit HUC subwatershed, IDEM has identified several AUIDs, which represent individual stream segments. Through the process of segmenting subwatersheds into AUIDs, IDEM identifies streams reaches and stream networks that are representative for the purposes of assessment. In practice, this process leads to grouping tributary streams into smaller catchment basins of similar hydrology, land use, and other characteristics such that all tributaries within the catchment basin can be expected to have similar potential water quality impacts. Catchment basins, as defined by the aforementioned factors and are typically very small, which significantly reduces the variability in the water quality expected from one stream or stream reach to another. Given this, all tributaries within a catchment basin are assigned a single AUID. Grouping tributary systems into smaller catchment basins also allows for better characterization of the larger watershed and more localized recommendations for implementation activities. Variability within the larger watershed will be accounted for by the differing AUIDs assigned to the different catchment basins.

Table 16 contains the AUIDs in the subwatersheds of the Whitewater River watershed and the associated drainage area. Subsequent sections of the TMDL report organize information by subwatershed (if applicable) and AUID.

Table 62 Assessment Units in Whitewater River Watershed

Name of Subwatershed	Surface Area (sq.miles)	Percent of Total Surface Area	Current AUID 2012	Length (mi)	Drainage Area (sq. miles)
Headwaters Blue Creek (050800030801)	18.31	10.43	ING0381_01	12.50	18.31
			ING0381_02	8.66	
			ING0381_T1001	3.14	
			ING0381_T1002	1.81	
			ING0381_T1003	0.91	
			ING0381_T1004	2.33	
Wolf Creek (050800030802)	14.54	8.29	ING0382_01	5.11	32.85
			ING0382_02	6.83	
			ING0382_T1001	4.19	
			ING0382_T1002	3.76	
			ING0382_T1003	2.23	
			ING0382_T1004	0.54	
			ING0382_T1005	2.25	
			ING0382_T1006	1.65	
			ING0382_T1007	1.01	
			ING0382_T1008	0.60	
			ING0382_T1009	0.87	
Big Cedar Creek (050800030803)	29.61	16.87	ING0383_01	14.02	29.61
			ING0383_02	11.42	
			ING0383_T1001	2.49	
			ING0383_T1002	8.69	
			ING0383_T1003	2.59	
			ING0383_T1004	2.68	
			ING0383_T1005	9.38	
			ING0383_T1006	1.36	
Little Cedar Creek (050800030804)	26.64	15.18	ING0384_01	14.32	1284.04
			ING0384_T1001	9.29	
			ING0384_T1002	3.69	
			ING0384_T1003	24.85	
			ING0384_T1004	11.22	
Blackburn Creek (050800030805)	17.19	9.80	ING0385_01	11.71	1330.85
			ING0385_01A	2.32	
			ING0385_T1001	6.50	
			ING0385_T1002	2.54	
			ING0385_T1003	1.52	
			ING0385_T1004	1.06	
			ING0385_T1005	4.00	
			ING0385_T1006	1.25	
			ING0385_T1007	4.34	

Name of Subwatershed	Surface Area (sq.miles)	Percent of Total Surface Area	Current AUID 2012	Length (mi)	Drainage Area (sq. miles)
			ING0385_T1008	0.74	
			ING0385_T1009	0.99	
			ING0385_T1010	1.24	
Johnson Fork (050800030806)	32.88	18.74	ING0386_01	2.22	1363.73
			ING0386_02	17.65	
			ING0386_T1001	26.20	
			ING0386_T1002	7.99	
			ING0386_T1003	6.13	
			ING0386_T1004	4.79	
			ING0386_T1005	1.67	
			ING0386_T1006	5.04	
			ING0386_T1006A	1.29	
			ING0386_T1007	3.22	
			ING0386_T1008	1.23	
Headwaters Dry Fork Whitewater River (050800030807)	14.01	7.98	ING0387_02	13.85	14.01
			ING0387_03	3.13	
Howard Creek (050800030808)	10.05	5.73	ING0388_01	8.94	10.05
			ING0388_P1001	0.21	
			ING0388_T1005	1.35	
			ING0388_T1006	0.91	
			ING0388_T1007	5.57	
			ING0388_T1008	0.51	
Lee Creek (050800030809)	1.04	0.59	ING0389_01	0.94	1.04
Jameson Creek (050800030810)	11.21	6.39	ING038A_01	2.91	1374.94
			ING038A_01A	0.69	
			ING038A_P1001	0.28	
			ING038A_T1001	3.41	
			ING038A_T1002	13.41	
			ING038A_T1003	3.96	

***Understanding* Table 65:** Land area helps IDEM to define the pollutant load reductions needed for each AUID in each 12-digit HUC subwatershed that comprises the Whitewater River watershed. Information in each column is as follows:

- *Column 1: Name of Subwatershed.* Lists the name of the subwatersheds.
- *Column 2: Surface Area.* Indicates the total surface area for each subwatershed.
- *Column 3: Percent of Total Drainage Area.* Indicates the percent of the total surface area, providing a relative understanding of the portion of each subwatershed in the Whitewater River watershed.

- *Column 4: Current AUID*. Provides the updated AUIDs associated with each subwatershed.
- *Column 5: Length.* Quantifies the length of each AUID stream segment.
- *Column 6: Drainage Area.* Quantifies the area the subwatershed drains.

IDEM bases percent load reductions on the drainage area for each AUID in the 12-digit HUC subwatersheds. The information contained in this table is the foundation for the technical calculations. This table will help watershed stakeholders look at the smaller segments within the Whitewater River watershed and understand the smaller areas contributing to the impaired waterbody, helping to quantify the geographic scale that influences source characterization and areas for implementation.

8.2 Source Assessment by Subwatershed

This section summarizes the available information on significant point and nonpoint sources of *E. coli*, nutrients and TSS in the 10 subwatersheds of the Whitewater River watershed.

The term “point source” refers to any discernible, confined and discrete conveyance, such as a pipe, ditch, channel, tunnel or conduit, by which pollutants are transported to a waterbody. It also includes vessels or other floating craft from which pollutants are or may be discharged. By law, the term “point source” also includes: concentrated animal feeding operations (CAFO) which are places where animals are confined and fed; storm water runoff from Municipal Separate Storm Sewer Systems (MS4s), construction site of one acre or more of land disturbance, and specific categories of industrial activities that convey storm water; and illicitly connected “straight pipe” discharges of household waste. Permitted point sources are regulated through the NPDES.

Nonpoint sources include all other categories not classified as point sources. In urban areas, nonpoint sources can include leaking or faulty septic systems, runoff from lawn fertilizer applications, pet waste, storm water runoff (outside of MS4 communities), and other sources. In rural areas, nonpoint sources can include runoff from cropland, pastures and animal feeding operations and inputs from streambank erosion, leaking or failing septic systems, and wildlife.

8.2.1 Whitewater River Subwatershed Summary

This section of the report presents the available information on the sources of *E.coli*, nutrients and TSS in the Whitewater River subwatersheds. The Whitewater River watershed is located along the Ohio state line. Most of the subwatersheds described in this section drain into the Whitewater River mainstem before entering Ohio. However, there are a few subwatersheds (Headwaters Dry Fork, Howard Creek, Jameson Creek and Lee Creek) that drain into Ohio before entering the Whitewater River. This section addresses only those parts of the subwatersheds located within the State of Indiana.

Table 63 Land Use in the Whitewater River Subwatersheds

Subwatershed	Area	Land Use							Total
		Agriculture	Developed	Forest	Hay/ Pasture	Shrub	Open Water	Wetlands	
Headwaters Blue Creek	Acres	3,623	558	5,818	1,681	23	24	0	11,727
	Sq. Mi.	5	1	9	3	<1	<1	0	18
	Percent	31	5	50	14	<1	<1	0	100
Wolf Creek	Acres	1,615	335	5,891	1,379	56	27	1	9,304
	Sq. Mi.	3	1	9	2	<1	<1	<1	15
	Percent	17	4	63	15	1	<1	<1	100

Big Cedar Creek	Acres	9,620	922	5,114	3,179	101	12	<1	18,948
	Sq. Mi.	15	1	8	5	<1	<1	<1	30
	Percent	50	5	27	17	1	<1	<1	100
Little Cedar Creek	Acres	4,677	1,200	7,658	3,223	121	172	1	17,052
	Sq. Mi.	7	2	12	5	<1	<1	<1	27
	Percent	27	7	45	19	1	1	<1	100
Blackburn Creek	Acres	1,181	770	6,725	2,081	53	188	4	11,002
	Sq. Mi.	2	1	11	3	<1	<1	<1	17
	Percent	11	7	61	19	<1	2	<1	100
Johnson Fork	Acres	1,622	1,577	11,505	6,066	167	109	2	21,048
	Sq. Mi.	3	3	18	9	<1	<1	<1	33
	Percent	8	7	55	29	1	<1	<1	100
Headwaters Dry Fork Whitewater River	Acres	6,406	419	915	1,196	9	5	0	8,950
	Sq. Mi.	10	1	1	2	<1	<1	0	14
	Percent	72	5	10	13	<1	<1	0	100
Howard Creek	Acres	3,786	364	798	1,421	11	20	1	6,401
	Sq. Mi.	6	1	1	2	<1	<1	<1	10
	Percent	59	6	12	22	<1	<1	<1	100
Lee Creek	Acres	312	53	69	227	<1	<1	0	662
	Sq. Mi.	<1	<1	<1	<1	<1	<1	0	1
	Percent	47	8	10	34	<1	<1	0	100
Jameson Creek	Acres	173	533	4,457	1,843	29	68	1	7,104
	Sq. Mi.	<1	1	7	3	<1	<1	<1	11
	Percent	2	8	63	26	<1	1	<1	100

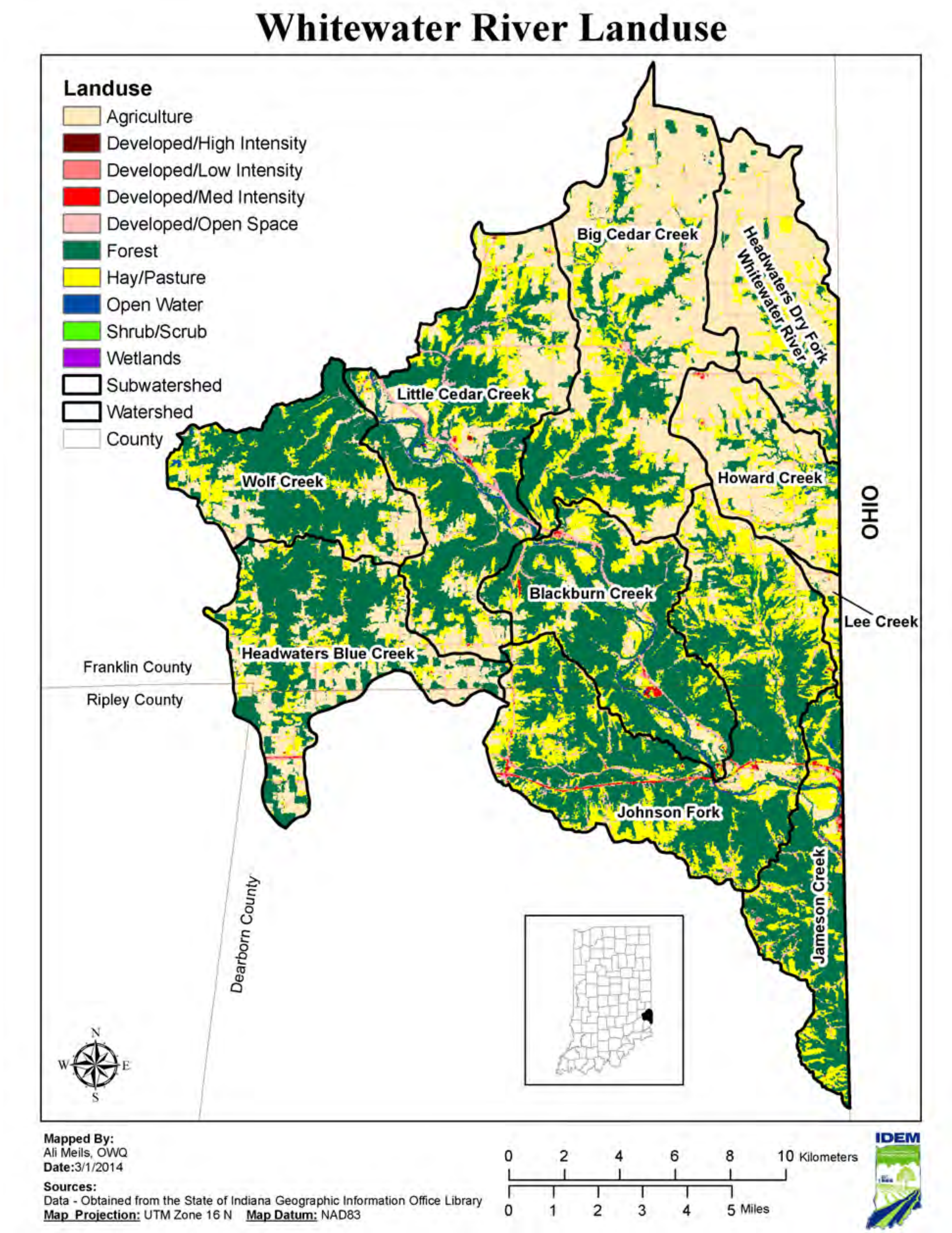


Figure 56 Landuse in the Whitewater River Subwatersheds

Point Sources

The State of Indiana regulates the direct discharge of pollutants to waters of the State through the National Pollutant Discharge Elimination System (NPDES) Permit Program. The permits issued place limits on the amount of pollutants that may be discharged to surface waters by each facility. These limits are set at levels protective of both aquatic life in the waters which receive the discharge and protective of human health. This section summarizes the potential point sources of *E. coli*, nutrients and sediment in the Whitewater River watershed, as regulated through the National Pollutant Discharge Elimination System (NPDES) Program.

Municipal Facilities

A municipal facility, or wastewater treatment plant (WWTP), is designed to remove biological or chemical waste products from water, thereby permitting the treated water to be used for other purposes. Some of the functions of a WWTP include agricultural wastewater treatment, sewage treatment and industrial wastewater treatment. WWTPs are critical for maintaining public sanitation and a healthy environment.

Municipal facilities in Indiana are required to disinfect their effluent during the recreational season (April 1 to October 31). IDEM does not require disinfection for waste-stabilization lagoons as long as *E. coli* limits from the permit are met utilizing the lagoon's retention time. Table 67 contains the maximum design flow for the active facilities.

Treated municipal sewage is a point source of nutrients. WWTPs may release water with elevated concentrations of nutrients into streams. As discussed in Section 2.2, the target value for total phosphorus is 0.30 mg/L and the target value for total nitrogen is 10 mg/L. These target values are used to establish potential permit limits.

Flows used to calculate nutrient loads from each treatment plant are estimated based on current flow data from discharge monitoring reports (DMR) or design flows from the facility permits when actual flow data is not available. Nutrient concentrations used to calculate nutrient loads from each treatment plant are based on known technological limitations of the facilities (literature values for facilities with similar treatment levels). Because the phosphorus loads from these NPDES facilities had to be estimated, it is recommended that effluent monitoring be added to the WWTP permits. Additional in-stream monitoring should also be performed. If the monitoring confirms that the WWTP loads represent a large proportion of low flow loads, this will need to be addressed by IDEM and the individual facilities after the sampling results are available.

The TMDL target value for TSS is set at the WWTP's permit effluent limit for TSS. Therefore, a target of 30 mg/L for total suspended solids TSS has been identified as a permit limit for NPDES facilities.

There are four WWTP dischargers that discharge wastewater within the Whitewater River watershed (Table 67). These facilities are as follows: Big Cedar Mobile Home Park, St. Leon WWTP, Mount Carmel Elementary School and Brookville WWTP. Summaries of the WWTP permits within the Whitewater River watershed are described below.

The Big Cedar Mobile Home Park WWTP is a minor, semi-public Class I extended aeration treatment facility consisting of a flow equalization tank, an aeration tank, a clarifier, and chlorination/dechlorination stations. The collection system is comprised entirely of separate sanitary sewers by design with no overflow or bypass points. A violation letter was issued in 2011 based on the frequency and magnitude of ammonia and total suspended solids violations from 2009 to 2011. The violations were considered instances of significant noncompliance. A formal enforcement action was also initiated in March of 2012 for effluent violations and failure to submit reports. In total, there have been eight informal enforcement actions and one formal enforcement action in the last five years resulting in a penalty of $1,025. The most recent enforcement action was 11/4/2013.

The town of St. Leon operates a minor Class II wastewater treatment plant that was upgraded in 2011. The facility now operates an activated sludge-type wastewater treatment facility consisting of three sequencing batch reactor basins, two aerobic digesters, sludge drying beds, ultraviolet light disinfection facilities, and an effluent flow meter. Final solids are disposed of in a landfill. The collection system is comprised of 100% separate sanitary sewers with no overflows and one bypass point.

The Mount Carmel Elementary School operates a minor semi-public Class I extended aeration treatment facility with flow equalization, aerobic digestion, final clarification, a 24-hour settling tank, ultraviolet light disinfection, post aeration, and an effluent flow meter. Solids are dewatered by settling and drawing off of supernatant and eventually hauled off site. The collection system is comprised of 100% separate sanitary sewers by design with no overflow or bypass points. In August 2014 the school had a mound system put in for sewage disposal. This facility no longer discharges to waters of the state and no longer require an NPDES permit. Facility information for the past five years is included in the table but the facility will not be included in the TMDL wasteload allocation.

The town of Brookville operates a Class II oxidation ditch treatment facility consisting of screening, an oxidation ditch, two final clarifiers, ultraviolet light disinfection, and an effluent flow meter. Sludge handling includes aerobic digestion and drying beds. Sludge is then land applied or hauled offsite. The collection system is comprised of 100% separate sanitary sewers by design with no overflow or bypass points.

Table 64 NPDES Permitted Wastewater Treatment Plants Discharging within the Whitewater River Subwatersheds

Subwatershed	Facility Name	Permit Number	AUID	Receiving Stream	Maximum Design Flow (MGD)
Headwaters Blue Creek	NA	NA	NA	NA	NA
Wolf Creek	NA	NA	NA	NA	NA
Big Cedar Creek	Big Cedar Mobile Home Park WWTP	IN0037168	ING0383_02	Tributary to Big Cedar Creek	0.0108
Little Cedar Creek	NA	NA	NA	NA	NA
Blackburn Creek	St. Leon WWTP	IN0058408	ING0385_01	Whitewater River	0.57
Johnson Fork	NA	NA	NA	NA	NA
Headwaters Dry Fork Whitewater River	NA	NA	NA	NA	NA
Howard Creek	Mount Carmel Elementary School	IN0054534	ING0388_01	Sours Run	0.0038
Lee Creek	NA	NA	NA	NA	NA
Jameson Creek	NA	NA	NA	NA	NA
**	Brookville WWTP	IN0022446	ING037H_01	East Fork Whitewater River	0.702

** Site is located outside the Whitewater River watershed but data will be used to calculate East Fork

Whitewater River pollutant loadings.

Table 65 presents a summary of permit compliance for WWTP NPDES facilities in the Whitewater River watershed for the five year period between 2009 and 2014. It presents the date of the facility's last inspection and findings from the inspection (i.e., compliance or violation for facility maintenance). The table also presents the total number of violations in the five year period for the NPDES permitted parameters. According to Table 68, there have been six NPDES facility inspections resulting in violations in the five year period. Overall, there are a number of permit violations for *E. coli*, TSS, DO, pH, CBOD and ammonia in the Whitewater River watershed.

Table 65 Summary of WWTP Inspections and Permit Compliance in the Whitewater River Subwatersheds for the Five Year Period Ending September 30, 2014

Subwatershed	Facility Name	Permit Number	AUID	Date of Last Inspection and Findings	Violations from 4/2009 through 9/2014				
					Month	Year	Parameter	Type	# Violations
Headwaters Blue Creek	NA	NA	NA	NA	NA				
Wolf Creek	NA	NA	NA	NA	NA				
Big Cedar Creek	Big Cedar Mobile Home Park WWTP	IN0037168	ING0383_02	3/23/2010: Violations observed 3/6/2012: Violations observed 8/5/2013: Violations observed 11/4/2013: Violations observed	Apr	2009	TSS	Max Wk Avg	1
					May	2009	TSS	Max Wk Avg	1
					Nov	2009	TSS	Max Wk Avg	1
					Dec	2009	TSS	Max Wk Avg	1
					Dec	2009	TSS	Month Avg	1
					Jan	2010	TSS	Max Wk Avg	1
					Feb	2010	TSS	Max Wk Avg	1
					Feb	2010	TSS	Month Avg	1
					Mar	2010	TSS	Max Wk Avg	1
					Mar	2010	TSS	Month Avg	1
					Apr	2010	TSS	Max Wk Avg	1
					Apr	2010	Ammonia	Max Wk Avg	1
					Dec	2010	Ammonia	Max Wk Avg	1
					Dec	2010	Ammonia	Month Avg	1
					Jan	2011	TSS	Max Wk Avg	1
					Jan	2011	TSS	Month Avg	1
					Jan	2011	Ammonia	Max Wk Avg	1
					Jan	2011	Ammonia	Month Avg	1
					Feb	2011	TSS	Max Wk Avg	1
					Feb	2011	TSS	Month Avg	1
					Feb	2011	Ammonia	Max Wk Avg	1
					Feb	2011	Ammonia	Month Avg	1
					Mar	2011	TSS	Max Wk Avg	1
					Mar	2011	TSS	Month Avg	1
					Mar	2011	CBOD	Max Wk Avg	1
					May	2011	Ammonia	Max Wk Avg	1
					Jun	2011	TSS	Max Wk Avg	1
					Jun	2011	TSS	Month Avg	1
					Jun	2011	Ammonia	Max Wk Avg	1
					Jun	2011	Ammonia	Month Avg	1
					Jul	2011	Ammonia	Max Wk Avg	1
					Jul	2011	Ammonia	Month Avg	1
					Oct	2011	Ammonia	Max Wk Avg	1
					Oct	2011	TSS	Max Wk Avg	1

					Oct	2011	TSS	Month Avg	1
					Feb	2012	TSS	Month Avg	1
					Feb	2012	TSS	Max Wk Avg	1
					Feb	2012	CBOD	Month Avg	1
					Feb	2012	CBOD	Max Wk Avg	1
					Mar	2012	CBOD	Max Wk Avg	1
					May	2012	Chlorine	Max Wk Avg	1
					May	2012	Chlorine	Month Avg	1
					Jun	2012	Chlorine	Max Wk Avg	1
					Jul	2012	Chlorine	Max Wk Avg	1
					Aug	2012	Chlorine	Max Wk Avg	1
					Aug	2012	Chlorine	Month Avg	1
					Sep	2012	Chlorine	Max Wk Avg	1
					Oct	2012	DO	Daily Min	1
					Jun	2012	TSS	Max Wk Avg	1
					Dec	2012	TSS	Month Avg	1
					Dec	2012	CBOD	Max Wk Avg	1
					Dec	2012	CBOD	Month Avg	1
					Dec	2012	TSS	Max Wk Avg	1
					Feb	2013	TSS	Max Wk Avg	1
					Mar	2013	TSS	Max Wk Avg	1
					Apr	2013	DO	Daily Min	1
					Apr	2013	Chlorine	Max Wk Avg	1
					May	2013	DO	Daily Min	1
					May	2013	Chlorine	Max Wk Avg	1
					Jun	2013	TSS	Max Wk Avg	1
					Jul	2013	*E. coli*	Daily Max	1
					Jul	2013	Chlorine	Max Wk Avg	1
					Jul	2013	Chlorine	Month Avg	1
					Aug	2013	Chlorine	Max Wk Avg	1
					Aug	2013	Chlorine	Month Avg	1
					Aug	2013	CBOD	Max Wk Avg	1
					Aug	2013	TSS	Month Avg	1
					Aug	2013	TSS	Max Wk Avg	1
					Sep	2013	TSS	Max Wk Avg	1
					Sep	2013	*E. coli*	Monthly Geo	1
					Oct	2013	TSS	Month Avg	1
					Oct	2013	TSS	Month Avg	1
					Nov	2013	TSS	Max Wk Avg	1
					Dec	2013	TSS	Month Avg	1
					Dec	2013	TSS	Max Wk Avg	1
					Jan	2014	TSS	Month Avg	1
					Jan	2014	DO	Daily Min	1
Little Cedar	NA	NA	NA	NA	NA				

Creek									
Blackburn Creek	St. Leon WWTP	IN0058408	ING0385_01	6/29/2009: Potential problems observed 7/5/2011: No violations observed 1/4/2012: No violations observed 7/30/2013: Potential problems observed 2/24/2014: Potential problems observed	Feb	2010	Ammonia	Monthly Avg	1
Johnson Fork	NA	NA	NA	NA	NA				
Headwaters Dry Fork Whitewater River	NA	NA	NA	NA	NA				
Howard Creek	Mount Carmel Elementary School	IN0054534	ING0388_01	4/15/2009: Potential problems observed 9/14/2010: No violations observed 11/17/2011: No violations observed 10/4/2013: Violations observed 8/14/2014: No violations observed	Apr	2009	pH	Daily Min	1
					Apr	2009	pH	Daily Min	1
					Nov	2009	pH	Daily Min	1
					Dec	2009	TSS	Max Wk Avg	1
					Dec	2009	CBOD	Monthly Avg	1
					Dec	2009	Ammonia	Max Wk Avg	1
					Dec	2009	Ammonia	Monthly Avg	1
					Jan	2010	TSS	Monthly Avg	1
					Feb	2010	TSS	Monthly Avg	1
					Mar	2010	Ammonia	Max Wk Avg	1
					Mar	2010	Ammonia	Max Wk Avg	1
					Mar	2010	Ammonia	Monthly Avg	1
					Oct	2011	Ammonia	Monthly Avg	1
					Dec	2012	Ammonia	Max Wk Avg	1
					Jan	2013	Ammonia	Max Wk Avg	1
					Jan	2013	Ammonia	Monthly Avg	1
					Nov	2013	Ammonia	Max Wk Avg	1
					Feb	2014	Ammonia	Max Wk Avg	1
					Feb	2014	Ammonia	Monthly Avg	1
Lee Creek	NA	NA	NA	NA	NA				
Jameson Creek	NA	NA	NA	NA	NA				
**	Brookville WWTP	IN0022446	ING037H_01	12/28/2009: Potential problems observed 7/18/2011: No violations observed	None				

				6/11/2012: No violations observed 2/26/2013: No violations observed 1/29/2014: Violations observed	

Industrial Facilities

Industrial facilities with NPDES permits produce wastewater generated through producing a product. Wastewater discharges from industrial sources may contain pollutants at levels that could affect the quality of receiving waters. The NPDES permit program establishes specific requirements for dischargers from industrial sources. If the industrial facility discharges wastewater directly to a surface water then it requires an individual or general NPDES permit. A general permit, or permit-by-rule, is a "one size fits all" type of activity-specific permit. The general permit rule (327 IAC 15-1 through 15-4) covers the following activities: coal mining, coal processing, and reclamation activities, noncontact cooling water, petroleum products terminals, groundwater petroleum remediation systems, hydrostatic testing of commercial pipelines, and sand, gravel and stone operations. In contrast, individual permits are tailored to the specific activities of the facility and may regulate a number of additional pollutants other than those described under the general permits.

There are a total of two industrial facilities with NPDES permits within the Whitewater River watershed (Table 69). Based on the industrial activities and the regulated parameters within the specific permits there are only two active industrial facilities that discharge wastewater within the Whitewater River watershed (Table 69). These facilities are as follows: Sperry and Rice Manufacturing Company and Elrod Water Company. Summaries of the industrial permits within the Whitewater River watershed are described below.

Table 69 NPDES Permitted Industrial Facilities in the Whitewater River Subwatersheds

Subwatershed	Facility Name	Permit Number	AUID	Receiving Stream	Maximum Design Flow (MGD)
Headwaters Blue Creek Wolf Creek	NA	NA	NA	NA	NA
	NA	NA	NA	NA	NA
Wolf Creek	NA	NA	NA	NA	NA
Big Cedar Creek	NA	NA	NA	NA	NA
Little Cedar Creek	Sperry and Rice Mfg. Co.	IN0001473	ING0384_T1003	Tributary to Richland Creek	0.15
	Elrod Water Co.	IN0058947	ING0384_01	Tributary to Whitewater River	0.068
Blackburn Creek	NA	NA	NA	NA	NA
Johnson Fork	NA	NA	NA	NA	NA
Headwaters Dry Fork Whitewater River	NA	NA	NA	NA	NA
Howard Creek	NA	NA	NA	NA	NA
Lee Creek	NA	NA	NA	NA	NA
Jameson Creek	NA	NA	NA	NA	NA

Elrod Water Company is a Class A-SO industrial wastewater treatment plant which discharges filter backwash wastewater from one outfall. Groundwater is the source of the permitted facility's drinking water supply. The wastewater regulated by the permit consists of filter backwash, which may contain total residual chlorine. The filter backwash wastewater is stored and settled in a lagoon prior to discharging to a tributary of Whitewater River. Discharge occurs every 35-40 days.

Sperry and Rice Manufacturing Company is a rubber and sponge rubber manufacturing company. The facility is authorized to discharge from a single outfall and the effluent is limited to process, non-contact cooling, boiler blowdown, storm water and sanitary wastewaters. The facility has been in noncompliance status seven out of the last twelve quarters and has had nine informal enforcement actions in the last five years.

Table 70 presents a summary of permit compliance for industrial NPDES facilities in the Whitewater River watershed for the five year period between 2009 and 2014. It presents the date of the facility's last inspection and findings from the inspection (i.e., compliance or violation for facility maintenance). The table also presents the total number of violations in the five year period for NPDES permitted parameters. According to Table 70, there have been seven NPDES industrial facility inspections resulting in violations in the five year period. Overall, there have been a total of two DO violations and one TSS permit violations in the Whitewater River watershed.

Table 66 Summary of Inspections and Permit Compliance for Industrial Facilities in the Whitewater River Subwatersheds for the Five Year Period Ending September 30, 2014

Subwatershed	Facility Name	Permit Number	AUID	Date of Last Inspection and Findings	Violations from 4/2009 through 9/2014				
					Month	Year	Parameter	Type	# Violations
Headwaters Blue Creek Wolf Creek	NA	NA	NA	NA	NA				
Wolf Creek	NA	NA	NA	NA	NA				
Big Cedar Creek	NA	NA	NA	NA	NA				
Little Cedar Creek	Sperry and Rice Mfg. Co.	IN0001473	ING0384_01	8/29/2009: Violations observed 6/28/2010: Violations observed 11/9/2010: Violations observed 2/8/2012: Violations observed 9/25/2012: Violations observed 1/2/2013: Violations observed 9/19/2014: Violations observed	Aug Sep	2012 2012	DO DO	Daily Min Daily Min	1 1
	Elrod Water Co.	IN0058947	ING0384_01	9/16/2009: No violations observed 1/11/2013: Potential problems observed 2/20/2014: Potential problems observed	Apr	2014	TSS	Monthly Avg	1
Blackburn Creek	NA	NA	NA	NA	NA				
Johnson Fork	NA	NA	NA	NA	NA				

Headwaters Dry Fork Whitewater River	NA	NA	NA	NA	NA
Lee Creek	NA	NA	NA	NA	NA
Jameson Creek	NA	NA	NA	NA	NA
Howard Creek	NA	NA	NA	NA	NA
Lee Creek	NA	NA	NA	NA	NA
Jameson Creek	NA	NA	NA	NA	NA

Industrial Storm Water

Depending on the type of industrial facility operated more than one NPDES program may apply. Some industrial facilities require an additional permit under the storm water program which will be discussed in this section.

Industrial storm water permits are required for facilities where activities of the industrial operation are exposed to storm water and run-off is discharged though a point source to waters of the state. The general permit 327 IAC 15-6 (Rule 6) applies to specific categories of industrial activities that must obtain permit coverage. Determination of applicable industrial activities is based on a facility's Standard Industrial Classification (SIC) Code(s) or facility activities included in the listed narrative descriptions within the rule. Under certain circumstances, a facility may require an individual storm water permit. This permit is typically required only if a regulated industrial activity category has established effluent limitations or IDEM determines the storm water discharge will significantly lower water quality. Industrial storm water permits in the Whitewater River watershed are shown in Figure 57.

The facility must develop and implement a Storm Water Pollution Prevention Plan (SWP3), and submit a completed SWP3 Checklist Form certifying to IDEM that such a plan is in place. The SWP3 is used to identify potential and actual storm water pollutant sources, and to determine best management practices and measures that will minimize the pollutants transported in storm water run-off. The SWP3 itself must be retained at the facility, and made available for review during any on-site inspection. Periodically, the plan must be reviewed, and revised if changes at the facility alter conditions that could affect run-off.

Table 67 NPDES Industrial Storm Water Permits within the Whitewater River Subwatersheds

Subwatershed	Facility Name	Permit Number	AUID	Receiving Stream	Area (Sq. Mi.)
Headwaters Blue Creek	NA	NA	NA	NA	NA
Wolf Creek	NA	NA	NA	NA	NA
Big Cedar Creek	NA	NA	NA	NA	NA
Little Cedar Creek	Owens Corning Whites Off Site Storage Facility	INR700036	ING0384_T1001	Little Cedar Creek	0.022
Blackburn Creek	Rudicil Sand & Gravel	INR00R073	ING0385_01	Whitewater River	0.126
Johnson Fork	NA	NA	NA	NA	NA
Headwaters Dry Fork Whitewater River	NA	NA	NA	NA	NA
Howard Creek	NA	NA	NA	NA	NA
Lee Creek	NA	NA	NA	NA	NA
Jameson Creek	Wagner Auto Parts	INR00W108	ING038A_01	Whitewater River	0.0004

Construction Storm Water

Storm water run-off associated with construction activity is regulated under 327 IAC 15-5 which is commonly known as Rule 5. Rule 5 is a performance-based regulation designed to reduce pollutants that are associated with construction and/or land disturbing activities.

The requirements of Rule 5 now apply to all persons who are involved in construction activity (which includes clearing, grading, excavation and other land disturbing activities) that results in the disturbance of one (1) acre or more of total land area. If the land disturbing activity results in the disturbance of less than one (1) acre of total land area, but is part of a larger common plan of development or sale, the project is still subject to storm water permitting.

In Indiana most construction projects subject to Rule 5 are administered through a general permit. A general permit is a permit by rule, and as such it is not "issued" in the same manner as an individual NPDES permit would be issued. Rather, Rule 5 was "conditionally issued" to all future "project site owners" at the time that the rule was adopted by the Indiana Water Pollution Control Board. The permit conditions within Rule 5 apply universally to all "project site owners" who are eligible to operate under the rule.

Rule 5 requires the development of a Construction Plan and an integral part of the Construction Plan is a SWP3. The SWP3 addresses several issues. First, the plan outlines how erosion and sedimentation will be controlled on the project site to minimize the discharge of sediment off-site or to a water of the state. Second, the plan addresses other pollutants that may be associated with construction activity. This can include disposal of building materials, management of fueling operations, etc. Finally, the plan should also address pollutants that will be associated with the post construction land use. It is the responsibility of the project site owner to implement the storm water pollution prevention plan. In addition, it is critical that the site is monitored during the construction process and in field modifications are made to address the discharge of sediment and other pollutants from the project site. This may require modification of the plan and field changes on the project site, as necessary, to prevent pollutants, including sediment, from leaving the project site.

If an adverse environmental impact from a project site is evident, a Rule 5 permit or, in more significant situations, an individual storm water permit may be required. An individual storm water permit is typically required only if IDEM determines the discharge will significantly lower water quality. If an individual storm water permit is required, notice will be given to the project site owner. The acreage numbers in Table 72 were calculated by using an area weighted approach with using the past five years of permitted construction sites in Franklin, Ripley and Dearborn counties

Table 68 Permitted Construction Acreage in the Whitewater River Subwatersheds

Subwatershed	Estimated Construction Acreage
Headwaters Blue Creek	1.98
Wolf Creek	0.79
Big Cedar Creek	1.60
Little Cedar Creek	1.44
Blackburn Creek	1.91

Johnson Fork	6.93
Headwaters Dry Fork Whitewater River	0.76
Howard Creek	0.54
Lee Creek	0.05
Jameson Creek	3.42

Regulated Storm Water Sources – Municipal Separate Storm Sewer Systems (MS4s)

327 IAC 15-13 regulates Municipal Separate Storm Sewer Systems (MS4s). 327 IAC 15-13 (Rule 13) (Scroll to the bottom of Page 74 to access the Rule) is a storm water general permit rule. MS4s are defined as a conveyance or system of conveyances owned by a state, city, town, or other public entity that discharges to waters of the United States and is designed or used for collecting or conveying storm water. Regulated conveyance systems include roads with drains, municipal streets, catch basins, curbs, gutters, storm drains, piping, channels, ditches, tunnels and conduits. It does not include combined sewer overflows and publicly owned treatment works.

The federal Clean Water Act requires storm water discharges from certain types of urbanized areas to be permitted under the National Pollutant Discharge Elimination System (NPDES) program. In 1990, Phase I of these requirements became effective, and municipalities with a population served by a municipal separate storm sewer system (MS4) of 100,000, or more, were regulated. Under Phase I federal storm water regulations, regulated MS4 entities were required to obtain individual permits. In 1999, Phase II became effective, and any entity responsible for an MS4 conveyance, regardless of population size, could potentially be regulated. IDEM foresees that the vast majority, if not all, of the Phase II MS4 entities in Indiana will be covered under general permits. A general permit is a single permit that is written to cover multiple permittees with similar characteristics. No written draft permit is issued to the permittee under a general permit. Under 327 IAC 15-2-9(b), an individual NPDES permit is required when water quality standards are not being met under the general permit, technology or regulatory change has occurred that causes the implementation of specific controls or limitations not expressed in the general permit, or a general permit is no longer appropriate based on permittee changes. If any of these situations occur, MS4 entities covered under this general permit rule may be required to terminate coverage, and apply for an individual MS4 permit.

MS4 conveyances within urbanized areas have one of the greatest potentials for polluted storm water runoff. The Federal Register Final Rule explains the reason as: "urbanization alters the natural infiltration capacity of the land and generates...pollutants...causing an increase in storm water runoff volumes and pollutant loadings." Based on increased population and proportionally higher pollutant sources, urbanization results "in a greater concentration of pollutants that can be mobilized by, or disposed into, storm water discharges." MS4s can be significant sources of *E. coli*, nutrients, and sediment because they transport urban runoff that can be affected by pet waste, illicit sewer connections, failing septic systems, fertilizer, construction, and streambank erosion from hydrologic modifications.

There are two MS4 entities in the Whitewater River Watershed as shown in Table 73 and Figure 57. The City of Cincinnati is the co-permittee located within the watershed that is covered under the Hamilton County MS4 permit. Both of the MS4s located in the Whitewater River watershed are regulated by Ohio EPA.

Table 69 Whitewater River Watershed MS4 Communities

Subwatershed	MS4 Facility Permit ID	MS4 Name	Total Area (Sq. Mi)	Developed Area (Sq. Mi.)
Headwaters Blue Creek	NA	NA	NA	NA
Wolf Creek	NA	NA	NA	NA
Big Cedar Creek	NA	NA	NA	NA
Little Cedar Creek	NA	NA	NA	NA
Blackburn Creek	NA	NA	NA	NA
Johnson Fork	1GQ00046*BG	Hamilton County and 37 co-permittees	0.1234	0.0771
Jameson Creek	1GQ00034*BG	City of Harrison	0.2060	0.1546
	1GQ00046*BG	Hamilton County and 37 co-permittees	0.1196	0.0606
Headwaters Dry Fork Salt Creek	NA	NA	NA	NA
Howard Creek	NA	NA	NA	NA

Municipal boundaries and MS4 boundaries are not always the same, but are often used to delineate the regulated MS4 area if a system map is not readily available. Figure 57 shows the MS4 boundaries in the Whitewater River subwatersheds.

Illicitly Connected "Straight Pipe" Systems

Some household wastes within Indiana and potentially within the Whitewater River watershed directly discharge to a stream or are illegally connected directly to tile-drainage pipes in rural areas, providing a direct source of pollutants such as *E. coli*, nutrients, and sediments to the stream (these systems are sometimes referred to as "straight pipe" discharges). Dearborn County Health Department is the primary regulatory agency for onsite systems in the county. Information from the health department's sanitarian estimated the septic system failure rate at 50 percent throughout the county and identified several problem clusters in the Southern Whitewater River watershed. The following clusters were identified: Longnecker Road (Bonnie Lane and Herberts Lane, ~40 houses), Old U.S. 52 (~30 houses, ~12 businesses), Pinhook Road (~20 houses), and the Town of West Harrison (not on State Street, ~40 houses).

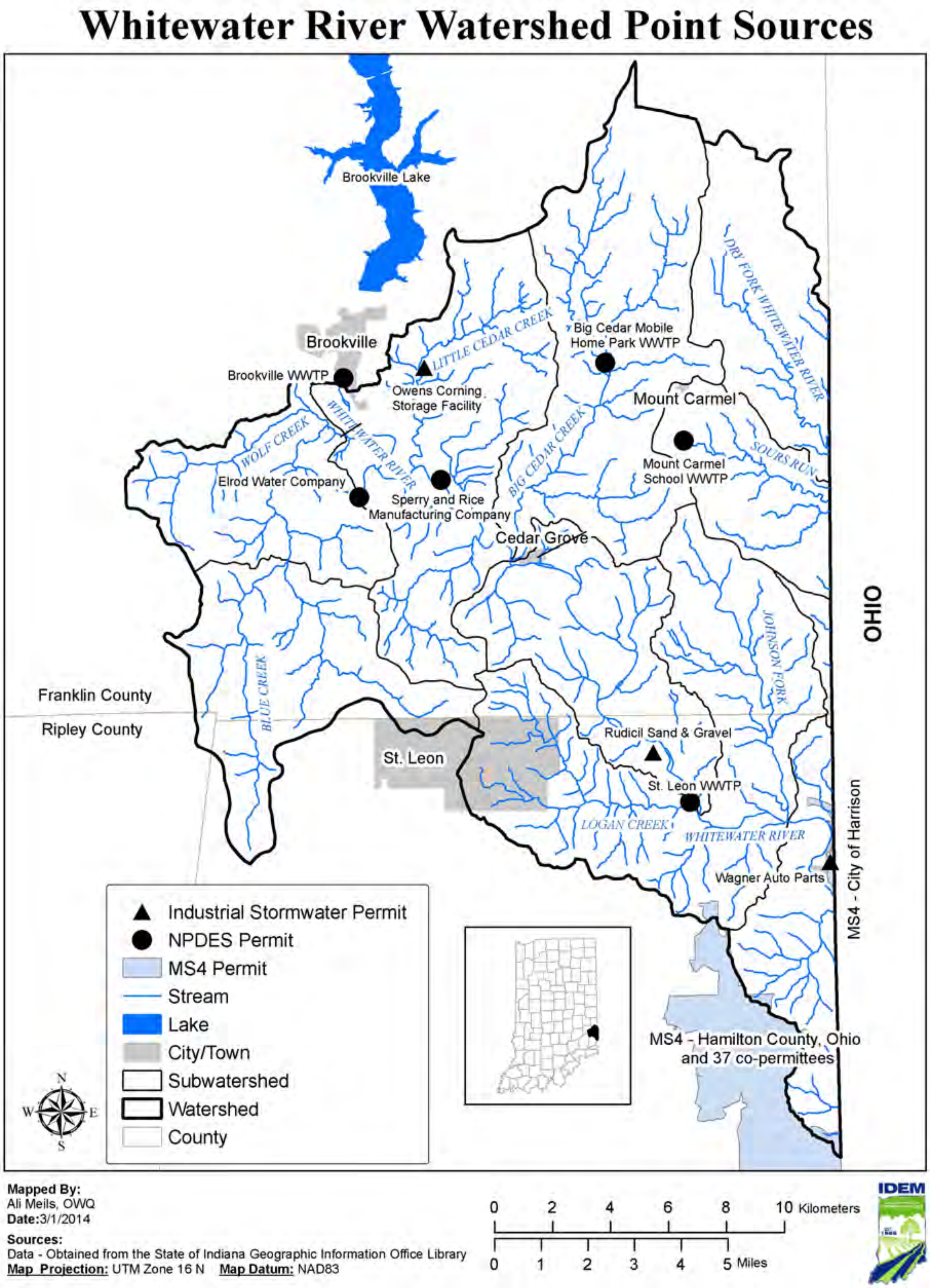


Figure 57 Point Sources in the Whitewater River Subwatersheds

Nonpoint Sources

This section summarizes the potential nonpoint sources of *E. coli*, nutrients and sediment in the Whitewater River watershed that are not regulated through the National Pollutant Discharge Elimination System (NPDES) Program.

Cropland

Croplands can be a source of *E. coli*, sediments, and nutrients. Accumulation of nutrients and *E. coli* on cropland occurs from decomposition of residual crop material, fertilization with chemical (e.g., anyhdrous ammonia) and manure fertilizers, inorganic fertilizers, wildlife excreta, irrigation water, and application of waste products from municipal and industrial wastewater treatment facilities. The majority of nutrient loading from cropland occurs from fertilization with commercial and manure fertilizers (USEPA, 2003). Use of manure for nitrogen supplementation often results in excessive phosphorus loads relative to crop requirements (USEPA, 2003).

Watershed specific data are not available for field specific crops. However, county-wide data available from the National Agricultural Statistic Service (NASS) were downloaded and area weighted to estimate crop acreage in the subwatersheds. The area of the county within the subwatersheds is divided by the area of the entire county and multiplied by the total acreage of crops in the county based on the NASS survey. This is done for each county in the subwatersheds and summed to get an area weighted estimate of cropland with the watershed. The 2012 NASS statistics were used in the analysis as shown in Table 74.

Table 70 Major Cash Crop Acreage in the Whitewater River watershed

Crop	Total Acreage in County		
	Dearborn	Franklin	Ripley
Corn	9,300	39,600	48,400
Soybean	9,600	35,800	55,600
Winter Wheat	0	1,800	0

Subwatershed Area (mi²)	Crop	Total Acreage	Percentage of Subwatershed Crop Acreage
Headwaters Blue Creek (18.32 mi²)	Corn	1,601	51
	Soybean	1,470	47
	Winter Wheat	66	2
	Total	**3,137**	**100**
Wolf Creek (14.54 mi²)	Corn	1,472	51
	Soybean	1,331	46
	Winter Wheat	67	3
	Total	**2,870**	**100**
Big Cedar Creek (29.61 mi²)	Corn	2,997	51
	Soybean	2,710	46
	Winter Wheat	136	3

	Total	**5,843**	**100**
Little Cedar Creek (26.64 mi²)	Corn	2,697	51
	Soybean	2,438	46
	Winter Wheat	123	3
	Total	**5,258**	**100**
Blackburn Creek (17.19 mi²)	Corn	1,467	51
	Soybean	1,341	47
	Winter Wheat	61	2
	Total	**2,869**	**100**
Johnson Fork (32.88 mi²)	Corn	1,877	51
	Soybean	1,776	48
	Winter Wheat	57	1
	Total	**3,710**	**100**
Headwaters Dry Fork Whitewater River (14.01 mi²)	Corn	1,418	51
	Soybean	1,282	46
	Winter Wheat	64	3
	Total	**2,765**	**100**
Howard Creek (10.05 mi²)	Corn	1,017	51
	Soybean	920	46
	Winter Wheat	46	3
	Total	**1,983**	**100**
Lee Creek (1.04 mi²)	Corn	102	51
	Soybean	93	47
	Winter Wheat	5	2
	Total	**200**	**100**
Jameson Creek (11.21 mi²)	Corn	339	49
	Soybean	350	51
	Winter Wheat	0	0
	Total	**689**	**100**

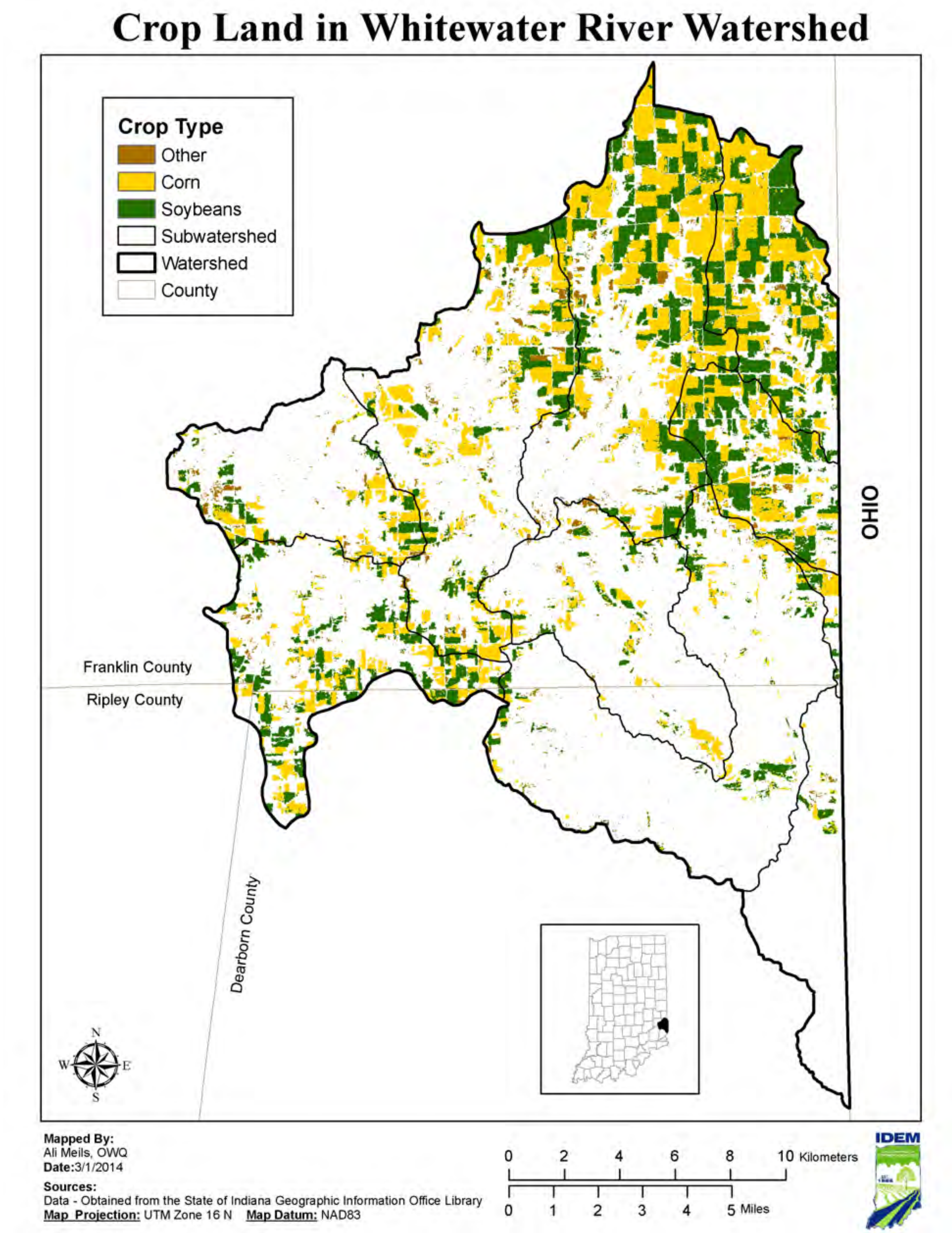


Figure 58 Crop Land in the Whitewater River Subwatersheds

Pastures and Livestock Operations

Runoff from pastures and livestock operations can be potential agricultural sources of *E. coli*, nutrients, and sediment. For example, animals grazing in pasturelands deposit manure directly upon the land surface and, even though a pasture may be relatively large and animal densities low, the manure will often be concentrated near the feeding and watering areas in the field. These areas can quickly become barren of plant cover, increasing the possibility of erosion and contaminated runoff during a storm event.

Livestock are potential source of *E. coli*, nutrients, and streambank erosion in streams, particularly when direct access is not restricted and/or where feeding structures are located adjacent to riparian areas. Watershed specific data are not available for livestock populations. However, county-wide data available from the National Agricultural Statistic Service were downloaded and area weighted to estimate animal population in the subwatersheds. The area of the county within the subwatersheds is divided by the area of the entire county and multiplied by the total number of animals in the county based on the 2007 NASS survey. This is done for each county in the subwatersheds and summed to get an area weighted estimate of animals with the subwatersheds. There are an estimated 9,420 animal units in the Whitewater River watershed and the animal unit density is 54 animal units per square mile as shown in Table 46.

Table 71 Animal Unit Density in the Whitewater River Subwatersheds

	Hogs and Pigs	**Cattle and Calves**	**Sheep and Goats**	**Horses and Ponies**	**Poultry**
Number of Animals in One Animal Unit	2.5	1	10	0.5	250
Total Number of Head in County					
Dearborn	342	7,133	619	568	777
Franklin	19,941	12,323	842	581	1,015
Ripley	32,591	9,474	1,268	593	915

Total Number of Animal Units in Subwatersheds							
Subwatershed	Hogs and Pigs	Cattle and Calves	Sheep and Goats	Horses and Ponies	Poultry	**Total**	**Animal Unit Density (animal units/mi²)**
Headwaters Blue Creek	891*	560	4	57	0	1512	83
Wolf Creek	352*	458	3	43	0	856	59
Big Cedar Creek	604	933	6	88	0	1,631	55
Little Cedar Creek	719*	839	6	79	0	1,643	62
Blackburn Creek	274	510	4	54	0	841	49
Johnson Fork	262	866	7	113	0	1,248	38
Headwaters Dry Fork Whitewater River	286	441	3	42	0	772	55
Howard Creek	205	317	2	30	0	554	55
Lee Creek	20	32	0	3	0	55	53
Jameson Creek	5	260	2	41	0	308	27

*Numbers adjusted based on known CFO farms in the subwatershed.

Confined Feeding Operations (CFOs)

A CFO is an agricultural operation where animals are kept and raised in confined situations. It is a lot or facility (other than an aquatic animal production facility) where the following conditions are met:

- Animals have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and
- Crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.
- The number of animal present meets the requirements for the state permitting action.

Confined feeding operations that are not classified as CAFOs are known as confined feeding operations (CFOs) in Indiana. Non-CAFO animal feeding operations are considered nonpoint sources by USEPA. CAFOs have federal permits and fall under the jurisdiction of the NPDES program, as described in Section 6.2.1.1. Indiana's CFOs have state-issued permits but are not under the jurisdiction of the federal NPDES program and are therefore categorized as nonpoint sources for the purposes of this TMDL. CFO permits are "no discharge" permits. Therefore it is prohibited for these facilities to discharge to any water of the State.

The CFO regulations (327 IAC 19, 327 IAC 15-16) require that operations "not cause or contribute to an impairment of surface waters of the state". IDEM regulates these confined feeding operations under IC 13-18-10, the Confined Feeding Control Law. The rules at 327 IAC 19, which implement the statute regulating confined feeding operations, were effective on July 1, 2012. The rule at 327 IAC 15-16, which regulates concentrated animal feeding operations and incorporates by reference the federal NPDES CAFO regulations, became effective on July 1, 2012.

Like CAFOs, the animals raised in CFOs 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. CFOs, however, can also be potential sources of TSS, total nitrogen, total phosphorus, and *E. coli* due to 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 or improper application can adversely impact soil productivity.

There are eight CFOs in the Whitewater River watershed as shown in Table 76 and Figure 59.

Table 72 CFOs in the Whitewater River Subwatersheds

Subwatershed	Operation Name	Farm ID	AUID	Animal Type and Number
Headwaters Blue Creek	Harold and Steve Wendel	4063	ING0381_02	650 Nursery Pigs 1950 Finishers 278 Sows
Wolf Creek	Greg Kunkel	4956	ING0382_T1001	880 Finishers
Big Cedar Creek	NA	NA	NA	NA
Little Cedar Creek	Virgil Kunkel	3962	ING0384_T1004	900 Nursery Pigs 1300 Finishers 497 Sows
Blackburn Creek	Victor Frey	3168	ING0385_T1005	480 Nursery Pigs 480 Finishers 84 Sows
Johnson Fork	NA	NA	NA	NA
Headwaters Dry Fork Whitewater River	NA	NA	NA	NA
Howard Creek	NA	NA	NA	NA
Lee Creek	NA	NA	NA	NA
Jameson Creek	NA	NA	NA	NA

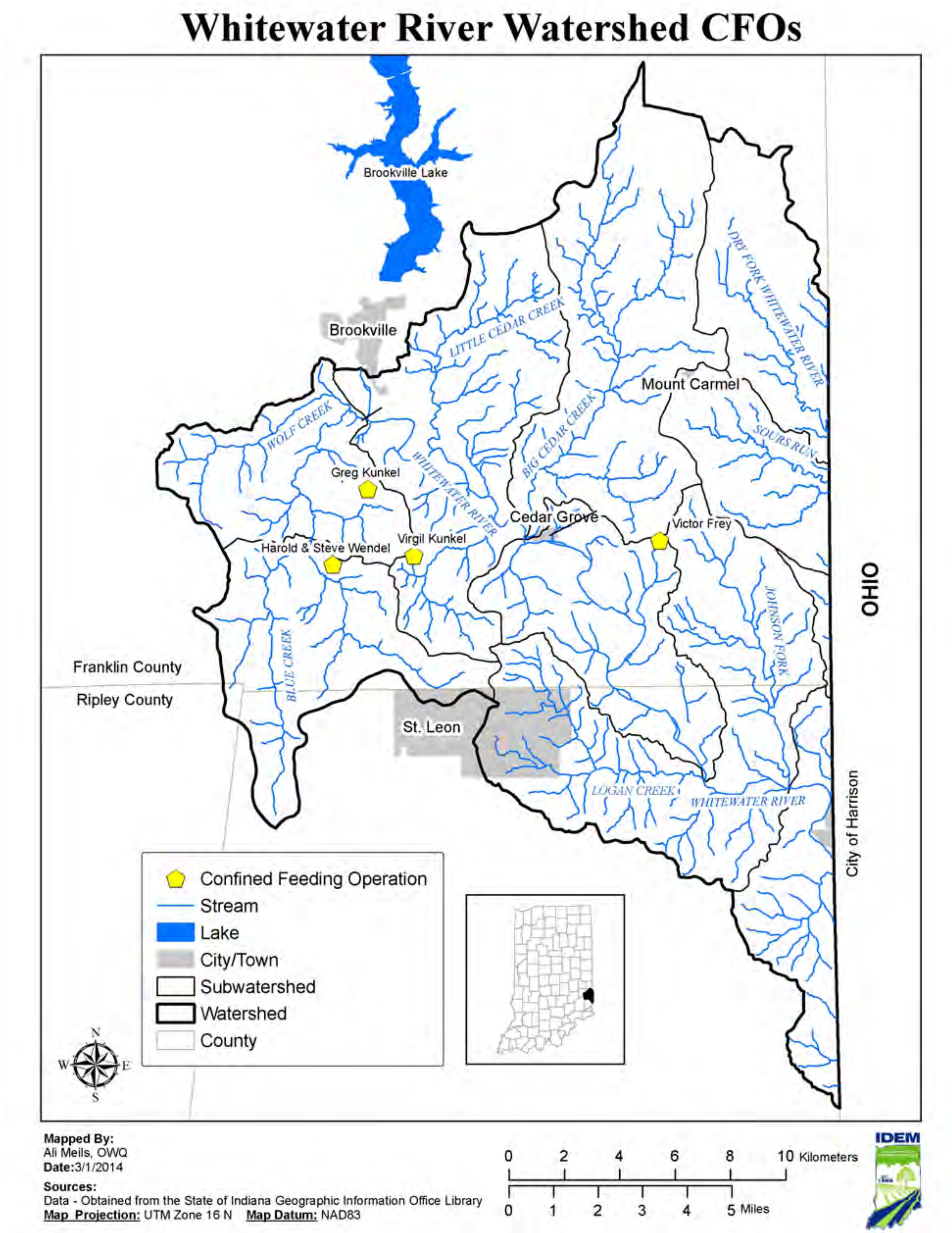


Figure 59 Confined Feeding Operations in the Whitewater River Subwatersheds

Streambank Erosion

Streambank erosion is potentially a significant source of TSS in the Whitewater River watershed. Streambank erosion is a natural process but can be accelerated due to a variety of human activities:

- Vegetation located adjacent to streams flowing through crop or pasture fields is often removed to promote drainage or cattle access to water. The loss of vegetation makes the streambanks more susceptible to erosion due to the loss of plant roots.
- Extensive areas of agricultural tiles promote much quicker delivery of rainfall into streams than would occur without subsurface drainage, which could potentially contribute to streambank erosion due to high velocities and shear stress.
- The creation of impervious surfaces (e.g., streets, rooftops, driveways, parking lots) can also lead to rapid runoff of rainfall and higher stream velocities that might cause streambank erosion.

Onsite Wastewater Treatment Systems

Onsite wastewater treatment systems (e.g., septic systems) that are properly designed and maintained should not serve as a source of contamination to surface waters. However, onsite systems do fail for a variety of reasons. Common soil-type limitations which contribute to failure are: seasonal water tables, compact glacial till, bedrock, coarse sand and gravel outwash and fragipan. When these septic systems fail hydraulically (surface breakouts) or hydrogeologically (inadequate soil filtration) there can be adverse effects to surface waters due to *E. coli,* nitrate + nitrite, and total phosphorus (Horsely and Witten, 1996). Septic systems contain all the water discharged from homes and business and can be significant sources of pathogens and nutrients.

The sanitarian at the Dearborn County Health Department estimated the septic system failure rate at about 50 percent throughout the county. Several of the problem clusters were identified in the Dearborn County WQMP which was updated in 2009, and those finding will be discussed in the site assessment portion of the document.

The Indiana State Department of Health (ISDH) regulates (410 IAC 6-8.3) through the local health departments the residential onsite sewage disposal program. Onsite sewage disposal systems (i.e., septic systems) are those, which do not result in an off-lot discharge of treated effluent, typically consisting of a septic tank to settle out and digest sewage solids, followed by a system of perforated piping to distribute the treated wastewater for absorption into the soil. More than 800,000 onsite sewage disposal systems are currently used in Indiana. Local health departments issue more than 15,000 permits per year for new systems, and about 6,000 permits for repairs.

410 IAC 6-8.3-52 General sewage disposal requirements

Sec. 52. (a) No person shall throw, run, drain, seep, or otherwise dispose into any of the surface waters or ground waters of this state, or cause, permit, or suffer to be thrown, run, drained, allowed to seep, or otherwise disposed into such waters, any organic or inorganic matter from a dwelling or residential onsite sewage system that would cause or contribute to a health hazard or water pollution.
(b) The: (1) design; (2) construction; (3) installation; (4) location; (5) maintenance; and (6) operation; of residential onsite sewage systems shall comply with the provisions of this rule.

410 IAC 6-8.3-55 Violations; permit denial and revocation

Sec. 55. (a) Should a residential onsite sewage system fail, the failure shall be corrected by the owner within the time limit set by the health officer. (b) If any component of a residential onsite sewage system is found to be: (1) defective; (2) malfunctioning; or (3) in need of service; the health officer may require the repair, replacement, or service of that component. The repair, replacement, or service shall be conducted within the time limit set by the health officer. (c) Any person found to be violating this rule may be served by the health officer with a written order stating the nature of the violation and providing a time limit for satisfactory correction thereof.

A comprehensive database of septic systems within the Whitewater River watershed is not available; therefore, the rural population of each subwatershed was calculated to obtain a general representation of the number of systems. The US Census provides the total number of people within a county as well as the total urban and rural population of the county. Subwatershed population is estimated by dividing the subwatershed area by the total county area and multiplying it by the county census population. It is assumed that the numbers of septic systems in the subwatersheds are directly proportional to rural population density. An additional estimate of septic systems can be made using the 1990 US Census, as that is the last Census that inventoried how household wastewater is disposed. The rural households in the Whitewater River subwatersheds are shown in Table 78, along with a calculated density (total rural households divided by total area). The rural household density can be used to compare the different subwatersheds within the Whitewater River watershed.

It should also be noted that hydrologic soil group A and B soils have good infiltration rates and have less risk for failing septic systems due to this factor. Group C and D soils have slow infiltration rates with finer textures and slow water movement. Table 77 illustrates the hydrologic soil groups for the Whitewater River subwatersheds.

Table 73 Hydrologic Soil Groups in the Whitewater River Subwatersheds

Subwatershed	Hydrologic Soil Group (Acres)			
	A	B	C	D
Headwaters Blue Creek	0	323.02	11,386.02	0
Wolf Creek	0	220.92	4,103.60	0
Big Cedar Creek	24.39	12,277.88	6,624.59	0
Little Cedar Creek	590.44	7,695.41	8,564.39	0
Blackburn Creek	481.06	2,801.8	7,388.11	0
Johnson Fork	59.6	7,033.74	13,770.5	0
Headwaters Dry Fork Whitewater River	30.34	6,427.44	2,481.15	0
Howard Creek	6.08	3,591.68	2,787.18	0
Lee Creek	0	325.86	326.53	0
Jameson Creek	43.2	1,817.24	5,145.5	0

Table 74 Rural Population Density in the Whitewater River Subwatersheds

Subwatershed	County	Area of County in Subwatershed (mi^2)	County Households in Subwatershed	Urban Households	Rural Households	Rural Household Density (Houses/mi^2)
Headwaters Blue Creek	Dearborn	3.6	167	30	137	**34**
	Franklin	14.41	470	0	470	
	Ripley	0.31	12	0	12	
	Total	18.32	649	30	619	
Wolf Creek	Franklin	14.54	507	0	507	**35**
	Total	14.54	507	0	507	
Big Cedar Creek	Franklin	29.61	667	23	644	**22**
	Total	29.61	667	23	644	
Little Cedar Creek	Franklin	26.64	871	22	849	**32**
	Total	26.64	871	22	849	

Blackburn Creek	Dearborn	3.85	288	0	288	**60**
	Franklin	13.34	825	89	736	
	Total	17.19	1,113	89	1,024	
Johnson Fork	Dearborn	20.45	1,768	397	1,371	**69**
	Franklin	12.43	887	0	887	
	Total	32.88	2,655	397	2,258	
Headwaters Dry Fork Whitewater River	Franklin	14.01	215	0	215	**15**
	Total	14.01	215	0	215	
Howard Creek	Franklin	10.05	414	32	382	**38**
	Total	10.05	414	32	382	
Lee Creek	Dearborn	0.04	9	0	9	**100**
	Franklin	1	95	0	95	
	Total	1.04	99	0	104	
Jameson Creek	Dearborn	11.21	2,063	374	1,689	**151**
	Total	11.21	2,063	374	1,689	

Urban Storm Water

In areas not covered under the NPDES MS4 program, storm water runoff from developed areas is not regulated under a permit and is therefore a nonpoint source. Runoff from urban areas can carry a variety of pollutants originating from a variety of sources. Typically urban sources of nutrients are fertilizer application to lawns and pet waste, which is also a source of *E. coli*. Depending on the amount of developed, impervious land in a watershed, urban nonpoint source inputs can result in localized or widespread water quality degradation. The percent and distribution of developed land in the Whitewater River watershed is discussed in Section 8.2.1. However, inputs from urban sources are difficult to quantify. Estimates can be made of pet populations and residential areas that might receive fertilizer treatment. These estimates provide insight into the potential of urban nonpoint sources as important sources of sediment, nutrients or *E. coli* in the Whitewater River watershed.

Dog and cat populations were estimated for the Whitewater River subwatersheds using statistics reported in the *2007 U.S. Pet Ownership & Demographics Sourcebook*[1]. Specifically, the *Sourcebook* reports that on average 37.2 percent of households own dogs and 32.4 percent of households own cats. Typically, the average number of pets per household is 1.7 dogs and 2.2 cats. However, pets are likely only a significant source of *E. coli* and nutrients in population centers (i.e., cities and towns). The estimates of domestic pets in cities and towns in the watershed are presented in Table 79 and are based on the average number of pets per household multiplied by the households in the urban areas of the subwatersheds.

Table 75 Estimated Pet Populations in the Cities and Towns in the Whitewater River Watershed

Subwatershed	City/Town	Households in 2010	Estimated Number of Cats	Estimated Number of Dogs
Headwaters Blue Creek	St. Leon	30	66	51
Wolf Creek	NA	NA	NA	NA
Big Cedar Creek	Cedar Grove	23	51	39
Little Cedar Creek	Brookville	22	48	37
Blackburn Creek	Cedar Grove	89	196	151

[1] http://www.avma.org/reference/marketstats/sourcebook.asp

Johnson Fork	St. Leon	263	579	447
	Cincinnati, OH – IN Urban Cluster	134	295	228
Headwaters Dry Fork Whitewater River	NA	NA	NA	NA
Howard Creek	Mount Carmel	32	70	54
Lee Creek	NA	NA	NA	NA
Jameson Creek	Harrison, OH – IN Urban Cluster	199	438	338
	Cincinnati, OH – IN Urban Cluster	175	385	298
	Total	967	2,128	1,643

Wildlife

The Indiana Department of Natural Resources (IDNR) is the primary entity responsible for monitoring wildlife populations and habitats throughout Indiana. Wildlife such as deer, geese, ducks, etc. can be sources of *E. coli*. Little information exist surrounding feces depositional patterns of wildlife and a direct inventory of wildlife populations is generally not available. However, based on the *Bacteria Source Load Calculator* developed by the Center for TMDL and Watershed Studies, bacteria production by animal type is estimated as well as their preferred habitat. Higher concentrations of wildlife in the habitats described in Table 80 could contribute *E. coli* and nutrients to the watershed, particularly during high flow conditions or flooding events.

Table 76 Bacteria Source Load by species

Wildlife Type	*E. coli* Production Rate (cfu/day – animal)	Habitat
Deer	1.86×10^8	Entire Watershed
Raccoon	2.65×10^7	Low density on forests in rural areas; high density on forest near a permanent water source or near cropland
Muskrat	1.33×10^7	Near ditch, medium sized stream, pond or lake edge
Goose	4.25×10^8	Near main streams and impoundments
Duck	1.27×10^9	Near main streams and impoundments
Beaver	2.00×10^5	Near streams and impoundments in forest and pastures

Managed lands include natural and recreation areas which are owned or managed by the Indiana Department of Natural Resources, federal agencies, local agencies, non-profit organizations, and conservation easements. Classified lands are public or private lands containing areas supporting growth of native or planted trees, native or planted grasses, wetlands or other acceptable types of cover that have been set aside for managed production of timber, wildlife habitat and watershed protection. These natural areas provide ideal habitat for wildlife. Some of the more common wildlife often found in natural areas include white-tailed deer, raccoon, muskrat, fowl and beaver. While wildlife is known to contribute *E.coli* and nutrients to the surface waters, natural areas provide economic, ecological and social benefits and should be preserved and protected. Management practices such as reducing impervious surfaces, native vegetation plantings, wetland creation and riparian buffers will help in reducing stormwater runoff transporting pollutants to the streams. Figure 60 shows the managed lands within the Whitewater River watershed. There are 2,838 acres of managed and classified lands in the Whitewater River watershed.

Table 77 Managed Land and Classified Land in the Whitewater River Watershed

Managed Lands			
Subwatershed	**Unit Name**	**Manager**	**Area (acres)**
Little Cedar Creek/Wolf Creek	Franklin County Park	Franklin Park Board	194
		Total	194

Classified Lands (Acres)						
Subwatershed	**Grassland**	**Woodland**	**Shrubland**	**Wetland**	**Other**	**Total**
Headwaters Blue Creek	0	539.91	3.5	0	0	543.41
Wolf Creek	0	184.64	0	0	0	184.64
Big Cedar Creek	0	140.85	0	0	0	140.85
Little Cedar Creek	1.56	1,008.12	39.63	0	0	1,049.31
Blackburn Creek	0	67.02	18.21	0	0	85.23
Johnson Fork	14.64	354.38	31.49	0	0	400.51
Headwaters Dry Fork Whitewater River	0	10.00	0	0	0	10.00
Howard Creek	0	0	0	0	0	0
Lee Creek	0	0	0	0	0	0
Jameson Creek	59	171.09	0	0	0	230.09
					Total	2,644.04

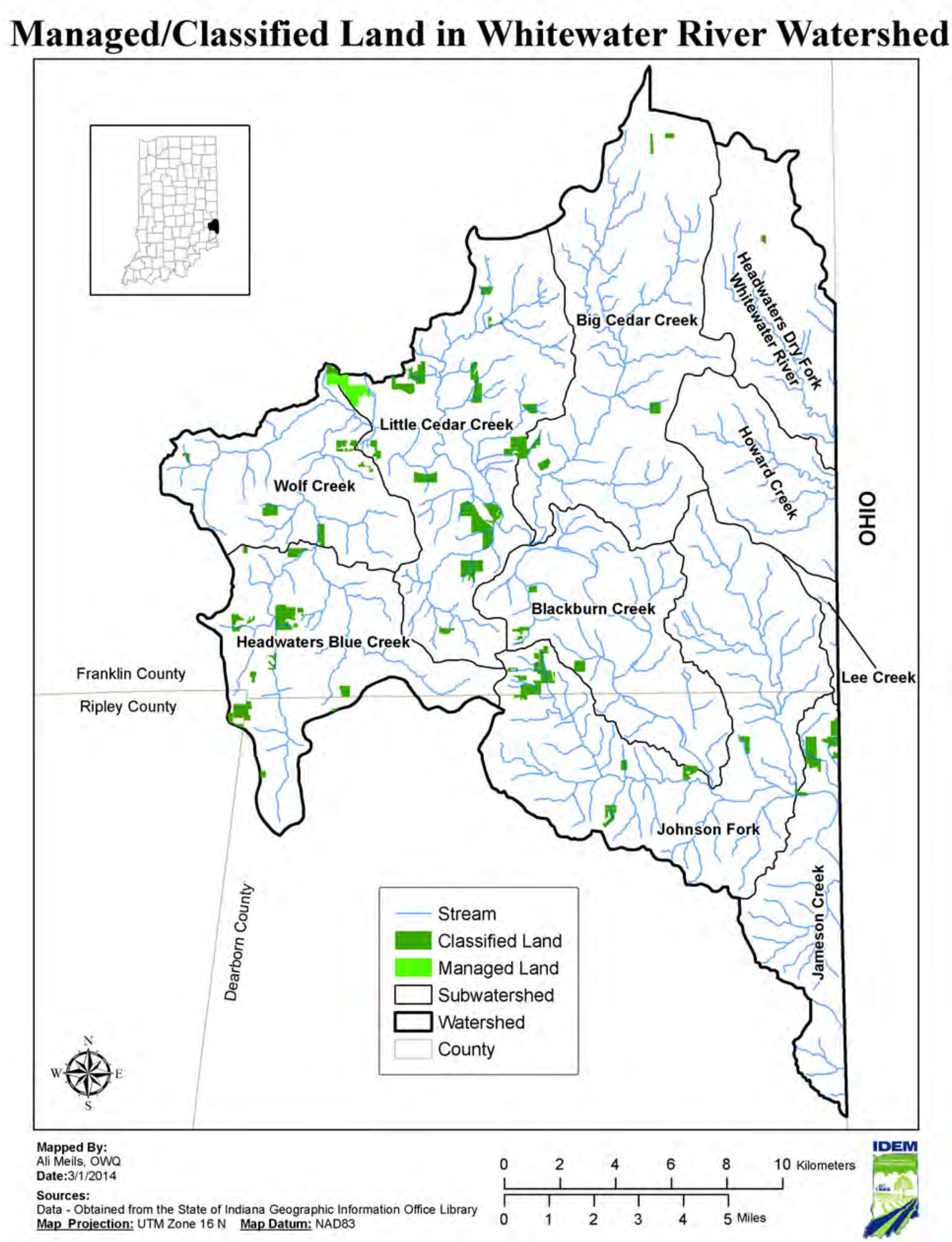


Figure 60 Managed Lands in the Whitewater River Watershed

9.0 INVENTORY AND ASSESSMENT OF WATER QUALITY INFORMATION

Below is an inventory assessment of the available biological and chemistry data for the Southern Whitewater River watershed related to *E. coli*, nutrients and sediment. Table 78 reiterates the TMDL target values presented in Section 1.0. These are the target values IDEM uses to assess water quality data collected in the Southern Whitewater River watershed.

Table 78 Target Values Used for Development of the Southern Whitewater River Watershed TMDLs

Parameter	Target Value
Total nitrogen	No value should exceed 10.0 mg/L
Total phosphorus	No value should exceed 0.30 mg/L
Total Suspended Solids	No value should exceed 30.0 mg/L
Total Suspended Solids (Protected areas)	No value should exceed 25.0 mg/L
E. coli	No value should exceed 235 cfu/100 mL
Dissolved Oxygen	No value should be below 4.0 mg/L

9.1 Water Chemistry Data

Table 79 summarizes the water chemistry data within the Southern Whitewater River watershed by displaying the maximum concentrations at all impaired stations along with the reduction needed to meet the TMDL. Data sampled in 2013-2014 by IDEM were used for the TMDL analysis. Franklin County SWCD suggested additional data be collected for the watershed tributaries in Ohio, however IDEM could not conduct samples across state lines, so the Franklin County SWCD worked in conjunction with IDEM to monitor additional stations in the Ohio portion of the watershed.

The percent reductions were calculated as follows:

$$\%\ \text{Reduction} = \frac{(\text{Observed} - \text{Target Value or WQS})}{\text{Observed}}$$

Appendix A shows the individual sample results and summaries of all the water quality data for all 45 monitoring stations.

Table 79 Summary of Chemistry Data in Southern Whitewater River Watershed for Nutrients and Total Suspended Solids

Subwatershed	Site #	Station ID	Date	Total Phosphorus Single Sample Maximum (mg/L)	% Reduction based on highest concentration	Total Suspended Solids Maximum (mg/L)	% Reduction based on highest concentration
Headwaters Salt Creek	T1	GMW050-0023	4/2014 – 10/2014	0.122	NA	35	14.29
Righthand Fork Salt Creek	T2	GMW-05-0006	4/2014 – 10/2014	0.128	NA	86	65.12
	T3	GMW-05-0014	4/2014 – 10/2014	0.185	NA	14	NA
	T4	GMW-05-0011	4/2014 – 10/2014	3.945	92.40	25	NA
	T6	GMW-05-0007	11/2013 – 10/2014	0.147	NA	43	30.23
	P12	GMW-05-0003	5/2014 – 9/2014	0.094	NA	7	NA
Bull Fork	T5	GMW-05-0009	4/2014 – 10/2014	0.03	NA	21	NA
	P6	GMW-05-0002	5/2014 – 9/2014	0.025	NA	3	NA
Little Salt Creek	T8	GMW-05-0015	4/2014 – 10/2014	0.212	NA	31	3.23
	T9	GMW-05-0008	4/2014 – 10/2014	0.104	NA	51	41.18
	P1	GMW-05-0001	5/2014 – 9/2014	0.94	68.09	400	92.5
Fremont Branch	T7	GMW-05-0012	4/2014 – 10/2014	0.198	NA	114	73.68
	T10	GMW-05-0010	11/2013 – 10/2014	0.124	NA	30	NA
Headwaters Pipe Creek	T17	GMW-06-0014	4/2014 – 10/2014	0.343	12.54	39	23.07

	T18	GMW060-0027	4/2014 – 10/2014	0.079	NA	14	NA
Clear Fork	T15	GMW-06-0013	4/2014 – 10/2014	0.16	NA	56	46.43
Duck Creek	T12	GMW-06-0019	4/2014 – 10/2014	0.569	47.28	768	96.09
Walnut Fork	T14	GMW-06-0015	11/2013 – 10/2014	0.104	NA	37	18.92
	T16	GMW-06-0020	4/2014 – 10/2014	0.188	NA	29	NA
	P10	GMW-06-0006	5/2014 – 9/2014	0.025	NA	7	NA
Yellow Bank Creek	T13	GMW-06-0022	4/2014 – 10/2014	0.584	48.63	380	92.11
	T19	GMW-06-0012	11/2013 – 10/2014	0.222	NA	76	60.53
	P3	GMW-06-0002	5/2014 – 9/2014	0.26	NA	140	78.57
	P4	GMW-06-0003	5/2014 – 9/2014	0.056	NA	15	NA
	P5	GMW-06-0004	5/2014 – 9/2014	0.25	NA	140	78.57
	P9	GMW-06-0005	5/2014 – 9/2014	0.27	NA	130	76.92
Headwaters Blue Creek	T24	GMW-08-0022	4/2014 – 10/2014	0.099	NA	14	NA
	P2	GMW-08-0001	5/2014 – 9/2014	0.23	NA	18	NA
Wolf Creek – Blue Creek	T21	GMW-08-0026	4/2014 – 10/2014	0.05	NA	12	NA
	T22	GMW080-0003	11/2013 – 10/2014	0.118	NA	14	NA
	T23	GMW-08-0014	11/2013 – 10/2014	0.126	NA	99	69.70

Big Cedar Creek	T26	GMW-08-0016	11/2013 – 10/2014	0.124	NA	15	NA
	T27	GMW-08-0024	4/2014 – 10/2014	0.141	NA	11	NA
Little Cedar Creek	T25	GMW-08-0015	11/2013 – 10/2014	0.056	NA	41	26.83
	P7	GMW-08-0013	5/2014 – 9/2014	0.26	NA	190	84.21
Blackburn Creek	T29	GMW-08-0030	4/2014 – 10/2014	0.068	NA	28	NA
Johnson Fork	T28	GMW-08-0019	4/2014 – 10/2014	0.114	NA	34	11.76
	T30	GMW-08-0018	4/2014 – 10/2014	0.053	NA	4	NA
	P8	GMW-08-0003	5/2014 – 9/2014	0.06	NA	9	NA
	P11	GMW-08-0005	5/2014 – 9/2014	0.069	NA	9	NA
Jameson Creek	T31	GMW-08-0021	11/2013 – 10/2014	0.155	NA	48	37.50
Headwaters Dry Fork Whitewater River	T33	GMW-08-0020	4/2014 – 10/2014	0.159	NA	8	NA
Howard Creek	T32	GMW-08-0027	4/2014 – 10/2014	0.166	NA	11	NA
*Bear Creek	T11	GMW-04-0018	11/2013 – 10/2014	0.245	NA	139	78.42
*Brookville Lake – East Fork Whitewater River	T20	GMW-07-0026	11/2013 – 10/2014	0.087	NA	5	NA

*These sites are not within the boundaries of the watershed but the data will be used in calculating loadings

9.2 *E. coli* Data

Table 80 provides a summary of *E. coli* data in the Southern Whitewater River subwatersheds to show which are impaired due to pathogens. The percent reduction is based on the maximum reported *E. coli* value.

Table 80 Summary of *E. coli* Data in Southern Whitewater River Watershed

Subwatershed	Site #	Station ID	Period of Record	Total Number of Samples	Percent of Samples Violating Target	Maximum MPN/100mL	Average MPN/100mL	% Reduction Based on Maximum Value
Headwaters Salt Creek	T1	GMW050-0023	4/21/2014 – 10/20/2014	10	60	24196	5275.73	99.03
Righthand Fork Salt Creek	T2	GMW-05-0006	4/21/2014 – 10/20/2014	10	90	24196	5747.37	99.03
	T3	GMW-05-0014	4/21/2014 – 10/20/2014	10	80	2419.6	984.01	90.29
	T4	GMW-05-0011	4/21/2014 – 10/20/2014	10	70	2419.6	1013.58	90.29
	T6	GMW-05-0007	4/21/2014 – 10/20/2014	10	40	5475	922.57	95.71
	P12	GMW-05-0003	7/15/20140-08/12/2014	5	100	4611	1690.76	94.90
Bull Fork	T5	GMW-05-0009	4/21/2014 – 8/11/2014	10	30	2419.6	402.17	90.29
	P6	GMW-05-0002	7/15/20140-08/12/2014	5	40	344.8	186.04	31.84
Little Salt Creek	T8	GMW-05-0015	4/21/2014 – 10/20/2014	10	80	2419.6	846.04	90.29
	T9	GMW-05-0008	4/21/2014 – 10/20/2014	10	10	4352	483.29	94.60
	P1	GMW-05-0001	7/15/20140-08/12/2014	5	100	727	459.02	67.67

Subwatershed	Site #	Station ID	Period of Record	Total Number of Samples	Percent of Samples Violating Target	Maximum MPN/100mL	Average MPN/100mL	% Reduction Based on Maximum Value
Fremont Branch	T7	GMW-05-0012	4/21/2014 – 10/20/2014	10	30	6488	820.56	96.38
	T10	GMW-05-0010	4/21/2014 – 10/20/2014	10	30	579.4	209.57	59.44
Headwaters Pipe Creek	T17	GMW-06-0014	4/22/2014 – 10/21/2014	7	86	2419.6	1109.06	90.29
	T18	GMW060-0027	4/22/2014 – 10/21/2014	7	86	2419.6	1006.99	90.29
Clear Fork	T15	GMW-06-0013	4/22/2014 – 10/21/2014	9	10	2419.6	318.1	90.29
Duck Creek	T12	GMW-06-0019	4/21/2014 – 10/20/2014	7	29	12997	3767.6	98.19
Walnut Fork	T14	GMW-06-0015	4/22/2014 – 10/21/2014	10	10	1413.6	227.16	83.37
	T16	GMW-06-0020	4/22/2014 – 10/21/2014	10	40	2419.6	398.82	90.29
	P10	GMW-06-0006	7/14/20140-08/11/2014	5	20	4106	893.24	94.28
Yellow Bank Creek	T13	GMW-06-0022	4/21/2014 – 10/20/2014	10	50	9804	1423.28	97.60
	T19	GMW-06-0012	4/22/2014 – 10/21/2014	10	20	686.7	170.56	65.78
	P3	GMW-06-0002	7/14/20140-08/11/2014	5	40	4106	980.94	94.28
	P4	GMW-06-0003	7/14/20140-08/11/2014	5	80	17329	4154.56	98.64
	P5	GMW-06-0004	7/15/20140-08/12/2014	5	40	727	275.1	67.68

Subwatershed	Site #	Station ID	Period of Record	Total Number of Samples	Percent of Samples Violating Target	Maximum MPN/100mL	Average MPN/100mL	% Reduction Based on Maximum Value
	P9	GMW-06-0005	7/15/20140-08/12/2014	5	40	770.1	276.56	69.48
Headwaters Blue Creek	T24	GMW-08-0022	4/22/2014 – 10/21/2014	10	20	1732.9	245.09	86.44
	P2	GMW-08-0001	7/14/20140-08/11/2014	5	80	2419.6	681.92	90.29
Wolf Creek – Blue Creek	T21	GMW-08-0026	4/22/2014 – 10/21/2014	10	20	1119.9	221.23	79.01
	T22	GMW080-0003	4/22/2014 – 10/21/2014	10	30	2419.6	482.78	90.29
	T23	GMW-08-0014	4/22/2014 – 10/21/2014	10	30	2419.6	475.8	90.29
Big Cedar Creek	T26	GMW-08-0016	4/23/2014 – 10/22/2014	8	38	488.4	243.47	51.88
	T27	GMW-08-0024	4/23/2014 – 10/22/2014	9	44	1732.9	585.5	86.44
Little Cedar Creek	T25	GMW-08-0015	4/23/2014 – 10/22/2014	10	10	290.9	89.11	19.22
	P7	GMW-08-0013	7/14/20140-08/11/2014	5	40	4907	1317.92	95.21
Blackburn Creek	T29	GMW-08-0030	4/23/2014 – 10/22/2014	10	0	157.6	77.76	NA
Johnson Fork	T28	GMW-08-0019	4/23/2014 – 10/22/2014	10	30	920.8	194.15	74.48
	T30	GMW-08-0018	4/23/2014 – 10/22/2014	10	30	1299.7	292.64	81.92
	P8	GMW-08-0003	7/14/20140-08/11/2014	5	40	2419.6	599	90.29

Subwatershed	Site #	Station ID	Period of Record	Total Number of Samples	Percent of Samples Violating Target	Maximum MPN/100mL	Average MPN/100mL	% Reduction Based on Maximum Value
	P11	GMW-08-0005	7/14/20140-08/11/2014	5	40	770.1	285.04	69.48
Jameson Creek	T31	GMW-08-0021	4/23/2014 – 10/22/2014	10	0	143	75.5	NA
Headwaters Dry Fork Whitewater River	T33	GMW-08-0020	4/23/2014 – 10/22/2014	10	80	1553.1	629.03	84.87
Howard Creek	T32	GMW-08-0027	4/23/2014 – 10/22/2014	10	70	1732.9	667.22	86.44
*Bear Creek	T11	GMW-04-0018	4/21/2014 – 10/20/2014	10	20	980.4	232.64	76.03
*Brookville Lake – East Fork Whitewater River	T20	GMW-07-0026	4/22/2014 – 10/21/2014	10	10	579.4	81.5	59.44

9.3 Biological Data

Sampling performed by IDEM in between June and October 2014 documented biological impairments in the Southern Whitewater River watershed as summarized in Table 6. Fish and macroinvertebrate community sampling took place at 43 sample sites in the Southern Whitewater River watershed. Sampling data indicate that the overall biological integrity of the Southern Whitewater River watershed was good. The explanations of each integrity class can be found in Table 4. Fourteen percent of the sample sites failed for fish community and 18 percent of the sample sites failed for macroinvertebrate community. Both communities are used in the criteria for aquatic life support.

Through the TMDL efforts, IDEM has identified several potential reasons for the widespread impairments:

- The topography of the watershed causes quick movement of water to the larger tributaries downstream. During hot and dry summer months isolated pools often form in the smaller tributaries. These isolated pools often have low dissolved oxygen, as well as, restrict the movement of aquatic life, therefore making them more susceptible to predation.
- TSS can reduce plants available for consumption by inhibiting growth of submerged aquatic plants, lower dissolved oxygen levels by reducing light penetration which impairs algal growth, impair the ability of fish to see and catch food, increase stream temperature, clog fish gills which may decrease disease resistance, slow growth rates, and prevent the development of eggs and larvae.
- Total phosphorus can cause excessive plant production resulting in increased turbidity, decrease dissolved oxygen levels, and cause greater fluctuations in diurnal dissolved oxygen and pH levels resulting in lower stream diversity.

Table 81 Impaired Biotic Community Stream Segments in the Southern Whitewater River Watershed Identified During Biological Sampling

Subwatershed	Sampling Site		Stream Name	Score	Integrity Class	QHEI	Score	Integrity Class	QHEI
	Site #	Station ID		mIBI	mIBI	mIBI	IBI	IBI	IBI
Headwaters Salt Creek	T1	GMW050-0023	Tributary of Salt Creek	38	Fair	55	44	Fair	67
Righthand Fork Salt Creek	T2	GMW-05-0006	Salt Creek	36	Fair	48	34	Poor	56
	T3	GMW-05-0014	Righthand Fork Salt Creek	36	Fair	54	12	Very Poor	59
	T4	GMW-05-0011	Righthand Fork Salt Creek	36	Fair	60	28	Poor	65
	T6	GMW-05-0007	Salt Creek	42	Fair	68	52	Good	67
	P12	GMW-05-0003	Salt Creek	No Sample			No Sample		
Bull Fork	T5	GMW-05-0009	Bull Fork	44	Fair	67	52	Good	65
	P6	GMW-05-0002	Bull Fork	40	Fair	57	42	Fair	64
Little Salt Creek	T8	GMW-05-0015	South Fork Little Salt Creek	46	Good	66	44	Fair	72
	T9	GMW-05-0008	Little Salt Creek	42	Fair	61	38	Fair	60
	P1	GMW-05-0001	Little Salt Creek	42	Fair	58	42	Fair	79
Fremont Branch	T7	GMW-05-0012	Harvey Branch	34	Poor	61	44	Fair	61
	T10	GMW-05-0010	Salt Creek	44	Fair	57	44	Fair	55
Headwaters Pipe Creek	T17	GMW-06-0014	Tributary of Pipe Creek	36	Fair	61	36	Fair	66
	T18	GMW060-0027	Pipe Creek	38	Fair	49	38	Fair	50
Clear Fork	T15	GMW-06-0013	Clear Fork	40	Fair	59	46	Fair	57
Duck Creek	T12	GMW-06-0019	Duck Creek	Dry			Dry		
Walnut Fork	T14	GMW-06-0015	Pipe Creek	40	Fair	43	46	Good	58

	T16	GMW-06-0020	Pipe Creek	42	Fair	55	48	Good	66
	P10	GMW-06-0006	Walnut Fork	46	Good	51	40	Fair	55
Yellow Bank Creek	T13	GMW-06-0022	Whitewater Canal	36	Fair	24	16	Very Poor	25
	T19	GMW-06-0012	Whitewater River	36	Fair	69	54	Excellent	78
	P3	GMW-06-0002	Whitewater River	44	Fair	64	48	Good	71
	P4	GMW-06-0003	McCartys Run	38	Fair	63	22	Very Poor	67
	P5	GMW-06-0004	Whitewater River	42	Fair	70	54	Excellent	82
	P9	GMW-06-0005	Whitewater River	44	Fair	71	54	Excellent	80
Headwaters Blue Creek	T24	GMW-08-0022	East Fork Blue Creek	40	Fair	64	40	Fair	64
	P2	GMW-08-0001	Blue Creek	28	Poor	46	32	Poor	62
Wolf Creek – Blue Creek	T21	GMW-08-0026	Wolf Creek	36	Fair	62	38	Fair	64
	T22	GMW080-0003	Blue Creek	34	Poor	63	48	Good	52
	T23	GMW-08-0014	Blue Creek	36	Fair	58	42	Fair	56
Big Cedar Creek	T26	GMW-08-0016	Big Cedar Creek	38	Fair	61	42	Fair	59
	T27	GMW-08-0024	Big Cedar Creek	42	Fair	58	40	Fair	68
Little Cedar Creek	T25	GMW-08-0015	Whitewater River	36	Fair	77	56	Excellent	82
	P7	GMW-08-0013	Whitewater River	36	Fair	56	44	Fair	83
Blackburn Creek	T29	GMW-08-0030	Whitewater River	34	Poor	73	50	Good	82
Johnson Fork	T28	GMW-08-0019	Logan Creek	38	Fair	45	36	Fair	47
	T30	GMW-08-0018	Johnson Fork	42	Fair	59	46	Good	61
	P8	GMW-08-0003	Logan Creek	36	Fair	55	54	Excellent	67
	P11	GMW-08-0005	Logan Creek	32	Poor	64	48	Good	72
Jameson Creek	T31	GMW-08-0021	Whitewater River	34	Poor	65	54	Excellent	75
Headwaters Dry Fork Whitewater River	T33	GMW-08-0020	Dry Fork Whitewater River	28	Poor	50	48	Good	63
Howard Creek	T32	GMW-08-0027	Sours Run	36	Fair	56	38	Fair	58

*Bear Creek	T11	GMW-04-0018	Whitewater River	42	Fair	70	52	Good	70
*Brookville Lake – East Fork Whitewater River	T20	GMW-07-0026	East Fork Whitewater River	22	Very Poor	65	44	Fair	70

Notes: IBI = Index of Biotic Integrity. Scores were calculated using IDEM's *Summary of Protocols: Probability Based Site Assessment*. (IDEM, 2005).

10.0 TECHNICAL APPROACH

Previous sections of the report have provided a description of the Southern Whitewater River watershed and summarized the applicable water quality standards, water quality data, and identified the potential sources of *E. coli*, nutrients and sediment for assessment units in each subwatershed. This section presents IDEM's technical approach for using water quality sampling data and flow data for each subwatershed to estimate the current allowable loads of *E. coli*, nutrients and sediment in each subwatershed. This section focuses on describing the methodology and is helpful in understanding subsequent sections of the TMDL report.

10.1.1 Load Duration Curves

To determine allowable loads for the TMDL, IDEM uses a load duration curve approach. This approach helps to characterize water quality problems across flow conditions and provide a visual display that assists in determining whether loadings originate from point or nonpoint sources. Load duration curves present the frequency and magnitude of water quality violations in relation to the allowable loads, communicating the magnitude of the needed load reductions.

Developing a load duration curve is a multi-step process. To calculate the allowable loadings of a pollutant at different flow regimes, the load duration curve approach involves multiplying each flow by the TMDL target value or Water Quality Standard and an appropriate conversion factor. The steps are as follows:

- A flow duration curve for the stream is developed by generating a flow frequency table and plotting the observed flows in order from highest (left portion of curve) to lowest (right portion of curve).
- The flow curve is translated into a load duration (or TMDL) curve. To accomplish this, each flow value is multiplied by the TMDL target value or Water Quality Standard with the appropriate conversion factor and the resulting points are graphed. Conversion factors are used to convert the units of the target (e.g., #/100 mL for *E. coli*) to loads (e.g., G-org/day for *E. coli* [G-org=1E+09 organisms]) with the following factors used for this TMDL:
- Flow (cfs) x TMDL Concentration Target (#/100mL) x Conversion Factor (0.024463) = Load (G-org/day)
- Flow (cfs) x TMDL Concentration Target (mg/L) x Conversion Factor (5.39) = Load (lb/day)
- To estimate existing loads, each water quality sample is converted to a load by multiplying the water quality sample concentration by the average daily flow on the day the sample was collected and the appropriate conversion factor. Then, the existing individual loads are plotted on the TMDL graph with the curve.
- Points plotting above the curve represent violations of the applicable water quality standard or exceedances of the applicable target and the daily allowable load. Those points plotting below the curve represent compliance with standards and the daily allowable load.
- The area beneath the load duration curve is interpreted as the loading capacity of the stream. The difference between this area and the area representing the current loading conditions above the curve is the load that must be reduced to meet water quality standards.

The load duration curve approach can consider seasonal variation in TMDL development as required by the CWA and USEPA's implementing regulations. Because the load duration curve approach establishes loads based on a representative flow regime, it inherently considers seasonal variations and critical conditions attributed to flow conditions.

The stream flows displayed on water quality or load duration curves may be grouped into various flow regimes to aid with interpretation of the load duration curves. The flow regimes are typically divided into the following five “hydrologic zones” (USEPA, 2007):

- Very High Flows: Flows in this represent flooding or near flooding stages of a stream. These flows are exceeded 0 – 10 percent of the time.
- Moist Zone: Flows in this range are related to wet weather conditions. These flows are exceeded 10 – 40 percent of the time.
- Mid-Range Zone: Flows in this range represent median stream flow conditions. These flows are exceeded 40 – 60 percent of the time.
- Dry Zone: Flows in this range are related to dry weather flows. These flows are exceeded 60 -90 percent of the time.
- Very Low Flows: Flows in this range are seen in drought-like conditions. These flows are exceeded 90 -100 percent of the time.

The load duration curve approach helps to identify the sources contributing to the impairment and to roughly differentiate between sources. Exceedances of the load duration curve at higher flows (0-40 percent ranges) are indicative of wet weather sources (e.g., nonpoint sources, regulated storm water discharges). Exceedances of the load duration curve at lower flows (60 to 100 percent range) are indicative of point source sources (e.g., wastewater treatment facilities, livestock in the stream). Table 82 summarizes the general relationship between the five hydrologic zones and potentially contributing source areas (the table is not specific to any individual pollutant). For example, the table indicates that impacts from wastewater treatment plants are usually most pronounced during dry and low flow zones because there is less water in the stream to dilute their loads. In contrast, impacts from channel bank erosion is most pronounced during high flow zones because these are the periods during which stream velocities are high enough to cause erosion to occur.

Table 82 Relationship between Load Duration Curve Zones and Contributing Sources

	Duration Curve Zone				
Contributing Source Area	**Very High**	**Moist**	**Mid-Range**	**Dry**	**Very Low**
Wastewater treatment plants				M	H
Livestock direct access to streams				M	H
Wildlife direct access to streams				M	H
On-site wastewater systems/Unsewered Areas	M	M-H	H	H	H
Riparian areas		H	H	M	
Storm water: Impervious		H	H	H	
Storm water: Upland	H	H	M		
Field drainage: Natural condition	H	M			
Field drainage: Tile system	H	H	M-H	L-M	
Bank erosion	H	M			

Note: Potential relative importance of source area to contribute loads under given hydrologic condition (H: High; M: Medium; L: Low)

10.1.2 Stream Flow Estimates

Daily stream flows are necessary to implement the load duration curve approach. Load duration assessment locations in the Southern Whitewater River watershed were chosen based on the location of the impaired stream segments and the availability of water quality samples to estimate existing loads.

The USGS gage, used for the development of the load duration curves, is located upstream of the Southern Whitewater River watershed boundary near Alpine, Indiana (USGS gage ID: 03275000). There is one additional gage located on East Fork Whitewater River in Brookville, Indiana however those flows are often influenced by water released from Brookville Reservoir. The USGS gage (03275000) is located on the mainstem Whitewater River in Fayette County.

Since the load duration approach requires a stream flow time series for each site included in the analysis, stream flows were extrapolated from USGS gage (03275000) for each assessment location by using a multiplier based upon the ratio of the upstream drainage area for a given location to the drainage area of the Southern Whitewater River watershed.

Flows were estimated using the following equation:

$$Q_{ungaged} = \frac{A_{ungaged}}{A_{gaged}} \times Q_{gaged}$$

Where,

$Q_{ungaged}$:	Flow at the ungaged location
Q_{gaged}:	Flow at surrogate USGS gage station
$A_{ungaged}$:	Drainage area of the ungaged location
A_{gaged}:	Drainage area of the gaged location

In this procedure, the drainage area of each of the load duration stations was divided by the drainage area of the surrogate USGS gage. The flows for each of the stations were then calculated by multiplying the flows at the surrogate gage by the drainage area ratios. Additional flows were added to certain locations to account for permitted activities, such as wastewater treatment plants and CSOs that discharge upstream and are not directly accounted for using the drainage area weighting method.

11.0 LINKAGE ANALYSIS

A linkage analysis connects the observed water quality impairment to what has caused that impairment. An essential component of developing a TMDL is establishing a relationship between the source loadings and the resulting water quality. Potential point and nonpoint sources are inventoried in previous sections and water quality data within the Southern Whitewater River watershed have been discussed. The purpose of this section of the report is to evaluate which of the various potential sources is most likely to be contributing to the observed water quality impairments.

Load duration curves were created for the sampling sites in the Southern Whitewater River watershed that were sampled by IDEM in 2013-2014. The load duration curve method considers how stream flow conditions relate to a variety of pollutant loadings and their sources (point and nonpoint). Section 10.1.1 summarizes the load duration curve approach. This section discusses the load duration curves and the linkage between the potential sources in the Southern Whitewater River watershed and the observed water quality impairment.

11.1 Linkage Analysis for *E. coli*

Establishing a linkage analysis for *E. coli* is challenging because there are so many potential sources and *E. coli* counts have a high degree of variability. While it is difficult to perform a site-specific assessment of the causes of high *E. coli* for each location in a watershed, it is reasonable to expect that general patterns and trends can be used to provide some perspective on the most significant sources.

To further investigate sources, *E. coli*/precipitation graphs have been created. Elevated levels of *E. coli* during rain events indicate *E. coli* contribution due to runoff. The precipitation data was taken from a weather station in Brookville, Indiana and managed by the Midwestern Regional Climate Center.

E. coli sources typically associated with high flow and moist conditions include failing onsite wastewater systems, urban storm water, runoff from agricultural areas, and bacterial re-suspension from the streambed. *E. coli* sources typically associated with low flow conditions include a large number of homes on failing or illicitly connected septic systems that would provide a constant source. Elevated *E. coli* levels at low flow could also result from inadequate disinfection at wastewater treatment plants or animals with direct access to streams.

11.2 Linkage Analysis for Nutrients

Nutrients come in many forms, including nitrogen, phosphorus, ammonia, total Kjeldahl nitrogen (TKN), nitrite and nitrate. Information presented in the water quality assessment describes nutrient conditions in the Southern Whitewater River watershed.

Total phosphorus concentrations are naturally low in surface waters, but high in rivers and streams located in agricultural and urban areas, or that receive wastewater discharges. High phosphorus levels in streams increase the growth of plants and algae, reducing the quality of the habitat and causing low oxygen levels at night when the plants and algae are respiring but not photosynthesizing.

The load duration curve indicates that the TMDL target is exceeded under dry flow conditions. This suggests that nonpoint sources as well as point sources may be contributing to the impairment. Nonpoint sources might include sediment-bound phosphorus that enters the river during erosional processes, as well as the runoff of storms over fertilized fields and residential areas. Septic systems might also be a potential source of phosphorus if the systems are failing and located adjacent to the streams.

11.3 Linkage Analysis for Sediment

Developing a linkage analysis to address the connection between siltation and its effect on aquatic life uses often involves an evaluation of multiple factors. The interaction between erosion processes and hydrology is an important part of the assessment, with land use, riparian areas, and channel conditions being key considerations. Each can play a potential role in both creating and solving sediment problems. A stream becomes impaired by sediment when its capacity to handle sediment loads is exceeded. The sediment issues can occur when external inputs (e.g., sediment, runoff volume) to the stream become excessive, or when stream characteristics are altered so that it can no longer assimilate the loads, or a combination of both occur.

Sheet erosion is the detachment of soil particles by raindrop impact and their removal by water flowing overland as a sheet instead of in channels or rills. Rill erosion refers to the development of small, ephemeral concentrated flow paths, which function as both sediment source and sediment delivery systems for erosion on hillslopes. Sheet and rill erosion occurs more frequently in areas that lack or have sparse vegetation.

Bank and channel erosion refers to the wearing away of the banks of a stream or river. High rates of bank and channel erosion can often be associated with water flow and sediment dynamics being out of balance. This may result from land use activities that either alter flow regimes, adversely affect the floodplain and streamside riparian areas, or a combination of both. Hydrology is a major driver for both sheet/rill and stream channel erosion. Bank and channel erosion is made worse when streams are straightened or channelized because channelization shortens overall stream lengths and results in increased velocities, bed and bank erosion, and sedimentation. Modified stream channels often have little habitat structure and variability necessary for diverse and abundant aquatic species. Channelization also disconnects streams from floodplain and riparian areas that are often converted to developed or agricultural lands.

Since monitoring began in November 2013, TSS in the Southern Whitewater River watershed has sporadically exceeded the target. No long-term trend is apparent, with TSS greatest during or after rainfall events. Further analysis pairing the TSS concentrations with flow conditions reveals elevated TSS concentrations during high flows and lower concentrations during mid-range and lower flow conditions. Elevated TSS concentrations during high flows are consistent with significant loads coming from stream bank and channel erosion. Based on the high gradient and steep topography in the watershed a portion of the sediment load is likely a natural condition. The high loads in the spring may also be related to the plowing and planting of agricultural fields occurs during these months, increasing the opportunity for sheet and rill erosion.
The following sections discuss the load duration curves, precipitation graphs and linkage of sources to the water quality exceedances for each subwatershed.

11.3.1 Headwaters Salt Creek Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Headwaters Salt Creek subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 87 provides a summary of the Headwaters Salt Creek subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli,* nutrient, and TSS. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli,* nutrient, and TSS concentrations.

Table 83 Summary of Headwaters Salt Creek Subwatershed Characteristics

Headwaters of Salt Creek (050800030501)					
Drainage Area (sq. mi.): 17.32					
TMDL Sample Sites: GMW050-0023 (T1), GMW-05-0006 (T2),					
Listed Segments: ING0351_01, ING0351_T1001, ING0351_T1002, ING0351_T1003					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90-100%**
Bacteria TMDL (billions of bacteria/day)	**395.8**	**129.36**	**57.93**	**26.60**	**12.20**
Wasteload Allocation (WLA): Total	0	0	0	0	0
Load Allocation (LA)	357.17	116.74	52.23	23.97	10.99
Margin Of Safety (MOS) (5%)	19.8	6.47	2.90	1.33	0.61
Future Growth (5%)	18.8	6.1	2.8	1.3	0.6

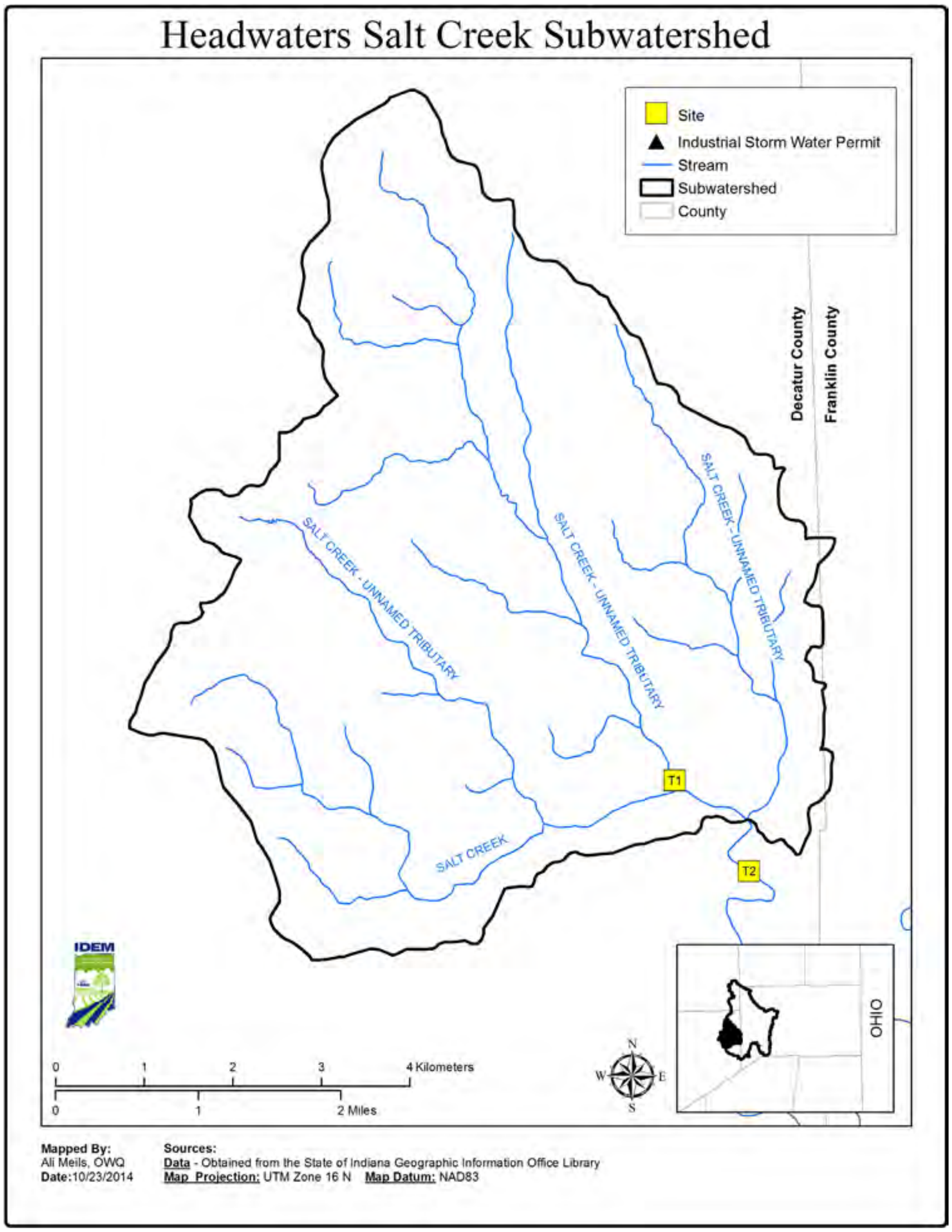


Figure 61 Sampling Stations in Headwaters Salt Creek Subwatershed

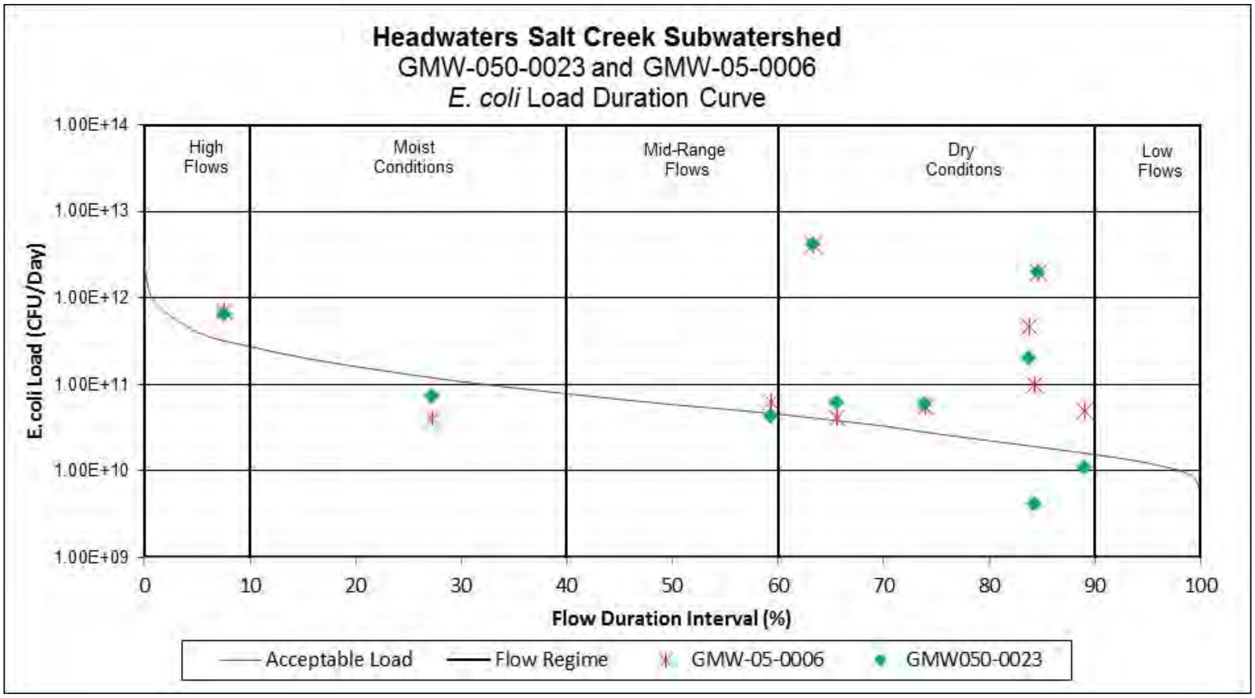


Figure 62 Load Duration Curve for Headwaters Salt Creek Subwatershed

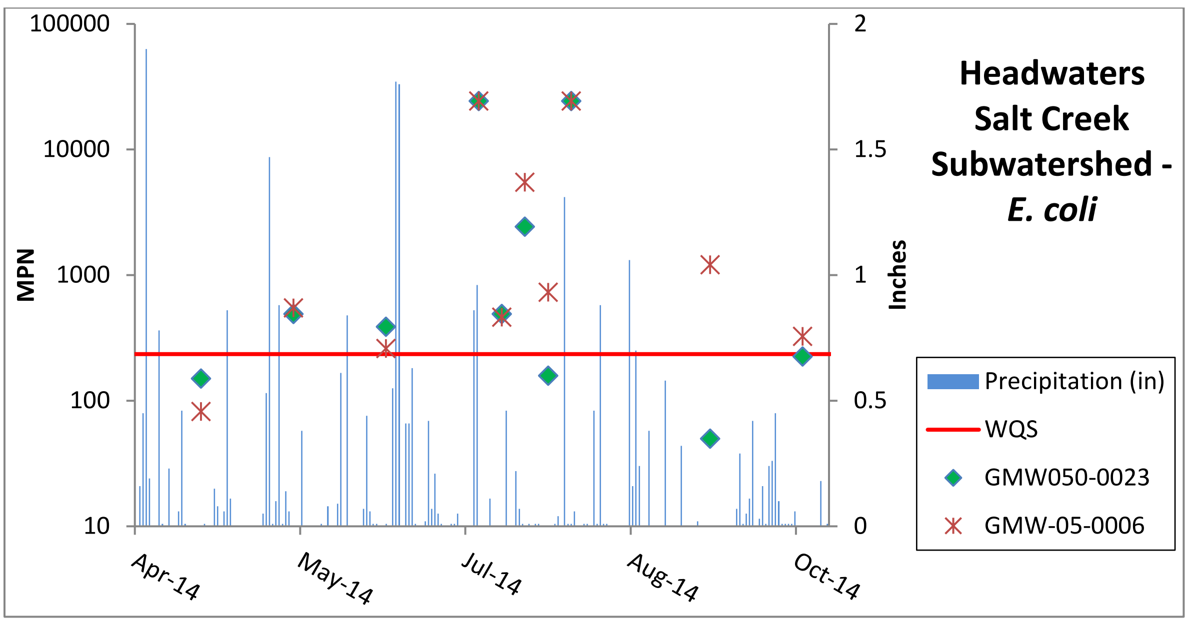


Figure 63 Graph of Precipitation and *E. coli* Data in the Headwaters Salt Creek Subwatershed

The Headwaters of Salt Creek drain approximately 17 square miles. The landuse is primarily agriculture (47%) followed by forested land (31%) and hay and pasture land (16%). Since there is little to no development in this subwatershed all homes pump to on-site septic systems. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area consists of gentle rolling hills in the headwaters and becomes steeper towards the base of the subwatershed. Highly erodible soil types make up a good portion of this subwatershed. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. There is a large area in the north central part of the subwatershed as well as speckled areas in the extreme headwaters identified as having hydric soil types. These areas could be potential areas for wetland restoration. While there are no permitted NPDES facilities in the subwatershed there are five confined feeding operations, as well as, numerous smaller animal farms. The total number of animal units in this area (223 animals/square mile) more than doubles what was calculated for the other subwatersheds. There are approximately 34 miles of stream in the subwatershed. According to the Draft 2012 List of Impaired Waters there are no impaired stream segments in the subwatershed. There had also been no historical samples collected in the subwatershed. Based on IDEM data collected in 2009, 2013 and 2014 there will be 14 stream miles impaired for *E. coli* in the subwatershed.

In September and October of 2009 IDEM collected data from a site (GMW050-0024) along the mainstem of Salt Creek at CR 850 East. *E. coli* and hydrolab chemistry readings were sampled once per week for five weeks at this site. The *E. coli* geometric mean at this site was 1,100.38 MPN/100mL which is significantly higher than the Indiana water quality standard of (125 MPN/100mL). The riparian area around the stream is well buffered with forested land. The steep slopes, agricultural lands in the headwaters and leaky septic systems in limited use soils may be contributing to these high levels of *E.coli*.

There was an additional site (GMW050-0023) sampled in 2009 for *E. coli*. This site is located on a tributary to Salt Creek at CR 150 North, and was resampled as part of the watershed characterization study in 2013 and 2014. In figure 61 it is site T1. In 2009, the *E. coli* geometric mean was 210.78 MPN/100mL which is slightly above the Indiana water quality standard. In 2014 *E. coli* was sampled ten times between April and October. The geometric mean, calculated with the samples collected in July and August, was 2,555.72 MPN/mL which is significantly higher than the WQS. Load duration curves and precipitation graphs are presented in Appendix B. The curve for this site shows *E. coli* exceedances during extremely high flows and during dry conditions. The highest concentrations can be attributed to rainfall events but high levels of *E. coli* remained constant from May through August. The precipitation graph for this site shows the stream is susceptible to high loads of *E. coli* from run-off. There are also three hog farms located in the headwaters of this tributary surrounded by agricultural fields. The overuse of manure application to agricultural fields or the mishandling of animal waste could also contribute to high levels of bacteria in the stream. Failing septic systems and runoff from smaller animal operations could be another potential source of *E. coli*.

In 2013 and 2014 water chemistry, fish and aquatic insects were also collected at this site. There were no significant water chemistry violations. From April through June the total nitrogen levels were high but not in exceedance of the WQS (10 mg/L). Total suspended solids were above the TMDL target of 30 mg/L in July which can impact biological communities but this was the only exceedance throughout the year. The fish community IBI score was 44 which is considered fair and the habitat score was 67 which is considered good. The macroinvertebrate community IBI score was 38 which is considered fair and the habitat score was 55 which is considered good.

Site GMW-05-0006 which is site T2 on Figure 61 is not within the Headwaters of Salt Creek watershed boundary but it represents the pour point the subwatershed. The site is located on Salt Creek at CR 50 North. This site was sampled in 2013 and 2014 for *E. coli*, water chemistry, and biological communities. The *E. coli* geometric mean was collected in July and August of 2014 and was significantly higher than the WQS. The results calculated showed a geometric mean of 4,038.69 MPN/100mL. Based on the load duration curve, samples were consistently high across different flow regimes and exceeded the single sample maximum of 235 MPN/100mL nine out of ten times. The total nitrogen was never in exceedance of a WQS but it was relatively high during the months of May and June. Total suspended solids were also above the TMDL target during the July and August sampling event. The fish community IBI score was 34 which is considered poor and the habitat score was 56 which is considered fair. The macroinvertebrate community IBI score was 36 which is considered fair and the habitat score was 48 which is considered fair. Based on the IBI scores this stream segment is considered impaired for biological communities. During a sampling event in April cows were observed having access downstream of the bridge and a manure odor was observed. Excessive algae growing on rocks in stream was also observed during a site visit which can be caused by excessive nutrient loading. The data also shows dissolved oxygen swings from month to month. In the Spring samples were reading 11-15 mg/L then fell to 5-6 mg/L the following two months and read unusually high again in July. During the July sampling events the fish crew recorded a DO of 5 mg/L and within an hour the water chemistry crew recorded a DO of 15 mg/L. After further investigation all equipment had been calibrated that day making the difference in results valid. After discussions with sampling crews it seems one crew sampled from the bridge in the sun, while the other crew sampled further upstream in the shade. The DO readings on the same day, coupled with the fact that excessive algae was present at this site, supports extreme DO swings. While our sampling was not designed to capture dissolved oxygen swings they are definitely occurring, which supports excessive nutrient loading signatures. Nitrogen and total phosphorus results were not above the water quality target, however these parameters are often linked to excessive algae growth. Excessive algae growth then causes DO swings, which impacts the biological communities that are able to inhabit the streams. Low dissolved oxygen puts stress on biological communities and could be a contributing factor in the biological impairment located at this site.

Half of the watershed is agriculture and there are five large confined feeding operations influencing this stream. The highest levels of *E. coli* in the subwatershed occurred after rainfall events therefore, the stream is susceptible to high loads of *E. coli* from run-off. Since the results seem dependent on precipitation events non-point sources are the most likely source of the highest values. However, high levels of *E. coli* were consistent throughout the year which indicates point sources in addition to any runoff. Cattle having access to the stream is a direct source of *E. coli* and nutrients and destroys the instream habitat utilized by the biological communities. Total suspended solids were higher than the WQ target following rainfall events which indicates sediment loadings are primarily nonpoint source driven. The high percentage of agricultural lands in the subwatershed and the location of animal operations near streams can contribute to sediment loss through rainfall events. Narrow riparian buffers surrounding the stream can also lead to additional loading of sediment, nutrients and *E. coli* during rainfall events.

11.3.2 Righthand Fork Salt Creek Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Righthand Fork Salt Creek subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 88 provides a summary of the Righthand Fork Salt Creek subwatershed, including segment AUIDs assigned a TMDL, drainage area, sampling sites, NPDES facilities, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli*, total nitrogen and total phosphorus. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* and nutrient concentrations.

Table 84 Summary of Righthand Fork Salt Creek Subwatershed Characteristics

Righthand Fork Salt Creek (050800030502)					
Drainage Area (sq. mi.): 45.76					
TMDL Sample Sites: GMW-05-0014 (T3), GMW-05-0011 (T4), GMW-05-0007 (T6), GMW-05-0003 (P12)					
Listed Segments: ING0352_01, ING0352_T1001, ING0352_T1002, ING0352_T1003, ING0352_T1004, ING0352_T1005, ING0352_T1006					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10 %**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90-100%**
Bacteria TMDL (billions of bacteria/day)	**650.7**	**213.30**	**96.01**	**44.57**	**20.93**
Wasteload Allocation (WLA): Total	**0.89**	**0.89**	**0.89**	**0.89**	**0.89**
Lake Santee Regional Waste and Water District WWTP (IN0060704) 0.1 MGD	**0.89**	**0.89**	**0.89**	**0.89**	**0.89**
Load Allocation (LA)	**586.40**	**191.61**	**85.72**	**39.36**	**17.99**
Margin Of Safety (MOS) (5%)	**32.5**	**10.7**	**4.8**	**2.2**	**1.05**
Future Growth (5%)	**30.9**	**10.1**	**4.6**	**2.1**	**1.0**
Drainage Area (sq. mi.): 5.482					
TMDL Sample Sites: GMW-05-0011 (T4)					
Listed Segments: ING0352_T1006					
Flow Regime TMDL analysis for Total Phosphorus (pounds/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10 %**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90-100%**
Total Phosphorus TMDL (pounds/day)	**35.5**	**11.76**	**5.41**	**2.62**	**1.34**
Wasteload Allocation (WLA): Total	**0.83**	**0.83**	**0.83**	**0.83**	**0.83**
Lake Santee Regional Waste and Water District WWTP (IN0060704) 0.1 MGD	**0.83**	**0.83**	**0.83**	**0.83**	**0.83**
Load Allocation (LA)	**31.19**	**9.79**	**4.05**	**1.54**	**0.38**
Margin Of Safety (MOS) (5%)	**1.80**	**0.59**	**0.27**	**0.13**	**0.07**
Future Growth (5%)	**1.68**	**0.56**	**0.26**	**0.12**	**0.06**

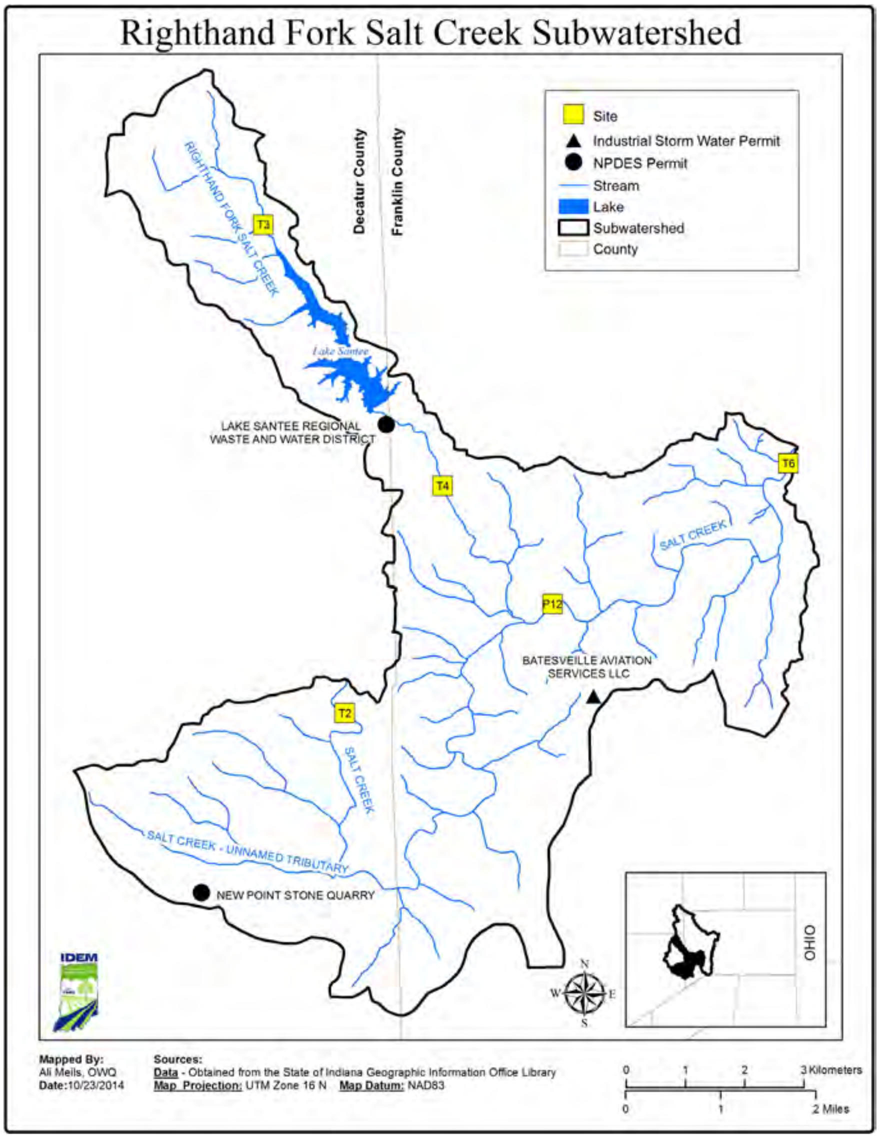


Figure 64 Sampling Stations in Righthand Fork Salt Creek Subwatershed

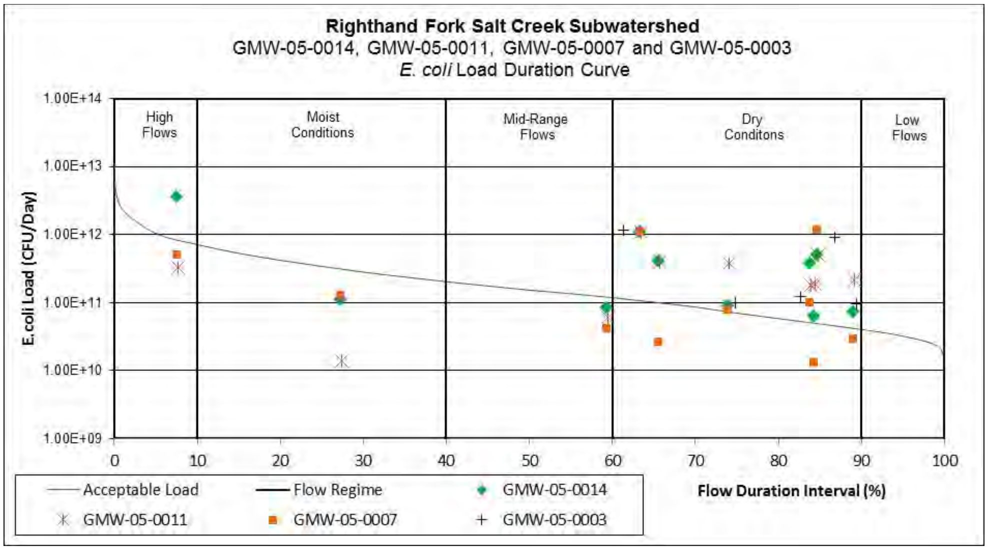


Figure 65 Load Duration Curve for *E. coli* in the Righthand Fork Salt Creek

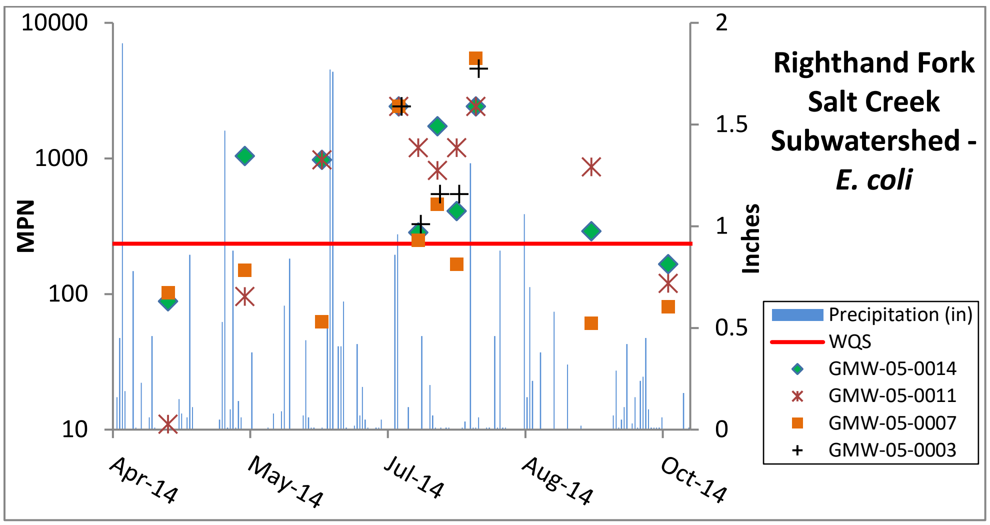


Figure 66 Graph of Precipitation and *E. coli* Data in the Righthand Fork Salt Creek Subwatershed

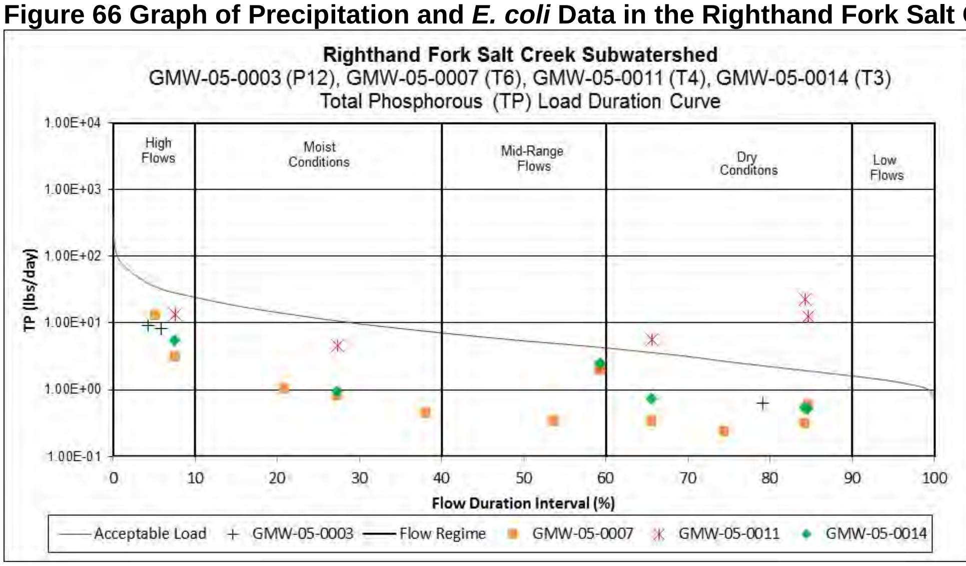


Figure 67 Load Duration Curve for Total Phosphorus in the Righthand Fork Salt Creek

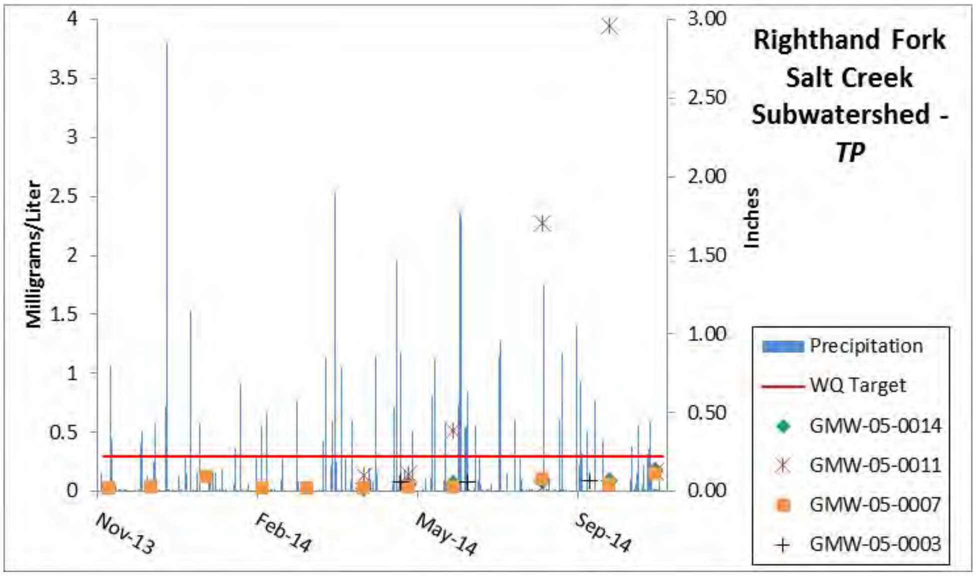


Figure 68 Graph of Precipitation and Total Phosphorus Data in the Righthand Fork Salt Creek Subwatershed

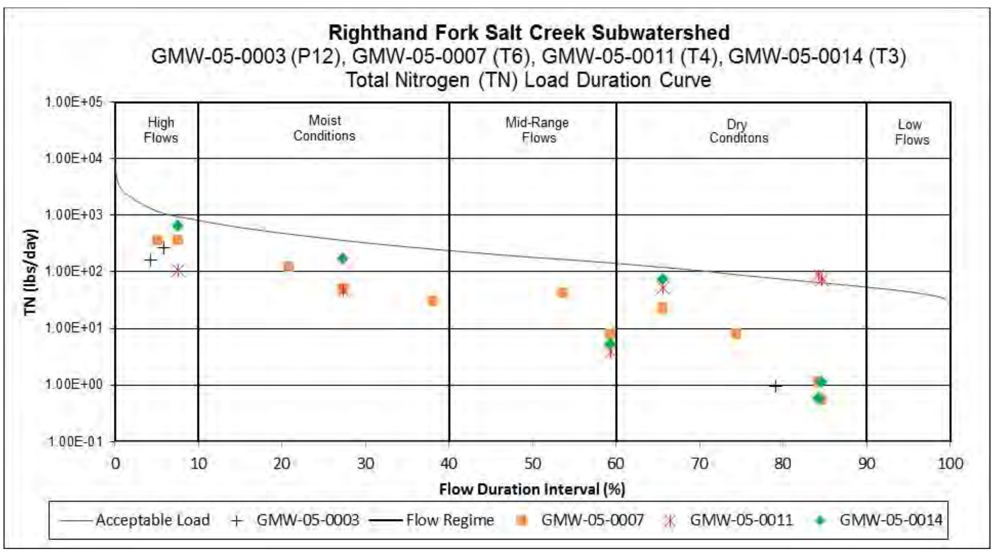


Figure 69 Load Duration Curve for Total Nitrogen in the Righthand Fork Salt Creek

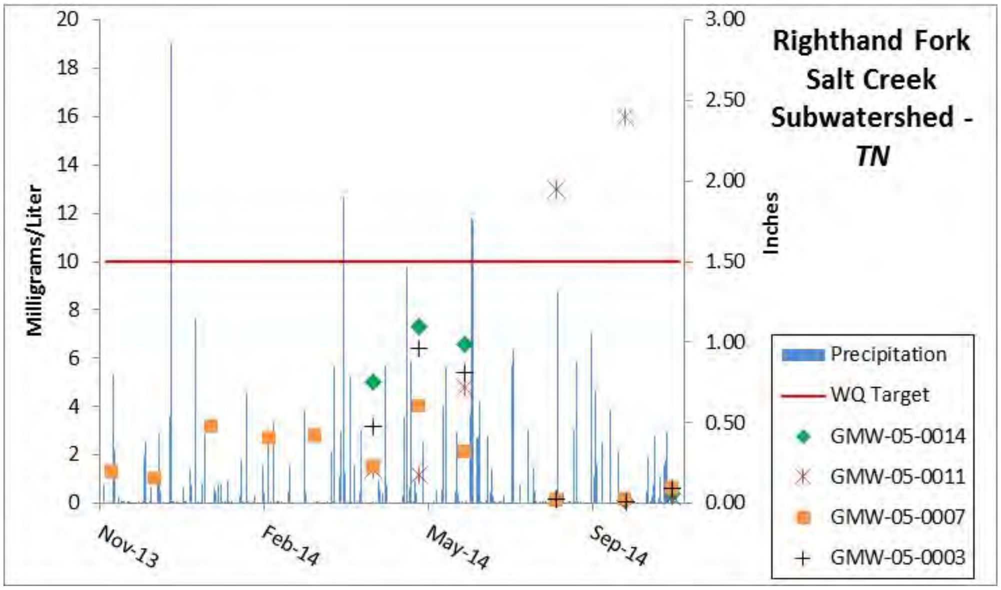


Figure 70 Graph of Precipitation and Total Nitrogen Data in the Righthand Fork Salt Creek Subwatershed

The Righthand Fork Salt Creek subwatershed drains approximately 46 square miles. The Headwaters Salt Creek subwatershed drains into the southern portion of this watershed. There is also the major tributary Righthand Fork Salt Creek that drains into the mainstem in this subwatershed. Righthand Fork Salt Creek has been impounded at the upper end to form Lake Santee which is a drinking water source for the surrounding area. The land use is primarily agriculture (28%) followed by forested land (48%) and hay and pasture land (15%). There are houses surrounding Lake Santee which are sewered to the Lake Santee WWTP. The remaining parts of the subwatershed are primarily rural and those homes pump to on-site septic systems. The Towns of Hamburg and Enochsburg are populated areas within the drainage with septic systems. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area consists of gentle rolling hills in the headwaters and becomes steeper towards the base of the subwatershed. Highly erodible soil types make up a small portion of this subwatershed. The majority of the HEL lands are located upstream of Lake Santee, which is dominated by agriculture uses. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. There are small patches of the subwatershed identified as having hydric soil types. These areas could be potential areas for wetland restoration. In addition to the Lake Santee WWTP, the New Point Stone Quarry is another NPDES permitted facility in the subwatershed. The Batesville Aviation Services LLC is a small airport with a storm water permit in the subwatershed. There are two confined feeding operations, as well as, numerous smaller animal farms. The total number of animal units in this area (94 animals/square mile) which is the second highest concentration when compared to other subwatersheds in Salt Creek. There are approximately 61 miles of stream in the subwatershed. According to the Draft 2012 List of Impaired Waters, the mainstem Salt Creek is impaired for E. coli and DO based on a sampling site in 2007. In 2009, the LARE diagnostic study results for this subwatershed indicated a nutrient problem based on TP results greater than 0.3 mg/L. Based on IDEM data collected in 2013 and 2014 there will be 49 stream miles impaired for *E. coli*, 35 stream miles impaired for nutrients and 39 stream miles with impaired biological communities listed on the 2016 List of Impaired Waters.

Site GMW-05-0006 which is site T2 is within the Righthand Fork Salt Creek subwatershed boundary, however it represents the pour point the Headwaters Salt Creek subwatershed. Based on the results of this

site we know there are high *E. coli* levels (geometric mean > 4,000 MPN) and nutrients loadings to support nuisance algae mats entering the watershed along Salt Creek. See the site discussion in Section 11.3.1. There is another site along Salt Creek located downstream of the confluence with Righthand Fork Salt Creek, GMW-05-0003 (P12), which was sampled as part of the IDEM probabilistic program. The geometric mean from this site was 1018.8 MPN which remains above the Indiana water quality standard. The fish and macroinvertebrate communities were not sampled at this site. The third site along Salt Creek is GMW-05-0007 (T6), and is the pour point of the watershed. The *E. coli* geometric mean at this site was 758.62 MPN/100mL which is significantly higher than the Indiana water quality standard of (125 MPN/100mL). White the *E. coli* levels are still in violation of the Indiana WQS, there is dilution occurring in a downstream direction. The *E. coli* geometric mean was > 4,000 MPN entering the subwatershed and is ~750 MPN exiting the subwatershed. The fish community IBI score was 52 which is considered good and the habitat score was 67 which is considered good. The macroinvertebrate community mIBI score was 42 which is considered fair and the habitat score was 68 which is considered good. Based on the IBI scores from site T2 (upstream site) this stream segment is considered impaired for biological communities, however based on biological results from site T6 (downstream site) the communities have recovered. The riparian area around the stream transitions in a downstream direction to a more forested buffer. The steep slopes, agricultural lands in the headwaters, land application of animal manure and leaky septic systems in limited use soils may be contributing to high levels of *E.coli*.
There were three sites located on the mainstem Salt Creek in this subwatershed, which was previously impaired for dissolved oxygen. No data results collected in 2013 or 2014 indicate a DO impairment exists based on IDEM WQS of 4 mg/L. Although dissolved oxygen swings and excessive algae were observed during sampling, there were no violations of the WQS. Based on this information the mainstem Salt Creek in this subwatershed will be delisted for DO on the 2016 List of Impaired Waters.

Righthand Fork Salt Creek is one of the major tributaries in this watershed and in 2013 and 2014 water chemistry, fish and aquatic insects were also collected at two sites along this stream. Site GMW-05-0014 (T3) is located upstream of Lake Santee. This is a small headwater tributary and the field notes indicate there is little flow or isolated pools during dry summer months. The *E. coli* geometric mean was 1034.99 MPN and was in violation of the single sample maximum 8/10 times. The fish community IBI score was 12 which is considered very poor and the habitat score was 59 which is considered good. The macroinvertebrate community mIBI score was 36 which is considered fair and the habitat score was 54 which is considered fair. Based on these results this stream is considered impaired for biological communities. There were no significant water chemistry violations, however total nitrogen was elevated from April through June, although not in exceedance of the WQS (10 mg/L). This same site was sampled as part of the 2009 LARE diagnostic study and results indicated high levels of both TP and nitrogen during high flow events. Nutrients were identified as being a management priority for this stream segment based on the LARE study. There is one CFO located in the drainage of this stream and several others in the surrounding watershed which indicate land application could be a potential source. There is very little riparian buffer along the stream leading to higher pollutant loadings during rain events. The Town of Clarksburg is also along this stream which is a populated area where septic's may be an issue. *E.coli* sampling results were consistently high during low flow events indicating there are possible point sources or failing septic systems entering the stream.

An additional site, GMW-05-0011 (T4), was located downstream of Lake Santee and the Lake Santee WWTP outfall. The *E. coli* geometric mean was 1472.41 MPN with 7/10 samples failing the single sample maximum. There are often low levels of *E. coli* downstream of lakes however these results indicate otherwise. The Lake Santee WWTP does have a land application permit and if those fields are in close proximity to the stream that could be contributing to the high levels of *E. coli*. The fish community IBI score was 28 which is considered poor and the habitat score was 65 which is considered good. The macroinvertebrate community mIBI score was 36 which is considered fair and the habitat score was 60 which is considered good. Based on these results this stream is considered impaired for biological communities. The habitat scores indicate the stream could support a healthy biological community which implies there may be a chemical stressor causing the fish community impairment. Water chemistry collected at this site in August and September had high nutrient levels (TN = 13, 16 mg/L and TP = 2.278, 3.945 mg/L). These results are in exceedance of the Indiana WQ targets. There were high nutrient values upstream of the lake which could lead to high nutrient levels in the lake. Lake dischargers are often more nutrient rich than natural streams which could be contributing to high nutrient levels. There is also a possibility that the Lake Santee WWTP is discharging high levels of TP and TN. The results indicate the exceedances occur during low flow when the discharge makes up a higher percentage of the stream. These higher levels of nutrients are likely discharged year round but are diluted by the natural stream flow during normal to high flow regimes. Nutrients are not regulated in the NPDES permit unless the facility is considered a major discharger (>1.0 MGD), therefore the facility is not in violation of the parameters currently regulated. The treatment processes used in some WWTPs converts ammonia to nitrate and then to nitrite. This is the reason elevated levels of nitrate-nitrite are sometimes found downstream of dischargers. If the WWTP is contributing to the high nutrient levels, the NPDES permit program addresses facilities discharging to impaired streams during the permit renewal process. At that time the permit limits may be revised to incorporate nutrient limits. The stream is surrounded by mixed forest and agricultural land uses. A number of CFO farms are located within a 5 mile radius which makes land application a potential source for bacteria and nutrient loads.

11.3.3 Bull Fork Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Bull Fork subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 89 provides a summary of the Bull Fork subwatershed, including segment AUIDs, drainage area, sampling sites, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli*. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* concentrations.

Table 85. Summary of Bull Fork Subwatershed Characteristics

Bull Fork (050800030503)					
Drainage Area (sq. mi.): 21.56					
TMDL Sample Sites: GMW-05-0009 (T5), GMW-05-0002 (P6)					
Listed Segments: ING0353_01, ING0353_02, ING0353_T1001, ING0353_T1002, ING0353_T1003, ING0353_T1004, ING0353_T1005, ING0353_T1007					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 – 10 %**	**10 – 40%**	**40 - 60 %**	**60 – 90%**	**90-100%**
Bacteria TMDL (billions of bacteria/day)	**492.60**	**161.02**	**72.11**	**33.12**	**15.19**
Wasteload Allocation (WLA): Total	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**444.61**	**145.32**	**65.10**	**29.86**	**13.73**
Margin Of Safety (MOS) (5%)	**24.6**	**8.05**	**3.61**	**1.66**	**0.76**
Future Growth (5%)	**23.4**	**7.6**	**3.4**	**1.6**	**0.7**

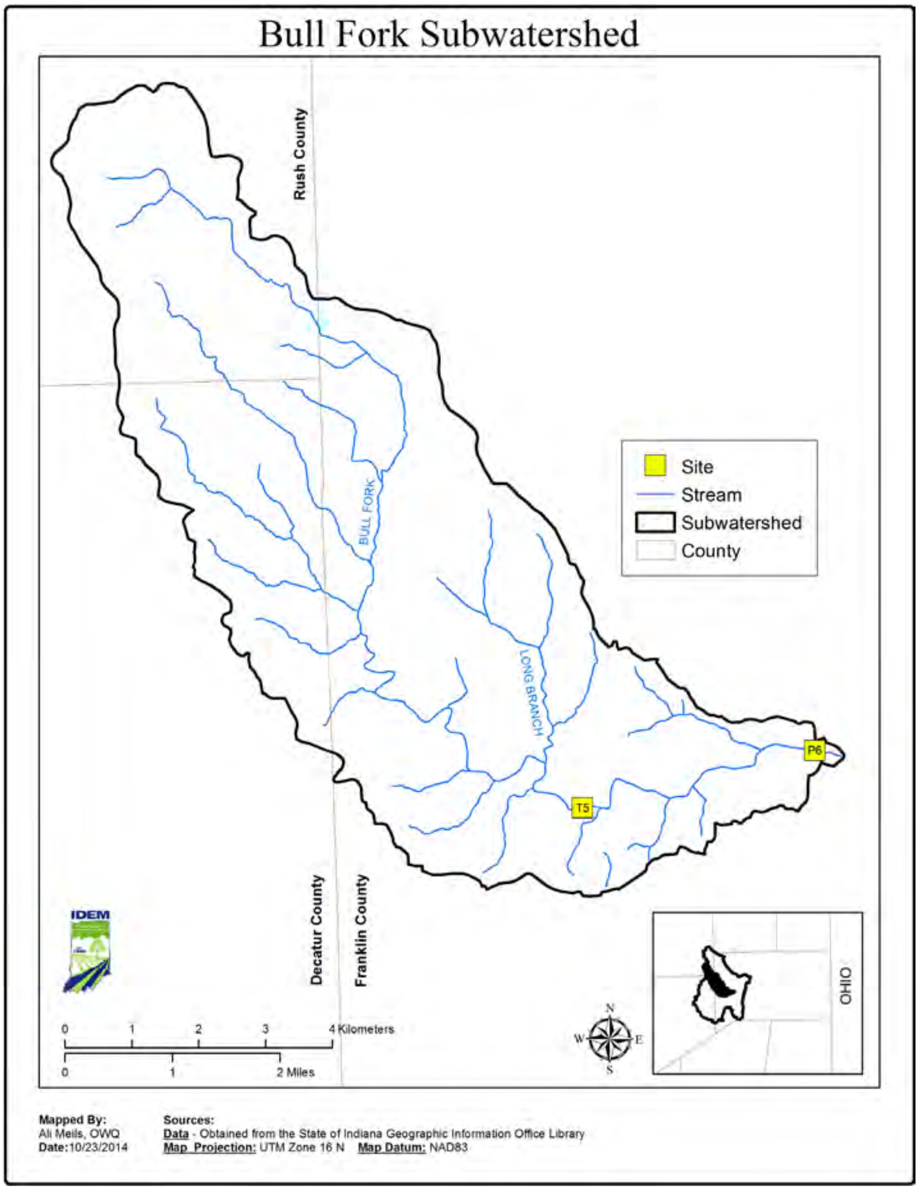


Figure 71 Sampling Stations in Bull Fork Subwatershed

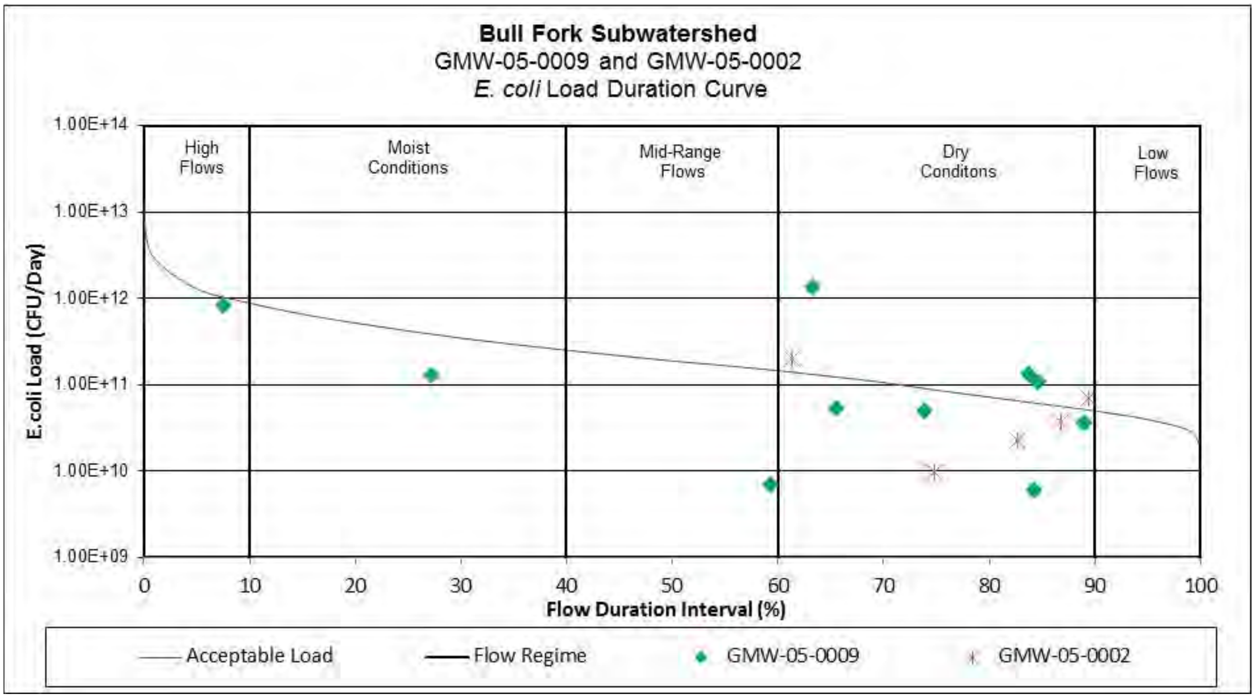


Figure 72 Load Duration Curve for Most Representative Site in the Bull Fork Subwatershed

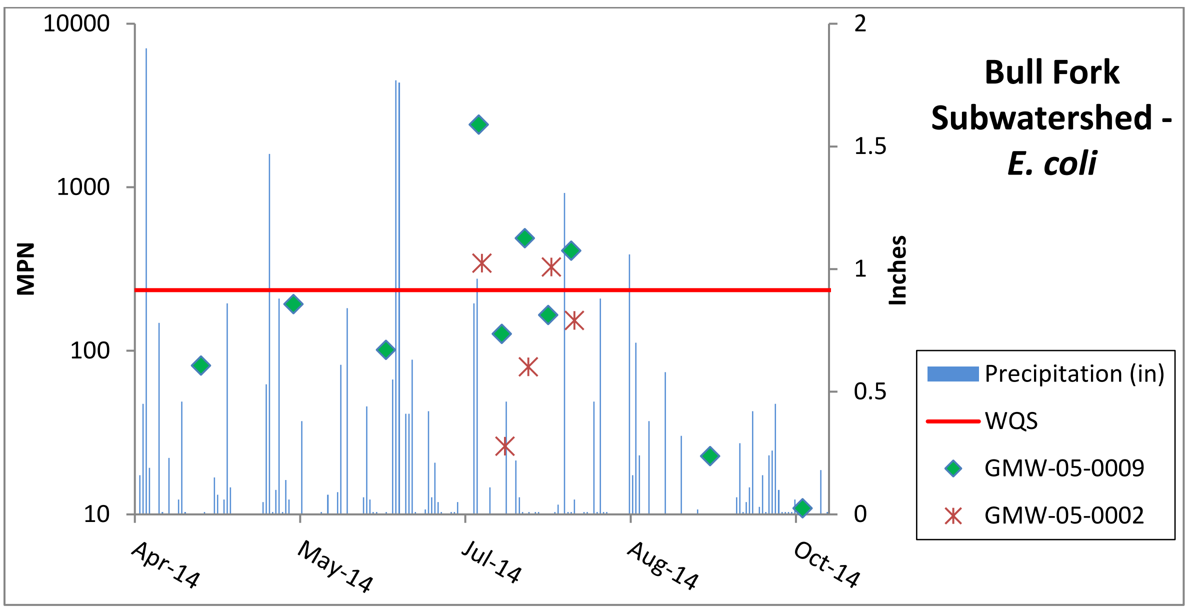


Figure 73 Graph of Precipitation and *E. coli* Data in the Bull Fork Subwatershed

The Bull Fork subwatershed drains approximately 46 square miles. The Bull Fork subwatershed drains into the mainstem of Salt Creek. The land use is primarily agriculture (28%) followed by forested land (55%) and hay and pasture land (12%). There are no permitted facilities in the subwatershed. The majority of the subwatershed is rural indicating homes pump to on-site septic systems. The Town of Buena Vista within the watershed yet it represents only a very small portion of the drainage. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area consists of gentle rolling hills in the headwaters and becomes steeper towards the base of the subwatershed. Highly erodible soil types make up nearly a third of this subwatershed. The majority of the HEL lands are located in the headwater portion of the subwatershed, which is dominated by agriculture uses. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. There are small patches of the subwatershed identified as having hydric soil types. These areas could be potential areas for wetland restoration. The land use is comprised of 12 percent pasture land which indicates the potential for numerous smaller animal farms. The total number of animal units in this area (78 animals/square mile) which is the second lowest concentration when compared to other subwatersheds in Salt Creek. There are approximately 43 miles of stream in the subwatershed. Based on IDEM data collected in 2013 and 2014 there will be 33 stream miles impaired for *E. coli* and 6 stream miles with impaired biological communities listed on the 2016 List of Impaired Waters.

There are two sites located in this subwatershed, both of which are located on Bull Fork. Site GMW-05-0009 (T5) is the upstream site along Bull Fork. It is located just downstream from the confluence with Long Branch at Bullfork Road. The downstream site, GMW-05-0002 (P6), is located at the pour point of the subwatershed also at Bullfork Road. This stream reach is impaired for *E. coli* and dissolved oxygen based on a 2002 sample in the headwaters of Bull Fork. In 2013 and 2014 DO was sampled 21 times between the two sites located on this stream and there were no WQS violations. This stream reach will be delisted for dissolved oxygen in the 2016 303(d) list of impaired waters. However the headwaters of Bull Fork will remain impaired for DO since there was no data collected in that location to show an improvement.

In 2009, there was an E. coli only sample collected just upstream of site T5 and the geometric mean was 360.62 MPN with 4/5 samples exceeding the single sample maximum. After the 2014 sampling, site T5 had a geometric mean was 400.07 MPN and site P6 had a geometric mean of 129.33 MPN. While the *E. coli* levels are still in violation of the Indiana WQS, there is dilution occurring in a downstream direction. Agricultural land use dominates the headwaters of the subwatershed and could be contributing to higher levels of *E. coli* in the headwaters. The fish community IBI score at site T5 was 52 which is considered good and the habitat score was 65 which is considered good. The macroinvertebrate community mIBI score was 44 which is considered fair and the habitat score was 67 which is considered good. Downstream at site P6 the fish community IBI score at site T5 was 42 which is considered fair and the habitat score was 64 which is considered good. The macroinvertebrate community mIBI score was 40 which is considered fair and the habitat score was 57 which is considered good.

In 2009 there were two LARE sites (5 and 6) located on this stream. The results of that study showed low DO during base flow and high TP, high nitrogen and high TSS during storm flow. The study determined this subwatershed has high nutrient loadings and defined nutrients as the primary pollutant in this stream. While IDEM data did not collect any nutrient samples in violation of water quality targets, IDEM did not capture any storm events as targeted by LARE studies. The riparian area around the stream transitions in a downstream direction to a more forested buffer. The steep slopes, agricultural lands in the headwaters, land application of animal manure, unsewered communities and leaky septic systems in limited use soils may be contributing to high levels of *E.coli* and nutrients in the subwatershed.

11.3.4 Little Salt Creek Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Little Salt Creek subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 90 provides a summary of the Little Salt Creek subwatershed, including segment AUIDs, drainage area, sampling sites, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli*. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* concentrations

Table 86 Summary of Little Salt Creek Subwatershed Characteristics

Little Salt Creek (050800030504)					
Drainage Area (sq. mi.): 25.13					
TMDL Sample Sites: GMW-05-0015 (T8), GMW-05-0008 (T9), GMW-05-0001 (P1)					
Listed Segments: ING0354_02, ING0354_T1002, ING0354_T1003, ING0354_T1004					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90-100%**
Bacteria TMDL (billions of bacteria/day)	**574.2**	**187.69**	**84.05**	**38.60**	**17.71**
Wasteload Allocation (WLA): Total	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**518.23**	**169.39**	**75.84**	**34.87**	**16.02**
Margin Of Safety (MOS) (5%)	**28.7**	**9.38**	**4.20**	**1.93**	**0.89**
Future Growth (5%)	**27.3**	**8.9**	**4.0**	**1.8**	**0.8**

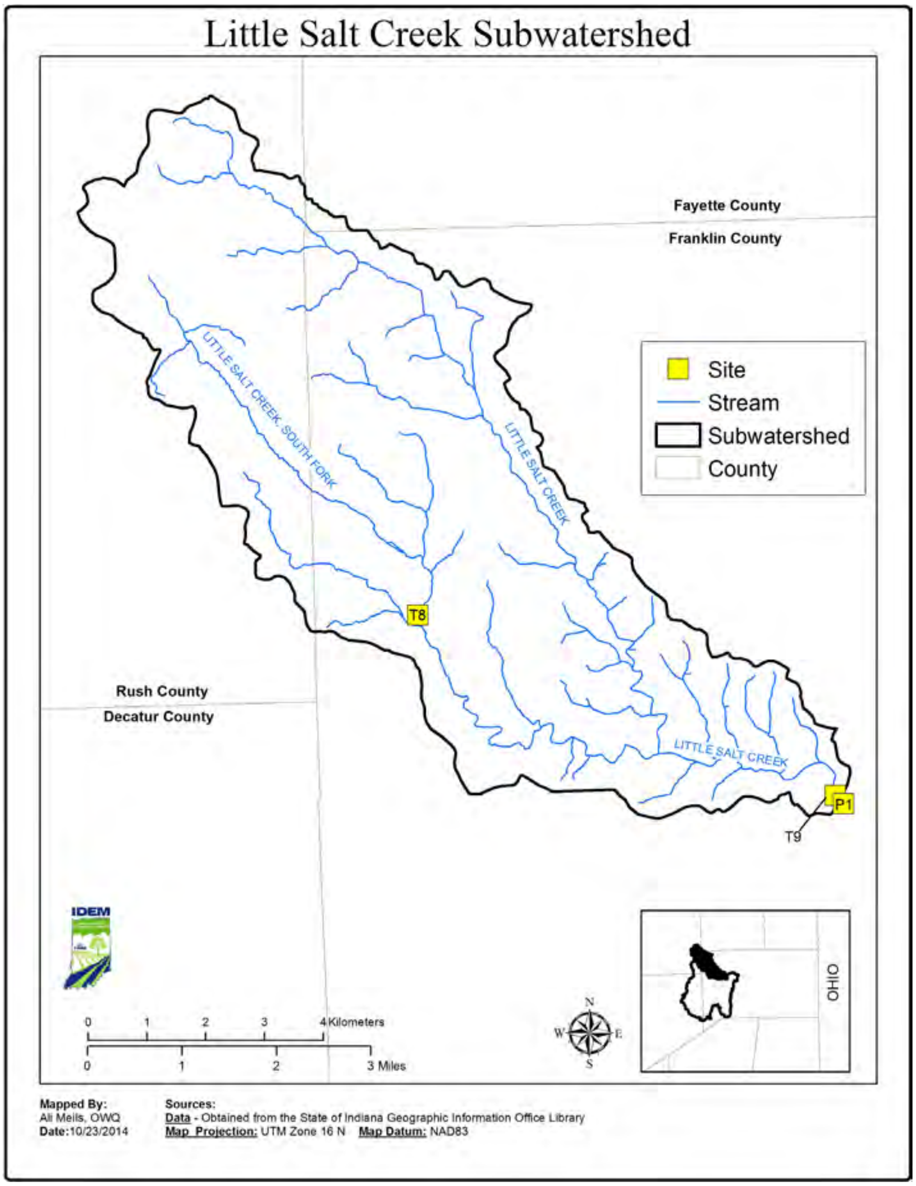


Figure 74 Sampling Stations in Little Salt Creek Subwatershed

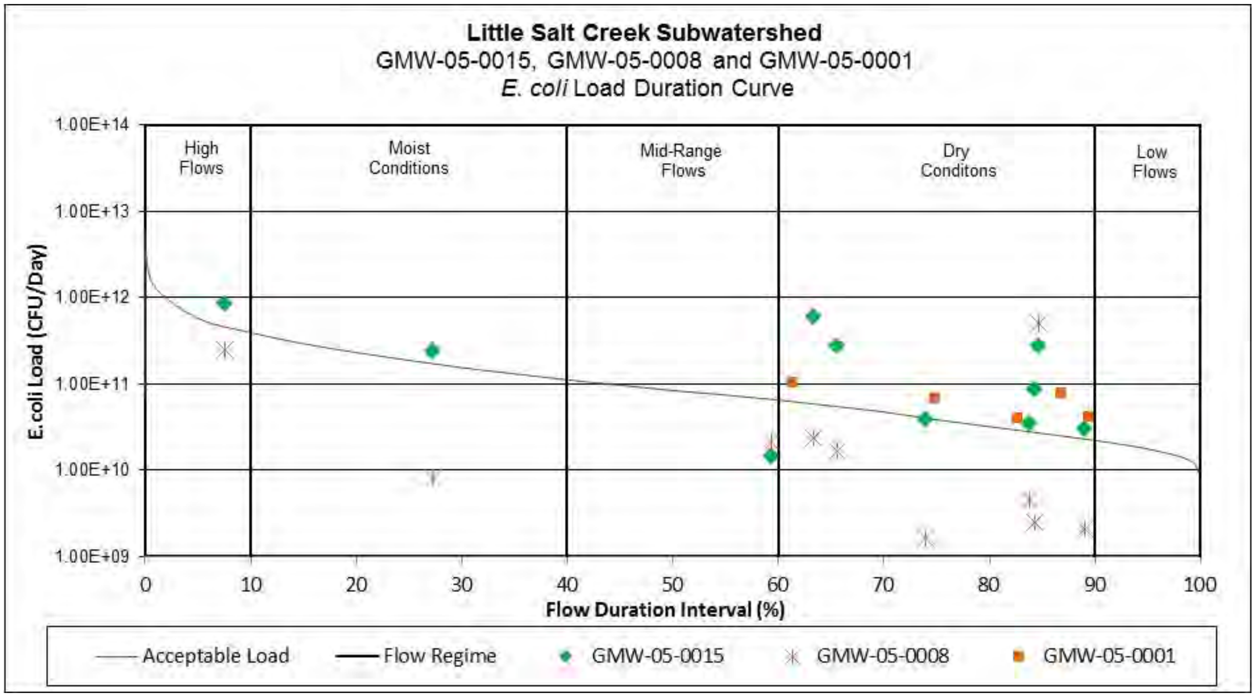


Figure 75 Load Duration Curve for Most Representative Site in the Little Salt Creek Subwatershed

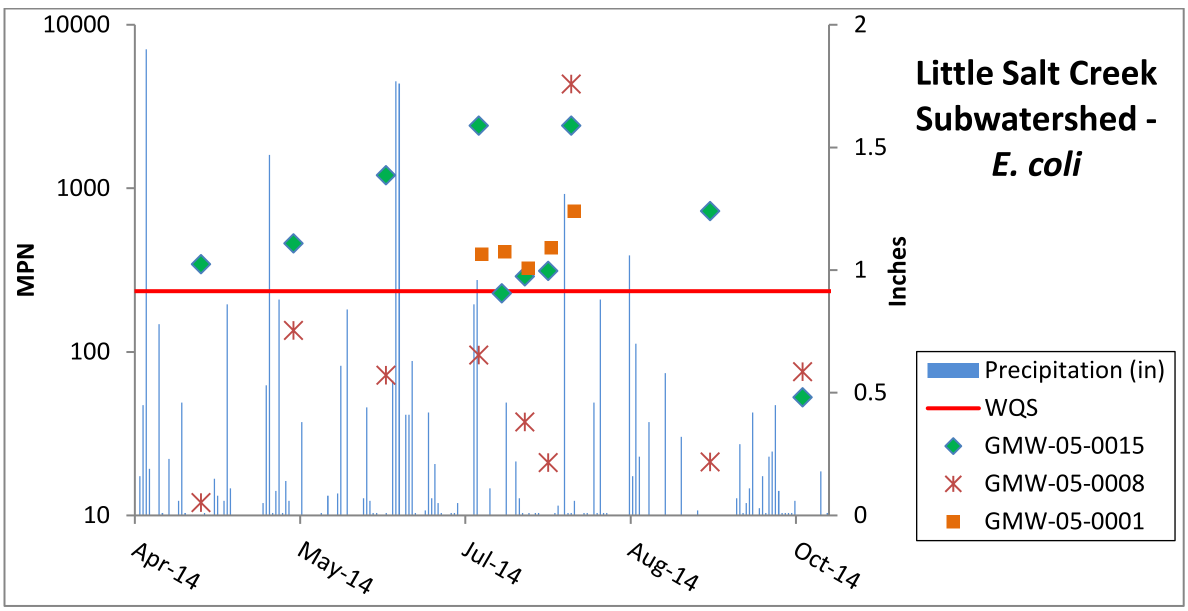


Figure 76 Graph of Precipitation and *E. coli* Data in the Little Salt Creek Subwatershed

The Little Salt Creek subwatershed drains approximately 25 square miles. The Little Salt Creek subwatershed drains into the mainstem of Salt Creek. The land use is primarily agriculture (36%) followed by forested land (48%) and hay and pasture land (11%). There are no permitted facilities in the subwatershed. The majority of the subwatershed is rural indicating homes pump to on-site septic systems. The Town of Andersonville is within the watershed yet it represents approximately 5 percent of the drainage. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area consists of gentle rolling hills in the headwaters and becomes steeper towards the base of the subwatershed. Highly erodible soil types make up nearly a third of this subwatershed. The majority of the HEL lands are located in the headwater portion of the subwatershed, which is dominated by agriculture uses. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. There are small patches of the subwatershed identified as having hydric soil types. These areas could be potential areas for wetland restoration. The land use is comprised of 11 percent pasture land which indicates the potential for smaller animal farms. The total number of animal units in this area (89 animals/square mile) which is median concentration when compared to other subwatersheds in Salt Creek. There are approximately 56 miles of stream in the subwatershed. Based on IDEM data collected in 2013 and 2014 there will be 41 stream miles impaired for *E. coli* listed on the 2016 List of Impaired Waters.

There are three sites located in this subwatershed, two located on Little Salt Creek GMW-05-0001 (P1) and GMW-05-008 (T9) and one located on South Fork Little Salt Creek GMW-05-0015 (T8) located in the middle of the South Fork Little Salt Creek. In 2014 this watershed was sampled 29 times between the three sites the *E.coli* WQS were violated. This stream reach will remain listed for *E.coli* in the 2016 303(d) list of impaired waters.

In 2009 a site was sampled for E. coli only and the geometric mean was 95.38 MPN with 1/5 samples exceeding the single sample max. In 2014 there were two samples taken from T9 and P1 which are located at the pour point of this subwatershed, downstream of the confluence with ING0354_T1003. The geometric mean for T9 was 79.40 MPN and there was 1/10 samples in exceedance of the single sample max. In 2014 there was another site P1 located in close proximity to site T9 and the geometric mean was 441.52 MPN with 5/5 samples in exceedance of the single sample max. The geometric means from site T9 and P1 were taken one day apart for five consecutive weeks. There was a historical site sampled in 2002 and the E. coli geometric mean was 30.65 MPN. The fish community IBI score for site T9 was 38 (fair) and the QHEI was 60 (good). The macro community mIBI score was 42 (fair) and the QHEI was 61 (good). The fish community IBI score for site P1 was 42 (fair) and the QHEI was 79 (excellent). The macro community mIBI score was 42 (fair) and the QHEI was 58 (good). The historical site in close proximity was sampled in 1994 with macro score of 4.8 and QHEI of 70 and again in 2004 with an mIBI score of 34 and a QHEI of 54. In 2009 there were also two LARE sites (8 and 10) located on this AUID. The results indicated that this subwatershed has high loads of sediment.

In 2009 site T8 had a geometric mean of 136.73 MPN, with 0/5 exceeding the single sample max. In 2014 this same site was sampled and the geometric mean was 656.17 MPN with 8/10 samples exceeding the single sample max. The fish community IBI score for site T8 was 44 (fair) and the QHEI was 72 (excellent). The macro community mIBI score was 46 (good) and the QHEI was 66 (good). No other chemical impairments but the TSS was > 30 mg/L in July which is more than the WQ target.

The land use is primarily steep forested lands with wide riparian buffers surrounding the stream. However further upstream the land use is dominantly agriculture with little to no riparian buffers. Small clusters of homes are also present along US 52. T9 (2014): Geometric mean of 79 cfu/100 mL. 0019 (2009): 95 cfu/100 mL. P1(2014): 442 cfu/100 mL. T9 and P1 were sampled a day apart with results geometric means that are drastically different. No weather events happened during the sampling period to explain the differing results. These results suggest consistent loadings and a specific cause has not been identified.

11.3.5 Fremont Branch Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Fremont Branch subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 91 provides a summary of the Fremont Branch subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli* and TSS. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* and TSS concentrations.

Table 87 Summary of Fremont Branch Subwatershed Characteristics

Fremont Branch (050800030505)					
Drainage Area (sq. mi.): 117.36					
TMDL Sample Sites: GMW-05-0012 (T7), GMW-05-0010 (T10)					
Listed Segments: ING0355_01, ING0355_T1001, ING0355_T1002, ING0355_T1003, ING0355_T1004					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90-100%**
Bacteria TMDL (billions of bacteria/day)	**569.60**	**186.50**	**83.80**	**38.70**	**18.0**
Wasteload Allocation (WLA): Total	**1.33**	**1.33**	**1.33**	**1.33**	**1.33**
Oldenburg WTTP (IN0023973) 0.15 MGD	**1.33**	**1.33**	**1.33**	**1.33**	**1.33**
Load Allocation (LA)	**513.65**	**167.86**	**74.27**	**33.67**	**14.87**
Margin Of Safety (MOS) (5%)	**27.55**	**8.61**	**4.2**	**1.9**	**0.9**
Future Growth (5%)	**27.1**	**8.7**	**4.0**	**1.8**	**0.9**
Drainage Area (sq. mi.): 117.36					
TMDL Sample Sites: GMW-05-0010 (T10)					
Listed Segments: ING0355_01					
Flow Regime TMDL analysis TSS (pounds/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90-100%**
TSS TMDL (lbs/day)	**62849.4**	**20542.81**	**9199.05**	**4224.84**	**1938.00**
Wasteload Allocation (WLA): Total	**1.07**	**0.35**	**N/A**	**N/A**	**N/A**
Construction Activities (0.0021 sq. mi.)	**1.07**	**0.35**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**56720.50**	**18539.54**	**8302.09**	**3812.90**	**1749**
Margin Of Safety (MOS) (5%)	**3142.5**	**1027.14**	**459.95**	**211.24**	**96.90**
Future Growth (5%)	**2985.3**	**975.8**	**437.0**	**200.7**	**92.1**

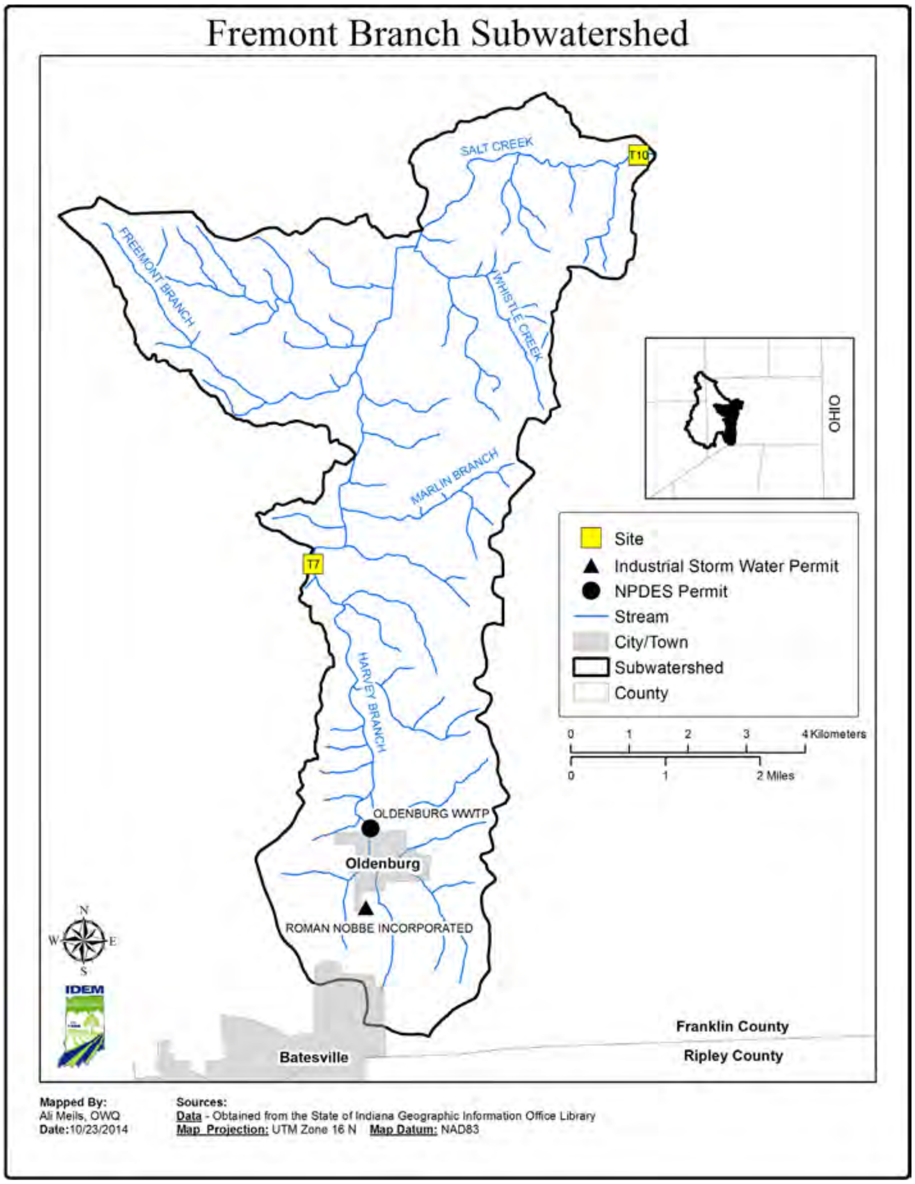


Figure 77 Sampling Stations in Fremont Branch Subwatershed

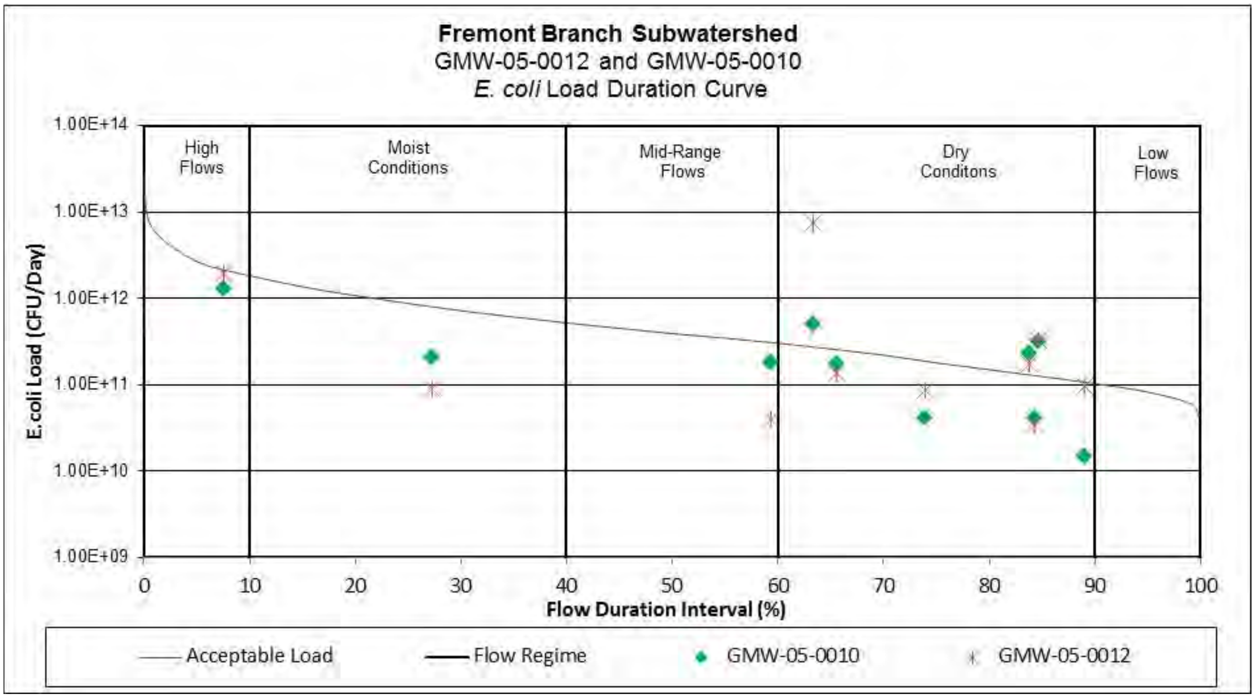


Figure 78 Load Duration Curve *E. coli* in the Fremont Branch Subwatershed

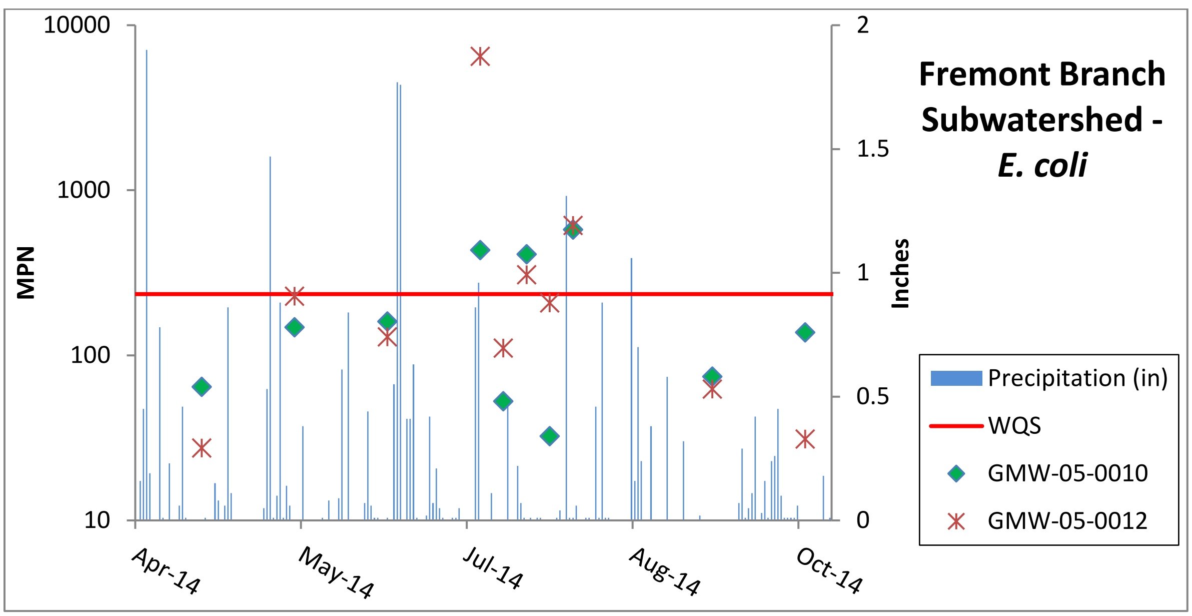


Figure 79 Graph of Precipitation and *E. coli* Data in the Fremont Branch Subwatershed

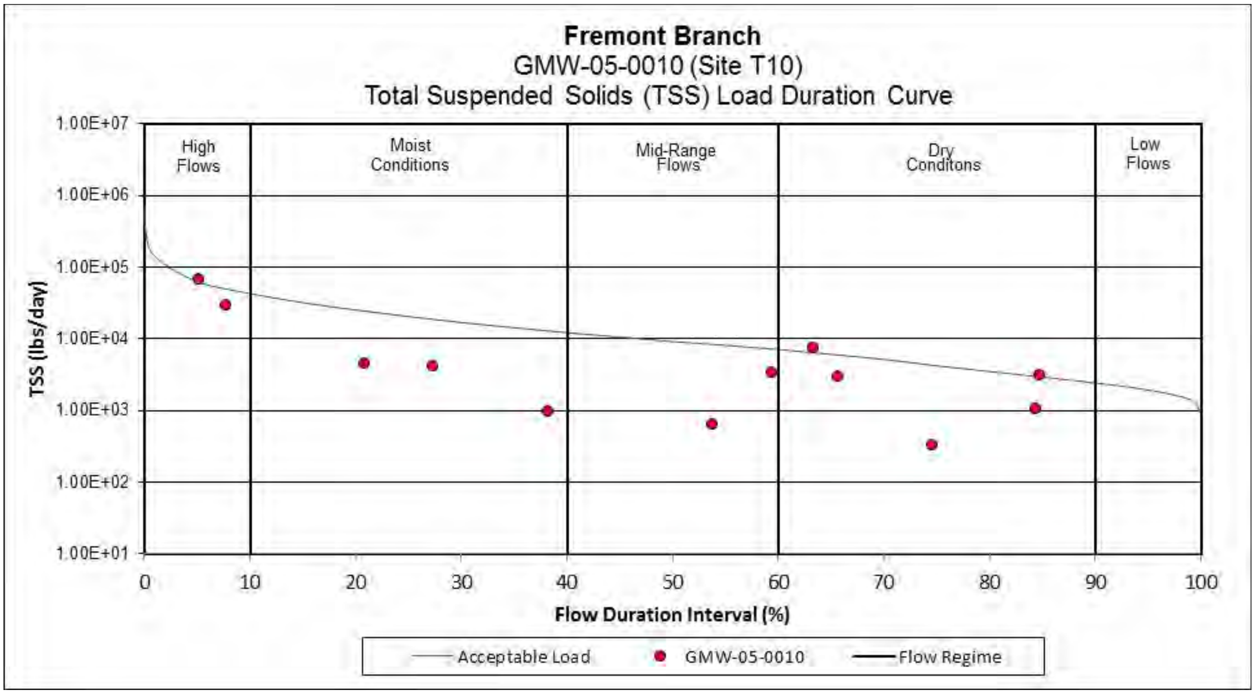


Figure 80 Load Duration Curve for Most Representative Site in the Fremont Branch Subwatershed

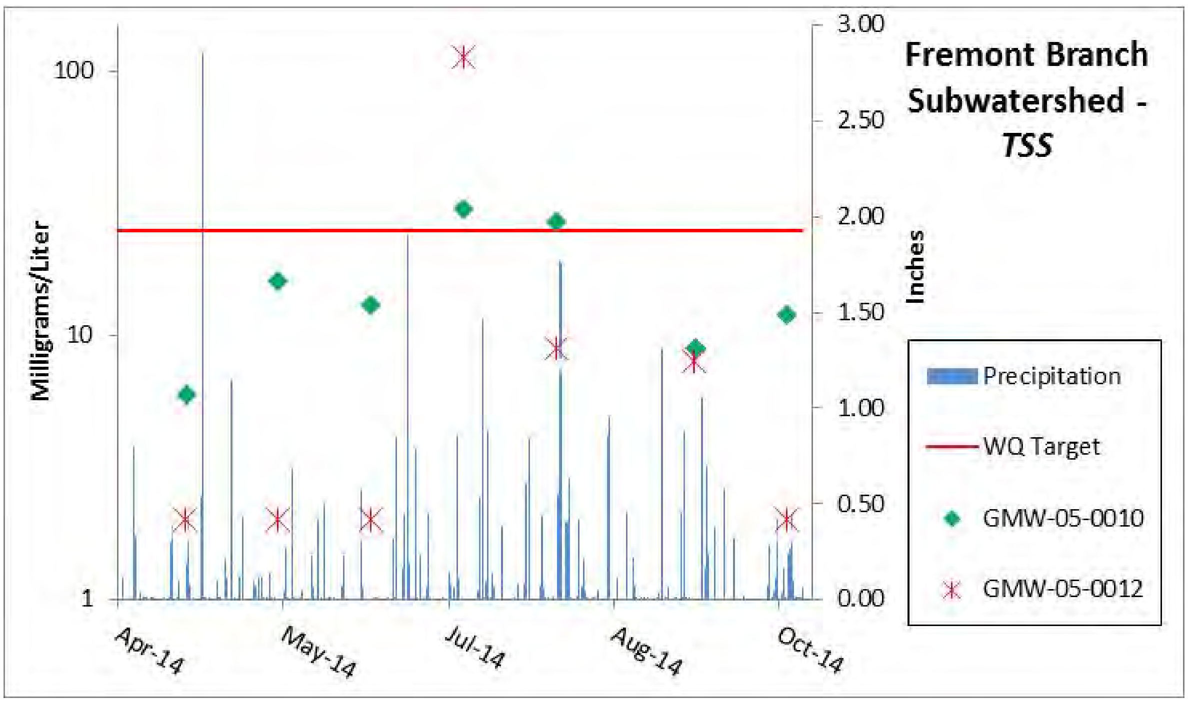


Figure 81 Graph of Precipitation and TSS Data in the Fremont Branch Subwatershed

The Fremont Branch subwatershed drains approximately 117 square miles. The Fremont Branch subwatershed drains into the mainstem of Salt Creek. The land use is primarily forested (67%) followed by hay and pasture (14%) and agricultural land (14%). There is one permitted facilities in the subwatershed Oldenburg. Oldenburg has had compliance issues in the past and continued compliance with the NPDES permit is necessary for meeting WQS. Oldenburg also has a sanitary sewer overflow which is not permitted to discharge and will continue to be monitored for discharge by IDEM. There is one confined animal feeding operation (CAFO) and one confined feeding operation (CFO) in the subwatershed. These permits are no discharge permits and as long as the permittee complies with the current discharge regulation and land applies septage as permitted they should not be a source for the Fremont Branch subwatershed. The majority of the subwatershed is rural indicating homes pump to on-site septic systems. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area consists of gentle rolling hills in the headwaters and becomes steeper towards the base of the subwatershed. Highly erodible soil types make up nearly a third of this subwatershed. The majority of the HEL lands are located in the headwater portion of the subwatershed, which is dominated by agriculture uses. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. There are small patches of the subwatershed identified as having hydric soil types. These areas could be potential areas for wetland restoration. There are approximately 64 miles of stream in the subwatershed. Based on IDEM data collected in 2014 there will be 35 stream miles impaired for *E. coli* and 10 stream miles impaired for TSS listed on the 2016 List of Impaired Waters.

Site GMW-05-0012 (T7) is located on Harvey Branch. This site T7 had a geometric mean of 489.42 MPN with 3/10 samples exceeding the single sample max. In 1997 this AUID was sampled just downstream and the biological fish IBI = 48 (good), QHEI = 80 (excellent). In 2014 the fish community IBI score for site T7 was 44 (fair) and the QHEI was 61 (good). The macro community mIBI score was 34 (poor) and the QHEI was 61 (good). From the site collected upstream in 2009 the data shows there are heavy loads of nutrients coming downstream. The data collected in 2014 did not show any nutrient exceedances. This study does not indicate this was a priority area for management. The surrounding land use is a mixture of forested and agricultural land.

Site GMW-05-0010 (T10) is located on Salt Creek and is the pour point for this subwatershed. T10 was sampled in 2002 and the E. coli geometric mean was ~72 MPN. In 2014 this same site was sampled and the geometric mean was 177.69 MPN with 3/10 samples exceeding the single sample max. The fish community IBI score for site T10 was 44 (fair) and the QHEI was 55 (good). The macro community mIBI score was 44 (fair) and the QHEI was 57 (good). There is a 1994 historical macroinvertebrate site upstream on this AUID and the macro score was 2.6 with QHEI of 70. This is the mainstem Salt Creek and all other subwatersheds are contributing loads. Given the higher levels of E. coli in some of the other subwatersheds this is a major factor in the elevated levels of E. coli. The geometric mean decreases in a downstream direction from site T7 to T10. In 2009 LARE site 15 is located at the same location as T10. The study showed there were high TP (0.41 mg/L) and high TSS (97 mg/L) during storm flows. The study identified the lower portion of this watershed as having high sediment loadings. The land use is primarily forest in the downstream portion. Small clusters of homes exist along SR229, other than that is it fairly rural. Wide riparian buffers exist and help filter out pollutants.

11.3.6 Headwaters Pipe Creek

Load duration curves and precipitation graphs were created for all the sampling sites in the Headwaters Pipe Creek subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 92 provides a summary of the Headwaters Pipe Creek subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli*. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* concentrations.

Table 88 Summary of Headwaters Pipe Creek Subwatershed Characteristics

Headwaters of Pipe Creek (050800030601)					
Drainage Area (sq. mi.): 18.28					
TMDL Sample Sites: GMW-06-0014 (T17), GMW060-0027 (T18)					
Listed Segments: ING0361_02, ING0361_T1003, ING0361_T1004, ING0361_T1005, ING0361_T1006, ING0361_T1006A, ING0361_T1007, ING0361_T1008, ING0361_T1009					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 – 10%**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90-100%**
Bacteria TMDL (billions of bacteria/day)	**417.70**	**136.53**	**61.14**	**28.08**	**12.88**
Wasteload Allocation (WLA): Total	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**376.97**	**123.22**	**55.18**	**25.37**	**11.64**
Margin Of Safety (MOS) (5%)	**20.9**	**6.83**	**3.06**	**1.40**	**0.64**
Future Growth (5%)	**19.8**	**6.5**	**2.9**	**1.3**	**0.6**

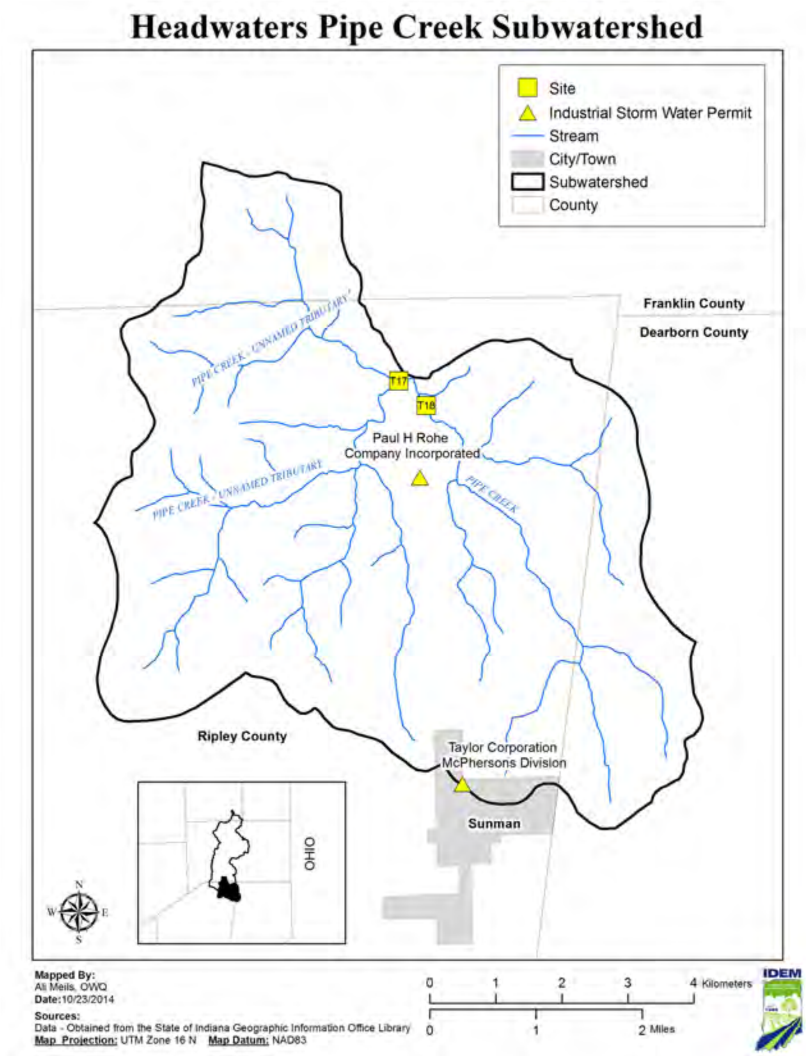


Figure 82 Sampling Stations in Headwaters Pipe Creek Subwatershed

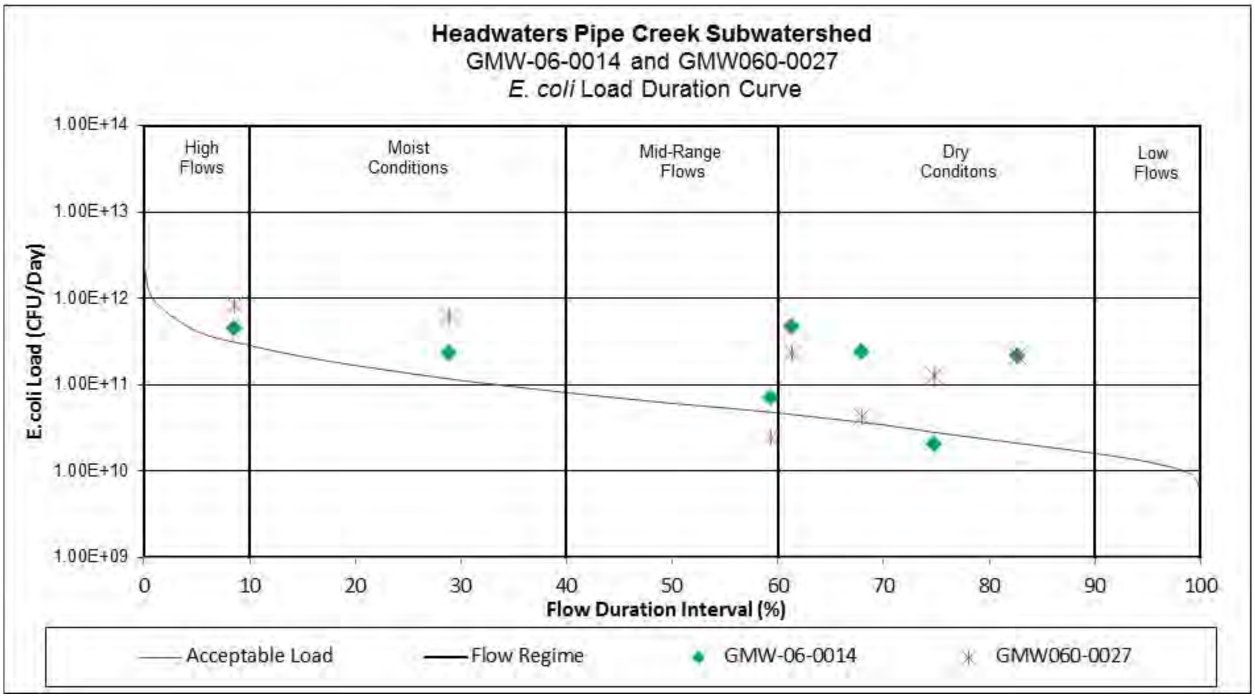


Figure 83 Load Duration Curve for Most Representative Site in the Headwaters Pipe Creek Subwatershed

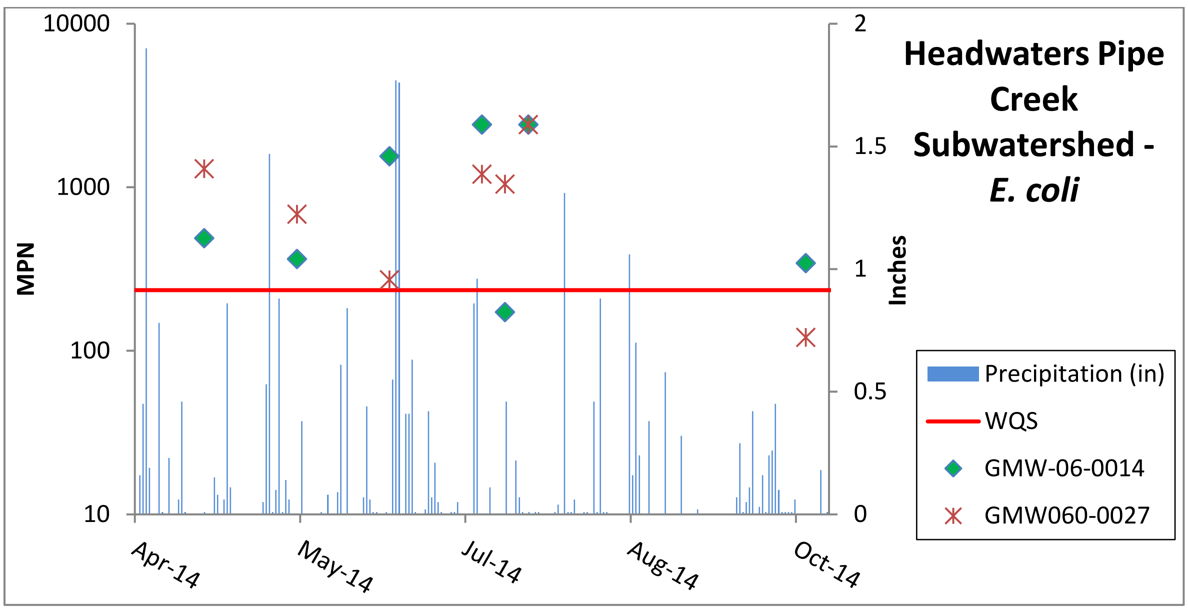


Figure 84 Graph of Precipitation and *E. coli* Data in the Headwaters Pipe Creek Subwatershed

The Headwaters Pipe Creek subwatershed drains approximately 18 square miles. The Headwaters Pipe Creek subwatershed drains into the mainstem of Pipe Creek. The land use is primarily forested (37%) followed by agricultural land (34%) hay and pasture (21%). There are no permitted facilities in the subwatershed. There are no confined animal feeding operation (CAFO) and one confined feeding operation (CFO) in the subwatershed. These permits are no discharge permits and as long as the permittee complies with the current discharge regulation and land applies septage as permitted they should not be a source for the Headwaters Pipe Creek subwatershed. The majority of the subwatershed is rural, with a small portion in Sunman, indicating homes pump to on-site septic systems. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area consists of steep gradient at the headwaters and more rolling hills toward the mouth of the watershed. Highly erodible soil types make up the majority of this subwatershed. The HEL lands are located in the headwater portion of the subwatershed, which is dominated by agriculture uses. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. Small patches on the edges of the watershed have been identified as having hydric soil types. These areas could be potential areas for wetland restoration. There are small wetland areas There are approximately 40 miles of stream in the subwatershed. Based on IDEM data collected in 2014 there will be 37 stream miles impaired for *E. coli* listed on the 2016 List of Impaired Waters.

Site GMW-060-0027 (T18) is located Pipe Creek Road on Pipe Creek. The geometric mean value for Site 9 is 210 MPN/100mL. In 2009 this site was sampled for E. coli only and the geometric mean was 260.07 MPN with 3/5 exceeding the single sample max. In 2014 this same site (T18) was sampled. The geometric mean could not be calculated because the site went dry during the 5 weeks of sampling. However there were 6/7 sampling events where the results were in exceedance of the single sample max. Three of those samples were >1000 MPN. In 2014 the fish community IBI score for site T18 was 38 (fair) and the QHEI was 50 (fair). The macro community mIBI score was 38 (fair) and the QHEI was 49 (fair). This site went dry in August and September. The DO results never went below 4 mg/L while sampling however, while there was water in the stream, the DO was 4.5-6 mg/L from July through October. These low DO levels could be putting stress on the biological communities. Based on the small drainage area and high gradient this stream going dry in the summer months is likely a natural condition. As the stream is going dry and isolated pooling occurs low dissolved oxygen levels are likely as the Results indicate. The geometric in 2009 was 260 cfu/100 mL, No GM in 2014 because stream went dry (2/7), but results violate 10% rule indicating impairment.

Site GMW-060-0014 (T17) is located Unnamed Tributary of Pipe Creek Road on St. Marys Road. In 2009 this site was sampled for E. coli only and the geometric mean was 260.07 MPN with 3/5 exceeding The single sample max. In 2014 this same site (T18) was sampled. The geometric mean could not be calculated because the site went dry during the 5 weeks of sampling. However there were 6/7 sampling events where the results were in exceedance of the single sample max. Three of those samples were >1000 MPN. In 2014 the fish community IBI score for site T18 was 38 (fair) and the QHEI was 50 (fair). The macro community mIBI score was 38 (fair) and the QHEI was 49 (fair). This site went dry in August and September. The DO results never went below 4 mg/L while sampling however, while there was water in the stream, the DO was 4.5-6 mg/L from July through October. These low DO levels could be putting stress on the biological communities. Based on the small drainage area and high gradient this stream going dry in the summer months is likely a natural condition. As the stream is going dry and isolated pooling occurs low dissolved oxygen levels are likely as the results indicate. The geometric in 2009 was 260 cfu/100 mL, there was no geometric mean in 2014 because stream went dry (2/7), but results violate 10% rule indicating impairment.

Individual results were pretty high. Land use is predominately agricultural fields throughout this watershed. Possible sources are CFOs in nearby watershed that land apply also pasture land where animals have direct or near access to water. Sparse rural population on septic systems. Penntown an unsewered community is also located in this watershed.

11.3.7 Clear Fork Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Clear Fork subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 93 provides a summary of the Clear Fork subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli*. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* concentrations.

Table 89 Summary of Clear Fork Subwatershed Characteristics

Clear Fork (050800030602)					
Drainage Area (sq. mi.): 13.30					
TMDL Sample Sites: GMW-06-0013 (T15)					
Listed Segments: ING0362_02A, ING0362_T1002, ING0362_T1003, ING0362_T1004					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 – 40%**	**40 - 60 %**	**60 – 90%**	**90-100%**
Bacteria TMDL (billions of bacteria/day)	**303.9**	**99.33**	**44.48**	**20.43**	**9.37**
Wasteload Allocation (WLA): Total	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**274.27**	**89.65**	**40.16**	**18.41**	**8.50**
Margin Of Safety (MOS) (5%)	**15.2**	**4.97**	**2.22**	**1.02**	**0.47**
Future Growth (5%)	**14.4**	**4.7**	**2.1**	**1.0**	**0.4**

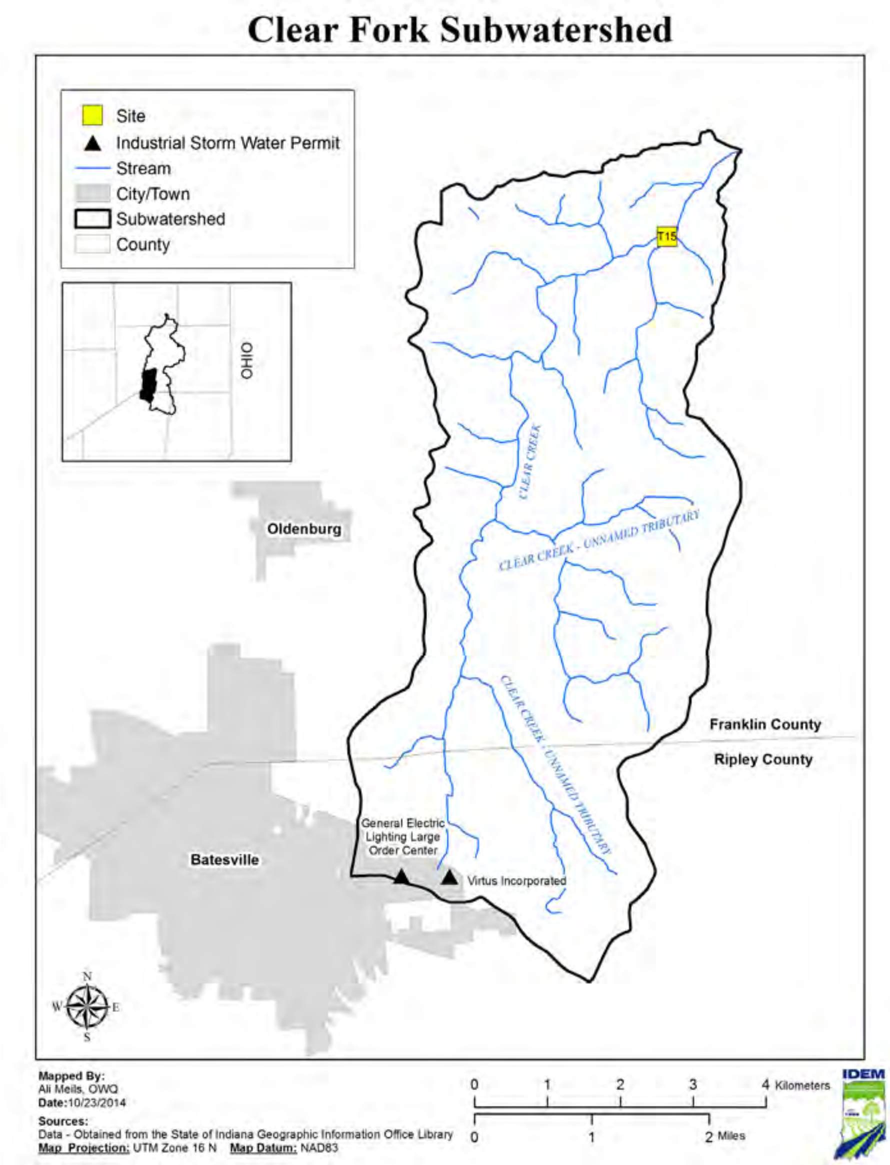


Figure 85 Sampling Stations in Clear Fork Subwatershed

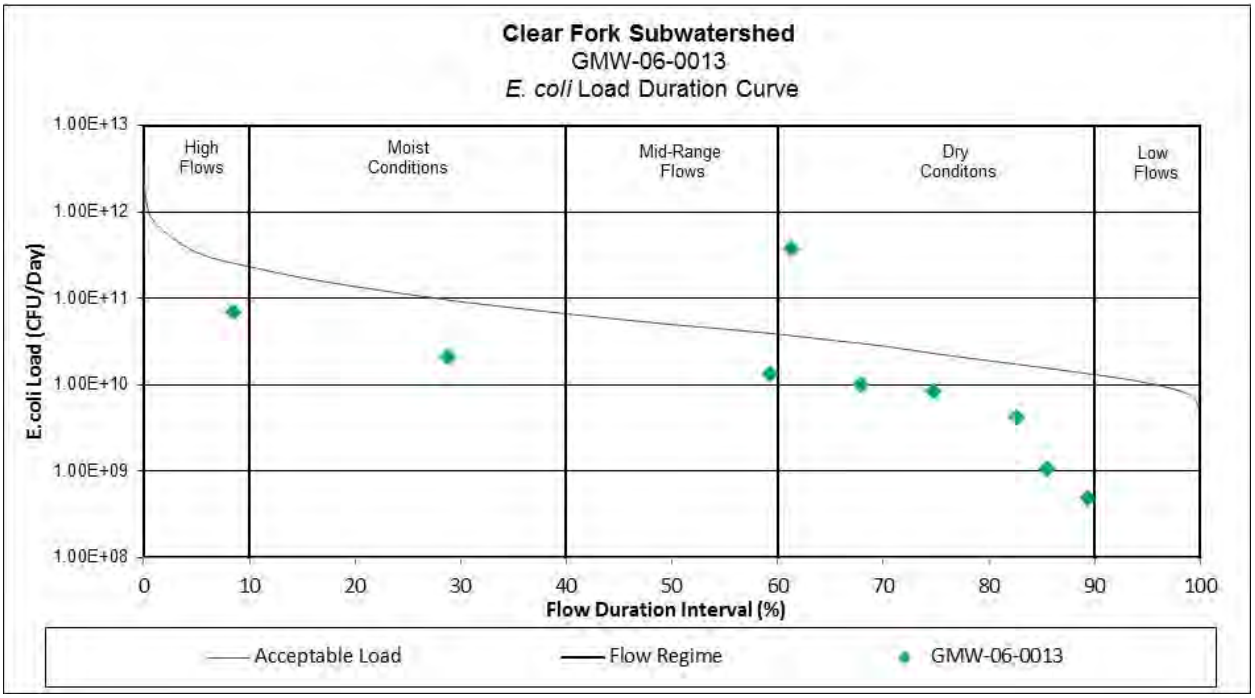


Figure 86 Load Duration Curve for Most Representative Site in the Clear Fork Subwatershed

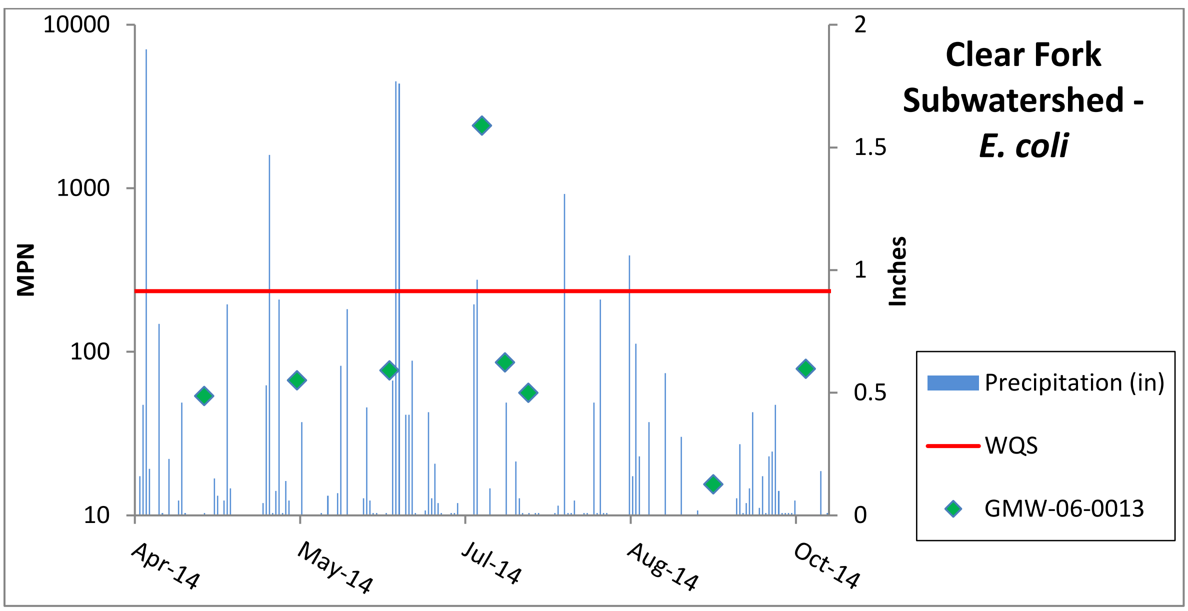


Figure 87 Graph of Precipitation and *E. coli* Data in the Clear Fork Subwatershed

The Clear Fork subwatershed drains approximately 13 square miles. The Clear Fork subwatershed drains into the mainstem of Pipe Creek. The land use is primarily forested (47%) followed by agricultural land (26%) hay and pasture (20%). There are no permitted facilities in the subwatershed. There are no confined animal feeding operation (CAFO) and one confined feeding operation (CFO) in the subwatershed. These permits are no discharge permits and as long as the permittee complies with the current discharge regulation and land applies septage as permitted they should not be a source for the Clear Fork subwatershed. The majority of the subwatershed is rural, with a small portion in Batesville, indicating homes pump to on-site septic systems. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area consists of rolling hills. Highly erodible soil types make up the majority of this subwatershed. The HEL lands are located in the headwater portion of the subwatershed, which is dominated by agriculture uses. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. Small patches on the edges of the watershed near the headwaters have been identified as having hydric soil types. These areas could be potential areas for wetland restoration. There are small wetland areas throughout the watershed. There are approximately 33 miles of stream in the subwatershed. Based on IDEM data collected in 2014 there will be 15 stream miles impaired for *E. coli* listed on the 2016 List of Impaired Waters.

Site GMW-060-00113 (T1) is located Schwegman Road on Clear Creek. In 2009 there was an E. coli only sample taken and the geometric mean was 291.17 MPN with 3/5 samples exceeding the single sample max. In 2014 the sample location was downstream on the segment and the geometric mean could not be calculated because the stream went dry in August. Only 1/9 sample was above the single sample max. In 2014 the fish community IBI score for site T15 was 46 (fair) and the QHEI was 57 (good). The macro community mIBI score was 40 (fair) and the QHEI was 59 (good). The WQ Target for TSS was exceeded one time in July but this appears to be related to a precipitation event, which indicates this stream is susceptible to large sediment loads during heavy rainfall events. The land use is primarily agriculture in the headwater portion of the stream and becomes heavily forested in the downstream portion of the subwatershed. Since the sample in 2009 was located further upstream and had higher E. coli results, the heavily forested downstream tributaries likely help dilute the concentration of pollutants. Since the 2009 samples indicated an impairment this stream segment will be impaired. There is also one CFO hog farm in the drainage, a portion of Batesville, and two storm water permits (Virtus – mattress pads and GE –trucking station).

Exceedance occurred after a rain event, all other results very low indicating event-driven. NPS is the likely source. Possible sources are CFOs in nearby watershed that land apply also pasture land where animals have direct or near access to water. Sparse rural population on septic systems. The outskirts of Batesville, IN (sewered) are located in the watershed. Some clusters of unsewered homes in the watershed septic systems a likely source.

11.3.8 Duck Creek Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Duck Creek subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 94 provides a summary of the Duck Creek subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli*. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* concentrations.

Table 90 Summary of Duck Creek Subwatershed Characteristics

Duck Creek (050800030603)					
Drainage Area (sq. mi.): 21.65					
TMDL Sample Sites: GMW-06-0019 (T12)					
Listed Segments: ING0363_01, ING0363_02, ING0363_T1001, ING0363_T1002, ING0363_T1003, ING0363_T1004, ING0363_T1005, ING0363_T1006, ING0363_T1007, ING0363_T1008, ING0363_T1009, ING0363_T1010					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10 %**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90-100%**
Bacteria TMDL (billions of bacteria/day)	**494.7**	**161.7**	**72.41**	**33.25**	**15.25**
Wasteload Allocation (WLA): Total	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**446.47**	**145.93**	**65.39**	**29.99**	**13.79**
Margin Of Safety (MOS) (5%)	**24.7**	**8.08**	**3.62**	**1.66**	**0.76**
Future Growth (5%)	**23.5**	**7.7**	**3.4**	**1.6**	**0.7**

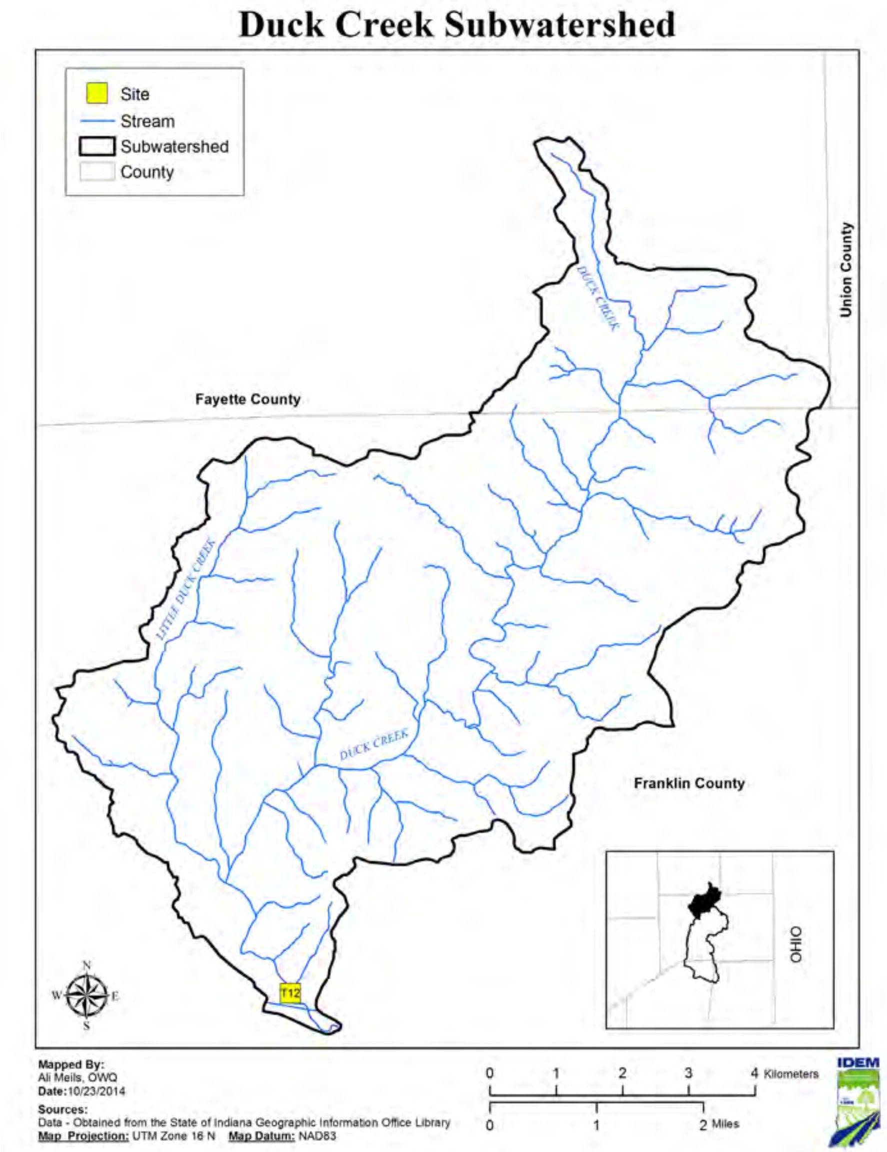


Figure 88 Sampling Stations in Duck Creek Subwatershed

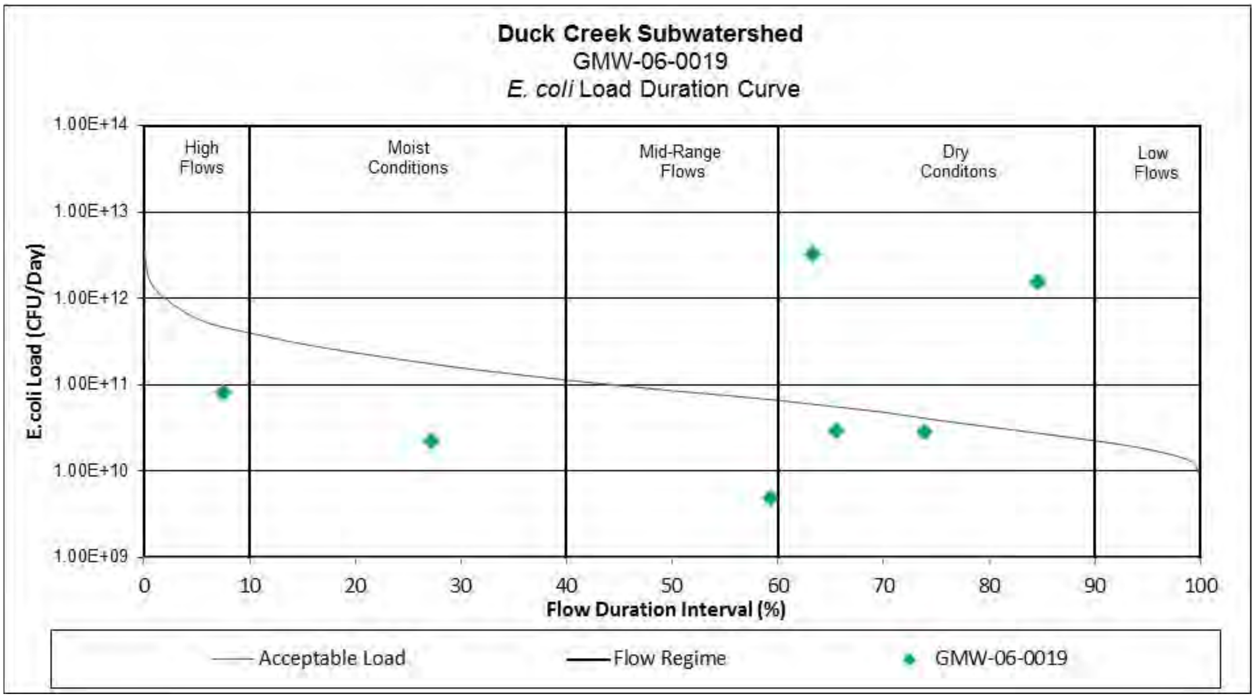


Figure 89 Load Duration Curve for Most Representative Site in the Duck Creek Subwatershed

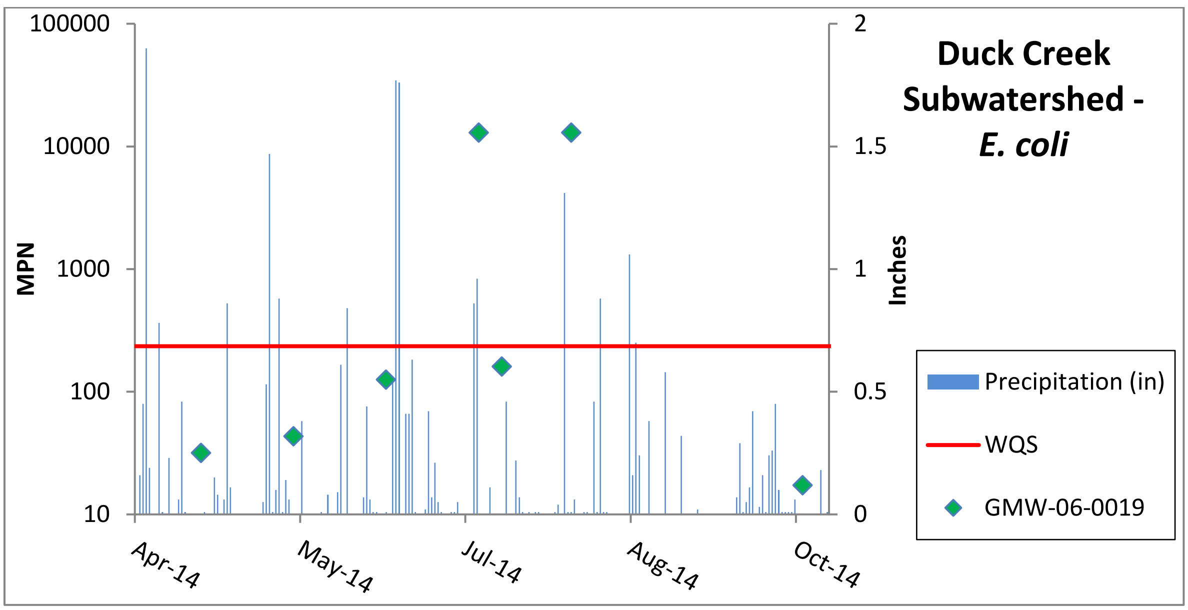


Figure 90 Graph of Precipitation and *E. coli* Data in the Duck Creek Subwatershed

The Duck Creek subwatershed drains approximately 22 square miles. The Duck Creek subwatershed runs mainstem of Whitewater River. The land use is primarily forested (62%) followed by agricultural land 20%) hay and pasture (12%). There are no permitted facilities in the subwatershed. There is no confined animal feeding operation (CAFO) and one confined feeding operation (CFO) partially in the subwatershed. These permits are no discharge permits and as long as the permittee complies with the current discharge regulation and land applies septage as permitted they should not be a source for the Duck Creek subwatershed. The majority of the subwatershed is forested with wide riparian buffers but the Town of Metamora is at the pour point of the watershed. In the forested rural areas homes with pump to on-site septic systems. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape high gradient with steep hills. Highly erodible soil types make up the majority of this subwatershed. The HEL lands are located in the headwater portion of the subwatershed, which is dominated by agriculture uses. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. Small patches of areas in the extreme headwaters of the watershed have been identified as having hydric soil types. These areas could be potential areas for wetland restoration. There are small wetland areas throughout the watershed. There are approximately 54 miles of stream in the subwatershed. Based on IDEM data collected in 2014 there will be 54 stream miles impaired for *E. coli* listed on the 2016 List of Impaired Waters.

Site GMW-060-0019 (T12) is located US 52 on Duck Creek. This watershed was sampled in 2002 and the geometric mean was 62.46 MPN. In 2014 this watershed was sampled further downstream at site T12 and there were 2/7 samples that exceeded the single sample max. Both of those samples had extremely high levels of E. coli (>12000 MPN). This stream went dry during the summer months and the geometric mean was not able to be collected, nor were the biological communities. Field staff also observed that just downstream of site T12 the Whitewater Canal aquaduct crosses over the stream and it was leaking. It was noted that large amounts of sediment were entering the stream through the aquaduct. Two times during the 2014 sampling the TP target was exceeded (0.569 and 0.309 mg/L) and the TSS target was exceeded (768 and 286 mg/L). There was no other supporting biological data to determine if there is a nutrient problem but the data results indicate high levels of TP and extremely high levels of sediment entering the stream during rain events. T12 is located at the pour point of the subwatershed in the Town of Metamora before it enters the Whitewater River. There may be some urban influences since the site is located in a populated area. Based on the extremely high levels of E. coli entering the stream and the lack of data upstream to pinpoint the bacteria sources, the E. coli impairment will be extrapolated to all contributing tributaries. The subwatershed is predominantly forested with wide riparian buffers along the stream. The landscape is high gradient with steep hillsides. Agriculture us the dominant land use the headwaters, there is one CFO that is partially in the drainage, the Town of Metamora and the Town of Blooming Grove (unsewered) are in the drainage. SR 1 goes through the subwatershed and there are small clusters of homes along the highway.

11.3.9 Walnut Fork Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Walnut Fork subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 95 provides a summary of the Walnut Fork subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli*. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* concentrations.

Table 91 Summary of Walnut Fork Subwatershed Characteristics

Walnut Fork (050800030604)					
Drainage Area (sq. mi.): 56.54					
TMDL Sample Sites: GMW-06-0015 (T14), GMW-06-0020 (T16), GMW-06-0006 (P10)					
Listed Segments: ING0364_01, ING0364_02, ING0364_T1001, ING0364_T1002, ING0364_T1003					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90-100%**
Bacteria TMDL (billions of bacteria/day)	**570.3**	**186.4**	**83.5**	**38.3**	**17.6**
Wasteload Allocation (WLA): Total	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**514.72**	**168.24**	**75.30**	**34.62**	**15.91**
Margin Of Safety (MOS) (5%)	**28.5**	**9.3**	**4.2**	**1.9**	**0.9**
Future Growth (5%)	**27.1**	**8.9**	**4.0**	**1.8**	**0.8**

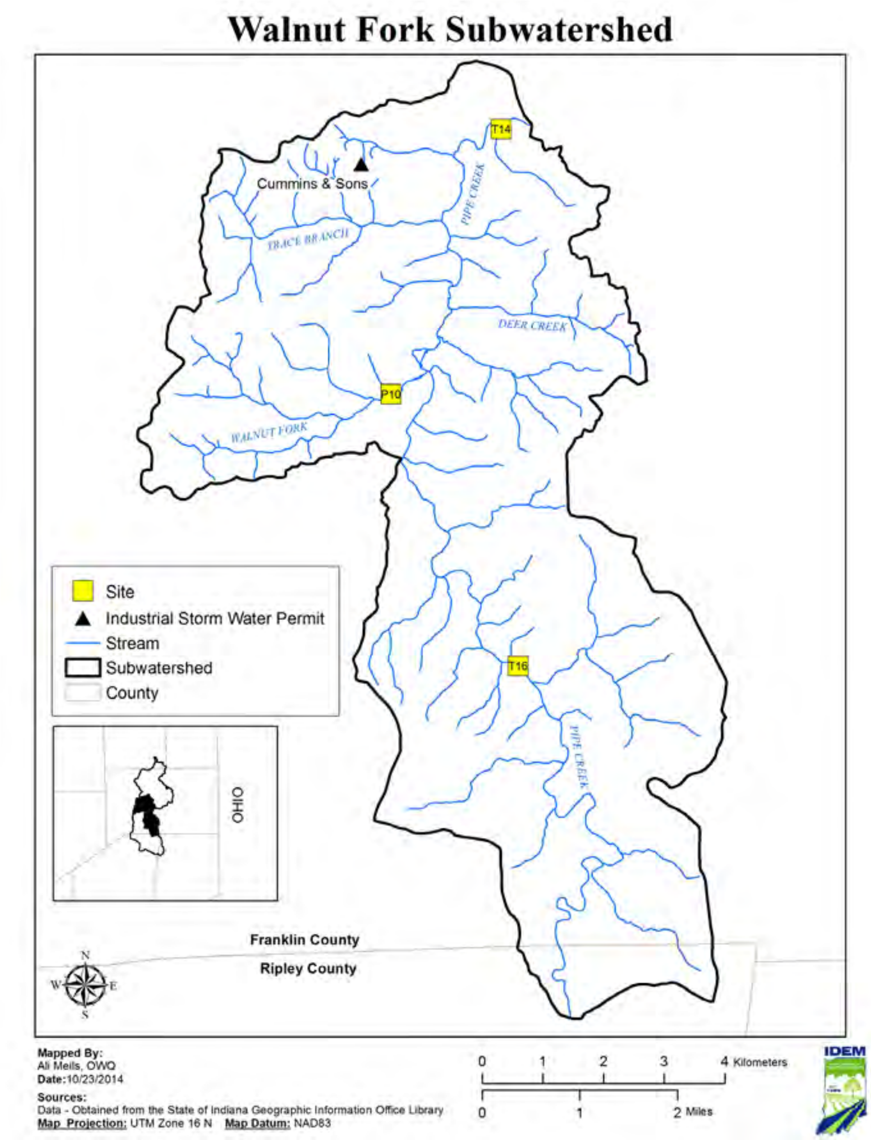


Figure 91 Sampling Stations in Walnut Fork Subwatershed

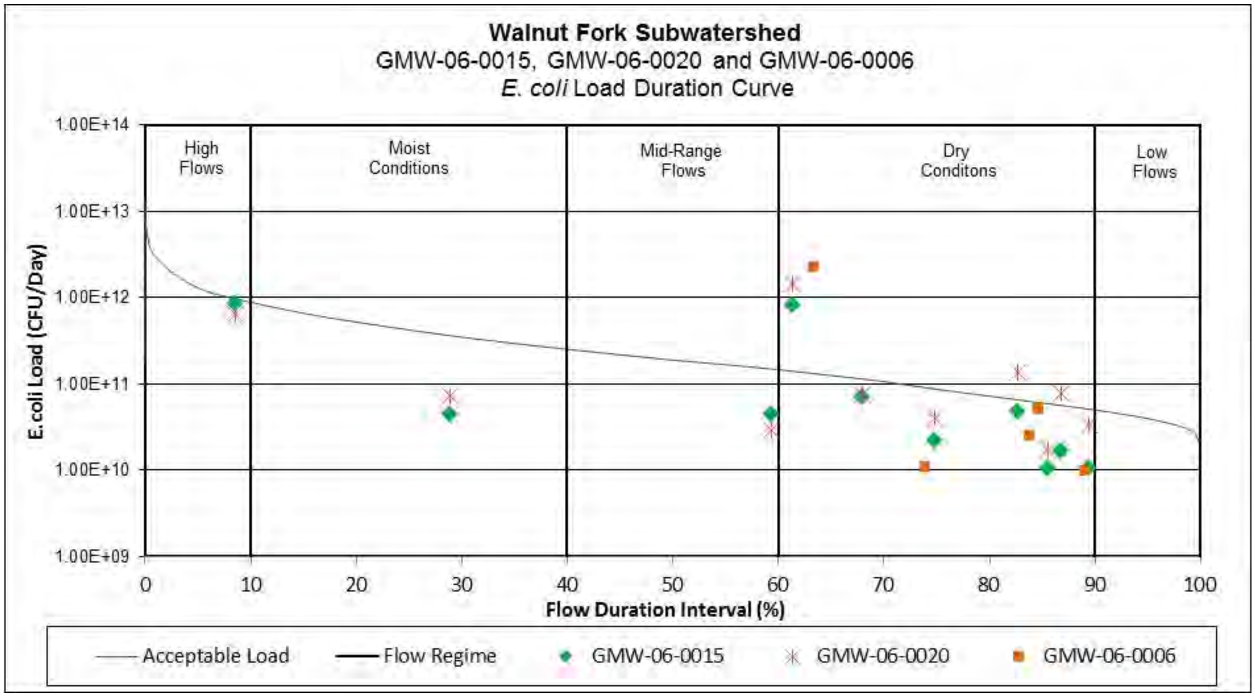


Figure 92 Load Duration Curve for Most Representative Site in the Walnut Fork Subwatershed

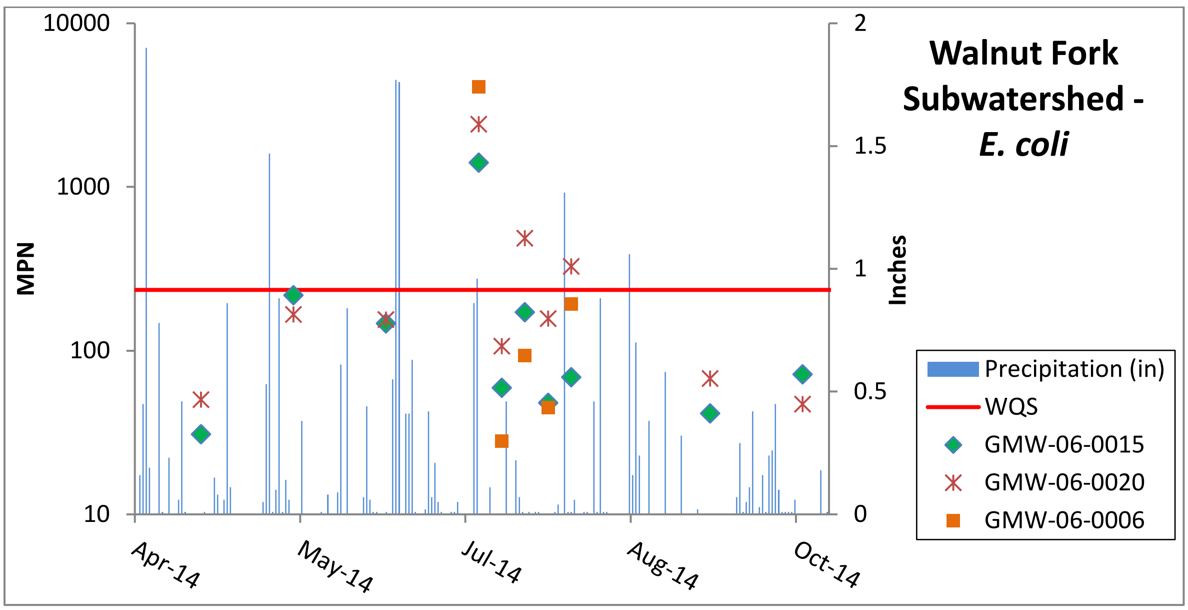


Figure 93 Graph of Precipitation and *E. coli* Data in the Walnut Fork Subwatershed

The Walnut Fork subwatershed drains approximately 57 square miles. The Walnut Fork subwatershed runs mainstem of Whitewater River. The land use is primarily forested (72%) followed by hay and pasture (13%) agricultural land (11%). There are no permitted facilities in the subwatershed. There is no confined animal feeding operation (CAFO) and two confined feeding operation (CFO) partially in the subwatershed. These permits are no discharge permits and as long as the permittee complies with the current discharge regulation and land applies septage as permitted they should not be a source for the Duck Creek subwatershed. The majority of the subwatershed is forested but the Towns St. Joe and Pepperton are in this watershed. In the forested rural areas homes with pump to on-site septic systems. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape is high gradient with steep hills. Highly erodible soil types make up the very little of this subwatershed. It is mainly around the streams. These soil types can contribute to sediment loss from agricultural lands and stream banks, as well as, lands from the high gradient slopes. Small patches of areas in the extreme headwaters of the watershed have been identified as having hydric soil types. These areas could be potential areas for wetland restoration. There are very few wetland areas throughout the watershed. There are approximately 54 miles of stream in the subwatershed. Based on IDEM data collected in 2014 there will be 76 stream miles impaired for *E. coli* listed on the 2016 List of Impaired Waters.

Site GMW-060-0015 (T14) is located at Silver Creek Road on an Pipe Creek. In 1994 macroinvertebrates were sampled on this stream and the score was 3.4 with QHEI of 68 (good). In 2002 E. coli was sampled at this site and the geometric mean was 94.76 MPN. This AUID was sampled (T14) at the pour point of the subwatershed in 2014 and the geometric mean was 136.81 MPN with 1/10 samples exceeding the single sample max. The E. coli data suggest the high levels of E. coli are driven by rainfall events, as it only exceeded the single sample max one time and it occurred when the TSS was also elevated. The data from other sites tells us there are elevated levels flowing into the stream from upstream, the Headwaters Pipe Creek subwatershed and the Walnut Fork tributary. The land use is almost entirely forested surrounding this watershed and the E. coli geometric mean was only slightly elevated. In 2014, the fish IBI score was 46 (good) and the QHEI was 58 (good) and the macro mIBI score was 40 (fair) and the QHEI was 43 (fair). This site located in lower part of watershed where land use is largely forested. One sample exceeded suggesting event driven nonpoint sources.

Site GMW-060-0025 (T16) is located at St. Marys Road on Pipe Creek. This stream was sampled in 2007 and the geometric mean was 167.57 MPN with 2/5 in exceedance of the single sample maximum. In 2014 the E. coli geometric mean was 365.49 MPN with 3/10 samples exceeding the single sample max. Results from upstream site T17 indicate there are high levels of E. coli flowing into the subwatershed there is still a good percentage of agricultural lands, two CFO hog farms and the Town of St. Marys (unsewered) that could be impacting the stream. Forested land exists around the streams as you work downstream and eventually becomes predominant. There was also one DO reading from 2007 <4 mg/L. In 2002, the fish IBI score was 52 (good) and the QHEI was 57 (good). In 2007, the fish IBI score was 48 (good) and the QHEI was 78 (excellent) and the macro mIBI score was 42 (fair) and the QHEI was 79 (excellent). In 2014, the fish IBI score was 48 (good) and the QHEI was 66 (good) and the macro mIBI score was 42 (fair) and the QHEI was 55 (good). GM 365 cfu/100 mL. Two CFO hog farms in upper drainage w/high percentage of agricultural fields and pasture.

Site GMW-06-0006 (P10) is located on Walnut Fork Road on Walnut Fork. The E. coli in 2007 had a geometric mean of 141.05 MPN with 2/5 samples exceeding the single sample max. In 2014, the geometric mean was 156.6 with 1/5 samples exceeding the single sample max. In 2014, the fish IBI score was 40 (fair) and the QHEI was 55 (good) and the macro mIBI score was 46 (good) and the QHEI was 51 (fair). The land use is dominated by forested lands. Wide forested riparian buffers along steep sloping terrain. There are a few agricultural fields in the extreme headwaters and a small portion of the Town of Peppertown (unsewered) is within the drainage.

11.3.10 Yellow Bank Creek Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Yellow Bank Creek subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 96 provides a summary of the Yellow Bank Creek subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli* and TSS. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* and TSS concentrations.

Table 92 Summary of Yellow Bank Creek Subwatershed Characteristics

Yellow Bank Creek (050800030605)					
Drainage Area (sq. mi.): 842.10					
TMDL Sample Sites: GMW-06-0022 (T13), GMW-06-0012 (T19), GMW-06-0002 (P3), GMW-06-0003 (P4), GMW-06-0004 (P5), GMW-06-0005 (P9)					
Listed Segments: ING0365_02, ING0365_01, ING0365_T1003					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90 – 100%**
Bacteria TMDL (billions of bacteria/day)	**931.67**	**303.27**	**134.77**	**60.89**	**26.92**
Wasteload Allocation (WLA): Total	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**842.11**	**274.98**	**123.44**	**55.96**	**25.31**
Margin Of Safety (MOS) (5%)	**45.81**	**14.39**	**5.43**	**2.54**	**0.84**
Future Growth (5%)	**43.75**	**13.90**	**5.90**	**2.39**	**0.77**
TMDL Sample Sites: GMW-06-0012 (T19), GMW-06-0002 (P3), GMW-06-0004 (P5), GMW-06-0005 (P9)					
Listed Segments: ING0365_01					
Flow Regime TMDL analysis TSS (pounds/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90 – 100%**
TSS TMDL (lbs/day)	**450904.2**	**147381.57**	**65997.28**	**30310.55**	**13903.92**
Wasteload Allocation (WLA): Total	**13.67**	**4.45**	**N/A**	**N/A**	**N/A**
Construction Activities (0.0022 sq. mi.)	**1.2**	**0.37**	**0**	**0**	**0**
Storm Water – Owens Corning (INR700015)	**12.47**	**4.08**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**406927.43**	**133007.42**	**59562.52**	**27355.22**	**12548.33**
Margin Of Safety (MOS) (5%)	**22545.2**	**7369.1**	**3299.86**	**1515.53**	**695.20**
Future Growth (5%)	**21417.9**	**7000.6**	**3134.9**	**1439.8**	**660.4**

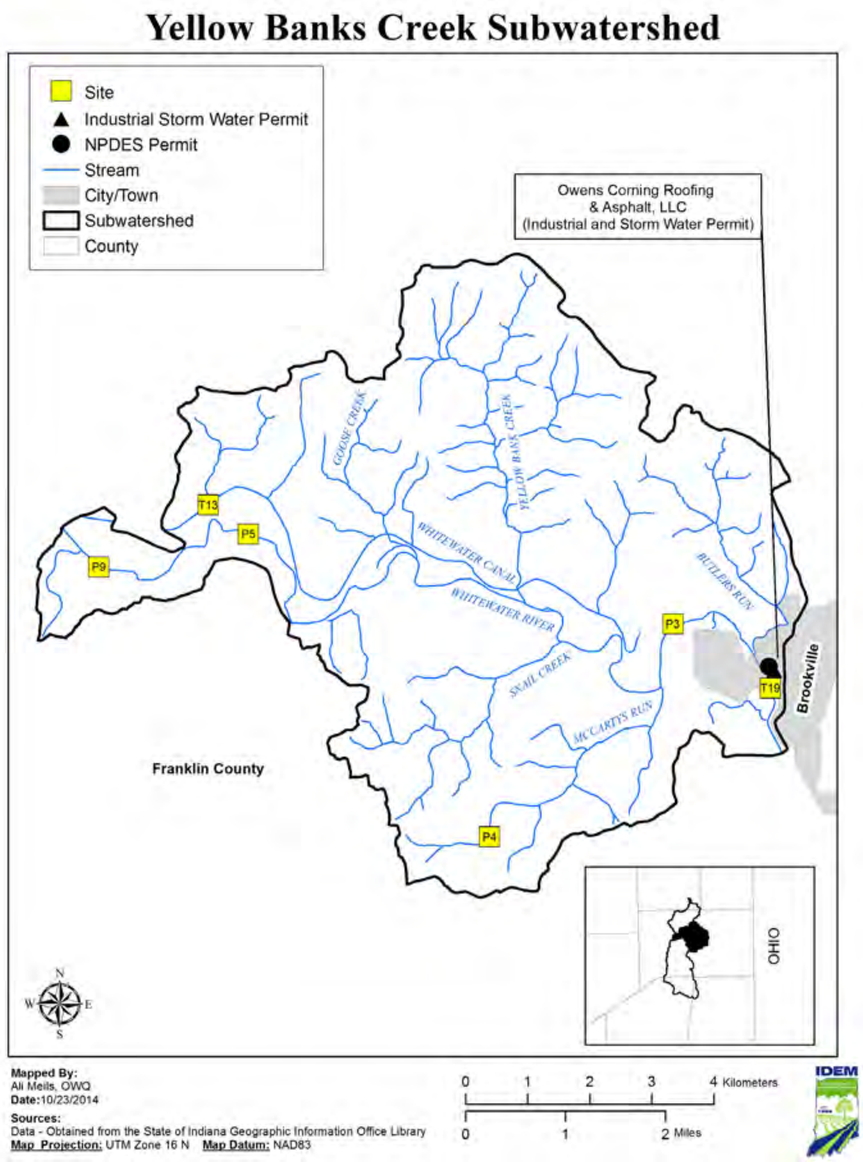


Figure 94 Sampling Stations in Yellow Banks Creek Subwatershed

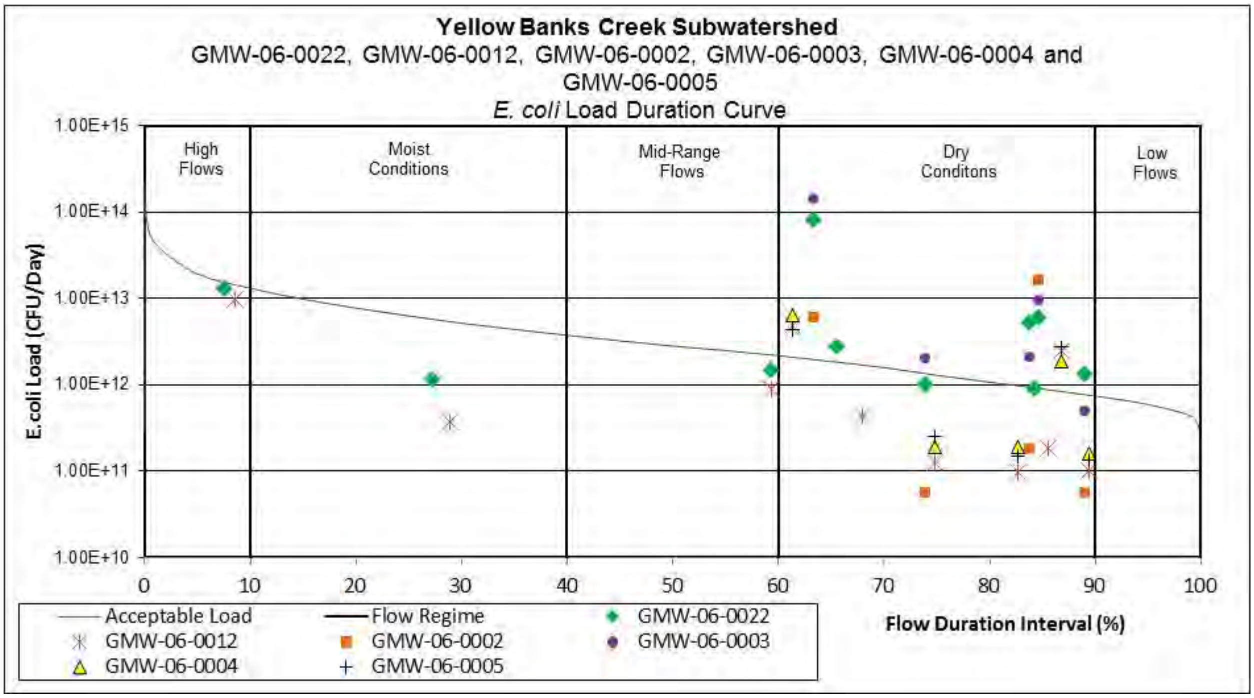


Figure 95 Load Duration Curve for *E. coli* in the Yellow Banks Creek Subwatershed

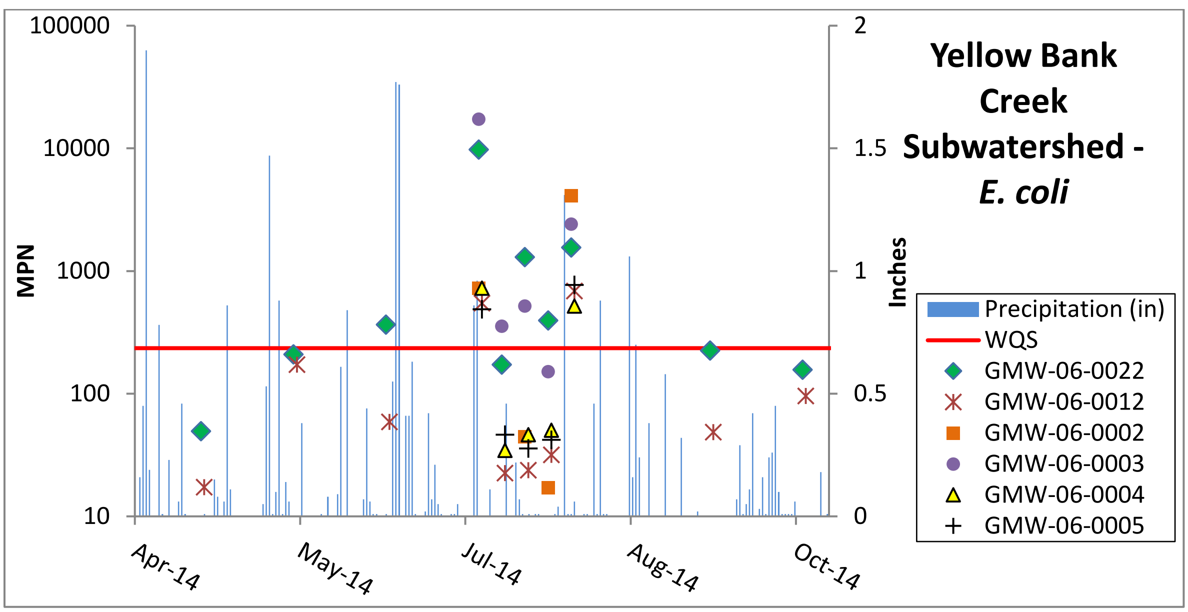


Figure 96 Graph of Precipitation and *E. coli* Data in the Yellow Bank Creek Subwatershed

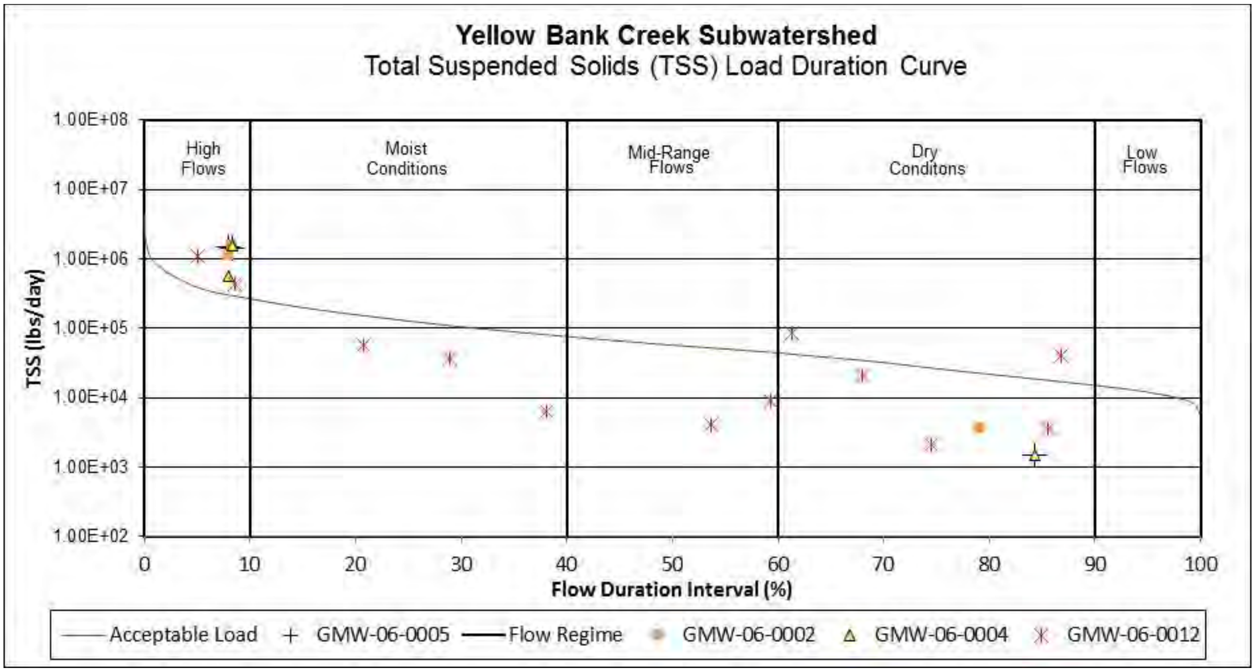


Figure 97 Load Duration Curve for TSS in the Yellow Banks Creek Subwatershed

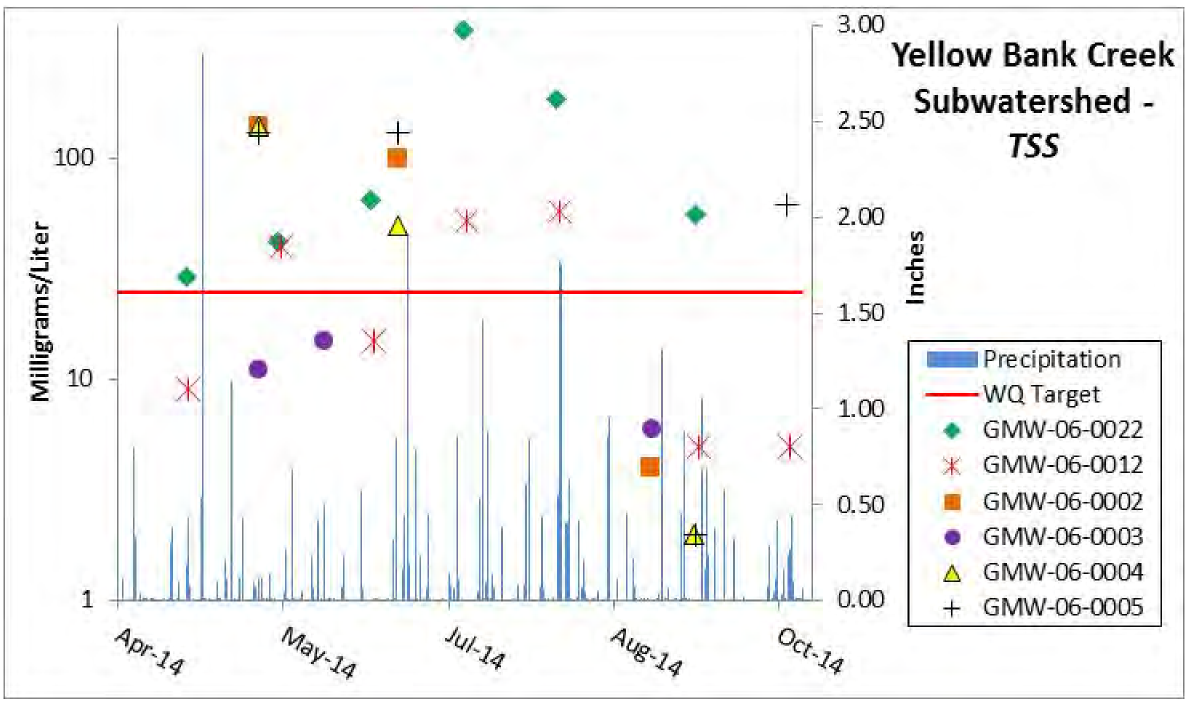


Figure 98 Graph of Precipitation and TSS Data in the Yellow Bank Creek Subwatershed

The Yellow Bank Creek subwatershed drains approximately 842 square miles. The Yellow Bank Creek subwatershed runs into mainstem of Whitewater River. The land use is primarily forested (68%) followed by hay and pasture (13%) agricultural land (12%). There are no permitted facilities in the subwatershed. There is no confined animal feeding operation (CAFO) and one confined feeding operation (CFO) partially in the subwatershed. These permits are no discharge permits and as long as the permittee complies with the current discharge regulation and land applies septage as permitted they should not be a source for the Yellow Bank Creek subwatershed. The majority of the subwatershed is forested but the Brookville is in this watershed. In the forested rural areas homes with pump to on-site septic systems. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic system in the area is important to ensure proper function and capacity. The landscape is high gradient with steep hills. Highly erodible soil types make up the very little of this subwatershed, it is mainly around the streams. These soil types can contribute to sediment loss from agricultural lands and stream banks, as well as, lands from the high gradient slopes. Almost no hydric soil types have been identified within this watershed. These areas could be potential areas for wetland restoration. There are very few wetland areas throughout the watershed. There are approximately 52 miles of stream in the subwatershed. Based on IDEM data collected in 2014 there will be 32 stream miles impaired for E. coli listed on the 2016 List of Impaired Waters.

There are four sites GMW-06-0012 (T19) St. Marys Road, GMW-06-0002 (P3) St. Marys Road, GMW-06-0004 (P5) Silver Creek Road, GMW-06-0005 (P9) Penninton road all are located on the Whitewater River mainstem in this subwatershed. The stream is currently impaired for PCBs. This watershed was sampled in 2002 and the fish IBI = 54, QHEI = 77 and macro score = 5.2, QHEI = 77. Working downstream there was another site sampled in 2002 and the fish IBI = 50, QHEI = 75 and the macro score = 6, QHEI = 75. Continuing downstream there were another two sites sampled at the same location. The site in 1997 had a fish IBI = 50, QHEI = 81 and in 2002 the fish IBI = 52, QHEI = 77 and macro score = 6, QHEI = 77. Even further downstream there were two sites sampled in 2007 and the fish IBI = 50, 52 QHEI = 78,85 and macro mIBI = 44, 42 QHEI = 58, 75. In 1994 there was another site sampled very close to site T19 and the macro score was 4, QHEI = 87.

In 2007 there was a site sampled for E. coli and the geometric mean was 43.28 MPN, 66.29 MPN. In 1994 there was another site sampled very close to site T19 and the macro score was 4, QHEI = 87. In 2014 there were four sites sampled along this watershed. Entering the mainstem are Salt Creek(T10) = 177.69 , West Fork Whitewater River (T11) = 81.42 MPN , Duck Creek (T12) = >12000 MPN during rain events , and Pipe Creek (T14) = 136.81 MPN. Working in a downstream direction the 2014 E. coli results are P9 = 121.35 MPN, P5 = 124.85 MPN, P3 = 117.51 MPN, and T19 = 91.55 MPN. 2014 biological community scores working in a downstream direction are P9 fish IBI = 54, QHEI = 80 and macro mIBI = 44, QHEI = 71, P5 fish IBI = 54, QHEI = 82 and macro mIBI = 42, QHEI = 70, P3 fish IBI = 48 QHEI = 71 and macro mIBI = 44, QHEI = 64, T19 fish IBI = 54, QHEI = 78 and macro mIBI = 36, QHEI = 69. Land use is dominated by steep forested land mixed with small pockets of agriculture. Most of your agricultural lands are in the extreme headwater areas or in the flood plain where the land flattens out. This mainstem flows from Metamora to Brookville. It is mostly forested and rural in between the two Towns but there could be some urban impacts downstream towards Brookville given the amount of impervious surface.

Site GMW-060-0022 (T13) is located at Park Avenue on whitewater Canal. Both these AUIDs are on the Whitewater canal. The canal does not follow normal drainage patterns so a small portion of the canal flows through the Duck Creek subwatershed. The canal at one point is raised via an aquaduct and flows over Duck Creek. This aquaduct was seen leaking into Duck Creek containing heavy loads of sediment. The Whitewater canal begins in Laurel Indiana where a low head dam pumps water from the river into the canal. The canal is currently impaired for E. coli based on a sample collected in 2002 with a geometric mean of 478.93 MPN. In 2014 the E. coli geometric mean was 1062.58 MPN with 5/10 samples exceeding the single sample max. In 2014, the fish IBI score was 16 (very poor) and the QHEI was 25 (very poor) and the macro mIBI score was 36 (fair) and the QHEI was 24 (very poor). The TP target was exceeded one time in July with a 0.5 mg/L result. The TSS target was exceeded 6/7 times with the highest concentration at 380 mg/L. High levels of sediment in the water can negatively impact biological communities. The very poor habitat indicated by the QHEIs is also contributing to poor biological communities. The canal flows through the Town of Metamora and it is also used to power a grain mill in Metamora. The canal does not fit the natural drainage of most watersheds so it is difficult to determine drainage area and contributing nonpoint sources. Previously impaired based on data collected in 2002. Recent data indicates impairment persists. Geometric mean of 1063 cfu/100 mL. The Canal starts in Laurel, IN (sewered) where there is a lowhead dam that may be restricting fish movement. There are no buffer, knee deep muck. Possibly tile drains draining ag land but no readily apparent source.

Site GMW-060-0003 (P4) is located on St. Mary Road on McCarty S Run. In 2014 the E. coli geometric mean was 1031.54 MPN with 4/5 samples exceeding the single sample max. In 2014, the fish IBI score was 22 (very poor) and the QHEI was 67 (good) and the macro mIBI score was 38 (fair) and the QHEI was 63 (poor). This is a small headwater stream with steep forested terrain. The site is surrounded by wide forested riparian buffers. There are small clusters of homes in the drainage area. Geometric mean of 1,031 cfu/100 mL. Site located in extreme headwaters of the watershed and is mostly forested. Results suggest septic's are most likely source due to continuously high results suggesting consistent loads.

11.3.11 Headwaters Blue Creek Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Headwaters Blue Creek subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 97 provides a summary of the Headwaters Blue Creek subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli*. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* concentrations.

Table 93 Summary of Headwaters Blue Creek Subwatershed Characteristics

Headwaters of Blue Creek (050800030801)					
Drainage Area (sq. mi.): 18.31					
TMDL Sample Sites: GMW-08-0022 (T24), GMW-08-0014 (T23), GMW-08-0001 (P2)					
Listed Segments: ING0381_01					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 – 10%**	**10 – 40%**	**40 - 60%**	**60 – 90 %**	**90-100%**
Bacteria TMDL (billions of bacteria/day)	**418.40**	**136.75**	**61.24**	**28.12**	**12.90**
Wasteload Allocation (WLA): Total	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**377.59**	**123.42**	**55.28**	**25.42**	**11.66**
Margin Of Safety (MOS) (5%)	**20.9**	**6.84**	**3.06**	**1.41**	**0.65**
Future Growth (5%)	**19.9**	**6.5**	**2.9**	**1.3**	**0.6**

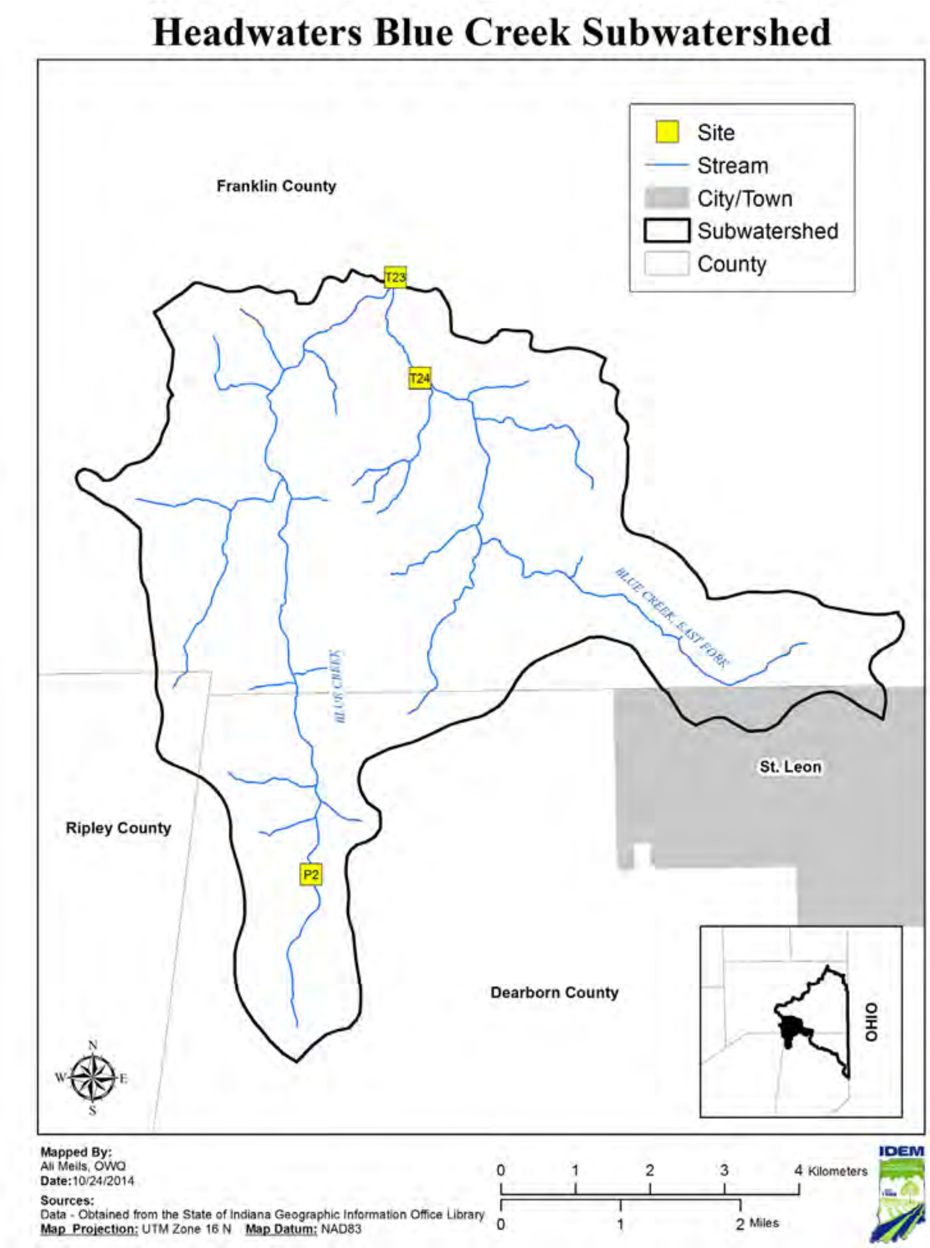


Figure 99 Sampling Stations in Headwaters Blue Creek Subwatershed

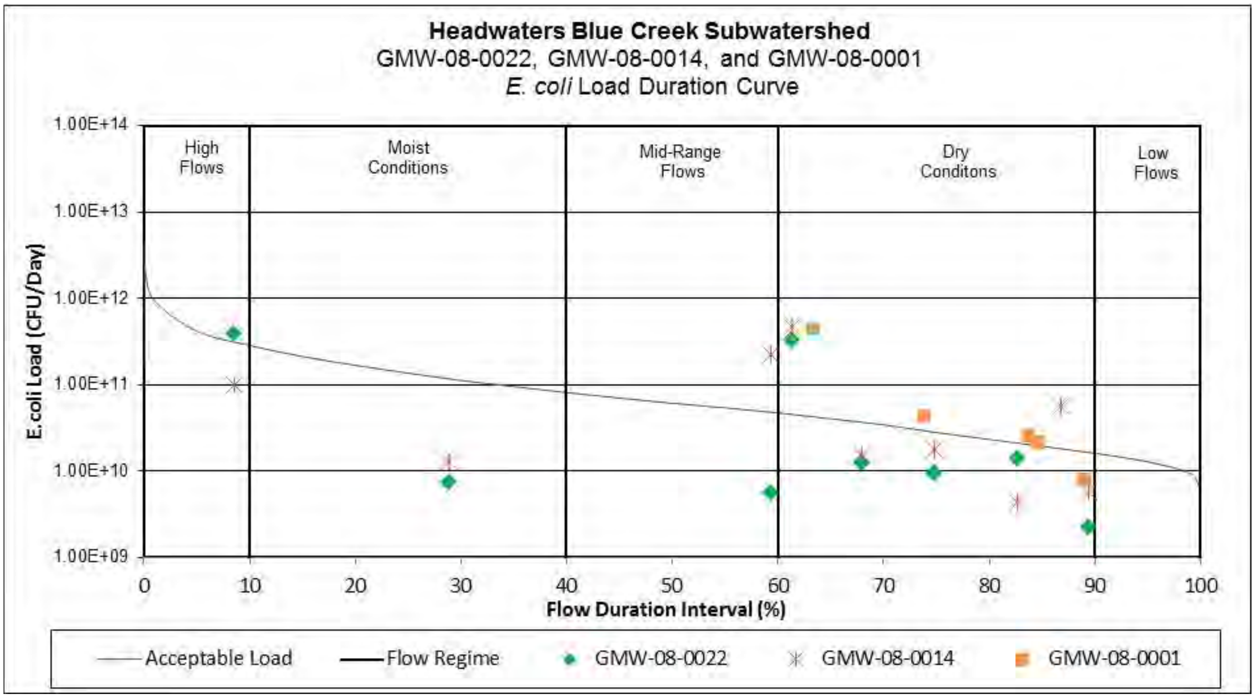


Figure 100 Load Duration Curve for Most Representative Site in the Headwaters Blue Creek Subwatershed

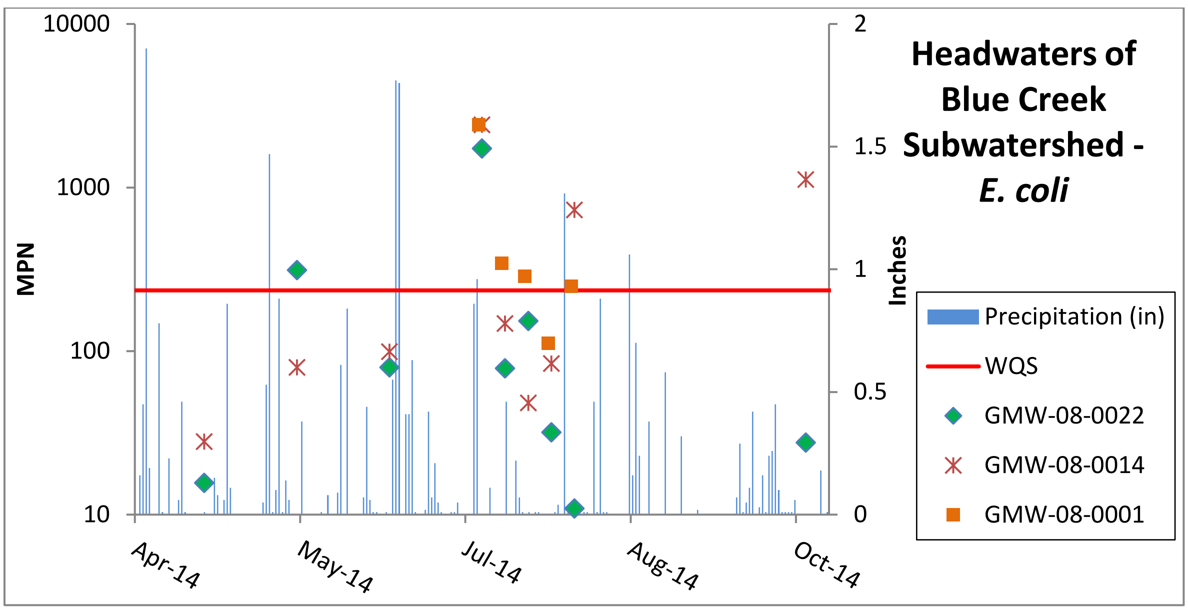


Figure 101 Graph of Precipitation and *E. coli* Data in the Headwaters of Blue Creek Subwatershed

The Headwaters of Blue Creek drain approximately 18 square miles. The land use is primarily forested land (50%) followed by agriculture (31%) and hay and pasture land (14%). A portion of the Town of St. Leon is located in the subwatershed. Since there is little development in this subwatershed the majority of homes pump to on-site septic systems. Based on the septic suitability of the soil, almost the entire subwatershed is classified as very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area consists of gentle rolling hills in the headwaters and becomes steeper towards the stream channels. Highly erodible soil types make up the majority of this subwatershed. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. There are large areas in the extreme headwaters identified as having hydric soil types. These areas could be potential areas for wetland restoration. While there are no permitted NPDES facilities in the subwatershed there is one confined feeding operation, as well as, numerous small animal farms. The total number of animal units in this area (83 animals/square mile) is the highest in the Whitewater River watershed. There are approximately 29 miles of stream in the subwatershed. According to the Draft 2012 List of Impaired Waters there are no impaired stream segments in the subwatershed. There had also been no historical samples collected in the subwatershed. Based on IDEM data collected in 2009, 2013 and 2014 there will be 14 stream miles impaired for *E. coli* in the subwatershed.

In September and October of 2009 IDEM collected data from a site (GMW080-0045) along East Fork Blue Creek at Blue Creek Road. *E. coli* and hydrolab chemistry readings were sampled once per week for five weeks at this site. The *E. coli* geometric mean at this site was 85.78 MPN/100mL which is below the Indiana water quality standard of (125 MPN/100mL). This site was resampled in 2014 as part of the watershed characterization study. This site in 2014 was T24 (GMW-08-0022). The *E.coli* sampled in July and August resulted in a geometric mean of 93.64 MPN/100mL which is also below the WQS. *E. coli* was sampled ten times from April through October and exceeded the WQS two times (May and July). The sampling exceedance in May was during high flow conditions and was slightly over the WQS. The exceedance in July was significant and occurred during dry flow conditions but followed a 1 inch rain event. The data results for this site shows the stream regularly has low levels of *E. coli* across several years but is susceptible to high loads of *E. coli* from run-off following rainfall events. The steep slopes and agricultural lands in the headwaters may be contributing to the high levels of *E.coli*. In 2013 and 2014 water chemistry, fish and aquatic insects were also collected at this site. There were no significant water chemistry violations. The fish community IBI score was 41 which is considered fair and the habitat score was 64 which is considered good. The macroinvertebrate community IBI score was 40 which is considered fair and the habitat score was 64 which is considered good.

Site P2 (GMW-08-0001) on Blue Creek was sampled as part of the IDEM probabilistic sampling program. The site is located close to the origin of Blue Creek. In 2014, the *E. coli* geometric mean was 366.17 MPN/100mL which is slightly above the Indiana water quality standard. In 2014 *E. coli* was sampled five times in July and August and exceeded the WQS four times. According to the load duration curve and precipitation graphs (Appendix B) all sites were sampled during dry, low flow conditions. The highest concentrations can be attributed to rainfall events but high levels of *E. coli* remained constant throughout sampling. This stream is uncharacteristic of the subwatershed and is surrounded by agricultural land use with little to no riparian buffers along the stream. The precipitation graph for this site shows the stream is susceptible to high loads of *E. coli* from run-off but there may also be contributions from failing septic systems. The overuse of manure application to agricultural fields or the mishandling of animal waste could also contribute to high levels of bacteria in the stream. In 2014 water chemistry, fish and aquatic insects were also collected at this site. There were dissolved oxygen violations at all ten sampling events. The fish community IBI score was 32 which is considered poor and is considered not to be fully supporting for aquatic life. The habitat score was 62 which is considered good and means the habitat exists to support a healthy fish community. Dissolved oxygen is essential for the survival of aquatic organisms. When dissolved oxygen drops below 5mg/L, aquatic life is put under stress and since dissolved oxygen was never recorded above 4mg/L it is a likely candidate for the poor biological communities. It was also recorded that a beaver dam exists just upstream of the bridge at this site. This could be restricting flow and contributing to the low dissolved oxygen. The macroinvertebrate community IBI score was 28 which is considered poor and the habitat score was 46 which is considered fair.

Site GMW-08-0014 which is site T23 is not within the Headwaters of Blue Creek watershed boundary but it represents the pour point the subwatershed. The site is located just downstream of the confluence between East Fork Blue Creek and mainstem Blue Creek. The site is located on Blue Creek at Blue Creek Road. This site was sampled in 2009 for *E. coli* only and again in 2013 and 2014 for *E. coli*, water chemistry, and biological communities. In 2009 the *E. coli* geometric mean was collected in September and October and was below the WQS at 30.80 MPN/100mL. In 2014 the geometric mean was collected in July and August and was slightly higher (253.44 MPN/100mL) than the WQS. Based on the load duration curve, samples were high during the midrange and dry flow regimes and exceeded the single sample maximum of 235 MPN/100mL three out of ten times. Two of the exceedances can be attributed to rainfall events which suggest the subwatershed is susceptible to high bacteria loads from runoff. Total suspended solids were also above the TMDL target (30 mg/L) during the August sampling event. The fish community IBI score was 45 which is considered good and the habitat score was 56 which is considered fair. The macroinvertebrate community IBI score was 36 which is considered fair and the habitat score was 58 which is considered good. Excessive algae growing on rocks in stream was also observed during several site visits which can be caused by excessive nutrient loading. Overall the majority of the streams have wide forested riparian areas which are ideal for filtering out pollutants and reducing runoff. The topography contains some steep gradients that naturally erode and cause fast transportation of runoff during rainfall events. There is heavier agricultural land uses with narrow riparian areas in the headwater areas, as seen in site P2, but the stream recovers as it moves downstream. Further investigation may be needed to identify causes of low dissolved oxygen in the headwaters of Blue River.

11.3.12 Wolf Creek – Blue Creek Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Wolf Creek-Blue Creek subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 98 provides a summary of the Wolf Creek-Blue Creek subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli*. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* concentrations.

Table 94 Summary of Wolf Creek-Blue Creek Subwatershed Characteristics

Wolf Creek-Blue Creek (050800030802)					
Drainage Area (sq. mi.): 32.85					
TMDL Sample Sites: GMW-08-0026 (T21), GMW080-0003 (T22), GMW-08-0014 (T23)					
Listed Segments: ING0382_01, ING0382_02					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90 - 100%**
Bacteria TMDL (billions of bacteria/day)	**332.24**	**108.59**	**48.63**	**22.33**	**10.24**
Wasteload Allocation (WLA): Total	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**299.84**	**98.01**	**43.89**	**20.16**	**9.24**
Margin Of Safety (MOS) (5%)	**16.61**	**5.43**	**2.43**	**1.12**	**0.51**
Future Growth (5%)	**15.78**	**5.16**	**2.31**	**1.06**	**0.49**

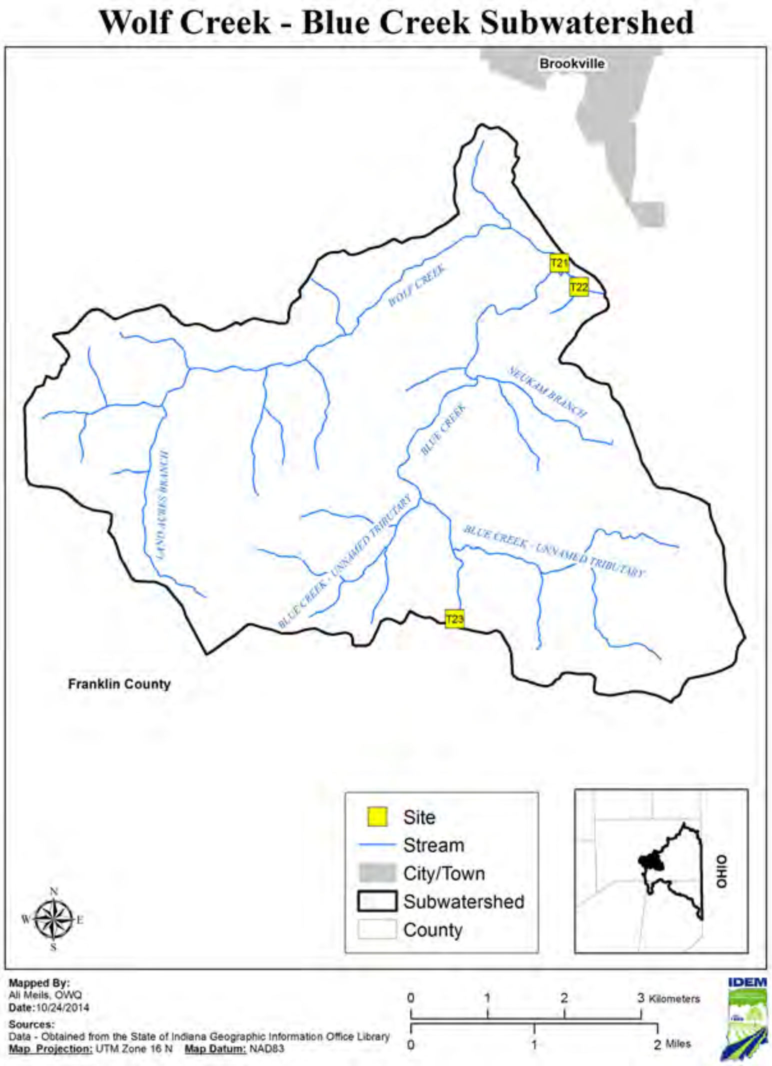


Figure 102 Sampling Stations in Wolf Creek – Blue Creek Subwatershed

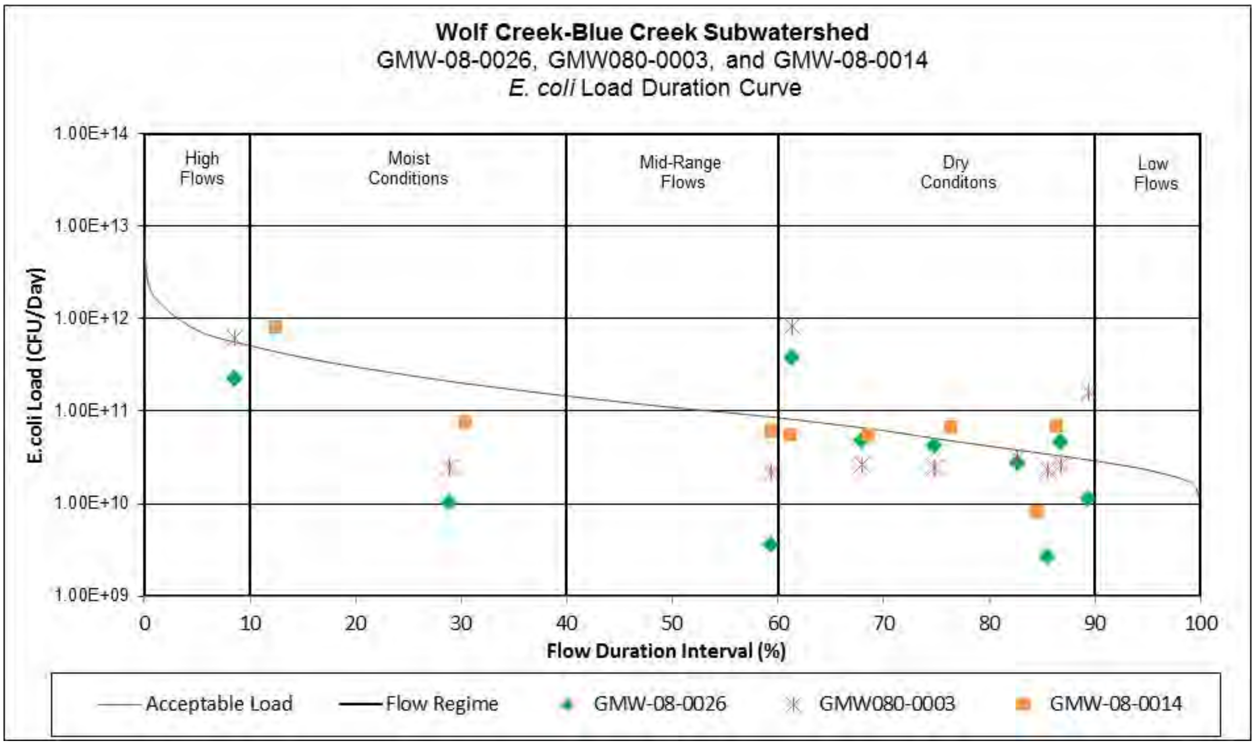


Figure 103 Load Duration Curve for Most Representative Site in the Wolf Creek – Blue Creek Subwatershed

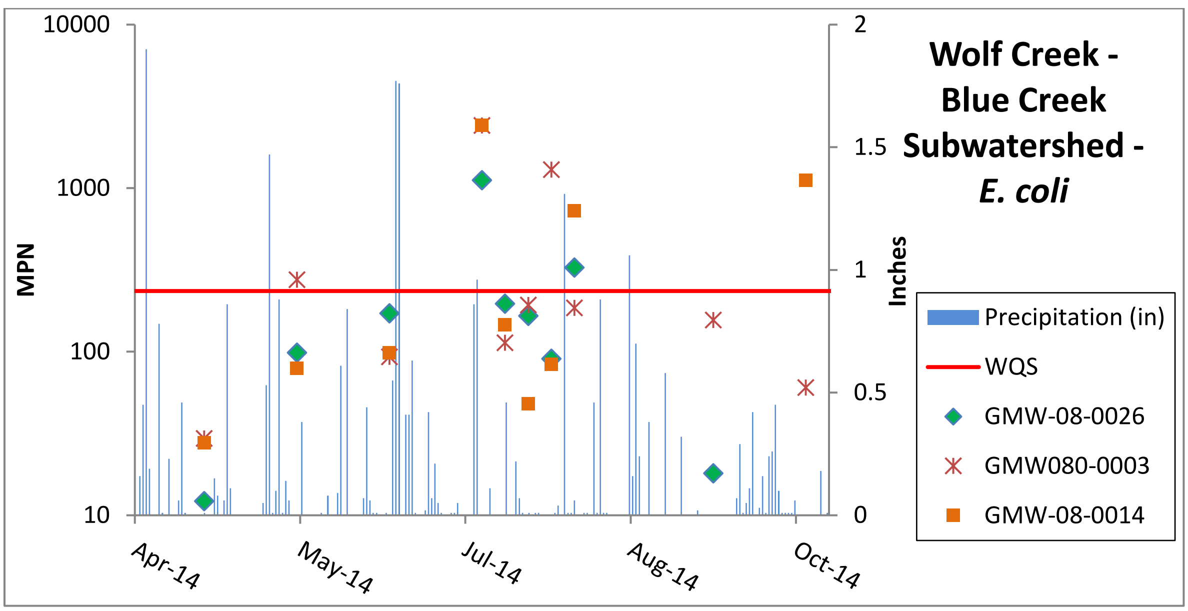


Figure 104 Graph of Precipitation and *E. coli* Data Site in the Wolf Creek – Blue Creek Subwatershed

The Wolf Creek subwatershed drains approximately 15 square miles. The Wolf Creek subwatershed drains into the mainstem of the Whitewater River through Blue Creek. The land use is primarily forest (63%) followed by agriculture (17%) and hay and pasture land (16%). There are no permitted facilities in the subwatershed. While the Town of Oak Forest is within this watershed, the majority of the subwatershed is rural indicating homes pump to on-site septic systems. The land use is primarily steep forested lands that make up the valleys of both

Wolf and Blue creek. However in the upland plains the land use is dominantly agriculture. Based on the septic suitability of the soil, the majority of the subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area consists of agricultural fields in the headwaters and becomes steeper towards the base of the subwatershed. Highly erodible soil types are found in the hillsides that drain into creek and make up much of the eastern portion of the subwatershed. While much of these areas are forested agricultural practice is occurring in some erodible areas. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. There is a small area in the south eastern portion of the watershed where hydric soils exits. This area could be potential areas for wetland restoration. The land use is comprised of 16 percent pasture land which indicates the potential for smaller animal farms. The total number of animal units in this area (59 animals/square mile) is just above median concentration when compared to other subwatersheds in the Whitewater River subwatershed. There are approximately 29 miles of stream in the subwatershed. Based on IDEM data collected in 2013 and 2014 there will be 12 stream miles impaired for *E. coli*, and 5 miles of IBC impairment listed on the 2016 List of Impaired Waters.

There are three sites located in this subwatershed, two located on Blue Creek GMW-08-0014 (T23) and GMW080-0003 (T22) and one located on Wolf Creek GMW-08-0026 (T21). The mainstem Blue Creek is currently impaired for E. coli. A 2007 probabilistic site was sampled downstream of site T23 and had a geometric mean of 23.97 MPN. Site T23 had a geometric mean in 2009 of 30.79 MPN and the geometric mean collected at the same site in 2014 was 253.44 MPN. The site had DO readings in July and August near 4 mg/L but not below. The field notes recorded that there was pooling and very low flow, which is likely a natural condition during hot, dry summer months. These low DO readings could negatively impact the biological communities. Site T22 is located at the pour point of the subwatershed. The geometric mean from a sample taken at this site in 2002 was 515.19 MPN which is what caused the initial impairment. In 2014, the geometric mean at site T22 was 418.71 MPN with 3/10 sites in exceedance of the single sample maximum. T21 is currently impaired for E. coli based on the site sampled on the Blue Creek in 2002. Since that time the stream reaches have been resegmented. The site, T21, located on this stream had a geometric mean of 255.39 MPN, having only exceeded the single sample maximum 2/10 times.

The fish community IBI score for site T23 was 42 (fair) and the QHEI was 56 (good). The macro community mIBI score was 36 (fair) and the QHEI was 58 (good). The biological communities at a site downstream (GMW080-0036) sampled in 2007 had a fish IBI = 48 (good) QHEI = 78. The fish community IBI score for site T22 was 48 (good) and the QHEI was 52 (fair). The macro community mIBI score was 34 (poor) and the QHEI was 63 (good). There was no biological community sampled at this site in 2002. The fish community IBI score for site T21 was 38 (fair) and the QHEI was 64 (good). The macro community mIBI score was 36 (fair) and the QHEI was 62 (good). While both T23 and T22 are located on the same AUID site T22 represents the condition of this particular AUID. Site T23 represents the condition of the Headwaters Blue Creek subwatershed. This is why the sample results from site T22 were used in the IBC impairment.
While both T23 and T22 are located on the same AUID site T22 represents the condition of this particular AUID. Site T23 represents the condition of the Headwaters Blue Creek subwatershed. This is why the sample results from site T22 were used in the IBC impairment.

11.3.13 Big Cedar Creek Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Big Cedar Creek subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 99 provides a summary of the Big Cedar Creek subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli*. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* concentrations.

Table 95 Summary of Big Cedar Creek Subwatershed Characteristics

Big Cedar Creek (050800030803)					
Drainage Area (sq. mi.): 29.61					
TMDL Sample Sites: GMW-08-0016 (T26), GMW-08-0024 (T27)					
Listed Segments: ING0383_01, ING0383_02, ING0383_T1003, ING0383_T1004, ING0383_T1005					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 - 40%**	**40 - 60%**	**60 - 90%**	**90 - 100%**
Bacteria TMDL (billions of bacteria/day)	**676.7**	**221.24**	**99.13**	**45.58**	**20.96**
Wasteload Allocation (WLA): Total	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
Big Cedar Mobile Home Park WWTP (IN0037168) 0.0108 MGD	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
Load Allocation (LA)	**610.61**	**199.58**	**89.37**	**41**	**18.81**
Margin Of Safety (MOS) (5%)	**33.8**	**11.06**	**4.96**	**2.28**	**1.05**
Future Growth (5%)	**32.1**	**10.5**	**4.7**	**2.2**	**1.0**

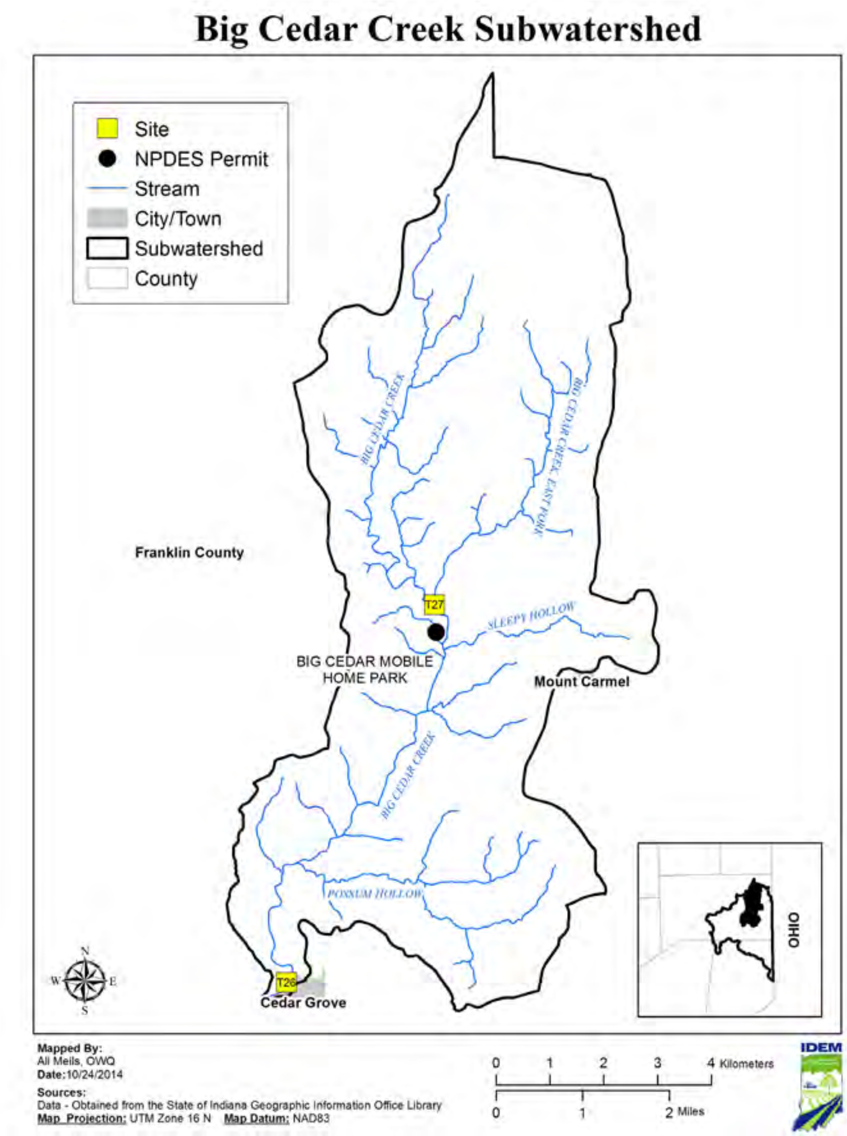


Figure 105 Sampling Stations in Big Cedar Creek Subwatershed

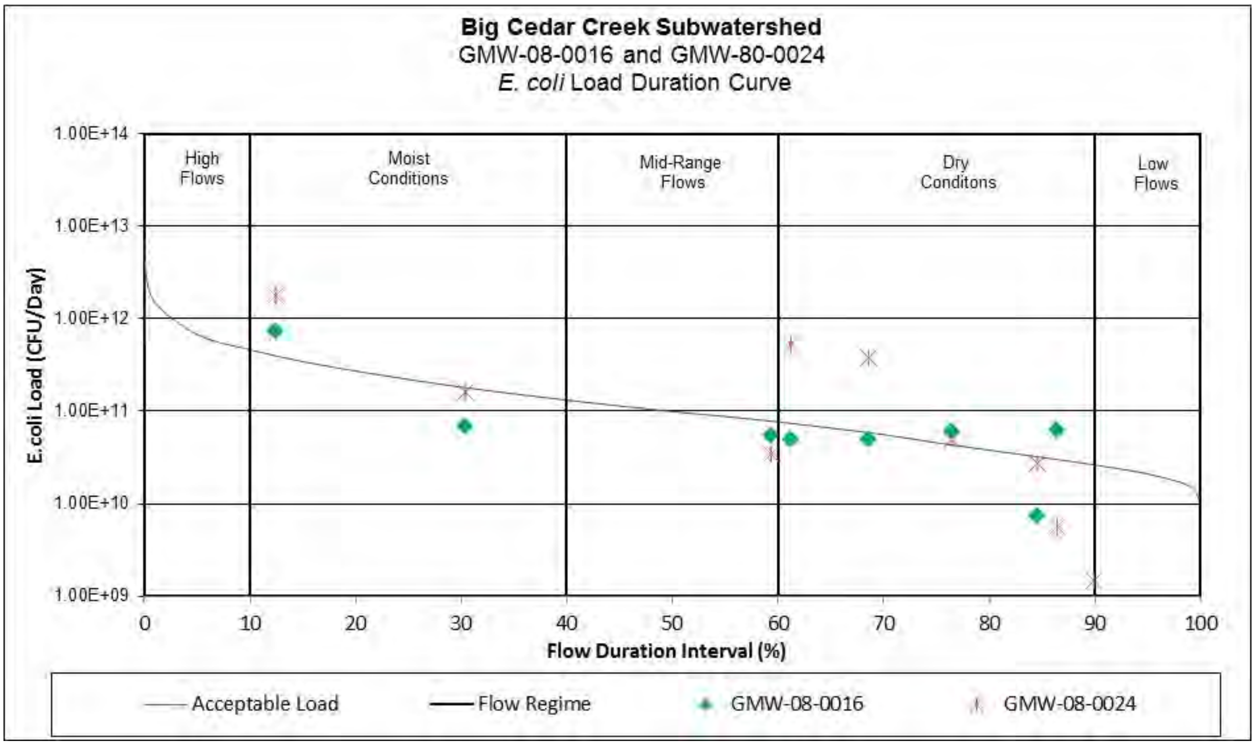


Figure 106 Load Duration Curve the Big Cedar Creek Subwatershed

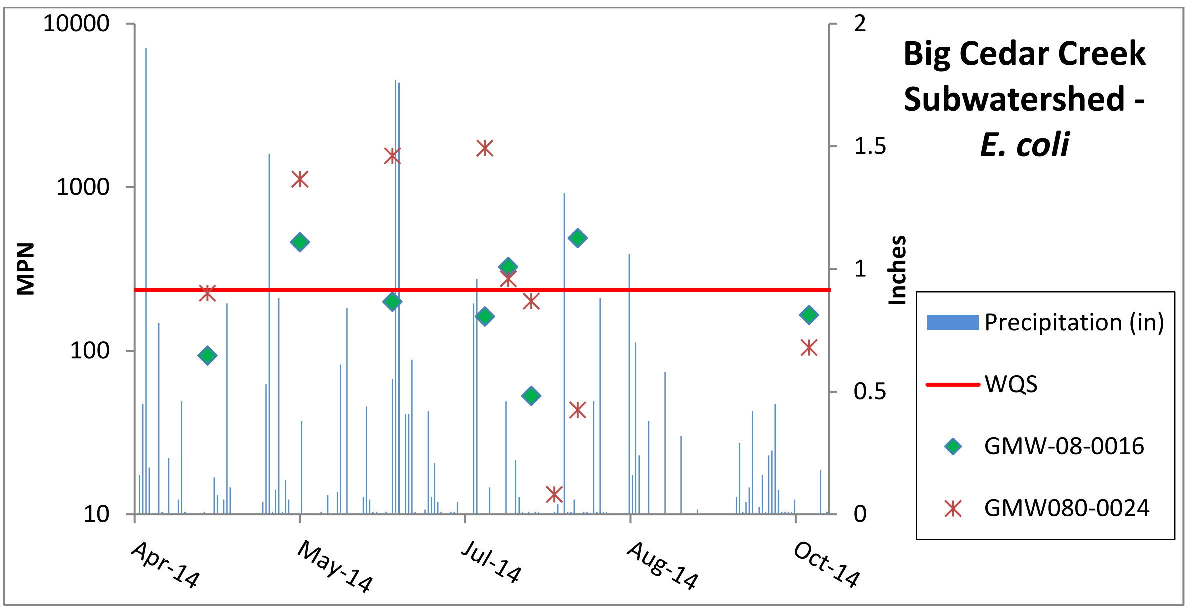


Figure 107 Graph of Precipitation and *E. coli* Data in the Big Cedar Creek Subwatershed

The Big Cedar Creek subwatershed drains approximately 27 square miles. The Big Cedar Creek subwatershed drains into the mainstem of the Whitewater River. The land use is primarily agriculture (50%) followed by forested land (17%) and hay and pasture land (11%). There are one permitted facilities in the subwatershed, the Big Cedar Mobile Home Park WWTP. The subwatershed is rural indicating homes pump to on-site septic systems. There are no incorporated towns within the subwatershed. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area consists of gentle rolling hills in the headwaters and becomes steeper towards the base of the subwatershed. The land use is primarily agricultural in the headwaters, with pasture land and forested areas making up the hills in the southern portion of the subwatershed. Highly erodible soil types make up nearly half of this subwatershed. The majority of the HEL lands are located in the southern portion of the subwatershed, which is characterized by wooded hillsides. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. There are small area in the northern portion of the subwatershed identified as having hydric soil types. These areas could be potential areas for wetland restoration. The land use is comprised of 11 percent pasture land which indicates the potential for smaller animal farms. The total number of animal units in this area (55 animals/square mile) which is median concentration when compared to other subwatersheds in Salt Creek. There are approximately 52 miles of stream in the subwatershed. Based on IDEM data collected in 2013 and 2014 there will be 40 stream miles impaired for *E. coli* listed on the 2016 List of Impaired Waters.

There are two sites located in this subwatershed, both located on Big Cedar Creek GMW-08-0016 (T26) and GMW-08-0024 (T27). Site T26 was previously impaired for E. coli based on historical samples collected in 2002 and the geometric mean was 169.92 MPN with only 1/5 in exceedance of the single sample maximum. In 2014 there was no geometric mean because the site went dry. There were 3/8 in exceedance of the single sample maximum and that is > 10% which means this site will remain impaired for E. coli. The nitrogen was high Jan - May although they were not in exceedance of WQ targets. This could indicate manure spreading on frozen ground or potentially the only point source in the subwatershed which is Big Cedar Mobile Home Park. They were in significant noncompliance from 2009-2011 and their most recent enforcement action was in Nov. 2013. Eight informal enforcement actions and one formal action violations include DO, TSS, Chlorine, Ammonia, CBOD, and E. coli. Site T27 was sampled in 2014 and the E. coli geometric mean was 140.74 MPN and 4/8 samples were in exceedance of the single sample maximum. In 2009, this stream was sampled farther upstream and the geometric mean was 1060.20MPN. In addition, there were high levels of nutrients in 2014 from April - June although the levels were not above the WQ target.

The fish community IBI score for site T26 was 42 (fair) and the QHEI was 59 (good). The macro community mIBI score was 38 (fair) and the QHEI was 61 (good). The biological scores indicate there has been degradation in the fish community over the last 12 years. The fish community IBI score for site T27 was 40 (fair) and the QHEI was 68 (good). The macro community mIBI score was 42 (fair) and the QHEI was 58 (good).

11.3.14 Little Cedar Creek Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Little Cedar Creek subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 100 provides a summary of the Little Cedar Creek subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli*, nutrient, and TSS. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli*, nutrient, and TSS concentrations.

Table 96 Summary of Little Cedar Creek Subwatershed Characteristics

Little Cedar Creek (050800030804)					
Drainage Area (sq. mi.): 1284.04					
TMDL Sample Sites: GMW-08-0015 (T25), GMW-08-0013 (P7)					
Listed Segments: ING0384_01, ING0384_T1001, ING0384_T1003					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 - 40%**	**40 - 60%**	**60 - 90%**	**90 - 100 %**
Bacteria TMDL (billions of bacteria/day)	**612.80**	**201.20**	**90.83**	**42.44**	**20.19**
Wasteload Allocation (WLA): Total	**1.33**	**1.33**	**1.33**	**1.33**	**1.33**
Sperry and Rice Mfg. Co. (IN0001473) 0.15 MGD	**1.33**	**1.33**	**1.33**	**1.33**	**1.33**
Load Allocation (LA)	**551.71**	**180.24**	**80.65**	**36.96**	**16.89**
Margin Of Safety (MOS) (5%)	**30.64**	**10.06**	**4.54**	**2.12**	**1.01**
Future Growth (5%)	**29.11**	**9.56**	**4.31**	**2.02**	**0.96**
Drainage Area (sq. mi.): 1284.04					
TMDL Sample Sites: GMW-08-0015 (T25), GMW-08-0013 (P7)					
Listed Segments: ING0384_01					
Flow Regime TMDL analysis TSS (pounds/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 – 40%**	**40 - 60%**	**60 – 90%**	**90 – 100%**
TSS TMDL (pounds/day)	**688,077.06**	**224,903.39**	**100,711.45**	**46,253.72**	**21,217.30**
Wasteload Allocation (WLA): Total	**1.17**	**0.38**	**N/A**	**N/A**	**N/A**
Construction Activities (0.0023 sq. mi.)	**1.17**	**0.38**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**620988.38**	**202974.93**	**90,892.09**	**41743.98**	**19148.62**
Margin Of Safety (MOS) (5%)	**34,403.85**	**11,245.17**	**5,035.57**	**2,312.69**	**1,060.87**
Future Growth (5%)	**32,683.66**	**10,682.91**	**4,783.79**	**2,197.05**	**1,007.82**

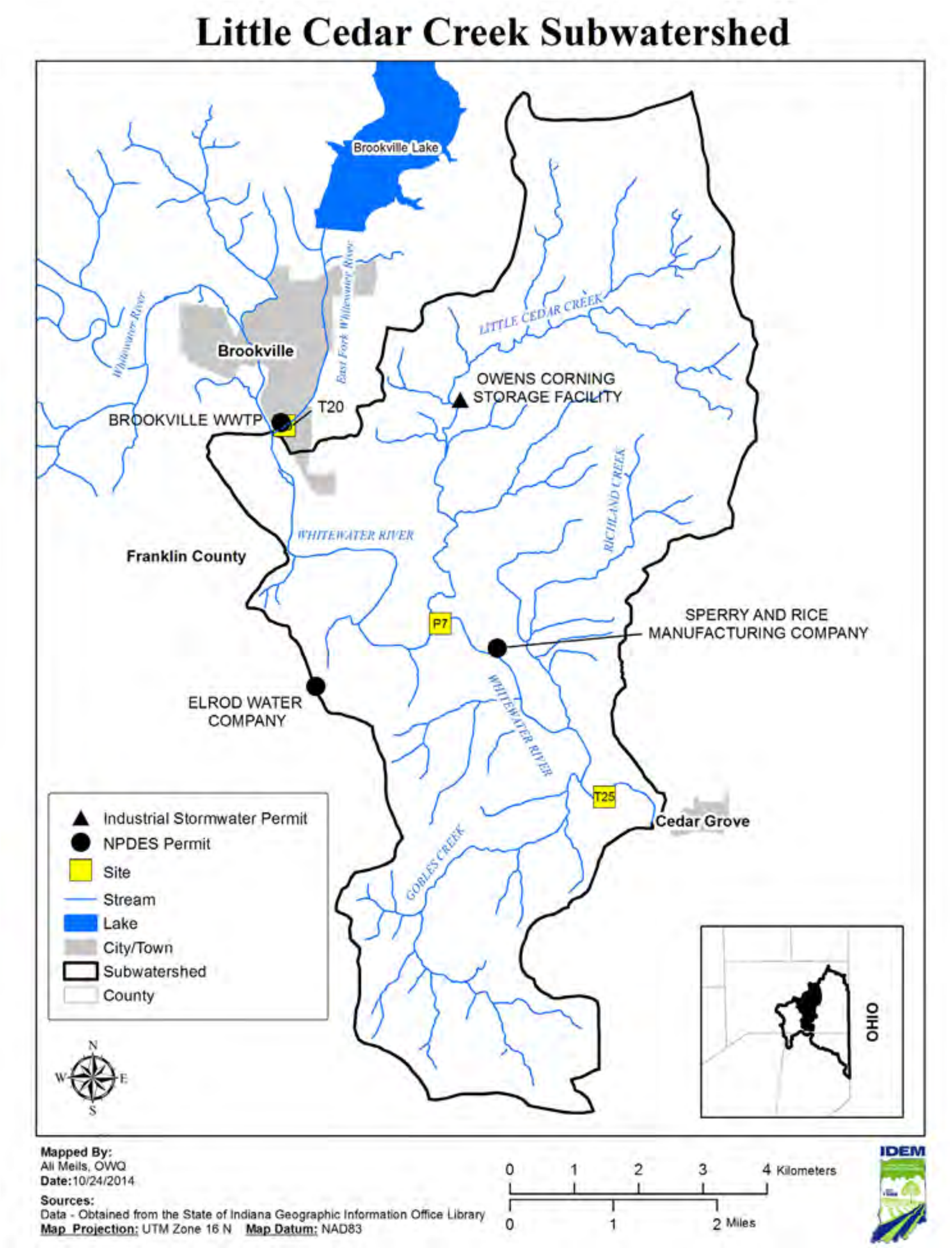


Figure 108 Sampling Stations in Little Cedar Creek Subwatershed

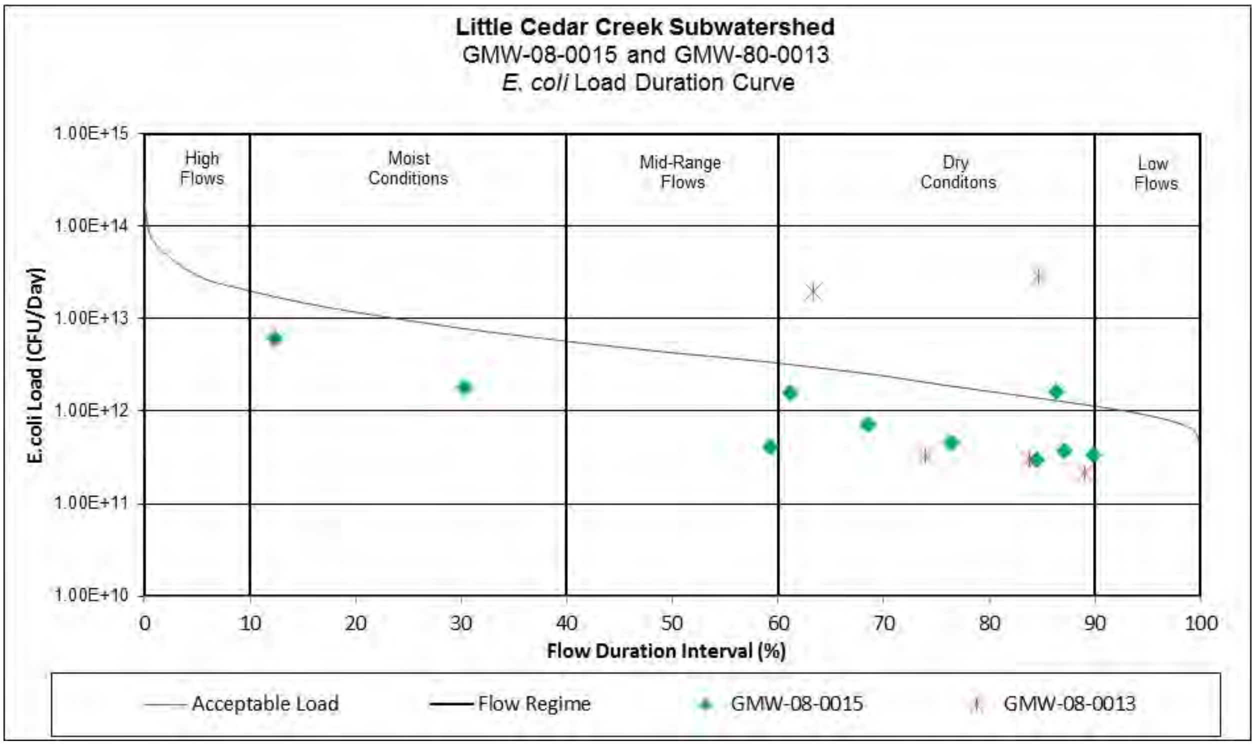


Figure 109 Load Duration Curve for the Little Cedar Creek Subwatershed

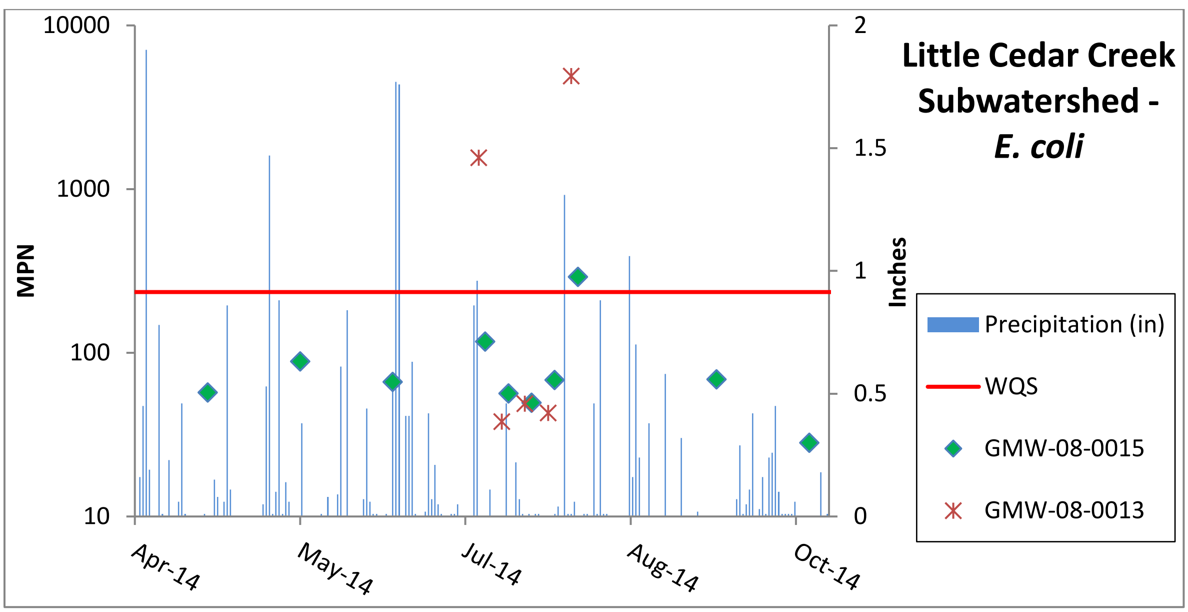


Figure 110 Graph of Precipitation and *E. coli* Data in the Little Cedar Creek Subwatershed

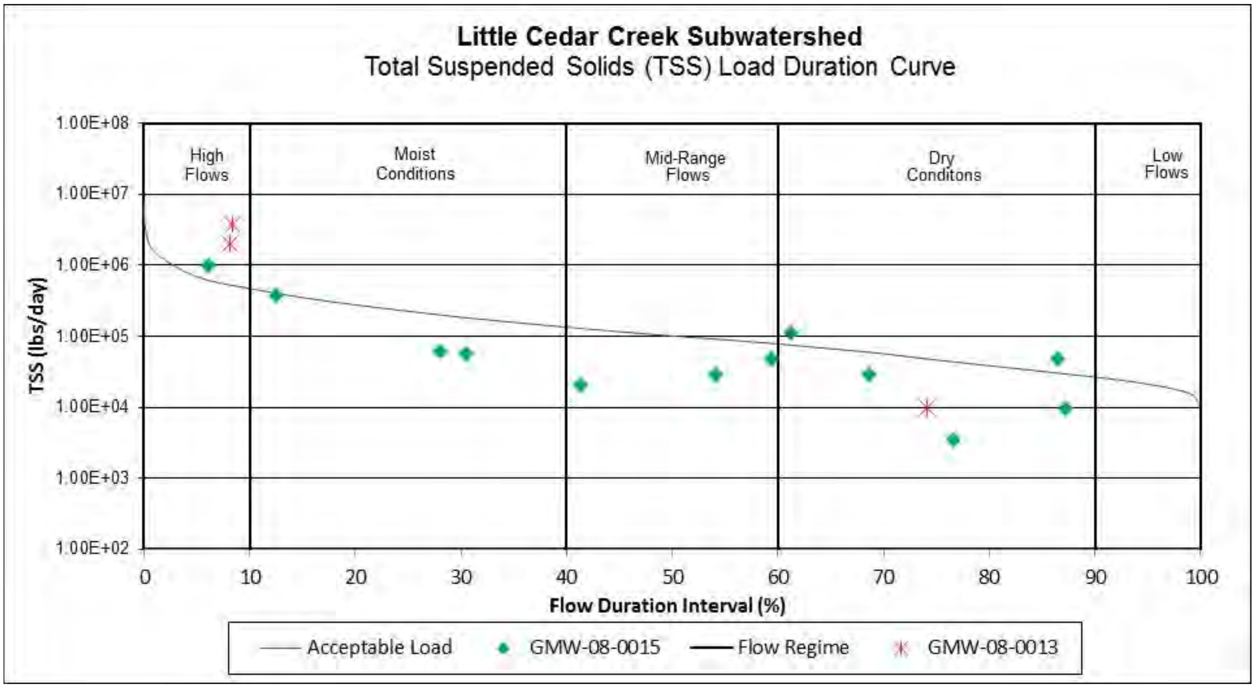


Figure 111Load Duration Curve for TSS in the Little Cedar Creek Subwatershed

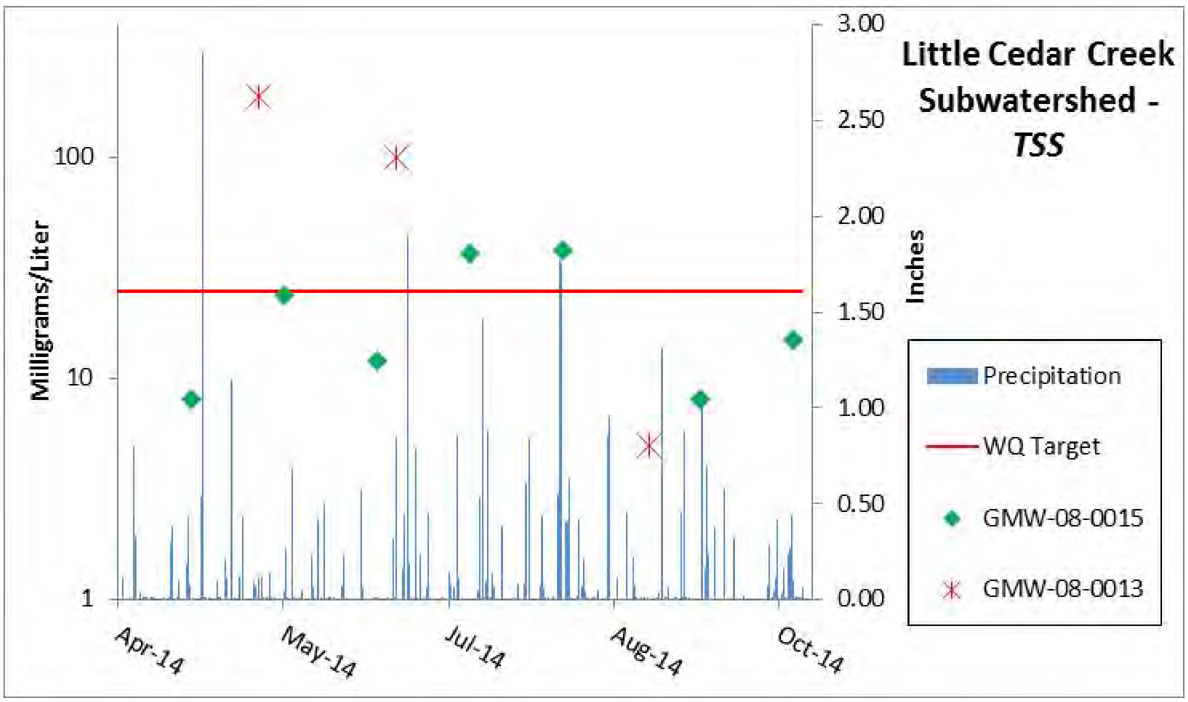


Figure 112 Graph of Precipitation and TSS Data in the Little Cedar Creek Subwatershed

The Little Cedar Creek subwatershed drains approximately 27 square miles. The Little Cedar Creek subwatershed drains into the mainstem of the Whitewater River. The land use is primarily forest (45%) followed by agriculture (27%) and hay and pasture land (19%). There are two permitted facilities in the subwatershed, Sperry and Rick Mfg. Co. and Elrod Water Company. The subwatershed is rural indicating homes pump to on-site septic systems. While no incorporated towns lie in the subwatershed, the southern growth of Brookeville does spread into this area. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to

ensure proper function and capacity. The landscape in the area consists of the flat upland plains which have steep drainages as they flow into the Whitewater valley. The land use is predominantly agricultural in the upland and whitewater valley portions of the subwatershed with steep forested areas connecting the two. Riparian zones are wide along these drainages but reduced in many areas along the mainstem of the river. Development is limited in the watershed with interspersed housing a farming operations.
Highly erodible soil types make up most land in this watershed apart from the flat uplands in the north. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. There are areas in the south and east of the subwatershed identified as having hydric soil types. These areas could be potential areas for wetland restoration. The land use is comprised of 19 percent pasture land which indicates the potential for smaller animal farms. The total number of animal units in this area (62 animals/square mile) which is a higher concentration when compared to other subwatersheds in the Whitewater river. There are approximately 63 miles of stream in the subwatershed. Based on IDEM data collected in 2013 and 2014 there will be 45 stream miles impaired for *E. coli,* and 25 miles for D.O. listed on the 2016 List of Impaired Waters.

There are two sites located in this subwatershed, both are located on the Whitewater River, GMW-08-0015 (T25) and GMW-08-00013 (P7). This AUID is currently impaired for DO and E. coli. There are no DO violations for site P7, T25 or any of the contributing tributaries we have sampled (T22, T20. T19). The DO impairment should be removed. Original DO impairment was from a 2007 sample on Little Cedar Creek (AUID ING0384_T1001). Since 2007 the streams have been reindexed. We know the geometric means of what is coming into the subwatershed by site T19 (~91 MPN), T20 (~51MPN), and T22 (~418 MPN). In 2002 an E. coli geometric mean of 101 MPN was taken just downstream of site T19. Site P7 is located at the confluence with Little Cedar Creek. The 2014 geometric mean for site P7 227.04 MPN with 2/5 samples exceeding the single sample maximum. Farther downstream, at the base of the subwatershed is site T25 with a geometric mean of 91.73 MPN with 1/10 samples exceeding the single sample maximum. In 2007 a geometric mean of 55.33 MPN was collected at a similar location to T25. There are a number of tributaries entering the mainstrem between the sites which could be diluting the bacteria.

There are historical sites located as the Whitewater River enters the subwatershed and the biological scores were macro mIBI = 6.2 (1994) and 5.4 (1997) both with excellent QHEI scores. In 1994 near site T25 the mIBI = 4 and QHEI = 88. In 1997 near site T25 the mIBI = 5.4 and QHEI = 88 and in 2007 near site T25 the mIBI = 42 and QHEI = 80. The fish IBI at that site in 2007 was 52 and the QHEI = 84.The fish community IBI score for site T25 was 56 (excellent) and the QHEI was 82 (excellent). The macro community mIBI score was 36 (fair) and the QHEI was 77 (excellent). The fish community IBI score for site P7 was 44 (fair) and the QHEI was 83 (excellent). The macro community mIBI score was 36 (fair) and the QHEI was 56 (fair). In 1997 there was fish community sampled just downstream of site P7 and the fish IBI = 38 (fair) and the QHEI = 70 (excellent).

The Sperry and Rice Manufacturing Company and Elrod Water Company are point sources in the watershed. Sperry and Rice is a rubber and sponge manufacturing company and they have been in noncompliance 7/12 quarters and have had 9 informal enforcement actions in the last five years. The only violations recorded have been for DO in 2012. There is one CFO hog farm and a portion of the Town of Stavetown and Palestine that drain into the river or its tributaries.
Whitewater River in this WS is currently indexed as one AUID (ING0384_01) this reach needs to be split at Little Cedar Creek to more accurately capture the potential influences of Brookeville on the upper end of Whitewater River in this WS which would likely not have as great an impact, if any, at its lower end given flow conditions and its overall length. Once reindexed, ING0384_01 will represent the US reach, and ING0384_02 will represent the DS reach. Results for this reach are from a site located midway in the WS and indicate impairment to the upper half of Whitewater River in this WS w/a GM of 227 cfu/100 mL. Results for site 0015 on this lower reach indicate FS w/a GM of 92 cfu/100 mL.

11.3.15 Blackburn Creek Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Blackburn Creek subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 101 provides a summary of the Blackburn Creek subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for TSS. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated TSS concentrations.

Table 97 Summary of Blackburn Creek Subwatershed Characteristics

Blackburn Creek (050800030805)					
Drainage Area (sq. mi.): 1330.85					
Listed Segments: ING0385_01					
Flow Regime TMDL analysis TSS (pounds/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 - 40%**	**40 - 60%**	**60 – 90%**	**90 - 100%**
TSS TMDL (pounds/day)	**713,279.98**	**233,221.19**	**104,501.81**	**48,058.80**	**22,109.68**
Wasteload Allocation (WLA): Total	**201.24**	**161.83**	**142.68**	**142.68**	**142.68**
St. Leon WWTP (IN0058408) 0.57 MGD	**142.68**	**142.68**	**142.68**	**142.68**	**142.68**
Construction Activities (0.003 sq. mi.)	**1.53**	**0.50**	**N/A**	**N/A**	**N/A**
Storm Water – Rudicil Sand & Gravel (INR00R073)	**57.03**	**18.65**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**643391.27**	**210320.30**	**94312.88**	**43373.07**	**19811.31**
Margin Of Safety (MOS) (5%)	**35,664.00**	**11,661.06**	**5,225.09**	**2,260.26**	**1,105.48**
Future Growth (5%)	**33,880.80**	**11,078.01**	**4,963.84**	**2,282.79**	**1,050.21**

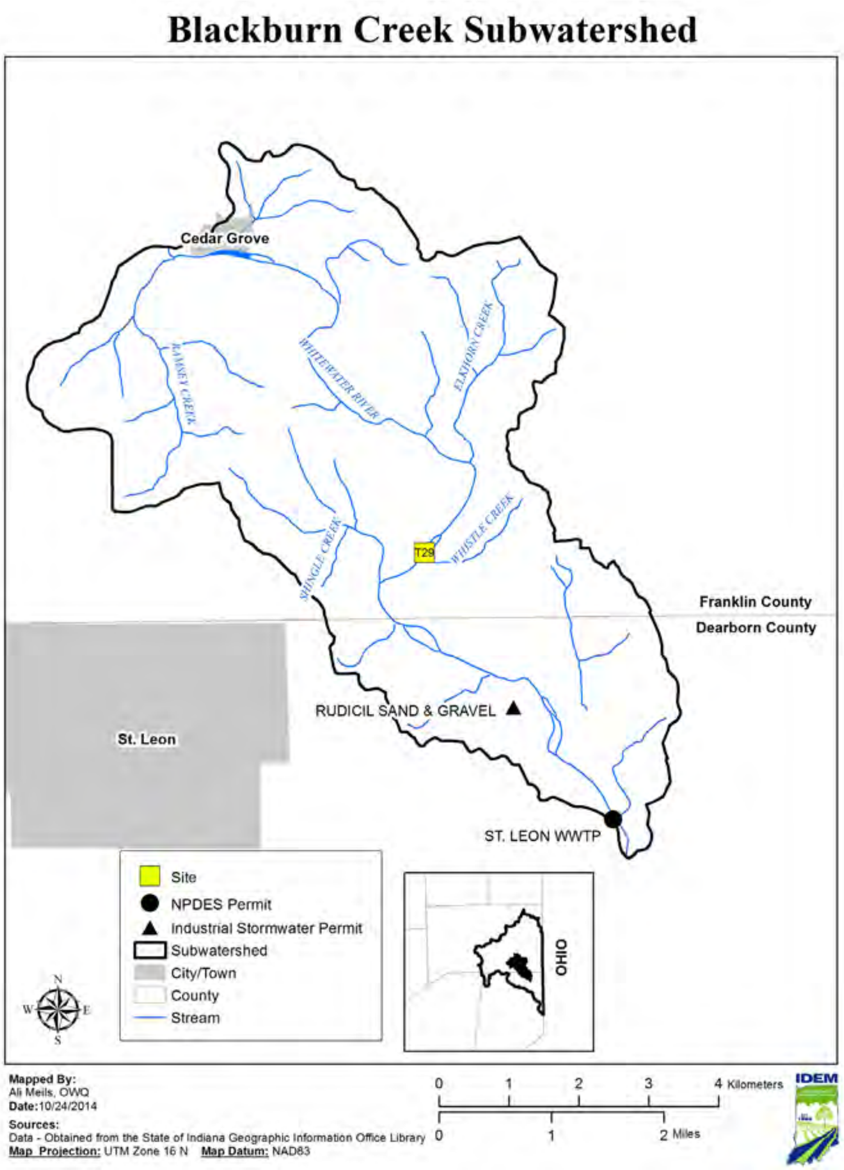


Figure 113 Sampling Stations in Blackburn Creek Subwatershed

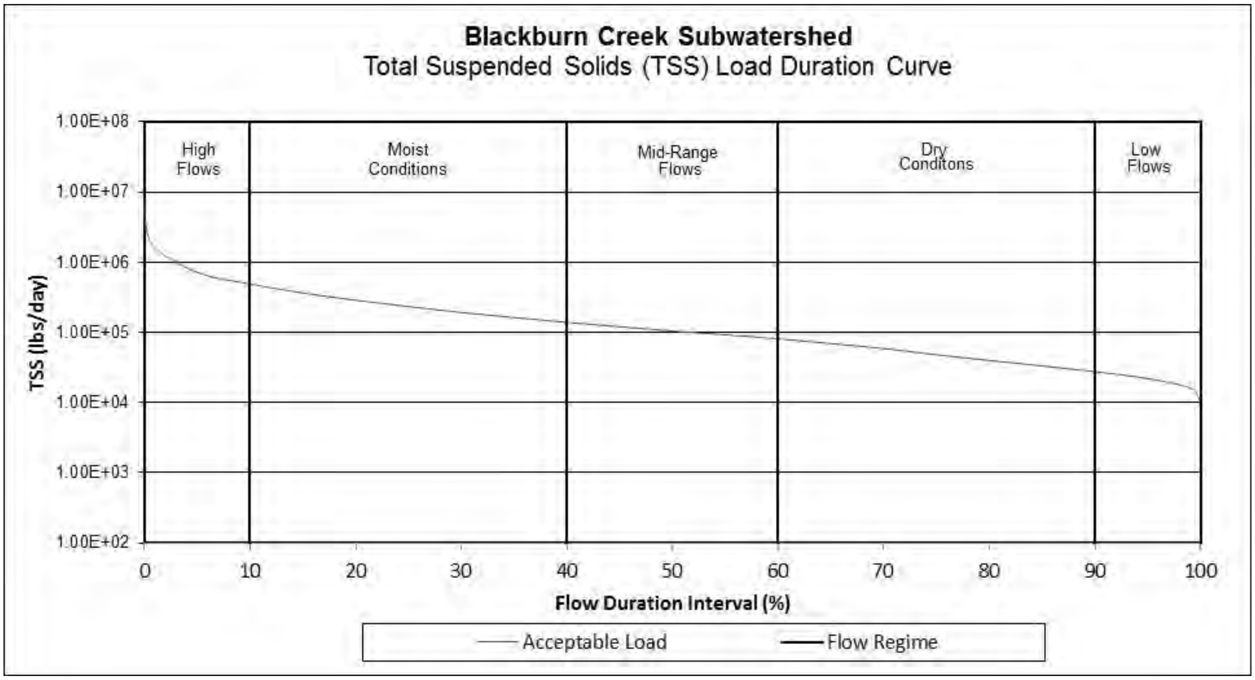


Figure 114 Load Duration Curve for TSS in the Blackburn Creek Subwatershed

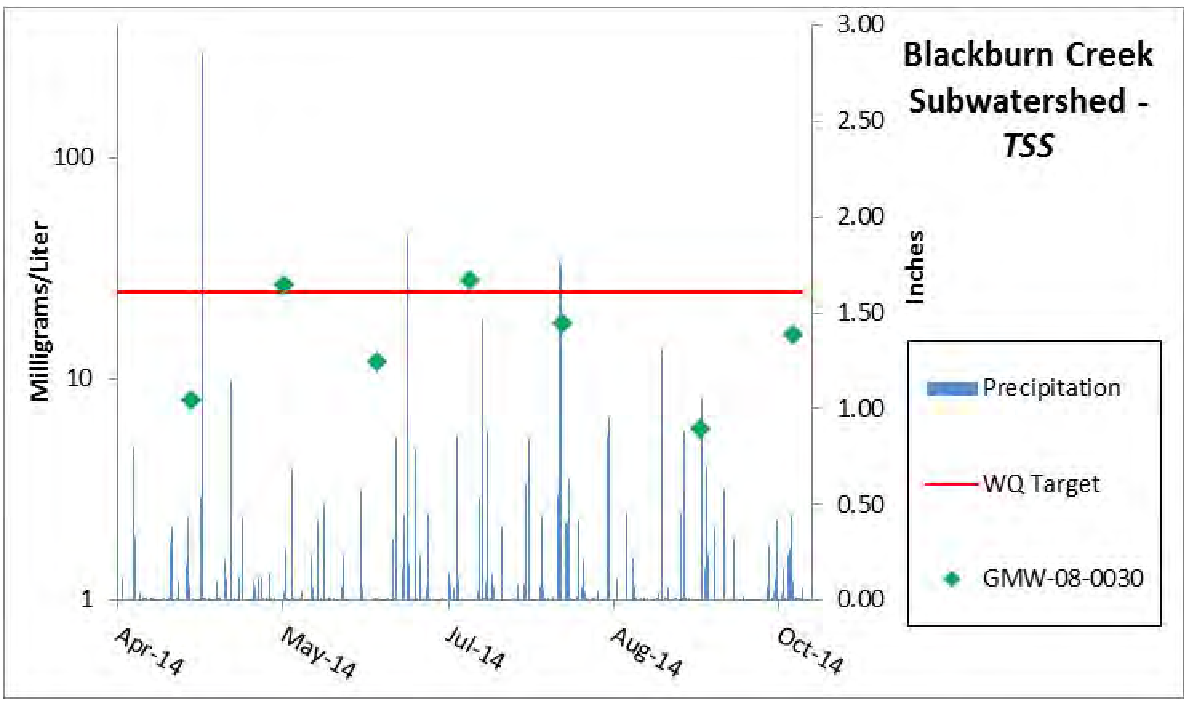


Figure 115 Graph of Precipitation and TSS Data in the Blackburn Creek Subwatershed

The Blackburn Creek subwatershed drains approximately 17 square miles. Blackburn Creek subwatershed drains into the mainstem of the Whitewater river. The land use is primarily forest (61%) followed by hay and pasture (19%) and Agriculture (11%). There are two permitted facilities in the subwatershed, St. Leon wastewater treatment plant and Rudicil Sand and Gravel. The majority of the subwatershed is rural indicating homes pump to on-site septic systems. The small towns of Cedar Grove and New Trenton are within the watershed along U.S. 52. This subwatershed has one CFO hog farm, runoff from the towns of Cedar Grove and New Trenton, some agricultural lands but primarily steep sloping forested lands. There is one sand and gravel quarry with a SW permit. The St. Leon WWTP also discharges at the pour point of this watershed. According to the Dearborn Co. Health Dept. there are two home sewage problem clusters identified that may be impacting this stream (Longnecker Road community with ~ 40 houses and Chappalow Ridge Rd ~40 houses). Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area consists of the flat plain of the Whitewater valley and its steep hillsides on either side of the river. Highly erodible soil types make up the valley walls of this subwatershed. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. There is little to no patches of the subwatershed identified as having hydric soil types. The land use is comprised of 19 percent pasture land which indicates the potential for smaller animal farms. The total number of animal units in this area (49 animals/square mile) which is median concentration when compared to other subwatersheds in Whitewater River. There are approximately 38 miles of stream in the subwatershed. Based on IDEM data collected in 2013 and 2014 there will be 11 stream miles impaired for PCB in fish tissue listed on the 2016 List of Impaired Waters.

There is one site located in this subwatershed, two located on the Whitewater River GMW-08-0030 (T29). This AUID is currently impaired for PCBs and Mercury. We know that entering this subwatershed we have loads from site T25 (geometric mean ~91 MPN) and site T26 (3/8 exceeded). There are historical samples located on this stream reach. One of the sites is a fixed station (GMW080-0001) from which there have been samples taken since 1991, none of which have caused an impairment. In 2002, as site at the pour point of the AUID had a geometric mean of ~95. In 2007, there were two probabilistic sites on this AUID and the E. coli results had geometric means of 51.62 and 46.98 MPN. In 2014, site T29 had a geometric mean of 74.82 MPN.

In 2007, biological communities scored the following on this AUID: fish IBI = 50 and 48 (good) QHEI = 86 and 82 (excellent) and macro mIBI = 38 and 42 (fair) QHEI = 83 and 73 (excellent). In 2104 he fish community IBI score for site T29 was 50 (Good) and the QHEI was 82 (Excellent). The 2014 macro community mIBI score was 34 (poor) and the QHEI was 73 (excellent).

11.3.16 Johnson Fork Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Johnson Fork subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 102 provides a summary of the Johnson Fork subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli* and TSS. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* and TSS concentrations.

Table 98 Summary of Johnson Fork Subwatershed Characteristics

Johnson Fork (050800030806)					
Drainage Area (sq. mi.): 1363.73					
TMDL Sample Sites: GMW-08-0019 (T28), GMW-08-0018 (T30), GMW-08-0003 (P8), GMW-08-0005 (P11)					
Listed Segments: ING0386_02, ING0386_T1001, ING0386_T1002, ING0386_T1006, ING0386_T1006A, ING0386_T1007, ING0386_T1008					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 – 40%**	**40 - 60%**	**60 - 90%**	**90 - 100%**
Bacteria TMDL (billions of bacteria/day)	**914.15**	**302.21**	**138.13**	**66.18**	**33.10**
Wasteload Allocation (WLA): Total	**2.03**	**0.67**	**N/A**	**N/A**	**N/A**
MS4 – Hamilton Co., OH (1GQ00034*BG) 0.0771 sq. mi.	**2.03**	**0.67**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**823.02**	**272.74**	**124.66**	**59.73**	**29.88**
Margin Of Safety (MOS) (5%)	**45.71**	**15.11**	**6.91**	**3.31**	**1.66**
Future Growth (5%)	**43.42**	**14.35**	**6.56**	**3.14**	**1.57**
Drainage Area (sq. mi.): 1363.73					
Listed Segments: ING0386_01					
Flow Regime TMDL analysis TSS (pounds/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 – 40%**	**40 - 60%**	**60 - 90%**	**90 - 100%**
TSS TMDL (pounds/day)	**730,780.45**	**238,861.33**	**106,961.80**	**49,124.31**	**22,534.09**
Wasteload Allocation (WLA): Total	**5.50**	**1.80**	**N/A**	**N/A**	**N/A**
Construction Activities (0.0108 sq. mi.)	**5.50**	**1.80**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**659523.86**	**215,570.55**	**96533.02**	**44334.69**	**20,337.01**
Margin Of Safety (MOS) (5%)	**36,539.02**	**11,943.07**	**5,348.09**	**2,456.22**	**1,126.70**
Future Growth (5%)	**34,712.07**	**11,345.91**	**5,080.69**	**2,333.40**	**1,070.37**

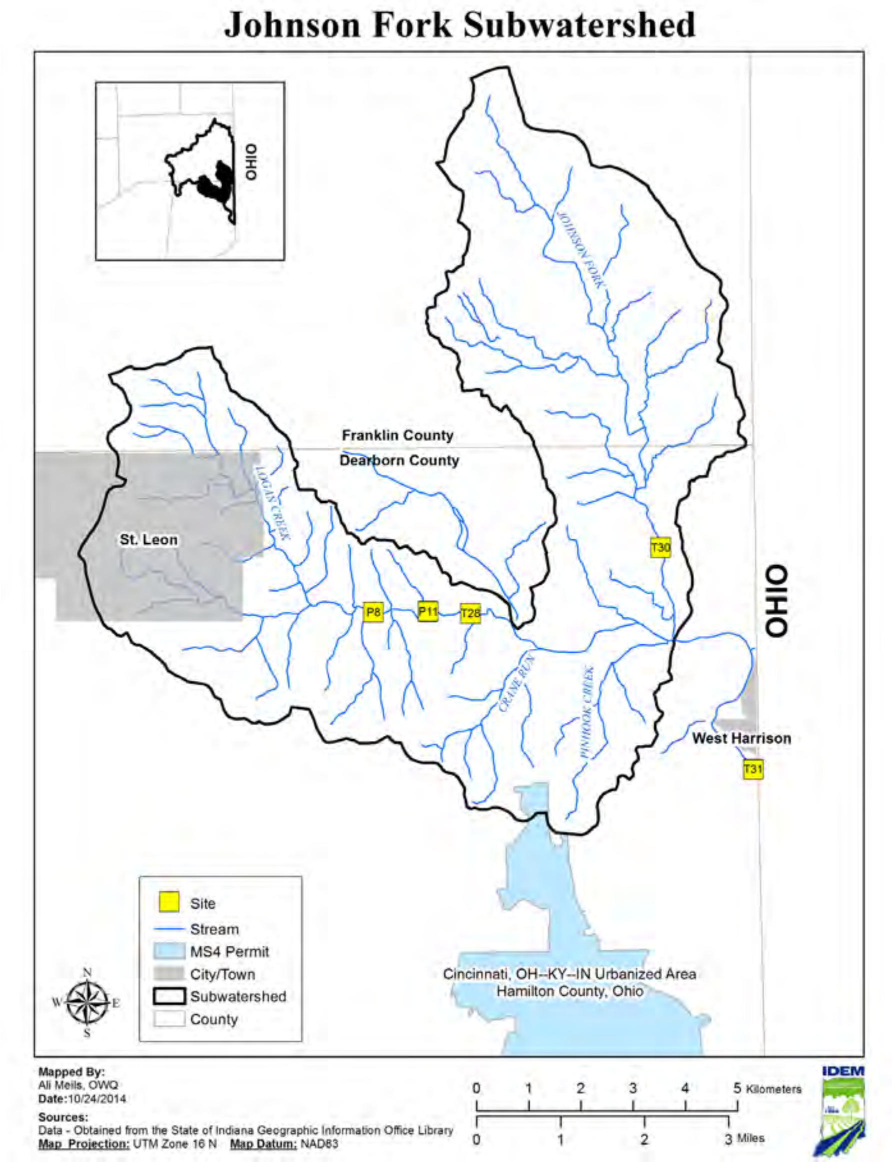


Figure 116 Sampling Stations in Johnson Fork Subwatershed

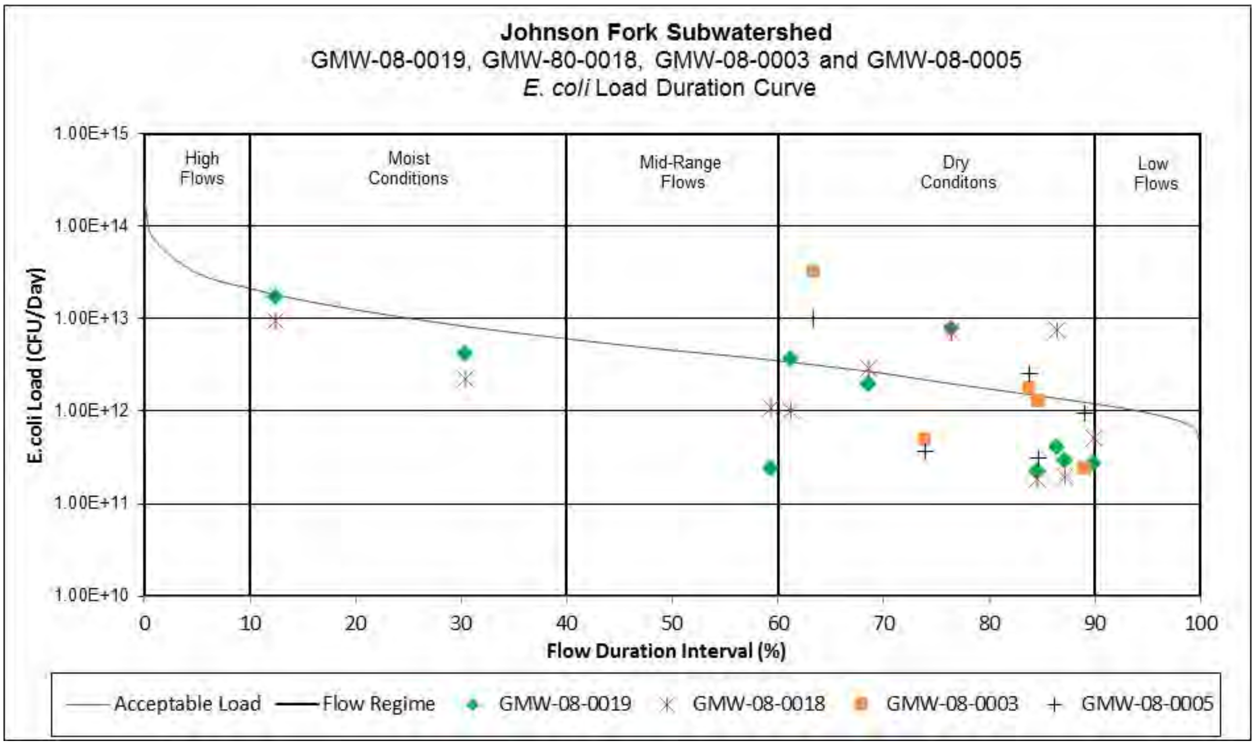


Figure 117 Load Duration Curve for *E. coli* in the Johnson Fork Subwatershed

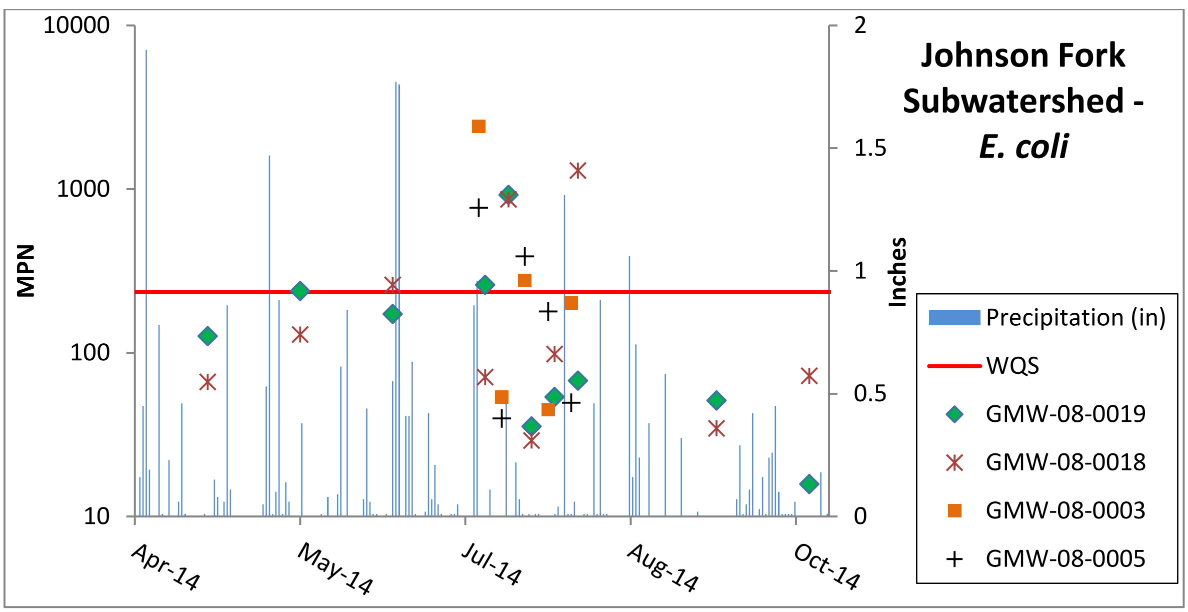


Figure 118 Graph of Precipitation and *E. coli* Data in the Johnson Fork Subwatershed

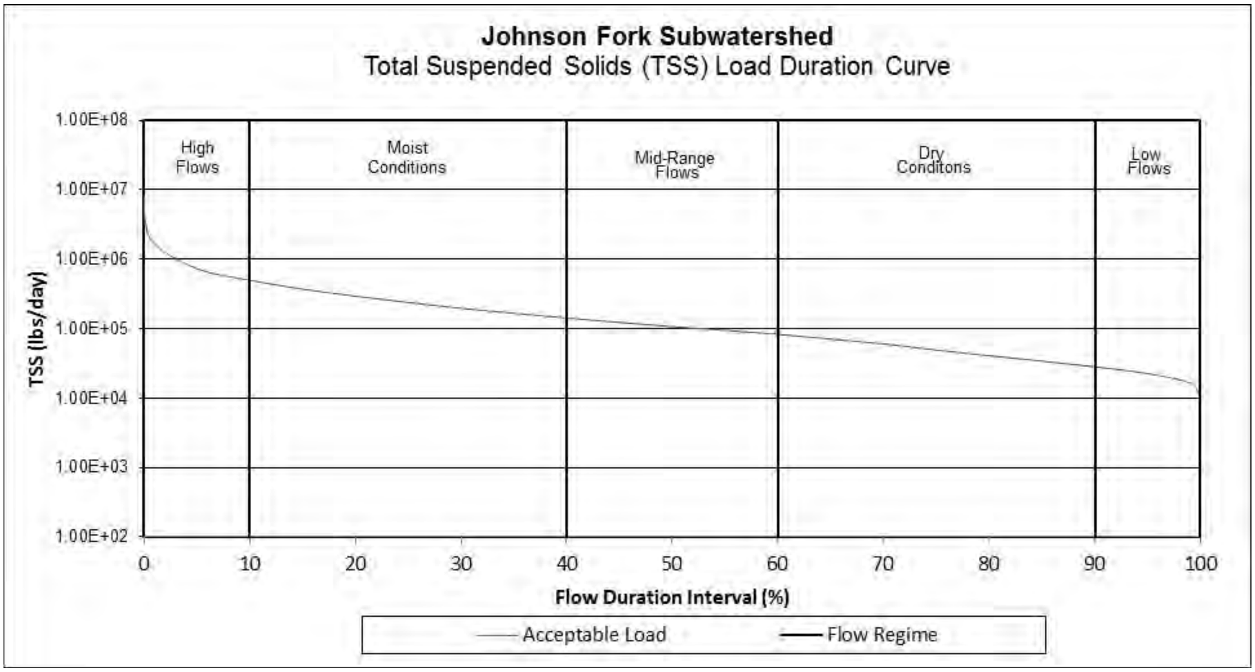


Figure 119 Load Duration Curve for *TSS* in the Johnson Fork Subwatershed

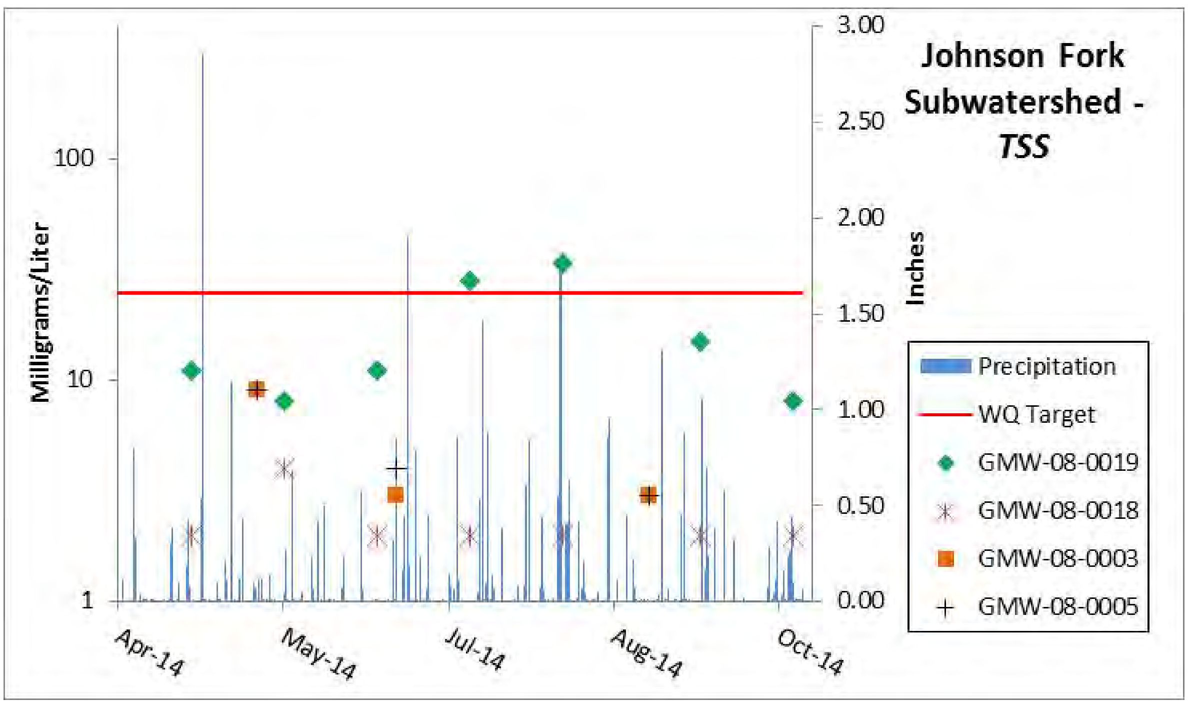


Figure 120 Graph of Precipitation and TSS Data in the Johnson Fork Subwatershed

The Johnson Fork subwatershed drains approximately 33 square miles. The Johnson Fork subwatershed drains through the mainstem of Whitewater. The land use is primarily forest (55%) followed by hay and pasture land (29%) and agriculture (8%). There are no permitted facilities in the subwatershed. The majority of the subwatershed is rural indicating homes pump to on-site septic systems. The Town of St. Leon has part of its incorporated area within the watershed, developed land represents seven percent of land use in the watershed. The land use is primarily steep forested lands with wide riparian buffers surrounding the stream. Small crop fields do occur in the whitewater valley, however most agriculture in the watershed is pasture based. Small housing developments exist near St. Leon, Logan, and Rockdale. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area consists of high gradient headwaters that join the mainstem of the Whitewater river in its valley. Highly erodible soil types make up nearly this entire subwatershed outside of the whitewater valley. The majority of the HEL lands are located in the headwater portion of the subwatershed, which is primarily forested. There are few patches of the subwatershed identified as having hydric soil types, these are mostly along the main stem of the river. These areas could be potential areas for wetland restoration. The land use is comprised of 29 percent pasture land which indicates the potential for smaller animal farms. The total number of animal units in this area (38 animals/square mile) which is a lower concentration when compared to other subwatersheds in the Whitewater River Watershed. There are approximately 77 miles of stream in the subwatershed. Based on IDEM data collected in 2013 and 2014 there will be 54 stream miles impaired for *E. coli*, 32 miles for D.O., and 26 miles of Mercury and PCB impairment listed on the 2016 List of Impaired Waters.

There are four sites located in this subwatershed, three located on Logan Creek; GMW-08-0019 (P28), GMW-08-0003 (P8), GMW-08-0005 (P11), and one located on Johnson Fork GMW-08-0018 (T30). Logan Creek is currently impaired for E. coli, PCBs and Hg. E. coli was collected at a site in 2002 and the geometric mean was ~334 MPN. The E. coli results were: P8 geometric mean = 200.4 MPN, P11 geometric mean = 159.99 MPN and T28 geometric mean = 125.35 MPN. The E. coli concentration is decreasing as you move downstream which suggests the sources for higher E. coli values are located upstream. In July, August and October the DO results were below the 4 mg/L WQS at site T28. There were no DO violations at the two sites upstream. The low DO would also impact the health of the biological communities. According to the Dearborn Co. Health Dept. there is a home sewage problem cluster identified that may be impacting this stream (Chappalow Ridge Rd ~40 houses) and the Health Dept. also estimated that 50% of the septic systems are failing in Dearborn County. This stream has runoff coming from St. Leon. The land use is primarily steep forested terrain with housing clusters as you move between St. Leon and the Ohio border. The City of Cincinnati is just across the state line so this part of the watershed is more heavily populated. The Logan creek segment was previously impaired for E. coli and DO based on a sample collected in 2007. In 2007 the E. coli geometric mean was ~413 MPN and there were 2/7 DO readings < 4 mg/L. This stream has since been reindexed and the original sample falls on a different AUID. In 2009 a site (GMW080-0048) was sampled on this AUID for E. coli only and the geometric mean was 482.21 (5/5 samples exceeded the single sample maximum). In 2014 E. coli was taken at this same site and the geometric mean was 187.04 MPN (3/10 exceeded the single sample max). Both years of sampling indicate the stream is still impaired for E. coli. There were no DO violations in 2009 or 2014 to support a DO impairment. There are several Towns that run off into the stream including: Sharptown, Drewersburg, and Rockdale. According to the Dearborn Co. Health Dept. there are several home sewage problem clusters identified that may be impacting this stream. Those are the Old US 52 area with approximately 30 houses and approximately 12 businesses and the Longnecker Road community with approximately 40 houses.

The fish community IBI score for site T28 was 36 (fair) and the QHEI was 47 (fair). The macro community mIBI score was 38 (fair) and the QHEI was 45 (fair). The fish community IBI score for site P8 was 54 (excellent) and the QHEI was 67 (excellent). The macro community mIBI score was 36 (poor) and the QHEI was 55 (Good). The fish community IBI score for site P11 was 48 (good) and the QHEI was 72 (excellent). The macro community mIBI score was 32 (poor) and the QHEI was 64 (Good). Another site was sampled further downstream on Logan Creek in 2002 and had a fish IBI score of 48 and a QHEI score of 64. The field notes for fish community sampling at site T28 indicated there was an oil sheen on the water’s surface. This may have impacted the biological communities at this site. Five out of six biological communities passed but stream will still be impaired. The fish community IBI score for site T30 was 46 (good) and the QHEI was 61 (good). The macro community mIBI score was 42 (fair) and the QHEI was 59 (good).

11.3.17 Headwaters Dry Fork Whitewater River Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Headwaters Dry Fork Whitewater River subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 103 provides a summary of the Headwaters Dry Fork Whitewater River subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli*. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* concentrations.

Table 99 Summary of Headwaters Dry Fork Whitewater River Subwatershed Characteristics

Headwaters of Dry Fork Whitewater River (050800030807)					
Drainage Area (sq. mi.): 14.01					
TMDL Sample Sites: GMW-08-0020 (T33)					
Listed Segments: ING0387_02					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 - 40%**	**40 - 60%**	**60 – 90%**	**90 - 100%**
Bacteria TMDL (billions of bacteria/day)	**320.1**	**104.64**	**46.86**	**21.52**	**9.87**
Wasteload Allocation (WLA): Total	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**288.91**	**94.43**	**42.31**	**19.44**	**8.88**
Margin Of Safety (MOS) (5%)	**16.0**	**5.23**	**2.34**	**1.08**	**0.49**
Future Growth (5%)	**15.2**	**5.0**	**2.2**	**1.0**	**0.5**

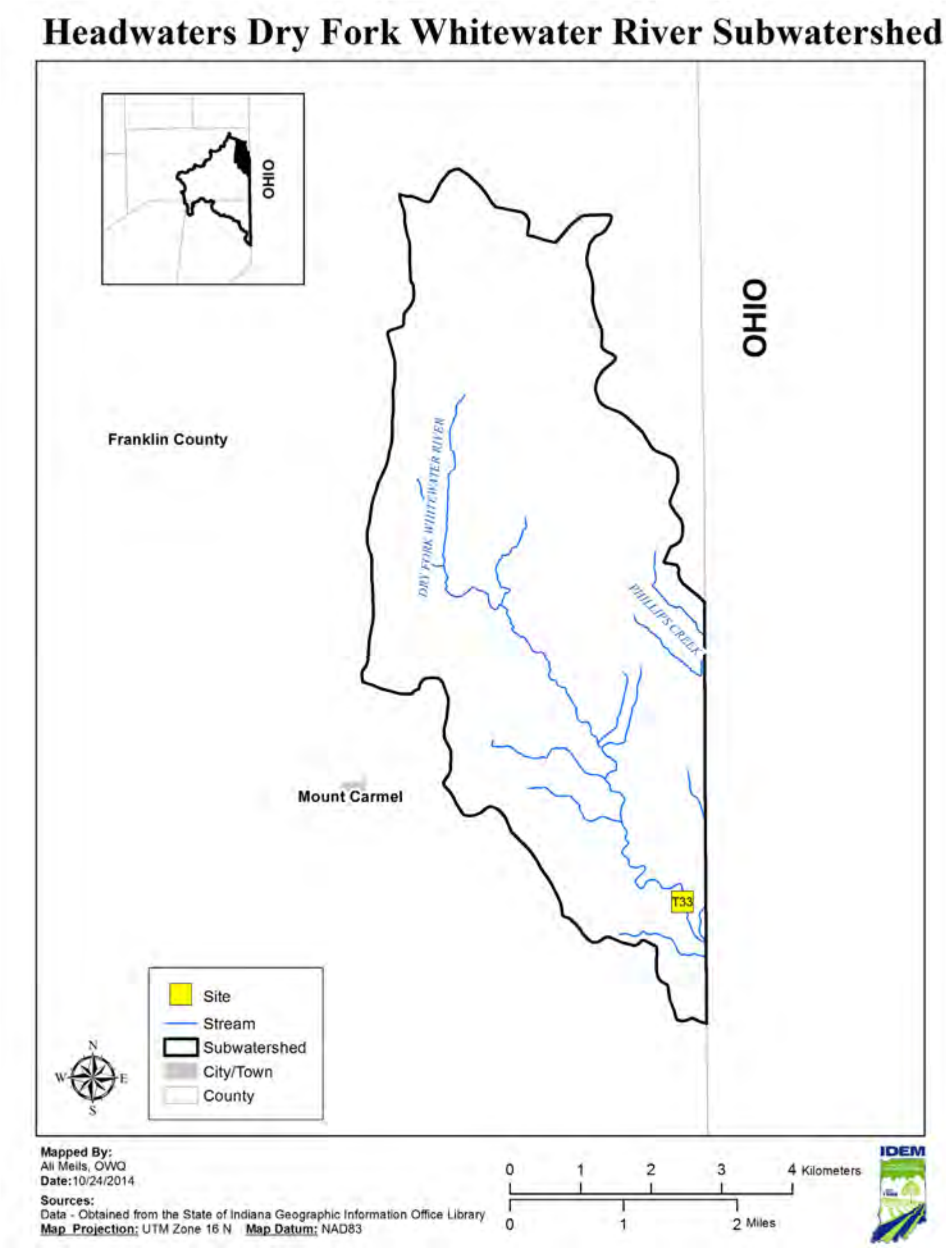


Figure 121 Sampling Stations in Headwaters Dry Fork Whitewater River Subwatershed

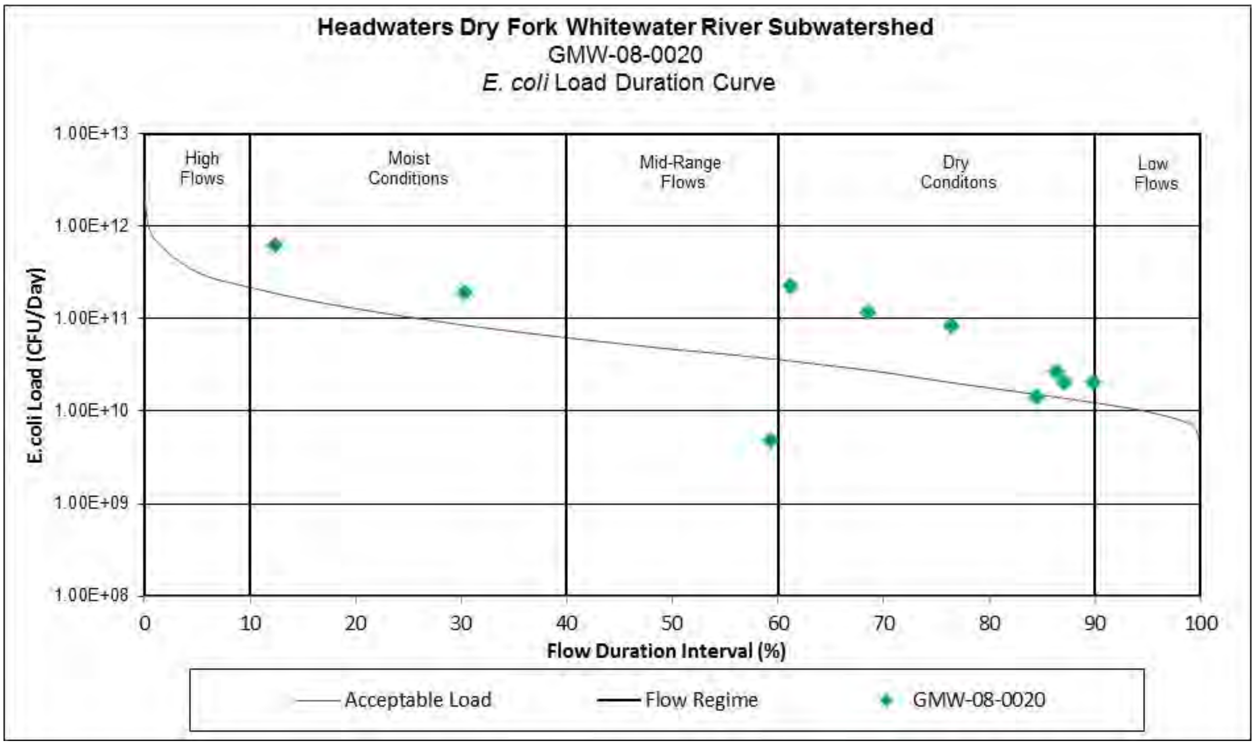


Figure 122 Load Duration Curve for the Headwaters Dry Fork Whitewater River Subwatershed

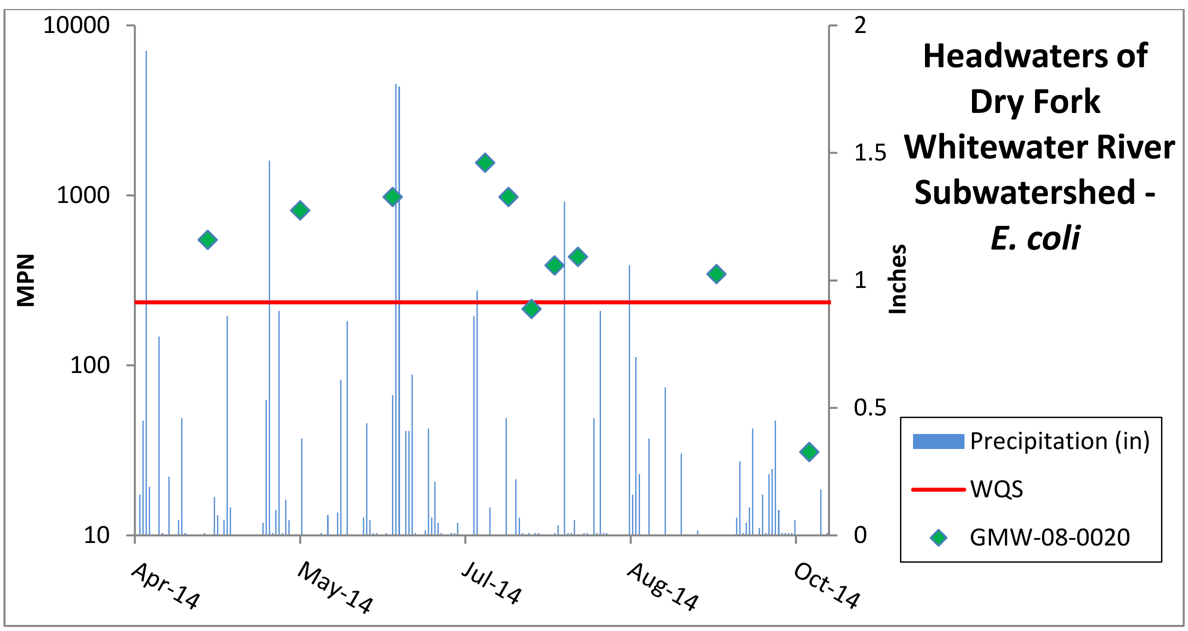


Figure 123 Graph of Precipitation and *E. coli* Data in the Headwaters Dry Fork Whitewater River Subwatershed

The Headwaters Dry Fork Whitewater River subwatershed drains approximately 14 square miles. The Headwaters Dry Fork Whitewater River subwatershed drains through Ohio into Dry Fork creek and the Whitewater River. The land use is primarily agriculture (72%) followed by hay and pasture land (13%) and forest (10%). There are no permitted facilities in the subwatershed. The majority of the subwatershed is rural indicating homes pump to on-site septic systems. There are no municipalities within the watershed. Mount Carmel Elementary School WWTP has been a point source in the extreme headwaters but they no longer discharge and no longer have a permit. Pollutant sources could be coming from the land use which is dominantly agriculture, manure spreading, faulty septic systems and runoff from the Town of Mount Carmel. Mt. Carmel Elementary School used to have a permit but put in an onsite mound system. The school is likely not impacting the impairment based on this and location in the extreme headwaters. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area is more level that what is typically found in the watershed leading to its agricultural intensity in in contrast to much of the overall watershed. Highly erodible soil types are present in a small capacity in this subwatershed, with the majority of the HEL lands located on the sloping lands near waterways. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. Though dominated by agricultural uses many tributaries are buffered and the main stem riparian area is forested along much of its course .There are small patches of the subwatershed identified as having hydric soil types. These areas could be potential areas for wetland restoration. The land use is comprised of 13 percent pasture land which indicates the potential for smaller animal farms. The total number of animal units in this area (55 animals/square mile) which is median concentration when compared to other subwatersheds in the Whitewater River Watershed. There are approximately 17 miles of stream in the subwatershed. Based on IDEM data collected in 2013 and 2014 there will be 14 stream miles impaired for *E. coli* listed on the 2016 List of Impaired Waters.

There is one sites located in this subwatershed, located on the Dry Fork Whitewater River GMW-08-0020 (T33). The 2014 samples resulted in 7/10 E. coli concentrations were in exceedance of the single sample maximum. The geometric mean was 478.15 MPN. Nitrogen levels were moderately high from April - June but not in exceedance of the IN WQ target. The stream is currently listed as impaired for E. coli and will remain impaired. In 2007 this same site was sampled in the IDEM probabilistic program and the E. coli geometric mean was 250.60 MPN. While TP was not in exceedance of the WQ target in 2014, the 2007 results indicate that TP was greater than the WQ target (0.3 mg/L) 2/3 samples (0.24, 0.32, 1.2 mg/L). In addition the DO results from 2007 were close to the 4 mg/L WQS 4/11 times (4.09, 4.22, 4.07, 4.07 mg/L), and > 13 2/11 times. While the TP and DO did not occur on the same day to warrant a nutrient impairment, data suggests there are high levels of nutrients in the stream.

The fish community IBI score for site T33 was 48 (good) and the QHEI was 63 (good). The macro community mIBI score was 28 (poor) and the QHEI was 61 (good). The biological communities collected in 2007 were: fish IBI = 38 (fair) QHEI = 62 (good) and macro mIBI = 38 (fair) QHEI 54 (good). The high levels of nutrients and DO extremes could be a source of stress on the biological communities.

11.3.18 Howard Creek

Load duration curves and precipitation graphs were created for all the sampling sites in the Howard Creek subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 104 provides a summary of the Howard Creek subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for *E. coli*. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* concentrations.

Table 100 Summary of Howard Creek Subwatershed Characteristics

Howard Creek (050800030808)					
Drainage Area (sq. mi.): 10.05					
TMDL Sample Sites: GMW-08-0027 (T32)					
Listed Segments: ING0388_01, ING0388_T1005, ING0388_T1007					
Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 – 40%**	**40 - 60%**	**60 - 90%**	**90 - 100%**
Bacteria TMDL (billions of bacteria/day)	**229.6**	**75.06**	**33.61**	**15.44**	**7.08**
Wasteload Allocation (WLA): Total	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Load Allocation (LA)	**207.25**	**67.74**	**30.33**	**13.97**	**6.43**
Margin Of Safety (MOS) (5%)	**11.5**	**3.75**	**1.68**	**0.77**	**0.35**
Future Growth (5%)	**10.9**	**3.6**	**1.6**	**0.7**	**0.3**

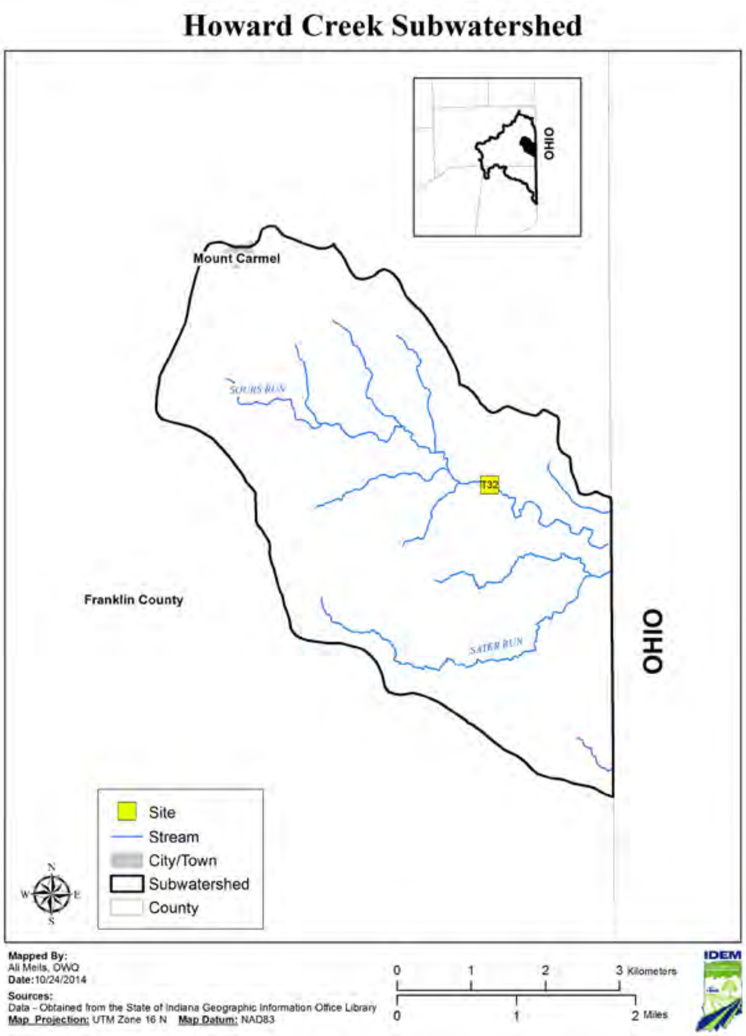


Figure 124 Sampling Stations in Howard Creek Subwatershed

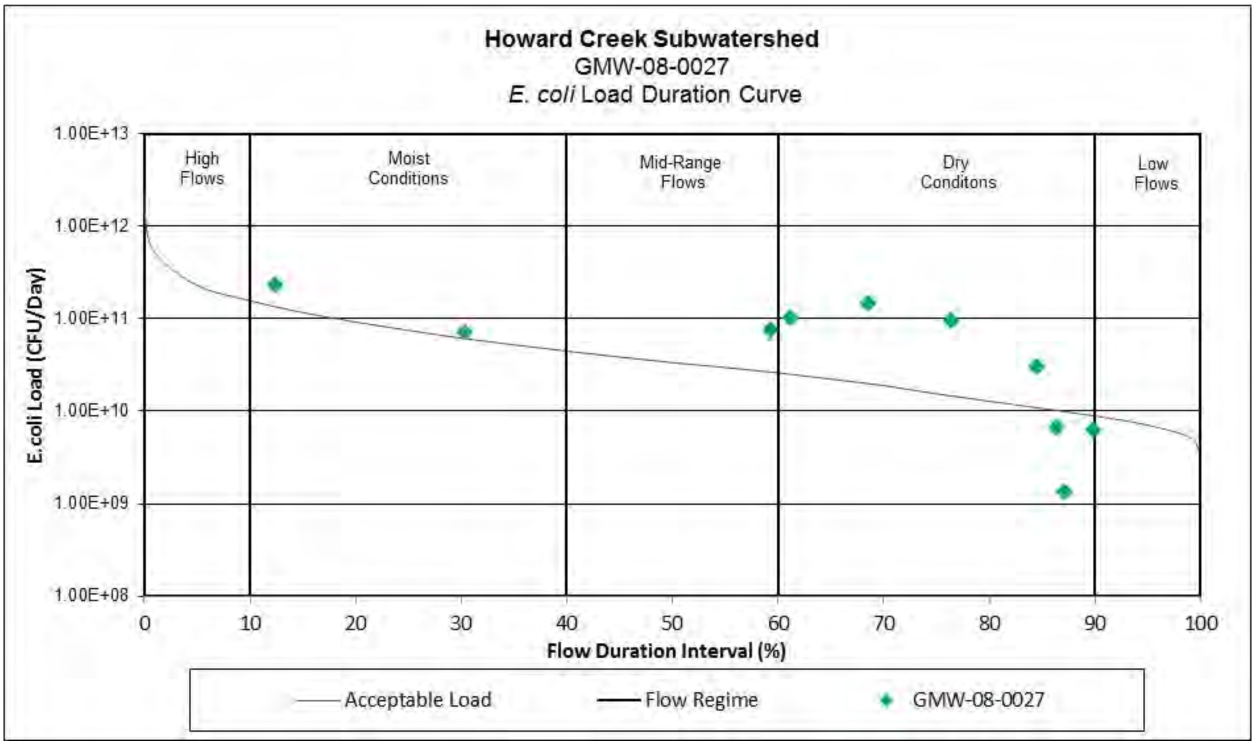


Figure 125 Load Duration Curve for the Howard Creek Subwatershed

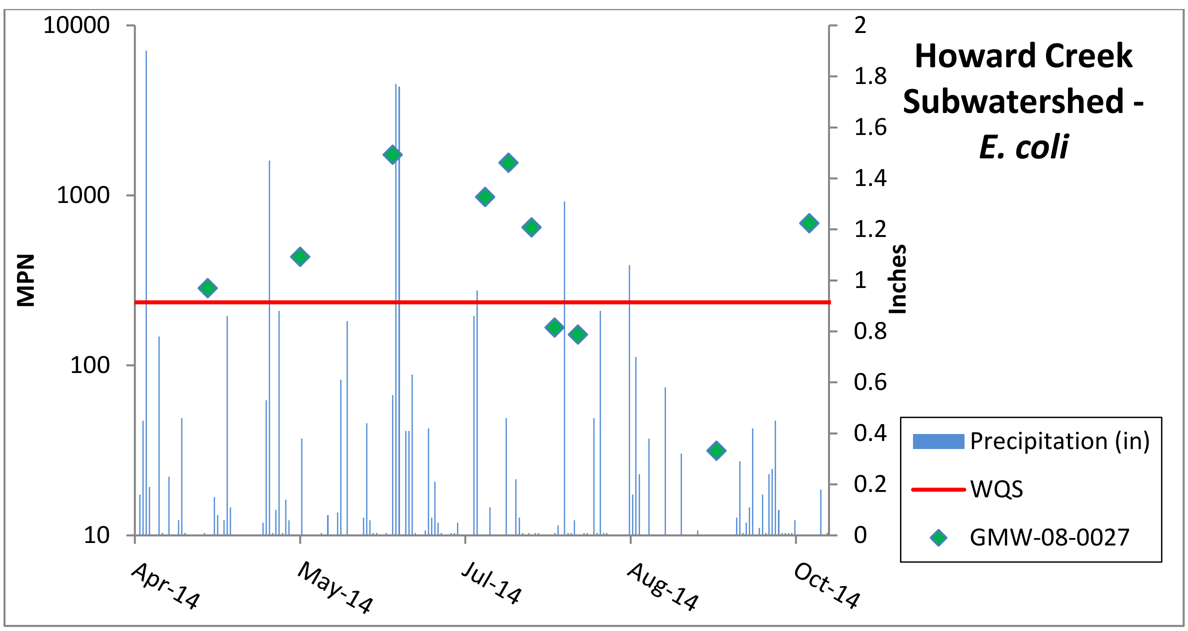


Figure 126 Graph of Precipitation and *E. coli* Data in the Howard Creek Subwatershed

The Howard Creek subwatershed drains approximately 10 square miles. The Howard Creek subwatershed drains through Ohio into Dry Fork creek and the Whitewater River. The land use is primarily agriculture (59%) followed by hay and pasture land (22%) and forest (12%). There is one permitted facilities in the subwatershed, the Mount Carmel Elementary School. The majority of the subwatershed is rural indicating homes pump to on-site septic systems. The small village of Mount Carmel is the only Municipality in the subwatershed. The high levels of nutrients and DO extremes could be a source of stress on the biological communities. Mount Carmel Elementary School WWTP has been a point source in the extreme headwaters but they no longer discharge and no longer have a permit. Pollutant sources could be coming from the land use which is dominantly agriculture, manure spreading, faulty septic systems and runoff from the Town of Mount Carmel. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area consists of relatively flat land making up the upland of the watershed with depressions where the creek drains into Ohio. Highly erodible soil types make up nearly a third of this subwatershed. The majority of the HEL lands are located near the waterways in the small valleys they have carved. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. There are many isolated patches of the subwatershed identified as having hydric soil types. These areas could be potential areas for wetland restoration. The land use is comprised of 22 percent pasture land which indicates the potential for smaller animal farms. The total number of animal units in this area (55 animals/square mile) which is median concentration when compared to other subwatersheds in Salt Creek. There are approximately 16 miles of stream in the subwatershed. Based on IDEM data collected in 2013 and 2014 there will be 16 stream miles impaired for *E. coli* listed on the 2016 List of Impaired Waters.

There are one sites located in this subwatershed, Located on GMW-08-0027 (T32). The 2014 samples resulted in 7/10 E. coli concentrations were in exceedance of the single sample maximum. The geometric mean was 478.15 MPN. Nitrogen levels were moderately high from April - June but not in exceedance of the IN WQ target. The stream is currently listed as impaired for E. coli and will remain impaired. In 2007 this same site was sampled in the IDEM probabilistic program and the E. coli geometric mean was 250.60 MPN. While TP was not in exceedance of the WQ target in 2014, the 2007 results indicate that TP was greater than the WQ target (0.3 mg/L) 2/3 samples (0.24, 0.32, 1.2 mg/L). In addition the DO results from 2007 were close to the 4 mg/L WQS 4/11 times (4.09, 4.22, 4.07, 4.07 mg/L), and > 13 2/11 times. While the TP and DO did not occur on the same day to warrant a nutrient impairment, data suggests there are high levels of nutrients in the stream.

The fish community IBI score for site T32 was 38 (fair) and the QHEI was 58 (good). The macro community mIBI score was 36 (fair) and the QHEI was 56 (good). The biological communities collected in 2007 were: fish IBI = 38 (fair) QHEI = 62 (good) and macro mIBI = 38 (fair) QHEI 54 (good). The high levels of nutrients and DO extremes could be a source of stress on the biological communities.

11.3.19 Lee Creek Subwatershed

There is only a small portion of Lee Creek subwatershed located in Indiana before flowing east into Ohio. There were no sampling sites in the Lee Creek subwatershed. With little information and only a small portion of the drainage in Indiana it is difficult to characterize the area.

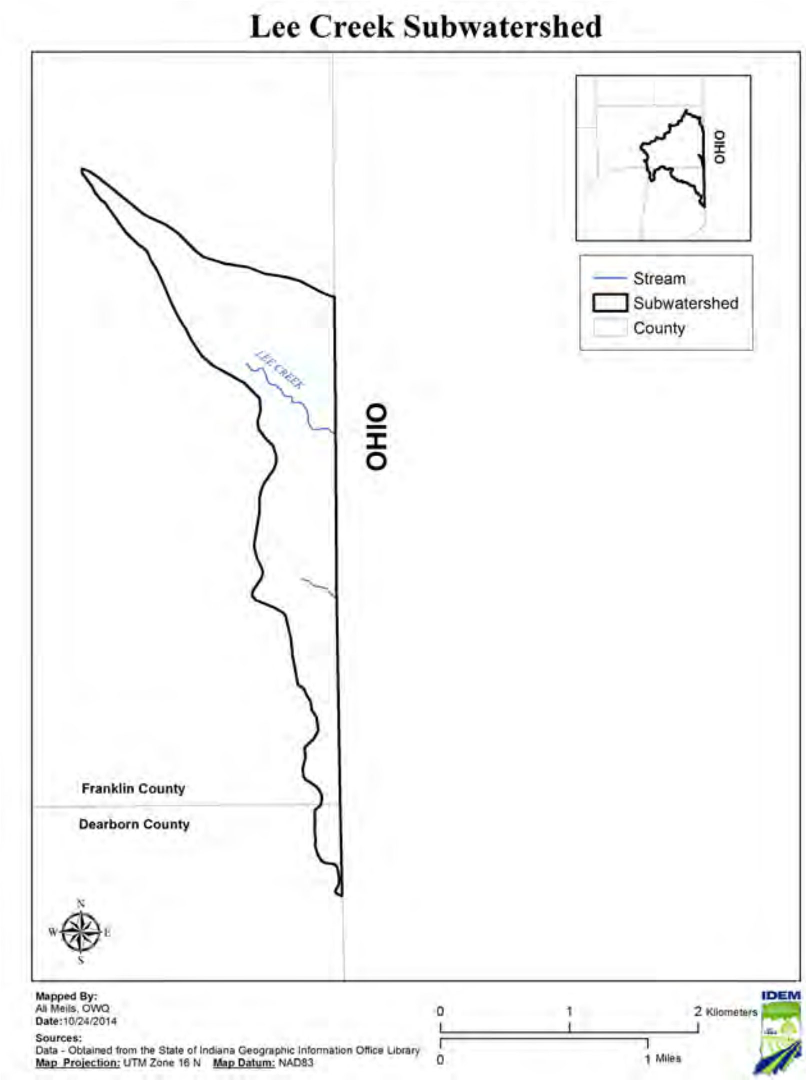


Figure 127 Sampling Stations in Lee Creek Subwatershed

11.3.20 Jameson Creek Subwatershed

Load duration curves and precipitation graphs were created for all the sampling sites in the Jameson Creek subwatershed. The figures below illustrate water quality standards violations during all flow ranges that occurred during sampling events. A discussion of key sampling sites in the subwatershed is included following the figures. Table 105 provides a summary of the Jameson Creek subwatershed, including segment AUIDs, drainage area, sampling sites, NPDES facilities, CFOs, as well as Load Allocations, Wasteload Allocations, Future Growth and Margin of Safety values for TSS. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated TSS concentrations.

Table 101 Summary of Jameson Creek Subwatershed Characteristics

Jameson Creek (050800030810)					
Drainage Area (sq. mi.): 1374.94					
TMDL Sample Sites: GMW-08-0021 (T31)					
Listed Segments: ING038A_01					
Flow Regime TMDL analysis TSS (pounds/day)	**Very High Flows**	**Higher Flow Conditions**	**Normal Flows**	**Lower Flow Conditions**	**Low Flows**
Duration Interval	**0 - 10%**	**10 – 40%**	**40 - 60%**	**60 - 90%**	**90 - 100%**
TSS TMDL (pounds/day)	**733994.6**	**239911.89**	**107432.24**	**49340.37**	**22633.20**
Wasteload Allocation (WLA): Total	**81.91**	**26.77**	**NA**	**NA**	**NA**
MS4 – City of Harrison, OH (1GQ00034*BG) 0.1546 sq. mi.	**78.70**	**25.72**	**NA**	**NA**	**NA**
Storm Water – Wagner Auto Parts (INR00W108)	**0.51**	**0.17**	**NA**	**NA**	**NA**
Construction Activities (0.0053 sq. mi.)	**2.7**	**0.88**	**NA**	**NA**	**NA**
Load Allocation (LA)	**662348.21**	**216493.71**	**96957.63**	**44529.65**	**20426.44**
Margin Of Safety (MOS) (5%)	**36699.7**	**11995.59**	**5371.61**	**2467.02**	**1131.66**
Future Growth (5%)	**34864.78**	**11395.9**	**5103.0**	**2343.7**	**1075.1**

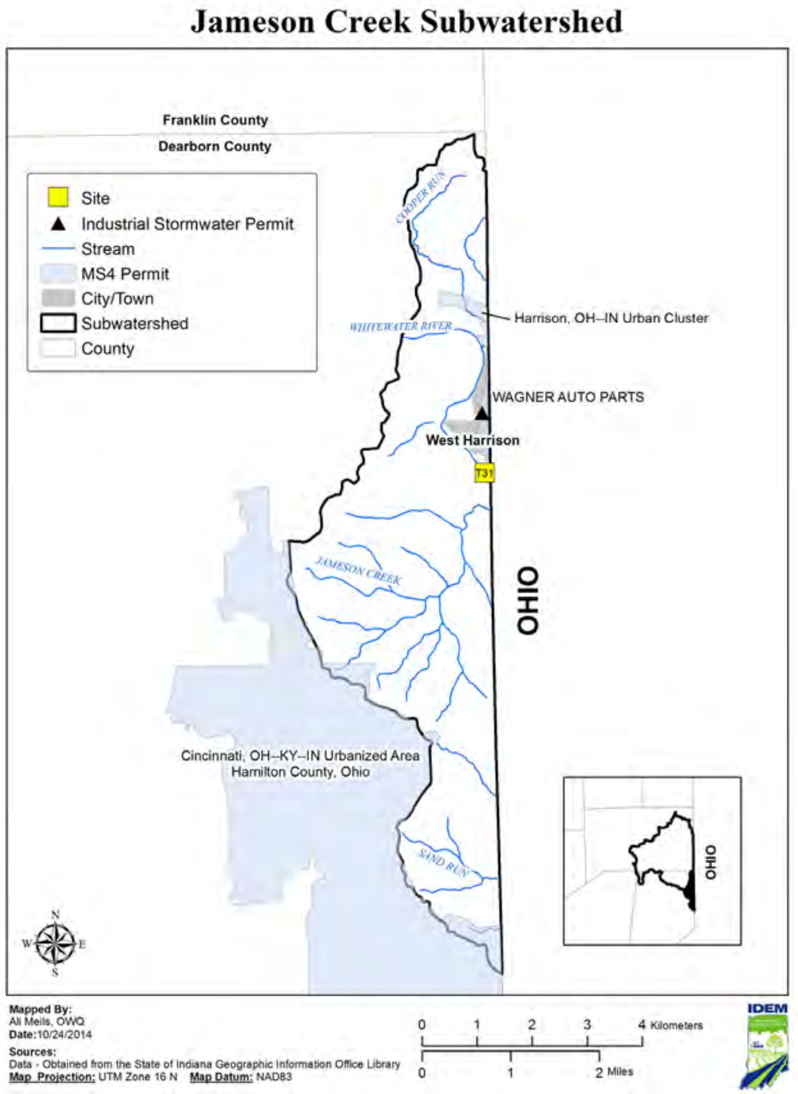


Figure 128 Sampling Stations in Jameson Creek Subwatershed

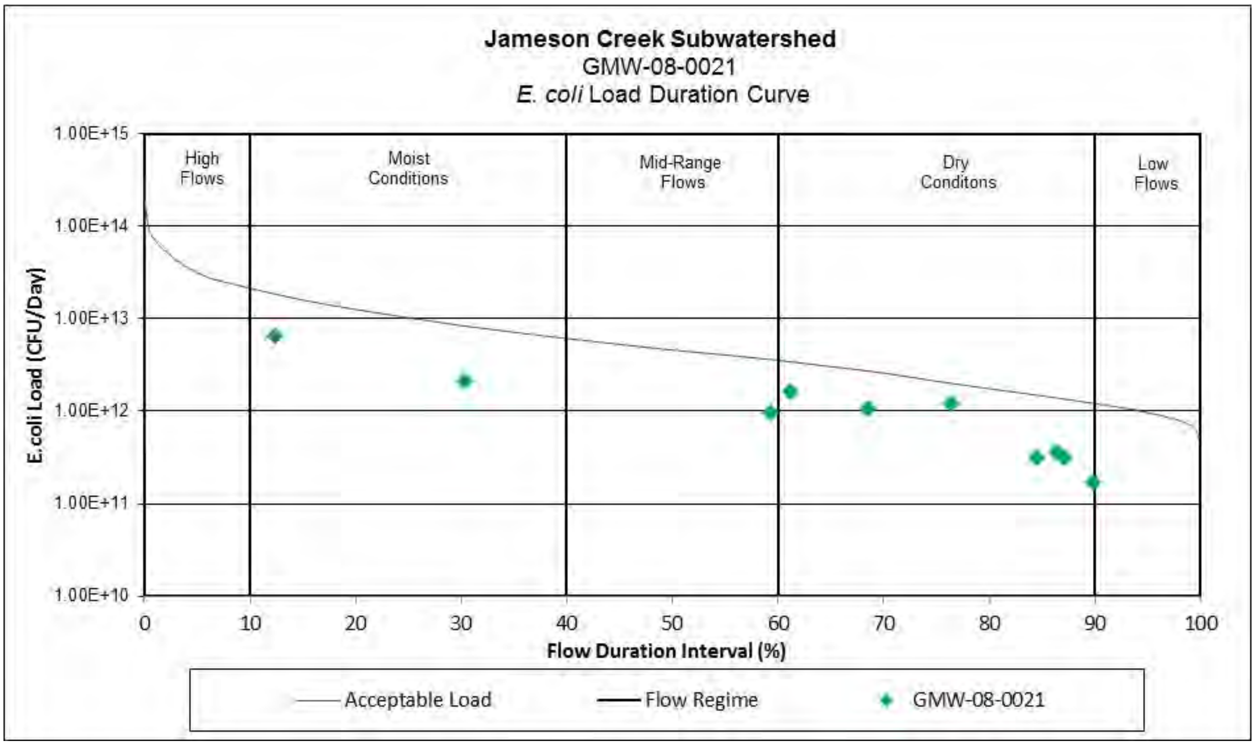


Figure 129 *E. coli* Load Duration Curve for the Jameson Creek Subwatershed

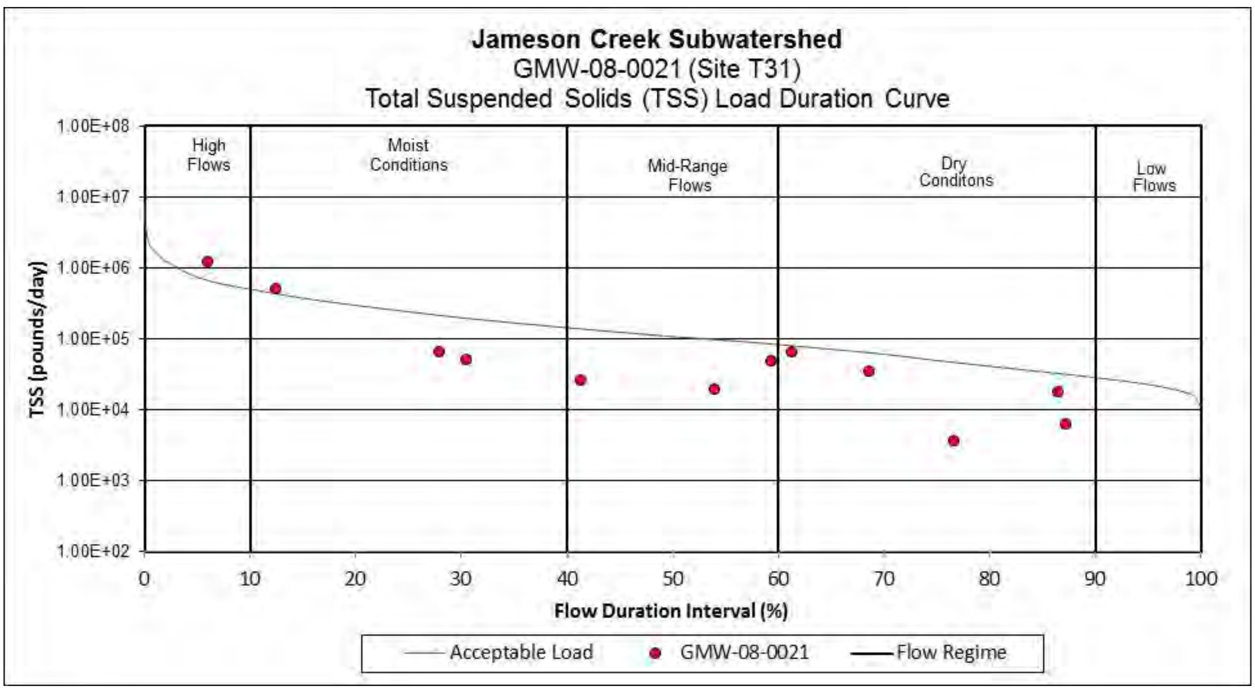


Figure 130 TSS Load Duration Curve for the Jameson Creek Subwatershed

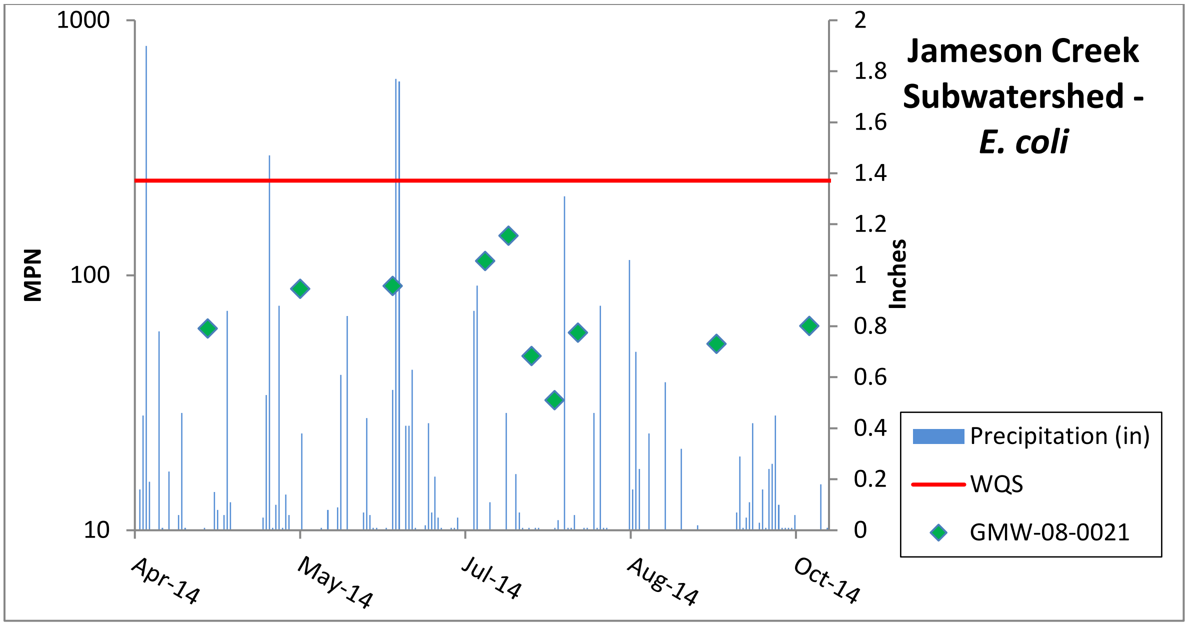


Figure 131 Graph of Precipitation and *E. coli* Data in the Jameson Creek Subwatershed

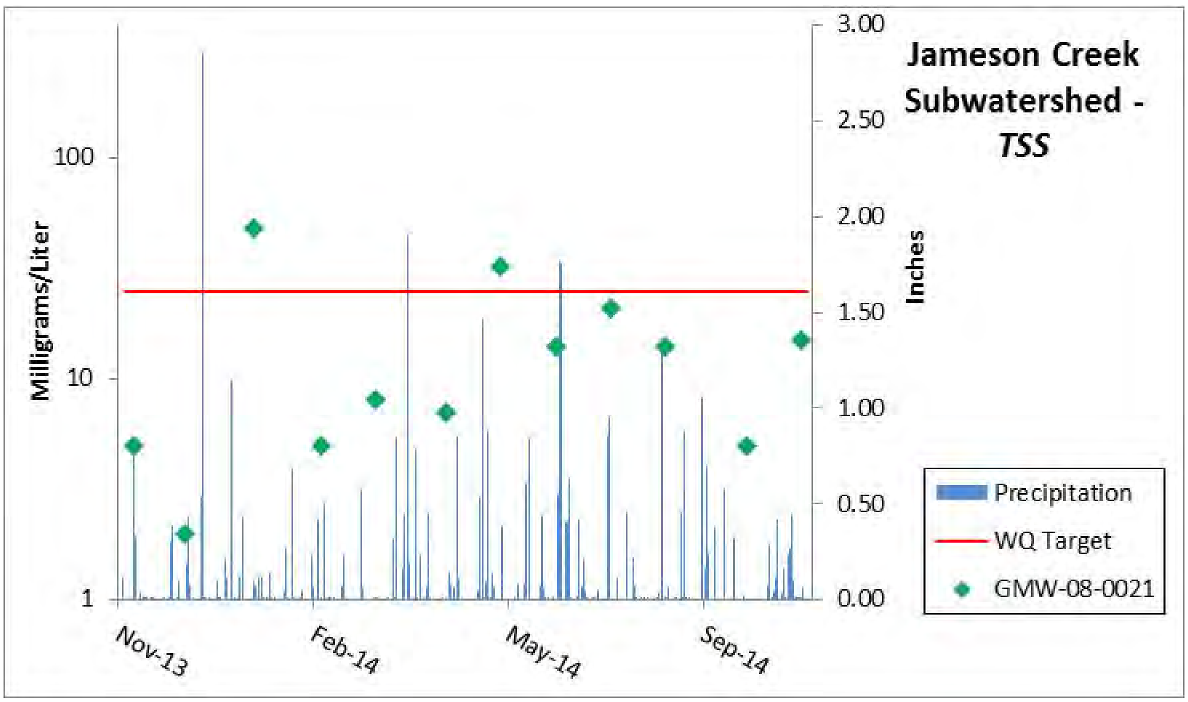


Figure 132 Graph of Precipitation and TSS Data in the Jameson Creek Subwatershed

The Jameson Creek subwatershed drains approximately 11 square miles. The Jameson Creek subwatershed drains into the mainstem of the Whitewater River. The land use is primarily Forested land (63%) followed by hay and pasture land (26%) and developed (8%). There are no permitted facilities in the subwatershed. The majority of the subwatershed is rural indicating homes pump to on-site septic systems. The Town of West Harrison is within the watershed yet it represents approximately 8 percent of the drainage. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area is important to ensure proper function and capacity. The landscape in the area consists of Steeper drainages in the headwaters which reduces in slope as they flow to the mainstem. Highly erodible soil types make up nearly a two thirds of this subwatershed. The majority of the HEL lands are located in the headwater portion of the subwatershed, which is predominantly forested interspersed with pasture land. These soil types can contribute to sediment loss from agricultural lands, as well as, lands from the high gradient slopes. There no areas of the subwatershed identified as having hydric soil types. These areas could be potential areas for wetland restoration. The land use is comprised of 26 percent pasture land which indicates the potential for smaller animal farms. The total number of animal units in this area (27 animals/square mile) which is the lowest concentration when compared to other subwatersheds in the Whitewater river watershed. Based on IDEM data collected in 2013 and 2014 there are no impaired streams listed on the 2016 List of Impaired Waters.

There is one site located in this subwatershed, located on the mainstem Whitewater River GMW-08-0021 (T31). In 2009 this stream was sampled for E. coli only. The geometric mean was 94.64 MPN with 0/5 exceeding the single sample maximum. In 2014, the E. coli geometric mean was 68.52 MPN with 0/10 exceeding the single sample maximum. There are two historical sites located just upstream of site T31. The macro community in 1994 scored 4.2, QHEI= 81 and the macro score in 1997 was 5.6, QHEI = 83. In 2014, biological communities scored the following: fish IBI = 54 (excellent) QHEI = 75 (excellent) and macro mIBI = 34 (poor) QHEI = 65 (good). In January and May the TSS was greater than the WQ target but these were likely attributed to high flows. This site has a drainage area of 1370 sq. miles. The majority of the Southern Whitewater River watershed is forested with steep to rolling terrain. This particular AUID has a portion of the Greater Cincinnati MS4 contributing to the drainage, however a good portion of the drainage remains forested.

The fish community IBI score for site T31 was 54 (excellent) and the QHEI was 75 (excellent). The macro community mIBI score was 34 (poor) and the QHEI was 65 (good). This macro score is poor however based on biologist’s best professional judgment this site will be fully supporting for aquatic communities.

12.0 ALLOCATIONS

A TMDL is the total amount of a pollutant that can be assimilated by the receiving water while still achieving water quality standards. TMDLs are composed of the sum of individual WLAs for regulated sources and LAs for sources not directly regulated by a permit. In addition, the TMDL must include a MOS, either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this is defined by the equation:

$$\text{TMDL} = \sum \text{WLAs} + \sum \text{LAs} + \text{MOS}$$

12.1 Margin of Safety (MOS)

Section 303(d) of the Clean Water Act and USEPA regulations at 40 CFR 130.7 require that “TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numeric water quality standards with seasonal variations and a MOS which takes into account any lack of knowledge concerning the relationship between limitations and water quality.” USEPA guidance explains that the MOS may be implicit (i.e., incorporated into the TMDL through conservative assumptions in the analysis) or explicit (i.e., expressed in the TMDL as loadings set aside for the MOS). This TMDL uses both an implicit and explicit MOS. An implicit MOS was used by applying a couple of conservative assumptions. A moderate explicit MOS has been applied by reserving five percent of the allowable load. five percent was considered an appropriate MOS based on the following considerations:

- The use of the load duration curve approach minimizes a great deal of uncertainty associated with the development of TMDLs because the calculation of the loading capacity is simply a function of flow multiplied by the target value. Most of the uncertainty is therefore associated with the estimated flows in each assessed segment which were based on extrapolating flows from the nearest downstream USGS gage.
- An additional implicit MOS for *E. coli* is included because the load duration analysis does not address die-off of pathogens. As stated in EPA’s Protocol for Developing Pathogen TMDLs (EPA 841-R-00-002), many different factors affect the survival of pathogens, including the physical condition of the water. These factors include, but are not limited to sunlight, temperature, salinity, and nutrient deficiencies. These factors vary depending upon the environmental condition/circumstances of the water, and therefore it would be difficult to assert that the rate of decay caused by any given combination of these environmental variables was sufficient enough to meet the water quality standards of 235 cfu/100mL and 125 cfu/100 mL. Thus, it is more conservative to apply the State's water quality standard in determining bacteria TMDLs, because this standard must be met at all times under all environmental conditions.
- The identified percent reduction required for IBC surrogate TMDLs are based on the highest sampled result of all of the monitoring sites within the HUC 12 watershed, relative to the standard. The use of the maximum sample result provides an implicit margin of safety.

12.2 Future Growth

The rate of future growth was estimated from population in Southern Whitewater River Watershed by the U.S. Census Bureau. Based on the comparison of the 2000 to 2010 census, the future growth was set as 5% in TMDL allocation.

12.3 Critical Conditions

The Clean Water Act requires that TMDLs take into account critical conditions for stream flow, loading, and water quality parameters as part of the analysis of loading capacity. Through the load duration curve approach it has been determined that load reductions for the parameters of concern are needed for specific flow conditions; the critical conditions (the periods when the greatest reductions are required) vary by parameter and location and are summarized in Table 102. The critical condition is defined as the set of environmental conditions that, if controls are designed to protect, will ensure attainment of objectives for all other conditions. For example, the critical condition for control of continuous point source discharge is the drought stream flow. Point source pollution controls designed to meet water quality standards for draught flow conditions will ensure compliance with standards for all other conditions. The 7Q10 flow value is typically chosen as the critical condition for this situation. The 7Q10 flow value represents the 7-day low flow period that occurs on average every 10 years in a stream system. The critical condition for wet weather-driven sources may be a particular rainfall event, coupled with stream flow associated with that event. Nutrient sources arise from a mixture of continuous and wet weather-driven sources. Loading from failing septic systems is assumed to be relatively constant over time whereas agricultural runoff will be greatest during wet weather periods. The TMDL will therefore examine the combined impact of both continuous and wet-weather sources. The table indicates that critical conditions for most pollutants for most locations occur during multiple flows and therefore implementation of controls should be targeted for these conditions.

Table 102 Critical Conditions for TMDL Parameters

Station ID	Parameter	Critical Condition				
		High	Moist	Mid-Range	Dry	Low Flow
GMW050-0023	*E. coli* (counts/mL)	X			X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-05-0006	*E. coli* (counts/mL)	X		X	X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-05-0014	*E. coli* (counts/mL)	X			X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-05-0011	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-05-0007	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-05-0003	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-05-0009	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-05-0002	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-05-0015	*E. coli* (counts/mL)	X	X		X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-05-0008	*E. coli* (counts/mL)					
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-05-0001	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-05-0012	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-05-0010	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-06-0014	*E. coli* (counts/mL)	X	X	X	X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					

Station ID	Parameter	Critical Condition				
		High	Moist	Mid-Range	Dry	Low Flow
GMW060-0027	*E. coli* (counts/mL)	X	X		X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-06-0013	*E. coli* (counts/mL)					
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-06-0019	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-06-0015	*E. coli* (counts/mL)					
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-06-0020	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-06-0006	*E. coli* (counts/mL)					
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-06-0022	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-06-0012	*E. coli* (counts/mL)					
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-06-0002	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-06-0003	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-06-0004	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-06-0005	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0022	*E. coli* (counts/mL)	X				
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0001	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0026	*E. coli* (counts/mL)				X	

Station ID	Parameter	Critical Condition				
		High	Moist	Mid-Range	Dry	Low Flow
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW080-0003	*E. coli* (counts/mL)	X			X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0014	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0016	*E. coli* (counts/mL)		X		X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0024	*E. coli* (counts/mL)		X		X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0015	*E. coli* (counts/mL)					
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0013	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0030	*E. coli* (counts/mL)					
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0019	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0018	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0003	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0005	*E. coli* (counts/mL)				X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0021	*E. coli* (counts/mL)					
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0020	*E. coli* (counts/mL)		X		X	
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-08-0027	*E. coli* (counts/mL)		X	X	X	
	Phosphorus, Total (mg/L)					

Station ID	Parameter	Critical Condition				
		High	Moist	Mid-Range	Dry	Low Flow
	Total Suspended Solids (mg/L)					
GMW-04-0018	*E. coli* (counts/mL)					
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					
GMW-07-0026	*E. coli* (counts/mL)					
	Phosphorus, Total (mg/L)					
	Total Suspended Solids (mg/L)					

12.4 Potential Priority Implementation Areas (PPIAs)

The information and the allocations presented provide the foundation necessary to identify subwatersheds that are in need of the most significant *E. coli*, nutrients and sediment reductions to achieve water quality standards in the Southern Whitewater River watershed. Using the PPIA rankings, watershed organizations will gain a better understanding of which subwatersheds require the most pollutant load reductions. This can assist in future efforts to identify critical areas in the Southern Whitewater River watershed for implementation. PPIAs differ from critical areas in that PPIAs focus on the information and data collected and analyzed through the TMDL development process for ranking purposes, whereas critical areas take into account other factors into consideration (e.g., political, social, economic) to help determine implementation feasibility that will affect progress toward pollutant load reductions and, ultimately, attainment of water quality standards.

In order to rank each subwatershed IDEM used EPA's Recovery Potential Screening Tool which is a technical method for comparing the relative restorability of large numbers of water bodies. This is a method that measures, for each water or watershed, several ecological, stressor, and social context indicators that are associated with the likelihood that a restoration effort may succeed. The user selects the indicators based on what is most appropriate to the waters being assessed and their surrounding communities, the availability of quality data, and the goals of the restoration effort. Measuring the same indicators on all waters allows for systematic, even-handed and information-based comparison. Calculating separate ecological, stressor, and social indices enables the user to consider each of these three classes of factors, individually or in combination. The ecological index score reflects overall condition and the capacity of the watershed to regain functionality, based on metrics related to natural watershed processes and structure. The stressor score reflects the pressures on watershed condition from several primary sources of pollutants and water quality impairments. The social context score includes many factors, such as community involvement, incentives, economics, governance, regulation and planning status that do not constitute watershed condition but often strongly influence the level of effort and complexity of making improvements. A Recovery Potential Integrated (RPI) score is calculated by combining these three indices. For more information on the Recovery Potential Screening process visit EPA's website: (http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/recovery/index.cfm)

12.4.1 Potential Priority Implementation Areas (PPIAs)

The information and the allocations presented provide the foundation necessary to identify subwatersheds that are in need of the most significant *E. coli*, nutrients, and TSS reductions to achieve water quality standards in the Southern Whitewater River watershed. Using the PPIA rankings, watershed organizations will gain a better understanding of which subwatersheds will show improvements with watershed planning activities. This can assist in future efforts to identify critical areas in the Southern Whitewater River watershed for implementation. PPIAs differ from critical areas in that PPIAs focus on the information and data collected and analyzed through the TMDL development process for ranking purposes, whereas critical areas take into account other factors (e.g., political, social, economic) to help determine implementation feasibility that will affect progress toward pollutant load reductions and, ultimately, attainment of water quality standards.

In order to rank each subwatershed IDEM used EPA's Recovery Potential Screening Tool (RPT) which is a technical method for comparing the relative restorability of large numbers of water bodies. This is a method that measures, for each water or watershed, several ecological, stressor, and social context indicators that are associated with the likelihood that a restoration effort may succeed. The user selects the indicators based on what is most appropriate to the waters being assessed and their surrounding communities, the availability of quality data, and the goals of the restoration effort. Measuring the same indicators on all waters allows for systematic, even-handed and information-based comparison. Calculating separate ecological, stressor, and social indices enables the user to consider each of these three classes of factors, individually or in combination. The ecological index score reflects overall condition and the capacity of the watershed to regain functionality, based on metrics related to natural watershed processes and structure. The stressor score reflects the pressures on watershed condition from several primary sources of pollutants and water quality impairments. The social context score includes many factors, such as community involvement, incentives, economics, governance, regulation and planning status that do not constitute watershed condition but often strongly influence the level of effort and complexity of making improvements. A Recovery Potential Integrated (RPI) score is calculated by combining these three indices. For more information on the Recovery Potential Screening process visit EPA's website: (http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/recovery/index.cfm)

Table 103 PPIA Ranking for Subwatersheds in the Southern Whitewater River Watershed

Watershed	PPIA Ranking	Subwatershed	RPI Score	Ecological Rank	Stressor Rank	Social Rank
Salt Creek	1	Fremont Branch	3.2	1	2	1
	2	Bull Fork	1.99	3	1	3
	3	Little Salt Creek	1.65	4	3	4
	4	Righthand Fork Salt Creek	1.57	2	5	2
	5	Headwaters Salt Creek	0.84	5	4	5
Pipe Creek	1	Yellow Bank Creek	2.37	1	4	1
	2	Walnut Fork	1.87	2	2	4
	3	Clear Fork	1.74	3	3	3
	4	Headwaters Pipe Creek	1.31	4	5	2
	5	Duck Creek	1.31	5	1	5
Whitewater River	1	Jameson Creek	5.07	4	1	1
	2	Johnson Fork	2.5	1	5	2
	3	Blackburn Creek	2.33	3	4	4
	4	Little Cedar Creek	2.15	2	9	3
	5	Wolf Creek	1.68	5	2	7
	6	Big Cedar Creek	1.45	6	3	6
	7	Headwaters Blue Creek	1.43	7	6	5
	8	Howard Creek	0.79	9	8	8
	9	Headwaters Dry Fork Whitewater River	0.76	8	7	9
	10	Lee Creek	NA	NA	NA	NA

Table 104 Indicators Used in the Recovery Potential Calculator

Ecological Indicator	Stressor Indicator	Social Indicator
Percent Forested Land Watershed Surface Area Watershed Drainage Area Fish IBI Score Total QHEI Score Stream Order (%2-4) Slope of Land (mean)	Percent Agricultural Land Number of Impairment Parameters Percent Developed Land Percent Stream Miles Impaired Soil Erodability (mean) Percent Agriculture in Riparian Number of CFOs	Percent Managed Lands Population Density Jurisdictional Complexity Number of Ecological Attributes Drinking Water Source

This information is important for watershed organizations in the process of identifying and selecting critical areas and implementation activities for the purposes of watershed management plan development. While PPIAs are not intended to dictate those critical areas for watershed organizations, IDEM recommends that watershed organizations take the PPIA rankings into consideration when selecting critical areas for purposes of watershed management planning.

13.0 PROTECTION MEASURES/RECOMMENDATION

The Southern Whitewater River watershed has several unique characteristics to take into account when discussing protection measures and recommendations in this section. The mainstem Whitewater River is classified as a DNR State Outstanding Water from Cambridge City to the Ohio State line. The variegate darter, a state endangered fish species, is also located within the watershed. The species distribution is restricted by the Ohio River downstream, which does not have the necessary habitat for the species, and by dams (Brookville Lake Dam and Laurel Feeder Dam) upstream. Based on the information above, this Section will discuss protection measures as described in the Indiana anti-degradation rule, the protective strategy calculated in this TMDL document, and future protection actions to take into consideration.

Historically Indiana’s State Outstanding Waters were based on environmental and aesthetic interests. In 1993, the Natural Resources Commission revised the original listings and adopted the State Outstanding Waters as an official recognition of the resource values of these waters. The Whitewater River specifically is designated a State Outstanding Water because it has been identified as having statewide significance based on assessments, it has been identified by the state natural heritage programs as having outstanding ecological importance, the river is designated as a canoe/boating route, and it has been formally proposed for state protection.

The State’s anti-degradation rule (327 IAC 2-1.3) requires streams that presently have conditions better than the proposed targets are maintained at those above par conditions. This rule applies to a proposed new or increased loading of a regulated pollutant to a surface water of the state that results from a deliberate activity subject to the Clean Water Act (CWA) including a change in process or operation that will result in a significant lowering of water quality. Any future discharge, new or increased loadings, to the water will require an anti-degradation demonstration to ensure the permit limits are protective of the water quality. The components of the anti-degradation demonstrations include, providing basic information about the discharge, showing that a discharge is necessary, outlining treatment alternatives, and indicating the social and economic benefit of discharges. The anti-degradation rule and the demonstration components work collectively to prevent future degradation to Whitewater River.

With no fixed numeric criterion, a major challenge to preparing a TMDL for sediment is development of a numeric target that can be used to derive a load capacity. Setting targets for surrogate measures of sediment load is a process that attempts to account for yields, delivery, transport, and deposition in both natural and potentially disturbed conditions. A surrogate is often selected for relative efficiency of measurement and because the effects on biological endpoints are better understood than general effects of higher sediment loads. As such, a concentration goal is used in a TMDL, providing a bridge over the uncertainty in the connection between sediment loading and support of beneficial uses (IDEQ, 2003). While effects of light penetration are usually associated solely with primary production, turbidity is also associated with elevated stress in fish, predatory efficiency, inducement of invertebrate drift, and suffocation of incubating embryos. TSS is perhaps the most direct measurement of sediment loads in the stream in terms of its effects on fish, macroinvertebrates, and the aquatic habitat. Historically, Indiana TMDLs for sediment have used a TSS target of 30 mg/L, based on the target for permitted facilities. Due to the presence of a State Endangered Species, the variegate darter, the TSS target has been lowered to the U.S. EPA recommended target of 25 mg/L (Waters, 1995). The variegate darter, *Etheostoma variatum*, typically occurs in swift, rubble-boulder-gravel riffles with some sand. Embedded substrates lack the interstitial spaces that allow intergravel flow and provide habitat and cover for benthic invertebrates and juvenile fish. Restricting the sediment load in the streams should help protect this specific habitat from being embedded with silt and other fine sediment, as well as, reduce the negative effects reduction of light penetration has on aquatic communities. The fish and macroinvertebrate assemblages are the living resources that should be protected through TMDL planning, and measurements of their condition should be integral to TMDL evaluation. Based on the 2014 IDEM sampling, the mainstem Whitewater River does not show signs of biological impairment, thus it may be assumed that environmental conditions are suitable and excessive sediments are not a problem. However, in order to implement a higher level of protection, TSS TMDLs were developed for all rivers and streams where the variegate darter has known distributions in the Southern Whitewater River project area to ensure the habitat remains suitable for the survival and fecundity of the endangered species.

In Indiana the variegate darter is found only in the Whitewater River drainage. The species distribution has been studied throughout the basin (Fisher, 2008) and has a very limited range. In addition to protecting the known rivers and tributaries supporting the variegate darter, expanding the range should also be discussed. The habitat requirements do not exist in the Ohio River, which prevents the species from moving downstream. The East Fork Whitewater River is impounded by Brookville Lake and this creates a large barrier preventing the upstream movement of the species along the East Fork Whitewater River. South of the Town of Laurel, in Franklin County, there is a low-head dam on the West Fork Whitewater River which functions as a feeder dam for the Whitewater Canal. This barrier restricts the species from expanding its range upstream along the West Fork Whitewater River. The necessary riffle habitat exists upstream of the dam in Laurel to support the endangered species, however without a functional fish passage for darters the species distribution is limited. After reviewing other fish species distribution maps from the IDNR and IDEM there are a number of other species restricted by the Laurel Feeder Dam. Those species distributions that end at the Laurel Feeder Dam include the longnose gar, eastern sand darter, smallmouth redhorse, brindled madtom, suckermouth minnow, brook silverside, freshwater drum, and the slenderhead darter.

A fourteen-mile section of the original Whitewater Canal is preserved from Laurel to Brookville as a state memorial. The canal currently powers a working grain mill and is a tourist site in the Town of Metamora. The Laurel Feeder Dam was built in the 1940s to provide water to the restored canal section in Metamora. The canal is a DNR State historical site and has great value in terms of tourism and the local economy. However, it is a barrier to the aquatic communities and restricts species ranges, specifically the endangered variegate darter. Just as in the 1940s engineered devices (dams) were used to raise the river level to a useable depth to feed the canal, engineered devices in the 21st century should be explored to replace the 75 year old dam, while preserving the function of the Whitewater Canal. The removal of the Laurel Feeder Dam or the installation of a functional fish passage could expand the range of up to nine fish species and remove a barrier allowing canoeist's access to the West Fork Whitewater River in its entirety.

During the draft TMDL public meeting the watershed group brought an additional endangered species (cobblestone tiger beetle, *Cicindela marginipennis*) to the attention of the TMDL program. This was done to assist in protecting the area of concern where the cobblestone tiger beetle was found. The cobblestone tiger beetle is found two miles upstream of Brookville in Franklin County. Due the information provided by the watershed group the TMDL program, the Storm water program and the Indiana Department of Natural Resources (IDNR) are reviewing the storm water treatment at the Haspin Acres. This facility falls outside the watershed and the regulation of IDNR. The Storm water may need to be regulated and IDEM is currently reviewing this facility.

The IDEM TMDL and NPS staff worked together to provide data, a monitoring demonstration/field day, and draft load reductions to the local watershed group. The draft TMDL meeting provided an opportunity for public input on the TMDL and included a presentation from the watershed group on their efforts and how to become more involved in restoration activities. The TMDL outlined the areas of protection to the watershed group and provided information on pollutants of concern. The NPS staff will continue to provide technical assistance to the watershed group to assist in providing protection in the areas of concern.

14.0 REASONABLE ASSURANCES/IMPLEMENTATION

This section of the Southern Whitewater River watershed TMDL focuses on implementation activities that have the potential to achieve the WLAs and LAs presented. The focus of this section is to identify and select the most appropriate structural and non-structural best management practices (BMPs) and control technologies to reduce pollutant loads from sources throughout the Southern Whitewater River watershed, particularly in the PPIAs identified. This section also addresses the programs that are available to facilitate implementation of structural and non-structural BMPs to achieve the allocations, as well as current ongoing activities in the Southern Whitewater River watershed at the local level that will play a key role in successful TMDL implementation.

To select appropriate BMPs and control technologies, it is important to review the significant sources in the Southern Whitewater River watershed.

Point Sources

- WWTPs
- Industrial facilities
- Regulated storm water sources
- SSOs
- Illicitly connected straight pipe systems
- Regulated construction sites

Nonpoint Sources

- Cropland

- Pastures and livestock operations
- CFOs
- Streambank erosion
- Onsite wastewater treatment systems
- Wildlife/domestic pets
- Urban nonpoint source runoff

14.1 Implementation Activity Options for Sources in the Southern Whitewater River Watershed

Keeping the list of significant sources in the Southern Whitewater River watershed in mind, it is possible to review the types of BMPs that are most appropriate for the *E. coli*, nutrients and sediment and the source type. Table 106 provides a list of implementation activities that are potentially suitable for the Southern Whitewater River watershed based on the *E. coli*, nutrients and sediment and the types of sources. The implementation activities are a combination of structural and non-structural BMPs to achieve the assigned WLAs and LAs. IDEM recognizes that actions taken in any individual subwatershed may depend on a number of factors (including socioeconomic, political and ecological factors). The recommendations in Table 106 are not intended to be prescriptive. Any number or combination of implementation activities might contribute to water quality improvement, whether applied at sites where the actual impairment was noted or other locations where sources contribute indirectly to the water quality impairment.

Table 105 List of Potentially Suitable BMPs for the Southern Whitewater River Watershed

	Pollutant			**Point Sources**			**Nonpoint Sources**						
Implementation Activities	**Bacteria**	**Nutrients**	**Sediment**	**WWTPs and Industrial Facilities**	**Regulated Stormwater Sources**	**Illicitly Connected "Straight Pipe" Systems**	**Cropland**	**Pastures and Livestock Operations**	**CFOs**	**Streambank Erosion**	**Onsite Wastewater Treatment Systems**	**Wildlife/Domestic Pets**	**Urban NPS Runoff**
Disinfection of primary effluent	X			X									
Biological nutrient removal		X		X									
Inspection and maintenance	X	X	X	X	X						X		X
Outreach and education and training	X	X	X	X	X	X	X	X	X	X	X	X	X
System replacement	X	X				X					X		
Conservation tillage/residue management	X	X	X				X						
Cover crops	X	X	X				X			X			
Filter strips	X	X	X		X		X	X	X	X			
Grassed waterways	X		X				X		X	X			
Riparian forested/herbaceous buffers	X	X	X				X	X	X	X		X	

Implementation Activities	Pollutant			Point Sources			Nonpoint Sources						
	Bacteria	Nutrients	Sediment	WWTPs and Industrial Facilities	Regulated Stormwater Sources	Illicitly Connected "Straight Pipe" Systems	Cropland	Pastures and Livestock Operations	CFOs	Streambank Erosion	Onsite Wastewater Treatment Systems	Wildlife/Domestic Pets	Urban NPS Runoff
Manure handling, storage, treatment, and disposal	X	X							X				
Composting	X	X			X								X
Alternative watering systems	X		X					X	X	X			
Stream fencing (animal exclusion)	X	X	X					X	X	X			
Grazing land management	X	X	X					X	X	X			
Conservation easements	X	X	X										
Two-stage ditches		X	X										
Rain barrel		X	X		X								X
Rain garden		X	X		X								X
Street rain garden		X	X		X								X
Block bioretention		X	X		X								X
Regional bioretention		X	X		X								X
Porous pavement		X	X		X								X
Green alley		X	X										
Green roof		X	X		X								X
Dam modification or removal		X	X										
Levee or dike modification or removal		X	X										
Stormwater planning and management	X	X	X	X	X					X	X	X	X
Comprehensive Nutrient Management Plan	X	X					X		X				
Constructed Wetland	X	X	X	X		X	X					X	
Critical Area Planting			X					X		X			
Drainage Water Management		X					X						
Heavy Use Area Pad	X		X					X					
Nutrient Management Plan		X					X			X			
Terrace			X				X						
Sediment Basin		X	X										
Pasture and Hay Planting	X	X	X				X	X	X	X		X	
Streambank and Shoreline Protection			X				X	X	X	X		X	
Conservation Crop Rotation	X	X	X				X	X	X	X			
Field Border	X	X					X	X	X			X	
Waste Treatment Lagoon	X	X						X	X				

The information provided in Table 106 assisted in the development of Table 106, which provides a more refined suite of recommended implementation activities targeted to the PPIAs identified.

Watershed stakeholders can use the implementation activities identified in Table 106 for each PPIA and select activities that are most feasible in the Southern Whitewater River watershed. This table can also help watershed stakeholders to identify implementation activities for critical areas that they select through the watershed management planning process.

Table 106 Recommended Implementation Activities for the Salt Creek Watershed

Subwatershed	PPIA Rank	Implementation Action
Fremont Branch (050800030505)	1	Outreach and education and training
		Filter Strips
		Grazing land management
Bull Fork (050800030503)	2	Filter Strips
		Riparian forested/herbaceous buffers
		Grazing land management
Little Salt Creek (050800030504)	3	Cover crops
		Riparian forested/herbaceous buffers
		Grazing land management
Righthand Fork Salt Creek (050800030502)	4	Comprehensive Nutrient Management Plan
		Conservation tillage/residue management
		Heavy Use Area Pad
Headwaters Salt Creek (050800030501)	5	Comprehensive Nutrient Management Plan
		Conservation tillage/residue management
		Heavy Use Area Pad

Table 107 Recommended Implementation Activities for the Pipe Creek Watershed

Subwatershed	PPIA Rank	Implementation Action
Yellow Bank Creek (050800030605)	1	Outreach and education and training
		System replacement
		Nutrient Management Plan
Walnut Fork (050800030604)	2	Outreach and education and training
		Filter strips
		Nutrient Management Plan
Clear Fork (050800030602)	3	Outreach and education and training
		Conservation tillage/residue management
		System replacement
Headwaters Pipe Creek (050800030601)	4	Outreach and education and training
		Conservation tillage/residue management
		System replacement
Duck Creek (050800030603)	5	Outreach and education and training
		Nutrient Management Plan
		Filter strips

Table 108 Recommended Implementation Activities for the Whitewater River Watershed

Subwatershed	PPIA Rank	Implementation Action
Jameson Creek (050800030810)	1	Not enough information to prioritize
Johnson Fork	2	Outreach and education and training

Subwatershed	PPIA Rank	Implementation Action
(050800030806)		Riparian forested/herbaceous buffers
		Constructed Wetland
Blackburn Creek (050800030805)	3	Outreach and education and training
		Riparian forested/herbaceous buffers
		Constructed Wetland
Little Cedar Creek (050800030804)	4	Riparian forested/herbaceous buffers
		Outreach and education and training
		Grazing land management
Wolf Creek (050800030802)	5	Riparian forested/herbaceous buffers
		Outreach and education and training
		Grazing land management
Big Cedar Creek (050800030803)	6	Outreach and education and training
		Nutrient Management Plan
		Filter strips
Headwaters Blue Creek (050800030801)	7	Manure handling, storage, treatment, and disposal
		Outreach and education and training
		Filter strips
Howard Creek (050800030808)	8	Manure handling, storage, treatment, and disposal
		Nutrient Management Plan
		Filter strips
Headwaters Dry Fork Whitewater River (050800030807)	9	Manure handling, storage, treatment, and disposal
		Nutrient Management Plan
		Filter strips
Lee Creek	10	Not enough information to prioritize

14.2 Implementation Goals and Indicators

For each *E. coli*, nutrients and sediment in the Southern Whitewater River watershed, IDEM has identified broad goal statements and indicators. This information is to help watershed stakeholders determine how to track implementation progress over time and also provides the information necessary to complete a watershed management plan.

***E. coli* Goal Statement:** The waterbodies (or streams) in the Southern Whitewater River watershed should meet the 235 cfu/100 mL TMDL target value.

***E. coli* Indicator:** Water quality monitoring by IDEM will serve as the environmental indicator to determine progress toward the *E. coli* target value.

Total Phosphorus Goal Statement: The waterbodies (or streams) in the Southern Whitewater River watershed should meet the 0.30 mg/L TMDL total phosphorus target value.

Total Phosphorus Indicator: Water quality monitoring by IDEM will serve as the environmental indicator to determine progress toward the total phosphorus target value.

Total Nitrogen Goal Statement: The waterbodies (or streams) in the Southern Whitewater River watershed should meet the 10 mg/L TMDL total nitrogen target value.

Total Nitrogen Indicator: Water quality monitoring by IDEM will serve as the environmental indicator to determine progress toward the total nitrogen target value.

Total Suspended Solids Goal Statement: The waterbodies (or streams) in the Southern Whitewater River watershed should meet the 30 mg/L TMDL total suspended solids target value.

Total Suspended Solids Indicator: Water quality monitoring by IDEM will serve as the environmental indicator to determine progress toward the total suspended solids target value.

14.3 Summary of Programs

There are a number of federal, state, and local programs that either require or can assist with the implementation activities recommended for the Southern Whitewater River watershed in Table 106 and Table 106. A description of these programs is provided in this section. The following section discusses how some of these programs relate to the various sources in the Southern Whitewater River watershed.

14.3.1 Federal Programs

14.3.1.1 Clean Water Act Section 319(h) Grants

Section 319 of the federal Clean Water Act contains provisions for the control of nonpoint source pollution. The Section 319 program provides for various voluntary projects throughout the state to prevent water pollution and also provides for assessment and management plans related to waterbodies in Indiana impacted by NPS pollution. The Watershed Planning and Restoration Section within the Watershed Assessment and Planning Branch of the Office of Water Quality administers the Section 319 program for the NPS-related projects.

USEPA offers Clean Water Act Section 319(h) grant monies to the state on an annual basis. These grants must be used to fund projects that address nonpoint source pollution issues. Some projects which the Office of Water Quality has funded with this money in the past include developing and implementing Watershed Management Plans (WMPs), BMP demonstrations, data management, educational programs, modeling, stream restoration, and riparian buffer establishment. Projects are usually two to three years in length. Section 319(h) grants are intended to be used for project start-up, not as a continuous funding source. Units of government, nonprofit groups, and universities in the state that have expertise in nonpoint source pollution problems are invited to submit Section 319(h) proposals to the Office of Water Quality.

14.3.1.2 Clean Water Action Section 205(j) Grants

Section 205(j) provides for planning activities relating to the improvement of water quality from nonpoint and point sources by making funding available to municipal and county governments, regional planning commissions, and other public organizations. For-profit entities, non-profit organizations, private associations, universities and individuals are not eligible for funding through Section 205(j). The CWA states that the grants are to be used for water quality management and planning, including, but not limited to:

- Identifying most cost effective and locally acceptable facility and non-point source measures to meet and maintain water quality standards;

- Developing an implementation plan to obtain state and local financial and regulatory commitments to implement measures developed under subparagraph A;
- Determining the nature, extent, and cause of water quality problems in various areas of the state.

The Section 205(j) program provides for projects that gather and map information on nonpoint and point source water pollution, develop recommendations for increasing the involvement of environmental and civic organizations in watershed planning and implementation activities, and develop watershed management plans.

14.3.1.3 USDA's Conservation of Private Grazing Land Initiative (CPGL)

The Conservation of Private Grazing Land initiative will ensure that technical, educational, and related assistance is provided to those who own private grazing lands. It is not a cost-share program. This technical assistance will offer opportunities for: better grazing land management; protecting soil from erosive wind and water; using more energy efficient ways to produce food and fiber; conserving water; providing habitat for wildlife; sustaining forage and grazing plants; using plants to sequester greenhouse gases and increase soil organic matter; and using grazing lands as a source of biomass energy and raw materials for industrial products.

14.3.1.4 USDA's Conservation Reserve Program (CRP)

NRCS provides technical assistance to landowners interested in participating in the Conservation Reserve Program administered by the USDA Farm Service Agency. The Conservation Reserve Program reduces soil erosion, protects the Nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filter strips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost-share funding is provided to establish the vegetative cover practices.

14.3.1.5 USDA's Conservation Technical Assistance (CTA)

The purpose of the CTA program is to assist land users, communities, units of state and local government, and other Federal agencies in planning and implementing conservation systems. The purpose of the conservation systems is to reduce erosion, improve soil and water quality, improve and conserve wetlands, enhance fish and wildlife habitat, improve air quality, improve pasture and range condition, reduce upstream flooding, and improve woodlands.

One objective of the program is to assist individual land users, communities, conservation districts, and other units of State and local government and Federal agencies to meet their goals for resource stewardship and assist individuals in complying with State and local requirements. NRCS assistance to individuals is provided through conservation districts in accordance with the Memorandum of Understanding signed by the Secretary of Agriculture, the Governor of the State, and the conservation district. Assistance is provided to land users voluntarily applying conservation practices and to those who must comply with local or State laws and regulations.

Another objective is to provide assistance to agricultural producers to comply with the highly erodible land (HEL) and wetland (Swampbuster) provisions of the 1985 Food Security Act as amended by the Food, Agriculture, Conservation and Trade Act of 1990 (16 U.S.C. 3801 et. seq.), the Federal Agriculture Improvement and Reform Act of 1996, and wetlands requirements of Section 404 of the Clean Water Act. NRCS makes HEL and wetland determinations and helps land users develop and implement conservation plans to comply with the law. The program also provides technical assistance to participants in USDA cost-share and conservation incentive programs.

NRCS collects, analyzes, interprets, displays, and disseminates information about the condition and trends of the Nation's soil and other natural resources so that people can make good decisions about resource use and about public policies for resource conservation. They also develop effective science-based technologies for natural resource assessment, management, and conservation.

14.3.1.6 USDA's Environmental Quality Incentives Program (EQIP)

The Environmental Quality Incentives Program provides technical, educational, and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, State, and tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation. The purposes of the program are achieved through the implementation of a conservation plan, which includes structural, vegetative, and land management practices on eligible land. Five to ten year contracts are made with eligible producers. Cost-share payments may be made to implement one or more eligible structural or vegetative practices, such as animal waste management facilities, terraces, filter strips, tree planting, and permanent wildlife habitat. Incentive payments can be made to implement one or more land management practices, such as nutrient management, pest management, and grazing land management.

Fifty percent of the funding available for the program is targeted at natural resource concerns relating to livestock production. The program is carried out primarily in priority areas that may be watersheds, regions, or multi-state areas, and for significant statewide natural resource concerns that are outside of geographic priority areas.

14.3.1.7 USDA's Small Watershed Program and Flood Prevention Program (WF 08 or FP 03)

The Small Watershed Program works through local government sponsors and helps participants solve natural resource and related economic problems on a watershed basis. Projects include watershed protection, flood prevention, erosion and sediment control, water supply, water quality, fish and wildlife habitat enhancement, wetlands creation and restoration, and public recreation in watersheds of 250,000 or fewer acres. Both technical and financial assistance are available.

14.3.1.8 USDA's Watershed Surveys and Planning

The Watershed and Flood Prevention Act, P.L. 83-566, August 4, 1954, (16 U.S.C. 1001-1008) authorized this program. Prior to fiscal year 1996, small watershed planning activities and the cooperative river basin surveys and investigations authorized by Section 6 of the Act were operated as separate programs. The 1996 appropriations act combined the activities into a single program entitled the Watershed Surveys and Planning program. Activities under both programs are continuing under this authority.

The purpose of the program is to assist Federal, State, and local agencies and tribal governments to protect watersheds from damage caused by erosion, floodwater, and sediment and to conserve and develop water and land resources. Resource concerns addressed by the program include water quality, opportunities for water conservation, wetland and water storage capacity, agricultural drought problems, rural development, municipal and industrial water needs, upstream flood damages, and water needs for fish, wildlife, and forest-based industries.

Types of surveys and plans include watershed plans, river basin surveys and studies, flood hazard analyses, and floodplain management assistance. The focus of these plans is to identify solutions that use land treatment and non-structural measures to solve resource problems.

14.3.1.9 USDA's Agricultural Conservation Easement Program (ACEP)

The Agricultural Conservation Easement Program provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. ACEP consolidated three former USDA programs – Wetland Reserve Program, Grassland Reserve Program, and Farm and Ranchland Protection Program. NRCS provides financial assistance to eligible partners for purchasing Agricultural Land Easements that protect the agricultural use and conservation values of eligible land. In the case of working farms, the program helps farmers and ranchers keep their land in agriculture. The program also protects grazing uses and related conservation values by conserving grassland, including rangeland, pastureland and shrubland. Eligible partners include Indian tribes, state and local governments and non-governmental organizations that have farmland or grassland protection programs.

NRCS also provides technical and financial assistance directly to private landowners and Indian tribes to restore, protect, and enhance wetlands through the purchase of a wetland reserve easement. Through the wetland reserve enrollment options, NRCS may enroll eligible land through: Permanent Easements, 30-year Easements, Term Easements, or 30-year Contracts.

Land eligible for agricultural easements includes cropland, rangeland, grassland, pastureland and nonindustrial private forest land. NRCS will prioritize applications that protect agricultural uses and related conservation values of the land and those that maximize the protection of contiguous acres devoted to agricultural use. Land eligible for wetland reserve easements includes farmed or converted wetland that can be successfully and cost-effectively restored. NRCS will prioritize applications based the easement's potential for protecting and enhancing habitat for migratory birds and other wildlife.

14.3.1.10 USDA's Wildlife Habitat Incentives Program (WHIP)

The Wildlife Habitat Incentives Program provides financial incentives to develop habitat for fish and wildlife on private lands. Participants agree to implement a wildlife habitat development plan and USDA agrees to provide cost-share assistance for the initial implementation of wildlife habitat development practices. USDA and program participants enter into a cost-share agreement for wildlife habitat development. This agreement generally lasts a minimum of 10 years from the date that the contract is signed.

14.3.2 State Programs

14.3.2.1 State Point Source Control Program

The purpose of the NPDES permit is to control the point source discharge of pollutants into the waters of the State such that the quality of the water of the State is maintained in accordance with applicable water quality standards. NPDES permit requirements ensure that the minimum amount of control is imposed upon any new or existing point source through the application of technology-based treatment requirements. Control of discharges from WWTPs, industrial facilities, storm water and CSOs consistent with WLAs is implemented through the NPDES program.

14.3.2.2 State Nonpoint Source Control Program

The state's Nonpoint Source Program, administered by the IDEM Office of Water Quality's Watershed Planning and Restoration Section, focuses on the assessment and prevention of nonpoint source water pollution. The program also provides for education and outreach to improve the way land is managed. Through the use of federal funding for the installation of BMPs, the development of watershed management plans, and the implementation of watershed restoration pollution prevention activities, the program reaches out to citizens so that land is managed in such a way that less pollution is generated.

Nonpoint source projects funded through the Office of Water Quality are a combination of local, regional, and statewide efforts sponsored by various public and not-for-profit organizations. The emphasis of these projects has been on the local, voluntary implementation of nonpoint source water pollution controls. The Watershed Planning and Restoration Section administers the Section 319 funding for nonpoint source-related projects, as well as Section 205(j) grants.

To award 319 grants, Watershed Planning and Restoration Section staff review proposals for minimum 319(h) eligibility criteria and rank each proposal. In their review, members consider such factors as: technical soundness; likelihood of achieving water quality results; strength of local partnerships; and competence/reliability of contracting agency. They then convene to discuss individual project merits and pool all rankings to arrive at final rankings for the projects. All proposals that rank above the funding target are included in the annual grant application to USEPA, with USEPA reserving the right to make final changes to the list. Actual funding depends on approval from USEPA and yearly congressional appropriations.

Section 205(j) projects are administered through grant agreements that define the tasks, schedule, and budget for the project. IDEM project manager's work closely with the project sponsors to help ensure that the project runs smoothly and the tasks of the grant agreement are fulfilled. Site visits are conducted at least quarterly to touch base on the project, provide guidance and technical assistance as needed, and to work with the grantee on any issues that arise to ensure a successful project closeout.

Hoosier Riverwatch, is a water quality monitoring initiative which aims to increase public awareness of water quality issues and concerns through hands-on training of volunteers in-stream monitoring and cleanup activities. Hoosier Riverwatch collaborates with agencies and volunteers to educate local communities about the relationship between land use and water quality and to provide water quality information to citizens and governmental agencies working to protect Indiana's rivers and streams.

14.3.2.3 Indiana State Department of Agriculture Division of Soil Conservation

The Division of Soil Conservation's mission is to ensure the protection, wise use, and enhancement of Indiana's soil and water resources. The Division's employees are part of Indiana's Conservation Partnership, which includes the 92 soil and water conservation districts (SWCDs), the USDA Natural Resources Conservation Service, and the Purdue University Cooperative Extension Service. Working together, the partnership provides technical, educational, and financial assistance to citizens to solve erosion and sediment-related problems occurring on the land or impacting public waters.

The Division administers the Clean Water Indiana soil conservation and water quality protection program under guidelines established by the State Soil Conservation Board, primarily through the local SWCDs in direct service to land users. The Division staff includes field-based resource specialists who work closely with land users, assisting in the selection, design, and installation of practices to reduce soil erosion on agricultural land. The Storm water and Sediment Control Program works primarily with developers, contractors, realtors, property holders and others to address erosion and sediment concerns on non-agricultural lands, especially those undergoing development.

14.3.2.4 Indiana Department of Natural Resources, Division of Fish and Wildlife

The Lake and River Enhancement (LARE) program utilizes a watershed approach to reduce nonpoint source sediment and nutrient pollution of Indiana's and adjacent states' surface waters to a level that meets or surpasses state water quality standards. To accomplish this goal, LARE provides technical and financial assistance to local entities for qualifying projects that improve and maintain water quality in public access lakes, rivers, and streams.

14.3.2.5 State Revolving Fund (SRF) Loan Program

The SRF is a fixed rate, 20-year loan administered by the Indiana Finance Authority. The SRF provides low-interest loans to Indiana communities for projects that improve wastewater and drinking water infrastructure. The Program's mission is to provide eligible entities with the lowest interest rates possible on the financing of such projects while protecting public health and the environment. SRF also funds non-point source projects that are tied to a wastewater loan. Any project where there is an existing pollution abatement need is eligible for SRF funding.

14.3.3 Funding Utilized by Local Stakeholders

Programs taking place at the local level are key to successful TMDL implementation. Partners are instrumental to bringing grant funding into the Southern Whitewater River watershed to support local protection and restoration projects. This section provides a brief summary of the local programs taking place in the Southern Whitewater River watershed that will help to reduce pollutant loads, as well as provide ancillary benefits to the Southern Whitewater River watershed.

The county funding information is based on information from the Indiana Conservation Partnership website. The dollar amounts were calculated using an area weighted approach to account for the Southern Whitewater River watershed area.

Dearborn County
Dearborn County has received the following funding to improve water quality in 2012 and 2013:
Clean Water Indiana (CWI) - $7,662
Wildlife Habitat Cost-Share Program (WHCP) - $89
Conservation Reserve Program (CRP) and Conservation Reserve Enhancement Program (CREP) - $197,496
Environmental Quality Incentives Program (EQIP) - $34,512
Game Bird Habitat Development Program (GDHP) - $276
Wildlife Habitat Incentive Program (WHIP) - $1,771
Local funding from non-state and non-federal sources - $43,165

In 2012 and 2013 the Dearborn County SWCD sponsored rain barrels, tumbling composters, a native plantings and a rain garden installations and the expense was cost shared.

Decatur County
Decatur County has received the following funding to improve water quality in 2012 and 2013:
CWI - $4,447
WHCP - $336
CRP/CREP - $59,669
EQIP - $90,607
WHIP - $1,086
Conservation Stewardship Program (CSP) - $2,099
Local funding from non-state and non-federal sources - $19,524

The Decatur County SWCD hosted a pond seminar to discuss the permitting process and regulations required by the county. Also discussed was site selection, construction, dealing with nuisance animals and aquatic weed controls and fish stocking.

The Decatur County SWCD hosted a forestry and wildlife field day in 2013. A small group of local residents learned about invasive species, forestry and wetland management and how to control nuisance animals.

Fayette County
Fayette County has received the following funding to improve water quality in 2012 and 2013:
CWI -$394
CRP\CREP - $13,548
EQIP - $2,521
WHIP - $78
CSP - $84
Local funding from non-state and non-federal sources - $671

Franklin County
Franklin County has received the following funding to improve water quality in 2012 and 2013:
CWI -$18,508
CRP\CREP - $470,299
EQIP - $127,249
Local funding from non-state and non-federal sources - $54,678

Ripley County
Ripley County has received the following funding to improve water quality in 2012 and 2013:
CWI -$1,122
CRP\CREP - $56,238
EQIP - $10,777
WHIP - $318
CSP - $2,000
WHCP - $34
GHDP - $35
Local funding from non-state and non-federal sources - $11,042

In addition, in 2013 the Ripley County SWCD teamed with the Regional No-Till Committee and held the 20th Annual No-Till Breakfast. Over 150 farmers and landowners attended to learn about new advancements in farming and possible weed problems in no-till fields. This event promotes conservation tillage and other conservation methods pertaining to soil health.

Rush County
Rush County has received the following funding to improve water quality in 2012 and 2013:
CWI -$613
CRP\CREP - $16,898
EQIP - $764
CSP - $4,624
Local funding from non-state and non-federal sources - $2,979

The Dearborn County Soil and Water Conservation District received $138,600 from IDEM through a Section 319 grant to produce a WMP for the Whitewater River Watershed, HUC 0508000308. They have also received $92,400 in matched funds. The WMP will meet both the IDEM WMP checklist and OH EPA guidelines. An education and outreach program will also be conducted including newsletters to watershed stakeholders, press releases to the local media, public service announcement to local radio station(s), newspaper articles to the local media, a watershed brochure, watershed signs to increase watershed awareness, workshops to educate stakeholders on BMPs that reduce pollutant loading from urban and/or agricultural areas, field days to promote conservation practices. The watershed group will also hold two workshops to educate stakeholders about urban nonpoint pollution. Dearborn County SWCD has received letters of commitment on the project from the following partners:

Name of Partner	Type(s) of commitment to project success
Franklin Co SWCD	Provide information and input for the watershed project, assist with public outreach and educational programs and have a representative on the steering committee
Butler Co SWCD	Provide information and input for the watershed project, assist with public outreach and educational programs and have a representative on the steering committee
Hamilton Co SWCD	Provide information and input for the watershed project, assist with public outreach and educational programs and have a representative on the steering committee
OH-KY-IN Regional Council of Governments	Provide any data relevant to the watershed and assist in developing the management plan
Purdue Extension Service	Provide assistance in the educational and outreach efforts
Ohio State Extension	Provide assistance in the educational and outreach efforts
Oxbow, Inc	Provide assistance in awareness and education
County Health Departments	Assist in developing the management plan by providing information on problem areas and assist with educational efforts
Miami University, Stream Team and S. Dearborn Regional Sewer District	Assist in the water testing program for the watershed by assisting in the collection and/or analysis of samples
County and State Highway Departments	Assist in developing the management plan by providing information on problem erosion sites and assist with installing signage throughout the watershed

14.4 Implementation Programs by Source

Previous sections identified a number of federal, state, and local programs that can support implementation of the recommended management or restoration activities for the Southern Whitewater River watershed (Table 106). Table 109 and the following sections identify which programs are relevant to the various sources in the Southern Whitewater River watershed.

Table 109 Summary of Programs Relevant to Sources in the Southern Whitewater River Watershed

Source	State NPDES program	Local agencies/programs	Section 319 program	Section 205(j) program	ISDA Division of Soil Conservation	IDNR Division of Fish and Wildlife	USDA's Conservation of Private Grazing Land Initiative	USDA's Conservation Reserve Program	USDA's Conservation Technical Assistance	USDA's Environmental Quality Incentives Program	USDA's Small Watershed Program and Flood Prevention Program	USDA's Watershed Surveys and Planning	USDA's Wetlands Reserve Program	USDA's Wildlife Habitat Incentives Program
WWTPs and Industrial Facilities	X			X										
CSOs	X			X										
Regulated Stormwater Sources	X			X										
Illicitly Connected "Straight Pipe" Systems	X	X		X										
Cropland		X	X	X	X	X		X	X	X	X	X	X	
Pastures and Livestock Operations		X	X	X	X	X	X	X	X	X	X	X		
CFOs	X			X		X								
Streambank Erosion		X	X	X	X	X	X		X	X	X	X		
Onsite Wastewater Treatment Systems		X		X										
Wildlife/Domestic Pets	X	X	X											
In-stream Habitat	X	X	X											X

14.4.1 Point Source Programs

14.4.1.1 WWTPs

Discharges from WWTPs are regulated under the NPDES program, with permits that authorize the discharge of substances at levels that meet the more stringent of technology- or water quality-based effluent limits. The NPDES program provides IDEM the authority to ensure that recommended effluent limits are applied to the appropriate permit holders within the watershed.

14.4.1.2 Industrial facilities

As with discharges from WWTPs, industrial discharges are regulated under the NPDES program, with permits that authorize the discharge of substances at levels that meet the more stringent of technology- or water quality-based effluent limits. The NPDES program provides IDEM the authority to ensure that recommended effluent limits are applied to the appropriate permit holders within the watershed.

14.4.1.3 Regulated storm water sources

Regulated MS4s are required to obtain permit covered under IDEM's MS4 general permit that requires a storm water management program (SWMP) to address six minimum control measures. There are two MS4s in the Southern Whitewater River watershed that have coverage under Ohio's MS4 permit program. The SWMPs for each of these MS4s describes best management practices implemented to fulfill the six minimum control measure requirements.

According to the 2013 Annual Report for the City of Harrison (1GQ00034*BG) the following activities support the implementation practices described in the SWMP.

1. Education and Outreach
    - An updated City webpage and creation of a new storm water brochure were completed in 2013.
    - Monthly storm water meeting are held to receive complaints. All areas of improvements are scheduled for construction.
2. Public Involvement and Participation:
    - Hold monthly storm water meetings where resident complaints will be documented and construction projects can be scheduled
    - Meetings are open to all residents, commercial and industrial businesses
3. Illicit Discharge Detection and Elimination:
    - Regular inspections of construction and city storm water controls
    - Keep an updated storm sewer system map
    - Conduct pretreatment inspections at all industrial facilities
    - Conducted dry-weather screenings of outfalls to identify any illicit discharges
4. Construction Site Runoff Control:
    - Performs inspections of erosion controls according to the City Ordinance 42-2007 and Codified Ordinance 1111
    - Perform inspections for document violations according to the planning and zoning code
5. Post-Construction Storm Water Management in New Development and Redevelopment:
    - Reduction of impervious surfaces using detention basins, dry wells and storm catch basins
    - Post construction reviews of site plans and inspection for proper drainage
    - Long term management requires home owner associations to maintain storm water facilities
6. Pollution Prevention/Good Housekeeping for Municipal Operations:
    - Provide weekly street sweepings, daily Fall leaf collections, and monthly yard waste collections. In 2013 1,431 miles were cleaned and 218 yards of trash were collected.
    - Make yard waste chipping available to residence
    - Road salt is used on primary streets and overpasses first. Secondary streets are plowed only.
    - Provide training to employees for pollution prevention measures
    - Inspect, repair and document storm water facilities
    - Performs maintenance on storm water structures when needed
    - Disposes of street sweepings to a nearby landfill
    - Future plans to reduce the amount of road salt used in winter months

According to the 2013 Annual Report for the City of Cincinnati (1GQ00046*BG) the following activities support the implementation practices described in the SWMP.

1. Education and Outreach
    - Update internet based education and outreach annually. This includes the Hamilton county Storm Water District website, the Hamilton County SWCD website and the Regional Storm Water Collaborative website, in addition to social media like Facebook, Twitter, You tube and Pinterest.
    - Provide content and programming for other respective media outlets
    - Development of new outreach brochures including storm water awareness property management and storm corridor awareness. These brochures along with others were distributed at 41 events, reaching 5,900 participants. Additional brochures reached

thousands of residents in the eco-Safe Alternatives to Household Cleaners education pamphlet. Copies (250) of the Ohio Clean Boater flyer were distributed as well as 475 storm water door tags educating residents on impacts of dumping materials into storm drains.
- Conduct classroom presentations and review and update curriculum as necessary as it relates to general awareness and stream and watershed awareness.

2. Public Involvement and Participation:
   - The MS4 received 271 storm water related nuisance complaints, 277 stream related complaints and 119 construction complaints.
   - Distribution of 390 soil fertility kits, three stream clean up kits and rain barrel/rain garden seminars.
   - Respond to citizen inquiries and track follow-up to evaluate program effectiveness.
3. Illicit Discharge Detection and Elimination:
      - Storm sewer mapping and maintaining the existing MS4 map.
      - Map drainage systems for government facilities and development project infrastructure.
      - Keeping an updated map for BMPs installed.
      - Map household sewage treatment systems and their connections to the MS4 according to the established protocol.
      - Perform dry weather screenings and identify illicit discharges
      - Routinely inspect businesses with pretreatment requirements, respond to storm water related complaints, respond to spills, inspect new storm and sanitary sewers and repair or replace malfunctioning home sewage treatment systems.
4. Construction Site Runoff Control:
   - Performs inspections of erosion
   - Review all applicable site plans
   - Issue Notices of Violation, stop work orders and legal action if necessary.
   - Respond to citizen inquiries related to construction sites.
5. Post-Construction Storm Water Management in New Development and Redevelopment:
   - Conduct enforcement actions as necessary
   - Post construction reviews of site plans and inspection for proper drainage
6. Pollution Prevention/Good Housekeeping for Municipal Operations:
   - Provide programs or demonstrations for rain barrels, rain gardens and pond clinics.
   - Incorporate storm water awareness messages into existing household hazardous waste and recycling opportunities
   - Develop a method for collecting and incorporating soil nutrient and pH information.
   - Conduct and track watershed protection activities, including trash clean-ups.
   - In 2014 the County plans to expand its County buffer, cover crop and tree program.
   - Implement stream signage activities including sign maintenance and new installations.
   - Provide hands on opportunities to riparian property owners to understand stream processes and water quality concerns.
   - Provide training to employees for pollution prevention measures
   - Implement appropriate techniques to minimize the application of road salt, pesticides, herbicides and fertilizer.
   - Develop sustainable capital improvement project program as a way to evaluate water quality issues within the districts permitted area.
   - Clean and repair drainage system as necessary

14.4.1.4 Illegal straight pipes

Local health departments are responsible for locating and eliminating illicit discharges and illegal connections to the sewer system.

14.4.2 Nonpoint Sources Programs

14.4.2.1 Cropland

Nonpoint source pollution from cropland areas is typically reduced through the voluntary implementation of BMPs by private landowners. Programs available to support implementation of cropland BMPs, whether through cost-share or technical assistance and education, include:

- Clean Water Act Section 319 program
- Indiana Department of Natural Resources Division of Fish and Wildlife (LARE)
- Indiana State Department of Agriculture Division of Soil Conservation/SWCDs
- USDA’s Conservation Reserve Program (CRP)
- USDA’s Conservation Technical Assistance (CTA)
- USDA’s Environmental Quality Incentives Program (EQIP)
- USDA’s Small Watershed Program and Flood Prevention Program (WF 08 or FP 03)
- USDA’s Watershed Surveys and Planning
- USDA’s Wetlands Reserve Program (WRP)
- USDA’s Wildlife Habitat Incentives Program (WHIP)

14.4.2.2 Pastures and livestock operations

Nonpoint source pollution from pasture and livestock areas is typically reduced through the voluntary implementation of BMPs by private landowners. Programs available to support implementation of pasture and grazing BMPs, whether through cost-share or technical assistance and education, include:

- Clean Water Act Section 319 program
- Indiana Department of Natural Resources Division of Fish and Wildlife (LARE)
- Indiana State Department of Agriculture Division of Soil Conservation/SWCDs
- USDA’s Conservation of Private Grazing Land Initiative (CPGL)
- USDA’s Conservation Reserve Program (CRP)
- USDA’s Conservation Technical Assistance (CTA)
- USDA’s Environmental Quality Incentives Program (EQIP)
- USDA’s Small Watershed Program and Flood Prevention Program (WF 08 or FP 03)
- USDA’s Watershed Surveys and Planning
- USDA’s Wildlife Habitat Incentives Program (WHIP)

14.4.2.3 CFOs

While CAFOs are regulated by federal law, CFOs are not. However, Indiana has CFO regulations 327 IAC 16, 327 IAC 15 that require that operations manage manure, litter, and process wastewater in a manner that "does not cause or contribute to an impairment of surface waters of the state." IDEM regulates CFOs under IC 13-18-10, the Confined Feeding Control Law. The rules at 327 IAC 16, which implement the statute regulating CFOs, were effective on March 10, 2002. IDEM's Office of Land Quality administers the regulatory program, which includes permitting, compliance monitoring and enforcement activities.

14.4.2.4 Streambank erosion

Streambank erosion can be the result of changes in the physical structure of the immediate bank from activities such as removal of riparian vegetation or frequent use by livestock, or it can be the result of increased flow volumes and velocities resulting from increased surface runoff throughout the upstream watershed. Therefore, streambank erosion might be addressed through BMPs and restoration targeted to the specific stream reach, and further degradation could be addressed through the use of BMPs implemented to address storm water issues throughout the watershed. Programs available to support implementation of BMPs to address streambank erosion, whether through cost-share or technical assistance and education, include:

- Clean Water Act Section 319 program
- Indiana Department of Natural Resources Division of Soil Conservation
- USDA's Conservation Technical Assistance (CTA)
- USDA's Environmental Quality Incentives Program (EQIP)
- USDA's Small Watershed Program and Flood Prevention Program (WF 08 or FP 03)
- USDA's Watershed Surveys and Planning
- USDA's Wildlife Habitat Incentives Program (WHIP)
- Mitigation Funds

14.4.2.5 Onsite wastewater treatment systems

Indiana State Department of Health (ISDH) Rule 410 IAC 6-8.1 outlines regulations for septic systems, including a series of regulatory constraints on the location and design of current septic systems in an effort to prevent system failures. The rule prohibits failing systems, requiring that:

- No system will contaminate ground water.
- No system will discharge untreated effluent to the surface.

14.4.2.6 Wildlife/domestic pets

Addressing pollutant contributions from wildlife and domestic pets is typically done at the local level through education and outreach efforts. For wildlife, educational programs focus on proper maintenance of riparian areas and discouraging the public from feeding wildlife. For domestic pets, education programs focus on responsible pet waste maintenance (e.g., scoop the poop campaigns) coupled with local ordinances.

14.5 Potential Implementation Partners and Technical Assistance Resources

Agencies and organizations at the federal, state, and local levels will play a critical role in implementation to achieve the WLAs and LAs assigned under this TMDL. Table 110 identifies key potential implementation partners and the type of technical assistance they can provide to watershed stakeholders.

Table 110 Potential Implementation Partners in the Southern Whitewater River Watershed

Potential Implementation Partner	Funding Source
Federal	
USDA	Conservation of Private Grazing Land Initiative (technical and education assistance only)
USDA	Conservation Reserve Program
USDA	Conservation Technical Assistance (technical assistance only)
USDA	Environmental Quality Incentives Program
USDA	Small Watershed Program and Flood Prevention Program
USDA	Watershed Surveys and Planning
USDA	Wetlands Reserve Program
USDA	Wildlife Habitat Incentives Program
State	
ISDA	Division of Soil Conservation soil and water conservation districts
IDNR	Division of Fish and Wildlife Lake and River Enhancement program
IDEM	Section 319 program grants
IDEM	Section 205(j) program grants
Local	

IDEM has compiled a matrix of public and private grants and other funding resources available to fund watershed implementation activities. The matrix is available on IDEM's website at http://www.in.gov/idem/nps/3439.htm .

15.0 PUBLIC PARTICIPATION

Public participation is an important and required component of the TMDL development process. The following public meetings were held in the watershed to discuss this project:

- Two TMDL public kickoff meetings were held on October 29, 2013. The first meeting was held at 2:00 PM (EST) at the Franklin County Government Center, 1010 Franklin Avenue, Brookville, IN 47012. The second kickoff meeting was held at 6:00 PM (EST) at the Batesville Middle School, 201 N. Mulberry Street, Batesville, IN 47006. IDEM described the TMDL program and provided a summary of the available data and the proposed sampling approach at both meetings.
- A Southern Whitewater River Monitoring Field Day was held on June 16, 2014 from 10:00 AM – 12:00 PM (EST). This event was held at the Brookville City Park along the East Fork Whitewater River. At this event, participants learned more about sampling methods from conducted by IDEM and Hoosier Riverwatch staff in the watershed. Field procedures for fish & macroinvertebrate collection, habitat assessment and water chemistry were demonstrated. Live wells and voucher specimens were on hand for observation.
- Draft TMDL public meetings will be held in the watershed on the August 6, 2015. The draft findings of the TMDL will be presented at these meetings and the public will have the opportunity ask questions and provide information to be included in the final TMDL report. A public comment period was from August 6- September 6, 2015. No public comments were received.

APPENDIX A. REASSESSMENT NOTES FOR THE SOUTHERN WHITEWATER RIVER WATERSHED TMDL

APPENDIX B. SITE SPECIFIC PHOTOS, LOAD DURATION CURVES AND PRECIPITATION GRAPHS

APPENDIX C. REFERENCES

Subwatershed	HUC	AUID	Waterbody	Station	TMDL Site	Baseline Site	Location	Date	Sampling Comments	% Saturation	Alkalinity (mg/L)	Chloride (mg/L)	COD (mg/L)	Total Coliforms	Dissolved Oxygen (mg/L)	E. coli	Flow (cf/sec)	Hardness (mg/L)	Ammonia (mg/L)	Nitrate+Nitrite (mg/L)	pH (SU)	Total Phosphorus (mg/L)	Total Suspended Solids (mg/L)	Total Solids (mg/L)	Total Dissolved Solids (mg/L)	Specific Conductance (umho/cm)	Sulfate (mg/L)	Temperature (°C)	TKN (mg/L)	TOC (mg/L)	Turbidity (NTU)	Notes	2016 303(d) Listing	2016 Delisting
Headwaters Salt Creek	5.08E+10	ING0351_T1001	Unnamed Tributary to Salt Creek																													Landuse is primarily agricultural with some small patches of forested land. No CFOs or point sources although some small animal feedlots may exist. The unincorporated town of St. Maurice has runoff contributing to the stream. While there is no data collected from this stream, the extrememly high levels of E. coli in the other parts of the subwatershed and the similar landuse give me reason to extrapolate the impairment to include this AUID. GM 2555 cfu/100 mL (2014) and 210 cfu/100 mL (2009). Site is located on Salt Creek DS of its confluence with this reach. Extremely high results suggest contributions from this stream. Individual results suggest flushing. Three CFOs in HW and almost all ag fields. Land app of CFO waste is a likely source. LARE Study supports this assessment. 0006: GM 4038 cfu/100 mL.	E. coli	
		ING0351_T1002	Tributary of Salt Creek	GMW050-0023	T1	14T-001	CR 150 N	################		91.2	255	22	18	2419.6	9.86	224.7	NA	284	0.05	0.7	7.87	0.034	<4	350	331	557	25	11.79	0.15	4.7	2.54	This site was sampled in September and October of 2009 for E. coli only and the geomean was 210.78 MPN. The site was sampled again from April to October in 2014, 4/12 samples were below the single sample maximum WQS. The E. coli geomean collected in July and August was 2555.72 MPN, with two of the samples resulting in > 24,000 MPN. The fish community IBI score was 44 (fair) and the QHEI was 67 (good). The macro community mIBI score was 38 (fair) and the QHEI was 55(good). No other chemical parameters were in violation of WQS. There are no point sources upstream. Nonpoint source pollution could be attributed to three CFO hog farms upstream and a good percentage of agricultural lands. There was also a LARE study in 2009 and those results indicated that there were highest nutrient loadings coming from this subwatershed with livestock as the most important source (STEPL model). The LARE mIBI in 2009 was 33 and the QHEI was fair. GM 2555 cfu/100 mL (2014) and 210 cfu/100 mL (2009). Individual results suggest flushing. Three CFOs in HW and almost all ag fields. Land app of CFO waste is a likely source.	E. coli	
								################	Some algae on rocks	142.39	153	21	19.9	1732.9	14.36	149.7	NA	203	0.05	5.6	8.75	0.024	<4	278	255	462	22	14.92	0.4	3.1	8.66			
								################		110.2	199	19	13.1	2419.6	11.48	488.4	NA	258	0.05	9.6	8.21	0.027	4	340	329	551	20	13.42	0.4	1.9	5.16			
								################		100.8	216	22	10.1	2419.6	8.92	387.3	NA	294	0.05	7.9	8.08	0.032	4	374	348	550	20	21.29	0.4	2.2	5.79			
								################		90.5	102	12	NA	24196	7.83	24196	NA	136	NA	NA	7.79	NA	35	256	203	302	14	22.54	NA	NA	76.9			
								################		92.3	NA	NA	NA	2419.6	8.42	488.4	NA	NA	NA	NA	7.91	NA	NA	NA	NA	430	NA	19.77	NA	NA	3.93			
								################		47.8	NA	NA	NA	NA	4.78	NA	NA	NA	NA	NA	8.04	NA	NA	NA	NA	414	NA	19.97	NA	NA	5.77			
								################		92.3	NA	NA	NA	2419.6	8.52	2420	NA	NA	NA	NA	7.93	NA	NA	NA	NA	464	NA	19.19	NA	NA	26.9			
								################		85.1	157	14	26.2	24196	7.35	24196	NA	177	0.05	0.3	7.74	0.122	26	270	226	387	18	22.62	0.8	5.9	56.5			
								8/4/2014 10:40		79.7	NA	NA	NA	2419.6	7.4	157.6	NA	NA	NA	NA	7.38	NA	NA	NA	NA	446	NA	18.97	NA	NA	3.82			
								################		70.7	212	19	20.1	2419.6	7.13	49.6	NA	234	0.05	0.05	7.66	0.05	<4	296	275	458	18	14.84	0.4	4.7	3.49			
		ING0351_T1003	Unnamed Tributary to Salt Creek																													Landuse is primarily agricultural with some small patches of forested land. One hog CFO located on a small tributary of this AUID. No point sources. The unincorporated town of St. Maurice has runoff contributing to the stream. While there is no data collected from this stream, the extrememly high levels of E. coli in the other parts of the subwatershed and the similar landuse give me reason to extrapolate the impairment to include this AUID. Site T2 is located downstream of the confluence of this stream and Salt Creek. T2 E. coli results indicate there was no dilution taking place to reduce the E. coli concentration. GM 2555 cfu/100 mL (2014) and 210 cfu/100 mL (2009). Individual results suggest flushing. Three CFOs in HW and almost all ag fields. Land app of CFO waste is a likely source. LARE Study supports this assessment. 0006: GM 4038 cfu/100 mL.	E. coli	
		ING0351_01	Salt Creek																													In 2009 this stream was sampled (GMW050-0024) for E. coli only and the geomean was 1100.38 MPN. This was also a LARE study site in 2009 and the mIBI was 40, QHEI was fair and the E. coli value at base flow was 1660 MPN. This AUID has the most forested land surrounding it in the subwatershed and the E. coli values are still high at base flow. There are no CFOs or point sources upstream although there maybe small animal feedlots. 0023: GM 2555 cfu/100 mL (2014) and 210 cfu/100 mL (2009). Individual results suggest flushing. Three CFOs in subwatershed and almost all ag fields. Land app of CFO waste is a likely source. LARE Study supports this assessment. 0006: GM 4038 cfu/100 mL.	E. coli	
Righthand Fork-Salt Creek	5.08E+10	ING0352_01	Salt Creek	GMW-05-0006	T2	14T-002	CR 50 N	################		99.4	249	20	21.5	2419.6	10.72	325.5	NA	284	0.05	0.6	7.89	0.057	<4	183	165	545	24	11.9	0.4	6	4.77	**E. coli** - This stream segment is currently impaired for E. coli and DO. Three sites were sampled from April to October in 2014. Site T2 is farthest upstream and is the pour point for all tributaries of Headwaters Salt Creek subwatershed. 1/10 samples were below the E. coli single sample maximum WQS. The geomean was 4038.69 MPN with two of the samples > 24000 MPN. A probabilistic site (P12) is located downstream and had a geomean of 1018.8 MPN. In 2009 a site (GMW050-0022) was sampled farther downstream and the geomean was 180.01 MPN. Site T6 is at the pour point of the subwatershed and the geomean was 758.62 MPN. There was a historical sample (GMW050-0017) collected in 2007 which impaired the stream for E. coli (135.93 MPN) and DO (3.88 mg/L). **DO** - While we do not currenlty impair for TP, one of the readings from site GMW050-0017 was 22 mg/L (0.3 mg/L Target) in 2007. DO had the following readings: May - 8.47, June - 3.88, July - 5.16, 6.9, 9.54, 4.62, 6.35, Aug - 10.63, 7.2, Sept - 6.36 mg/L. The 9.54 reading was 7/23 at 3:30pm and the 4.62 reading was on 7/24 at 8:00am. Similar diurnal swings are seen from historical site GMW050-0008 in 2002 on the mainstem. As you move downstream there was another historical site sampled in 2002. DO results in June, July, Aug, and September were ~11, 10, 6 and 5 mg/L. Those samples in late afternoon had the 10/11mg/L readings while those earlier in the day had the lower readings. DO swings occurring which would indicate a nutrient problem. A nutrient problem was also identified for this watershed in the 2009 LARE study. During storm flow LARE site 13 had TP of 0.32 mg/L and 10 mg/L for nitrate. The LARE study also identified this subwatershed as having biological communities impacted by nutrient loadings. Based on this information I recommend we delist for DO and impair the stream for nutrients. DO readings in 2014, while not <4 mg/L did show signs of extreme DO swings depending on where the sample was taken (sun vs shade). There were two seperate occurances where two samples were taken within an hour of each other and the DO values were ~5 and ~15. **IBC** - At site T2 the fish community IBI scores was 34 (poor) and the QHEI was 56 (good). The macro community mIBI score was 36 (fair) and the QHEI was 48 (fair). At site T6 the fish community IBI score was 52 (good) and the QHEI was 67 (good). The macro community mIBI score was 42 (fair) and the QHEI was 68 (good). The LARE site on the AUID had a mIBI of 40 in 2009. **Discussion** - No other chemical parameters were in violation of WQS. There is a gravel quarry, a small airport with a stormwater permit and two CFOs in the subwatershed. The town of Enochsburg and Hamburg are populated areas where septic issues may be a problem. High loads of nutrients and E. coli are coming from upstream. The majority of the watershed consist of forested lands with good riparian areas. This could be a reason E. coli geomean coming into the watershed was >4000 and by the pour point of the watershed it was only ~750MPN. These numbers are still in exceednece of WQS but have been diluted as it flows downstream. There are also high levels of nutrients entering the mainstem from Righthand Fork Salt Creek which will be impaired for nutrients. 0006: GM 4038 cfu/100 mL. 0003: 1018 cfu/100 mL. 0007: 758 cfu/100 mL. Impairment decreases in DS direction. Land use transitions in DS directions to more buffered, forested riparian buffer. Two CFOs in this area of the WS. Land app is a potential source. Enochsburg, IN and Hamburg, IN (both unsewered) are also located in this WS; septic is a potential source.	E. coli, IBC, Nutrients	DO
								################	Cows d/s of bridge. Smell of manure in the air	145.9	154	16	17.5	2419.6	14.62	82	NA	188	0.05	3.2	8.52	0.024	<4	264	239	442	24	15.21	0.4	3.3	11.8			
								################		113.8	189	18	10.4	2419.6	11.99	547.5	NA	230	0.05	6.4	8.04	0.026	4	322	302	515	21	13.02	0.4	2.4	6.18			
								################		123.3	198	21	0.5	2419.6	10.91	260.3	NA	254	0.05	5.4	8.2	0.026	<4	344	313	523	22	21.33	0.4	2.5	4.89			
								################	Very muddy	80	116	14	NA	24196	6.88	24196	NA	153	NA	NA	7.71	NA	86	317	217	329	15	22.7	NA	NA	156			
								################	Site sampled u/s of bridge. Electric fence d/s Excessive algae in sunny areas	58.6	NA	NA	NA	NA	5.18	NA	NA	NA	NA	NA	8.17	NA	NA	NA	NA	372	NA	20.05	NA	NA	6.59			
								################		176.7	NA	NA	NA	2419.6	15.37	461.1	NA	NA	NA	NA	8.49	NA	NA	NA	NA	370	NA	22.19	NA	NA	16.3			
								################		88.3	NA	NA	NA	24196	8.02	5475	NA	NA	NA	NA	7.97	NA	NA	NA	NA	418	NA	19.98	NA	NA	47.9			
								################		86.2	152	14	24.4	24196	7.38	24196	NA	172	0.05	0.2	7.79	0.128	34	270	221	382	18	23.23	0.8	6	56.6			
								8/4/2014 10:20		90.1	NA	NA	NA	2419.6	8.38	727	NA	NA	NA	NA	8.01	NA	NA	NA	NA	445	NA	18.69	NA	NA	5.86			
								################		77.1	196	17	16.7	2419.6	7.76	1203	NA	211	0.05	0.05	7.73	0.036	5	285	263	480	25	14.93	0.5	5.5	9.12			
				GMW-05-0007	T6	14T-006	Rail Fence Rd	1/13/2014 9:15		94.6	145	15	15.7	NA	12.73	NA	112.4797	178	0.05	3.2	7.49	0.119	9	255	230	400	18	2.97	0.15	3.4	15.5			
								################		81.6	182	24	25.1	2419.6	8.89	80.9	5.5315	207	0.05	0.6	7.59	0.147	5	296	280	467	28	11.46	0.5	6.9	9.06			
								################	Algae on rocks	95.2	218	21	0.5	NA	12.95	NA	9.6599	238	0.05	1.3	7.92	0.019	<4	305	292	574	35	2.51	0.15	3.1	2.08			
								12/9/2013 9:20		94	162	18	21.8	NA	13.14	NA	40.726	181	0.05	1	7.82	0.03	<4	232	216	439	19	1.61	0.5	4.4	4.39			
								2/17/2014 9:55	Partially ice covered u/s of bridge	93.2	212	18	10.8	NA	13.57	NA	12.7812	239	0.05	2.7	7.89	0.022	<4	303	281	553	29	0.07	0.15	1.8	4.46			
								3/17/2014 9:50	Algae on rocks	95.3	183	16	12.1	NA	13.43	NA	29.3846	229	0.05	2.8	8.14	0.024	<4	273	257	497	27	1.23	0.15	2	5.68			
								################	Some algae on rocks	110.3	147	14	16.7	2419.6	11.38	101.9	25.8526	183	0.05	1.5	8.35	0.024	<4	241	222	412	25	13.91	0.5	3.4	4			
								################	Algae on Rocks	103.7	180	17	19.3	2419.6	11.08	150	39.6644	218	0.05	4	7.84	0.035	5	300	273	475	22	12.34	0.7	3.1	7.12			
								6/16/2014 9:45		90.9	164	22	12.3	2419.6	8.03	62.4	5.2737	194	0.05	2.1	7.94	0.031	9	295	265	456	24	21.41	0.5	3.1	10.9			
								################		83.1	152	21	NA	2419.6	7.12	2420	12.951	193	NA	NA	7.75	NA	23	276	239	419	25	23.01	NA	NA	32			
								################		83.3	NA	NA	NA	NA	6.52	NA	NA	NA	NA	NA	8.15	NA	NA	NA	NA	381	NA	26.42	NA	NA	8.38			
								7/21/2014 9:15		76.9	NA	NA	NA	2419.6	6.96	248.1	NA	NA	NA	NA	7.67	NA	NA	NA	NA	420	NA	20.19	NA	NA	11.9			
								7/28/2014 9:05		85.6	NA	NA	NA	2419.6	7.58	461.1	NA	NA	NA	NA	7.93	NA	NA	NA	NA	420	NA	21.31	NA	NA	25.5			
								8/11/2014 9:35	Recent rain-creek up	85.9	157	18	17	24196	7.32	5475	26.3897	182	0.05	0.1	7.82	0.106	43	290	238	416	23	23.95	0.8	4.3	44.4			
								8/4/2014 9:00		73.4	NA	NA	NA	2419.6	6.76	165.8	NA	NA	NA	NA	7.81	NA	NA	NA	NA	424	NA	19.3	NA	NA	15.1			
								9/22/2014 9:30		64.1	192	25	17.5	2419.6	6.49	60.9	0.5011	246	0.05	0.2	7.45	0.056	13	326	296	528	36	14.8	0.5	3.6	12.6			
				GMW-05-0003	P12	INRB14-057	Giesting Road	5/14/2014 9:10		83.2	170	15	15	NA	7.81	NA	NA	200	0.05	1.3	8.01	0.074	4	220	220	415	19	18.33	0.15	NA	14.9			
								################		105.9	170	17	5	NA	9.03	NA	NA	210	0.05	2.6	8.15	0.08	2	250	240	436	17	23.22	0.57	4.2	5.41			
								7/15/2014 9:30		89.6	NA	NA	NA	24196	8.06	2420	NA	NA	NA	NA	7.96	NA	NA	NA	NA	391	NA	20.47	NA	NA	65.6			
								################		88.7	NA	NA	NA	2419.6	8	328.2	NA	NA	NA	NA	7.99	NA	NA	NA	NA	432	NA	20.36	NA	NA	5.65			
								7/29/2014 9:45		98.9	NA	NA	NA	9208	9.61	547.5	NA	NA	NA	NA	8.06	NA	NA	NA	NA	363	NA	16.25	NA	NA	25.6			
								8/5/2014 9:45		89.1	NA	NA	NA	2419.6	8.28	547.5	NA	NA	NA	NA	7.92	NA	NA	NA	NA	447	NA	18.81	NA	NA	9.36			
								8/12/2014 9:30		90.1	NA	NA	NA	24196	8	4611	NA	NA	NA	NA	8	NA	NA	NA	NA	400	NA	21.13	NA	NA	29.6			
								9/9/2014 15:20		172.7	160	22	22	NA	14.92	NA	NA	180	0.05	0.14	8.58	0.094	7	240	210	424	22	22.59	0.56	5.3	9.02			
		ING0352_01A	Unnamed Tributary to Salt Creek																													No data for this stream. Appears to be an interstittial stream which may dry up during the summer months. This reach appears to be an interstittial stream which may dry up during the summer months. Given this, MS results that may otherwise suggest impairment of tributaries are likely not representative of this reach.	NA	
		ING0352_P1001	Lake Santee																													Lake - not assessed	NA	
		ING0352_T1001	Unnamed Tributary to Salt Creek																													There is no data collected on this AUID. The landuse is agriculture mixed with forested lands. Considering there is a small lake in the headwaters which could be diluting the stream and there are no point sources I would not extrapolate any impairments to this stream segment Results from Salt Creek MS considered representative of this reach based on similarity in land uses. Assessed as impaired based on extremely high results for Salt Creek MS and similar land use.	E. coli	
		ING0352_T1002	Unnamed Tributary to Salt Creek																													There is no data collected on this AUID. There is a sand and gravel quarry in the headwaters of this stream segment and it also flows though the town of Enochsburg. The landuse is also heavy with agriculture and there is one large CFO hog farm in the watershed. Given the landuse is similar to that in the Headwaters Salt Creek I would extrapolate the E. coli impairment to this stream segment. Results from Salt Creek MS considered representative of this reach based on similarity in land uses. Assessed as impaired based on extremely high results for Salt Creek MS and similar land use.	E. coli	
		ING0352_T1003	Righthand Fork Salt Creek	GMW-05-0014	T3	14T-003	E CR 550 N	################		63.3	340	51	18.7	2419.6	6.95	166.4	NA	365	0.05	0.4	7.51	0.185	<4	501	474	783	31	10.95	0.3	5.1	5.33	E. coli geomean was 1034.09 MPN and was in violation of the single sample max 8/10 times. Total Nitrogen was high April-June but was not exceeding the WQS. The fish community IBI score was 34 (fair) and the QHEI was 59 (good). The macro community mIBI score was 36 (fair) and the QHEI was 54 (fair). In 2009 LARE site 1 was located at the same point. The LARE study indicated there was high TP (0.5mg/L) during high flow and nitrate was 1.5mg/L. The LARE mIBI score was 30 and the QHEI was 60 (good). This suggests there may be a management priority for this stream segment. There is one CFO hog farm upstream from the headwaters. The land use is primarily agriculture and the town of Clarksburg runs off into the stream. The field notes indicate there is little flow or isolated pools in the dry summer months. Reach located US of Lake Santee. GM 1034 cfu/100 mL, Clarksburg, IN located on this reach and there is one CFO along one of the HW. Almost no riparian buffer anywhere along these streams. Land app of CFO waste is a likely source. Septics may also be contributing. Individual results suggest a combination of consistent low-level loadings from tributaries and flushing events.	E. coli, IBC	
								################	Algae on rocks	157.5	220	26	15.6	2419.6	16.37	98.4	NA	305	0.05	5	8.5	0.038	4	360	326	585	21	13.58	0.15	3.4	18.7			
								################		101.6	256	31	16.7	2419.6	10.64	1046	NA	311	0.05	7.3	7.86	0.061	12	415	386	660	18	13.14	0.5	2	10.8			
								################		92.5	274	31	0.5	2419.6	8.49	980.4	NA	326	0.05	6.4	7.96	0.066	12	446	406	680	21	19.43	0.5	1.9	14.5			
								################	small velocity	83.3	267	36	NA	2419.6	7.39	2420	NA	353	NA	7.6	7.76	NA	14	450	409	670	29	21.18	NA	NA	17.5			
								################		70.5	NA	NA	NA	2419.6	6.68	285.1	NA	NA	NA	NA	7.65	NA	NA	NA	NA	718	NA	17.98	NA	NA	6.92			
								################	some isolated pools	66.9	NA	NA	NA	2419.6	5.68	NA	NA	NA	NA	NA	7.77	NA	NA	NA	NA	705	NA	22.51	NA	NA	3.98			
								################		86.8	NA	NA	NA	2419.6	8.14	1733	NA	NA	NA	NA	7.88	NA	NA	NA	NA	748	NA	18.41	NA	NA	10.2			
								################		64.4	295	26	16.2	2419.6	6.43	2420	NA	350	0.05	0.2	7.59	0.091	12	422	390	676	30	21.07	0.5	4	17.9			
								8/4/2014 11:00		54.4	NA	NA	NA	2419.6	5.18	410.6	NA	NA	NA	NA	7.44	NA	NA	NA	NA	744	NA	17.55	NA	NA	16.3			
								################		54.8	315	47	17.8	2419.6	5.64	290.9	NA	299	0.05	0.1	7.6	0.092	7	477	444	748	31	13.94	0.4	4.2	10.7			
		ING0352_T1004	Unnamed Tributary to Righthand Fork Salt Creek																													There is no data for this stream segment. The landuse is mixed with agriculture, forest and residential. There are likely nonpoint sources for E. coli there is no data supporting an impairment and given the mixed land use extrapolation is not appropriate. Results from MS on Righthand Fork Salt Creek suggest consistent, low-level loadings from this and other tributaries US of MS site. this reach impaired based on this and on similar land use. This reach is better buffered that T1005, however, land uses are otherwise much the same. See source notes for ING0352_T1003. Land app of CFO waste a likely source. Lots of residential development in this area making septics a likely source.	E. coli	
		ING0352_T1005	Unnamed Tributary to Righthand Fork Salt Creek																													No data collected from this stream. There is a very small drainage area and the majority of the landuse is agriculture and residential, including a CFO hog farm. All these sources are potential sources of E. coli. Therefore given the high levels of E. coli from site T3 the E. coli impairment will be extrapolated to this stream segment. Results from site located on MS Righthand Fork Salt Creek suggest consistent, low-level loadings from this and other tributaries US of MS site. this reach impaired based on this and on similar land use. See source notes for ING0352_T1003. Land app of CFO waste. Lots of residential development in this area making septics a likely source.	E. coli	
		ING0352_T1006	Righthand Fork Salt Creek	GMW-05-0011	T4	14T-004	Hamburg Rd	################		95.2	125	16	28.7	2419.6	10.05	119.8	NA	125	0.05	0.3	7.79	0.17	12	201	180	320	10	12.87	1.1	6	11.7	In 2014 site T4 had an E. coli geomean of 1472.41MPN, 7/10 samples failed the single sample maximum. Since this site is located downstream of a large lake and the Lake Santee WWTP you would expect there to be a good deal of dilution occuring. The lake does contain residents otherwise. The fish community IBI score was 28 (poor) and the QHEI was 65 (good). The macro community mIBI score was 36 (fair) and the QHEI was 60 (good). The QHEI for the biology suggests it can support a healthy fish community, yet the stream is impaired. This suggests there may be chemical stressors causing the impairment. The August samples resulted in Total Nitrogen of 13mg/L and TP as 2.278 mg/L. In September the TN was 16mg/L and the TP was 3.945 mg/L. These values are above the IN WQ targets. Lake outfalls are often more nutrient rich than stream water which could be a potential source of high nutrients. There are higher nutrients entering the lake upstream which would support a eutrophic lake. Another possible source is the Lake Santee WWTP located just upstream of site T4. There were LARE sites upstream (Site 2) and downstream (Site 3) sampled in 2009. The results indicated that site 2 just downstream of the lake has a QHEI that can support a healthy community, yet biological communities are impaired. This indicated degraded water quality although the study did not specify the cause. Site 2 had an mIBI of 23 and site 3 which is just before the confluence with Salt Creek had an mIBI of 60. Site 2 and 3 had high TP (>0.3 mg/L) during storm flow and site 3 had high TP (>0.3 mg/L) during base flow also. Based on aerial photography site 2 appears to be upstream of the WWTP and site 3 would be impacted by any discharge. There are large patches of forested land mixed with agricultural uses. No other large farms or point sources. GM 1472 cfu/100 mL. Almost all ag fields along this reach. Lake Santee WWTP has a land app permit and is likely spreading it on fields nearby. Land app of waste from CFO in neighboring WS is also a potential source.	E. coli, Nutrients, IBC	
								################	Fair amount of algae on rocks	141.5	119	16	20.2	2419.6	14.75	11	NA	156	0.05	1.4	9.18	0.138	4	205	187	332	14	14.6	0.6	4.7	19.8			
								################		105.2	119	15	28.9	2419.6	10.49	96	NA	132	0.05	1.2	8.23	0.151	8	210	193	341	14	15.49	1	5.3	8.57			
								################		87.5	142	22	12.2	2419.6	7.91	980.4	NA	172	0.05	4.8	7.81	0.511	<4	276	255	417	13	20.2	0.8	4.3	5.23			
								################		90	117	22	NA	2419.6	8	2420	NA	154	NA	NA	7.73	NA	25	292	255	387	22	21.12	NA	NA	31.6			
								################		83.4	NA	NA	NA	2419.6	7.69	1203	NA	NA	NA	NA	7.71	NA	NA	NA	NA	574	NA	19.32	NA	NA	10.1			
								################		117.2	NA	NA	NA	NA	6.03	NA	NA	NA	NA	NA	8.18	NA	NA	NA	NA	569	NA	22.75	NA	NA	14.2			
								################		84.9	NA	NA	NA	2419.6	7.88	816.4	NA	NA	NA	NA	7.72	NA	NA	NA	NA	476	NA	18.89	NA	NA	10.9			
								################		78.3	112	42	25.9	2419.6	6.86	2420	NA	160	0.05	13	7.5	2.278	17	364	312	518	20	21.55	1	6	15.2			
								8/4/2014 10:05		78.3	NA	NA	NA	2419.6	7.25	1203	NA	NA	NA	NA	7.64	NA	NA	NA	NA	561	NA	18.95	NA	NA	11.5			
								################		72.6	133	58	22.5	2419.6	7.26	866.4	NA	209	0.05	16	7.48	3.945	11	429	376	631	21	15.05	0.7	4.9	5.3			
		ING0352_T1007	Unnamed Tributary to Salt Creek																													No data to assess this stream. The landuse is mostly forest with good riparian buffers, little agriculture and no point sources. A portion of Hamburg may runoff into this stream but it is not a large enough town to extrapolate any impairments to this stream.	NA	
		ING0352_T1008	Unnamed Tributary to Salt Creek																													No data to assess this stream. The landuse is mostly forest with good riparian buffers, little agriculture and no point sources. No known causes to extrapolate any impairments to this stream.	NA	
		ING0352_T1009	Unnamed Tributary to Salt Creek																													No data to assess this stream. The landuse is mostly forest with good riparian buffers, little agriculture and no point sources. No known causes to extrapolate any impairments to this stream.	NA	
		ING0352_T1010	Hamburg Branch																													No data to assess this stream. The landuse is mostly forest with good riparian buffers, little agriculture and no point sources. Two large lakes in the headwaters of this stream which would probably help dilute any pollution. A portion of Hamburg may runoff into this stream but it is not a large enough town to extrapolate any impairments to this stream.	NA	
		ING0352_T1011	Unnamed Tributary to Salt Creek																													No data to assess this stream. The landuse is mostly forest with good riparian buffers, little agriculture and no point sources. Several lakes in the headwaters which would help in diluting any pollutants. No known causes to extrapolate any impairments to this stream.	NA	
Bull Fork	5.08E+10	ING0353_01	Bull Fork																													This AUID is currently impaired for dissolved oxygen based on a September sample in 2002. No new data was collected to show that DO is no longer a problem so this site will remain impaired for DO. There is little to no riparian buffers and this is a headwater stream in an agricultural dominated drainage area. In 2002 the nitrogen was greater than the 10 mg/L target 1/3 samples. There were no other violations of WQS or Targets however the DO %Sat was > 100% 3/4 times and only 29% during the time of violation. These extreme fluctuations in in DO along with the high nitrogen result could indicate high levels of nutrients in the stream. The agricultural dominated land use supports this theory. Based on a downstream E. coli impairment on the recieving stream and the fact that data shows the E. coli levels decrease moving downstream, the impairment will be extrapolated to include this AUID. However there is no data to determine which upstream sources are causing the high levels of E. coli in the recieving stream. 0009: 400 cfu/100 mL. 0002: 129 cfu/100 mL. Impairment decreases in DS direction. Cattle access to streams, small pasture operation. Town of Buena Vista (unsewered) likely not an issue (very small). Land app of CFO waste likely occurring in upper WS. Results extrapolated to HW tributaries above site 0009, but not the tributary coming out of Buena Vista (ING0353_T1006).	E. coli, DO	
		ING0353_02	Bull Fork	GMW-05-0009	T5	14T-005	Bullfork Road	################		92.4	270	12	13.8	1299.7	10.27	10.9	NA	220	0.05	0.9	7.87	0.014	<4	342	331	548	21	10.63	0.3	4.1	2.59	This AUID is currently impaired for dissolved oxygen based on a 2002 sample upstream on AUID ING0353_01. The DO results sampled in 2014 had no DO violations from either site. This AUID should be delisted for DO. In 2009 an E. coli only site was sampled upstream on this AUID and resulted in a geomean of 360.62 MPN with 4/5 sampled exceeding the single sample maximum. In 2014 site T5 was sampled downstream of the 2009 site and resulted in a geomean of 400.07 MPN having 3/10 samples exceeding the geomean. In 2014, another site (P6) was sampled farther downstream on this AUID and the geomean was 129.33 MPN, with 2/5 samples exceeding the single sample max. While the E. coli concentrations decrease in a downstream direction there are still sources upstream causing this stream to be impaired for E. coli. In 2002 the fish IBI = 44 and the QHEI = 47. In 2014, the fish IBI for T5 was = 52 (good), QHEI = 65 (good) and for P6 the IBI = 42 (fair), QHEI = 64 (good). In 2014, the macro IBI for T5 was = 44 (fair), QHEI = 67 (good) and for P6 the IBI = 40 (fair), QHEI = 57 (good). The biological integrity seems to be decreasing as you move downstream from site T5 to P6. In 2009 there were two LARE sites (5 and 6) on this AUID. During base the flow the site farthest downstream had low DO (3.9 mg/L) and during storm flow both sites had high TP (>0.3 mg/L), high nitrogen (>10 mg/L) and high TSS (>30 mg/L). The LARE study determined this subwatershed has high nutrient loadings and defined nutrients as the primary pollutant in this stream. This stream has some wide riparian buffers mixed with some reaches with little to no riparian buffers. The watershed land use is about half forest and half agriculture (dominant in the headwaters). The Town of Buana Vista is in the drainage area. No point sources present. 0009: 400 cfu/100 mL. 0002: 129 cfu/100 mL. Impairment decreases in DS direction. Cattle access to streams, small pasture operation. Town of Buena Vista (unsewered) likely not an issue (very small). Land app of CFO waste likely occurring in upper WS. Results extrapolated to HW tributaries above site 0009, but not the tributary coming out of Buena Vista (ING0353_T1006).	E. coli	DO
								################		117.6	172	9.8	17.5	1299.7	12.11	81.3	NA	225	0.05	2.3	8.62	0.015	<4	262	243	446	21	13.95	0.15	2.7	2.87			
								################		105.5	221	11	12.6	2419.6	11.45	193.5	NA	238	0.05	5.5	8.12	0.016	<4	322	302	518	17	11.59	0.3	2.3	4.6			
								################		104.3	219	14	0.5	2419.6	9.44	101.4	NA	252	0.05	5.5	8.19	0.019	<4	340	309	519	18	20.11	0.3	2	NA			
								################		94.1	151	11	NA	2419.6	8.28	2420	NA	199	NA	NA	7.88	NA	21	273	233	392	19	21.68	NA	NA	44.1			
								7/21/2014 9:50		90.5	NA	NA	NA	2419.6	8.31	127.4	NA	NA	NA	NA	7.87	NA	NA	NA	NA	472	NA	19.47	NA	NA	6.17			
								################	Turbidity measured w/ hatch meter B1 in lab on 7/23	58.2	NA	NA	NA	NA	5	NA	NA	NA	NA	NA	8.03	NA	NA	NA	NA	454	NA	21.56	NA	NA	4.96			
								7/28/2014 9:40		92.3	NA	NA	NA	2419.6	8.47	488.4	NA	NA	NA	NA	7.96	NA	NA	NA	NA	460	NA	19.47	NA	NA	14.9			
								################		83.2	237	12	11.6	2419.6	7.22	410.6	NA	271	0.05	0.2	7.79	0.03	10	312	338	509	20	22.07	0.3	2.8	12.4			
								8/4/2014 9:30		82	NA	NA	NA	2419.6	7.67	165.8	NA	NA	NA	NA	7.81	NA	NA	NA	NA	505	NA	18.52	NA	NA	10.6			
								################		81.1	252	10	10.6	2419.6	8.5	22.8	NA	250	0.05	0.05	7.77	0.02	<4	317	300	534	15	13.19	0.15	2.1	4.48			
				GMW-05-0002	P6	INRB14-035	Bullfork Road	5/14/2014 8:15		93	200	9	9	NA	8.9	NA	NA	220	0.05	2.5	8.11	0.025	3	260	260	465	16	17.4	0.52	NA	10.6			
								6/3/2014 10:40		97.5	NA	NA	NA	NA	8.55	NA	NA	NA	NA	NA	8.26	NA	NA	NA	NA	410	NA	21.72	NA	NA	1.98			
								################		109.2	180	11	5	NA	9.4	NA	NA	260	0.05	5.1	8.07	0.025	2	280	260	500	14	22.11	0.6	2.2	4.21			
								7/15/2014 9:55		102.8	NA	NA	NA	2419.6	9.14	344.8	NA	NA	NA	NA	7.99	NA	NA	NA	NA	417	NA	21.07	NA	NA	11.2			
								################		99.1	NA	NA	NA	2419.6	8.86	26.2	NA	NA	NA	NA	7.63	NA	NA	NA	NA	493	NA	20.77	NA	NA	2.04			
								################		113.4	NA	NA	NA	2419.6	10.84	80.1	NA	NA	NA	NA	7.98	NA	NA	NA	NA	452	NA	17.52	NA	NA	2.51			
								8/5/2014 10:00		94.7	NA	NA	NA	2419.6	7.9	325.5	NA	NA	NA	NA	7.52	NA	NA	NA	NA	510	NA	18.95	NA	NA	3.9			
								8/6/2014 14:25	Excessive algae in stream upstream of X	74.1	NA	NA	NA	7258.8	6.89	153.6	NA	NA	NA	NA	7.79	NA	NA	NA	NA	456	NA	24.82	NA	NA	3.9			
								################		85.3	NA	NA	NA	NA	6.67	NA	NA	NA	NA	NA	7.46	NA	NA	NA	NA	525	NA	20.17	NA	NA	1.34			
								9/10/2014 9:50		77.8	220	8.6	6	NA	7.35	NA	NA	240	0.05	0.2	7.52	0.025	0.5	280	270	503	15	18.03	0.15	1.1	1.32			
		ING0353_02A	Unnamed Tributary to Bull Fork																													There is no current of historical data for this AUID. Since the geomean from site T5 to P6 decreases there is no reason to presume additional sources of E. coli are entering the mainstem through this tributary.	NA	
		ING0353_T1001	Unnamed Tributary to Bull Fork																													No current or historical data for this AUID. However based on a downstream E. coli impairment on the recieving stream and the fact that data shows the E. coli levels decrease moving downstream, the impairment will be extrapolated to include this AUID. Primarily agricultural land use. Results from Bull Fork MS extrapolated to HW tributaries above site 0009, but not the trib coming out of Buena Vista (ING0353_T1006).	E. coli	
		ING0353_T1002	Unnamed Tributary to Bull Fork																													No current or historical data for this AUID. However based on a downstream E. coli impairment on the recieving stream and the fact that data shows the E. coli levels decrease moving downstream, the impairment will be extrapolated to include this AUID. Primarily agricultural land use. Results from Bull Fork MS extrapolated to HW tributaries above site 0009, but not the trib coming out of Buena Vista (ING0353_T1006).	E. coli	
		ING0353_T1003	Unnamed Tributary to Bull Fork																													No current or historical data for this AUID. However based on a downstream E. coli impairment on the recieving stream and the fact that data shows the E. coli levels decrease moving downstream, the impairment will be extrapolated to include this AUID. Mixed forest and agricultural land use which would help in filtering out pollutants. However there is no data to determine which upstream sources are causing the high levels of E. coli in the recieving stream. Results from Bull Fork MS extrapolated to HW tributaries above site 0009, but not the trib coming out of Buena Vista (ING0353_T1006).	E. coli	
		ING0353_T1004	Unnamed Tributary to Bull Fork																													No current or historical data for this AUID. However based on a downstream E. coli impairment on the recieving stream and the fact that data shows the E. coli levels decrease moving downstream, the impairment will be extrapolated to include this AUID. Primarily forested land use which would help filter out pollutants. However there is no data to determine which upstream sources are causing the high levels of E. coli in the recieving stream.	E. coli	
		ING0353_T1005	Unnamed Tributary to Bull Fork																													No current or historical data for this AUID. However based on a downstream E. coli impairment on the recieving stream and the fact that data shows the E. coli levels decrease moving downstream, the impairment will be extrapolated to include this AUID. Primarily forested land use which would help filter out pollutants. However there is no data to determine which upstream sources are causing the high levels of E. coli in the recieving stream. Results from Bull Fork MS extrapolated to HW tributaries above site 0009, but not the trib coming out of Buena Vista (ING0353_T1006).	E. coli	

		ING0353_T1006	Long Branch																													This stream is currently impaired for DO based on a sample taken in 2002 from ING0353_01. There is no current or historical data for this AUID. The land use is primarily forested land with wide riparian buffers, which is much different than the agricultural dominated ING0353_01 AUID. The recieving stream does not have a DO impairment which shows no cause to say this tributary is contributing to low DO. Based on a downstream E. coli impairment on the recieving stream and the fact that data shows the E. coli levels decrease moving downstream, the impairment will be extrapolated to include this AUID. However there is no data to determine which upstream sources are causing the high levels of E. coli in the recieving stream. Results from Bull Fork MS extrapolated to HW tributaries above site 0009 except for this one, which flows out of Buena Vista, IN.	NA	DO
		ING0353_T1007	Unnamed Tributary to Bull Fork																													No current or historical data for this AUID. However based on a downstream E. coli impairment and the fact that data shows the E. coli levels decrease moving downstream, the impairment will be extrapolated to include this AUID. Primarily forested land use which would help filter out pollutants. However there is no data to determine which upstream sources are causing the high levels of E. coli in the recieving stream.	E. coli	
		ING0353_T1008	Unnamed Tributary to Bull Fork																													There is no current of historical data for this AUID. Since the geomean from site T5 to P6 decreases there is no reason to presume additional sources of E. coli are entering the mainstem through this tributary. 0009: 400 cfu/100 mL. 0002: 129 cfu/100 mL. Impairment on Bull fork MS decreases in DS direction below its confluence with this tributary suggesting that this stream is not contributing to the impairment, but rather possibly mitigating it with clean flow. Need more data to determine if FS. Stream will remain NA.	NA	
Little Salt Creek	5.08E+10	ING0354_01	Little Salt Creek																													There is no current of historical data for this AUID. There are no impairments downstream of this AUID in the subwatershed. While the land use is primarily agricultural with little to no riparian buffers, there are no data to support impairments. Previously assessed as FS. No new data to suggest otherwise	NA	
		ING0354_02	Little Salt Creek	GMW-05-0008	T9	14T-009	Stipps Hill Rd	###############		111.4	255	18	14.2	1986.3	11.33	75.9	NA	281	0.05	0.05	7.77	0.016	<4	329	308	533	23	14.49	0.15	2.2	2.53	In 2009 a site was sampled for E. coli only and the geomean was 95.38 MPN with 1/5 samples exceeding the single sample max. In 2014 there were two samples taken from T9 and P1 which are located at the pour point of this subwatershed, downstream of the confluence with ING0354_T1003. The geomean for T9 was 79.40 MPN and there was 1/10 samples in exceedence of the single sample max. In 2014 there was another site P1 located in close proximity to site T9 and the geomean was 441.52 MPN with 5/5 samples in exceedence of the single sample max. The geomeans from site T9 and P1 were taken one day apart for five consecutive weeks. There was a historical site sampled in 2002 and the E. coli geomean was 30.65 MPN. The fish community IBI score for site T9 was 38 (fair) and the QHEI was 60 (good). The macro community mIBI score was 42 (fair) and the QHEI was 61 (good). The fish community IBI score for site P1 was 42 (fair) and the QHEI was 79 (excellent). The macro community mIBI score was 42 (fair) and the QHEI was 58 (good). The historical site in close proximity was sampled in 1994 with macro score of 4.8 and QHEI of 70 and again in 2004 with an mIBI score of 34 and a QHEI of 54. In 2009 there were also two LARE sites (8 and 10) located on this AUID. The results indicated that this subwatershed has high loads of sediment. During storm flow site 8 had high TSS (>30 mg/L) and site 10 had high TP (>0.3 mg/L). Both sites had high levels of TN during storm flow but they were not exceeding the WQ Target. The chemistry collected in 2014 shows high TSS 2/10 times, one of which was 400 mg/L. The same day the TSS of 400 was recorded the TP was 0.94 mg/L. During storm events there are large sources of sediment and phosphorus entering the stream. The land use is primarily steep forested lands with wide riparian buffers surrounding the stream. However further upstream the land use is dominantly agriculture with little to no riparian buffers. Small clusters of homes are also present along US 52. 0008 (2014): GM 79 cfu/100 mL. 0019 (2009): 95 cfu/100 mL. 0001 (2014): 442 cfu/100 mL. Very strange results. 0008 and 0001 were sampled a day apart with results GM that are drastically different. No weather event to explain it. US site (0008) had one result result that drove the GM above criterion. 0001: Results suggest consistent loadings. Suspect unidentified septic/straightpipe issue or direct dumping of waste in vicinity of site 0001. Possibly highly localized application of CFO waste. Needs further study.	E. coli	
								###############		124.5	188	15	16.1	488.4	12.46	12	NA	240	0.05	1.6	8.5	0.008	<4	285	264	486	22	15.31	0.15	2.1	8.57			
								###############		105.8	226	17	13.1	2419.6	10.61	135.4	NA	255	0.05	4.7	8.15	0.022	4	337	312	546	19	15.14	0.3	2	5.77			
								###############		108.8	229	19	0.5	2419.6	9.8	72.3	NA	209	0.05	2.8	7.92	0.015	<4	333	308	542	21	20.37	0.15	1.4	3.63			
								###############	Stream clear, many minnows	125.5	230	16	0.5	2419.6	10.63	96	NA	251	0.05	0.3	7.81	0.017	<4	312	293	521	18	23.75	0.15	1.2	2.3			
								###############	Algae mats observed in the stream	146	NA	NA	NA	2419.6	12.54	9.6	NA	NA	NA	NA	7.73	NA	NA	NA	NA	484	NA	22.76	NA	NA	3.56			
								###############		91	NA	NA	NA	NA	7.09	NA	NA	NA	NA	NA	7.83	NA	NA	NA	NA	499	NA	26.6	NA	NA	1.75			
								###############	Algae mats observed in-stream	124.8	NA	NA	NA	2419.6	11.25	37.3	NA	NA	NA	NA	7.66	NA	NA	NA	NA	560	NA	20.39	NA	NA	1.89			
								###############		85.1	167	11	13.9	24196	7.18	4352	NA	184	0.05	0.3	7.57	0.104	51	308	234	396	19	23.06	0.6	3.7	98.5			
								8/4/2014 12:05		126.5	NA	NA	NA	2419.6	10.92	21.1	NA	NA	NA	NA	7.58	NA	NA	NA	NA	574	NA	22.46	NA	NA	4.76			
								###############		116	258	15	13.4	2419.6	10.7	21.3	NA	290	0.05	0.1	7.57	0.021	<4	331	317	567	18	19.15	0.15	1.3	4.56			
				GMW-05-0001	P1	INRB14-003	Stipps Hill Road	###############		60.8	NA	NA	NA	NA	6.24	NA	NA	NA	NA	NA	7.74	NA	NA	NA	NA	542	NA	15.91	NA	NA	1.64			
								5/14/2014 7:30		92	66	13	48	NA	9.05	NA	NA	210	0.14	4.1	7.81	0.94	400	670	230	382	12	16.14	1.5	NA	682			
								6/25/2014 8:30		86.7	200	15	5	NA	7.81	NA	NA	280	0.05	1.7	7.78	0.025	10	260	290	528	16	20.38	0.57	2	9.77			
								6/3/2014 14:40		112.2	NA	NA	NA	NA	9.24	NA	NA	NA	NA	NA	8.17	NA	NA	NA	NA	459	NA	23.82	NA	NA	3.34			
								###############		94.7	NA	NA	NA	NA	8.6	396.8	NA	NA	NA	NA	7.87	NA	NA	NA	NA	511	NA	19.98	NA	NA	12.9			
								###############		82.8	NA	NA	NA	NA	7.31	410.6	NA	NA	NA	NA	7.56	NA	NA	NA	NA	572	NA	21.34	NA	NA	9.63			
								###############		84.2	NA	NA	NA	NA	8	325.5	NA	NA	NA	NA	7.54	NA	NA	NA	NA	578	NA	17.15	NA	NA	5.32			
								###############		98.9	NA	NA	NA	NA	8.16	727	NA	NA	NA	NA	7.74	NA	NA	NA	NA	488	NA	20.36	NA	NA	17.1			
								8/5/2014 10:25		73.3	NA	NA	NA	NA	6.72	435.2	NA	NA	NA	NA	7.43	NA	NA	NA	NA	601	NA	19.43	NA	NA	3.86			
								9/10/2014 8:20		100.9	260	15	5	NA	9.53	NA	NA	270	0.05	0.13	7.68	0.025	6	290	250	553	16	18.03	0.15	1.3	3.16			
		ING0354_T1001	Unnamed Tributary to Little Salt Creek																													There is no current of historical data for this AUID. There are no impairments downstream of this AUID in the subwatershed. While the land use is primarily agricultural with little to no riparian buffers, there are no data to support impairments.	NA	
		ING0354_T1002	Unnamed Tributary to Little Salt Creek																													There is no current of historical data for this AUID. There is an E. coli impairment downstream of this AUID and therefore this stream is likely contributing to the downstream impairment. The land use is dominated by agricultural lands and a portion of the Town of Andersonville is in the drainage area. GMW050-0018 (2009): GM 137 cfu/100 mL. 0015 (2014): GM 656 cfu/100 mL. Results considered representative of tributaries US. Land app of CFO waste likely occurring in upper WS. Pastures also a likely source. Andersonville, IN (unsewered). Septics are a potential source.	E. coli	
		ING0354_T1003	South Fork Little Salt Creek	GMW-05-0015	T8	14T-008	Chapel Rd	###############		94.2	315	35	19.7	2419.6	10.12	52.9	NA	356	0.05	0.8	7.89	0.038	<4	441	413	692	29	12.03	0.15	4.1	2.58	In 2009 this AUID had a geomean of 136.73 MPN, with 0/5 exceeding the single sample max. In 2014 this same site was sampled (T8) and the geomean was 656.17 MPN with 8/10 samples exceeding the single sample max. The fish community IBI score for site T8 was 44 (fair) and the QHEI was 72 (excellent). The macro community mIBI score was 46 (good) and the QHEI was 66 (good). No other chemical impairments but the TSS was > 30 mg/L in July which is more than the WQ target. And there were high nitrogen levels in May and June although not in exceedence of WQ targets. There was also a LARE site (9) in 2009 on this AUID and the results indicate that this subwatershed has high sediment loads. During storm flow both sites had high TSS (>30 mg/L) and site 9 had high TP (>0.3 mg/L) and high TN (>10 mg/L). GMW050-0018 (2009): GM 137 cfu/100 mL. 0015 (2014): GM 656 cfu/100 mL. Results considered representative of tributaries US. Land app of CFO waste likely occurring in upper WS. Pastures also a likely source. Andersonville, IN (unsewered). Septics are a potential source.	E. coli	
								###############		135.6	187	26	17.6	2419.6	13.51	344.8	NA	260	0.05	4.2	8.78	0.017	<4	337	301	529	25	15.5	0.4	3	11.6			
								###############		110.6	222	26	14.1	2419.6	11.48	461.1	NA	288	0.05	8.3	8.29	0.025	5	376	349	600	25	13.66	0.15	2	7.38			
								###############		103.5	248	28	0.5	2419.6	9.42	1203	NA	288	0.05	6.9	8.18	0.037	<4	408	378	637	27	19.84	0.15	1.9	5.54			
								###############		96.4	178	26	NA	2419.6	8.43	2420	NA	223	NA	NA	8.05	NA	31	328	284	470	19	21.77	NA	NA	41.9			
								###############		99.5	NA	NA	NA	2419.6	9.21	228.2	NA	NA	NA	NA	7.98	NA	NA	NA	NA	586	NA	18.97	NA	NA	4.74			
								###############	SOME ISOLATED POOLING	61.8	NA	NA	NA	NA	5.39	NA	NA	NA	NA	NA	8.06	NA	NA	NA	NA	554	NA	21.13	NA	NA	3.07			
								###############		89.1	NA	NA	NA	2419.6	8.24	290.9	NA	NA	NA	NA	7.96	NA	NA	NA	NA	581	NA	19.05	NA	NA	4.69			
								###############		84.3	117	12	27.1	2419.6	7.41	2420	NA	128	0.05	0.6	7.78	0.212	17	228	194	312	15	21.74	0.9	7.7	49.1			
								8/4/2014 11:40		71.9	NA	NA	NA	2419.6	6.61	313	NA	NA	NA	NA	7.54	NA	NA	NA	NA	574	NA	19.33	NA	NA	6.16			
								###############		77.5	266	26	15.8	2419.6	7.89	727	NA	303	0.05	0.05	7.65	0.041	<4	362	340	612	20	14.36	0.15	3.6	3.5			
		ING0354_T1004	Unnamed Tributary to South Fork Little Salt Creek																													There is no current of historical data for this AUID. There is an E. coli impairment downstream of this AUID and therefore this stream is likely contributing to the downstream impairment. The land use is dominated by agricultural lands with forested patches. GMW050-0018 (2009): GM 137 cfu/100 mL. 0015 (2014): GM 656 cfu/100 mL. Results considered representative of tributaries US. Land app of CFO waste likely occurring in upper WS. Pastures also a likely source. Andersonville, IN (unsewered). Septics are a potential source.	E. coli	
		ING0354_T1005	Unnamed Tributary to South Fork Little Salt Creek																													There is no current of historical data for this AUID. There are no impairments downstream of this AUID in the subwatershed. The land use is primarily forested with wide riparian buffers. Few agricultural fields in the headwaters. No new data for assessment. South Fork Little Salt Creek site indicating impairment is US of its confluence with this tributary. Data are not considered representative of conditions along this reach.	NA	
Fremont Branch-Salt Creek	5.08E+10	ING0355_01	Salt Creek	GMW-05-0010	T10	14T-010	SR 229	###############		92.2	168	14	17	NA	12.33	NA	233.0347	206	0.05	3	7.86	0.124	29	303	252	436	21	3.2	0.3	3.2	26.4	The pour point of this subwatershed was sampled in 2002 and the E. coli geomean was ~73 MPN. In 2014 this same site was sampled (T10) and the geomean was 177.69 MPN with 3/10 samples exceeding the single sample max. The fish community IBI score for site T10 was 44 (fair) and the QHEI was 55 (good). The macro community mIBI score was 44 (fair) and the QHEI was 57 (good). There is a 1994 historical macroinvertebrate site upstream on this AUID and the macro score was 2.6 with QHEI of 70. This is the mainstem Salt Creek and all other subwatersheds are contributing loads. Given the higher levels of E. coli in some of the other subwatersheds this is a major factor in the elevated levels of E. coli. The geomean decreases in a downstream direction from site T7 to T10. In 2009 LARE site 15 is located at the same location as T10. The study showed there were high TP (0.41 mg/L) and high TSS (97 mg/L) during storm flows. The study identified the lower portion of this AUID as having high sediment loadings. The land use is primarily forested in the downstream portion of this AUID. Small clusters of homes exist along SR229, other than that it is fairly rural. Wide riparian buffers exist and help filter out pollutants.	E. coli	
								###############	Algae on rocks	89.5	218	18	27.3	2419.6	9.19	137.6	8.5314	243	0.05	0.2	7.67	0.044	12	319	293	497	26	14.11	0.4	4.6	16.1			
								###############		99.2	259	18	0.5	NA	12.88	NA	18.2945	250	0.05	0.4	7.89	0.016	<4	314	292	526	30	4.29	0.5	2.7	5.6			
								###############		95.2	182	18	14.8	NA	13.54	NA	46.633	195	0.05	0.7	7.95	0.027	<4	245	229	439	19	0.95	0.4	3.9	4.51			
								###############	Mostly ice covered u/s of bridge	90.8	244	16	0.5	NA	13.16	NA	41.517	221	0.05	2.1	7.85	0.012	<4	327	302	553	28	0.74	0.15	1.4	4.25			
								###############	Some algae on rocks	95.1	211	15	15.6	NA	13.01	NA	80.0253	264	0.05	2.2	8.2	0.02	5	297	274	520	25	2.35	0.15	1.4	8.31			
								###############	Some algae on rocks	117.7	177	13	15	2419.6	11.6	64.4	67.6022	216	0.05	1.3	8.19	0.019	6	272	249	466	24	16.02	0.15	2.7	13.1			
								###############		106.1	213	14	17.1	2419.6	10.56	148.3	105.8567	220	0.05	4	7.98	0.034	16	343	311	517	20	15.51	0.5	2.3	13.2			
								###############		109	216	18	10.9	2419.6	9.23	160.7	19.7914	232	0.05	1.9	7.88	0.023	13	327	295	516	22	23.58	0.4	2.4	10.8			
								###############		92.5	230	16	0.5	2419.6	7.36	435.2	17.6746	262	0.05	0.05	7.79	0.051	30	342	300	522	20	27.37	0.5	2.2	25.7			
								###############		106.3	NA	NA	NA	2419.6	8.52	52.8	NA	NA	NA	NA	7.7	NA	NA	NA	NA	510	NA	26.62	NA	NA	14			
								###############		81.6	NA	NA	NA	2419.6	7.02	410.6	NA	NA	NA	NA	7.81	NA	NA	NA	NA	424	NA	22.79	NA	NA	35.6			
								###############		84.8	224	14	10.7	2419.6	6.72	579.4	8.9014	247	0.05	0.05	7.72	0.049	27	322	284	503	18	27.22	0.3	2	20.3			
								###############		81.8	NA	NA	NA	NA	6.55	NA	NA	NA	NA	NA	7.59	NA	NA	NA	NA	464	NA	25.02	NA	NA	8.86			
								8/4/2014 12:25		97.7	NA	NA	NA	2419.6	7.78	32.4	NA	NA	NA	NA	7.77	NA	NA	NA	NA	499	NA	26.89	NA	NA	12.7			
								###############		105.6	227	17	14.9	2419.6	9.52	74.3	1.6487	269	0.05	0.05	7.78	0.027	9	314	292	530	20	20.24	0.15	2.3	11.7			
		ING0355_T1001	Harvey Branch																													In 2009 there was an E. coli only sample taken and the geomean was 199.60 MPN with 3/5 samples exceeding the single sample max. The DO was also > 12 mg/L 4/5 times (ranging from 13-18 mg/L) and the pH was > 9 SU one time. The percent saturation during the high DO samples ranged from 140-215%. The field notes stated there was excess algae in the stream. No biological data collected. This is a small headwater stream that originates in agricultural dominated lands. A small portion of the Town of Batesville is in the drainage and it then runs through the Town of Oldenburg. It is a more heavily populated area then other parts of the watershed. There is a CFO hog farm in the extreme headwaters, Roman Nobb Incorporated storm water permit and the site is located just downstream from the Oldenburg WWTP. There were no nutrient parameters collected but the nitrification of ammonia in the WWTP treatment process may be contributing to the elevated nutrient signatures we see in the sampling. This coupled with the fact that it is a small headwater stream and there is less dilution. This AUID is comprised of Harvey Branch and its HW just US from Oldenburg, IN. 0021: Located just DS of Oldenburg. GM 199 cfu/100 mL. Oldenburg is a decent sized facility (150K gpd). Suspect land app of CFO waste on ag fields US of Oldenburg. No effluent violations for E. coli. Flow from WWTP may actually be mitigating impairment. Results at this site likely representative of tributaries system US based on nearly homogenous land uses below Oldenburg	E. coli	
		ING0355_T1002	Harvey Branch	GMW-05-0012	T7	14T-007	Rail Fence Rd	###############		84.8	202	41	26.8	2419.6	9.51	31.1	NA	221	0.05	0.3	7.67	0.198	<4	353	338	571	38	10.24	0.4	6.2	3.74	This site T7 had a geomean of 489.42 MPN with 3/10 samples exceeding the single sample max. In 1997 this AUID was sampled just downstream and the biological fish IBI = 48 (good), QHEI = 80 (excellent). In 2014 the fish community IBI score for site T7 was 44 (fair) and the QHEI was 61 (good). The macro community mIBI score was 34 (poor) and the QHEI was 61 (good). From the site collected upstream in 2009 the data shows there are heavy loads of nutrients coming downstream. The data collected in 2014 did not show any nutrient exceedences. There was one sample in July where high TSS was collected (114 mg/L). In 2009 there was a LARE site (4) collected at this site. the results of that study indicate that there was low DO during base flow. However the study did not indicate this was a priority area for management. The surrounding land use is a mixture of forested and agricultural land. GM 489 cfu/100 mL. Site 0021 just below Oldenburg, IN was sampled in 2009. The higher GM at 0012, sampled in 2014 suggests that impairment persists DS. It is suspected that flow from Oldenburg may be mitigating impairment at the US site.from US. Magnitude of impairment at DS site suggests loadings from tributaries DS of Oldenburg. Suspect land app of CFO waste on ag fields US of Oldenburg. Likely pasture impacts in this area as well.	E. coli, IBC	
								###############	Some algae on rocks	145.2	156	19	18.5	1413.6	14.97	27.5	NA	202	0.05	0.6	8.74	0.021	<4	265	248	450	28	13.88	0.4	3.4	7.37			
								###############		127.5	211	21	16.2	2419.6	13.7	228.2	NA	236	0.05	1.7	8.32	0.039	<4	322	303	525	26	12.19	0.4	3.5	4.11			
								###############		110.6	198	35	12	2419.6	9.96	129.6	NA	208	0.05	0.5	8.09	0.099	<4	330	310	549	29	20.54	0.4	3.6	6.78			
								###############		93	122	60	NA	24196	8.09	6488	NA	180	NA	NA	7.89	NA	114	463	331	542	33	22.21	NA	NA	120			
								7/21/2014 9:25		83	NA	NA	NA	2419.6	7.66	110.6	NA	NA	NA	NA	7.75	NA	NA	NA	NA	453	NA	19.18	NA	NA	12.4			
								7/22/2014 9:25	ALMOST POOLED; INTERSTITIAL FLOW FARTHER UPSTREAM	54.1	NA	NA	NA	NA	4.67	NA	NA	NA	NA	NA	7.91	NA	NA	NA	NA	511	NA	21.09	NA	NA	19.9			
								7/28/2014 9:15		94	NA	NA	NA	2419.6	8.6	307.6	NA	NA	NA	NA	7.94	NA	NA	NA	NA	494	NA	19.58	NA	NA	14.7			
								###############		74.3	177	53	16.8	2419.6	6.43	613.1	NA	215	0.05	0.05	7.73	0.107	9	366	342	588	35	22.39	0.5	4.5	17.4			
								8/4/2014 9:10		59	NA	NA	NA	2419.6	5.54	207.5	NA	NA	NA	NA	7.69	NA	NA	NA	NA	543	NA	19.13	NA	NA	18.3			
								9/22/2014 9:50		62	172	53	21.6	2419.6	6.35	62.4	NA	211	0.05	0.4	7.61	0.098	8	342	320	591	34	13.79	0.5	4.4	11.1			
		ING0355_T1003	Unnamed Tributary to Harvey Branch																													There is no current or historical data for this stream. The land use is a mixture of forested and agricultural lands. This tributary is contributing to the bacteria impairment in the receiving stream and that impairment will be extrapolated to this AUID based on the similarities in land use. GM results from sites on Harvey Branch increase DS of site below Oldenburg suggesting loadings from tributaries US. Land uses along this reach are very similar to those along Harvey Branch. Results are considered representative of this tributary.	E. coli	
		ING0355_T1004	Bachelors Run																													There is no current or historical data for this stream. The land use is a mixture of forested and agricultural lands. This tributary is contributing to the bacteria impairment in the receiving stream and that impairment will be extrapolated to this AUID based on the similarities in land use. GM results from sites on Harvey Branch increase DS of site below Oldenburg suggesting loadings from tributaries in between. Land uses along this reach are very similar to those along Harvey Branch. Results are considered representative of this tributary.	E. coli	
		ING0355_T1005	Marlin Branch																													There is no current or historical data for this AUID. There is an E. coli impairment in the receiving stream. However, the geomean decreases in a downstream direction from site T7 to T10 in the recieving stream. This stream may be helping dilute the concentration of E. coli on the mainstem since its confluence is between site T7 and T10. The land use is primarily forested with wide riparian buffers. Few agricultural fields in the headwaters. 0007: 750 cfu/100 mL. 0012: 129 cfu/100 mL. Sites located on Salt Creek MS, US and DS of this tributary. MS impairment decreases in DS direction below its confluence with this tributary suggesting that this stream is not contributing to the impairment and may actually be contributing clean flow. Need more data to determine if FS. Stream will remain NA.	NA	
		ING0355_T1006	Fremont Branch																													There is no current or historical data for this AUID. There is an E. coli impairment in the receiving stream. However, the geomean decreases in a downstream direction from site T7 to T10 in the recieving stream. This stream may be helping dilute the concentration of E. coli on the mainstem since its confluence is between site T7 and T10. The land use is primarily forested with wide riparian buffers. Few agricultural fields in the headwaters. There was a LARE site (7) on this stream in 2009 and the results did not indicate there were any exceedences or WQ problems in this stream. 0007: 750 cfu/100 mL. 0012: 129 cfu/100 mL. Sites located on Salt Creek MS, US and DS of this tributary. MS impairment decreases in DS direction below its confluence with this tributary suggesting that this stream is not contributing to the impairment and may actually be contributing clean flow. Need more data to determine if FS. Stream will remain NA.	NA	
		ING0355_T1007	Dodson Branch																													There is no current or historical data for this AUID. There is an E. coli impairment in the receiving stream. However, the geomean decreases in a downstream direction from site T7 to T10 in the recieving stream. This stream may be helping dilute the concentration of E. coli on the mainstem since its confluence is between site T7 and T10. The land use is primarily forested with wide riparian buffers. Few agricultural fields in the headwaters. 0007: 750 cfu/100 mL. 0012: 129 cfu/100 mL. Sites located on Salt Creek MS, US and DS of this tributary. MS impairment decreases in DS direction below its confluence with this tributary suggesting that this stream is not contributing to the impairment and may actually be contributing clean flow. Need more data to determine if FS. Stream will remain NA.	NA	
		ING0355_T1008	Whistle Creek																													There is no current or historical data for this AUID. There is an E. coli impairment in the receiving stream. However, the geomean decreases in a downstream direction from site T7 to T10 in the recieving stream. This stream may be helping dilute the concentration of E. coli on the mainstem since its confluence is between site T7 and T10. The land use is primarily forested with wide riparian buffers. Few agricultural fields in the headwaters. 0007: 750 cfu/100 mL. 0012: 129 cfu/100 mL. Sites located on Salt Creek MS, US and DS of this tributary. MS impairment decreases in DS direction below its confluence with this tributary suggesting that this stream is not contributing to the impairment and may actually be contributing clean flow. Need more data to determine if FS. Stream will remain NA.	NA	
		ING0355_T1009	Unnamed Tributary to Salt Creek																													There is no current or historical data for this AUID. There is an E. coli impairment in the receiving stream. However, the geomean decreases in a downstream direction from site T7 to T10 in the recieving stream. This stream may be helping dilute the concentration of E. coli on the mainstem since its confluence is between site T7 and T10. The land use is primarily forested with wide riparian buffers. Few agricultural fields in the headwaters. 0007: 750 cfu/100 mL. 0012: 129 cfu/100 mL. Sites located on Salt Creek MS, US and DS of this tributary. MS impairment decreases in DS direction below its confluence with this tributary suggesting that this stream is not contributing to the impairment and may actually be contributing clean flow. Need more data to determine if FS. Stream will remain NA.	NA	
		ING0355_T1010	Unnamed Tributary to Salt Creek																													There is no current or historical data for this AUID. There is an E. coli impairment in the receiving stream. However, the geomean decreases in a downstream direction from site T7 to T10 in the recieving stream. This stream may be helping dilute the concentration of E. coli on the mainstem since its confluence is between site T7 and T10. The land use is primarily forested with wide riparian buffers. Few agricultural fields in the headwaters. 0007: 750 cfu/100 mL. 0012: 129 cfu/100 mL. Sites located on Salt Creek MS, US and DS of this tributary. MS impairment decreases in DS direction below its confluence with this tributary suggesting that this stream is not contributing to the impairment and may actually be contributing clean flow. Need more data to determine if FS. Stream will remain NA.	NA	
Headwaters Pipe Creek	5.08E+10	ING0361_02	Pipe Creek	GMW060-0027	T18	14T-018	Pipe Creek Rd	###############		40.8	184	36	37.6	2419.6	4.52	121.1	NA	187	0.05	0.05	7.33	0.065	<4	303	292	446	20	10.71	0.6	9.7	5.91	In 2009 this site was sampled for E. coli only and the geomean was 260.07 MPN with 3/5 exceeding the single sample max. In 2014 this same site (T18) was sampled. The geomean could not be calculat ed because the site went dry d uring the 5 weeks of sampling. However there were 6/7 sampling events where the results were in exceedence of the single sample max. Three of those samples were >1000 MPN. In 201 4 the fish community IBI score for site T18 was 38 (fair) and the QHEI was 50 (fair). The macro community mIBI score was 38 (fair) and the QHEI was 49 (fair). This site went dry in August and September. The DO results never went below 4 mg/L while sampling however, while there was water in the stream, the DO was 4.5-6 mg/L from July through October. These low DO levels could be putting stress on the biological communities. Based on the small drainage area and high gradient this stream going dry in the summer months is likely a natural condition. As the stream is going dry and isolated pooling occurs low dissolved oxygen levels are likely as the results indicate. GM in 2009 was 260 cfu/100 mL, No GM in 2014 because stream went dry (2/7), but results violate 10% rule indicating impairment. Individual results were pretty high. Land use is predominately ag fields throughout this catchment. CFOs in nearby WS likely land apply here. Pastures also a likely source. Sparse rural development, some newer homes. Penntown (unsewered) is also located in this catchment; Septics may be another potential source. Results likely representative of tributaries US of site.	E. coli, DO (4C)	
								4/22/2014 9:00	Algae on rocks	85.3	178	25	15.7	2419.6	8.59	1300	NA	196	0.05	0.6	7.97	0.024	8	293	276	388	27	15.03	0.5	3.8	11.9			
								5/20/2014 8:15		80	212	31	15.3	2419.6	8.1	686.7	NA	252	0.05	0.5	7.57	0.022	7	337	320	546	24	14.61	0.4	3.8	9.7			
								6/17/2014 8:15		67.5	212	37	16.7	2419.6	5.97	272.3	NA	263	0.05	0.4	7.59	0.053	14	374	340	565	20	21.32	0.6	4.7	16.2			
								7/15/2014 8:10		61.6	178	43	18.9	2419.6	5.5	1203	NA	208	0.3	0.5	7.65	0.079	14	328	300	510	17	20.92	1.3	7.3	19.2			
								7/22/2014 9:00		62.8	NA	NA	NA	2419.6	5.64	1046	NA	NA	NA	NA	7.62	NA	NA	NA	NA	462	NA	20.57	NA	NA	11.9			
								7/29/2014 8:45		61.4	NA	NA	NA	2419.6	5.99	2420	NA	NA	NA	NA	7.57	NA	NA	NA	NA	361	NA	16.51	NA	NA	42.2			
								8/4/2014 10:15	Q4 Turbidity = 64.7; DO taken again at 11:30 w/Q4 = 3.3 mg/L	30.1	NA	NA	NA	NA	2.84	NA	NA	NA	NA	NA	7.71	NA	NA	NA	NA	403	NA	17.93	NA	NA	9.61			
		ING0361_P1001																														Lake - not assessed	NA	
		ING0361_P1002	Tall Oaks Lake																													Lake - not assessed	NA	
		ING0361_T1003	Unnamed Tributary to Pipe Creek																													There is no current or historical data for this AUID. There is an E. coli impairment in the receiving stream. The land use is primarily agricultural with a few patches of forested land. There are little to no riparian buffers along the stream. The Town of Penntown is in the drainage of this tributary. Since the recieving stream goes dry during the summer months this stream likely goes dry as well. As the stream is going dry and isolated pooling occurs low dissolved oxygen levels are likely as the results indicate on the recieving stream. Results from site located on Pipe Creek are considered representative of this site. See notes for ING0361_02.	E. coli	
		ING0361_T1004	Unnamed Tributary to Pipe Creek																													There is no current or historical data for this AUID. There is an E. coli impairment in the receiving stream. The land use is mixed agricultural and forested land. There are some forested riparian buffers along the stream. Since the recieving stream goes dry during the summer months this stream likely goes dry as well. As the stream is going dry and isolated pooling occurs low dissolved oxygen levels are likely as the results indicate on the recieving stream. Results from site located on Pipe Creek are considered representative of this site. See notes for ING0361_02.	E. coli	
		ING0361_T1005	Unnamed Tributary of Pipe Creek	GMW-06-0014	T17	14T-017	St Marys Rd	###############		48.3	226	32	30	2419.6	5.33	344.8	NA	249	0.05	0.3	7.43	0.134	<4	349	333	554	26	10.91	0.6	9.2	4.48	In 2009 an E. coli only site was sampled on this AUID. The geomean was 176.66 MPN, with 2/5 samples exceeding the single sample max. In 2014 site T17 was sampled just downstream of the site in 2009 and there were 6/7 samples greater than the single sample max. The stream went dry in August and September so the geomean could not be calculated. In July the TP and TSS measured was above the WQ target of 0.3 mg/L and 30 mg/L. While these are high levels they did not co-occur with high TN, pH or low DO which would indicate a nutrient impairment. In 2014 the fish community IBI score for site T17 was 36 (fair) and the QHEI was 66 (good). The macro community mIBI score was 36 (fair) and the QHEI was 61 (good). Tall Oaks Lake is in the headwaters of this stream and is surrounded by clusters of homes. SR 101 and SR 46 both run through the subwatershed and are lined with homes. So there are some small populated pockets in the drainage. There is one CFO in the drainage. Primarily agricultural fields mixed with pockets of forested lands. 0014 (2014): No GM (site went dry) but exceeded in more than 10% of samples, indicating impairment. Results were consistently over SSM (in the 300s). GMW060-0026 (2009) just US had a GM of 176 cfu/100 mL. One CFO in the WS. Rural development along state roads and one small community, Tall Oaks Lake (unsewered); Septics are a likely source. Results considered representative of other tributaries flowing in US of site based on similar land uses and consistent exceedences.	E. coli, DO	
								4/22/2014 8:35	Algae on rocks	81.6	165	26	18.4	2419.6	8.19	488.4	NA	189	0.05	0.8	8	0.035	10	274	252	460	22	15.17	0.4	4	10.6			
								5/20/2014 8:30		83	186	26	17.4	2419.6	8.4	365.4	NA	219	0.05	1.8	7.72	0.036	8	314	292	493	22	14.73	0.5	3.7	9.63			
								6/17/2014 8:30		67.3	212	36	18	2419.6	6.03	1553	NA	227	0.05	0.9	7.59	0.068	9	354	329	559	19	20.64	0.6	4.4	16.5			
								7/15/2014 8:35		69.7	126	38	24.8	2419.6	6.27	2420	NA	166	0.2	1.3	7.66	0.343	39	312	260	422	17	20.22	1.5	8.9	46.9			
								7/22/2014 9:20	Very low flow. Stream is nearly pooled at bridge	26.7	NA	NA	NA	2419.6	2.41	172.5	NA	NA	NA	NA	7.37	NA	NA	NA	NA	523	NA	20.72	NA	NA	8.18			
								7/23/2014 9:50		31.9	NA	NA	NA	NA	2.76	NA	NA	NA	NA	NA	7.6	NA	NA	NA	NA	480	NA	21.99	NA	NA	14.6			
								7/29/2014 9:00		76.5	NA	NA	NA	2419.6	7.44	2420	NA	NA	NA	NA	7.71	NA	NA	NA	NA	356	NA	16.64	NA	NA	38.1			
		ING0361_T1005/	Unnamed Tributary to Pipe Creek																													This is a small tributary that flows into Tall Oaks Lake. There is no current or historical data to assess this tributary. Results from site GMW-06-0014 are not respresentative of this reach, which flows into a lake.	NA	

		ING0361_T1005	Unnamed Tributary to Pipe Creek																													This is a small tributary that flows into Tall Oaks Lake. There is no current or historical data to assess this tributary. Results from site GMW-06-0014 are not respresentative of this reach, which flows into a lake.	NA
		ING0361_T1005	Unnamed Tributary to Pipe Creek																													This is a small tributary that flows into Tall Oaks Lake. There is no current or historical data to assess this tributary. Results from site GMW-06-0014 are not respresentative of this reach, which flows into a lake.	NA
		ING0361_T1006	Unnamed Tributary to Pipe Creek																													There is no current or historical data for this AUID. There is an E. coli impairment in the receiving stream and that impairment will be extrapolated to this tributary based on similar land use. The land use is primarily agricultural with some forested patches. There are some forested riparian buffers along the stream. There is also a CFO hog farm in the extreme headwaters of this tributary. Results considered representative of other tributaries flowing in US of site based on similar land uses and consistent exceedances. The land use is primarily agricultural with some forested patches. There are some forested riparian buffers along the stream. There is also a CFO hog farm in the extreme headwaters of this catchment.	E. coli
		ING0361_T1006A	Unnamed Tributary to Pipe Creek																													This stream appears to be interstitial. There is no current of historical data for this site. While this stream does not continually flow into the receiving stream, based on the impairment in the receiving stream and the similar land use of this stream the E. coli impairment will be extrapolated. Results considered representative of other tributaries flowing in US of site based on similar land uses and consistent exceedances. The land use is primarily agricultural with some forested patches. There are some forested riparian buffers along the stream. There is also a CFO hog farm in the extreme headwaters of this catchment. Land app of CFO waste a potential source.	E. coli
		ING0361_T1007	Unnamed Tributary to Pipe Creek																													There is no current or historical data for this AUID. There is an E. coli impairment in the receiving stream and that impairment will be extrapolated to this tributary based on similar land use. The land use is primarily agricultural with some forested patches. There are some forested riparian buffers along the stream. There is a gravel quarry with a storm water permit in the drainage as well. Results considered representative of other tributaries flowing in US of site based on similar land uses and consistent exceedances. The land use is primarily agricultural with some forested patches. There are some forested riparian buffers along the stream. There is also a CFO hog farm located nearby. Land app of CFO waste a potential	E. coli
		ING0361_T1008	Unnamed Tributary to Pipe Creek																													There is no current or historical data for this AUID. There is an E. coli impairment in the receiving stream and that impairment will be extrapolated to this tributary based on similar land use. The land use is primarily agricultural with some forested patches. There are some forested riparian buffers along the stream. Results considered representative of other tributaries flowing in US of site based on similar land uses and consistent exceedances. The land use is primarily agricultural with some forested patches. There are some forested riparian buffers along the stream. There is also a CFO hog farm located nearby. Land app of CFO waste a potential source.	E. coli
		ING0361_T1009	Unnamed Tributary to Pipe Creek																													There is no current or historical data for this AUID. There is an E. coli impairment in the receiving stream and that impairment will be extrapolated to this tributary based on similar land use. The land use is primarily agricultural with some forested patches. There are some forested riparian buffers along the stream. Results considered representative of other tributaries flowing in US of site based on similar land uses and consistent exceedances. The land use is primarily agricultural with some forested patches. There are some forested riparian buffers along the stream. There is also a CFO hog farm located nearby. Land app of CFO waste a potential source.	E. coli
Clear Creek	5.08E+10	ING0362_02	Clear Creek	GMW-06-0013	T15	14T-015	Schwegman Rd	################		87.3	216	22	14.9	1732.9	9.51	78.9	NA	235	0.05	0.05	7.82	0.014	<4	302	290	500	21	11.47	0.15	3.1	5.89	In 2009 there was an E. coli only sample taken and the geomean was 291.17 MPN with 3/5 samples exceedi ng the single sample max. In 2014 this AUID was sampled downstream on the AUID and the geomean could not be calculated because the stream went dry in Augu st. Only 1/9 samples were above the single sample max. I n 2014 the fish community IBI score for site T15 was 46 (fair) and the QHEI was 57 (good). The macro community mIBI score was 40 (fair) and the QHEI was 59 (good). The WQ Target for TSS was exceeded one time in July but this appears to be related to a precipitation event, which indicates this stream is susceptible to large sediment loads during heavy reainfall events. The land use is primarily agriculture in the headwater portion of the stream and becomes heavily forested in the downstream portion of the subwatershed. Since the sample in 2009 was located further upstream and had higher E. coli results, the heavily forested downstream tributaries likely help dilute the concentration of pollutants. Since the 2009 samples indicated an impairment this AUID will be impaired. There is also one CFO hog farm in the drainage, a portion of Batesville, and two storm water permits (Virtus - matress pads and GE - trucking station). GMW060-0025 (2009): GM 291 cfu/100 mL. 0013 further DS was sampled in 2014; Stream went dry (1/10). Results exceeded SSM (1/9). The exceedance occurred after a rain event. All other results very low indicating event-driven; NPS is the likely source. Several CFOs in the area. Land app of CFO waste is likely. The outskirts of Batesville, IN (sewered) are located in upper WS. Some clusters of unsewered homes in the WS, though; septics still a likely source. Results likely representative of US tributaries given their similar land uses.	NA
								4/22/2014 9:55	Algae on rocks	109	174	16	11.5	1986.3	11.05	13.8	NA	202	0.05	0.2	8.41	0.018	4	260	251	454	21	14.81	0.3	3	3.76		
								5/20/2014 9:00		113.8	196	20	10.5	2419.6	11.54	67	NA	217	0.05	1.2	8.19	0.016	<4	308	293	489	25	14.72	0.4	2.9	4.21		
								6/17/2014 9:10		104.8	196	27	0.5	2419.6	9.47	77.1	NA	231	0.05	1	7.98	0.026	<4	320	311	497	21	20.31	0.3	3	5.96		
								7/15/2014 9:20		96.2	125	15	11.2	2419.6	8.6	2420	NA	162	0.05	0.9	7.96	0.16	16	288	219	346	16	20.8	0.9	5.5	86.8		
								################		100.5	NA	NA	NA	2419.6	8.76	86.2	NA	NA	NA	NA	7.85	NA	NA	NA	NA	488	NA	22.06	NA	NA	5.55		
								7/29/2014 9:50		108.2	NA	NA	NA	2419.6	10.43	56.3	NA	NA	NA	NA	8.05	NA	NA	NA	NA	462	NA	17.03	NA	NA	4.43		
								################	Q6 = 5.3	110.7	NA	NA	NA	NA	10.07	NA	NA	NA	NA	NA	8.36	NA	NA	NA	NA	451	NA	18.38	NA	NA	2.61		
								8/5/2014 9:40		63.3	NA	NA	NA	2419.6	5.77	8.5	NA	NA	NA	NA	7.62	NA	NA	NA	NA	500	NA	19.7	NA	NA	5.73		
								9/23/2014 8:40		78.8	219	21	14.8	1732.9	8.73	15.5	NA	250	0.05	0.05	7.7	0.017	<4	307	280	520	20	10.69	0.15	2.3	3.32		
		ING0362_02A	Unnamed Tributary to Clear Creek																													There is no current or historical data for the tributary. This appears to be a small interstittial tributary that likely goes dry in the hot summer months. Although indexed as a separate, disconnected waterbody, areal photos clearly show that this stream connects to ING0362_02 and should be reindexed as such. In the meantime, the assessment of ING0362_02 will be applied to this reach.	E. coli
		ING0362_T1002	Unnamed Tributary to Clear Creek																													Results collected in 2009 indicate MS impairment; GM 291 cfu/100 mL. Results are considered representative of tributaries US based on similar land uses.	E. coli
		ING0362_T1003	Unnamed Tributary to Clear Creek																													The receiving stream has an E. coli impairment and that impairment will be extrapolated to this tributary based on similar land use and because it is contributing to the impairment. There is no other current or historical data for the tributary. Results for sites located on Clear Creek DS of its confluence with this reach are considered respresentative based on similar land uses. See notes for ING0362_02.	E. coli
		ING0362_T1004	Unnamed Tributary to Clear Creek																													The receiving stream has an E. coli impairment and that impairment will be extrapolated to this tributary based on similar land use and because it is contributing to the impairment. There is no other current or historical data for the tributary. Results for sites located on Clear Creek DS of its confluence with this reach are considered respresentative based on similar land uses. See notes for ING0362_02.	E. coli
		ING0362_T1005	Unnamed Tributary to Clear Creek																													There is no other current or historical data for the tributary. This tributary is located between the site in 2009 which showed an impairment and site T15 which was sampled in 2014 showing that there was not an impairment. Therefore it is likely diluting the pollutants as they travel downstream. No extrapolation of the impairment is warranted for this tributary. The landuse for this tributary is heavily forested with some agriculture in the	NA
		ING0362_T1006	Unnamed Tributary to Clear Creek																													There is no other current or historical data for the tributary. This tributary is located between the site in 2009 which showed an impairment and site T15 which was sampled in 2014 showing that there was not an impairment. Therefore it is likely diluting the pollutants as they travel downstream. No extrapolation of the impairment is warranted for this tributary. The landuse for this tributary is heavily forested with some agriculture in the	NA
Duck Creek	5.08E+10	ING0363_01	Duck Creek																													This AUID was sampled for macroivertebrates in 1994 and the score was 2.4, QHEI = 48. Based on the E. coli impairment on the receiving stream this AUID may be contributing to that impairment and the impairment will be extrapolated to cover all tributaries to Duck Creek. E. coli results collected from MS reach immediately DS and are representative of this reach. No GM. Stream went dry (3/10). However, results exceeded the SSM, w/two exceeding 12,000 cfu/100 mL. High flow when flowing at all. High gradient, rocky streams. Forested throughout most of WS. One CFO on WS boundary but few ag fields. Town of Bloomingrove, IN (unsewered) located US. No readily apparent sources. NPS likely. Land uses similar throughout WS, ag fields in upper WS and forest in lower half. Results extrpolated to entire WS.	E. coli
		ING0363_02	Duck Creek	GMW-06-0019	T12	14T-012	US 52	################		112.6	249	8.9	16.6	1732.9	11.71	17.3	NA	240	0.05	0.3	7.94	0.012	<4	311	294	508	25	13.53	0.15	2.8	3.6	This AUID was sampled in 2002 and the geomean was 62.46 MPN. In 2014 this AUID was sampled further downstream at site T12 and there were 2/7 samples that exceeded the single sample max. Both of those samples had extremely high levels of E. coli (>12000 MPN). This stream went dry during the summer months and the geomean was not able to be collected, nor were the biological communities. Field staff also observed that just downstream of site T12 the Whitewater Canal aquaduct crosses over the stream and it was leaking. It was noted that large amounts of sediment were entering the stream through the aquaduct. Two times during the 2014 sampling the TP target was exceeded (0.569 and 0.309 mg/L) and the TSS target was exceeded (768 and 286 mg/L). There was no other supporting data to determine if there is a nutrient problem but the data results indicate high levels of TP and extrememly high levels of sediment entering the stream during rain events. T12 is located at the pou point of the subwatershed in the Town of Metamora before it enters the Whitewater River. There may be some urban influences since the site is located in a populated area. Based on the extremely high levels of E. coli entering the stream and the lack of data upstream to pinpoint the bacteria sources, the E. coli impairment will be extrapolated to all contributing tributaries. The subwatershed is predominantly forested with wide riparian buffers along the stream. The landscape is high gradient with steep hillsides. Agriculture becomes dominant in the headwaters, there is one CFO that is partially in the drainage, the Town of Metamora and the Town of Blooming Grove are in the drainage. SR 1 goes through the subwatershed and there are small clusters of homes along the highway. The E. coli impairment from 2007 on ING0363_T1008 gives further reason to impair all tributaries to Duck Creek. ING0363_T1008 has a forested drainage area with no point sources and it is still impaired. No GM. Stream went dry (3/10). However, results exceeded the SSM, w/two exceeding 12,000 cfu/100 mL. High flow when flowing at all. High gradient, rocky streams. Forested throughout most of WS. One CFO on WS boundary but few ag fields. Town of Bloomingrove, IN (unsewered) located US. No readily apparent sources. NPS likely. Land uses similar throughout WS, ag fields in upper WS and forest in lower half. Results extrpolated to entire WS.	E. coli
								################		128.9	199	10	0.5	547.5	12.61	31.8	NA	245	0.05	0.7	8.51	0.012	<4	288	270	488	25	16.35	0.15	1.9	9.62		
								################		105.5	255	9.8	14.1	1986.3	10.31	43.5	NA	299	0.05	1.4	8.11	0.037	4	345	329	543	22	16.45	0.3	1.7	6.5		
								################		118.3	239	11	0.5	2419.6	10.39	125.9	NA	268	0.05	1.2	8.09	0.015	4	329	309	520	24	21.67	0.15	1	5.01		
								################		93.1	119	<5	0.5	24196	7.87	12997	NA	190	0.05	0.4	7.8	0.569	768	1010	215	291	12	23.69	2	5.8	1000		
								################	Stream nearly pooled and very low flow	132.5	NA	NA	NA	2419.6	11.16	160.7	NA	NA	NA	NA	8.01	NA	NA	NA	NA	465	NA	24.02	NA	NA	15.8		
								################	Muddy	91.8	104	16	12.1	24196	7.29	12997	NA	159	0.1	0.5	7.26	0.308	286	512	237	318	15	23.57	1.2	5.1	511		
		ING0363_T1001	Unnamed Tributary to Duck Creek																													There is no current or historical data for this AUID. Based on the E. coli impairment on the receiving stream this AUID may be contributing to that impairment and the impairment will be extrapolated to cover all tributaries to Duck Creek. E. coli results site located on Duck Creek MS consdidered representative of entire WS based on similar land uses throughout.	E. coli
		ING0363_T1002	Unnamed Tributary to Duck Creek																													There is no current or historical data for this AUID. Based on the E. coli impairment on the receiving stream this AUID may be contributing to that impairment and the impairment will be extrapolated to cover all tributaries to Duck Creek. E. coli results site located on Duck Creek MS consdidered representative of entire WS based on similar land uses throughout.	E. coli
		ING0363_T1003	Unnamed Tributary to Duck Creek																													There is no current or historical data for this AUID. Based on the E. coli impairment on the receiving stream this AUID may be contributing to that impairment and the impairment will be extrapolated to cover all tributaries to Duck Creek. E. coli results site located on Duck Creek MS consdidered representative of entire WS based on similar land uses throughout.	E. coli
		ING0363_T1004	Unnamed Tributary to Duck Creek																													There is no current or historical data for this AUID. Based on the E. coli impairment on the receiving stream this AUID may be contributing to that impairment and the impairment will be extrapolated to cover all tributaries to Duck Creek. E. coli results site located on Duck Creek MS consdidered representative of entire WS based on similar land uses throughout.	E. coli
		ING0363_T1005	Unnamed Tributary to Duck Creek																													There is no current or historical data for this AUID. Based on the E. coli impairment on the receiving stream this AUID may be contributing to that impairment and the impairment will be extrapolated to cover all tributaries to Duck Creek. E. coli results site located on Duck Creek MS consdidered representative of entire WS based on similar land uses throughout.	E. coli
		ING0363_T1006	Unnamed Tributary to Duck Creek																													There is no current or historical data for this AUID. Based on the E. coli impairment on the receiving stream this AUID may be contributing to that impairment and the impairment will be extrapolated to cover all tributaries to Duck Creek. E. coli results site located on Duck Creek MS consdidered representative of entire WS based on similar land uses throughout.	E. coli
		ING0363_T1007	Unnamed Tributary to Duck Creek																													There is no current or historical data for this AUID. Based on the E. coli impairment on the receiving stream this AUID may be contributing to that impairment and the impairment will be extrapolated to cover all tributaries to Duck Creek. E. coli results site located on Duck Creek MS consdidered representative of entire WS based on similar land uses throughout.	E. coli
		ING0363_T1008	Jim Run																													This tributary is currently listed as impaired for E. coli. In 2007 this AUID was sampled and the geomean was 165.38 MPN, with 2/5 samples exceeding the single sample max. In 2007 the TP exceeded the WQ target of 0.3 mg/L 1/3 times. The biology was also sampled in 2007 and the fish IBI = 38, QHEI = 63 and the macro mIBI = 46, QHEI = 71. Based on the E. coli impairment on the receiving stream this AUID may be contributing to that impairment. There is no new data to prove this tributary has improved and warrants a delisting. Site will remain impaired for E. coli. E. coli results site located on Duck Creek MS consdidered representative of entire WS based on similar land uses throughout.	E. coli
		ING0363_T1009	Unnamed Tributary to Duck Creek																													There is no current or historical data for this AUID. Based on the E. coli impairment on the receiving stream this AUID may be contributing to that impairment and the impairment will be extrapolated to cover all tributaries to Duck Creek. E. coli results site located on Duck Creek MS consdidered representative of entire WS based on similar land uses throughout.	E. coli
		ING0363_T1010	Little Duck Creek																													There is no current or historical data for this AUID. Based on the E. coli impairment on the receiving stream this AUID may be contributing to that impairment and the impairment will be extrapolated to cover all tributaries to Duck Creek. E. coli results site located on Duck Creek MS consdidered	E. coli
Walnut Fork-Pipe Creek	5.08E+10	ING0364_01	Pipe Creek	GMW-06-0020	T16	14T-016	St Marys Rd	################		84.1	228	32	19	980.4	9.38	47.3	NA	226	0.05	0.05	7.74	0.031	<4	345	338	555	27	10.42	0.4	4.9	3.51	This stream is currently impaired for E. coli based on historical samples collected in 2007 and the geomean was 167.57 MPN with 2/5 in exceedence of the single sample maximum. In 2014 the E. coli geomean was 365.49 MPN with 3/10 samples exceeding the single sample max. Results from upstream site T17 indicate there are high levels of E. coli flowing into the subwatershed there is still a good percentage of agricultural lands, two CFO hog farms and the Town of St. Marys that could be impacting the stream. Forested land exists aound the streams as you work downstream and eventually becomes predominant. There was also one DO reading from 2007 <4 mg/L. In 2002, the fish IBI score was 52 (good) and the QHEI was 57 (good). In 2007, the fish IBI score was 48 (good) and the QHEI was 78 (excellent) and the macro mIBI score was 42 (fair) and the QHEI was 79 (excellent). In 2014, the fish IBI score was 48 (good) and the QHEI was 66 (good) and the macro mIBI score was 42 (fair) and the QHEI was 55 (good). GM 365 cfu/100 mL. Two CFO hog farms in upper drainage w/high percentage of ag fields and pasture. Land app of CFO waste and pastures a likely source. St. Marys, IN (unsewered) also located US of site. Septics a potential source. Tributaries US are likely contributing loads.	E. coli
								4/22/2014 9:30	Algae on rocks	106	161	19	19.8	2419.6	10.53	50.4	NA	188	0.05	0.2	8.36	0.019	5	251	235	440	24	15.62	0.3	3.9	4.84		
								5/20/2014 8:45		107	188	22	10.6	2419.6	10.8	167	NA	219	0.05	0.6	8.07	0.036	4	292	276	476	24	14.91	0.3	3.6	4.86		
								6/17/2014 8:50		82.3	189	33	11.9	2419.6	7.31	155.3	NA	231	0.05	0.05	7.81	0.03	4	322	295	507	20	21.09	0.4	4.2	6.48		
								7/15/2014 8:55		90.4	150	20	17.5	2419.6	8.08	2420	NA	176	0.05	0.6	7.92	0.188	29	279	238	399	16	20.68	0.9	6.2	39.9		
								7/22/2014 9:40		90.3	NA	NA	NA	2419.6	8.02	106.7	NA	NA	NA	NA	7.77	NA	NA	NA	NA	505	NA	21.17	NA	NA	5.41		
								7/29/2014 9:30		98.1	NA	NA	NA	2419.6	9.55	488.4	NA	NA	NA	NA	7.95	NA	NA	NA	NA	443	NA	16.55	NA	NA	13.7		
								################	Q6 TURB = 5.3	119.9	NA	NA	NA	NA	10.44	NA	NA	NA	NA	NA	8.54	NA	NA	NA	NA	474	NA	20.51	NA	NA	2.61		
								8/12/2014 8:40		73.1	208	25	20.5	2419.6	6.98	328.2	NA	243	0.05	0.2	7.52	0.032	19	325	293	590	24	21.2	0.4	3.8	7.93		
								8/5/2014 9:20	Very low flow	81.3	NA	NA	NA	2419.6	7.39	157.6	NA	NA	NA	NA	7.7	NA	NA	NA	NA	530	NA	19.91	NA	NA	7.94		
								9/23/2014 8:20		62.7	221	28	15.8	2419.6	6.7	67.7	NA	276	0.05	0.05	7.43	0.017	4	335	317	600	23	12.34	0.15	3.6	4.5		
		ING0364_02	Pipe Creek	GMW-06-0015	T14	14T-014	Silver Creek Rd	################		93.8	147	16	19.2	NA	10.16	NA	104.6673	175	0.05	1.4	7.72	0.104	12	253	226	390	18	3.04	0.4	3.9	21.1	In 1994 macroinvertebrates were sampled on this stream and the score was 3.4 with QHEI of 68 (good). In 2002 E. coli was sampled at this site and the geomean was 94.76 MPN. This AUID was sampled (T14) at the pour point of the subwatershed in 2014 and the geomean was 136.81 MPN with 1/10 samples exceeding the single sample max. The E. coli data suggest the high levels of E. coli are driven by rainfall events, as it only exceeded the single sample max one time and it occurred when the TSS was also elevated. The data from other sites tells us there are elevated levels flowing into the stream from upstream, the Headwaters Pipe Creek subwatershed and the Walnut Fork tributary. The land use is almost entirely forested surrounding this AUID and the E. coli geomean was only slightly elevated. There are no obvious point or nonpoint sources that suggest the other tributaries are contributing to the impairment so these AUID results will not be extrapolated to other unsampled tributaries. I n 2014, the fish IBI score was 46 (good) and the QHEI was 58 (good) and the macro mIBI score was 40 (fair) and the QHEI was 43 (fair). This site located in lower part of WS where land use is largely forested. One sample exceeded suggesting event driven NPS. Impairment from US site decreases DS. This, along with very low GM at DS site suggests tributaries in between are FS.	E. coli
								################		55.4	188	20	26.8	2419.6	5.83	71.7	2.2267	173	0.05	0.05	7.46	0.04	16	299	275	460	25	13.05	0.5	6.3	23.2		
								################	Stream pooled at bridge. Algae on rocks	91.4	235	17	0.5	NA	11.62	NA	6.204	264	0.05	0.1	7.84	0.014	<4	306	286	526	27	5.11	0.15	3.3	11.1		
								################		99.3	222	20	10.9	NA	13.85	NA	13.92	245	0.05	0.2	7.89	0.014	<4	294	274	555	26	3.62	0.15	2.6	5.34		
								################	Nearly ice covered. No discharge measured.	92.8	240	23	10.5	NA	13.49	NA	NA	259	0.05	1.3	7.96	0.006	<4	333	310	603	33	0.13	0.15	1.8	3.76		
								################		98.4	193	21	16	NA	13.16	NA	34.5345	247	0.05	3	8.31	0.034	6	288	266	508	27	3.24	0.15	2.4	10.7		
								################	Algae on rocks	100.7	170	14	16.1	1986.3	9.88	30.9	28.6134	188	0.05	0.2	8.11	0.041	16	269	251	450	26	16.25	0.15	3	17.3		
								5/20/2014 9:40		92.8	207	16	16.8	2419.6	9.17	218.7	26.229	222	0.05	0.6	7.85	0.019	17	315	286	494	25	15.86	0.4	2.9	18.6		
								6/17/2014 9:45		76.2	205	23	16.7	2419.6	6.48	146.7	4.788	230	0.05	0.9	7.61	0.06	17	340	318	519	21	23.32	0.5	3.9	18.9		
								7/15/2014 9:50		71.3	191	15	0.5	2419.6	5.98	1414	32.3843	214	0.05	0.1	7.73	0.082	28	301	261	455	24	24.02	0.6	3.2	28.9		
								################		76.1	NA	NA	NA	2419.6	6.42	59.4	NA	NA	NA	NA	7.47	NA	NA	NA	NA	413	NA	23.86	NA	NA	18.4		
								################		63.1	NA	NA	NA	2419.6	5.65	172.2	NA	NA	NA	NA	7.66	NA	NA	NA	NA	440	NA	20.64	NA	NA	28.3		
								################	Water appearance also had a sheen	55	NA	NA	NA	NA	4.4	NA	NA	NA	NA	NA	7.32	NA	NA	NA	NA	445	NA	24.87	NA	NA	10.3		
								8/12/2014 9:40		45.4	209	16	19.9	2419.6	3.77	68.9	1.4351	229	0.05	0.05	7.34	0.059	37	304	266	479	17	23.86	0.5	3.1	21.1		
								8/5/2014 10:10		71.7	NA	NA	NA	2419.6	6.12	48.1	NA	NA	NA	NA	7.58	NA	NA	NA	NA	475	NA	23.2	NA	NA	18.8		
								9/23/2014 9:15		61.5	190	15	16.1	2419.6	6.14	41.4	0.3092	211	0.05	0.05	7.53	0.035	21	277	250	449	13	15.45	0.5	4	26.9		
		ING0364_T1001	Unnamed Tributary to Pipe Creek																													There are no current of historical data for this tributary. Based on similar land use and an E. coli impairment in the receiving stream the impairment will be extended to cover this tributary. This stream has primarily agricultural practices surrounding it. Little to no riparian buffers. Magnitude of impairment on Pipe Creek MS along with similar land uses suggest tributaries US of site are impaired. Two CFO hog farms in upper drainage w/high percentage of ag fields and pasture. Land app of CFO waste and pastures a likely source. St. Marys, IN (unsewered) also located US of site. Septics a	E. coli
		ING0364_T1002	Russell Branch																													There are no current of historical data for this tributary. Based on similar land use and an E. coli impairment in the receiving stream the impairment will be extended to cover this tributary. This stream has a good percentage covered by forested land however the headwaters are still dominated by agricultural lands. Magnitude of impairment on Pipe Creek MS along with similar land uses suggest tributaries US of site are impaired. Two CFO hog farms in upper drainage w/high percentage of ag fields and pasture. Land app of CFO waste and pastures a likely source. St. Marys, IN	E. coli
		ING0364_T1003	Walnut Fork	GMW-06-0006	P10	INRB14-044	Walnut Fork Road	################		126.2	200	6.2	5	NA	10.81	NA	NA	240	0.05	0.038	8.14	0.025	2	270	250	446	25	23	0.32	NA	6.24	This stream is currently impaired for E. coli based on a sample from 2007. The E. coli in 2007 had a geomean of 141.05 MPN with 2/5 samples exceeding the single sample max. In 2014, the geomean was 156.6 with 1/5 samples exceeding the single sample max. This tributary will remain impaired for E. coli. In 2014, the fish IBI score was 40 (fair) and the QHEI was 55 (good) and the macro mIBI score was 46 (good) and the QHEI was 51 (fair). The land use is dominated by forested lands. Wide forested riparian buffers along steep sloping terrain. There are a few agricultural fields in the extreme headwaters and a small portion of the Town of Peppertown is within the drainage. Previously assessed as impaired for E. coli. Recent data from Pipe Creek MS DS of its confluence with this reach suggests impairment persists.	E. coli
								################	Q6 Turbidity = 14.8	86.3	220	12	5	NA	7.96	NA	NA	250	0.05	0.88	8	0.025	7	270	270	526	20	17.79	0.15	2.2	5		
								################		109.1	NA	NA	NA	NA	9.14	NA	NA	NA	NA	NA	7.95	NA	NA	NA	NA	512	NA	24.06	NA	NA	7.21		
								################		96.7	NA	NA	NA	24196	8.59	4106	NA	NA	NA	NA	7.96	NA	NA	NA	NA	372	NA	21.07	NA	NA	81.6		
								################		114.2	NA	NA	NA	2419.6	9.97	28.2	NA	NA	NA	NA	8.03	NA	NA	NA	NA	510	NA	22.04	NA	NA	3.07		
								################		108.9	NA	NA	NA	2419.6	9.95	93.3	NA	NA	NA	NA	8.19	NA	NA	NA	NA	471	NA	19.62	NA	NA	4.14		
								8/4/2014 12:25		96.7	NA	NA	NA	2419.6	8.89	45	NA	NA	NA	NA	8.03	NA	NA	NA	NA	499	NA	19.28	NA	NA	5.14		
								8/6/2014 12:45		75.1	NA	NA	NA	2419.6	6.45	193.7	NA	NA	NA	NA	7.72	NA	NA	NA	NA	479	NA	22.43	NA	NA	1.65		
								################		107.2	NA	NA	NA	NA	9.26	NA	NA	NA	NA	NA	8.14	NA	NA	NA	NA	461	NA	22.59	NA	NA	5.08		
								9/9/2014 13:20		128.1	240	6.5	5	NA	11.92	NA	NA	270	0.05	0.078	7.95	0.025	2	310	300	537	23	18.8	0.15	1.2	2.95		
		ING0364_T1004	Indian Creek																													There is no current of historical data for this tributary. The receiving stream is impaired for E. coli however there is no information available that suggests this tributary if contributing to the impairment. The land use is almost entirely forested with wide riparian buffers protecting the stream from pollutants. MS Pipe Creek impairment decreases from US site to DS stie. This, along with very low GM at DS site suggests tributaries in between may be contributing clean flow. Another MS site in between that was sampled in 2009 showed very high E. coli results, which would seem to support the idea of mitigating effects from tributaries. However one tributrary (Walnut Fork) with very similar land uses and which flows into Pipe Creek between the two MS sites sampled in 2014 is known to be impaired. More data is needed to assess remaining tributaries in this WS.	NA
		ING0364_T1005	Deer Creek																													There is no current of historical data for this tributary. The receiving stream is impaired for E. coli however there is no information available that suggests this tributary if contributing to the impairment. The land use is almost entirely forested with wide riparian buffers protecting the stream from pollutants. MS Pipe Creek impairment decreases from US site to DS stie. This, along with very low GM at DS site suggests tributaries in between may be contributing clean flow. Another MS site in between that was sampled in 2009 showed very high E. coli results, which would seem to support the idea of mitigating effects from tributaries. However one tributrary (Walnut Fork) with very similar land uses and which flows into Pipe Creek between the two MS sites sampled in 2014 is known to be impaired. More data is needed to assess remaining tributaries in this WS.	NA
		ING0364_T1006	Trace Branch																													There is no current of historical data for this tributary. The receiving stream is impaired for E. coli however there is no information available that suggests this tributary if contributing to the impairment. The land use is almost entirely forested with wide riparian buffers protecting the stream from pollutants. There is a junk yard in this drainage area and they hold a stormwater permit. MS Pipe Creek impairment decreases from US site to DS stie. This, along with very low GM at DS site suggests tributaries in between may be contributing clean flow. Another MS site in between that was sampled in 2009 showed very high E. coli results, which would seem to support the idea of mitigating effects from tributaries. However one tributrary (Walnut Fork) with very similar land uses and which flows into Pipe Creek between the two MS sites sampled in 2014 is known to be impaired. More data is needed to assess remaining tributaries in this WS.	NA

		ING0364_T1007	Unnamed Tributary to Pipe Creek																													There is no current of historical data for this tributary. The receiving stream is impaired for E. coli however there is no information available that suggests this tributary if contributing to the impairment. The land use is almost entirely forested with wide riparian buffers protecting the stream from pollutants. MS Pipe Creek impairment decreases from US site to DS stie. This, along with very low GM at DS site suggests tributaries in between may be contributing clean flow. Another MS site in between that was sampled in 2009 showed very high E. coli results, which would seem to support the idea of mitigating effects from tributaries. However one tributary (Walnut Fork) with very similar land uses and which flows into Pipe Creek between the two MS sites sampled in 2014 is known to be impaired. More data is needed to assess remaining tributaries in this WS.	NA
		ING0364_T1008	Silver Creek																													There is no current of historical data for this tributary. The receiving stream is impaired for E. coli however there is no information available that suggests this tributary if contributing to the impairment. The land use is almost entirely forested with wide riparian buffers protecting the stream from pollutants. MS Pipe Creek impairment decreases from US site to DS stie. This, along with very low GM at DS site suggests tributaries in between may be contributing clean flow. Another MS site in between that was sampled in 2009 showed very high E. coli results, which would seem to support the idea of mitigating effects from tributaries. However one tributary (Walnut Fork) with very similar land uses and which flows into Pipe Creek between the two MS sites sampled in 2014 is known to be impaired. More data is needed to assess remaining tributaries in this WS.	NA
Yellow Bank Creek-Whitewater River	5.08E+10	ING0365_01	Whitewater River	GMW-06-0012	T19	14T-019	St Marys Rd	################		93.7	180	18	17.9	NA	12.39	NA	NA	199	0.05	3.3	8.03	0.222	76	357	265	460	20	3.6	0.6	3.6	64.5	There are four sites located on the mainstem in this subwatershed. The stream is currently impaired for PCBs. This AUID was sampled in 2002 and the fish IBI = 54, QHEI = 77 and macro score = 5.2, QHEI = 77. Working downstream there was another site sampled in 2002 and the fish IBI = 50, QHEI = 75 and the macro score = 6, QHEI = 75. Continuing downstream there were another two sites sampled at the same location. The site in 1997 had a fish IBI = 50, QHEI = 81 and in 2002 the fish IBI = 52, QHEI = 77 and macro score = 6, QHEI = 77. Even further downstream there were two sites sampled in 2007 and the fish IBI = 50, 52 QHEI = 78,85 and macro mIBI = 44, 42 QHEI = 58, 75. In 1994 there was another site sampled very close to site T19 and the macro score was 4, QHEI = 87. In 2007 there was a site sampled for E. coli and the geomean was 43.28 MPN, 66.29 MPN. In 1994 there was another site sampled very close to site T19 and the macro score was 4, QHEI = 87. In 2014 there were four sites sampled along this AUID. Entering the mainstem are Salt Creek(T10) = 177.69 , West Fork Whitewater River (T11) = 81.42 MPN , Duck Creek (T12) = >12000 MPN during rain events , and Pipe Creek (T14) = 136.81 MPN.Working in a downstream direction the 2014 E. coli results are P9 = 121.35 MPN, P5 = 124.85 MPN, P3 = 117.51 MPN, and T19 = 91.55 MPN. 2014 biological community scores working in a downstream direction are P9 fish IBI 54, QHEI = 80 and macro mIBI = 44, QHEI = 71, P5 fish IBI = 54, QHEI = 82 and macro mIBI = 42, QHEI = 70, P3 fish IBI = 48 QHEI = 71 and macro mIBI = 4 QHEI = 64, T19 fish IBI = 54, QHEI = 78 and macro mIBI = 36, QHEI = 69Land use is dominated by steep forested land mixed with small pockets of agriculture. Most of your agricultural lands are in the extreme headwater areas or in the flood plain where the land flattens out. This mainstem flows from Metamora to Brookville. It is mostly forested and rural in between the two Towns but there could be some urban impacts downstream towards Brookville given the amount of impervious surface.	PCB
								################		95.4	257	22	11.1	1986.3	10.01	95.8	NA	296	0.05	1.6	7.91	0.009	5	369	347	587	27	13.15	0.15	2.2	5.74		
								################		114.9	265	23	0.5	NA	13.9	NA	NA	302	0.05	1.6	8.24	0.009	<4	343	321	640	32	6.98	0.3	1.5	2.25		
								################		101.4	257	25	14.6	NA	13.6	NA	NA	286	0.05	1.8	8.09	0.015	<4	339	318	619	28	3.06	0.15	2.1	2.95		
								################		99.1	284	22	0.5	NA	13.5	NA	NA	269	0.05	2.9	8.22	0.016	<4	386	358	667	33	2.5	0.15	1	4.97		
								################		100	257	21	13.4	NA	12.62	NA	NA	298	0.05	3	8.34	0.038	10	364	332	690	30	5.39	0.15	1.5	13.2		
								################		113.6	245	19	14.6	727	11.1	17.3	NA	261	0.05	2.4	8.34	0.019	9	358	325	587	28	16.4	0.15	1.8	9.21		
								################		93.7	257	19	15.2	2419.6	9.29	172.3	NA	288	0.05	3.8	8.07	0.049	40	415	357	592	25	15.7	0.4	1.8	25.2		
								################		107.4	232	21	10.3	2419.6	9.28	59.1	NA	287	0.05	2.5	8.01	0.029	15	363	325	560	25	22.54	0.4	1.8	9.48		
								################		103.9	222	18	0.5	2419.6	8.77	547.5	NA	299	0.05	1.8	8.05	0.068	52	384	311	524	28	22.68	0.5	2.6	42.2		
								################		100.2	NA	NA	NA	2419.6	8.48	22.6	NA	NA	NA	NA	7.91	NA	NA	NA	NA	570	NA	23.64	NA	NA	11.1		
								################		98.2	NA	NA	NA	2419.6	9.05	23.8	NA	NA	NA	NA	7.97	NA	NA	NA	NA	598	NA	19.2	NA	NA	13.4		
								################		91.5	243	20	13.6	24196	7.93	686.7	NA	279	0.05	1.8	7.94	0.054	58	408	334	578	28	22.41	0.6	1.9	49.2		
								################		97.5	NA	NA	NA	NA	8.11	NA	NA	NA	NA	NA	8.1	NA	NA	NA	NA	540	NA	22.83	NA	NA	12.3		
								8/5/2014 11:15		97.4	NA	NA	NA	2419.6	8.38	31.8	NA	NA	NA	NA	7.94	NA	NA	NA	NA	594	NA	22.72	NA	NA	10.7		
								################		120.3	238	22	14.2	1986.3	11.61	48.7	NA	311	0.05	1.5	7.99	0.012	5	364	336	579	26	17.06	0.15	1.7	6		
				GMW-06-0002	P3	INRB14-016	St. Mary Road	################		99.1	190	14	16	NA	8.29	NA	NA	270	0.05	3.1	8.07	0.26	140	420	270	474	19	24.33	0.48	NA	123		
								################		94.1	190	16	8	NA	7.95	NA	NA	270	0.05	4.1	8.15	0.25	100	140	290	531	18	23.65	0.57	3.2	113		
								7/1/2014 10:44	O6 Turb = 17.1	99.8	NA	NA	NA	NA	8.57	NA	NA	NA	NA	NA	8.19	NA	NA	NA	NA	590	NA	23.06	NA	NA	17		
								################		118.7	NA	NA	NA	2419.6	10.13	727	NA	NA	NA	NA	8.15	NA	NA	NA	NA	528	NA	23.21	NA	NA	22.9		
								################		132	NA	NA	NA	2419.6	11.16	9.8	NA	NA	NA	NA	8.11	NA	NA	NA	NA	550	NA	23.77	NA	NA	4.54		
								################		109.2	NA	NA	NA	2419.6	9.77	44.8	NA	NA	NA	NA	8.12	NA	NA	NA	NA	590	NA	20.77	NA	NA	9.06		
								8/4/2014 13:00		119.3	NA	NA	NA	2419.6	10.17	17.1	NA	NA	NA	NA	8.09	NA	NA	NA	NA	602	NA	23.27	NA	NA	6.94		
								8/5/2014 11:00	O4 turbidity = 9.43	96.2	NA	NA	NA	NA	8.18	NA	NA	NA	NA	NA	7.81	NA	NA	NA	NA	554	NA	22.61	NA	NA	6.57		
								################		88.7	NA	NA	NA	24196	7.42	4106	NA	NA	NA	NA	7.96	NA	NA	NA	NA	484	NA	24.14	NA	NA	189		
								9/9/2014 10:10		134.6	220	20	7	NA	12.53	NA	NA	300	0.05	1.5	8.07	0.025	4	320	300	585	25	18.82	0.15	1.4	3.64		
				GMW-06-0004	P5	INRB14-031	Silver Creek Road	################		93.5	170	15	22	NA	8.54	NA	NA	300	0.1	3.4	7.96	0.25	140	480	290	506	19	19.73	1.1	NA	105		
								################		100.2	220	17	5	NA	8.36	NA	NA	330	0.05	4.4	8.1	0.15	50	380	320	577	20	24.37	0.62	2.7	37.2		
								################		108.8	NA	NA	NA	19863	9.63	727	NA	NA	NA	NA	8.12	NA	NA	NA	NA	554	NA	21.29	NA	NA	43.6		
								################		116.4	NA	NA	NA	2419.6	10.07	34.5	NA	NA	NA	NA	8.08	NA	NA	NA	NA	584	NA	22.58	NA	NA	5.73		
								################		107.5	NA	NA	NA	2419.6	10.12	46.4	NA	NA	NA	NA	8.1	NA	NA	NA	NA	609	NA	18.29	NA	NA	9.33		
								################		113.5	NA	NA	NA	NA	10.12	NA	NA	NA	NA	NA	7.7	NA	NA	NA	NA	565	NA	20.23	NA	NA	5.11		
								################		142.4	NA	NA	NA	NA	11.72	NA	NA	NA	NA	NA	8.17	NA	NA	NA	NA	548	NA	23.27	NA	NA	5.11		
								8/5/2014 11:05		100.9	NA	NA	NA	2419.6	8.94	50.4	NA	NA	NA	NA	8	NA	NA	NA	NA	617	NA	21.27	NA	NA	8.63		
								################		99.5	NA	NA	NA	2419.6	8.46	517.2	NA	NA	NA	NA	8.04	NA	NA	NA	NA	612	NA	21.46	NA	NA	49.4		
								################		131.9	250	24	5	NA	12.49	NA	NA	300	0.05	1.9	8.34	0.025	2	340	340	506.2	26	17.03	0.15	17	3.16		
				GMW-06-0005	P9	INRB14-042	Pennington Road	################		92.8	190	15	14	NA	8.6	NA	NA	290	0.15	3.5	7.95	0.25	130	400	280	505	19	18.99	1.3	NA	123		
								################		94.5	200	16	10	NA	8.04	NA	NA	310	0.05	4.1	7.98	0.27	130	420	290	551	19	23.4	0.82	3.1	92.2		
								################		108	NA	NA	NA	2419.6	9.66	488.4	NA	NA	NA	NA	8.12	NA	NA	NA	NA	574	NA	20.8	NA	NA	26.6		
								################		117.8	NA	NA	NA	2419.6	10.22	46.4	NA	NA	NA	NA	8.1	NA	NA	NA	NA	415	NA	22.31	NA	NA	7.91		
								################		106	NA	NA	NA	2419.6	10	35.9	NA	NA	NA	NA	7.94	NA	NA	NA	NA	578	NA	18.04	NA	NA	5.77		
								################		106	NA	NA	NA	NA	10	NA	NA	NA	NA	NA	7.94	NA	NA	NA	NA	578	NA	18.04	NA	NA	5.77		
								################		108.6	NA	NA	NA	NA	10.25	NA	NA	NA	NA	NA	8.1	NA	NA	NA	NA	621	NA	18.06	NA	NA	9.03		
								8/5/2014 11:25		101.6	NA	NA	NA	2419.6	9.02	42	NA	NA	NA	NA	7.98	NA	NA	NA	NA	618	NA	21.17	NA	NA	11.1		
								################		95.3	NA	NA	NA	24196	8.47	770.1	NA	NA	NA	NA	8.07	NA	NA	NA	NA	630	NA	20.9	NA	NA	36		
								################		175	240	22	5	NA	15.52	NA	NA	280	0.05	1.8	8.42	0.025	2	310	310	544	26	20.09	0.15	19	2.09		
		ING0362_01 ING0365_02	Whitewater Canal	GMW-06-0022	T13	14T-013	Park Ave at Whitewater Canal State Historic Site	################		97.4	260	23	17.5	2419.6	10	156.5	NA	320	0.05	1.7	8.06	0.073	62	436	353	596	29	14.07	0.5	2.8	71.3	Both these AUIDs are on the Whitewater canal. The canal does not follow normal drainage patterns so a small portion of the canal flows throgh the Duck Creek subwatershed. The canal at one point is raised via an aquduct and flows over Duck Creek. This aquaduct was seen leaking into Duck Creek containing heavy loads of sediment. The Whitewater canal begins in Laurel Indiana where a low head dam pumps water from the river into the canal. The canal is currently impaired for E. coli based on a sample collected in 2002 with a geomean of 478.93 MPN. In 2014 the E. coli geomean was 1062.58 MPN with 5/10 samples exceeding the single sample max. In 2014, the fish IBI score was 16 (very poor) and the QHEI was 25 (very poor) and the macro mIBI score was 36 (fair) and the QHEI was 24 (very poor). The TP target was exceeded one time in July with a 0.5 mg/L result. The TSS target was exceeded 6/7 times with the highest concentration at 380 mg/L. High levels of sediment in the water can negatively impact biological communties. The very poor habitat indicated by the QHEIs is also contributing to poor biological communities. The canal flows through the Town of Metemora and it is also used to power a grain mill in Metemora. The canal does not fit the natural drainage of most watersheds so it is difficult to determine drainage area and contributing nonpoint sources. Previously impaired based on data collected in 2002. Recent data indicates impairment persists. GM 1063 cfu/100 mL. Canal starts in Laurel, IN (sewered) where there is a lowhead dam that may be restricting fish movement. No buffer. Knee deep muck. Possibly tile drains draining ag land but no readily apparent source. NPS likely.	E. coli, IBC, (PCB for ING0362_01 only)
								################		77.2	200	48	35.2	1553.1	6.78	49.6	NA	254	0.05	0.05	7.98	0.23	29	381	340	606	17	21.64	1.2	7.6	40.6		
								################		112	256	19	11.1	2419.6	10.73	209.8	NA	295	0.05	4.6	8.17	0.09	42	442	378	604	24	17.4	0.5	2.2	53.4		
								################		106	235	22	0.5	2419.6	9.05	365.4	NA	258	0.05	2.8	8.15	0.056	65	435	354	573	28	23.19	0.5	1.3	70.6		
								################		89.4	104	5.8	0.5	24196	7.35	9804	NA	141	0.7	1.5	7.55	0.584	380	822	324	268	8.8	25.16	1.3	4.9	1000		
								################		129.4	NA	NA	NA	2419.6	10.87	172.5	NA	NA	NA	NA	8.18	NA	NA	NA	NA	557	NA	23.97	NA	NA	51.4		
								################		106.2	NA	NA	NA	2419.6	9.25	1300	NA	NA	NA	NA	8.19	NA	NA	NA	NA	624	NA	22.06	NA	NA	72.2		
								################		86.2	139	19	11	24196	7.18	1553	NA	178	0.2	1	7.78	0.233	186	475	263	350	25	24.51	0.9	3.9	388		
								8/4/2014 13:00		103.3	NA	NA	NA	NA	8.5	NA	NA	NA	NA	NA	8.13	NA	NA	NA	NA	560	NA	23.87	NA	NA	44.7		
								8/4/2014 13:05		112.4	NA	NA	NA	2419.6	9.48	396.8	NA	NA	NA	NA	8.12	NA	NA	NA	NA	604	NA	23.87	NA	NA	74		
								################		113.4	240	23	15.9	2419.6	10.46	225.4	NA	283	0.05	1.8	8.14	0.058	56	404	330	585	32	19.23	0.5	1.9	63.9		
		ING0365_T1001	Unnamed Tributary to Whitewater River																													There is no current or historical data for this tributary. There is only a PCB impairment in the receiving stream. No data to assess and no impairment downstream to extrapolate to this tributary. Dominantly forested land use, very rural with steep forested terrain. Some areas of agriculture closer to the mainstem where it begins to flatten out.	NA
		ING0365_T1002	Snail Creek																													There is no current or historical data for this tributary. There is only a PCB impairment in the receiving stream. No data to assess and no impairment downstream to extrapolate to this tributary. Dominantly forested land use, very rural with steep forested terrain.	NA
		ING0365_T1003	McCartys Run	GMW-06-0003	P4	INRB14-024	St. Mary Road	################		99	210	8.3	7	NA	8.78	NA	NA	260	0.05	0.087	8.08	0.025	11	330	290	462	24	21.2	0.15	NA	25.1	In 2014 the E. coli geomean was 1031.54 MPN with 4/5 samples exceeding the single sample max . In 2014, the fish IBI score was 22 (very poor) and the QHEI was 67 (good) and the macro mIBI score was 38 (fair) and the QHEI was 63 (poor). This is a small headwater stream with steep forested terrain. The site is surrounded by wide forested riparian buffers. There are small clusters of homes in the drainage area. GM 1,031 cfu/100 mL. Site located in extreme HW. Mostly forested with a cluster of homes. Results suggest septics are most likely source (all results high suggesting consistent loads.	E. coli, IBC
								6/2/2014 14:45		84.1	250	8.7	5	NA	7.4	NA	NA	280	0.05	0.18	8.19	0.056	15	320	310	506	19	20.93	0.15	3.8	43.2		
								################		94	NA	NA	NA	NA	8.27	NA	NA	NA	NA	NA	7.98	NA	NA	NA	NA	553	NA	21.4	NA	NA	20.4		
								################		57.7	NA	NA	NA	24196	8.5	17329	NA	NA	NA	NA	8.05	NA	NA	NA	NA	433	NA	20.54	NA	NA	68.3		
								################		101.3	NA	NA	NA	2419.6	9.3	355.5	NA	NA	NA	NA	8.18	NA	NA	NA	NA	554	NA	19.41	NA	NA	10.2		
								################		98.1	NA	NA	NA	2419.6	9.2	517.2	NA	NA	NA	NA	8.15	NA	NA	NA	NA	560	NA	18.4	NA	NA	12.7		
								8/4/2014 12:45		102.5	NA	NA	NA	2419.6	9.51	151.5	NA	NA	NA	NA	8.19	NA	NA	NA	NA	532	NA	18.88	NA	NA	12.1		
								8/5/2014 12:10		70.6	NA	NA	NA	NA	6.78	NA	NA	NA	NA	NA	8.06	NA	NA	NA	NA	493	NA	19.58	NA	NA	53.6		
								################		97.2	NA	NA	NA	2419.6	8.61	2420	NA	NA	NA	NA	8.17	NA	NA	NA	NA	490	NA	21.29	NA	NA	23.8		
								9/9/2014 11:40		115.3	230	15	5	NA	11.4	NA	NA	270	0.05	0.87	8.12	0.025	6	340	310	565	30	15.9	0.15	2.1	9.3		
		ING0365_T1004	Butlers Run																													There is no current of historical data for this tributary. It does flow near the Town of Brookville so there may be some urban impacts to the stream. There is no impairment in the receiving stream therefore there is no reason to assume this tributary is contributing to a downstream impairment.	NA
		ING0365_T1005	Unnamed Tributary to Whitewater Canal																													There is no current of historical data for this tributary. The receiving stream is the Whitewater canal which has an E. coli and IBC impairment. This stream is a natural stream surrounded entirely by forested land. There is no indication that this tributary is contributing to the canal impairment.	NA
		ING0365_T1006	Unnamed Tributary to Whitewater Canal																													There is no current of historical data for this tributary. The receiving stream is the Whitewater canal which has an E. coli and IBC impairment. This stream is a natural stream surrounded entirely by forested land. There is no indication that this tributary is contributing to the canal impairment.	NA
		ING0365_T1007	Goose Creek																													There is no current of historical data for this tributary.	NA
		ING0365_T1008	Yellow Bank Creek																													There is no current of historical data for this tributary.	NA
		ING0365_T1009	Unnamed Tributary to Whitewater Canal																													There is no current of historical data for this tributary.	NA
Headwaters Blue Creek	5.08E+10	ING0381_01	Blue Creek	GMW-08-0001	P2	INRB14-012	County Line Road	5/13/2014 7:10		38.6	130	50	41	NA	3.63	NA	NA	170	0.05	0.17	7.2	0.23	18	360	330	503	17	18.49	0.7	14	566	Site P2 was sampled in 2014 and had a geomean of 366.17 MPN. The site exceeded the single sample maximum 4/5 times. The dissolved oxygen was consistently low from May - Sept. The DO was < 4 mg/L 10/10 times. Biological communities scored the following: fish IBI = 32 (poor) QHEI = 62 (good) and macro mIBI = 28 (poor) QHEI = 46 (fair). The TP was high 2/3 times but it was not in exceedence of WQ targets. The habitat to support a healthy biological community exists within the stream however the lack of oxygen does not support healthy communities. Site T23 is located just downstream of the confluence with East Fork Blue Creek and the geomean was 253 MPN. When looking at site T23 being the combination of sites P2 and T24 these numbers suggest that higher levels of E. coli are coming from this stream and being diluted as the East Fork Blue Creek joins Blue Creek. This is a small headwater stream surrounded by agricultural land uses. Little to no riparian buffers. A beaver dam was noted at this site as well as piles of trash in the stream. This stream had low DO across all flow regimes therefore while it is small stream the DO problem is likely not flow driven. There a some clusters of homes (Lawrenceville) that could be contributing to the problem as well as agricultural practices and manure management.	E. coli, DO, IBC
								6/2/2014 13:00		35.7	NA	NA	NA	NA	3.82	NA	NA	NA	NA	NA	7.46	NA	NA	NA	NA	544	NA	20.17	NA	NA	147		
								6/24/2014 8:20		24.7	200	42	5	NA	2.18	NA	NA	280	0.05	0.3	7.3	0.11	2	440	360	630	21	21.44	0.62	4.7	4.44		
								################		19	NA	NA	NA	2419.6	1.68	2420	NA	NA	NA	NA	7.35	NA	NA	NA	NA	655	NA	20.44	NA	NA	12.5		
								################		35.3	NA	NA	NA	14136	3.31	344.8	NA	NA	NA	NA	7.34	NA	NA	NA	NA	691	NA	17.78	NA	NA	6.95		
								################		27.5	NA	NA	NA	2419.6	2.54	285.1	NA	NA	NA	NA	7.41	NA	NA	NA	NA	686	NA	18.5	NA	NA	4.31		
								8/4/2014 11:00		26.4	NA	NA	NA	2419.6	2.48	111.2	NA	NA	NA	NA	7.34	NA	NA	NA	NA	715	NA	17.25	NA	NA	4.72		
								################		23.9	NA	NA	NA	2419.6	2.57	248.9	NA	NA	NA	NA	7.39	NA	NA	NA	NA	695	NA	20.39	NA	NA	2.8		
								9/8/2014 10:30		27.5	190	37	28	NA	2.6	NA	NA	220	0.12	0.005	7.3	0.23	17	310	250	519	11	16.79	0.93	7.7	6.82		
								################	X located in stream behind beaver dam - impounded	6.8	NA	NA	NA	NA	0.62	NA	NA	NA	NA	NA	7.51	NA	NA	NA	NA	671	NA	14.64	NA	NA	131		
		ING0381_02	East Fork Blue Creek	GMW-08-0022	T24	14T-024	Blue Creek Rd	################		91.8	244	30	15.5	648.8	9.8	27.5	NA	309	0.05	0.05	7.48	0.016	<4	443	422	629	62	12.39	0.15	2.9	3.11	In 2009 this stream was sampled for E. coli only and the geomean wa s 85.78 MPN. In 2014 this stream was sampled at the same location and the geomean was 93.64 MPN and 2/10 samples exceeded the single sample maximum. Biological communities scored the following: fish IBI = 40 (fair) QHEI = 64 (good) and macro mIBI = 40 (fair) QHEI = 64 (good). There are no other chemisty parameters of concern. There is one CFO hog farm in the drainage and the Town of Saint Peter. The headwaters of the stream are primarily agriculture but the majority of the stream reach has a wide riparian buffer surrounding them helping to filter out pollutants.	FS
								################	Algae on rocks	142.2	161	19	18.4	2419.6	13.23	15.6	NA	206	0.05	0.4	8.79	0.019	<4	276	261	448	35	18.75	0.3	3.1	5.8		
								################		99.7	198	23	15.7	2419.6	10.15	313	NA	247	0.05	1.9	8.08	0.02	<4	341	313	530	32	14.56	0.3	2.9	5.66		
								################		158	200	31	10.9	2419.6	13.49	79.4	NA	251	0.05	0.7	8.22	0.037	<4	353	330	526	31	22.91	0.4	3.1	5.52		
								################		115.6	169	18	23.7	2419.6	10.04	1733	NA	194	0.05	0.6	7.98	0.099	9	294	269	438	26	21.88	0.5	5.9	15.9		
								################		127.1	NA	NA	NA	2419.6	10.47	78.4	NA	NA	NA	NA	7.76	NA	NA	NA	NA	544	NA	25.03	NA	NA	4.75		
								################	In-stream algae mats observed	114.8	NA	NA	NA	2419.6	10.51	152.9	NA	NA	NA	NA	7.69	NA	NA	NA	NA	552	NA	19.55	NA	NA	8.54		
								7/29/2014 9:40	O6 TURB = 8.8	82.8	NA	NA	NA	NA	7.8	NA	NA	NA	NA	NA	7.86	NA	NA	NA	NA	545	NA	16.82	NA	NA	4.16		
								################	Not much flow, but not stagnant	97.1	257	29	18.9	2419.6	8.3	10.9	NA	294	0.05	0.05	7.71	0.052	14	394	367	609	28	23.05	0.5	2.6	19.5		
								8/5/2014 11:55	Very low flow. Stream nearly pooled at bridge	97	NA	NA	NA	2419.6	8.38	31.8	NA	NA	NA	NA	7.67	NA	NA	NA	NA	632	NA	22.51	NA	NA	5.29		
								################		97.4	277	29	12.6	0.5	9.93	8.5	NA	362	0.05	0.05	7.56	0.024	<4	441	418	693	52	14.35	0.15	2.1	3.86		
		ING0381_T1001	Unnamed Tributary to Blue Creek																													There was no data collected on this stream. The land use is primarily agriculture with some patches of forested areas. The data collected on the mainstem is not similar enough to this stream to extrapolate any impairments.	NA
		ING0381_T1002	Unnamed Tributary to Blue Creek																													There was no data collected on this stream and based on the good water quality of the receiving stream, no impairment can be extrapolated to this stream. This stream does include runoff from the Town of saint Peter and agricultural lands but there is no indication of WQ violations.	NA
		ING0381_T1003	Unnamed Tributary to East Fork Blue Creek																													There was no data collected on this stream and based on the good water quality of the receiving stream, no impairment can be extrapolated to this stream. This stream does include runoff from the Town of saint Peter and agricultural lands but there is no indication of WQ violations.	NA
		ING0381_T1004	Unnamed Tributary to East Fork Blue Creek																													There was no data collected on this stream and based on the good water quality of the receiving stream, no impairment can be extrapolated to this stream. This stream is mostly forested land with little agricultural lands in the outskirts but there is no indication of WQ violations.	NA
Wolf Creek-Blue Creek	5.08E+10	ING0382_01	Blue Creek	GMW-08-0014	T23	14T-023	Blue Creek Rd	################		95.2	136	16	20.4	NA	12.41	NA	25.0566	161	0.05	1.4	7.99	0.126	6	253	229	376	21	4.19	0.3	4.9	22	This site is located in the upper most part of the subwatershed where Blue Creek and East Fork Blue Creek join, so it is a better representation of the entire headwaters Blue Creek subwatershed even though its location is within the Wolf Creek subwatershed. The mainstem Blue Creek is currently impaired for E. coli. A 2007 probabilistic site was sampled downstream of site T22 and had a geomean of 23.97 MPN. Site T23 had a geomean in 2009 of 30.79 MPN and the geomean collected at the same site in 2014 was 253.44 MPN. The biological communities at the site downstream (GMW080-0026) sampled in 2007 had a fish IBI = 48 (good) QHEI = 78 (excellent) and macro mIBI = 34 (poor) QHEI = 71 (excellent). In 2014 the biological community at site T23 was fish IBI = 42 (good) QHEI = 56 (good) and macro mIBI = 36 (fair) QHEI = 58 (good). The site had DO readings in July and August near 4 mg/L but not below. The field notes recorded that there was pooling and very low flow, which is likely a natural condition during hot, dry summer months. These low DO readings could negatively impact the biological communities. This site has a wide riparian forested buffer with agricultural practices farther out. The higher levels of E. coli can be traced back to Blue Creek. The results from this site are diluted by the East Fork Blue Creek contribution. No obvious point sources. The steeper terrain makes NPS runoff more of an issue during rainfall. Site T22 is located at the pour point of the subwatershed. The geomean from a sample taken at this site in 2002 was 515.19 MPN which is what caused the initial impairment. Shouldn't the sample collected in 2007 detected this AUID for E. coli? There was no biological community sampled at this site in 2002. In 2014, the geomean at site T22 was 418.71 MPN with 3/10 samples in exceedence of the single sample maximum. The biological community at site T22 was fish IBI = 48 (good) QHEI = 52 (good) and macro mIBI = 34 (poor) QHEI = 64 (good). All chemistry results are within WQS and targets. While both T23 and T22 are located on the same AUID site T22 represents the condition of the Headwaters Blue Creek subwatershed. This is why the sample results from site T22 were used in the IBC impairment.	E. coli, IBC
								################		85.2	227	29	0.5	2419.6	9.13	1120	0.4231	253	0.05	0.05	7.66	0.017	<4	389	373	583	48	12.21	0.15	2.9	3.63		
								################	Algae on rocks	111.5	250	23	0.5	NA	14.18	NA	1.3412	287	0.05	0.1	8.16	0.02	<4	341	326	627	41	5.1	0.15	2.2	1.93		
								################	Algae on rocks	106.9	232	25	0.5	NA	15.04	NA	3.461	257	0.05	0.4	8.29	0.018	<4	323	308	590	34	1.31	0.15	2.3	3.53		
								################	Mostly ice covered. Flow not measured.	94.3	236	25	0.5	NA	13.73	NA	NA	262	0.05	1.4	8.15	0.018	<4	343	320	612	39	0.09	0.15	1.5	2		
								################		111.7	185	22	15.6	NA	14.26	NA	9.6578	220	0.05	1.1	8.65	0.029	<4	296	281	505	32	4.94	0.15	2.8	8.25		
								################		135.7	165	17	14.6	613.1	12.33	27.9	8.4882	210	0.05	0.1	8.8	0.015	4	267	251	441	33	19.99	0.3	3.1	6.04		
								################		118	201	20	11.6	2419.6	11.72	79.4	6.302	243	0.05	0.9	8.31	0.022	<4	327	308	501	30	15.63	0.15	3.2	2.63		
								################		133	197	29	12	1986.3	11.22	98.8	1.0097	227	0.05	0.2	8.18	0.029	<4	332	317	520	29	23.77	0.15	3	2.43		
								################		107	163	15	19.8	2419.6	9.28	2420	3.8006	188	0.05	0.4	8.14	0.076	23	291	255	421	25	22.38	0.5	6	23.7		
								################		103.4	NA	NA	NA	2419.6	8.64	147	NA	NA	NA	NA	7.82	NA	NA	NA	NA	510	NA	24.49	NA	NA	4.82		
								################	O6 TURB = 8.8	102.6	NA	NA	NA	NA	9.16	NA	NA	NA	NA	NA	8.27	NA	NA	NA	NA	500	NA	19.38	NA	NA	3.14		
								################		112	NA	NA	NA	2419.6	10.26	48.2	NA	NA	NA	NA	7.99	NA	NA	NA	NA	525	NA	19.54	NA	NA	9.98		
								################		91.5	207	24	13.7	2419.6	7.94	727	0.5613	235	0.05	0.1	7.95	0.025	99	403	302	520	28	22.33	0.3	2.7	7.96		
								8/5/2014 12:10	Very low flow. Stream nearly pooled at bridge	49.2	NA	NA	NA	2419.6	4.33	83.9	NA	NA	NA	NA	7.36	NA	NA	NA	NA	546	NA	21.77	NA	NA	2.93		
								################	Very low flow	44.5	223	24	13.7	727	4.44	6.3	0.0575	284	0.05	0.2	7.37	0.026	<4	353	332	570	39	15.38	0.15	2.3	4.77		
				GMW080-0003	T22	14T-022	Highland Center Rd	################	The water level was too high to measure flow	94.6	157	14	15.8	NA	12.39	NA	NA	179	0.05	1.9	7.84	0.118	6	265	243	413	23	4.03	0.15	3.8	17.2		
								################		72.7	222	19	0.5	2419.6	7.66	60.5	1.0674	235	0.05	0.05	7.54	0.016	<4	345	326	521	36	13.02	0.15	2.6	6.5		
								################	Algae on rocks	110.4	233	18	0.5	NA	13.65	NA	2.7191	273	0.05	0.6	7.79	0.016	<4	319	301	595	37	6.19	0.15	1.9	3.59		
								################	Algae on rocks	103.2	224	22	0.5	NA	14.17	NA	6.859	246	0.05	0.9	7.93	0.012	<4	317	301	582	34	2.17	0.15	1.5	3.05		
								################	Partially ice covered u/s and d/s of bridge	97.4	238	20	10.8	NA	14.03	NA	7.2041	270	0.05	1.7	8.07	0.009	6	339	286	612	38	0.39	0.15	1.2	2.38		
								################	Fish observed	112	200	19	15.1	NA	14.37	NA	17.4725	235	0.05	1.5	8.19	0.028	<4	304	286	637	33	4.74	0.15	2.2	7.81		
								################	Algae on rocks	131.4	186	15	13.1	547.5	12.29	29.5	13.6448	203	0.05	0.5	8.22	0.016	5	293	273	484	35	18.52	0.4	2.4	5.14		
								################		95.8	202	16	0.5	2419.6	9.48	275.5	11.4093	243	0.05	0.8	7.83	0.018	8	310	289	503	30	15.81	0.3	2.7	6.77		
								################		104.6	203	20	14.4	2419.6	8.83	93.3	2.2014	221	0.05	0.4	7.55	0.061	4	328	308	512	27	23.78	0.15	2.2	6.55		
								################		114.3	178	16	0.5	2419.6	9.73	2420	9.6814	212	0.05	0.6	7.91	0.054	14	297	269	451	29	23.23	0.5	5.1	22.7		
								################		94.3	NA	NA	NA	2419.6	7.73	113.7	NA	NA	NA	NA	7.42	NA	NA	NA	NA	519	NA	25.33	NA	NA	6.4		
								################		93.4	NA	NA	NA	2419.6	8.5	193.5	NA	NA	NA	NA	7.6	NA	NA	NA	NA	517	NA	19.88	NA	NA	9.08		
								################	O6 TURB = 9.4	111.1	NA	NA	NA	NA	9.51	NA	NA	NA	NA	NA	7.95	NA	NA	NA	NA	487	NA	21.67	NA	NA	6.29		
								################		68.7	219	16	14.3	2419.6	5.95	186	1.0211	240	0.05	0.1	7.43	0.032	6	310	291	517	27	22.48	0.3	2.3	13.2		
								8/5/2014 12:40	Very low flow	74.1	NA	NA	NA	2419.6	6.48	1300	NA	NA	NA	NA	7.31	NA	NA	NA	NA	547	NA	21.86	NA	NA	7.66		
								################		59.8	239	17	14.6	2419.6	6.09	156.5	0.566	290	0.05	0.1	7.27	0.028	5	337	319	514	29	14.41	0.15	2.2	10.1		
		ING0382_02	Wolf Creek	GMW-08-0026	T21	14T-021	Blue Creek Rd	################		83.4	219	18	12	1119.9	8.77	9.7	NA	246	0.05	0.05	7.6	0.02	<4	326	314	529	35	13	0.15	2.3	3.44	There is no historical data collected on this stream. It is currently impaired for E. coli based on the site sampled on the Blue Creek in 2002. Since that time the stream reaches have been resegmented. The site, T21, located on this stream had a geomean of 255.39 MPN, having only exceeded the single sample maximum 2/10 times. The biological community at site T21 was fish IBI = 38 (fair) QHEI = 64 (good) and macro mIBI = 36 (poor) QHEI = 62 (good). All chemical parameters are within the WQS and targets. The Town of Oak Forest is in the headwaters of the stream. The landuse is predominately agriculture in the headwaters but becomes mostly forested along the majority of the stream.	E. coli
								################		124.3	171	15	0.5	2419.6	11.25	12.2	NA	199	0.05	0.05	8.48	0.01	<4	273	257	454	37	20.12	0.15	2.4	5.42		
								################		112.7	213	14	15.7	2419.6	11.26	98.7	NA	251	0.05	0.4	8.13	0.017	<4	304	290	504	33	15.41	0.15	2	2		
								################		66	219	18	11.1	1986.3	5.8	172.3	NA	257	0.05	0.3	7.5	0.024	<4	343	330	537	33	20.49	0.15	1.6	3.54		
								################		98.6	183	14	0.5	2419.6	8.59	1120	NA	206	0.05	0.2	7.99	0.05	9	285	266	446	27	22.14	0.4	5.3	8.59		
								################		104	NA	NA	NA	2419.6	9.01	196.8	NA	NA	NA	NA	7.71	NA	NA	NA	NA	521	NA	22.39	NA	NA	2.85		
								################		107.4	NA	NA	NA	NA	8.83	NA	NA	NA	NA	NA	7.85	NA	NA	NA	NA	499	NA	23.71	NA	NA	1.3		
								################		100.8	NA	NA	NA	2419.6	9.42	165.8	NA	NA	NA	NA	7.79	NA	NA	NA	NA	498	NA	18.64	NA	NA	3.86		
								################		91.7	212	14	0.5	2419.6	8.16	328.2	NA	241	0.05	0.1	7.63	0.035	12	311	288	506	32	21.11	0.15	1.7	3.83		
								8/5/2014 12:30	Very low flow	94.3	NA	NA	NA	2419.6	8.52	90.6	NA	NA	NA	NA	7.52	NA	NA	NA	NA	549	NA	20.16	NA	NA	3.5		
								################		73.7	242	15	0.5	2419.6	7.69	18.1	NA	262	0.05	0.05	7.43	0.016	<4	339	327	566	31	13.32	0.15	1.6	2.45		
		ING0382_T1001	Unnamed Tributary to Blue Creek																													There was no data collected on this stream. The stream has steeper terrain but the majority of the landuse is forested. The Town of Klemmes Corner runoff into this stream which may contribute to NPS pollution. There is also one CFO hog farm located in the drainage area. Given the forested land that should filter pollutants there is no reason to extrapolate any impairments to this stream.	NA

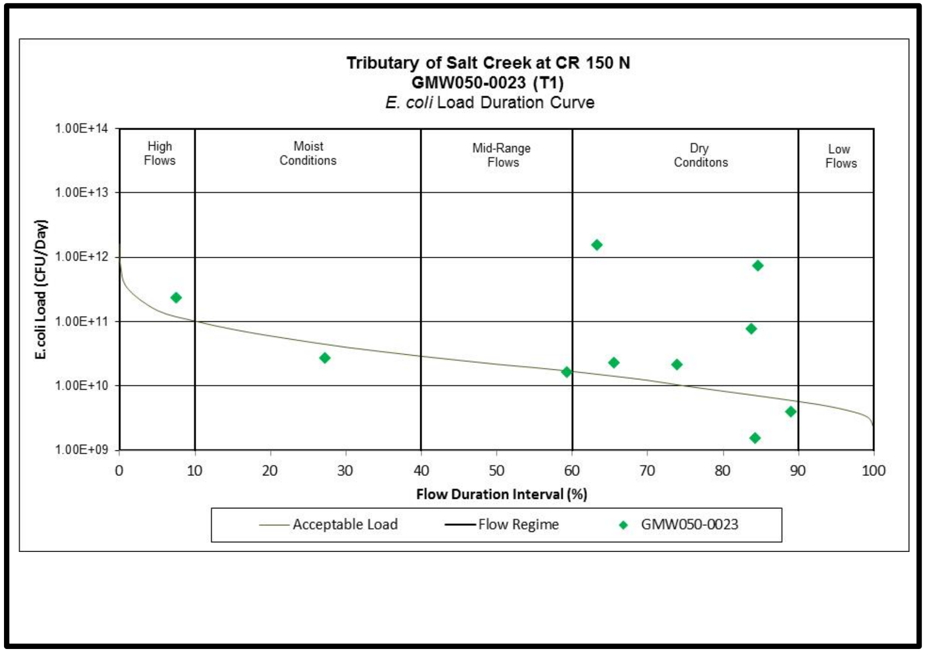
		ING0382_T1002	Unnamed Tributary to Blue Creek																													There was no data collected from this stream. The stream has steeper terrain but the majority of the landuse is forested. Given the forested land that should filter pollutants there is no reason to extrapolate any impairments to this stream.	NA	
		ING0382_T1003	Neukam Branch																													There was no data collected from this stream. The stream has steeper terrain but the majority of the landuse is forested. Given the forested land that should filter pollutants there is no reason to extrapolate any impairments to this stream.	NA	
		ING0382_T1004	Unnamed Tributary to Blue Creek																													There was no data collected from this stream. The stream has steeper terrain but the majority of the landuse is forested. Given the forested land that should filter pollutants there is no reason to extrapolate any impairments to this stream.	NA	
		ING0382_T1005	Land Acres Branch																													No data was collected from this stream. This tributary is unlike the others, as it is primarily agriculture with little to no forested riparian areas. There are no point sources or populated areas although it could be potential for agricultural runoff and nutrient loadings. However given the good water quality of Wolf Creek there is no evidence to suggest any impairments on this tributary.	NA	
		ING0382_T1006	Unnamed Tributary to Wolf Creek																													There was no data collected from this stream. The stream has steeper terrain but the majority of the landuse is forested. Given the forested land that should filter pollutants there is no reason to extrapolate any impairments to this stream.	NA	
		ING0382_T1007	Unnamed Tributary to Wolf Creek																													There was no data collected from this stream. The stream has steeper terrain but the majority of the landuse is forested. Given the forested land that should filter pollutants there is no reason to extrapolate any impairments to this stream.	NA	
		ING0382_T1008	Unnamed Tributary to Wolf Creek																													There was no data collected from this stream. The stream has steeper terrain but the majority of the landuse is forested. Given the forested land that should filter pollutants there is no reason to extrapolate any impairments to this stream.	NA	
		ING0382_T1009	Unnamed Tributary to Wolf Creek																													There was no data collected from this stream. The stream has steeper terrain but the majority of the landuse is forested. Given the forested land that should filter pollutants there is no reason to extrapolate any impairments to this stream.	NA	
Big Cedar Creek	5.08E+10	ING0383_01	Big Cedar Creek	GMW-08-0024	T27	14T-027	Big Cedar Rd	###############		75.6	309	30	10.5	1986.3	8.72	104.6	NA	342	0.05	0.05	7.72	0.036	<4	453	430	692	43	8.95	0.3	3.9	5.96	In 2014 this stream was sampled and the E. coli geomean was 140.74 MPN and 4/8 samples were in exceedence of the single sample maximum. In 2009, this stream was sampled farther upstream and the geomean was 1060.20MPN. In addition, there were high levels of nutrients in 2014 from April - June although the levels were not above th e WQ target. Biological communities scored the following: fish IBI = 40 (fair) QHEI = 68 (good) and macro mIBI = 42 (fair) QHEI = 58 (good). This stream drains primarily agricultural landuse with small patches of forested areas. There are good forested riparian areas around portions of the stream.	E. coli	
								4/23/2014 9:50	Algae on rocks	110.4	209	18	12.6	2419.6	12.37	225.4	NA	269	0.05	5.3	8.56	0.013	<4	329	303	534	21	10.21	0.4	2.4	4.44			
								5/21/2014 9:25		105	234	19	16.3	2419.6	10.27	1120	NA	295	0.05	8.4	8.24	0.035	6	389	356	578	19	16.42	0.4	2	5.85			
								6/18/2014 9:15		98	250	21	11.9	2419.6	8.62	1553	NA	302	0.05	7.7	8.19	0.07	5	408	374	597	18	21.66	0.15	2.3	7.26			
								7/16/2014 9:12		97.3	245	20	20.4	2419.6	9.36	1733	NA	331	0.05	2.7	8.13	0.141	7	391	349	561	28	17.13	0.4	4.1	11.2			
								###############		91.6	NA	NA	NA	2419.6	8.08	275.5	NA	NA	NA	NA	7.89	NA	NA	NA	NA	578	NA	21.45	NA	NA	5.58			
								###############	O6 TURB = 2.3 NTU	123.3	NA	NA	NA	NA	10.68	NA	NA	NA	NA	NA	8.8	NA	NA	NA	NA	504	NA	20.89	NA	NA	3.15			
								7/30/2014 9:55		107.5	NA	NA	NA	2419.6	10.16	201.4	NA	NA	NA	NA	8.11	NA	NA	NA	NA	556	NA	17.97	NA	NA	4.2			
								8/13/2014 9:15		64.6	229	17	18.4	2419.6	5.87	43.5	NA	292	0.05	0.05	7.84	0.065	11	344	315	534	32	20	0.6	3.9	12.6			
								8/6/2014 9:40	Very low flow. Flow through rocks is just a trickle	76.9	NA	NA	NA	2419.6	6.88	13.2	NA	NA	NA	NA	7.85	NA	NA	NA	NA	537	NA	20.73	NA	NA	7.81			
		ING0383_02	Big Cedar Creek	GMW-08-0016	T26	14T-026	US 52	1/14/2014 9:05		96.1	209	16	12.7	NA	12.89	NA	74.3824	260	0.05	5.4	8.25	0.124	15	350	303	512	20	3.07	0.5	2.8	21	This stream is currently impaired for E. coli based on historical samples collected in 2002 and the geomean was 169.92 MPN with only 1/5 in exceedence of the single sample maximum. The fish IBI score was 48 (good) and the QHEI was 64 (good). In 2014 there was no geomean because the site went dry. There were 3/8 in exceedence of the single sample maximum and that is > 10% which means this site will remain impaired for E. coli. Biological communities scored the following: fish IBI = 42 (fair) QHEI = 59 (good) and macro mIBI = 38 (fair) QHEI = 61 (good). The biological scores indicate there has been degredation in the fish community over the last 12 years. The nitrogen was high Jan - May although they were not in exceedence of WQ targets. This could indicate manure spreading on frozen ground or potentially the only point source in the subwatershed which is Big Cedar Mobile Home Park. They were in significant noncompiance from 2009-2011 and they were most recently enforcement action was in Nov. 2013. Eight informal enforcement actions and one formal action. Violations include DO, TSS, Chlorine, Ammonia, CBOD, and E. coli. The land use in the watershed is agricultural in the headwaters and outskirts of the subwatershed with steep forested areas surrounding the stream.	E. coli	
								###############		92.2	240	20	10.9	920.8	10.47	165.8	0.5712	243	0.05	0.05	8.06	0.005	<4	370	343	562	47	9.69	0.15	2.6	1.95			
								###############	Algae on rocks	98.6	276	20	0.5	NA	13.96	NA	1.5386	325	0.05	0.2	8.07	0.016	<4	370	349	656	44	1.08	0.15	2.1	2.37			
								###############		95.4	277	22	0.5	NA	13.91	NA	3.555	311	0.05	0.8	7.97	0.011	<4	367	344	651	40	0.03	0.15	1.9	2.59			
								2/18/2014 8:55	Mostly ice coverd. No flow measured	94.9	254	19	12.2	NA	13.82	NA	NA	286	0.05	3	8.21	0.033	9	377	342	624	37	0.04	0.3	1.8	19.9			
								3/18/2014 9:15	Algae on rocks	98.4	248	17	12.7	NA	13.57	NA	19.641	307	0.05	4	8.44	0.02	<4	353	325	620	29	1.99	0.15	1.4	4			
								4/23/2014 9:05	Algae on rocks	102.9	214	15	12	866.4	11.66	93.6	14.5457	268	0.05	3	8.42	0.012	<4	333	308	531	28	9.8	0.4	1.9	3.68			
								5/21/2014 8:45		107.5	246	17	10.8	2419.6	10.62	461.1	21.0442	305	0.05	5.9	8.14	0.023	<4	380	345	580	24	15.83	0.3	1.8	3.66			
								6/18/2014 8:35		96.7	229	19	53.8	2419.6	8.33	198.9	4.9713	246	0.05	4.5	8.09	0.022	<4	360	331	549	21	22.67	0.4	2.3	4.68			
								7/16/2014 8:40		95.6	224	16	22.7	2419.6	9.05	161.6	3.3824	258	0.05	1.2	8.12	0.02	4	342	315	516	25	17.84	0.5	3.2	5.99			
								7/23/2014 9:45		75.5	NA	NA	NA	2419.6	6.38	325.5	NA	NA	NA	NA	7.85	NA	NA	NA	NA	467	NA	23.8	NA	NA	5.76			
								###############	O6 TURB = 23.9	96	NA	NA	NA	NA	8.22	NA	NA	NA	NA	NA	8.44	NA	NA	NA	NA	445	NA	22.02	NA	NA	7.78			
								7/30/2014 9:30	Algae mats observed in-stream	82.8	NA	NA	NA	2419.6	7.64	52.9	NA	NA	NA	NA	7.97	NA	NA	NA	NA	467	NA	19.24	NA	NA	5.47			
								8/13/2014 8:30	Attached algae: brown, possibly indicating stream has been dry	92.2	207	12	18.6	2419.6	8.38	488.4	0.1474	239	0.05	0.05	8.1	0.018	<4	299	278	486	34	19.88	0.15	2.8	9.15			
		ING0383_T1001	Unnamed Tributary to Big Cedar Creek																													No data was collected from this stream. Since the 2009 E. coli results were taken upstream of the confluence with this stream and the results were much higher than the results collected downstream in 2014, no extrapolation of data to impair this stream. Althouth there are many other factors, the data indicates that this stream could actually be diluting the E. coli in Big Cedar Creek. Drains a much smaller area and has a good forested riparian buffer although land use is still agricultural.	NA	
		ING0383_T1002	East Fork Big Cedar Creek																													No data was collected in 2014 although there are two historical samples collected on this stream. In 1997 there was a sample taken on this stream and the fish community IBI was 32 with a QHEI of 53. In 2002 there was a probabilistic sample just downstream that went dry during the summer months. No biology was collected. Land use is primarily agriculture with good forested riparian buffers towareds the lower end of the stream.	NA	
		ING0383_T1003	Unnamed Tributary to Big Cedar Creek																													This stream is currently impaired for E. coli. No data was collected on this stream segment to remove the site from the 303d list. Site will remain impaired.	E. coli	
		ING0383_T1004	Unnamed Tributary to Big Cedar Creek																													This stream is currently impaired for E. coli. No data was collected on this stream segment to remove the site from the 303d list, although this stream was impaired based on a site on a different AUID. Due to the reach indexing it is now seperate but would take data to delist. Site will remain impaired. Great forested riparian buffer on this stream segment with agriculture in the headwaters.	E. coli	
		ING0383_T1005	Possum Hollow																													The stream is currenlty impaired for E. coli based on historical samples collected on the old AUID. No historical data has been collected on the new AUID. This stream was sampled in 2009 for E. coli only. The geomean was 158.64 MPN. It was in exceedence of the single sample maximum only 1/5 times. Highest value was 435 MPN which isn't that high. Great forested riparian buffer surrounding entire stream. Agricultural land in the outskirts of the drainage. Only a slight bacterial impairment but still in exceednece of the IN WQS and will remain impaired.	E. coli	
		ING0383_T1006	Unnamed Tributary to Big Cedar Creek																													There was no data collected on this stream. Given the landuse is primarily forested with a small drainage the E. coli data will not be used to assess this stream.	NA	
Little Cedar Creek-Whitewater River	5.08E+10	ING0384_02	Whitewater River	GMW-08-0015	T25	14T-025	SR 1	1/14/2014 8:40		95.7	187	22	15	NA	12.75	NA	NA	235	0.05	2.5	8.12	0.152	41	337	272	480	23	3.35	0.4	3.1	33.5	This is a portion of the mainstem Whitewater River. This AUID is currently impaired for DO and E. coli. There are no DO violations for site P7, T25 or any of the contributing tributaries we have sampled (T22, T20. T19). The DO impairment should be removed. Original DO impairment was from a 2007 sample on Little Cedar Creek (AUID ING0384_T1001). Since 2007 the streams have been reindexed. We know the geomeans of what is coming into the subwatershed by site T19 (~91 MPN), T20 (~51MPN), and T22 (~418 MPN). In 2002 an E. coli geomean of 101 MPN was taken just downstream of site T19. Site P7 is located at the confluence with Little Cedar Creek. The 2014 geomean for site P7 227.04 MPN with 2/5 samples exceeding the single sample maximum. Farther downstream, at the base of the subwatershed is site T25 with a geomean of 91.73 MPN with 1/10 samples exceeding the single sample maximum. In 2007 a geomean of 55.33 MPN was collected at a similar location to T25. There are a number of tributaries entering the mainstrem between the sites which could be diluting the bacteria. There are historical sites located as the Whitewater River enters the subwatershed and the biological scores were macro mIBI = 6.2 (1994) and 5.4 (1997) both with excellent QHEI scores. In 1994 near site T25 the mIBI = 4 and QHEI = 88. In 1997 near site T25 the mIBI = 5.4 and QHEI = 88 and in 2007 near site T25 the mIBI = 42 and QHEI = 80. The fish IBI at that site in 2007 was 52 and the QHEI = 84. In 2014, biological communities scored the following at site P7: fish IBI = 44 (fair) QHEI = 83 (excellent) and macro mIBI = 36 (fair) QHEI = 56 (good). Biological communities scored the following at site T25: fish IBI = 56 (excellent) QHEI = 82 (excellent) and macro mIBI = 36 (fair) QHEI = 77 (good). In 1997 there was fish community sampled just downstream of site P7 and the fish IBI = 38 (fair) and the QHEI = 70 (excellent). The Sperry and Rice Manufacturing Company and Elrod Water Company are point sources in the watershed. Sperry and Rice is a rubber and sponge manufacturing company and they have been in noncompliance 7/12 quarters and have had 9 informal enforcement actions in the last five years. The only violations recorded have been for DO in 2012. There is one CFO hog farm and a portion of the Town of Stavetown and Palestine that drain into the river or its tributaries.	NA	DO
								###############		85.8	201	24	12.8	2419.6	8.83	28.2	NA	200	0.05	0.9	7.79	0.018	15	327	295	492	24	13.99	0.4	2.9	11.6			
								###############	Agae on rocks	91.4	195	28	0.5	NA	10.42	NA	NA	218	0.05	0.8	8	0.019	8	290	266	525	27	9.49	0.4	2.2	8.66			
								###############	Algae on rocks	90.9	244	26	10.5	NA	12.43	NA	NA	265	0.05	1.5	7.85	0.012	<4	327	309	596	27	2.34	0.15	1.9	3.06			
								2/18/2014 8:30		92.6	261	28	0.5	NA	12.85	NA	NA	287	0.05	2.7	8.2	0.027	4	377	345	641	33	1.77	0.15	1.4	8.84			
								3/18/2014 8:30		91.9	231	22	14.4	NA	11.89	NA	NA	266	0.05	2.6	8.3	0.054	8	338	307	575	26	4.44	0.15	1.9	12.5			
								4/23/2014 8:30		89.7	232	20	0.5	920.8	9.51	57.2	NA	251	0.05	2.5	8.31	0.036	8	358	331	566	26	12.6	0.4	1.9	7.95			
								5/21/2014 8:30		93.8	213	22	19.4	2419.6	9.65	88.4	NA	271	0.05	2.8	7.75	0.056	24	363	319	528	25	13.99	0.4	2.2	22.6			
								6/18/2014 8:15		85	220	22	0.5	2419.6	7.21	66.3	NA	238	0.05	2.3	7.91	0.031	12	354	309	530	25	23.5	0.15	1.6	11.2			
								7/16/2014 8:10		84.4	214	22	19.8	2419.6	7.74	116.9	NA	268	0.05	1.9	7.95	0.06	37	379	318	533	30	19.45	0.6	2.8	25.8			
								7/23/2014 9:25		80.3	NA	NA	NA	2419.6	6.98	56.5	NA	NA	NA	NA	7.76	NA	NA	NA	NA	532	NA	22.28	NA	NA	13.8			
								7/30/2014 9:10		85.7	NA	NA	NA	NA	7.74	49.5	NA	NA	NA	NA	8.03	NA	NA	NA	NA	568	NA	20.27	NA	NA	11			
								8/13/2014 8:07		84.4	240	22	10	2419.6	7.65	290.9	NA	267	0.05	1.9	8.02	0.06	38	386	336	570	26	20.09	0.4	2	27.9			
								8/6/2014 9:00		81	NA	NA	NA	2419.6	7.13	68.3	NA	NA	NA	NA	7.93	NA	NA	NA	NA	573	NA	21.56	NA	NA	10.8			
								9/24/2014 8:15		85.4	223	23	14.7	2419.6	8.37	68.9	NA	266	0.05	1.4	7.95	0.025	8	352	316	544	24	16.2	0.15	2	8.03			
								9/8/2014 13:50	O2 Turbidity= 50.2	108.8	NA	NA	NA	NA	9.56	NA	NA	NA	NA	NA	8.18	NA	NA	NA	NA	460	NA	20.6	NA	NA	3.63			
		ING0384_01	Whitewater River	GMW-08-0013	P7	INRB14-036	River Road	5/13/2014 9:30		92.3	180	15	16	NA	8.95	NA	NA	270	0.1	2.7	7.93	0.26	190	480	280	470	19	16.75	1.4	NA	160	Whitewater River in this WS is currently indexed as one AUID (ING0384_01). this reach needs to be split at Little Cedar Creek to more accurately capture the potential influences of Brookeville on the upper end of Whitewater River in this WS which would likely not have as great an impact, if any, at its lower end given flow conditions and its overall length. Once reindexed, ING0384_01 will represent the US reach, and ING0384_02 will represent the DS reach. Results for this reach are from a site located midway in the WS and indicate impairment to the upper half of Whitewater River in this WS w/a GM of 227 cfu/100 mL. Results for site 0015 on this lower reach indicate FS w/a GM of 92 cfu/100 mL.	E. coli	DO
								###############		98	170	19	11	NA	9.33	NA	NA	250	0.05	2.9	7.82	0.22	100	360	240	485	19	17.7	0.51	3.5	96.2			
								###############		99	NA	NA	NA	2419.6	8.85	1553	NA	NA	NA	NA	7.99	NA	NA	NA	NA	501	NA	20.75	NA	NA	17.2			
								###############		107.8	NA	NA	NA	2419.6	9.74	37.9	NA	NA	NA	NA	8	NA	NA	NA	NA	553	NA	20.25	NA	NA	8.98			
								###############		100.8	NA	NA	NA	2419.6	9.14	48.8	NA	NA	NA	NA	8.03	NA	NA	NA	NA	575	NA	20.01	NA	NA	8.07			
								8/4/2014 11:50		109.3	NA	NA	NA	2419.6	9.75	42.8	NA	NA	NA	NA	8.07	NA	NA	NA	NA	570	NA	20.91	NA	NA	7.87			
								###############		92	NA	NA	NA	24196	7.95	4907	NA	NA	NA	NA	8.01	NA	NA	NA	NA	524	NA	22.48	NA	NA	33.5			
								9/8/2014 16:00		169.6	210	22	12	NA	14.7	NA	NA	260	0.05	1.3	8.16	0.025	5	310	280	534	22	22.38	0.46	1.9	4.69			
								9/9/2014 14:40	O2 turbidity = 41.3	127.5	NA	NA	NA	NA	10.95	NA	NA	NA	NA	NA	8.43	NA	NA	NA	NA	466	NA	21.89	NA	NA	4.65			
								9/9/2014 14:40		126.4	NA	NA	NA	NA	10.86	NA	NA	NA	NA	NA	8.41	NA	NA	NA	NA	466	NA	21.81	NA	NA	4.65			
		ING0384_T1001	Little Cedar Creek																													This stream is currently impaired for DO and E. coli. There is no new data to delist this stream. In 2007 the E. coli geomean was 255.03 MPN and there were 2 DO readings < 4 mg/L. TP results were high in May, July and Sept however they were not above the WQ target. No biology was collected at this site in 2007. Good forested riparian buffers around the streams but there is also a lot of agricultural land use in the drainage.	E. coli, DO	
		ING0384_T1002	Unnamed Tributary to Whitewater River																													This tributary enters the Whitewater River downstream of site P7 and before site T25. Since the E. coli levels decrease moving downstream this tributary likely adds to the dilution. With no other data from this stream, impirments cannot be extrapolated from mainstem.	NA	
		ING0384_T1003	Richland Creek																													This stream is currenlty impaired for DO and E. coli although there has never been data collected from this stream. The new reach indexing seperated the stream from ING0384_T1001. The receiving Whitewater River is not impaired for E. coli or DO. There is a good percentage of agricultural land use in this stream drainage which is similar to AUID ING0384_T1001 with some patches of forested land surrounding the stream. Stream will remain impaired for E. coli until data is collected to prove otherwise.	E. coli	DO
		ING0384_T1004	Gobles Creek																													This tributary enters the Whitewater River downstream of site P7 and before site T25. Since the E. coli levels decrease moving downstream this tributary likely adds to the dilution. There is one CFO hog farm in the stream drainage. With no other data from this stream, impirments cannot be extrapolated from mainstem.	NA	
Blackburn Creek-Whitewater River	5.08E+10	ING0385_01	Whitewater River	GMW-08-0030	T29	14T-029	St Peters Rd	###############		88.8	203	25	12.2	2419.6	9.33	58.1	NA	236	0.05	1	7.92	0.022	16	330	295	494	27	13.07	0.4	2.9	13	This AUID is currently imapired for PCBs and Mercury. We know that entering this subwatershed we have loads from site T25 (geomean ~91 MPN) and site T26 (3/8 exceeded). There are historical samples located on this stream reach. One of the sites is a fixed station (GMW080-0001) from which there have been samples taken since 1991, none of which have caused an impairment. In 2002, as site at the pour point of the AUID had a geomean of ~95. In 2007, therewere two probabilistic sites on this AUID and the E. coli results had geomeans of 51.62 and 46.98 MPN. In 2014, site T29 had a geomean of 74.82 MPN. In 2007, biological communities scored the following on this AUID: fish IBI = 50 and 48 (good) QHEI = 86 and 82 (excellent) and macro mIBI = 38 and 42 (fair) QHEI = 83 and 73 (excellent). In 2014, biological communities scored the following at site T29: fish IBI = 50 (good) QHEI = 82 (excellent) and macro mIBI = 34 (poor) QHEI = 73 (excellent) . This subwatershed has one CFO hog farm, runoff from the towns of Cedar Grove and New Trenton, some agricultural lands but primarily steep sloping forested lands. There is one sand and gravel quarry with a SW permit. The St. Leon WWTP also discharges at the pour point of this watershed. According to the Dearborn Co. Health Dept. there are two home sewage problem clusters identified that may be impacting this stream (Longnecker Road community with ~ 40 houses and Chappalow Ridge Rd ~40 houses). PBJ to not impair this stream based on 50m of macro habitat available at the X location. This reach was not representative of river and therefore should not be impaired.	PCB, Hg	
								###############		98.9	231	20	12.1	770.1	10.42	63.1	NA	273	0.05	2.2	8.38	0.021	8	348	314	562	29	12.98	0.4	1.8	8.09			
								###############		96	214	22	13.4	2419.6	9.62	93.3	NA	267	0.05	2.8	8.01	0.068	27	366	312	530	24	15.18	0.5	2	15.4			
								###############		95.5	218	22	14.5	2419.6	7.95	74.9	NA	247	0.05	2.2	8.08	0.035	12	355	312	532	25	24.53	0.4	1.6	11			
								###############		93.4	214	23	23.1	2419.6	8.48	101.9	NA	290	0.05	1.8	8.04	0.053	28	364	307	529	29	19.98	0.4	2.5	18.8			
								###############		88.4	NA	NA	NA	2419.6	7.59	81.3	NA	NA	NA	NA	7.95	NA	NA	NA	NA	531	NA	23.07	NA	NA	10.3			
								###############		94.8	NA	NA	NA	2419.6	8.48	31.8	NA	NA	NA	NA	8.11	NA	NA	NA	NA	563	NA	20.77	NA	NA	9.31			
								###############		92.7	240	21	13	2419.6	8.27	157.6	NA	305	0.05	1.8	8.07	0.043	18	372	325	566	26	20.81	0.4	2.1	15.9			
								8/6/2014 10:45		93.5	NA	NA	NA	2419.6	8.11	56.5	NA	NA	NA	NA	8.04	NA	NA	NA	NA	564	NA	22.4	NA	NA	9.72			
								9/24/2014 9:40		89.1	226	23	14.1	2419.6	8.86	59.1	NA	279	0.05	1.3	8.1	0.028	6	352	315	549	25	15.55	0.15	1.9	7.43			
								9/9/2014 9:00	O2 turbidity = 12.9	93.1	NA	NA	NA	NA	8.18	NA	NA	NA	NA	NA	8.2	NA	NA	NA	NA	469	NA	20.23	NA	NA	5.66			
		ING0385_01A	Unnamed Tributary to Whitewater River																													There is no data for this tributary and no chemical or biological impairments to the receiving stream. This stream will not be impaired.	NA	
		ING0385_T1001	Ramsey Creek																													There is no data for this tributary and no chemical or biological impairments to the receiving stream. This stream will not be impaired.	NA	
		ING0385_T1002	Unnamed Tributary to Whitewater River																													There is no data for this tributary and no chemical or biological impairments to the receiving stream. The land use is primarily agricultureal and it runs through the Town of Cedar Grove. No data to show impairments.	NA	
		ING0385_T1003	Unnamed Tributary to Whitewater River																													There is no data for this tributary and no chemical or biological impairments to the receiving stream. This stream will not be impaired.	NA	
		ING0385_T1004	Unnamed Tributary to Whitewater River																													There is no data for this tributary and no chemical or biological impairments to the receiving stream. This stream will not be impaired.	NA	
		ING0385_T1005	Elkhorn Creek																													There is no data for this tributary and no chemical or biological impairments to the receiving stream. There is a hog CFO in the headwaters but the land use is primarily steep forested land. No data to show impairments.	NA	
		ING0385_T1006	Whistle Creek																													There is no data for this tributary and no chemical or biological impairments to the receiving stream. This stream will not be impaired.	NA	
		ING0385_T1007	Shingle Creek																													There is no data for this tributary and no chemical or biological impairments to the receiving stream. This stream will not be impaired.	NA	
		ING0385_T1008	Unnamed Tributary to Whitewater River																													There is no data for this tributary and no chemical or biological impairments to the receiving stream. This stream will not be impaired.	NA	
		ING0385_T1009	Unnamed Tributary to Whitewater River																													There is no data for this tributary and no chemical or biological impairments to the receiving stream. This stream will not be impaired.	NA	
		ING0385_T1010	Unnamed Tributary to Whitewater River																													There is no data for this tributary and no chemical or biological impairments to the receiving stream. This stream will not be impaired.	NA	
		ING0386_01	Whitewater River																													This stream segment is currently impaired for E. coli. There is no current or historical data for this AUID. Due to reach indexing this AUID was impaired based on data from ING0386_T1001. Based on E. coli data upstream and other E. coli values in the mainstem Whitewater River this stream segment should be delisted until a sample on the AUID can prove otherwise. Previously impaired for E.coli based on data collected on a tributary (T1001). Likely as a function of indexing. Results cannot be reliably extrapolated to MS given differences in flow regime. Results from sites US and DS show consistently low GMs over time. 0030: Site located US of this reach. GM 75 cfu/100 mL. 0049 and 0021 located in virtually same location DS of this reach near the state line. Both sites indicate low GMs, 95 cfu/100 mL and 66 cfu/100 mL, respectively.		E. coli
		ING0386_02	Johnson Fork	GMW-08-0018	T30	14T-030	Johnson Fork Rd	###############		86.8	222	31	11.8	980.4	9.53	72.3	NA	327	0.05	0.05	7.8	0.005	<4	469	448	643	88	11.06	0.15	2.2	2.31	This stream segment is currently impaired fo E. coli and DO based on a sample collected in 2007. In 2007 the E. coli geomean was ~413 MPN and there were 2/7 DO readings < 4 mg/L. This stream has since been reindexed and the original sample falls on a different AUID. In 2009 a site (GMW080-0048) was sampled on this AUID for E. coli only and the geomean was 482.21 (5/5 samples exceeded the single sample maximum). In 2014 E. coli was taken at this same site and the geomean was 187.04 MPN (3/10 exceeded the single sample max). Both years of sampling i ndicate the stream is still impaired for E. coli. There were no DO violations in 2009 or 2014 to support a DO impairment. In 2014, biological communities scored the following at site T30: fish IBI = 46 (good) QHEI = 61 (excellent) and macro mIBI = 42 (fair) QHEI = 59 (good) . This stream has steep forested land use with agricultural lands around the edges of the watershed. There are several Towns that run off into the stream including: Sharptown, Drewersburg, and Rockdale. According to the Dearborn Co. Health Dept. there are several home sewage problem clusters identified that may be impacting this stream. Those are theOld US 52 area with ~30 houses and ~12 businesses and the Longnecker Road community with ~ 40 houses.	E. coli	DO
								###############	Might go dry later in summer	128.9	213	19	19.2	378.4	13.22	66.3	NA	270	0.05	0.05	8.52	0.013	<4	347	325	570	55	14.19	0.4	2.2	4.45			
								###############		123.2	243	18	15	2419.6	11.61	129.1	NA	262	0.05	0.3	8.22	0.036	4	375	350	585	48	18.2	0.15	2	6.46			
								###############		92.3	212	26	10.5	2419.6	7.9	259.5	NA	260	0.05	0.05	7.91	0.022	<4	362	341	570	52	23.06	0.15	2.2	2.81			
								###############		98.7	215	23	14.9	2419.6	9.01	71	NA	288	0.05	0.05	8.01	0.053	<4	358	333	563	48	19.8	0.15	2.6	3.41			
								###############	O2 turb = 40.2	85.6	NA	NA	NA	NA	7.47	NA	NA	NA	NA	NA	7.69	NA	NA	NA	NA	561	NA	21.09	NA	NA	6.66			
								###############		82.2	NA	NA	NA	2419.6	7.05	866.4	NA	NA	NA	NA	7.78	NA	NA	NA	NA	554	NA	22.93	NA	NA	9.56			
								###############		84.5	NA	NA	NA	2419.6	7.53	29.1	NA	NA	NA	NA	7.86	NA	NA	NA	NA	588	NA	21.05	NA	NA	3.67			
								###############		77.7	194	30	13.8	2419.6	6.99	1300	NA	288	0.05	0.05	7.68	0.015	<4	377	355	590	57	20.46	0.15	2.1	5.41			
								8/6/2014 11:25	Very low flow	64.5	NA	NA	NA	2419.6	5.5	98.4	NA	NA	NA	NA	7.62	NA	NA	NA	NA	568	NA	23.12	NA	NA	4.08			
								###############		66.2	198	31	14.5	1299.7	6.64	34.6	NA	292	0.05	0.05	7.5	0.018	<4	412	386	620	69	15.12	0.15	1.8	4.5			
				GMW-08-0019	T28	14T-028	SR 46	###############		36.2	213	58	15.3	1203.3	3.9	15.8	NA	254	0.05	0.05	7.33	0.049	8	456	429	691	68	11.89	0.4	5	13.2	This stream is currently impaired for E. coli, PCBs and Hg. E. coli was collected at a site in 2002 and the geomean was ~334 MPN. Further downstream another site was sampled in 2002 and had a fish IBI score of 48 and a QHEI score of 64. In 2014 there were three sites sampled on this AUID. Working downstream the E. coli results were: P8 geomean = 200.4 MPN, P11 geomean = 159.99 MPN and T28 geomean = 125.35 MPN. The E. coli concentration is decreasing as you move downstream which suggests the sources for higher E. coli values are located upstream. In 2014, working downstream the biological communities scored the following at site P8: fish IBI = 54 (excellent) QHEI = 76 (excellent), P11: fish IBI = 48 (good) QHEI = 72 (excellent), T28: fish IBI = 36 (fair) QHEI = 47 (fair). In 2014, working downstream the biological communities scored the following at site P8:		
								###############		87.8	227	29	17.8	613.1	8.95	126.1	NA	292	0.05	0.05	8.19	0.054	11	428	391	645	66	14.65	0.3	2.5	15.2			
								###############		92.1	231	28	15.2	2419.6	8.66	238.2	NA	302	0.05	0.05	7.95	0.035	8	411	384	622	63	18.19	0.15	2.6	10.1			
								###############		78.5	229	43	18.8	2419.6	6.61	172.2	NA	274	0.05	0.05	7.75	0.067	11	463	425	665	58	23.92	0.4	2.8	15			
								###############		68.9	211	48	21.5	2419.6	5.94	260.3	NA	309	0.05	0.05	7.6	0.112	28	438	387	634	45	21.45	0.6	3.8	35.2			
								###############		73.1	NA	NA	NA	2419.6	6.29	920.8	NA	NA	NA	NA	7.65	NA	NA	NA	NA	662	NA	22.83	NA	NA	21.8			
								###############	O6 TURB = 36.8	35.8	NA	NA	NA	NA	3.07	NA	NA	NA	NA	NA	7.62	NA	NA	NA	NA	693	NA	21.76	NA	NA	23.5			
								###############		63.5	NA	NA	NA	2419.6	5.73	35.5	NA	NA	NA	NA	7.57	NA	NA	NA	NA	713	NA	20.48	NA	NA	32.4			
								###############		41.6	219	68	27.3	2419.6	3.67	67.6	NA	312	0.05	0.05	7.45	0.114	34	488	424	715	41	21.65	0.9	4.5	43.5			
								8/6/2014 11:00	Stream nearly pooled at bridge	65.1	NA	NA	NA	2419.6	5.7	53.8	NA	NA	NA	NA	7.55	NA	NA	NA	NA	700	NA	21.9	NA	NA	26.1			
								###############		54.5	198	60	21.9	1986.3	5.51	51.2	NA	288	0.05	0.05	7.44	0.054	15	468	434	693	59	14.65	0.6	4.4	20.5			
								5/13/2014 8:00		89.8	180	18	5	NA	8.67	NA	NA	230	0.05	0.067	7.88	0.06	9	300	290	570	38	16.98	0.42	NA	19.4			
								6/2/2014 9:50		76.3	NA	NA	NA	NA	6.1	NA	NA	NA	NA	NA	7.76	NA	NA	NA	NA	603	NA	21.98	NA	NA	4.55			
								6/24/2014 9:40		81.8	190	39	5	NA	7.02	NA	NA	270	0.05	0.091	7.8	0.025	3	340	380	615	58	22.89	0.15	2.8	5.79			

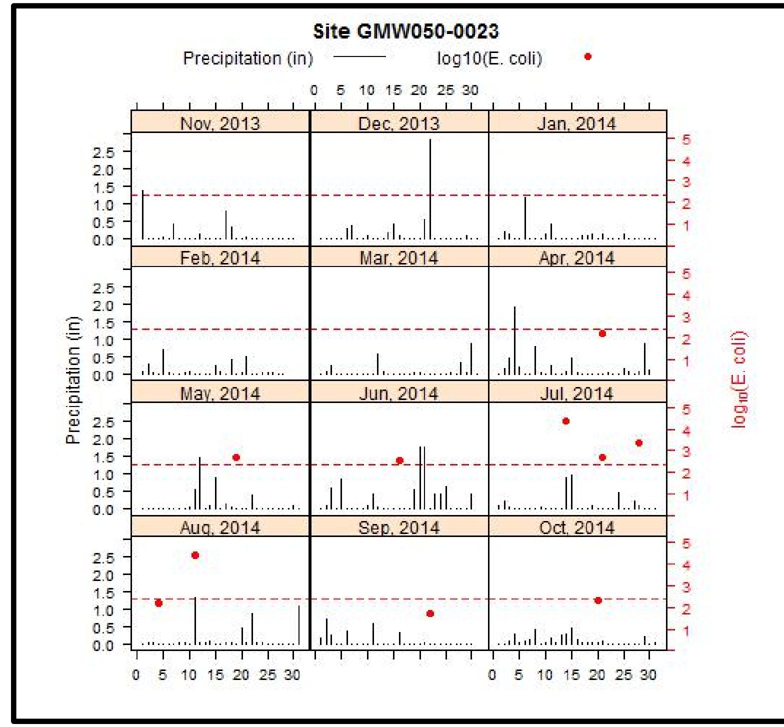
Johnson Fork-Whitewater River	5.08E+10	ING0386_T1001	Logan Creek	GMW-08-0003	P8	INR814-040	Covered Bridge Road	################		65.8	NA	NA	NA	2419.6	5.64	2420	NA	NA	NA	NA	7.63	NA	NA	NA	NA	670	NA	22.8	NA	NA	12.7	72 (excellent), T28: fish IBI = 30 (fair) QHEI = 47 (fair). In 2014, working downstream the biological communities scored the following at site P8: macro mIBI = 36 (fair) QHEI = 55 (excellent), P11: macro mIBI = 32 (poor) QHEI = 64 (excellent), T28: macro mIBI = 38 (fair) QHEI = 45 (fair). The field notes for fish community sampling at site T28 indicated there was an oil sheen on the waters surface. This may have impacted the biological communities at this site. Five out of six biological communities passed but stream will still be impaired. In July, August and October the DO results were below the 4 mg/L WQS at site T28. There were no DO violations at the two sites upstream. The low DO would also impact the health of the biological communities. According to the Dearborn Co. Health Dept. there is a home sewage problem cluster identified that may be impacting this stream (Chappalow Ridge Rd ~40 houses) and the Health Dept also estimated that 50% of the septic systems are failing in Dearborn County. This stream has runoff coming from St. Leon. The land use is primarily steep forested terrain with housing clusters as you move between St. Leon and the Ohio border. The City of Cincinnati is just across the state line so this part of the watershed is more heavily populated.	PCB, Hg, E. coli, DO, IBC	
								################		82.3	NA	NA	NA	8664	7.29	53.5	NA	NA	NA	NA	7.8	NA	NA	NA	NA	726	NA	21.15	NA	NA	16.6			
								################		90.8	NA	NA	NA	2419.6	8.25	275.5	NA	NA	NA	NA	7.8	NA	NA	NA	NA	755	NA	19.92	NA	NA	7.5			
								8/4/2014 11:10		72.5	NA	NA	NA	2419.6	7.24	45	NA	NA	NA	NA	7.75	NA	NA	NA	NA	740	NA	20.71	NA	NA	7.12			
								8/6/2014 11:05		73.2	NA	NA	NA	2419.6	6.05	201.4	NA	NA	NA	NA	7.45	NA	NA	NA	NA	678	NA	22.44	NA	NA	6.36			
								################		81	NA	NA	NA	NA	6.16	NA	NA	NA	NA	NA	7.74	NA	NA	NA	NA	732	NA	23.73	NA	NA	5.33			
								9/8/2014 12:30		141.9	180	42	11	NA	12.59	NA	NA	250	0.05	0.073	7.87	0.025	3	390	360	640	66	20.83	0.35	2.7	5.15			
				GMW-08-0005	P11	INR814-055	Higher Ground Lane	5/13/2014 8:40		90.4	180	18	9	NA	8.63	NA	NA	230	0.05	0.059	7.9	0.069	9	310	280	489	39	17.54	2.5	NA	21.2			
								################		82.5	190	40	5	NA	6.92	NA	NA	270	0.05	0.03	7.83	0.051	4	360	350	627	58	24.17	0.32	3	7.96			
								7/9/2014 10:05	O6 Turb = 13.7	63	NA	NA	NA	NA	5.3	NA	NA	NA	NA	NA	7.74	NA	NA	NA	NA	642	NA	22.24	NA	NA	10			
								################		80.5	NA	NA	NA	2419.6	6.88	770.1	NA	NA	NA	NA	7.79	NA	NA	NA	NA	633	NA	23.04	NA	NA	15.2			
								################		80.6	NA	NA	NA	1986.3	7.26	39.7	NA	NA	NA	NA	7.79	NA	NA	NA	NA	712	NA	20.38	NA	NA	9.89			
								################		80	NA	NA	NA	2419.6	7.05	387.3	NA	NA	NA	NA	7.77	NA	NA	NA	NA	706	NA	21.18	NA	NA	8.9			
								8/4/2014 11:25		69.8	NA	NA	NA	2419.6	6.32	178.5	NA	NA	NA	NA	7.68	NA	NA	NA	NA	706	NA	19.89	NA	NA	8.15			
								################		82.7	NA	NA	NA	2419.6	7.04	49.6	NA	NA	NA	NA	7.77	NA	NA	NA	NA	710	NA	23.09	NA	NA	5.04			
								9/8/2014 14:00		108.6	190	50	8	NA	9.73	NA	NA	270	0.05	0.052	7.79	0.025	3	400	290	679	63	20.74	0.42	2.9	5.62			
								################		45.8	NA	NA	NA	NA	4.58	NA	NA	NA	NA	NA	7.87	NA	NA	NA	NA	668	NA	15.02	NA	NA	NA			
		ING0386_T1002	Unnamed Tributary to Logan Creek																													In 2009 this stream was sampled for E. coli only. The geomean was 572.63 MPN with 5/5 exceeding the single sample maximum. The land use is primarily steep forested land intermixed with agricultural fields and residential clusters. According to the Dearborn Co. Health Dept. there is a 50% failure rate of septic systems in the county which may be impacting this stream. Half of the headwaters of run though the Town of St. Leon which	E. coli	
		ING0386_T1003	Crane Run																													There is no current or historical data for this stream. Portions of the the Town of Bright run off into this stream but the majority of the drainage area is steep forested land.	NA	
		ING0386_T1004	Pinhook Creek																													There is no current or historical data for this stream. Portions of the the Town of Bright run off into this stream but the majority of the drainage area is steep forested land.	NA	
		ING0386_T1005	Unnamed Tributary to Whitewater River																													This stream segment was not identified until IN streams were reach indexed. There is no data to assess any impairments.	NA	
		ING0386_T1006	Cranes Run																													This stream segment is currently impaired fo E. coli and DO based on a sample collected in 2007. In 2007 the E. coli geomean was ~413 MPN and there were 2/7 DO readings < 4 mg/L. There is no new data to assess otherwise.	E. coli and DO (4c)	
		ING0386_T1006/	Unnamed Tributary to Cranes Run																													This stream segment was not identified until IN streams were reach indexed. Based on the location of this stream to that of the2007 sample which impaired the recieving stream, the impairment should be extrapolated to cover this segment as well. There is similar land use to that of the ING0386_T1006. During the 2016 303d impaired list of waters this AUID will be merged with ING0386_T1006. This stream segment was not identified until IN streams were reach indexed. Based on the location of this stream to that of the 2007 sample which impaired the receiving stream, the impairment should be extrapolated to cover this segment as well. There is similar land use to that of the ING0386_T1006 and it appears to be an interstitial stream which often have DO issues due to lack of water and pooling. Verified with areal photos that this reach should indeed be indexed as ING0386_T1006. DO impairment applied to this reach in anticipation of corrected indexing. Suspect natural sources; Possible Cat 4C impairment.	E. coli and DO (4c)	
		ING0386_T1007	Unnamed Tributary to Johnson Fork																													This stream segment is currently impaired for E. coli and DO based on a 2007 sample collected from ING0386_T1006. There is no current of historical data for this particular AUID. Based on the high levels of E. coli collected in the receiving stream and the high levels of E. coli in the tributary that was sampled in 2007 this stream will remain impaired for E. coli based on similar geographic area and land use. Low DO is more of a site specific condition and without data to support a DO impairment this stream should be delisted for DO. Data from 2009 and 2014 supports that there is no DO impairement in the recieving stream, therefore no reason to extrapolate an impairment to the tributaries.	E. coli	DO
		ING0386_T1008	Unnamed Tributary to Johnson Fork																													This stream segment is currently impaired for E. coli and DO based on a 2007 sample collected from ING0386_T1006. There is no current of historical data for this particular AUID. Based on the high levels of E. coli collected in the receiving stream and the high levels of E. coli in the tributary that was sampled in 2007 this stream will remain impaired for E. coli based on similar geographic area and land use. Low DO is more of a site specific condition and without data to support a DO impairment this stream should be delisted for DO. Data from 2009 and 2014 supports that there is no DO impairement in the recieving stream, therefore no reason to extrapolate an impairment to the tributaries.	E. coli	DO
Headwaters Dry Fork Whitewater River	5.08E+10	ING0387_02	Dry Fork Whitewater River	GMW-08-0020	T33	14T-033	Dickson Rd	################		81.5	296	26	15.7	1986.3	9.37	30.9	NA	335	0.05	0.05	7.92	0.029	<4	413	392	633	25	9.12	0.3	5	2.55	Site T33 was sampled from April to October in 2014. This site was also sampled for E. coli in 2009. In 2014, the geomean was 559.85 MPN, with 8/10 samples exceeding the single sample maximum for E. coli. In 2009, the geomean was 231.13 MPN. Nitrogen levels were high in the April - July samples, however they were not above the IN WQ target. Biological communities scored the following: fish IBI = 48 (good) QHEI = 63 (good) and macro mIBI = 28 (poor) QHEI = 50 (fair).There are no historical data sites in this subwatershed. There are no point sources in the watershed. The land use is predominantly agriculture with a few small towns, including Raymond and Scipio. NPS pollutants include agricultural land use, small towns, possible septic issues and little to no riparian buffers around the stream. Sampled in 2009 and 2014. GM 231 cfu/100 mL (2009), GM 560 cfu/100 mL (2014). Site located at lower end of WS where stream flows into Ohio. Per C. Cooley, Ohio results from just DS were consistently high. Two small towns, Raymond, IN located in extreme HW and Scipio, IN located are located very near site. Both are likely unsewered; septics a potential source. Land use is predominantly ag w/no point sources. Almost all crop fields with some pastures; pastures are mostly small operations.	E. coli, IBC	
								################		109.5	203	20	13.3	2419.6	12.23	547.5	NA	257	0.05	5.7	8.54	0.017	5	334	317	538	22	10.42	0.4	2.4	5.34			
								5/21/2014 9:45		104.9	239	20	13.6	2419.6	10.25	816.4	NA	289	0.05	8.8	8.26	0.033	5	401	380	592	21	16.4	0.4	2.1	6.08			
								6/18/2014 9:35		97.8	249	21	0.5	2419.6	8.53	980.4	NA	303	0.05	6.6	8.19	0.064	8	411	368	597	20	22	0.3	1.9	7.43			
								7/16/2014 9:40		95.7	247	18	20.7	2419.6	9.26	1553	NA	311	0.05	4.6	8.22	0.159	7	398	369	577	25	17.03	0.6	3.6	8.14			
								################		140.2	NA	NA	NA	NA	11.53	NA	NA	NA	NA	NA	8.39	NA	NA	NA	NA	512	NA	23.52	NA	NA	3.32			
								################		100.2	NA	NA	NA	2419.6	8.8	980.4	NA	NA	NA	NA	8.04	NA	NA	NA	NA	547	NA	21.69	NA	NA	5.76			
								################		103.8	NA	NA	NA	2419.6	9.96	214.3	NA	NA	NA	NA	8.15	NA	NA	NA	NA	516	NA	17.27	NA	NA	5.86			
								8/13/2014 9:40		68.8	230	20	16.4	2419.6	6.44	435.2	NA	275	0.05	0.05	7.76	0.044	5	320	296	523	18	18.39	0.4	3.5	9.07			
								8/6/2014 10:00	Very low flow	100.5	NA	NA	NA	2419.6	9.09	387.3	NA	NA	NA	NA	7.98	NA	NA	NA	NA	540	NA	20.18	NA	NA	5.63			
								9/24/2014 8:50		60.9	244	21	16.8	2419.6	6.64	344.8	NA	266	0.05	0.05	7.62	0.04	<4	331	308	544	28	11.34	0.3	3.6	5.61			
		ING0387_03	Phillips Creek																													There was no data collected on this stream.	NA	
Howard Creek-Dry Fork Whitewater River	5.08E+10	ING0388_01	Sours Run	GMW-08-0027	T32	14T-032	Drewersburg Rd	################		47.8	315	28	19.2	2419.6	5.38	686.7	NA	351	0.05	0.05	7.49	0.068	<4	443	424	668	26	9.77	0.4	5.7	4.27	The 2014 samples resulted in 7/10 E. coli concentrations were in exceedence of the single sample maximum. The geomean was 478.15 MPN. Nitrogen levels were moderately high from April - June but not in exceedance of the IN WQ target. Biological communities scored the following: fish IBI = 38 (fair) QHEI = 58 (good) and macro mIBI = 36 (fair) QHEI = 56 (good). The stream is currently listed as impaired for E. coli and will remain impaired. In 2007 this same site was sampled in the IDEM probabilistic program and the E. coli geomean was 250.60 MPN. While TP was not in exceedence of the WQ target in 2014, the 2007 results indicate that TP was greater than the WQ target (0.3 mg/L) 2/3 samples (0.24, 0.32, 1.2 mg/L). In addition the DO results from 2007 were close to the 4 mg/L WQS 4/11 times (4.09, 4.22, 4.07, 4.07 mg/L), and > 13 2/11 times. While the TP and DO did not occur on the same day to warrant a nutrient impairment, data suggests there are high levels of nutrients in the stream. The biological communities collected in 2007 were: fish IBI = 38 (fair) QHEI = 62 (good) and macro mIBI = 38 (fair) QHEI 54 (good). The high levels of nutrients and DO extremes could be a source of stress on the biological communities. Mount Carmel Elementary School WWTP has been a point source in the extreme headwaters but they no longer discharge and no longer have a permit. Pollutant sources could be coming from the land use which is dominantly agriculture, manure spreading, faulty septic systems and runoff from the Town of Mount Carmel. Currently impaired. GM 478 cfu/100 mL. Mt. Carmel Elementary School used to have a permit but put in an onsite mound system. School likely not impacting impairment based on this and location in extreme HW. Mt. Carmel (unsewered) is also located in the HW; septics are a possible source. Land use is mostly ag, lots of row crops. Very narrow riparian zones.	E. coli	
								################	Algae on rocks	114.8	250	16	18.6	2419.6	12.6	285.1	NA	295	0.05	3	8.31	0.03	4	359	335	580	24	11.11	0.4	2.7	7.96			
								################		102	264	18	13.2	2419.6	10.07	435.2	NA	313	0.05	4.7	8.02	0.032	4	388	370	595	21	16.06	0.4	2	5.79			
								6/18/2014 9:50		84.5	266	21	13.2	2419.6	7.36	1733	NA	300	0.05	3.9	8.01	0.091	9	401	365	599	18	22.08	0.4	2.3	12.8			
								################		82.9	228	21	23.5	2419.6	7.86	980.4	NA	239	0.05	2.4	7.97	0.166	11	365	331	536	23	17.76	0.6	4.6	15.4			
								################		90.1	NA	NA	NA	NA	7.97	NA	NA	NA	NA	NA	7.97	NA	NA	NA	NA	585	NA	20.29	NA	NA	5.43			
								################		81.6	NA	NA	NA	2419.6	7.2	1553	NA	NA	NA	NA	7.76	NA	NA	NA	NA	596	NA	21.54	NA	NA	5.89			
								################		99.3	NA	NA	NA	2419.6	9.35	648.8	NA	NA	NA	NA	7.94	NA	NA	NA	NA	586	NA	18.2	NA	NA	8.31			
								8/13/2014 9:55		47.2	298	29	20.8	2419.6	4.94	151.5	NA	322	0.05	0.2	7.37	0.036	9	416	383	677	27	17.76	0.6	4	6.06			
								8/6/2014 10:15	Very low flow	67.3	NA	NA	NA	2419.6	6.13	167	NA	NA	NA	NA	7.53	NA	NA	NA	NA	599	NA	19.79	NA	NA	7.1			
								9/24/2014 9:10		64	305	22	16.5	1732.9	7.03	31.5	NA	367	0.05	0.2	7.44	0.041	<4	419	396	683	19	11.03	0.4	3.9	3.25			
		ING0388_P1001	Bartmess Lake																													This is a lake and will not be assessed.	NA	
		ING0388_T1005	Unnamed Tributary to Sours Run																													This stream is currently impaired for E. coli. No new data was collected from the stream to show improvement. Based on similar land uses and the fact that this stream is contributing to the high E. coli levels measured downstream it will reamin impaired.	E. coli	
		ING0388_T1006	Dry Fork (Ohio)																													This stream is a headwater stream that flows into Ohio. There was no data collected for this stream. The headwaters is primarily agriculture but then flows through a lake and the landuse becomes forested. Due to the mixed land use and the dilution factor of the lake no extrapolation of data will be used to assess this stream.	NA	
		ING0388_T1007	Sater Run																													This stream is currently impaired for E. coli. No new data was collected from the stream to show improvement. Based on similar land uses and the high levels of E. coli sampled in the subwatershed this stream will remain impaired.	E. coli	
		ING0388_T1008	Howard Creek																													No data was collected from this stream. Only a small portion of this stream falls in Indiana and there is no data to assess.	NA	
Lee Creek	5.08E+10	ING0389_01	Lee Creek																													Results from a site on the Ohio side of the state line suggest that the stream is impaired as it enters Indiana (GM 324 cfu/100 mL). Stream will remain unassessed until data are collected on the Indiana reach.	NA	
Jameson Creek-Whitewater River	5.08E+10	ING038A_01	Whitewater River	GMW-08-0021	T31	14T-031	Jamison Rd	################		96	183	22	15	NA	12.79	NA	NA	212	0.05	2.5	8.16	0.155	48	337	271	475	23	3.4	0.4	3.3	45.3	In 2009 this stream was sampled for E. coli only. The geomean was 94.64 MPN with 0/5 exceeding the single sample maximum. In 2014, the geomean was 68.52 MPN with 0/10 exceeding the single sample maximum. There are two historical sites located just upstream of site T31. The macro community in 1994 scored 4.2, QHEI = 81 and the macro score in 1997 was 5.6, QHEI = 83a 2014, biological communities scored the following: fish IBI = 54 (excellent) QHEI = 75 (excellent) and macro mIBI = 34 (poor) QHEI = 65 (good). In January and May the TSS was greater than the WQ target but those were likely attributed to high flows. This site has a drainage area of 1370 sq. miles (E. coli results are impressive!). The majority of the Southern Whitewater River watershed is forested with steep to rolling terrain. This particular AUID has a portion of the Greater Cincinnati MS4 contributing to the drainage, however a good portion of the drainage remains forested. The macro score is poor however based on biologists BPJ this site will be fully supporting for aquatic communities.	NA	
								################		97.2	208	25	13.1	2419.6	10.05	63.3	NA	195	0.05	1	7.95	0.022	15	341	310	501	25	13.82	0.3	2.8	14			
								################		94.6	199	28	0.5	NA	11.11	NA	NA	210	0.05	0.8	8.08	0.023	5	293	268	532	27	8.27	0.3	2.5	8.05			
								################	Algae on rocks	94.7	236	28	0.5	NA	12.89	NA	NA	272	0.05	1.4	8.05	0.011	<4	322	300	590	28	2.54	0.15	1.9	3.31			
								2/18/2014 9:45		97.4	256	30	0.5	NA	13.38	NA	NA	302	0.05	2.6	8.23	0.028	5	381	347	648	35	2.17	0.15	1.3	10.5			
								################		94.6	232	22	10.3	NA	12.1	NA	NA	296	0.05	2.6	8.37	0.051	8	339	309	582	27	4.85	0.15	1.7	13.7			
								################		109.7	231	21	10.7	436	11.07	61.8	NA	252	0.05	2.1	8.41	0.034	7	347	318	567	29	14.85	0.15	1.7	7.98			
								################		96.2	216	22	15.1	2419.6	9.63	88.4	NA	267	0.05	2.8	7.99	0.058	32	372	321	528	24	15.28	0.4	2.2	14.9			
								################		116.7	221	22	11	2419.6	9.61	90.9	NA	243	0.05	2.1	8.02	0.033	14	351	313	532	26	25.09	0.4	1.6	8.18			
								################		107.7	217	20	18.8	2419.6	9.38	113.7	NA	280	0.05	1.6	8.08	0.068	21	353	310	522	28	22.12	0.5	2.1	13.1			
								################		85.5	NA	NA	NA	2419.6	7.26	143	NA	NA	NA	NA	7.87	NA	NA	NA	NA	531	NA	23.53	NA	NA	7.93			
								################		105.2	NA	NA	NA	2419.6	9.27	48.2	NA	NA	NA	NA	8	NA	NA	NA	NA	566	NA	21.46	NA	NA	10.2			
								################		100.6	225	21	13.1	2419.6	8.81	59.5	NA	275	0.05	1.6	8.01	0.029	14	345	314	543	25	21.82	0.5	2.4	12			
								8/6/2014 11:45		100.9	NA	NA	NA	2419.6	8.59	32.4	NA	NA	NA	NA	7.95	NA	NA	NA	NA	564	NA	23.3	NA	NA	9.27			
								################		103.1	NA	NA	NA	NA	8.93	NA	NA	NA	NA	NA	8.24	NA	NA	NA	NA	468	NA	21.42	NA	NA	5.92			
								################		103.6	220	24	13.6	2419.6	10.04	53.8	NA	271	0.05	1.4	7.99	0.016	5	343	311	536	25	16.83	0.15	1.9	6.2			
		ING038A_01A	Unnamed Tributary to Whitewater River																													This stream appears to be intermittal. The land use is dominated by forested land with a few clusters of homes. There is no current of historical data for this site. The data on the receiving stream does not indicate this tributary is contributing to an impairment.	NA	
		ING038A_P1001	Snyders Lake																													Lake - not assessed	NA	
		ING038A_T1010	Cooper Run																													There is no current of historical data for this AUID. There is only a small portion of the stream in IN before flowing into OH. The stream does flow through the populated area of West Chester. Upstream the land use is mixed with forested lands and residential areas. There is no data to assess.	NA	
		ING038A_T1011	Jameson Creek																													There is no current of historical data for this AUID. This stream originates in IN before flowing into OH. The stream does flow through the city of Bright. The land use is mixed with forested lands, residential areas, and high density populated areas. There is no data to assess this stream.	NA	
		ING038A_T1012	Sand Run (Ohio)																													There is no current of historical data for this AUID. There is only a small portion of the stream in IN before flowing into OH. The stream does flow through the city of Bright. The land use is mixed with forested lands and residential areas. There is no data to assess this stream.	NA	
Brookville Lake-East Fork Whitewater River	5.08E+10	ING037H_01	East Fork Whitewater River	GMW-07-0026	T20	14T-020	US 52	################		100.8	157	27	14.8	NA	13.57	NA	NA	185	0.05	0.9	7.98	0.07	4	266	242	441	25	2.95	0.5	3.3	13.6	In 2014 the geomean was 51.00 MPN. Biological communities scored the following: fish IBI = 44 (fair) QHEI = 70 (excellent) and macro mIBI = 22 (very poor) QHEI = 65 (good).	IBC	
								################		86.9	175	25	20.1	2419.6	8.44	13.5	NA	199	0.2	0.5	7.52	0.023	4	273	255	446	23	16.67	0.5	3.5	5.6			
								################		102.8	175	29	0.5	NA	10.77	NA	NA	207	0.05	0.5	7.9	0.021	<4	267	246	512	25	13.2	0.5	2.7	7			
								################	Lots of algae on exposed rocks and in-stream rooted macrophytes	147.2	178	32	14.6	NA	18.11	NA	NA	207	0.05	0.6	8.94	0.011	<4	275	252	504	26	6.39	0.3	2.8	3.21			
								################		115.7	231	36	12.4	NA	15.73	NA	NA	263	0.05	2.5	8.35	0.04	<4	363	324	627	31	2.86	0.5	2.4	9.8			
								################		128.1	169	26	20.6	NA	16.61	NA	NA	205	0.05	1.7	8.65	0.086	<4	268	249	480	24	4.41	0.3	2.7	9.98			
								################	Algae on rocks	175.7	166	25	14.7	307.6	19.7	1	NA	199	0.05	1.6	8.99	0.057	<4	277	259	460	24	10.22	0.4	3.1	8.58			
								################		102.6	169	25	17.5	2419.6	11.42	6.3	NA	209	0.05	2	7.74	0.058	5	288	269	471	22	10.61	0.5	3.1	4.91			
								################		149.3	179	25	15.2	1732.9	15.51	83.3	NA	212	0.05	1.2	8.42	0.073	<4	301	273	464	19	13.76	0.6	3.7	5.53			
								################	water clear (below reservoir)	143.8	186	24	0.5	2419.6	14.38	39.3	NA	228	0.05	1.6	8.24	0.048	<4	306	280	476	25	16.03	0.5	4.1	3.62			
								################		97.6	NA	NA	NA	NA	9.57	NA	NA	NA	NA	NA	7.93	NA	NA	NA	NA	473	NA	14.85	NA	NA	1.76			
								################		123.3	NA	NA	NA	2419.6	12.12	11.6	NA	NA	NA	NA	7.9	NA	NA	NA	NA	487	NA	16.04	NA	NA	3.99			
								################	Thick algae mats observed in-stream	112.3	NA	NA	NA	2419.6	10.27	579.4	NA	NA	NA	NA	8.01	NA	NA	NA	NA	474	NA	19.65	NA	NA	3.98			
								################	Below reservoir	116.3	193	24	18.9	2419.6	11.5	42	NA	225	0.05	1.5	8	0.059	<4	301	281	488	20	16.54	0.4	3.6	3.82			
								8/5/2014 11:30		132.1	NA	NA	NA	2419.6	13.03	31.1	NA	NA	NA	NA	8.08	NA	NA	NA	NA	490	NA	15.93	NA	NA	2.92			
								################		71.2	197	24	16.5	2419.6	7.24	7.5	NA	245	0.05	1.2	7.43	0.087	<4	301	286	495	18	14.53	0.4	3.6	3.17			
Bear Creek-Whitewater River	5.08E+10	ING0348_03	Whitewater River	GMW-04-0018	T11	14T-011	US 52	################		93.1	188	19	20.3	NA	12.4	NA	NA	246	0.05	3.6	8.08	0.245	73	365	276	478	20	3.31	0.5	3.4	63.4	In 2014 the geomean was 81.42 MPN. Biological communities scored the following: fish IBI = 52 (good) QHEI = 70 (excellent) and macro mIBI = 42 (fair) QHEI = 70 (excellent).	NA	
								################		125.6	266	23	16.2	1046.2	12.82	33.6	NA	322	0.05	1.8	8.17	0.015	<4	249	232	591	28	14.44	0.15	2.4	4.48			
								################	Algae on rocks	122.2	282	24	0.5	NA	15.2	NA	NA	270	0.05	2	8.24	0.01	<4	365	342	670	31	5.92	0.15	1.6	3.56			
								################	Algae on rocks	103.7	285	27	11.7	NA	13.64	NA	NA	316	0.05	2.2	8.12	0.016	<4	375	350	668	29	3.79	0.15	1.5	2.86			
								################		98.2	290	23	0.5	NA	13.45	NA	NA	325	0.05	3.1	8.2	0.022	<4	394	365	682	34	2.24	0.15	0.5	4.52			
								################	Some algae on rocks	97.7	266	22	11.4	NA	12.53	NA	NA	330	0.05	3.4	8.33	0.044	13	382	346	645	30	4.78	0.15	1	15.5			
								################		112.6	237	21	15	365.4	11.04	15.5	NA	268	0.05	2.8	8.36	0.029	8	374	337	601	29	16.25	0.15	1.7	17.4			
								################		99.3	263	19	13.5	2419.6	9.74	178.5	NA	284	0.05	4.8	8.03	0.059	30	433	377	613	24	16.22	0.4	2	22.2			
								################		125.7	241	21	0.5	1986.3	11.05	44.3	NA	272	0.05	2.9	8.16	0.02	15	400	357	589	28	21.72	0.3	1.4	9.55			
								################	O6 Turb = 20.8	89.1	NA	NA	NA	NA	7.82	NA	NA	NA	NA	NA	8.15	NA	NA	NA	NA	608	NA	21.6	NA	NA	13.1			
								################		115.1	233	22	0.5	24196	9.57	980.4	NA	311	0.05	2.4	8.02	0.098	139	500	337	572	26	24.48	0.5	1.8	112			
								################		136.2	NA	NA	NA	2419.6	11.73	22.5	NA	NA	NA	NA	8.06	NA	NA	NA	NA	573	NA	22.73	NA	NA	7.87			
								################		112.3	NA	NA	NA	2419.6	10.03	19.7	NA	NA	NA	NA	8.05	NA	NA	NA	NA	625	NA	20.81	NA	NA	8.99			
								################		104.3	235	20	13.5	12033	8.67	980.4	NA	305	0.05	2.1	7.95	0.073	74	430	334	571	26	24.74	0.5	2.1	57.1			
								8/4/2014 12:50		125.2	NA	NA	NA	2419.6	10.76	8.4	NA	NA	NA	NA	8.09	NA	NA	NA	NA	604	NA	23.13	NA	NA	5.97			
								8/5/2014 15:00		109.7	NA	NA	NA	2419.6	8.99	NA	NA	NA	NA	NA	8.04	NA	NA	NA	NA	558	NA	24.08	NA	NA	5.23			
								################		146.4	240	23	12.6	1732.9	13.72	43.1	NA	304	0.05	1.9	8.18	0.021	5	360	330	588	27	18.45	0.3	1.7	4.07			

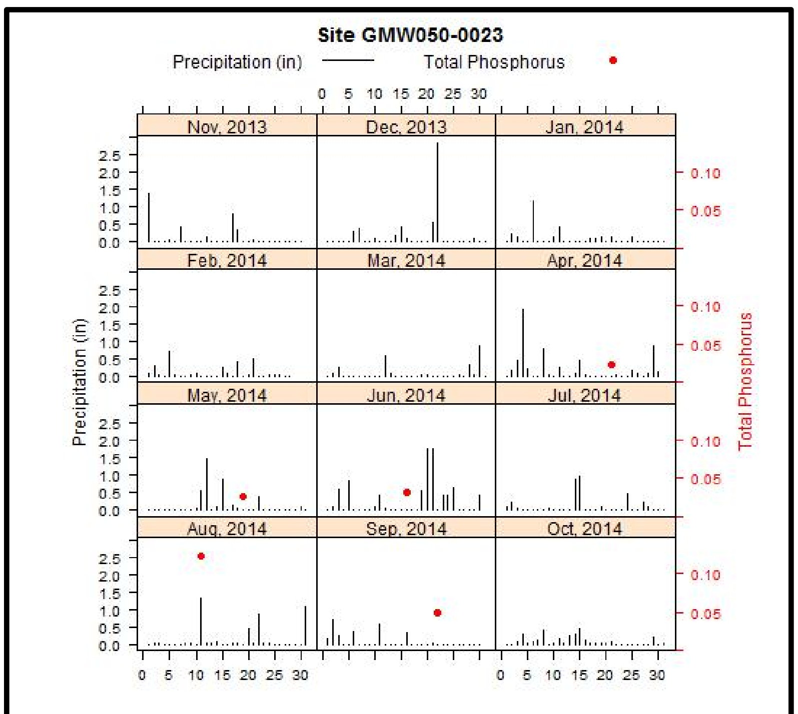
Site T1
GMW050-0023
Tributary of Salt Creek at CR 150 N

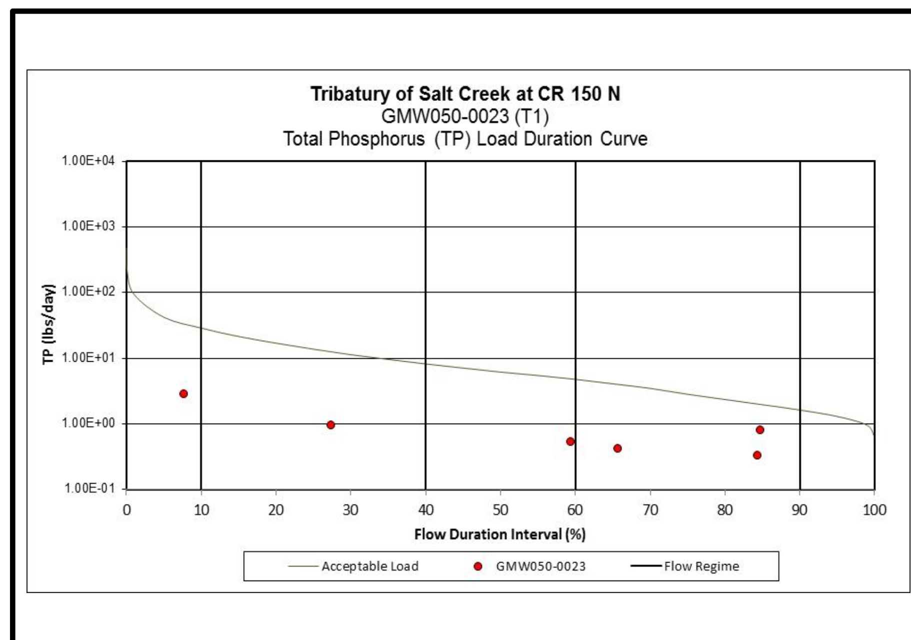
Upstream

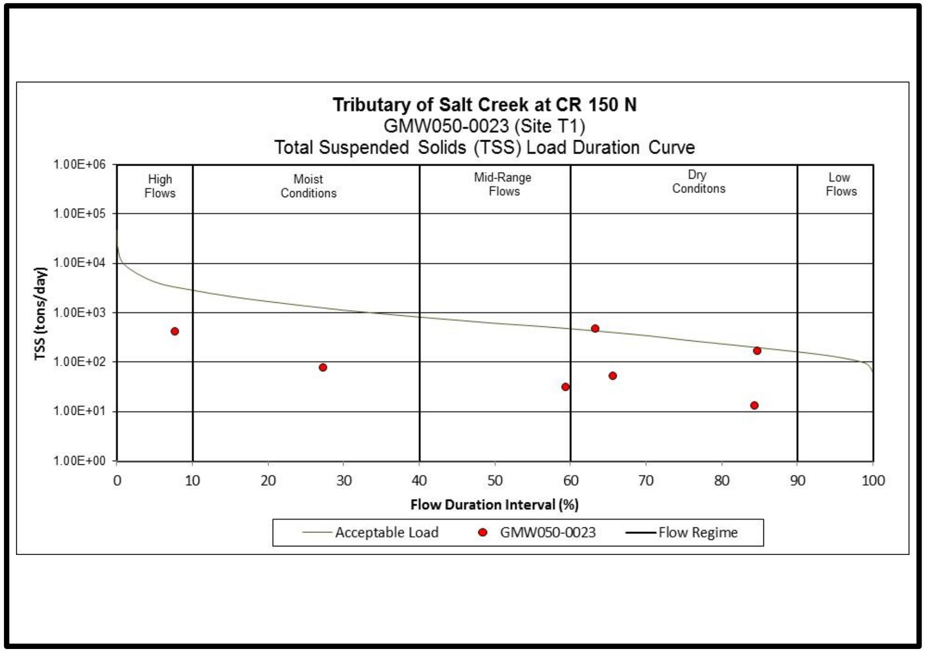
Downstream

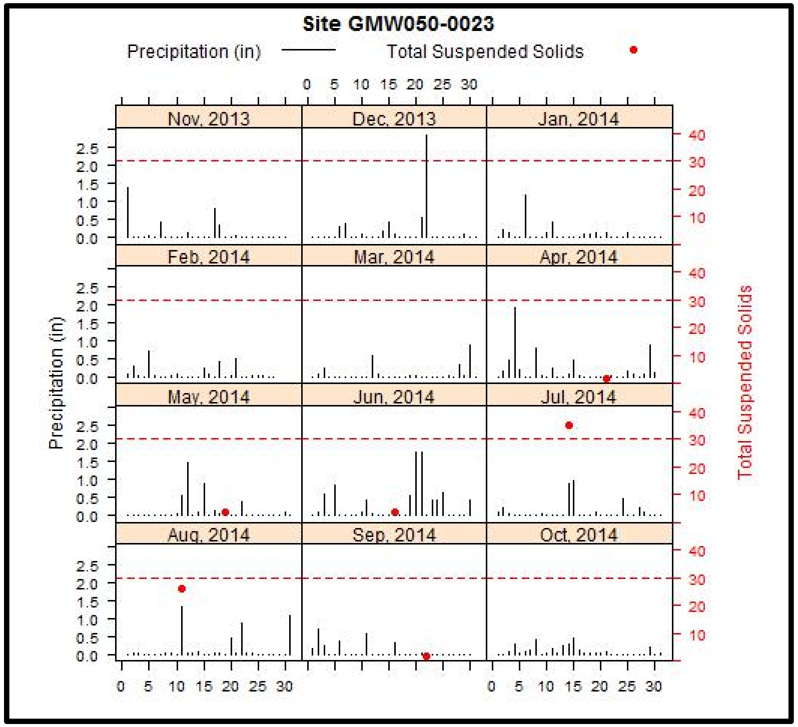

Tributary of Salt Creek at CR 150 N
GMW050-0023 (T1)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+14
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW050-0023


Site GMW050-0023
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log10(E. coli)
0.0
0.5
1.0
1.5
2.0
2.5
1
2
3
4
5
0
5
10
15
20
25
30


Site GMW050-0023
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus
0.0
0.5
1.0
1.5
2.0
2.5
0.05
0.10
0
5
10
15
20
25
30


Tributary of Salt Creek at CR 150 N
GMW050-0023 (T1)
Total Phosphorus (TP) Load Duration Curve
TP (lbs/day)
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
GMW050-0023
Flow Regime





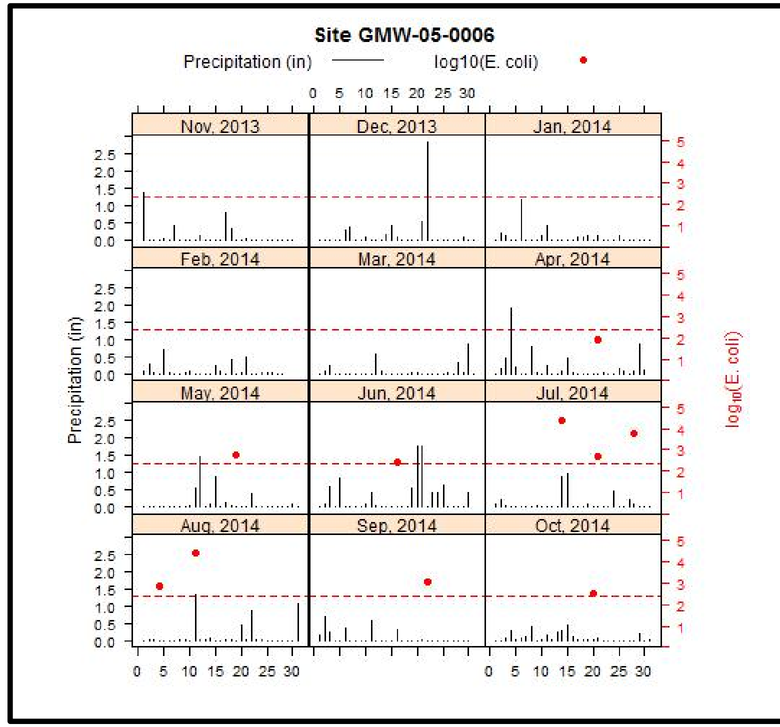
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

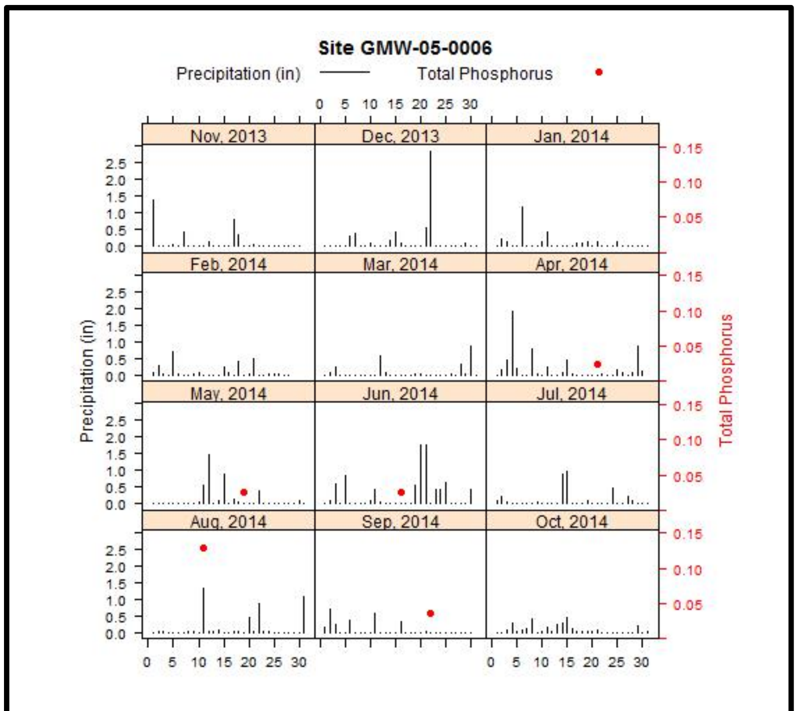
Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	2.68E+10	2.35E+11	2.30E+10	5.46E+11	3.66E+11	1.52E+09	1.62E+10
TP (lbs/day)	0.95	2.86	0.42	NA	0.81	0.34	0.54
TSS (lbs/day)	78.98	424.33	52.46	491.35	172.38	13.55	31.77

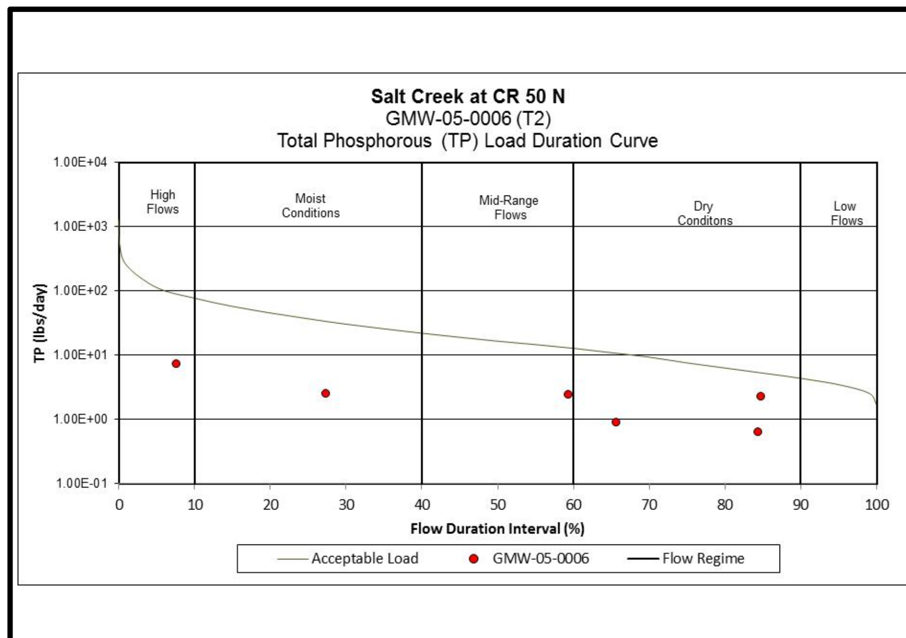
Site T2
GMW-05-0006
Salt Creek at CR 50 N

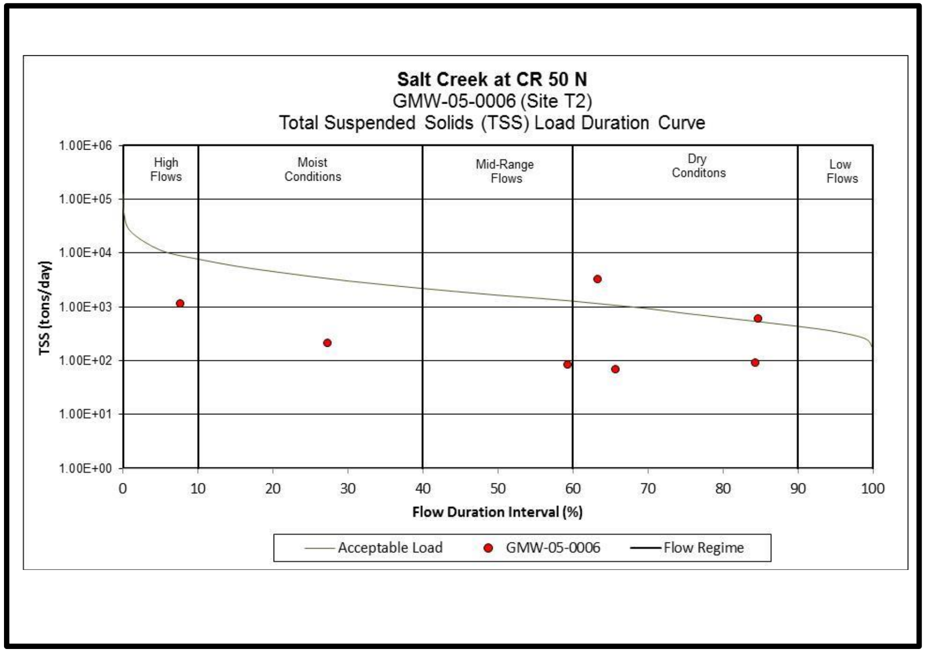
Upstream

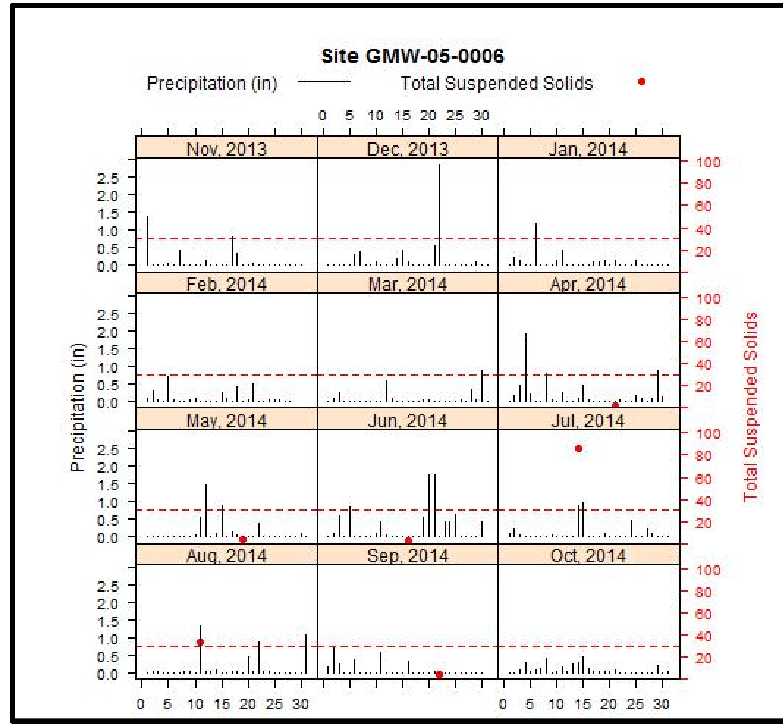
Downstream


Site GMW-05-0006
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log10(E. coli)


Site GMW-05-0006
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus


Salt Creek at CR 50 N
GMW-05-0006 (T2)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-05-0006
Flow Regime





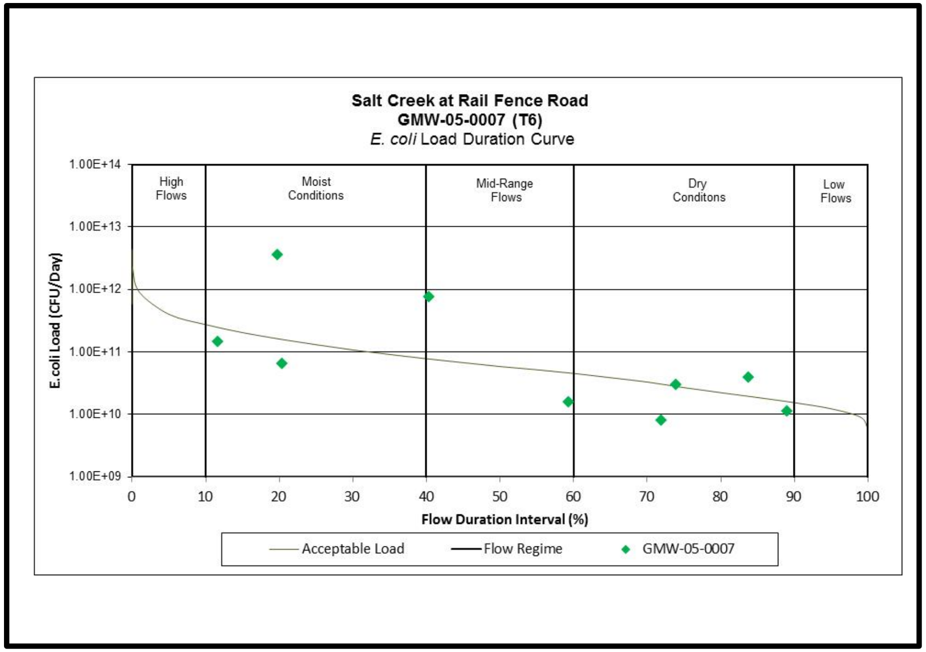
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

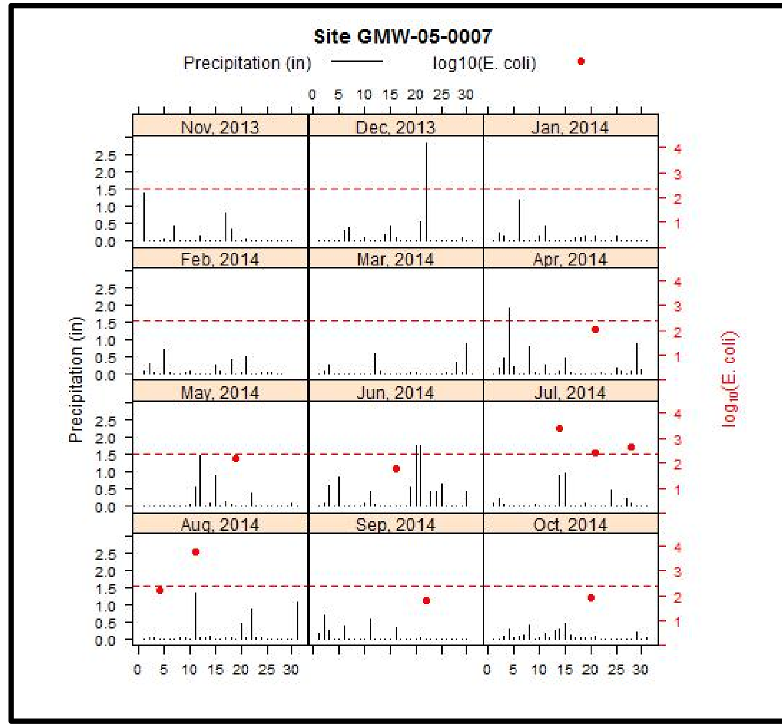
Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)							
TP (lbs/day)	2.54	7.4	0.915	NA	2.28	0.654	2.43
TSS (lbs/day)	212.83	1138	70.35	3237.88	604.56	90.84	85.2

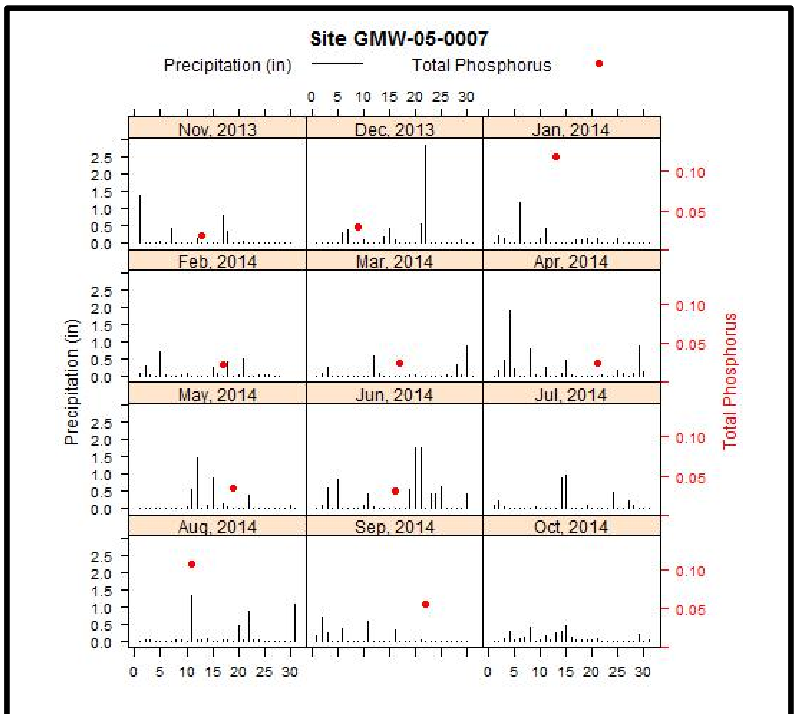
Site T6
GMW-05-0007
Salt Creek at Rail Fence Road

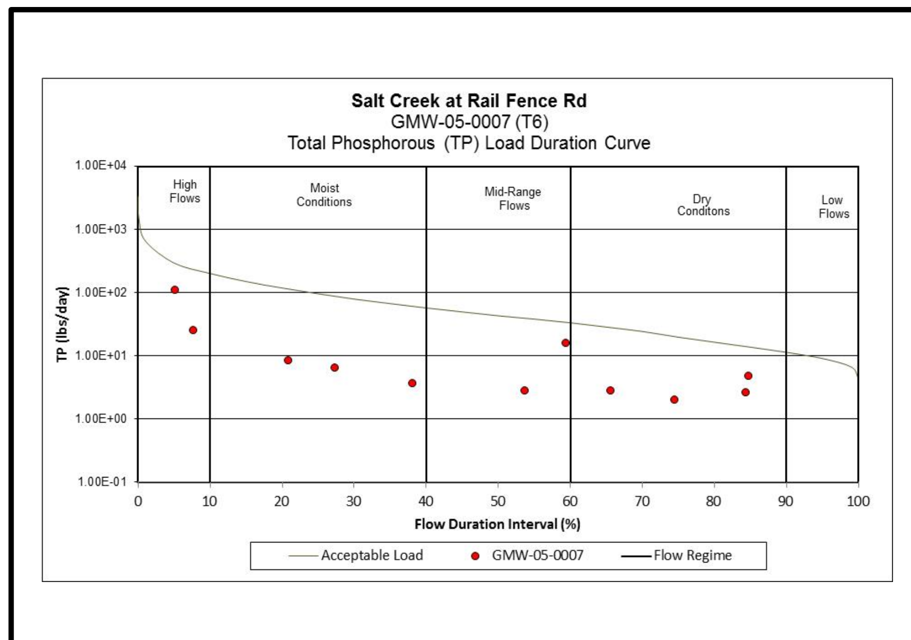
Upstream

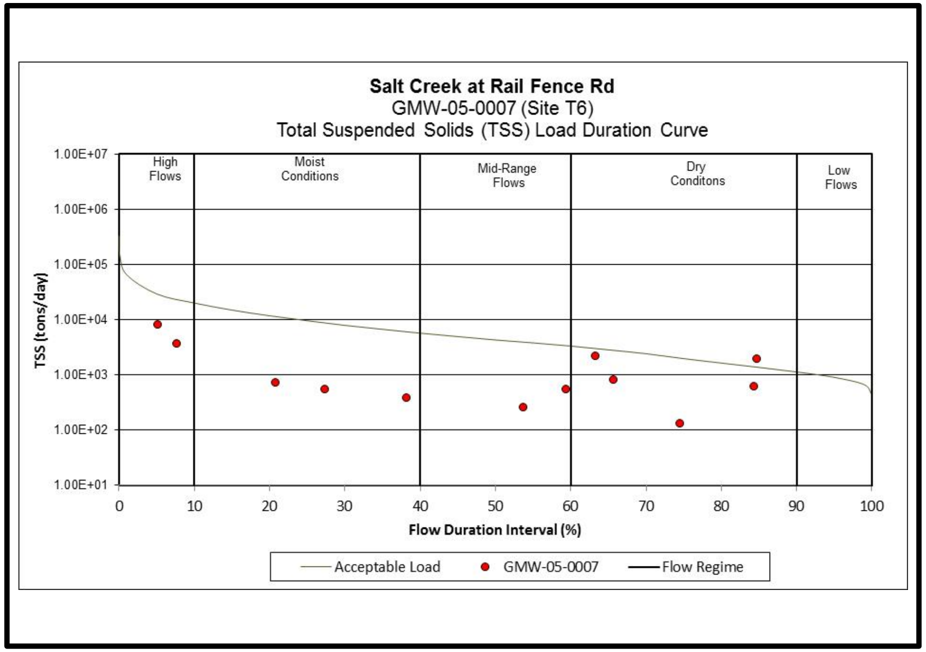
Downstream

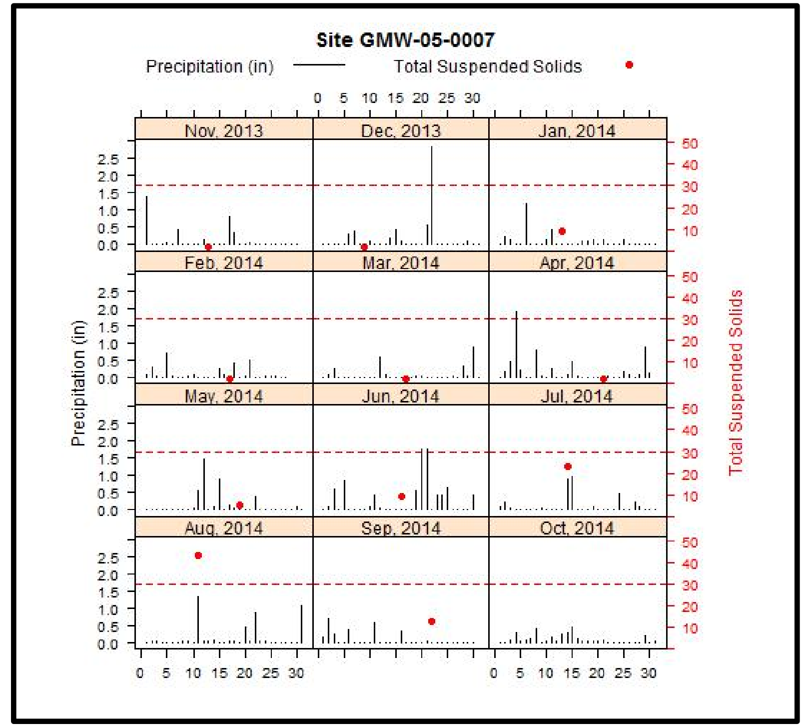

Salt Creek at Rail Fence Road
GMW-05-0007 (T6)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-05-0007


Site GMW-05-0007
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014


Site GMW-05-0007
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014


Salt Creek at Rail Fence Rd
GMW-05-0007 (T6)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-05-0007
Flow Regime





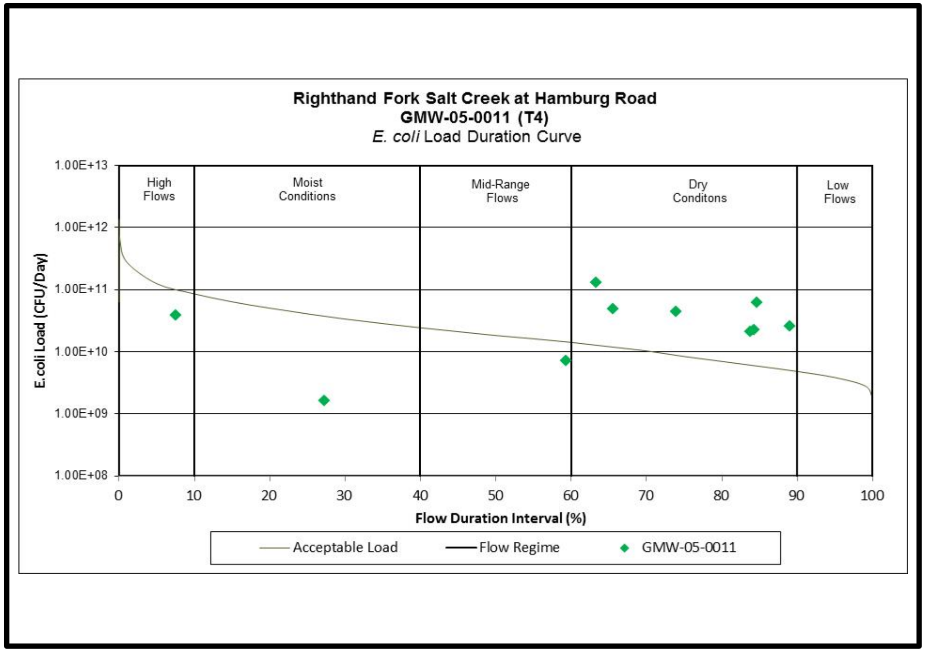
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

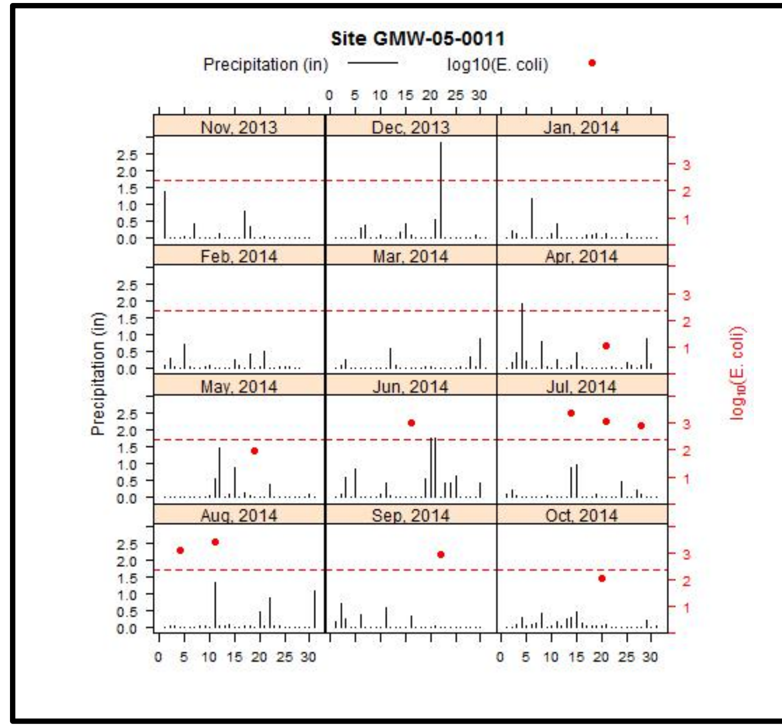
Parameter	January	February	March	April	May	June	July	August	Sept	Oct	November	December
E. Coli (MPN)	NA	NA	NA	6.45E+10	1.46E+11	8.05E+09	2.78E+11	1.13E+10	1.77E+12	1.56E+10	NA	NA
TP (lbs/day)	109.56	2.83	8.65	6.62	25.95	2.84	NA	4.91	2.65	16.32	3.7	2
TSS (lbs/day)	8286.01	257.06	721.22	552	3706.84	824.97	2265.54	1992.43	615.46	555.02	389.62	133.37

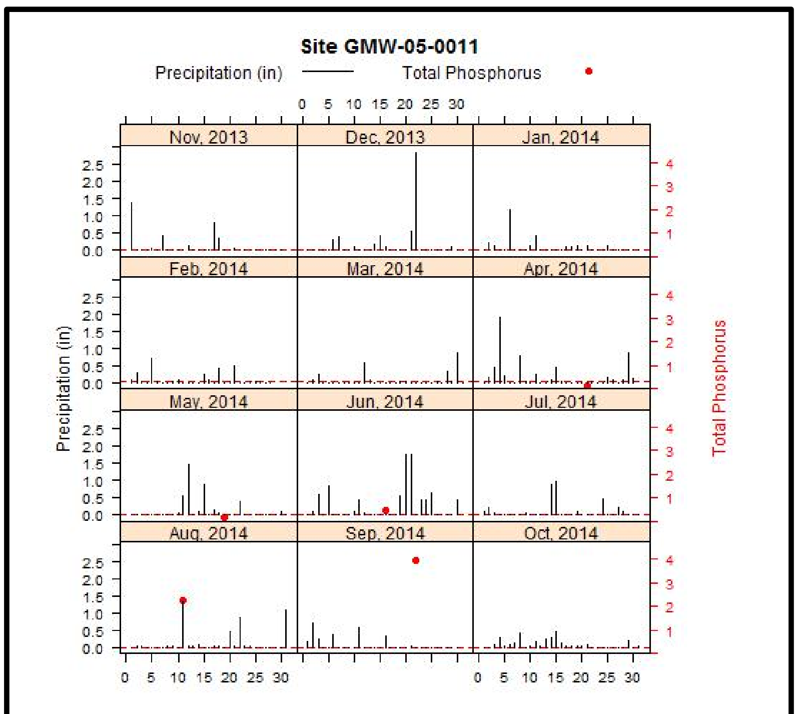
Site T4
GMW-05-0011
Righthand Fork Salt Creek at Hamburg Road

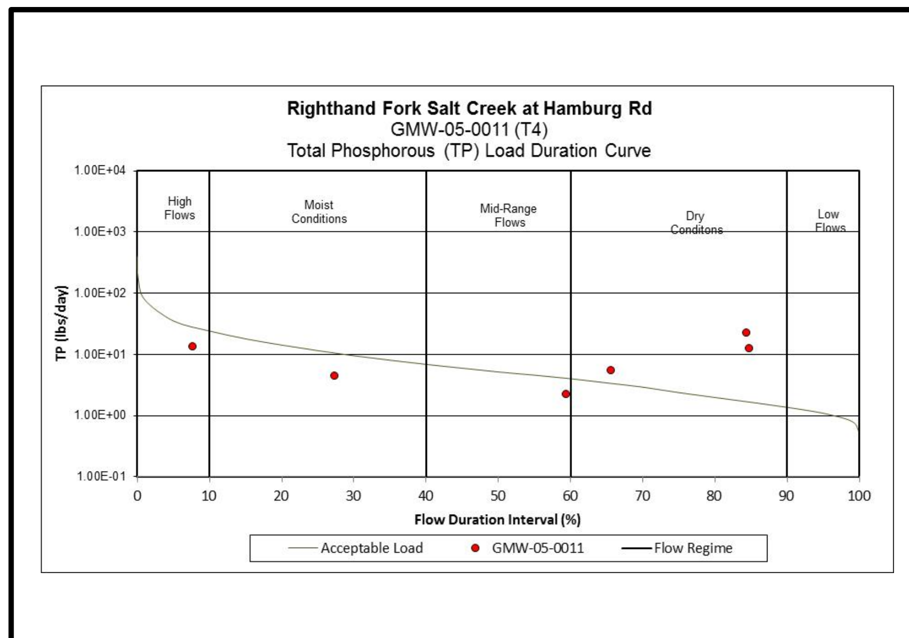
Upstream

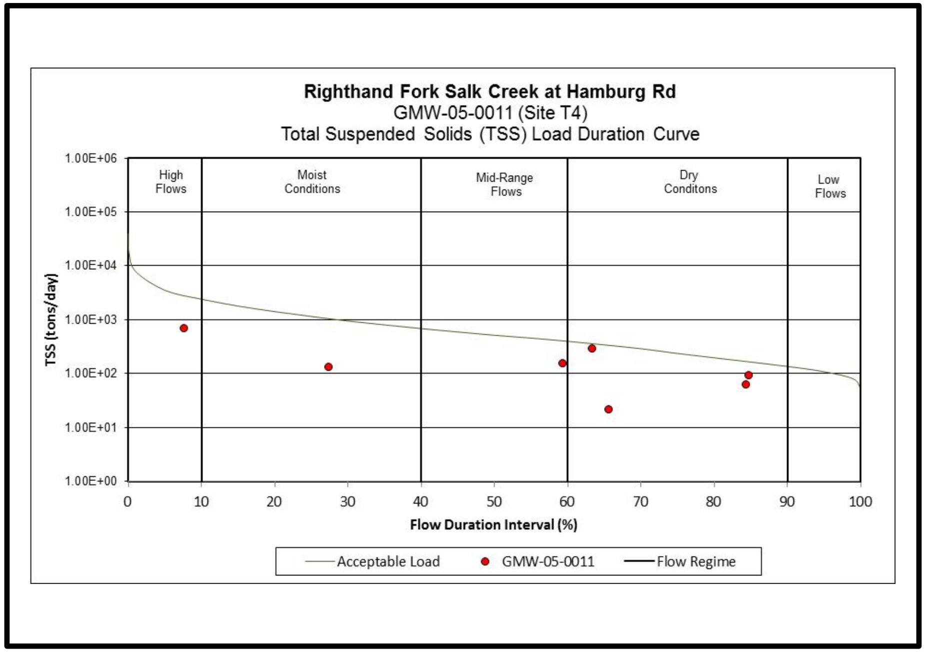
Downstream

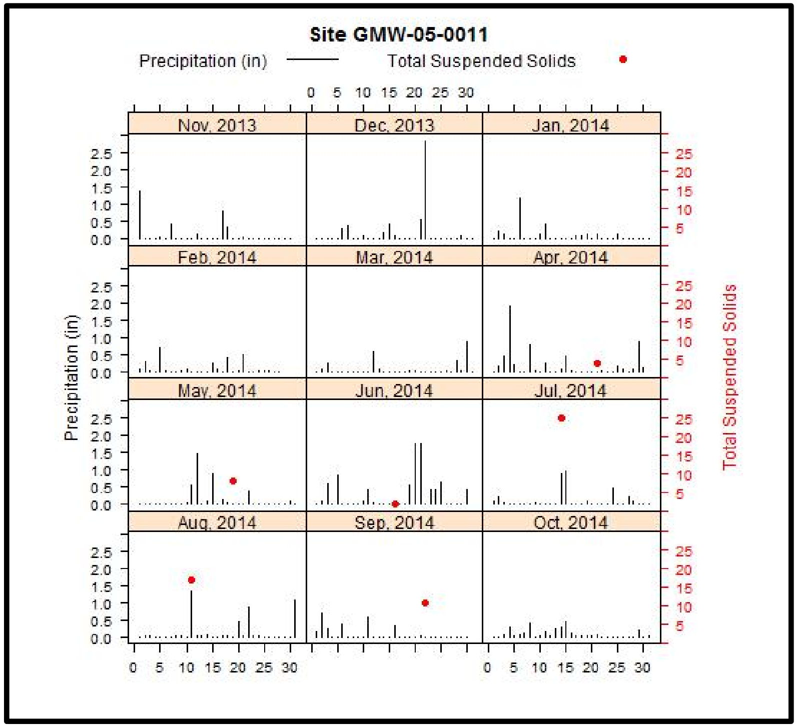

Righthand Fork Salt Creek at Hamburg Road
GMW-05-0011 (T4)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-05-0011


Site GMW-05-0011
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log10(E. coli)


Site GMW-05-0011
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus


Righthand Fork Salt Creek at Hamburg Rd
GMW-05-0011 (T4)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
GMW-05-0011
Flow Regime





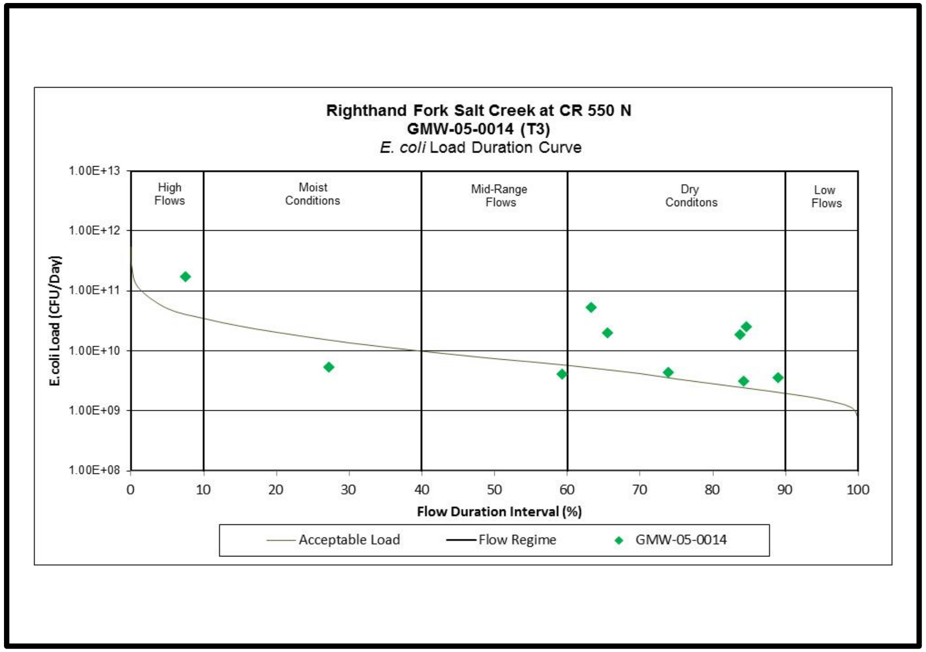
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

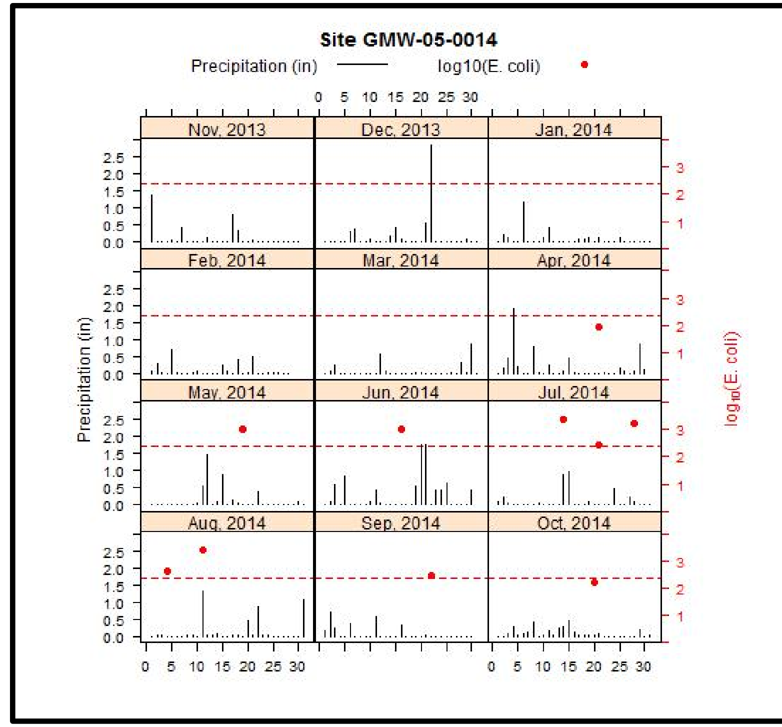
Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	1.65E+09	3.87E+10	4.89E+10	6.50E+10	4.33E+10	2.23E+10	7.23E+09
TP (lbs/day)	4.57	13.4	5.62	NA	12.7	22.4	2.26
TSS (lbs/day)	132.37	711.14	21.98	294.1	94.45	62.44	159.72

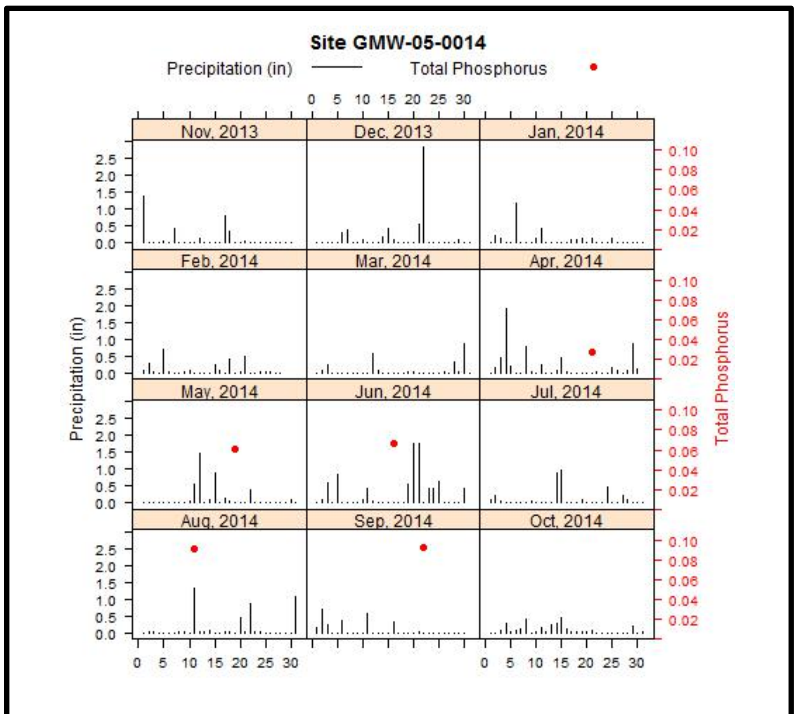
Site T3
GMW-05-0014
Righthand Fork Salt Creek at E CR 550 N

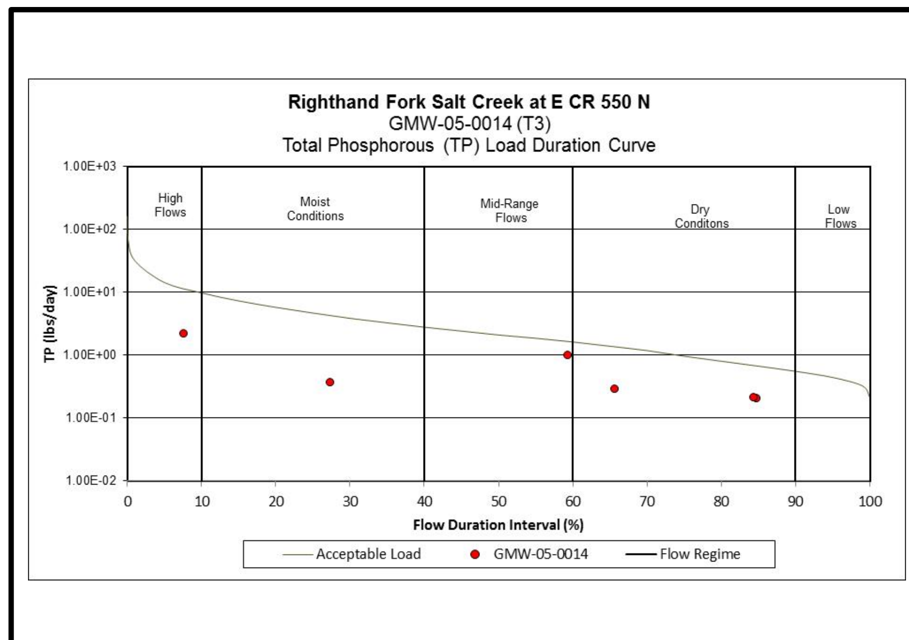
Upstream

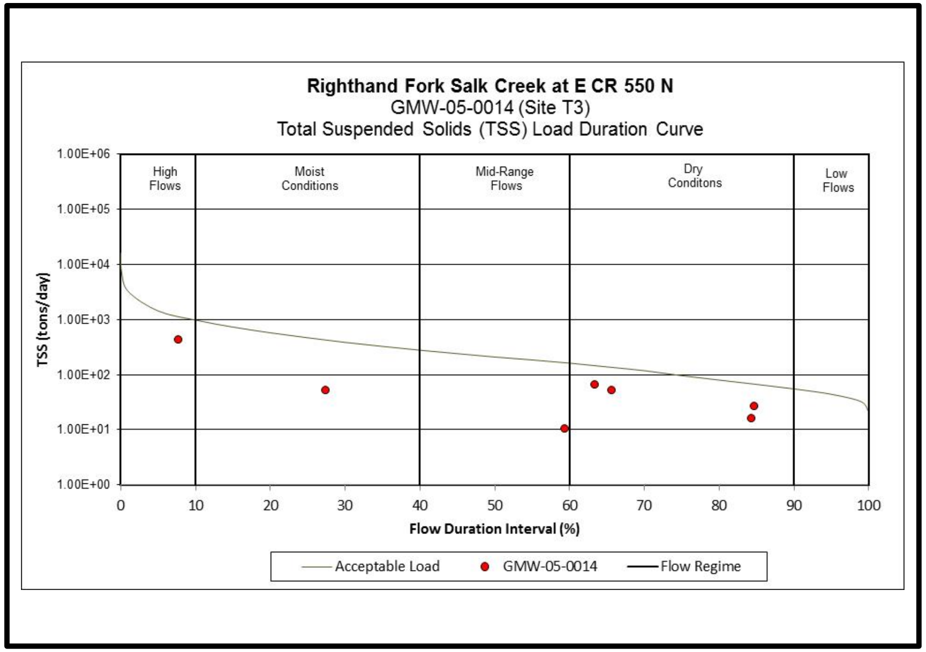
Downstream

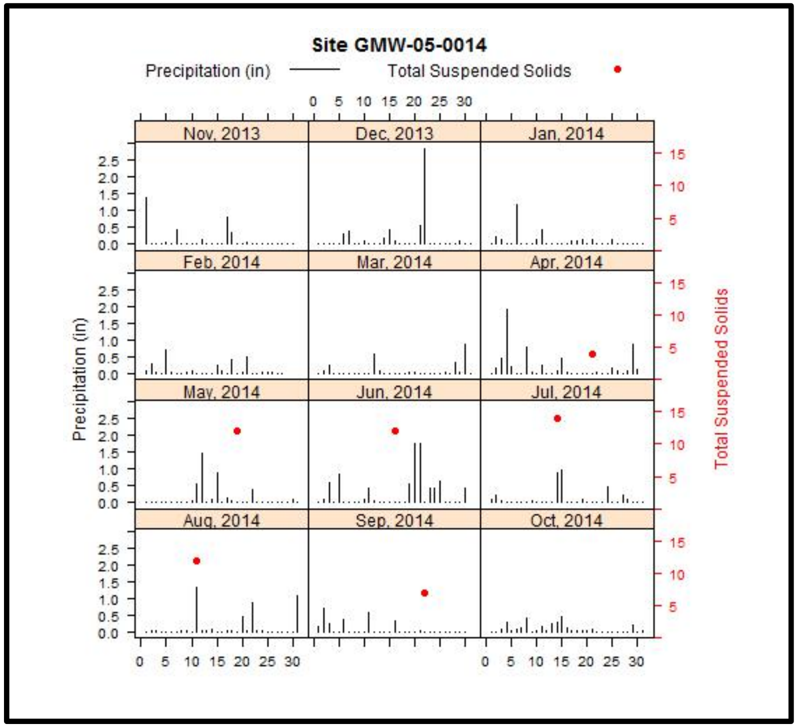

Righthand Fork Salt Creek at CR 550 N
GMW-05-0014 (T3)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-05-0014


Site GMW-05-0014
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014


Site GMW-05-0014
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014


Righthand Fork Salt Creek at E CR 550 N
GMW-05-0014 (T3)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-05-0014
Flow Regime





Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	5.38E+09	1.71E+11	1.98E+10	2.50E+10	1.41E+10	3.04E+09	4.07E+09
TP (lbs/day)	0.376	2.2	2.94	NA	0.205	0.212	0.998
TSS (lbs/day)	53.68	432.56	53.48	66.78	27.04	16.11	10.79

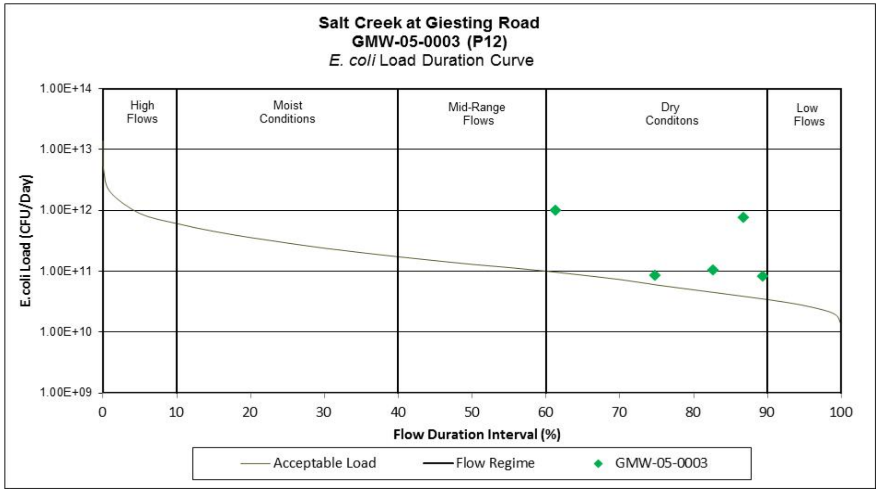
Site P12

GMW-05-0003

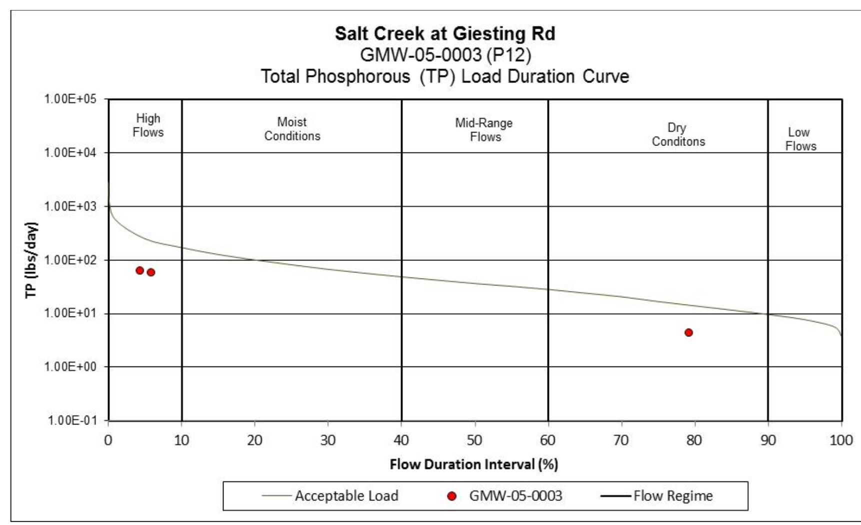
Salt Creek at Giestling Road

Upstream

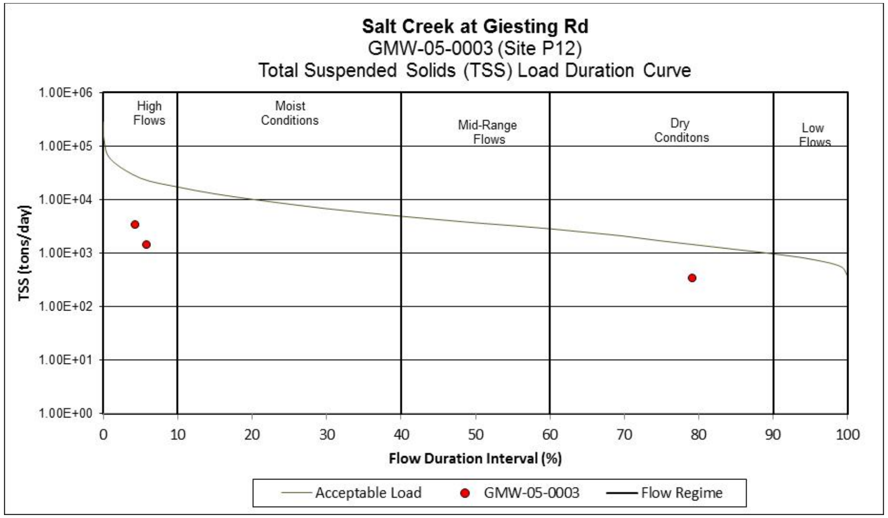
Downstream



Salt Creek at Giesting Road
GMW-05-0003 (P12)
E. coli Load Duration Curve
E.coli Load (CFU/Day)
1.00E+14
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-05-0003



Salt Creek at Giesting Rd
GMW-05-0003 (P12)
Total Phosphorous (TP) Load Duration Curve
TP (lbs/day)
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
GMW-05-0003
Flow Regime



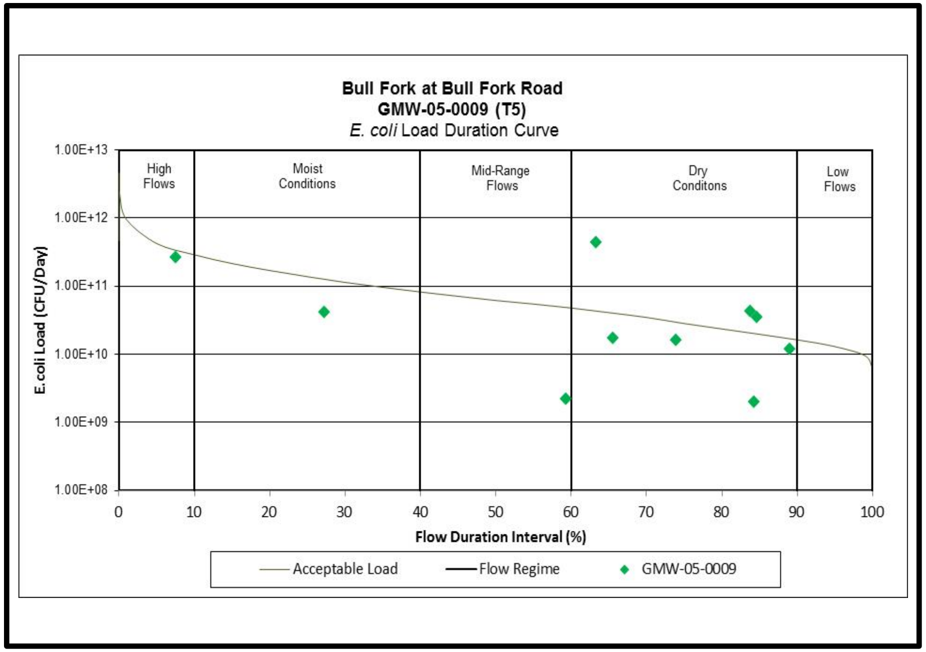
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

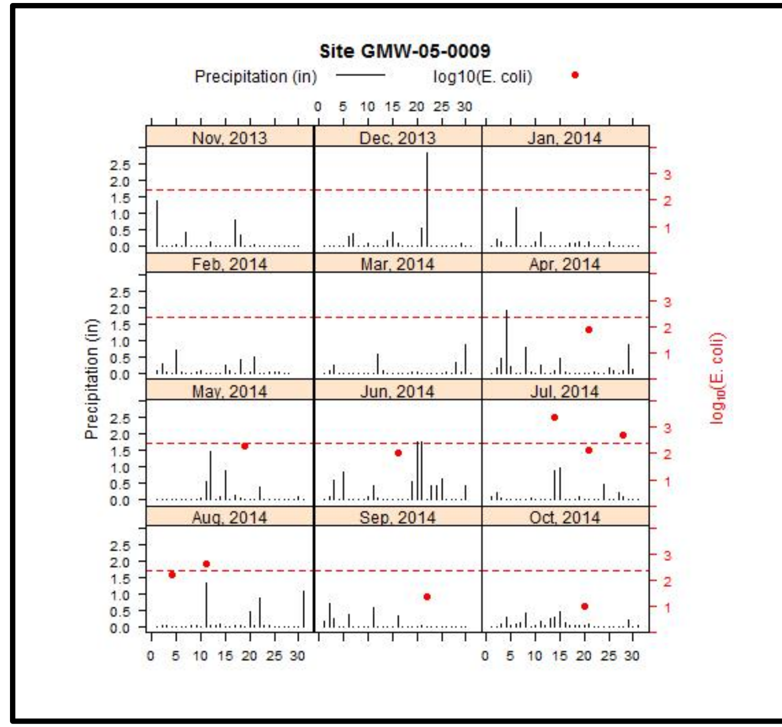
Parameter	May	June	July	August	Sept
E. Coli (MPN)	NA	NA	3.89E+11	4.23E+11	NA
TP (lbs/day)	64.36	58.32	NA	NA	4.53
TSS (lbs/day)	3478.83	1458.09	NA	NA	337.42

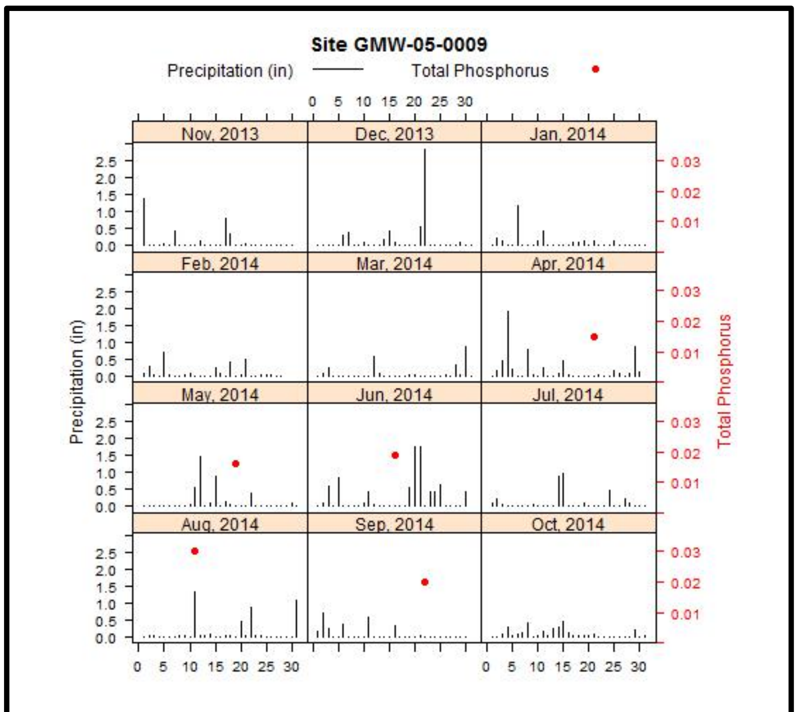
Site T5
GMW-05-0009
Bull Fork at Bullfork Road

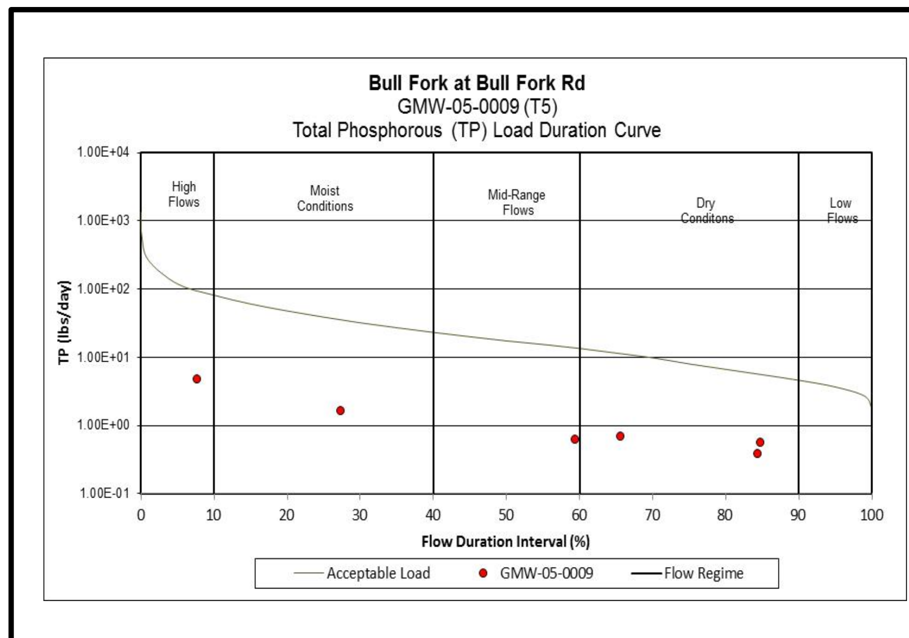
Upstream

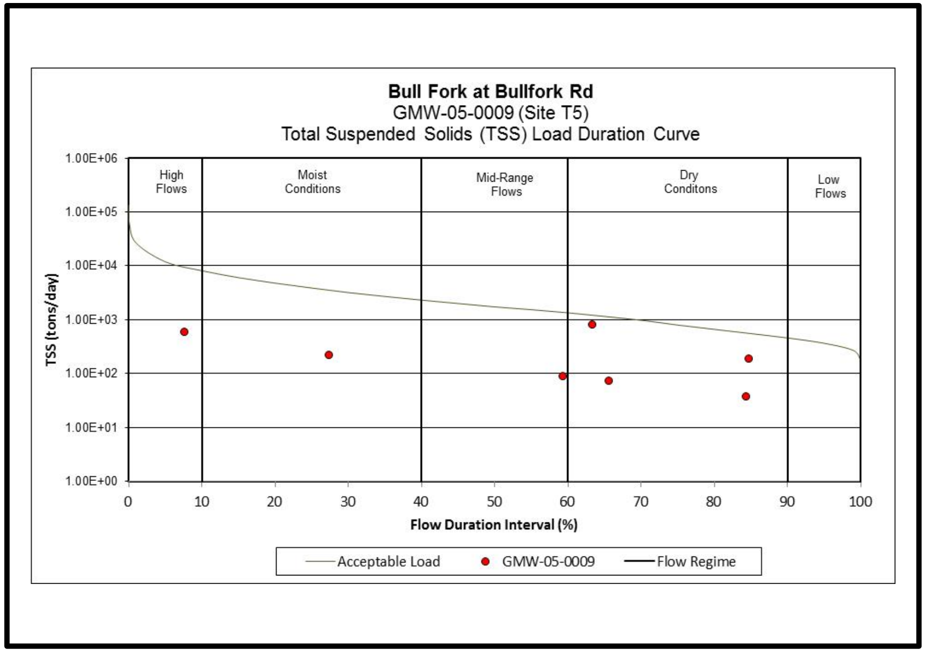
Downstream

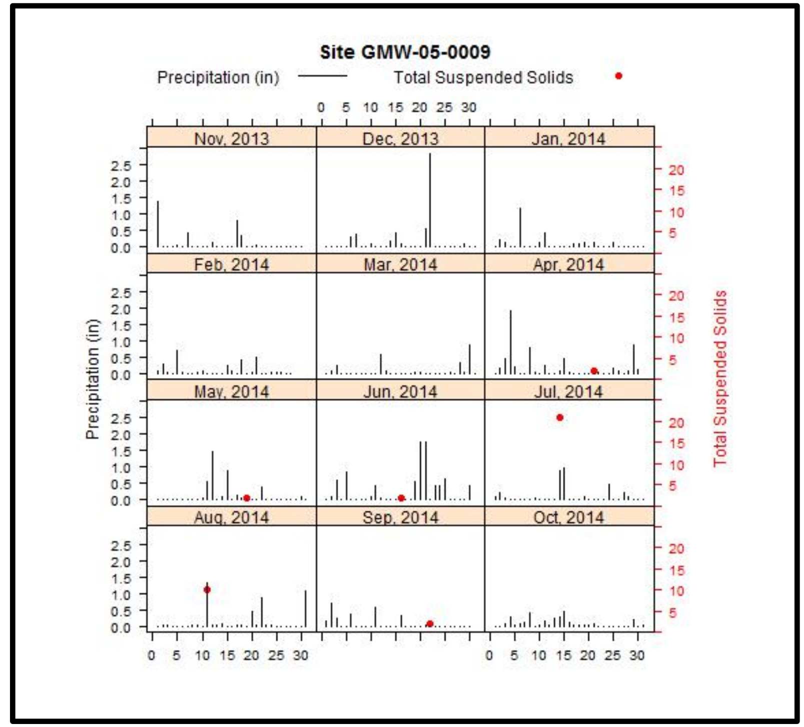

Bull Fork at Bull Fork Road
GMW-05-0009 (T5)
E. coli Load Duration Curve
E.coli Load (CFU/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
Flow Regime
GMW-05-0009


Site GMW-05-0009
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014


Site GMW-05-0009
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014


Bull Fork at Bull Fork Rd
GMW-05-0009 (T5)
Total Phosphorous (TP) Load Duration Curve
TP (lbs/day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
GMW-05-0009
Flow Regime





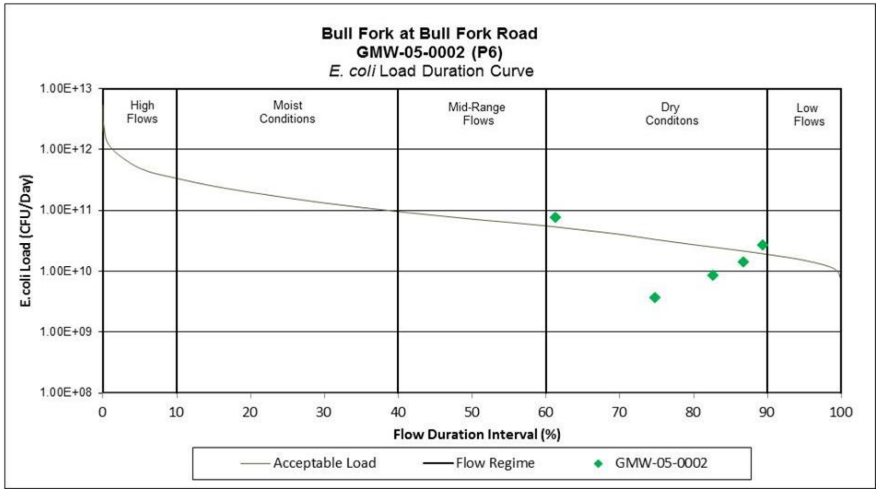
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

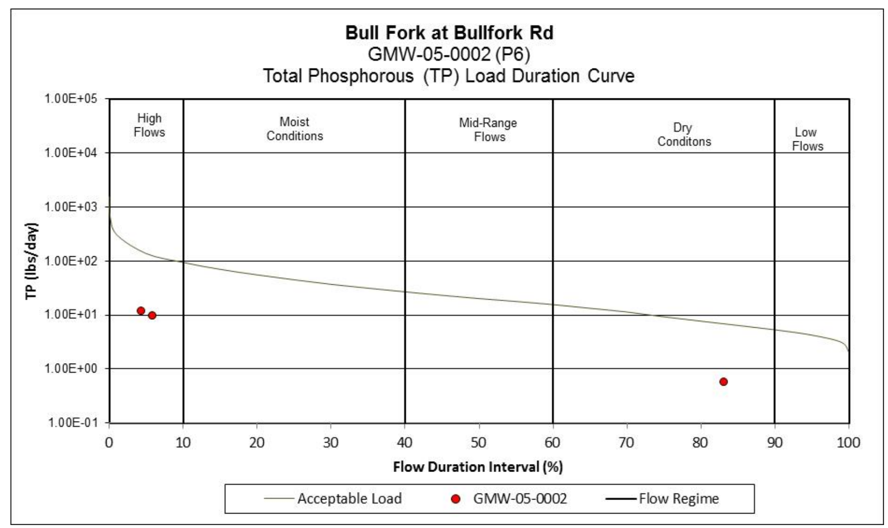
Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	4.12E+10	2.63E+11	1.71E+10	1.64E+11	2.34E+10	1.98E+09	2.22E+09
TP (lbs/day)	1.67	4.8	0.7	NA	0.56	0.38	0.63
TSS (lbs/day)	223.24	599.65	74.14	833.23	187.39	38.29	89.78

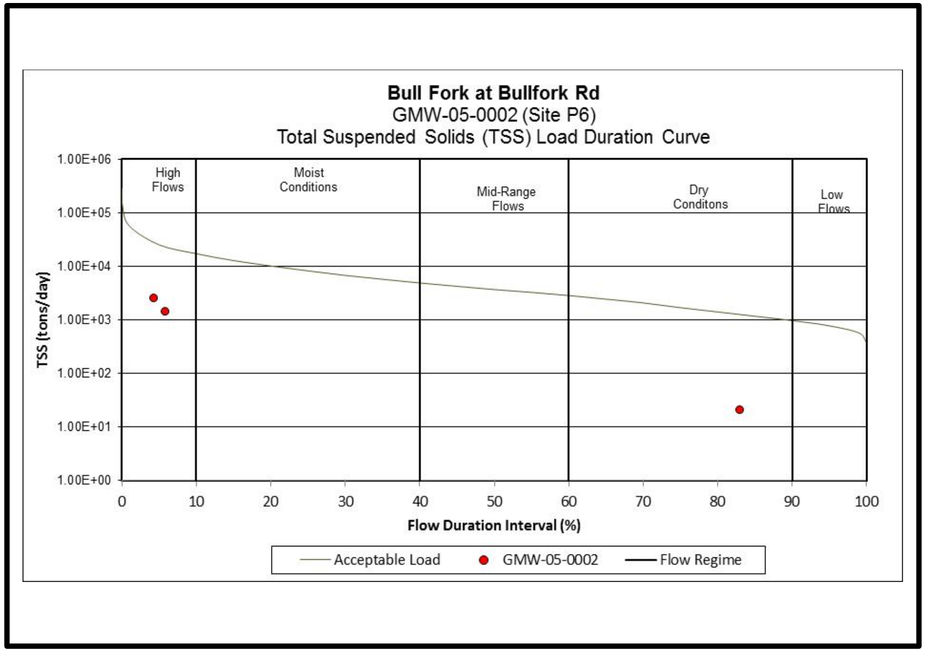
Site P6
GMW-05-0002
Bull Fork at Bullfork Road

Upstream

Downstream


Bull Fork at Bull Fork Road
GMW-05-0002 (P6)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-05-0002


Bull Fork at Bullfork Rd
GMW-05-0002 (P6)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
GMW-05-0002
Flow Regime



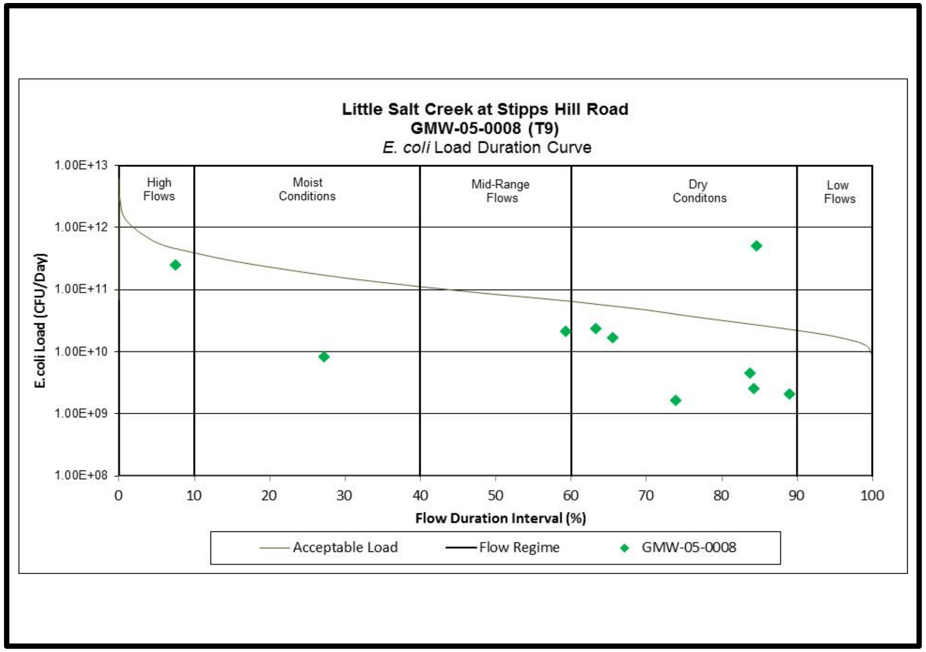
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

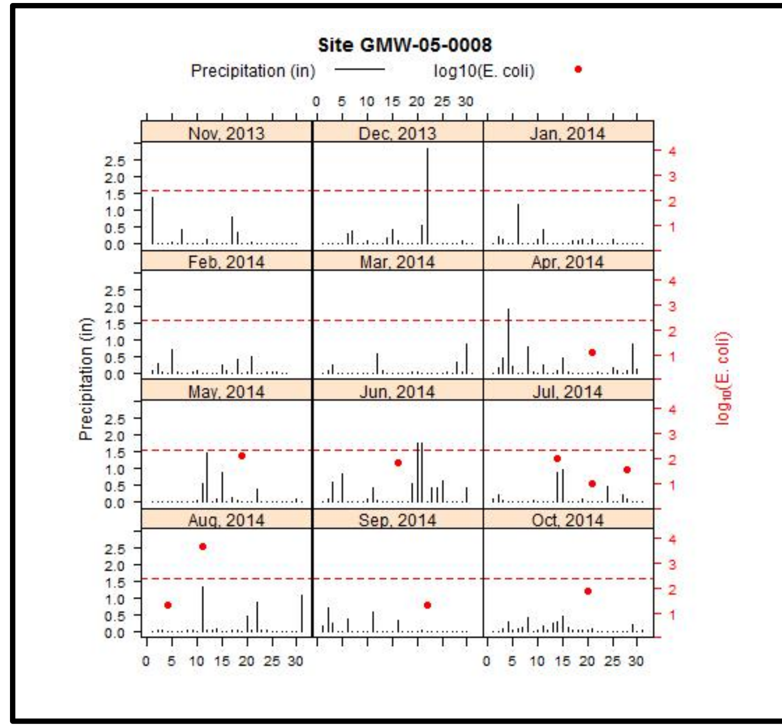
Parameter	May	June	July	August	Sept
E. Coli (MPN)	NA	NA	2.97E+10	4.07E+10	NA
TP (lbs/day)	12.01	10.06	NA	NA	0.58
TSS (lbs/day)	2609.12	1458.09	NA	NA	23.09

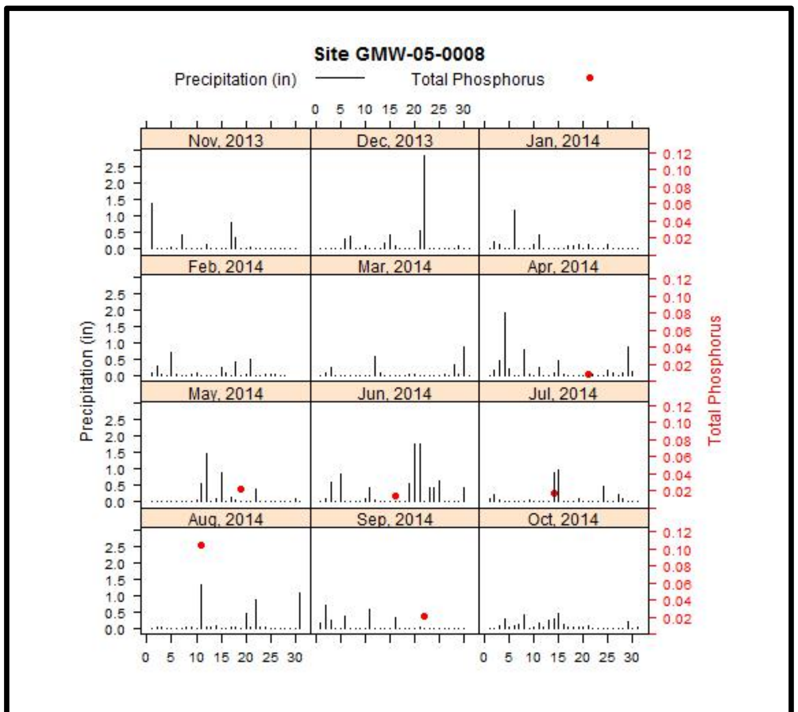
Site T9
GMW-05-0008
Little Salt Creek at Stipps Hill Road

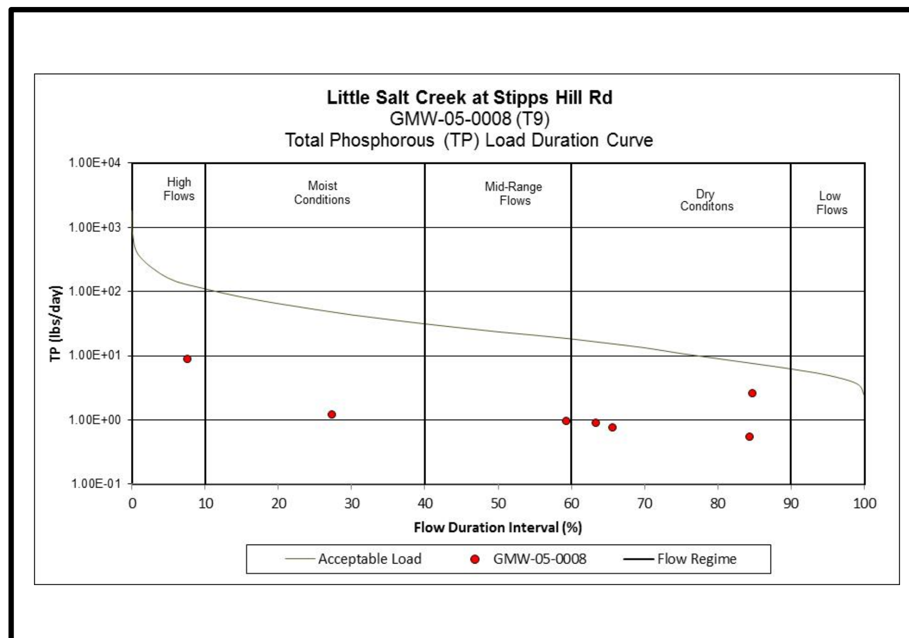
Upstream

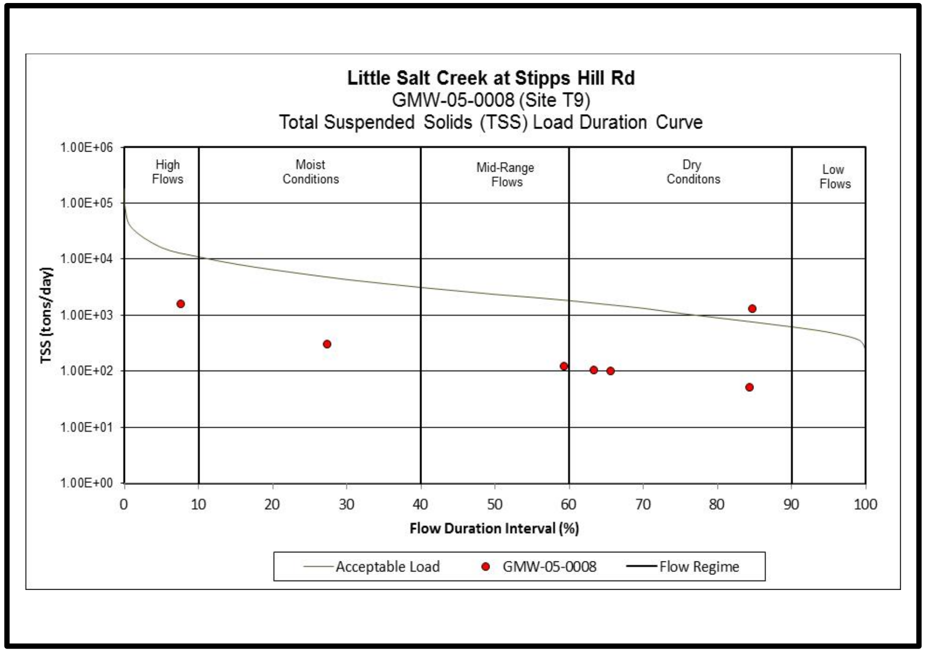
Downstream

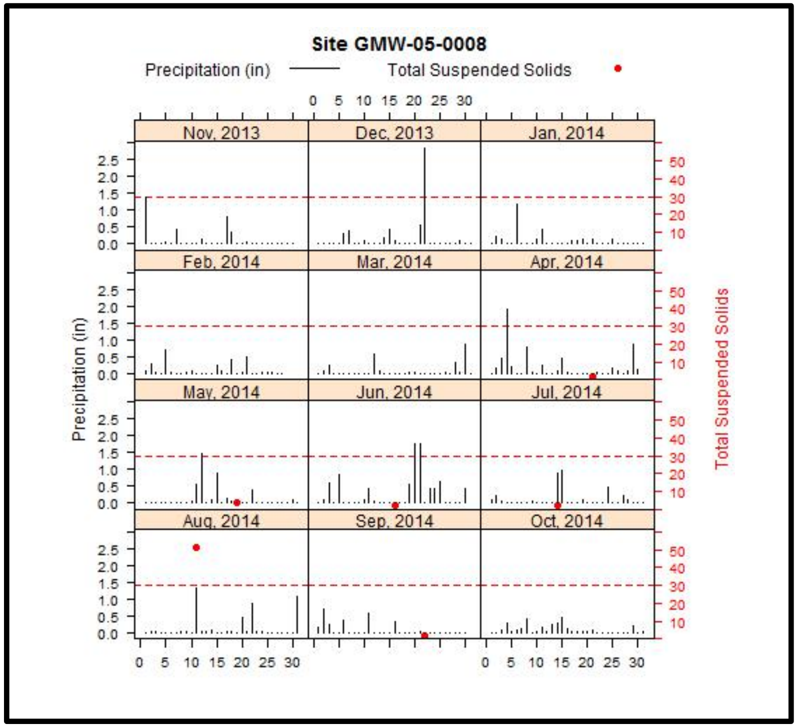

Little Salt Creek at Stipps Hill Road
GMW-05-0008 (T9)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-05-0008


Site GMW-05-0008
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014


Site GMW-05-0008
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014


Little Salt Creek at Stipps Hill Rd
GMW-05-0008 (T9)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-05-0008
Flow Regime





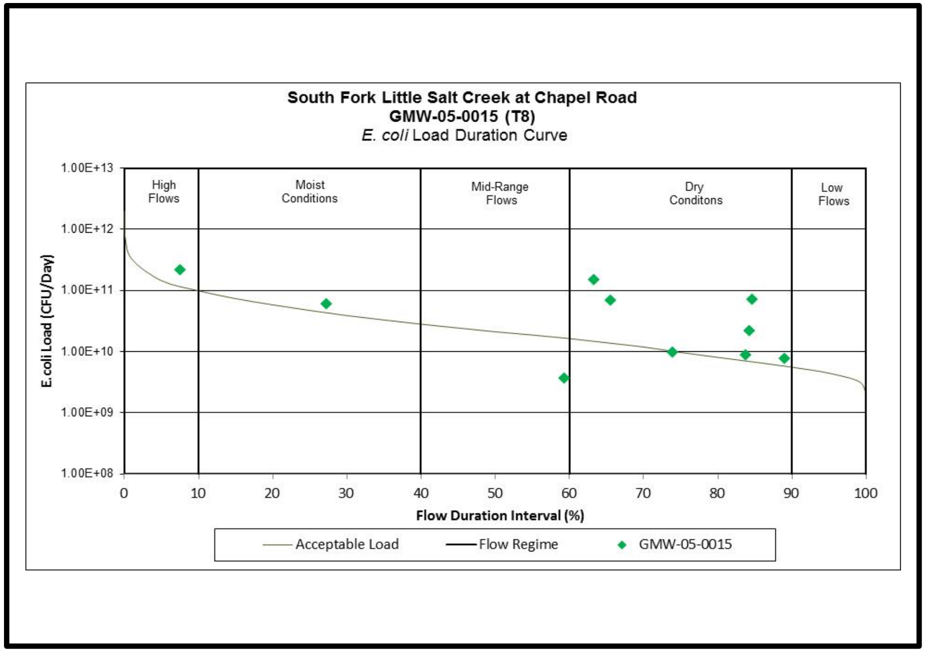
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

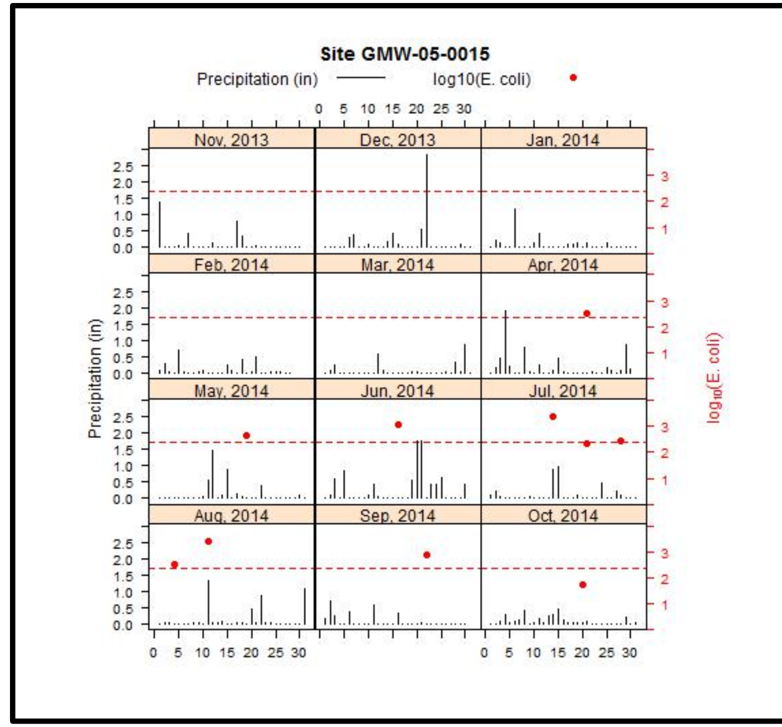
Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	8.24E+09	2.50E+11	1.65E+10	2.95E+10	5.03E+11	2.51E+09	2.10E+10
TP (lbs/day)	1.21	8.94	0.75	0.91	2.64	0.55	0.97
TSS (lbs/day)	302.72	1626.28	100.54	107.61	1295.94	51.93	121.75

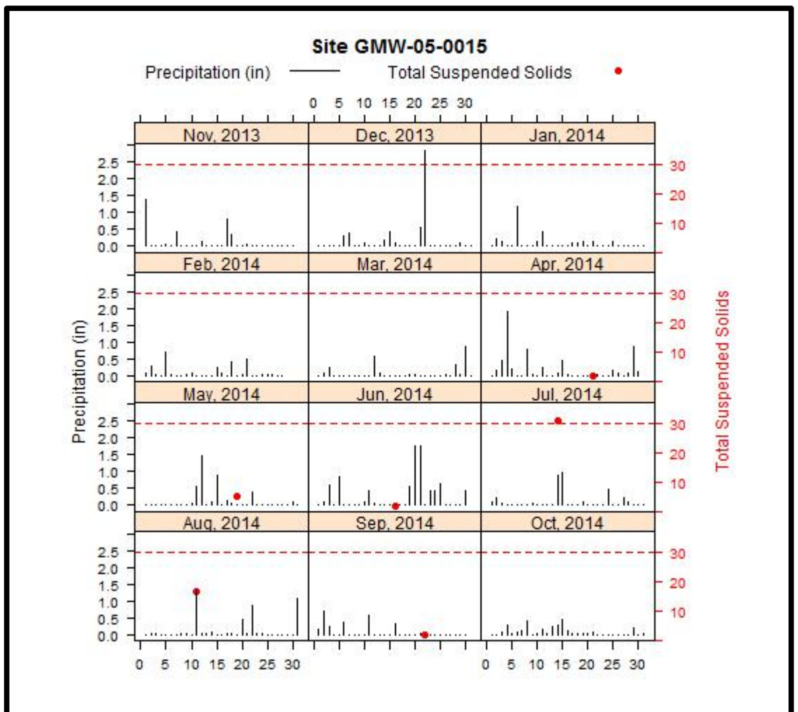
Site T8
GMW-05-0015
South Fork Little Salt Creek at Chapel Road

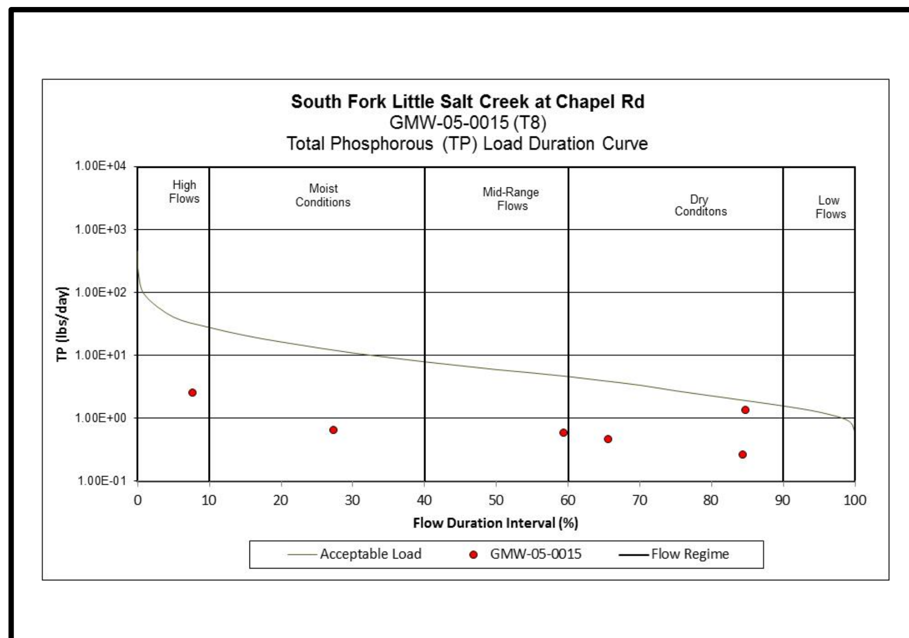
Upstream

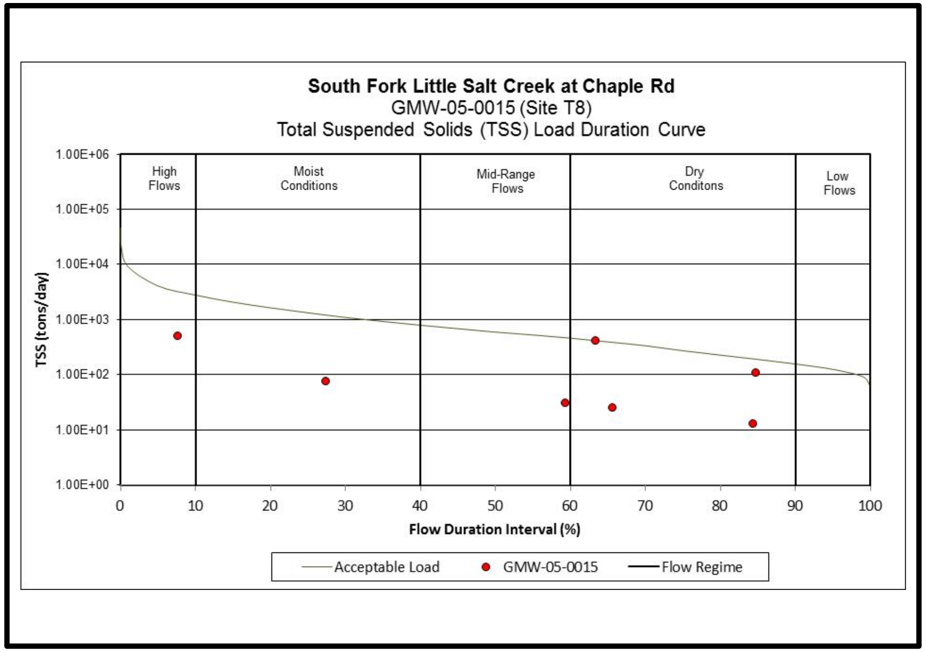
Downstream

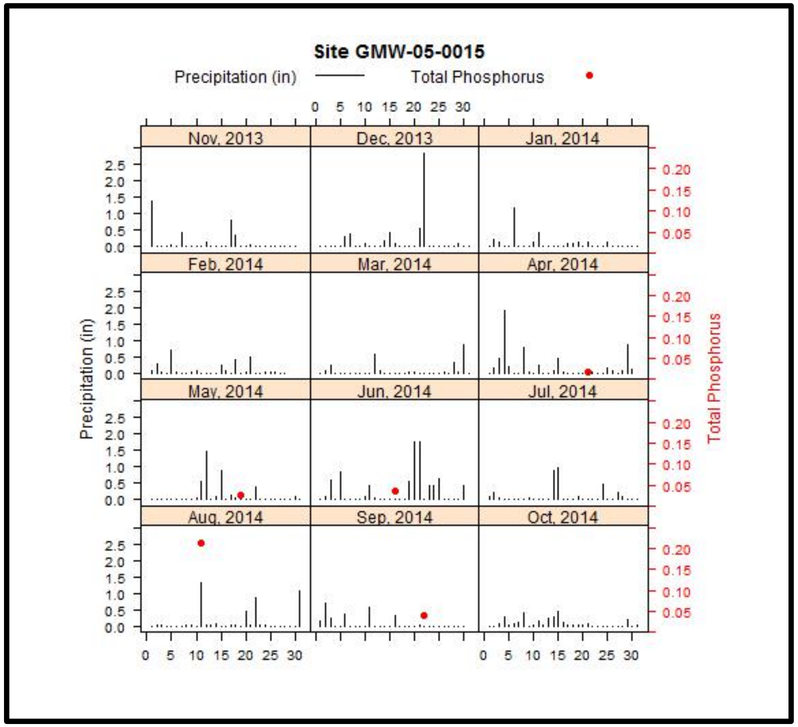

South Fork Little Salt Creek at Chapel Road
GMW-05-0015 (T8)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-05-0015


Site GMW-05-0015
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014


Site GMW-05-0015
Precipitation (in)
Total Suspended Solids
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014


South Fork Little Salt Creek at Chapel Rd
GMW-05-0015 (T8)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-05-0015
Flow Regime





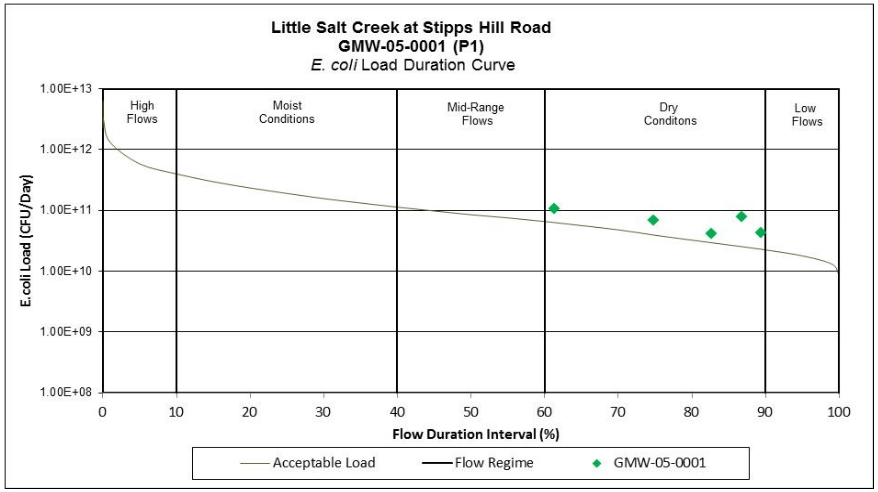
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	5.97E+10	2.15E+11	6.93E+10	5.59E+10	3.90E+10	2.16E+10	3.69+E09
TP (lbs/day)	0.65	2.57	0.47	NA	1.36	0.27	0.58
TSS (lbs/day)	76.4	513.06	25.37	420.96	109.02	13.11	30.73

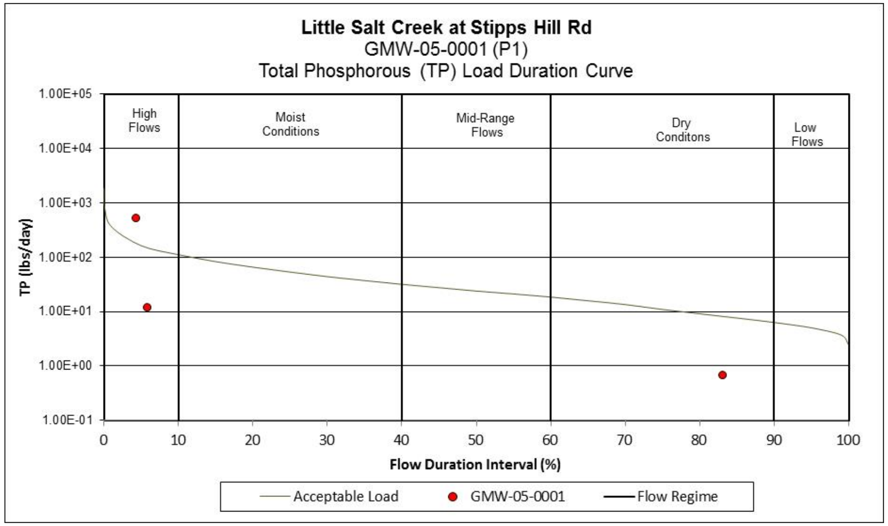
Site P1
GMW-05-0001
Little Salt Creek at Stipps Hill Road

Upstream

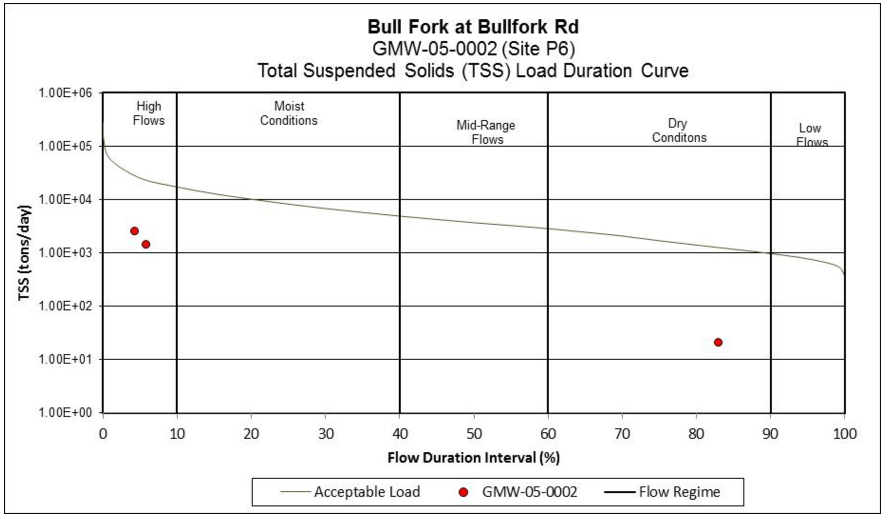
Downstream



Little Salt Creek at Stipps Hill Road
GMW-05-0001 (P1)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-05-0001



Little Salt Creek at Stipps Hill Rd
GMW-05-0001 (P1)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditons
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-05-0001
Flow Regime



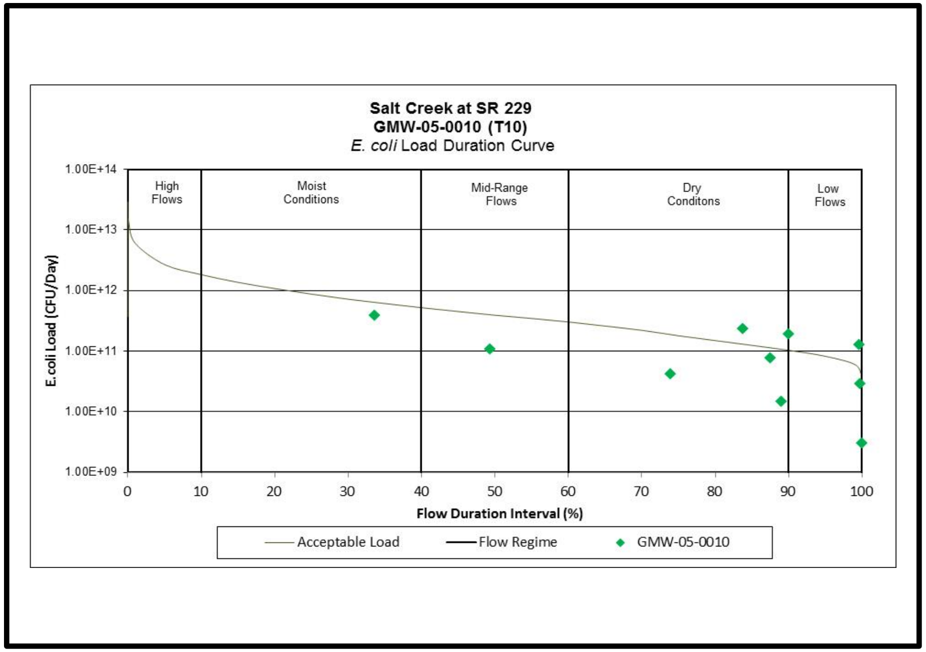
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

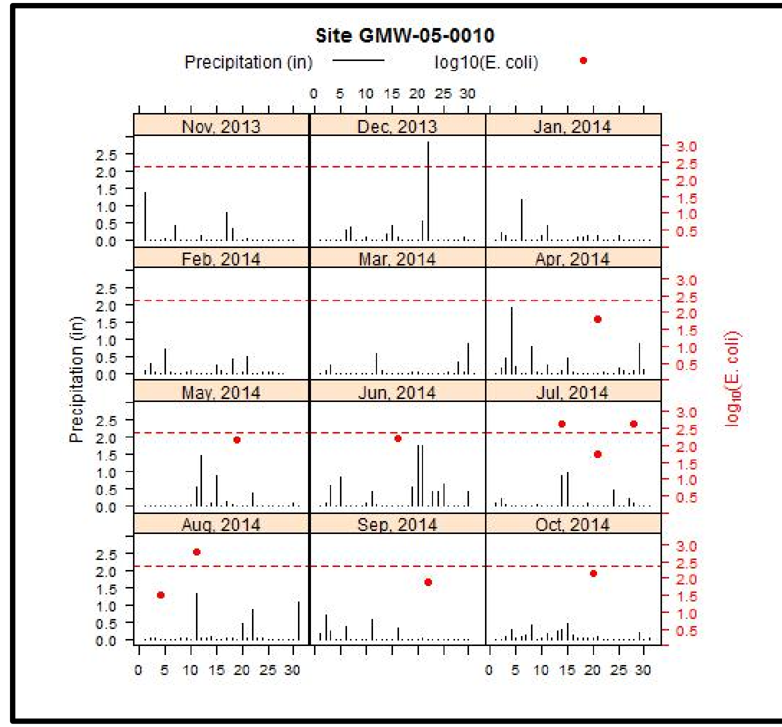
Parameter	May	June	July	August	Sept
E. Coli (MPN)	NA	NA	7.14E+10	6.05E+10	NA
TP (lbs/day)	535.03	11.93	NA	NA	0.068
TSS (lbs/day)	2609.12	1458.09	NA	NA	20.93

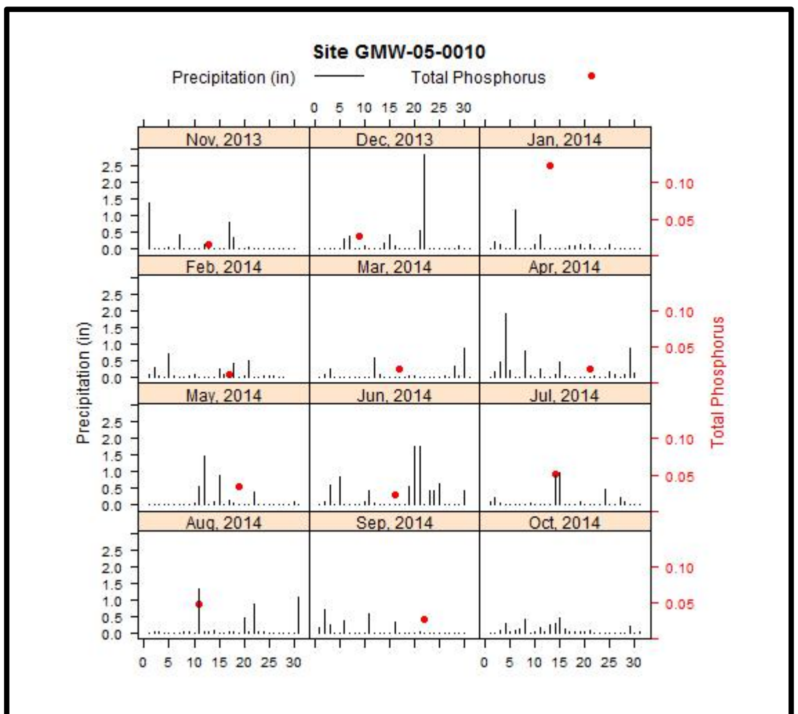
Site T10
GMW-05-0010
Salt Creek at SR 229

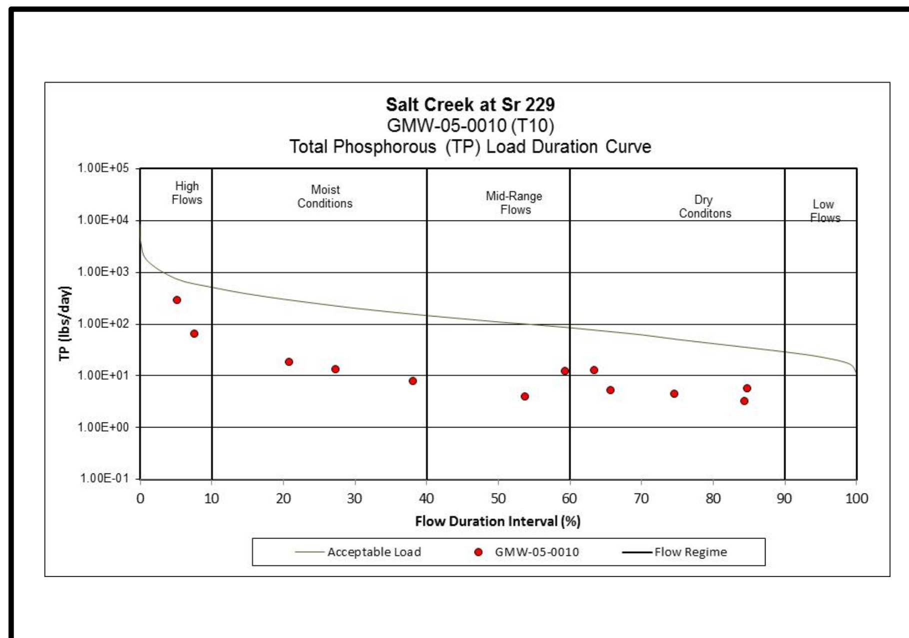
Upstream

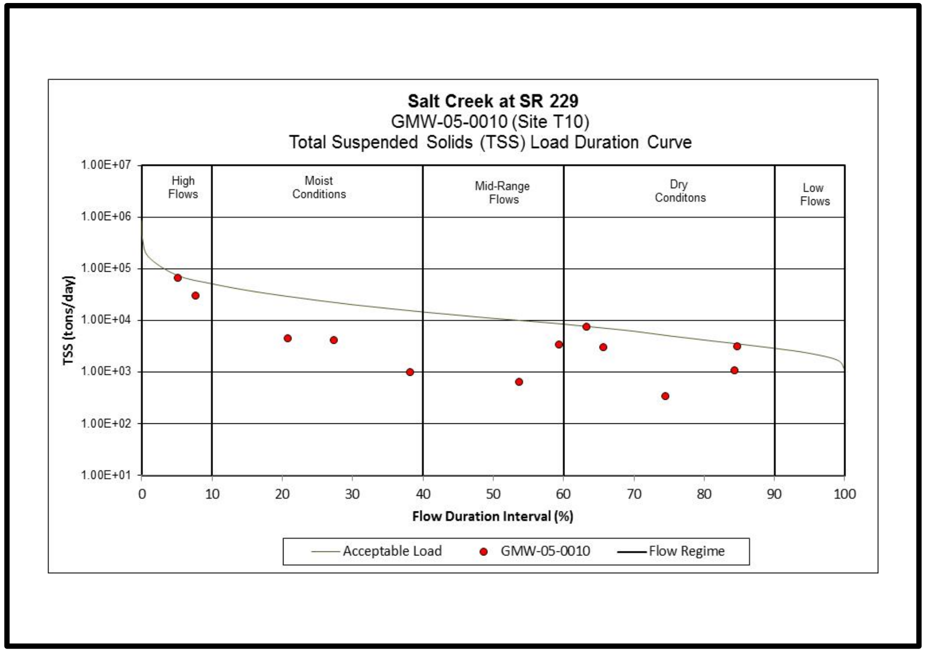
Downstream

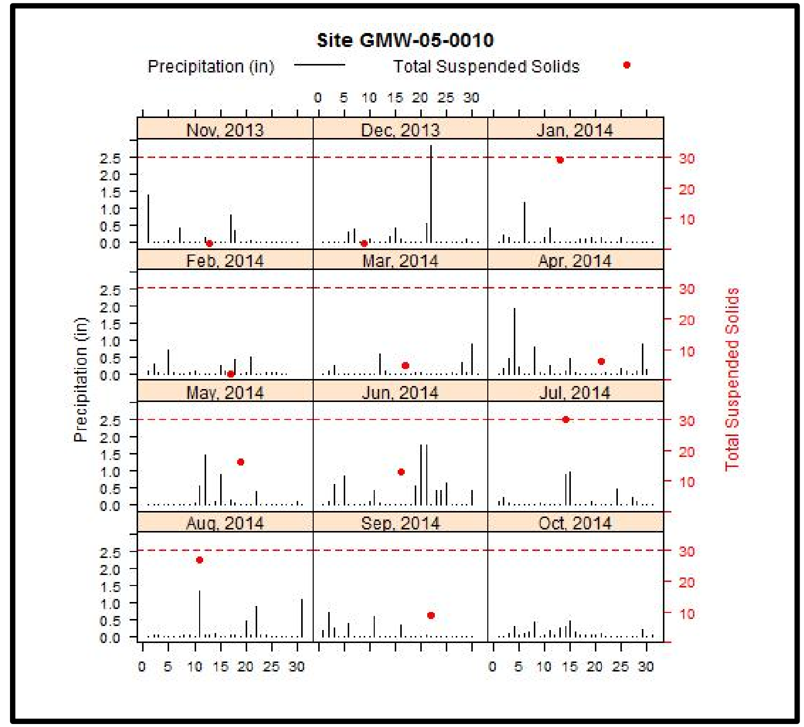

Salt Creek at SR 229
GMW-05-0010 (T10)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-05-0010


Site GMW-05-0010
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log10(E. coli)


Site GMW-05-0010
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus


Salt Creek at Sr 229
GMW-05-0010 (T10)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-05-0010
Flow Regime





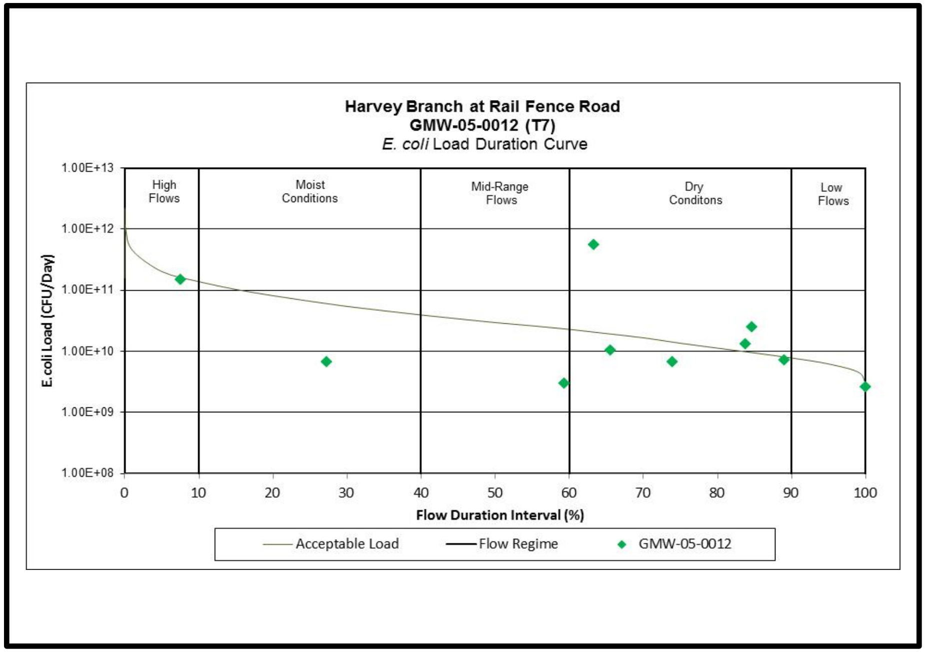
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

Parameter	January	February	March	April	May	June	July	August	Sept	Oct	November	December
E. Coli (MPN)	NA	NA	NA	1.07E+11	3.84E+11	7.78E+10	1.53E+11	7.05E+10	3.00E+09	2.87E+10	NA	NA
TP (lbs/day)	292.86	3.96	18.5	13.45	64.66	5.41	12.84	5.82	3.28	12.53	8	4.62
TSS (lbs/day)	68491.55	659.44	4625.36	4248.1	30429.2	3056.87	7550.45	3209.33	1093.03	3417.08	999.49	342.12

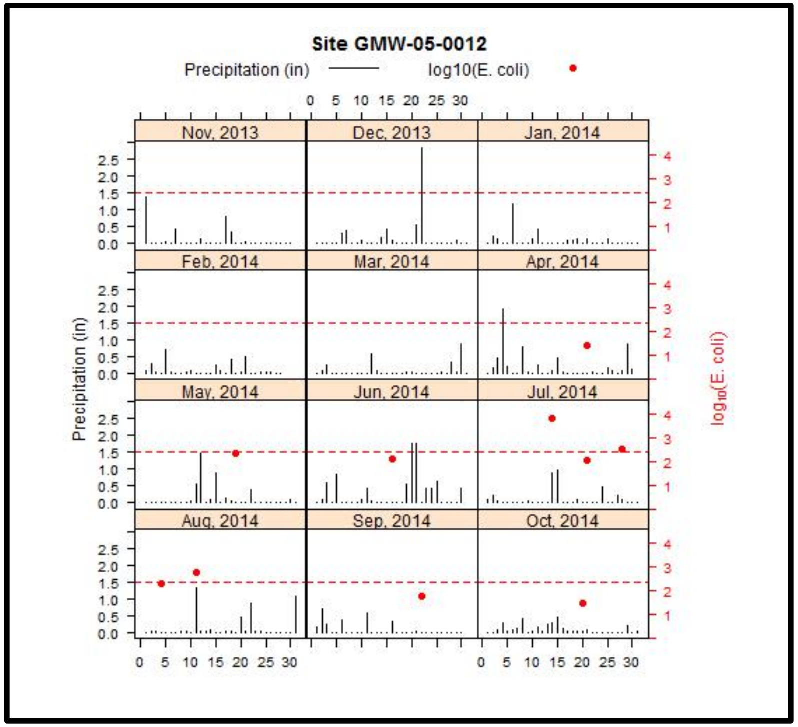
Site T7
GMW-05-0012
Harvey Branch at Rail Fence Road

Upstream

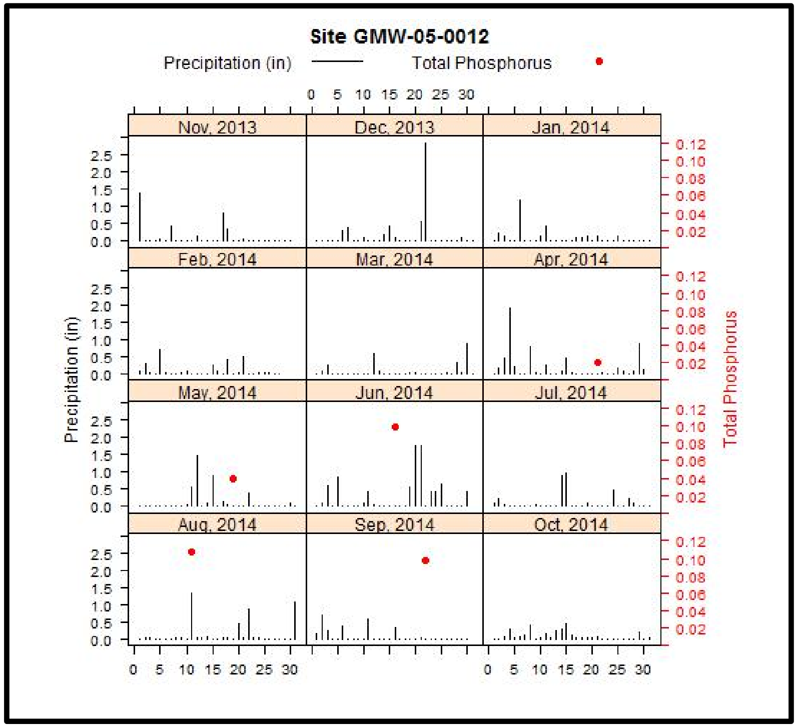
Downstream



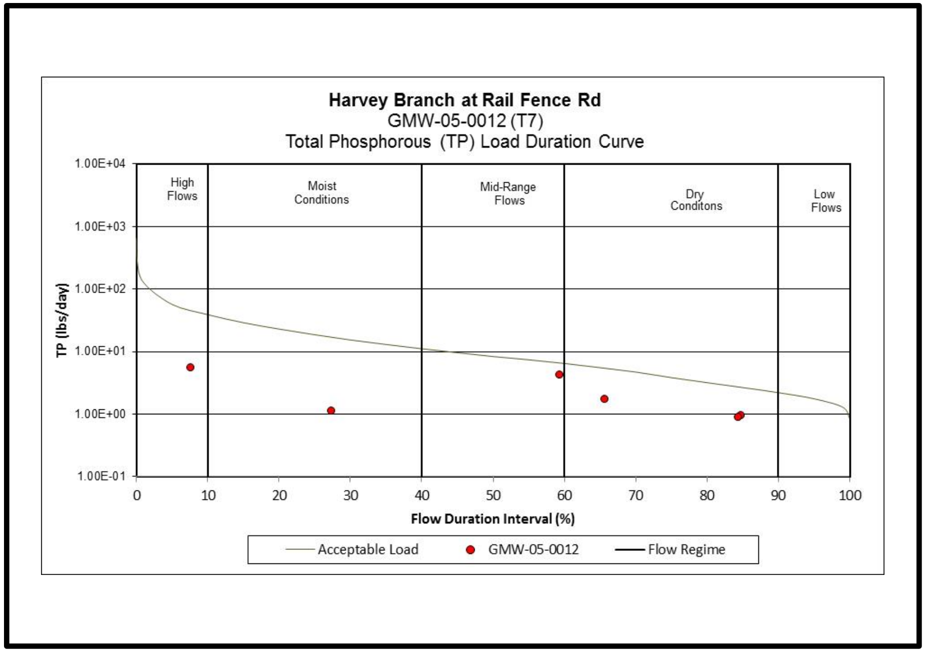
Harvey Branch at Rail Fence Road
GMW-05-0012 (T7)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-05-0012



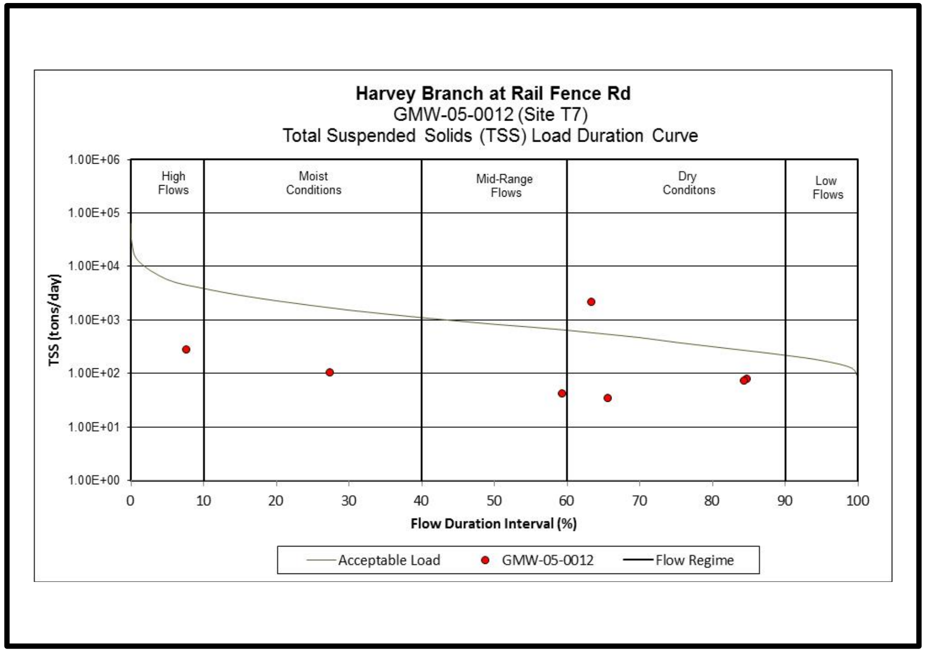
Site GMW-05-0012
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014

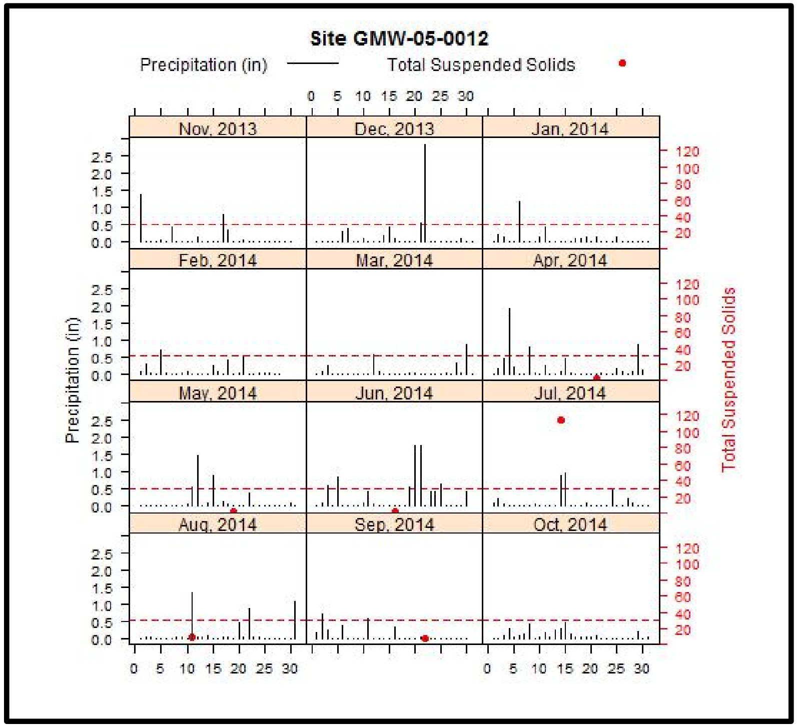


Site GMW-05-0012
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014



Harvey Branch at Rail Fence Rd
GMW-05-0012 (T7)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-05-0012
Flow Regime





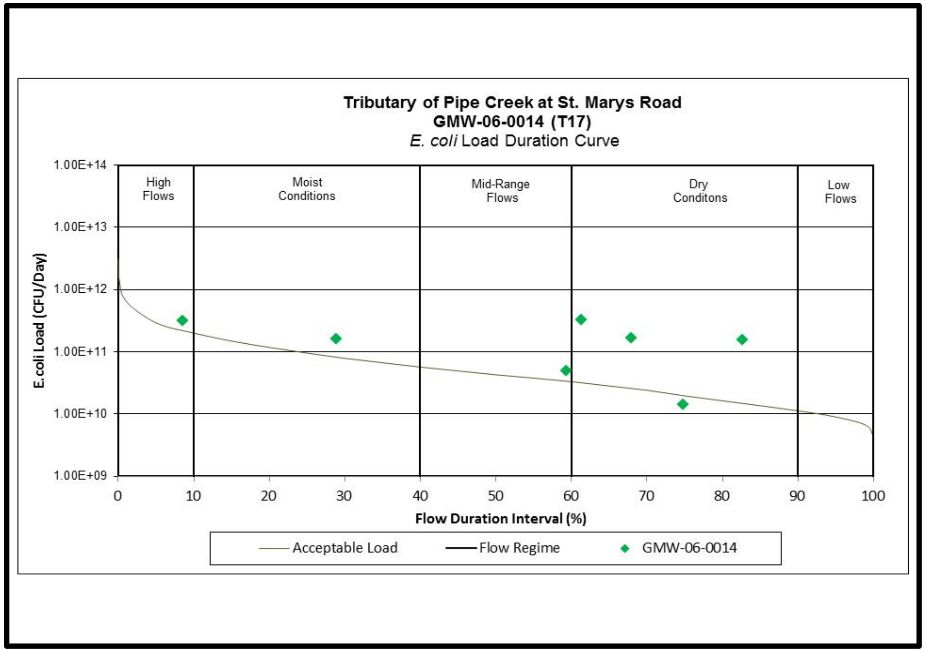
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

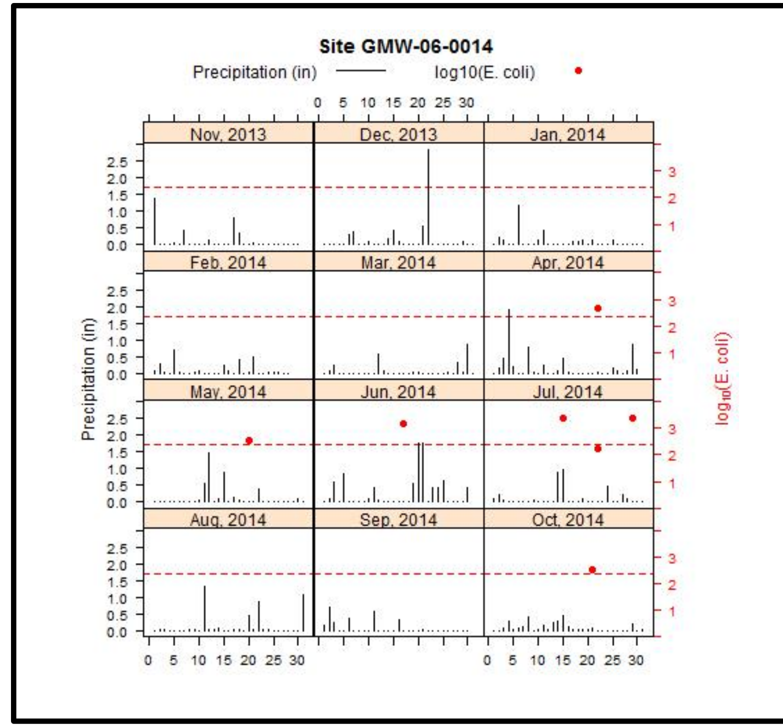
Parameter	April	May	June	July	August	Sept	Oct	November
E. Coli (MPN)	6.67E+09	1.49E+11	1.04E+10	1.93E+11	1.60E+10	2.60E+09	2.60E+09	3.04E+09
TP (lbs/day)	1.12	5.6	1.76	NA	0.96	0.92	4.26	NA
TSS (lbs/day)	106.98	287.37	35.53	2167.69	80.82	73.4	43.03	NA

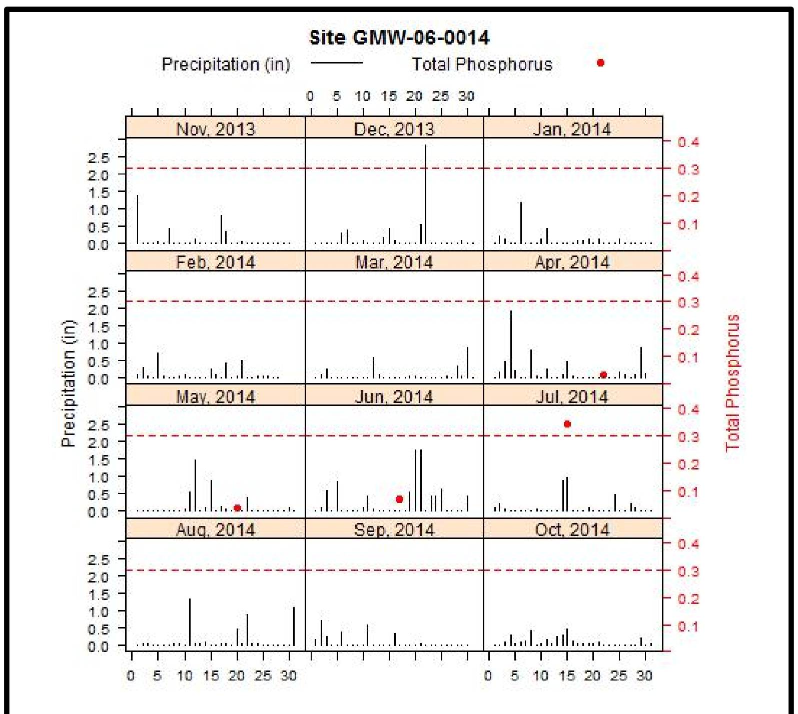
Site T17
GMW-06-0014
Tributary of Pipe Creek at St Marys Road

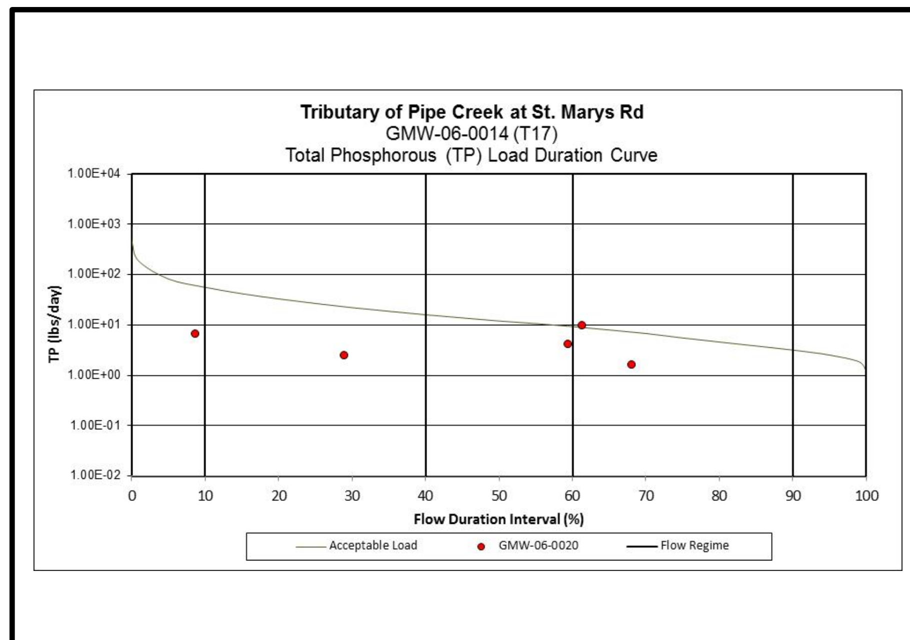
Upstream

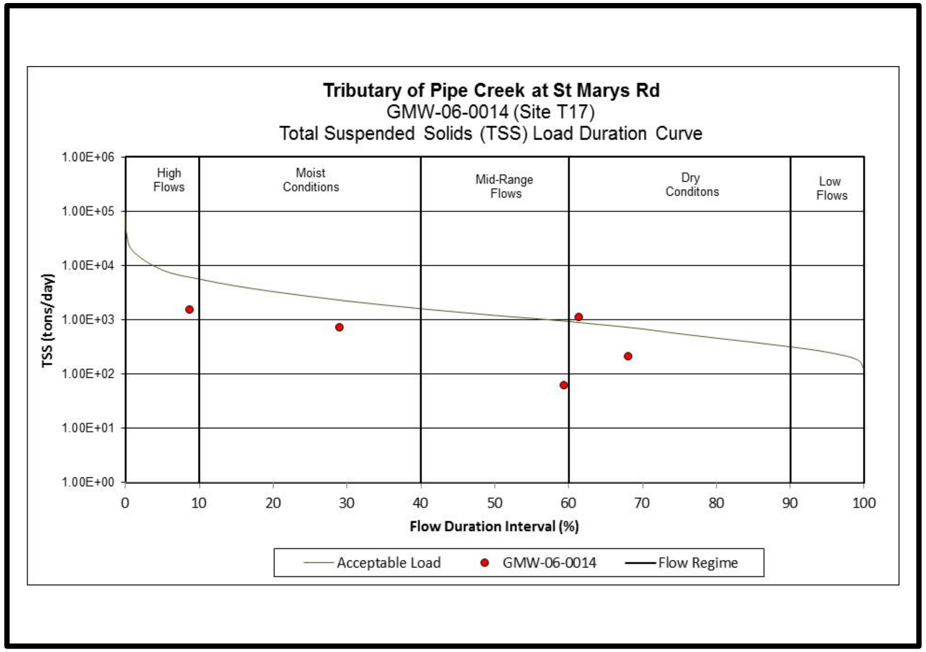
Downstream

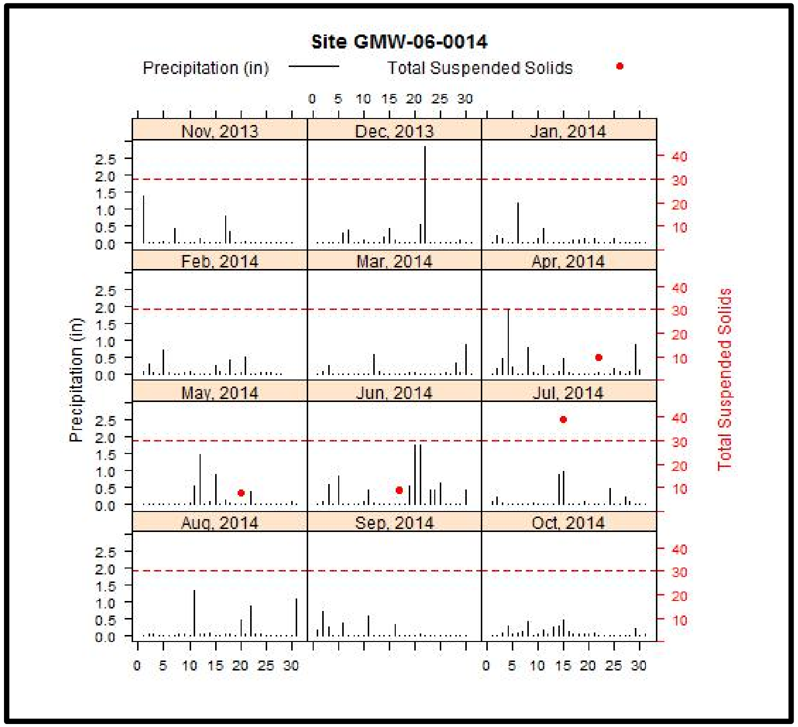

Tributary of Pipe Creek at St. Marys Road
GMW-06-0014 (T17)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-06-0014


Site GMW-06-0014
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014


Site GMW-06-0014
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014


Tributary of Pipe Creek at St. Marys Rd
GMW-06-0014 (T17)
Total Phosphorous (TP) Load Duration Curve
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-06-0020
Flow Regime





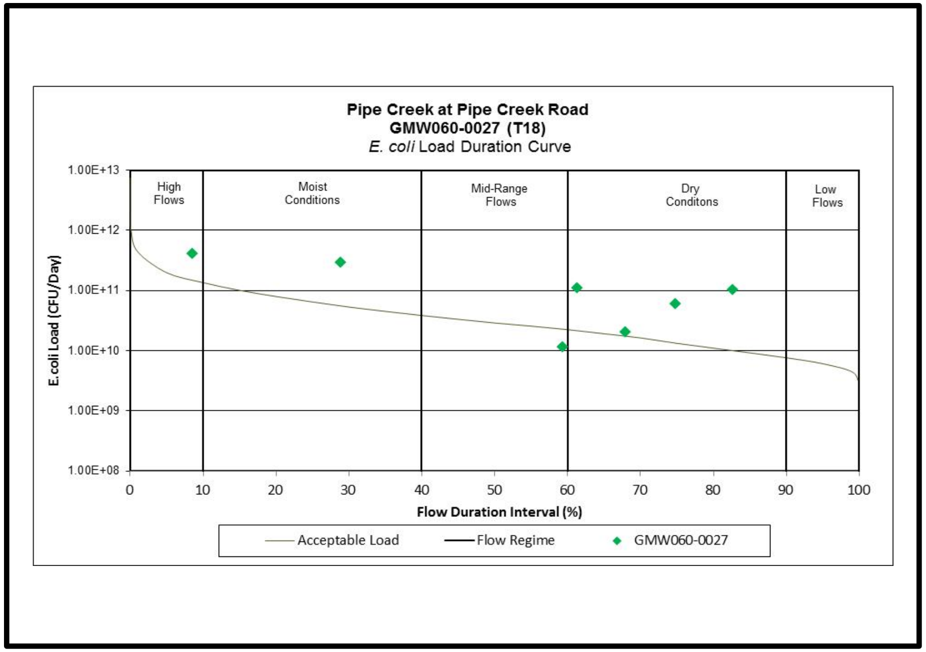
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

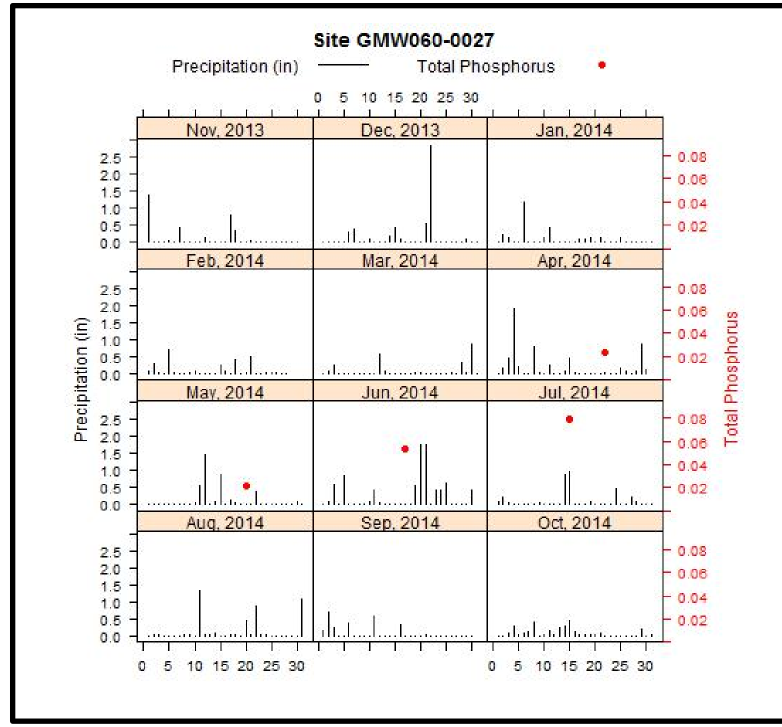
Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	1.62E+11	3.19E+11	1.69E+11	1.63E+11	NA	NA	4.87E+10
TP (lbs/day)	2.55	6.92	1.63	10.08	NA	NA	4.17
TSS (lbs/day)	729.06	1537.24	216.17	1146.14	NA	NA	62.28

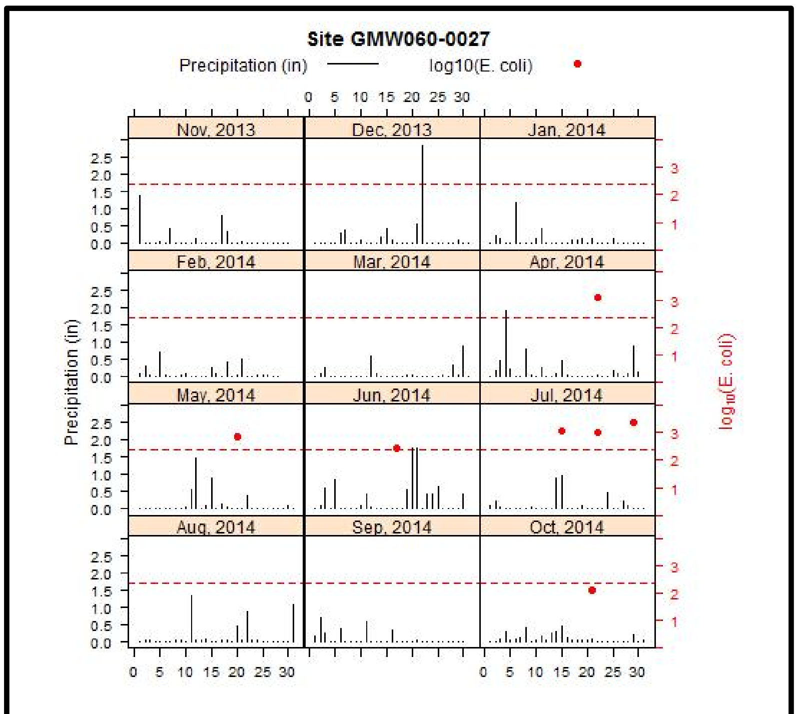
Site T18
GMW060-0027
Pipe Creek at Pipe Creek Road

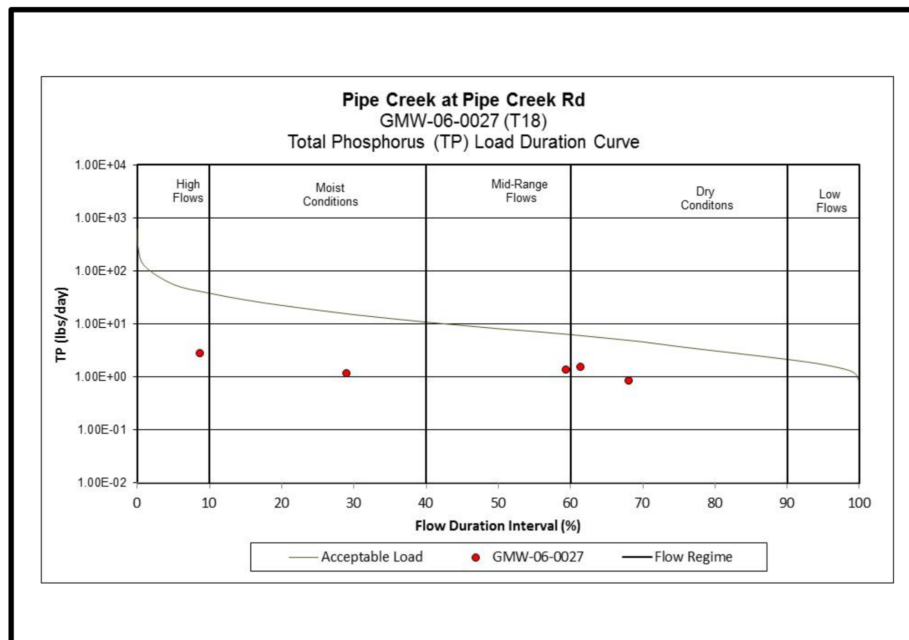
Upstream

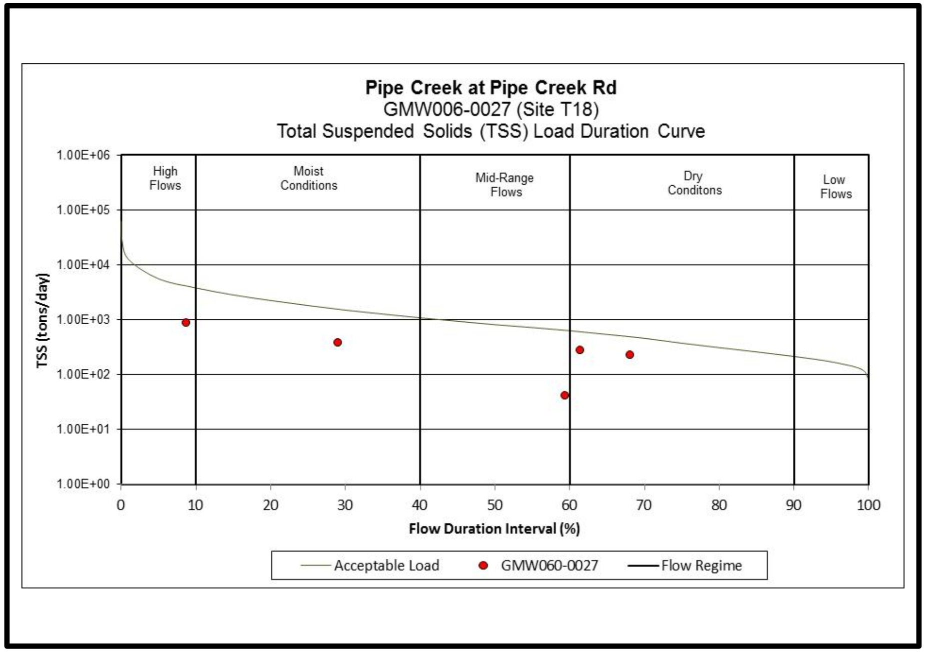
Downstream

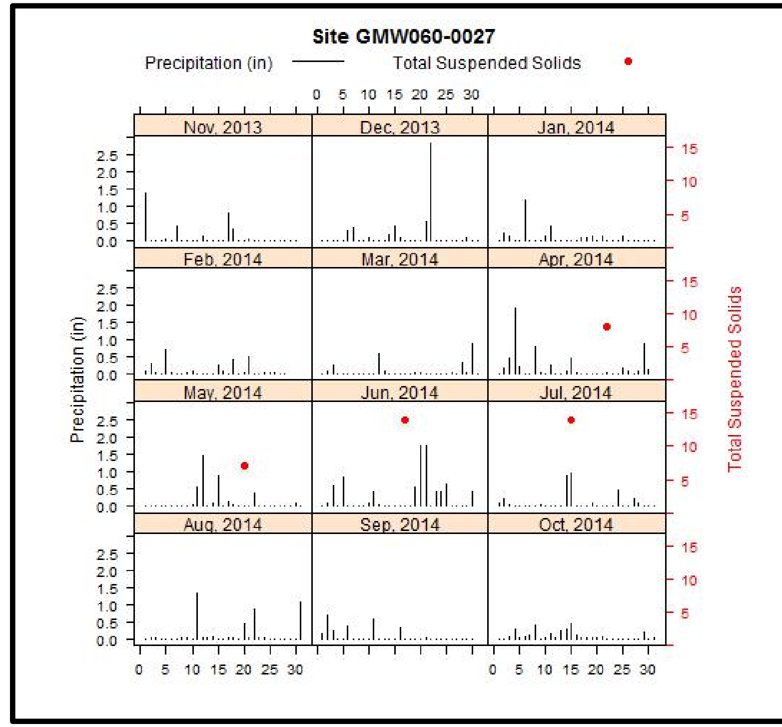

Pipe Creek at Pipe Creek Road
GMW060-0027 (T18)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW060-0027


Site GMW060-0027
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014


Site GMW060-0027
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014


Pipe Creek at Pipe Creek Rd
GMW-06-0027 (T18)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-06-0027
Flow Regime





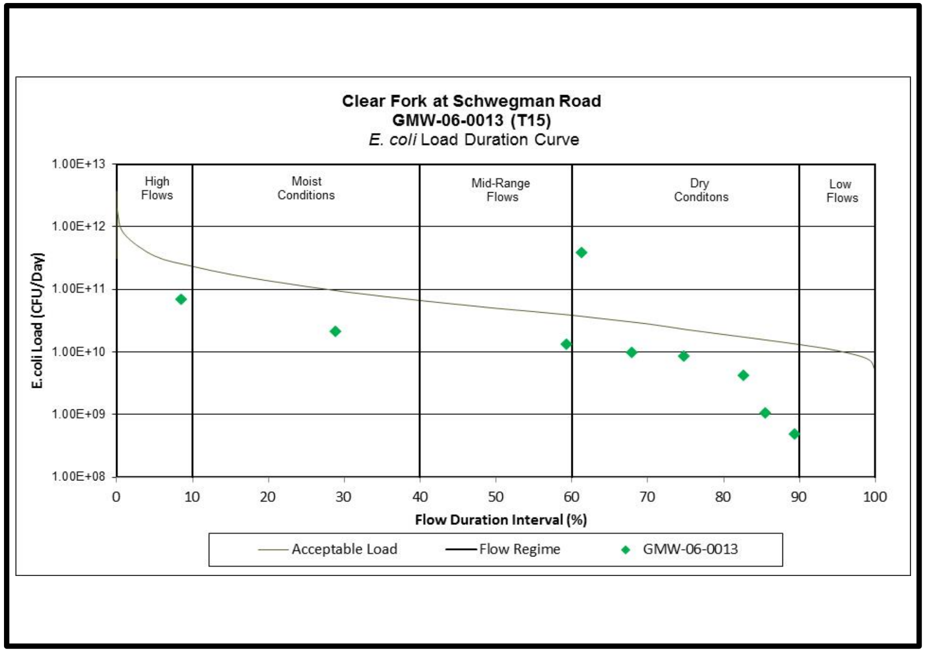
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

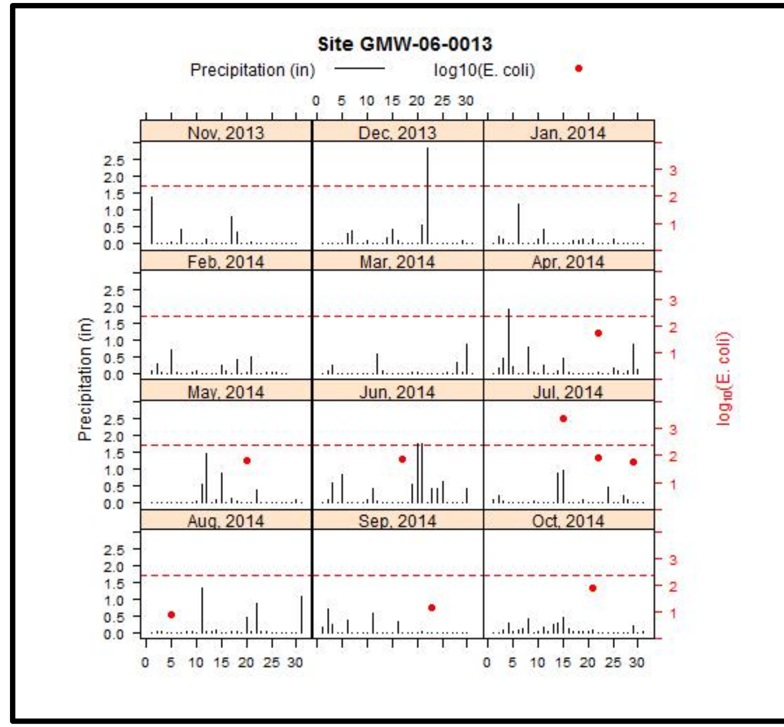
Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	2.90E+11	4.04E+11	2.00E+10	9.04E+10	NA	NA	1.16E+10
TP (lbs/day)	1.18	2.86	0.86	1.57	NA	NA	1.37
TSS (lbs/day)	394.07	908.82	227.2	277.99	NA	NA	42.08

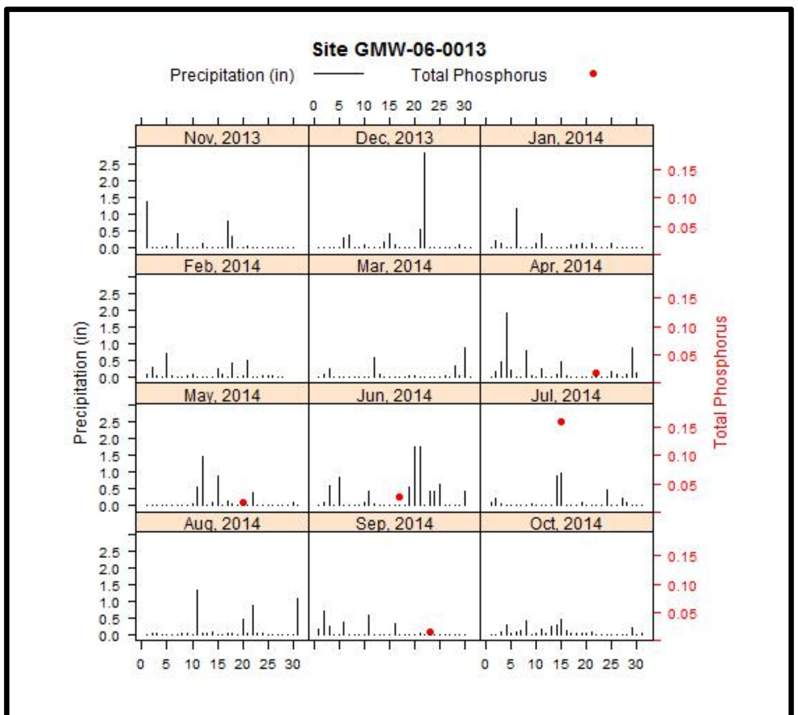
Site T15
GMW-06-0013
Clear Fork at Schwegman Road

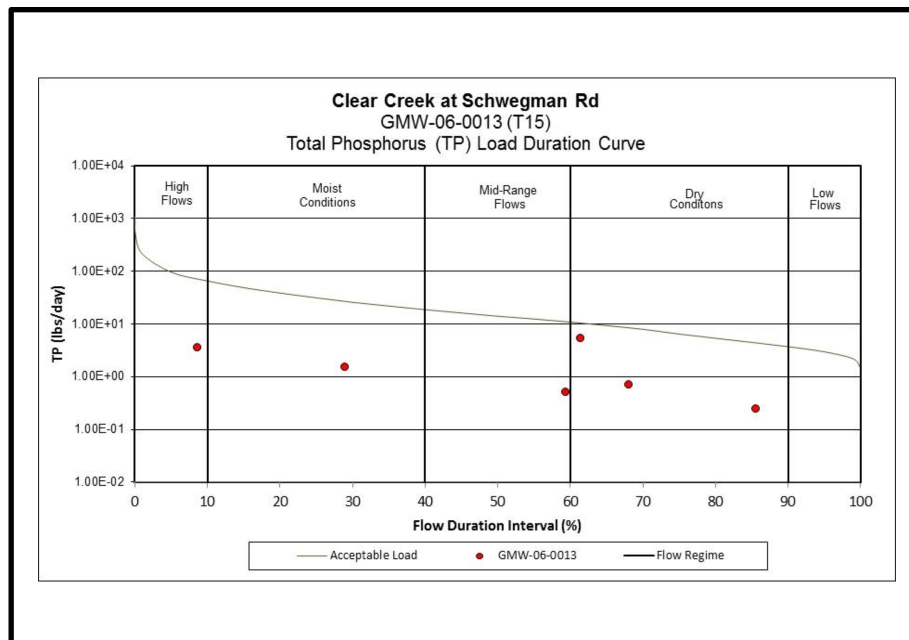
Upstream

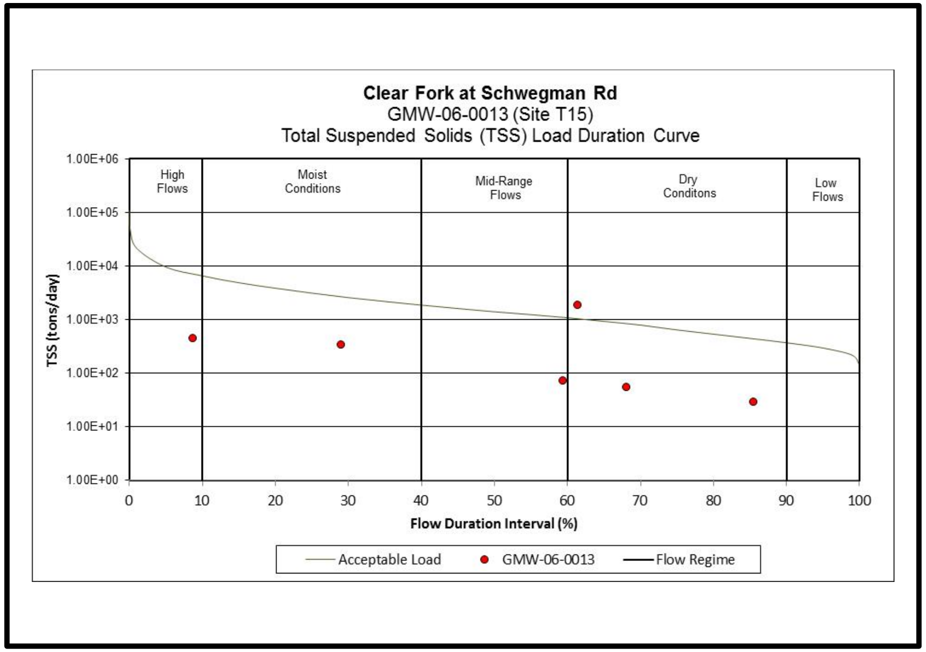
Downstream

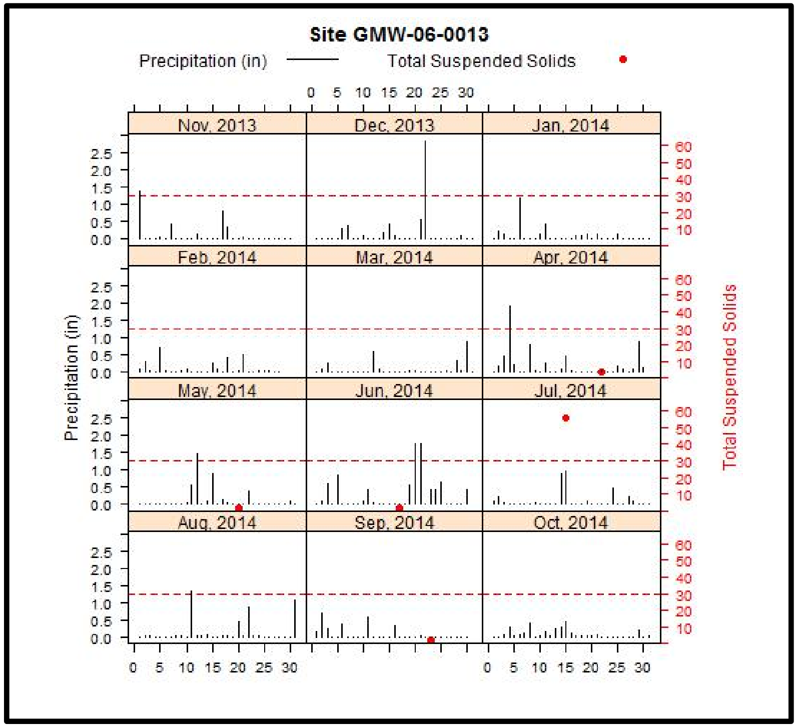

Clear Fork at Schwegman Road
GMW-06-0013 (T15)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-06-0013


Site GMW-06-0013
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
0 5 10 15 20 25 30
0.0 0.5 1.0 1.5 2.0 2.5
1 2 3
Precipitation (in)
log10(E. coli)


Site GMW-06-0013
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
0 5 10 15 20 25 30
0.0 0.5 1.0 1.5 2.0 2.5
0.05 0.10 0.15
Precipitation (in)
Total Phosphorus


Clear Creek at Schwegman Rd
GMW-06-0013 (T15)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
GMW-06-0013
Flow Regime





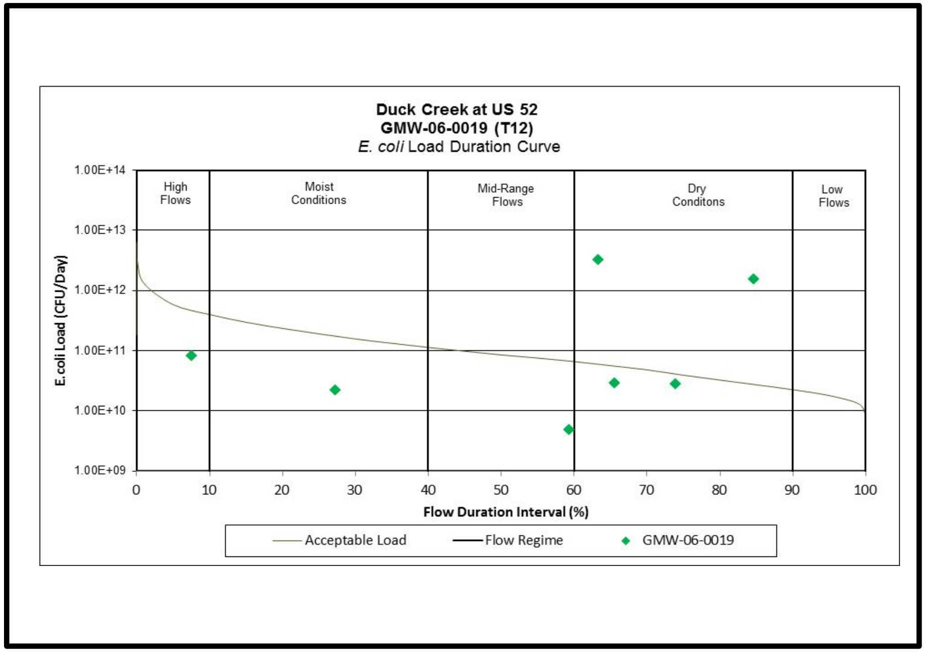
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

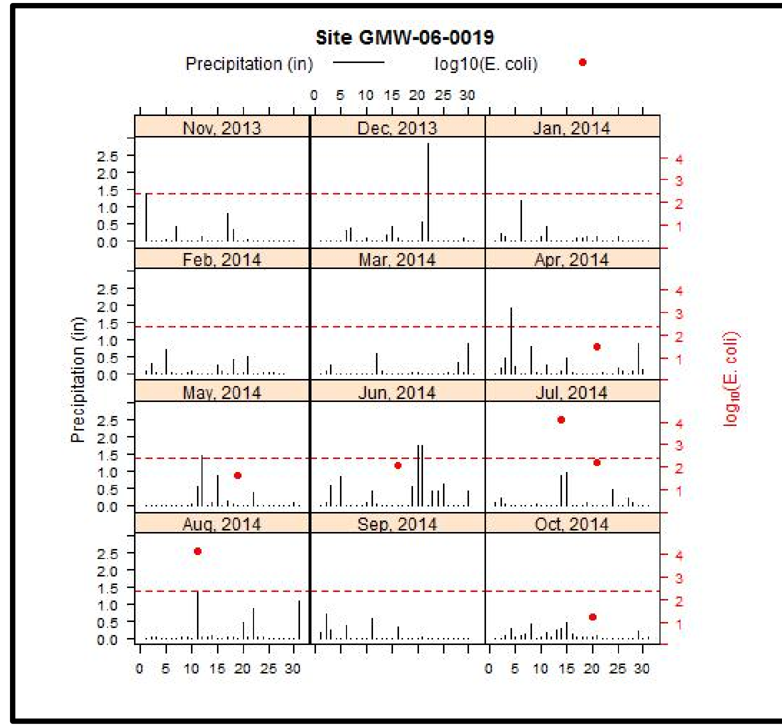
Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	2.07E+10	6.80E+10	9.78E+09	1.29E+11	4.85E+08	1.04E+09	1.30E+10
TP (lbs/day)	1.53	3.58	0.73	5.47	NA	0.25	0.51
TSS (lbs/day)	339.55	447.47	55.93	1916.23	NA	29.48	72.52

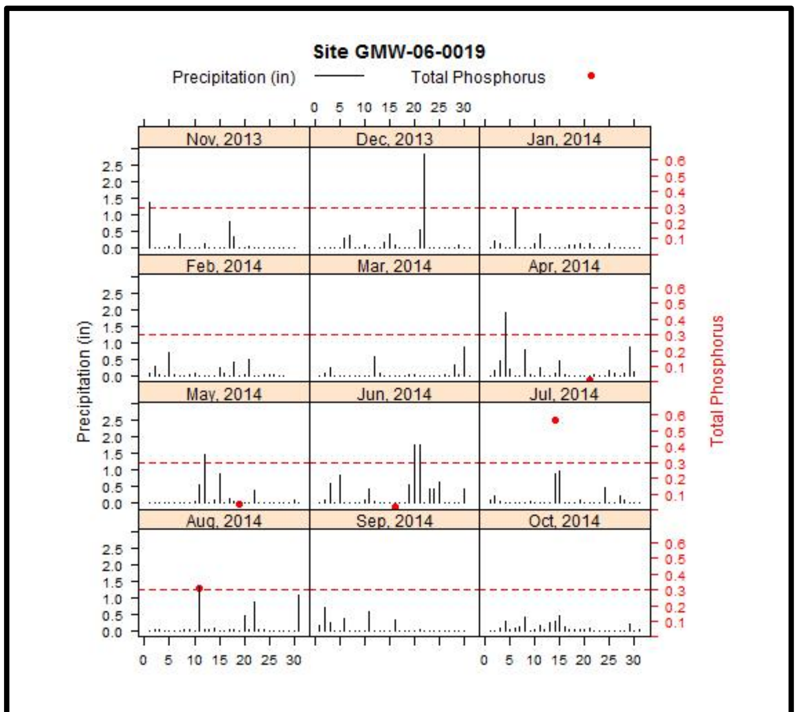
Site T12
GMW-06-0019
Duck Creek at US 52

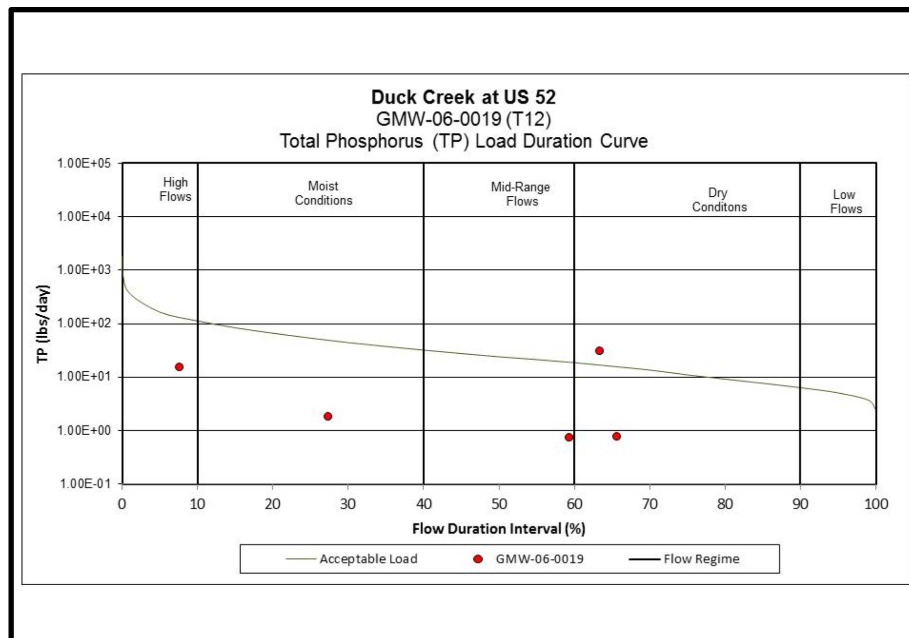
Upstream

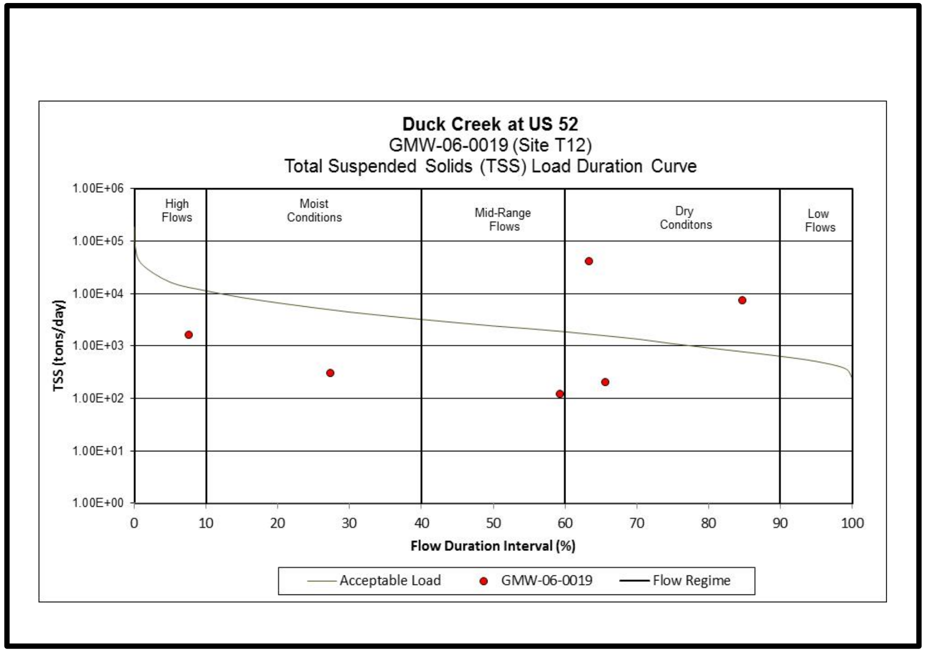
Downstream

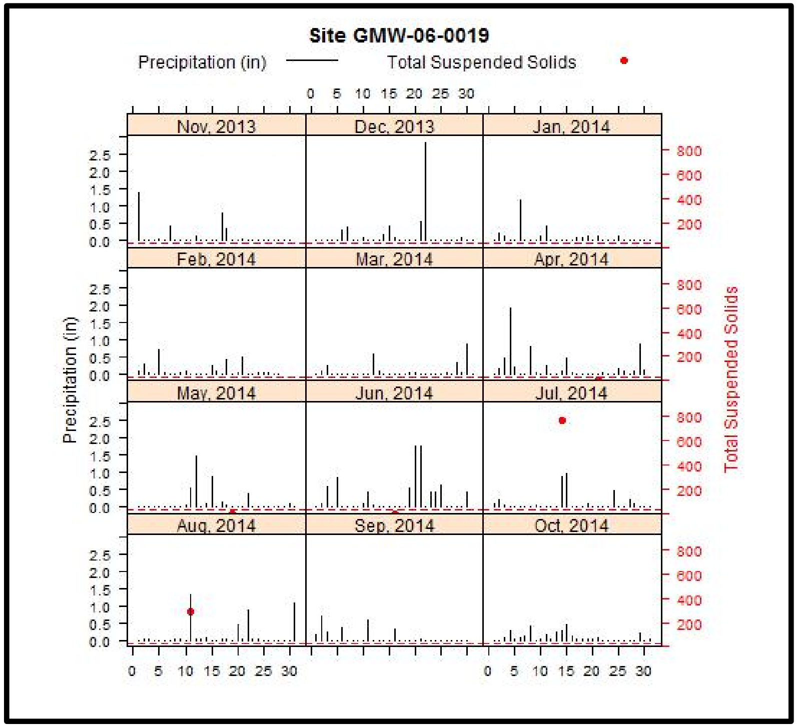

Duck Creek at US 52
GMW-06-0019 (T12)
E. coli Load Duration Curve
E.coli Load (CFU/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
Flow Regime
GMW-06-0019


Site GMW-06-0019
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log_{10}(E. coli)


Site GMW-06-0019
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus


Duck Creek at US 52
GMW-06-0019 (T12)
Total Phosphorus (TP) Load Duration Curve
TP (lbs/day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
GMW-06-0019
Flow Regime





Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	2.23E+10	8.18E+10	2.93E+10	1.61E+12	1.53E+12	NA	4.87E+09
TP (lbs/day)	1.85	15.34	0.77	31.22	NA	NA	0.74
TSS (lbs/day)	308.67	1658.25	205.03	42134.06	7410.32	NA	124.14

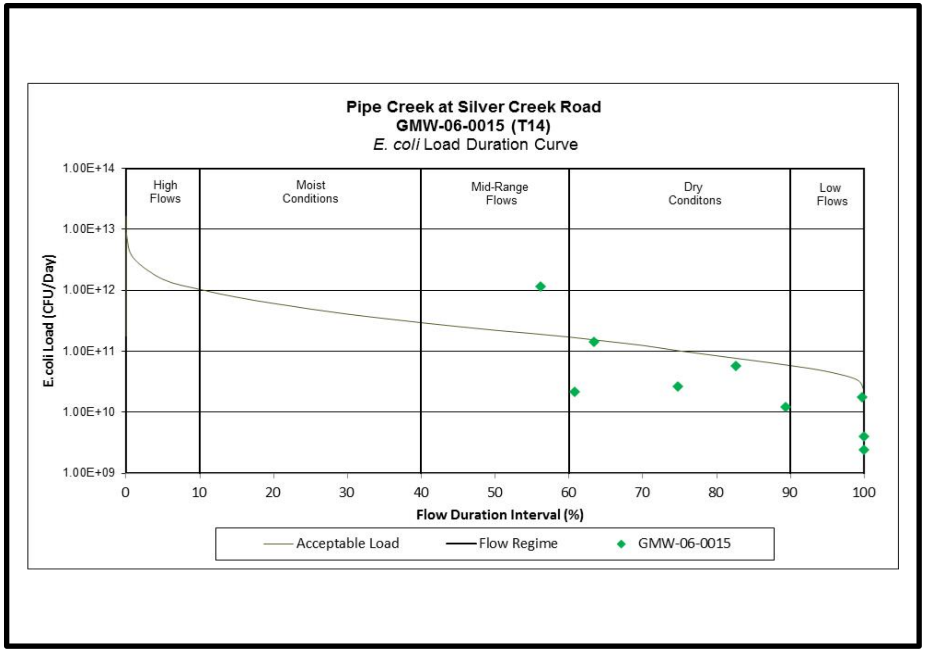
Site T14

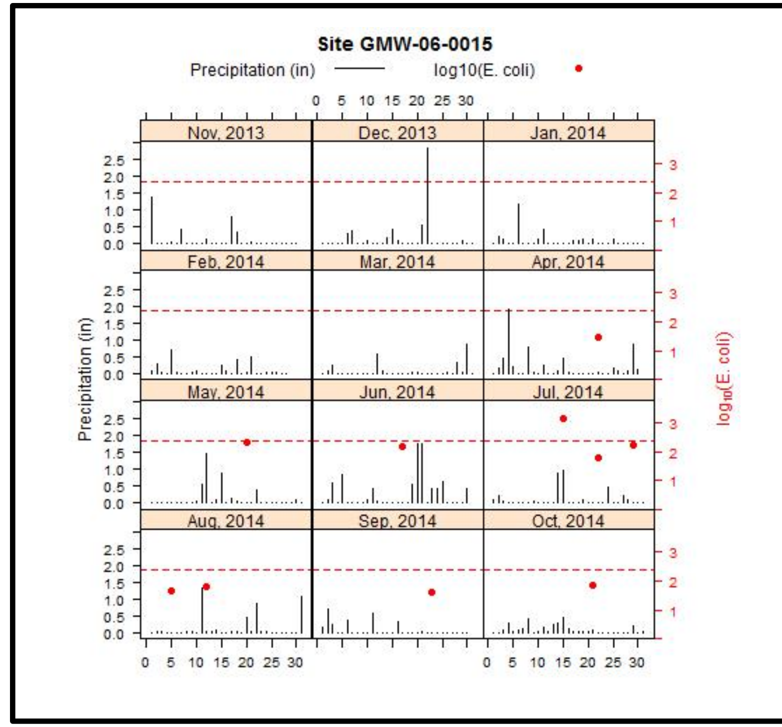
GMW-06-0015

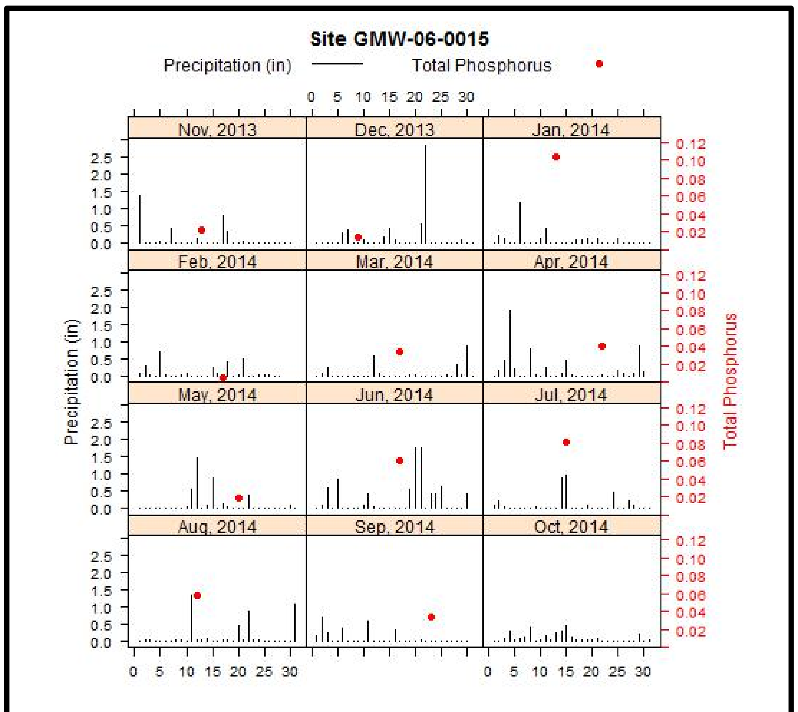
Pipe Creek at Silver Creek Road

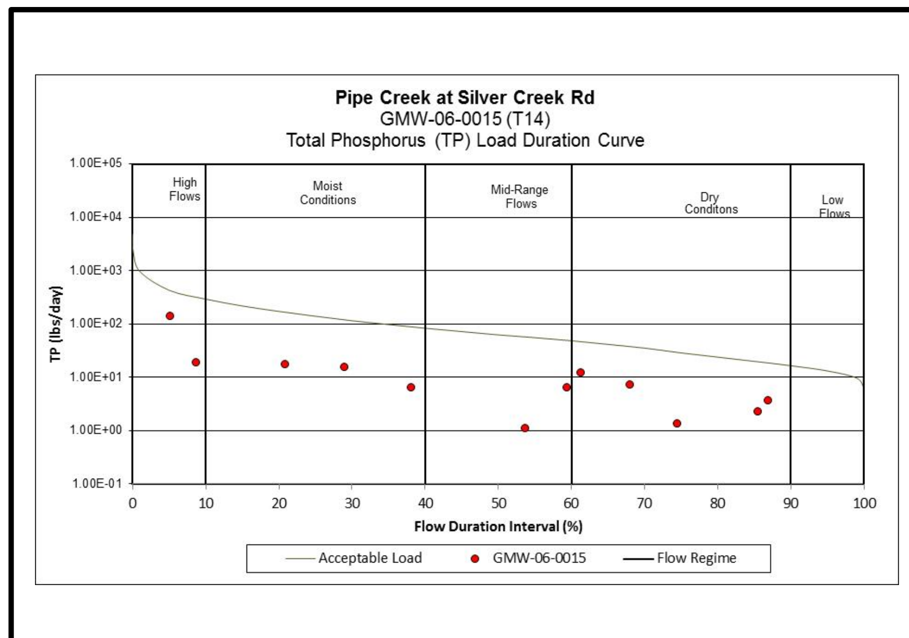
Upstream

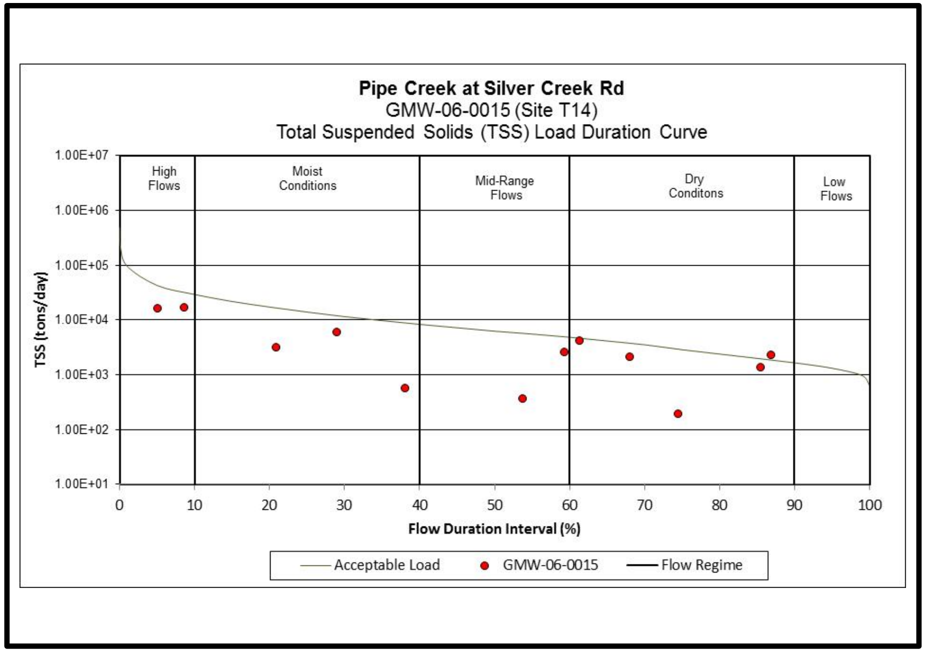
Downstream

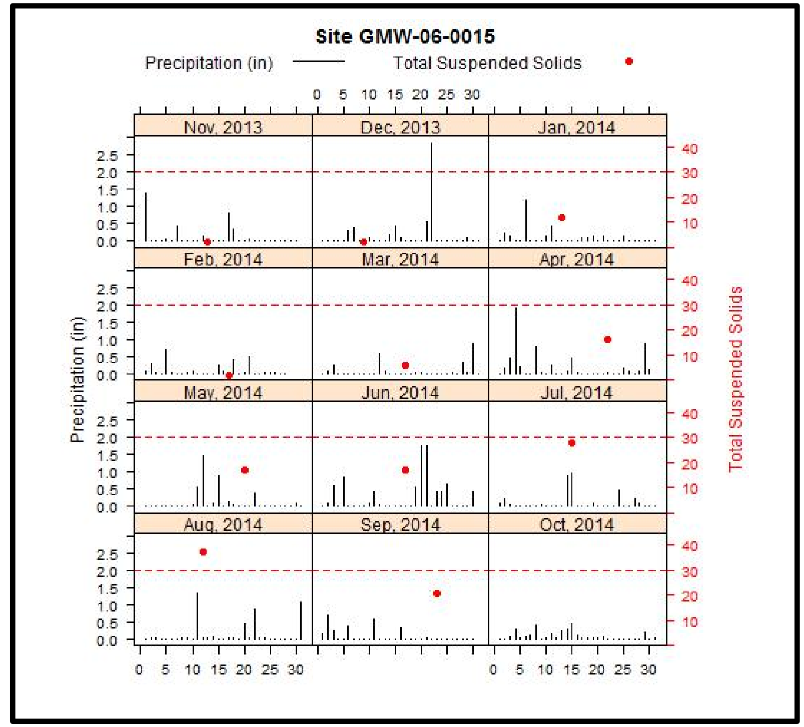

Pipe Creek at Silver Creek Road
GMW-06-0015 (T14)
E. coli Load Duration Curve
E.coli Load (CFU/Day)
1.00E+14
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-06-0015


Site GMW-06-0015
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log10(E. coli)


Site GMW-06-0015
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus


Pipe Creek at Silver Creek Rd
GMW-06-0015 (T14)
Total Phosphorus (TP) Load Duration Curve
TP (lbs/day)
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
GMW-06-0015
Flow Regime





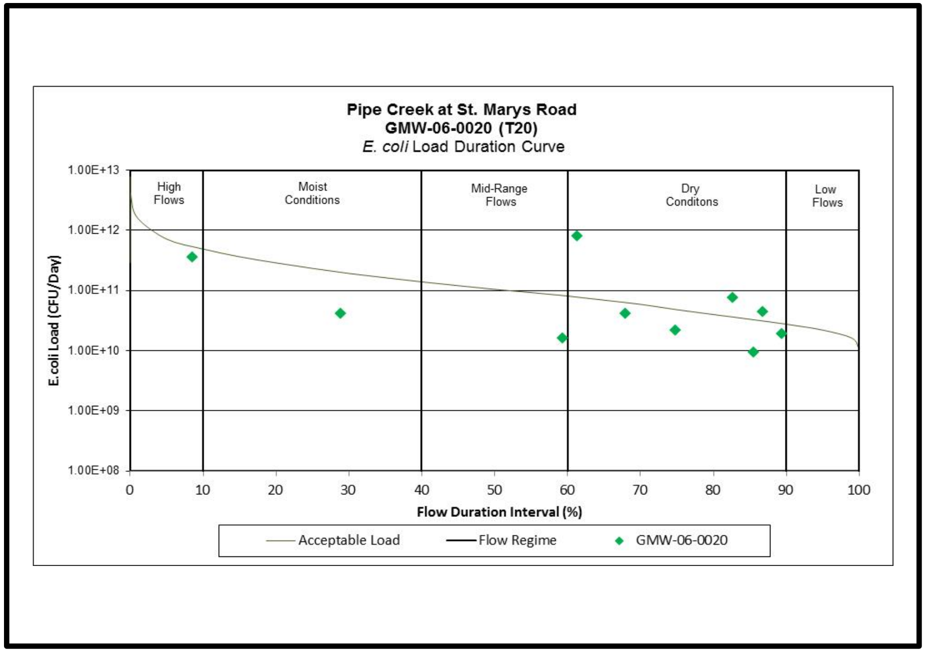
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

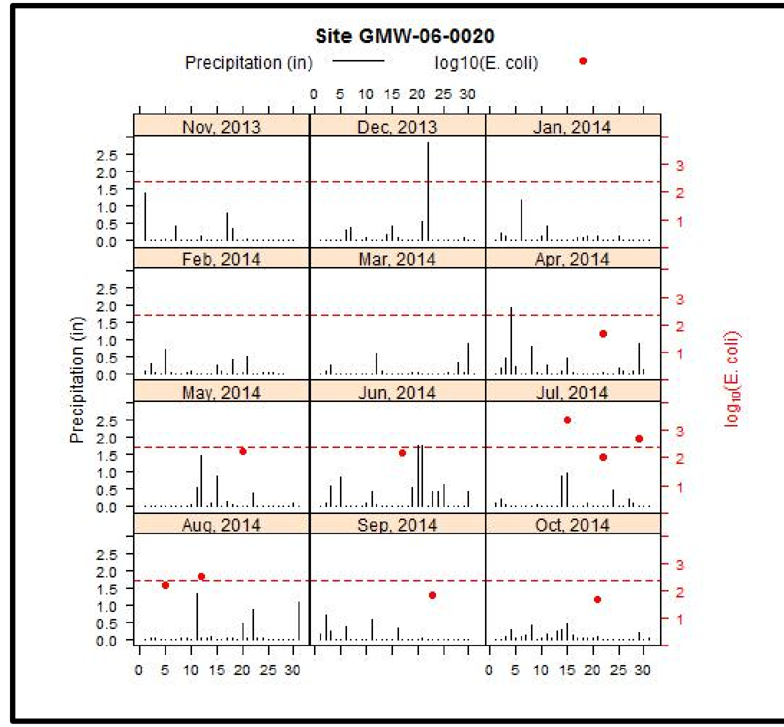
Parameter	January	February	March	April	May	June	July	August	Sept	Oct	November	December
E. Coli (MPN)	NA	NA	NA	2.16E+10	1.40E+11	1.72E+10	4.01E+11	7.30E+09	3.13E+08	3.91E+09	NA	NA
TP (lbs/day)	138.86	1.11	17.78	15.45	18.87	7.45	12.46	3.67	2.29	6.44	6.5	1.35
TSS (lbs/day)	16022.51	372.81	3137.89	6030.35	16887.3	2110.92	4253.97	2302.58	1374.36	2575.76	565.05	193.42

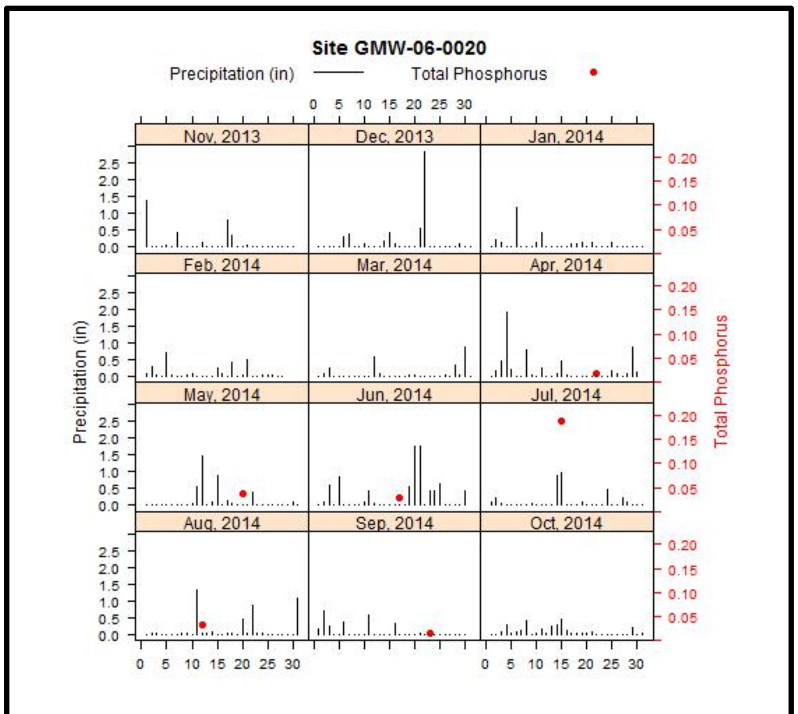
Site T16
GMW-06-0020
Pipe Creek at St Marys Road

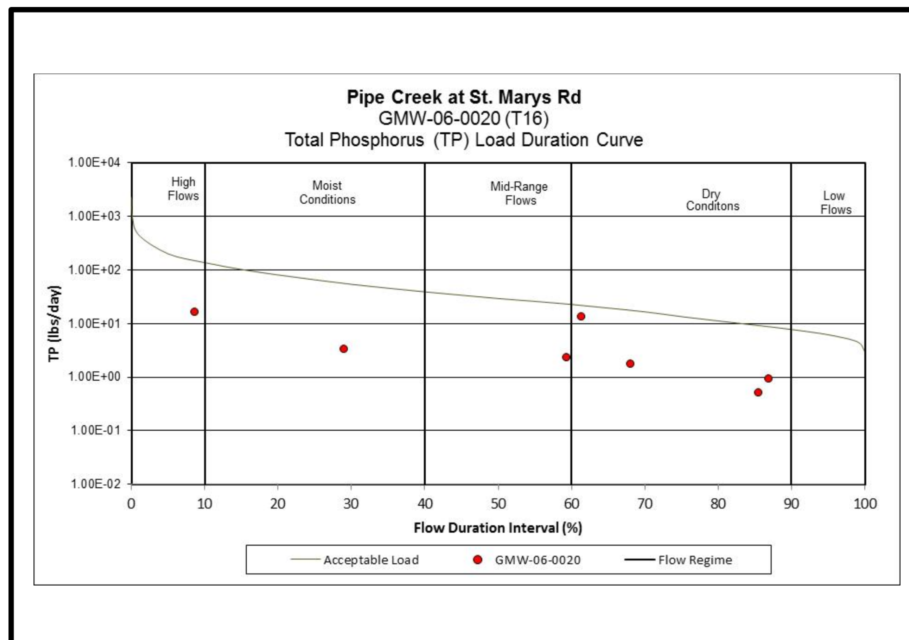
Upstream

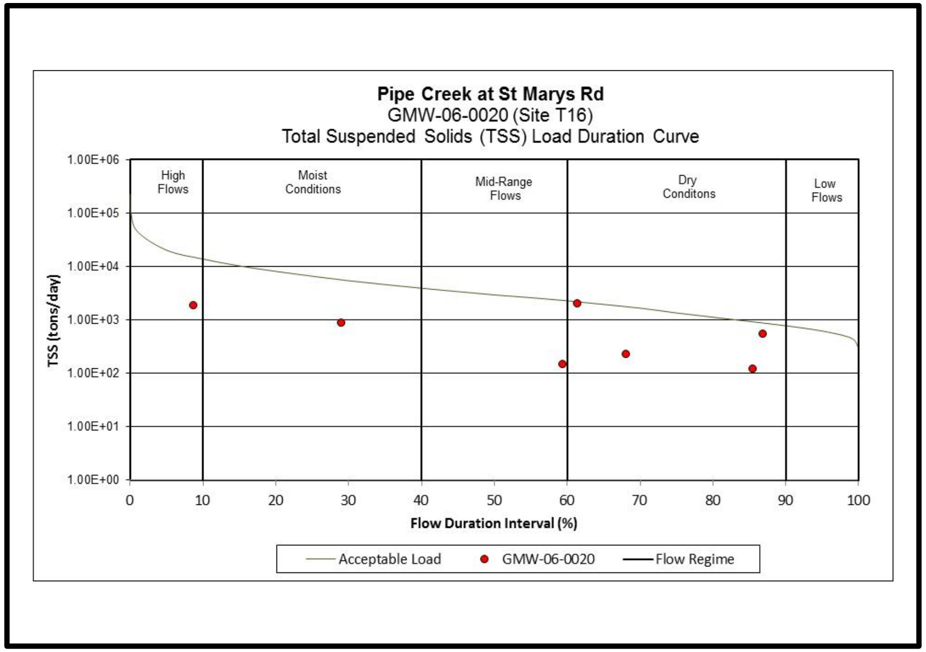
Downstream

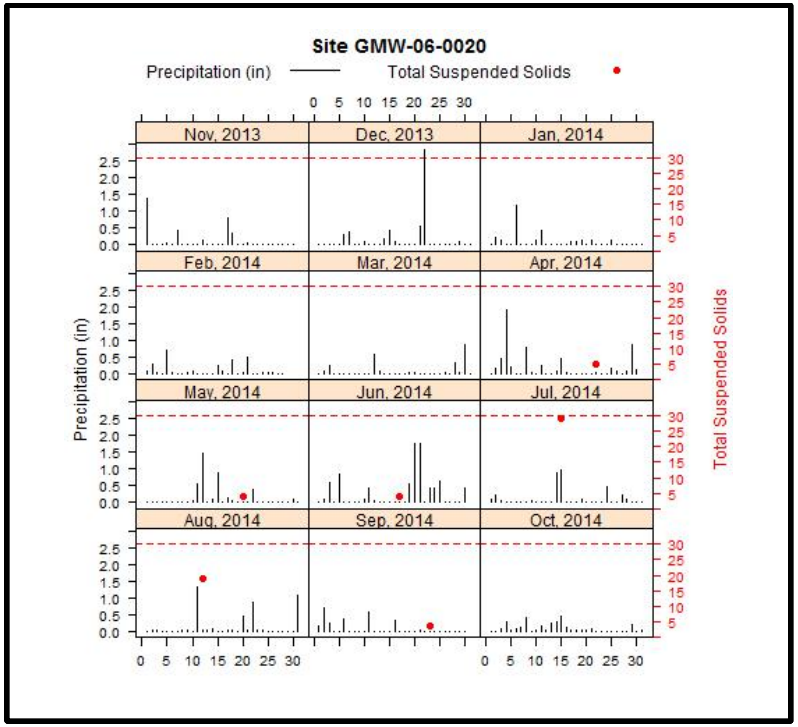

Pipe Creek at St. Marys Road
GMW-06-0020 (T20)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-06-0020


Site GMW-06-0020
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log10(E. coli)


Site GMW-06-0020
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus


Pipe Creek at St. Marys Rd
GMW-06-0020 (T16)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-06-0020
Flow Regime





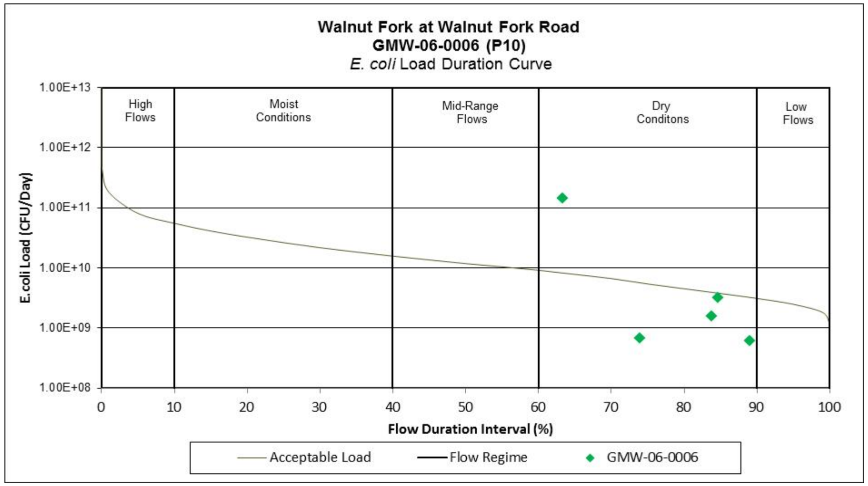
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	4.07E+10	3.56E+11	4.14E+10	2.95E+11	3.13E+10	9.50E+09	1.63E+10
TP (lbs/day)	3.39	16.91	1.76	13.5	0.94	0.53	2.36
TSS (lbs/day)	890.97	1878.97	234.83	2083.08	559.03	123.77	152.22

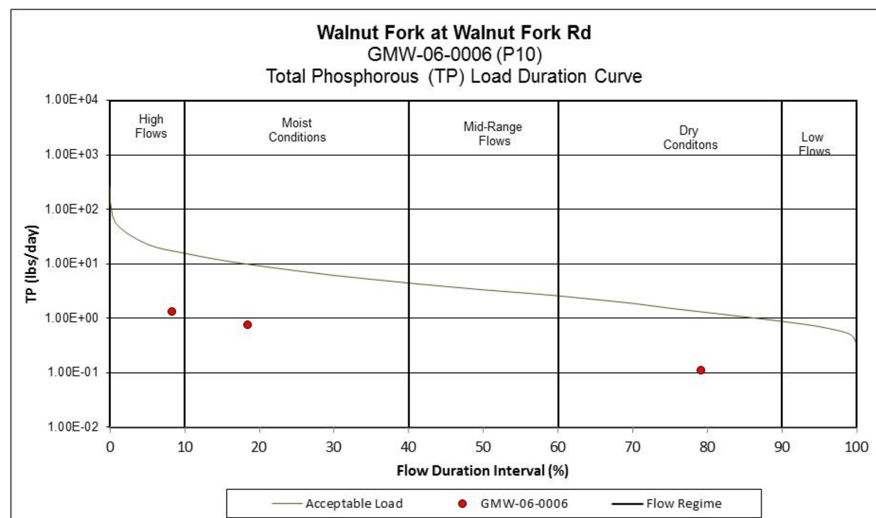
Site P10
GMW-06-0006
Walnut Fork at Walnut Fork Road

Upstream

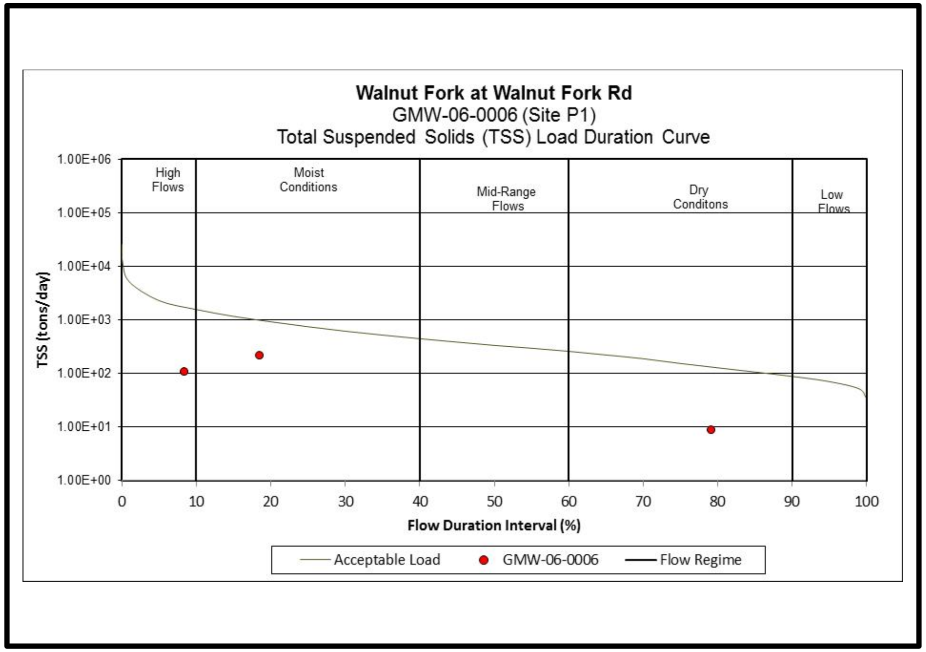
Downstream



Walnut Fork at Walnut Fork Road
GMW-06-0006 (P10)
E. coli Load Duration Curve
E.coli Load (CFU/Day)
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-06-0006



Walnut Fork at Walnut Fork Rd
GMW-06-0006 (P10)
Total Phosphorous (TP) Load Duration Curve
TP (lbs/day)
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
GMW-06-0006
Flow Regime



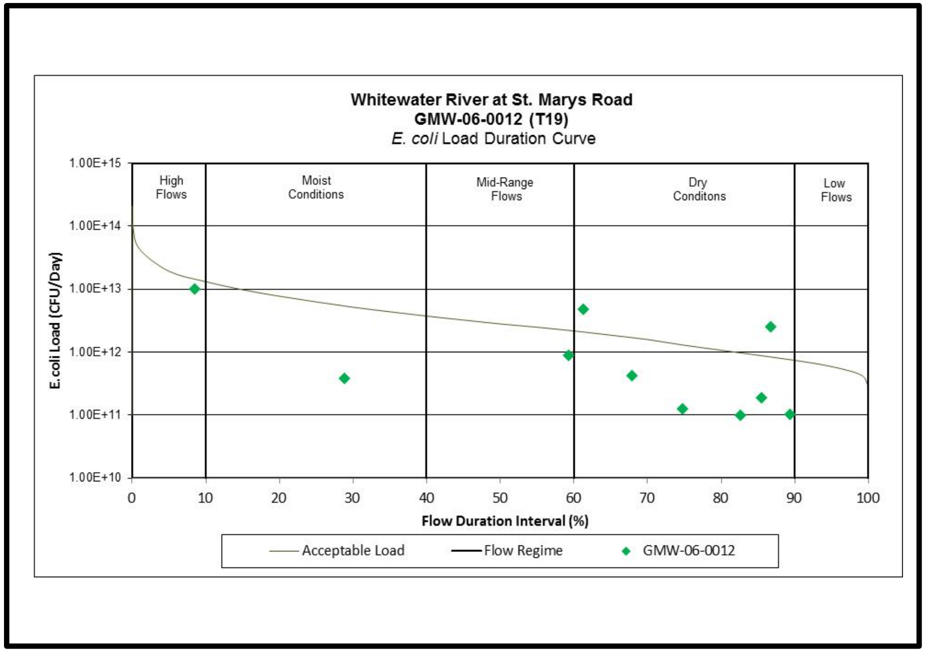
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

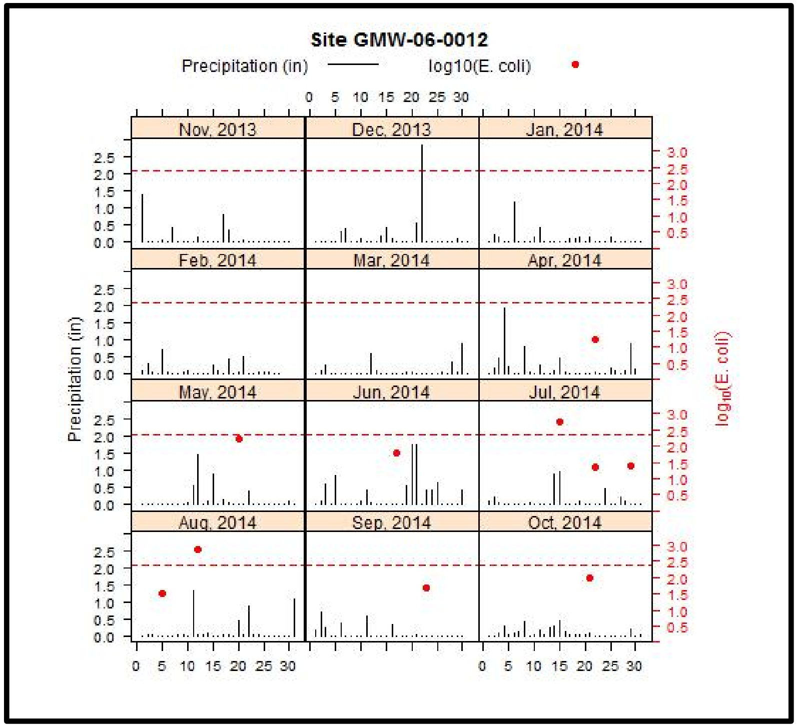
Parameter	May	June	July	August	Sept
E. Coli (MPN)	NA	NA	4.79E+10	3.77E+09	NA
TP (lbs/day)	1.35	0.77	NA	NA	0.11
TSS (lbs/day)	108.19	214.98	NA	NA	8.76

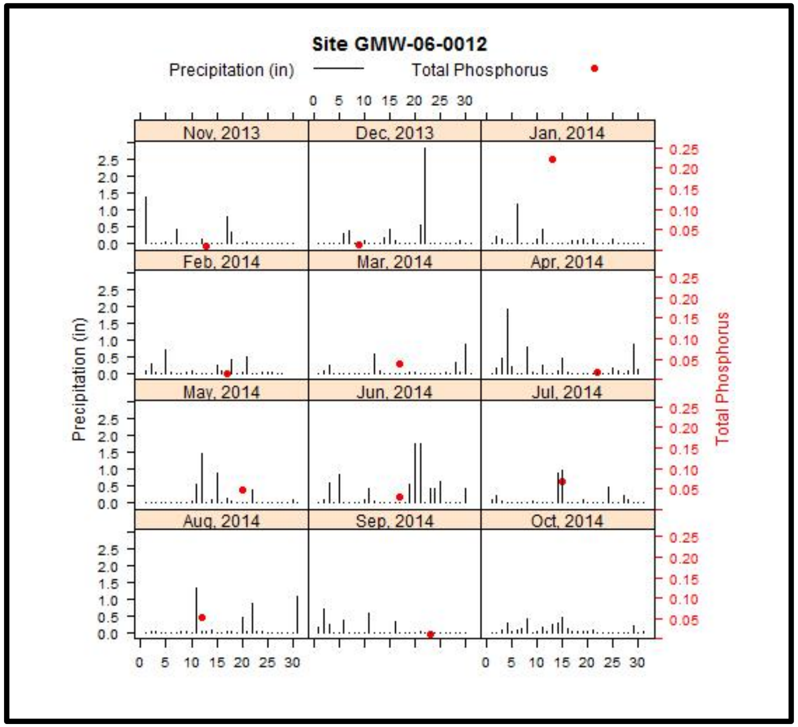
Site T19
GMW-06-0012
Whitewater River at St Marys Road

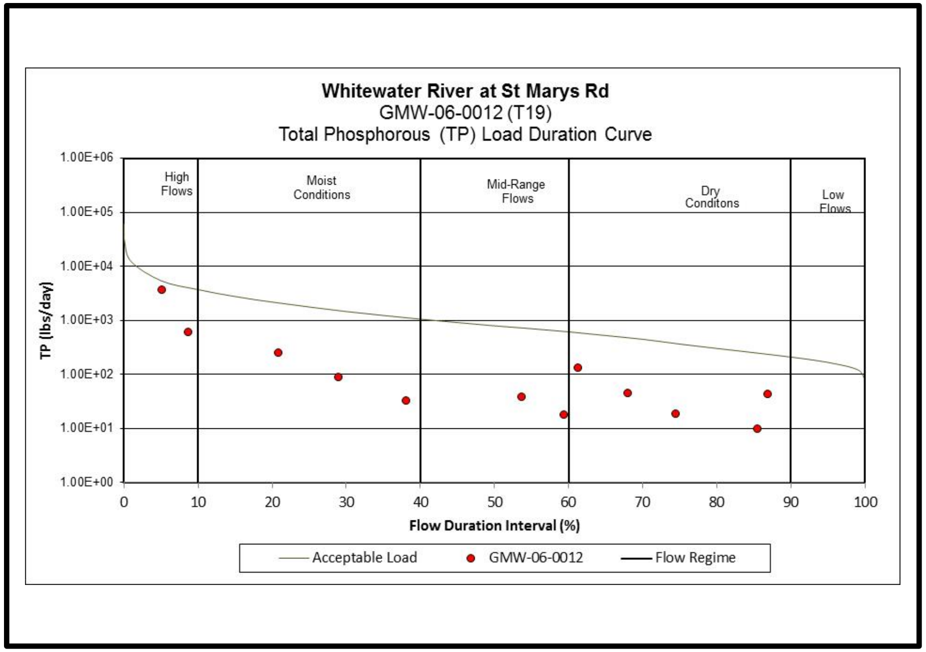
Upstream

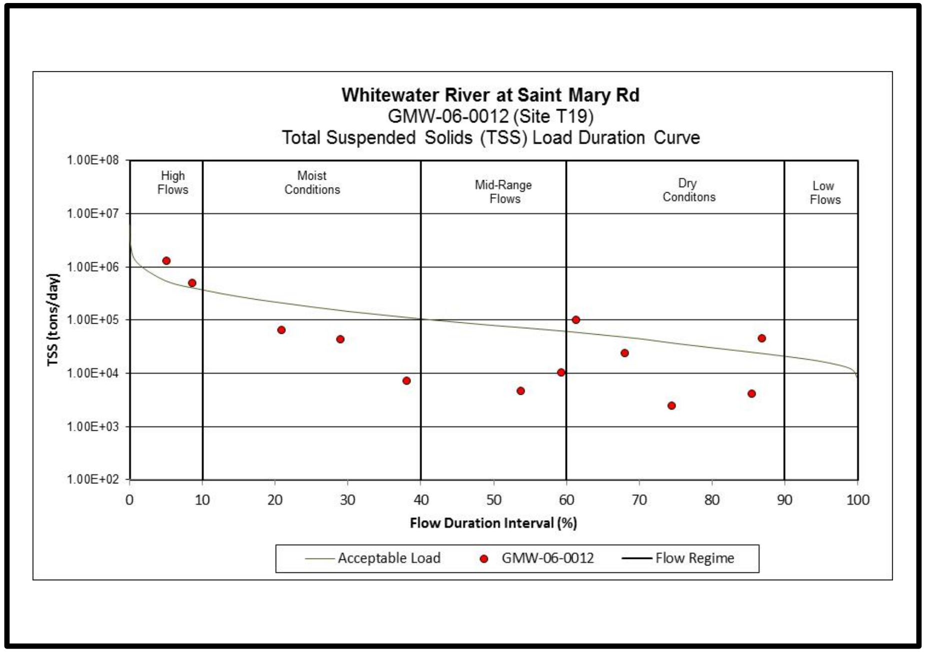
Downstream

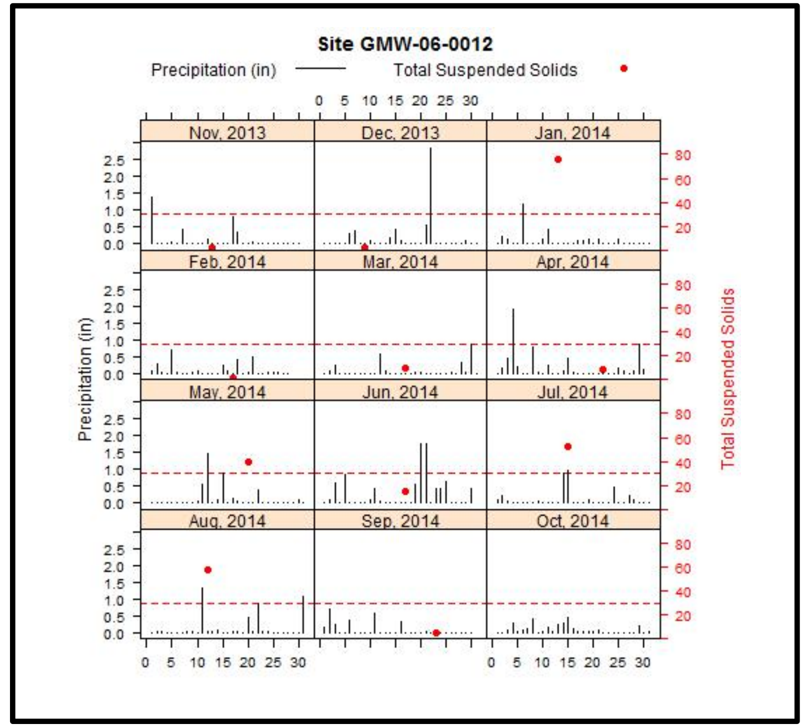

Whitewater River at St. Marys Road
GMW-06-0012 (T19)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-06-0012


Site GMW-06-0012
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log10(E. coli)


Site GMW-06-0012
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus


Whitewater River at St Marys Rd
GMW-06-0012 (T19)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-06-0012
Flow Regime





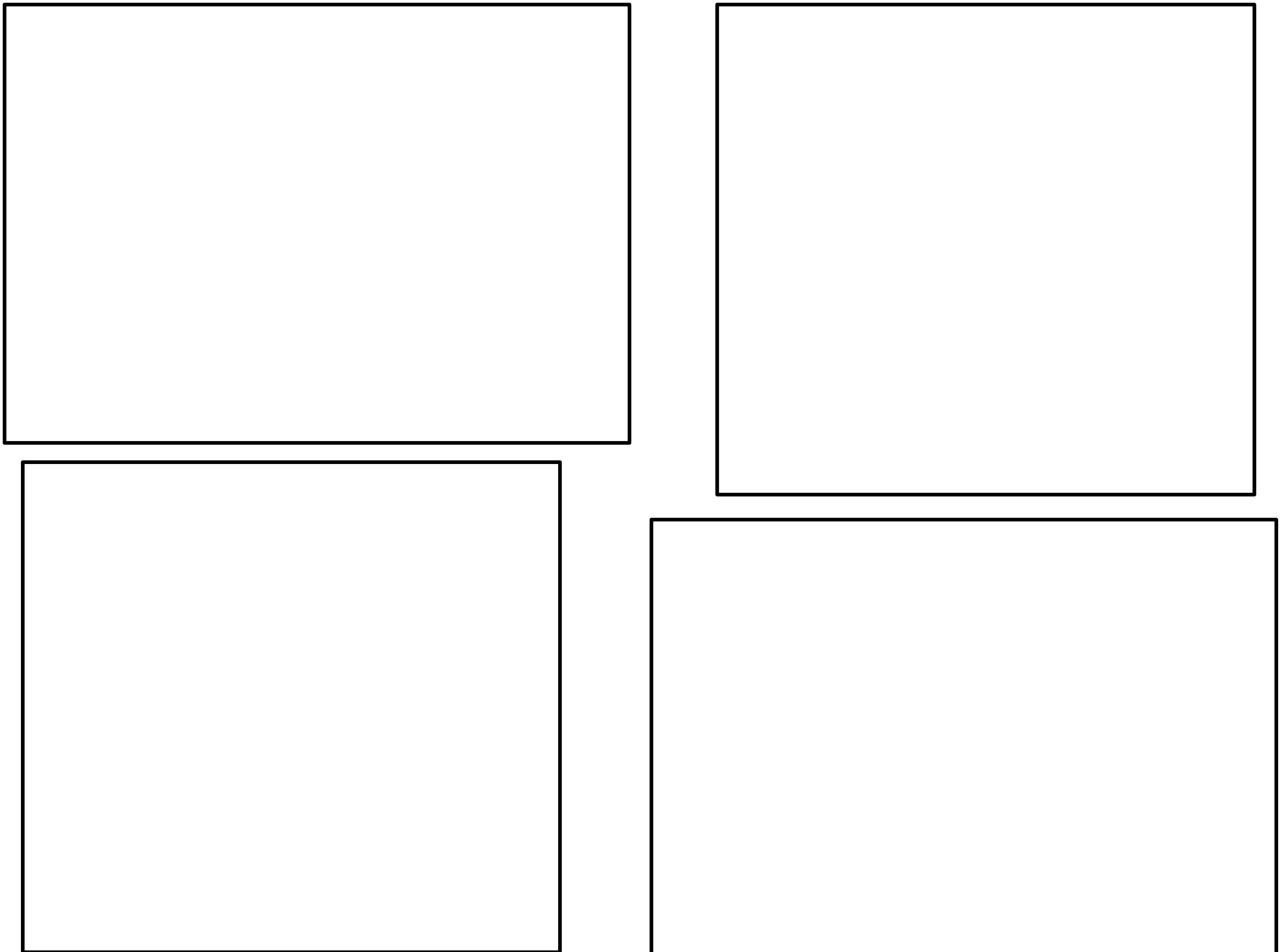
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

Parameter	January	February	March	April	May	June	July	August	Sept	Oct	November	December
E. Coli (MPN)	NA	NA	NA	3.75E+11	9.85E+12	4.22E+11	1.67E+12	1.25E+12	1.83E+11	8.88E+11	NA	NA
TP (lbs/day)	3761.6	37.85	252.2	90.88	617.7	45.7	131.1	42.65	9.97	19.93	32.27	18.41
TSS (lbs/day)	1287755.04	4731.01	66367.66	43046.29	504245.9	23636.5	100255.95	45804.81	4152.61	10214.69	7170.67	2454.49

Site T13
GMW-06-0022
Whitewater Canal at Park Avenue

Upstream

Downstream

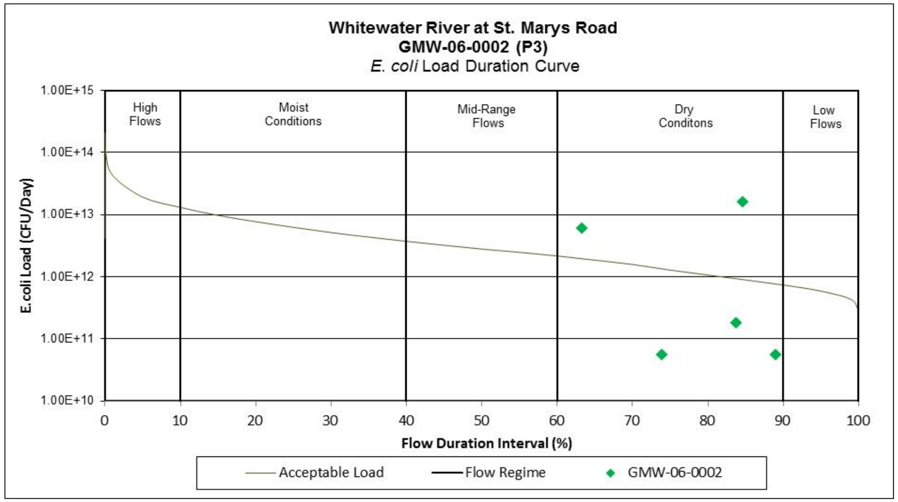


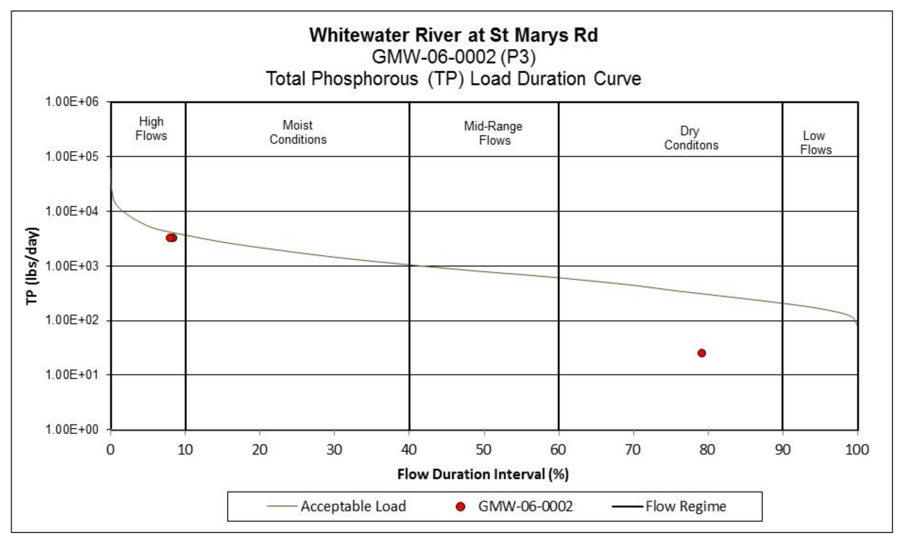
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

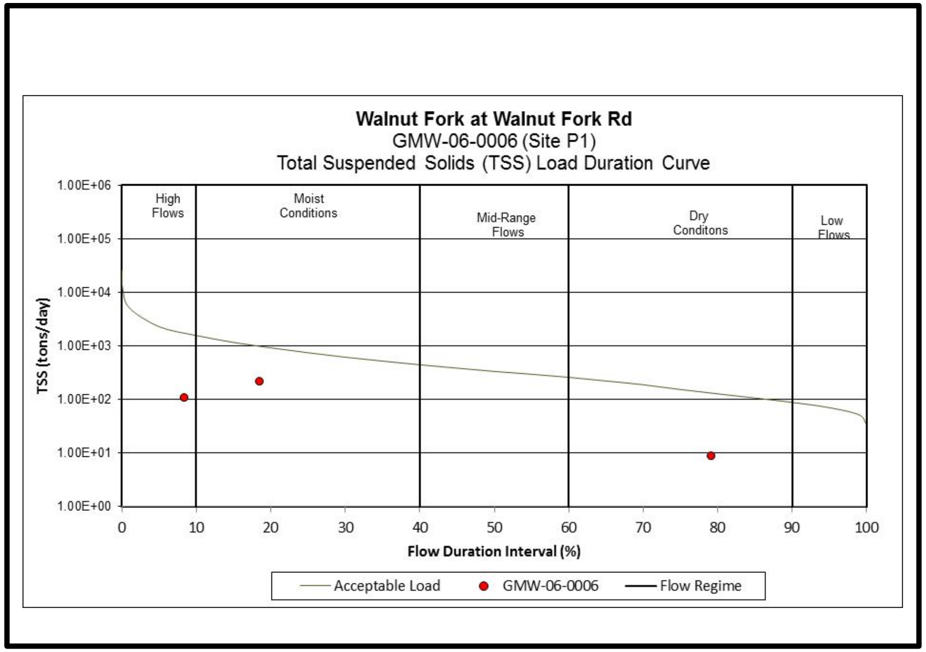
Site P3
GMW-06-0002
Whitewater River at St Marys Road

Upstream

Downstream


Whitewater River at St. Marys Road
GMW-06-0002 (P3)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+15
1.00E+14
1.00E+13
1.00E+12
1.00E+11
1.00E+10
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-06-0002


Whitewater River at St Marys Rd
GMW-06-0002 (P3)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
GMW-06-0002
Flow Regime



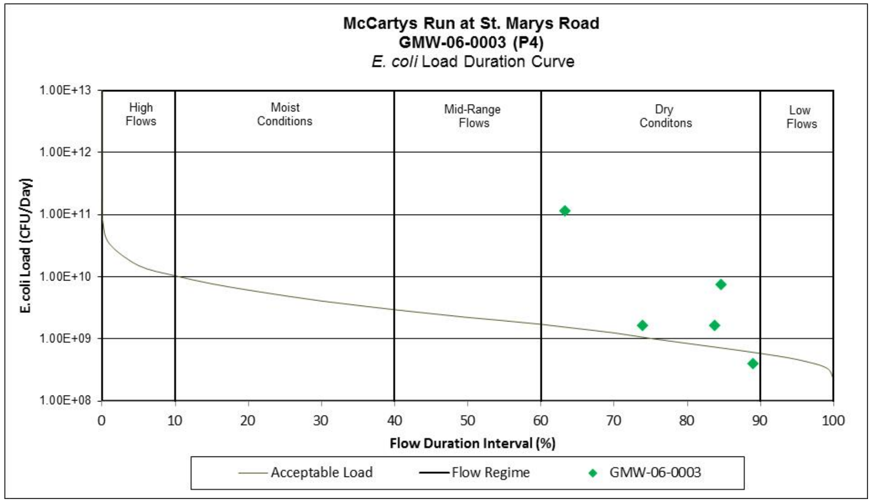
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

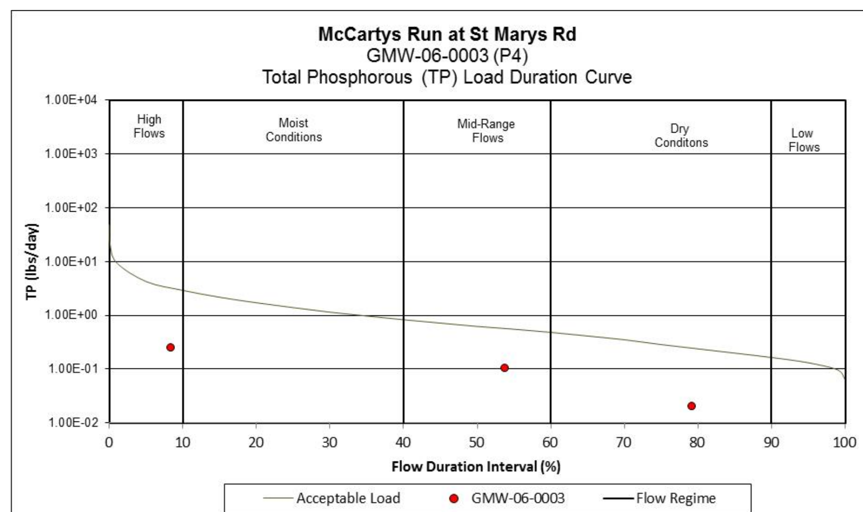
Parameter	May	June	July	August	Sept
E. Coli (MPN)	NA	NA	2.05E+12	7.94E+12	NA
TP (lbs/day)	3330.93	3295.12	NA	NA	25.94
TSS (lbs/day)	108.19	214.98	NA	NA	8.76

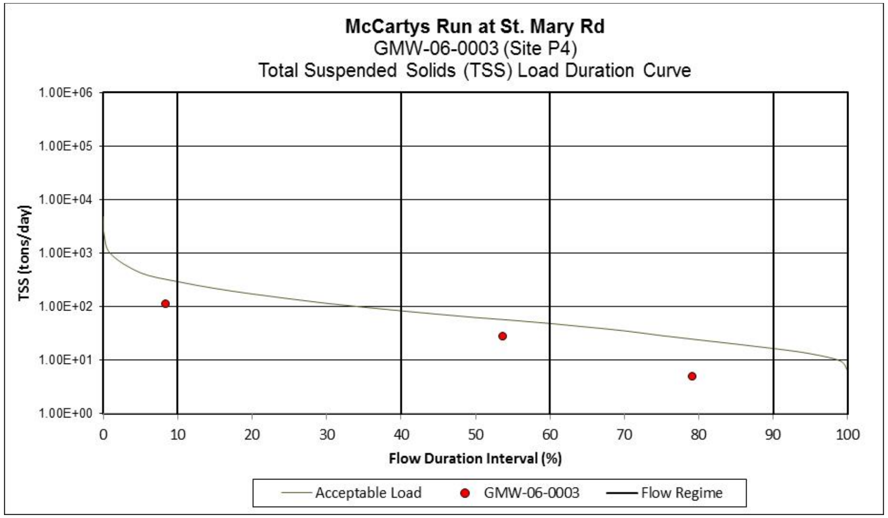
Site P4
GMW-06-0003
McCartys Run at St Marys Road

Upstream

Downstream


McCartys Run at St. Marys Road
GMW-06-0003 (P4)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
E.coli Load (CFU/Day)
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-06-0003


McCartys Run at St Marys Rd
GMW-06-0003 (P4)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
TP (lbs/day)
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
GMW-06-0003
Flow Regime



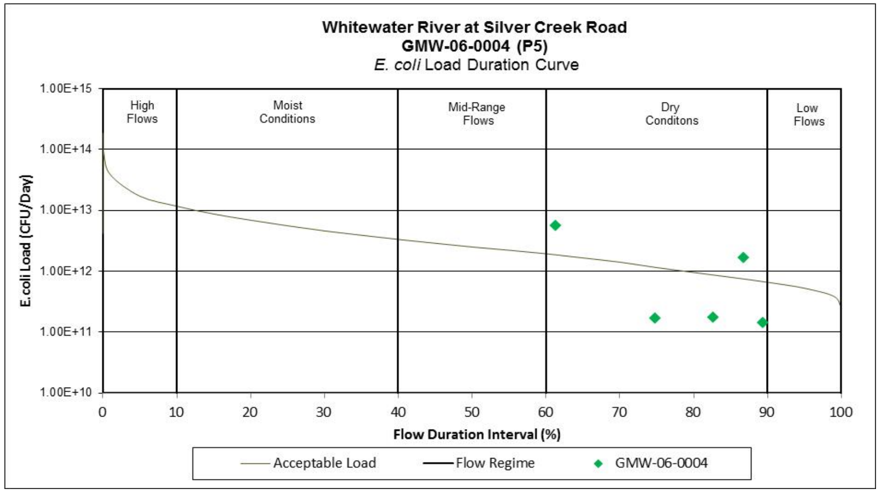
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

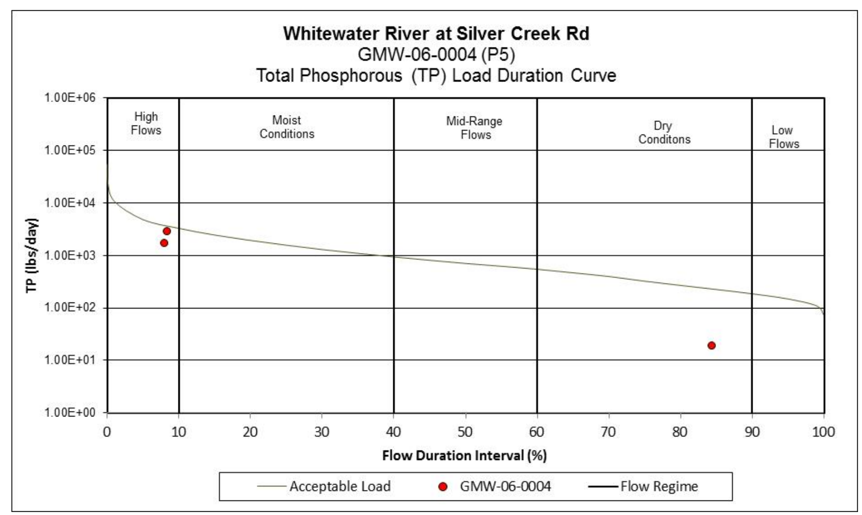
Parameter	May	June	July	August	Sept
E. Coli (MPN)	NA	NA	3.85E+10	3.90E+09	NA
TP (lbs/day)	0.25	0.1	NA	NA	0.02
TSS (lbs/day)	111.85	28.09	NA	NA	4.94

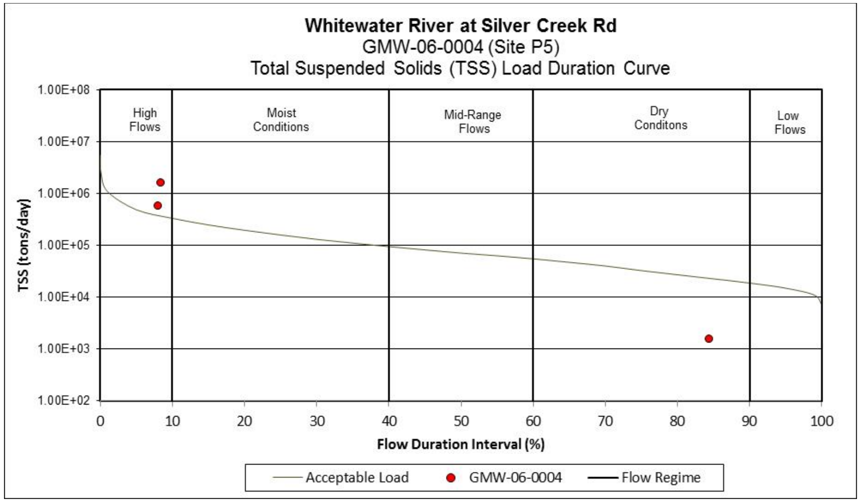
Site P5
GMW-06-0004
Whitewater River at Silver Creek Road

Upstream

Downstream


Whitewater River at Silver Creek Road
GMW-06-0004 (P5)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+15
1.00E+14
1.00E+13
1.00E+12
1.00E+11
1.00E+10
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-06-0004


Whitewater River at Silver Creek Rd
GMW-06-0004 (P5)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
GMW-06-0004
Flow Regime



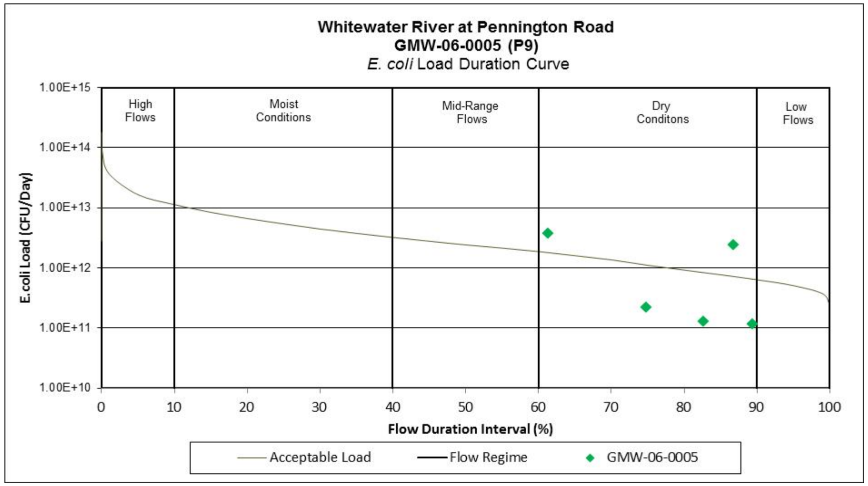
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

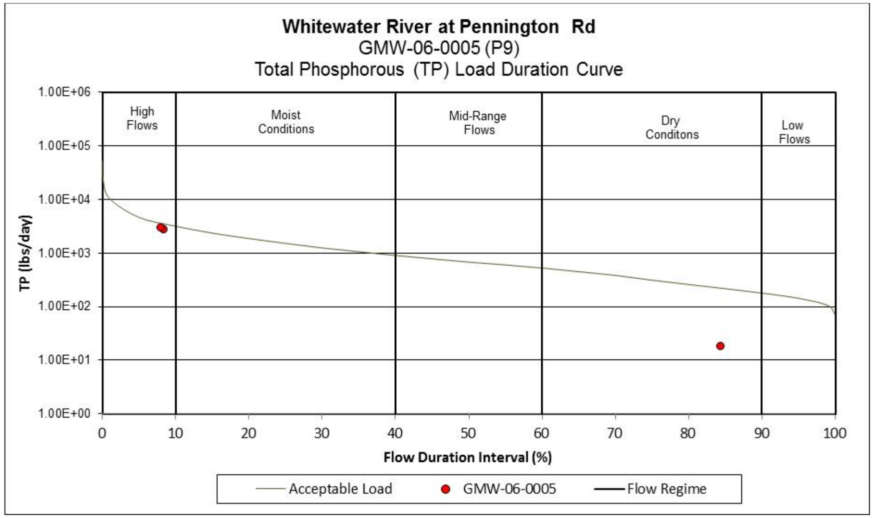
Parameter	May	June	July	August	Sept
E. Coli (MPN)	NA	NA	2.00E+12	8.98E+11	
TP (lbs/day)	2868.71	1770.83	NA	NA	19.43
TSS (lbs/day)	1606475.29	590275.5	NA	NA	1554.23

Site P9
GMW-06-0005
Whitewater River at Pennington Road

Upstream

Downstream


Whitewater River at Pennington Road
GMW-06-0005 (P9)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-06-0005


Whitewater River at Pennington Rd
GMW-06-0005 (P9)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-06-0005
Flow Regime

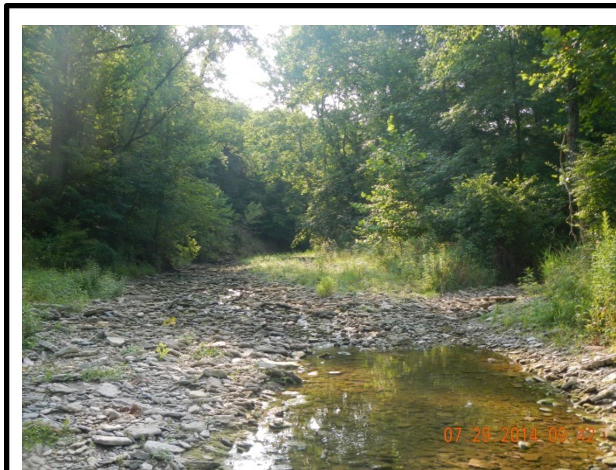
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

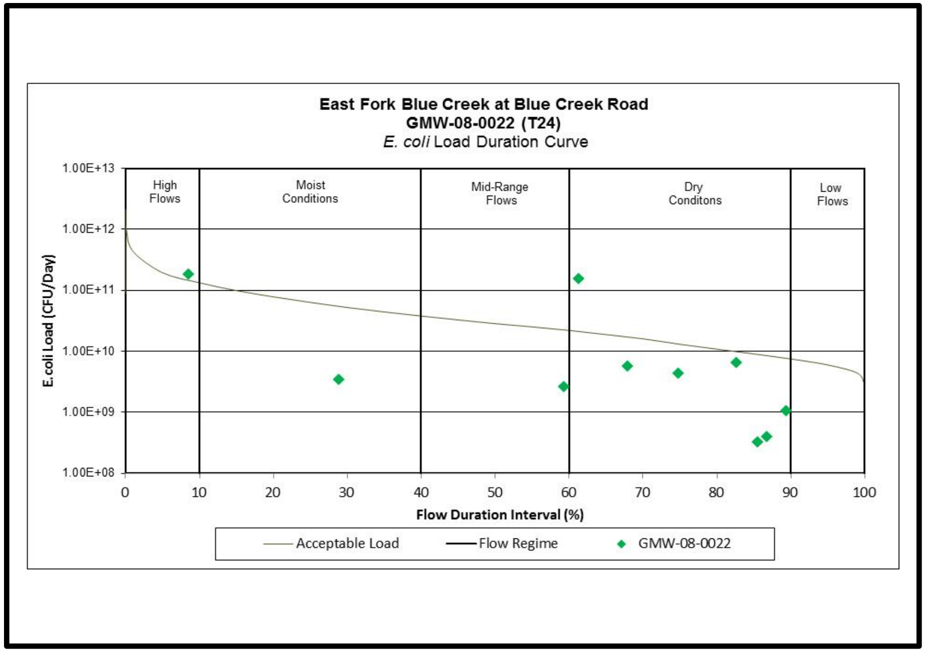
Parameter	May	June	July	August	Sept
E. Coli (MPN)			1.34E+12	1.24E+12	
TP (lbs/day)	2766.71	3074.16			18.74
TSS (lbs/day)					

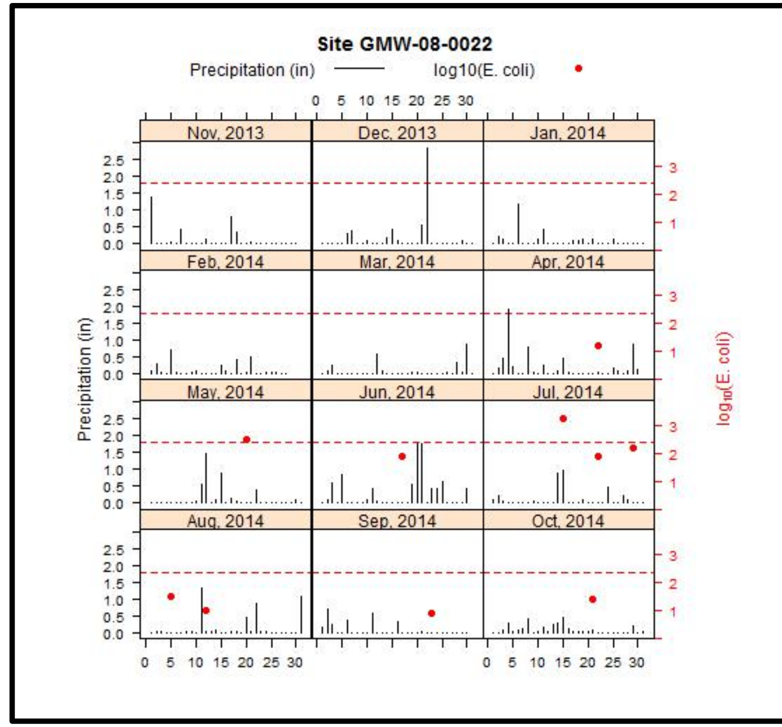
Site T24
GMW-08-0022
East Fork Blue River at Blue Creek Road

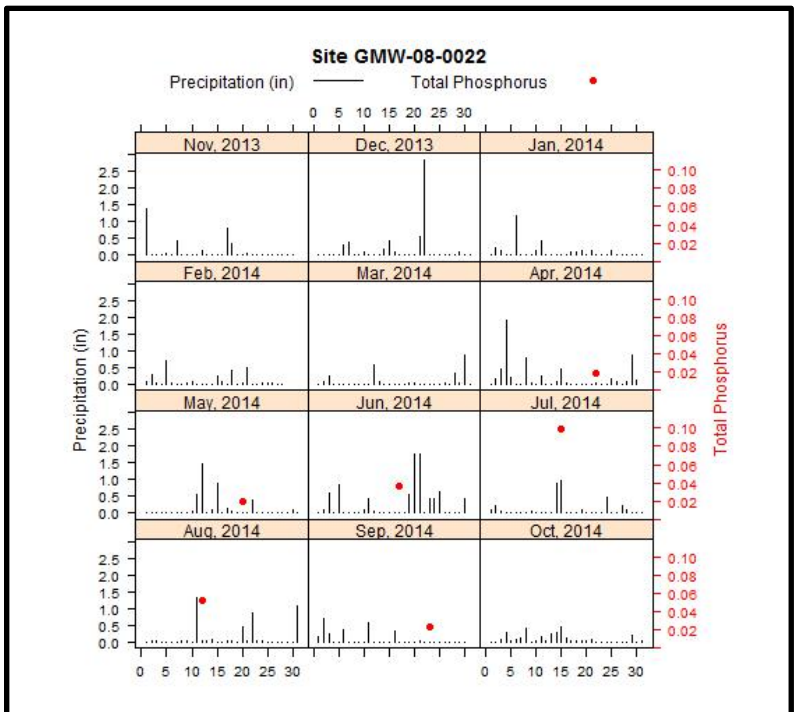
Upstream

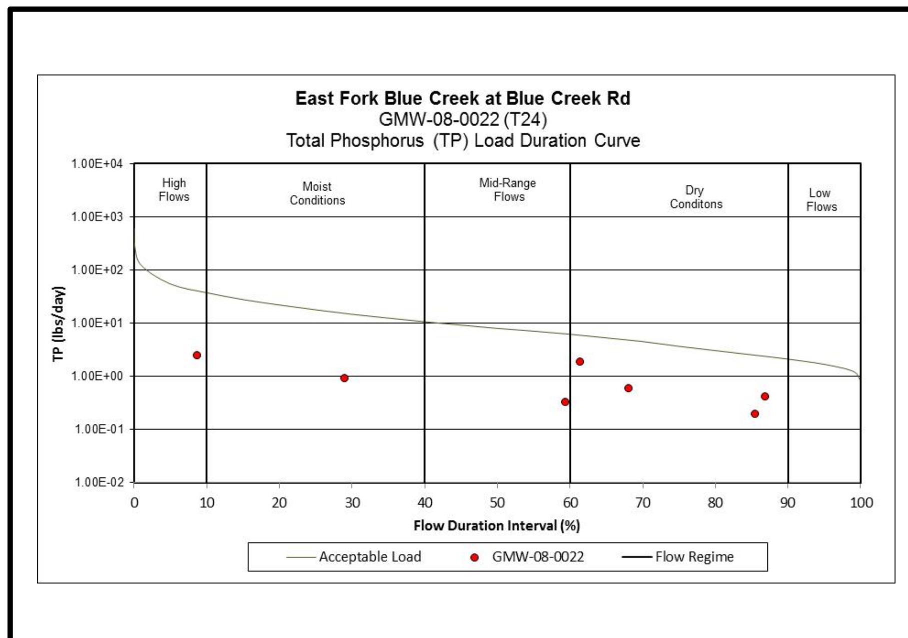
Downstream

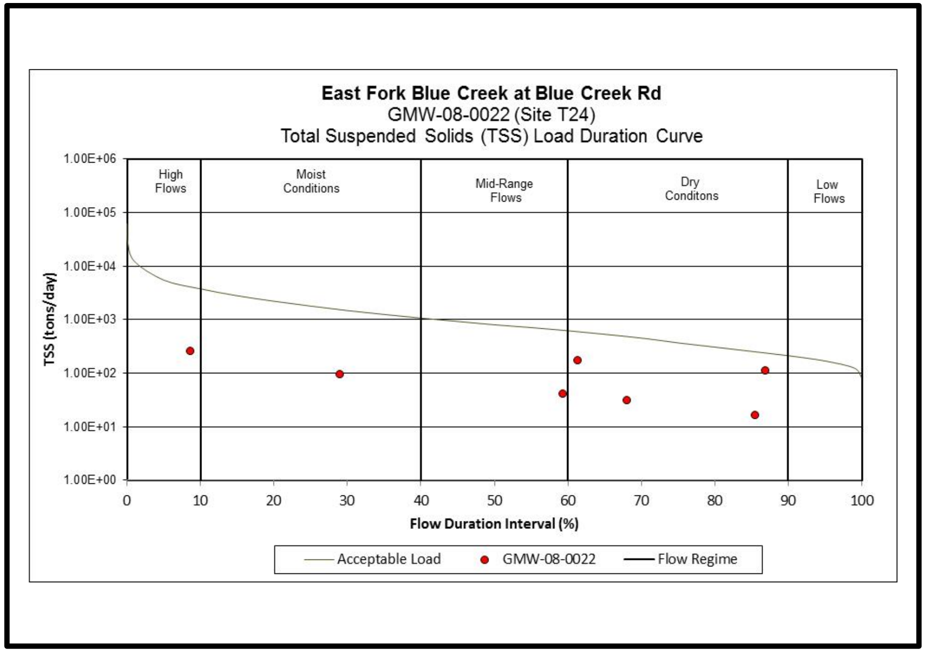


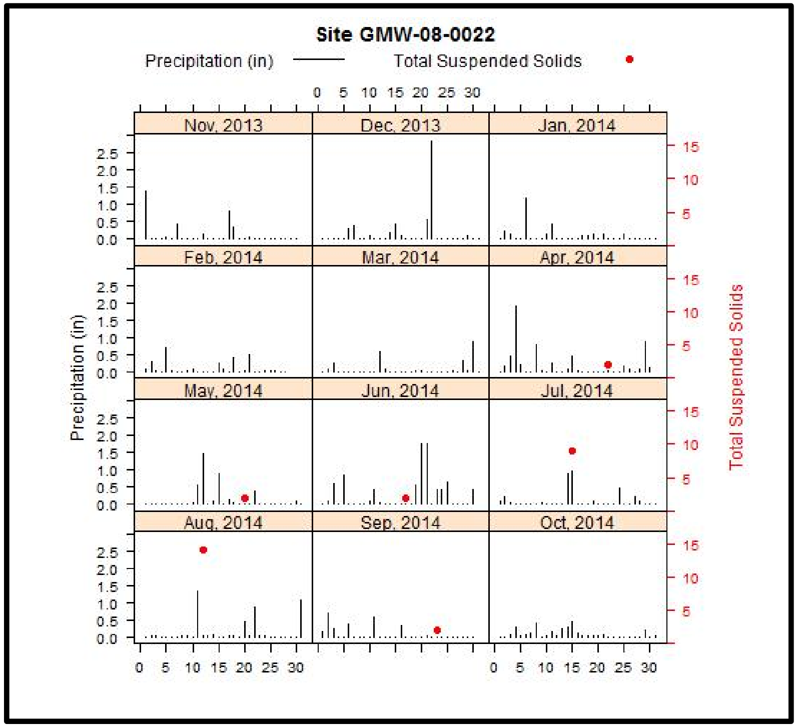

East Fork Blue Creek at Blue Creek Road
GMW-08-0022 (T24)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
E.coli Load (CFU/Day)
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0022


Site GMW-08-0022
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
0.0 0.5 1.0 1.5 2.0 2.5
1 2 3
0 5 10 15 20 25 30


Site GMW-08-0022
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
0.0 0.5 1.0 1.5 2.0 2.5
0.02 0.04 0.06 0.08 0.10
0 5 10 15 20 25 30


East Fork Blue Creek at Blue Creek Rd
GMW-08-0022 (T24)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
TP (lbs/day)
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
GMW-08-0022
Flow Regime





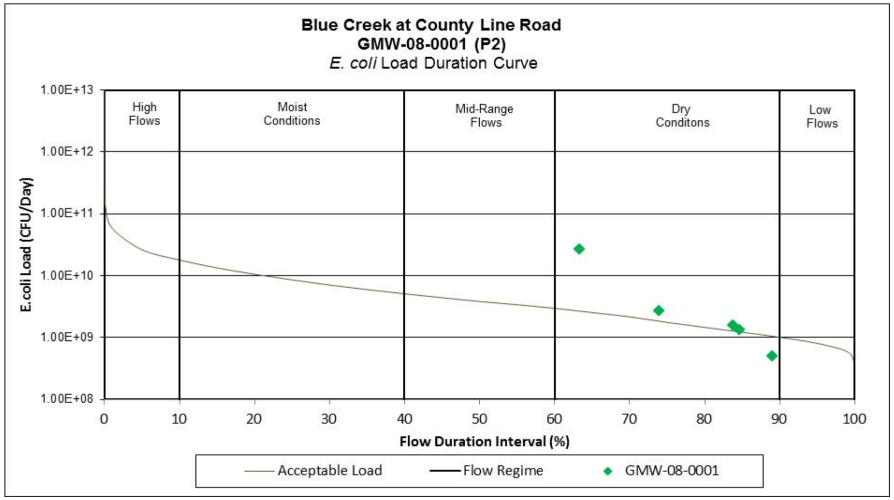
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	3.42E+09	1.81E+11	5.74E+09	5.47E+10	7.14E+08	3.24E+08	2.58E+09
TP (lbs/day)	0.92	2.55	0.59	1.93	0.42	0.2	0.33
TSS (lbs/day)	96.77	255.05	31.88	175.53	111.85	16.8	41.33

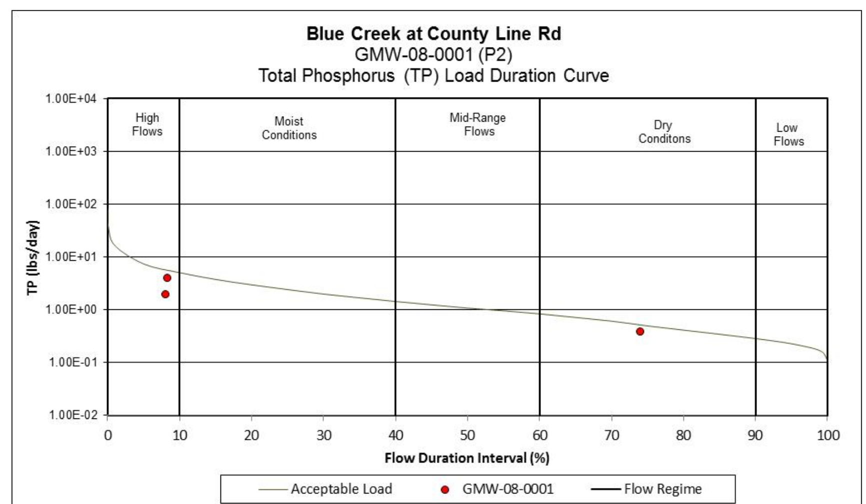
Site P2
GMW-08-0001
Blue Creek at County Line Road

Upstream

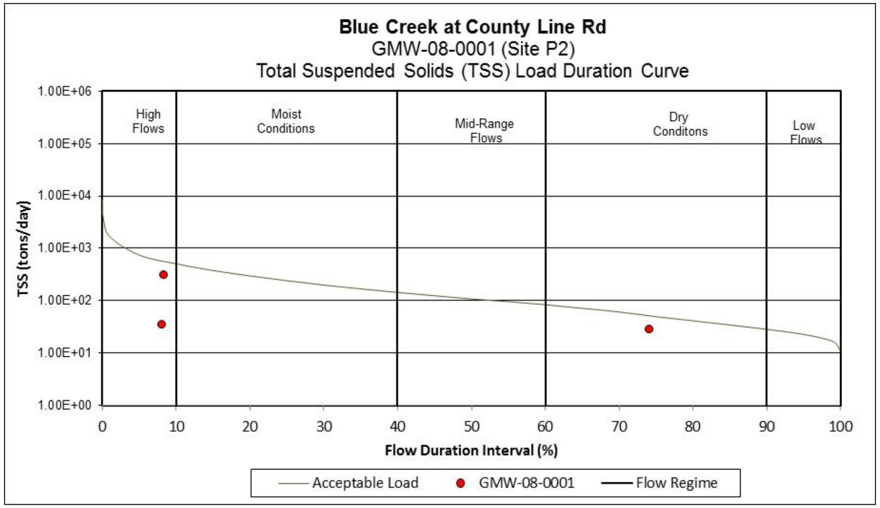
Downstream



Blue Creek at County Line Road
GMW-08-0001 (P2)
E. coli Load Duration Curve
E.coli Load (CFU/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
Flow Regime
GMW-08-0001



Blue Creek at County Line Rd
GMW-08-0001 (P2)
Total Phosphorus (TP) Load Duration Curve
TP (lbs/day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
GMW-08-0001
Flow Regime



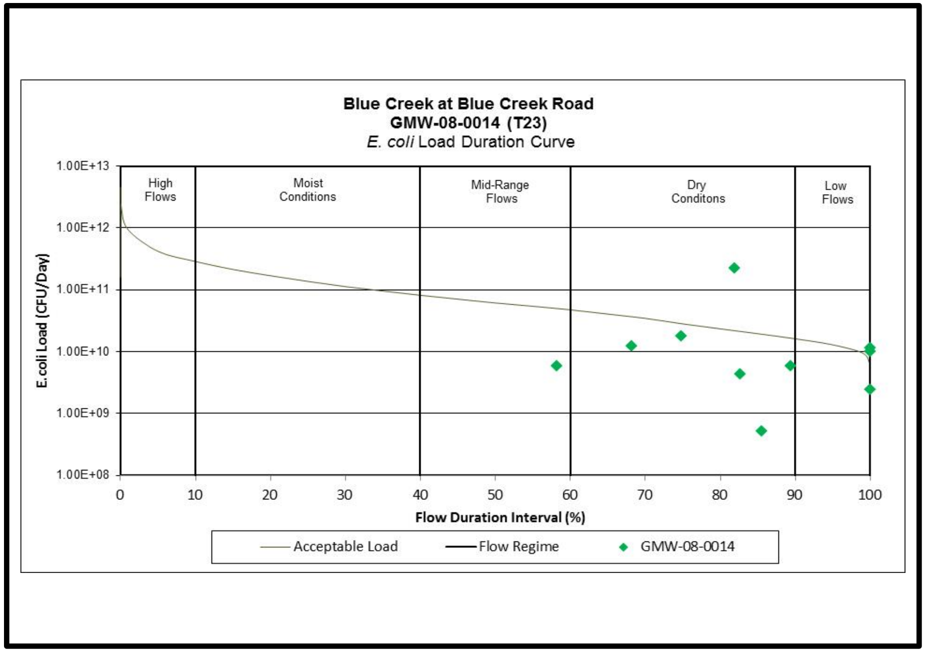
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

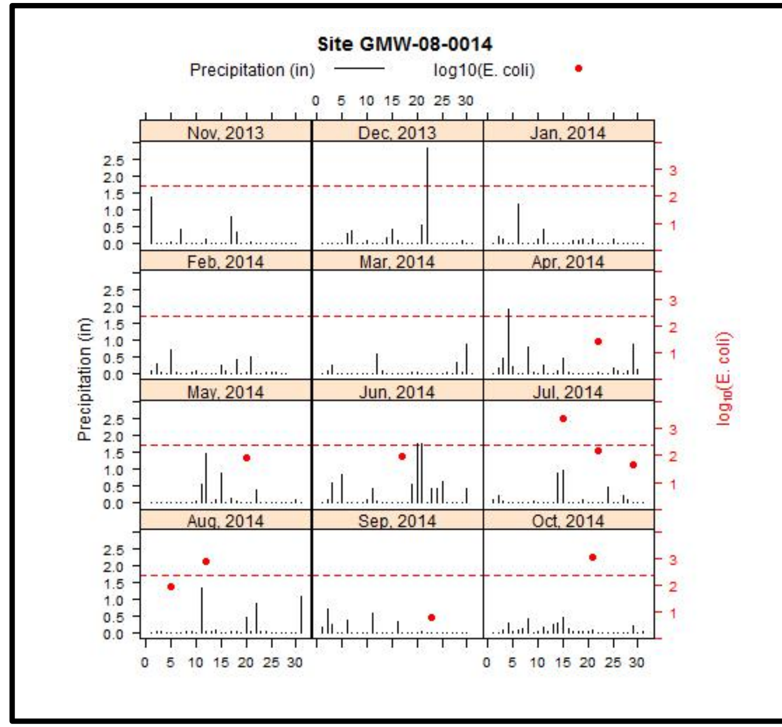
Parameter	May	June	July	August	Sept
E. Coli (MPN)	NA	NA	1.04E+10	9.05E+08	NA
TP (lbs/day)	4.04	1.99	NA	NA	0.4
TSS (lbs/day)	316.23	36.15	NA	NA	29.26

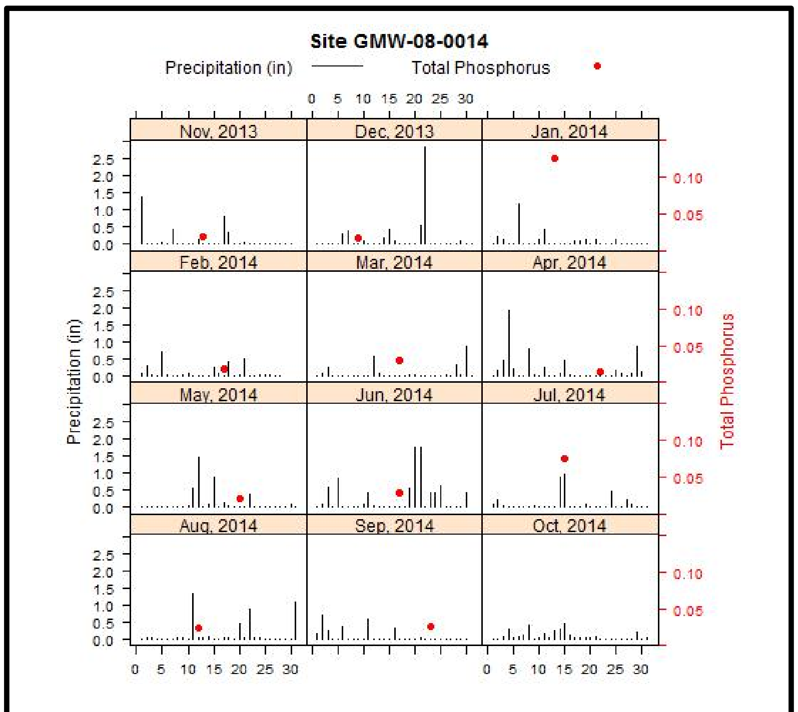
Site T23
GMW-08-0014
Blue Creek at Blue Creek Road

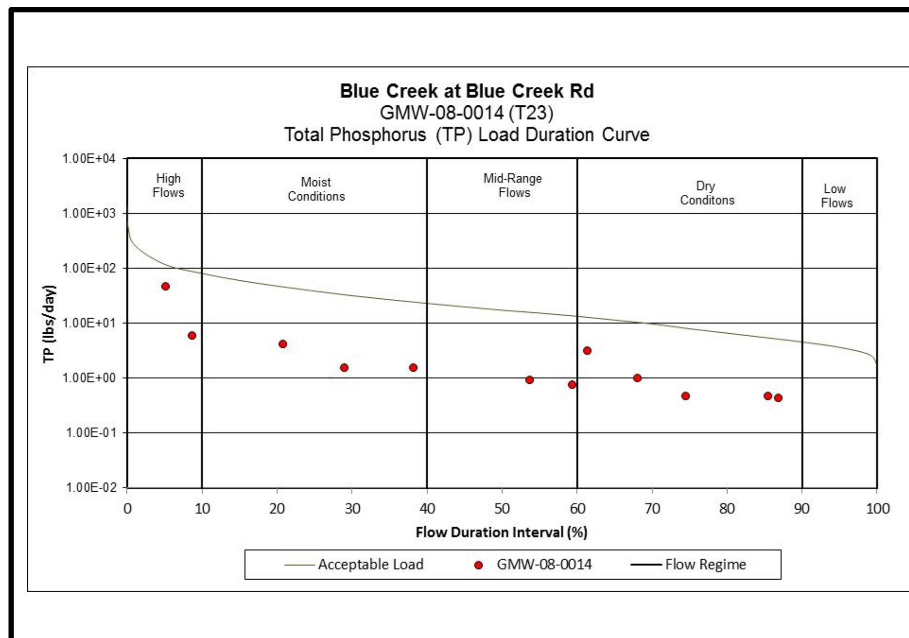
Upstream

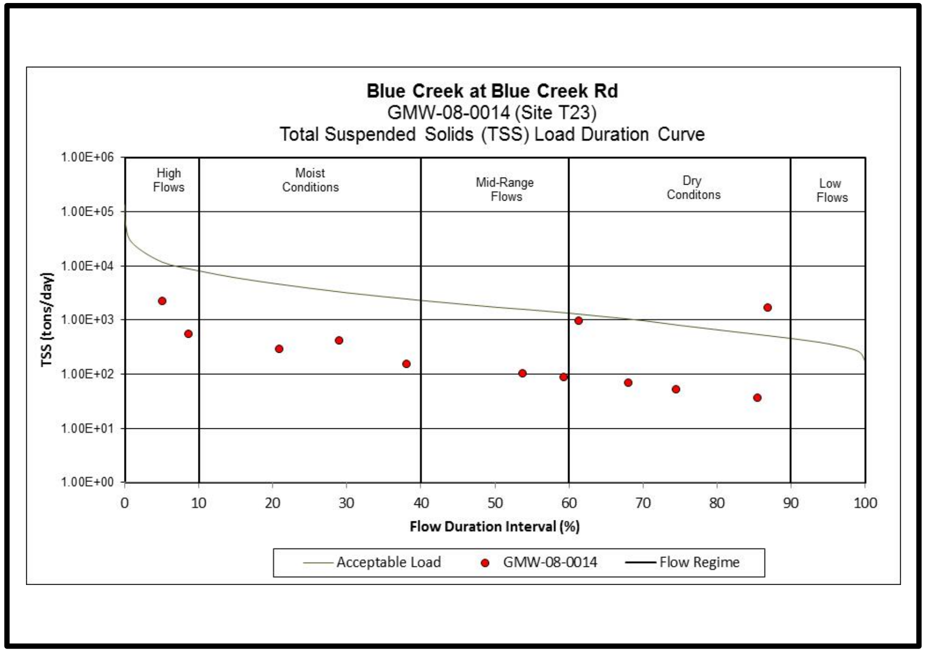
Downstream

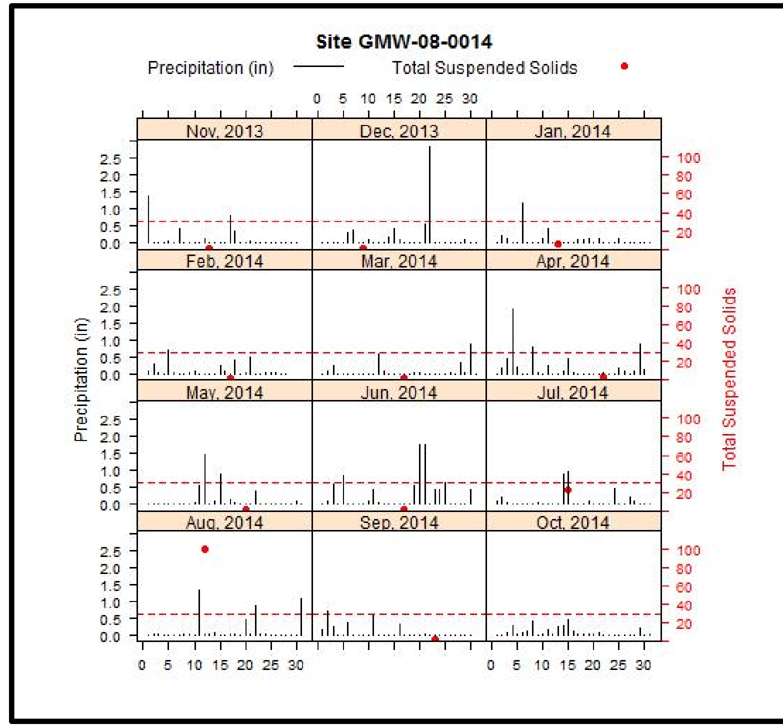

Blue Creek at Blue Creek Road
GMW-08-0014 (T23)
E. coli Load Duration Curve
E.coli Load (CFU/Day)
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0014


Site GMW-08-0014
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
0 5 10 15 20 25 30
0.0 0.5 1.0 1.5 2.0 2.5
1 2 3


Site GMW-08-0014
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
0 5 10 15 20 25 30
0.0 0.5 1.0 1.5 2.0 2.5
0.05 0.10


Blue Creek at Blue Creek Rd
GMW-08-0014 (T23)
Total Phosphorus (TP) Load Duration Curve
TP (lbs/day)
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
GMW-08-0014
Flow Regime





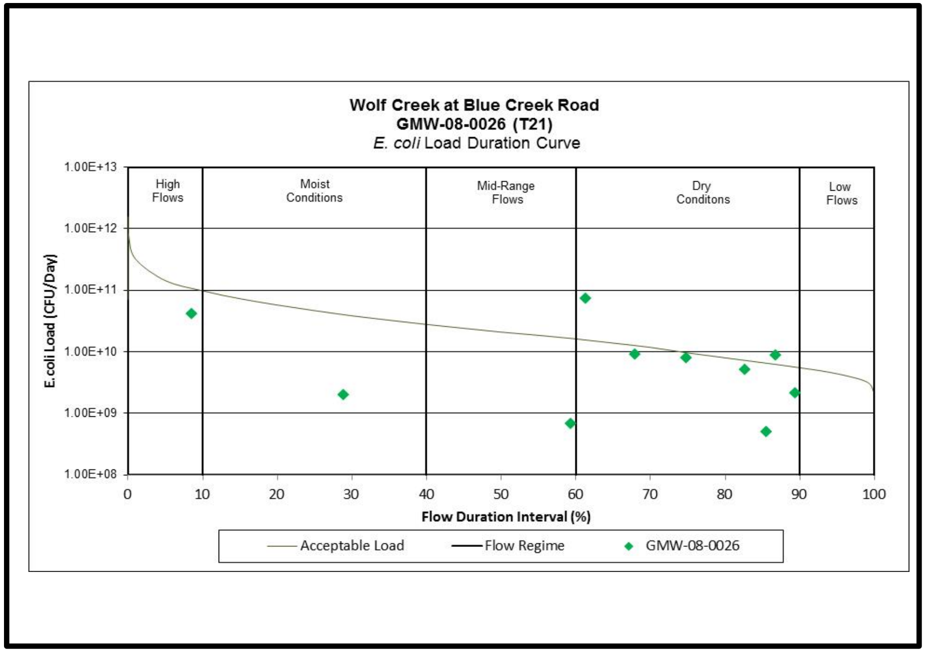
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

Parameter	January	February	March	April	May	June	July	August	Sept	Oct	November	December
E. Coli (MPN)	NA	NA	NA	5.79E+09	1.22E+10	2.43E+09	8.23E+10	7.93E+09	5.18E+08	1.16E+10	NA	NA
TP (lbs/day)	4.67E+01	0.93	4.21	1.57	6.06	1	3.2	0.43	0.47	0.76	1.57	0.48
TSS (lbs/day)	2218.18	103.22	289.61	417.43	550.1	68.76	967.52	1705.86	36.24	89.15	156.46	53.55

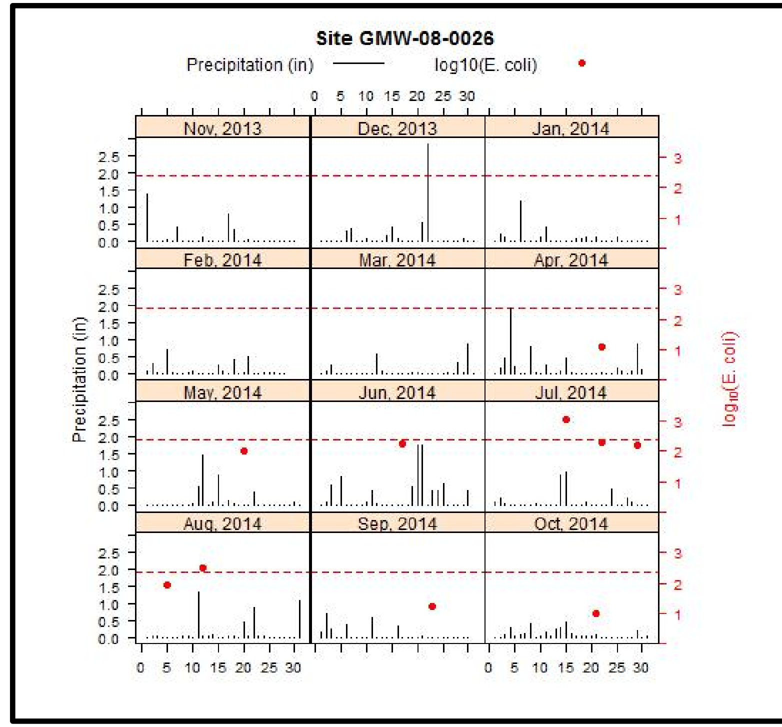
Site T21
GMW-08-0026
Wolf Creek at Blue Creek Road

Upstream

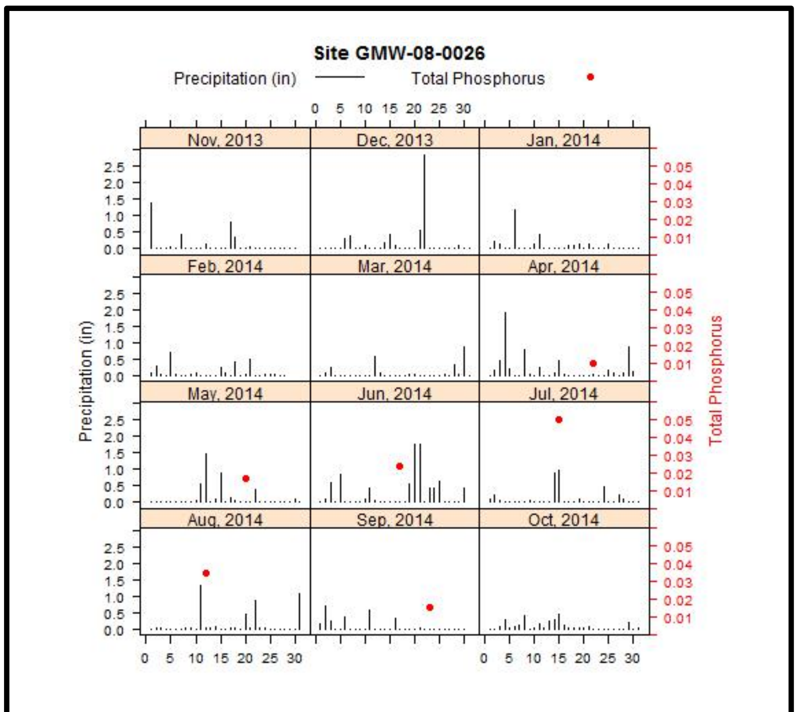
Downstream



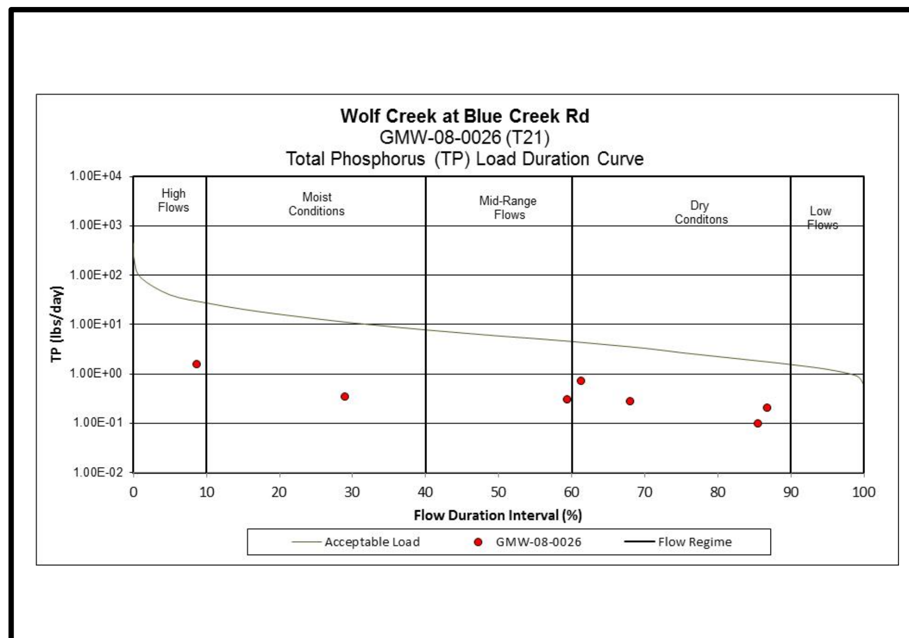
Wolf Creek at Blue Creek Road
GMW-08-0026 (T21)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0026



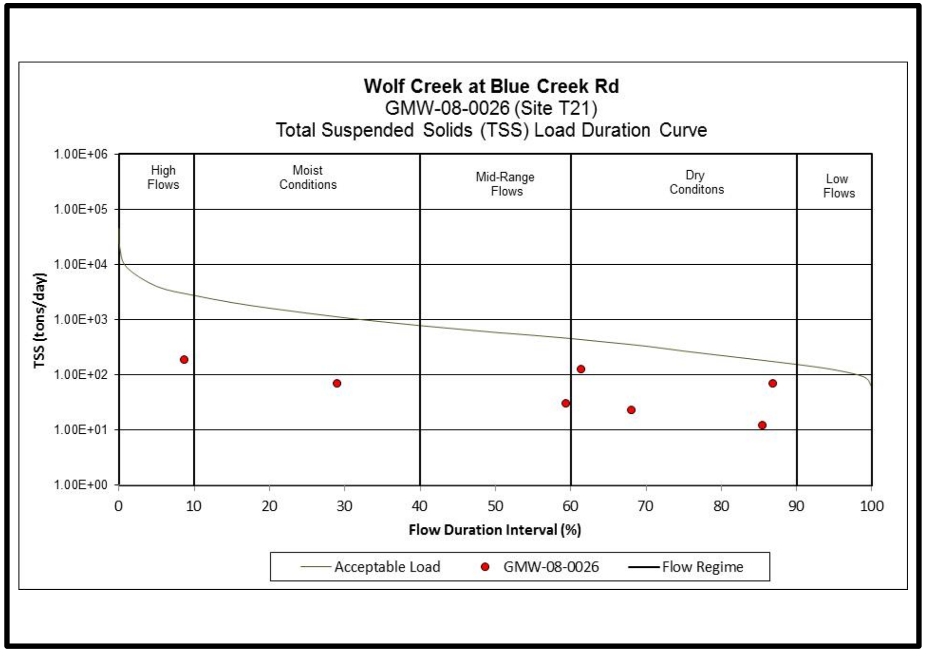
Site GMW-08-0026
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014

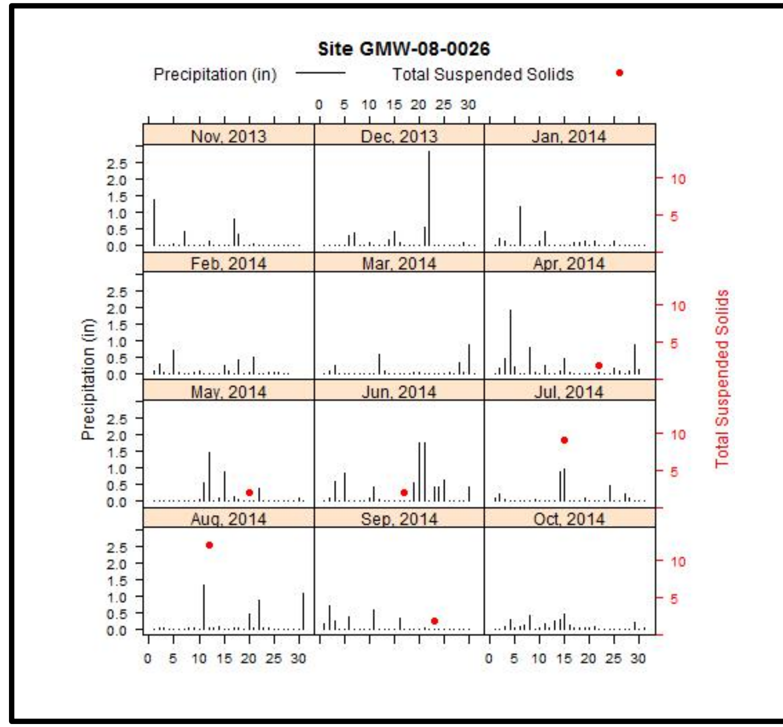


Site GMW-08-0026
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014



Wolf Creek at Blue Creek Rd
GMW-08-0026 (T21)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-08-0026
Flow Regime





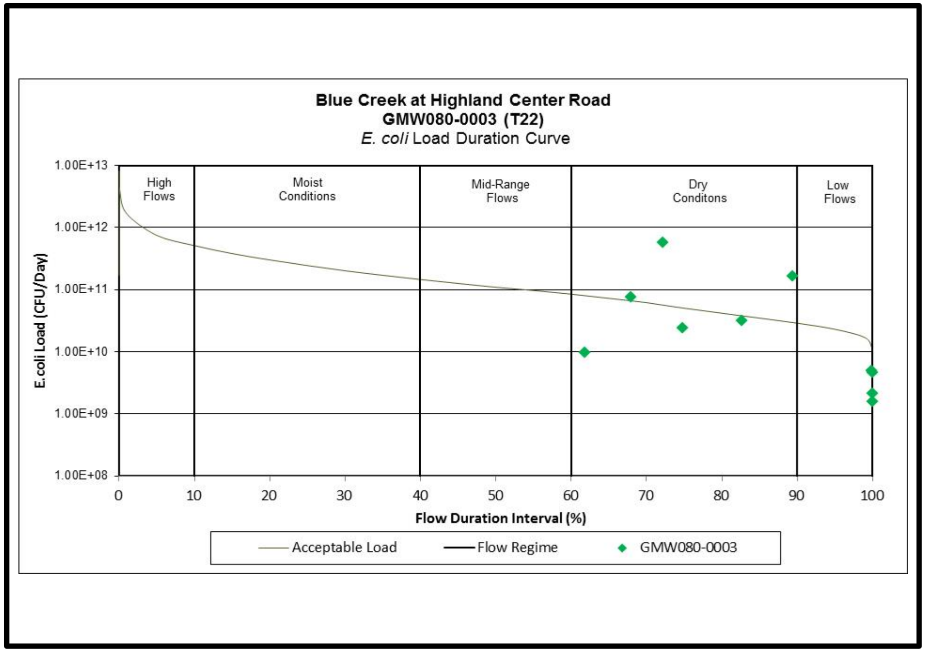
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

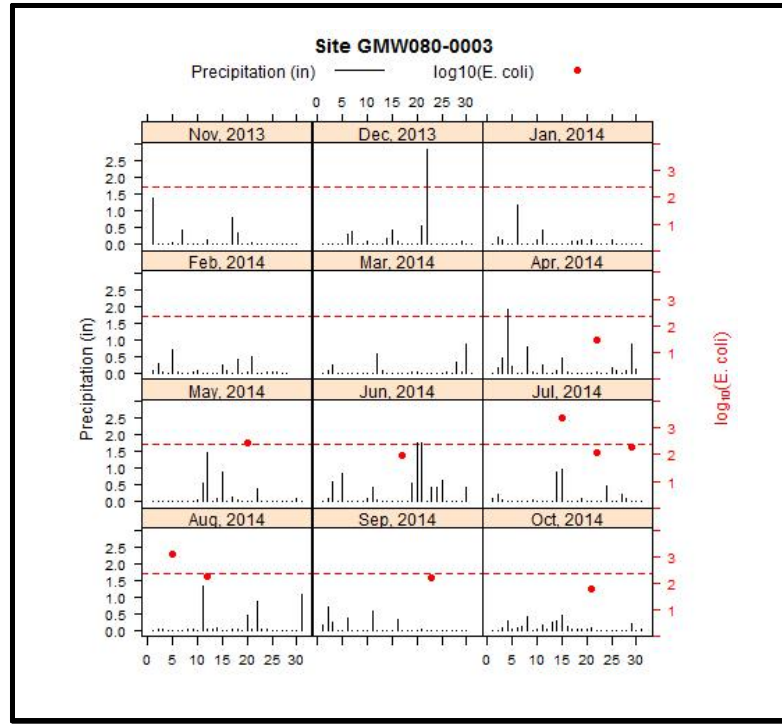
Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	1.97E+09	4.20E+10	9.17E+09	2.87E+10	5.46E+09	5.08E+08	6.69E+08
TP (lbs/day)	0.36	1.6	0.28	0.72	0.21	0.1	0.3
TSS (lbs/day)	71.21	187.69	23.46	129.17	70.55	12.37	30.42

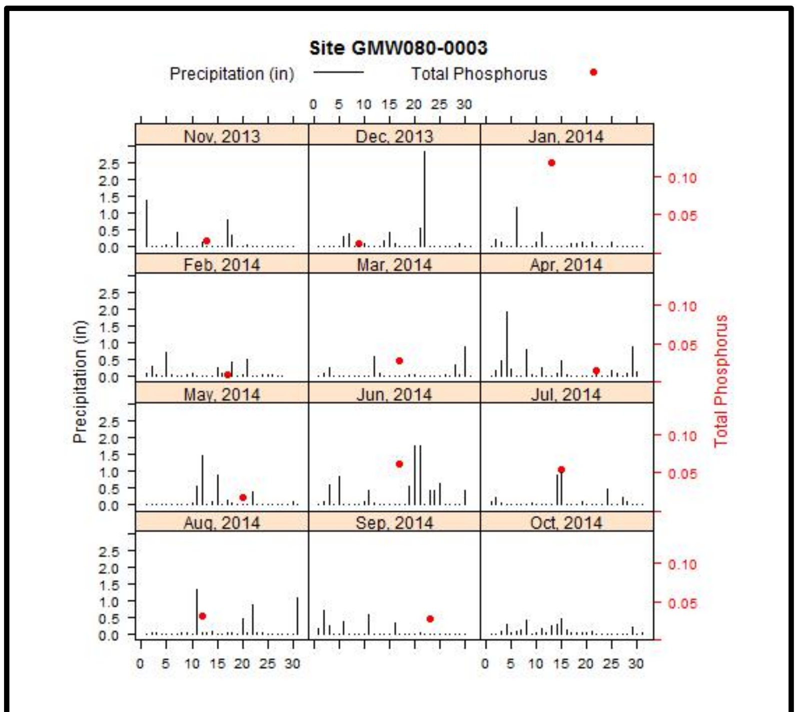
Site T22
GMW080-0003
Blue Creek at Highland Center Road

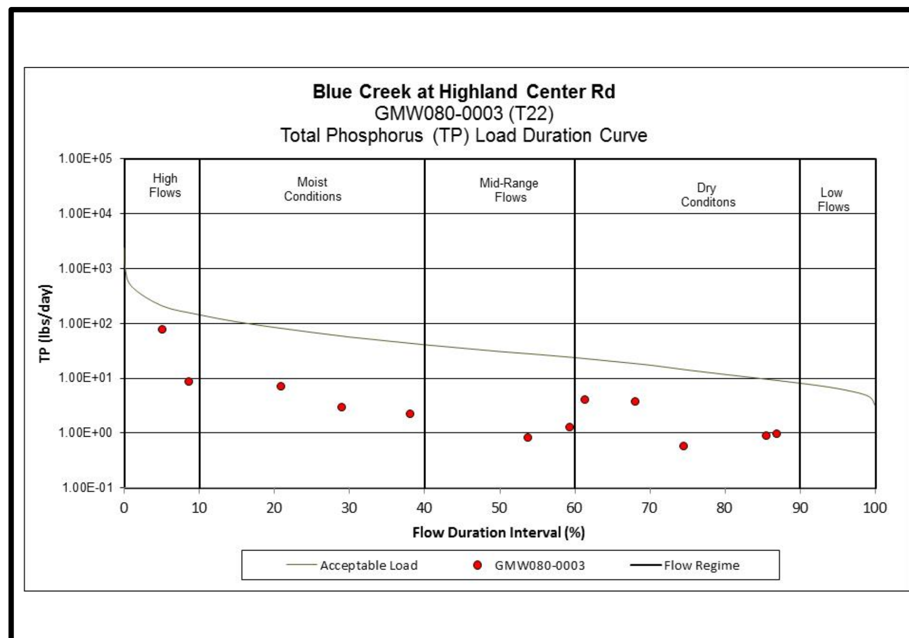
Upstream

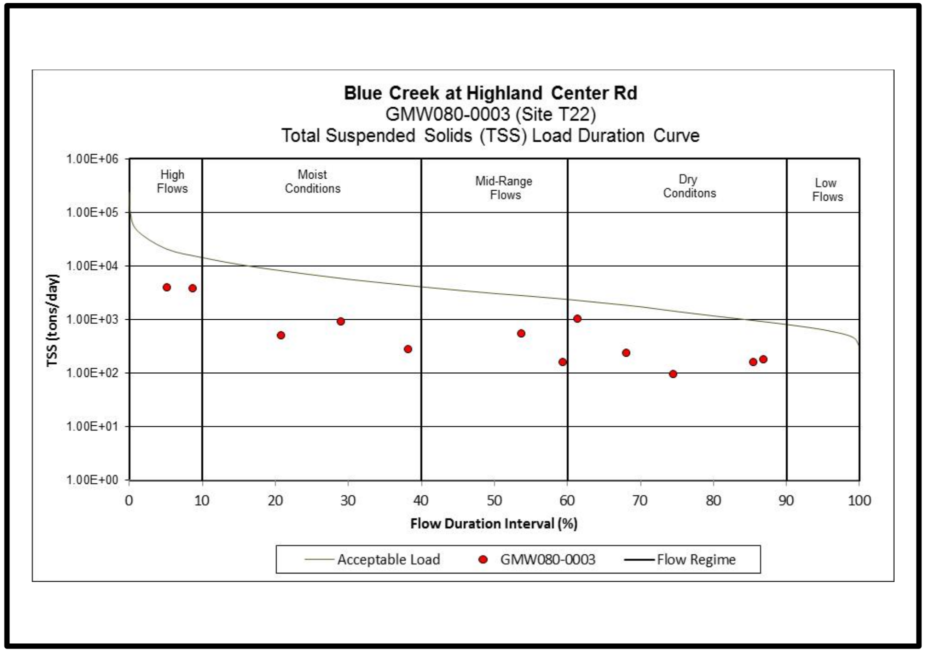
Downstream

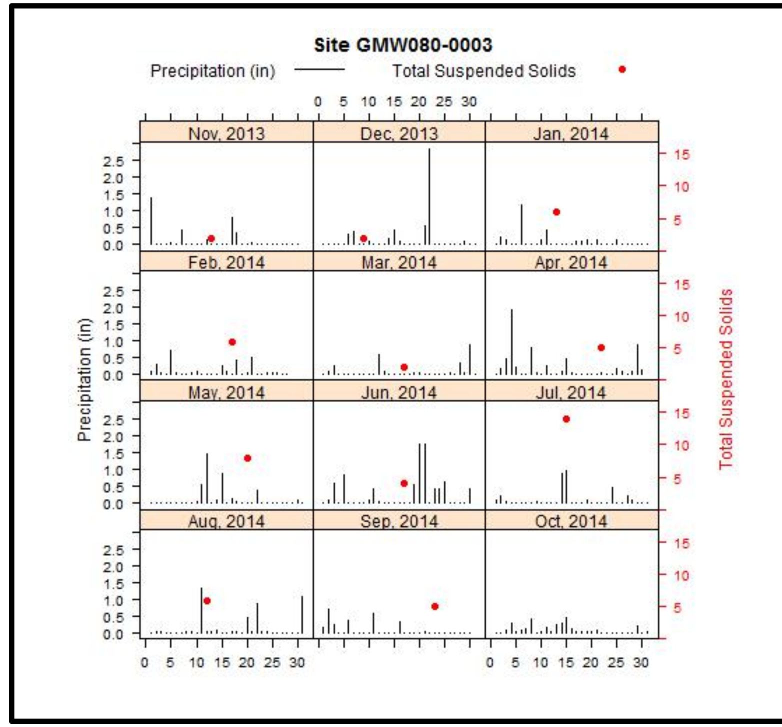

Blue Creek at Highland Center Road
GMW080-0003 (T22)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW080-0003


Site GMW080-0003
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log10(E. coli)


Site GMW080-0003
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus


Blue Creek at Highland Center Rd
GMW080-0003 (T22)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
GMW080-0003
Flow Regime





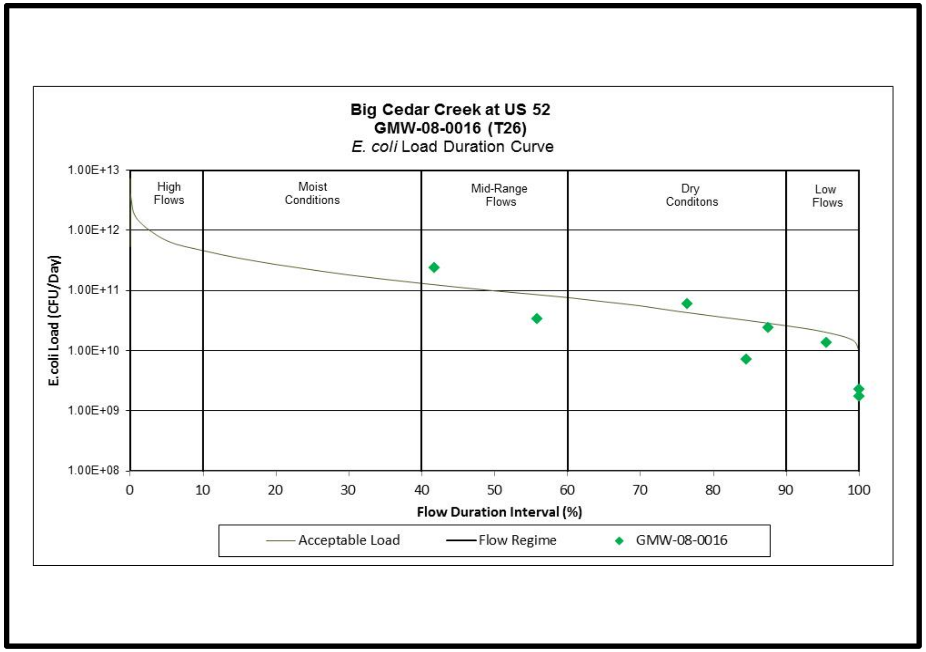
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

Parameter	January	February	March	April	May	June	July	August	Sept	Oct	November	December
E. Coli (MPN)	NA	NA	NA	9.85E+09	7.69E+10	5.03E+09	2.10E+11	8.37E+10	2.17E+09	1.58E+09	NA	NA
TP (lbs/day)	77.29	0.83	7.24	2.98	8.84	3.75	4.06	0.98	0.91	1.27	2.24	0.57
TSS (lbs/day)	3961.89	553.1	517.27	931.95	3930.1	245.63	1051.88	184.66	161.83	159.23	279.44	95.65

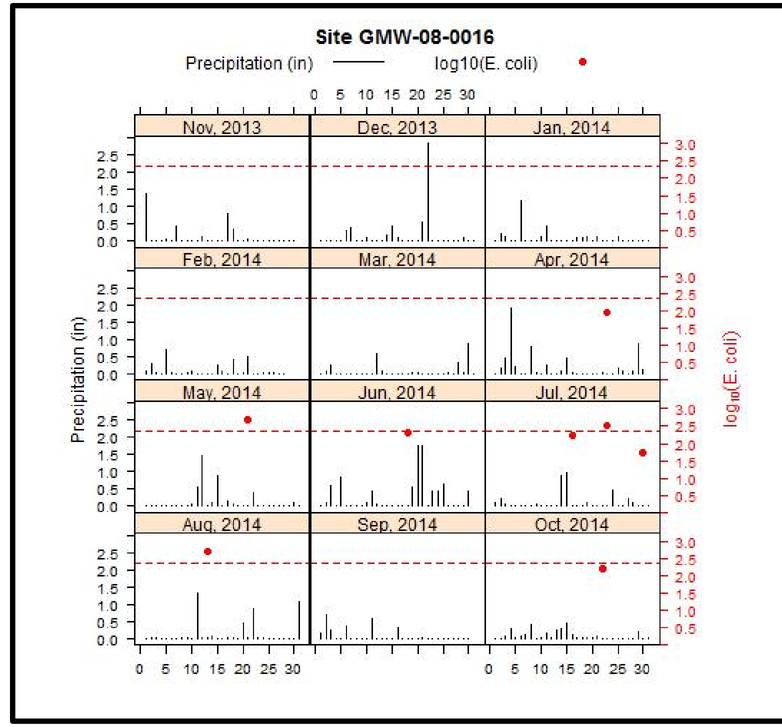
Site T26
GMW-08-0016
Big Cedar Creek at US 52

Upstream

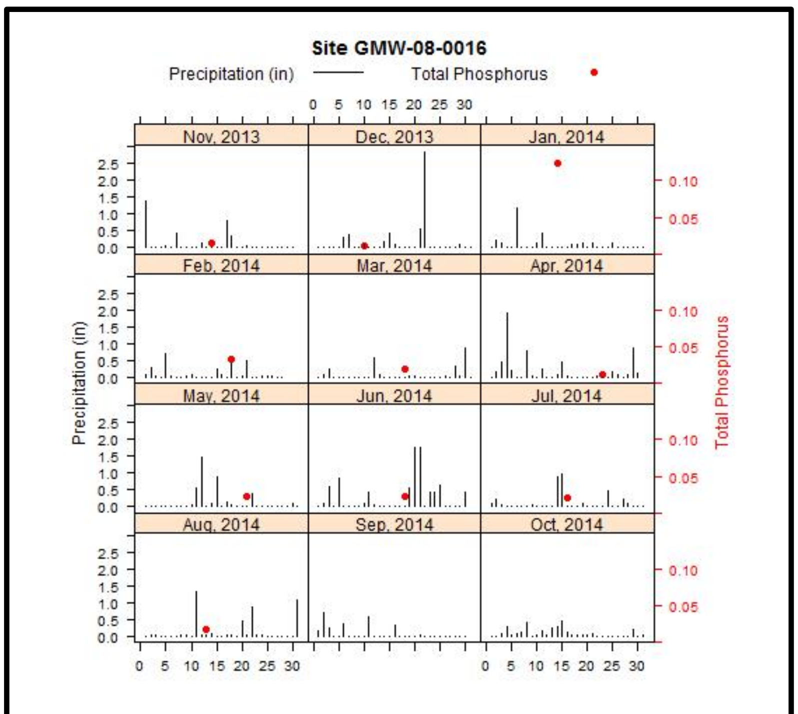
Downstream



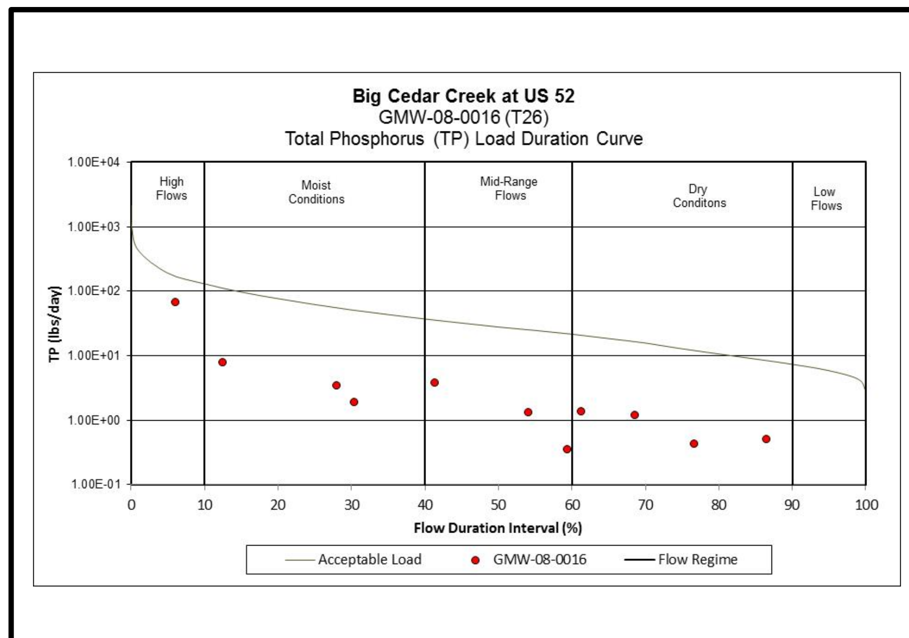
Big Cedar Creek at US 52
GMW-08-0016 (T26)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0016



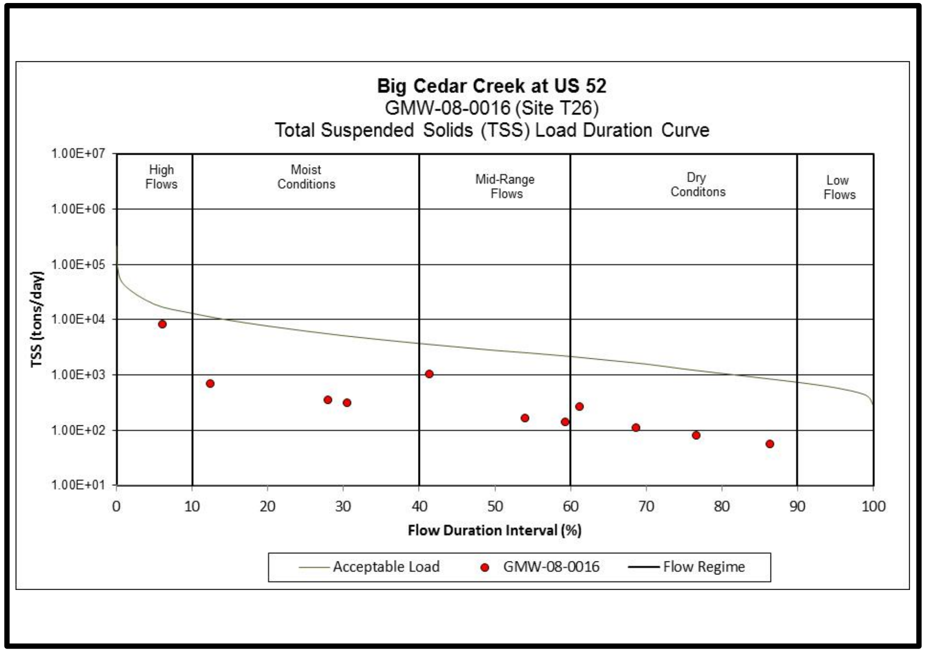
Site GMW-08-0016
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014

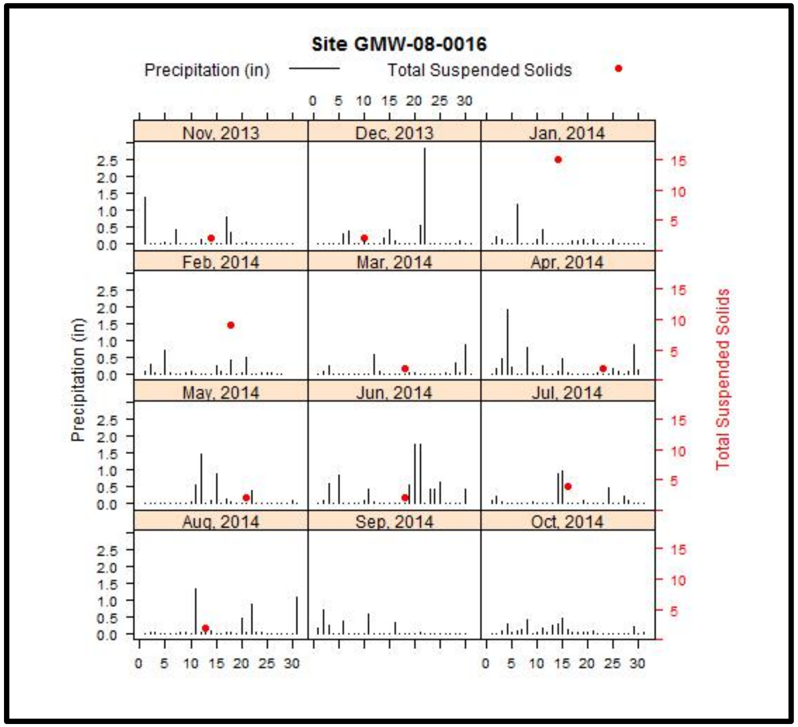


Site GMW-08-0016
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014



Big Cedar Creek at US 52
GMW-08-0016 (T26)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-08-0016
Flow Regime





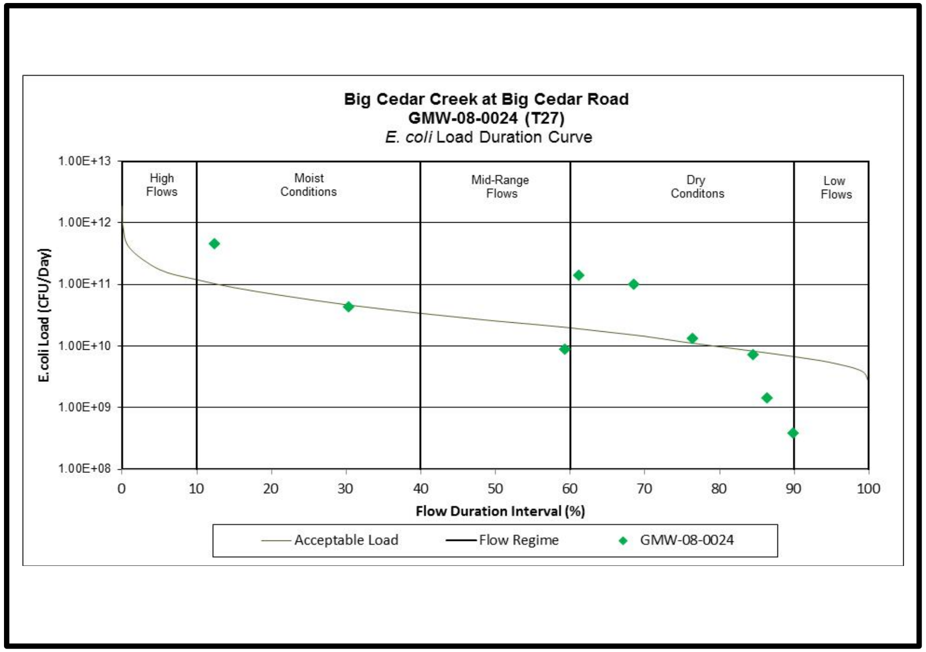
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

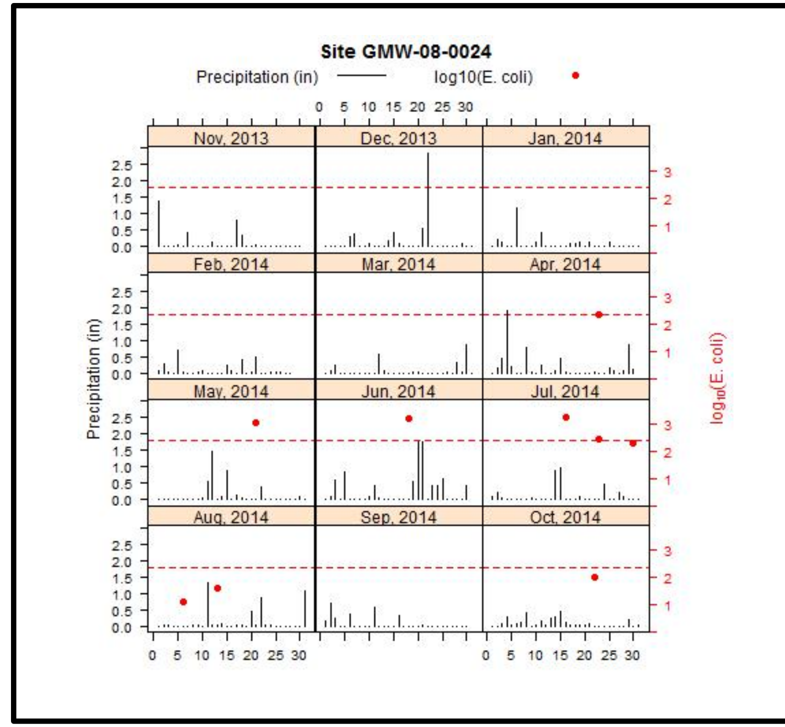
Parameter	January	February	March	April	May	June	July	August	Sept	Oct	November	December
E. Coli (MPN)	NA	NA	NA	3.33E+10	2.37E+11	2.42E+10	2.65E+10	1.76E+09	NA	2.32E+09	NA	NA
TP (lbs/day)	67.63	3.78	3.49	1.91	7.99	1.2	1.36	0.51	NA	0.36	1.32	0.44
TSS (lbs/day)	8181.36	1032.14	348.86	317.62	695.12	108.82	271.28	56.23	NA	143.45	164.8	79.67

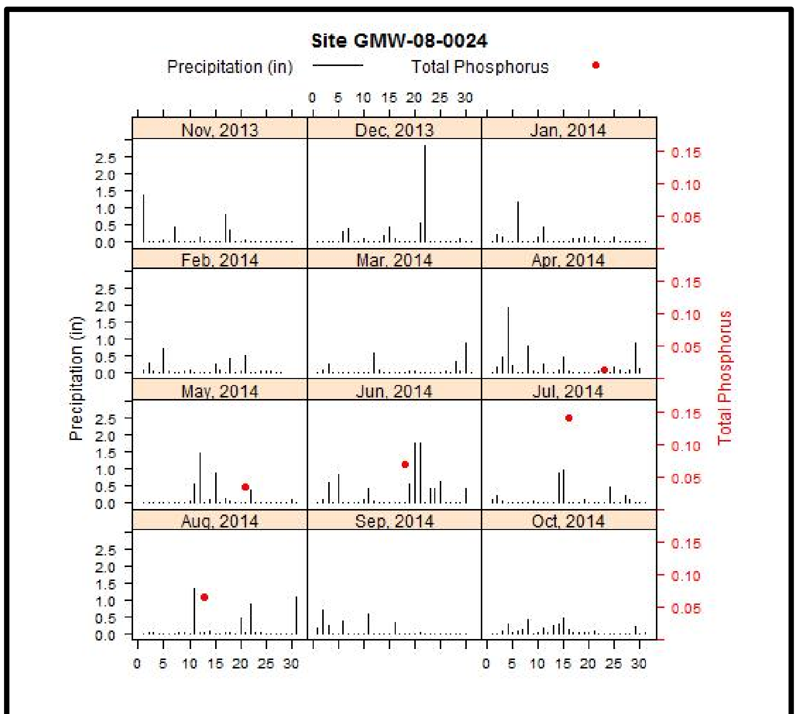
Site T27
GMW-08-0024
Big Cedar Creek at Big Cedar Road

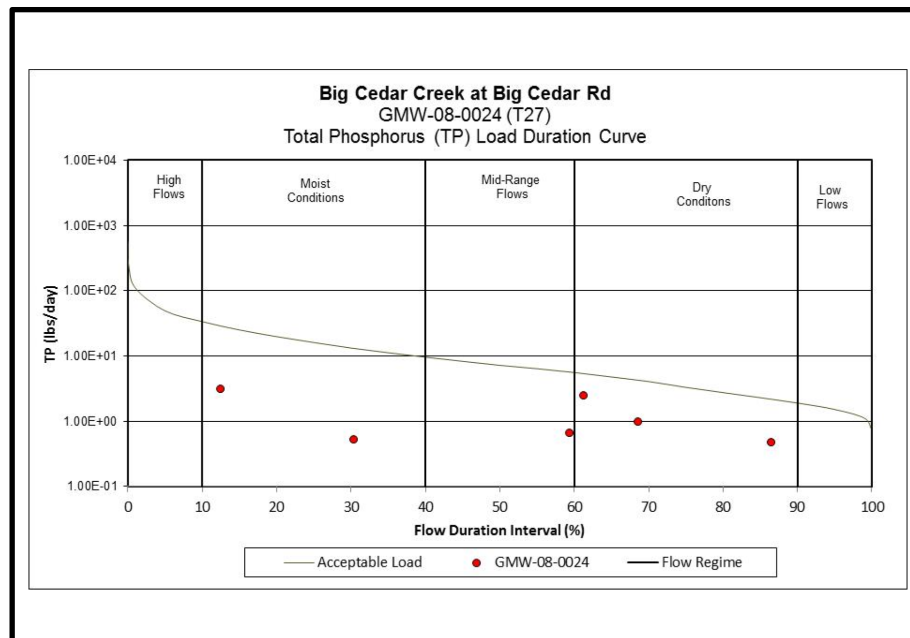
Upstream

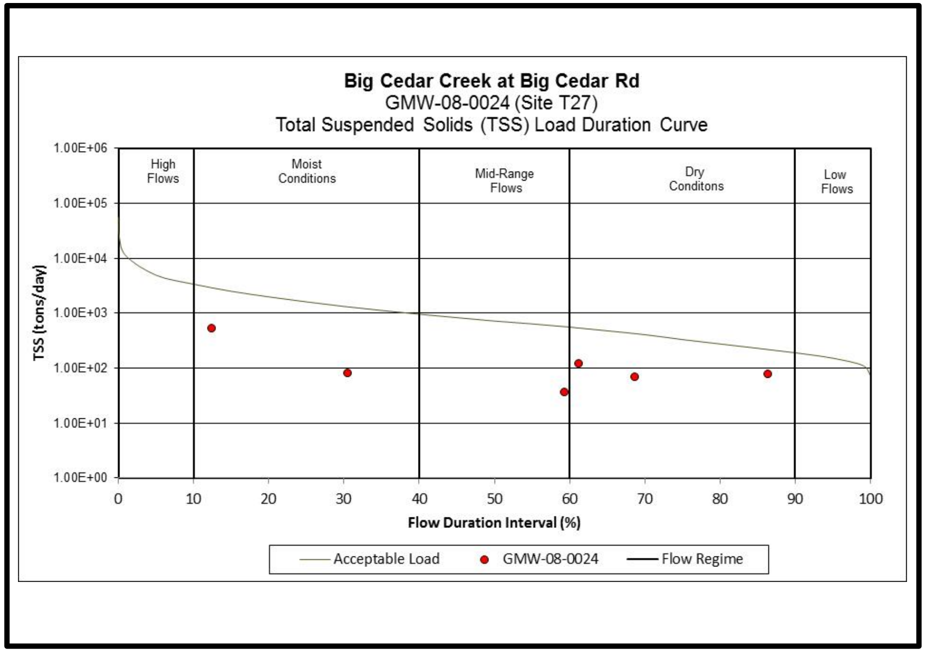
Downstream

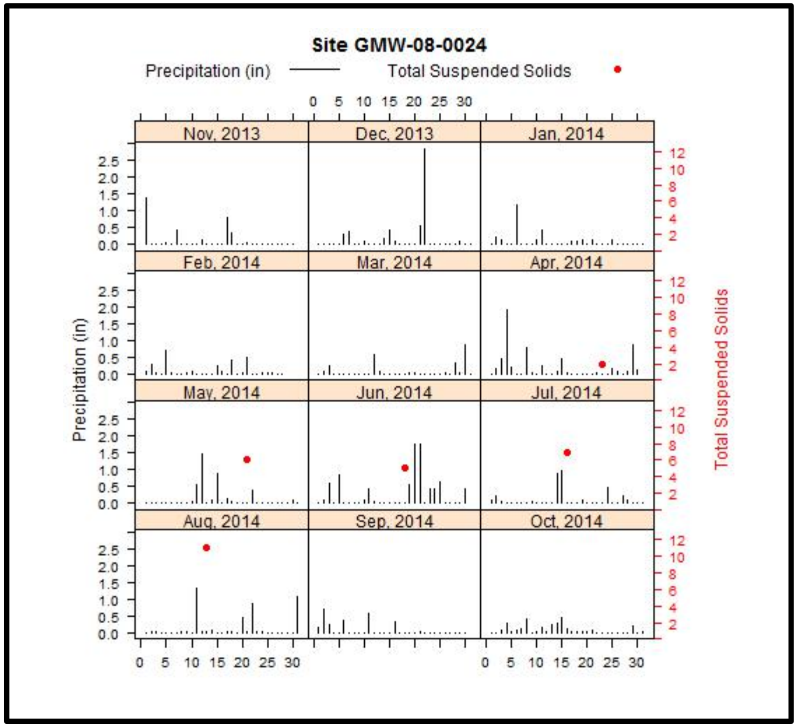

Big Cedar Creek at Big Cedar Road
GMW-08-0024 (T27)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0024


Site GMW-08-0024
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log10(E. coli)
0 5 10 15 20 25 30


Site GMW-08-0024
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus
0 5 10 15 20 25 30


Big Cedar Creek at Big Cedar Rd
GMW-08-0024 (T27)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
GMW-08-0024
Flow Regime





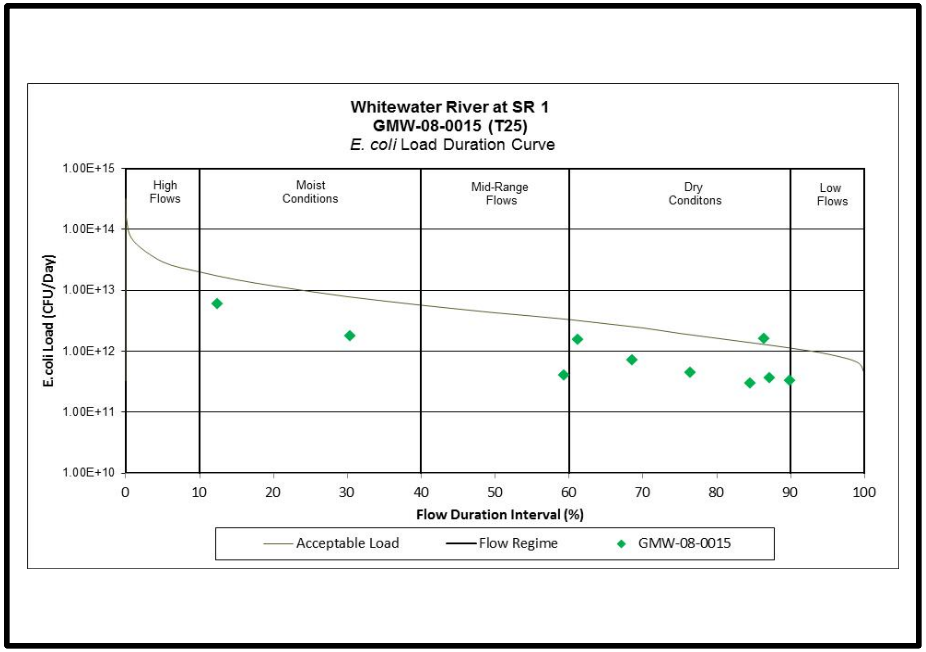
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

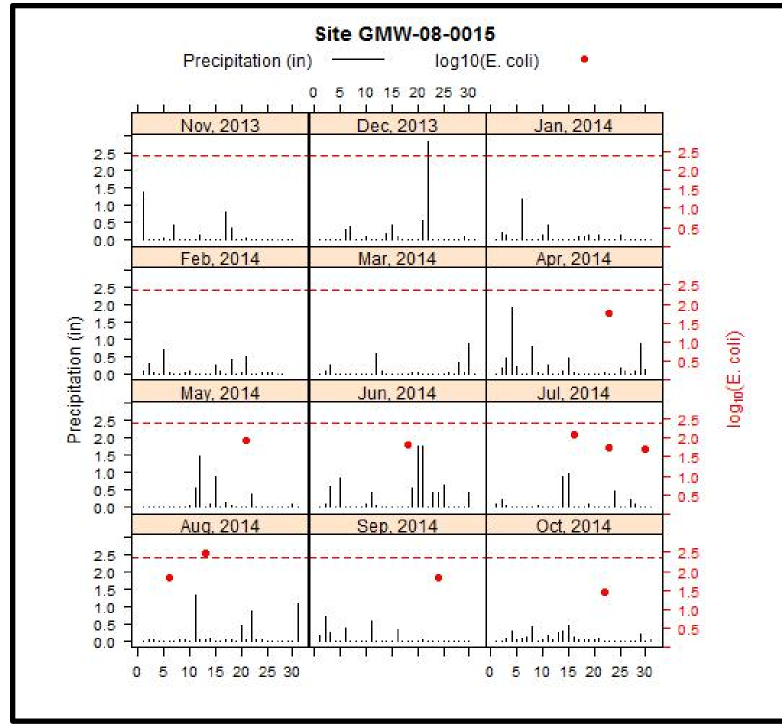
Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	4.20E+10	4.53E+11	9.92E+10	5.27E+10	9.07E+08	NA	8.81E+09
TP (lbs/day)	0.53	3.15	0.99	2.47	0.47	NA	0.67
TSS (lbs/day)	82.21	539.73	70.41	122.87	80.05	NA	37.13

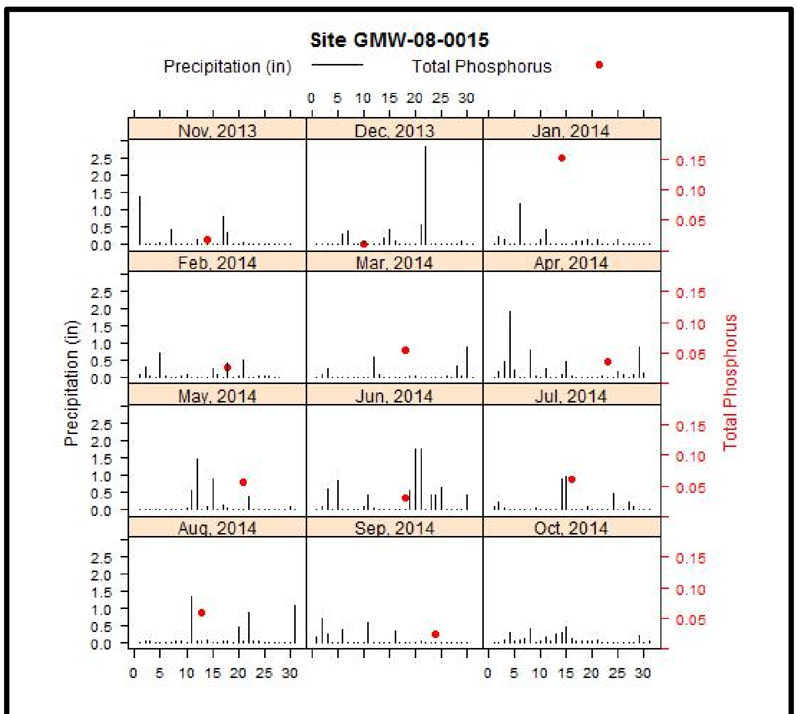
Site T25
GMW-08-0015
Whitewater River at SR 1

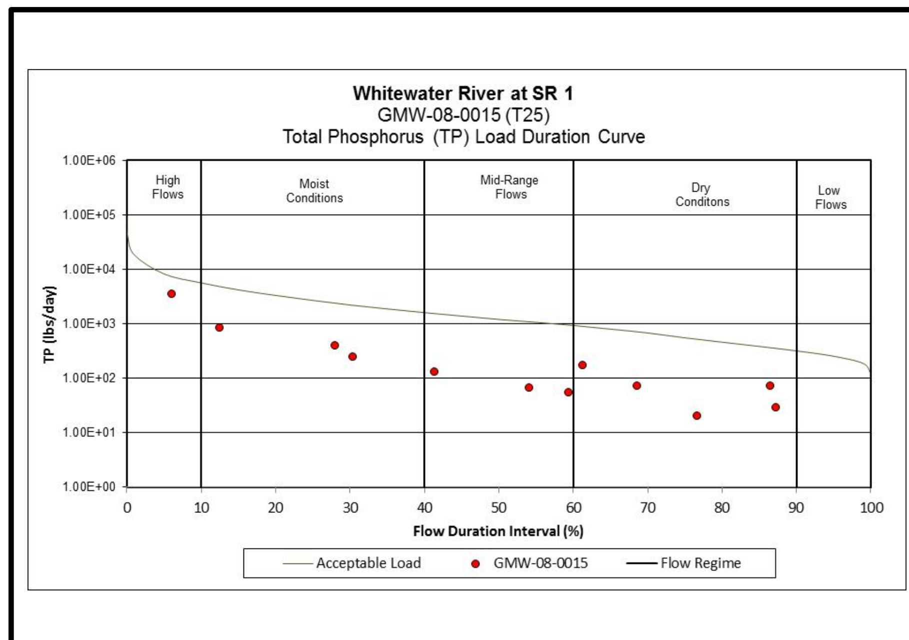
Upstream

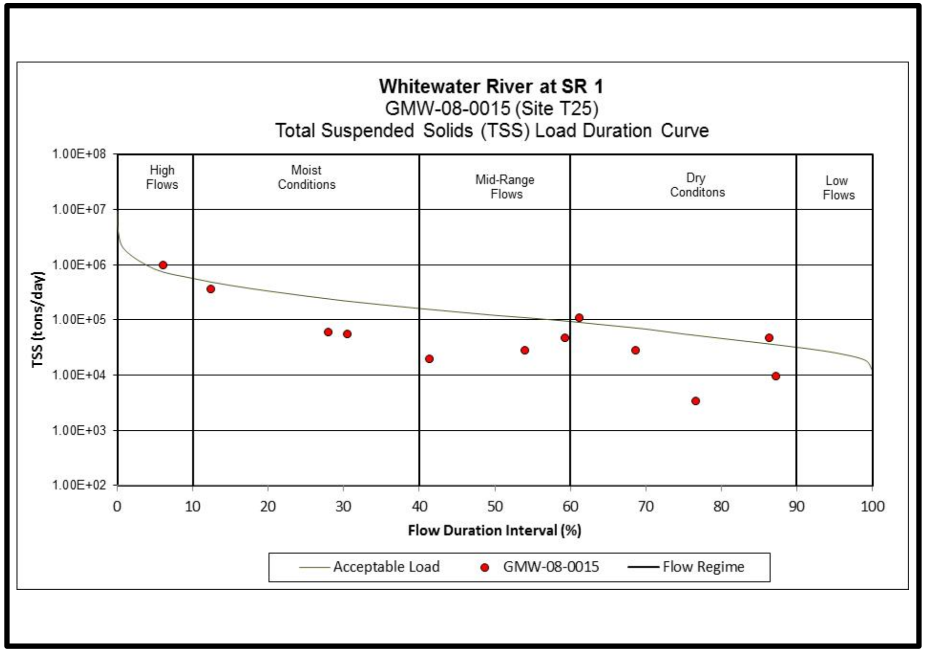
Downstream

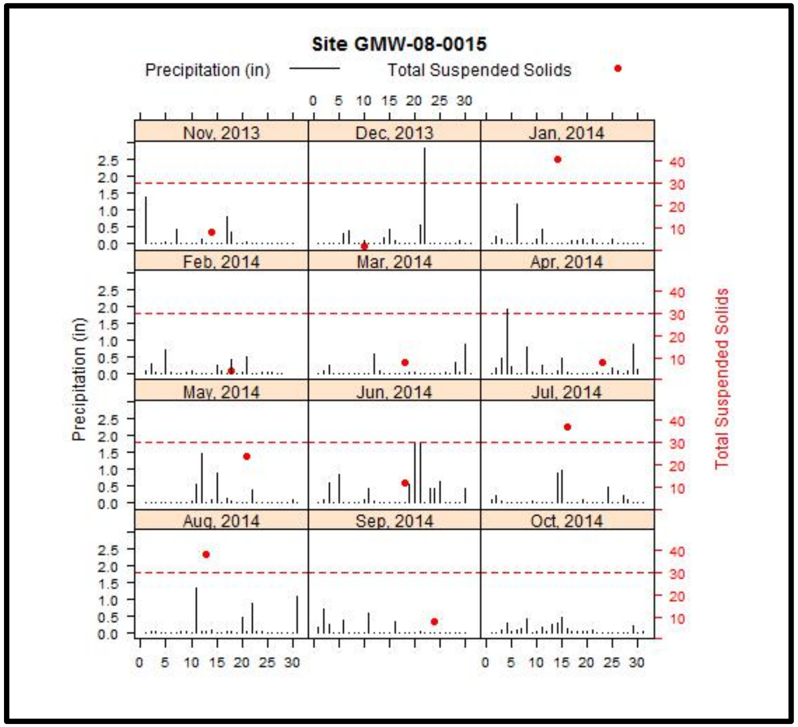

Whitewater River at SR 1
GMW-08-0015 (T25)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+15
1.00E+14
1.00E+13
1.00E+12
1.00E+11
1.00E+10
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0015


Site GMW-08-0015
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
$\log_{10}$(E. coli)
0 5 10 15 20 25 30


Site GMW-08-0015
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus
0 5 10 15 20 25 30


Whitewater River at SR 1
GMW-08-0015 (T25)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
GMW-08-0015
Flow Regime





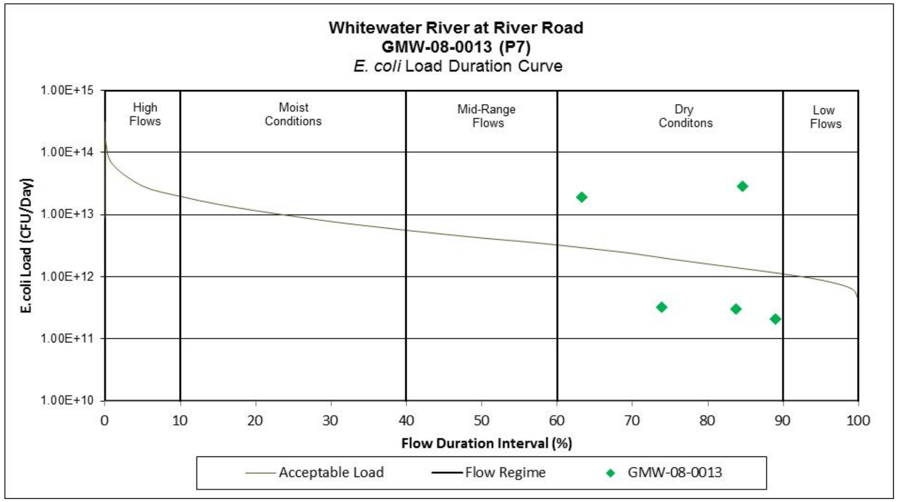
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

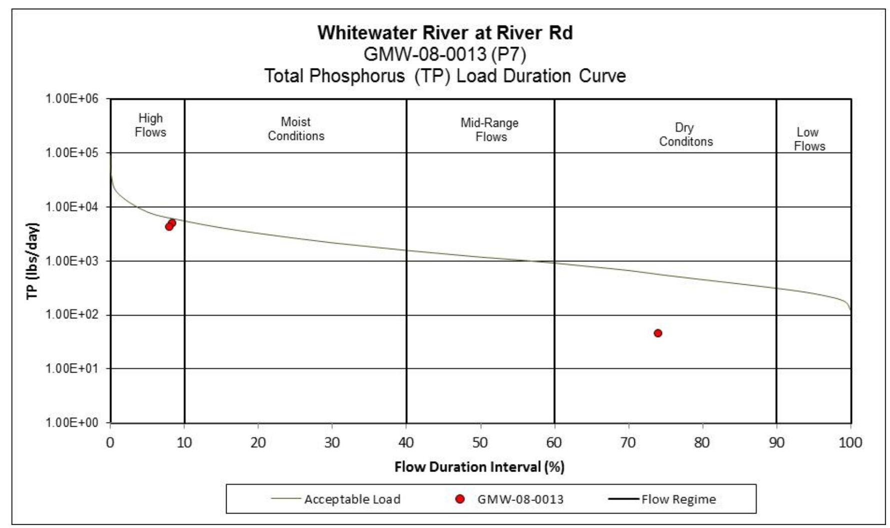
Parameter	January	February	March	April	May	June	July	August	Sept	Oct	November	December
E. Coli (MPN)	NA	NA	NA	1.79E+12	6.06E+12	7.11E+11	7.67E+11	9.70E+11	3.69E+11	3.99E+11	NA	NA
TP (lbs/day)	3602.3	134.54	409.28	248.42	845.71	73.29	176.81	73.3	29.55	56.1	68.03	20.77
TSS (lbs/day)	971673.63	19932.35	60634.15	55204.23	362447.44	28371.35	109034.01	46425.85	9457.12	46748.25	28642.85	3461.58

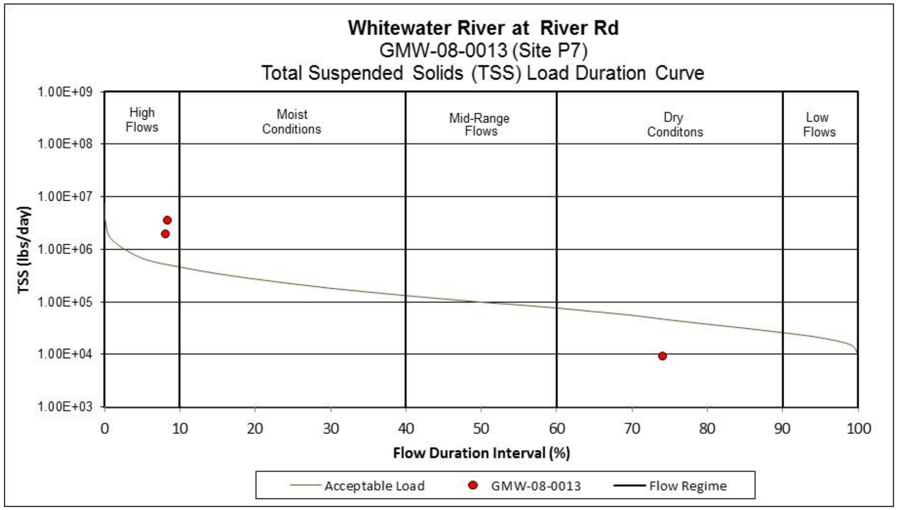
Site P7
GMW-08-0013
Whitewater River at River Road

Upstream

Downstream


Whitewater River at River Road
GMW-08-0013 (P7)
E. coli Load Duration Curve
E.coli Load (CFU/Day)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
1.00E+15
1.00E+14
1.00E+13
1.00E+12
1.00E+11
1.00E+10
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0013


Whitewater River at River Rd
GMW-08-0013 (P7)
Total Phosphorus (TP) Load Duration Curve
TP (lbs/day)
High Flows
Moist Conditons
Mid-Range Flows
Dry Conditons
Low Flows
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
GMW-08-0013
Flow Regime



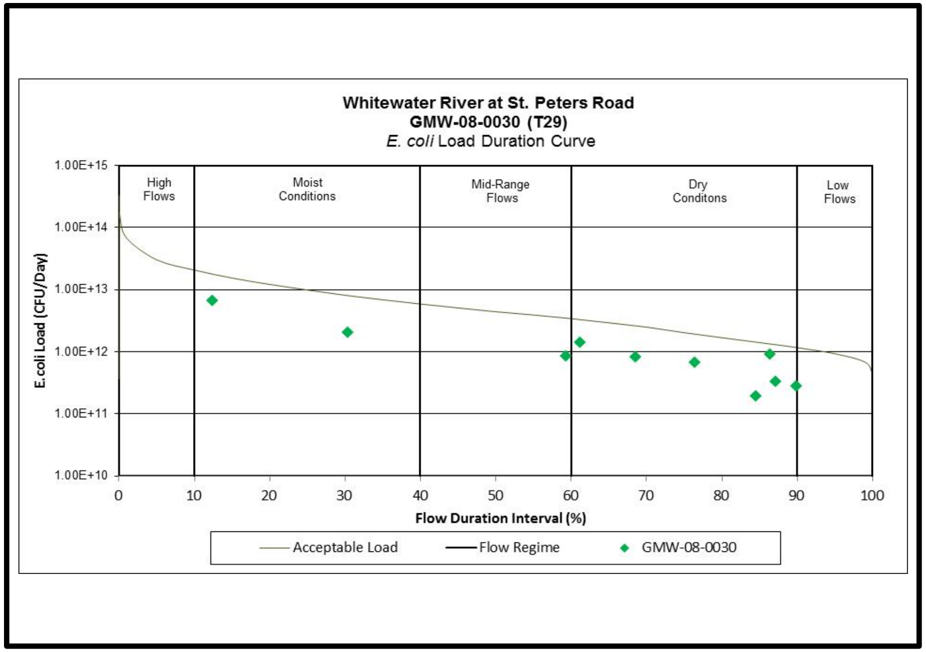
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

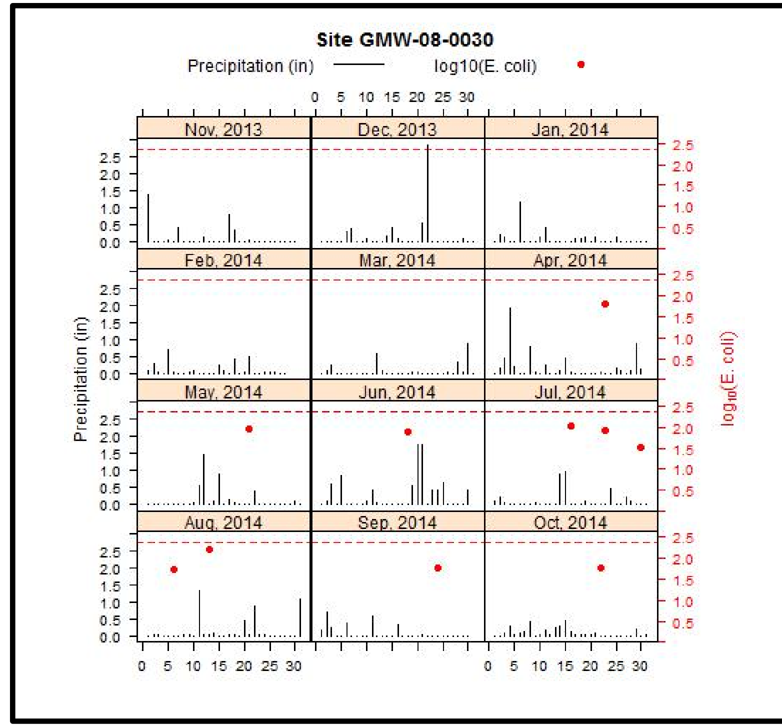
Parameter	May	June	July	August	Sept
E. Coli (MPN)	NA	NA	6.56E+12	1.43E+13	NA
TP (lbs/day)	5013.96	4364.84	NA	NA	47.24
TSS (lbs/day)	3664044.83	1984019.42	NA	NA	9447.71

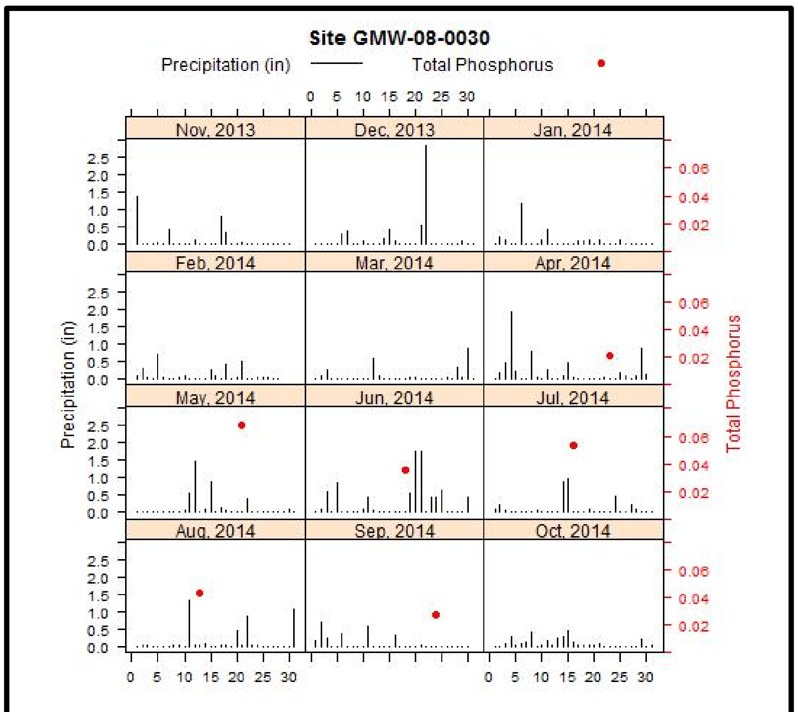
Site T29
GMW-08-0030
Whitewater River at St Peters Road

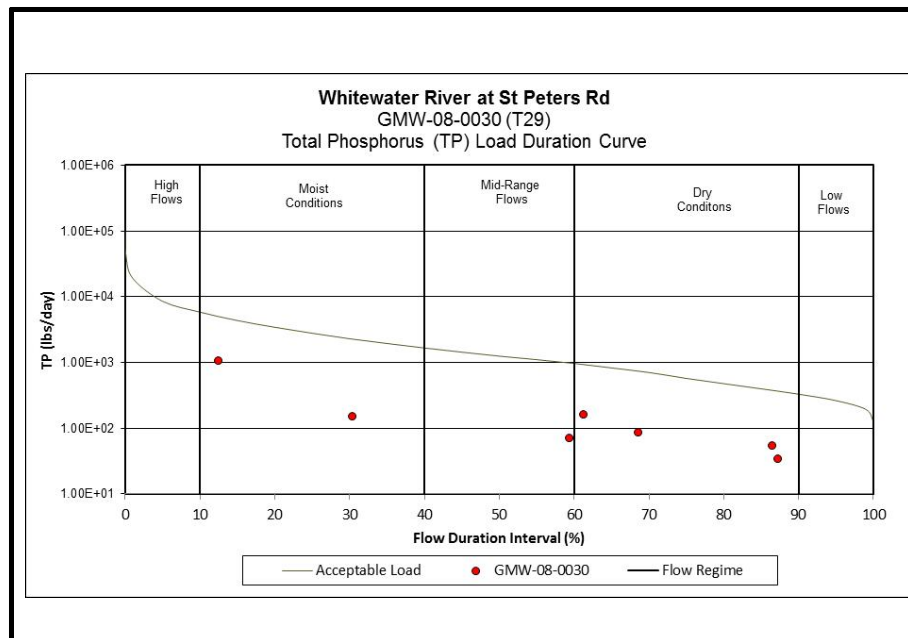
Upstream

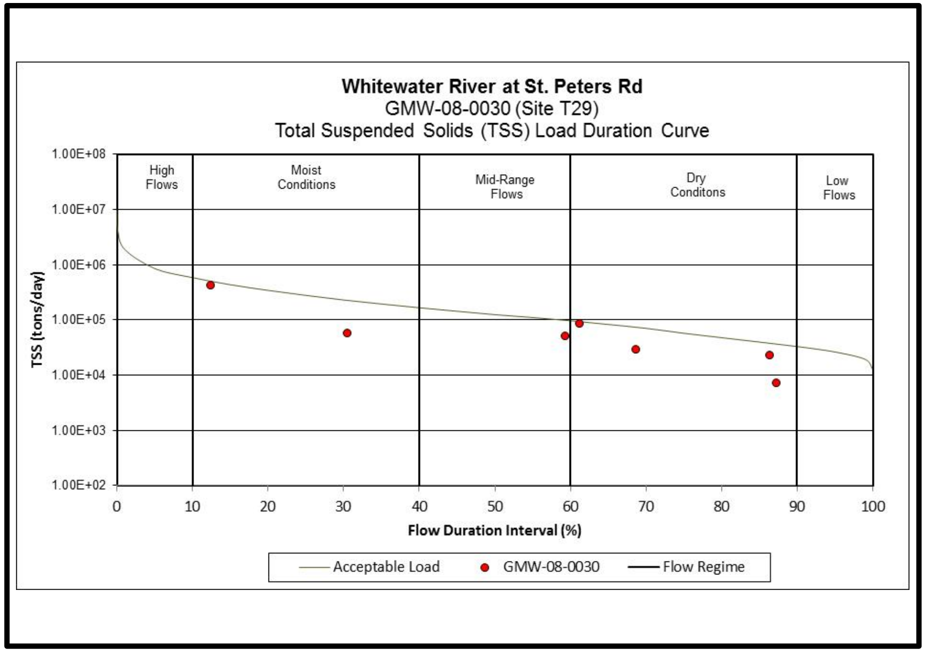
Downstream

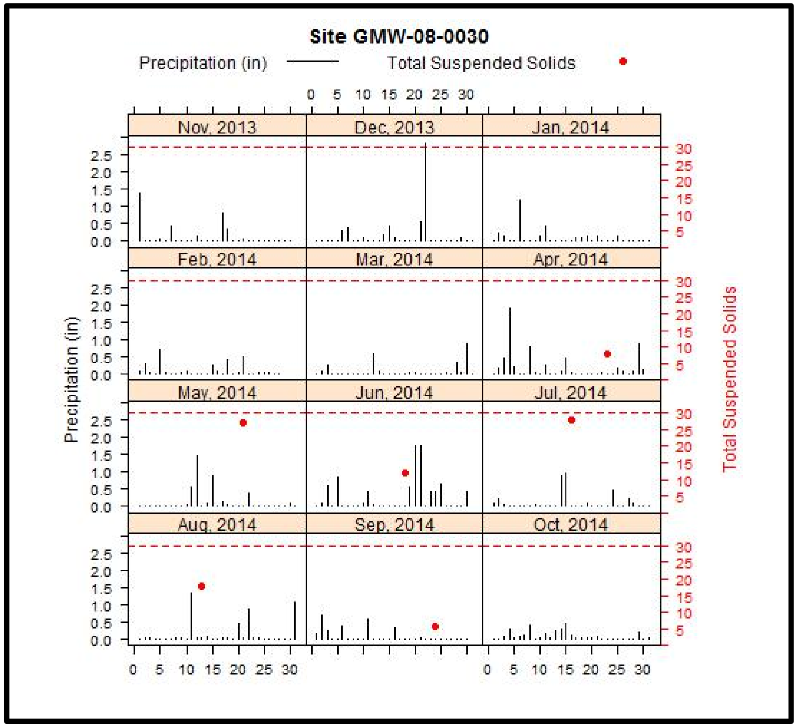

Whitewater River at St. Peters Road
GMW-08-0030 (T29)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0030


Site GMW-08-0030
Precipitation (in)
log10(E. coli)
Precipitation (in)
log10(E. coli)


Site GMW-08-0030
Precipitation (in)
Total Phosphorus
Precipitation (in)
Total Phosphorus


Whitewater River at St Peters Rd
GMW-08-0030 (T29)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-08-0030
Flow Regime





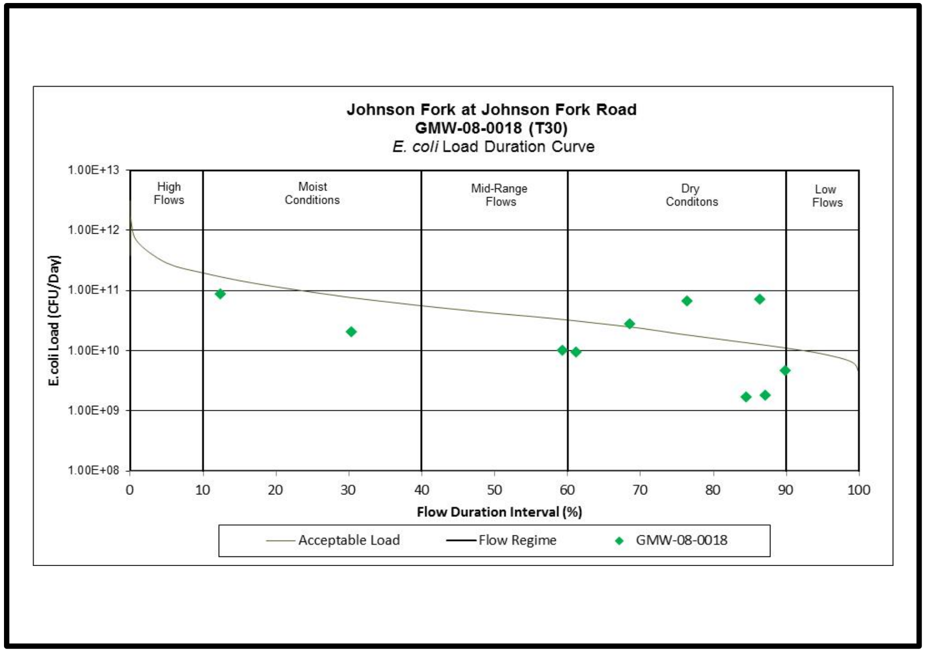
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	2.04E+12	6.59E+12	8.29E+11	7.54E+11	5.90E+10	3.27E+11	8.47E+11
TP (lbs/day)	149.46	1059.18	85.35	161.09	54.18	34.14	70.72
TSS (lbs/day)	56937.72	420557.4	29262.25	85103.22	22681.75	7315.56	51430.63

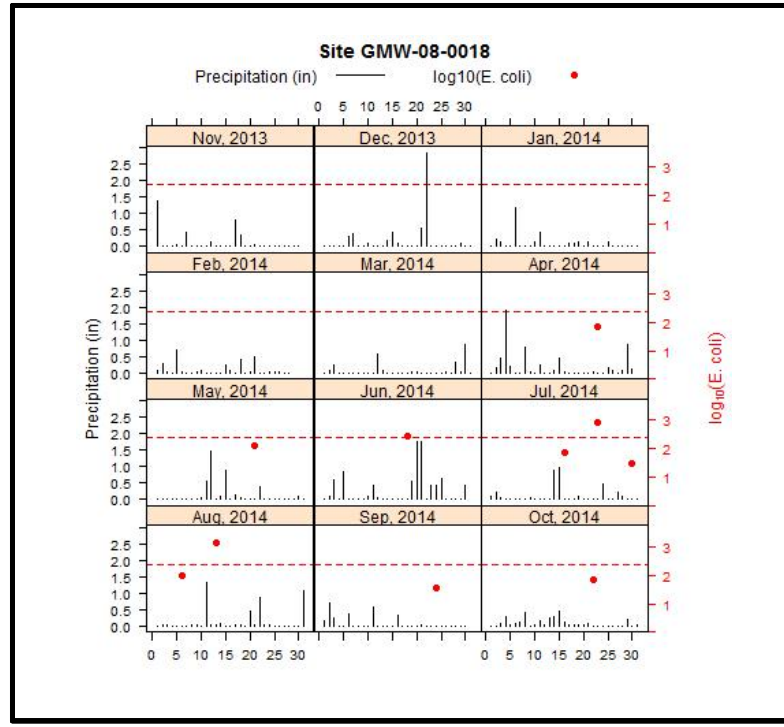
Site T30
GMW-08-0018
Johnson Fork at Johnson Fork Road

Upstream

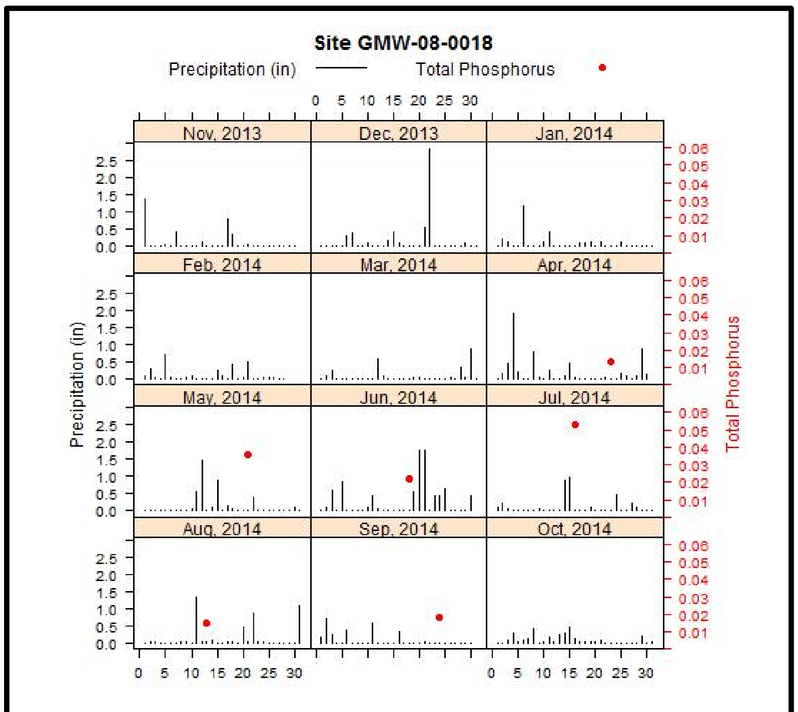
Downstream



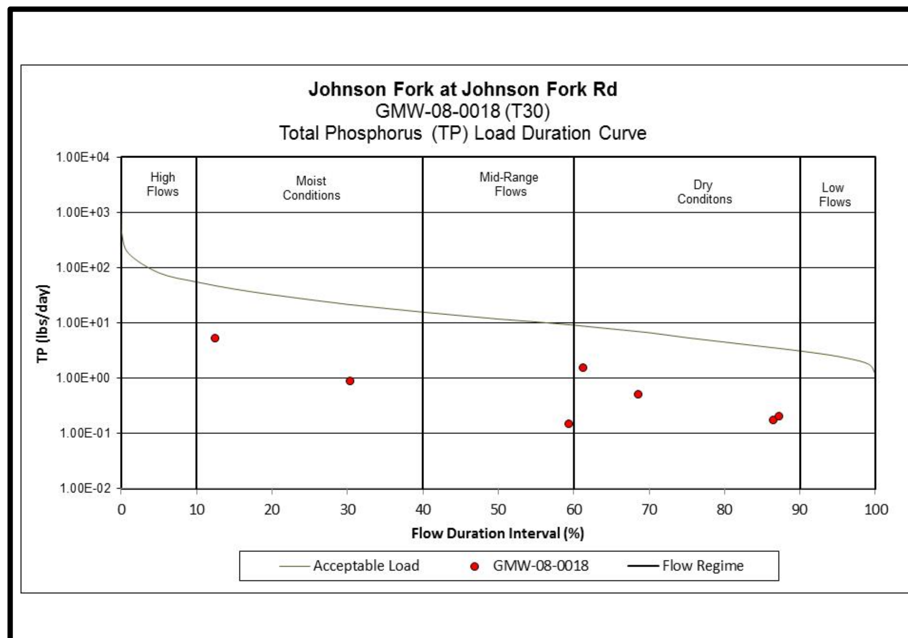
Johnson Fork at Johnson Fork Road
GMW-08-0018 (T30)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
E.coli Load (CFU/Day)
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0018



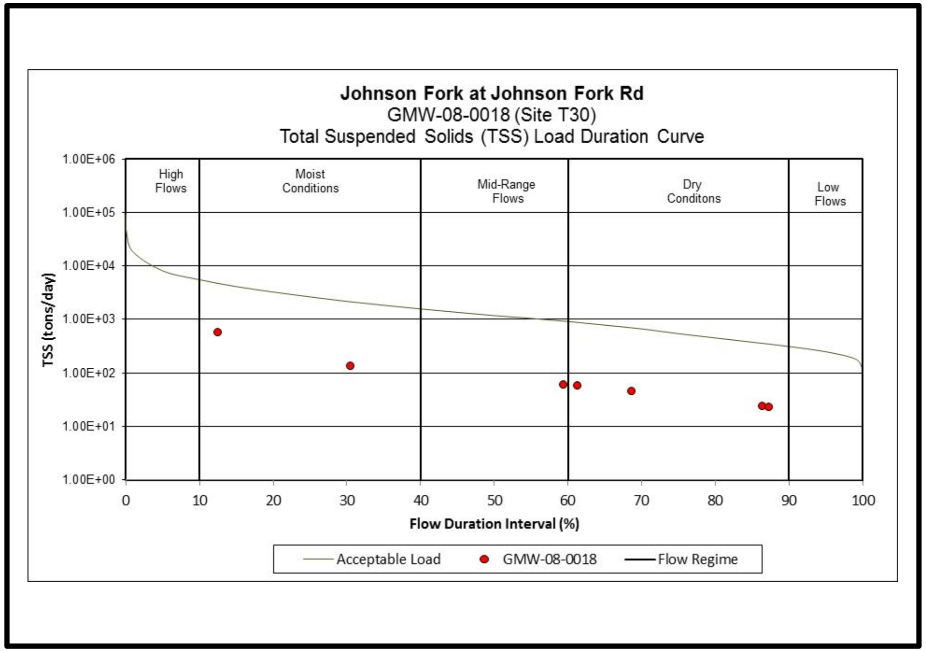
Site GMW-08-0018
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log10(E. coli)

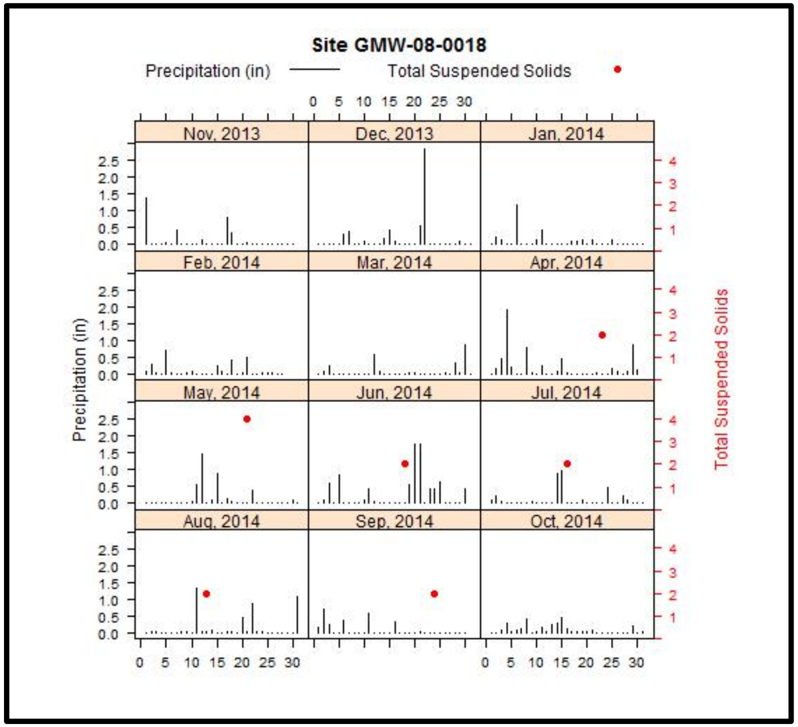


Site GMW-08-0018
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus



Johnson Fork at Johnson Fork Rd
GMW-08-0018 (T30)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
TP (lbs/day)
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
GMW-08-0018
Flow Regime





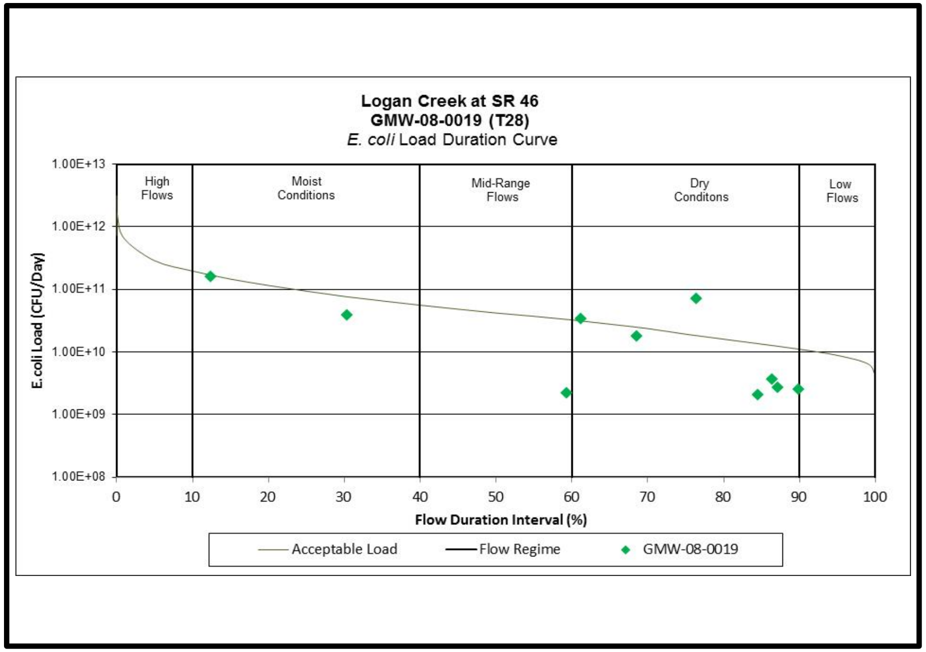
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

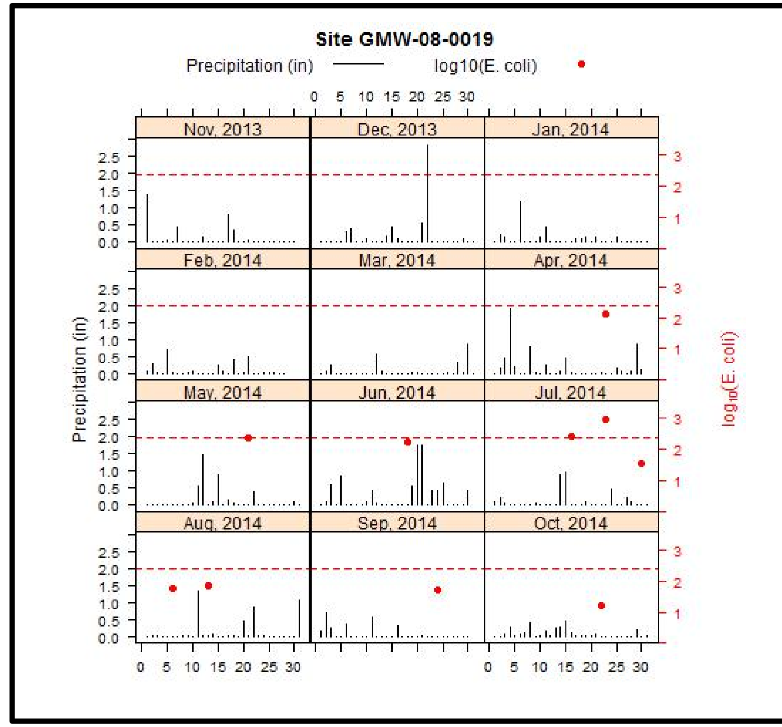
Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	2.03E+10	8.65E+10	2.72E+10	2.59E+10	3.76E+10	1.82E+09	1.00E+10
TP (lbs/day)	0.88	5.32	0.51	1.53	0.18	0.21	0.15
TSS (lbs/day)	135.05	591.12	46.27	57.97	23.91	23.14	60.99

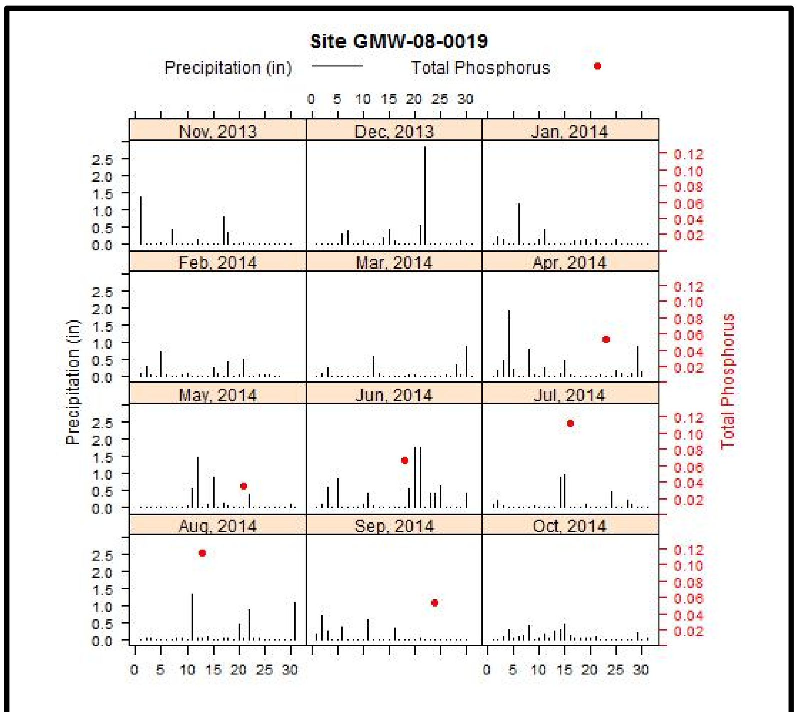
Site T28
GMW-08-0019
Logan Creek at SR 46

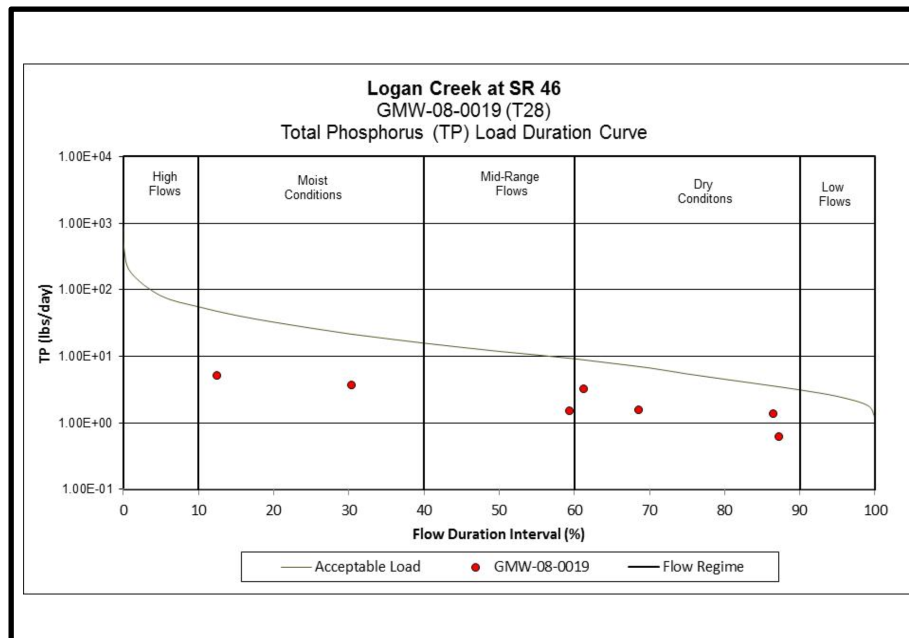
Upstream

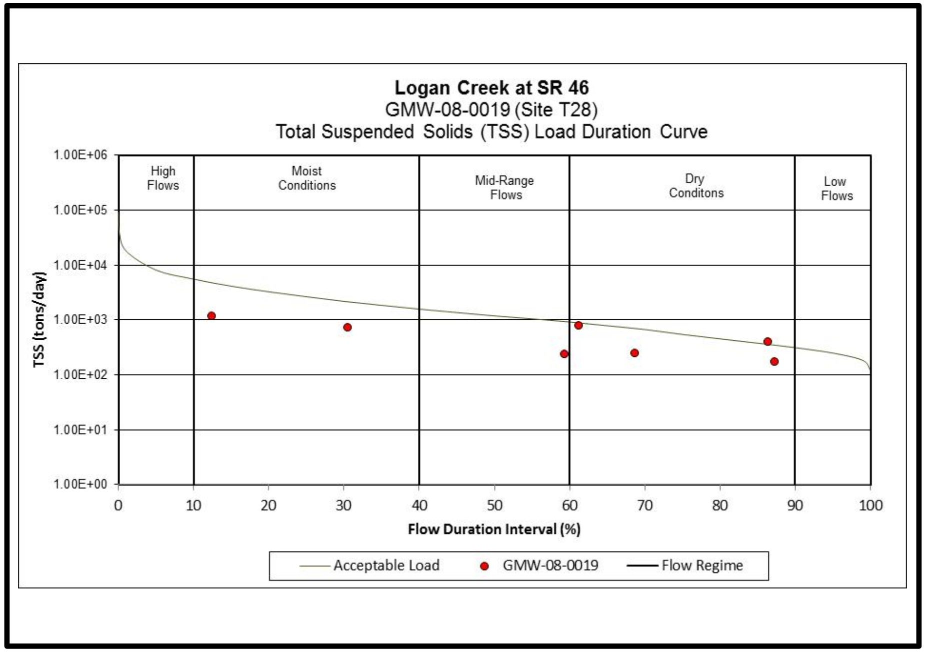
Downstream

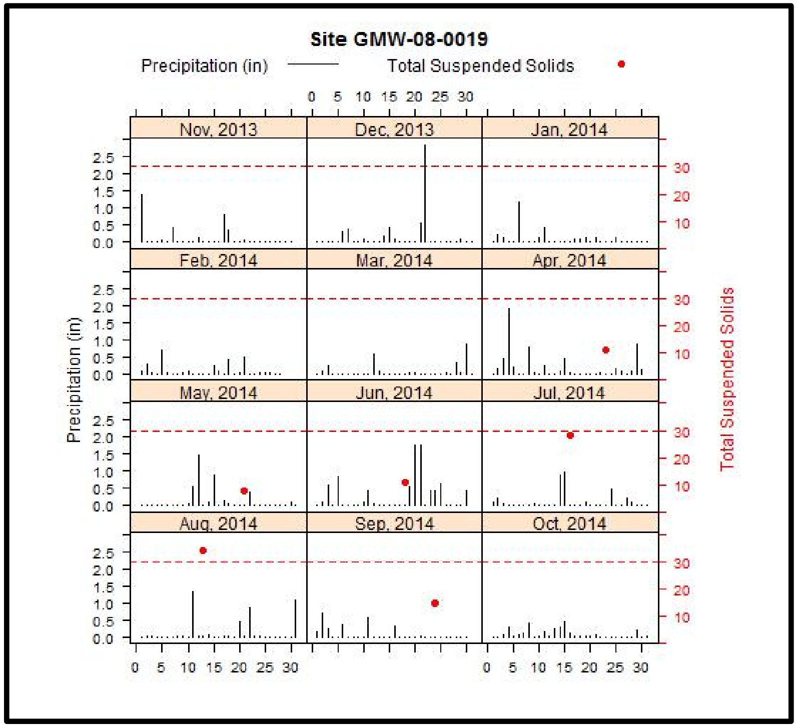

Logan Creek at SR 46
GMW-08-0019 (T28)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0019


Site GMW-08-0019
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log10(E. coli)
0.0
0.5
1.0
1.5
2.0
2.5
1
2
3
0
5
10
15
20
25
30


Site GMW-08-0019
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus
0.0
0.5
1.0
1.5
2.0
2.5
0.02
0.04
0.06
0.08
0.10
0.12
0
5
10
15
20
25
30


Logan Creek at SR 46
GMW-08-0019 (T28)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
GMW-08-0019
Flow Regime





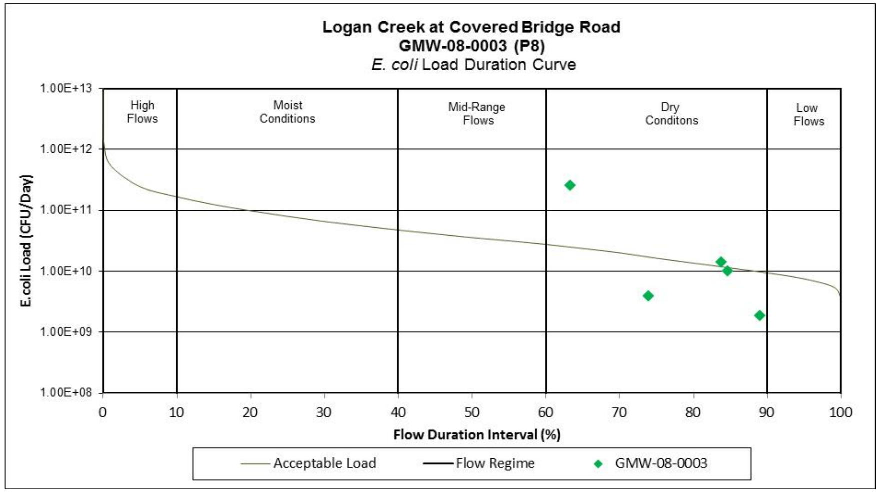
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

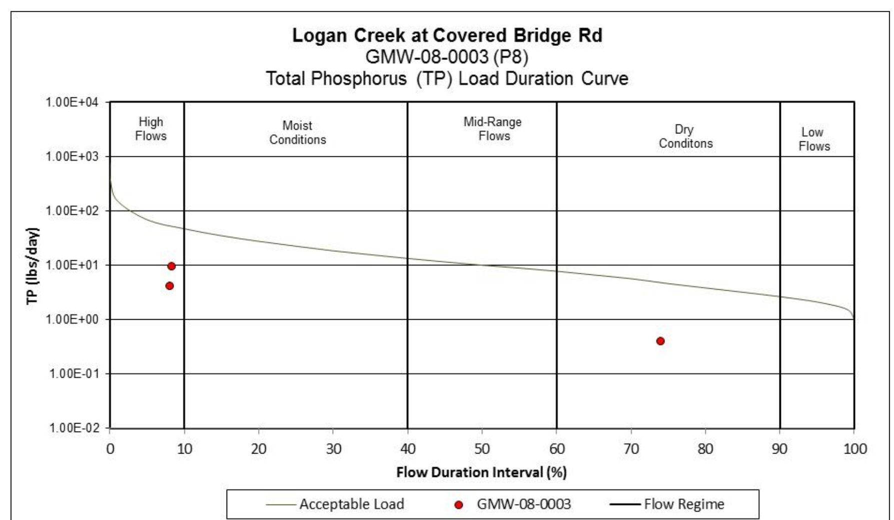
Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	3.87E+10	1.60E+11	1.81E+10	3.57E+10	3.10E+09	2.69E+09	2.19E+09
TP (lbs/day)	3.65	5.18	1.55	3.23	1.36	0.63	1.5
TSS (lbs/day)	743.43	1183.28	254.71	808.13	406.83	173.67	244.19

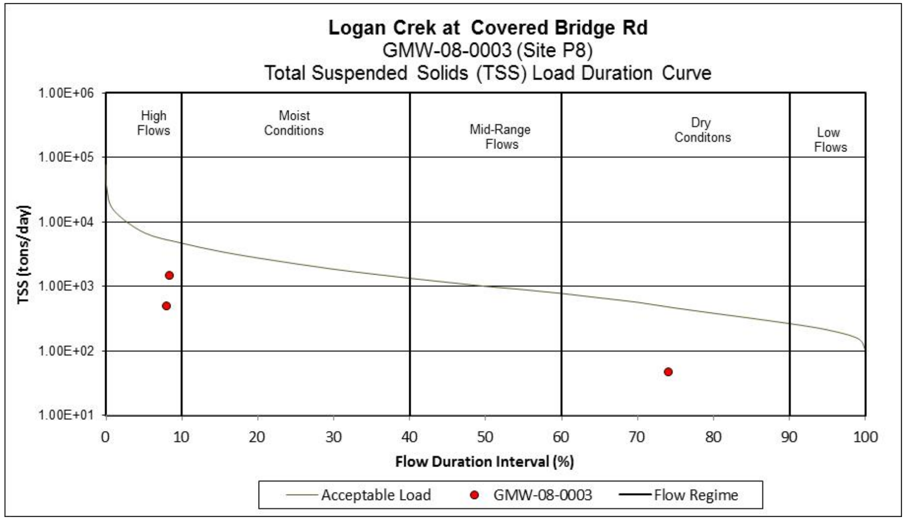
Site P8
GMW-08-0003
Logan Creek at Covered Bridge Road

Upstream

Downstream


Logan Creek at Covered Bridge Road
GMW-08-0003 (P8)
E. coli Load Duration Curve
E.coli Load (CFU/Day)
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0003


Logan Creek at Covered Bridge Rd
GMW-08-0003 (P8)
Total Phosphorus (TP) Load Duration Curve
TP (lbs/day)
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
GMW-08-0003
Flow Regime



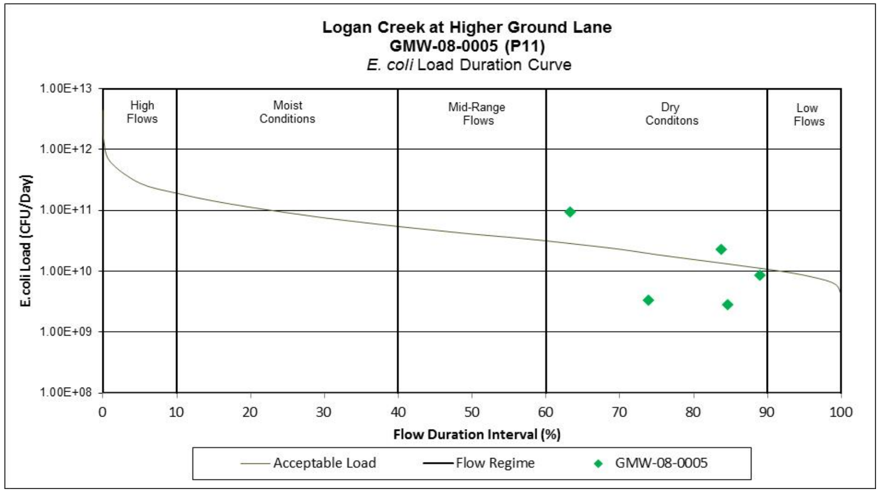
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

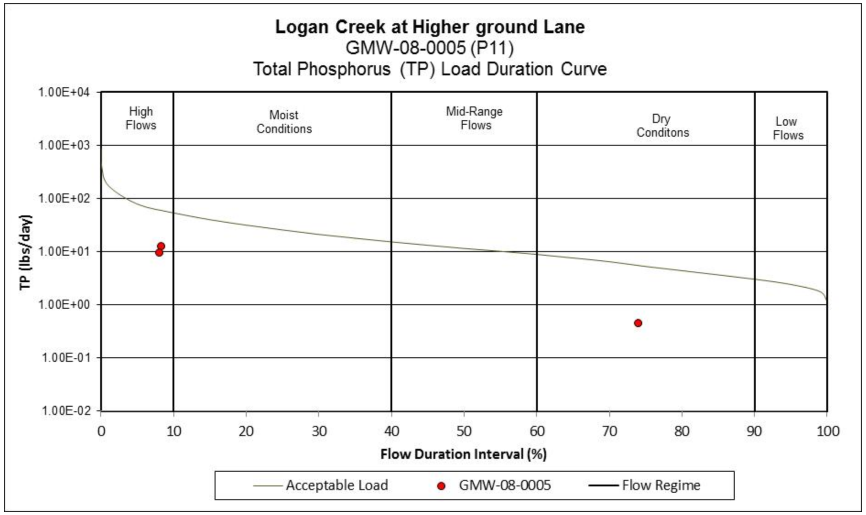
Parameter	May	June	July	August	Sept
E. Coli (MPN)	NA	NA	9.00E+10	5.88E+09	NA
TP (lbs/day)	9.81	4.2	NA	NA	0.4
TSS (lbs/day)	1471.33	504.58	NA	NA	48.06

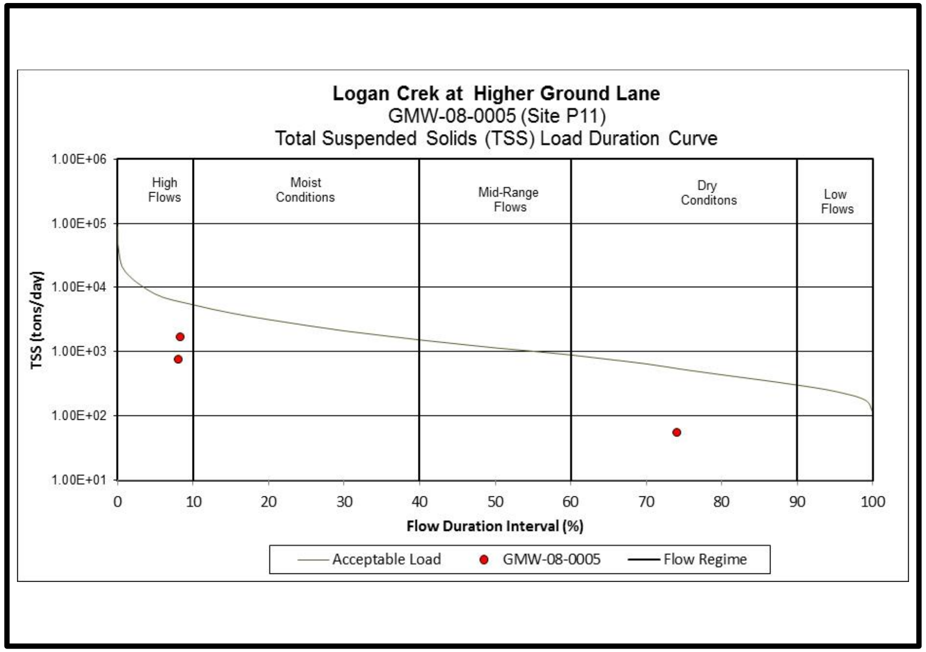
Site P11
GMW-08-0005
Logan Creek at Higher Ground Lane

Upstream

Downstream


Logan Creek at Higher Ground Lane
GMW-08-0005 (P11)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0005


Logan Creek at Higher ground Lane
GMW-08-0005 (P11)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-08-0005
Flow Regime



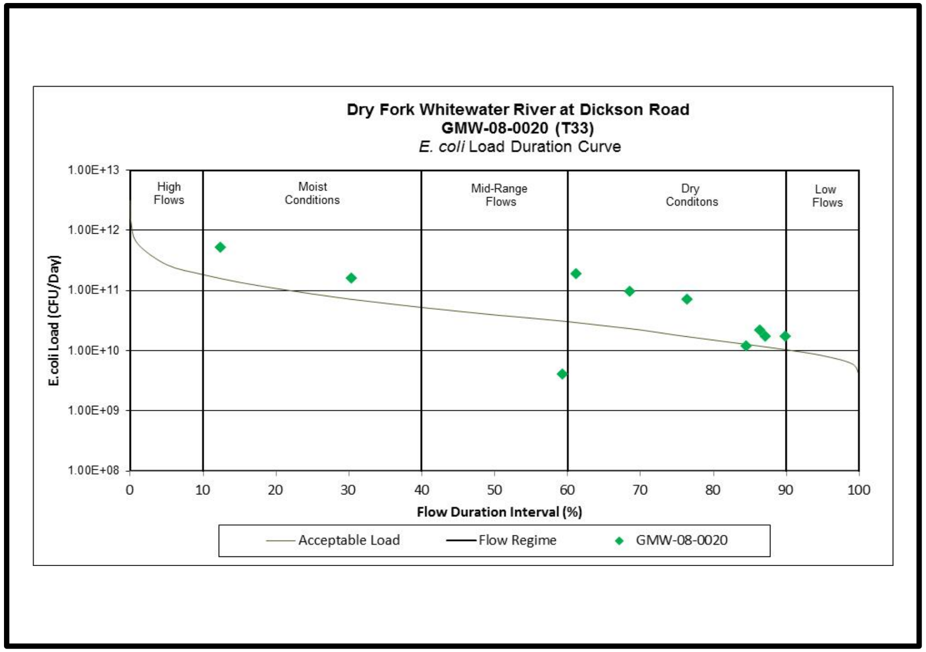
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

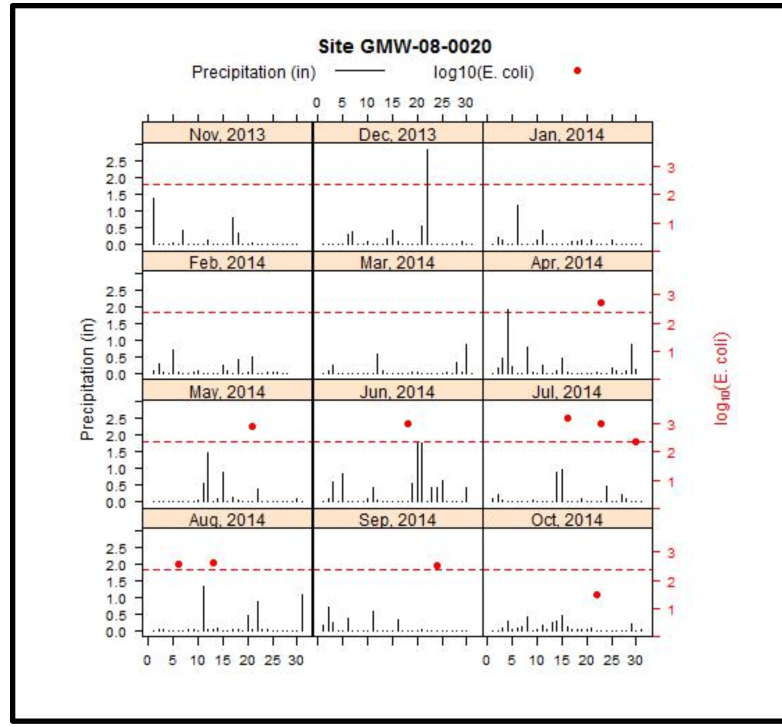
Parameter	May	June	July	August	Sept
E. Coli (MPN)	NA	NA	3.92E+10	5.63E+09	NA
TP (lbs/day)	12.91	9.82	NA	NA	0.46
TSS (lbs/day)	1684.08	770.05	NA	NA	55

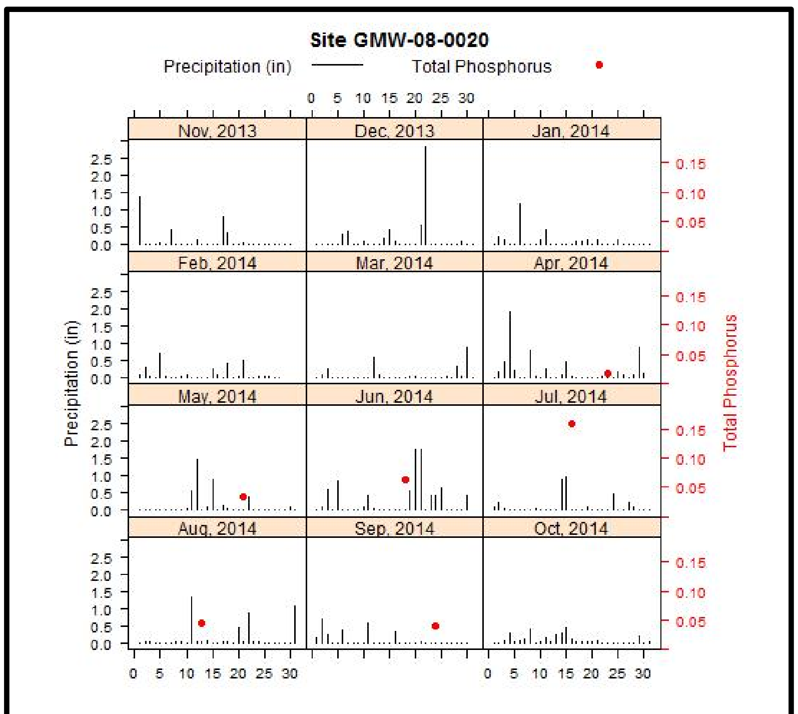
Site T33
GMW-08-0020
Dry Fork Whitewater River at Dickson Road

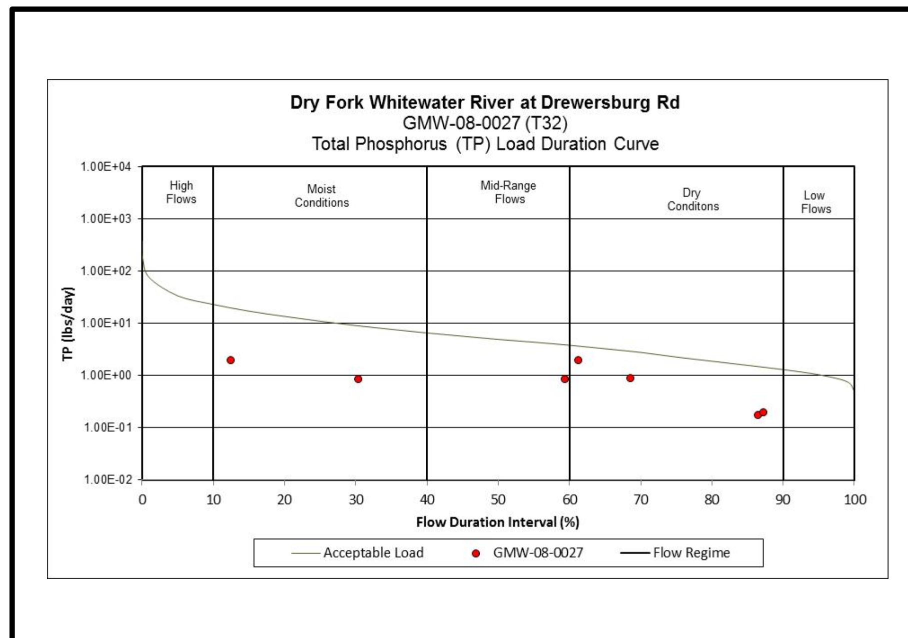
Upstream

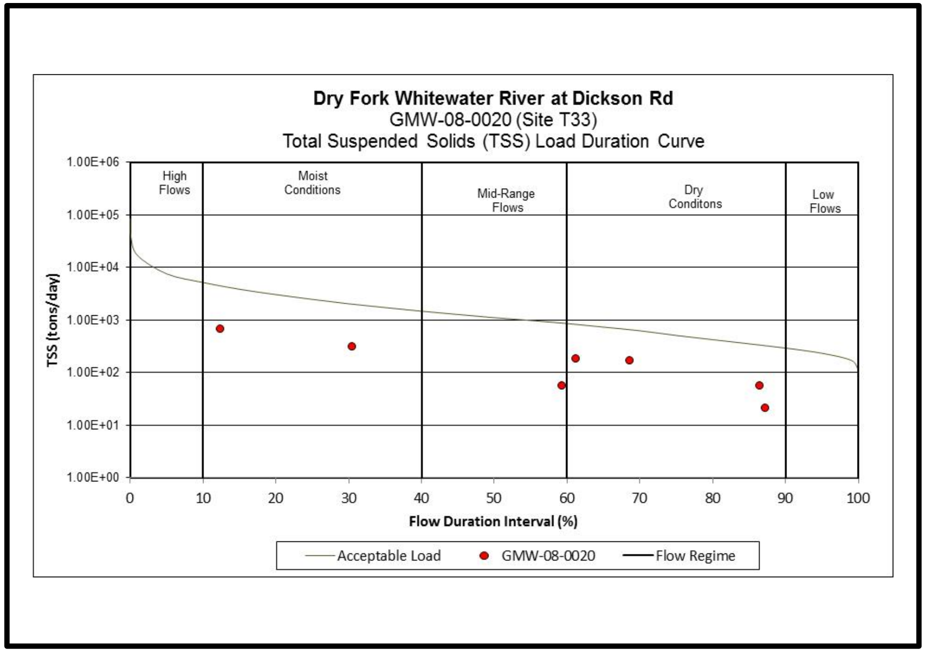
Downstream

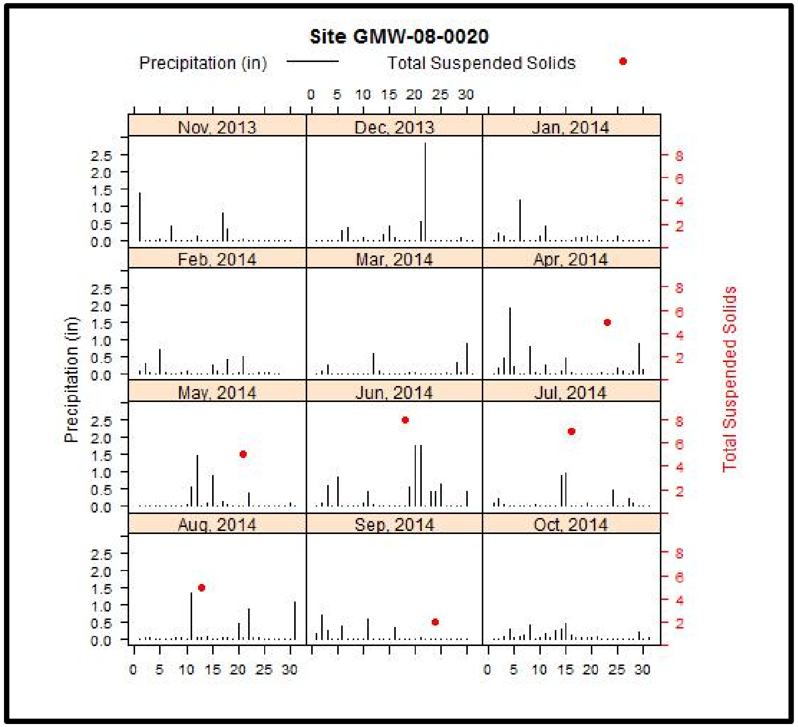

Dry Fork Whitewater River at Dickson Road
GMW-08-0020 (T33)
E. coli Load Duration Curve
High Flows
Moist Conditons
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0020


Site GMW-08-0020
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log10(E. coli)
0 5 10 15 20 25 30


Site GMW-08-0020
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus
0 5 10 15 20 25 30


Dry Fork Whitewater River at Drewersburg Rd
GMW-08-0027 (T32)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
GMW-08-0027
Flow Regime





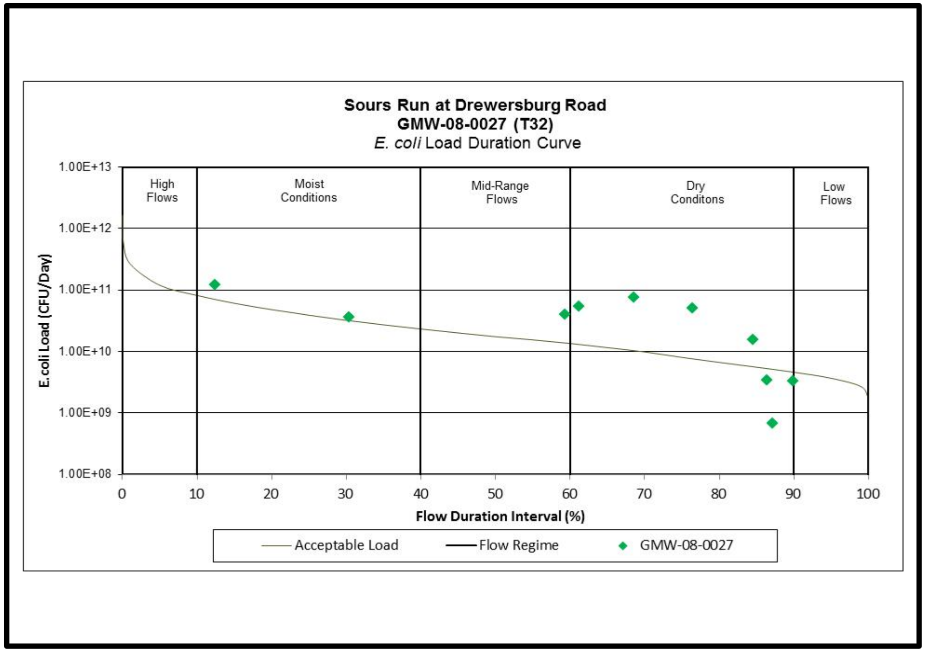
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

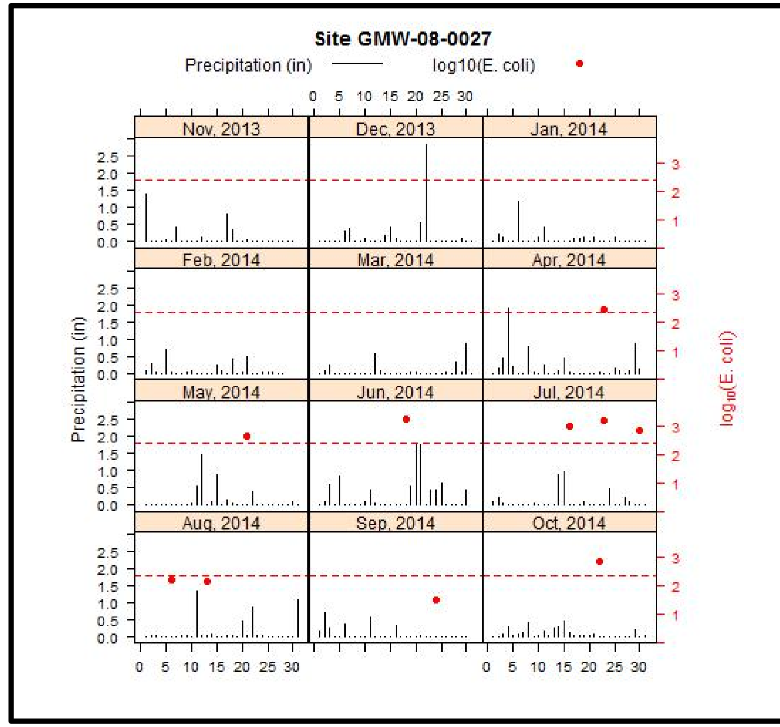
Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	1.57E+11	5.13E+11	9.64E+10	9.10E+10	1.96E+10	1.70E+10	4.01E+09
TP (lbs/day)	0.84	1.97	0.88	1.99	0.18	0.2	0.86
TSS (lbs/day)	316.47	692.6	173.49	189.21	56.03	21.69	57.17

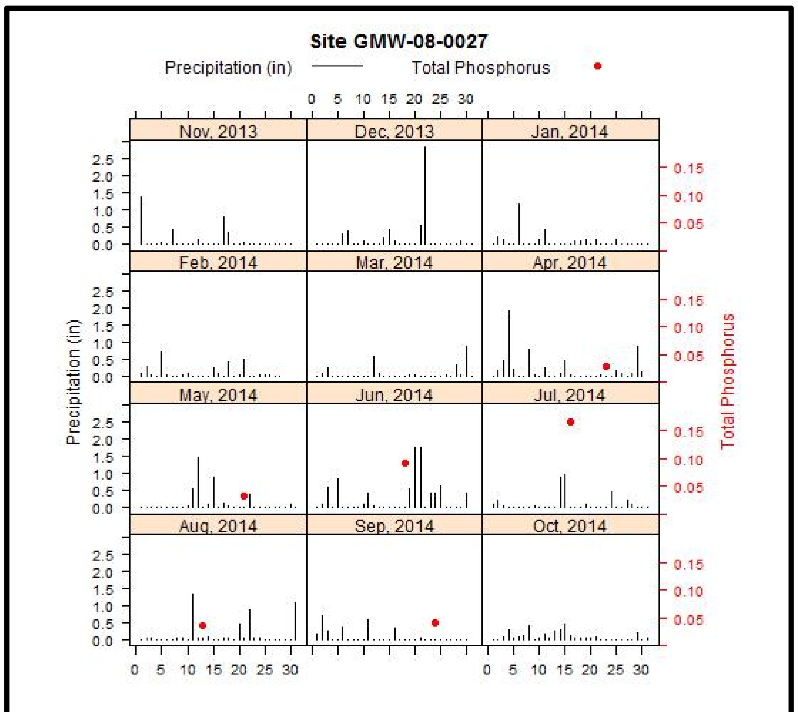
Site T32
GMW-08-0027
Sours Run at Drewersburg Road

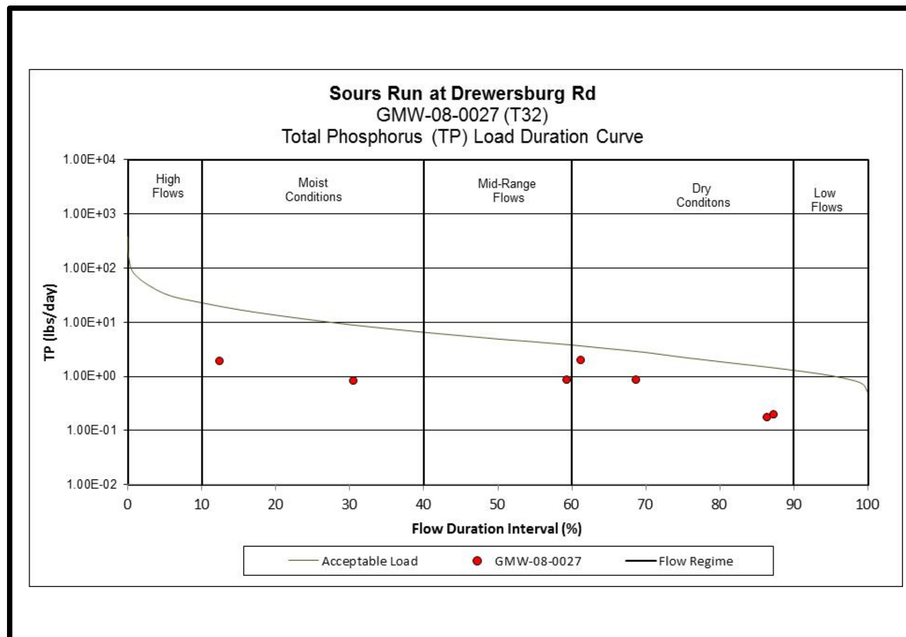
Upstream

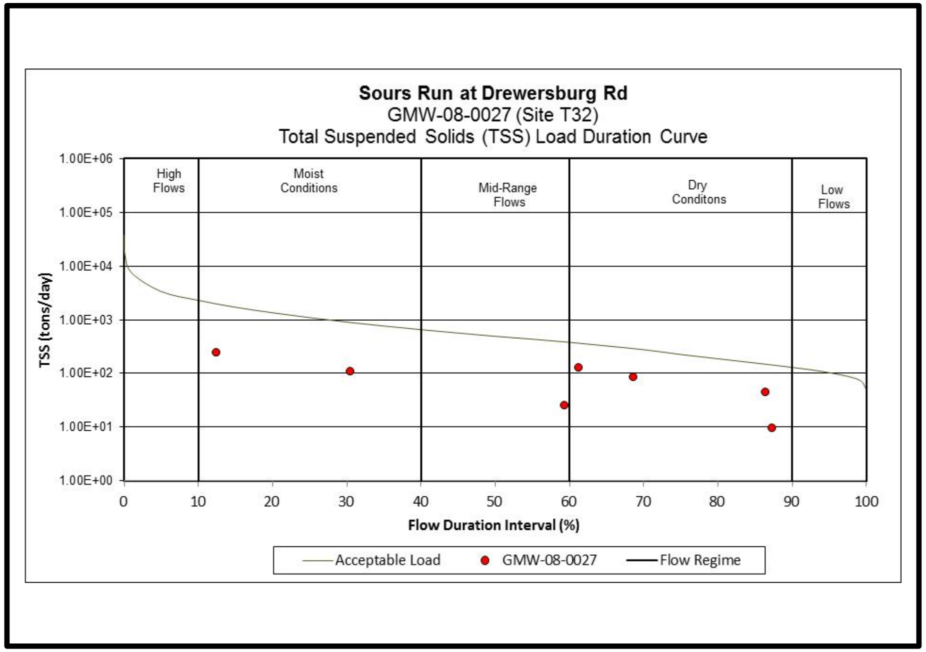
Downstream

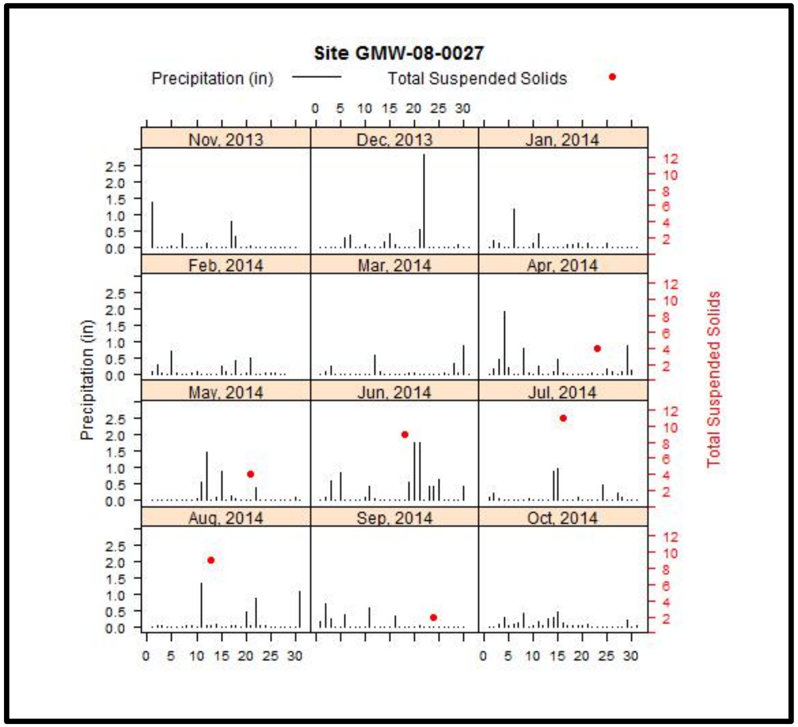

Sours Run at Drewersburg Road
GMW-08-0027 (T32)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0027


Site GMW-08-0027
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log10(E. coli)


Site GMW-08-0027
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus


Sours Run at Drewersburg Rd
GMW-08-0027 (T32)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
Flow Duration Interval (%)
Acceptable Load
GMW-08-0027
Flow Regime





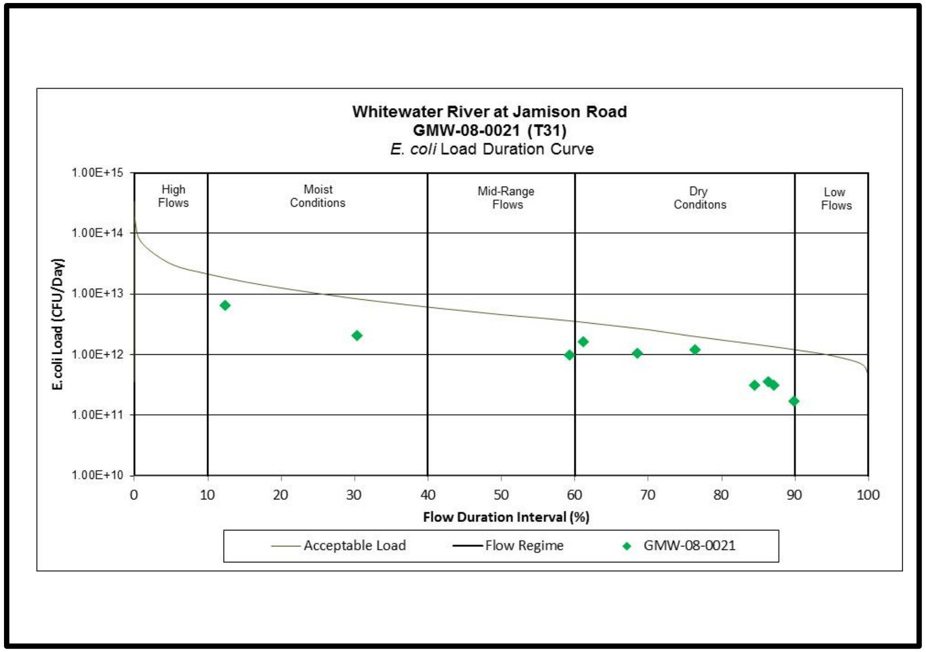
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

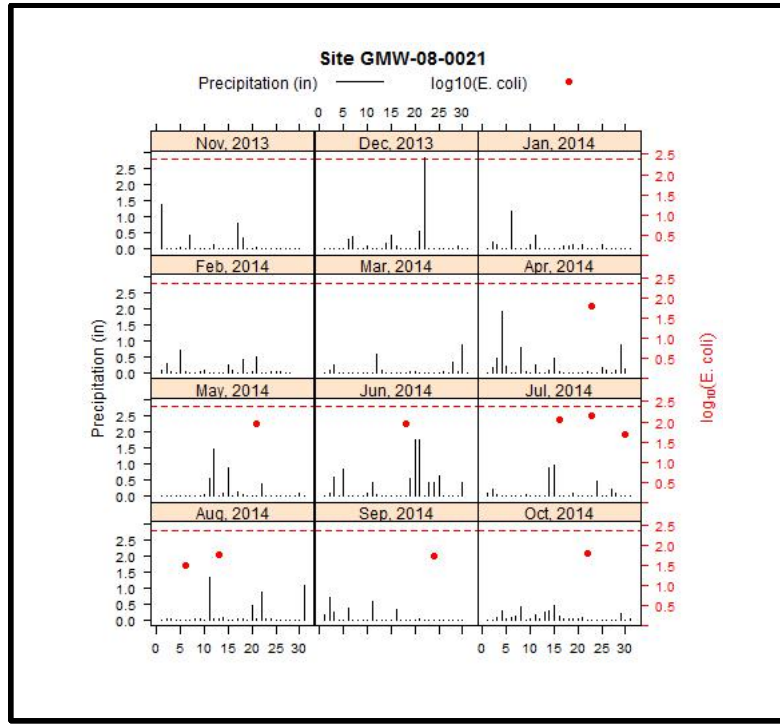
Parameter	April	May	June	July	August	Sept	Oct
E. Coli (MPN)	3.64E+10	1.22E+11	7.58E+10	3.97E+10	3.34E+09	6.88E+08	3.96E+10
TP (lbs/day)	0.84	1.97	0.88	1.99	0.18	0.2	0.86
TSS (lbs/day)	112.5	246.22	86.73	132.12	44.82	9.64	25.41

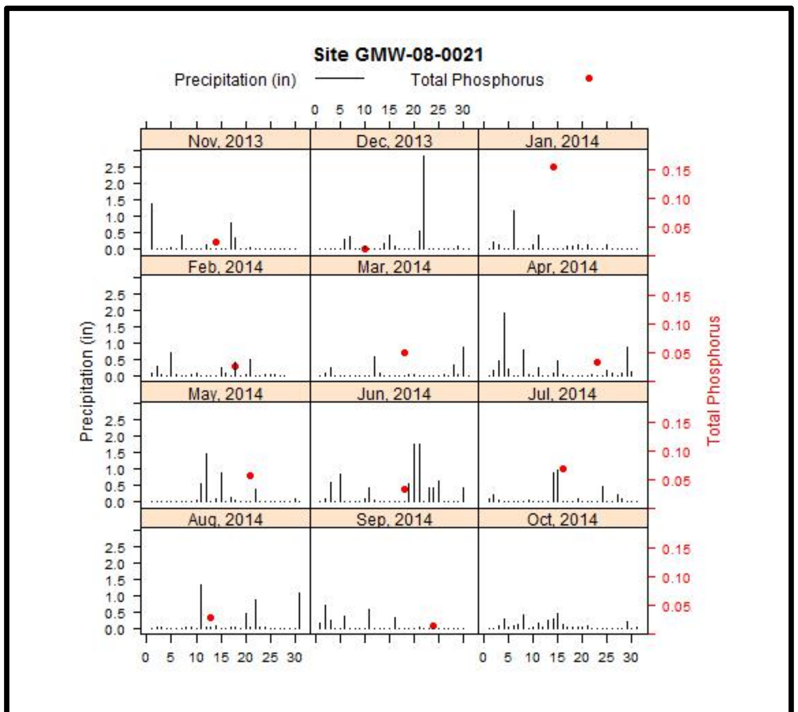
Site T31
GMW-08-0021
Whitewater River at Jamison Road

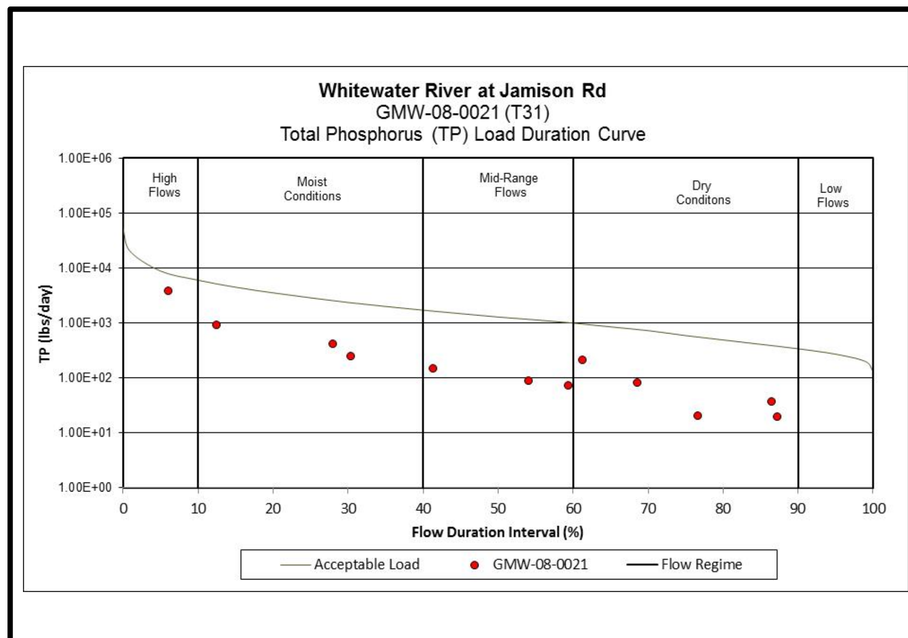
Upstream

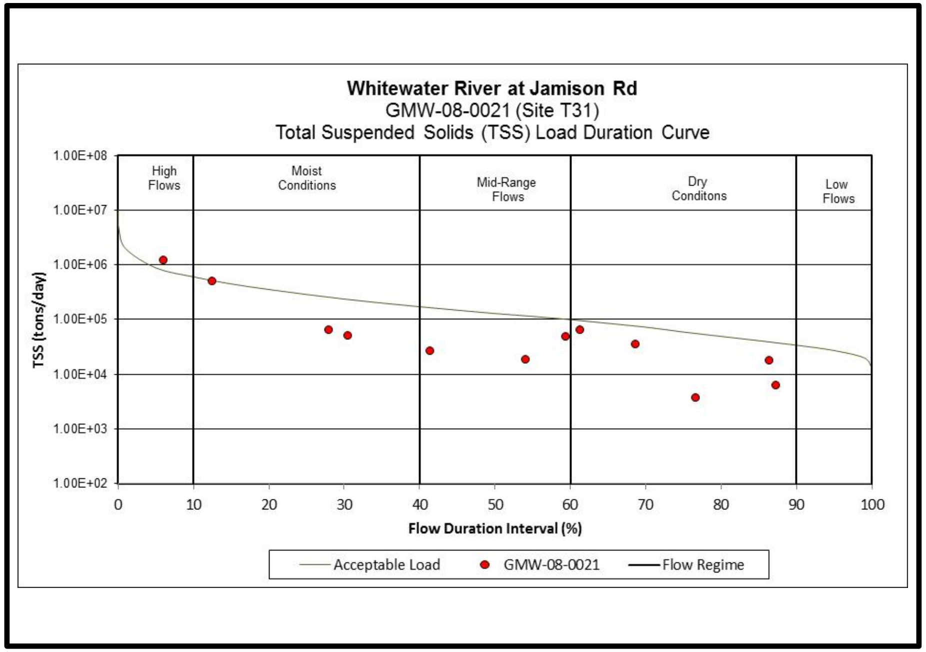
Downstream

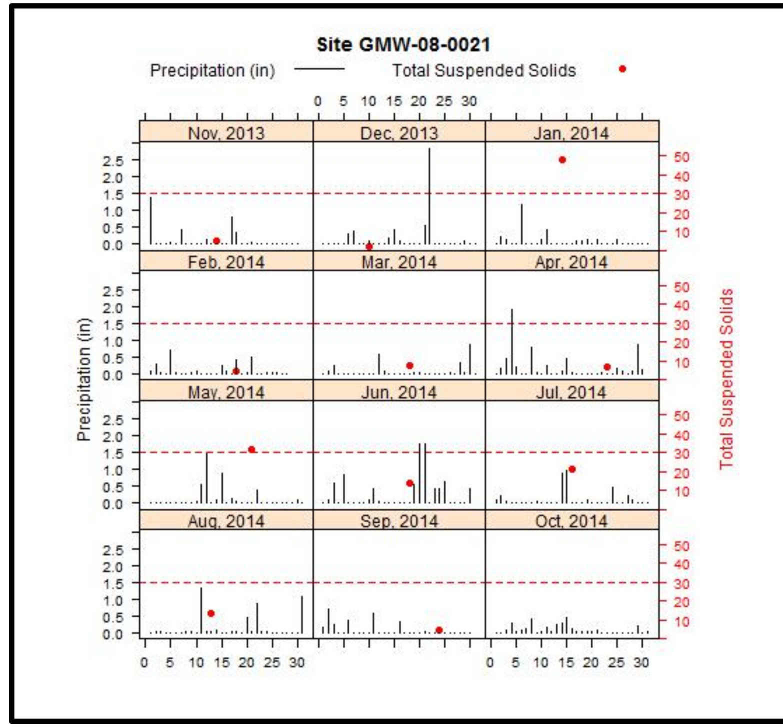

Whitewater River at Jamison Road
GMW-08-0021 (T31)
E. coli Load Duration Curve
E.coli Load (CFU/Day)
1.00E+15
1.00E+14
1.00E+13
1.00E+12
1.00E+11
1.00E+10
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Flow Regime
GMW-08-0021


Site GMW-08-0021
Precipitation (in)
log10(E. coli)
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
log10(E. coli)
0 5 10 15 20 25 30


Site GMW-08-0021
Precipitation (in)
Total Phosphorus
Nov, 2013
Dec, 2013
Jan, 2014
Feb, 2014
Mar, 2014
Apr, 2014
May, 2014
Jun, 2014
Jul, 2014
Aug, 2014
Sep, 2014
Oct, 2014
Precipitation (in)
Total Phosphorus
0 5 10 15 20 25 30


Whitewater River at Jamison Rd
GMW-08-0021 (T31)
Total Phosphorus (TP) Load Duration Curve
TP (lbs/day)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
GMW-08-0021
Flow Regime





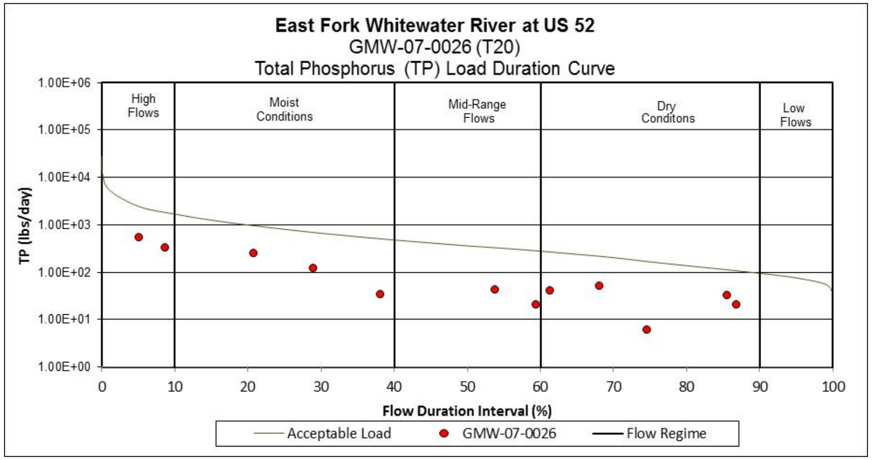
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

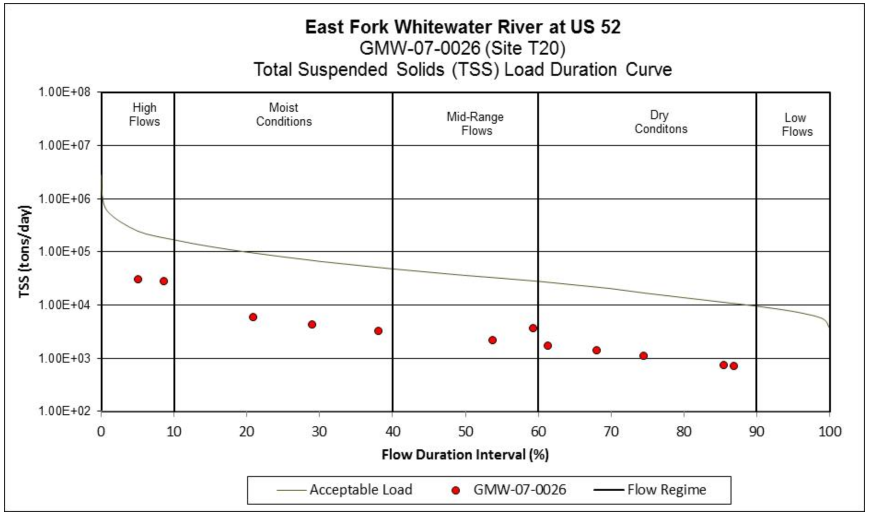
Parameter	January	February	March	April	May	June	July	August	Sept	Oct	November	December
E. Coli (MPN)	NA	NA	NA	2.06E+12	6.46E+12	1.04E+12	1.04E+12	2.59E+11	3.08E+11	9.55E+11	NA	NA
TP (lbs/day)	3919.77	148.88	412.47	250.35	934.66	83.25	213.83	37.81	20.18	73.16	87.87	20.32
TSS (lbs/day)	1213863.65	26586.46	64700.77	51543.34	515674.77	35319.86	66034.62	18251.41	6307.12	49883.57	19102.42	3693.74

Site T20
GMW-07-0026
East Fork Whitewater River at US 52

Upstream

Downstream


East Fork Whitewater River at US 52
GMW-07-0026 (T20)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
GMW-07-0026
Flow Regime



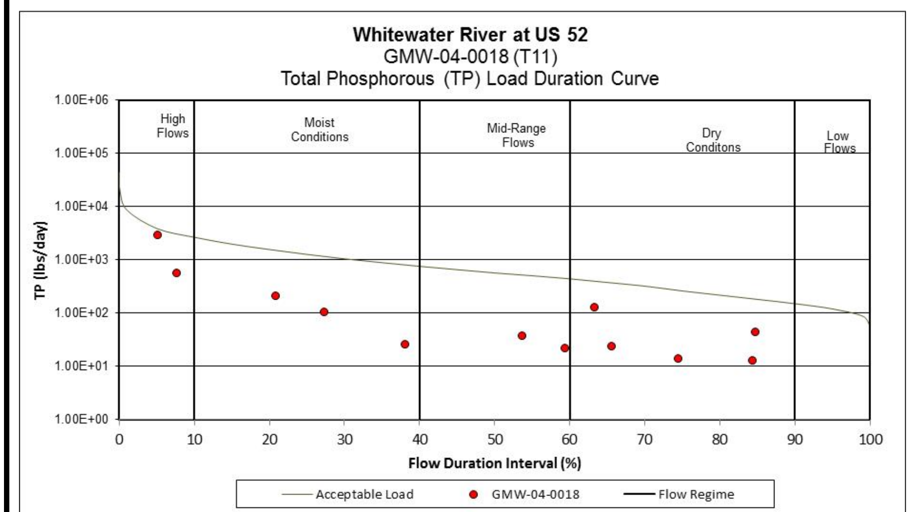
Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

Parameter	January	February	March	April	May	June	July	August	Sept	Oct	November	December
E. Coli (MPN)												
TP (lbs/day)	538.93	42.99	259.34	123.87	332.22	52.27	42.05	21.17	32.83	21.35	34.21	6.13
TSS (lbs/day)	30796.04	2149.66	6031.17	4346.49	28639.64	1431.98	1752.07	717.68	754.74	3713.05	3258.18	1115.26

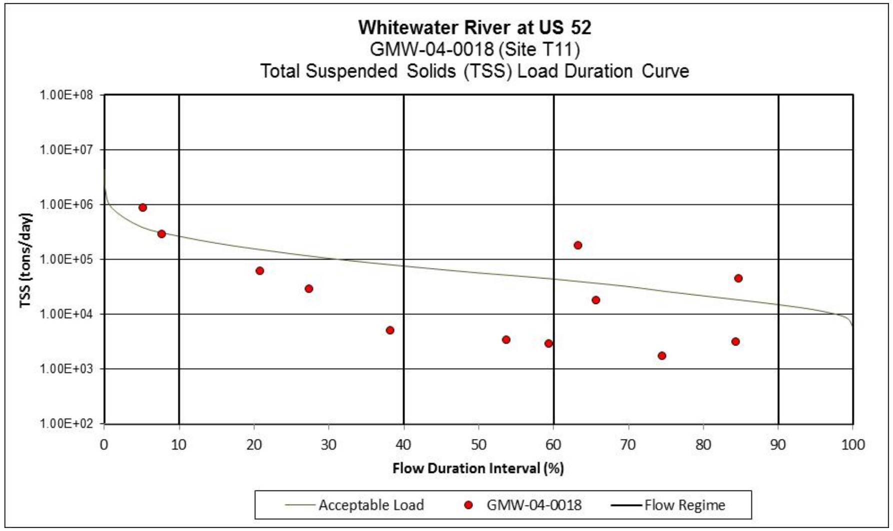
Site T11
GMW-04-0018
Whitewater River at US 52

Upstream

Downstream



Whitewater River at US 52
GMW-04-0018 (T11)
Total Phosphorous (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
TP (lbs/day)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
GMW-04-0018
Flow Regime



Calculated Loads Based on IDEM Sampling Events in 2014. *E. coli* is averaged for those Months with more than one sampling event.

Parameter	January	February	March	April	May	June	July	August	Sept	Oct	November	December
E. Coli (MPN)												
TP (lbs/day)	2988.25	37.46	210.2	106.04	579.47	24.29	127.38	44.81	13.17	22.06	25.81	14.13
TSS (lbs/day)	890375.83	3405.53	62105.59	29251.28	294647.92	18215.33	180666.68	45424.89	3135.97	2941.14	5161.68	1766.82

References

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2. Waters, Thomas F. *Sediment in Streams: Sources, Biological Effects and Control*. Bethesda: American Fisheries Society, Monograph 7, 1995.

3. Fisher, Brant E. *Current Status and Distribution of Indiana's seven endangered darter species (Percidae).* Proceedings of the Indiana Academy of Science, 2008. <http://www.thefreelibrary.com/Current+status+and+distribution+of+Indiana's+seven+endangered+darter...-a0193735311>

4. Huron Pines. *Leading Small Dam Removal: A Guidebook for Understanding the Natural And Social Characteristics.* Grayling, 2012. <http://www.thefreelibrary.com/Current+status+and+distribution+of+Indiana's+seven+endangered+darter...-a0193735311>