Total Maximum Daily Load Report for the Deep River-Portage Burns Watershed

FINAL

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Prepared for

U.S. Environmental Protection Agency Region 5

Prepared by

Indiana Department of Environmental Management

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1.0 EXECUTIVE SUMMARY

The Deep River-Portage Burns watershed (HUC: 0404000105) is located in northwest Indiana along Lake Michigan and drains a total of 180 square miles. The Deep River-Portage Burns headwaters originate near Crown Point in Lake County, and then flow east before bending back to the north, flowing through parts of Merrillville and Hobart, Indiana. Deep River-Portage Burns then flows into West Branch Little Calumet River on the eastern edge of Gary and flows east into Porter County where it merges with East Branch Little Calumet River and becomes Burns Ditch. The watershed ultimately empties into Lake Michigan near Portage, Indiana. Land use throughout the watershed is predominantly urban with agriculture in the southeastern portion of the watershed.

The Clean Water Act 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 unregulated sources. 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:

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

This TMDL has been developed for *E. coli*, phosphorus, dissolved oxygen, impaired biotic communities, and siltation in the Deep River-Portage Burns 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 Deep River-Portage Burns watershed, the pollutants and the impaired segments for which TMDLs were developed differ from the pollutants and impaired segments appearing on the Draft 2012 Section 303(d) list for the following reasons:

- Sampling performed by the Indiana Department of Environmental Management (IDEM) 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 gathered from 35 stream sites by IDEM between April 2013 and March 2014.

Potential sources of *E. coli*, nutrients, dissolved oxygen, impaired biotic communities, and siltation in the watershed include regulated point sources such as waste water treatment plants (WWTPs), municipal separate storm sewer systems (MS4s), combined sewer overflows (CSOs), sanitary sewer overflows (SSOs), industrial facilities, and construction activities. Point sources are regulated through the National Pollutant Discharge Elimination System (NPDES) program. Nonpoint sources of *E. coli*, nutrients, and siltation in the watershed include unregulated urban storm water and agricultural runoff. Determining the specific reasons for high *E. coli*, nutrients, low dissolved oxygen, impaired biotic communities, and siltation any given waterbody is challenging. There are many potential sources and the pollutants are inherently variable. Within the Deep River-Portage Burns watershed, subwatersheds with high developed land use have elevated *E. coli*, nutrients, low dissolved oxygen and elevated levels of siltation, along with impaired biotic communities. However, other factors could also explain this correlation, such as leaking and failing septic systems, WWTPs, MS4s, industrial activity, construction activity, agricultural land use, and precipitation. Specific sources of each impaired waterbody should be further evaluated during follow-up implementation activities.

Various subwatersheds in the Deep River-Portage Burns 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 impacting water quality conditions over time. An IBC listing on Indiana's 303(d) list, suggests that one or more of the aquatic biological communities is 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 Deep River-Portage Burns watershed dissolved oxygen (DO), total phosphorus (TP) and total suspended solids (TSS) have been identified as pollutants for IBC TMDL development.

An important step in the TMDL process is the allocation of the allowable loads to individual point sources as well as unregulated nonpoint sources. The Deep River-Portage Burns watershed TMDL includes these allocations, which are presented for each of the 65 Assessment Units (AUIDs) located in the nine 12-digit hydrologic unit code (HUC) subwatersheds.

There are seven permitted WWTPs, and 23 permitted industrial facilities located in the Deep River-Portage Burns watershed. Of these facilities, five have been found to be in violation of their permit limits for *E. coli*, nutrients, and TSS. Although five NPDES facilities have been found to be in violation of their permit limits for *E. coli*, nutrients, and TSS, the majority of the discharge effluent from these facilities meets water quality standards.

There are several types of nonpoint sources located in the Deep River-Portage Burns watershed, including unregulated livestock operations, livestock with direct access to streams, agricultural row crop landuse, straight piped, leaking or failing septic systems and wildlife. These are found in all subwatersheds with elevated levels of *E. coli*, TP and TSS in the Deep River-Portage Burns watershed. 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 Deep River-Portage Burns 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 partners in the watershed can consider to achieve the pollutant load reductions calculated for each subwatershed. PPIAs can help stakeholders identify critical areas and select best management practices (BMPs) through a watershed management planning process. Table 1 presents the PPIAs and associated BMP recommendations identified as having a high degree of effectiveness to achieve the *E. coli*, nutrients, dissolved oxygen, impaired biotic communities, and siltation load reductions allocated to sources in each subwatershed.

Table 1. PPIAs and Recommended BMPs to Achieve Pollutant Load Reductions by Subwatershed

<table>
<tr><th>Subwatershed</th><th>PPIA Rank</th><th>Implementation Actions</th></tr>
<tr><td>Lake George- Deep River (040400010507)</td><td>1</td><td rowspan="9">Outreach and education and training
Stormwater Planning and Management
Conservation tillage/residue management
Cover crops
Conservation easements
Grazing land management
Comprehensive Nutrient Management Plan
Drainage Water Management
Stream fencing (animal exclusion)
Manure handling, storage, treatment, and disposal
Riparian buffers
Filter strips
Rain garden
Green roof
Dam modification or removal
Constructed Wetland</td></tr>
<tr><td>Willow Creek- Burns Ditch (040400010509)</td><td>2</td></tr>
<tr><td>Deer Creek- Deep River (040400010504)</td><td>3</td></tr>
<tr><td>City of Merrillville- Turkey Creek (040400010505)</td><td>4</td></tr>
<tr><td>Little Calumet River- Deep River (040400010508)</td><td>5</td></tr>
<tr><td>Headwaters Turkey Creek (040400010503)</td><td>6</td></tr>
<tr><td>Main Beaver Dam Ditch (040400010502)</td><td>7</td></tr>
<tr><td>Headwaters of Main Beaver Dam Ditch (040400010501)</td><td>8</td></tr>
<tr><td>Duck Creek (040400010506)</td><td>9</td></tr>
</table>

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 March 13, 2013. The first meeting was held at 2:00 PM (CDT) at the Lake County SWCD & Extension Offices, 880 E. 99th Ct., Suite A, Crown Point, IN 46307. The second kickoff meeting was held at 6:00 PM (CDT) at the Portage Lakefront and Riverwalk, Riverwalk Drive Portage, IN 46368.described the TMDL Program and provided a summary of the project.
- A Deep River Monitoring Field Day was held on October 23, 2013 from 1:00 PM - 3:00 PM (CDT). This event was held at Deep River County Park, 9410 Old Lincoln Highway, Hobart, Indiana 46342. At this event, participants learned more about sampling methods from conducted by IDEM, USGS, 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 Deep River TMDL Interim Public meeting was held on December 5, 2013 from 1:00 PM - 3:00 PM (CST). The meeting was held at the Lake County Soil and Water Conservation District, 880 E. 99th Ct, Suite A, Crown Point, Indiana 46307. At this meeting IDEM staff discussed the 2013 recreation sampling season and results
- A Draft TMDL Meeting was held at the Hobart Community Center, 111 E. Old Ridge Road, Hobart IN 46342 on July 14, 2014 at 2:00pm, during which IDEM described the TMDL Program and provided an overview of the draft TMDL results.

2.0 INTRODUCTION

This section of the TMDL provides an overview of the Deep River-Portage Burns (HUC: 0404000105) watershed location and the regulatory requirements that have led to the development of this TMDL to address impairments in the Deep River-Portage Burns watershed.

The Deep River-Portage Burns watershed, shown in Figure 1, is located in the northwest corner of Indiana and drains a total of 180 square miles. The Deep River-Portage Burns headwaters originates near the City of Crown Point in Lake County, and then flows east before bending back to the north, flowing through parts of the City of Merrillville and the City of Hobart, Indiana. Deep River-Portage Burns watershed then flows into West Branch Little Calumet River on the eastern edge of the City of Gary and flows east into Porter County where it merges with East Branch Little Calumet River and becomes Burns Ditch. The watershed ultimately empties into Lake Michigan near the City of Portage, Indiana. Land use throughout the watershed is predominantly urban.

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) lists. USEPA defines a TMDL as the sum of the individual wasteload allocations for point sources and load allocations for nonpoint sources, and a margin of safety 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 Deep River-Portage Burns 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.

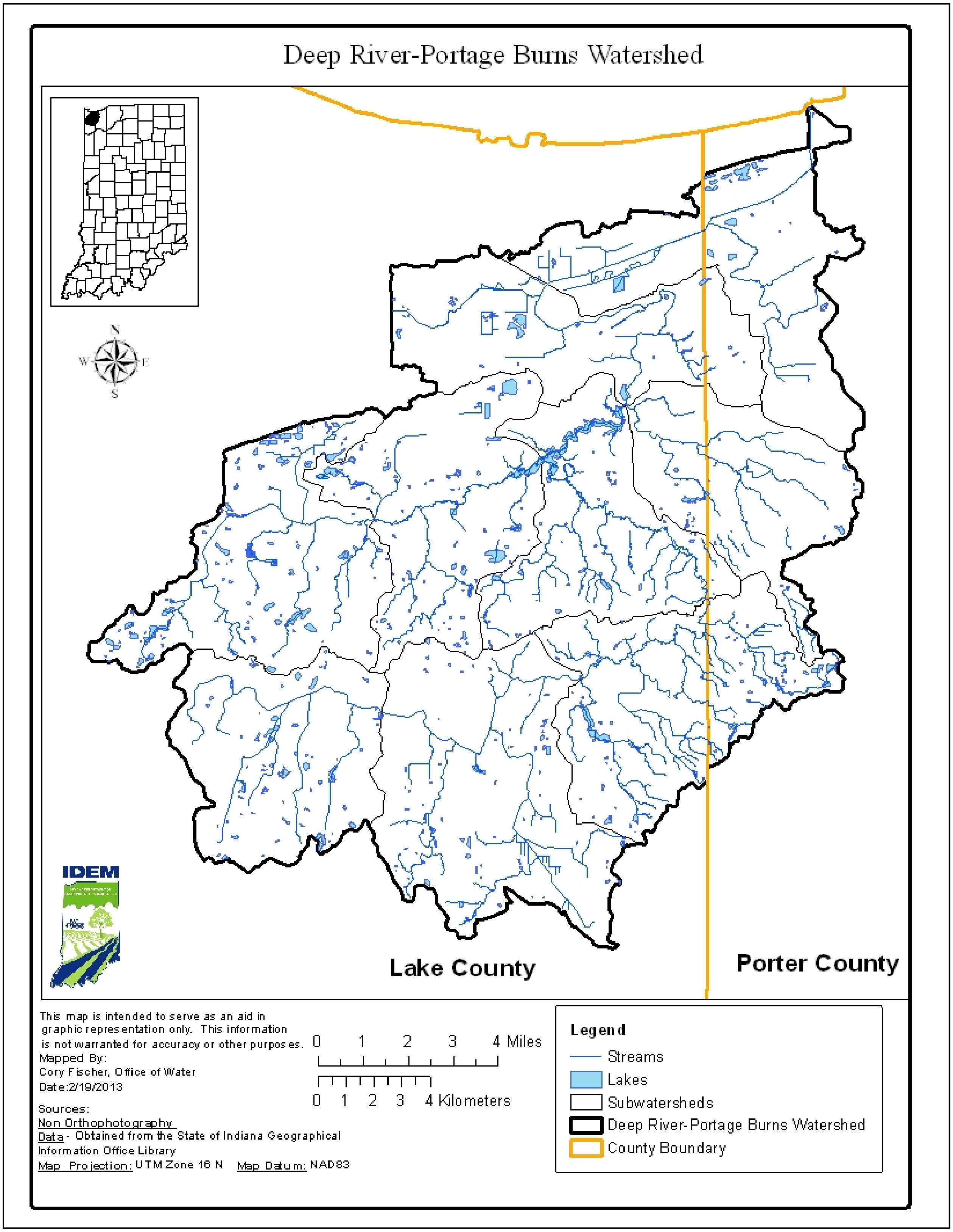


Figure 1. Location of Deep River-Portage Burns Watershed

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 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 Deep River-Portage Burns TMDLs focus on protecting the designated aquatic life support 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 TSS were used as the basis of the Deep River-Portage Burns TMDLs.
- Antidegradation policies protect existing uses and provide extra protection for high-quality or unique waters.

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

E. coli is an indicator of the possible presence of pathogenic organisms such as pathogenic bacteria, viruses, protozoa, and parasites 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(d) (3)]

The numeric dissolved oxygen criteria associated with protecting the aquatic life use are described below.

> *"Concentrations of dissolved oxygen shall:*
> *(A) average at least five (5.0) milligrams per liter per calendar day; and*
> *(B) not be less than four (4.0) milligrams per liter at any time. "* [Source: Indiana Administrative Code Title 327 Water Pollution Control Board. Article 2. Section 1-6(a).]

Additionally the Indiana consolidated assessment and listing methodology (CALM) identifies dissolved oxygen levels greater than 12 mg/l as indicators of nutrient impairment.

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, in general are not directly toxic to aquatic communities. However, excess nutrients primarily nitrogen (N) and phosphorus (P) have been linked to nutrient enrichment of aquatic systems. Nutrient enrichment can lead to shifts in species composition, and reduced dissolved oxygen concentrations, fish kills, and toxic algae blooms; and also results in taste and odor problems if the system is used as a drinking water source. 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 strictly pollution tolerant species*" [327 IAC 2-1-9(49)].

Table 2 presents the criteria associated with the fish community 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 2. Aquatic Life Use Support Criteria for Biological Communities

Biotic Index		Integrity Class	Corresponding Integrity Class	Attributes
Fish community 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	12	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 Deep River-Portage Burns TMDL are presented below.

2.2.1 *E. coli*

The target value used for the Deep River-Portage Burns TMDL was based on the 125 counts/100 mL geometric mean component of the standard (i.e., daily loading capacities were calculated by multiplying flows by 125 counts/100 mL). This approach ensures that both components of the standard will be met since a daily loading capacity based on 125 counts/100 mL will, by definition, meet the 235 counts/100 mL component of the standard. The use of the geometric mean component of the standard results in an added margin of safety (see Section 8.2 for more details).

2.2.2 Nutrient, Dissolved Oxygen, IBC and Total Suspended Sediment TMDLs

The following sections describe the TMDL target values used for nutrients and TSS when developing an IBC, dissolved oxygen and siltation TMDLs.

2.2.2.1 Nutrient TMDLs

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) was used as a TMDL target during the development of the Deep River-Portage Burns TMDL. The target value for total phosphorus is intended to limit the negative effects on aquatic ecosystems that can occur due to increasing algal and aquatic plant life production associated with higher nutrient concentrations (Sharpley et al., 1994). Increased plant production increases turbidity, decreases average dissolved oxygen concentrations, and increases fluctuations in diurnal dissolved oxygen and pH levels. Such changes shift aquatic species composition away from functional assemblages comprised of pollution intolerant species, benthic insectivores, and top carnivores that are typical of high quality streams towards less desirable assemblages of pollution tolerant species, generalists, omnivores, and detritivores that are typical of degraded streams (OEPA, 1999). Such a shift in community structure lowers the diversity of the system. IDEM has determined that meeting this target will result in achieving the narrative biological criterion by improving water quality and promoting a well-balanced aquatic community.

The total nitrogen value of 10 mg/L was not used as a target in the development of the Deep River-Portage Burns TMDL. IDEM is in the process of determining the appropriate water quality criteria for nitrogen based on toxicity and other harmful effects to aquatic communities. Therefore, nitrogen TMDLs will not be completed for this watershed.

2.2.2.2 Total Suspended Solids TMDLs

Although Indiana has not yet adopted numeric water quality criteria for TSS, IDEM has identified a target value based on its National Pollutant Discharge Elimination System (NPDES) permitting process. A target of 30.0 mg/L for total suspended solids TSS has been identified as a permit limit for NPDES facilities. A target value of 30.0 mg/L TSS was therefore used as the TSS TMDL target value to ensure consistency with IDEM's NPDES permitting process. 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. Note that the TSS permit limit for 10:1 dilution ratio wastewater systems is 75 mg/L.

Various subwatersheds in the Deep River-Portage Burns watershed have impaired biotic communities. 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 Deep River-Portage Burns watershed, phosphorus and total suspended solids (TSS) have been identified as a pollutant for TMDL development.

Various subwatersheds in the Deep River-Portage Burns 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 Deep River-Portage Burns watershed, phosphorus where applicable has been identified as a pollutant for TMDL development.

2.3 Listing Information

The Deep River-Portage Burns Ditch and a number of tributaries are listed as impaired for *E. coli*, nutrients, dissolved oxygen, impaired biotic communities, and siltation on Indiana's Impaired Waters List, as shown in Figure 2. IDEM identifies the Deep River-Portage Burns 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.) Figure 5 shows the 12-digit HUCs located in the Deep River-Portage Burns watershed.

A total of 29 AUIDs within the Deep River-Portage Burns watershed are cited as impaired for *E. coli*, nutrients, dissolved oxygen, impaired biotic communities, and siltation on the Indiana 2012 303(d) list. These impaired segments account for approximately 233 miles. The listings and causes of impairment have been adjusted as a result of reassessment data. Table 4 presents listing information for the Deep River-Portage Burns 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 Deep River-Portage Burns watershed are available in Appendix B.

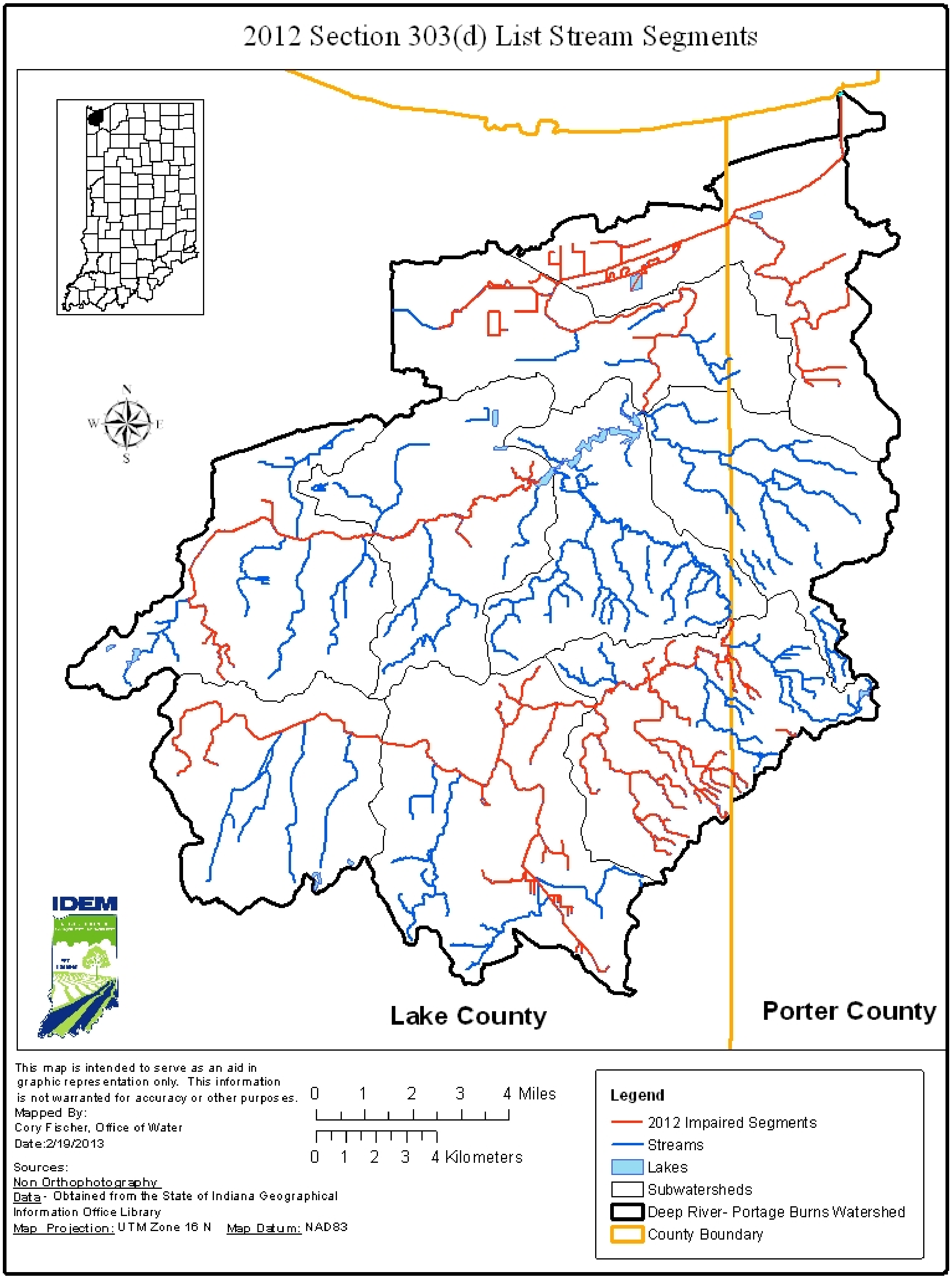


Figure 2. Streams Listed on the 2012 Section 303(d) List in the Deep River-Portage Burns Watershed

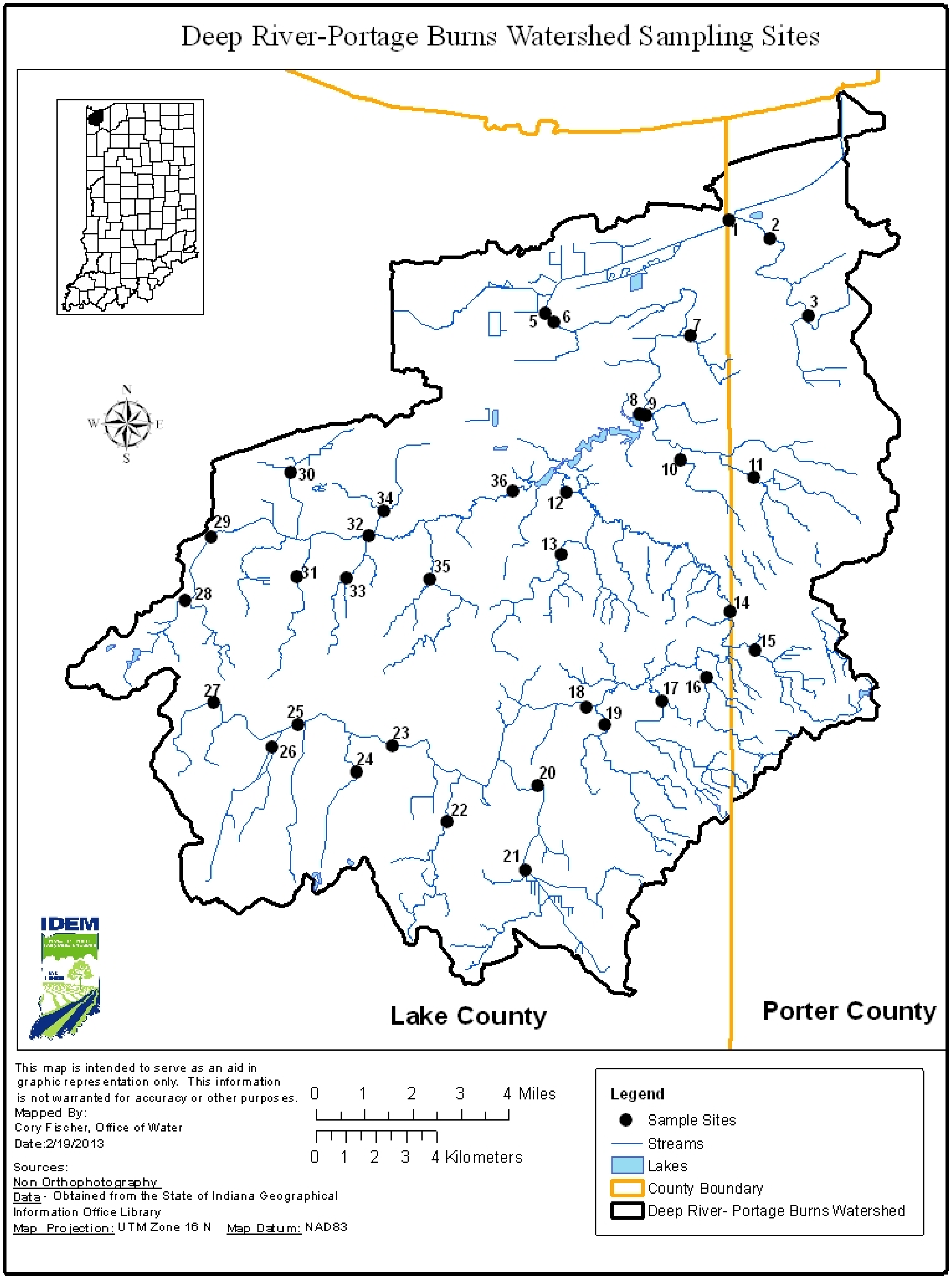


Figure 3. Sampling Locations in 2013 Deep River - Portage Burns Watershed TMDL

Table 3. Deep River - Portage Burns Watershed Sampling Site Information

Site #	L-Site #	Stream Name	Road Name	AUID 2012
1	LMG-05-0002	Burns Ditch	US 20	INC0159_01
2	LMG-05-0003	Willow Creek	Clem Road	INC0159_T1001
3	LMG-05-0004	Willow Creek	Stone Ave	INC0159_T1001
5	LMG-05-0006	Deep River	29th Ave	INC0158_01
6	LMG-05-0007	Deep River	Liverpool Road	INC0158_01
7	LMG-05-0008	Tributary of Deep River	Shelby Street	INC0158_T1002
8	LMG030-0008	Deep River	Ridge Road	INC0157_P1001
9	LMG-05-0009	Duck Creek	Front Street	INC0156_01
10	LMG-05-0010	Tributary of Duck Creek	10th Street	INC0156_T1003
11	LMG-05-0032	Duck Creek	750 W	INC0156_01
12	LMG-05-0011	Deep River	Arizona Street	INC0157_01
13	LMG-05-0033	Sprout Ditch	70th Ave	INC0157_T1002
14	LMG-05-0012	Deep River	Joliet Road	INC0157_01
15	LMG-05-0013	Tributary of Deep River	750 W	INC0154_T1005
16	LMG-05-0034	Tributary of Deep River	89th Avenue	INC0154_T1004
17	LMG-05-0014	Tributary of Deep River	93rd Avenue	INC0154_T1003
18	LMG-05-0015	Deep River	Clay Street	INC0152_04
19	LMG-05-0035	Deer Creek	97th Street	INC0154_T1001
20	LMG-05-0016	Niles Ditch	Colorado Street	INC0152_T1009
21	LMG-05-0017	Niles Ditch	121st Avenue	INC0152_T1009
22	LMG-05-0036	Smith Ditch	113th Street	INC0152_T1008
23	LMG-05-0018	Main Beaver Dam Ditch	Grant Street	INC0152_04
24	LMG-05-0019	Tributary of Main Beaver Dam Ditch	Summit Street	INC0151_T1003
25	LMG-05-0020	Main Beaver Dam Ditch	Clark Road	INC0151_01
26	LMG-05-0021	Tributary of Main Beaver Dam Ditch	77th Avenue	INC0151_T1001
27	LMG-05-0022	Main Beaver Dam Ditch	Blaine Street	INC0151_01
28	LMG-05-0023	Tributary of Turkey Creek	77th Avenue	INC0153_T1001
29	LMG-05-0024	Turkey Creek	Broad Street	INC0153_01
30	LMG-05-0025	Johnson Ditch	Oak Ridge Praire Park	INC0153_T1003
31	LMG-05-0026	Tributary of Turkey Creek	W Old Lincoln Highway	INC0153_T1004
32	LMG-05-0027	Turkey Creek	SR55	INC0153_01
33	LMG-05-0028	Tributary of Turkey Creek	73rd Avenue	INC0153_T1005
34	LMG-05-0029	Tributary of Turkey Creek	Arthur Street	INC0155_T1003
35	LMG-05-0030	Tributary of Turkey Creek	73rd Avenue	INC0155_T1002
36	LMG-05-0031	Turkey Creek	Liverpool Road	INC0155_01

Understanding Table 3:

- *Column 1: Site #.* Lists the site number that corresponds to the site location in Figure 3.
- *Column 2: L-Site #*. Provides the IDEM Station Name
- *Column 3: Stream Name.* Identifies the Stream Name that the site is located on.
- *Column 4: Road Name.* Identifies the Road Name that the site is located on
- *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.

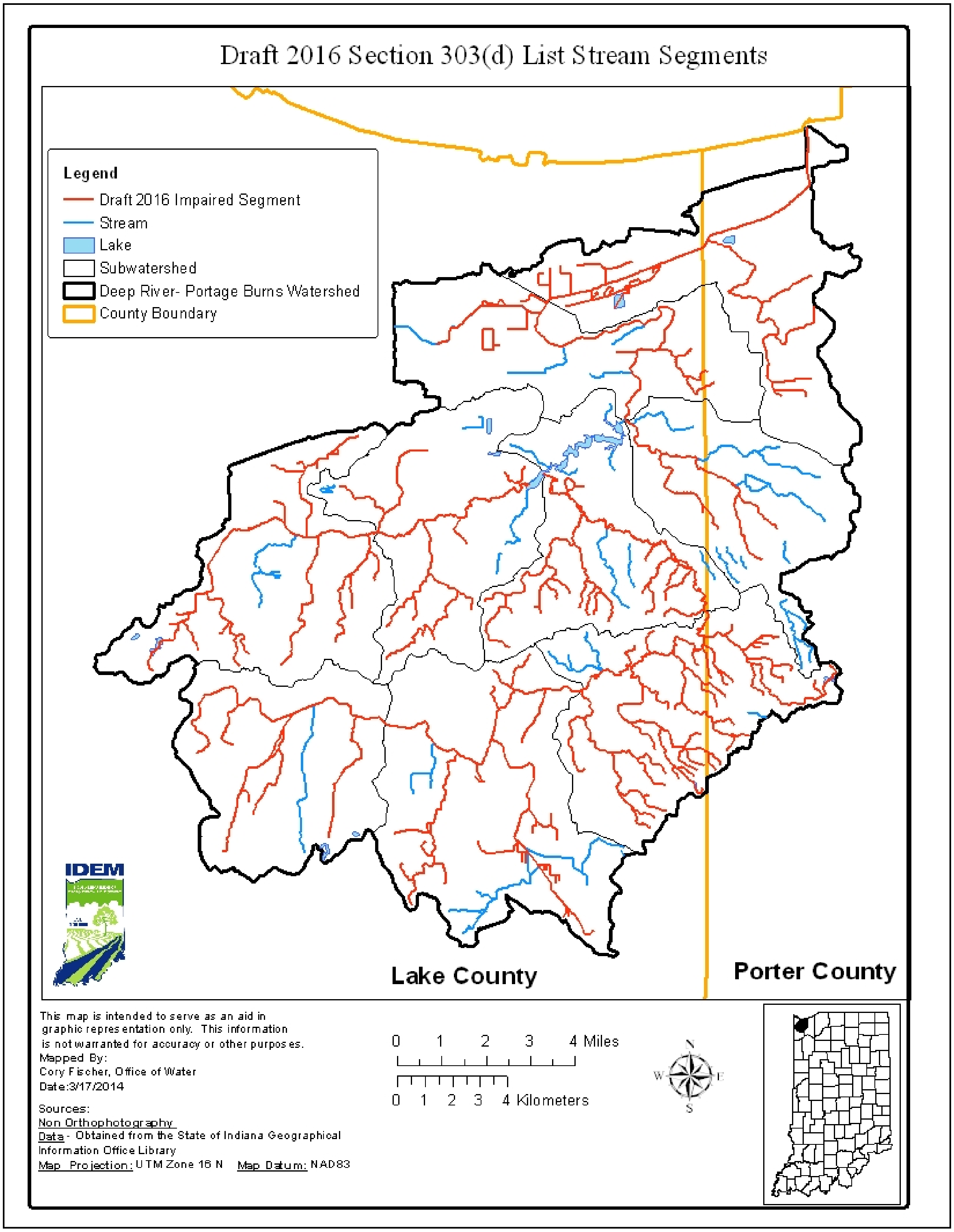


Figure 4. Streams Listed on the Draft 2016 Section 303(d) List in the Deep River- Portage Burns Watershed

Table 4. Section 303(d) List Information for the Deep River-Portage Burns Watershed for 2012 and 2016.

Watershed (10-digit HUC)	Subwatershed (12-digit HUC)	Previous AUID 2010	New AUID 2012	2012Section 303(d) Listed Impairment	Updated Impairments to be Listed on 4A in 2016
Deep River-Portage Burns – Portage Burns Waterway (0404000105)	Headwaters of Main Beaver Dam Ditch (040400010501)	INC0133_00 INC0133_T1005	INC0151_01	IBC	DO, *E. coli,* Nutrients, IBC
		INC0133_00 INC0133	INC0151_T1001		DO, *E. coli,* IBC
		INC0133_00	INC0151_T1002		
		INC0133	INC0151_T1003		DO, *E. coli,* Nutrients, IBC
	Main Beaver Dam Ditch (040400010502)	INC0134 INC0134_00 INC0134_T1006	INC0152_04	IBC	*E. coli,* Nutrients, IBC
		INC0134	INC0152_P1001		
		INC0134_00 INC0134	INC0152_T1007		
		INC0134_00 INC0134	INC0152_T1008		DO, *E. coli,*
		INC0134_T1068 INC0134	INC0152_T1009	IBC	DO, *E. coli,* Nutrients, IBC
		INC0134_00 INC0134	INC0152_T1010		
		INC0134_00 INC0134	INC0152_T1011		
	Headwaters of Turkey Creek (040400010503)	INC0131_T1003 INC0131_00	INC0153_01	IBC, *E.coli*	IBC, *E.coli*
		INC0131_00 INC0131	INC0153_T1001		DO, IBC, Nutrients
		INC0131_00 INC0131	INC0153_T1002		
		INC0131_00 INC0131	INC0153_T1003		DO, *E. coli,* IBC
		INC0131_00	INC0153_T1004		IBC
		INC0131_00 INC0131	INC0153_T1005		DO, *E. coli,* IBC
	Deer Creek (040400010504)	INC0135_00 INC0135 INC0135_T1069	INC0154_01	IBC, *E.coli*	IBC, *E.coli*
		INC0135_00 INC0135	INC0154_T1001	*E.coli*	DO, *E. coli,* Nutrients, IBC
		INC0135_00 INC0135	INC0154_T1002		
		INC0135_T1094 INC0135_00 INC0135	INC0154_T1003	IBC, Siltation	IBC, *E.coli,* Siltation
		INC0135_00 INC0135	INC0154_T1004		IBC, *E.coli*
		INC0135_00 INC0135	INC0154_T1005		IBC, *E.coli*

	City of Merrillville (040400010505)	INC0132	INC0155_01	*E.coli*	DO, IBC, *E.coli*
		INC0132	INC0155_01A		
		INC0136_P1007	INC0155_P1001		
		INC0136	INC0155_P1002		
		INC0136_00 INC0136	INC0155_T1001		
		INC0132_00 INC0132	INC0155_T1002		IBC, *E.coli*
		INC0132_00	INC0155_T1003		DO, *E. coli,* Nutrients, IBC
		INC0132	INC0155_T1003A		
	Duck Creek (040400010506)	INC0141_00	INC0156_01		DO, *E. coli,* Nutrients, IBC
		INC0141_00 INC0141	INC0156_01A		
		INC0141	INC0156_01B		
		INC0141	INC0156_01C		
		INC0141	INC0156_01D		
		INC0141	INC0156_01E		
		INC0141_00 INC0141	INC0156_T1001		
		INC0141_00 INC0141	INC0156_T1002		
		INC0141_00 INC0141	INC0156_T1003		IBC, *E.coli*
		INC0141_00	INC0156_T1004		
	Lake George (040400010507)	INC0136_P1070 INC0136_00 INC0136	INC0157_01		IBC, *E.coli*
		INC0136	INC0157_01A		
		INC0136	INC0157_01B		
		INC0136_P1007	INC0157_P1001		IBC, DO, *E.coli*
		INC0136_00	INC0157_T1001		
		INC0136_00 INC0136	INC0157_T1002		IBC, *E.coli*
		INC0136	INC0157_T1003		
		INC0136	INC0157_T1004		
		INC0136_00	INC0157_T1005		
	Little Calumet River (040400010508)	INC0142_T1008 INC0142	INC0158_01	IBC, cyanide	IBC
		INC0142_00	INC0158_T1001		
		INC0142_00 INC0142	INC0158_T1002		IBC, *E.coli*
		INC0142_00	INC0158_T1003		
		INC0142_00	INC0158_T1004		
		INC0142_T1009 INC0142	INC0158_T1005	IBC, PCB Fish	IBC,
	Willow Creek (040400010509)	INC0143_01 INC0143_02 INC0143_03	INC0159_01	DO, PCB Fish	DO, IBC, *E.coli,*

		INC0143_T1001 INC0143			
		INC0143_T1108	INC0159_02	IBC, *E.coli*, PCB Fish	IBC, *E.coli*,
		INC0143 INC0143_T1002 INC0143_T1002A INC0143_T1002B INC0143_T1003	INC0159_T1001	IBC, *E.coli*, PCB Fish	IBC, *E.coli*,

Understanding Table 4:

- *Column 1: Watershed (10-digit HUC).* Lists the subwatersheds at the 10-digit HUC scale that were part of the initial assessment for the Deep River-Portage Burns 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 2010.* Identifies the Assessment Unit identification (AUID) given to waterbodies within the 12-digit HUC subwatershed for purposes of the 2010 Section 303(d) listing assessment process.
- *Column 4: New AUID 2012.* 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 5: 2012Section 303(d) Listed Impairment.* Identifies the cause of impairment associated with the 2012 Section 303(d) listing.
- *Column 6: Updated Impairment to be Listed 2016.* Provides the updated causes of impairment if new data and information are available.

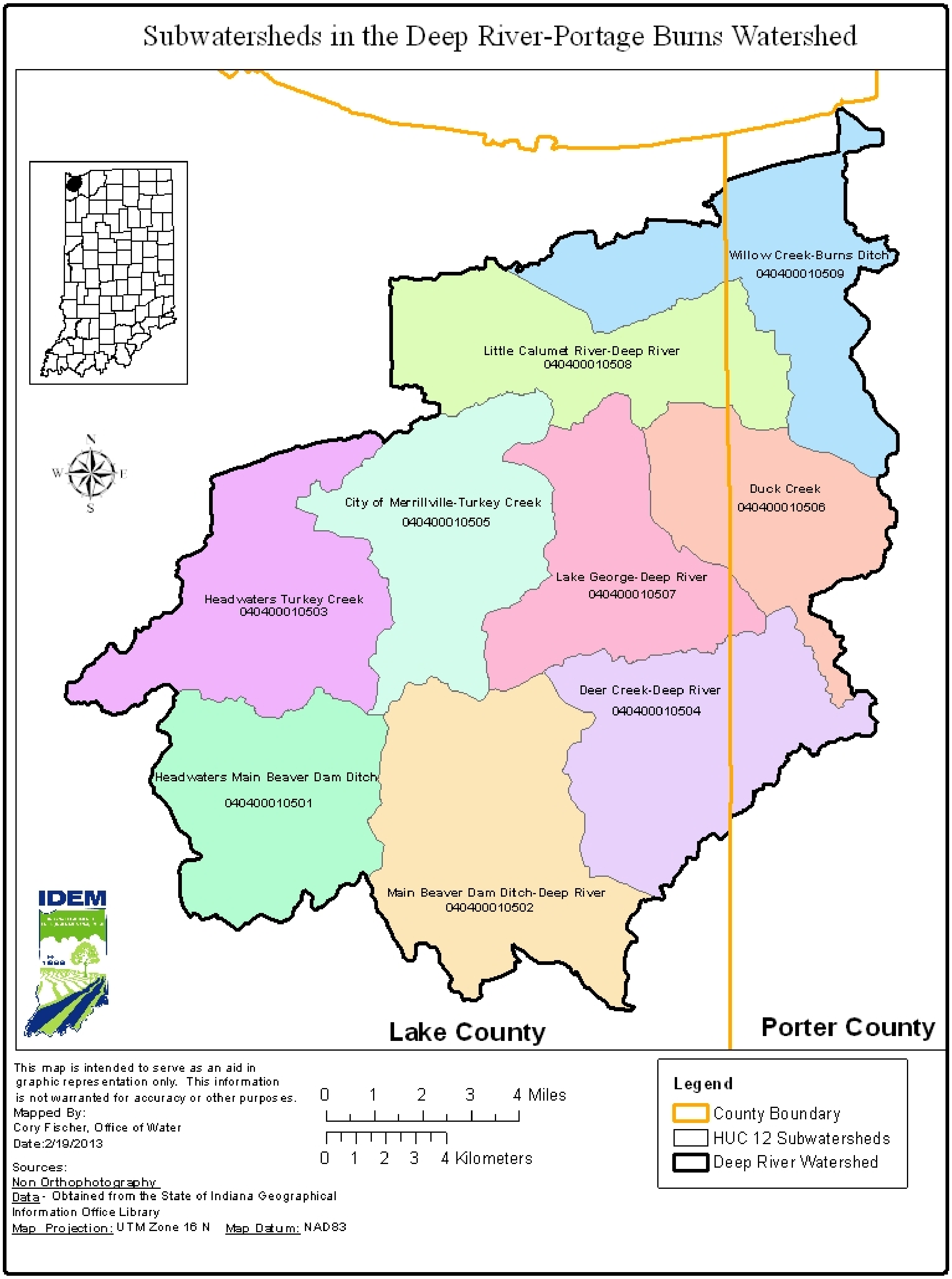


Figure 5. Subwatersheds (12-Digit HUCs) in the Deep River-Portage Burns Watershed

2.4 Priority Ranking Discussion

The Deep River-Portage Burns 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 WATERSHED

This section of the TMDL report contains a brief characterization of the Deep River-Portage Burns 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, dissolved oxygen, impaired biotic communities, and siltation 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.

3.1 Land Use

Land use patterns provide important clues to the potential sources of *E. coli*, nutrients, and TSS in a watershed. Land use information for the Deep River-Portage Burns 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 circa 2012. Figure 6 displays the spatial distribution of the land uses and the data are summarized in Table 5.

Land use in the Deep River-Portage Burns watershed is primarily developed land, comprising 42 percent of the Deep River-Portage Burns watershed. The high percentage of developed land in the watershed is an indicator of high levels of impervious surfaces that can be significant sources of *E. coli*, nutrients, and TSS. Impervious cover doesn't allow for water to infiltration into the ground, but instead is directed through storm sewers directly into the stream. This provides a direct route for the pollutants to enter waterbodies. Approximately 24 percent of the land is agriculture and 10 percent is shrub and herbaceous land. 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 23 percent of the total land area.

The Deep River-Portage Burns watershed has a diverse network of streams. Tributaries include the Main Beaver Dam Ditch, Turkey Creek, Duck Creek and Deer Creek, among others.

Table 5. Land Use of Deep River-Portage Burns Watershed

Land Use	Watershed		
	Area		Percent
	Acres	Square Miles	
Open Water	1,036.137	1.62	0.90
Developed, Open Space	10,359.151	16.19	9.01
Developed, Low Intensity	25,931.238	40.52	22.54
Developed, Medium Intensity	9,947.943	15.54	8.64
Developed, High Intensity	2,551.536	3.99	2.22
Forest	10,049.355	15.70	8.73
Shrub/Herbaceous	12,230.604	19.11	10.63
Hay/Pasture	6,391.627	9.99	5.56
Agriculture	27,795.352	43.43	24.16
Wetlands	8,753.905	13.68	7.61
TOTAL	**115,046.85**	**179.77**	**100**

Understanding Table 5: The predominant land use types in the Deep River-Portage Burns watershed can indicate potential sources of E. *coli*, nutrients, and TSS 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 TSS 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 changes in hydrology, land use types are associated with different types of activities that could contribute *E. coli*, nutrients, and TSS to the watershed. Understanding types of land uses will help identify the type of implementation approaches that watershed stakeholders use to achieve E. *coli*, nutrients, and TSS load reductions.

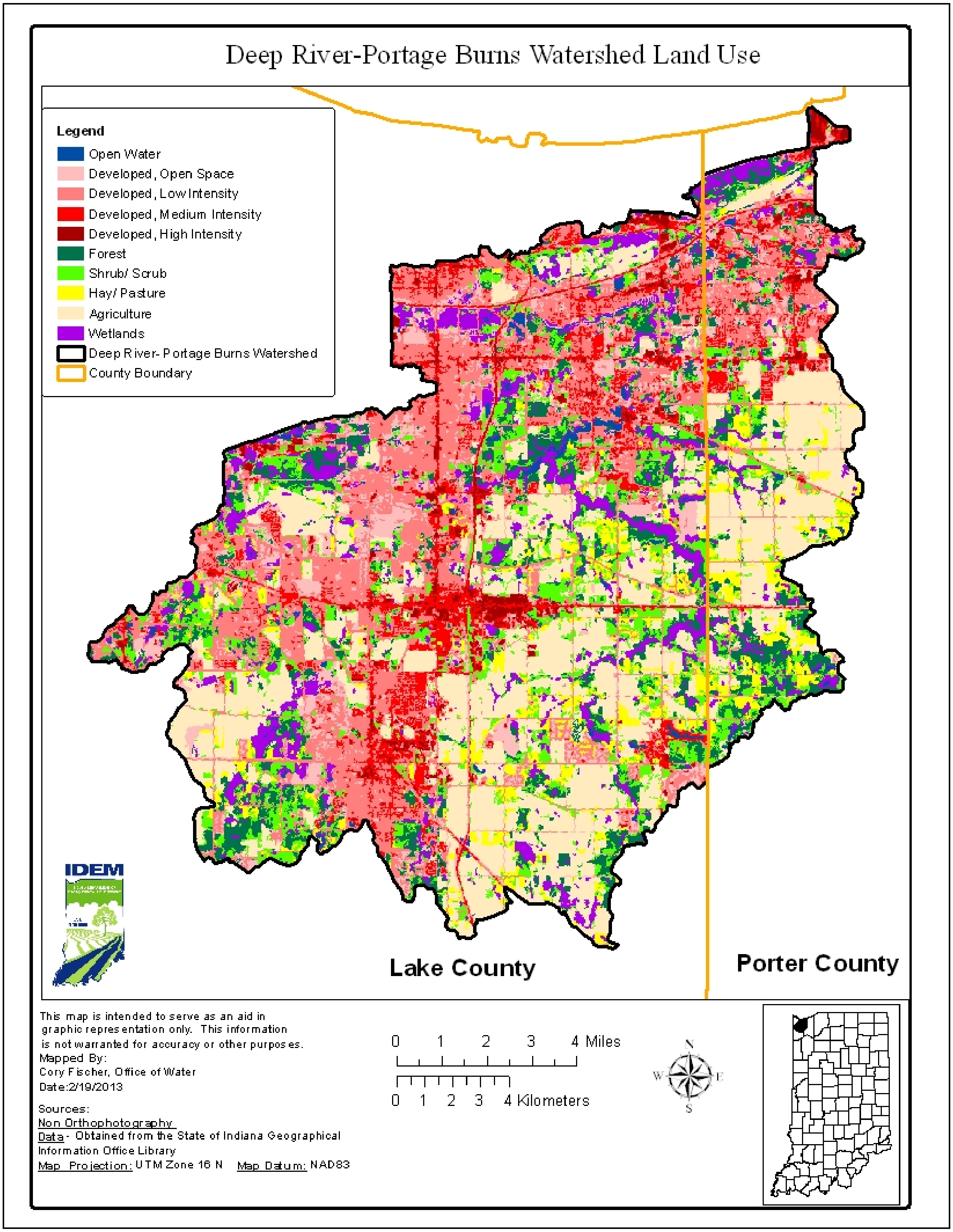


Figure 6. Land Use in the Deep River-Portage Burns Watershed

3.2 Cropland

Agricultural land use information for the Deep River-Portage Burns watershed is available from the USDA, National Agriculture Statistics Service (NASS), and 2012 Indiana Cropland Data Layer. The purpose of the Cropland Data Layer Program is to use satellite imagery to provide acreage estimates to the Agricultural Statistics Board for the state's major commodities and to produce digital crop-specific, categorized geo-referenced output products. These data categorize the land use for each 30 meter by 30 meter parcel of land in the watershed based on satellite imagery from circa 2012. Figure 7 displays the spatial distribution of the crop land uses and the data are summarized in Table 6.

Land use in the southeastern portion of the Deep River-Portage Burns watershed is primarily agricultural, comprising approximately 24 percent of the Deep River-Portage Burns watershed. Corn and soybean crops are not typically associated with high *E. coli* loads, unless they have been fertilized with manure. Approximately 47 percent of the agricultural land is planted in corn and approximately 51 percent is planted in soybeans. Other cropland comprises approximately two percent of the watershed.

Table 6. Major Cash Crop Acreage in the Deep River- Portage Burns watershed

	Watershed		
	Area		
Crop Data	Acres	Square Miles	Percent
Corn	11,304.77	17.66	46.54
Soybean	12,431.87	19.42	51.19
Winter Wheat	531.52	0.83	2.19
Double Crop Winter Wheat/ Soybeans	19.13	0.03	0.08
TOTAL	24,287.30	37.95	100.00

Understanding Table 6: The predominant cropland types in the Deep River-Portage Burns watershed can indicate potential sources of *E.coli* loadings. Land use in the Deep River-Portage Burns watershed is primarily developed, comprising approximately 42.41 percent of the Deep River-Portage Burns watershed. Corn and soybean crops are not typically associated with high *E. coli* loads, unless they have been fertilized with manure. Understanding types of cropland will help identify the type of implementation approaches that watershed stakeholders use to achieve *E.coli* load reductions.

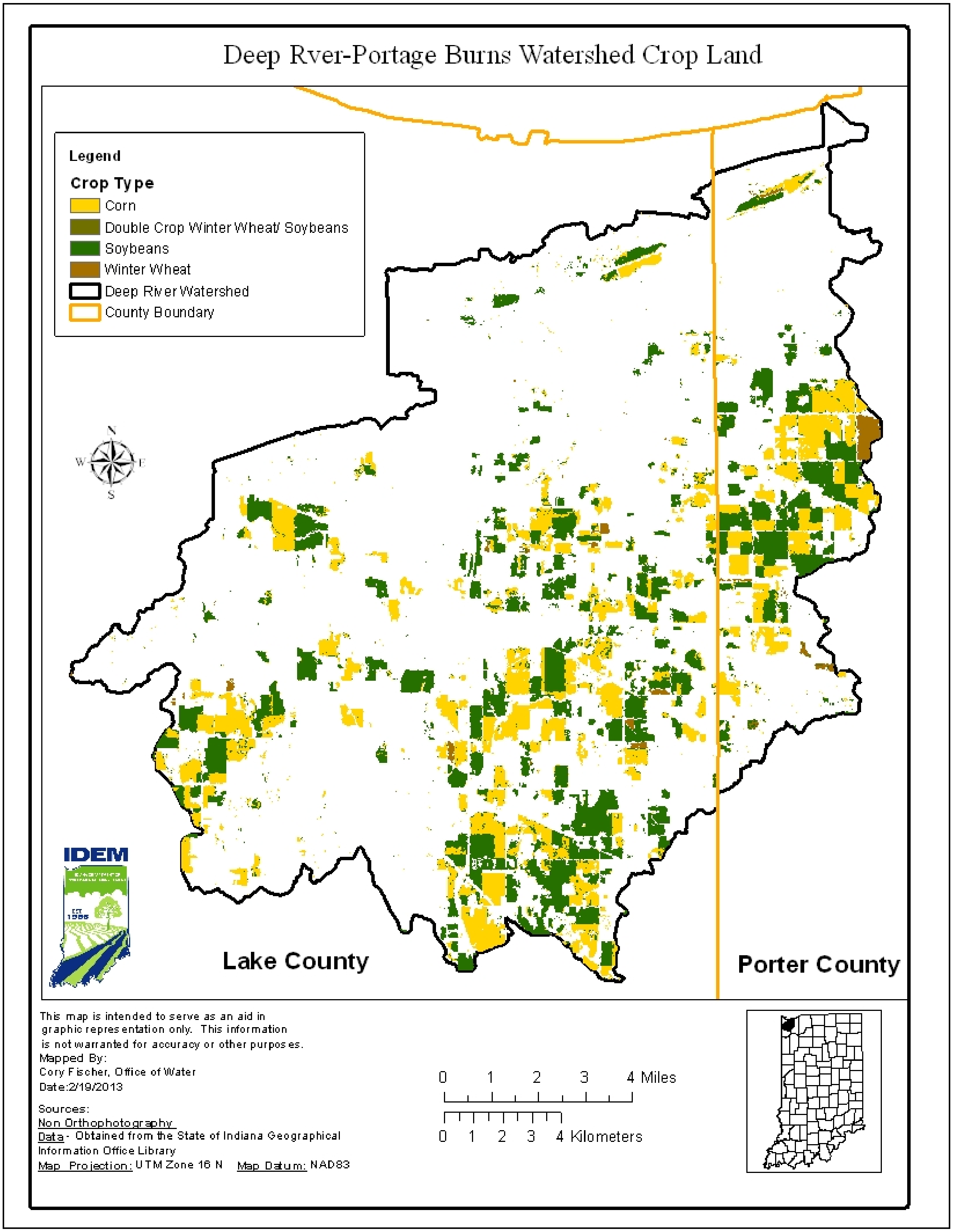


Figure 7. Crop Land in the Deep River-Portage Burns Watershed

3.3 Human Population

The Deep River-Portage Burns watershed includes land in both Lake and Porter counties. Major government units with jurisdiction in at least part of the Deep River-Portage Burns watershed includes St. Johns, Schererville, Merrillville, Crown Point, Winfield, Hobart, Gary, Lake Station, and Portage. U.S. Census data for each county during the past three decades are provided in Table 7. Municipalities are labeled in Figure 8.

Table 7. Population Data for Counties in the Deep River-Portage Burns Watershed

County	1990	2000	2010
Lake	475,594	484,564	496,005
Porter	128,932	146,798	164,343
TOTAL	***604,526***	***631,362***	***660,348***

Source: U.S. Census Bureau.

Understanding Table 7: 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 7 provides information that shows how population has changed in each of the counties located in the Deep River-Portage Burns 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 Deep River-Portage Burns watershed are based on US Census data 2010 and the percentage of the total county and urban area that is within the watershed (Table 8). Based on this analysis, the estimated population of the watershed is 154,000 with approximately 10 percent of the population classified as rural residents and 90 percent classified as urban residents. Figure 9 indicates population density within the Deep River-Portage Burns watershed.

Table 8. Estimated Population in the Deep River-Portage Burns Watershed

County	2010 Population	Total Estimated Watershed Population	Percent of Total Watershed Population	Non-urban Population	Urban Population
Lake	496,005	140,220	91.04	11,588	128,632
Porter	164,343	13,804	8.96	3,780	10,024
TOTAL	**660,348**	**154,024**	**100**	**15,368**	**138,656**

Understanding Table 8: Understanding where the greatest population is concentrated within the Deep River-Portage Burns 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 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. Comparing the information in Table 7 with the information in Table 8 can provide an understanding of how population might change in the Deep River-Portage Burns watershed and which counties are experiencing the most growth and shifts in urban and non-urban population. Population change can serve as an indicator for changes in land uses. For example, growing populations might mean more development, resulting in increased impervious surfaces and more infrastructure (e.g., sanitary sewer and storm sewer). Declining population in areas of the Deep River-Portage Burns watershed might signify communities with under-utilized infrastructure and indicate opportunities to "right-size" existing infrastructure and promote changes to land use that would benefit water quality. The population trends are indicating that this watershed has been growing and likely will continue to grow in the future. IDEM choose to allocate 5% of the loading capacity toward future growth. IDEM anticipates that land uses will likely be changing in the Deep River-Portage Burns watershed in the future and in anticipation of those land use changes has set aside approximately 5% of the loading capacity to address increased bacteria, nutrient and sediment loads from those future contributors.

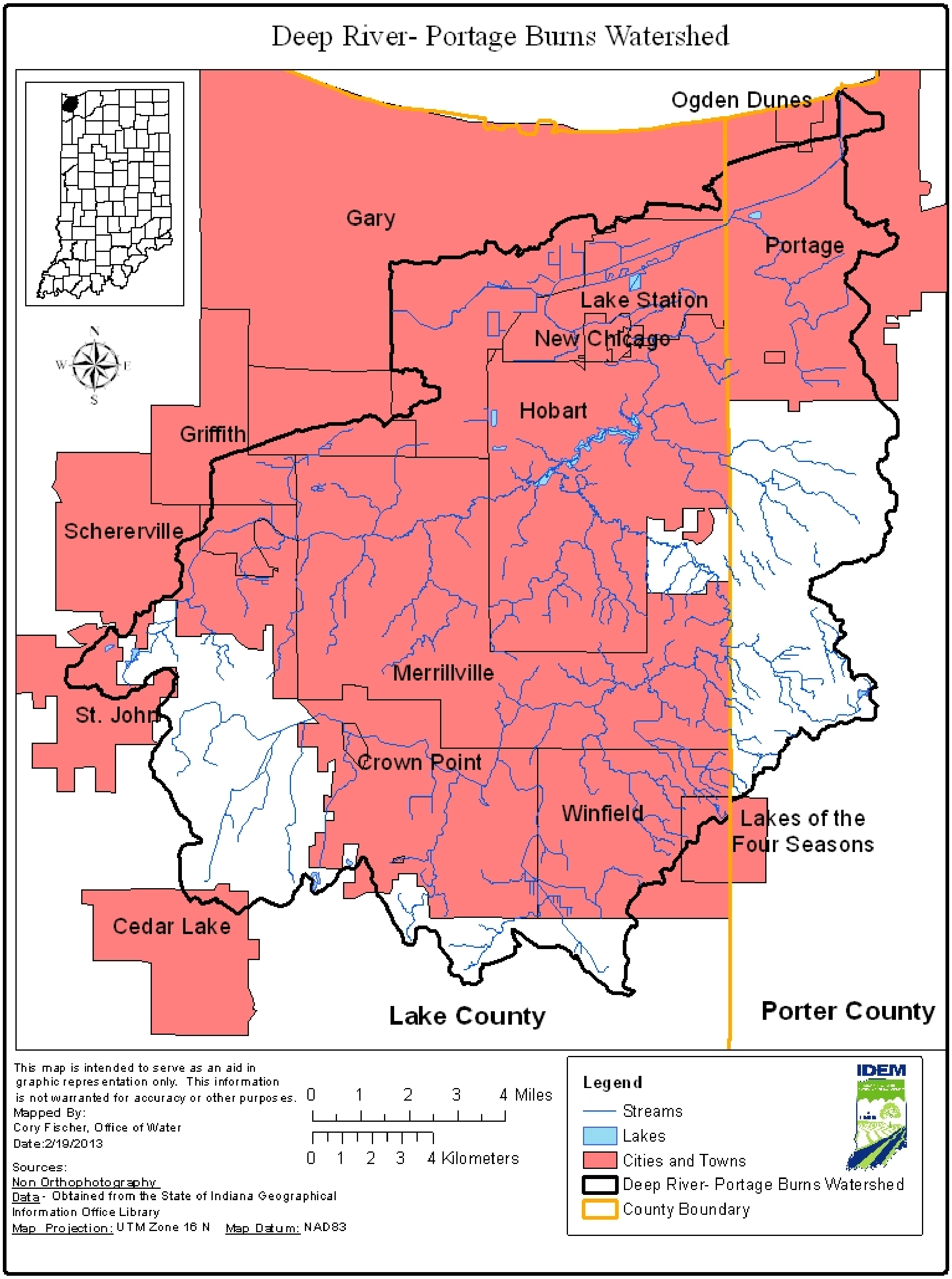


Figure 8. Municipalities in the Deep River-Portage Burns Watershed

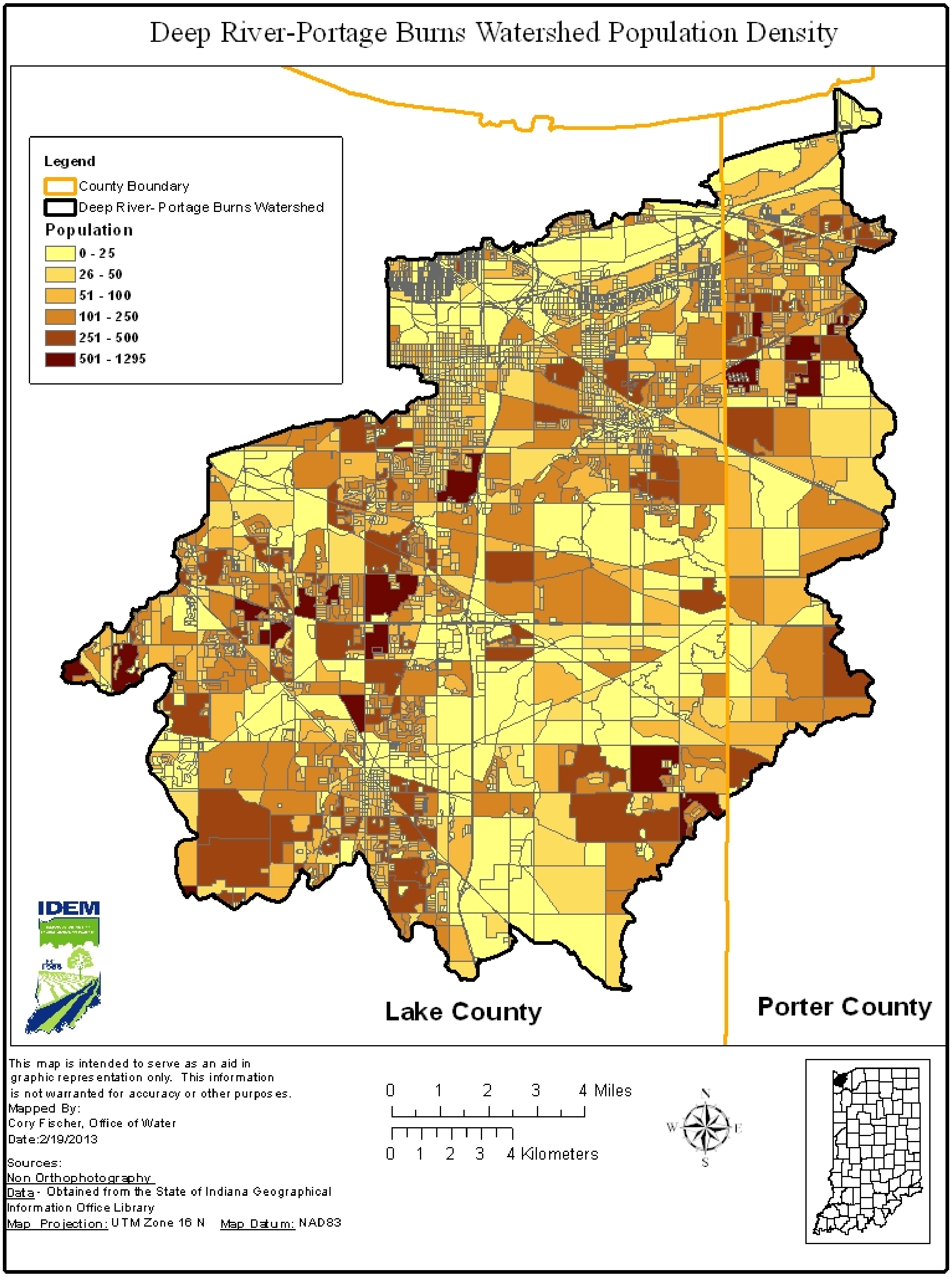


Figure 9. Population Density in the Deep River-Portage Burns Watershed

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 Deep River-Portage Burns watershed is available from the Indiana Geologic Survey. The Deep River-Portage Burns watershed originates in Lake County and travels east before bending to the north where it merges with Turkey Creek. Deep River-Portage Burns continues north to the confluence with West Branch Little Calumet River and travels east crossing into Porter County, eventually discharging into Lake Michigan. The Deep River-Portage Burns watershed is located in the southern Lake Michigan drainage of Northwest Indiana. This area was formed by the ridge and swale fluctuations of Lake Michigan. The landscape includes rows of ponds that parallel the Lake Michigan shore. Those nearest the present lake shore are the youngest, and pond age increases with increasing distance from the present shoreline. The drainage contains several large wetlands and water bodies between the rows of dunes. Streams in the area are primarily lowland streams characterized by long, deep pools and short, shallow riffles. These streams lack significant habitat heterogeneity as characterized by a variety of substrates. Wetland draining, channelization and removal of riparian corridors destroyed habitat stability by reducing the amount of the formerly prevalent emergent wetlands. The Deep River-Portage Burns watershed is located in the Central Corn Belt Plain ecoregion which is consists of dissected glacial till mantled with loess. Elevation varies from about 590 feet in the northern portion along the lake shore of the watershed to over 820 feet on a few hills in southeastern part of the watershed. Figure 10 shows the topography of the Deep River-Portage Burns watershed. National Elevation Data (NED) is available from the USGS National Map seamless server (http://seamless.usgs.gov/website/seamless/viewer.htm). While the topography of the watershed can have an effect on hydrology, it is more likely that soil characteristics will play a greater role in affecting hydrologic processes.

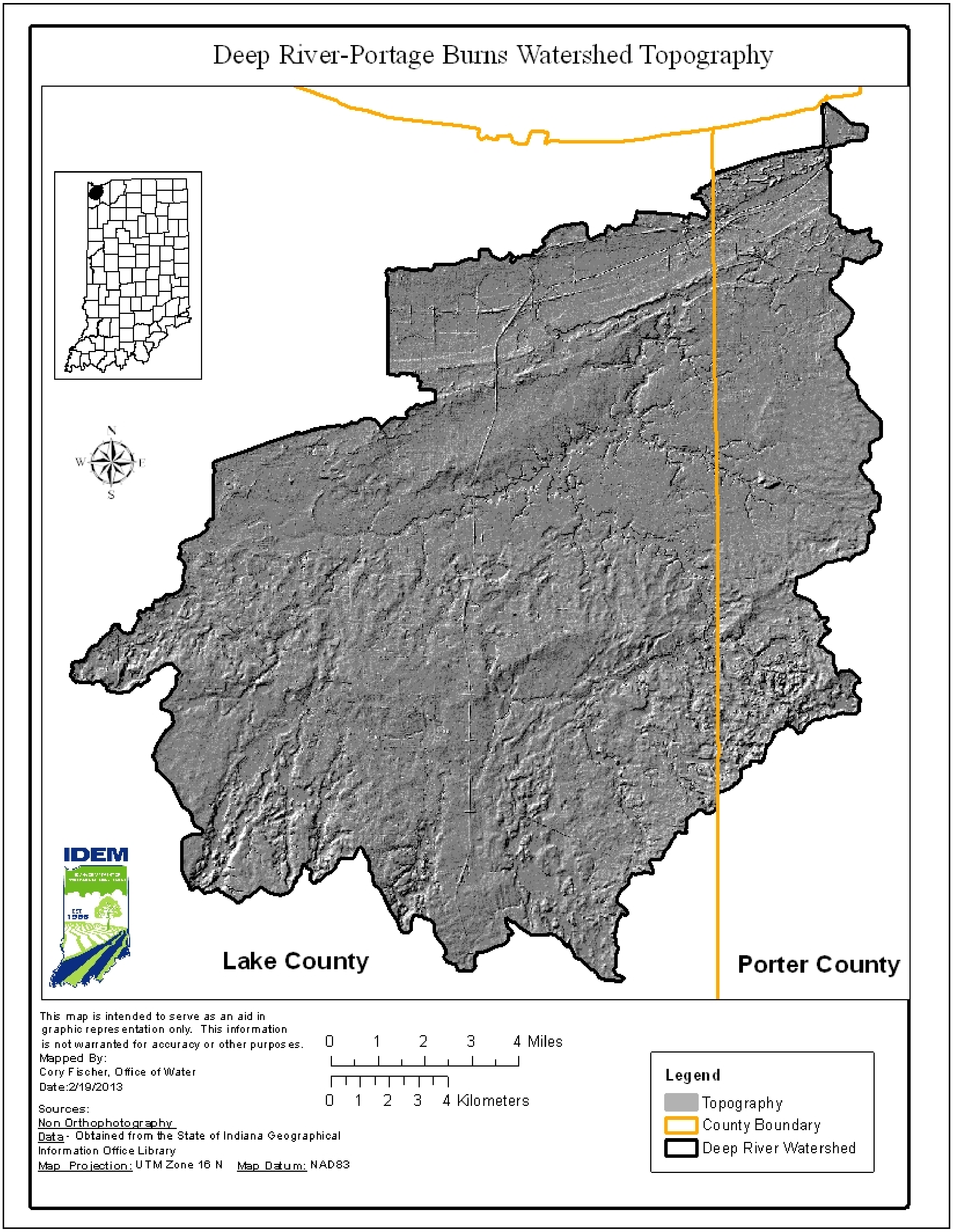


Figure 10. Topography of the Deep River-Portage Burns Watershed

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 9 (NRCS, 2001). Data for the Deep River-Portage Burns 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 11.

The majority of the watershed is covered primarily by soil group C (63%) followed by soil group B (20%), soil group A (14%) and soil group D (2%).

Table 9. 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 9: 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 TSS loading within a watershed. During high flows, areas with low soil infiltration capacity can flood and therefore discharge high *E. coli*, nutrients, and TSS loads to nearby waterways. In contrast, soils with high infiltration rates can slow the movement of *E. coli*, nutrients, and TSS to streams.

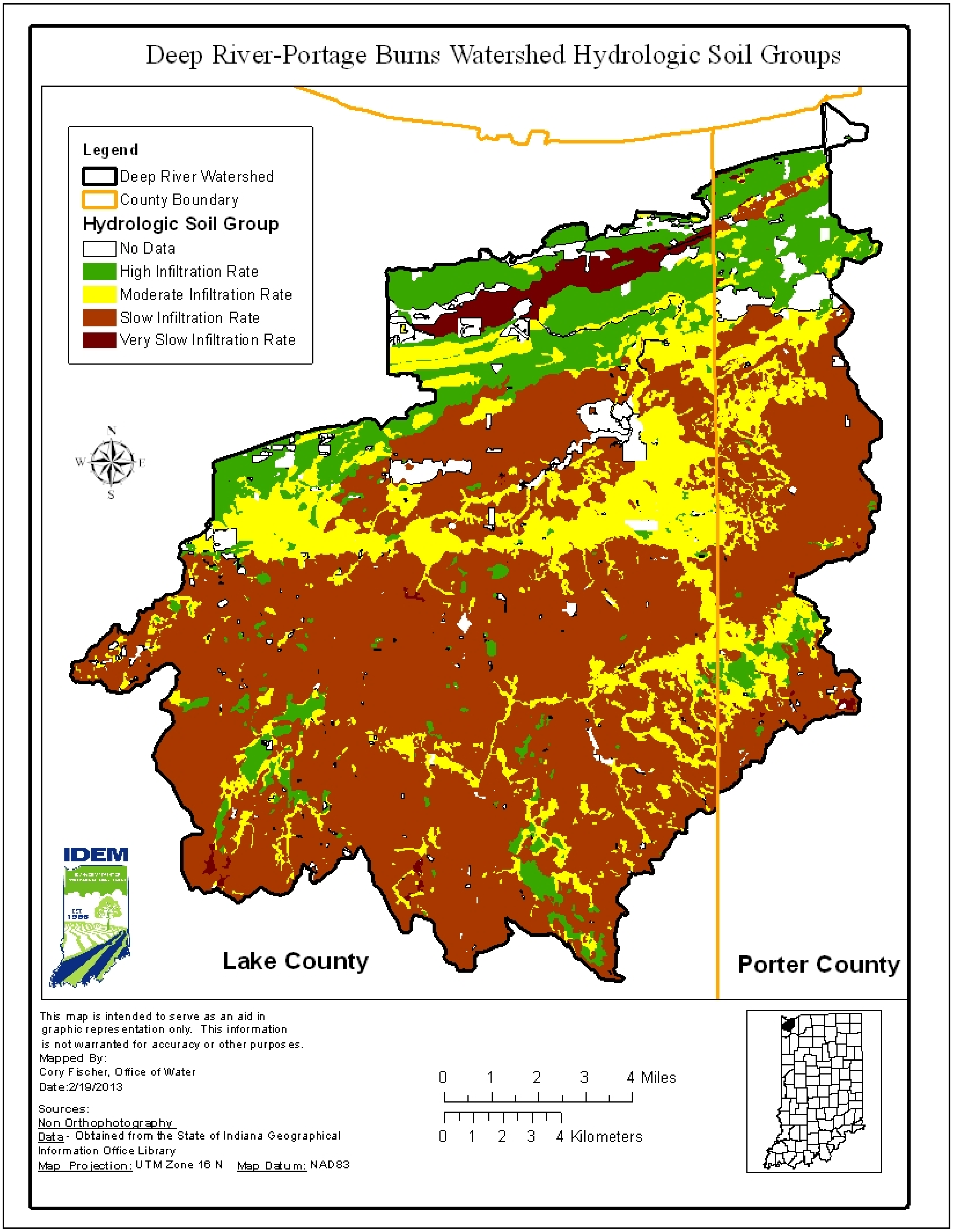


Figure 11. Hydrologic Soil Groups in the Deep River-Portage Burns Watershed

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 12 shows ratings that indicate the extent to which the soils are suitable for septic systems within the Deep River-Portage Burns 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 93 percent of the Deep River-Portage Burns 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 six percent of the soils within the Deep River-Portage Burns 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. Approximately one percent of the soils in the Deep River-Portage Burns watershed are designated “somewhat limited,” meaning that the soil type is suitable for septic systems. Section 3.0 provides more information on septic systems throughout the Deep River-Portage Burns watershed.

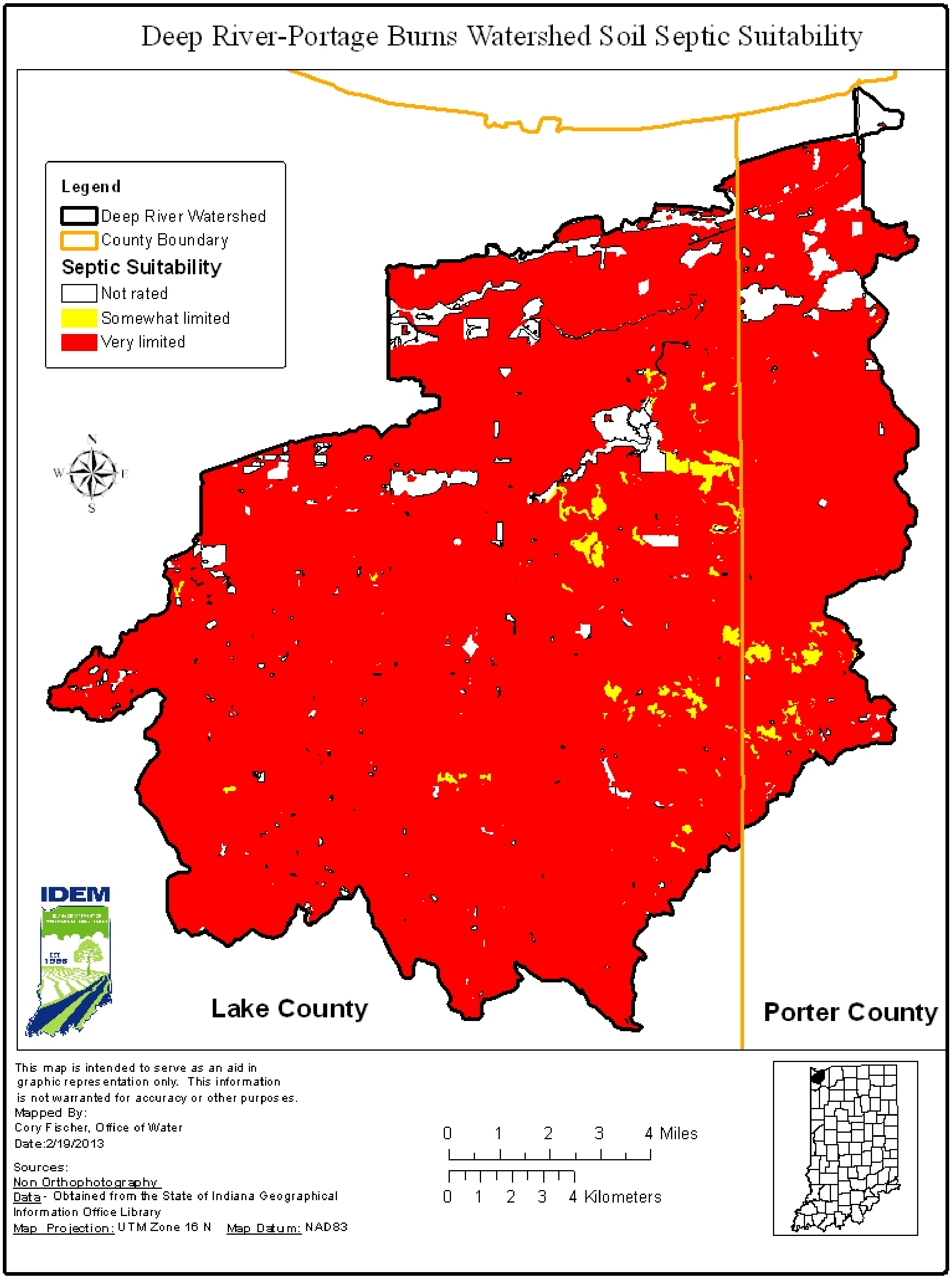


Figure 12. Suitability of Soils for Septic Systems in the Deep River-Portage Burns Watershed

3.5.3 Soil Saturation and Wetlands

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 Deep River-Portage Burns and are important in consideration of wetland restoration activities. Approximately 36,992 acres or 32 percent of the Deep River-Portage Burns watershed area contains soils that are considered hydric, as shown in Table 10. However, a large majority of these soils have been drained for either agricultural production or urban development and would only support a wetland if restoration objectives were created, pavement was removed, agricultural production discontinued and hydrology restored. The location of undeveloped hydric soils, as shown in Figure 13, 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 Deep River-Portage Burns watershed, Lake 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.

Table 10. Hydric Soils by County in the Deep River-Portage Burns Watershed

County	Map Unit	Hydric Soil Type	Acres
Lake	Ta	Adrian muck	329
	Bn	Bono silty clay	177
	Gd	Gilford fine sandy loam	352
	Gf	Gilford mucky fine sandy loam	138
	Ca	Houghton muck	2,611
	Mb	Marl beds	269
	Mh	Marsh	171
	Mm	Maumee loamy fine sand	2,642
	Mt	Milford-Palms-Wallkill complex	1631
	Mo	Milford silt loam	2,560
	Mr	Milford silty clay loam	1,590
	OkB	Oakville-Adrian complex	114
	Lm	Palms muck	151
	Pc	Pewamo silty clay loam	13,738
	Re	Rensselaer loam	1,656
	Rr	Rensselaer mucky loam	79
	Wa	Wallkill silt loam	648
	We	Warners silt loam	2,038
	Wo	Wauseon fine sandy loam	211
		Total	**31,105**
Porter	Ad	Adrian muck	100
	Ed	Edwards muck	48
	Gf	Gilford sandy loam	53
	Ho	Houghton muck	288
	Mm	Maumee loamy sand	453
	Mp	Milford silty clay loam	1,791
	Nf	Newton loamy fine sand	224
	Pa	Palms muck	28

County	Map Unit	Hydric Soil Type	Acres
	Pe	Pewamo siltyclay loam	1,523
	Ph	Pinhook loam	4
	Sb	Sebewa loam	269
	So	Suman silt loam	479
	Wa	Wallkill silt loam	111
	We	Warners silt loam	375
	Wh	Washtenaw silt loam	141
		Total	**5,887**

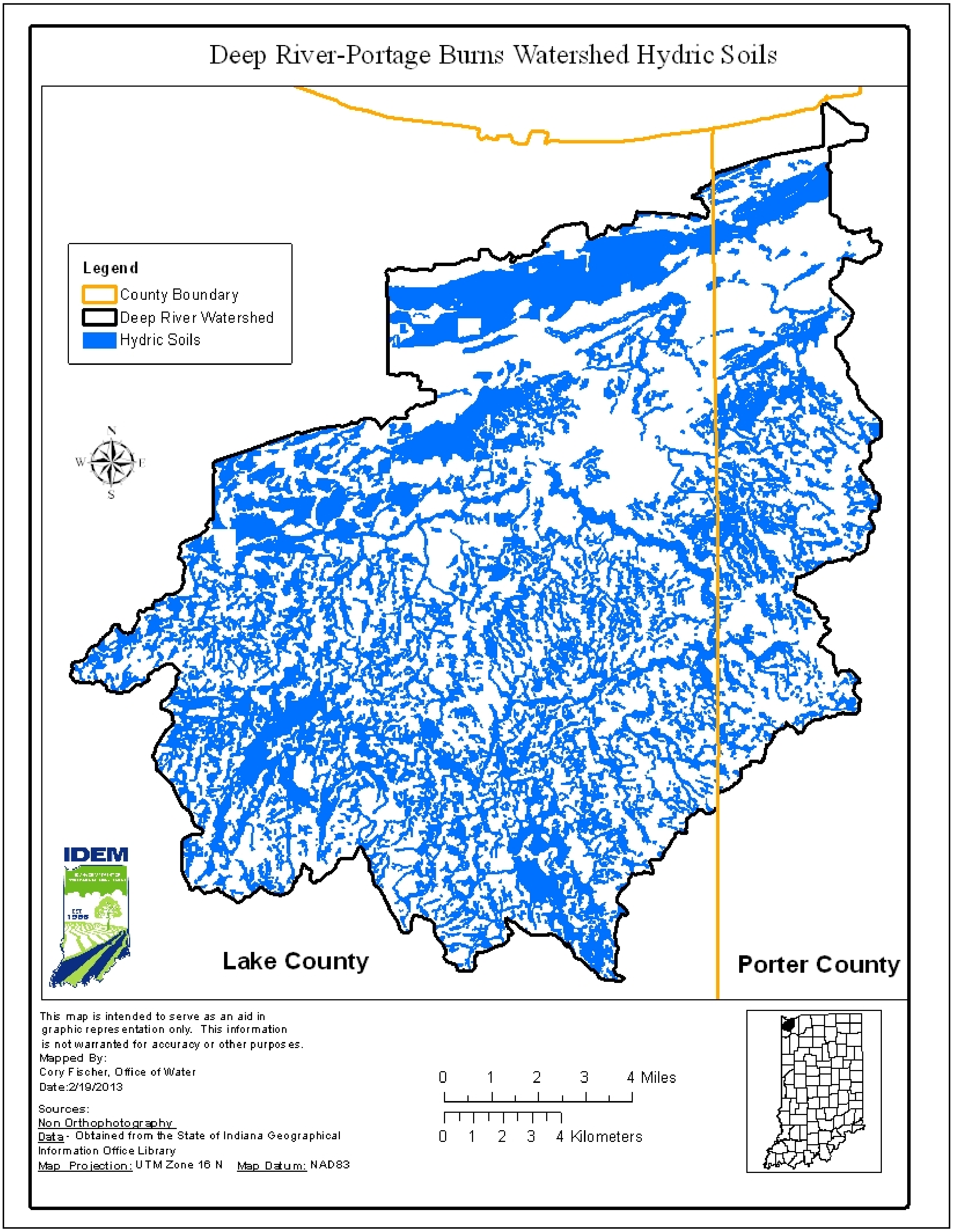


Figure 13. Hydric Soils in the Deep River-Portage Burns Watershed

Data on hydric soils by county available from NRCS at http://soils.usda.gov/use/hydric/
Agencies such as the USGS and U.S. Fish and Wildlife Service 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 Deep River-Portage Burns watershed contains approximately 9,100 acres of wetlands or less than eight percent of the total surface area (USFWS, 2003). Figure 14 shows estimated locations of wetlands as defined by the U.S. Fish and Wildlife Service'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/WebMapServices.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. It should be noted that the estimate of the current extent of wetlands in the Deep River-Portage Burns watershed from the NWI may not agree with those listed in Section 3.1, which are based upon the Multi-Resolution Land Characteristics Consortium (MRLC) 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 to be washed-off to waterbodies

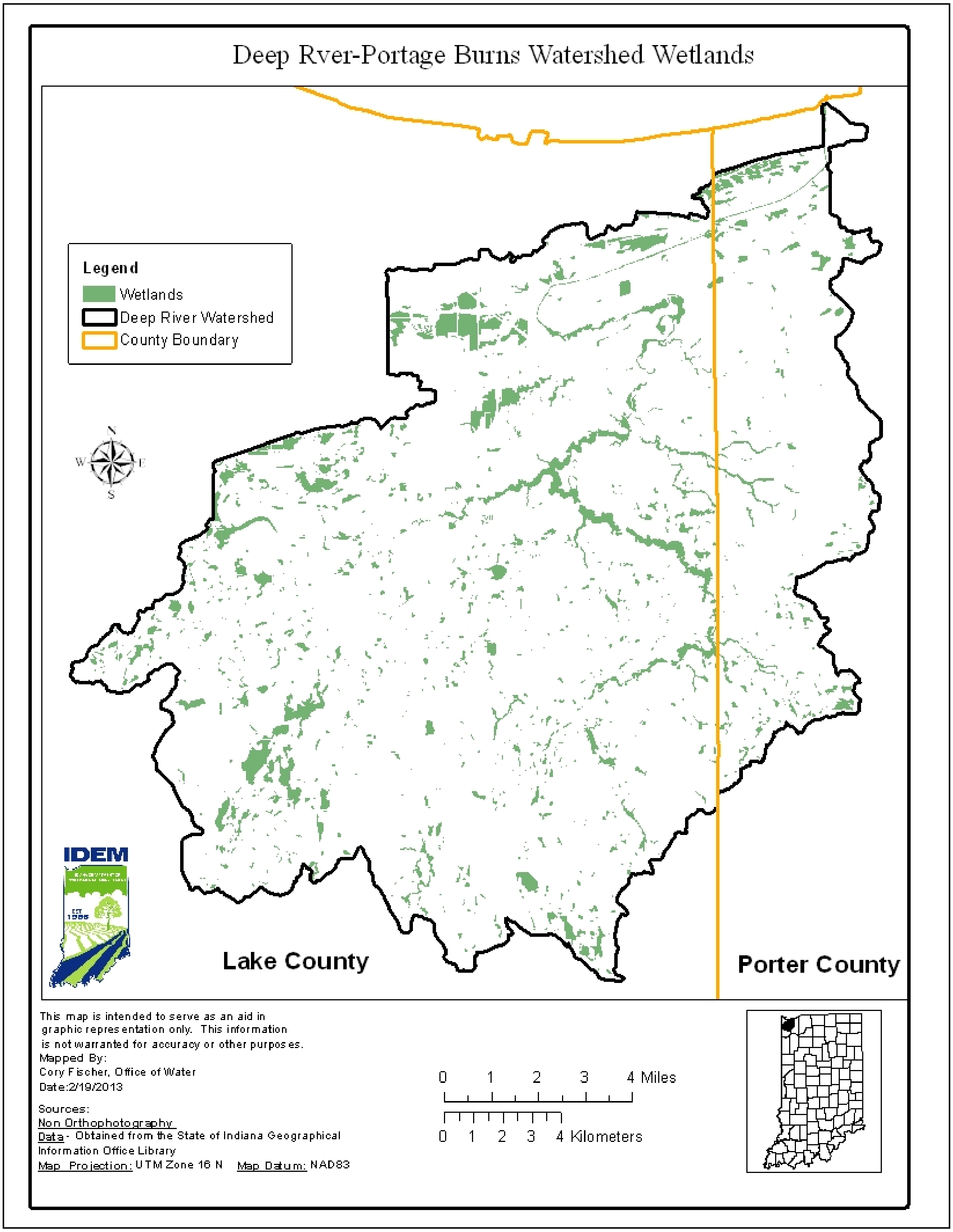


Figure 14. Locations of Wetlands in Deep River-Portage Burns Watershed

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, legal drains and ditches are other forms of hydromodification. In the Deep River-Portage Burns watershed, there are approximately three legal ditches under the jurisdiction of the Lake County Drainage Board.

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 land (HEL) units for each county based upon the potential of soil units to erode from the land. Highly erodible lands 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 highly erodible land 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 Deep River-Portage Burns watershed are listed by county in Table 11. Highly erodible land and potentially highly erodible land in the Deep River-Portage Burns watershed are mapped in Figure 15. The data used to create Figure was collected from the NRCS offices of Lake and Porter counties. A total of 30,114 acres or 26 percent of the Deep River-Portage Burns watershed is considered highly erodible or potentially highly erodible. Rainfall within the Deep River-Portage Burns watershed is moderately heavy with an annual average of 39-40 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 11. HEL/Potential HEL by County in the Deep River-Portage Burns Watershed

County	Map Unit	HES/Potential HES Soil Types	Acres
Lake	Bp	Borrow pits	296
	Cp	Clay pits	14
	DoB	Door loam	93
	DrB	Door loam, silty clay loam substratum	53
	LyB	Lydick loam	21
	MaB2	Markham silt loam	3,968
	MuD2	Morley silt loam	13,960
	MvB3	Morley silty clay loam	2,970
	OaE	Oakville fine sand	103
	OsA	Oshtemo fine sandy loam	493
	PlB	Plainfield fine sand	322
	TcC	Tracy loam	547
	TrB	Tracy loam, silty clay loam substratum	84
		Total	**22,924**
Porter	BaA	Blount silt loam	665
	ChB	Chelsea fine sand	151
	LyB	Lydick loam	12
	McB	Markham silt loam	980
	MfA	Martinsville loam	13
	MrD2	Morley silt loam	3,003
	MsC3	Morley silty clay loam	42
	OaE	Oakville fine sand	1,373
	Pk	Pits	16
	RaC2	Rawson loam	75
	RmC2	Riddles loam	113
	RlB	Riddles silt loam	215
	TcD	Tracy sandy loam	481
	UcG	Udorthents, loamy	81
		Total	**7,220**

Understanding Table 11: In the Deep River-Portage Burns watershed, Lake County has the most acreage of HEL/potential HEL. 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.

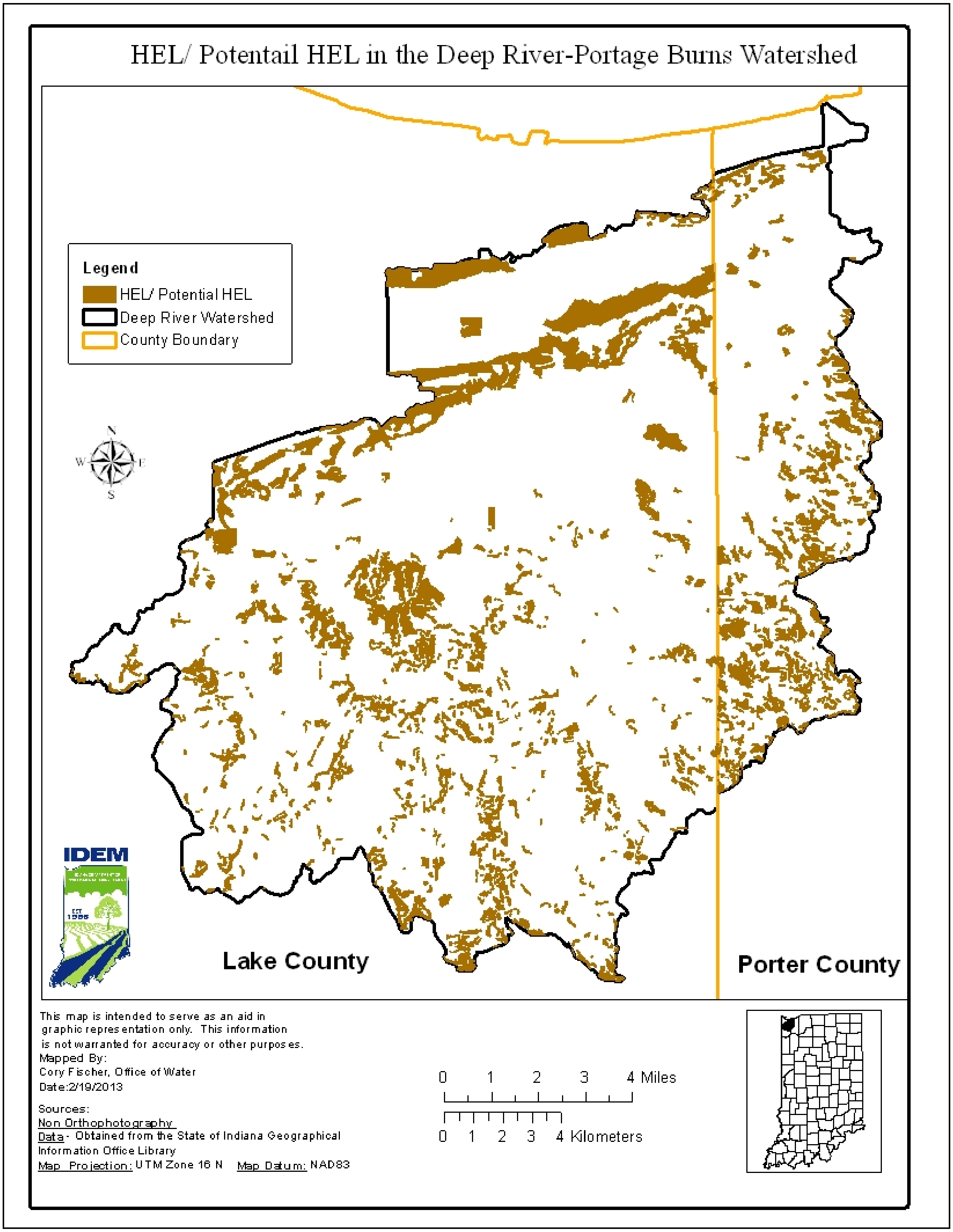


Figure 15. HEL/Potential HEL Soils in the Deep River-Portage Burns Watershed

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 Deep River-Portage Burns watershed are shown in Table 12. 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. Conventional tillage is any tillage system leaving less than 15 percent residue cover after planting.

Table 12. Tillage Transect Data for 2013 by County in the Deep River-Portage Burns Watershed

County	Tillage Practice 2013							
	No Till		Mulch Till		Reduced Till		Conventional Till	
	Soybean	Corn	Soybean	Corn	Soybean	Corn	Soybean	Corn
Lake	29,100 ac. 58%	12,700 ac. 20%	14,100 ac. 28%	8,900 ac. 14%	4,500 ac. 9%	12,100 ac. 19%	2,500 ac. 5%	29,200 ac. 46%
Porter	23,300 ac. 48%	3,500 ac. 5%	19,400 ac. 40%	14,800 ac. 21%	3,400 ac. 7%	21,200 ac. 30%	2,400 ac. 5%	31,000 ac. 44%

Understanding Table 12: According to Table 12, in the Deep River-Portage Burns watershed no-till is predominant in both counties for soybeans and conventional till is predominant for corn.

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 121940 located in Crown Point, Indiana were used for climate analysis of the Deep River-Portage Burns watershed. Monthly data from 1992 - 2012 were available at the time of analysis. From 1992 to 2012, the average winter temperature in Crown Point was 37°F and the average summer temperature was 82°F. The average growing season (consecutive days with low temperatures greater than or equal to 32 degrees) is 160 days.

Examination of precipitation patterns is also a key component of watershed characterization because of the impact of runoff on water quality. From 1992 to 2012, the annual average precipitation in Crown Point at Station 121940 was approximately 39 inches, including approximately 17 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 Deep River-Portage Burns watershed. Using data from 121940 during 1992 to 2012, 47 percent of the measureable precipitation events were very low intensity (i.e., less than 0.2 inches), while nine percent of the measurable precipitation events were greater than one inch.

Knowing when precipitation events occur helps in the linkage analysis (Section 7), which correlates flow conditions to pollutant concentrations and loads. Data indicates that the wet weather season in the Deep River-Portage Burns watershed occurs between the months of April and August. Precipitation/ Rainfall graphs can be found for all sampling sites in Appendix B.

3.7 Summary

The information presented in Section 3 helps to provide a better comprehensive understanding of the conditions and characteristics in the Deep River-Portage Burns watershed that, when coupled with the sources presented in Section 4, affect both water quality and water quantity. In summary, the predominant land uses in the Deep River-Portage Burns watershed of developed land and agriculture serve as indicators as to the type of sources that are likely to contribute to water quality impairments in the Deep River-Portage Burns watershed. Human population, which is greatest in Lake County in the Deep River-Portage Burns 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 Deep River-Portage Burns watershed. These features interact with land use activities and human population to create pressures on both water quality and quantity in the Deep River-Portage Burns 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 Deep River-Portage Burns watershed in order to present a source assessment specific to the Deep River-Portage Burns watershed as well as summaries of significant sources of *E. coli*, nutrients, and TSS for each subwatershed within the Deep River-Portage Burns watershed.

4.1 Understanding Subwatersheds and Assessment Units

As briefly discussed in Section 2.3, the Deep River-Portage Burns watershed contains nine 12-digit HUC subwatersheds. Examining subwatersheds enables a closer look at key factors that affect water quality. The subwatersheds include (Figure 5):

- Headwaters of Main Beaver Dam Ditch (040400010501)
- Main Beaver Dam Ditch (040400010502)
- Headwaters of Turkey Creek (040400010503)
- Deer Creek (040400010504)
- City of Merrillville (040400010505)
- Duck Creek (040400010506)
- Lake George (040400010507)
- Little Calumet River (040400010508)
- Willow Creek (040400010509)

Within each 12-digit HUC subwatershed, IDEM has identified several Assessment Units (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 assessment unit identification (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 13 contains the AUIDs in the subwatersheds of the Deep River-Portage Burns watershed and the associated drainage area. Subsequent sections of the TMDL report organize information by subwatershed (if applicable) and AUID.

Table 13. Assessment Units in Deep River-Portage Burns Watershed

Name of Subwatershed	12-digit HUC	Current AUID 2012	Length Miles	Area (sq. miles)	Percent of Total Watershed Area
Headwaters of Main Beaver Dam Ditch	040400010501	INC0151_01	8.27	18.28	10.17%
		INC0151_T1001	6.82		
		INC0151_T1002	3.65		
		INC0151_T1003	3.26		
Main Beaver Dam Ditch	040400010502	INC0152_04	10.87	26.27	14.61%
		INC0152_T1007	2.02		
		INC0152_T1008	7.50		
		INC0152_T1009	11.89		
		INC0152_T1010	4.90		
		INC0152_T1011	3.51		
		INC0152_P1001	0.14		
Headwaters of Turkey Creek	040400010503	INC0153_01	9.70	21.23	11.81%
		INC0153_T1001	4.14		
		INC0153_T1002	3.70		
		INC0153_T1003	5.06		
		INC0153_T1004	3.70		
		INC0153_T1005	4.92		
Deer Creek	040400010504	INC0154_01	10.16	21.45	11.93%
		INC0154_T1001	11.31		
		INC0154_T1002	3.09		
		INC0154_T1003	12.28		
		INC0154_T1004	6.93		
		INC0154_T1005	10.26		
City of Merrillville	040400010505	INC0155_01	7.07	19.51	10.85%
		INC0155_01A	0.81		
		INC0155_T1001	2.00		
		INC0155_T1002	8.69		
		INC0155_T1003	4.16		
		INC0155_T1003A	1.04		
		INC0155_P1001	0.46		
		INC0155_P1002	0.51		
Duck Creek	040400010506	INC0156_01	7.27	15.83	8.81%
		INC0156_T1001	3.57		
		INC0156_T1002	3.98		
		INC0156_T1003	3.01		
		INC0156_T1004	1.80		
		INC0156_01A	3.51		
		INC0156_01B	0.63		
		INC0156_01C	0.40		
		INC0156_01D	0.51		
		INC0156_01E	1.09		

Name of Subwatershed	12-digit HUC	Current AUID 2012	Length Miles	Area (sq. miles)	Percent of Total Watershed Area
Lake George	040400010507	INC0157_01	16.02	17.30	9.62%
		INC0157_01A	0.83		
		INC0157_01B	1.11		
		INC0157_P1001	3.99		
		INC0157_T1001	2.47		
		INC0157_T1002	13.45		
		INC0157_T1003	0.75		
		INC0157_T1004	0.45		
		INC0157_T1005	1.14		
Little Calumet River	040400010508	INC0158_01	9.02	18.97	10.55%
		INC0158_T1001	1.04		
		INC0158_T1002	3.25		
		INC0158_T1003	0.89		
		INC0158_T1004	1.85		
		INC0158_T1005	6.09		
		INC0142_T1009	3.98		
Willow Creek	040400010509	INC0159_01	15.44	20.93	11.64%
		INC0159_T1001	11.02		
		INC0159_02	1.28		

Understanding Table 13: Land area helps IDEM to define the pollutant load reductions needed for each AU in each 12-digit HUC subwatershed that comprises the Deep River-Portage Burns watershed. Information in each column is as follows:

- *Column 1: Name of Subwatershed.* Lists the name of the subwatersheds.
- *Column 2: 12-digit HUC.* Identifies the subwatershed 12-digit HUC.
- *Column 3: Current AUID.* Provides the updated AUIDs associated with each subwatershed.
- *Column 4: Area.* Quantifies the area of the subwatershed.
- *Column 5: Percent of Total Watershed Area.* Indicates the percent of the total area, providing a relative understanding of the portion of the AUIDs in the overall Deep River-Portage Burns watershed.

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 Sections 5, 6, and 7 of this report. This table will help watershed stakeholders look at the smaller segments within the Deep River-Portage Burns 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 TSS in the nine subwatersheds of the Deep River-Portage Burns 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: confined feeding operations (which are places where animals are confined and fed); storm water runoff from Municipal Separate Storm Sewer Systems (MS4s); and illicitly connected "straight pipe" discharges of household waste. Permitted point sources are regulated through the National Pollutant Discharge Elimination System (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, failing or straight-piped septic systems, and wildlife.

4.2.1 Deep River- Portage Burns Subwatershed Summary

This section of the report presents the available information on the sources of *E. coli*, nutrients, and TSS in the Deep River- Portage Burns subwatersheds.

Table 14. Land Use in the Deep River- Portage Burns Subwatersheds

Subwatershed	Area	Land Use							Total
		Agriculture	Developed	Forest	Hay/ Pasture	Shrub/ Scrub	Open Water	Wetlands	
Headwaters of Main Beaver Dam Ditch (040400010501)	Acres	2,957	4,533	1,105	576	1,437	87	1,005	11,699
	Sq. Mi.	4.62	7.08	1.73	0.90	2.25	0.14	1.57	18.28
	Percent	**25.27**	**38.75**	**9.45**	**4.92**	**12.29**	**0.74**	**8.59**	**100**
Main Beaver Dam Ditch (040400010502	Acres	7,241	4,978	1,096	1,277	1,374	45	801	16,812
	Sq. Mi.	11.31	7.78	1.71	2.00	2.15	0.07	1.25	26.27
	Percent	**43.07**	**29.61**	**6.52**	**7.60**	**8.17**	**0.27**	**4.76**	**100**
Headwaters of Turkey Creek (040400010503)	Acres	1,794	7,380	1,201	372	1,663	111	1,063	13,585
	Sq. Mi.	2.80	12	1.88	0.58	2.60	0.17	1.66	21.23
	Percent	**13.20**	**54.33**	**8.84**	**2.74**	**12.24**	**0.82**	**7.83**	**100**
Deer Creek (040400010504)	Acres	4,625	2,187	1.920	1,650	2,103	131	1,118	13,735
	Sq. Mi.	7.223	3.42	3.00	2.58	3.29	0.21	1.75	21.46
	Percent	**33.68**	**15.93**	**13.98**	**12.01**	**15.31**	**0.96**	**8.14**	**100**
City of Merrillville (040400010505)	Acres	1,405	7,887	840	167	1,162	121	901	12,482
	Sq. Mi.	2.19	12.32	1.31	0.26	1.82	0.19	1.41	19.50
	Percent	**11.25**	**63.19**	**6.73**	**1.34**	**9.31**	**0.97**	**7.22**	**100**
Duck Creek (040400010506)	Acres	4,285	1,906	948	1,160	1,124	34	673	10,130
	Sq. Mi.	6.70	2.98	1.48	1.81	1.76	0.05	1.05	15.83
	Percent	**42.30**	**18.82**	**9.36**	**11.46**	**11.09**	**0.33**	**6.65**	**100**
Lake George (040400010507)	Acres	2,418	3,567	1,157	975	1,719	235	1,003	11,073
	Sq. Mi.	378	5.57	1.81	1.52	2.69	0.37	1.57	17.30
	Percent	**21.84**	**32.22**	**10.45**	**8.80**	**15.52**	**2.12**	**9.06**	**100**

Little Calumet River (040400010508)	Acres	470	8,855	735	50	832	137	1,061	12,140
	Sq. Mi.	0.73	13.84	1.15	0.08	1.30	0.21	1.66	18.97
	Percent	**3.87**	**72.95**	**6.05**	**0.41**	**6.85**	**1.12**	**8.74**	**100**
Willow Creek (040400010509)	Acres	2,605	7,524	1,035	163	801	136	1,127	13,391
	Sq. Mi.	4.07	11.76	1.62	0.25	1.25	0.21	1.76	20.92
	Percent	**19.45**	**56.18**	**7.73**	**1.22**	**5.98**	**1.02**	**8.42**	**100**

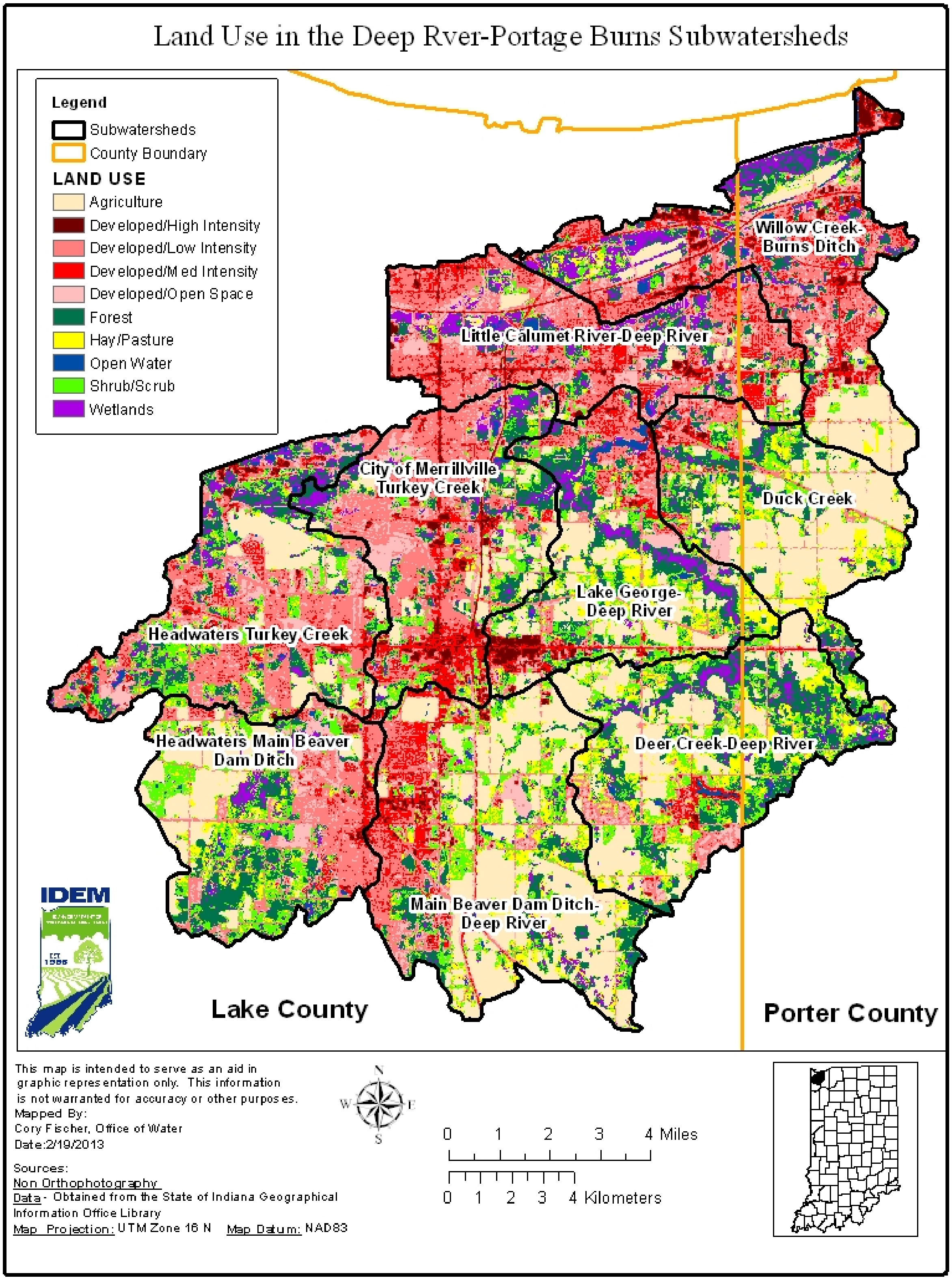


Figure 16. Land Use in the Deep River- Portage Burns Subwatersheds

Point Sources

This section summarizes the potential point sources of *E. coli*, nutrients, and TSS in the Deep River-Portage Burns watershed, as regulated through the National Pollutant Discharge Elimination System (NPDES) Program.

Wastewater Treatment Plants (WWTPs)

Wastewater treatment facilities have NPDES permits to discharge wastewater within the Deep River-Portage Burns watershed. There are seven active WWTPs that discharge wastewater containing *E. coli*, nutrients, and TSS within the Deep River- Portage Burns watershed (Table 15 and Figure 17). As authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating WWTPs that discharge pollutants into waters of the United States.

Municipal facilities in Indiana are required to disinfect their effluent during the recreational season (April 1 to October 31). Table 16 contains the maximum design flow for the active facilities.

Treated municipal sewage is a point source of phosphorus. WWTPs may release water with elevated concentrations of phosphorus into streams. As discussed in Section 1.1, the target value for total phosphorus is 0.30 mg/L. This target value is used to establish potential permit limits. Phosphorus is interpreted as an average in the NPDES permits. Monitoring data, reviewed by IDEM during the TMDL development process, indicated that when WWTPs were in compliance with their individual permit limit for phosphorus (1.0 mg/L), the in-stream target for phosphorus (0.30 mg/L) was typically met.

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 (30 mg/l) is set at the WWTP's permit effluent limit for TSS.

The City of Crown Point currently owns and operates a Class III, 5.2 MGD conventional activated sludge treatment facility with primary and secondary clarification, phosphorus removal, mixed media filters and ultraviolet light disinfection. Biosolids are anaerobically treated to a Class B product, dewatered via a belt filter press and disposed of through a permitted land application program The effluent limits contained in the permit are based on an effluent peak design flow of 8.1 MGD in accordance with IDEM's CSO policy to allow for the maximization of flow through the treatment facility in accordance with 327 IAC 5-2-11.6(g) (2). The collection system is comprised of combined sanitary and storm sewers with five Combined Sewer Overflow (CSO) locations. The CSO locations have been identified and permitted with provisions in Attachment A of their permit. The facility discharges into Main Beaver Dam Ditch via outfall 001. The receiving water has a seven day, ten year low flow ($Q_{7,10}$) of zero cubic feet per second at the outfall location. There is no significant industrial flow into the City of Crown Point WWTP; the NPDES permit doesn't authorize the facility to accept industrial contributions until the permitee has provided IDEM with a characterization of the waste.

The Town of Winfield currently operates a Class II, 0.4 MGD activated sludge treatment facility consisting of a semi-cylindrical fine screen, an equalization influent basin, two-bioreactor basins, three secondary clarifiers, three final chlorine contact basins with fine bubble diffused post-aeration, dechlorination, phosphorus removal, an effluent flow meter, and one sludge holding tank. The collection system is comprised of 100% separate sanitary sewers be design with no overflow or bypass points. The facility discharges into an unnamed tributary to Deer Creek via Outfall 001. The receiving water has a seven day, ten year low flow ($Q_{7,10}$) of 0.0 cubic feet per second at the outfall location. There is no industrial flow into the WWTP; the NPDES permit doesn't authorize the facility to accept industrial contributions until the permitee has provided IDEM with a characterization of the waste.

The Deep River Water Park (IN0062596) is limited to pool filter backwash. Samples taken in compliance with the monitoring requirements in the permit shall be taken at a point representative of the discharge but prior to entry into the unidentified ditch into Deep River. The Deep River Water Park WWTP (IN0058378) currently operates a Class I, 0.030 MGD treatment facility consisting of two septic tanks, with two re-circulating sand filters containing eight submersible pumps that recirculate the inflow through the sand filters, chlorination/dechlorination facilities, and an effluent flow meter. The collection system is comprised of 100% separate sanitary sewers by design with now overflow or bypass points. The facility discharges into the Deep River to Burns Ditch via Outfall 001. The Deep River has a seven day, ten year low flow ($Q_{7,10}$) of 2.9 cubic feet per second (1.9 MGD) at the outfall location; this provides a dilution ratio of 63:1. There is no industrial flow into the WWTP; the NPDES permit doesn't authorize the facility to accept industrial contributions until the permitee has provided IDEM with a characterization of the waste.

The Chicagoland Christian Village WWTP currently operates a Class I, 0.05 MGD extended aeration type wastewater treatment plant consisting of a surge tank, a bar screen, a splitter box, two aeration basins, two primary clarifiers, three secondary clarifiers, a contact chamber, ultraviolet light disinfection, two digester, and an effluent flow meter. Final sludge is hauled offsite for disposal. The collection system is comprised of 100% separate sanitary sewers be design with no overflow or bypass points. The facility discharges to an on-site lake via Outfall 001. The on-site lake flows to an unnamed tributary of Deer Creek. The receiving water has a seven day, ten year low flow ($Q_{7,10}$) of 0.0 cubic feet per second at the outfall location. There is no industrial flow into the WWTP; the NPDES permit doesn't authorize the facility to accept industrial contributions until the permitee has provided IDEM with a characterization of the waste.

The Falling Waters Conservancy District WWTP currently operates a Class I, 0.214 MGD Intermittent Cycle Extended Aeration System (ICEAS) Sequential Batch Reactor (SBR) treatment facility consisting of ultraviolet light disinfection and an effluent flow meter. The collection system is comprised of 100% separate sanitary sewers be design with no overflow or bypass points. The facility discharges into an unnamed tributary to Deep River via Outfall 001. The receiving water has a seven day, ten year low flow ($Q_{7,10}$) of 0.0 cubic feet per second at the outfall location. There is no industrial flow into the WWTP; the NPDES permit doesn't authorize the facility to accept industrial contributions until the permitee has provided IDEM with a characterization of the waste.

The City of Hobart WWTP proposes to construct a wastewater treatment plant which would be a Class IV, 4.8 MGD facility with two equalization basins, microscreening, grit removal, extended aeration basins operated in conjunction with membrane filtration, chemical addition for pH and phosphorus control, ultraviolet light disinfection, and effluent reaeration. The collection system is comprised of 100% separate sanitary sewers be design with no overflow or bypass points. The facility discharges to the Deep River via Outfall 001. The receiving water has a seven day, ten year low flow ($Q_{7,10}$) of 5.8 cubic feet per second (3.7 MGD) at the outfall location. There are no plans for significant industrial flow into the WWTP; the NPDES permit doesn't authorize the facility to accept industrial contributions until the permitee has provided IDEM with a characterization of the waste.

The Portage Utility Service Facility WWTP currently operates a Class III, 4.95 MGD extended aeration wastewater treatments facility with a 12 MGD equalized flow treatment capacity and a 15 MGD peak hydraulic capacity. The treatment facility consists of two mechanical screens, two aerated grit chambers, two primary clarifiers, and Aqua Diamond cloth media filtration system, post-aeration, ultra violet light

(UV) disinfection and influent and effluent flow meters. Final solids are land applied under Land Application Permit No. INLA000076. The collection system is comprised of 100% sanitary sewers by design with one Sanitary Sewer Overflow (SSO) point. The SSO has been identified and prohibited in Attachment A of the permit. The facility discharges to Burns Ditch via outfall 001, Burns ditch has a seven day, ten year low flow ($Q_{7,10}$) of 7.2 cubic feet per second (4.7 MGD) at the outfall location. This provides a dilution ratio of receiving stream flow to treated effluent of 1:1.1. The permitee accepts industrial flow from Advanced Waste Services, Indiana Pickling and Processing Co., Meritex, Inc., MonoSol, Rx Melton, Monosol, Rx Ameriplex, NEO industries Inc., and Precoat Metals Division- Sequa Coatings Division.

Table 15. NPDES Permitted Wastewater Treatment Plants Discharging within the Deep River-Portage Burns Subwatersheds

Subwatershed	Facility Name	Permit Number	AUID	Receiving Stream	Maximum Design Flow (MGD)
Headwaters of Main Beaver Dam Ditch	Crown Point WWTP	IN0025763	INC0151_01	Main Beaver Dam Ditch	8.1
Main Beaver Dam Ditch	NA	NA	NA	NA	NA
Headwaters of Turkey Creek	NA	NA	NA	NA	NA
Deer Creek	Winfield WWTP	IN0058343	INC0154_T1001	Unnamed Tributary to Deer Creek	0.4
	Deep River Water Park WWTP	IN0058378	INC0154_01	Deep River	0.030
	Chicagoland Christian Village	IN0054470	INC0154_T1001	Unnamed Tributary to Deer Creek	0.05
	Falling Waters Conservancy District	IN0062090	INC0154_T1004	Unnamed Tributary to Deep River	0.124
City of Merrillville	NA	NA	NA	NA	NA
Duck Creek	NA	NA	NA	NA	NA
Lake George	NA	NA	NA	NA	NA
Little Calumet River	Hobart WWTP	IN0061344	INC0157_P1001	Deep River	4.8
Willow Creek	Portage Utility Service Facility WWTP	IN0024368	INC0159_01	Burns Ditch	4.95

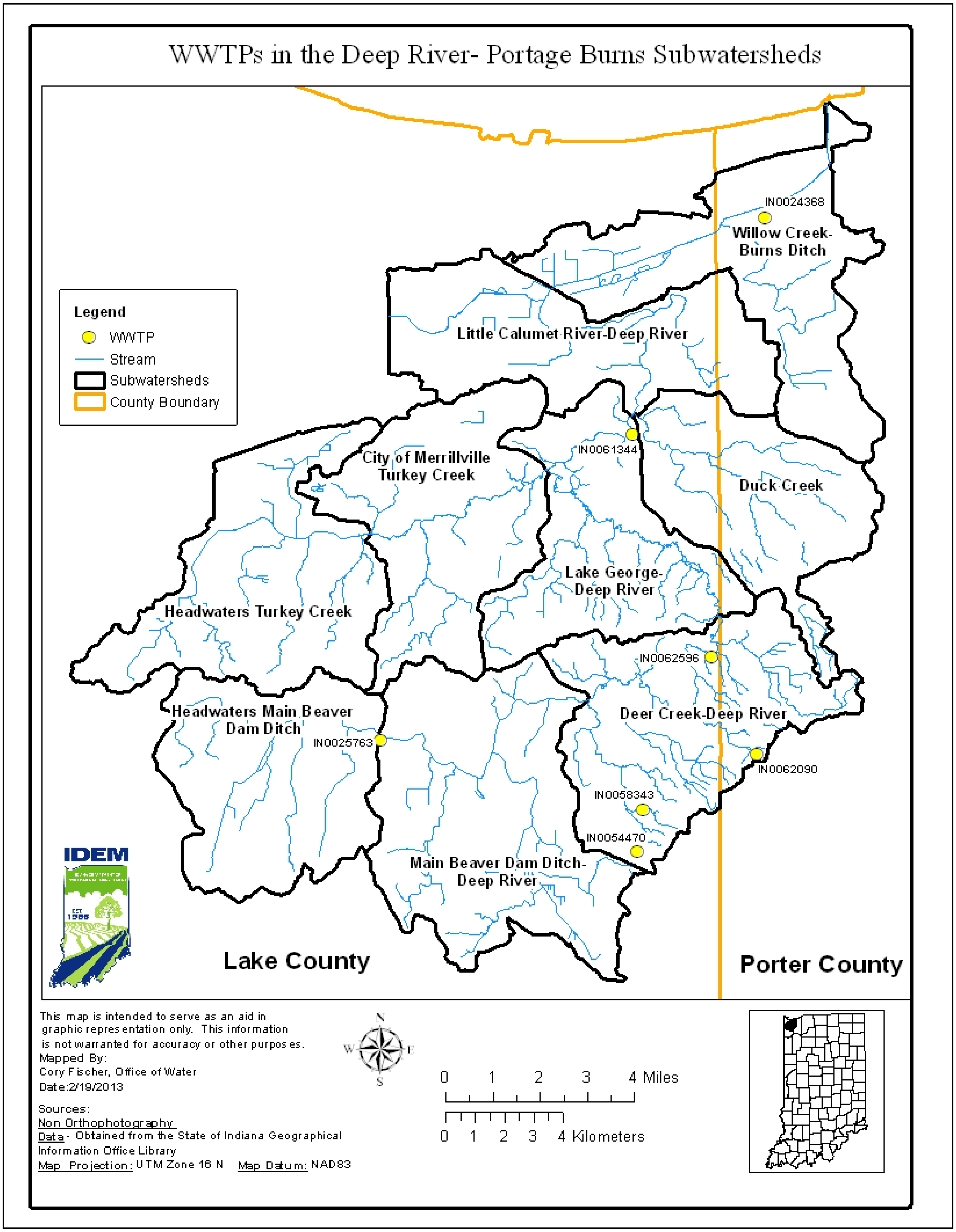


Figure 17. NPDES Permitted Wastewater Treatment Plants Discharging within the Deep River-Portage Burns Subwatersheds

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 and 15-10) 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.

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

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.

There are a total of 23 industrial facilities with NPDES permits within the Deep River- Portage Burns watershed (Table 16 and Figure 18).

Table 16. NPDES Permitted Industrial Facilities in the Deep River- Portage Burns Subwatersheds

Subwatershed	Facility Name	Permit Number	Receiving Stream
Headwaters Main Beaver Dam Ditch	Bulk Marathon 2108	ING080230	Main Beaver Dam Ditch
	Speedway LLC Store 6677	ING080263	Main Beaver Dam Ditch
Main Beaver Dam Ditch	Vesuvius USA Crown Point Plant	INR00B062	Main Beaver Dam Ditch
	East Chicago Machine Tool Corporation	INR00B085	Main Beaver Dam Ditch
	Conquest Ready Mix	INR00C073	Main Beaver Dam Ditch
	Crown Brick & Supply Inc.	INR210008	Main Beaver Dam Ditch
	US Gypsum Company	INR210155	Niles Ditch
	Illiana Disposal and Recycling	INR800146	Main Beaver Dam Ditch
Headwaters of Turkey Creek	Calumet Bus Service Inc.	INR00C114	Unnamed Tributary to Turkey Creek
	Laketon Refining Corporation	INR00L018	Unnamed Tributary to Turkey Creek
	American Chemical Service Inc.	INR230064	Unnamed Tributary to Turkey Creek
	Wild Bills Incorporated	INR600286	Unnamed Tributary to Turkey Creek
	Travel Centers of America	INR700040	Unnamed Tributary to Turkey Creek
	Griffith Merrillville Airport	INR800012	Unnamed Tributary to Turkey Creek
	Walsh and Kelly Incorporated	INRM00438	Unnamed Tributary to Turkey Creek
Deer Creek	NA	NA	NA
City of Merrillville	CHNUPA & Hoffman Corp. Nummies Auto Parts	INR00N049	Unnamed Tributary to Turkey Creek
	Frito Lay Incorporated	INRM00083	Unnamed Tributary to Turkey Creek
Duck Creek	NA	NA	NA
Lake George	NA	NA	NA
Little Calumet River	NA	NA	NA
Willow Creek	Precoat Metals Division Sequa	INR200111	Burns Ditch
	Steel Technologies LLC	INR200173	Little Calumet River
	Illiana Transfer 4	INR500030	Little Calumet River
	Pauls Auto Lake Station Yard	INRM00623	Little Calumet River
	NLMK- Indiana	IN0059714	Burns Ditch
	US Steel Corp Midwest Plant	IN0059714	Burns Ditch

ING are General Permits
INR are Storm water permits

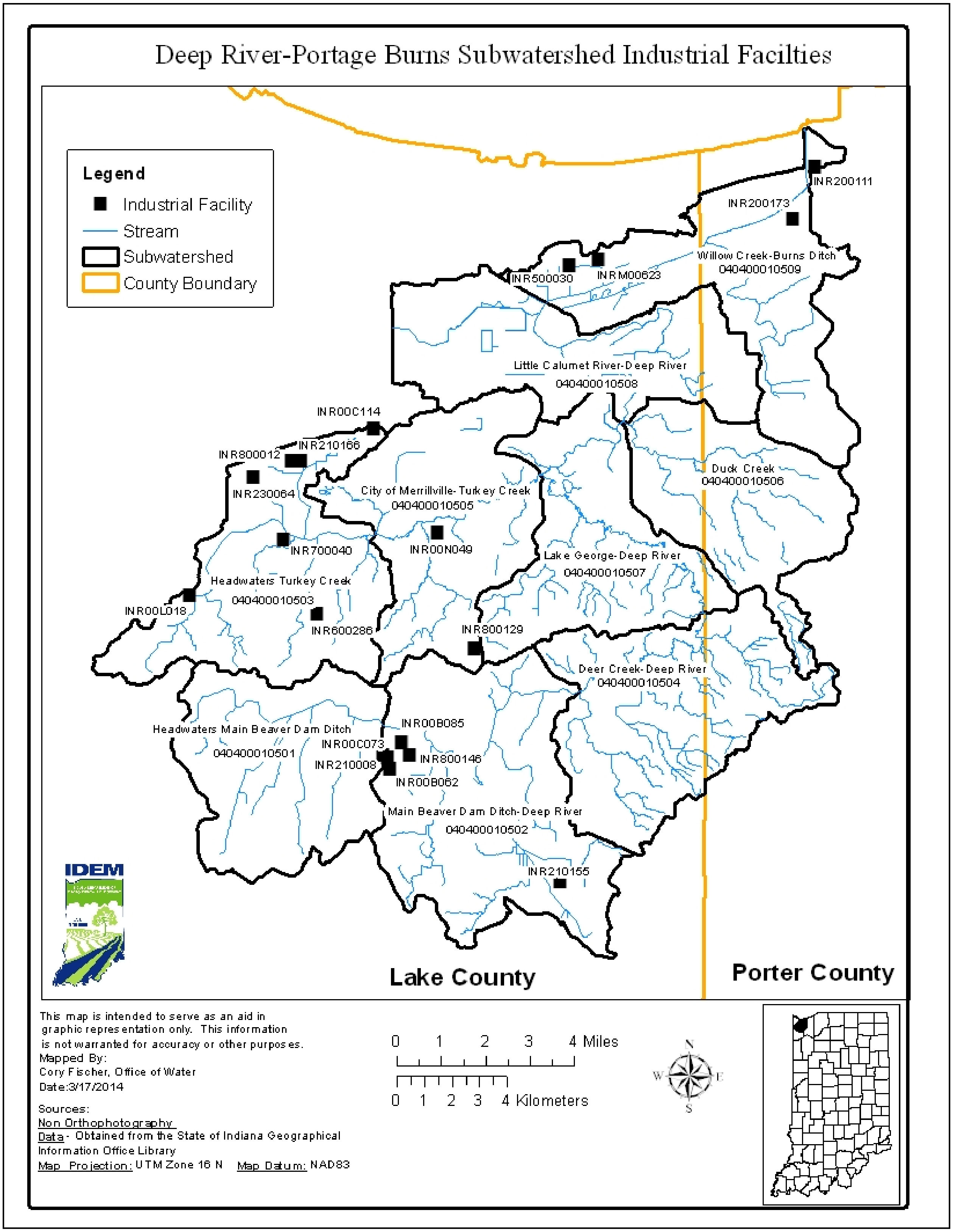


Figure 18. NPDES Industrial Facilities in the Deep River- Portage Burns Watershed

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. In Indiana most construction projects subject to Rule 5 are administered through a general permit. 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.

Rule 5 requires the development of a construction plan. 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. Secondly, 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 17 were calculated by using an area weighted approach with using the past five years of permitted construction sites in Lake and Porter County.

Table 17. Permitted Construction Acreage in the Deep River- Portage Burns Subwatersheds

Subwatershed	Estimated Construction Acreage
Headwaters of Main Beaver Dam Ditch	23.46
Main Beaver Dam Ditch	33.70
Headwaters Turkey Creek	27.25
Deer Creek- Deep River	22.70
City of Merrillville- Turkey Creek	25.04
Duck Creek	12.47
Lake George- Deep River	21.77
Little Calumet River- Deep River	22.28
Willow Creek- Burns Ditch	16.51

Table 18 presents a summary of permit compliance for all NPDES facilities in the Deep River- Portage Burns watershed for the five year period between 2010 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 18, there have been 31 NPDES facility inspections resulting in violations in the five year period. Overall, there are a total of 52 permit violations for the NPDES permitted parameters in the Deep River- Portage Burns watershed.

Table 18. Summary of Inspections and Permit Compliance in the Deep River- Portage Burns Watershed

Subwatershed	Facility Name	Permit Number	Stream	Date of Inspection for the Last Five Years	Violations for the Last Five Years				
					Month	Year	Parameter	Type	# violations
Headwaters of Main Beaver Dam Ditch	Crown Point	IN0025763	Main Beaver Dam Ditch	8/25/2009: No Violations 2/24/2010: No Violations 9/24/2010: No Violations 8/10/2011: Potential Problems Observed 1/30/2012: Potential Problems Observed 9/27/2013: No Violations 1/3/2014: Violations Observed 6/27/2014: Violations Observed (Phosphorus June 2013- May 2014)	Dec.	2010	TSS	Mx Wk Avg	1
					Jan.	2011	TSS	Mo. Avg	1
					Jan.	2011	TSS	Mx Wk Avg	1
					Feb.	2011	Copper	Mo. Avg	1
					Feb.	2011	Copper	D. Max	1
					July	2011	NH3-N	Mx Wk Avg	1
					July	2011	NH3-N	Mo. Avg	1
					Feb.	2011	Copper	D. Max	1
					Feb.	2011	Copper	Mo. Avg	1
					Jan.	2011	TSS	Mx Wk Avg	1
					Jan.	2013	TSS	Mx Wk Avg	1
					Jan.	2013	NH3-N	Mx Wk Avg	1
					Feb.	2013	NH3-N	Mx Wk Avg	1
					Apr.	2013	TSS	Mx Wk Avg	1
					Sep.	2013	Copper	Mo. Avg	1
					Oct.	2013	TSS	Mx Wk Avg	1
					Oct.	2013	Copper	Mo. Avg	1
					Nov.	2013	NH3-N	Mx Wk Avg	1
					Nov.	2013	NH3-N	Mo. Avg	1
Main Beaver Dam Ditch	NA	NA	NA	NA	NA				
Headwaters Turkey Creek	NA	NA	NA	NA	NA				
Deer Creek-Deep River	Winfield WWTP	IN0058343	Unnamed Tributary to Deer Creek	2/23/2010: Violations Observed 9/2/2010: No Violations Observed 1/3/2012: Violations Observed 2/6/2014: No Violations Observed	Sep	2011	TSS	Mx Wk Avg	1

	Deep River Water Park WWTP	IN0058378	Deep River	12/15/2010: Violations Observed 7/16/2012: No Violations Observed 6/7/2013: No Violations Observed 6/5/2014: No Violations Observed	Jan.	2010	NH3-N	Mo. Avg	1
					July	2010	NH3-N	Mo. Avg	2
					July	2010	NH3-N	Mx Wk Avg	2
					Aug.	2010	NH3-N	Mx Wk Avg	1
					Aug.	2010	NH3-N	Mo. Avg	1
					Aug.	2010	*E. coli*	D. Max	1
					May	2013	Chlorine	D. Max	3
City of Merrillville-Turkey Creek	Chicagoland Christian Village	IN0054470	Unnamed Tributary to Deer Creek	8/28/2010: Violations Observed 12/6/2010: No Violations Observed 11/15/2011: Violations Observed 6/21/2013: Violations Observed:(Referred to Enforcement) 11/14/2013: Violations Observed	May	2010	CBOD	Mx Wk Avg	1
					June	2010	*E. coli*	Mo. Avg	3
					June	2010	*E. coli*	Mo. Geo Mean	1
					Nov	2010	NH3-N	Mo. Avg	1
					April	2011	TSS	% removal	1
					June	2011	NH3-N	Mx Wk Avg	1
					June	2011	NH3-N	Mo. Avg	1
					July	2011	*E. coli*	D. Max	1
					July	2011	NH3-N	D. Max	2
					July	2011	NH3-N	Mo. Avg	1
					Aug.	2011	NH3-N	D. Max	1
					Aug.	2011	NH3-N	Mo. Avg	1
					Aug.	2011	*E. coli*	D. Max	1
					May	2012	*E. coli*	D. Max	1
					May	2012	NH3-N	Mo. Avg	1
					May	2012	NH3-N	Mx Wk Avg	1
					May	2012	NH3-N	Mo. Avg	1
					May	2012	NH3-N	Mx Wk Avg	1
					June	2012	*E. coli*	D. Max	3
					June	2012	*E. coli*	Mo. Geo Mean	1
					July	2012	*E. coli*	D. Ma	1
					Aug	2012	NH3-N	Mx Wk Avg	3
					Aug	2012	NH3-N	Mo. Avg	1
					Aug	2012	Phosphorus	Mo. Avg	1
					Sep	2012	NH3-N	Mx Wk Avg	1
					Sep	2012	NH3-N	Mo. Avg	1
	Falling Waters Conservancy District	IN0062090	Unnamed Tributary to Deep River	1/29/2010: No Violations Observed 1/25/2012: No Violations Observed 2/8/2013: Violations Observed 5/22/2014: Violations Observed	Jul.	2011	*E. coli*	D. Max	1
					Aug.	2011	*E. coli*	D. Max	1
					Apr.	2012	*E. coli*	D. Max	2
					May.	2012	*E. coli*	D. Max	1
					May.	2012	NH3-N	Mx Wk Avg	1
					Jun.	2012	NH3-N	Mx Wk Avg	1
					Aug.	2013	*E. coli*	D. Max	1
Duck Creek	NA	NA	NA	NA	NA				
Lake George-Deep River	NA	NA	NA	NA	NA				

Lake George-Deep River	NA	NA	NA	NA	NA				
Little Calumet River- Deep River	Hobart WWTP	IN0061344	Deep River	3/31/2010: Violations Observed 4/5/2010: Violations Observed 6/15/2011: Violations Observed:(Referred to Enforcement)	NA	NA	NA	NA	NA
Willow Creek-Burns Ditch	Portage Utility Service Facility WWTP	IN0024368	Burns Ditch	4/27/2010: No Violations Observed 5/2/2011: No Violations Observed 6/12/2012: No Violations Observed 2/20/2013: Violations Observed	NA	NA	NA	NA	NA

Combined Sewer Overflows (CSOs)

CSO systems are sewers that are designed to collect rainwater runoff, domestic sewage, and industrial wastewater into the same pipe. Most of the time, combined sewer systems transport all of their wastewater to a sewage treatment plant, where it is treated and then discharged to a waterbody. During periods of heavy rainfall or snowmelt, the wastewater volume in a combined sewer system can exceed the capacity of the sewer system or treatment plant. For this reason, combined sewer systems are designed to overflow occasionally and discharge excess wastewater directly to nearby streams, rivers, or other water bodies. These overflows, called CSOs, can contain both storm water and untreated human and industrial waste, including pollutants such as *E. coli*, total nitrogen, total phosphorus, and TSS. Because they are associated with wet weather events, CSOs typically discharge for short periods of time at random intervals. IDEM regulates CSOs in Indiana through the state's NPDES program. Combined Sewer Overflows are point sources subject to both technology-based and water quality based requirements of the Clean Water Act and state law. The permitee is authorized to have wet weather discharges from outfalls listed in their permit. One key component of this program is locating all CSO outfalls for tracking purposes. There are two combined sewer systems in Deep River- Portage Burns Watershed operated by City of Crown Point and the City of Gary. There are nine CSO outfalls associated with these combined sewer systems shown in Table 19 and Figure 19.

Table 19. CSOs in the Deep River- Portage Burns Watershed

Subwatershed	Facility	Permit #	AUID	Outfall #	Pipe Description	Receiving Stream
Headwaters of Main Beaver Dam Ditch	Crown Point WWTP	IN0025763	INC0151_01	002	Treated CSO	Main Beaver Dam Ditch
				003	Untreated CSO	Main Beaver Dam Ditch
				005	Untreated CSO	Main Beaver Dam Ditch
				006	Untreated CSO	Main Beaver Dam Ditch
Main Beaver Dam Ditch	Crown Point WWTP	IN0025763	INC0152_04	004	Untreated CSO	Main Beaver Dam Ditch
Headwaters Turkey Creek	NA	NA	NA	NA	NA	NA
Deer Creek-Deep River	NA	NA	NA	NA	NA	NA
City of Merrillville-Turkey Creek	NA	NA	NA	NA	NA	NA
Duck Creek	NA	NA	NA	NA	NA	NA
Lake George-Deep River	NA	NA	NA	NA	NA	NA
Little Calumet River- Deep River	Gary Sanitary District WWTP	IN0022977	INC0142_T1009	004	Untreated CSO	Little Calumet River
				005	Untreated CSO	Little Calumet River
				013	Untreated CSO	Little Calumet River
				014	Untreated CSO	Little Calumet River
				015	Untreated CSO	Little Calumet River
Willow Creek-Burns Ditch	NA	NA	NA	NA	NA	NA

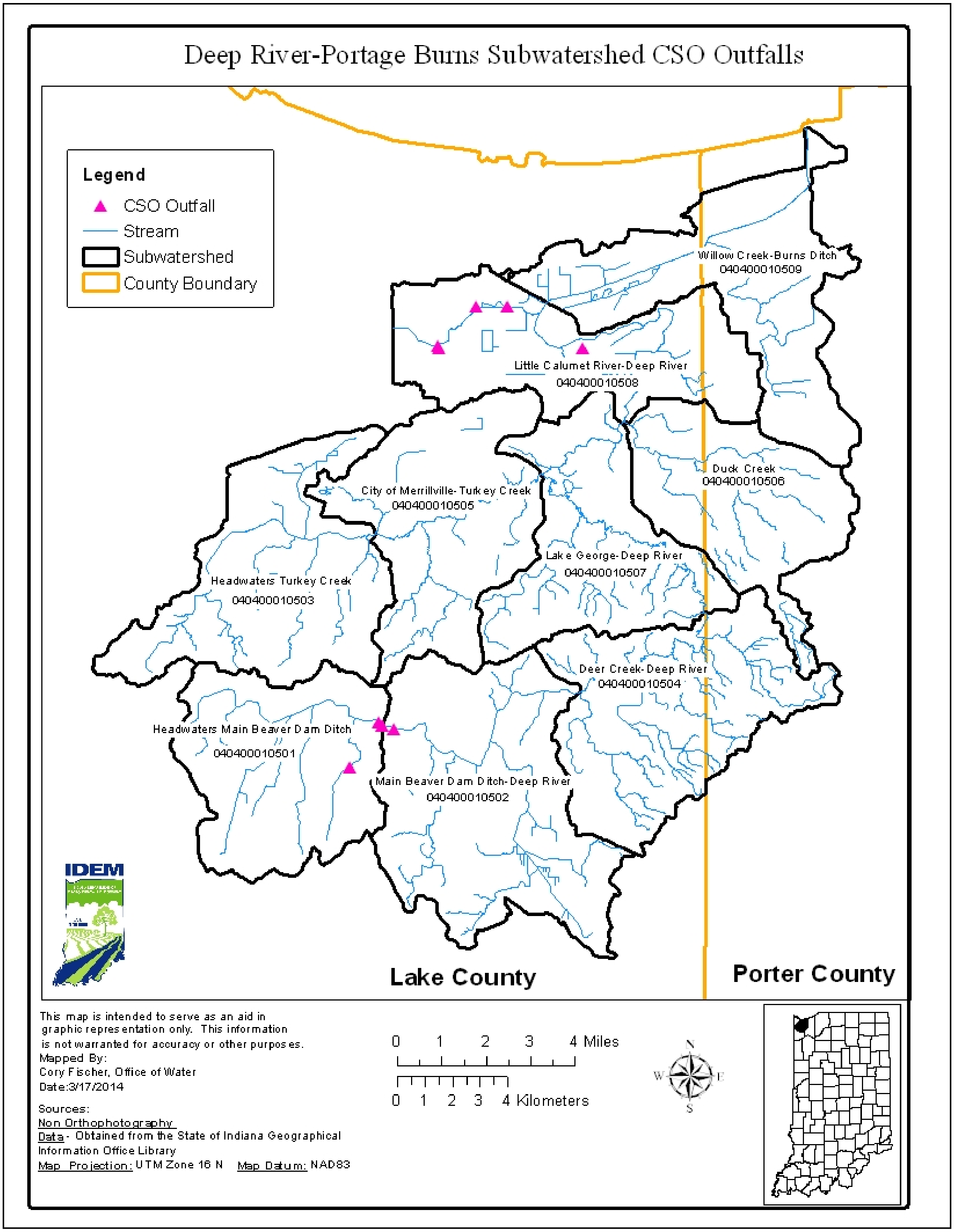


Figure 19. CSOs in the Deep River- Portage Burns Subwatersheds

Table 20 provides the number of CSO events per year in the Deep River-Portage Burns watershed by facility.

Table 20. Number of CSO Events per Year in the Deep River- Portage Burns Watershed

Subwatershed	Facility Name	Permit #	AUID	Outfall #	Number of CSO Events Per Year				
					2009	2010	2011	2012	2013
Headwaters of Main Beaver Dam Ditch	Crown Point WWTP	IN0025763	INC0151_01	002 003 004 005 006	10	10	20	5	15
Main Beaver Dam Ditch	NA	NA	NA	NA	NA	NA	NA	NA	NA
Headwaters Turkey Creek	NA	NA	NA	NA	NA	NA	NA	NA	NA
Deer Creek-Deep River	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Merrillville-Turkey Creek	NA	NA	NA	NA	NA	NA	NA	NA	NA
Duck Creek	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lake George-Deep River	NA	NA	NA	NA	NA	NA	NA	NA	NA
Little Calumet River- Deep River	Gary Sanitary District WWTP	IN0022977	INC0142_T1009	005 013 015 014	64	80	44	24	48
Willow Creek-Burns Ditch	NA	NA	NA	NA	NA	NA	NA	NA	NA

All CSOs in Indiana either have Long Term Control Plans (LTCPs) in place or are in the process of developing them, as required under their NPDES permits. The section below summarizes the requirements of the LTCPs and the expected completion date for each facility in the Deep River- Portage Burns Watershed.

The Indiana Department of Environmental Management (IDEM) has conducted a substantive review of the City of Crown Point's Long-Term Control Plan (LTCP), which was submitted to IDEM on September 3, 2002. A revision was submitted on May 29, 2013. The revision outlined that the City shall prioritize the removal of clear water from the system. Evaluate the resulting reduction of and flows to the WWTP and through the remaining active CSOs. Then appropriately size, if needed, a primary or secondary treatment/disinfection CSO facility for any remaining qualified CSO discharges at the WWTP (CSO 002) and properly quantify storage/transport and treat flows at CSOs 004 and 005. The current revised schedule started in May 2013 and has completion date of December 2018.

The City of Crown Point's approved CSOOP, LTCP and issued NPDES permit outline the wet weather operating procedures and design capabilities of the WWTP and CSO treatment facility. All CSO treatment facility wet weather discharges shall receive the specified treatment e to the extent possible. In conditions where wet weather discharges from CSO 002, 003, 004, and 005 result from a storm event, rainfall amount, or intensity which exceed the design capacity of the facility, the permitee shall provide documentation that all conditions and requirements expressed in their NPDES permit, including Attachment A, were achieved. All documentation regarding performance of the WWTP and the CSO treatment facility, during storm events identified above, would be reviewable by IDEM with exercise of enforcement discretion for discharges from CSO 002, 003, 004, and 005 accorded to it under IC 13-30 for these storm events. Based on this information, IDEM has determined that the plan is acceptable and formally approves the City of Crown Point's LTCP. The City of Crown Point must implement their approved LTCP consistent with the approved implementation schedule and consistent with the terms and conditions of Agreed Judgment Cause No. 49D06 07 09 CC 040349.

The City of Gary's LTCP is still in the consent decree stage with US EPA.

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 permitee is required to notify the Enforcement Section of the Office of Water Quality orally within 24 hours and in writing within 5 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.

The Merrillville Conservancy District operates a sewer collection system. The Merrillville Conservancy District transports wastewater to the Gary Sanitary District Wastewater Treatment Plant (WWTP). The wastewater collection system is 100% separate sanitary sewers by design with no bypass points and one Sanitary Sewer Overflow (SSO) point.

For discussion on the Portage Utility Service Facility WWTP, see the WWTP discussion in section 4.2.1 (page 59).

Two permitted site with two SSO locations were identified in the Deep River- Portage Burns watershed (Table 21, Figure 20).

Table 21. Sanitary Sewer Overflows in the Deep River- Portage Burns Subwatersheds

Subwatershed	Facility Name	Permit #	Type	AUID
Headwaters of Main Beaver Dam Ditch	NA	NA	NA	NA
Main Beaver Dam Ditch	NA	NA	NA	NA
Headwaters of Turkey Creek	NA	NA	NA	NA
Deer Creek- Deep River	NA	NA	NA	NA
City of Merrillville- Turkey Creek	Merrillville Conservancy District	INJ035548	Lift Station	INC0155_01
Duck Creek	NA	NA	NA	NA

Lake George- Deep River	NA	NA	NA	NA
Little Calumet River- Deep River	NA	NA	NA	NA
Willow Creek- Burns Ditch	Portage Utility Service Facility WWTP	IN0024368	Lift Station	INC0159_01

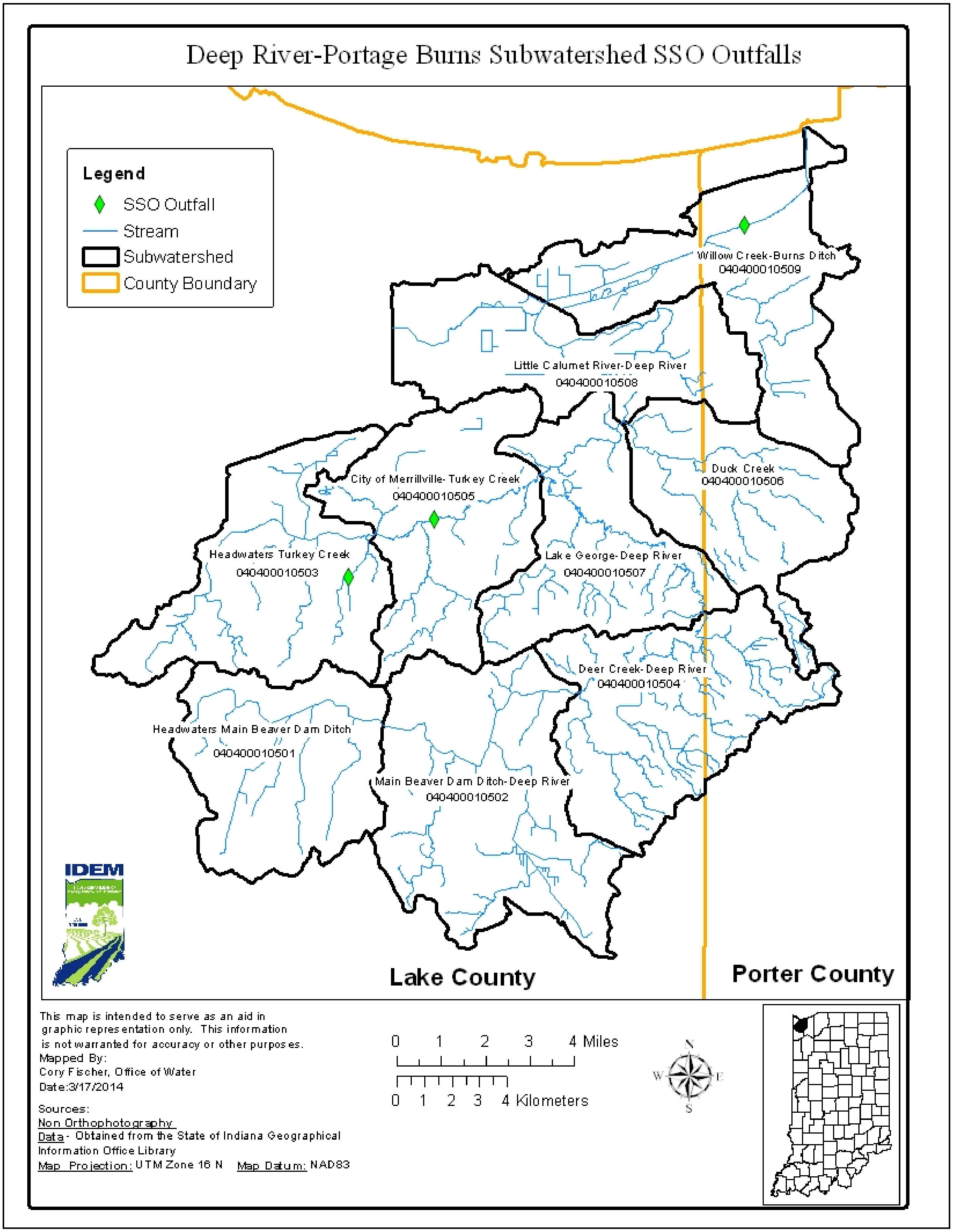


Figure 20. Sanitary Sewer Overflows in the Deep River- Portage Burns Subwatersheds

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 15 MS4 entities in the Deep River-Portage Burns Watershed subwatersheds as shown in Table 22 and Figure 21.

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 21 shows the MS4 boundaries in the Deep River-Portage Burns Watershed subwatersheds.

Table 22. Deep River- Portage Burns Watershed MS4 Communities

Subwatershed	MS4 Community	Permit ID	Area in Drainage (sq miles)
Headwaters of Main Beaver Dam Ditch	St John	INR040047	0.49
	Schererville	INR040112	0.02
	Merrillville	INR040049	0.20
	Crown Point	INR040054	3.87
	Cedar Lake	INR040075	0.15
	Lake County	INR040124	2.04
Main Beaver Dam Ditch	Merrillville	INR040049	0.97
	Crown Point	INR040054	5.53
	Lake County	INR040124	1.23
Headwaters Turkey Creek	St John	INR040047	0.98
	Schererville	INR040112	4.17
	Merrillville	INR040049	3.23
	Griffith	INR040108	0.72
	Crown Point	INR040054	0.03
	Lake County	INR040124	2.41
Deer Creek- Deep River	Merrillville	INR040049	0.49
	Lakes of the Four Seasons	INR040007	0.54
	Hobart	INR040130	0.04
	Porter County	INR040140	0.53
	Lake County	INR040124	1.77
City of Merrillville- Turkey Creek	Merrillville	INR040049	8.65
	Hobart	INR040130	1.28
	Gary	INR040101	1.83
	Lake County	INR040124	0.53
Duck Creek	Hobart	INR040130	1.94
	Porter County	INR040140	0.80
	Lake County	INR040124	0.18
	Portage	INR040090	0.04
Lake George-Deep River	Merrillville	INR040049	0.50
	Hobart	INR040130	4.73
	Porter County	INR040140	0.03
	Lake County	INR040124	0.24
Little Calumet River-Deep River	Gary	INR040101	5.48
	Hobart	INR040130	3.04
	Portage	INR040090	1.83
	Lake Station	INR040087	2.62
	New Chicago	INR040031	0.56
	Porter County	INR040140	0.10
	Lake County	INR040124	0.18
Willow Creek-Burns Ditch	Gary	INR040101	1.17
	Lake Station	INR040087	2.39
	Portage	INR040090	8.01
	Porter County	INR040140	0.14

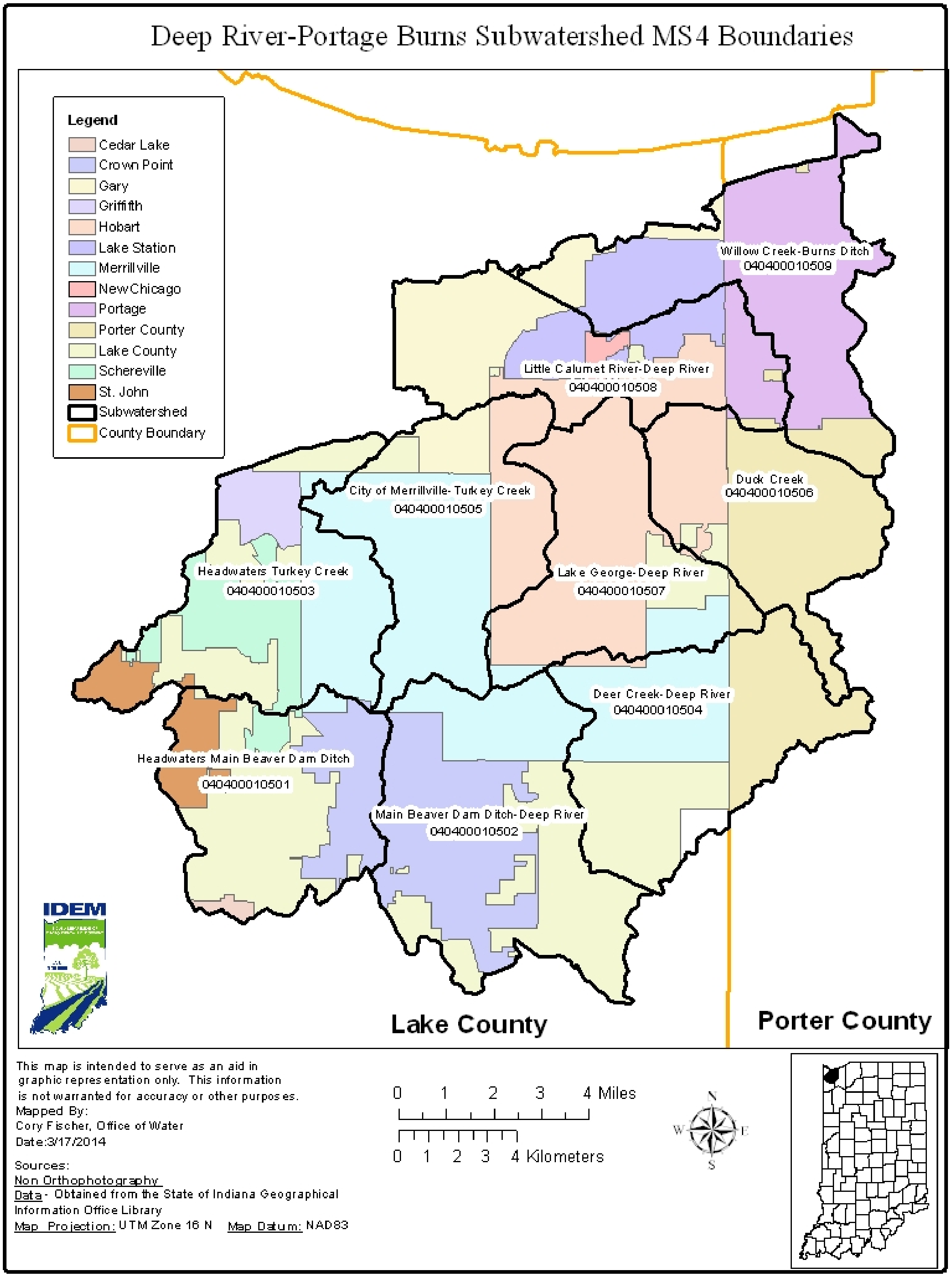


Figure 21. MS4 boundaries in the Deep River-Portage Burns Watershed

Illicitly Connected "Straight Pipe" Systems

Some household wastes within Indiana and potentially within the Deep River- Portage Burns 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 TSS in the Deep River-Portage Burns 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) 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 23.

Table 23. Major Cash Crop Acreage in the Deep River- Portage Burns watershed

Crop	Total Acreage in Deep River- Portage Burns Watershed by County	
	Lake	Porter
Corn	8,290	3,015
Soybean	9,327	3,102
Winter Wheat	203	328

Subwatershed Area (mi²)	Crop	Total Acreage	% of Subwatershed Cash Crop Acreage
Headwaters of Main Beaver Dam Ditch	Corn	1,447	61%
	Soybean	902	38%
	Winter Wheat	32	1%
	Total	**2,381**	**100%**
Main Beaver Dam Ditch	Corn	3153	49%
	Soybean	3195	50%
	Winter Wheat	33	1%
	Total	**6,381**	**100%**
Headwaters Turkey Creek	Corn	688	45%
	Soybean	848	54%
	Winter Wheat	3	1%
	Total	**1,539**	**100%**
Deer Creek- Deep River	Corn	1,580	41%
	Soybean	2,217	57%
	Winter Wheat	97	2%
	Total	**3,894**	**100%**
City of Merrillville- Turkey Creek	Corn	2,305	43%
	Soybean	2,946	56%
	Winter Wheat	49	1%
	Total	**5,300**	**100%**
Duck Creek	Corn	1,843	46%
	Soybean	2,088	52%
	Winter Wheat	51	1%
	Total	**3,982**	**100%**
Lake George-Deep River	Corn	955	41%
	Soybean	1314	57%
	Winter Wheat	54	2%
	Total	**2,323**	**100%**
Little Calumet River-Deep River	Corn	88	16%
	Soybean	455	83%
	Winter Wheat	**3**	1%
	Total	**546**	**100%**
Willow Creek- Burns Ditch	Corn	1073	52%
	Soybean	745	36%
	Winter Wheat	240	12%
	Total	**2,058**	**100%**

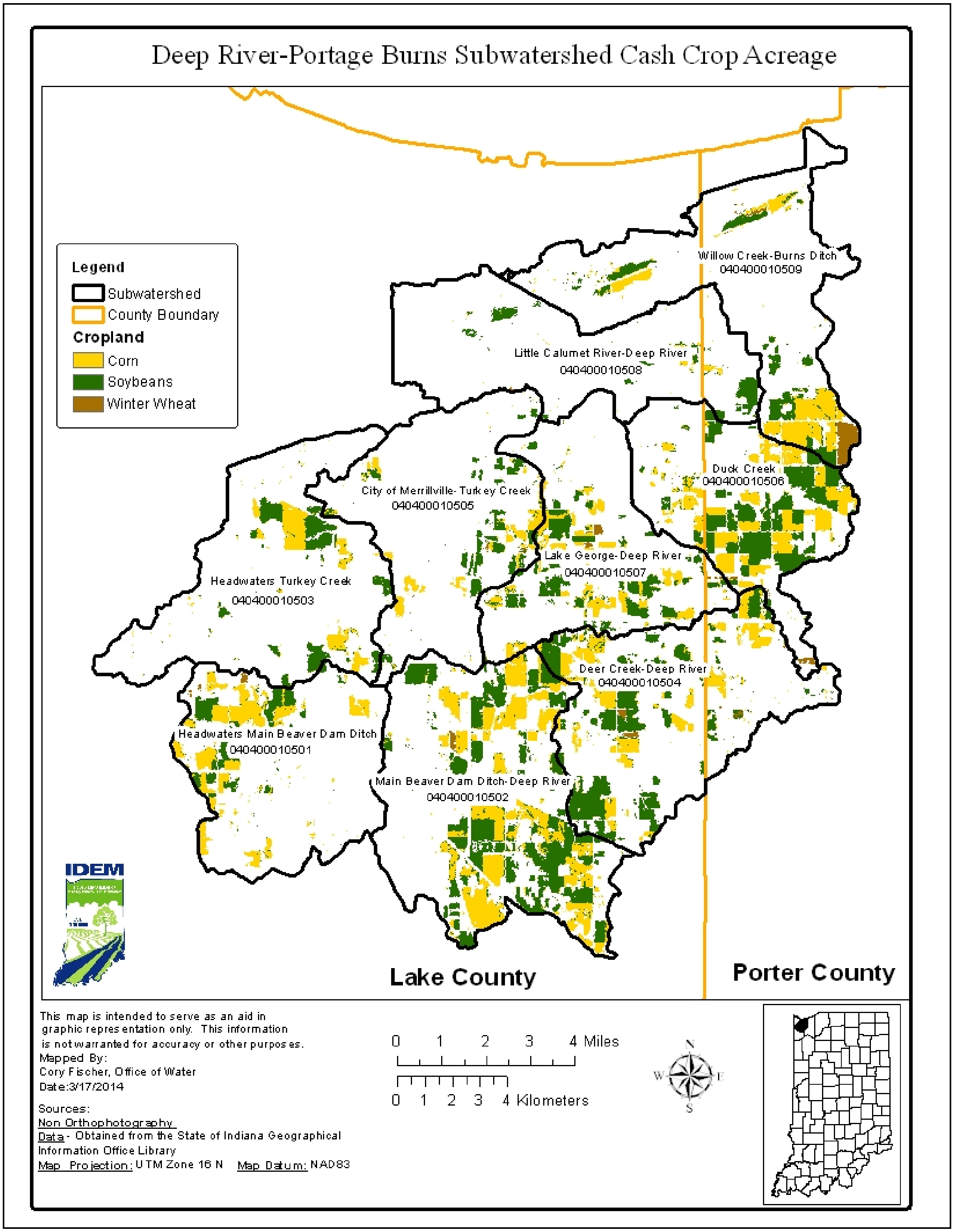


Figure 22. Cash Crop Acreage in the Deep River- Portage Burns watershed

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 potential source of *E. coli*, nutrients, and TSS 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 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 11,823 animal units in the Deep River- Portage Burns watershed and the animal unit density is 100 animal units per square mile as shown in Table 24.

Table 24. Animal Unit Density in the Deep River- Portage Burns 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									
Lake	2,767	2,400	639	2,400	652				
Porter	12,386	2,200	1,393	2,000	511				
Total Number of Animal Units in Subwatersheds									
	Headwaters Main Beaver Dam Ditch	Main Beaver Dam Ditch	Headwaters of Turkey Creek	Deer Creek	City of Merrillville	Duck Creek	Lake George	Little Calumet River	Willow Creek
Hogs and Pigs	40	58	47	188	43	140	44	69	184
Cattle and Calves	93	134	108	115	93	85	83	93	113
Sheep and Goats	1	1	1	3	2	2	2	2	3
Horses and Ponies	73	105	85	113	186	83	161	163	110
Poultry	1	1	1	1	1	1	1	1	1
Total	**208**	**299**	**242**	**420**	**325**	**311**	**290**	**328**	**411**
Animal Unit Density (animal units/mi²)	**11**	**11**	**11**	**20**	**17**	**20**	**17**	**17**	**20**

Streambank Erosion

Streambank erosion is potentially a significant source of TSS in the Deep River- Portage Burns 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 Deep River- Portage Burns 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 household 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 Deep River- Portage Burns subwatersheds are shown in Table 26, 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 Deep River- Portage Burns 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 illustrates the hydrologic soil groups for the Deep River- Portage Burns subwatersheds.

Table 25. Hydrologic Soil Groups in the Deep River- Portage Burns Subwatersheds

Subwatershed	Hydrologic Soil Group			
	A	B	C	D
Headwaters of Main Beaver Dam Ditch	8.56%	7.65%	83.03%	0.76%
Main Beaver Dam Ditch	5.49%	9.33%	84.89%	0.29%
Headwaters of Turkey Creek	16.00%	21.71%	62.30%	0%
Deer Creek	5.73%	10.61%	83.06%	0.60%
City of Merrillville	8.24%	19.92%	71.47%	0.38%
Duck Creek	1.47%	32.50%	65.83%	0.19%
Lake George	0.95%	25.04%	74.01%	0%
Little Calumet River	37.46%	36.75%	17.74%	8.05%
Willow Creek	52.18%	8.58%	20.68%	18.55%

Table 26. Rural Household Density in the Deep River- Portage Burns Subwatersheds

Subwatershed	County	Area of County in Subwatershed (mi²)	County Households in Subwatershed	Urban Households	Rural Households	Rural Household Density (Houses/mi²)
Headwaters Main Beaver Dam Ditch	Lake	18.28	22,091	15,744	7,347	**402**
	Total	**18.28**	**22,091**	**15,744**	**7,347**	
Main Beaver Dam Ditch	Lake	26.27	18,528	17,263	1,265	**48.15**
	Total	**26.27**	**18,528**	**17,263**	**1,265**	
Headwaters Turkey Creek	Lake	21.23	40,737	34,783	5,954	**280.45**
	Total	**21.23**	**40,737**	**34,783**	**5,954**	
Deer Creek	Lake	14.70	3,194	3,194	0	**49.07**
	Porter	6.76	1,053	0	1,053	
	Total	**21.46**	**4,247**	**3,194**	**1,053**	
City of Merrillville	Lake	19.51	17,072	17,072	0	**0**
	Total	**19.51**	**17,072**	**17,072**	**0**	
Duck Creek	Lake	4.87	8,285	8,229	56	**243.3**
	Porter	10.97	3,798	0	3,798	

	Total	15.84	12,083	8,229	3,854	
Lake George	Lake	16.70	17,576	17,326	250	**32.3**
	Porter	0.60	309	0	309	
	Total	**17.30**	**17,885**	**17,326**	**559**	
Little Calumet River	Lake	16.09	37,683	37,150	533	**88.45**
	Porter	2.88	11,566	10,421	1,145	
	Total	**18.97**	**49,249**	**47,571**	**1,678**	
Willow Creek	Lake	6.51	7,482	7,482	0	**6.4**
	Porter	14.42	20,938	20,804	134	
	Total	**20.93**	**28,420**	**28,286**	**134**	

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 Deep River-Portage Burns watershed is discussed in Section 3.3. 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 and *E. coli* in the Deep River- Portage Burns watershed.

Dog and cat populations were estimated for the Deep River- Portage Burns 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 27 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 Deep River- Portage Burns Watershed

Subwatershed	City/Town	Households in 2010	Estimated Number of Cats	Estimated Number of Dogs
Headwaters of Main Beaver Dam Ditch	Crown Point	3,744	8,237	6,365
	Cedar Lake	661	1,455	1,124
	St. John	61	135	1,034
Main Beaver Dam Ditch	Crown Point	6,725	14,795	11,433
	Merrillville	565	1,243	961
	Winfield	350	770	595
Headwaters of Turkey Creek	St. John	1,592	1,364	1,054
	Merrillville	10,791	10,254	7,924
	Schererville	14,234	12,386	9,571
	Griffith	281	250	194

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

Deer Creek	Merrillville	462	1,016	785
	Hobart	68	150	116
	Winfield	1387	3,051	2,358
	Lake of the Four Seasons	1277	2,809	2,171
City of Merrillville	Gary	4,752	10,454	8,078
	Hobart	10,625	23,375	18,063
	Merrillville	1,695	3,729	2,882
Duck Creek	Hobart	3,324	7,313	5,651
Lake George	Hobart	7,326	16,117	12,454
	Merrillville	350	770	595
Little Calumet River	Gary	9,169	20,172	15,587
	Hobart	3,664	8,061	6,229
	Lake Station	3,548	7,806	6,032
	New Chicago	8644	1,901	1,469
	Portage	4,471	9,836	7,601
Willow Creek	Lake Station	1,983	4,363	3,371
	Portage	8,254	18,159	14,032
	Ogden Dunes	1	2	2
	Gary	1,248	2,746	2,122
	Total	**11,252**	**192,719**	**147,495**

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* and nutrients. 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 28 could contribute *E. coli* and nutrients to the watershed, particularly during high flow conditions or flooding events.

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 shown in Table 29 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. 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 storm water runoff transporting pollutants to the streams. Table 29 and Figure 23 show the managed lands within the Deep River- Portage Burns watershed. Table 30 and Figure 23 show the classified lands within Deep River-Portage Burns watershed.

Table 29. Managed Lands Within the Deep River- Portage Burns Watershed

Unit Name	Manager	Area (acres)
BOWTIE PARK	CROWN POINT PARKS DEPT.	2.07
COLLINS PARK	CROWN POINT PARKS DEPT.	4.29
ERLENBACH PARK	CROWN POINT PARKS DEPT.	4.16
HIGH MEADOW	CROWN POINT PARKS DEPT.	1.19
JERRY ROSS PARK	CROWN POINT PARKS DEPT.	8.64
RUSS KELLER PARK	CROWN POINT PARKS DEPT.	9.21
SAUERMAN WOODS	CROWN POINT PARKS DEPT.	37.92
SOLON ROBINSON	CROWN POINT PARKS DEPT.	4.75
SPORTSPLEX	CROWN POINT PARKS DEPT.	39.32
THOMAS STREET PARK	CROWN POINT PARKS DEPT.	4.73
WILLOW TREE PARK	CROWN POINT PARKS DEPT.	1.45
BEAVER DAM WETLAND CONSERVATION AREA	DNR FISH AND WILDLIFE	17.45
CALUMET PRAIRIE	DNR NATURE PRESERVES	118.71
HOBART HERITAGE PRAIRIE	DNR NATURE PRESERVES	30.56
HOBART MARSH	DNR NATURE PRESERVES	362.45
LIVERPOOL NATURE PRESERVE	DNR NATURE PRESERVES	18.11
MCCLOSKEY'S BURR OAK SAVANNA NATURE PRESERVE	DNR NATURE PRESERVES	55.55
OAK RIDGE	DNR NATURE PRESERVES	5.00
GRAND LAKE RECREATION AREA	EAST GARY PARK BOARD	27.03
RIVERVIEW COMMUNITY PARK	EAST GARY PARK BOARD	38.00
25TH AVENUE PARK	GARY DEPARTMENT OF PUBLIC PARKS	0.60
HATCHER PARK	GARY DEPARTMENT OF PUBLIC PARKS	18.81
HOWE PARK	GARY DEPARTMENT OF PUBLIC PARKS	4.05
IRONWOOD PARK	GARY DEPARTMENT OF PUBLIC PARKS	11.94
PITTMAN SQUARE PARK	GARY DEPARTMENT OF PUBLIC PARKS	4.44
ROOSEVELT PARK	GARY DEPARTMENT OF PUBLIC PARKS	9.83
GOSS SOFTBALL COMPLEX	HOBART GIRLS SOFTBALL LEAGUE INC.	10.76
HOBART LITTLE LEAGUE PARK (LOCKE SOCCER FIELDS)	HOBART LITTLE LEAGUE, INC	24.57
HILLMAN PARK	HOBART PARK AND RECREATION DEPARTMENT	37.77
HOBART CITY BALL PARK	HOBART PARK AND RECREATION DEPARTMENT	5.07

HOBART LAKEFRONT PARK	HOBART PARK AND RECREATION DEPARTMENT	5.98
JERRY PAVESE PARK	HOBART PARK AND RECREATION DEPARTMENT	10.23
LAKESHORE PARK	HOBART PARK AND RECREATION DEPARTMENT	24.48
MCAFEE PARK	HOBART PARK AND RECREATION DEPARTMENT	2.36
PENNSY PARK	HOBART PARK AND RECREATION DEPARTMENT	2.22
RIVERFRONT PARK (HOBART SOCCER/RUGBY FIELD)	HOBART PARK AND RECREATION DEPARTMENT	10.25
VETERAN'S MEMORIAL PARK	HOBART PARK AND RECREATION DEPARTMENT	19.59
MAC JAY LAKE (HOBART IZAAK WALTON LEAGUE)	IZAAK WALTON LEAGUE	63.11
DEEP RIVER COUNTY PARK	LAKE COUNTY PARKS AND RECREATION	756.15
DEEP RIVER HEADWATERS	LAKE COUNTY PARKS AND RECREATION	237.12
DEEP RIVER WATERPARK	LAKE COUNTY PARKS AND RECREATION	421.78
LAKE COUNTY FAIRGROUNDS	LAKE COUNTY PARKS AND RECREATION	83.55
LEMON LAKE COUNTY PARK	LAKE COUNTY PARKS AND RECREATION	0.03
OAK RIDGE PRAIRIE COUNTY PARK	LAKE COUNTY PARKS AND RECREATION	26.01
OAK RIDGE PRAIRIE COUNTY PARK	LAKE COUNTY PARKS AND RECREATION	736.36
THREE RIVERS COUNTY PARK	LAKE COUNTY PARKS AND RECREATION	76.86
TURKEY CREEK GOLF COURSE	LAKE COUNTY PARKS AND RECREATION	124.15
COLUMBUS PARK	LAKE STATION PARKS AND REC DEPT	8.93
JOEL MOCK PARK	LAKE STATION PARKS AND REC DEPT	0.92
WARRICK PARK	LAKE STATION PARKS AND REC DEPT	2.55
T36NR7W10	LITTLE CALUMENT RIVER BASIN DEVELOPMENT COMISSION	12.80
DAVID ROSENBALM PARK	MERRILLVILLE PARKS AND REC. DEPT.	3.42
FOREST HILLS PARK	MERRILLVILLE PARKS AND REC. DEPT.	2.11
JOHN STEFEK PARK	MERRILLVILLE PARKS AND REC. DEPT.	3.41
INDIANA DUNES NATIONAL LAKESHORE	NATIONAL PARK SERVICE/IDNL	727.47
NEW CHICAGO CENTENNIAL PARK	NEW CHICAGO PARK BOARD	0.70
TWIN OAKS PARK	NEW CHICAGO PARK BOARD	4.53
OAK KNOLL GOLF COURSE	OAK KNOLL GOLF COURSE	169.95
ARTHUR H. OLSON MEMORIAL PARK	PORTAGE PARKS AND RECREATION	15.03
COMMUNITY ACRES PARK	PORTAGE PARKS AND RECREATION	0.48
COUNTRYSIDE PARK	PORTAGE PARKS AND RECREATION	28.98
PERRY PARK	PORTAGE PARKS AND RECREATION	2.94
PORTAGE (WOODLAND) PARK	PORTAGE PARKS AND RECREATION	52.82
PRAIRIE-DUNELAND TRAIL CO. PARK	PORTAGE PARKS AND RECREATION	10.14
VIKING VILLAGE PARK	PORTAGE PARKS AND RECREATION	1.57
WOLFE PARK	PORTAGE PARKS AND RECREATION	10.42
GREEN ACRES PARK	ROSS TOWNSHIP TRUSTEE	4.49
HIDDEN LAKE PARK	ROSS TOWNSHIP TRUSTEE	96.74
HOBART MARSH SDC	SAVE THE DUNES COUNCIL	10.86
FOXWOOD SOUTH PARK	SCHERERVILLE PARKS AND RECREATION DEPARTMENT	6.01
ROHRMAN PARK	SCHERERVILLE PARKS AND RECREATION DEPARTMENT	54.36
COULTER (JOHN MERLE) NATURE PRESERVE	SHIRLEY HEINZE ENVIRONMENTAL FUND	87.17
CRESSMOOR PRAIRIE NATURE PRESERVE	SHIRLEY HEINZE ENVIRONMENTAL FUND	37.24
HIDDEN PRAIRIE	SHIRLEY HEINZE ENVIRONMENTAL FUND	154.54

MCCLOSKEY SAVANNA - SHEF UNIT	SHIRLEY HEINZE ENVIRONMENTAL FUND	11.43
TOLLESTON ON THE HILL	SHIRLEY HEINZE ENVIRONMENTAL FUND	6.58
GREINER NATURE PRESERVE	SHIRLEY HEINZE LAND TRUST	69.64
LAURA LAKE CONSERVATION EASEMENT #1	SHIRLEY HEINZE LAND TRUST	10.22
LAURA LAKE CONSERVATION EASEMENT #2	SHIRLEY HEINZE LAND TRUST	23.10
LAURA LAKE CONSERVATION EASEMENT #3	SHIRLEY HEINZE LAND TRUST	10.42
LAURA LAKE CONSERVATION EASEMENT #4	SHIRLEY HEINZE LAND TRUST	12.99
LAURA LAKE CONSERVATION EASEMENT #5	SHIRLEY HEINZE LAND TRUST	9.63
LAURA LAKE CONSERVATION EASEMENT #6	SHIRLEY HEINZE LAND TRUST	8.18
LAURA LAKE CONSERVATION EASEMENT #7	SHIRLEY HEINZE LAND TRUST	15.41
REED KRSEK	SHIRLEY HEINZE LAND TRUST	4.81
TURKEY CREEK	SHIRLEY HEINZE LAND TRUST	14.26
WALNUT WOODS	SHIRLEY HEINZE LAND TRUST	10.02
TIMBER LANE PARK	ST. JOHN PARKS AND RECREATION DEPARTMENT	1.79
HOBART PRAIRIE GROVE	U.S. NATIONAL PARK SERVICE	317.43

Table 30. Classified Lands within the Deep River- Portage Burns Watershed

Classified Lands (Acres)						
Subwatershed	**Grassland**	**Woodland**	**Shrubland**	**Wetland**	**Other**	**Total**
Headwaters Main Beaver Dam Ditch	55.32	86.06	0	17.12	30	188.50
Main Beaver Dam Ditch	60.04	18.66	8.8	2	0	89.50
Headwaters Turkey Creek	41.52	0	0	9.82	2.26	53.60
Deer Creek- Deep River	87.46	27.6	28	58.98	0	202.04
City of Merrillville- Turkey Creek	223.15	62.9	53.08	57.57	0	396.70
Duck Creek	85.18	52.27	7	12.68	0	157.13
Lake George- Deep River	133.85	26.64	27.8	23	0	211.29
Little Calumet River- Deep River	108.89	95.04	7	34.88	0	245.81
Willow Creek- Burns Ditch	11	22.53	24.25	9.7	84.23	151.71

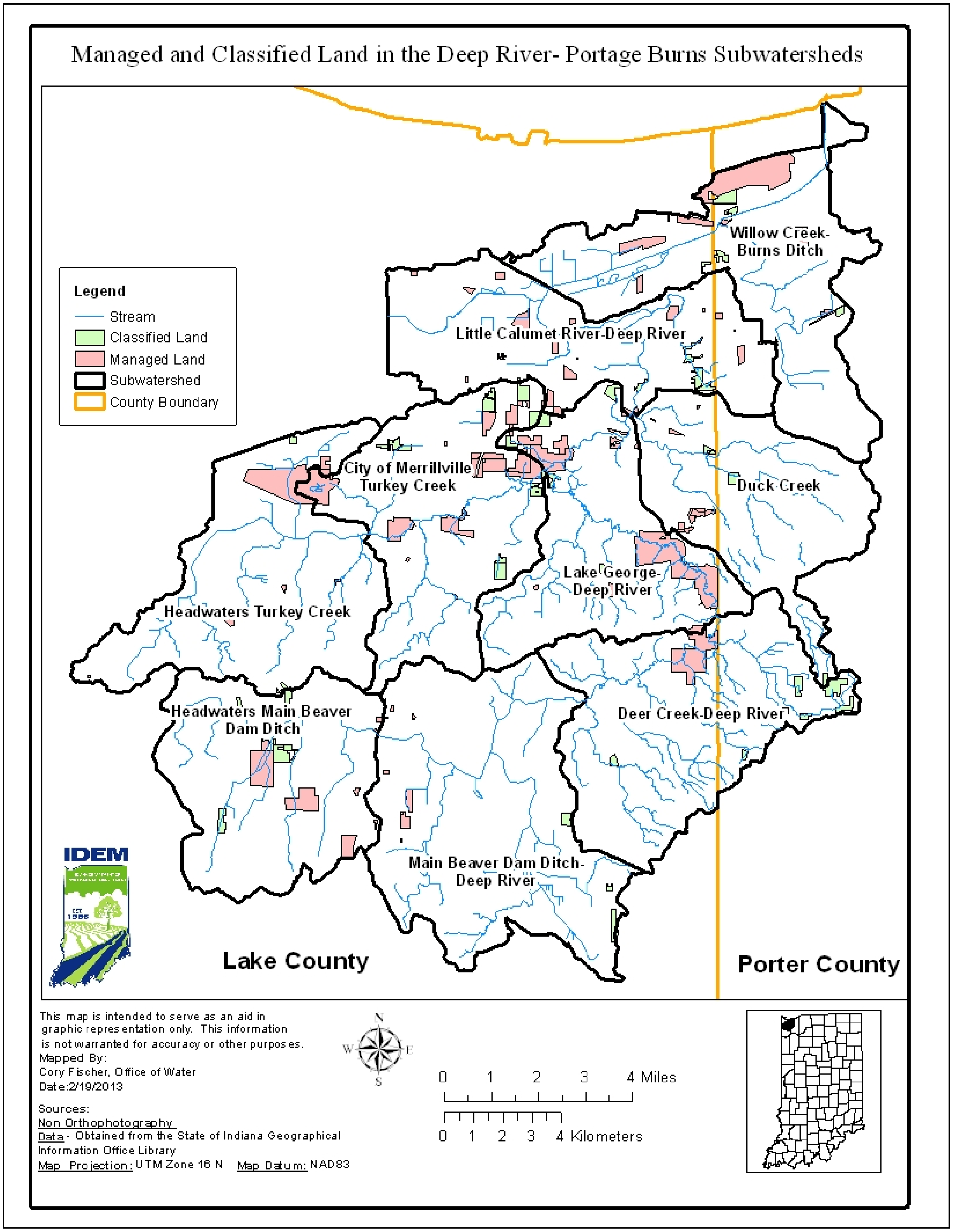


Figure 23. Managed and Classified Lands within the Deep River- Portage Burns Watershed

5.0 INVENTORY AND ASSESSMENT OF WATER QUALITY INFORMATION

Below is an inventory assessment of the available biological and chemistry data for the Deep River-Portage Burns watershed related to *E. coli*, nutrients, and TSS. Table 33 reiterates the TMDL target values presented in Section 2.0. These are the target values IDEM uses to assess water quality data collected in the Deep River-Portage Burns watershed.

Table 31. Target Values Used for Development of the Deep River-Portage Burns Watershed TMDLs

Parameter	Target Value
Total phosphorus	No value should exceed 0.30 mg/L
Total Suspended Solids	No value should exceed 30.0 mg/L
Dissolved Oxygen	No value should be below 4.0 mg/L
E. coli	No value should exceed 125 counts/100 mL (geometric mean)

5.1 Water Chemistry Data

Table 32 summarizes the water chemistry data within the Deep River-Portage Burns watershed by displaying the maximum concentrations (and geometric mean for *E.coli*) 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.

The percent reductions were calculated as follows:

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

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

Appendix A shows the individual sample results and summaries of all the water quality data for all 35 monitoring stations.

Table 32. Summary of Chemistry Data in Deep River-Portage Burns Watershed for Nutrients and TSS

Subwatershed	Station #	Date	Total Phosphorus Single Sample Maximum (mg/L)	% Reduction based on highest concentration	Total Suspended Solids Maximum (mg/L)	% Reduction based on highest concentration	Dissolved Oxygen Minimum (mg/L)	% Below WQS based on minimum concentration
Headwaters Main Beaver Dam Ditch	LMG-05-0022	4/09/2013 – 3/20/2014	0.74	59%	78	32%	1.11	72.25%
	LMG-05-0020		0.42	29%	25	0%	0.67	83.25%
	LMG-05-0021		0.62	52%	89	66%	0.54	86.50%
	LMG-05-0019		0.35	14%	18	0%	0.31	92.25%
Main Beaver Dam Ditch	LMG-05-0018	4/09/2013 – 3/20/2014	1.7	82%	29	0%	5.03	25.75%
	LMG-05-0015		0.64	53%	170	82%	4.78	0%
	LMG-05-0036		0.21	0%	75	60%	3.13	21.75%
	LMG-05-0017		1.3	77%	280	89%	0.24	94.00%
	LMG-05-0016		0.5	0%	20	0%	0.55	86.25%
Headwaters Turkey Creek	LMG-05-0024	4/09/2013 – 3/20/2014	0.13	0%	6	0%	4.44	0%
	LMG-05-0027		0.18	0%	84	64%	4.58	0%
	LMG-05-0023		2.8	89%	130	77%	1.16	71.00%
	LMG-05-0025		0.056	0%	5	0%	1.62	59.50%
	LMG-05-0026		0.18	0%	27	0%	2.03	49.25%
	LMG-05-0028		0.14	0%	44	32%	1.46	63.50%
Deer Creek-Deep River	LMG-05-0035	4/09/2013 – 3/20/2014	0.46	35%	92	67%	3.39	15.25%
	LMG-05-0014		0.094	0%	25	0%	6.14	0%
	LMG-05-0034		0.28	0%	110	73%	7.5	0%
	LMG-05-0013		0.099	0%	23	0%	7.95	0%
City of Merrillville-Turkey Creek	LMG-05-0031	4/09/2013 – 3/20/2014	0.19	0%	81	63%	4.63	0%
	LMG-05-0030		0.37	19%	150	80%	5.67	0%
	LMG-05-0029		0.39	23%	100	70%	0.41	89.75%
Duck Creek	LMG-05-0032	4/09/2013 – 3/20/2014	0.86	65%	98	69%	0.96	76.00%
	LMG-05-0009		0.23	0%	15	0%	3.8	5.00%
	LMG-05-0010		0.099	0%	4	0%	4.52	0%

Subwatershed	Station #	Date	Total Phosphorus Single Sample Maximum (mg/L)	% Reduction based on highest concentration	Total Suspended Solids Maximum (mg/L)	% Reduction based on highest concentration	Dissolved Oxygen Minimum (mg/L)	% Below WQS based on minimum concentration
Lake George-Deep River	LMG-05-0012	4/09/2013 – 3/20/2014	0.35	14%	180	83%	6.37	59.25%
	LMG-05-0011		0.28	0%	31	3%	5.91	47.75%
	LMG-30-0008		0.15	0%	15	0%	3.89	2.75%
	LMG-05-0033		0.69	57%	270	89%	4.2	0%
Little Calumet River- Deep River	LMG-05-007	4/09/2013 – 3/20/2014	0.14	0%	25	0%	5.65	0%
	LMG-05-006		0.13	0%	25	0%	3.31	17.25%
	LMG-05-0008		0.15	0%	33	9%	2.03	49.25%
Willow Creek-Burns Ditch	LMG-05-0002	4/09/2013 – 3/20/2014	0.17	0%	31	3%	3.14	21.50%
	LMG-05-0004		0.2	0%	78	62%	6.6	0%
	LMG-05-0003		0.1	0%	19	0%	6.53	0%

5.2 *E. coli* Data

Table 33 provides a summary of *E. coli* data in the Deep River-Portage Burns watershed to show which are impaired due to pathogens.

Table 33. Summary of *E. coli* Data in Deep River-Portage Burns Watershed

Subwatershed	Station #	Date	Total Number of Samples	Percent of Samples Violating Target	Maximum MPN/100mL	Average MPN/100mL	% Reduction based on highest concentration
Headwaters Main Beaver Dam Ditch	LMG-05-0022	4/09/2013 – 10/08/2013	10	50%	1413.6	360.0	34.7%
	LMG-05-0020		10	40%	2419.6	414.3	43.3%
	LMG-05-0021		10	29%	770.1	207.6	69.5%
	LMG-05-0019		10	80%	>2419.6	1,297.5	81.9%
Main Beaver Dam Ditch	LMG-05-0018	4/09/2013 – 10/08/2013	10	30%	1986.3	372.0	36.8%
	LMG-05-0015		10	80%	2419.6	785.8	70.1%
	LMG-05-0036		10	80%	>2419.6	687.6	65.8%
	LMG-05-0017		10	40%	613.1	233.2	0%
	LMG-05-0016		10	60%	2419.6	629.9	62.7%
Headwaters Turkey Creek	LMG-05-0024	4/09/2013 – 10/08/2013	10	80%	1986.3	668.9	64.9%
	LMG-05-0027		10	20%	866.4	238.0	1.2%
	LMG-05-0023		7	29%	770.1	207.6	69.5%
	LMG-05-0025		10	20%	344.8	168.8	0%
	LMG-05-0026		10	60%	1553.1	564.9	58.4%
	LMG-05-0028		10	80%	2419.6	810.9	71.0%
Deer Creek- Deep River	LMG-05-0035	4/09/2013 – 10/08/2013	10	50%	2419.6	511.5	54.1%
	LMG-05-0014		10	80%	1732.9	501.6	53.2%
	LMG-05-0034		10	80%	2419.6	720.0	67.4%
	LMG-05-0013		10	90%	2419.6	699.3	66.4%
City of Merrillville-Turkey Creek	LMG-05-0031	4/09/2013 – 10/08/2013	10	100%	2419.6	1301.9	81.9%
	LMG-05-0030		10	100%	2419.6	1001.3	76.5%
	LMG-05-0029		10	40%	1119.9	351.8	33.2%

Subwatershed	Station #	Date	Total Number of Samples	Percent of Samples Violating Target	Maximum MPN/100mL	Average MPN/100mL	% Reduction based on highest concentration
Duck Creek	LMG-05-0032	4/09/2013 – 10/08/2013	10	80%	2419.6	1216.0	80.7%
	LMG-05-0009		10	40%	2419.6	622.2	62.2%
	LMG-05-0010		10	60%	2419.6	661.2	64.5%
Lake George- Deep River	LMG-05-0012	4/09/2013 – 10/08/2013	10	40%	2419.6	438.5	46.4%
	LMG-05-0011		10	70%	2419.6	669.7	64.9%
	LMG-30-0008		10	80%	2419.6	612.9	61.7%
	LMG-05-0033		10	80%	2419.6	957.8	75.5%
Little Calumet River- Deep River	LMG-05-007	4/09/2013 – 10/08/2013	10	10%	260.3	107.3	0%
	LMG-05-006		10	20%	344.8	132.6	0%
	LMG-05-0008		10	90%	1732.9	656.1	64.2%
Willow Creek- Burns Ditch	LMG-05-0002	4/09/2013 – 10/08/2013	10	60%	1986.3	551.9	57.4%
	LMG-05-0004		10	80%	2419.6	1240.2	81.1%
	LMG-05-0003		10	90%	2419.6	1340.4	82.5%

5.3 Biological Data

Sampling performed by IDEM in June and July 2013 documented widespread biological impairments in the Deep River-Portage Burns watershed as summarized in Table 34. Fish and macro invertebrate community sampling took place at all 35 sample sites in the Deep River-Portage Burns watershed. Sampling data indicate that the overall biological integrity of the Deep River-Portage Burns watershed was poor to very poor. The explanations of each integrity class can be found in Table 2. More than 94 percent of the sample sites failed established criteria for aquatic life support during each sampling event.

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

- 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.

Attaining the TSS, DO, and TP target values shown in Table 34 will address the causes of impairment.

Table 34. Impaired Biotic Community Stream Segments in the Deep River-Portage Burns Watershed Identified During Biological Sampling

Sampling Site		Stream Name	Score	Integrity Class	QHEI	Score	Integrity Class	QHEI
EPA Station Name	Station ID		mIBI	mIBI	mIBI	IBI	IBI	IBI
13T-001	LMG-05-0002	Burns Ditch	36	Fair	45	16	Very Poor	48
13T-002	LMG-05-0003	Willow Creek	22	Very Poor	48	12	Very Poor	58
13T-003	LMG-05-0004	Willow Creek	26	Poor	40	30	Poor	37
13T-005	LMG-05-0006	Deep River	38	Fair	55	34	Poor	48
13T-006	LMG-05-0007	Deep River	30	Poor	44	36	Fair	52
13T-007	LMG-05-0008	Tributary of Deep River	30	Poor	34	18	Very Poor	46
13T-008	LMG030-0008	Deep River	28	Poor	33	32	Poor	66
13T-009	LMG-05-0009	Duck Creek	30	Poor	31	30	Poor	52
13T-010	LMG-05-0010	Tributary of Duck Creek	28	Poor	48	12	Very Poor	42
13T-011	LMG-05-0032	Duck Creek	30	Poor	45	24	Poor	49
13T-012	LMG-05-0011	Deep River	28	Poor	46	40	Fair	56
13T-013	LMG-05-0033	Sprout Ditch	42	Fair	57	30	Poor	66
13T-014	LMG-05-0012	Deep River	40	Fair	80	34	Poor	75
13T-015	LMG-05-0013	Tributary of Deep River	28	Poor	50	30	Poor	64
13T-016	LMG-05-0034	Tributary of Deep River	30	Poor	52	40	Fair	52
13T-017	LMG-05-0014	Tributary of Deep River	38	Fair	53	34	Poor	51
13T-018	LMG-05-0015	Deep River	40	Fair	59	34	Poor	57
13T-019	LMG-05-0035	Deer Creek	28	Poor	41	32	Poor	36
13T-020	LMG-05-0016	Niles Ditch	38	Fair	34	38	Fair	44
13T-021	LMG-05-0017	Niles Ditch	20	Poor	27	12	Very Poor	33
13T-022	LMG-05-0036	Smith Ditch	38	Fair	24	38	Fair	25

13T-023	LMG-05-0018	Deep River	26	Poor	52	36	Fair	58
13T-024	LMG-05-0019	Tributary Main Beaver Dam Ditch	24	Poor	22	14	Very Poor	26
13T-025	LMG-05-0020	Main Beaver Dam Ditch	26	Poor	24	28	Poor	37
13T-026	LMG-05-0021	Tributary Main Beaver Dam Ditch	26	Poor	27	12	Very Poor	40
13T-027	LMG-05-0022	Main Beaver Dam Ditch	28	Poor	25	40	Fair	27
13T-028	LMG-05-0023	Tributary of Turkey Creek	NA	NA	NA	12	Very Poor	37
13T-029	LMG-05-0024	Turkey Creek	26	Poor	42	36	Fair	49
13T-030	LMG-05-0025	Johnson Ditch	34	Poor	35	28	Poor	36
13T-031	LMG-05-0026	Tributary of Turkey Creek	28	Poor	42	12	Very Poor	41
13T-032	LMG-05-0027	Turkey Creek	30	Poor	41	42	Fair	51
13T-033	LMG-05-0028	Tributary of Turkey Creek	28	Poor	30	30	Poor	41
13T-034	LMG-05-0029	Tributary of Turkey Creek	30	Poor	27	12	Very Poor	31
13T-035	LMG-05-0030	Tributary of Turkey Creek	30	Poor	52	20	Very Poor	43
13T-036	LMG-05-0031	Turkey Creek	30	Poor	43	16	Very Poor	40

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

6.0 TECHNICAL APPROACH

Previous sections of the report have provided a description of the Deep River-Portage Burns watershed and summarized the applicable water quality standards, water quality data, and identified the potential sources of *E. coli*, nutrients, and TSS 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 as described in Section 4.0 to estimate the current allowable loads of *E. coli*, nutrients, and TSS in each subwatershed. This section focuses on describing the methodology and is helpful in understanding subsequent sections of the TMDL report.

6.1.1 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 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 Clean Water Act 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 35 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. The load duration curves for all sites can be found in Appendix B.

Table 35. Relationship between Load Duration Curve Zones and Contributing Sources

Contributing Source Area	Duration Curve Zone				
	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	
Abandoned mines	H	H	H	H	H
Storm water: Impervious		H	H	H	
Combined sewer overflows	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)

6.1.2 Stream Flow Estimates

Daily stream flows are necessary to implement the load duration curve approach. Load duration assessment locations in the Deep River-Portage Burns 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 for the Deep River at Lake George outlet near Hobart Indiana (04093000) (Table 36) located at the downstream end of Lake George was used for the development of the *E. coli*, nutrients, and TSS load duration curve analysis for the Deep River-Portage Burns watershed TMDL. USGS gage (04093000) is located on the Deep River in Lake 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 (04093000) 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 Deep River-Portage Burns 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.

Table 36. USGS Site Assignments for Development of Load Duration Curve

Gage Location	Gage ID	Period of Record
Deep River at Lake George Outlet (Hobart, IN)	04093000	1950-2014

7.0 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 Section 4.0 and water quality data within the Deep River-Portage Burns watershed are discussed in Section 5.0. The purpose of this section of the report is to evaluate which of the 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 Deep River-Portage Burns 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 6.1.1 summarizes the load duration curve approach. This section discusses the load duration curves and the linkage between the potential sources in the Deep River-Portage Burns watershed and the observed water quality impairment.

7.1 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 Crown Point and managed by the Indiana State Climate Office at Purdue University.

E. coli sources typically associated with high flow and moist conditions include failing onsite wastewater systems, urban storm water/CSOs, 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.

7.2 Linkage Analysis for Nutrients

Nutrients come in many forms, including nitrogen, phosphorus, ammonia, total Kjeldahl nitrogen (TKN), nitrite and nitrate. Elevated total phosphorus was noted throughout the basin, and was identified as a cause of aquatic life use impairment in multiple subwatersheds. Therefore, TMDLs were calculated at only those subwatersheds. Information presented in the water quality assessment (Section 3.0) describes phosphorus conditions in the Deep River- Portage Burns 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 high, mid-range, and 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, or are straight-piped/tiled to the streams.

7.3 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 the 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 April 2013, total suspended solids (TSS) in the Deep River- Portage Burns watershed has sporadically exceeded the target. No long-term trend is apparent, with TSS greatest in the spring and summer. Further analysis pairing the TSS concentrations with flow conditions reveals elevated TSS concentrations during high flows and slightly 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 gully erosion. 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.

7.3.1 Headwaters Main Beaver Dam Ditch

Load duration curves and precipitation graphs were created for all the sampling sites in the Headwaters Main Beaver Dam Ditch subwatershed. The figures 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 37 provides a summary of the Headwaters Main Beaver Dam Ditch subwatershed, including impaired segment AUID, drainage area, sampling sites, listed segments, land use, NPDES facilities, MS4 community, CSO communities, CFOs, and CAFOs, as well as Load Allocations, Wasteload Allocations, 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 37. Summary of Headwaters Main Beaver Dam Ditch Subwatershed Characteristics

Upstream Characteristics					
Drainage Area	18.28 square miles				
TMDL Sample Site	LMG-05-0019, LMG-05-0020, LMG-05-0021, LMG-05-0022				
AUID Segments	INC0151_01, INC0151_T1001, INC0151_T1002, INC0151_T1003				
Land Use	Agricultural Land: 25% Forested Land: 9% Developed Land: 39% Open Water: 1% Pasture/Hay: 5% Grassland/Shrubs: 12% Wetland: 9%				
NPDES Facilities	Crown Point WWTP (IN0025763): 8.1 MGD Bulk Marathon 2108 (ING080230) Speedway LLC Store 6677 (ING080263)				
MS4 Communities	St. John: INR040047 (0.49 sq miles) Schererville: INR040112 (0.02 sq miles) Merrillville: INR040049 (0.2 sq miles) Cedar Lake: INR040075 (0.15 sq miles) Crown Point: INR040054 (3.87 sq miles) Lake County: INR040124 (2.04 sq miles)				
CSO Communities	Crown Point WWTP (IN0025763) Outfalls: 002,003,0005,006				
CAFOs	NA				
CFOs	NA				
TMDL *E. coli* Allocations (billion MPN/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**"Normal" Flows**	**Lower Flow Conditions**	**Low Flows**
LA	200.67	24.24	32.75	11.33	1.39
Future Growth	23.55	8.33	5.52	4.39	3.86
WLA:	246.82	134.10	72.04	72.04	72.04
MOS (5%)	24.79	8.77	5.81	4.62	4.07
TMDL = LA+WLA+MOS	495.83	175.44	116.12	92.38	81.36
TMDL TSS Allocations lbs/day					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**"Normal" Flows**	**Lower Flow Conditions**	**Low Flows**
LA	5,620.62	672.80	921.73	318.96	39.12
Future Growth	662.81	234.53	155.22	123.50	108.77
WLA	6,972.72	3,723.30	2,027.49	2,027.49	2,027.49
MOS (5%)	697.69	246.88	163.39	130.00	114.49
TMDL = LA+WLA+MOS	13,953.84	4,937.52	3,267.83	2,599.95	2,289.87

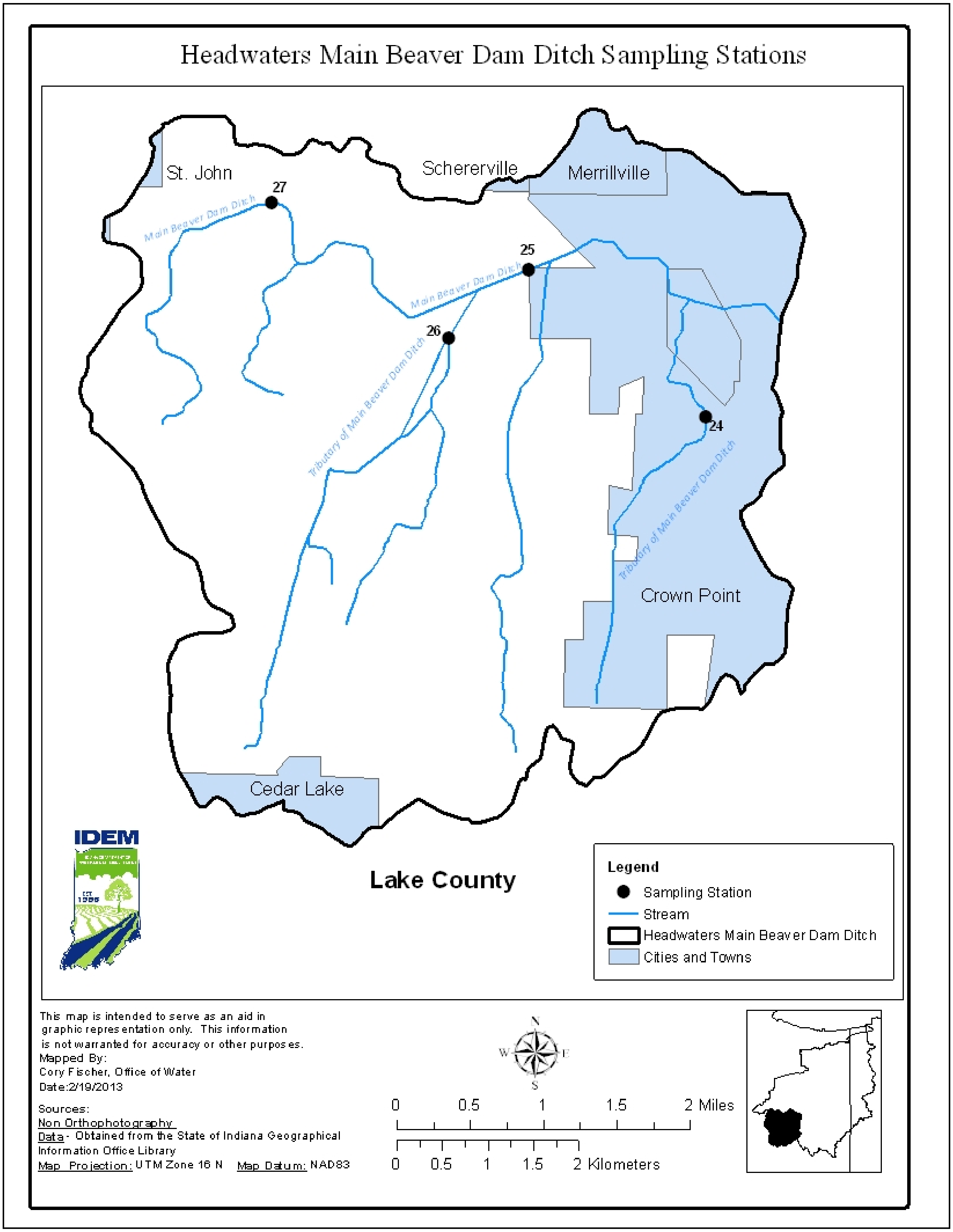


Figure 24. Sampling Stations in Headwaters Main Beaver Dam Ditch Subwatershed

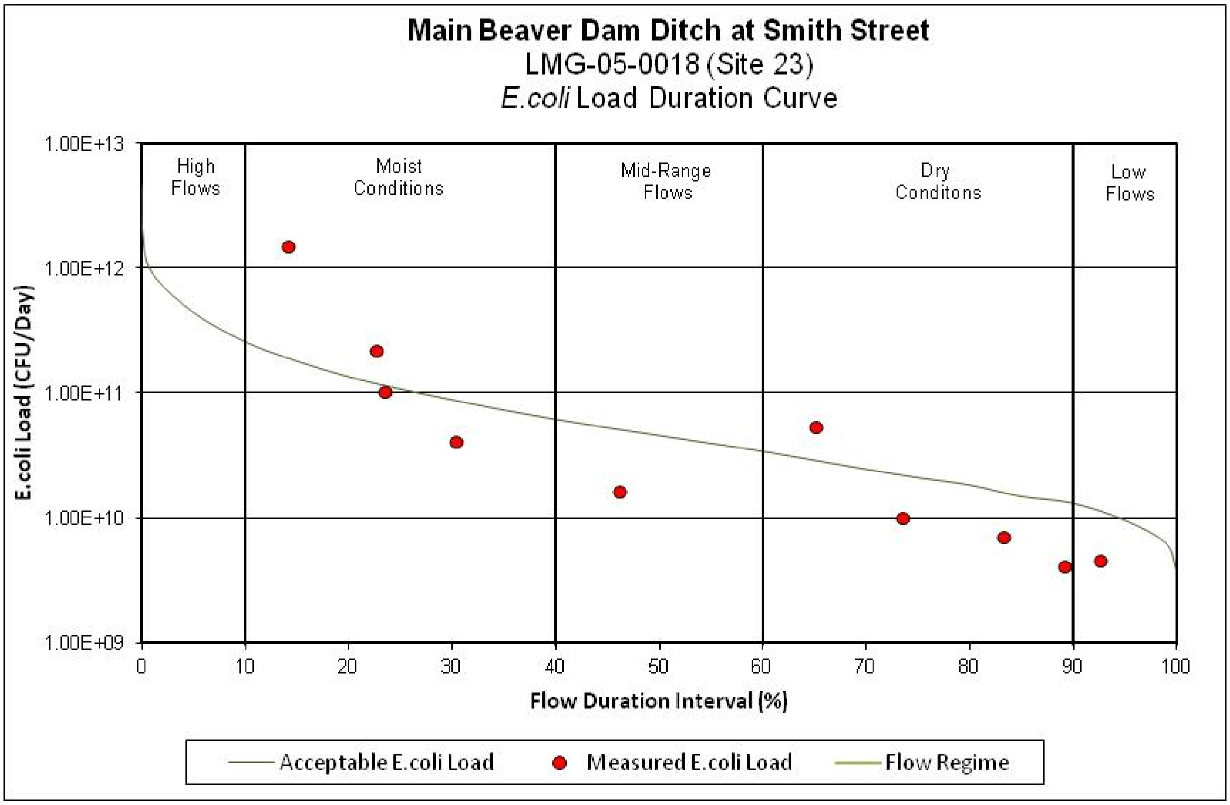


Figure 25. E. coli Load Duration Curve for Most Representative Site in the Headwaters Main Beaver Dam Ditch Subwatershed

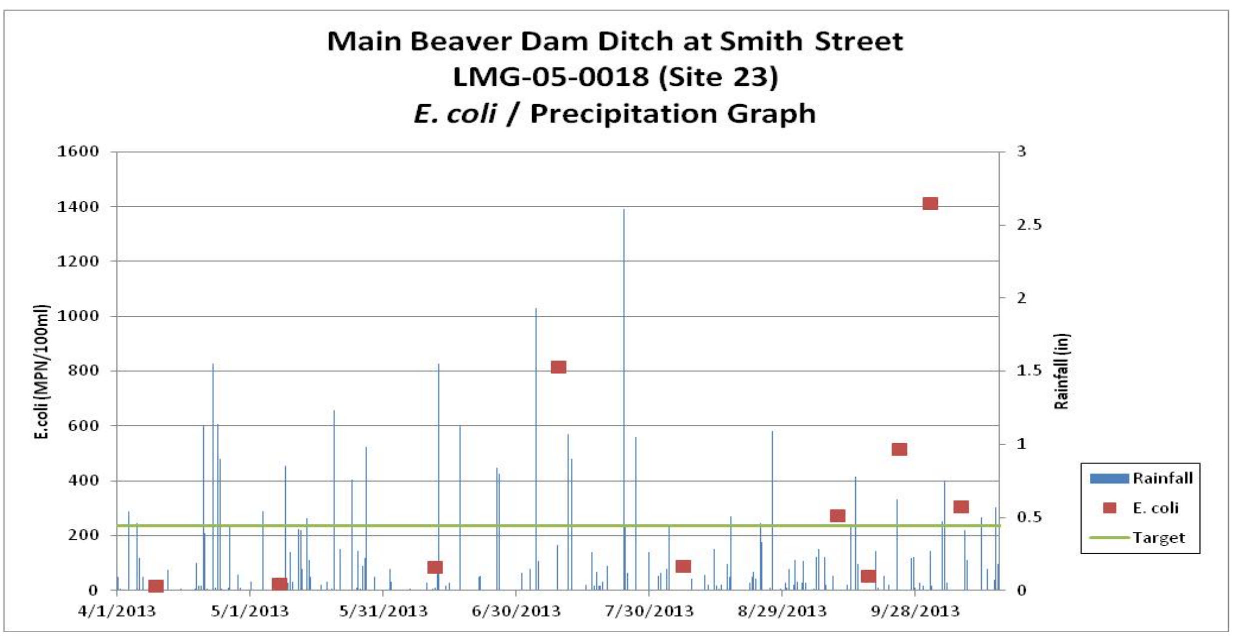


Figure 26. Graph of Precipitation and E. coli Data at Most Representative Site in the Headwaters Main Beaver Dam Ditch Subwatershed

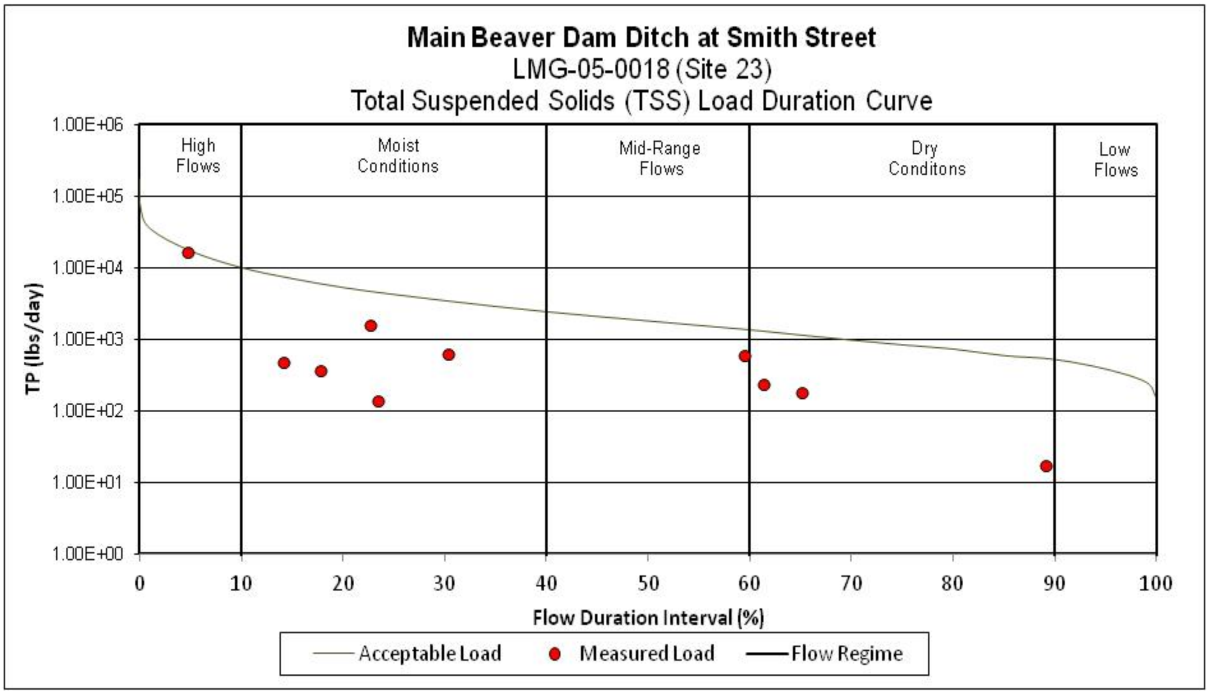


Figure 27. TSS Load Duration Curve for Most Representative Site in the Headwaters Main Beaver Dam Ditch

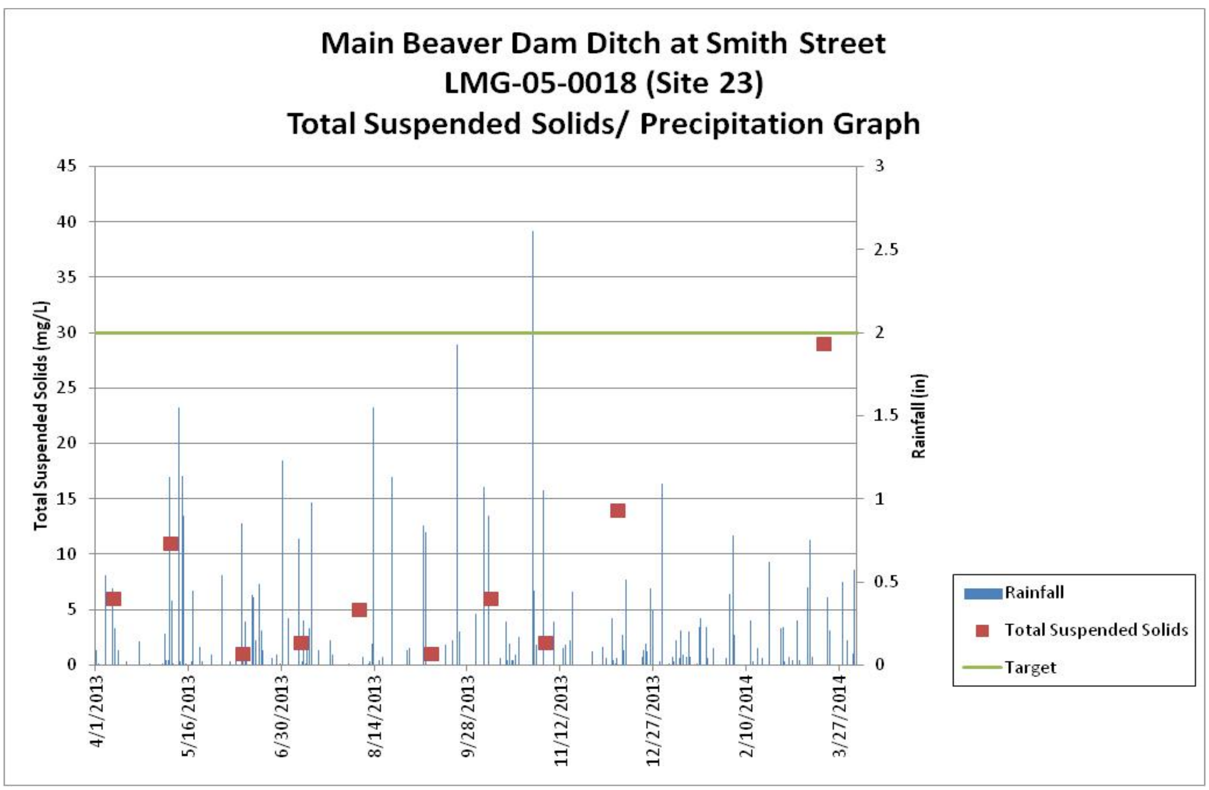


Figure 28. Graph of Precipitation and TSS Data at Most Representative Site in the Headwaters Main Beaver Dam Ditch Subwatershed

The Headwaters Main Beaver Dam Ditch subwatershed has a drainage area of 18.28 sq miles. The dominate land use in the Headwaters Main Beaver Dam Ditch is developed land accounting for approximately 40% of the drainage. The sampling locations that are within the Headwaters Main Beaver Dam Ditch Subwatershed include; LMG-05-0022, LMG-05-0020, LMG-05-0023, and LMG-05-0019. Site LMG-05-0018 located at Smith Street on Main Beaver Dam Ditch is being used as the pour point of the watershed to assess the contribution of Headwaters Main Beaver Dam Ditch to the overall Deep River- Portage Burns Watershed.

Site LMG-05-0018 has an *E. coli* geometric mean value of 372 MPN/100mL. The curve for this site shows a low level impairment of *E. coli* in the stream through different flows. This indicates point sources may be contributing along with nonpoint sources to the impairments. The precipitation graph for this site shows the stream is susceptible to high loads of *E. coli* from run-off events. The combined *E. coli* data for the subwatershed have an average single sample maximum violation 50% of the time and an average geometric mean violation 100% of the time. Based on the water quality duration curves, it can be concluded that the majority of high flow sources of *E. coli* in this watershed are point sources and nonpoint sources that include Crown Point CSOs, MS4s (St. John, Schererville, Merrillville, Cedar Lake, Crown Point, Lake County) , unregulated storm water, unregulated animal operations, wildlife, and animals with direct access to streams. During low flow sources of *E.coli* include Crown Point WWTP, straight piped, leaking and failing septic systems. If animals have direct access throughout the watershed it could contribute to *E. coli* violations at dry and wet conditions.

Total phosphorus concentrations at sampling station LMG-05-0018 are elevated throughout the entire sampling project. Site LMG-05-0018 has a total phosphorus reduction of 82% with the largest value being 1.7 mg/L. Further analysis of phosphorus concentrations and flow conditions in Deep River-Portage Burns watershed indicate a compliance issue with the Crown Point WWTP. The WWTP was in violation of the percent removal portion of their WWTP permit during the TMDL monitoring. Due to this violation there is no phosphorus TMDL needed for this segment. After the completion of the CSO LTCP and with the WWTP in compliance with their WWTP permit the exceedance of the phosphorus target should be addressed. However, using aerial photography there is a large golf course upstream of the sampling location which could also be a potential source of nutrients coming off the fertilized grounds. This facility while not suspected of violating the water quality target would be a location to review of nutrient management for nonpoint source.

The monitoring conducted in 2013-2014 showed elevated levels of TSS in the Headwaters Main Beaver Dam Ditch subwatershed that exceeded the target (30 mg/L), the largest was at 89 mg/l at site LMG-05-0023 (See Appendix B). This sample was taken in the spring; high loads in the spring may be attributed to the plowing and planting of agricultural fields occurring during these months, increasing the opportunity for sheet and rill erosion. Elevated TSS concentrations during high flows are consistent with significant loads coming from stream bank and gully erosion. The source assessment identifies the Crown Point WWTP is within the headwaters Main Beaver Dam Ditch subwatershed directly upstream of the sampling point which could also contribute to the violation. Other possible sources include those mentioned in the nutrient linkage analysis. High TSS can also cause an increase in surface temperature which can cause low dissolved oxygen levels and can harm aquatic life, resulting in the impaired biological community listing.

The monitoring conducted during the summer of 2013 showed impaired biotic communities throughout the Headwaters Main Beaver Dam Ditch. The fish and macroinvertebrate communities were sampled at all four sampling locations in the watershed. Scores for the macroinvertebrate community Index of Biotic Integrity (mIBI) ranged from 24-28 which are all below the established criteria for aquatic life support which is 36. Scores for the fish community Index of Biotic Integrity (IBI) ranged from 12-40, with only one out of the four sites marginally passing for the fish community. However since all the sites for mIBI each segment will be listed for IBC. Elevated TSS and phosphorus levels are both factors in why the biological communities are being stressed. Other concerns in the watershed include low dissolved oxygen values along with poor QHEI scores that contribute to the stressed biotic communities.

7.3.2 Main Beaver Dam Ditch

Load duration curves and precipitation graphs were created for all the sampling sites in the Main Beaver Dam Ditch subwatershed. The figures 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 38 provides a summary of the Main Beaver Dam Ditch subwatershed, including impaired segment AUID, drainage area, sampling sites, listed segments, land use, NPDES facilities, MS4 community, CSO communities, CFOs, and CAFOs, as well as Load Allocations, Wasteload Allocations, 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 38. Summary of Main Beaver Dam Ditch Subwatershed Characteristics

Upstream Characteristics					
Drainage Area	26.27 square miles				
TMDL Sample Site	LMG-05-0015, LMG-05-0016, LMG-05-0017, LMG-05-0018, LMG-05-0036				
AUID Segments	INC0152_04, INC0152_P1001, INC0152_T1008, INC0152_T1009, INC0152_T1010, INC0152_T1011				
Land Use	Agricultural Land: 43% Forested Land: 7% Developed Land: 30% Open Water: <1% Pasture/Hay: 8% Grassland/Shrubs: 8% Wetland: 5%				
NPDES Facilities	Vesuvius USA Crown Point Plant: (INR00B062) East Chicago Machine Tool Corporation: (INR00B085) Conquest Ready Mix: (INR00C073) Crown Brick & Supply Inc. (INR210008) US Gypsum Company: (INR210155) Illiana Disposal and Recycling: (INR800146)				
MS4 Communities:	Crown Point: INR040054 (5.53 sq miles) Merrillville: INR040049 (0.97 sq miles) Lake County: INR040124 (1.23 sq miles)				
CSO Communities	Crown Point WWTP (IN0025763) Outfall: 004				
CAFOs	NA				
CFOs	NA				
TMDL *E. coli* Allocations (billion MPN/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**“Normal” Flows**	**Lower Flow Conditions**	**Low Flows**
LA	379.32	92.45	57.13	26.34	12.13
Future Growth	28.9	7.1	3.0	1.4	0.6
WLA	170.33	41.62	0.00	0.00	0.00
MOS (5%)	30.45	7.43	3.17	1.46	0.67
TMDL = LA+WLA+MOS	609.0	148.6	63.3	29.2	13.4
TMDL Total Phosphorus Allocations (lbs/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**“Normal” Flows**	**Lower Flow Conditions**	**Low Flows**
LA	106.42	25.95	16.08	7.43	3.40
Future Growth	8.14	1.99	0.85	0.39	0.18
WLA	48.26	11.79	0.00	0.00	0.00
MOS (5%)	8.57	2.09	0.89	0.41	0.19
TMDL = LA+WLA+MOS	171.39	41.82	17.82	8.23	3.77
TMDL TSS Allocations (lbs/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**“Normal” Flows**	**Lower Flow Conditions**	**Low Flows**

LA	10,642.12	2,594.93	1,608.69	742.47	340.30
Future Growth	814.11	198.64	84.67	39.08	17.91
WLA	4,826.04	1,179.30	0.00	0.00	0.00
MOS (5%)	856.96	209.10	89.12	41.13	18.85
TMDL = LA+WLA+MOS	17,139.23	4,181.97	1,782.48	822.68	377.06

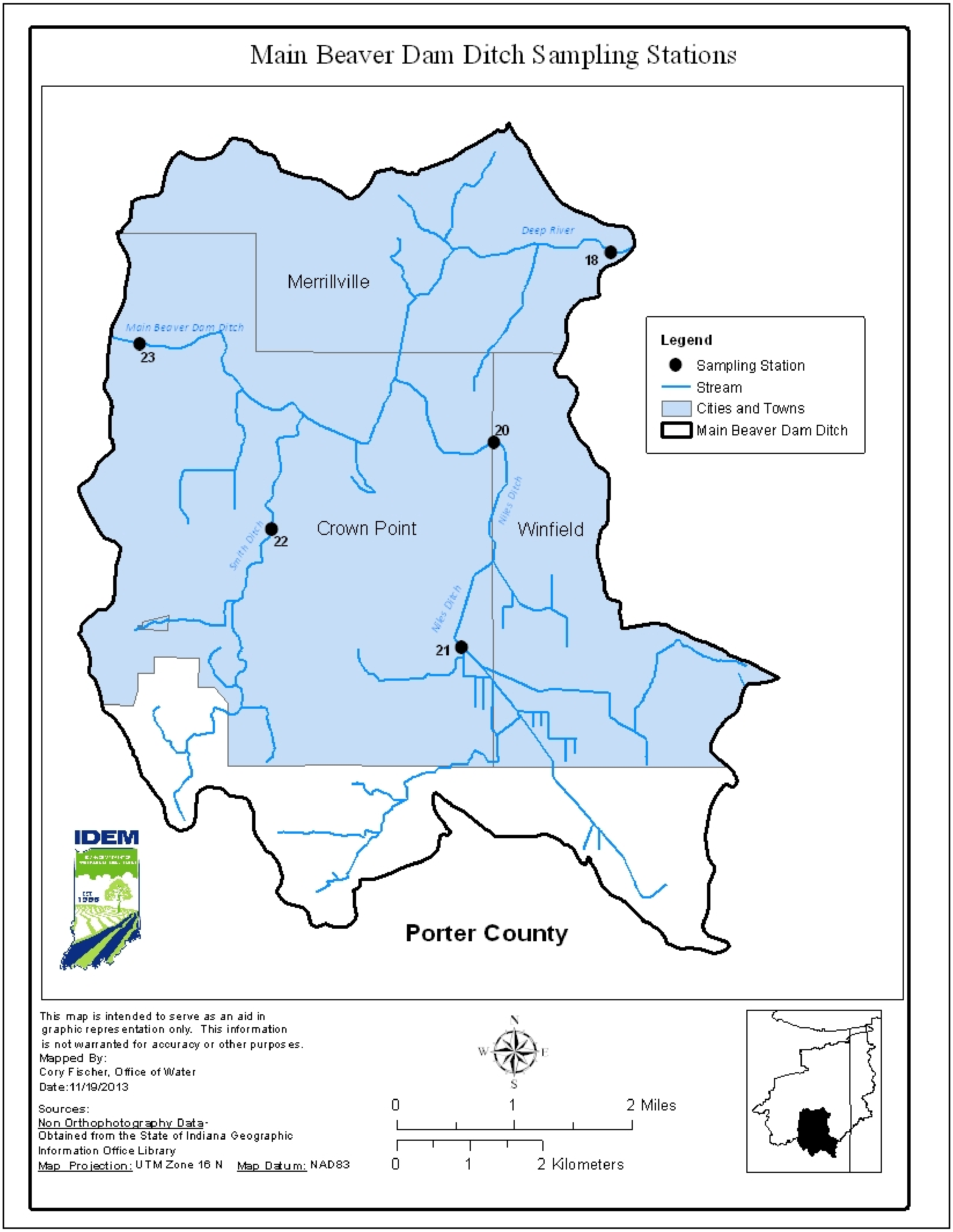


Figure 29. Sampling Stations in the Main Beaver Dam Ditch Subwatershed

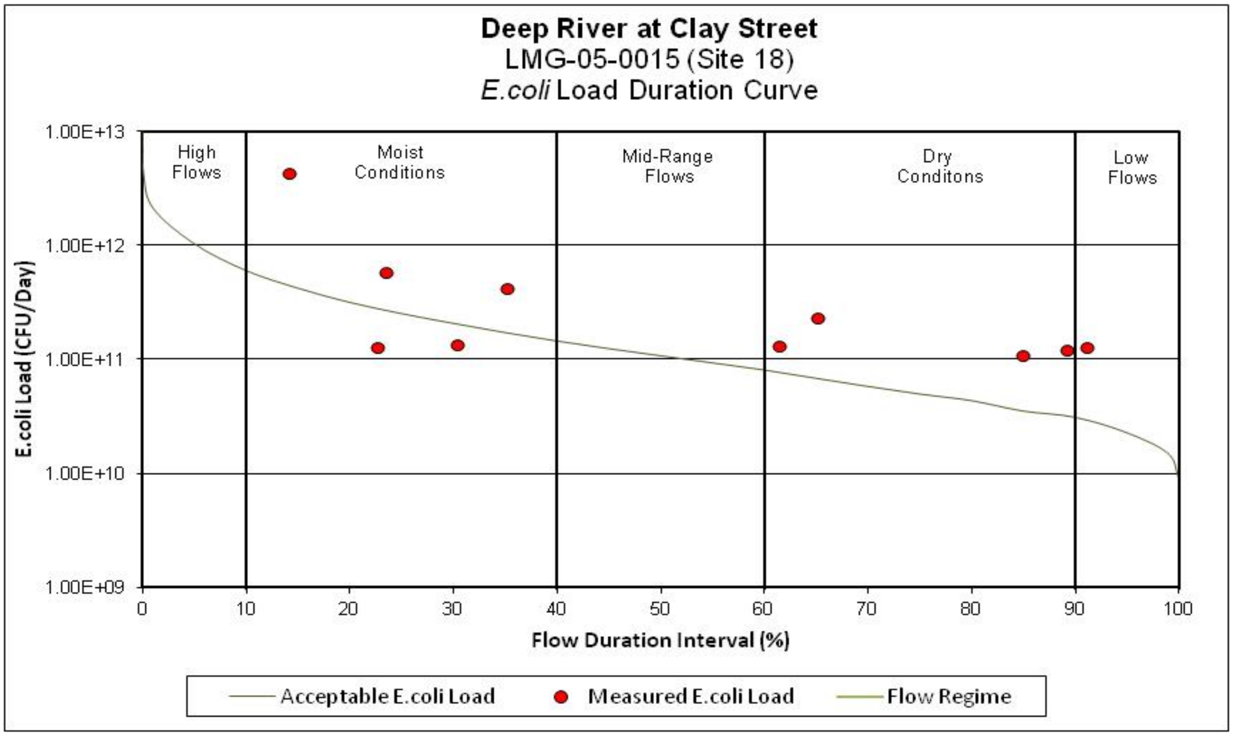


Figure 30. ***E. coli*** **Load Duration Curve for Most Representative Site in the Main Beaver Dam Ditch Subwatershed**

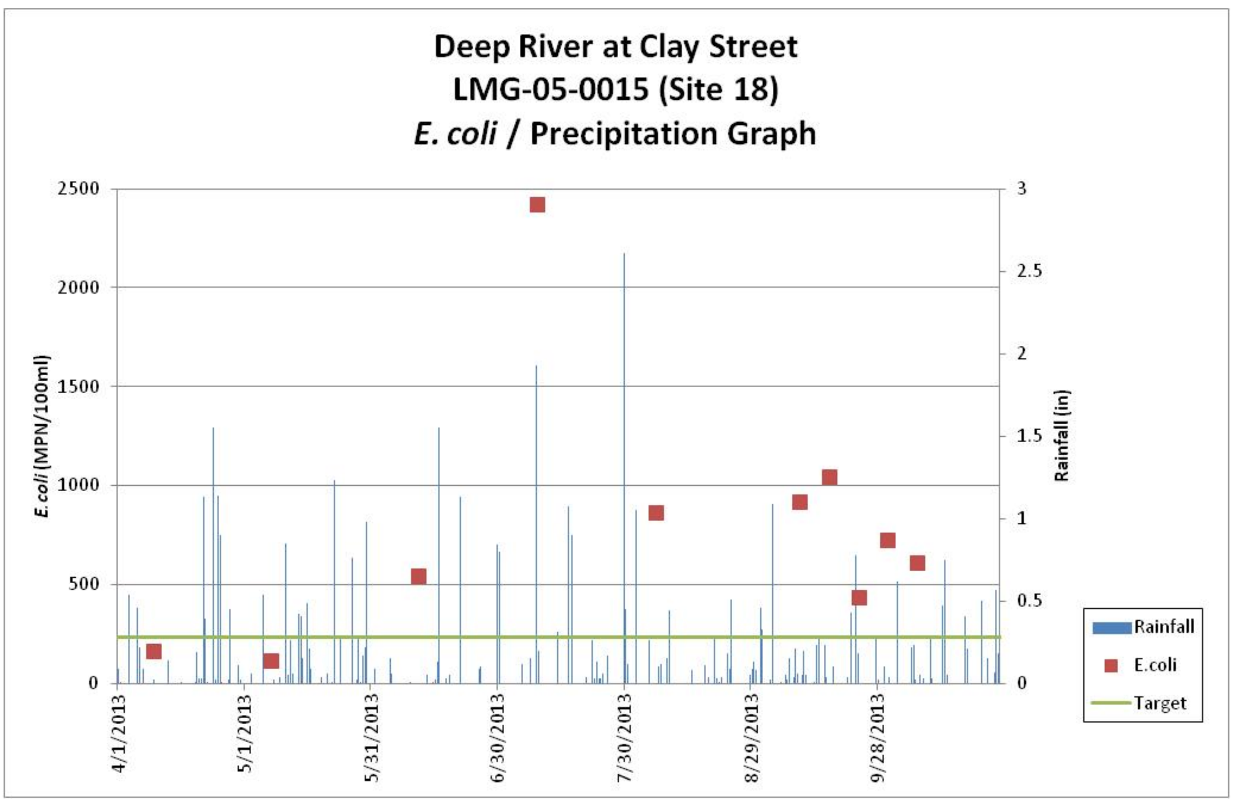


Figure 31. Graph of Precipitation and ***E. coli*** **Data at Most Representative Site in the Main Beaver Dam Ditch Subwatershed**

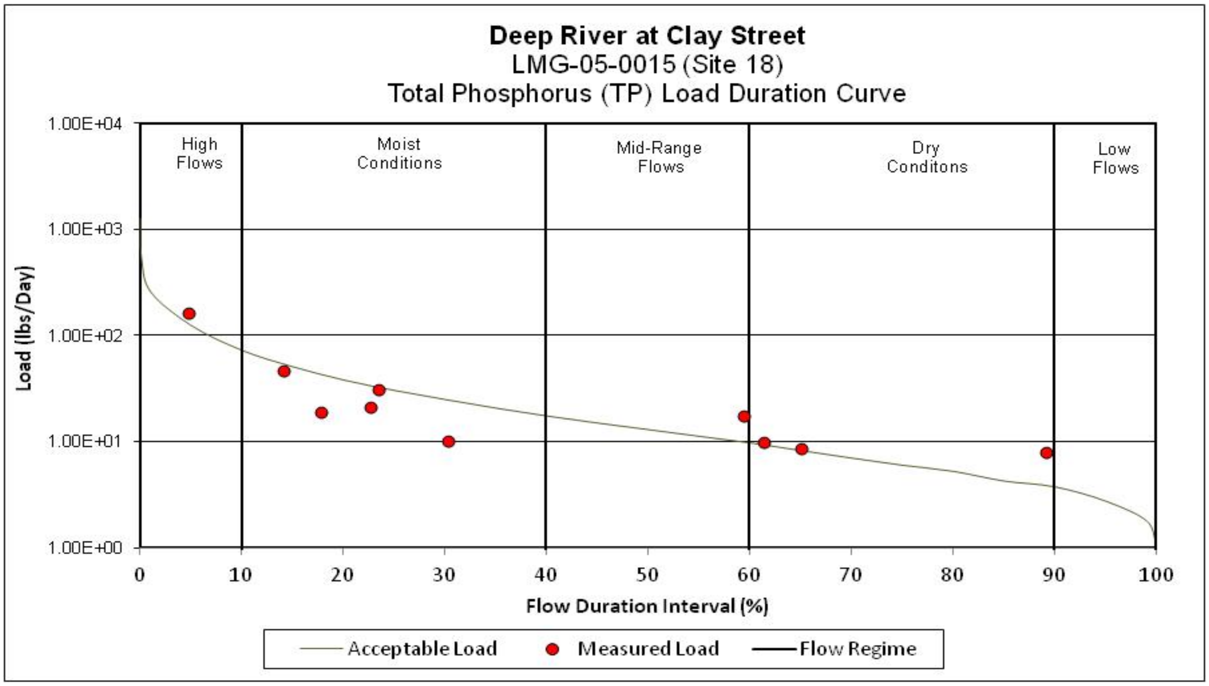


Figure 32. Total Phosphorus Load Duration Curve for Most Representative Site in the Main Beaver Dam Ditch Subwatershed

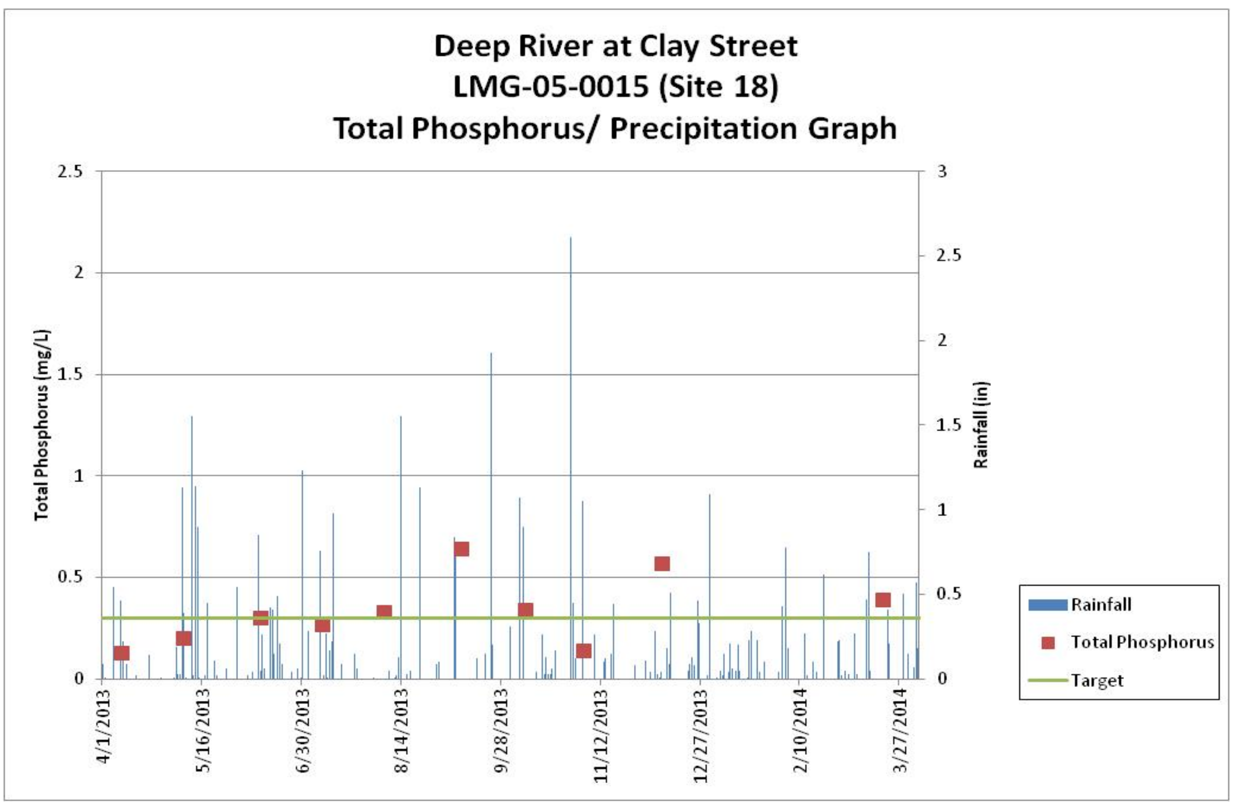


Figure 33. Graph of Precipitation and Total Phosphorus Data at Most Representative Site in the Main Beaver Dam Ditch Subwatershed

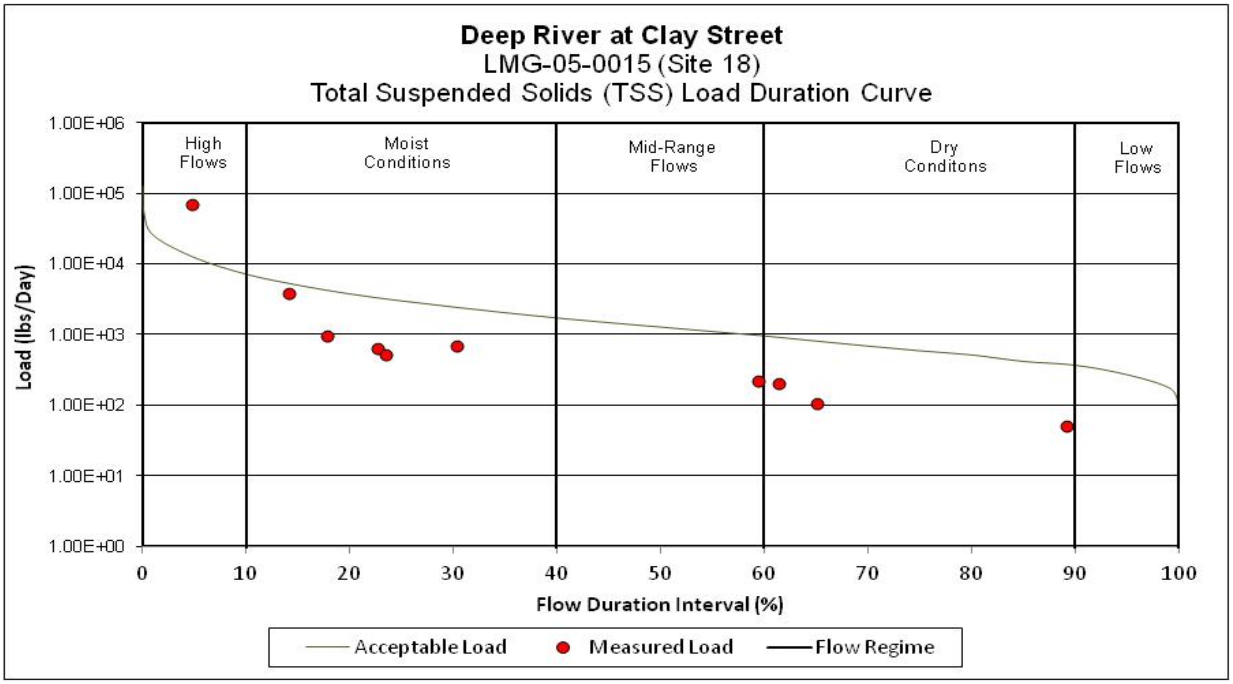


Figure 34. TSS Load Duration Curve for Most Representative Site in the Main Beaver Dam Ditch Subwatershed

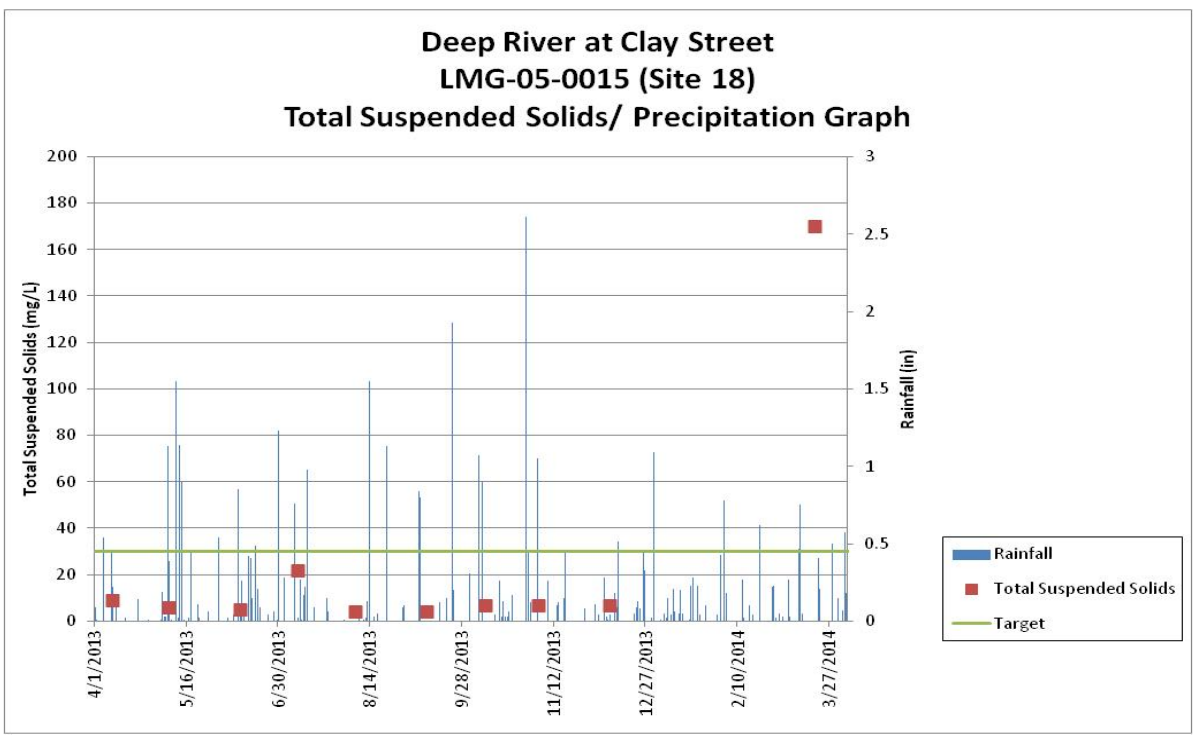


Figure 35. Graph of Precipitation and TSS Data at Most Representative Site in the Main Beaver Dam Ditch Subwatershed

The Main Beaver Dam Ditch subwatershed has a drainage area of 26.27 sq miles. The dominate land use in the Main Beaver Dam Ditch is agricultural land accounting for approximately 43% of the drainage. The sampling locations that are within the Main Beaver Dam Ditch subwatershed include; LMG-05-0018, LMG-05-0015, LMG-05-0036, LMG-05-0016, and LMG-05-0017. Site LMG-05-0015 located at Clay Street Deep River is being used as the pour point of the watershed to assess the contribution of Main Beaver Dam Ditch to the overall Deep River- Portage Burns Watershed.

Site LMG-05-0015 has an *E. coli* geometric mean value of 785.8 MPN/100mL. The curve for this site shows a moderate level impairment of *E. coli* in the stream through different flows. This indicates point sources may be contributing along with nonpoint sources to the violations. The precipitation graph for this site shows the stream is susceptible to high loads of *E. coli* from run-off events. The combined *E. coli* data for the subwatershed have an average single sample maximum violation 58% of the time and an average geometric mean violation 100% of the time. Based on the water quality duration curves, it can be concluded that the majority of high flow sources of *E. coli* in this watershed are point sources and nonpoint sources that include MS4s (Merrillville, Crown Point, Lake County) , unregulated storm water, unregulated animal operations, wildlife, farm field drainage, bank erosion, and animals with direct access to streams. During low flow sources of *E.coli* include straight piped, leaking and failing septic systems. If animals have direct access throughout the watershed it could contribute to *E. coli* violations at dry and wet conditions.

Total phosphorus concentrations at sampling station LMG-05-0015 are elevated throughout the entire sampling project. Site LMG-05-0015 has a total phosphorus percent reduction of 53% with the largest value being 0.64 mg/L. Further analysis of phosphorus concentrations and flow conditions in Deep River-Portage Burns watershed indicate a probable mixture of point and nonpoint sources of nutrients. High loads in the spring may be attributed to the plowing and planting of agricultural fields occurring during these months, increasing the opportunity for sheet and rill erosion with phosphorus attached to soil particles. Data analyzed shows increasing nutrient concentrations with decreasing flows. These results indicate a constant source of nutrients, which is likely related to unregulated animal operations and failing septic systems located upstream of the sampling point.

The monitoring conducted in 2013-2014 showed elevated levels of TSS in the Main Beaver Dam Ditch subwatershed that exceeded the target (30 mg/L), the largest was at 280 mg/l at site LMG-05-0017 (See Appendix B). This sample was taken in the spring of 2014; high loads in the spring may be attributed to the plowing and planting of agricultural fields occurring during these months, increasing the opportunity for sheet and rill erosion. Elevated TSS concentrations during high flows are consistent with significant loads coming from stream bank and gully erosion. Other possible sources include those mentioned in the nutrient linkage analysis. High TSS can also cause an increase in surface temperature which can cause low dissolved oxygen levels and can harm aquatic life, resulting in the impaired biological community listing.

The monitoring conducted during the summer of 2013 showed impaired biotic communities throughout the Main Beaver Dam Ditch. The fish and macroinvertebrate communities were sampled at all five sampling locations in the watershed. Scores for the macroinvertebrate community Index of Biotic Integrity (mIBI) ranged from 20-40, 2 out of the five sites were below the established criteria for aquatic life support which is 36. Scores for the fish community Index of Biotic Integrity (IBI) ranged from 12-38, with only three out of the five meeting the established criteria for aquatic life support which is 36. Sites LMG-05-0016 and LMG-05-0036 were the only two sites out of the five sites sampled to pass for both fish community and macroinvertebrates. Elevated TSS and phosphorus levels are all factors in why the biological communities are being stressed. Other concerns in the watershed include low dissolved oxygen values along with poor QHEI scores that contribute to the stressed biotic communities.

7.3.3 Headwaters Turkey Creek

Load duration curves and precipitation graphs were created for all the sampling sites in the Headwaters Turkey Creek subwatershed. The figures 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 39 provides a summary of the Headwaters Turkey Creek subwatershed, including impaired segment AUID, drainage area, sampling sites, listed segments, land use, NPDES facilities, MS4 community, CSO communities, CFOs, and CAFOs, as well as Load Allocations, Wasteload Allocations, 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 39. Summary of Headwaters Turkey Creek Subwatershed Characteristics

Upstream Characteristics					
Drainage Area	21.23 square miles				
TMDL Sample Site	LMG-05-0023, LMG-05-0024, LMG-05-0025, LMG-05-0026, LMG-05-0027, LMG-05-0028				
AUID Segments	INC0153_01, INC0153_T1001, INC0153_T1002, INC0153_T1003, INC0153_T1004, INC0153_T1005				
Land Use	Agricultural Land: 13% Forested Land: 9% Developed Land: 54% Open Water: 1% Pasture/Hay: 3% Grassland/Shrubs: 12% Wetland: 8%				
NPDES Facilities	Calumet Bus Services: (INR00C114) Laketon Refining Corporation: (INR00L018) Walsh and Kelly Incorporated: (INR210466); (INRM00438) American Chemical Service Inc.: (INR230064) Wild Bills Incorporated: (INR600286) Travel Centers of America: (INR700040) Griffifth Merrillville Airport: (INR800012)				
MS4 Communities	St. John: INR040047 (0.98 sq miles) Schererville: INR040112 (4.17 sq miles) Merrillville: INR040049 (3.23 sq miles) Crown Point: INR040054 (0.03 sq miles) Lake County: INR040124 (2.41 sq miles) Griffith: INR040108 (0.72 sq miles)				
CSO Communities	NA				
CAFOs	NA				
CFOs	NA				
TMDL *E. coli* Allocations (billion MPN/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**“Normal” Flows**	**Lower Flow Conditions**	**Low Flows**
LA	190.03	46.38	46.20	21.32	9.78
Future Growth	23.38	5.70	2.43	1.12	0.51
WLA	254.16	62.01	0.00	0.00	0.00
MOS (5%)	24.61	6.00	2.56	1.18	0.54
TMDL = LA+WLA+MOS	492.18	120.09	51.19	23.62	10.83
TMDL TSS Allocations (lbs/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**“Normal” Flows**	**Lower Flow Conditions**	**Low Flows**
LA	5,321.61	1,298.48	1,300.06	600.03	275.01
Future Growth	657.92	160.53	68.42	31.58	14.47
WLA	7,178.93	1,751.66	0.00	0.00	0.00
MOS (5%)	692.55	168.98	72.03	33.24	15.24
TMDL = LA+WLA+MOS	13,851.01	3,379.65	1,440.51	664.85	304.72

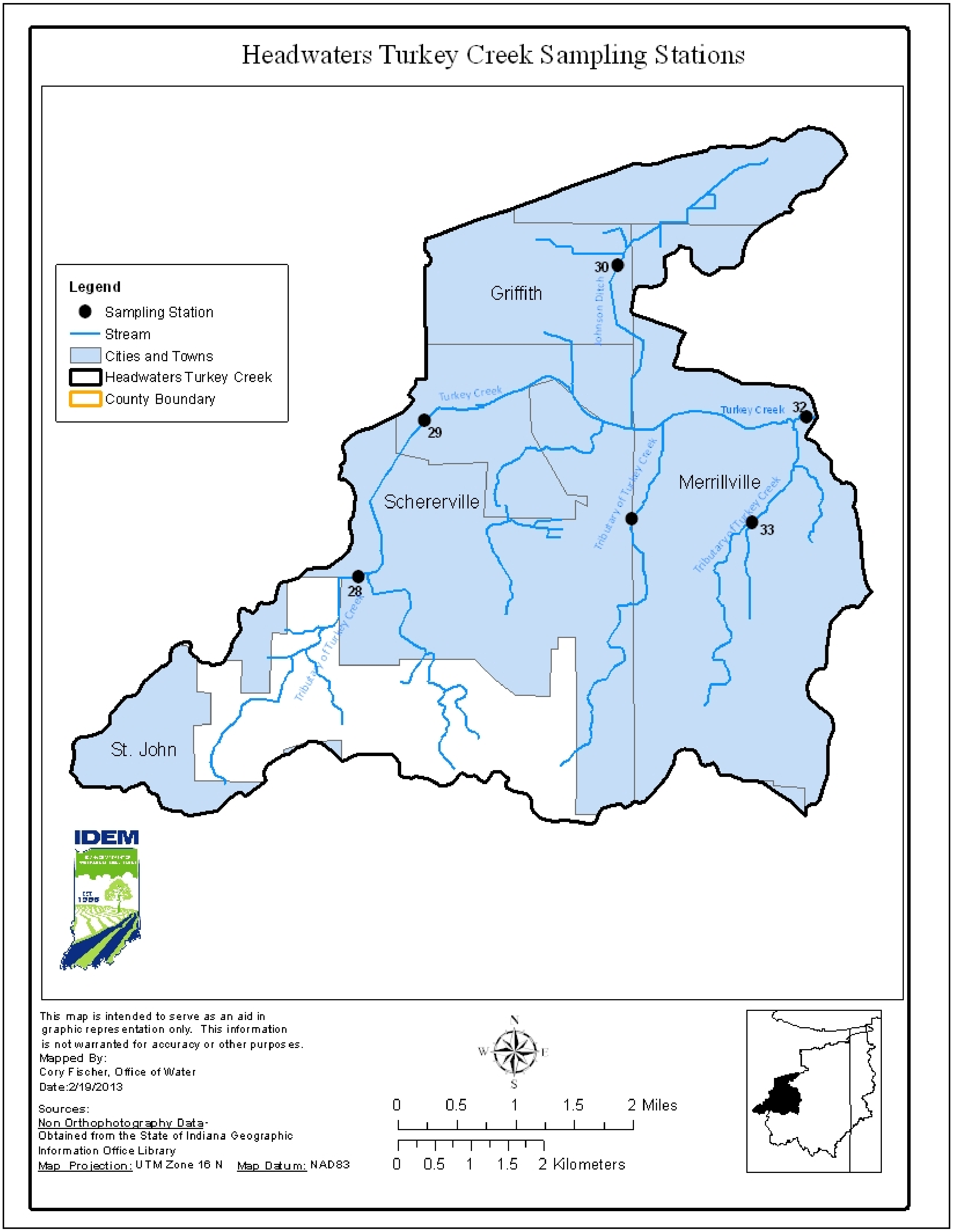


Figure 36. Sampling Stations in the Headwaters Turkey Creek Subwatershed

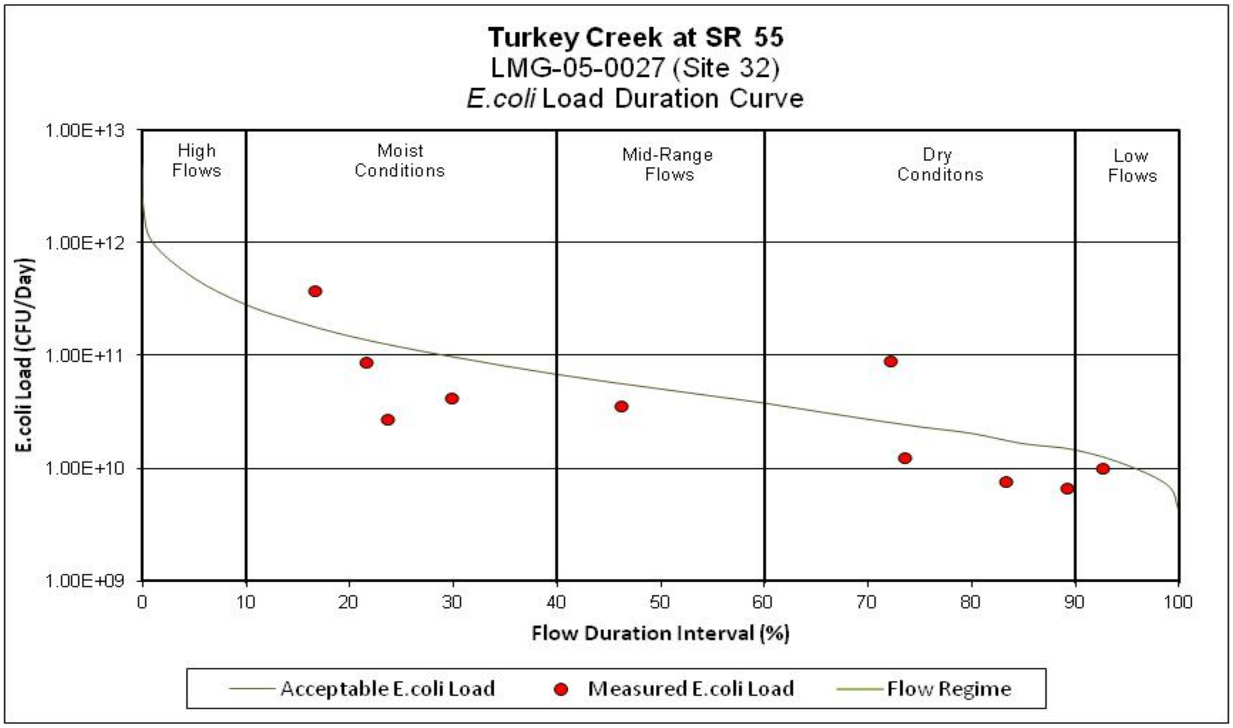


Figure 37. *E. coli* Load Duration Curve for Most Representative Site in the Headwaters Turkey Creek Subwatershed

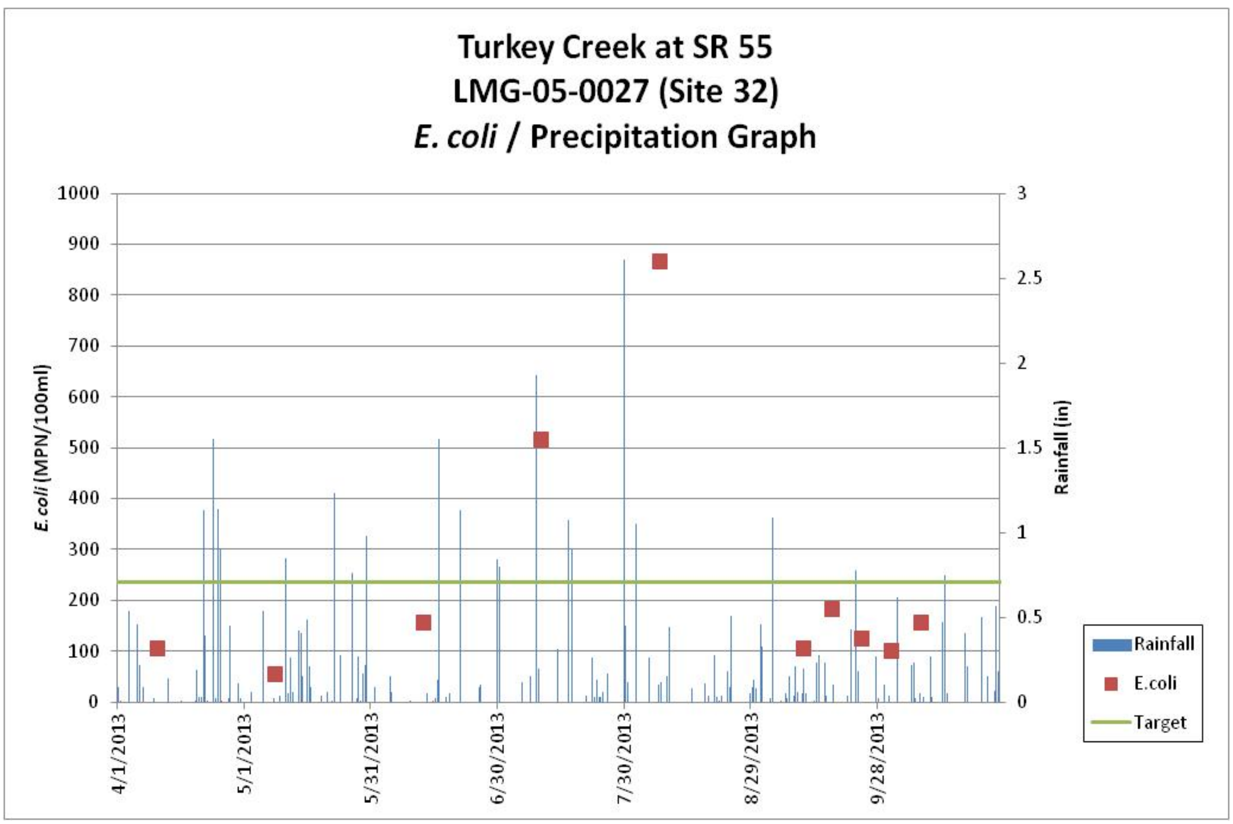


Figure 38. Graph of Precipitation and *E. coli* Data at Most Representative Site in the Headwaters Turkey Creek Subwatershed

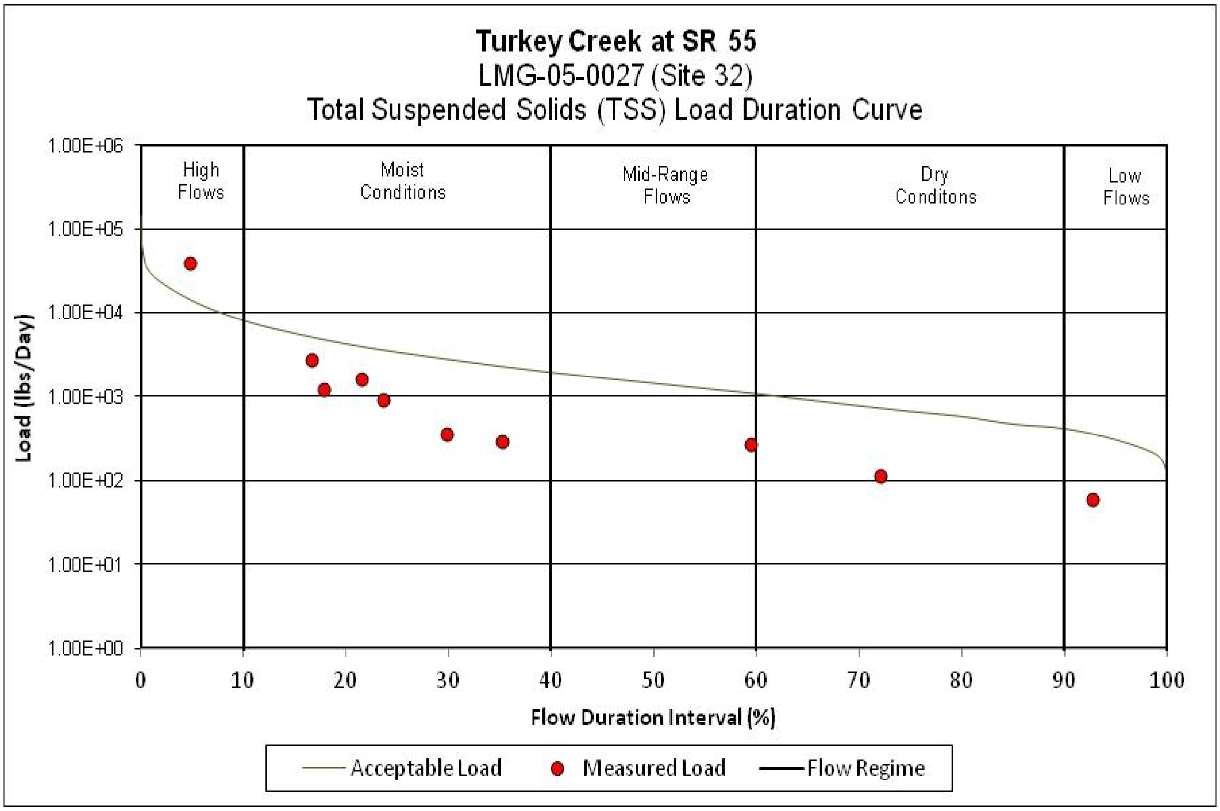


Figure 39. TSS Load Duration Curve for Most Representative Site in the Headwaters Turkey Creek Subwatershed

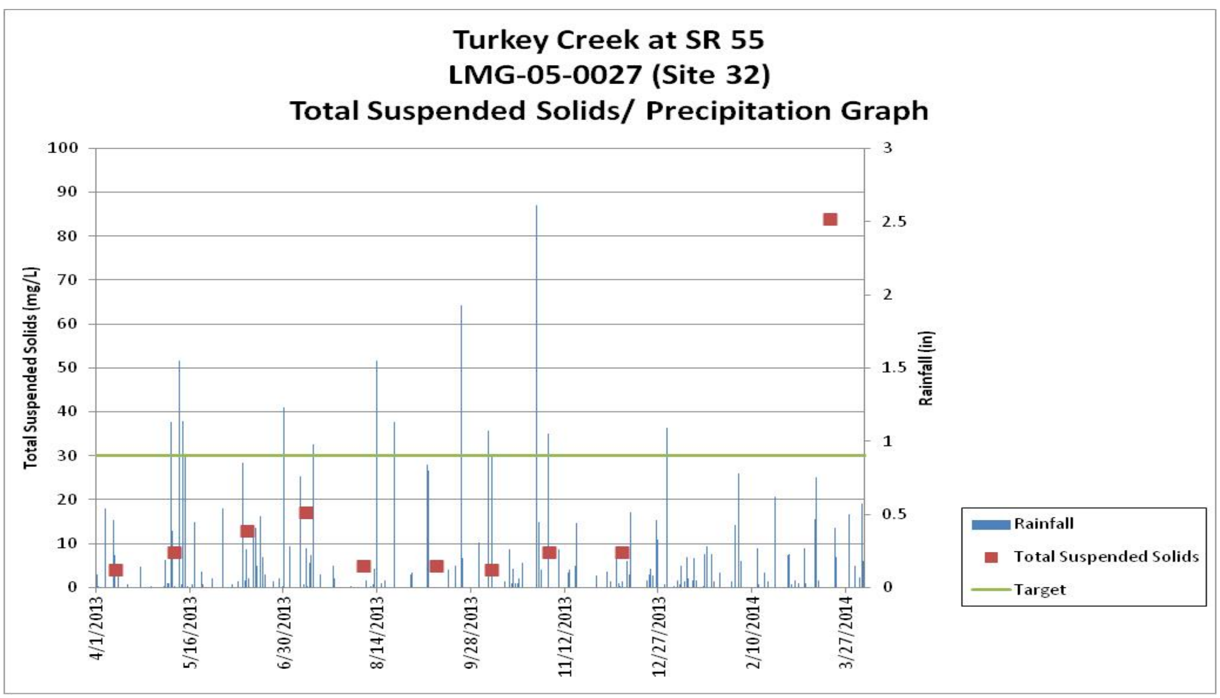


Figure 40. Graph of Precipitation and TSS Data at Most Representative Site in the Headwaters Turkey Creek Subwatershed

The Headwaters Turkey Creek subwatershed has a drainage area of 21.23 sq miles. The dominate land use in the Headwaters Turkey Creek is developed land accounting for approximately 54% of the drainage.

The sampling locations that are within the Headwaters Turkey Creek subwatershed include; LMG-05-0023, LMG-05-0024, LMG-05-0025, LMG-05-0026, LMG-05-0027, and LMG-05-0028. Site LMG-05-0027 located at SR55 on Turkey Creek is being used as the pour point of the watershed to assess the contribution of Headwaters Turkey Creek to the overall Deep River- Portage Burns Watershed.

Site LMG-05-0027 has an *E. coli* geometric mean value of 132 MPN/100mL. The curve for this site shows a low level impairment of *E. coli* in the stream through different flows. This indicates point sources may be contributing along with nonpoint sources to the impairments. The precipitation graph for this site shows the stream is susceptible to high loads of *E. coli* from run-off events. The combined *E. coli* data for the subwatershed have an average single sample maximum violation 48% of the time and violated the geometric mean at five out of six sites (83%) of the time. Site LMG-05-0026 was the only site to pass for *E.coli* with a geometric mean of 98 MPN/100mL. Based on the water quality duration curves, it can be concluded that the majority of high flow sources of *E. coli* in this watershed are point sources and nonpoint sources that include Crown Point CSOs, MS4s(St. John, Schererville, Merrillville, Crown Point, Lake County and Griffith) , unregulated storm water, unregulated animal operations, wildlife, and animals with direct access to streams. During low flow sources of *E.coli* include straight piped, leaking and failing septic systems. If animals have direct access throughout the watershed it could contribute to *E. coli* violations at dry and wet conditions.

Total phosphorus concentrations at sampling station LMG-05-0027 are under the TMDL targets throughout the entire sampling project. Site LMG-05-0027 has a total phosphorus maximum concentration of 0.18 mg/L, which is below the TMDL target.

The monitoring conducted in 2013-2014 showed elevated levels of TSS in the Headwaters Turkey Creek subwatershed that exceeded the target (30 mg/L), the largest was 130 mg/l at site LMG-05-0023, and three of the six sites in the subwatershed need reductions of TSS (See Appendix B). The elevated sample was taken in the spring of 2014; high loads in the spring may be attributed to the plowing and planting of agricultural fields occurring during these months, increasing the opportunity for sheet and rill erosion. Elevated TSS concentrations during high flows are consistent with significant loads coming from stream bank and gully erosion. Other possible sources include those mentioned in the nutrient linkage analysis. High TSS can also cause an increase in surface temperature which can cause low dissolved oxygen levels and can harm aquatic life, resulting in the impaired biological community listing.

The monitoring conducted during the summer of 2013 showed impaired biotic communities throughout the Headwaters Turkey Creek. The fish and macroinvertebrate communities were sampled at all six sampling locations in the watershed. Scores for the macroinvertebrate community Index of Biotic Integrity (mIBI) ranged from 26-34 all of which are below the established criteria for aquatic life support which is 36. Scores for the fish community Index of Biotic Integrity (IBI) ranged from 12-42, with four out of the six sites being below the established criteria for the fish community. However since all the sites failed for mIBI, each segment will be listed for IBC. Elevated TSS levels along with poor to fair QHEI scores are factors in why the biological communities are being stressed. Other concerns in the watershed include low dissolved oxygen values along with poor QHEI scores that contribute to the stressed biotic communities. Four out of the six sampling station had dissolved oxygen values less than our target of 4 mg/L, with the lowest being at site LMG-05-0023 at 1.16 mg/L.

7.3.4 Deer Creek- Deep River

Load duration curves and precipitation graphs were created for all the sampling sites in the Deer Creek-Deep River subwatershed. The figures 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 40 provides a summary of the Deer Creek- Deep River subwatershed, including impaired segment AUID, drainage area, sampling sites, listed segments, land use, NPDES facilities, MS4 community, CSO communities, CFOs, and CAFOs, as well as Load Allocations, Wasteload Allocations, 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 40. Summary of Deer Creek- Deep River Subwatershed Characteristics

Upstream Characteristics					
Drainage Area	21.45 square miles				
TMDL Sample Site	LMG-05-0013, LMG-05-0014, LMG-05-0034, LMG-05-0035				
AUID Segments	INC0154_01, INC0154_T1001, INC0154_T1002, INC0154_T1003, INC0154_T1004, INC0154_T1005				
Land Use	Agricultural Land: 34% Forested Land: 14% Developed Land: 16% Open Water: 1% Pasture/Hay: 12% Grassland/Shrubs: 15% Wetland: 8%				
NPDES Facilities	Winfield WWTP: IN0058343 (0.4 MGD) Deep River Water Park WWTP: IN0058378 (0.030 MGD) Chicagoland Christian Village: IN0054470 (0.05 MGD) Falling Waters Conservancy District: IN0062090 (0.124 MGD)				
MS4 Communities	Hobart: INR040130 (0.04 sq miles) Lakes of the Four Seasons: INR040007 (0.54 sq miles) Merrillville: INR040049 (0.49 sq miles) Porter County: INR040140 (0.53 sq miles) Lake County: INR040124 (1.77 sq miles)				
CSO Communities	NA				
CAFOs	NA				
CFOs	NA				
TMDL *E. coli* Allocations (billion MPN/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**“Normal” Flows**	**Lower Flow Conditions**	**Low Flows**
LA	373.24	90.07	46.16	21.02	9.35
Future Growth	23.88	6.02	2.71	1.39	0.77
WLA	80.40	24.28	5.37	5.37	5.37
MOS (5%)	25.13	6.34	2.85	1.46	0.82
TMDL = LA+WLA+MOS	502.65	126.71	57.09	29.24	16.31
TMDL Total Phosphorus Allocations (lbs/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**“Normal” Flows**	**Lower Flow Conditions**	**Low Flows**
LA	104.16	24.63	12.12	5.04	1.76
Future Growth	6.65	1.63	0.70	0.33	0.15
WLA	22.26	6.30	1.13	1.13	1.13
MOS (5%)	7.00	1.71	0.73	0.34	0.16
TMDL = LA+WLA+MOS	140.07	34.27	14.68	6.84	3.20
TMDL TSS Allocations (lbs/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**“Normal” Flows**	**Lower Flow Conditions**	**Low Flows**
LA	10,529.65	2,577.03	1,338.93	631.66	303.27
Future Growth	669.50	166.95	73.89	36.66	19.38
WLA	2,190.78	595.07	64.95	64.95	64.95
MOS (5%)	704.73	175.74	77.78	38.59	20.40
TMDL = LA+WLA+MOS	14,094.66	3,514.79	1,555.55	771.86	408.00

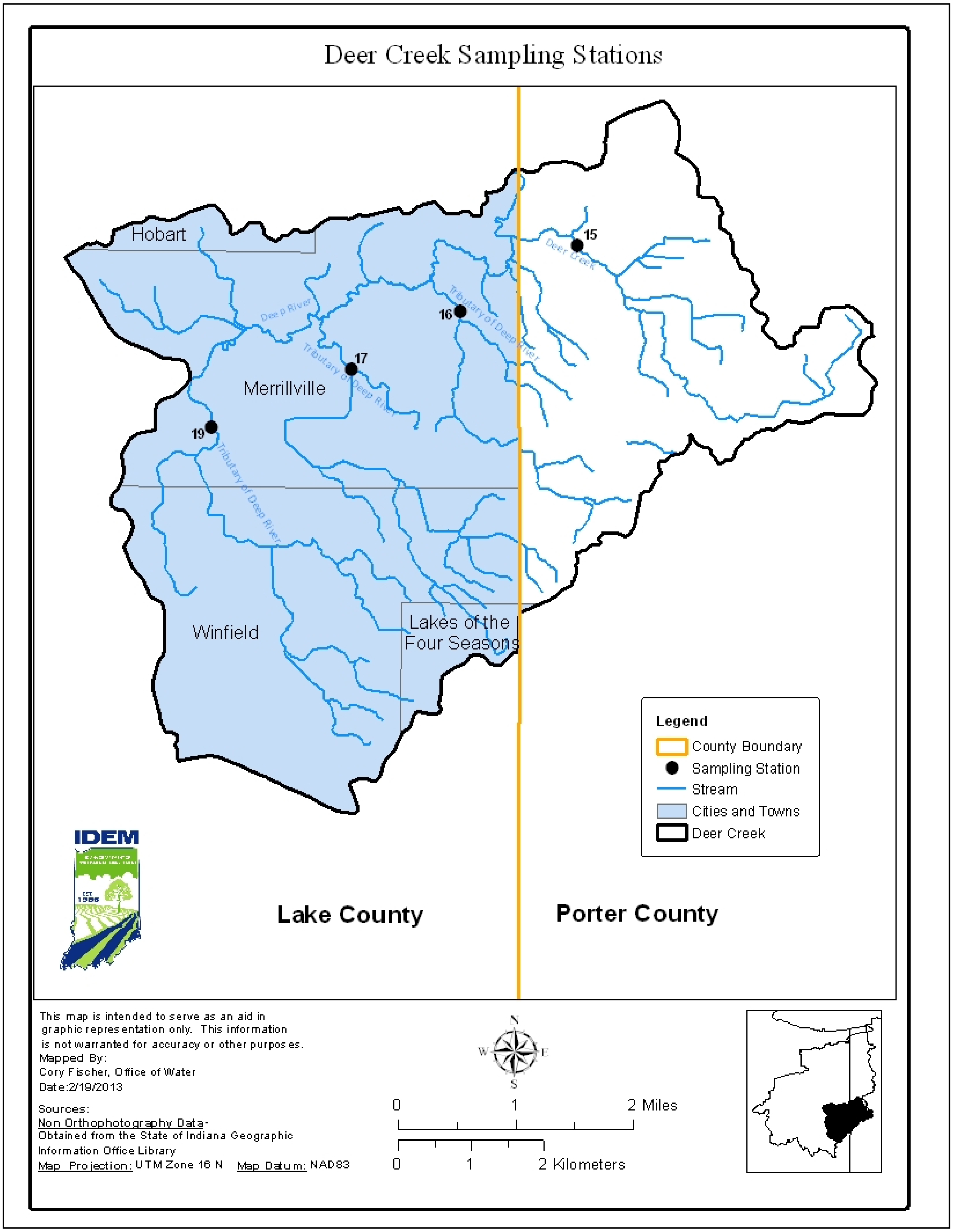


Figure 41. Sampling Stations in the Deer Creek- Deep River Subwatershed

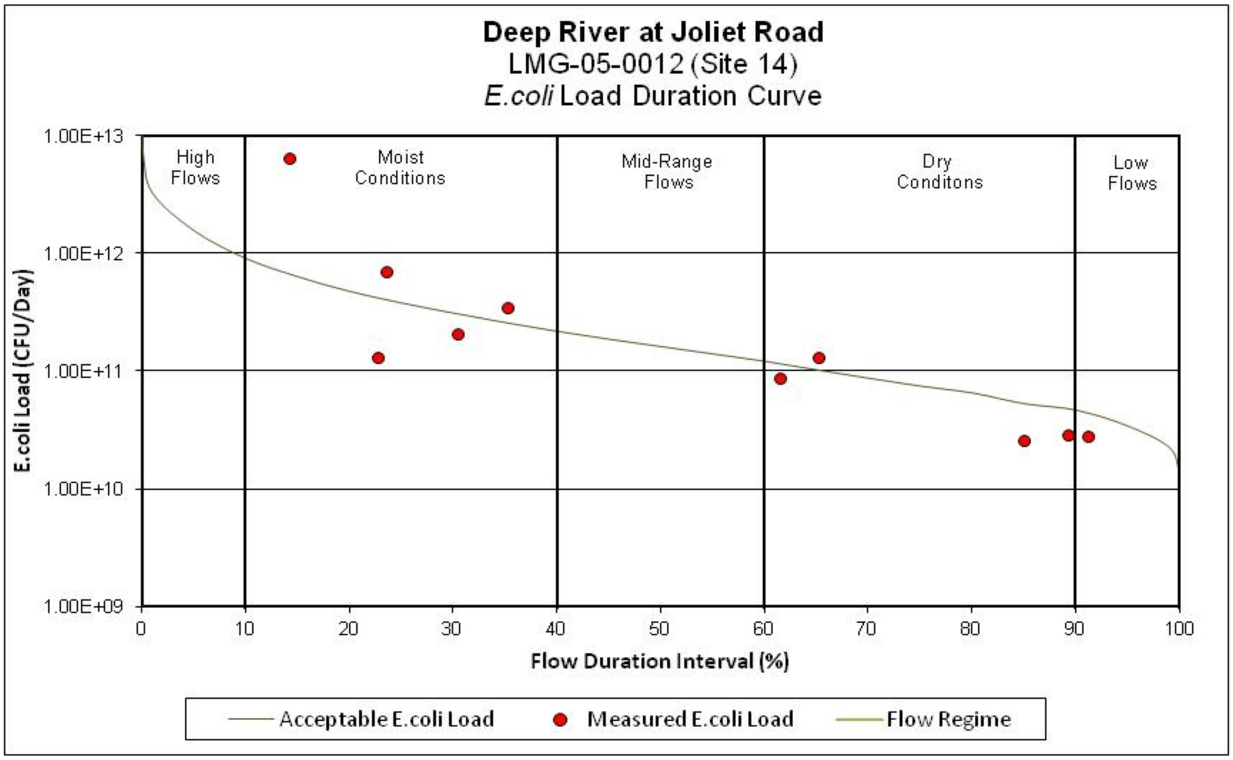


Figure 42. *E. coli* Load Duration Curve for Most Representative Site in the Deer Creek- Deep River Subwatershed

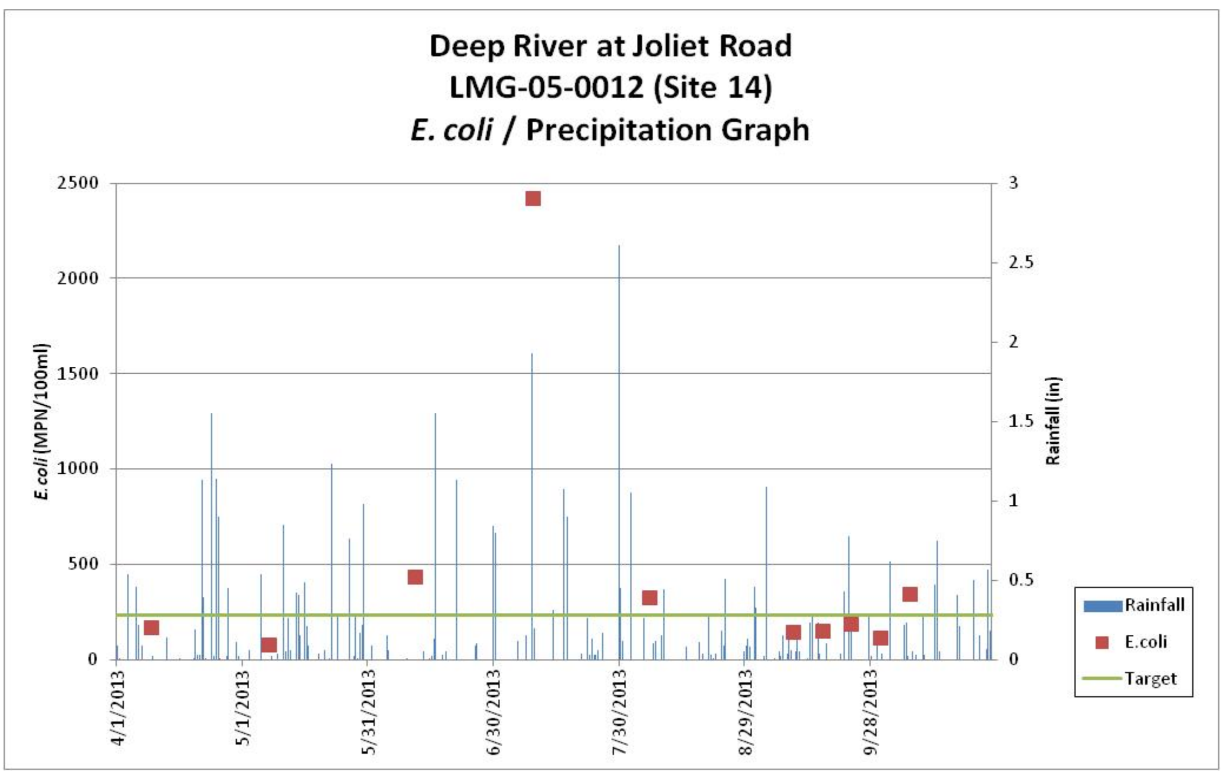


Figure 43. Graph of Precipitation and *E. coli* Data at Most Representative Site in the Deer Creek- Deep River Subwatershed

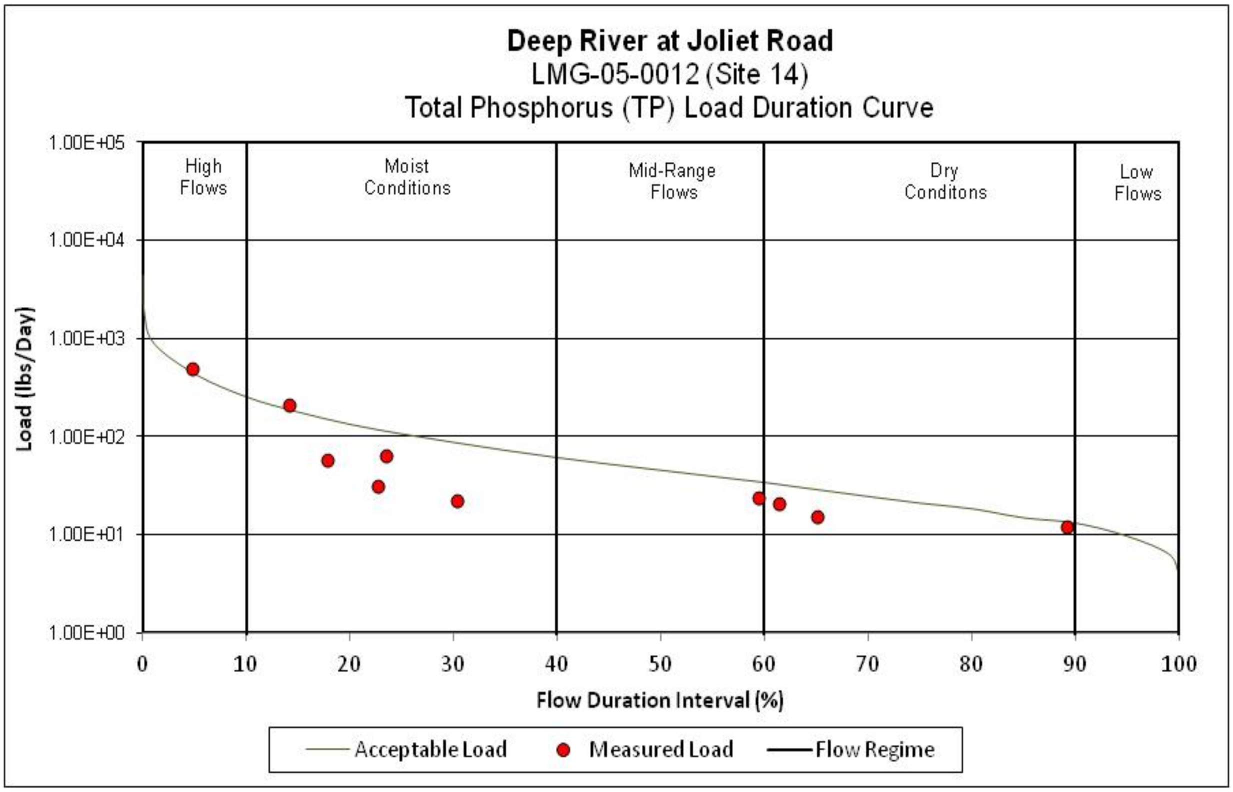


Figure 44. Total Phosphorus Load Duration Curve for Most Representative Site in the Deer Creek-Deep River Subwatershed

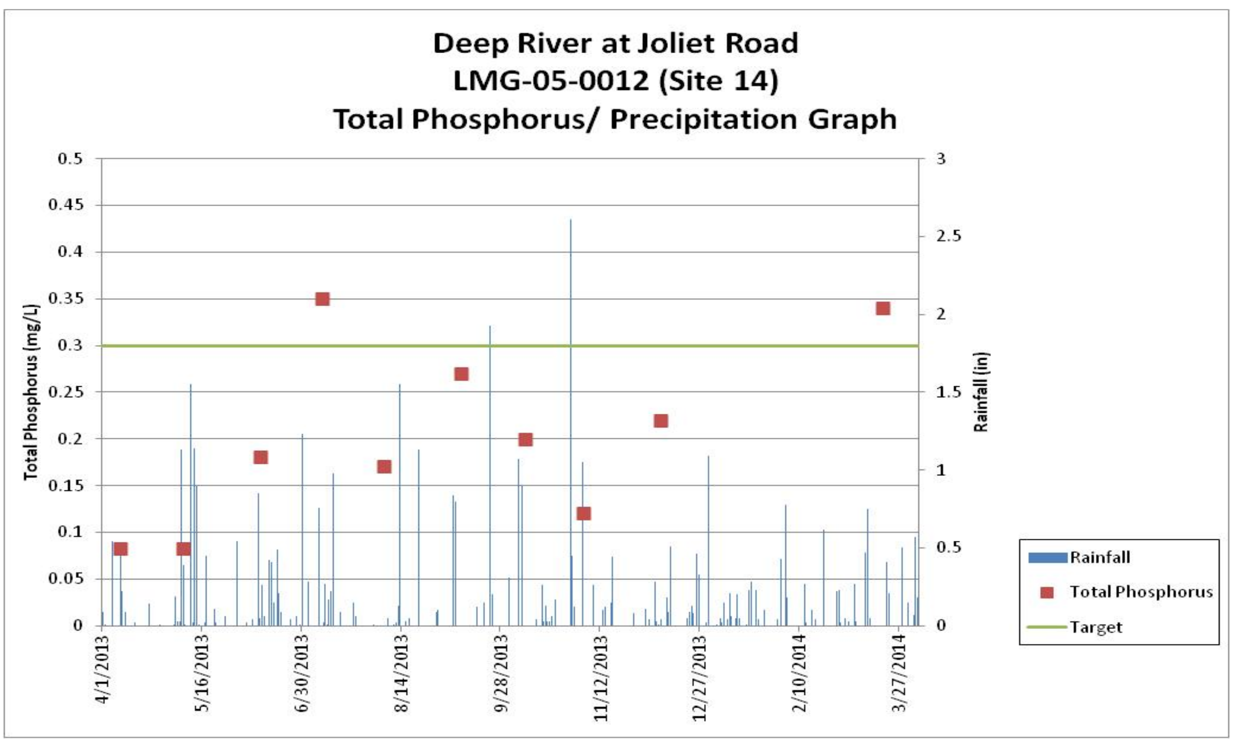


Figure 45. Graph of Precipitation and Total Phosphorus Data at Most Representative Site in the Deer Creek- Deep River Subwatershed

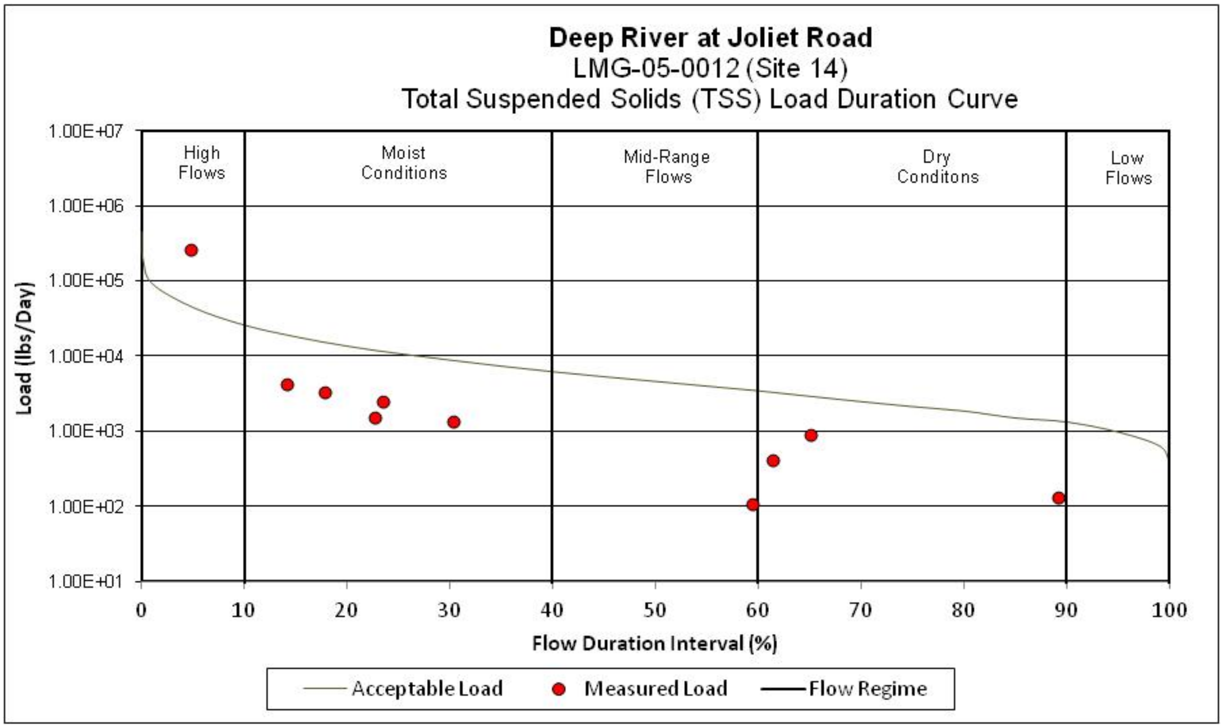


Figure 46. TSS Load Duration Curve for Most Representative Site in the Deer Creek- Deep River Subwatershed

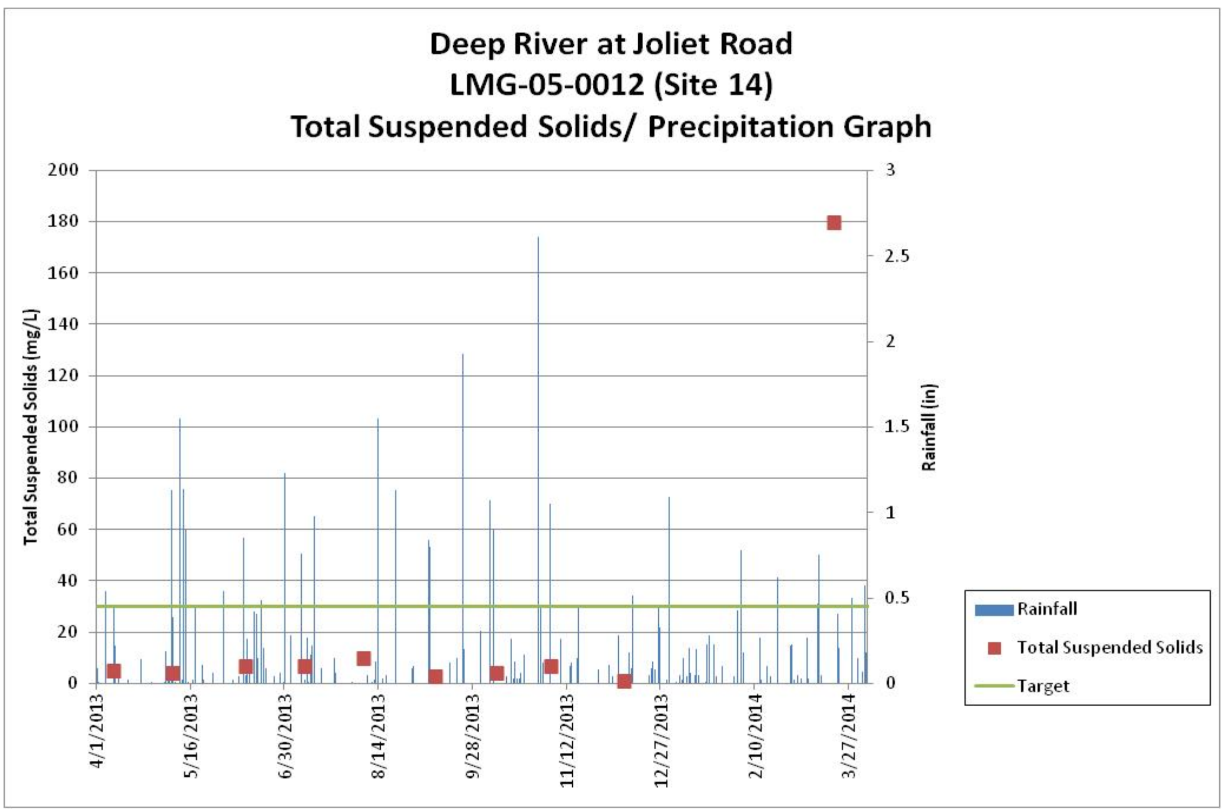


Figure 47. Graph of Precipitation and TSS Data at Most Representative Site in the Deer Creek- Deep River Subwatershed

The Deer Creek- Deep River subwatershed has a drainage area of 21.45 sq miles. The dominate land use in the Deer Creek- Deep River is agricultural accounting for approximately 34% of the drainage. The sampling locations that are within the Deer Creek- Deep River Subwatershed include; LMG-05-0013, LMG-05-0014, LMG-05-0034, LMG-05-0035. Site LMG-05-0012 located at Joliet Road on Deep River is being used as the pour point of the watershed to assess the contribution of Deer Creek- Deep River to the overall Deep River- Portage Burns watershed.

Site LMG-05-0012 has an *E. coli* geometric mean value of 177 MPN/100mL. The curve for this site shows a low level impairment of *E. coli* in the stream through different flows. This indicates point sources may be contributing along with nonpoint sources to the impairments. The precipitation graph for this site shows the stream is susceptible to high loads of *E. coli* from run-off events. The combined *E. coli* data for the subwatershed have an average single sample maximum violation 75% of the time and an average geometric mean violation 100% of the time. Based on the water quality duration curves, it can be concluded that the majority of high flow sources of *E. coli* in this watershed are point sources and nonpoint sources that include Winfield WWTP, Deep River Water Park WWTP, Chicagoland Christian Village, Falling Waters Conservency District, MS4s (Hobart, Lakes of the Four Seasons, Merrillville, Porter County, and Lake County), unregulated storm water, unregulated animal operations, wildlife, and animals with direct access to streams. During low flow sources of *E.coli* include the Winfield WWTP, Deep River Water Park WWTP, Chicagoland Christian Village, Falling Waters Conservancy District, straight piped, leaking and failing septic systems. If animals have direct access throughout the watershed it could contribute to *E. coli* violations at dry and wet conditions.

Total phosphorus concentrations at sampling station LMG-05-0012 are elevated during higher flow events suggesting nonpoint sources contributing to the majority of the load. Site LMG-05-0012 has a total phosphorus percent reduction of 14% with the largest value being 0.35 mg/L. Further analysis of phosphorus concentrations and flow conditions in Deep River- Portage Burns watershed indicate a probable mixture of point and nonpoint sources of nutrients. High loads in the spring may be attributed to the plowing and planting of agricultural fields occurring during these months, increasing the opportunity for sheet and rill erosion with phosphorus and nitrogen attached to soil particles. Additional potential low flow sources include unregulated animal operations and failing septic systems located adjacent to the stream.

The monitoring conducted in 2013-2014 showed elevated levels of TSS in the Deer Creek- Deep River subwatershed that exceeded the target (30 mg/L), the largest was at 92 mg/l at site LMG-05-0035. This sample was taken in the spring; high loads in the spring may be attributed to the plowing and planting of agricultural fields occurring during these months, increasing the opportunity for sheet and rill erosion. Elevated TSS concentrations during high flows are consistent with significant loads coming from stream bank and gully erosion. The source assessment identifies the Winfield WWTP, Deep River Water Park WWTP, Chicagoland Christian Village; Falling Waters Conservancy District is within the Deer Creek- Deep River subwatershed directly upstream of the sampling point which could also contribute to the violation. Other possible sources include those mentioned in the nutrient linkage analysis. High TSS can also cause an increase in surface temperature which can cause low dissolved oxygen levels and can harm aquatic life, resulting in the impaired biological community listing.

The monitoring conducted during the summer of 2013 showed impaired biotic communities throughout the Deer Creek- Deep River. The fish and macroinvertebrate communities were sampled at all four sampling locations in the watershed. Scores for the macroinvertebrate community Index of Biotic Integrity (mIBI) ranged from 38-38 three of the four sampling sites are all below the established criteria for aquatic life support which is 36. Scores for the fish community Index of Biotic Integrity (IBI) ranged from 30-40, three of the four sampling sites are all below the established criteria for aquatic life support which is 36. However since all the sites for mIBI each segment will be listed for IBC. Elevated TSS and phosphorus levels are both factors in why the biological communities are being stressed. Other concerns in the watershed include low dissolved oxygen values along with poor QHEI scores that contribute to the stressed biotic communities. One out of the four sites in the watershed show dissolved oxygen values less than the target of 4mg/L, with site LMG-05-0035 having a value of 3.39 mg/L.

7.3.5 City of Merrillville- Turkey Creek

Load duration curves and precipitation graphs were created for all the sampling sites in the City of Merrillville- Turkey Creek subwatershed. The figures 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 41 provides a summary of the City of Merrillville-Turkey Creek subwatershed, including impaired segment AUID, drainage area, sampling sites, listed segments, land use, NPDES facilities, MS4 community, CSO communities, CFOs, and CAFOs, as well as Load Allocations, Wasteload Allocations, 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 41. Summary of City of Merrillville- Turkey Creek Subwatershed Characteristics

Upstream Characteristics					
Drainage Area	19.51 square miles				
TMDL Sample Site	LMG-05-0029, LMG-05-0030, LMG-05-0031				
AUID Segments	INC0155_01, INC0155_01A, INC0155_T1001, INC0155_T1002, INC0155_T1003, INC0155_T1003A, INC0155_P1001, INC0155_P1002				
Land Use	Agricultural Land: 11% Forested Land: 7% Developed Land: 63% Open Water: 1% Pasture/Hay: 1% Grassland/Shrubs: 9% Wetland: 7%				
NPDES Facilities	CHNUPA & Hoffman Corp. Nummies Auto Parts: (INR00N049) Frito Lay Incorporated: (INRM00083)				
MS4 Communities	Hobart: INR040130 (1.28 sq miles) Gary: INR040101 (1.83 sq miles) Merrillville: INR040049 (8.65 sq miles) Lake County: INR040124 (0.53 sq miles)				
CSO Communities	NA				
CAFOs	NA				
CFOs	NA				
TMDL *E. coli* Allocations (billion MPN/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**"Normal" Flows**	**Lower Flow Conditions**	**Low Flows**
LA	137.53	33.55	42.46	19.59	8.98
Future Growth	21.48	5.24	2.23	1.03	0.47
WLA	270.68	66.05	0.00	0.00	0.00
MOS (5%)	22.62	5.52	2.35	1.09	0.50
TMDL = LA+WLA+MOS	452.31	110.36	47.04	21.71	9.95
TMDL TSS Allocations (lbs/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**"Normal" Flows**	**Lower Flow Conditions**	**Low Flows**
LA	3,847.65	938.83	1,194.73	551.41	252.73
Future Growth	604.62	147.53	62.88	29.02	13.30
WLA	7,640.12	1,864.19	0.00	0.00	0.00
MOS (5%)	636.44	155.29	66.19	30.55	14.00
TMDL = LA+WLA+MOS	12,728.83	3,105.84	1,323.80	610.98	280.03

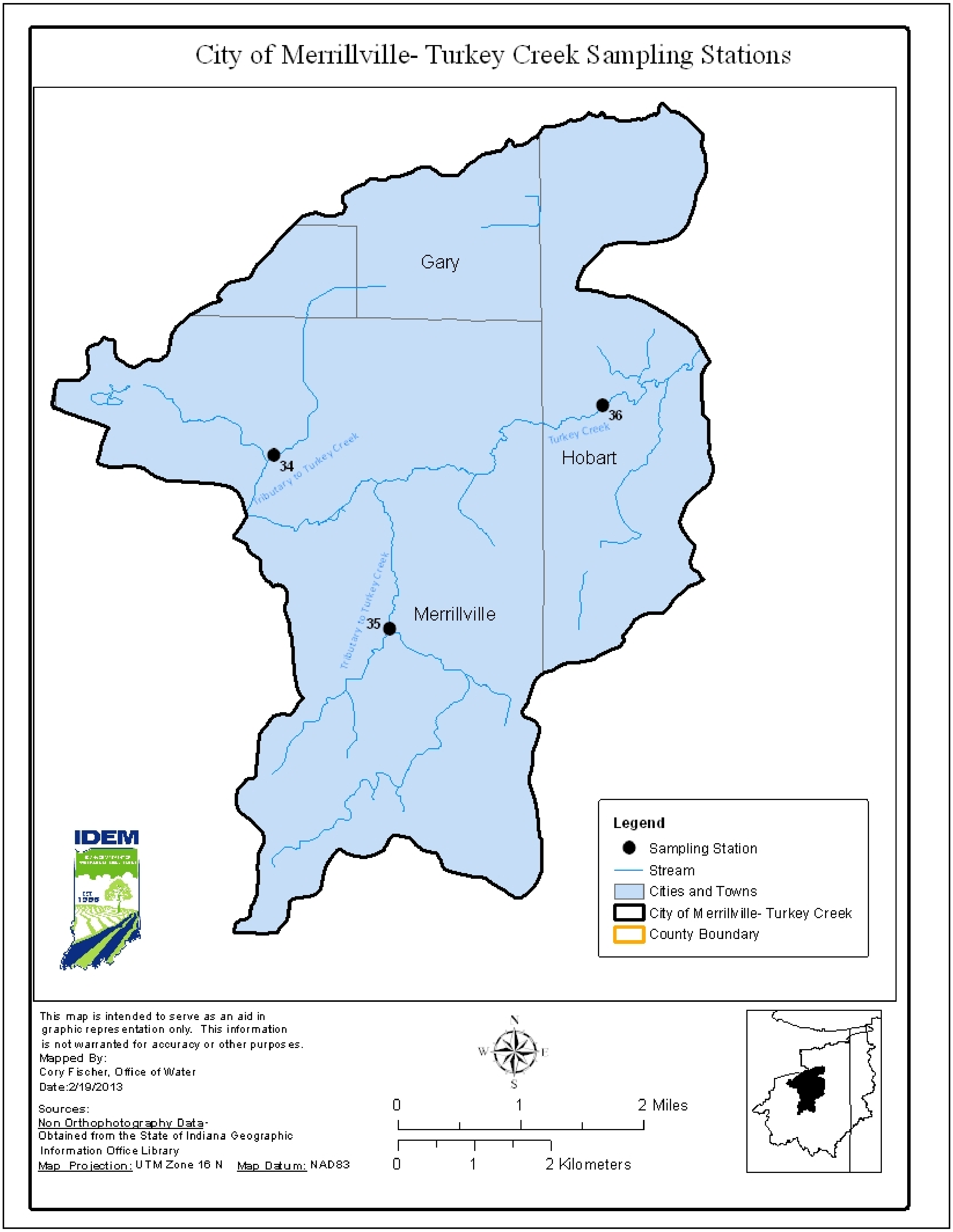


Figure 48. Sampling Stations in the City of Merrillville- Turkey Creek Subwatershed

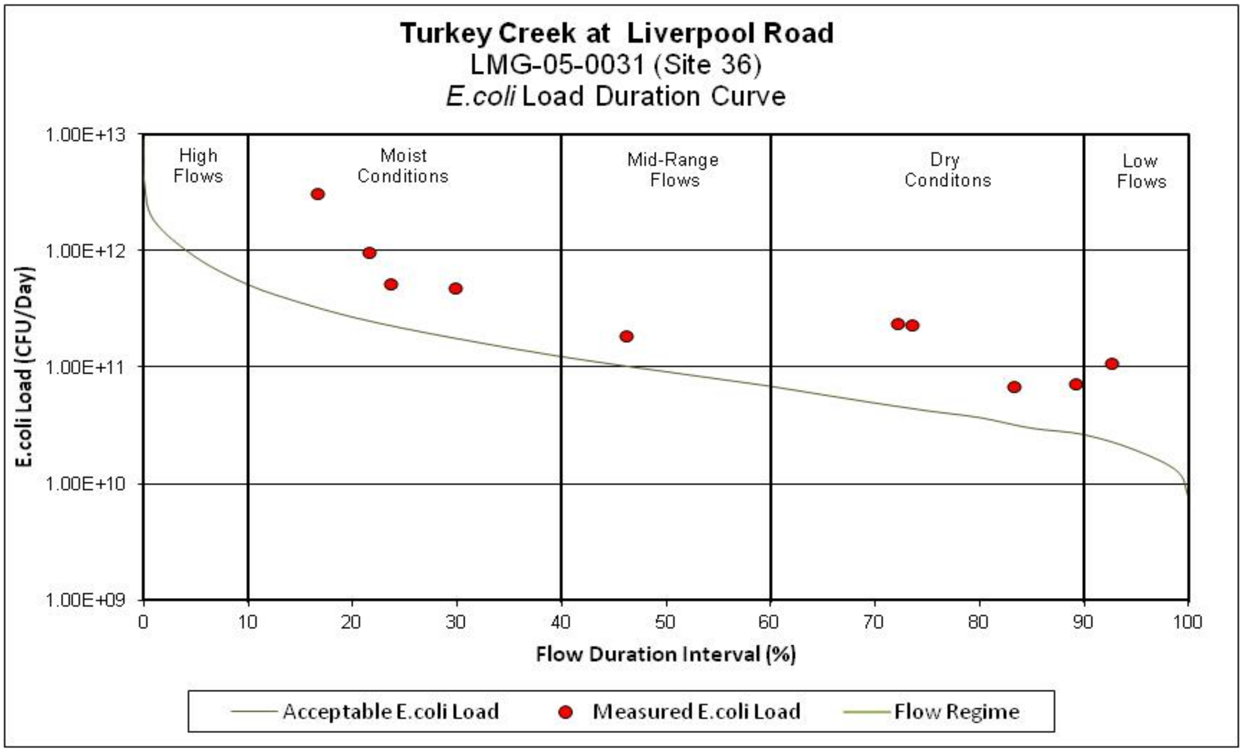


Figure 49. ***E. coli*** **Load Duration Curve for Most Representative Site in the City of Merrillville-Turkey Creek Subwatershed**

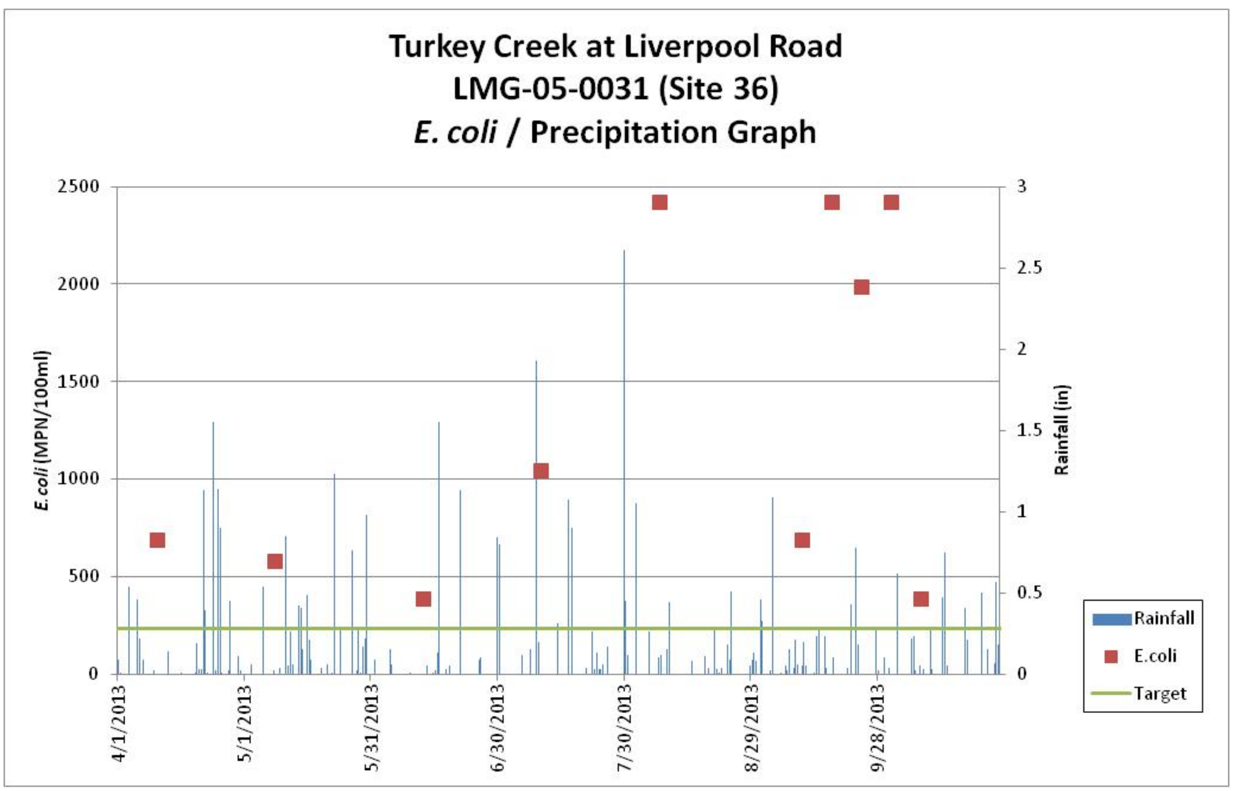


Figure 50. Graph of Precipitation and ***E. coli*** **Data at Most Representative Site in the City of Merrillville- Turkey Creek Subwatershed**

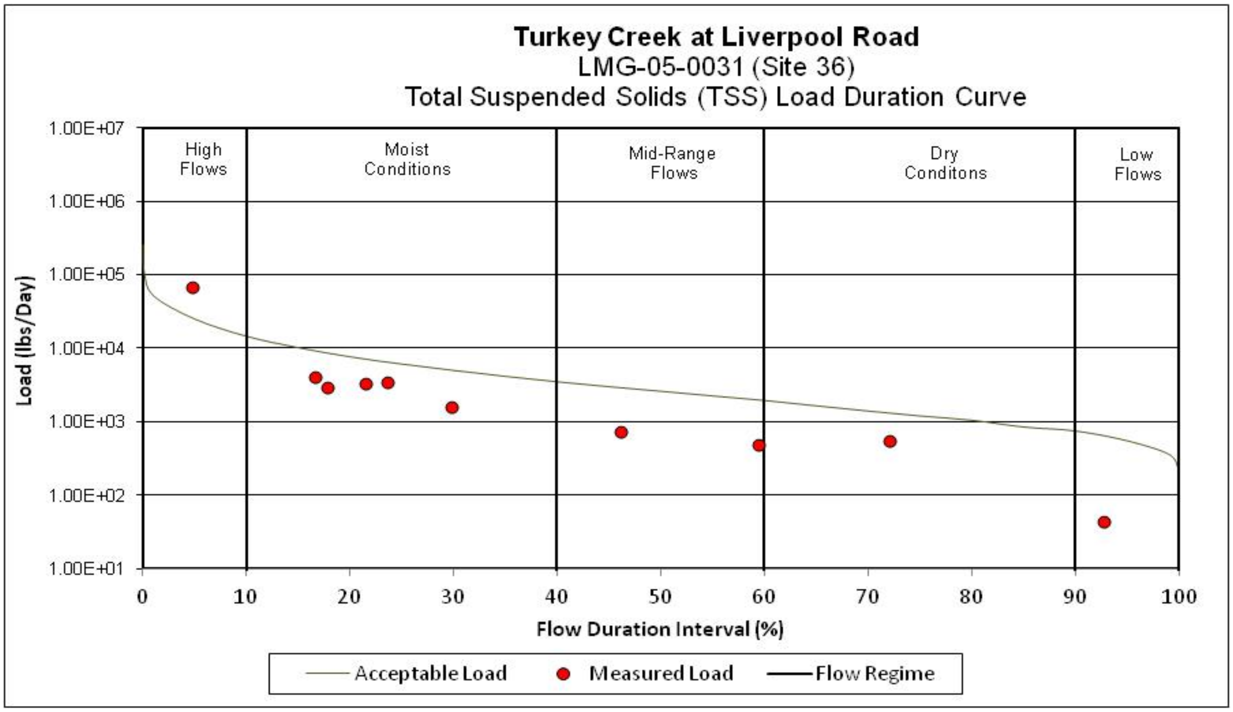


Figure 51. TSS Load Duration Curve for Most Representative Site in the City of Merrillville- Turkey Creek Subwatershed

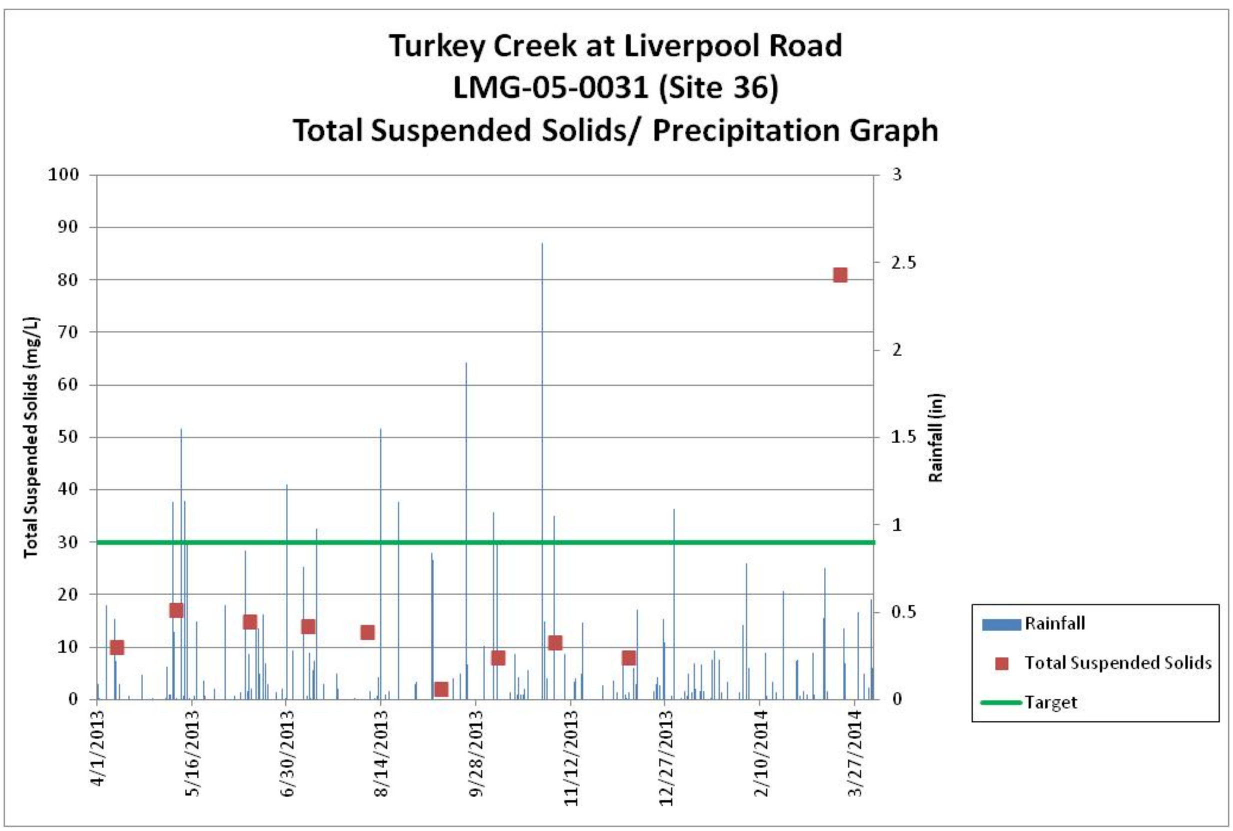


Figure 52. Graph of Precipitation and TSS Data at Most Representative Site in the City of Merrillville- Turkey Creek Subwatershed

The City of Merrillville- Turkey Creek subwatershed has a drainage area of 19.51 sq miles. The dominate land use in the City of Merrillville- Turkey Creek is developed land accounting for approximately 63% of the drainage. The sampling locations that are within the City of Merrillville- Turkey Creek subwatershed include; LMG-05-0029, LMG-05-0030, LMG-05-0031. Site LMG-05-0031 located at Smith Street on Main Beaver Dam Ditch is being used as the pour point of the watershed to assess the contribution of City of Merrillville- Turkey Creek to the overall Deep River- Portage Burns watershed.

Site LMG-05-0031 has an *E. coli* geometric mean value of >1253 MPN/100mL. The curve for this site shows a moderate level impairment of *E. coli* in the stream through all flow regimes that were sampled. This indicates point sources may be contributing along with nonpoint sources to the impairments. The precipitation graph for this site shows the stream is susceptible to high loads of *E. coli* from run-off events. The combined *E. coli* data for the subwatershed have an average single sample maximum violation 80% of the time and an average geometric mean violation 100% of the time. Based on the water quality duration curves, it can be concluded that the majority of high flow sources of *E. coli* in this watershed are point sources and nonpoint sources that include MS4s (Gary, Hobart Merrillville, and Lake County),unregulated storm water, unregulated animal operations, wildlife, and animals with direct access to streams. During low flow sources of *E.coli* include wildlife and straight piped, leaking and failing septic systems. If animals have direct access throughout the watershed it could contribute to *E. coli* violations at dry and wet conditions.

Total phosphorus concentrations at sampling station LMG-05-0031 were below the water quality targets throughout the entire sampling project. Site LMG-05-0031 has a total phosphorus percent reduction of 0% with the largest value being 0.19 mg/L

The monitoring conducted in 2013-2014 showed elevated levels of TSS in the City of Merrillville- Turkey Creek subwatershed that exceeded the target (30 mg/L), the largest was at 150 mg/l at site LMG-05-0030. This sample was taken in the spring; high loads in the spring may be attributed to the plowing and planting of agricultural fields occurring during these months, increasing the opportunity for sheet and rill erosion. Elevated TSS concentrations during high flows are consistent with significant loads coming from stream bank and gully erosion. The source assessment identifies the Gary, Hobart Merrillville, and Lake County MS4s within the City of Merrillville- Turkey Creek subwatershed directly upstream of the sampling point which could also contribute to the violation during high flows. Other possible sources include those mentioned in the nutrient linkage analysis. High TSS can also cause an increase in surface temperature which can cause low dissolved oxygen levels and can harm aquatic life, resulting in the impaired biological community listing.

The monitoring conducted during the summer of 2013 showed impaired biotic communities throughout the City of Merrillville- Turkey Creek. The fish and macroinvertebrate communities were sampled at all three sampling locations in the watershed. Scores for the macroinvertebrate community Index of Biotic Integrity (mIBI) at each of the three sites was 30 which are below the established criteria for aquatic life support which is 36. Scores for the fish community Index of Biotic Integrity (IBI) ranged from 12-20, which are also below the established criteria for the fish community. Other concerns in the watershed include low dissolved oxygen values along with poor QHEI scores that contribute to the stressed biotic communities. One out of the three sites failed to meet the water quality standard for DO, site LMG-05-0029 had a minimum DO concentration of 0.41 which is well below the standard of 4 mg/L.

7.3.6 Duck Creek

Load duration curves and precipitation graphs were created for all the sampling sites in the Duck Creek subwatershed. The figures 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 42 provides a summary of the Duck Creek subwatershed, including impaired segment AUID, drainage area, sampling sites, listed segments, land use, NPDES facilities, MS4 community, CSO communities, CFOs, and CAFOs, as well as Load Allocations, Wasteload Allocations, and Margin of Safety values for *E. coli,* nutrients, 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 42. Summary of Duck Creek Subwatershed Characteristics

Upstream Characteristics					
Drainage Area	15.83 square miles				
TMDL Sample Site	LMG-05-0009, LMG-05-0010, LMG-05-0032				
AUID Segments	INC0156_01, INC0156_T1001, INC0156_T1002, INC0156_T1003, INC0156_T1004, INC0156_01A, INC0156_01B, INC0156_01C, INC0156_01D, INC0156_01E				
Land Use	Agricultural Land: 42% Forested Land: 9% Developed Land: 19% Open Water: <1% Pasture/Hay: 11% Grassland/Shrubs: 11% Wetland: 7%				
NPDES Facilities	NA				
MS4 Communities	Hobart: INR040130 (1.94 sq miles) Portage: INR040090 (0.04 sq miles) Porter County: INR040140 (0.80 sq miles) Lake County: INR040124 (0.18 sq miles)				
CSO Communities	NA				
CAFOs	NA				
CFOs	NA				
TMDL *E. coli* Allocations (billion MPN/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**"Normal" Flows**	**Lower Flow Conditions**	**Low Flows**
LA	266.02	64.91	34.45	15.90	7.29
Future Growth	17.43	4.25	1.81	0.84	0.38
WLA	65.19	15.91	0.00	0.00	0.00
MOS (5%)	18.35	4.48	1.91	0.88	0.40
TMDL = LA+WLA+MOS	366.99	89.55	38.17	17.62	8.07
TMDL Total Phosphorus Allocations (lbs/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**"Normal" Flows**	**Lower Flow Conditions**	**Low Flows**
LA	74.74	18.23	9.69	4.47	2.05
Future Growth	4.91	1.20	0.51	0.24	0.11
WLA	18.47	4.51	0.00	0.00	0.00
MOS (5%)	5.16	1.26	0.54	0.25	0.11
TMDL = LA+WLA+MOS	103.28	25.20	10.74	4.96	2.27
TMDL TSS Allocations (lbs/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**"Normal" Flows**	**Lower Flow Conditions**	**Low Flows**
LA	7,474.22	1,823.71	969.37	447.40	205.06
Future Growth	490.58	119.70	51.02	23.55	10.79
WLA	1,846.70	450.60	0.00	0.00	0.00
MOS (5%)	516.40	126.00	53.71	24.79	11.36
TMDL = LA+WLA+MOS	10,327.90	2,520.01	1,074.10	495.74	227.21

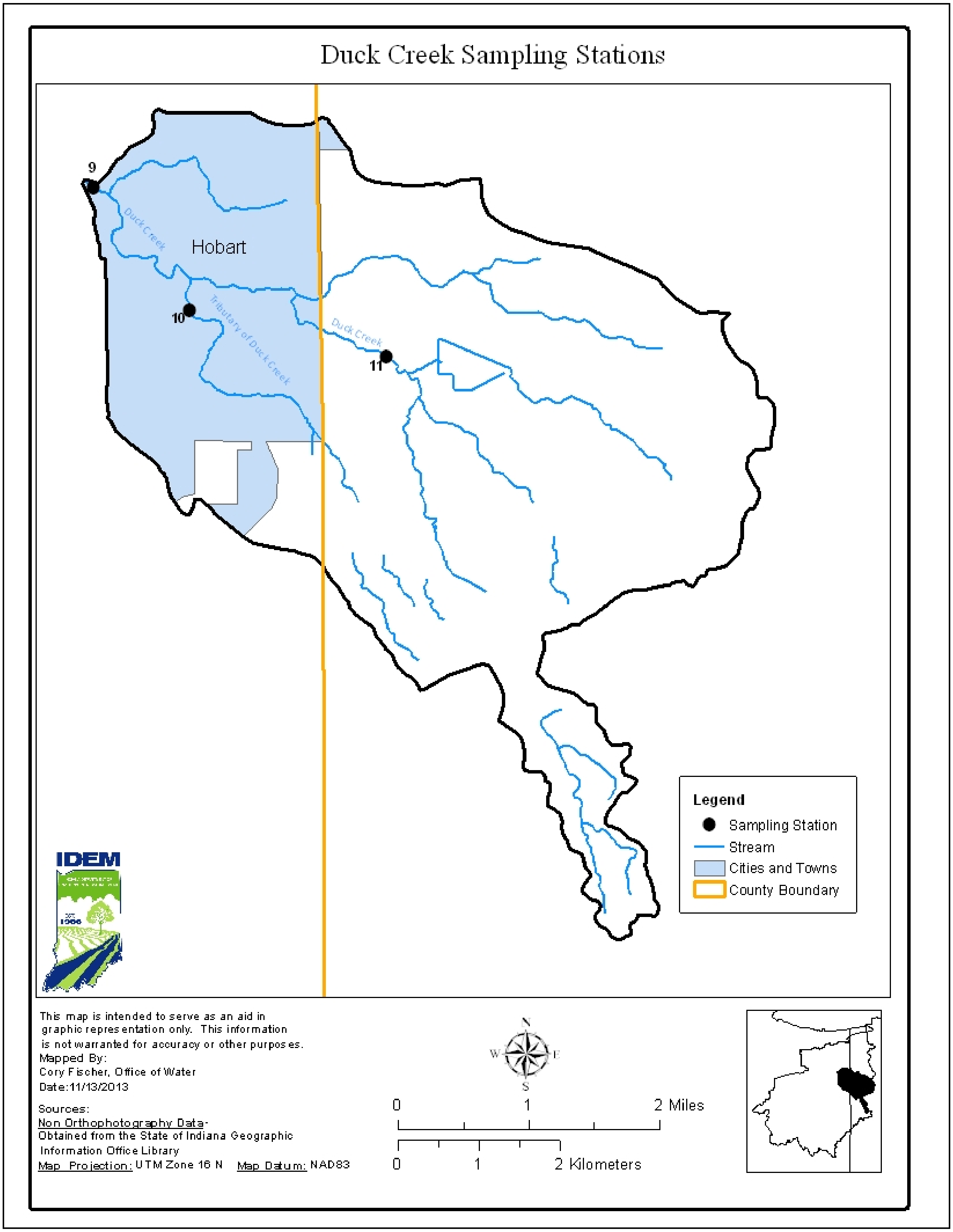


Figure 53. Sampling Stations in the Duck Creek Subwatershed

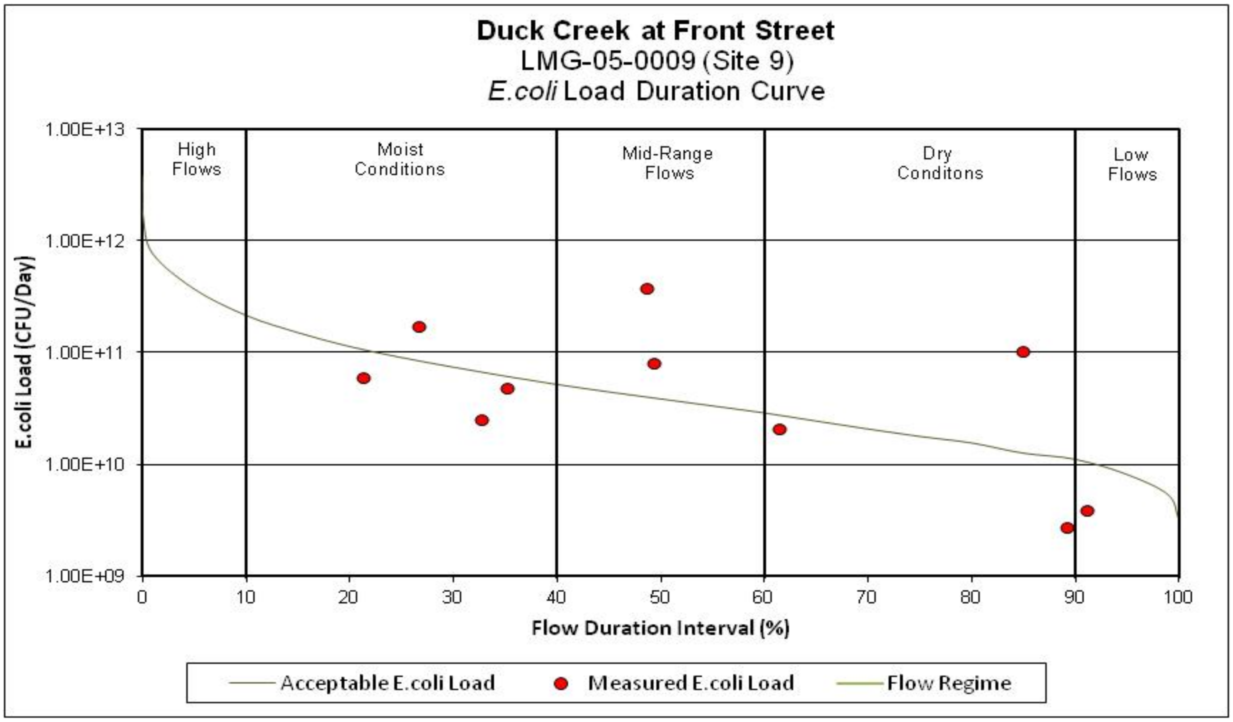


Figure 54. ***E. coli*** **Load Duration Curve for Most Representative Site in the Duck Creek Subwatershed**

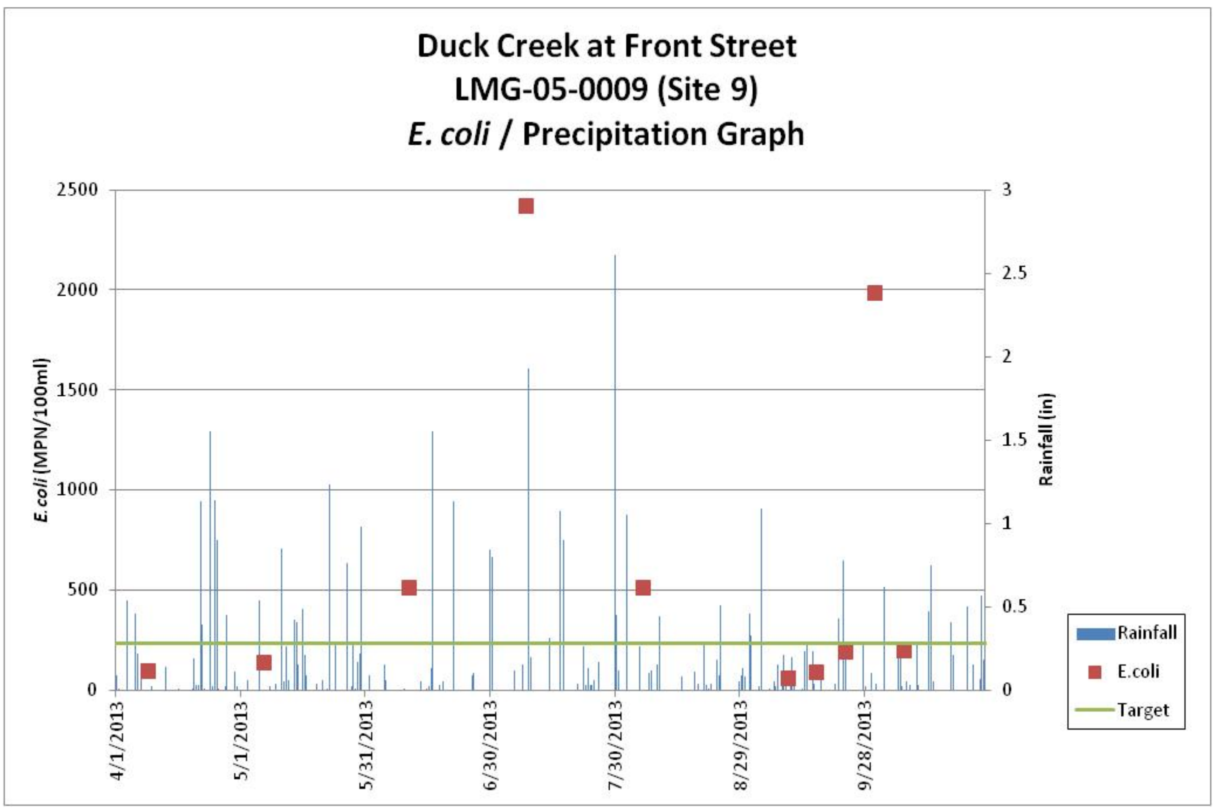


Figure 55. Graph of Precipitation and ***E. coli*** **Data at Most Representative Site in the Duck Creek Subwatershed**

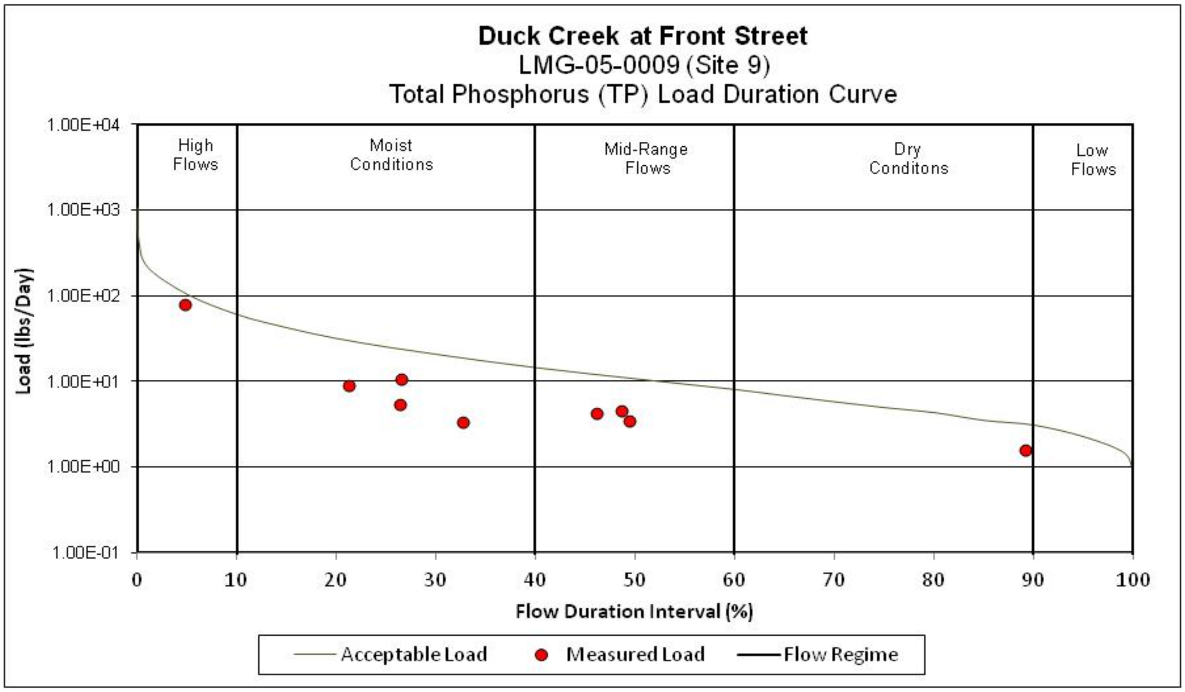


Figure 56. Total Phosphorus Load Duration Curve for Most Representative Site in the Duck Creek Subwatershed

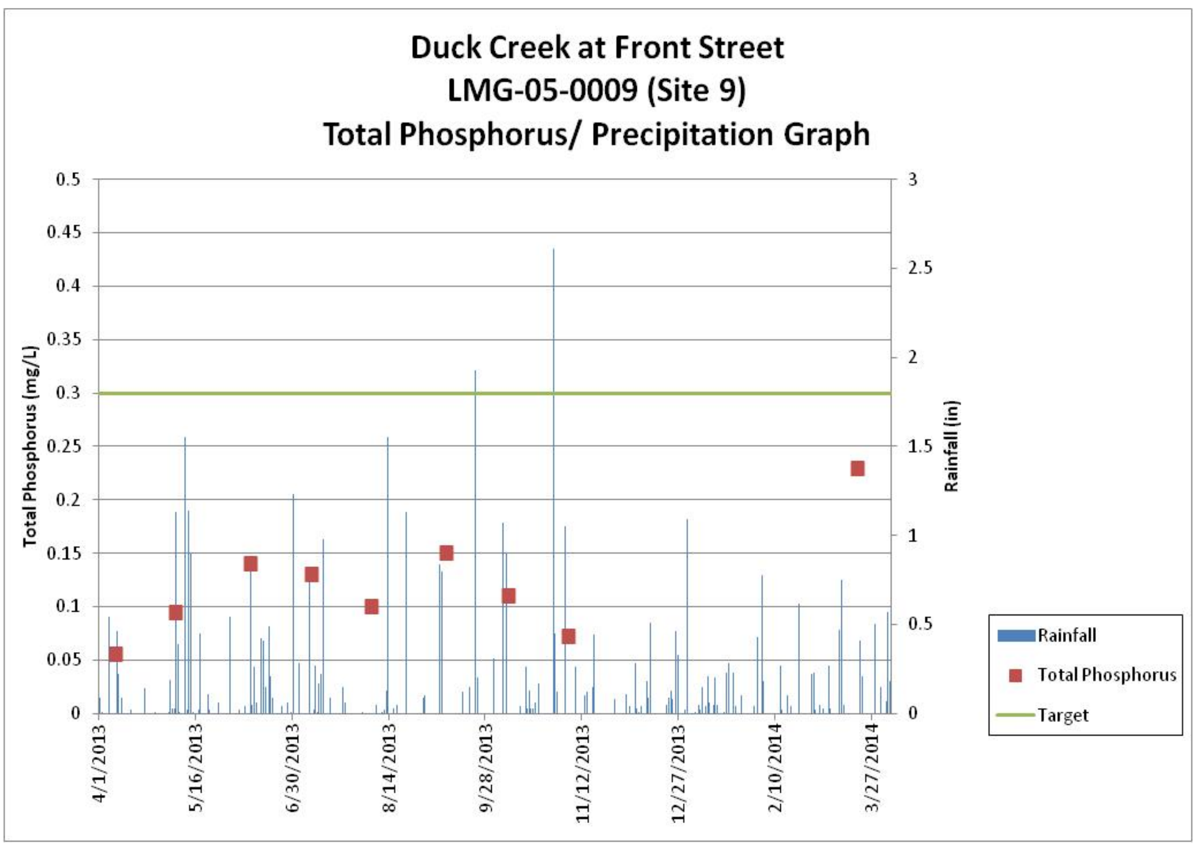


Figure 57. Graph of Precipitation and Total Phosphorus Data at Most Representative Site in the Duck Creek Subwatershed

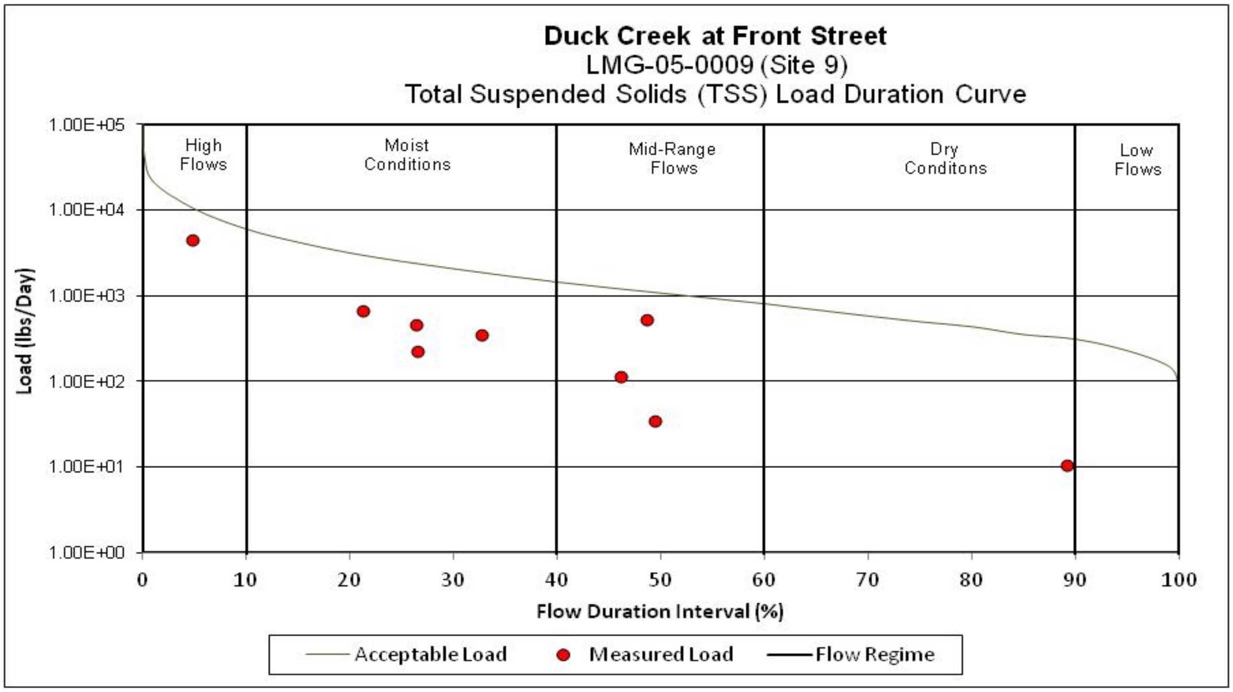


Figure 58. TSS Load Duration Curve for Most Representative Site in the Duck Creek Subwatershed

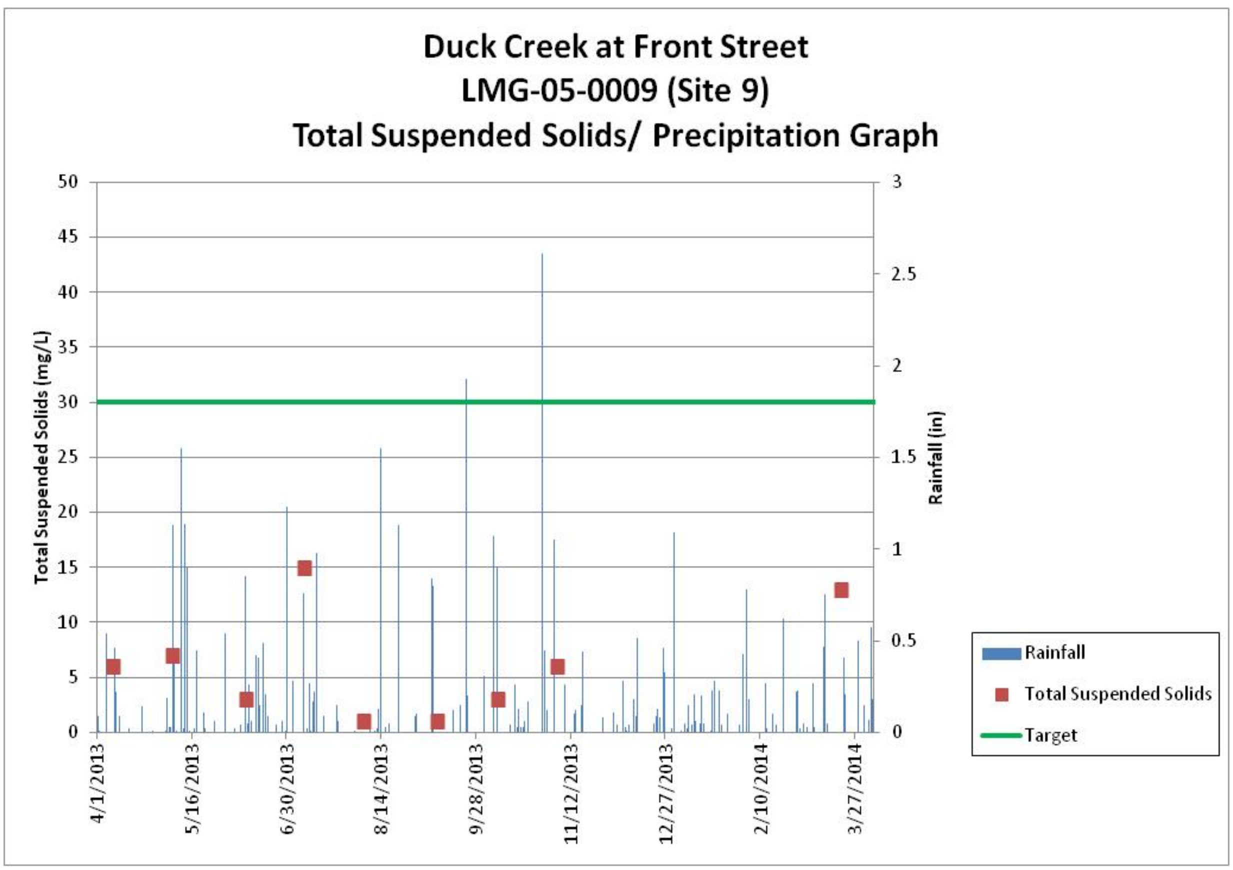


Figure 59. Graph of Precipitation and TSS Data at Most Representative Site in the Duck Creek Subwatershed

The Duck Creek subwatershed has a drainage area of 15.83 sq miles. The dominate land use in the Duck Creek is agricultural land accounting for approximately 42% of the drainage. The sampling locations that are within the Duck Creek subwatershed include; LMG-05-0009, LMG-05-0010, and LMG-05-0032. Site LMG-05-0009 located at Front Street on Duck Creek is being used as the pour point of the watershed to assess the contribution of Duck Creek to the overall Deep River- Portage Burns watershed.

Site LMG-05-0009 has an *E. coli* geometric mean value of 211MPN/100mL. The curve for this site shows a moderate impairment of *E. coli* in the stream through different flows. This indicates point sources may be contributing along with nonpoint sources to the impairments. The precipitation graph for this site shows the stream is susceptible to high loads of *E. coli* from run-off events. The combined *E. coli* data for the subwatershed have an average single sample maximum violation 60% of the time and an average geometric mean violation 100% of the time. Based on the water quality duration curves, it can be concluded that the majority of high flow sources of *E. coli* in this watershed are point sources and nonpoint sources that include MS4s (Hobart, Portage, Porter County, and Lake County) , unregulated storm water, unregulated animal operations, wildlife, and animals with direct access to streams. During low flow sources of *E.coli* include wildlife, straight piped, leaking and failing septic systems. If animals have direct access throughout the watershed it could contribute to *E. coli* violations at dry and wet conditions.

Total phosphorus concentrations at sampling station LMG-05-0009 are below the target throughout the entire sampling project. Site LMG-05-0009 has a total phosphorus percent reduction of 0% with the largest value being 0.23 mg/L.

The monitoring conducted in 2013-2014 showed elevated levels of TSS in the Duck Creek subwatershed that exceeded the target (30 mg/L), the largest was at 98 mg/l at site LMG-05-0032. This sample was taken in the spring; high loads in the spring may be attributed to the plowing and planting of agricultural fields occurring during these months, increasing the opportunity for sheet and rill erosion. Elevated TSS concentrations during high flows are consistent with significant loads coming from stream bank and gully erosion. Other possible sources include those mentioned in the nutrient linkage analysis. High TSS can also cause an increase in surface temperature which can cause low dissolved oxygen levels and can harm aquatic life, resulting in the impaired biological community listing.

The monitoring conducted during the summer of 2013 showed impaired biotic communities throughout the Duck Creek subwatershed. The fish and macroinvertebrate communities were sampled at all three sampling locations in the watershed. Scores for the macroinvertebrate community Index of Biotic Integrity (mIBI) ranged from 28-20 which are all below the established criteria for aquatic life support which is 36. Scores for the fish community Index of Biotic Integrity (IBI) ranged from 12-30, which are also all below the established criteria for aquatic life support for fish community. Poor QHEI scores, low dissolved oxygen values, and elevated TSS are all factors in why the biological communities are being stressed. Two out of the three sampling sites had dissolved oxygen values below the target of 4 mg/l; with the lowest being site LMG-05-0032 at 0.96 mg/L.

7.3.7 Lake George- Deep River

Load duration curves and precipitation graphs were created for all the sampling sites in the Lake George-Deep River subwatershed. The figures 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 43 provides a summary of the Lake George- Deep River subwatershed, including impaired segment AUID, drainage area, sampling sites, listed segments, land use, NPDES facilities, MS4 community, CSO communities, CFOs, and CAFOs, as well as Load Allocations, Wasteload Allocations, and Margin of Safety values for *E. coli,* nutrients, 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 43. Summary of Lake George- Deep River Subwatershed Characteristics

Upstream Characteristics					
Drainage Area	17.30 square miles				
TMDL Sample Site	LMG030-0008, LMG-05-0011, LMG-05-0033				
AUID Segments	INC0157_01, INC0157_01A, INC0157_01B, INC0157_P1001, INC0157_T1001, INC0157_T1002, INC0157_T1003, INC0157_T1004, INC0157_T1005				
Land Use	Agricultural Land: 22% Forested Land: 10% Developed Land: 32% Open Water: 2% Pasture/Hay: 9% Grassland/Shrubs: 16% Wetland: 9%				
NPDES Facilities	NA				
MS4 Communities	Hobart: INR040130 (4.73 sq miles) Merrillville: INR040049 (0.50 sq miles) Porter County: INR040140 (0.03 sq miles) Lake County: INR040124 (0.24 sq miles)				
CSO Communities	NA				
CAFOs	NA				
CFOs	NA				
TMDL *E. coli* Allocations (billion MPN/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**"Normal" Flows**	**Lower Flow Conditions**	**Low Flows**
LA	240.83	58.76	37.64	17.38	7.96
Future Growth	19.05	4.65	1.98	0.91	0.42
WLA	121.13	29.56	0.00	0.00	0.00
MOS (5%)	20.05	4.89	2.09	0.96	0.44
TMDL = LA+WLA+MOS	401.06	97.86	41.71	19.25	8.82
TMDL TSS Allocations (lbs/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**"Normal" Flows**	**Lower Flow Conditions**	**Low Flows**
LA	6,756.48	1,648.58	1,059.40	488.95	224.10
Future Growth	536.13	130.82	55.76	25.73	11.79
WLA	3,430.01	836.92	0.00	0.00	0.00
MOS (5%)	564.35	137.70	58.69	27.09	12.42
TMDL = LA+WLA+MOS	11,286.97	2,754.02	1,173.85	541.77	248.31

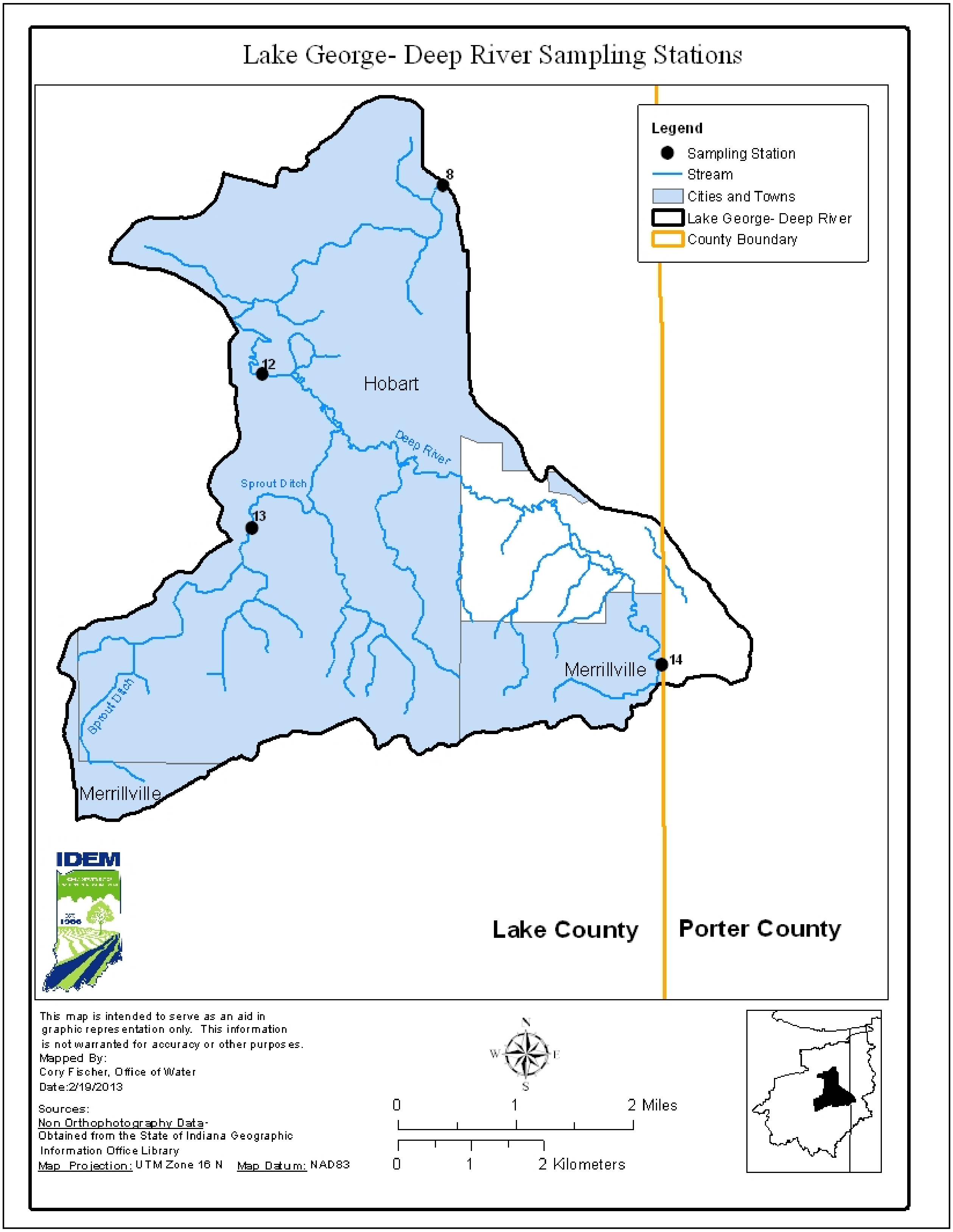


Figure 60. Sampling Stations in the Lake George- Deep River Subwatershed

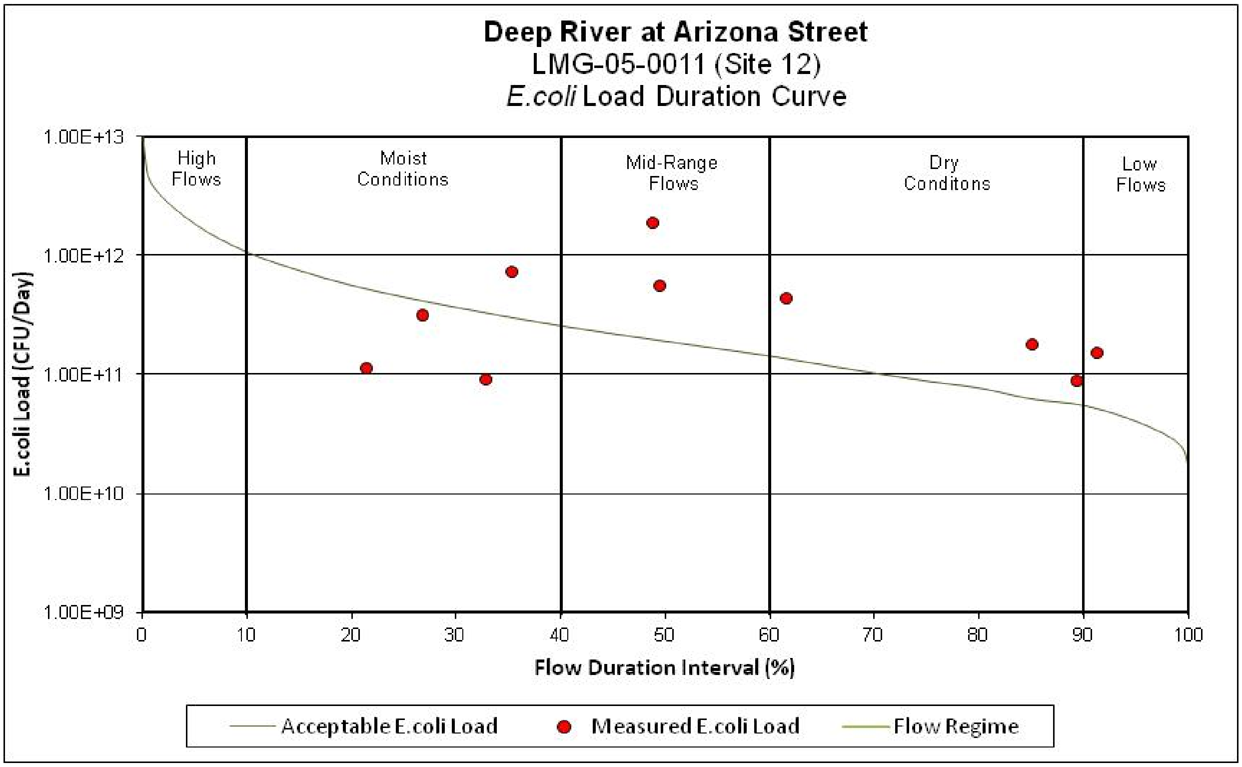


Figure 61. *E. coli* Load Duration Curve for Most Representative Site in the Lake George- Deep River Subwatershed

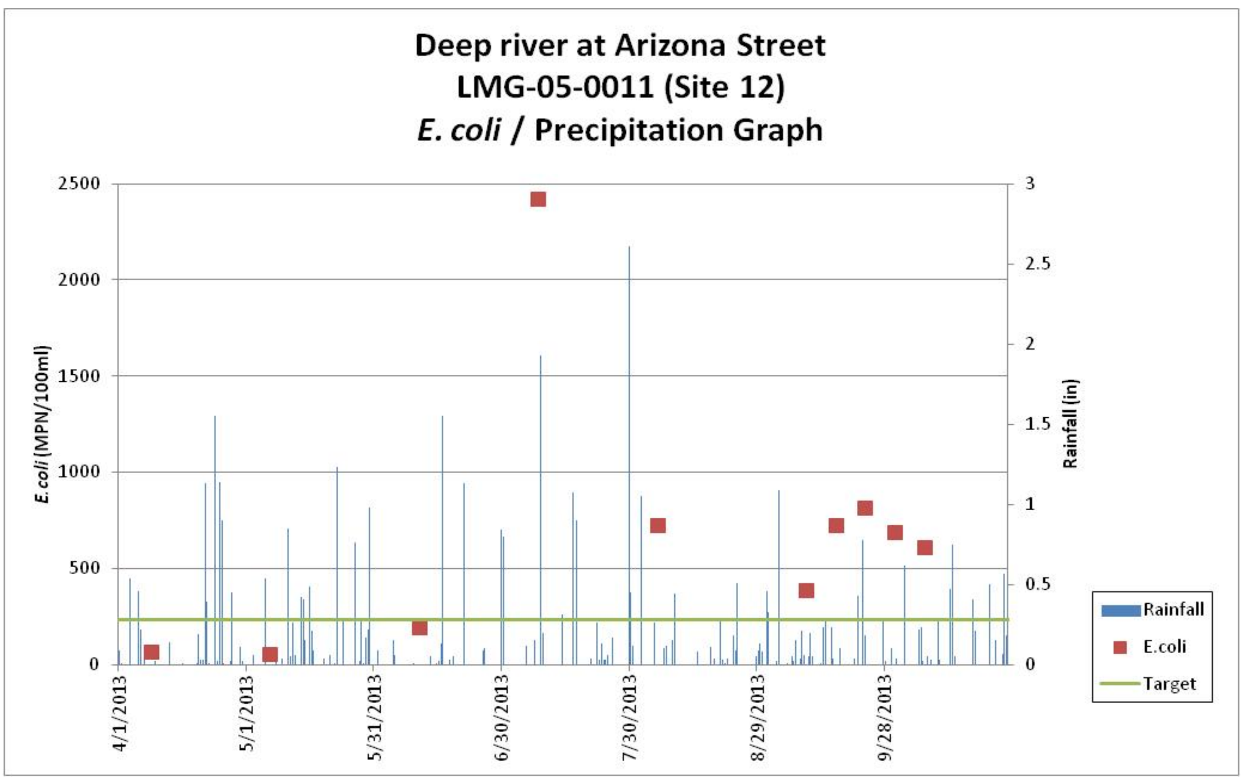


Figure 62. Graph of Precipitation and *E. coli* Data at Most Representative Site in the Lake George- Deep River Subwatershed

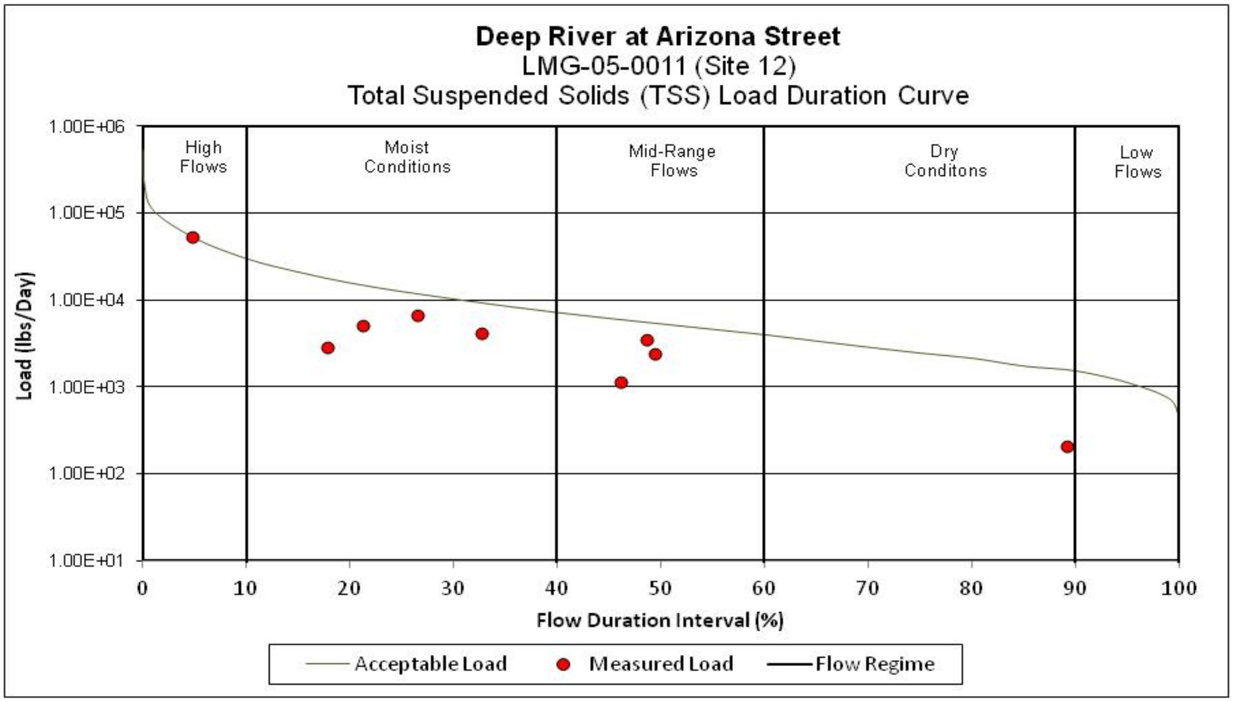


Figure 63. TSS Load Duration Curve for Most Representative Site in the Lake George- Deep River Subwatershed

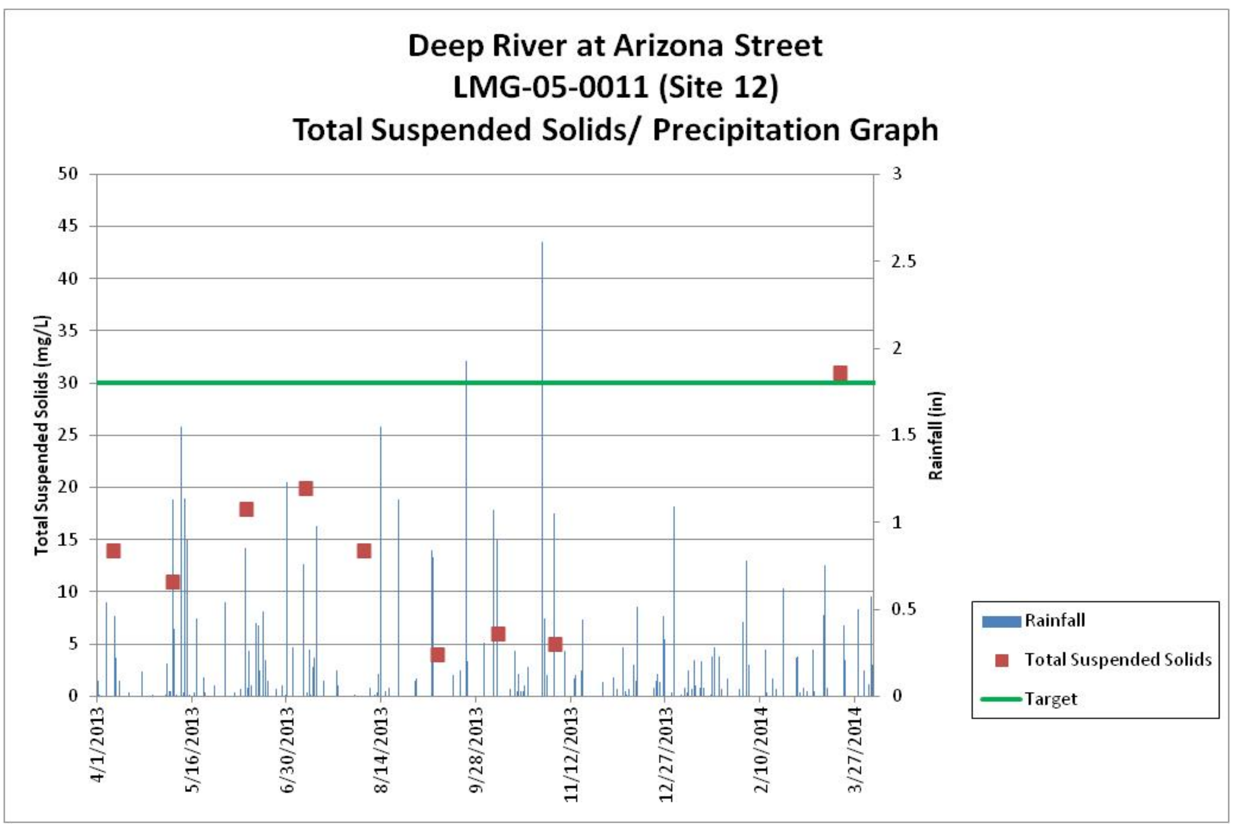


Figure 64. Graph of Precipitation and TSS Data at Most Representative Site in the Lake George- Deep River Subwatershed

The Lake George- Deep River subwatershed has a drainage area of 17.30 sq miles. The dominate land use in the Lake George- Deep River is developed land accounting for approximately 32% of the drainage. The sampling locations that are within the Lake George- Deep River subwatershed include; LMG030-0008, LMG-05-0011, LMG-05-0033. Site LMG-05-0011 located at Arizona Street on Deep River is being used as the pour point of the watershed to assess the contribution of Lake George- Deep River to the overall Deep River- Portage Burns watershed.

Site LMG-05-0011 has an *E. coli* geometric mean value of 627 MPN/100mL. The curve for this site shows a moderate impairment of *E. coli* in the stream through different flows. This indicates point sources may be contributing along with nonpoint sources to the impairments. The precipitation graph for this site shows the stream is susceptible to high loads of *E. coli* from run-off events. The combined *E. coli* data for the subwatershed have an average single sample maximum violation 68% of the time and an average geometric mean violation 100% of the time. Based on the water quality duration curves, it can be concluded that the majority of high flow sources of *E. coli* in this watershed are point sources and nonpoint sources that include MS4s (Hobart, Merrillville, Porter County, and Lake County) , unregulated storm water, unregulated animal operations, wildlife, and animals with direct access to streams. During low flow sources of *E.col* include wildlife and straight piped, leaking and failing septic systems. If animals have direct access throughout the watershed it could contribute to *E. coli* violations at dry and wet conditions.

Total phosphorus concentrations at sampling station LMG-05-0011 are below the target throughout the entire sampling project. Site LMG-05-0011 has a total phosphorus percent reduction of 0% with the largest value being 0.28 mg/L. However elevated levels of TP were found at sampling sites LMG-05-0012 and LMG-05-0033. Further analysis of phosphorus concentrations and flow conditions in Deep River- Portage Burns watershed indicate a probable mixture of point and nonpoint sources of nutrients. High loads in the spring may be attributed to the plowing and planting of agricultural fields occurring during these months, increasing the opportunity for sheet and rill erosion with phosphorus attached to soil particles.

The monitoring conducted in 2013-2014 showed elevated levels of TSS in the Lake George- Deep River subwatershed that exceeded the target (30 mg/L), the largest was at 270 mg/l at site LMG-05-0033. This sample was taken in the spring; high loads in the spring may be attributed to the plowing and planting of agricultural fields occurring during these months, increasing the opportunity for sheet and rill erosion. Elevated TSS concentrations during high flows are consistent with significant loads coming from stream bank and gully erosion. The source assessment identifies the following MS4s Merrillville, Porter County, and Lake County is within the Lake George- Deep River subwatershed directly upstream of the sampling point which could also contribute to the violation. Other possible sources include those mentioned in the nutrient linkage analysis. High TSS can also cause an increase in surface temperature which can cause low dissolved oxygen levels and can harm aquatic life, resulting in the impaired biological community listing.

The monitoring conducted during the summer of 2013 showed impaired biotic communities throughout the Lake George- Deep River. The fish and macroinvertebrate communities were sampled at all four sampling locations in the watershed. Scores for the macroinvertebrate community Index of Biotic Integrity (mIBI) ranged from 28-42 two out of four are below the established criteria for aquatic life support which is 36. Scores for the fish community Index of Biotic Integrity (IBI) ranged from 30-40, with only one out of the four sites marginally passing for the fish community. However since none of the sites passed the mIBI or IBI, each segment will be listed for IBC. Elevated TSS and phosphorus levels are both factors in why the biological communities are being stressed. Other concerns in the watershed include low dissolved oxygen values along with poor QHEI scores that contribute to the stressed biotic communities. One out of the four sites had dissolved oxygen values lower than the target of 4 mg/L, the lowest being 3.89 mg/L.

7.3.8 Little Calumet River- Deep River

Load duration curves and precipitation graphs were created for all the sampling sites in the Little Calumet River- Deep River subwatershed. The figures 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 44 provides a summary of the Little Calumet River- Deep River subwatershed, including impaired segment AUID, drainage area, sampling sites, listed segments, land use, NPDES facilities, MS4 community, CSO communities, CFOs, and CAFOs, as well as Load Allocations, Wasteload Allocations, and Margin of Safety values for *E. coli,* nutrients, 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 44. Summary of Little Calumet River- Deep River Subwatershed Characteristics

Upstream Characteristics					
Drainage Area	18.97 square miles				
TMDL Sample Site	LMG-05-0006, LMG-05-0007, LMG-05-0008				
AUID Segments	INC0158_01, INC0158_T1001, INC0158_T1002, INC0158_T1003, INC0158_T1004, INC0158_T1005, INC0158_T1009				
Land Use	Agricultural Land: 4% Forested Land: 6% Developed Land: 73% Open Water: 1% Pasture/Hay: 0% Grassland/Shrubs: 7% Wetland: 9%				
NPDES Facilities	Hobart WWTP: IN0061344 (4.8 MGD)				
MS4 Communities	Gary: INR040101 (5.48 sq miles) Hobart: INR040130 (3.04 sq miles) Portage: INR040090 (1.83 sq miles) Lake Station: INR040087 (2.62 sq miles) New Chicago: INR040031 (0.56 sq miles) Porter County: INR040140 (0.10 sq miles) Lake County: INR040124 (0.18 sq miles)				
CSO Communities	Gary WWTP: IN0022977 (Pipes: 004, 005, 013, 014, 015)				
CAFOs	NA				
CFOs	NA				
TMDL *E. coli* Allocations (billion MPN/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**“Normal” Flows**	**Lower Flow Conditions**	**Low Flows**
LA	75.55	5.43	57.10	34.87	24.55
Future Growth	22.92	7.13	4.20	3.03	2.49
WLA	359.88	129.94	22.71	22.71	22.71
MOS (5%)	24.12	7.50	4.42	3.19	2.62
TMDL = LA+WLA+MOS	482.47	150.00	88.43	63.80	52.37
TMDL TSS Allocations (lbs/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**“Normal” Flows**	**Lower Flow Conditions**	**Low Flows**
LA	2,337.35	376.04	1,845.50	1,219.99	929.58
Future Growth	644.95	200.51	118.21	85.29	70.00
WLA	9,916.79	3,433.72	400.49	400.49	400.49
MOS (5%)	678.90	211.07	124.43	89.78	73.69
TMDL = LA+WLA+MOS	13,579.00	4,221.34	2,488.63	1,795.55	1,473.76

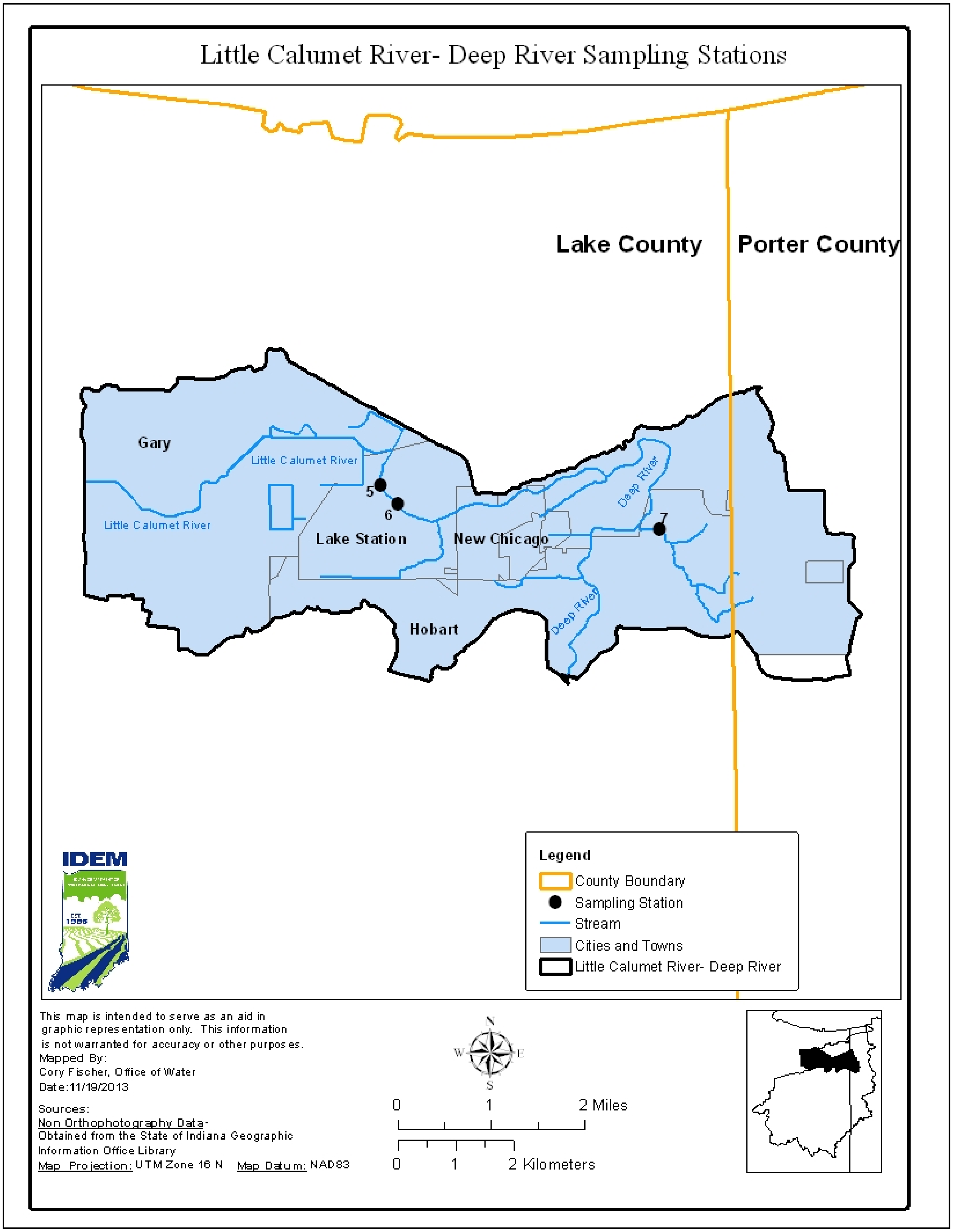


Figure 65. Sampling Stations in the Little Calumet River- Deep River Subwatershed

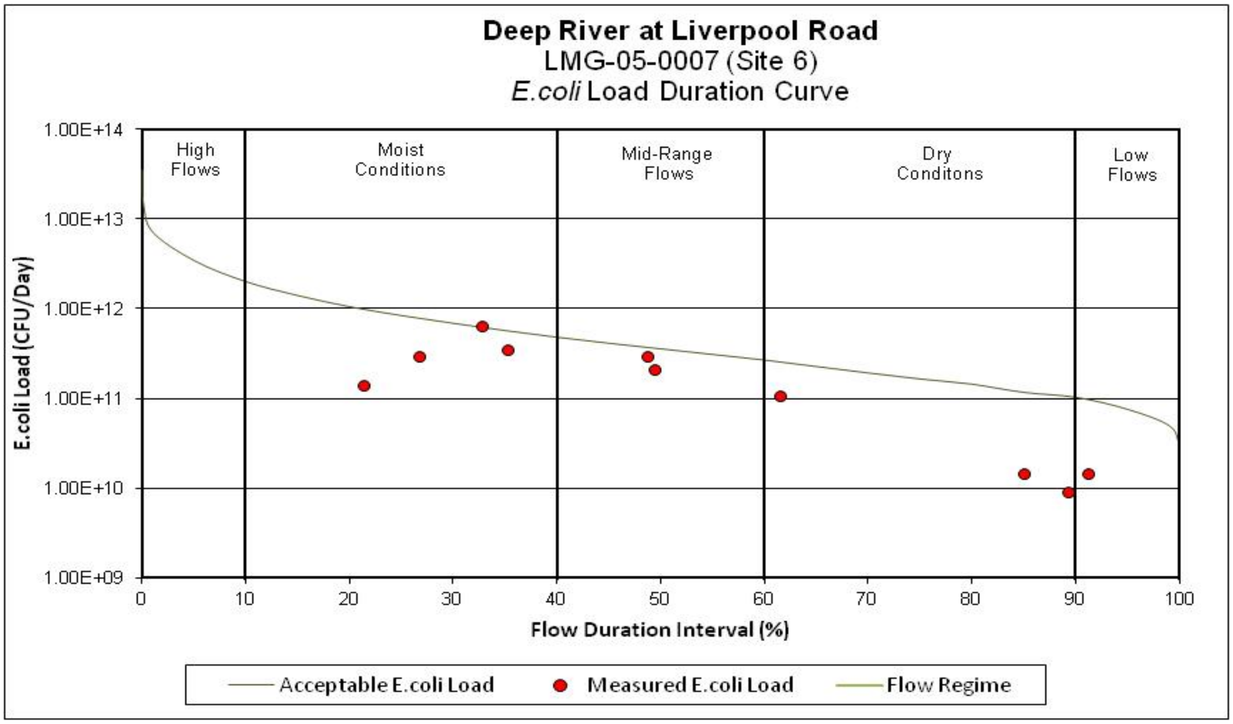


Figure 66. *E. coli* Load Duration Curve for Most Representative Site in the Little Calumet River-Deep River

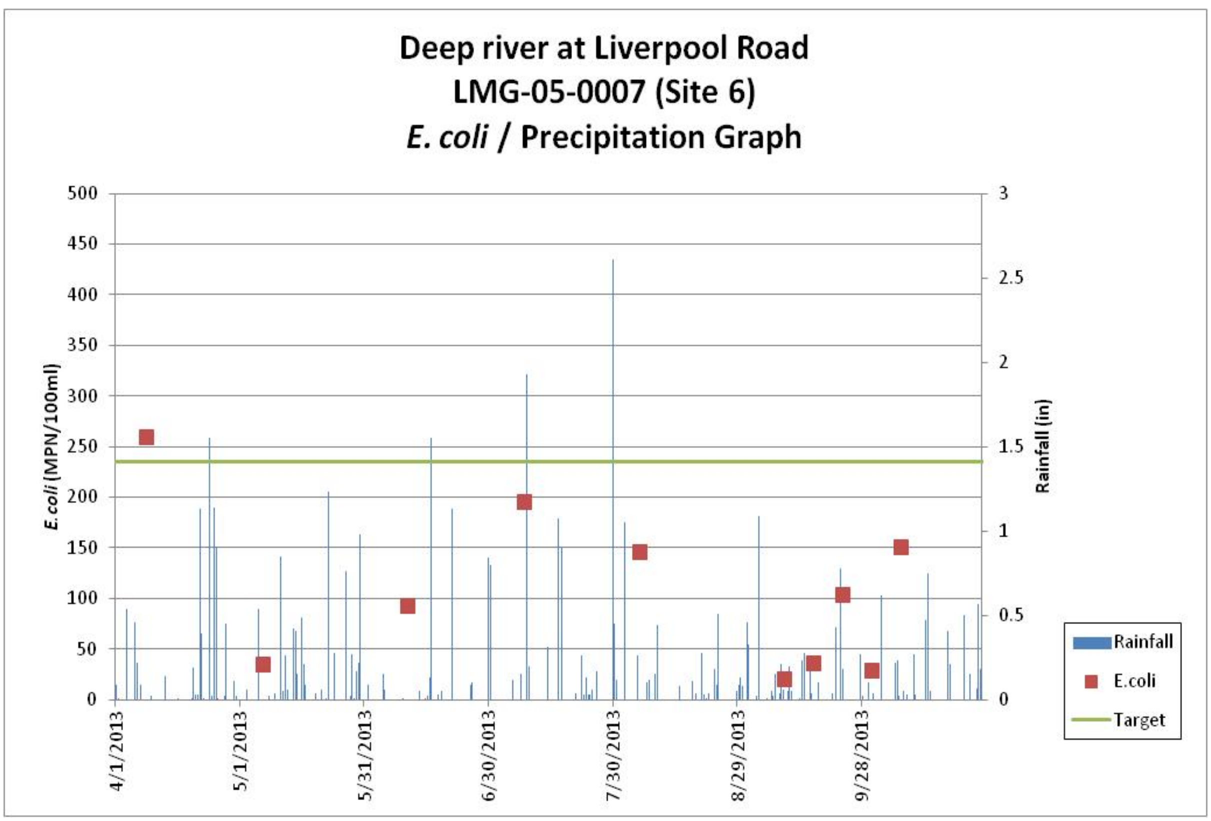


Figure 67. Graph of Precipitation and *E. coli* Data at Most Representative Site in the Little Calumet River- Deep River Subwatershed

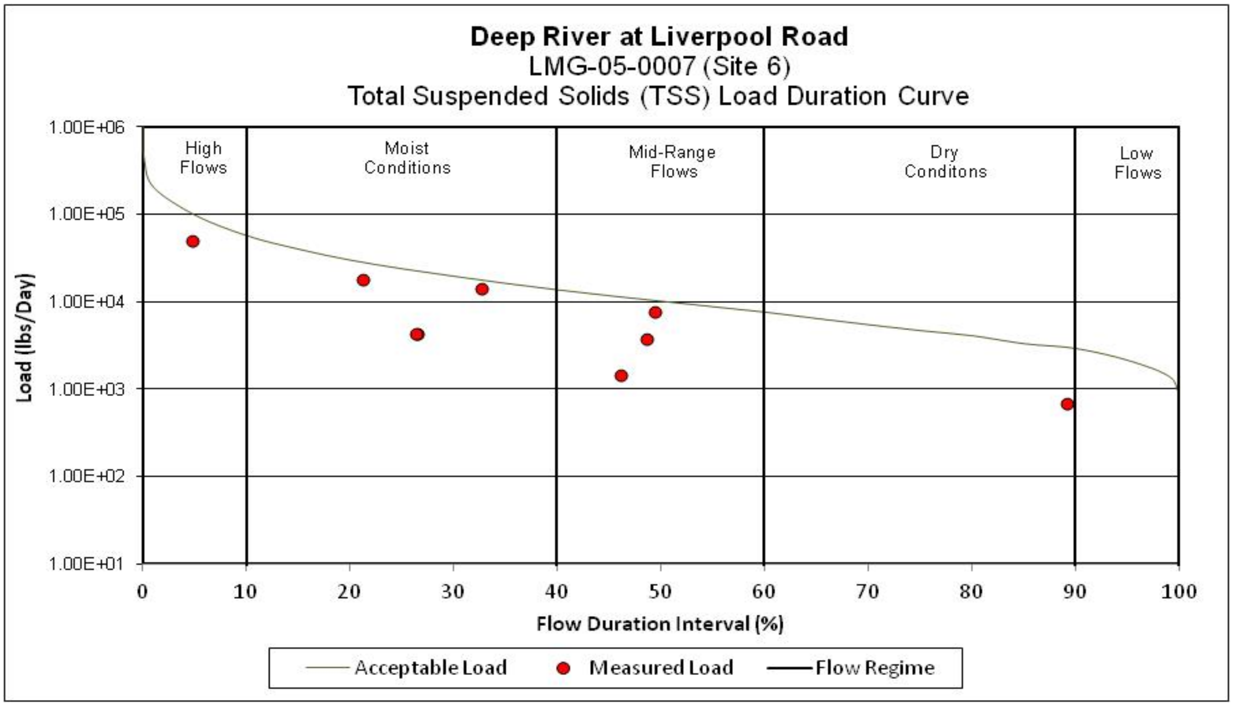


Figure 68. TSS Load Duration Curve for Most Representative Site in the Little Calumet River- Deep River Subwatershed

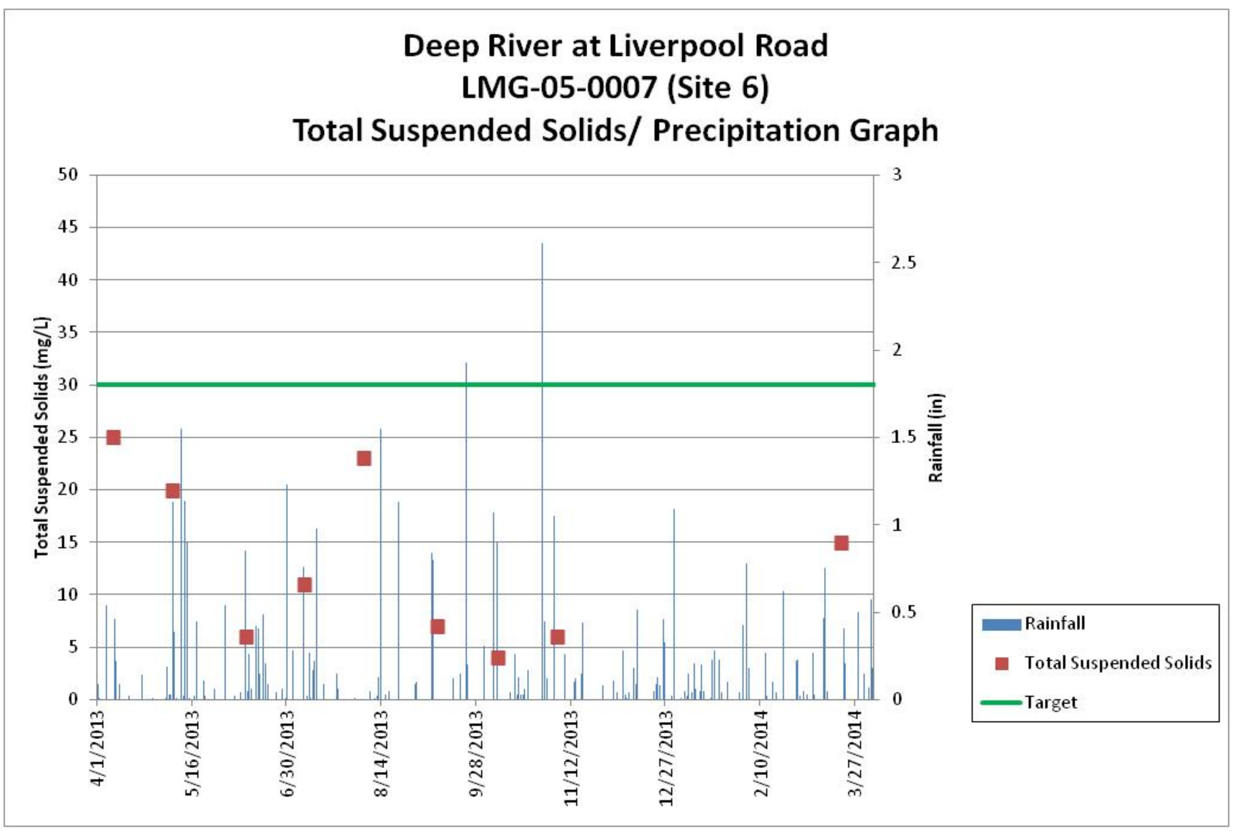


Figure 69. Graph of Precipitation and TSS Data at Most Representative Site in the Little Calumet River- Deep River Subwatershed

The Little Calumet River- Deep River subwatershed has a drainage area of 18.97 sq miles. The dominate land use in the Little Calumet River- Deep River is developed land accounting for approximately 73% of the drainage. The sampling locations that are within the Little Calumet River- Deep River subwatershed include; LMG-05-0006, LMG-05-0007, and LMG-05-0008. Site LMG-05-0007 located at Liverpool Road on Deep River is being used as the pour point of the watershed to assess the contribution of Little Calumet River- Deep River to the overall Deep River- Portage Burns watershed.

Site LMG-05-0007 has an *E. coli* geometric mean value of 51 MPN/100mL. The curve for this site shows low levels of *E. coli* in the stream through different flows, with only one low level exceedance during moist conditions. The combined *E. coli* data for the subwatershed have an average single sample maximum violation 40% of the time and an average geometric mean violation 67% of the time. Based on the water quality duration curves, it can be concluded that the majority of high flow sources of *E. coli* in this watershed are point sources and nonpoint sources that include Gary WWTP CSOs, MS4s (Gary, Hobart, Portage, Lake Station, New Chicago, Porter County, and Lake County), unregulated storm water, unregulated animal operations, wildlife, and animals with direct access to streams. During low flow sources of *E.coli* include Hobart WWTP, wildlife, straight piped, leaking and failing septic systems. If animals have direct access throughout the watershed it could contribute to *E. coli* violations at dry and wet conditions.

Total phosphorus concentrations are below the target throughout the entire sampling project at all three sampling locations in the Little Calumet River- Deep River subwatershed.

The monitoring conducted in 2013-2014 showed elevated levels of TSS in the Little Calumet River- Deep River subwatershed that exceeded the target (30 mg/L), the largest was at 33 mg/l at site LMG-05-0008. This sample was taken in the spring; high loads in the spring may be attributed to the plowing and planting of agricultural fields occurring during these months, increasing the opportunity for sheet and rill erosion. Elevated TSS concentrations during high flows are consistent with significant loads coming from stream bank and gully erosion. Other possible sources include those mentioned in the nutrient linkage analysis. High TSS can also cause an increase in surface temperature which can cause low dissolved oxygen levels and can harm aquatic life, resulting in the impaired biological community listing.

The monitoring conducted during the summer of 2013 showed impaired biotic communities throughout the Little Calumet River- Deep River. The fish and macroinvertebrate communities were sampled at all three sampling locations in the watershed. Scores for the macroinvertebrate community Index of Biotic Integrity (mIBI) ranged from 30-3, two out of three sampling locations are below the established criteria for aquatic life support which is 36. Scores for the fish community Index of Biotic Integrity (IBI) ranged from 18-36, with only one out of the four sites marginally passing for the fish community. However since none of the site passed both mIBI and IBI each segment will be listed for IBC. Elevated TSS, poor QHEI scores, and low dissolved oxygen values are all factors in why the biological communities are being stressed. Other concerns in the watershed include low dissolved oxygen values along with poor QHEI scores that contribute to the stressed biotic communities. Two out of the three sampling locations had dissolved oxygen values below the target of 4mg/L; the lowest was 2.03 mg/L at site LMG-05-0008.

7.3.9 Willow Creek- Burns Ditch

Load duration curves and precipitation graphs were created for all the sampling sites in the Willow Creek-Burns Ditch subwatershed. The figures 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 45 provides a summary of the Willow Creek- Burns Ditch subwatershed, including impaired segment AUID, drainage area, sampling sites, listed segments, land use, NPDES facilities, MS4 community, CSO communities, CFOs, and CAFOs, as well as Load Allocations, Wasteload Allocations, and Margin of Safety values for *E. coli,* nutrients, 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 45. Summary of Willow Creek- Burns Ditch Subwatershed Characteristics

Upstream Characteristics					
Drainage Area	20.93 square miles				
TMDL Sample Site	LMG-05-0002, LMG-05-0003, LMG-05-0004				
AUID Segments	INC0159_01, INC0159_02, INC0159_T1001				
Land Use	Agricultural Land: 19% Forested Land: 8% Developed Land: 56% Open Water: 1% Pasture/Hay: 1% Grassland/Shrubs: 6% Wetland: 8%				
NPDES Facilities	Portage Utility Service Facility WWTP (IN0024368): 4.95 MGD				
MS4 Communities	Gary: INR040101 (1.17 sq. miles) Portage: INR040090 (8.01 sq. miles) Lake Station: INR040087 (2.39 sq. miles) Porter County: INR00140 (0.14 sq miles)				
CSO Communities	NA				
CAFOs	NA				
CFOs	NA				
TMDL *E. coli* Allocations (billion MPN/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**"Normal" Flows**	**Lower Flow Conditions**	**Low Flows**
LA	152.32	16.22	41.25	16.72	5.33
Future Growth	25.14	7.72	4.49	3.20	2.60
WLA	325.33	130.36	44.03	44.03	44.03
MOS (5%)	26.46	8.12	4.72	3.37	2.74
TMDL = LA+WLA+MOS	529.25	162.42	94.49	67.32	54.70
TMDL TSS Allocations (lbs/day)					
Allocation Category	**Very High Flows**	**Higher Flow Conditions**	**"Normal" Flows**	**Lower Flow Conditions**	**Low Flows**
LA	5,095.20	1,277.40	1,986.89	1,296.75	976.34
Future Growth	707.48	217.12	126.31	89.99	73.12
WLA	8,346.91	2,847.84	413.01	413.01	413.01
MOS (5%)	744.71	228.55	132.96	94.72	76.97
TMDL = LA+WLA+MOS	14,894.30	4,570.91	2,659.17	1,894.47	1,539.44

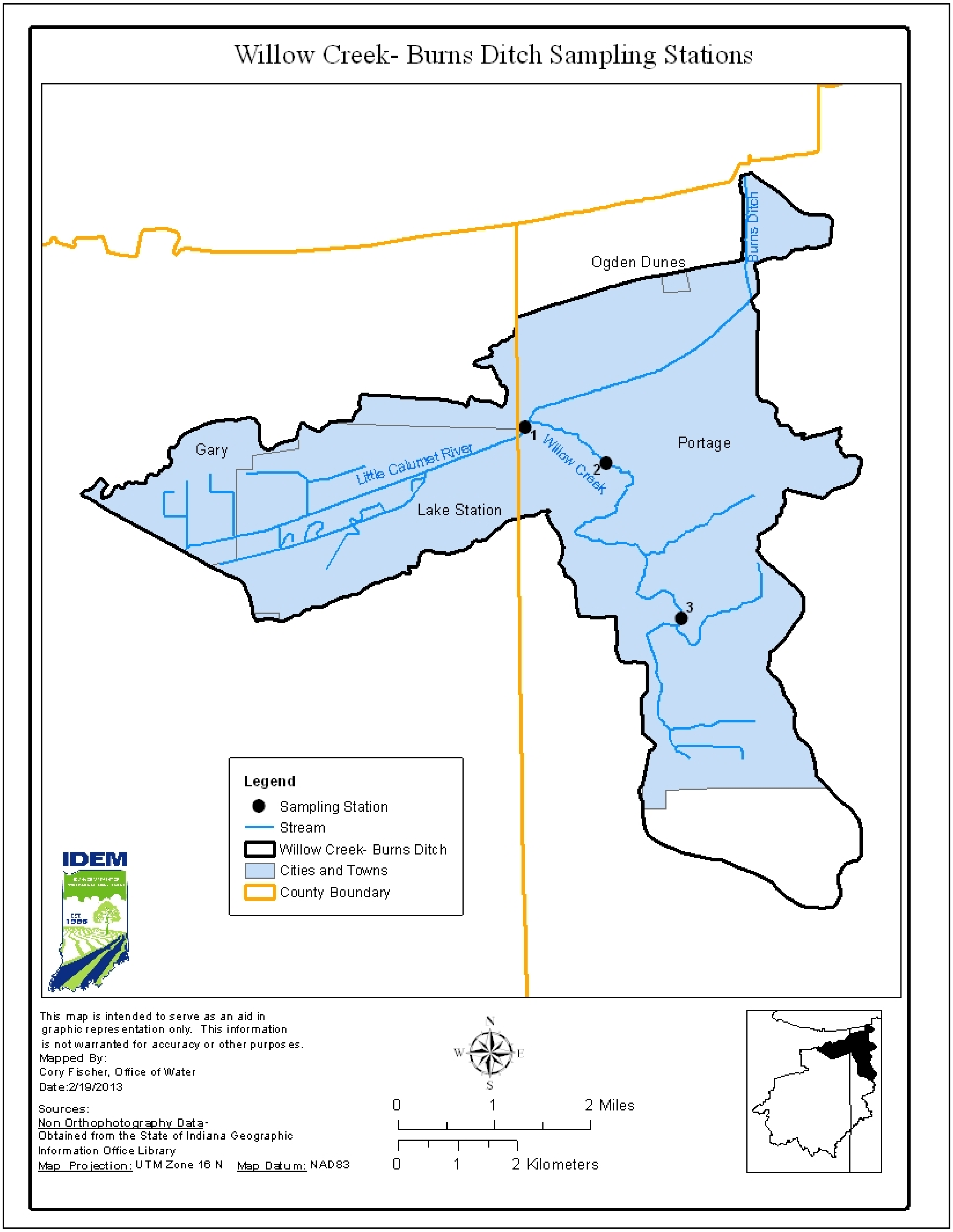


Figure 70. Sampling Stations in Willow Creek- Burns Ditch Subwatershed

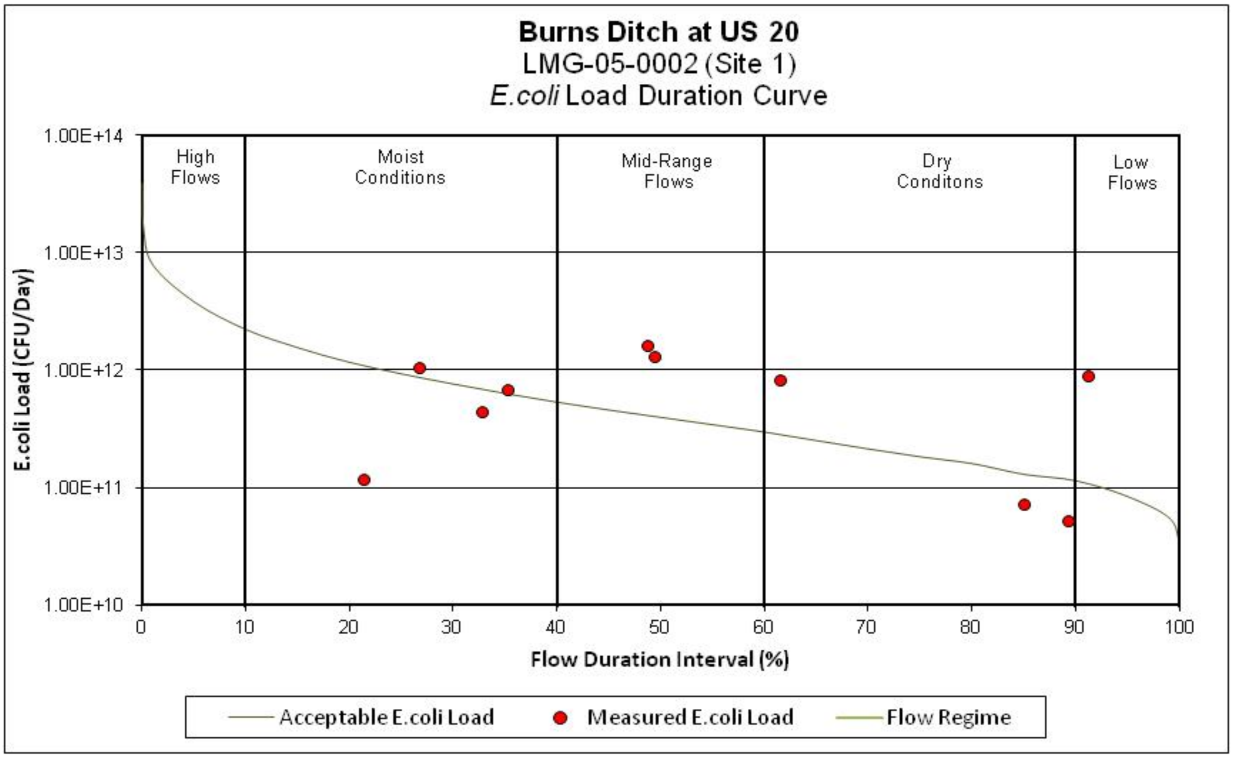


Figure 71. *E. coli* Load Duration Curve for Most Representative Site in the Willow Creek- Burns Ditch Subwatershed

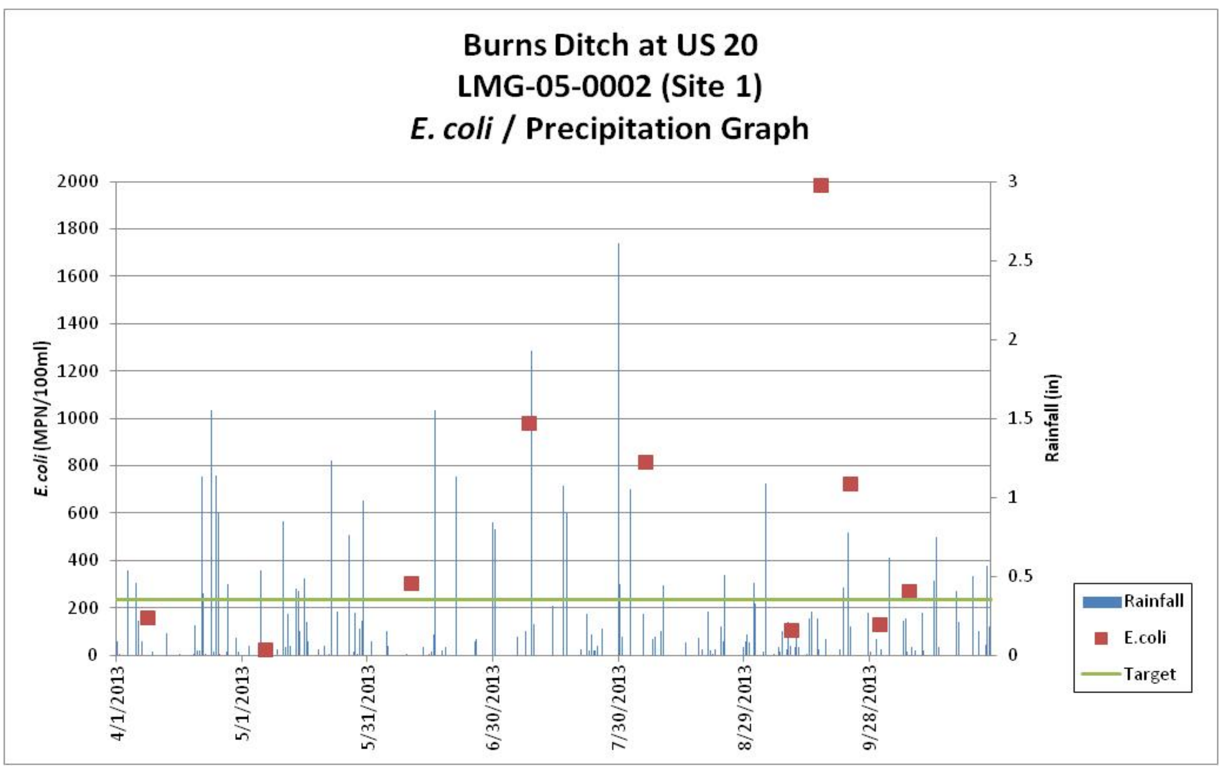


Figure 72. Graph of Precipitation and *E. coli* Data at Most Representative Site in the Willow Creek- Burns Ditch Subwatershed

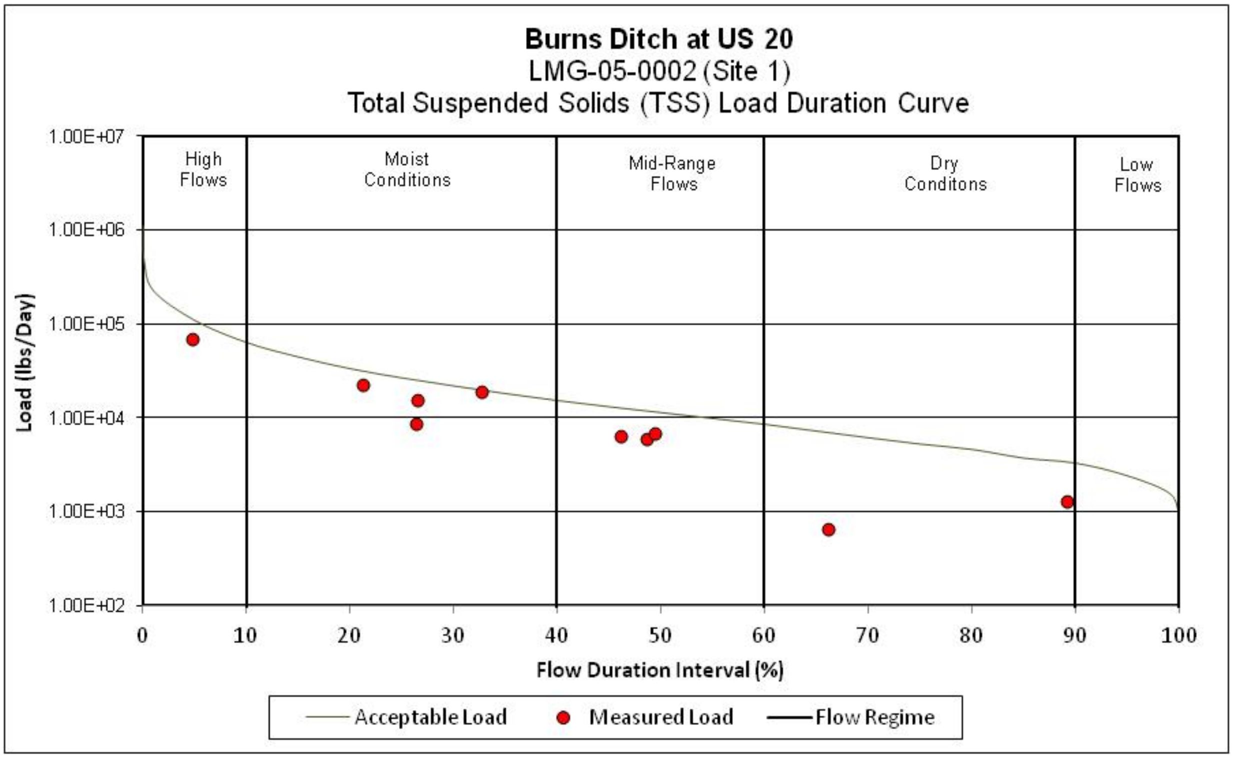


Figure 73. TSS Load Duration Curve for Most Representative Site in the Willow Creek- Burns Ditch Subwatershed

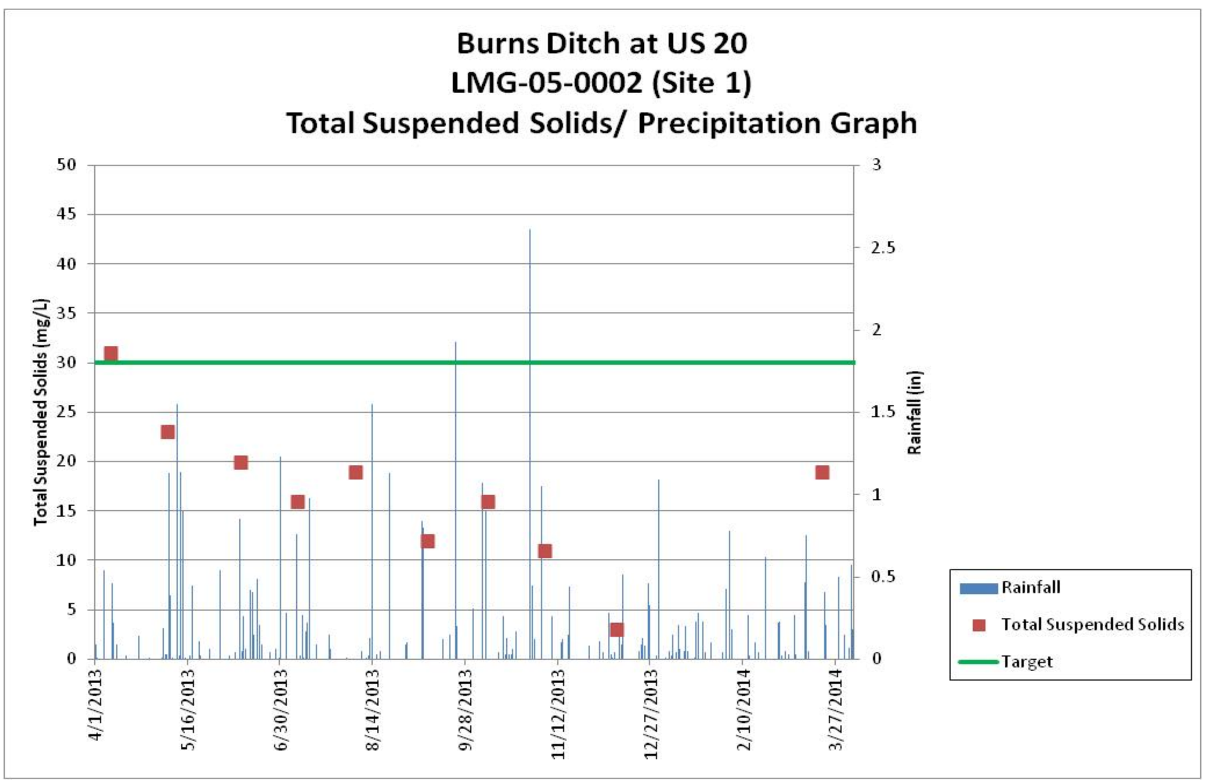


Figure 74. Graph of Precipitation and TSS Data at Most Representative Site in the Willow Creek-Burns Ditch Subwatershed

The Willow Creek- Burns Ditch subwatershed has a drainage area of 20.93 sq miles. The dominate land use in the Willow Creek- Burns Ditch is developed land accounting for approximately 56% of the drainage. The sampling locations that are within the Willow Creek- Burns Ditch subwatershed include; LMG-05-0002, LMG-05-0003, and LMG-05-0004. Site LMG-05-0002 located at US 20 on Burns Ditch is being used as the pour point of the watershed to assess the contribution of Willow Creek- Burns Ditch to the overall Deep River- Portage Burns watershed.

Site LMG-05-0002 has an *E. coli* geometric mean value of 354 MPN/100mL. The curve for this site shows a low to moderate level impairment of *E. coli* in the stream through different flows. This indicates point sources may be contributing along with nonpoint sources to the impairments. The precipitation graph for this site shows the stream is susceptible to high loads of *E. coli* from run-off events. The combined *E. coli* data for the subwatershed have an average single sample maximum violation 77% of the time and an average geometric mean violation 100% of the time. Based on the water quality duration curves, it can be concluded that the majority of high flow sources of *E. coli* in this watershed are point sources and nonpoint sources that include, MS4s (Gary, Portage, Lake Station, and Porter County) , unregulated storm water, unregulated animal operations, wildlife, and animals with direct access to streams. During low flow sources of *E.coli* include Portage Utility Service Facility WWTP, wildlife, straight piped, leaking and failing septic systems. If animals have direct access throughout the watershed it could contribute to *E. coli* violations at dry and wet conditions.

Total phosphorus concentrations at sampling station LMG-05-0007 are below the target throughout the entire sampling project at all three sampling locations in the Willow Creek- Burns Ditch subwatershed.

The monitoring conducted in 2013-2014 showed elevated levels of TSS at two of the three sampling locations in the Willow Creek- Burns Ditch subwatershed that exceeded the target (30 mg/L), the largest was at 78 mg/l at site LMG-05-0004. This sample was taken in the spring; high loads in the spring may be attributed to the plowing and planting of agricultural fields occurring during these months, increasing the opportunity for sheet and rill erosion. Elevated TSS concentrations during high flows are consistent with significant loads coming from stream bank and gully erosion. Other possible sources include those mentioned in the nutrient linkage analysis. High TSS can also cause an increase in surface temperature which can cause low dissolved oxygen levels and can harm aquatic life, resulting in the impaired biological community listing.

The monitoring conducted during the summer of 2013 showed impaired biotic communities throughout the Willow Creek- Burns Ditch. The fish and macroinvertebrate communities were sampled at all three sampling locations in the watershed. Scores for the macroinvertebrate community Index of Biotic Integrity (mIBI) ranged from 22-36, two out of three were below the established criteria for aquatic life support which is 36. Scores for the fish community Index of Biotic Integrity (IBI) ranged from 12-30, all three of which were below the established criteria for aquatic life for the fish community. Other concerns in the watershed include Elevated TSS, low dissolved oxygen values, along with poor QHEI scores that contribute to the stressed biotic communities. One out of the three sites had dissolved oxygen values less than the target of 4 mg/L; the lowest value was 3.14 mg/L at site LMG-05-0002.

8.0 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 wasteload allocations (WLAs) for regulated sources and load allocations (LAs) for unregulated sources. 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:

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

8.1 Results by Assessment Location

The following sections present the allowable *E. coli*, Nutrients, and TSS loads and associated allocations for each of the subwatersheds in the Deep River-Portage Burns watershed. Allocations were calculated for each 12-digit HUC. WLAs were calculated based on the design flow of the facility and the TMDL target.

Table 46 presents the individual WLAs for NPDES facilities in the Deep River-Portage Burns watershed by subwatershed.

The WWTPs are estimated to contribute to the phosphorus load in the Deep River-Portage Burns watershed. The WWTP TMDL loadings were established based on the design flow multiplied by the TMDL target value for bacteria: 125#/100 mL for *E. coli*, for TP: 0.3 mg/L and for TSS: 30 mg/L. These loadings are then incorporated into the NPDES permitted facility. The *E. coli* limitations are directly into the permit. TP and TSS are interpreted as an average in the NPDES permits. All monitoring data shows that these limits meet the TMDL targets in stream. One WWTP was found to be out of compliance with their TP limits and that stream segment was found to be impaired for TP. Similar facilities and streams within the watershed are discharging at the same permit limit and are not causing a violation of the TP target. Therefore if the permit is brought into compliance with the permit limit the TP violations should be addressed. An impairment due to a compliance issue does not need a TMDL. All other WWTPs have been in compliance with the correct average in their current WWTP permit and the current permit limits will not be revised.

Table 46. Individual WLAs for NPDES Facilities in the Deep River-Portage Burns Watershed

Subwatershed	Facility Name	Permit ID	Stream Name	Design Flow (MGD)	*E. coli* WLA (Billion/day)	TP WLA (lbs/day)	TSS WLA (lbs/day)
Headwaters of Main Beaver Dam Ditch	Crown Point WWTP	IN0025763	Main Beaver Dam Ditch	8.1	72.04	20.27	2,027.49
Main Beaver Dam Ditch	NA	NA	NA	NA	NA	NA	NA
Headwaters Turkey Creek	NA	NA	NA	NA	NA	NA	NA
Deer Creek	Winfield WWTP	IN0058343	Unnamed Tributary to Deer Creek	0.4	3.56	1.0	40.05
	Deep River Water Park WWTP	IN0058378	Deep River	0.030	0.27	NA	7.5
	Chicagoland Christian Village	IN0054470	Unnamed Tributary to Deer Creek	0.05	0.44	0.13	5.0
	Falling Waters Conservancy District	IN0062090	Unnamed Tributary to Deep River	0.124	1.10	NA	12.4
City of Merrillville	NA	NA	NA	NA	NA	NA	NA
Duck Creek	NA	NA	NA	NA	NA	NA	NA
Lake George	NA	NA	NA	NA	NA	NA	NA
Little Calumet River	Hobart WWTP	IN0061344	Deep River	4.8	22.71	40.05	400.49
Willow Creek	Portage Utility Service Facility WWTP	IN0024368	Burns Ditch	4.95	44.03	41.30	413.01

Table 47 presents the individual WLAs for CSO communities in the Deep River-Portage Burns watershed by subwatershed.

The WLAs for all the CSOs were calculated to be equal to the average observed daily flow (as reported on the 2013 discharge monitoring reports) multiplied by the TMDL target value of 235MPN/100 mL for *E. coli,* 0.3 mg/L for total phosphorus, and 30 mg/L for total suspended solids. The reported overflow events were assumed to occur during one day and the WLAs were only assigned to the high flow zones. During the development of Long-Term Control Plans for the CSO communities, IDEM might decide to modify the WLA if deemed appropriate.

Table 47. Individual WLAs for CSO Communities in the Deep River-Portage Burns Watershed TMDL

Subwatershed	Facility Name	Permit ID	Pipe ID	*E. coli* WLA (Billion/day)	TP WLA (lbs/day)	TSS WLA (lbs/day)
Headwaters Main Beaver Dam Ditch	Crown Point WWTP	IN0025763	002 003 006	0.33	0.09	9.23
Main Beaver Dam Ditch	Crown Point WWTP	IN0025763	004	0.08	0.02	2.31
Headwaters Turkey Creek	NA	NA	NA	NA	NA	NA
Deer Creek	NA	NA	NA	NA	NA	NA
City of Merrillville- Turkey Creek	NA	NA	NA	NA	NA	NA
Duck Creek	NA	NA	NA	NA	NA	NA
Lake George- Deep River	NA	NA	NA	NA	NA	NA
Little Calumet River- Deep River	Gary WWTP	IN0022977	004 005 013 014 015	3.49	0.98	108.33
Willow Creek- Burns Ditch	NA	NA	NA	NA	NA	NA

Table 48 presents the individual WLAs for MS4 communities in the Deep River-Portage Burns watershed by subwatershed. Different WLAs were established for each MS4 depending on the area of the MS4 upstream of the each assessment location. The jurisdictional areas of townships, municipalities, and urbanized areas were used as surrogates for the regulated area of each MS4. These areas were then used to calculate WLAs based on the proportion of the upstream drainage area located within the MS4 boundaries by multiplying that proportional area by the loading capacity of the assessment location. The MS4 WLAs therefore are equal to the estimated flows from the MS4 multiplied by the TMDL target value of 235 MPN/100 mL for *E. coli*, 0.3 mg/L for TP, and 30 mg/L for TSS. Table 49 presents the estimated WLAs for construction activities in the watershed.

Table 48. Individual WLAs for MS4 Communities in the Deep River-Portage Burns watershed TMDLs

Subwatershed	MS4 Community	Permit ID	Area in Drainage (sq miles)	*E. coli* WLA (Billion/day)		TP WLA (lbs/day)		TSS WLA (lbs/day)	
				Very High	Higher	Very High	Higher	Very High	Higher
Headwaters of Main Beaver Dam Ditch	St John	INR040047	0.49	12.63	4.47			355.33	125.73
	Schereville	INR040112	0.02	0.52	0.18			14.50	5.13
	Merrillville	INR040049	0.20	5.15	1.82			145.03	51.32
	Crown Point	INR040054	3.87	99.72	35.29			2,806.42	993.04
	Cedar Lake	INR040075	0.15	3.87	1.37			108.78	38.49
	Lake County	INR040124	2.04	52.57	18.60			1,479.35	523.46
Main Beaver Dam Ditch	Merrillville	INR040049	0.97	21.36	5.21	6.01	1.47	601.21	146.70
	Crown Point	INR040054	5.53	121.79	29.72	34.28	8.36	3,427.52	836.31
	Lake County	INR040124	1.23	27.09	6.61	7.62	1.86	762.36	186.02
Headwaters Turkey Creek	St John	INR040047	0.98	21.58	5.27			607.41	148.21
	Schereville	INR040112	4.17	91.84	22.41			2,584.59	630.64
	Merrillville	INR040049	3.23	71.14	17.36			2,001.97	488.48
	Crown Point	INR040054	0.03	0.66	0.16			18.59	4.54
	Lake County	INR040124	2.41	53.08	12.95			1,493.73	364.47
	Griffith	INR040108	0.72	15.86	3.87			446.26	108.89
Deer Creek	Hobart	INR040130	0.04	0.89	0.22	0.25	0.06	24.97	6.23
	Lakes of the Four Seasons	INR040007	0.54	12.02	3.03	3.35	0.82	337.09	84.06
	Merrillville	INR040049	0.49	10.91	2.75	3.04	0.74	305.88	76.28
	Porter County	INR040140	0.53	11.80	2.97	3.29	0.80	330.85	82.50
	Lake County	INR040124	1.77	39.40	9.93	10.98	2.69	1,104.90	275.53

Subwatershed	MS4 Community	Permit ID	Area in Drainage (sq miles)	*E. coli* WLA (Billion/day)		TP WLA (lbs/day)		TSS WLA (lbs/day)	
				Very High	Higher	Very High	Higher	Very High	Higher
City of Merrillville-Turkey Creek	Hobart	INR040130	1.28	28.19	6.88			793.35	193.58
	Gary	INR040101	1.83	40.30	9.83			1,134.24	276.76
	Merrillville	INR040049	8.65	190.51	46.48			5,361.31	1,308.16
	Lake County	INR040124	0.53	11.67	2.85			328.50	80.15
Duck Creek	Hobart	INR040130	1.94	42.73	10.43	12.02	2.93	1,202.42	293.39
	Portage	INR040090	0.04	0.88	0.21	0.25	0.06	24.79	6.05
	Porter County	INR040140	0.80	17.62	4.30	4.96	1.21	495.84	120.99
	Lake County	INR040124	0.18	3.96	0.97	1.12	0.27	111.56	27.22
Lake George-Deep River	Hobart	INR040130	4.73	104.17	25.42			2,931.68	715.33
	Merrillville	INR040049	0.50	11.01	2.69			309.90	75.62
	Porter County	INR040140	0.03	0.66	0.16			18.59	4.54
	Lake County	INR040124	0.24	5.29	1.29			148.75	36.30
Little Calumet River-Deep River	Gary	INR040101	5.48	132.41	41.17			3,726.25	1,158.48
	Hobart	INR040130	3.04	73.45	22.84			2,067.12	642.66
	Portage	INR040090	1.83	44.22	13.75			1,244.35	386.86
	Lake Station	INR040087	2.62	63.30	19.68			1,781.53	553.87
	New Chicago	INR040031	0.56	13.53	4.21			380.79	118.38
	Porter County	INR040140	0.10	2.42	0.75			68.00	21.14
	Lake County	INR040124	0.18	4.35	1.35			122.40	38.05
Willow Creek-Burns Ditch	Gary	INR040101	1.17	28.11	8.63			790.97	242.74
	Portage	INR040090	8.01	192.42	59.05			5,415.11	1,661.84
	Lake Station	INR040087	2.39	57.41	17.62			1,615.74	495.86
	Porter County	INR040140	0.14	3.36	1.03			94.65	29.05

Table 49.Estimated WLAs for Construction Activities in the Deep River-Portage Burns Subwatersheds

Subwatershed	Area in Drainage (sq miles)	TP WLA (lbs/day)		TSS WLA (lbs/day)	
		Very High	Higher	Very High	Higher
Headwaters Main Beaver Dam Ditch	0.04	0.27	0.09	26.58	9.41
Main Beaver Dam Ditch	0.05	0.33	0.08	32.64	7.96
Headwaters Turkey Creek	0.04	0.26	0.06	26.39	6.44
Deer Creek- Deep River	0.04	0.22	0.06	22.22	5.60
City of Merrillville- Turkey Creek	0.04	0.23	0.06	22.72	5.54
Duck Creek	0.02	0.12	0.03	12.08	2.95
Lake George- Deep River	0.03	0.21	0.05	21.09	5.15
Little Calumet River- Deep River	0.03	0.02	0.01	17.54	5.45
Willow Creek- Burns Ditch	0.03	0.17	0.05	17.43	5.35

8.2 Margin of Safety

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 margin of safety 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 ten percent of the allowable load. Ten 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.
- The *E. coli* TMDLs include an implicit MOS in that they were based on the geometric mean component of the standard rather than the single sample maximum standard. Using the single sample maximum standard would have resulted in larger loading capacities.
- An additional implicit MOS for *E. coli* is included because the load duration analysis does not address die-off of pathogens.

8.3 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 50. 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 form 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 multiple conditions.

Table 50. Critical Conditions for TMDL Parameters

Station ID (Site #)	Parameter	Critical Condition(s)				
		High	Moist	Mid-Range	Dry	Low
LMG-05-0002 (1)	*E. coli* (counts/mL)		X	X	X	X
	DO (mg/L)			X	X	
LMG-05-0003 (2)	Nitrogen, Total (mg/L)		X	X	X	X
	DO (mg/L)		X			
LMG-05-0004 (3)	*E. coli* (counts/mL)		X	X	X	X
LMG-05-0006 (5)	*E. coli* (counts/mL)		X	X		
	DO (mg/L)				X	
LMG-05-0007 (6)	*E. coli* (counts/mL)		X			
	DO (mg/L)		X			
LMG-05-0008 (7)	*E. coli* (counts/mL)		X	X	X	X
	DO (mg/L)				X	
LMG30-0008 (8)	*E. coli* (counts/mL)		X	X	X	X
	DO (mg/L)		X			X
LMG-05-0009 (9)	*E. coli* (counts/mL)		X	X	X	
	DO (mg/L)		X			X
LMG-05-0010 (10)	*E. coli* (counts/mL)		X	X	X	X
	DO (mg/L)		X			
LMG-05-0032 (11)	*E. coli* (counts/mL)		X	X	X	X
	Phosphorus, Total (mg/L)				X	
	Total Suspended Solids (mg/L)			X		
	DO (mg/L)		X		X	X
LMG-05-0011 (12)	*E. coli* (counts/mL)		X	X	X	X
	Total Suspended Solids (mg/L)	X				
	DO (mg/L)		X			
LMG-05-0033 (13)	*E. coli* (counts/mL)		X	X	X	
	Phosphorus, Total (mg/L)			X		
	Total Suspended Solids (mg/L)			X		
	DO (mg/L)		X		X	
LMG-05-0012 (14)	*E. coli* (counts/mL)		X		X	
	Nitrogen, Total (mg/L)					
	Phosphorus, Total (mg/L)	X	X			
	Total Suspended Solids (mg/L)	X				
	DO (mg/L)			X		
LMG-05-0013 (15)	*E. coli* (counts/mL)		X		X	X
LMG-05-0034 (16)	*E. coli* (counts/mL)		X		X	X
	Total Suspended Solids (mg/L)		X			
LMG-05-0014 (17)	*E. coli* (counts/mL)		X		X	X
	Nitrogen, Total (mg/L)				X	
	Phosphorus, Total (mg/L)		X		X	
	Total Suspended Solids (mg/L)		X			
LMG-05-0015 (18)	*E. coli* (counts/mL)		X		X	X
	Nitrogen, Total (mg/L)				X	
	Phosphorus, Total (mg/L)	X		X	X	

Station ID (Site #)	Parameter	Critical Condition(s)				
		High	Moist	Mid-Range	Dry	Low
	Total Suspended Solids (mg/L)	X				
LMG-05-0035 (19)	*E. coli* (counts/mL)		X		X	X
LMG-05-0016 (20)	*E. coli* (counts/mL)		X		X	X
	Phosphorus, Total (mg/L)				X	
	DO (mg/L)		X		X	X
LMG-05-0017 (21)	*E. coli* (counts/mL)		X		X	
	Phosphorus, Total (mg/L)				X	
	Total Suspended Solids (mg/L)				X	
	DO (mg/L)		X	X	X	X
LMG-05-0036 (22)	*E. coli* (counts/mL)		X	X	X	X
	Phosphorus, Total (mg/L)		X		X	
	DO (mg/L)			X	X	
LMG-05-0018 (23)	*E. coli* (counts/mL)		X		X	
	Nitrogen, Total (mg/L)		X	X	X	
	Phosphorus, Total (mg/L)		X	X		
	Total Suspended Solids (mg/L)	X				
	DO (mg/L)					
LMG-05-0019 (24)	*E. coli* (counts/mL)		X	X	X	X
	Phosphorus, Total (mg/L)				X	
	DO (mg/L)		X	X	X	X
LMG-05-0020 (25)	*E. coli* (counts/mL)		X		X	
	Phosphorus, Total (mg/L)				X	
	DO (mg/L)		X	X	X	X
LMG-05-0021 (26)	*E. coli* (counts/mL)		X	X		
	Phosphorus, Total (mg/L)		X		X	
	Total Suspended Solids (mg/L)		X			
	DO (mg/L)		X	X	X	X
LMG-05-0022 (27)	*E. coli* (counts/mL)		X	X	X	
	Phosphorus, Total (mg/L)				X	
	Total Suspended Solids (mg/L)		X		X	
	DO (mg/L)		X	X	X	X
LMG-05-0023 (28)	*E. coli* (counts/mL)			X	X	
	Phosphorus, Total (mg/L)				X	
	Total Suspended Solids (mg/L)				X	
	DO (mg/L)		X	X	X	
LMG-05-0024 (29)	*E. coli* (counts/mL)		X	X	X	
LMG-05-0025 (30)	*E. coli* (counts/mL)		X		X	
	DO (mg/L)		X		X	
LMG-05-0026 (31)	*E. coli* (counts/mL)		X	X	X	
	DO (mg/L)		X			
LMG-05-0027 (32)	*E. coli* (counts/mL)		X		X	
	Total Suspended Solids (mg/L)	X				
	DO (mg/L)			X		
LMG-05-0028	*E. coli* (counts/mL)		X	X	X	X

Station ID (Site #)	Parameter	Critical Condition(s)				
		High	Moist	Mid-Range	Dry	Low
(33)	Total Suspended Solids (mg/L)					X
	DO (mg/L)		X		X	X
LMG-05-0029 (34)	*E. coli* (counts/mL)			X	X	
	Phosphorus, Total (mg/L)					X
	Total Suspended Solids (mg/L)					X
	DO (mg/L)		X	X	X	X
LMG-05-0030 (35)	*E. coli* (counts/mL)		X	X	X	X
	Phosphorus, Total (mg/L)					X
	Total Suspended Solids (mg/L)					X
LMG-05-0031 (36)	*E. coli* (counts/mL)		X	X	X	X
	Total Suspended Solids (mg/L)		X			

8.4 Potential Priority Implementation Areas (PPIAs)

The information in Section 6 and the allocations presented in this section 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 Deep River-Portage Burns 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 Deep River-Portage Burns 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)

8.4.1 PPIAs for E. coli, Nutrients, IBC, DO, and TSS

Table 51 ranks subwatersheds in the Deep River-Portage Burns watershed according to the RPI score calculated using the Recovery Potential Screening tool.

Table 51. PPIA Ranking for Subwatersheds in the Deep River-Portage Burns Watershed

PPIA Ranking	Subwatershed	RPI Score	Ecological Rank	Stressor Rank	Social Rank
1	Lake George-Deep River	2.10	1	6	4
2	Willow Creek-Burns Ditch	2.09	3	2	1
3	Deer Creek-Deep River	1.81	2	4	7
4	City of Merrillville-Turkey Creek	1.73	9	5	2
5	Little Calumet River-Deep River	1.73	4	9	3
6	Headwaters Turkey Creek	1.69	5	3	5
7	Main Beaver Dam Ditch-Deep River	1.60	6	1	8
8	Headwaters Main Beaver Dam Ditch	1.42	8	7	6
9	Duck Creek	1.38	7	8	9

Section 9 identifies recommended implementation activities for each subwatershed and shows the associated PPIA rankings. 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 anticipates that watershed organizations will take the PPIA rankings into consideration when selecting critical areas for purposes of watershed management planning.

9.0 REASONABLE ASSURANCES/IMPLEMENTATION

This section of the Deep River-Portage Burns watershed TMDL focuses on implementation activities that have the potential to achieve the WLAs and LAs presented in Section 7. 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 *E. coli*, nutrients, and TSS loads from sources throughout the Deep River-Portage Burns watershed, particularly in the PPIAs identified in Section 8. 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 Deep River-Portage Burns 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 Deep River-Portage Burns watershed.

<u>Point Sources</u>

- WWTPs
- Industrial facilities
- CSOs, SSOs
- Regulated storm water sources
- Illicitly connected straight pipe systems
- Regulated construction sites

<u>Nonpoint Sources</u>

- Cropland
- Pastures and livestock operations
- Streambank erosion
- Onsite wastewater treatment systems
- Wildlife/domestic pets
- Urban nonpoint source runoff

9.1 Implementation Activity Options for Sources in the Deep River-Portage Burns Watershed

Keeping the list of significant sources in the Deep River-Portage Burns watershed in mind, it is possible to review the types of BMPs that are most appropriate for the *E. coli*, nutrients, and TSS and the source type. Table 52 provides a list of implementation activities that are potentially suitable for the Deep River-Portage Burns watershed based on the *E. coli*, nutrients, and TSS 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 52 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 52. List of Potentially Suitable BMPs for the Deep River-Portage Burns Watershed

	Pollutant			Point Sources			Nonpoint Sources						
Implementation Activities	Bacteria	Nutrients	Sediment	WWTPs and Industrial Facilities	CSOs	Regulated Stormwater Sources	Illicitly Connected "Straight Pipe" Systems	Cropland	Pastures and Livestock Operations	AFOs	Streambank Erosion	Onsite Wastewater Treatment Systems	Wildlife/Domestic Pets
Disinfection of primary effluent - chlorination	X			X									
Disinfection of primary effluent - ozonation	X			X									
Disinfection of primary effluent – UV disinfection	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					X	
Conservation tillage/residue management		X	X					X					
Cover crops		X	X					X			X		
Filter strips	X	X	X			X		X	X	X	X		
Grassed waterways	X		X					X		X	X		
Riparian buffers	X	X	X					X	X	X	X		X
Manure handling, storage, treatment, and disposal	X									X			
Composting													
Alternative watering systems	X		X						X	X	X		
Stream fencing (animal exclusion)	X		X						X		X		
Grazing land management	X	X	X						X		X		
Conservation easements	X	X	X										
Two-stage ditches		X	X										
Rain barrel		X	X			X							
Rain garden		X	X			X							
Street rain garden		X	X			X							
Block bioretention		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
Critical Area Planting			X						X		X		

Implementation Activities	Pollutant			Point Sources			Nonpoint Sources						
	Bacteria	Nutrients	Sediment	WWTPs and Industrial Facilities	CSOs	Regulated Stormwater Sources	Illicitly Connected "Straight Pipe" Systems	Cropland	Pastures and Livestock Operations	AFOs	Streambank Erosion	Onsite Wastewater Treatment Systems	Wildlife/Domestic Pets
Drainage Water Management		X						X					
Heavy Use Area Pad			X						X				
Nutrient Management Plan		X						X			X		

The information provided in Table 52 assisted in the development of Table 53, which provides a more refined suite of recommended implementation activities targeted to the PPIAs identified in Section 8.4.

Watershed stakeholders can use the implementation activities identified in Table 53 for each PPIA and select activities that are most feasible in the Deep River-Portage Burns 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 53. Recommended Implementation for the Deep River-Portage Burns Watershed

Subwatershed	PPIA Rank	Implementation Actions
Lake George- Deep River (040400010507)	1	Outreach and education and training Stormwater Planning and Management Conservation tillage/residue management Cover crops Conservation easements Grazing land management Comprehensive Nutrient Management Plan Drainage Water Management Stream fencing (animal exclusion) Manure handling, storage, treatment, and disposal Riparian buffers Filter strips Rain garden Green roof Dam modification or removal Constructed Wetland
Willow Creek- Burns Ditch (040400010509)	2	
Deer Creek- Deep River (040400010504)	3	
City of Merrillville- Turkey Creek (040400010505)	4	
Little Calumet River- Deep River (040400010508)	5	
Headwaters Turkey Creek (040400010503)	6	
Main Beaver Dam Ditch (040400010502)	7	
Headwaters of Main Beaver Dam Ditch (040400010501)	8	
Duck Creek (040400010506)	9	

9.2 Implementation Goals and Indicators

For each *E. coli*, nutrients, and TSS TMDL in the Deep River-Portage Burns 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 AUIDs in the Deep River-Portage Burns watershed should meet the 125 counts/100 mL (geometric mean) 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 AUIDs in the Deep River-Portage Burns 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 Suspended Solids Goal Statement: The AUIDs in the Deep River-Portage Burns 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.

Total Nitrogen Goal Statement: Until numeric nitrogen, criteria are developed and adopted by the State, nitrogen reductions strategies should be developed during the watershed planning process for point and nonpoint sources.

9.3 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 Deep River-Portage Burns watershed in Table 52 and Table 53. 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 Deep River-Portage Burns watershed.

9.3.1 Federal Programs

9.3.1.1 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 provides for the administration of the Section 319 funding source for the NPS-related projects.

USEPA offers Clean Water Act Section 319(h) grant moneys 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 BMP demonstrations, watershed water quality improvements, 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.

9.3.1.2 Great Lakes Restoration Initiative

The Great Lakes Restoration Initiative is the largest investment in the Great Lakes in two decades. A task force of eleven federal agencies developed a plan to put the President's historic initiative into action. This action plan covers fiscal years 2010 through 2014 and addresses five urgent focus areas: Cleaning up toxics and areas of concern; Combating invasive species; Promoting near shore health by protecting watersheds from polluted run-off; Restoring wetlands and other habitats; and Working with partners on outreach. Funding, up to $475 million, has been made available through a grant system that focuses on the Great Lakes and the focus areas.

9.3.1.3 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 act 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;
- 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.

9.3.1.4 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.

9.3.1.5 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.

9.3.1.6 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.

9.3.1.7 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.

9.3.1.8 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.

9.3.1.9 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.

9.3.1.10 USDA's Wetlands Reserve Program (WRP)

The Wetlands Reserve Program is a voluntary program to restore wetlands. Participating landowners can establish conservation easements of either permanent or 30 year duration, or can enter into restoration cost-share agreements where no easement is involved. In exchange for establishing a permanent easement, the landowner receives payment up to the agricultural value of the land and 100 percent of the restoration costs for restoring the wetlands. The 30 year easement payment is 75 percent of what would be provided for a permanent easement on the same site and 75 percent of the restoration cost. The voluntary agreements are for a minimum 10 year duration and provide for 75 percent of the cost of restoring the involved wetlands. Easements and restoration cost-share agreements establish wetland protection and restoration as the primary land use for the duration of the easement or agreement. In all instances, landowners continue to control access to their land.

9.3.1.11 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.

9.3.2 State Programs

9.3.2.1 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 and CSOs consistent with WLAs is implemented through the NPDES program.

9.3.2.2 State Nonpoint Source Control Program

The state's Nonpoint Source Program, administered by the IDEM Office of Water Quality 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; degree of balance lent to the statewide NPS Program in terms of project type; 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 staff 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.

9.3.2.3 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.

9.3.2.4 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.

9.3.3 Funding Utilized by Local Stakeholders

Programs taking place at the local level are important to successful TMDL implementation. Partners are instrumental to bringing grant funding into the Deep River-Portage Burns watershed to support local protection and restoration projects. This section provides a brief summary of the local programs taking place in the Deep River-Portage Burns watershed that will help to reduce *E. coli*, nutrients, and TSS loads, as well as provide ancillary benefits to the Deep River-Portage Burns watershed.

Lake County:
Lake County received the following funding to improve water quality in 2012:
Local: $192,472
CWI: $14,000
CRP/CREP: $203,606
CSP: $39,678
EQIP: $12,010
Total: $461,766

Porter County:
Porter County received the following funding to improve water quality in 2012:
Local: $105,683
CWI: $12,500
LARE: $18,400
GHDP: $856
CRP/CREP: $222,594
EQIP: $179,030
WRP/WREP: $975
Total: $540,038

Funding Name	Organization	Project Location Description	Project Description	Award Amount	Current Match Total	Project End Date
Chi-Cal Rivers Fund	The Nature Conservancy - Indiana	The Grand Calumet River Area of Concern in Lake County, Indiana, incorporating riparian habitats as well as dune and swale habitat adjacent to the river system	Develop and implement a cooperative and comprehensive approach to Early Detection Rapid Response, invasive species control, and restoration management in the Grand Calumet River Area of Concern.	$157,374.78	$157,374.78	2/1/2016
Sustain Our Great Lakes	Shirley Heinze Land Trust, Inc.	Meadowbrook Forest Nature Preserve, owned by Shirley Heinze Land Trust and located in the Salt Creek watershed in Porter County, in northwestern Indiana, in the Lake Michigan Watershed.	Control invasive species, restore native riparian canopy cover, and re-forest surrounding uplands to restore 60 acres of habitat for several species of concern in northwestern Indiana.	$30,000.00	$32,000.00	9/1/2015
	Indiana Department of Natural Resources	Lake Wolf/Lake George area of Grand Calumet River/Indiana Harbor AOC, Hammond, Lake County, Indiana.	Control invasive species to restore 33 acres of wetlands in northern Lake County, Indiana, within the Grand Calumet River Area of Concern.	$121,000.00	$121,000.00	12/30/2015
	Friends of the Forest Preserves	Calumet River watershed of southern Lake Michigan system; Forest Preserve District of Cook County, Calumet Memorial Park District, Shirley Heinze Trust and The Nature Conservancy ownership.	Work with partners to conduct prescribed burns and invasive species control. Project will restore 605 wetland acres and 100 upland acres of lakeplain habitat at nine sites in the Calumet region.	$500,000.00	$571,526.00	10/15/2013
	Shirley Heinze Land Trust, Inc.	Properties owned by Shirley Heinze Land Trust in Lake and Porter Counties, Indiana. Properties are adjacent to the Indiana Dunes National Lakeshore.	Help correct the effects of fire suppression and invasive plant infestations on privately-owned interdunal wetlands in the Indiana Dunes region in Lake and Porter Counties, Indiana.	$31,377.80	$8,963.00	5/31/2012
	Wildlife Habitat Council	Northwestern Indiana	Develop public-private partnerships for restoration on industrial and corporate landscapes in northwestern Indiana. Project will advance voluntary efforts by the industrial sector to restore and expand native habitats.	$64,477.00	$0.00	2/28/2007
	Gary Sanitary District	Gary, Indiana	Restore the ecological habitat on the east Marquette Park Lagoon through runoff control, bank restoration and stabilization, and fish and wildlife habitat restoration. The project will help set delisting targets for the degradation of fish and wildlife.	$49,355.00	$8,500.00	6/30/2008

	Portage Parks Department	Porter County, Indiana	Restore 10 acres of critical dune habitat and 1,000 linear feet of eroding stream bank on National Park Service property operated by the City of Portage, Indiana. Project will educate park visitors of the unique habitat through interpretative signage.	$70,000.00	$187,000.00	6/30/2007
	Field Museum of Natural History	This project will occur in the Calumet region in both Illinois and Indiana. This region covers southeast Cook County in Illinois, and Lake and Porter counties in Indiana.	Engage teachers and students in environmental education in the 15,000-acre Calumet region of northeastern Illinois and northwestern Indiana.	$50,000.00	$50,000.00	10/31/2010
	Shirley Heinze Land Trust, Inc.	Bur Oak Woods Nature Preserve on east side of Liverpool Road, north of Crabapple Lane, in Hobart, Lake County, IN. Within 1/2 mile of Indiana Dunes National Lakeshore - Hobart Prairie Grove Unit.	Restore 45 acres of fire-suppressed, remnant bur oak savanna habitat in the Hobart Marsh complex in northwest Indiana.	$30,000.00	$30,103.00	5/31/2012

NIRPC

The Northwestern Indiana Regional Planning Commission received $455,550 from IDEM through a Section 319 grant to produce a WMP for the Deep River – Portage Burns Waterway Watershed, HUC 0404000105. After the WMP is complete, NIRPC will develop and implement a cost-share program for BMPs such as low impact development and storm water retrofits, two stage ditches, wetland restoration, and others that address the water quality concerns outlined in the Deep River – Portage Burns Waterway WMP. NIRPC will implement one agricultural BMP and one urban BMP as demonstration projects to educate the public on improving water quality through BMPs. NIRPC will conduct a volunteer monitoring program based on Hoosier Riverwatch methods to identify potential problems and increase public involvement. An education and outreach program will also be conducted including e-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 agricultural conservation practices, and Fall Festivals to raise awareness about the project and share project accomplishments to date. NIRPC has received letters of commitment on the project from the following partners:

City of Crown Point
City of Gary (Sanitary District)
City of Hobart (Storm Water District)
Illinois – Indiana Sea Grant
Lake County Parks
Lake County Surveyor/MS4 program
Lake County SWCD
Town of Lake Station
IDNR – Lake Michigan Coastal Program
City of Merrillville (Storm Water Utility)
Northwest Indiana Paddling Association

Izaak Walton League – Porter County Chapter
City of Portage
Porter County SWCD
Purdue University – Calumet
Save the Dunes
Urban Waters Federal Partnership
Wildlife Habitat Council
USDA – NRCS

Steering Committee:

Shirley Heinze land trust
New Chicago
Porter County surveyor
Little Calumet River Basin Development
Izaak Walton League – Porter County Chapter
TNC
Sierra Club
NWIPA
Northwest Indiana Forum
NRCS
Indiana Dunes National Lakeshore
ISDA

9.4 Implementation Programs by Source

Section 9.3 identified a number of federal, state, and local programs that can support implementation of the recommended management or restoration activities for the Deep River-Portage Burns watershed. Table 54 and the following sections identify which programs are relevant to the various sources in the Deep River-Portage Burns watershed.

Table 54. Summary of Programs Relevant to Sources in the Deep River-Portage Burns 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		X	X	X	X	X	X	X	X	X	X	X		

Operations														
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

9.4.1 Point Source Programs

9.4.1.1 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.

9.4.1.2 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.

9.4.1.3 CSOs

IDEM regulates CSOs in Indiana through the state's NPDES program. As discussed in Section 3.0, all CSOs in the state have in place LTCPs. Enforcement mechanisms for LTCPs and their implementation schedules include associated NPDES permits and state consent decrees.

9.4.1.4 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 14 MS4s in the Deep River-Portage Burns watershed that have coverage under IDEM's MS4 general permit. The SWMPs for each of these MS4s describes best management practices implemented to fulfill the six minimum control measure requirements.

9.4.1.5 Illegal straight pipes

Local health departments are responsible for locating and eliminating illicit discharges and illegal connections to the sewer system.

9.4.2 Nonpoint Sources Programs

9.4.2.1 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)

9.4.2.2 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)

9.4.2.3 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)

9.4.2.4 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.

9.4.2.5 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.

9.5 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 55 identifies key potential implementation partners and the type of technical assistance they can provide to watershed stakeholders.

Table 55. Potential Implementation Partners in the Deep River-Portage Burns 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 .

10.0 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 March 13, 2013. The first meeting was held at 2:00 PM (CDT) at the Lake County SWCD & Extension Offices, 880 E. 99th Ct., Suite A, Crown Point, IN 46307. The second kickoff meeting was held at 6:00 PM (CDT) at the Portage Lakefront and Riverwalk, Riverwalk Drive Portage, IN 46368.described the TMDL Program and provided a summary of the project.
- A Deep River Monitoring Field Day was held on October 23, 2013 from 1:00 PM - 3:00 PM (CDT). This event was held at Deep River County Park, 9410 Old Lincoln Highway, Hobart, Indiana 46342. At this event, participants learned more about sampling methods from IDEM, USGS, and Hoosier Riverwatch staff. Field procedures for fish & macroinvertebrate collection, habitat assessment and water chemistry were demonstrated.
- A Deep River TMDL Interim Public meeting was held on December 5, 2013 from 1:00 PM - 3:00 PM (CST). The meeting was held at the Lake County Soil and Water Conservation District, 880 E. 99th Ct, Suite A, Crown Point, Indiana 46307. At this meeting IDEM staff discussed the 2013 recreation sampling season and results
- A Draft TMDL public meeting was held at the Hobart Community Center, 111 E. Old Ridge Road, Hobart IN 46342 on July 14, 2014 at 2:00pm, during which IDEM described the TMDL program and provided an overview of the draft TMDL results.

12 HUC	2012 AUID	L-Site #	Site ID	Stream Name	Drainage Area	Description	Date	% Sat	Alkalinity (CaCO3)	Chloride	COD	Coliforms (Total)	DO	E. Coli	Flow	Hardness (CaCO3)	Nitrogen, Ammonia	Nitrogen, Nitrate+Nitrite	pH (Field)	Phosphorus, Total	Solids, Suspended Total, (TSS)	Solids, Total (TS)	Solids, Total Dissolved (TDS)	Specific Conductance (Field)	Sulfate	Temperature	TKN	TOC	Turbidity
40400010501 Headwaters Main Beaver Dam Ditch	INC0151_01	LMG-05-0022	27	Main Beaver Dam Ditch	2.347	Blaine Street	4/9/2013	83.9				866.4	8.44	17.5			<0.1	<0.05	7.86	0.13	20	630	480	916		15.15	0.93		17.2
							5/7/2013	162.6				272.3	14.52	23.1			<0.1	<0.05	7.88	0.25	66	750	590	1075		20.96	1.7		64.8
							6/11/2013	108.2				>2419.6	8.43	85.7			<0.1	0.019	7.65	0.13	9	550	490	900		24.85	1.1		15.7
							7/9/2013	51.3	160	62	38	>2419.6	4.25	816.4		230	<0.1	<0.05	7.48	0.16	9	380	370	630	39	24.92	1.1	9.4	13
							7/23/2013	22.5					1.19						7.32					786		25.6			490
							8/6/2013	47.9	170	66	38	>2419.6	4.2	90.6		250	<0.1	0.016	7.24	0.11	14	440	360	623	42	21.6	0.76	10	20.4
							9/10/2013	12.9				>2419.6	1.11	275.5					7.47					765		22.91			20.8
							9/10/2013	21.4	190	110	100		1.79			260	0.12	0.01	7.38	0.74	78	520	400	773	21	23.53	1.5	17	52.7
							9/17/2013	33.7				>2419.6	3.44	52.8					7.81					807		14.33			15
							9/24/2013	40.8				>2419.6	4.24	517.2					7.65					798		13.57			10.4
							10/1/2013	38.3				2419.6	3.77	1413.6					7.73					768		16.11			14
							10/7/2013	68.5	170	73	22		6.79			280	< 0.1	0.067	7.84	0.096	12	490	430	784	84	15.49	0.84	7.4	21.2
							10/8/2013	36.2				>2419.6	3.73	307.6					7.49					771		13.98			12.8
		LMG-05-0020	25	Main Beaver Dam Ditch	9.86	Clark Road	4/9/2013	124.4				>2419.6	12.86	436			<0.1	1.1	8.07	0.077	9	520	440	772		13.49	1.4		11.2
							5/7/2013	68.8				>2419.6	6.35	613.1			<0.1	<0.05	7.63	0.21	18	410	360	604		19.03	2		15.6
							6/11/2013	88.6				2419.6	7.65	63.8			0.57	1.6	7.52	0.11	14	440	390	660		22.36	2.4		8.28
							7/9/2013	48.1	160	29	43	>2419.6	4.25	2419.6		240	0.16	5.9	7.31	0.15	6	360	290	571	22	21.69	1.4	12	15.5
							7/23/2013	19.4					1.61						7.39					531		24.38			70.1
							8/6/2013	71	200	52	45	2419.6	5.89	261.3		250	0.27	0.11	7.43	0.2	2	390	340	454	16	22.55	0.96	14	4.72
							9/10/2013	7.9				>2419.6	0.67	70.3					7.41					534		23.05			14.4
							9/10/2013	18	260	50	61		1.54			270	0.19	0.013	7.43	0.42	25	420	390	654	11	22.29	2.6	17	6.97
							9/17/2013	17.3				>2419.6	1.81	71.2					7.5					836		13.95			19.6
							9/24/2013	18.9				1299.7	2.01	64.5					7.46					858		12.5			17.1
							10/1/2013	20.4				1119.9	2.07	73.8					7.41					840		14.6			10.2
							10/7/2013	32.4	350	30	-1		3.28			400	0.11	0.058	7.57	0.32	10	570	550	916	110	14.67	0.91	7.6	10.8
							10/8/2013	20				>2419.6	2.14	69.7					7.48					917		12.86			3.9
	INC0151_T1001	LMG-05-0021	26	Tributary of Main Beaver Dam Ditch	4.992	101st Avenue	4/9/2013	113				613.1	11.4	172.3			<0.1	<0.05	7.93	0.091	8	680	540	915		14.81	1.8		9.97
							5/7/2013	75.9				648.8	6.82	73.3			<0.1	<0.05	7.65	0.21	16	530	350	592		20.7	2		12.6
							6/11/2013	29.8				>2419.6	2.62	648.8			0.65	<0.05	7.44	0.5	19	460	390	660		24.53	3		25.1
							7/9/2013	8.1	140	96	57	>2419.6	0.71	>2419.6		210	0.1	0.14	7.2	0.25	89	520	380	667	23	22.91	1.6	16	37
							7/23/2013	6.2					0.54						7.46					637		22.82			43.9
							8/6/2013	25.7	190	57	71	>2419.6	2.25	152.9		220	<0.1	0.025	7.35	0.38	22	390	330	541	11	20.55	1.2	13	19.5
							9/10/2013	16.3				2419.6	1.41	19.7					7.36					635		22.77			8.4
							9/10/2013	8.5	210	63	59		0.74			230	<0.1	<0.05	7.56	0.36	11	350	340	588	4.5	23.12	1.6	17	8.68
							9/17/2013	22.3				2419.6	2.27	42.2					7.5					626		14.57			22.2
							9/24/2013	14.5				980.4	1.5	34.1					7.28					664		13.62			12.1
							10/1/2013	16.1				1553.1	1.61	18.1					7.35					668		15.42			12.9
							10/7/2013	11.4	230	46	55		1.13			280	< 0.1	< 0.05	7.31	0.62	13	400	370	665	16	14.7	1.8	22	32.1
							10/8/2013	18.7				>2419.6	1.95	325.5					7.17					678		13.85			22.2
	INC0151_T1002																												
	INC0151_T1003	LMG-05-0019	24	Tributary of Main Beaver Dam Ditch	2.794	Summit Street	4/9/2013	75.6				2419.6	7.73	435.2			0.27	0.22	7.42	0.17	18	800	690	1304		12.62	1.6		24.3
							5/7/2013	204.6				>2419.6	19.77	920.8			0.18	0.3	8.48	0.14	5	600	550	966		18.04	1.2		7.55
							6/11/2013	7				>2419.6	1.05	103.6			0.96	<0.05	6.91	0.29	1	460	440	1267		14.05	2.1		6.52
							7/9/2013	28.2	150	72	38	>2419.6	2.49	>2419.6		180	0.56	0.095	7.31	0.18	3	320	310	566	15	21.22	1.4	10	5.99
							7/22/2013	3.6					0.31						7.38					1163		16.16			
							8/6/2013	8.2	180	140	43	>2419.6	0.8	>2419.6		230	0.92	0.019	7.19	0.35	8	490	430	990	24	17.9	1.4	12	11.7
							9/10/2013	8.6				>2419.6	0.81	148.3					7.06					1388		17.89			8.5
							9/10/2013	6.5	280	190	24		0.65			360	0.63	0.06	7.04	0.18	18	720	680	1355	80	17.42	1.5	7.3	10.4
							9/17/2013	23.8				>2419.6	2.36	>2419.6					7.51					1556		15.63			5.2
							9/24/2013	17.6				19863	1.78	275.5					7.43					921		14.87			9.7
							10/1/2013	14.2				>2419.6	1.42	2419.6					7.42					344		15.49			18.3
							10/7/2013	16.6	170	120	37		1.65			240	0.1	0.1	7.6	0.22	8	480	460	835	67	15.49	1.4	13	6.6
							10/8/2013	26.1				>2419.6	2.66	1413.6					7.41					876		14.64			2.5
40400010502 Main Beaver Dam Ditch-Deep River	INC0152_04	LMG-05-0018	23	Deep River	19.07	Grant Street	4/9/2013	86.5				920.8	9.18	120.1	7.4202		<0.1	10	7.45	0.29	6	700	560	1061		12.54	1.3		7.89
							5/7/2013	91.8				>2419.6	9.15	461.1	7.8196		0.23	12	7.49	0.54	11	580	480	897		15.43	1.4		6.08
							6/11/2013	61.1				>2419.6	5.67	224.7	8.1059		0.14	11	7.21	0.55	1	500	420	786		18.92	1.5		3.43
							7/9/2013	57.7	150	66	40	>2419.6	5.06	1986.3	17.7532	220	<0.1	7.3	7.33	0.38	2	390	340	621	34	21.78	1.2	9.5	4.6
							7/22/2013	84					7.05						7.71					635		22.57			3.56
							8/6/2013	65.3	120	96	24	>2419.6	5.84	461.1	6.9734	230	0.14	16	7.43	0.57	5	450	370	720	46	20.74	0.96	8.5	3.07
							9/10/2013	71				>2419.6	6.1	73.8					7.52					729		22.91			1.2
							9/10/2013	80.7	82	82	17		6.95		3.9153	190	0.13	20	7.26	1.1	<1	400	380	701	43	22.72	0.43	5.5	1.32
							9/17/2013	68.4				>2419.6	6.31	95.9					7.57					742		19.18			1.4
							9/24/2013	70				>2419.6	6.5	112.6					7.51					822		18.73			2.5
							10/1/2013	63.2				1986.3	5.77	105					7.34					768		19.69			1
							10/8/2013	70				>2419.6	6.6	79.8					7.48					782		18.03			1.5
							10/9/2013	68.9	120	87	19		6.51		6.9823	230	0.11	18	7.52	0.67	6	450	370	808	44	17.97	1	6.4	3.81
							11/4/2013	74.6	150	88	23		7.91		15.3815	260	< 0.1	7.5	7.37	0.31	2	470	420	805	82	12.59	1.5	8.9	6.1
							12/9/2013	79.8	120	99	34		9.22		5.6014	220	0.1	16	7.32	1.7	14	530	450	900	72	8.93	1.3	7.5	9.56
							3/19/2014	77.4	78	88	35		10.31			170	0.17	2	7.27	0.21	29	390	340	594	36	3.27	1.8	8.7	44.9
		LMG-05-0015	18	Deep River	44.481	Clay Street	4/9/2013	78.2				1986.3	8.44	166.4			<0.1	4.4	7.85	0.13	9	640	580	1050		11.82	1.2		9.86
							5/7/2013	94.1				>2419.6	9.62	116			<0.1	4.9	7.84	0.2	6	560	500	851		14.28	1.2		8.23
							6/11/2013	60				>2419.6	5.61	547.5			0.11	6.1	7.58	0.3	5	500	440	701		18.47	1.2		5.9
							7/9/2013	59	150	66	36	>2419.6	5.14	>2419.6	45.0057	220	0.17	3	7.49	0.27	22	410	340	635	35	22.14	1.3	9.6	16.1
							7/23/2013	64.8					5.4						7.58					700		23.08			5.28
							8/6/2013	73.1	170	84	20	>2419.6	6.72	866.4	8.1597	250	<0.1	7.3	7.76	0.33	4	470	410	737	50	19.4	0.33	7.1	5.59
							9/9/2013	84.1				>2419.6	7.21	920.8					7.78					824		22.97			4.6
							9/10/2013	64.1	130	93	6.8		5.48		6.4683	240	<0.1	15	7.66	0.64	4	440	420	772	53	23.07	0.48	5.5	7.37
							9/16/2013	83				>2419.6	8.04	1046.2					7.81					800		16.77			4.7
							9/23/2013	79.3				>2419.6	7.93	435.2					7.72					762		15.27			3
							10/7/2013	75				>2419.6	7.46	613.1					7.64					685		15.56			4.4
							10/9/2013	71.9	170	81	33		7.33		10.6436	260	< 0.1	6.1	7.84	0.34	7	430	420	794	52	14.31	0.34	9.2	9.24
							11/4/2013	78.5	170	76	34		8.92		32.9213	290	< 0.1	3.8	7.55	0.14	7	480	430	784	92	9.64	1.7	12	11.6
							12/9/2013	79.3	190	93	28		11.34		10.5956	340	0.18	8.1	7.72	0.57	7	670	540	785	99	0.76	< 0.3	9.6	9.99
							3/19/2014	79.6	57	110	46	79.6	10.59			170	0.32	1.5	7.43	0.39	170	560	370	614	36	3.32	2.3	9	227
	INC0152_T1007																												
	INC0152_T1008	LMG-05-0036	22	Smith Ditch	2.966	113th Avenue	4/9/2013	56.6				>2419.6	5.93	290.9			<0.1	<0.05	7.44	0.17	75	870	730	1396		13.02	1.1		92.4
							5/7/2013	86.9				>2419.6	8	365.4			0.1	<0.05	7.58	0.19	68	690	570	1014		18.14	1.1		94.2
							6/11/2013	137.9				>2419.6	10.86	307.6			<0.1	<0.05	7.78	0.14	38	630	550	1028		26.95	1.2		54.8
							7/9/2013	61.7	150	91	42	>2419.6	5.07	>2419.6		220	0.2	0.11	7.58	0.21	29	450	380	728	24	25.21	1.2	9.9	49.9
							7/22/2013	36.1					3.13						7.33					720		27.8			117
							8/6/2013	64.1	170	150	42	>2419.6	5.64	770.1		290	<0.1	0.014	7.52	0.17	60	600	510	861	64	21.66	0.96	9.9	106
							9/10/2013	48.1	220	150	31	>2419.6	3.91	1553.1		310	<0.1	<0.05	7.74	0.11	18	620	560	1026	50	26.11	0.35	11	39.1
							9/17/2013	71.4				>2419.6	7.11	488.4					7.98					1075		15.47			18.5
							9/24/2013	77.6				>2419.6	7.75	209.8					7.54					802		15.34			47.9
							10/1/2013	65.8				>2419.6	6.31	172.3					7.49					829		17.32			58
							10/8/2013	63.5				>2419.6	6.44	298.7					7.42					640		14.69			62.2
							10/9/2013	55.2	160	66	30		5.62			230	< 0.1	0.06	7.5	0.14	36	390	340	646	45	14.41	0.59	8.9	52.4
	INC0152_T1009	LMG-05-0017	21	Niles Ditch	7.237	121st Avenue	4/9/2013	115.5				866.4	12.26	307.6			0.1	0.82	7.79	0.1	16	570	500	877		12.56	1.3		14
							5/7/2013	157.2				1119.9	14.95	22.6			0.11	0.9	7.8	0.14	18	510	440	770		17.32	1.7		11.2
							6/11/2013	59.7				>2419.6	5.39	34.1			0.18	0.66	7.49	0.11	1	500	460	836		20.3	1.2		3.23
							7/9/2013	13.8	190	77	34	>2419.6	1.21	410.6		260	0.62	2.6	7.28	0.24	3	480	400	780	39	21.87	1.8	10	10.9
							7/23/2013	4.78					2.15						7.15					986		25.21			
							8/6/2013	37.6	280	34	32	>2419.6	3.15	118.7		370	0.44	0.057	7.55	0.42	8	480	440	715	50	21.34	1.1	8.5	6.79
							9/10/2013	2.7	380	23	76		0.24			420	1.5	0.014	7.16	1.3	280	720	470	839	42	22.47	4.9	11	16.3
							9/10/2013	19.3				>2419.6	1.55	387.3					7.6					824		26.71			9.8
							9/17/2013	31.2				>2419.6	3.25	122.3					7.64					731		13.48			8.2
							9/24/2013	34.3				>2419.6	3.5	87.8					7.49					880		14.33			7.4
							10/1/2013	27.2				>2419.6	2.7	613.1					7.39					933		16.5			11.4
							10/8/2013	16.3				>2419.6	1.72	228.2					7.2					1000		12.8			10.2
							10/9/2013	18.7	300	88	36		1.96			380	0.36	0.24	7.37	0.28	5	590	570	999	100	12.42	1.4	16	8.76
		LMG-05-0016	20	Niles Ditch	10.029	Colorado Street	4/9/2013	70.5				816.4	7.61	52			<0.1	0.77	7.63	0.1	6	560	510	841		11.75	1.1		8.61
							5/7/2013	91.7				1119.9	9.21	40.2			0.14	0.8	7.54	0.14	20	540	490	756		15.13	1.5		24.6
							6/11/2013	67.2				>2419.6	5.94	344.1			<0.1	0.54	7.63	0.13	11	550	460	849		20.94	1		9.13
							7/9/2013	22.1	190	43	61	>2419.6	1.93	>2419.6		330	0.52	1.7	7.39	0.57	12	500	420	750	42	22.21	2.6	17	35.3
							7/23/2013	36.3					3.12						7.14					790		23.25			16.3
							8/6/2013	11.1	270	130	29	>2419.6	1.02	156.5		400	0.43	0.013	7.32	0.3	5	680	610	984	100	19.01	1.2	9.1	6.63
							9/9/2013	10.3				>2419.6	0.95	365.4					7.27					983		19.6			6.1
							9/10/2013	6.5	380	55	38		0.55			440	0.49	0.014	7.23	0.42	13	580	550	892	58	20.16	2.3	9.5	7.26
							9/16/2013	13				>2419.6	1.31	920.8					7.35					1012		15.41			13.1
							9/23/2013	19.9				>2419.6	1.97	307.6					7.29					939		15.95			9.9
							10/7/2013	24.3				>2419.6	2.43	1553.1					7.29					967		15.36			8
							10/9/2013	16.7	280	84	42		1.75			360	0.38	0.25	7.41	0.25	4	600	590	1010	110	12.98	1.4	17	7.42
	INC0152_T1010			Tributary of Niles Ditch																									
	INC0152_T1011			Tributary of Niles Ditch																									

12 HUC	2012 AUID	L-Site #	Site ID	Stream Name	Drainage Area	Description	Date	% Sat	Alkalinity (CaCO3)	Chloride	COD	Coliforms (Total)	DO	E. Coli	Flow	Hardness (CaCO3)	Nitrogen, Ammonia	Nitrogen, Nitrate+Nitrite	pH (Field)	Phosphorus, Total	Solids, Suspended Total (TSS)	Solids, Total (TS)	Solids, Total Dissolved (TDS)	Specific Conductance (Field)	Sulfate	Temperature	TKN	TOC	Turbidity
40400010503 Headwaters Turkey Creek	INC0153_01	LMG-05-0024	29	Turkey Creek	5.545	Broad Street	4/10/2013	82.4				1732.9	9.44	260.3			<0.1	0.027	7.7	<0.05	3	830	700	1214		9.22	0.72		6.42
							5/8/2013	98.9				>2419.6	9.96	410.6			0.12	<0.05	7.66	0.073	5	620	590	941		15.2	<0.3		9.99
							6/12/2013	77.1				>2419.6	7.03	920.8			<0.1	0.062	7.58	0.13	4	500	390	722		19.85	1.1		7.46
							7/10/2013	70	190	78	41	>2419.6	6.02	1986.3		260	<0.1	0.17	7.63	0.13	6	440	390	726	37	22.86	0.94	12	9.27
							7/23/2013	78.1					6.92						7.8					940		20.82			14.5
							8/7/2013	63.9	220	84	23	>2419.6	5.82	517.2		370	0.1	0.12	7.54	<0.05	4	630	530	919	110	19.87	0.51	6.8	6.83
							9/10/2013	49.6				>2419.6	4.44	142.1					7.72					1182		20.62			0.8
							9/10/2013	89.7	390	91	14		7.78			540	<0.1	0.2	7.82	<0.05	2	740	720	1169	130	22.25	0.33	3.5	2.2
							9/17/2013	66				>2419.6	6.94	123.6					7.82					1200		13.01			1.4
							9/24/2013	64.8				>2419.6	6.77	1553.1					7.61					1065		13.33			5.5
							10/1/2013	62.1				>2419.6	6.13	387.3					7.66					1109		15.8			4.4
							10/7/2013	87.7	210	73	-1		8.9			280	< 0.1	0.16	7.9	0.068	2	450	440	795	62	14.48	0.78	10	5.96
							10/8/2013	66.9				>2419.6	7.07	387.3					7.62					856		12.83			3.3
		LMG-05-0027	32	Turkey Creek	21.178	SR 55	4/10/2013	74.3				1413.6	8.67	107.6	7.5854		<0.1	0.1	7.86	<0.05	4	710	580	1030		8.48	0.58		8.17
							5/8/2013	92.1				>2419.6	9.6	54.8	8.822		<0.1	0.2	7.87	<0.05	8	620	640	907		13.39	<0.3		10
							6/12/2013	68				>2419.6	6.15	156.5	11.4038		<0.1	0.5	7.68	0.084	13	530	450	777		20.19	0.78		11.9
							7/10/2013	61.1	180	42	38	>2419.6	5.2	517.2	20.7778	260	0.1	0.66	7.62	0.092	17	410	350	638	50	23.32	0.83	9.1	16.6
							7/23/2013	54.3					4.58						7.75					682		23.63			10.1
							8/7/2013	62.4	240	53	18	>2419.6	5.47	866.4	3.2559	370	<0.1	0.038	7.75	<0.05	5	560	490	811	140	21.82	0.53	5.5	5.93
							9/10/2013	63				>2419.6	5.29	107.6					7.91					819		24.02			7.3
							9/11/2013	71.8	300	29	<10		6.09		2.427	390	<0.1	0.022	7.83	0.058	5	520	500	791	110	23.55	0.35	4.6	6.93
							9/17/2013	71.9				>2419.6	7.28	185					8.04					757		14.67			7.9
							9/24/2013	74.4				>2419.6	7.59	125					7.89					793		14.35			7.1
							10/1/2013	66.6				>2419.6	6.47	101.9					7.86					884		16.63			7
							10/7/2013	78.5	210	42	17		8.11		6.9981	280	< 0.1	0.13	7.84	< 0.05	4	430	360	703	79	13.77	0.53	6	7.8
							10/8/2013	72.2				>2419.6	7.56	157.6					7.8					765		13.25			8.6
							11/4/2013	90	200	58	18		10.52		11.4082	310	0.11	0.35	7.56	<0.05	8	480	410	767	98	8.48	1.1	8	14.1
							12/9/2013	87.2	260	55	21		12.62		5.1056	440	0.15	0.17	7.5	< 0.05	8	570	550	938	130	0.32	0.66	5	10.7
							3/19/2014	82.9	110	77	20		11.21		146.5612	220	0.14	0.98	7.34	0.18	84	440	350	615	46	2.7	1.3	6.7	66.5
	INC0153_T1001	LMG-05-0023	28	Tributary of Turkey Creek	2.84	77th Avenue	4/10/2013	52.2				>2419.6	6.15	34.5			<0.1	<0.05	7.54	<0.05	<1	630	530	1004		8.22	0.78		2.1
							5/8/2013	79.7				>2419.6	7.58	9.7			<0.1	<0.05	7.53	0.094	2	450	420	745		17.63	0.95		2.57
							6/12/2013	40.8				>2419.6	3.7	115.3			<0.1	<0.05	7.26	0.12	1	390	330	652		19.98	0.98		2.66
							7/10/2013	21.4	190	69	50	>2419.6	1.82	90.8		230	<0.1	<0.05	7.32	0.16	1	390	360	657	13	23.15	1.1	15	2.28
							8/7/2013	23.3	180	100	39	>2419.6	2.04	87.8		290	0.11	0.011	7.27	0.086	5	540	460	825	40	21.09	0.89	15	5.34
							9/10/2013	17.4				>2419.6	1.51	344.8					7.47					1001		22.3			64.4
							9/10/2013	30.3	210	110	120		2.61			360	2.6	<0.05	7.49	2.8	130	760	620	967	120	22.83	2.9	22	127
							10/7/2013	56.6	250	90	34		5.92			340	< 0.1	0.051	7.6	0.084	1	580	560	962	94	13.07	0.49	16	2.12
							10/8/2013	47.9				>2419.6	5.21	770.1					7.47					969		11.53			1.2
	INC0153_T1002			Tributary of Turkey Creek		Tributary of Turkey Creek																							
	INC0153_T1003	LMG-05-0025	30	Johnson Ditch	2.132	Oak Ridge Prairie County Park	4/10/2013	87.9				517.2	10.22	7.4			<0.1	0.055	8.05	<0.05	5	450	400	709		8.58	0.45		6.33
							5/8/2013	128				>2419.6	12.45	75.9			<0.1	<0.05	8.15	<0.05	3	430	390	666		16.56	0.73		6.41
							6/12/2013	43.9				>2419.6	3.81	290.9			<0.1	0.019	7.65	0.056	2	360	310	590		21.88	0.69		4.16
							7/10/2013	63.8	190	32	30	>2419.6	5.43	178.9		230	<0.1	0.045	7.67	0.056	<1	330	330	586	41	24.58	0.57	9.7	2.66
							7/23/2013	107.7					8.49						8.16					488		26.74			
							8/7/2013	50	210	19	19	>2419.6	4.3	178.2		260	<0.1	0.018	7.72	<0.05	3	380	310	568	60	22.68	0.33	4.9	4.87
							9/10/2013	45.1				>2419.6	3.78	195.6					7.79					579		24.2			2.9
							9/11/2013	107.6	250	17	17		8.85			250	0.24	<0.05	8.14	<0.05	5	350	310	565	50	25.17	0.38	5.5	6
							9/17/2013	54.1				>2419.6	5.37	96					7.88					587		15.68			2.8
							9/24/2013	50				>2419.6	4.92	344.8					7.8					583		16.11			6
							10/1/2013	44.7				>2419.6	4.29	187.2					7.73					603		17.33			3.9
							10/7/2013	109.5	240	19	11		10.91			250	< 0.1	0.011	8.33	< 0.05	< 1	360	330	578	62	15.64	< 0.3	5.3	3.38
							10/8/2013	56				>2419.6	5.8	133.3					7.79					597		13.75			3
	INC0153_T1004	LMG-05-0026	31	Tributary of Turkey Creek	2.642	W Old Lincoln Highway	4/10/2013	87.5				1299.7	10.25	191.8			<0.1	0.085	8.07	0.058	7	690	610	1108		8.32	0.66		12.1
							5/8/2013	22.6				>2419.6	2.03	488.4			<0.1	<0.05	7.99	0.13	21	390	350	611		14.54	0.5		35.6
							6/12/2013	77.5				>2419.6	6.96	1203.3			<0.1	0.14	7.79	0.11	7	350	280	570		20.61	0.87		17.5
							7/10/2013	75.5	150	35	41	>2419.6	6.32	1553.1		180	<0.1	0.23	7.8	0.18	27	300	250	456	22	24.27	0.73	11	39.2
							7/23/2013	69.1					5.84						7.89					411		23.3			30.4
							8/7/2013	81.5	110	34	24	>2419.6	7.25	488.4		170	0.14	0.18	7.68	0.11	15	290	230	81.5	29	21.05	0.62	6.5	34.5
							9/10/2013	82.3				>2419.6	7.4	24.9					7.79					339		20.48			4.3
							9/11/2013	86.5	130	20	<10		7.88			140	<0.1	0.22	7.56	0.08	1	180	180	317	21	19.86	0.46	2.5	2.53
							9/17/2013	80.3				686.7	7.76	6.3					7.9					389		17.24			3.5
							9/24/2013	80.8				>2419.6	8.09	1046.2					7.82					409		15.3			20.4
							10/1/2013	78.8				1986.3	7.58	98.7					7.72					405		17.21			4.8
							10/7/2013	86.9	110	37	22		8.66			170	< 0.1	0.19	7.91	0.14	22	300	270	485	36	15.47	0.47	6.6	47.2
							10/8/2013	81.5				>2419.6	8.5	547.5					7.81					485		13.47			25.8
	INC0153_T1005	LMG-05-0028	33	Tributary of Turkey Creek	2.281	73rd Avenue	4/10/2013	77.4				2419.6	9.2	64.4			<0.1	0.071	7.88	0.052	5	620	530	963		7.72	0.78		6.86
							5/8/2013	90.6				>2419.6	9.16	980.4			<0.1	<0.05	7.87	0.079	7	510	470	805		14.7	0.83		10.9
							6/12/2013	24.8				>2419.6	2.4	1553.1			0.22	0.056	7.26	0.13	11	470	390	861		18.35	0.95		13.4
							7/10/2013	83.1	160	30	34	>2419.6	7.14	2419.6		200	<0.1	0.75	7.9	0.13	14	320	260	483	21	22.85	0.86	7.9	32.6
							7/23/2013	17.2					1.46						7.51					702		23.55			23.1
							8/7/2013	21.7	190	54	24	>2419.6	1.97	866.4		290	<0.1	0.013	7.56	0.071	3	430	360	967	36	20.74	0.79	6.9	7.1
							9/10/2013	24.8				>2419.6	2.14	103.9					7.5					1241		22.52			34.5
							9/11/2013	26.5	390	73	36		2.26			430	<0.1	<0.05	7.47	0.14	44	630	540	1356	33	22.32	1.3	7.6	16.1
							9/17/2013	49.7				>2419.6	5.2	920.8					7.75					877		13.28			19.5
							9/24/2013	86.4				>2419.6	9.13	344.8					7.87					620		12.77			7.4
							10/1/2013	67				>2419.6	6.62	547.5					7.68					793		15.91			10.4
							10/7/2013	96.9	180	41	22		9.63			200	< 0.1	0.13	8.04	0.057	4	290	300	558	34	15.56	0.47	7.1	6.8
							10/8/2013	84.9				>2419.6	9.14	307.6					7.88					586		11.97			9
40400010504 Deer Creek- Deep River	INC0154_01																												
	INC0154_T1001	LMG-05-0035	19	Deer Creek	5.883	97th Avenue	4/9/2013	79.4				>2419.6	8.73	151.5			<0.1	0.51	7.77	0.22	30	550	480	883		10.93	1.3		30.4
							5/7/2013	102.8				1413.6	10.45	129.1			0.1	0.4	7.87	0.14	16	470	400	735		14.54	1.3		13.8
							6/11/2013	58				>2419.6	5.34	313			0.36	0.35	7.57	0.23	34	510	430	799		19.29	1.3		33.8
							7/9/2013	39.2	120	57	64	>2419.6	3.39	>2419.6		210	<0.1	0.81	7.24	0.46	92	470	330	579	42	22.55	2.1	13	71.3
							7/23/2013	45.2					4.02						7.59					677		23.78			
							8/6/2013	60	180	79	26	>2419.6	5.46	228.2		270	0.38	0.22	7.58	0.18	7	460	390	717	62	20.01	<0.3	10	8.48
							9/9/2013	66.6				>2419.6	5.56	435.2					7.78					832		24.31			5.4
							9/10/2013	50.8	250	91	43		4.31			310	0.4	0.25	7.71	0.44	26	500	500	840	46	23.21	1.6	11	24.8
							9/16/2013	69.2				>2419.6	6.7	686.7					7.83					507		16.82			4.3
							9/23/2013	66.1				>2419.6	6.53	178.2					7.46					706		15.91			8.3
							10/7/2013	64.6				>2419.6	6.44	344.8					7.38					723		15.41			6.4
							10/9/2013	58.7	190	68	28		6.17			260	0.1	0.24	7.57	0.15	7	380	380	718	48	12.94	0.81	9.6	7.75
	INC0154_T1002																												
	INC0154_T1003	LMG-05-0014	17	Tributary of Deep River	3.505	93rd Avenue	4/9/2013	87.6				1203.3	10.02	185			<0.1	<0.05	7.99	<0.05	4	540	500	847		9.32	<0.3		6.45
							5/7/2013	94.1				2419.6	10.29	186			<0.1	0.1	8.02	<0.05	3	540	470	782		11.3	0.47		5.79
							6/11/2013	77.2				>2419.6	7.48	290.9			<0.1	0.088	7.89	<0.05	3	450	370	730		16.86	0.47		5.34
							7/9/2013	81.9	140	47	24	>2419.6	6.99	1732.9		210	<0.1	0.31	7.86	0.094	25	360	280	542	37	23.16	0.66	6.3	25.2
							7/23/2013	72.3					6.36						7.78					596		20.93			10.8
							8/6/2013	82.6	170	41	5	>2419.6	7.8	613.1		320	<0.1	0.077	7.93	<0.05	4	410	400	676	69	18.02	<0.3	3.1	5.73
							9/9/2013	89.3				>2419.6	7.85	435.2					7.97					725		21.63			6.4
							9/10/2013	69.5	270	41	22		6.14			330	<0.1	0.08	7.83	0.052	7	410	410	702	59	21.21	0.39	3.2	8.38
							9/16/2013	92.4				>2419.6	8.98	579.4					8.05					725		16.64			7.6
							9/23/2013	91.2				>2419.6	9.38	307.6					7.95					689		13.97			7.9
							10/7/2013	93.9				>2419.6	9.51	275.5					7.91					642		14.73			5.1
							10/9/2013	81.2	240	40	9		8.62			310	< 0.1	0.082	7.95	< 0.05	5	340	380	696	60	12.5	0.33	4	8.79
	INC0154_T1004	LMG-05-0034	16	Tributary of Deep River	2.362	89th Avenue	4/9/2013	90.4				2419.6	10.34	151.5			<0.1	0.14	8.01	<0.05	12	440	400	700		9.29	0.45		8.22
							5/7/2013	96.5				>2419.6	10.34	209.8			<0.1	0.2	8.08	<0.05	8	430	410	604		12.26	0.55		8.78
							6/11/2013	89.9				>2419.6	8.94	488.4			<0.1	0.3	8.02	0.091	36	480	420	730		15.53	0.69		15.5
							7/9/2013	83.8	190	22	50	>2419.6	7.5	>2419.6		250	<0.1	0.32	7.8	0.28	110	410	270	507	12	20.7	1.9	12	89.2
							7/23/2013	91.8					8.71						7.98					617		17.47			52.2
							8/6/2013	89.6	240	36	11	>2419.6	8.74	686.7		360	<0.1	0.33	8.07	0.052	30	470	440	724	58	16.47	0.42	2.4	9.84
							9/9/2013	93.5				>2419.6	8.15	816.4					8.17					755		22.09			10.8
							9/10/2013	86.5	300	46	15		8.23			360	<0.1	0.32	7.96	0.073	19	470	440	763	51	17.68	0.46	2.3	16.7
							9/16/2013	92.5				>2419.6	8.89	980.4					8.2					753		17.17			12.5
							9/23/2013	91.5				>2419.6	9.07	410.6					8.04					756		15.71			20.6
							10/7/2013	91				>2419.6	9.27	387.3					7.97					751		14.46			25.6
							10/9/2013	89.3	320	47	18		9.77			370	< 0.1	0.26	8.09	0.074	24	500	440	812	56	11.29	0.43	3.9	18.7
	INC0154_T1005	LMG-05-0013	15	Tributary of Deep River	2.916	750 W	4/9/2013	90.7				>2419.6	10.36	235.9			<0.1	0.1	8.08	<0.05	7	420	430	657		9.4	0.31		7.79
							5/7/2013	96.4				>2419.6	10.7	166.4			<0.1	0.1	8.11	<0.05	4	510	460	662		11.04	0.44		6.61
							6/11/2013	85.8				2419.6	8.71	461.1			<0.1	0.2	7.96	0.057	9	490	450	733		14.66	0.54		12.4
							7/9/2013	83.7	230	12	33	>2419.6	7.95	>2419.6		340	<0.1	0.36	7.76	0.099	23	440	360	624	58	17.73	1.3	8.3	23.4
							7/23/2013	80.1					8.13						7.75					734		18.84			11.3
							8/6/2013	88.8	270	12	14	>2419.6	8.81	686.7		410	<0.1	0.19	8.07	<0.05	12	470	450	700	79	15.67	0.41	3	13.4
							9/9/2013	92.4				>2419.6	8.43	517.2					8.13					744		19.72			6.8
							9/10/2013	86.4	350	9.9	18		8.18			410	<0.1	0.24	7.92	<0.05	9	450	440	716	65	17.9	0.46	2.6	11.9
							9/16/2013	91.1				>2419.6	9.1	727					8.14					743		15.37			7.5
							9/23/2013	90.2				>2419.6	9.35	613.1					7.99					727		13.61			9.1
							10/7/2013	86.9				>2419.6	9.18	648.8					7.94					768		12.82			5.6
							10/9/2013	86.5	350	12	5		9.4			410	< 0.1	0.16	8.07	< 0.05	11	420	430	762	76	11.52	0.47	4.1	11.8

12 HUC	2012 AUID	L-Site #	Site ID	Stream Name	Drainage Area	Description	Date	% Sat	Alkalinity (CaCO3)	Chloride	COD	Coliforms (Total)	DO	E. Coli	Flow	Hardness (CaCO3)	Nitrogen, Ammonia	Nitrogen, Nitrate+Nitrite	pH (Field)	Phosphorus, Total	Solids, Suspended Total, (TSS)	Solids, Total (TS)	Solids, Total Dissolved (TDS)	Specific Conductance (Field)	Sulfate	Temperature	TKN	TOC	Turbidity
40400010505 City of Merrillville- Turkey Creek	INC0155_01	LMG-05-0031	36	Turkey Creek	37.922	Liverpool Road	4/10/2013	69.6				>2419.6	7.65	686.7	12.209		<0.1	0.046	7.78	0.075	10	820	750	1281		10.99	0.82		14.7
							5/8/2013	72.7				>2419.6	7.31	579.4	22.047		<0.1	<0.05	7.86	0.051	17	660	580	998		15.04	1.1		16.5
							6/12/2013	57.9				>2419.6	5.09	387.3	20.956		0.12	0.45	7.66	0.097	15	560	460	840		21.51	1		15.1
							7/10/2013	59.8	170	64	33	>2419.6	5.07	1046.2	51.662	230	0.11	0.58	7.57	0.1	14	380	370	643	46	23.58	0.5	8.1	18.6
							7/23/2013	56.6					4.63						7.76					722		24.27			17
							8/7/2013	62.2	190	74	23	>2419.6	5.52	>2419.6	12.67	340	<0.1	0.094	7.72	0.064	13	580	490	840	89	21.12	0.62	5.1	23.4
							9/10/2013	60.7				24196	5.23	686.7					7.82					926		22.64			8.2
							9/11/2013	87	320	64	16		4.9		14.519	390	<0.1	0.046	7.82	0.063	2	560	540	884	100	22.82	0.67	4.1	7.14
							9/17/2013	73.1				>2419.6	7.22	2419.6					7.95					868		15.88			18.4
							9/24/2013	63.7				>2419.6	6.42	1986.3					7.78					806		14.98			19.6
							10/1/2013	68.8				>2419.6	6.78	>2419.6					7.8					907		15.97			15.4
							10/8/2013	64.5				17329	6.61	387.3					7.78					734		14.15			10.6
							10/8/2013	65	190	69	18		6.73		9.2729	250	0.12	0.16	7.66	0.057	8	420	410	747	60	13.64	< 0.3	5.6	11.5
							11/4/2013	78.9	200	72	18		9.1		27.102	280	< 0.1	0.35	7.64	0.054	11	480	410	762	80	9	0.43	7.4	14.2
							12/9/2013	77.1	280	77	18		11.18			430	0.14	0.13	7.72	< 0.05	8	590	560	992	110	0.22	0.68	4.8	12.2
							3/19/2014	85	100	130	26		11.24			210	0.12	0.72	7.63	0.19	81	520	460	765	44	3.23	1.3	6.6	85.4
	INC0155_01A																												
	INC0155_P1001																												
	INC0155_P1002																												
	INC0155_T1001																												
	INC0155_T1002	LMG-05-0030	35	Tributary of Turkey Creek	3.974	73rd Avenue	4/10/2013	81.2				>2419.6	9.25	686.7			<0.1	0.12	8.03	0.058	14	1500	1300	2595		9.16	0.85		12.2
							5/8/2013	87.2				>2419.6	8.86	579.4			<0.1	<0.05	8.03	<0.05	3	1100	950	1817		14.45	0.81		5.34
							6/12/2013	64.5				>2419.6	5.67	980.4			0.15	0.25	7.71	0.065	6	830	750	1440		21.63	0.98		14.5
							7/10/2013	77.5	110	160	22	>2419.6	6.5	>2419.6		160	<0.1	0.36	7.78	0.07	16	450	410	814	37	24.08	0.55	5	24
							7/22/2013	71.2					5.78						7.9					881		25.12			8.05
							8/7/2013	75.4	100	200	18	>2419.6	6.61	1299.7		190	<0.1	0.24	7.81	0.052	6	560	480	911	65	21.81	0.67	6	12.4
							9/10/2013	71				24196	6.04	648.8					7.89					846		23.38			13.3
							9/11/2013	75.1	67	41	15		6.51			170	0.13	0.34	7.91	0.37	150	480	260	439	29	22.34	0.96	3.2	408
							9/17/2013	82.8				>2419.6	8.35	1119.9					8.12					886		14.88			11.9
							9/24/2013	84.7				>2419.6	8.35	1299.7					7.99					786		15.96			24.4
							10/1/2013	78.4				>2419.6	7.42	517.2					7.96					953		17.88			18.8
							10/7/2013	84.7	110	110	17		8.46			150	< 0.1	0.17	7.78	0.054	9	390	380	714	44	15.36	< 0.3	7.2	16
							10/8/2013	84.5				>2419.6	8.51	461.1					7.94					741		14.97			17.3
	INC0155_T1003	LMG-05-0029	34	Tributary of Turkey Creek	5.597	Arthur Street	4/10/2013	54.3				>2419.6	6.28	228.2			0.16	0.11	7.71	0.15	22	850	580	1400		9.23	1.5		26.6
							5/8/2013	66				>2419.6	6.51	49.6			0.11	<0.05	7.73	0.1	7	530	480	881		15.95	1.4		9.17
							6/12/2013	41.3				>2419.6	3.68	48.7			0.21	0.064	7.41	0.15	2	360	320	629		21.44	0.95		4.1
							7/10/2013	35.8	150	56	36	>2419.6	3.04	125.9		170	0.15	0.18	7.31	0.13	3	340	280	536	18	23.38	1	10	3.83
							7/23/2013	4.7					0.41						7.5					783		23.15			58.9
							8/7/2013	24.4	100	85	34	>2419.6	2.14	686.7		140	0.3	0.059	7.4	0.19	9	350	280	535	23	22.51	1.7	9.2	12.5
							9/10/2013	8.4				>2419.6	0.71	131.4					7.4					833		23.89			97.2
							9/11/2013	12.2	140	150	28		0.98			200	0.59	<0.05	7.3	0.39	100	560	470	812	25	23.71	1.1	9.1	141
							9/17/2013	21.8				>2419.6	2.26	118.7					7.62					752		13.75			69.2
							9/24/2013	44.7				>2419.6	4.46	461.1					7.53					560		15.38			18.7
							10/1/2013	26.8				>2419.6	2.61	1119.9					7.49					651		16.58			29.5
							10/7/2013	32.8	110	46	26		3.32			130	0.43	0.2	7.44	0.14	3	260	260	463	28	14.82	0.92	7.7	9.1
							10/8/2013	26				>2419.6	2.66	547.5					7.51					490		14.28			43.9
	INC0155_T1003A																												
40400010506 Duck Creek	INC0156_01	LMG-05-0032	11	Duck Creek	6.519	750 W	4/8/2013	130.2				547.5	13.55	143			<0.1	2.8	8.26	<0.05	5	430	400	700		13.5	0.74		6.42
							5/6/2013	145.7				1732.9	14.53	85.2			<0.1	2.1	8.4	0.094	5	350	330	578		15.6	1.2		4.88
							6/10/2013	80				>2419.6	7.57	2419.6			<0.1	4.5	7.79	0.13	23	480	370	667		17.92	0.89		24.7
							7/8/2013	74.1	190	38	40	>2419.6	6.66	>2419.6		320	<0.1	4.2	7.91	0.26	98	490	340	659	31	20.56	0.86	9	14.2
							7/22/2013	22.1					2.33						7.62					649		23.71			18.6
							8/5/2013	68.4	180	74	31	>2419.6	6.46	770.1		310	<0.1	0.3	7.93	0.17	22	530	460	747	72	18.18	<0.3	10	34
							9/9/2013	10.9	350	52	42		0.96			350	2.6	0.016	7.72	0.86	16	470	430	795	4.2	18.37	4.3	12	20.5
							9/9/2013	13.7				>2419.6	1.26	2419.6					7.83					824		19.61			14.2
							9/16/2013	18.8				>2419.6	1.9	435.2					7.83					843		15.04			18.5
							9/23/2013	82				>2419.6	8.44	1046.2					7.82					927		13.92			16.2
							10/7/2013	70.4				>2419.6	7.37	435.2					7.8					929		13.14			5.4
							10/8/2013	66.6	310	100	24		7.09			370	< 0.1	0.2	7.91	0.093	1	620	540	965	72	12.41	0.69	10	5.02
		LMG-05-0009	9	Duck Creek	15.828	Front Street	4/8/2013	146				387.3	14.83	95.9	5.2591		<0.1	0.84	8.28	0.056	6	510	450	850		14.57	0.57		7.6
							5/6/2013	144.8				1986.3	13.74	142.1	6.3007		<0.1	0.8	8.21	0.095	7	400	370	690		17.78	0.88		9.01
							6/10/2013	62.1				>2419.6	5.38	517.2	7.6466		0.21	0.52	7.56	0.14	3	440	390	708		22.34	0.96		5.92
							7/8/2013	62.9	180	58	31	>2419.6	5.36	>2419.6	7.832	250	0.11	0.81	7.66	0.13	15	360	300	564	31	23.19	1.5	8	11.3
							7/23/2013	47.5					3.8						7.74					707		23.36			5.52
							8/5/2013	75.6	140	92	23	>2419.6	6.75	517.2	1.4024	280	<0.1	0.19	7.74	0.1	1	470	420	761	44	20.79	0.67	6.4	2.58
							9/9/2013	86.9				>2419.6	7.37	59.4					7.86					965		23.48			1
							9/9/2013	94.3	240	120	18		7.9		0.5259	300	<0.1	0.24	7.8	0.15	<1	520	490	930	46	24.14	0.58	5.5	7.12
							9/16/2013	85.5				>2419.6	8.19	90.8					7.86					927		17.33			1.2
							9/23/2013	69.3				>2419.6	6.91	191.8					7.54					722		15.74			2.3
							10/7/2013	78.2				>2419.6	7.84	201.4					7.62					782		15.21			4
							10/8/2013	71.6	250	89	26		7.25		1.552	300	< 0.1	0.16	7.7	0.11	3	460	410	845	47	14.62	0.72	6.8	4.02
							11/5/2013	70.1	230	61	12		8.07		9.1976	310	< 0.1	3.2	7.62	0.072	6	440	410	708	57	9.07	0.97	7.4	7.46
							3/20/2014	78.5	69	31	30		10.96			160	< 0.1	2.3	7.61	0.23	13	290	270	386	22	1.57	1.4	8.8	81.6
	INC0156_01A																												
	INC0156_01B																												
	INC0156_01C																												
	INC0156_01D																												
	INC0156_01E																												
	INC0156_T1001																												
	INC0156_T1002																												
	INC0156_T1003	LMG-05-0010	10	Tributary of Duck Creek	3.0914	10th Street	4/8/2013	144.4				316.9	14.6	43.5			<0.1	1.1	8.23	<0.05	3	380	360	628		14.77	0.57		2.87
							5/6/2013	138				>2419.6	12.96	214.3			<0.1	0.4	8.29	<0.05	1	330	320	582		18.25	0.78		3.18
							6/10/2013	88.6				>2419.6	7.78	435.2			<0.1	0.39	7.76	0.099	3	380	320	562		21.67	0.75		5.28
							7/8/2013	60.4	130	24	28	>2419.6	5.28	>2419.6		170	<0.1	0.37	7.56	0.098	4	230	190	390	19	21.95	0.53	7.5	5.46
							7/22/2013	52.8					4.52						7.45					676		22.21			5.8
							8/5/2013	71	170	50	18	>2419.6	6.59	770.1		280	<0.1	0.42	7.73	0.072	2	510	330	633	43	18.73	<0.3	5.6	3.85
							9/9/2013	64.9				>2419.6	5.85	344.8					7.62					846		20.21			8.4
							9/9/2013	84.9	230	96	22		7.45			300	<0.1	0.41	7.75	0.074	2	470	470	828	47	21.73	<0.3	3.4	4.33
							9/16/2013	74.2				>2419.6	7.29	1732.9					7.68					578		16.12			4.3
							9/23/2013	78.9				>2419.6	8	218.7					7.62					571		14.66			3
							10/7/2013	75.2				>2419.6	7.85	272.3					7.59					636		13.41			2.1
							10/8/2013	77	230	53	20		8.09			270	< 0.1	0.38	7.73	0.073	2	370	360	664	56	12.97	0.51	6.4	5.58
	INC0156_T1004																												
40400010507 Lake George- Deep River	INC0157_01	LMG-05-0012	14	Deep River	66.711	Joliet Road	4/9/2013	81.3				980.4	8.86	172.3	13.1919		<0.1	2.5	8.13	0.082	5	540	510	897		11.4	0.66		5.99
							5/7/2013	96				>2419.6	10.05	78.9	15.6038		<0.1	2.7	8.15	0.082	4	460	450	797		13.18	1.1		7.2
							6/11/2013	80.8				>2419.6	7.63	435.2	10.6319		<0.1	2.7	7.99	0.18	7	480	420	780		18.05	0.92		7.17
							7/9/2013	77.2	94	45	31	>2419.6	6.76	>2419.6	96.1718	160	<0.1	1.7	7.69	0.35	7	340	210	424	29	21.8	1.5	7.8	92.2
							7/22/2013	109.7					8.99						8.99					628		25.83			3.35
							8/6/2013	85.8	190	62	23	>2419.6	7.98	325.5	17.1057	280	<0.1	1.4	8.01	0.17	10	430	390	678	64	18.76	0.38	6.5	7.58
							9/9/2013	114.7				>2419.6	9.75	148.3					8.26					766		23.35			2.1
							9/10/2013	73.1	200	55	18		6.37		8.7728	310	<0.1	6.9	7.88	0.27	3	430	410	740	49	22.06	0.66	4.5	3.43
							9/16/2013	106.7				>2419.6	10.23	152.9					8.24					756		17.26			1.5
							9/23/2013	98.4				>2419.6	9.79	190.4					8.05					710		15.51			3.9
							10/7/2013	92				>2419.6	9.08	344.8					7.91					620		15.91			7.5
							10/9/2013	85.3	220	56	17		8.89		21.1991	270	< 0.1	2	8	0.2	4	410	390	715	53	13.32	< 0.3	8.2	5.25
							11/4/2013	94.4	180	64	26		10.69		52.533	280	< 0.1	2.5	7.86	0.12	7	450	420	728	81	9.73	1.1	10	10.4
							12/9/2013	100.2	220	69	13		14.66		20.06	370	< 0.1	5	7.95	0.22	< 1	510	490	883	89	-0.13	0.93	6.8	6.44
							3/19/2014	84.4	87	64	43		11.23			190	0.21	1.4	7.53	0.34	180	500	300	520	37	3.36	2.3	8.9	140
		LMG-05-0011	12	Deep River	78.789	Arizona Street	4/8/2013	156.7				128.1	15.87	70.3	41.577		<0.1	3.1	8.41	0.094	14	550	490	875		14.74	1		10.6
							5/6/2013	140.5				1732.9	13.34	55.6	46.377		<0.1	2.3	8.34	0.1	11	470	440	772		18.37	0.99		9.55
							6/10/2013	87.7				>2419.6	7.96	193.5	25.711		<0.1	3.1	7.96	0.28	18	500	420	508		20.18	1.5		5.73
							7/8/2013	74.8	200	58	30	>2419.6	6.37	>2419.6	52.267	300	0.12	2.5	7.8	0.24	20	450	360	744	40	23.28	1.4	8.2	29.7
							7/22/2013	76.3					6.02						7.96					654		26.34			12.5
							8/5/2013	85.1	170	73	33	>2419.6	7.72	727	32.132	240	<0.1	1.5	7.89	0.15	14	430	380	674	55	19.97	<0.3	6.9	11.7
							9/9/2013	97.5				>2419.6	8.44	387.3					8.12					787		22.41			17
							9/9/2013	101	260	67	20		8.67		17.226	320	<0.1	3.6	7.91	0.18	4	450	430	755	58	22.93	0.33	4.8	8.04
							9/16/2013	94.1				>2419.6	9.03	727					8.16					761		17.24			21
							9/23/2013	85.6				>2419.6	8.45	816.4					7.87					711		15.9			9.8
							10/7/2013	78.1				>2419.6	7.57	613.1					7.81					574		16.8			18
							10/8/2013	80.4	170	58	20		8.21		48.018	220	< 0.1	1	7.87	0.17	6	350	330	644	45	14.37	0.47	8	7.13
							11/4/2013	81	180	61	20		9.31		69.246	260	< 0.1	2.3	7.68	0.12	5	430	360	709	72	9.19	0.91	10	10.5
							3/19/2014	83.3	110	80	27		10.92		295.68	200	0.13	1.4	7.58	0.15	31	360	350	605	40	3.91	0.56	7.7	41.4
	INC0157_01A																												
	INC0157_01B																												

12 HUC	2012 AUID	L-Site #	Site ID	Stream Name	Drainage Area	Description	Date	% Sat	Alkalinity (CaCO3)	Chloride	COD	Coliforms (Total)	DO	E. Coli	Flow	Hardness (CaCO3)	Nitrogen, Ammonia	Nitrogen, Nitrate+Nitrite	pH (Field)	Phosphorus, Total	Solids, Suspended Total (TSS)	Solids, Total (TS)	Solids, Total Dissolved (TDS)	Specific Conductance (Field)	Sulfate	Temperature	TKN	TOC	Turbidity
40400010507 Lake George- Deep River	INC0157_P1001	LMG-030-0008	8	Deep River	124.048	Ridge Rd, D/S of Lake George Dam, Hobart	4/8/2013	98.5				435.2	10.62	285.1			<0.1	0.63	7.85	0.06	3	590	550	1033		11.98	0.51		4.39
							5/6/2013	98.3				>2419.6	9.86	172.5			<0.1	0.5	7.89	0.07	2	530	520	931		15.1	0.45		3.64
							6/10/2013	80.5				>2419.6	7.27	1732.9			0.14	0.43	7.64	0.15	15	500	440	781		20.18	1		13
							7/8/2013	71	210	80	26	>2419.6	6.39	1553.1		360	<0.1	0.76	7.71	0.15	2	520	450	866	53	20.95	0.8	6.1	9.08
							7/22/2013	25.1					2.03						7.46					808		22.8			7.34
							8/5/2013	80	190	90	22	>2419.6	7.49	547.5		320	<0.1	0.59	7.68	0.1	9	540	460	794	61	18.49	<0.3	5.1	7.42
							9/9/2013	47.4	310	100	20		4.06			420	0.19	0.52	7.66	0.12	9	580	530	957	68	20.11	0.63	4	11.3
							9/9/2013	35.4				>2419.6	3.17	325.5					7.63					989		20.68			23.6
							9/16/2013	69.7				>2419.6	6.99	686.7					7.74					1000		15.19			4.9
							9/23/2013	73				>2419.6	7.4	387.3					7.66					788		14.66			5.9
							10/7/2013	67				>2419.6	6.83	435.2					7.55					759		14.36			4
							10/8/2013	80.9	230	71	20		8.19			320	< 0.1	0.73	7.75	0.1	4	440	370	778	53	14.74	0.32	5.2	5.31
	INC0157_T1001																												
	INC0157_T1002	LMG-05-0033	13	Sprout Ditch	3.628	70th Avenue	4/8/2013	141.5				613.1	14.18	178.9			<0.1	0.26	8.4	0.05	6	1200	1100	2127		15.04	0.66		6.93
							5/6/2013	146				>2419.6	14.58	579.4			<0.1	0.2	8.42	0.074	11	800	760	1470		15.6	0.78		6.85
							6/10/2013	58.5				>2419.6	5.44	>2419.6			<0.1	0.4	7.61	0.089	8	610	540	1026		18.75	0.82		15.1
							7/8/2013	79.3	38	73	39	>2419.6	6.85	>2419.6		140	0.14	1.4	7.56	0.69	270	570	340	513	17	22.56	1.4	9.6	456
							7/22/2013	47.1					4.2						7.9					970		22.39			62
							8/5/2013	87.1	110	73	22	>2419.6	7.8	866.4		180	<0.1	0.16	7.9	0.053	10	480	450	847	55	20.61	0.62	6.8	12.9
							9/9/2013	60.2				>2419.6	5.39	387.3					7.72					1156		20.62			2.9
							9/9/2013	63.3	210	210	21		5.61			260	<0.1	0.26	7.86	0.067	1	580	600	1121	41	21.08	0.58	5.8	3.47
							9/16/2013	58.6				>2419.6	5.85	160.7					7.8					1041		15.39			2.8
							9/23/2013	86.1				>2419.6	8.68	579.4					7.77					899		14.88			14.9
							10/7/2013	86.7				>2419.6	8.72	1119.9					7.76					703		15.03			11.2
							10/8/2013	84.5	120	150	20		8.65			160	< 0.1	0.2	7.87	0.054	6	480	420	817	42	14.17	0.49	11	10.7
	INC0157_T1003																												
	INC0157_T1004																												
	INC0157_T1005																												
40400010508 Little Calumet River- Deep River	INC0142_T1009																												
	INC0158_01	LMG-05-007	6	Deep River	150.176	Liverpool Road	4/8/2013	132				1553.1	13.57	260.3	76.738		<0.1	0.55	8.53	0.11	25	590	540	977		13.93	1.3		29
							5/6/2013	188.4				328.2	17.66	35	75.255		<0.1	<0.05	8.65	0.11	20	460	420	835		18.7	1.4		16.1
							6/10/2013	96.3				>2419.6	8.22	93.2	71.361		<0.1	0.4	8.12	0.071	6	500	440	775		23.16	0.75		7.03
							7/8/2013	72.2	180	68	32	>2419.6	6.03	195.6	49.002	250	<0.1	0.42	7.82	0.12	11	380	380	663	40	24.36	1.2	8.6	12.5
							7/22/2013	87.4					6.43						7.92					545		30.08			9.46
							8/5/2013	92.6	200	68	30	>2419.6	7.95	146.7	68.499	300	<0.1	0.23	8.11	0.12	23	480	430	739	53	22.87	0.62	7.5	12.5
							9/9/2013	81.9				>2419.6	6.75	21.1					8.03					765		25.04			5.4
							9/9/2013	74.9	240	66	25		6.25		21.916	280	<0.1	0.055	7.98	0.11	7	430	410	739	51	24.4	0.8	6.4	7.01
							9/16/2013	63.7				>2419.6	5.83	35.9					7.95					753		19.55			7.5
							9/23/2013	65				>2419.6	6.03	104.6					7.68					507		18.89			9.3
							10/7/2013	59.5				>2419.6	5.65	151.5					7.74					648		17.77			7.4
							10/8/2013	97.6	190	58	24		8.98		104.6	250	< 0.1	0.71	8.11	0.066	4	400	370	616	52	19.07	1	6.4	7.34
							11/5/2013	57.8	150	50	24		6.54		109.25	210	0.1	1.6	7.58	0.12	6	350	290	570	55	9.78	1.3	10	13.8
							3/20/2014	79.9	110	88	27		11.04		699.44	180	0.12	1.2	7.65	0.14	15	380	340	622	42	1.95	1.6	7.6	36.1
		LMG-05-006	5	Deep River	150.342	29th Avenue	4/8/2013	107.5				1413.6	11.42	344.8			<0.1	0.51	8.47	0.11	25	590	530	972		12.52	0.8		23.2
							5/6/2013	116.2				1299.7	11.11	13.4			<0.1	0.1	8.47	0.11	21	460	420	758		17.37	0.53		22.6
							6/10/2013	86.2				>2419.6	7.61	214.3			0.11	0.43	7.94	0.11	12	490	460	779		21.21	0.54		12.1
							7/8/2013	84.9	180	65	34	>2419.6	7.15	275.5		250	<0.1	0.46	7.9	0.13	15	410	360	681	38	24.12	1.1	8.7	14.7
							7/22/2013	71.7					3.31						7.93					544		30.11			10.1
							8/5/2013	90.3	200	69	28	>2419.6	7.78	178.5		300	<0.1	0.22	8.05	0.13	18	470	390	739	53	22.72	0.7	7.4	15.4
							9/9/2013	84.7	240	64	21		7.08			300	<0.1	0.074	8.01	0.13	8	410	410	737	50	24.29	1.1	6.4	9.23
							9/9/2013	86.4				>2419.6	7.17	15.8					8.03					766		24.68			7.5
							9/16/2013	89.1				>2419.6	8.16	27.2					8.04					754		19.57			9.4
							9/23/2013	89.8				>2419.6	8.38	110.6					7.82					508		18.6			12.1
							10/7/2013	84.6				>2419.6	8	111.9					7.8					647		17.94			9.8
							10/8/2013	93.2	190	61	22		8.81			250	< 0.1	0.67	8.06	0.083	9	410	380	689	55	17.85	0.91	6.4	8.59
	INC0158_T1001																												
	INC0158_T1002	LMG-05-0008	7	Tributary of Deep River	3.864	Shelby Street	4/8/2013	115.4				980.4	12.12	1119.9			<0.1	0.64	8.55	0.13	33	620	550	996		13.03	1.1		22.9
							5/6/2013	134.2				1413.6	12.71	30.5			<0.1	0.2	8.53	0.078	19	470	440	772		17.96	1.2		11.4
							6/10/2013	138.4				>2419.6	11.82	272.3			<0.1	0.23	8.62	0.11	22	490	430	755		22.84	1.2		12.9
							7/8/2013	120.8	170	62	35	>2419.6	9.94	>2419.6		250	<0.1	0.17	8.43	0.11	25	400	330	654	40	25.09	1.8	8.8	16.5
							7/23/2013	51					3.89						7.74					571		27.97			12.3
							8/5/2013	122.1	190	70	30	>2419.6	10.27	461.1		290	<0.1	0.63	8.37	0.14	16	470	370	702	62	23.9	1.3	6.9	13.5
							9/9/2013	100.6				>2419.6	8.19	275.5					8.44					722		25.64			13
							9/9/2013	110.3	210	59	35		9			280	<0.1	0.32	8.46	0.15	14	410	670	693	48	25.8	1.3	6.5	10.6
							9/16/2013	100				>2419.6	8.8	866.4					8.34					688		21.57			16.9
							9/23/2013	85.3				>2419.6	7.72	285.1					7.77					469		20.12			15.4
							10/7/2013	83.9				>2419.6	7.74	150					7.9					699		19.19			13
							10/8/2013	81.7	150	60	17		7.63			260	0.13	1.8	7.98	0.1	13	370	330	690	55	18.59	0.81	5.8	13.6
	INC0158_T1003																												
	INC0158_T1004																												
	INC0158_T1005																												
40400010509 Willow Creek- Burns Ditch	INC0143_04																												
	INC0159_01	LMG-05-0002	1	Burns Ditch	164.935	US 20	4/8/2013	82.2				770.1	8.94	162.4	61.398		<0.1	0.83	7.99	0.13	31	670	620	1116		11.43	1.7		27.5
							5/6/2013	84.8				1986.3	8.28	26.9	133.06		<0.1	0.4	8.01	0.14	23	520	490	872		16.46	1.5		18
							6/10/2013	58.4				>2419.6	5.18	307.6	104.84		0.14	0.62	7.7	0.17	20	500	510	893		21.02	0.96		16.3
							7/8/2013	52	190	87	32	>2419.6	4.29	980.4	105.79	280	0.12	0.75	7.79	0.16	16	490	450	833	51	24.94	1.3	9.5	13.9
							7/22/2013	39.9					3.14						7.57					738		27.62			9.58
							8/5/2013	75.9	190	87	26	>2419.6	6.57	816.4	75.529	300	<0.1	0.67	7.95	0.14	19	500	450	808	63	22.42	0.44	7.7	13.8
							9/9/2013	64.1	230	93	16		5.42		-22.661	300	<0.1	0.28	7.87	0.13	12	490	450	831	71	23.56	1.3	7.1	12.6
							9/9/2013	65.8				>2419.6	5.52	108.1					7.92					862		23.99			9.7
							9/16/2013	57.6				>2419.6	5.41	1986.3					7.86					875		18.25			11.1
							9/23/2013	65.4				>2419.6	6.28	727					7.62					580		17.26			13.2
							10/7/2013	67.3				>2419.6	6.42	272.3					7.72					737		17.57			10.2
							10/8/2013	83.8	190	83	18		8.03		66.245	260	0.14	0.22	7.96	0.1	16	420	420	782	71	17.31	0.72	7.7	9.11
							11/5/2013	79.9	150	63	28		9.03		129.84	220	< 0.1	1.5	7.66	0.14	11	420	330	635	64	9.87	0.95	9.7	13.5
							12/10/2013	87.2	250	110	23		12.85			380	0.16	2.1	7.07	0.13	3	630	570	1030	97	-0.35	1.1	7.1	6.65
							3/20/2014	87.4	120	94	20		11.83			220	0.17	1.4	7.68	0.12	19	420	370	669	44	2.24	1.1	7.7	27.7
	INC0159_02																												
	INC0159_T1001	LMG-05-0004	3	Willow Creek	5.351	Stone Avenue	4/8/2013	94.8				1553.1	10.37	1413.6			0.1	2.5	7.88	0.06	10	1100	1000	1906		11.07	0.55		14.7
							5/6/2013	107.3				>2419.6	11	167			<0.1	3.4	8	<0.05	2	590	570	1088		13.61	<0.3		3.63
							6/10/2013	71.6				>2419.6	6.67	>2419.6			0.16	2.3	7.53	0.084	29	440	400	716		18.57	0.66		24.3
							7/8/2013	82.9	160	99	37	>2419.6	7.47	>2419.6		270	0.14	3.5	7.85	0.2	78	550	400	896	45	20.36	0.77	6.3	63.9
							7/22/2013	98					8.15						8.06					800		24.05			8.87
							8/5/2013	87.2	140	140	12	>2419.6	8.14	866.4		230	0.12	0.44	7.84	0.053	3	510	440	822	82	18.48	<0.3	4.4	4
							9/9/2013	90	150	61	14		8			210	<0.1	0.33	7.91	0.084	4	320	300	575	44	21.18	0.54	3.3	8.17
							9/9/2013	92.9				>2419.6	8.14	980.4					7.97					594		21.74			7.9
							9/16/2013	76.5				>2419.6	7.47	1299.7					7.78					800		16.38			8
							9/23/2013	86.6				>2419.6	8.8	178.2					7.87					882		14.51			4.9
							10/7/2013	77				>2419.6	7.91	2419.6					7.68					588		14.07			6
							10/8/2013	86	150	75	17		8.53			210	< 0.1	0.35	7.94	< 0.05	2	350	380	688	51	15.58	0.55	4.8	4.44
		LMG-05-0003	2	Willow Creek	8.556	Clem Road	4/8/2013	109.8				648.8	11.98	461.1			<0.1	1.1	7.97	<0.05	2	780	720	1363		11.24	0.53		5.06
							5/6/2013	121.7				>2419.6	12.78	167			<0.1	1.2	8.01	<0.05	1	700	680	1024		13.01	0.65		4.75
							6/10/2013	73.9				>2419.6	6.92	>2419.6			0.2	1.2	7.5	0.1	19	440	370	677		18.47	0.75		18.8
							7/8/2013	81.8	200	170	19	>2419.6	7.65	>2419.6		340	<0.1	1.5	7.84	0.076	9	670	580	1111	64	18.47	0.8	3.7	10.6
							7/22/2013	91.2					7.98						7.95					1013		20.7			5.78
							8/5/2013	91.1	150	190	13	>2419.6	8.81	2419.6		320	<0.1	0.44	7.84	<0.05	2	620	580	1062	74	16.79	<0.3	3.7	5.78
							9/9/2013	73.2	260	180	12		6.87			350	<0.1	0.35	7.76	0.067	1	660	630	1124	57	18.23	0.61	3.3	4.19
							9/9/2013	75.6				24196	7.04	290.9					7.86					1171		18.68			2.3
							9/16/2013	74.8				>2419.6	7.58	>2419.6					7.83					1040		14.6			7
							9/23/2013	77.6				24196	8.12	387.3					7.78					1116		13.17			4.8
							10/7/2013	73.4				>2419.6	7.64	866.4					7.66					814		13.46			3.5
							10/8/2013	83.3	230	150	12		8.23			290	< 0.1	0.36	7.88	< 0.05	1	530	510	999	53	14.58	0.5	4.6	4.02

	DO	E. coli	Nitrogen, Ammonia	Nitrogen, Nitrate+Nitrite	Phosphorus, Total
LMG030-0008					
4/8/2013	12.12	1119.9			
5/6/2013	12.71				
6/10/2013		272.3			
7/23/2013	3.89				
8/5/2013		461.1			
9/9/2013		275.5			
9/16/2013		866.4			
9/23/2013		285.1			
9/30/2013		248.9			
LMG-05-0002					
6/10/2013		307.6			
7/8/2013		980.4			
7/22/2013	3.14				
8/5/2013		816.4			
9/16/2013		1986.3			
9/23/2013		727			
10/7/2013		272.3			
12/10/2013	12.85				
LMG-05-0003					
4/8/2013		461.1			
5/6/2013	12.78				
8/5/2013		2419.6			
9/9/2013		290.9			
9/23/2013		387.3			
9/30/2013		1553.1			
10/7/2013		866.4			
LMG-05-0004					
4/8/2013		1413.6			
8/5/2013		866.4			
9/9/2013		980.4			
9/16/2013		1299.7			
9/30/2013		238.2			
10/7/2013		2419.6			
LMG-05-0006					
4/8/2013		344.8			
7/8/2013		275.5			
7/22/2013	3.31				
LMG-05-0007					
4/8/2013	13.57	260.3			
5/6/2013	17.66				

	DO	E. coli	Nitrogen, Ammonia	Nitrogen, Nitrate+Nitrite	Phosphorus, Total
LMG-05-0008					
4/8/2013		285.1			
6/10/2013		1732.9			
7/8/2013		1553.1			
7/22/2013	2.03				
8/5/2013		547.5			
9/9/2013	3.17	325.5			
9/16/2013		686.7			
9/23/2013		387.3			
9/30/2013		435.2			
10/7/2013		435.2			
LMG-05-0009					
4/8/2013	14.83				
5/6/2013	13.74				
6/10/2013		517.2			
7/23/2013	3.8				
8/5/2013		517.2			
9/30/2013		1986.3			
LMG-05-0010					
4/8/2013	14.6				
5/6/2013	12.96				
6/10/2013		435.2			
8/5/2013		770.1			
9/9/2013		344.8			
9/16/2013		1732.9			
10/7/2013		272.3			
LMG-05-0011					
4/8/2013	15.87				
5/6/2013	13.34				
8/5/2013		727			
9/9/2013		387.3			
9/16/2013		727			
9/23/2013		816.4			
9/30/2013		686.7			
10/7/2013		613.1			
LMG-05-0012					
6/11/2013		435.2			
7/9/2013					0.35
8/6/2013		325.5			
10/7/2013		344.8			
12/9/2013	14.66				
3/19/2014					0.34

	DO	E. coli	Nitrogen, Ammonia	Nitrogen, Nitrate+Nitrite	Phosphorus, Total
LMG-05-0013					
4/9/2013		235.9			
6/11/2013		461.1			
8/6/2013		686.7			
9/9/2013		517.2			
9/16/2013		727			
9/23/2013		613.1			
9/30/2013		517.2			
10/7/2013		648.8			
LMG-05-0014					
6/11/2013		290.9			
7/9/2013		1732.9			
8/6/2013		613.1			
9/9/2013		435.2			
9/16/2013		579.4			
9/23/2013		307.6			
9/30/2013		410.6			
10/7/2013		275.5			
LMG-05-0015					
6/11/2013		547.5			
8/6/2013		866.4			0.33
9/9/2013		920.8			
9/10/2013				15	0.64
9/16/2013		1046.2			
9/23/2013		435.2			
9/30/2013		727			
10/7/2013		613.1			
10/9/2013					0.34
12/9/2013					0.57
3/19/2014	79.6				0.39
LMG-05-0016					
6/11/2013		344.1			
6/26/2013	1.27				
7/9/2013	1.93				0.57
7/23/2013	3.12				
8/6/2013	1.02				
9/9/2013	0.95	365.4			
9/10/2013	0.55				0.42
9/16/2013	1.31	920.8			
9/23/2013	1.97	307.6			
9/30/2013	2.46				
10/7/2013	2.43	1553.1			
10/9/2013	1.75				

	DO	E. coli	Nitrogen, Ammonia	Nitrogen, Nitrate+Nitrite	Phosphorus, Total
LMG-05-0017					
4/9/2013	12.26	307.6			
5/7/2013	14.95				
6/26/2013	3.29				
7/9/2013	1.21	410.6			
7/23/2013	2.15				
8/6/2013	3.15				0.42
9/10/2013	0.24				1.3
9/10/2013	1.55	387.3			
9/17/2013	3.25				
9/24/2013	3.5				
10/1/2013	2.7	613.1			
10/8/2013	1.72				
10/9/2013	1.96				
LMG-05-0018					
5/7/2013		461.1		12	0.54
6/11/2013				11	0.55
7/9/2013		1986.3			0.38
8/6/2013		461.1		16	0.57
9/10/2013				20	1.1
10/9/2013				18	0.67
11/4/2013					0.31
12/9/2013				16	1.7
LMG-05-0019					
4/9/2013		435.2			
5/7/2013	19.77	920.8			
6/11/2013	1.05				
6/24/2013	0.49				
7/9/2013	2.49				
7/22/2013	0.31				
8/6/2013	0.8				0.35
9/10/2013	0.81				
9/10/2013	0.65				
9/17/2013	2.36				
9/24/2013	1.78	275.5			
10/1/2013	1.42	2419.6			
10/7/2013	1.65				
10/8/2013	2.66	1413.6			
LMG-05-0020					
4/9/2013	12.86	436			
5/7/2013		613.1			
7/9/2013		2419.6			
7/23/2013	1.61				
8/6/2013		261.3			
9/10/2013	0.67				
9/10/2013	1.54				0.42
9/17/2013	1.81				
9/24/2013	2.01				
10/1/2013	2.07				
10/7/2013	3.28				0.32
10/8/2013	2.14				

	DO	E. coli	Nitrogen, Ammonia	Nitrogen, Nitrate+Nitrite	Phosphorus, Total
LMG-05-0021					
6/11/2013	2.62	648.8			0.5
6/24/2013	0.78				
7/9/2013	0.71				
7/23/2013	0.54				
8/6/2013	2.25				0.38
9/10/2013	1.41				
9/10/2013	0.74				0.36
9/17/2013	2.27				
9/24/2013	1.5				
10/1/2013	1.61				
10/7/2013	1.13				0.62
10/8/2013	1.95	325.5			
LMG-05-0022					
5/7/2013	14.52				
7/9/2013		816.4			
7/23/2013	1.19				
9/10/2013	1.11	275.5			
9/10/2013	1.79				0.74
9/17/2013	3.44				
9/24/2013		517.2			
10/1/2013	3.77	1413.6			
10/8/2013	3.73	307.6			
LMG-05-0023					
6/12/2013	3.7				
6/24/2013	1.16				
7/10/2013	1.82				
8/7/2013	2.04				
9/10/2013	1.51	344.8			
9/10/2013	2.61		2.6		2.8
10/8/2013		770.1			
LMG-05-0024					
4/10/2013		260.3			
5/8/2013		410.6			
6/12/2013		920.8			
7/10/2013		1986.3			
8/7/2013		517.2			
9/24/2013		1553.1			
10/1/2013		387.3			
10/8/2013		387.3			
LMG-05-0025					
5/8/2013	12.45				
6/12/2013	3.81	290.9			
6/26/2013	1.62				
9/10/2013	3.78				
9/24/2013		344.8			
LMG-05-0026					
5/8/2013	2.03	488.4			
6/12/2013		1203.3			
7/10/2013		1553.1			
8/7/2013		488.4			
9/24/2013		1046.2			
10/8/2013		547.5			

	DO	E. coli	Nitrogen, Ammonia	Nitrogen, Nitrate+Nitrite	Phosphorus, Total
LMG-05-0027					
7/10/2013		517.2			
8/7/2013		866.4			
12/9/2013	12.62				
LMG-05-0028					
5/8/2013		980.4			
6/12/2013	2.4	1553.1			
7/10/2013		2419.6			
7/23/2013	1.46				
8/7/2013	1.97	866.4			
9/10/2013	2.14				
9/11/2013	2.26				
9/17/2013		920.8			
9/24/2013		344.8			
10/1/2013		547.5			
10/8/2013		307.6			
LMG-05-0029					
6/12/2013	3.68				
7/10/2013	3.04				
7/23/2013	0.41				
8/7/2013	2.14	686.7			
9/10/2013	0.71				
9/11/2013	0.98				0.39
9/17/2013	2.26				
9/24/2013		461.1			
10/1/2013	2.61	1119.9			
10/7/2013	3.32				
10/8/2013	2.66	547.5			
LMG-05-0030					
4/10/2013		686.7			
5/8/2013		579.4			
6/12/2013		980.4			
8/7/2013		1299.7			
9/10/2013		648.8			
9/11/2013					0.37
9/17/2013		1119.9			
9/24/2013		1299.7			
10/1/2013		517.2			
10/8/2013		461.1			
LMG-05-0031					
4/10/2013		686.7			
5/8/2013		579.4			
6/12/2013		387.3			
7/10/2013		1046.2			
9/10/2013		686.7			
9/17/2013		2419.6			
9/24/2013		1986.3			
10/8/2013		387.3			

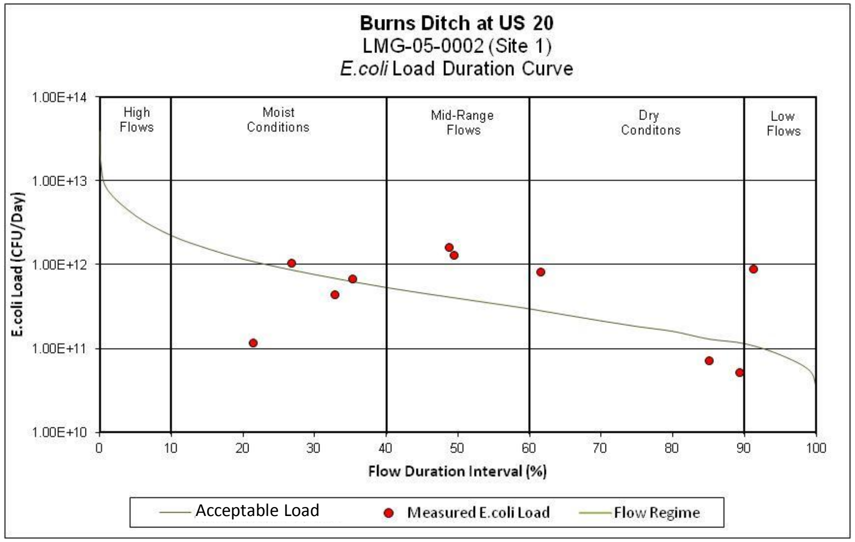
	DO	E. coli	Nitrogen, Ammonia	Nitrogen, Nitrate+Nitrite	Phosphorus, Total
LMG-05-0032					
4/8/2013	13.55				
5/6/2013	14.53				
6/10/2013		2419.6			
7/22/2013	2.33				
8/5/2013		770.1			
9/9/2013	0.96		2.6		0.86
9/9/2013	1.26	2419.6			
9/16/2013	1.9	435.2			
9/23/2013		1046.2			
9/30/2013		1986.3			
10/7/2013		435.2			
LMG-05-0033					
4/8/2013	14.18				
5/6/2013	14.58	579.4			
7/8/2013					0.69
8/5/2013		866.4			
9/9/2013		387.3			
9/23/2013		579.4			
9/30/2013		866.4			
10/7/2013		1119.9			
LMG-05-0034					
6/11/2013		488.4			
8/6/2013		686.7			
9/9/2013		816.4			
9/16/2013		980.4			
9/23/2013		410.6			
9/30/2013		648.8			
10/7/2013		387.3			
LMG-05-0035					
6/11/2013		313			
7/9/2013	3.39				0.46
9/9/2013		435.2			
9/10/2013					0.44
9/16/2013		686.7			
10/7/2013		344.8			
LMG-05-0036					
4/9/2013		290.9			
5/7/2013		365.4			
6/11/2013		307.6			
6/24/2013	3.38				
7/22/2013	3.13				
8/6/2013		770.1			
9/10/2013	7.36	1553.1			
9/17/2013		488.4			
10/8/2013		298.7			

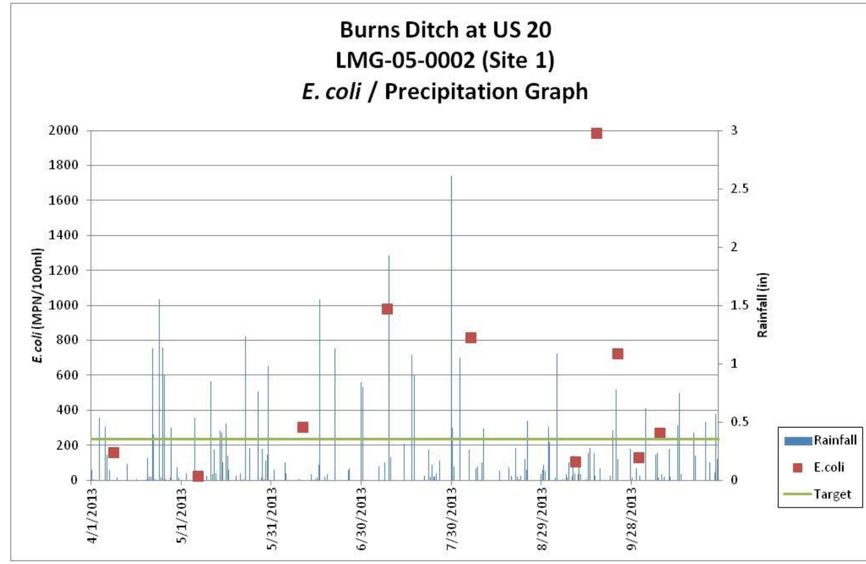
EPA Station Name	Station ID	AUID (2012)	IBI	QHEI (IBI)	mIBI	QHEI (mIBI)	Ammonia	DO	pH	Sulfate	Chloride	Nutrients	E.coli	
13T-001	LMG-05-0002	INC0159_01	16	48	36	45	Pass	Fail	Pass	Pass	Pass	Pass	Fail	
13T-002	LMG-05-0003	INC0159_T1001	12	58	22	48	Pass	Pass	Pass	Pass	Pass	Pass	Fail	
13T-003	LMG-05-0004	INC0159_T1001	30	37	26	40	Pass	Pass	Pass	Pass	Pass	Pass	Fail	
13T-005	LMG-05-0006	INC0158_01	34	48	38	55	Pass	Pass	Pass	Pass	Pass	Pass	Pass	
13T-006	LMG-05-0007	INC0158_01	36	52	30	44	Pass	Pass	Pass	Pass	Pass	Pass	Pass	
13T-007	LMG-05-0008	INC0158_T1002	18	46	30	34	Pass	Pass	Pass	Pass	Pass	Pass	Fail	
13T-008	LMG030-0008	INC0157_P1001	32	66	28	33	Pass	Fail	Pass	Pass	Pass	Pass	Fail	
13T-009	LMG-05-0009	INC0156_01	30	52	30	31	Pass	Pass	Pass	Pass	Pass	Pass	Fail	
13T-010	LMG-05-0010	INC0156_T1003	12	42	28	48	Pass	Pass	Pass	Pass	Pass	Pass	Fail	
13T-011	LMG-05-0032	INC0156_01	24	49	30	45	Pass	Fail	Pass	Pass	Pass	Fail	Fail	
13T-012	LMG-05-0011	INC0157_01	40	56	28	46	Pass	Pass	Pass	Pass	Pass	Pass	Fail	
13T-013	LMG-05-0033	INC0157_T1002	30	66	42	57	Pass	Pass	Pass	Pass	Pass	Pass	Fail	
13T-014	LMG-05-0012	INC0157_01	34	75	40	80	Pass	Pass	Pass	Pass	Pass	Pass	Fail	
13T-015	LMG-05-0013	INC0154_T1005	30	64	28	50	Pass	Pass	Pass	Pass	Pass	Pass	Fail	
13T-016	LMG-05-0034	INC0154_T1004	40	52	30	52	Pass	Pass	Pass	Pass	Pass	Pass	Fail	
13T-017	LMG-05-0014	INC0154_T1003	34	51	38	53	Pass	Pass	Pass	Pass	Pass	Pass	Fail	
13T-018	LMG-05-0015	INC0152_04	34	57	40	59	Pass	Pass	Pass	Pass	Pass	Fail	Fail	
13T-019	LMG-05-0035	INC0154_T1001	32	36	28	41	Pass	Fail	Pass	Pass	Pass	Fail	Fail	
13T-020	LMG-05-0016	INC0152_T1009	38	44	38	34	Pass	Fail	Pass	Pass	Pass	Fail	Fail	
13T-021	LMG-05-0017	INC0152_T1009	12	33	20	27	Pass	Fail	Pass	Pass	Pass	Fail	Fail	
13T-022	LMG-05-0036	INC0152_T1008	38	25	38	24	Pass	Fail	Pass	Pass	Pass	Pass	Fail	
13T-023	LMG-05-0018	INC0152_04	36	58	26	52	Pass	Pass	Pass	Pass	Pass	Fail	Pass	
13T-024	LMG-05-0019	INC0151_T1003	14	26	24	22	Pass	Fail	Pass	Pass	Pass	Fail	Fail	
13T-025	LMG-05-0020	INC0151_01	28	37	26	24	Pass	Fail	Pass	Pass	Pass	Fail	Pass	
13T-026	LMG-05-0021	INC0151_T1001	12	40	26	27	Pass	Fail	Pass	Pass	Pass	Fail	Pass	
13T-027	LMG-05-0022	INC0151_01	40	27	28	25	Pass	Fail	Pass	Pass	Pass	Fail	Fail	
13T-028	LMG-05-0023	INC0153_T1001	12	37			Pass	Fail	Pass	Pass	Pass	Fail	NA	
13T-029	LMG-05-0024	INC0153_01	36	49	26	42	Pass	Pass	Pass	Pass	Pass	Pass	Fail	
13T-030	LMG-05-0025	INC0153_T1003	28	36	34	35	Pass	Fail	Pass	Pass	Pass	Pass	Fail	
13T-031	LMG-05-0026	INC0153_T1004	12	41	28	42	Pass	Pass	Pass	Pass	Pass	Pass	Pass	
13T-032	LMG-05-0027	INC0153_01	42	51	30	41	Pass	Pass	Pass	Pass	Pass	Pass	Fail	
13T-033	LMG-05-0028	INC0153_T1005	30	41	28	30	Pass	Fail	Pass	Pass	Pass	Pass	Fail	
13T-034	LMG-05-0029	INC0155_T1003	12	31	30	27	Pass	Fail	Pass	Pass	Pass	Fail	Fail	
13T-035	LMG-05-0030	INC0155_T1002	20	43	30	52	Pass	Pass	Pass	Pass	Pass	Pass	Fail	
13T-036	LMG-05-0031	INC0155_01	16	40	30	43	Pass	Fail	Pass	Pass	Pass	Pass	Fail	
			26					16				12	28	82

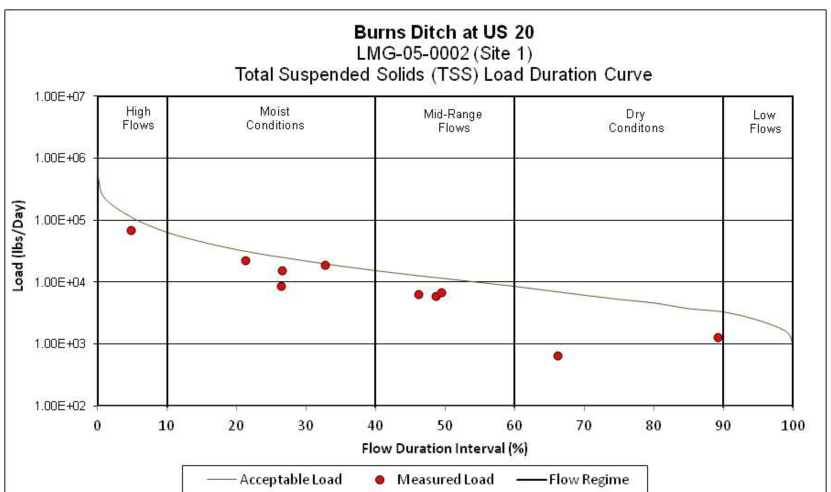
(Site 1)
LMG-05-0002
Burns Ditch at U.S. 20

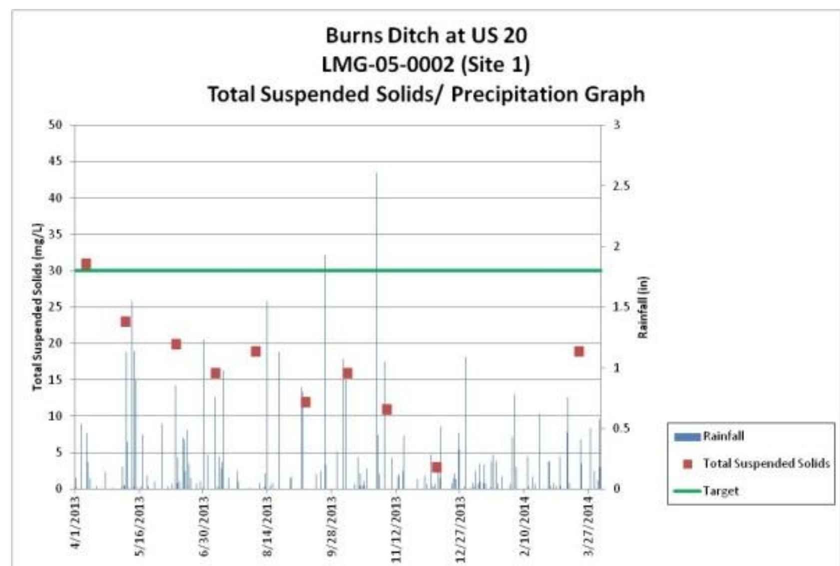
Upstream

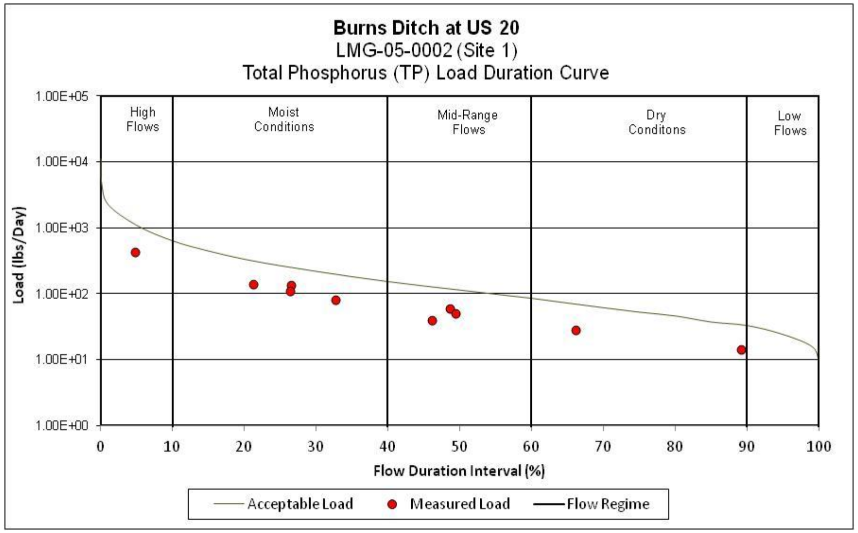
Downstream

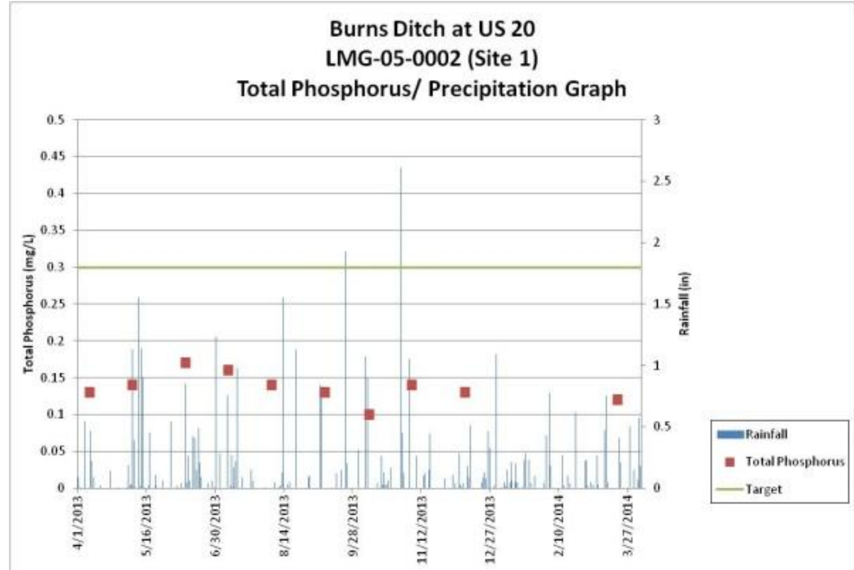

Burns Ditch at US 20
LMG-05-0002 (Site 1)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+14
1.00E+13
1.00E+12
1.00E+11
1.00E+10
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Measured E.coli Load
Flow Regime

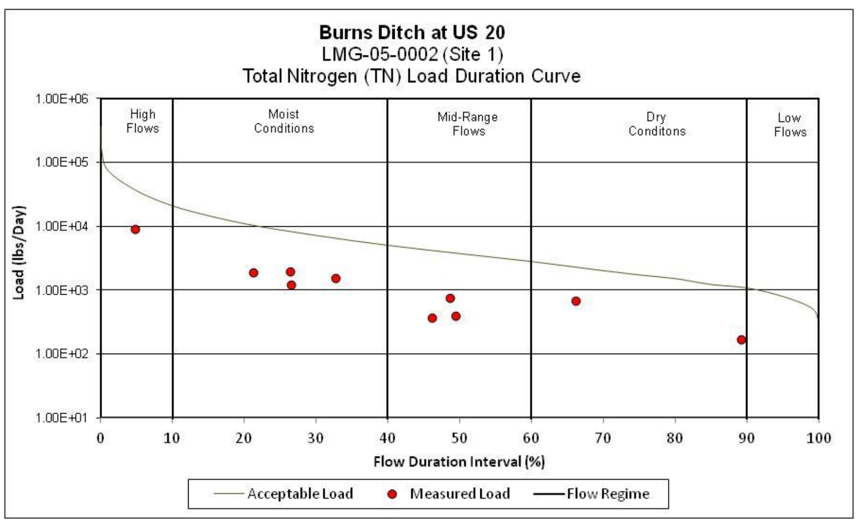

Burns Ditch at US 20
LMG-05-0002 (Site 1)
E. coli / Precipitation Graph
E.coli (MPN/100ml)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/1/2013
5/31/2013
6/30/2013
7/30/2013
8/29/2013
9/28/2013
Rainfall
E.coli
Target

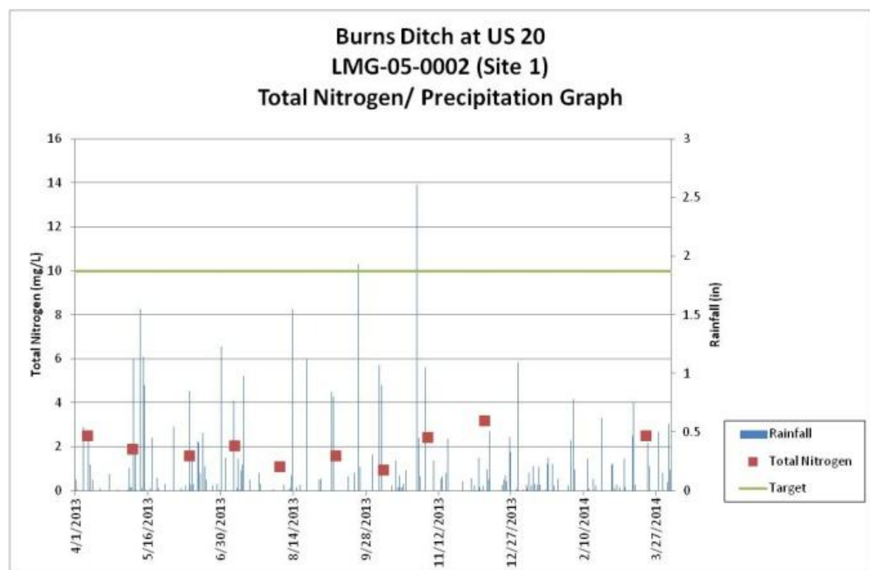

Burns Ditch at US 20
LMG-05-0002 (Site 1)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
1.00E+07
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Burns Ditch at US 20
LMG-05-0002 (Site 1)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
50
45
40
35
30
25
20
15
10
5
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
12/27/2013
2/10/2014
3/27/2014
Rainfall
Total Suspended Solids
Target


Burns Ditch at US 20
LMG-05-0002 (Site 1)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
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
Measured Load
Flow Regime


Burns Ditch at US 20
LMG-05-0002 (Site 1)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
0.5 0.45 0.4 0.35 0.3 0.25 0.2 0.15 0.1 0.05 0
3 2.5 2 1.5 1 0.5 0
4/1/2013 5/16/2013 6/30/2013 8/14/2013 9/28/2013 11/12/2013 12/27/2013 2/10/2014 3/27/2014
Rainfall
Total Phosphorus
Target

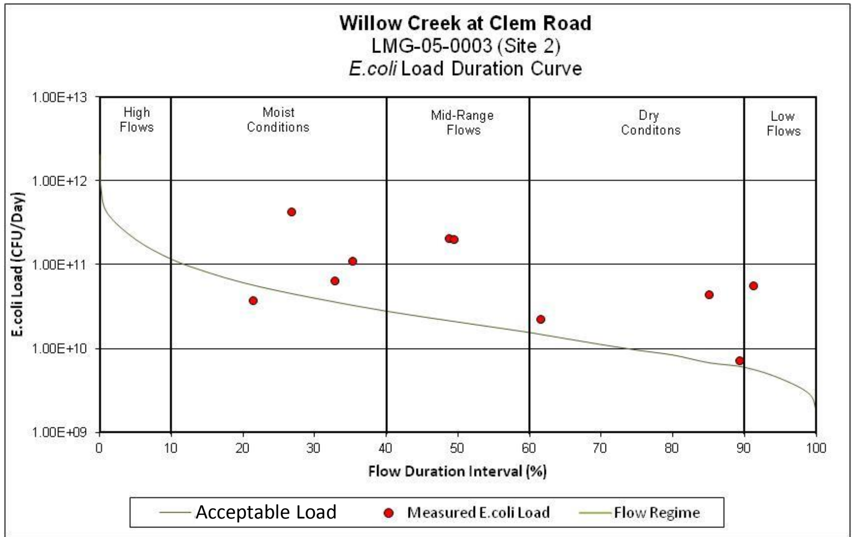

Burns Ditch at US 20
LMG-05-0002 (Site 1)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

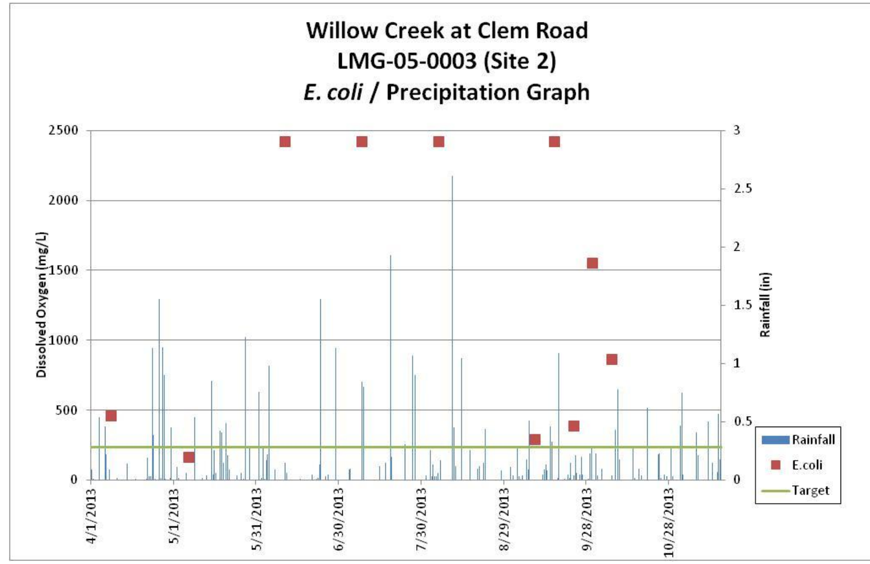

Burns Ditch at US 20
LMG-05-0002 (Site 1)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
16 14 12 10 8 6 4 2 0
3 2.5 2 1.5 1 0.5 0
4/1/2013 5/16/2013 6/30/2013 8/14/2013 9/28/2013 11/12/2013 12/27/2013 2/10/2014 3/27/2014
Rainfall
Total Nitrogen
Target

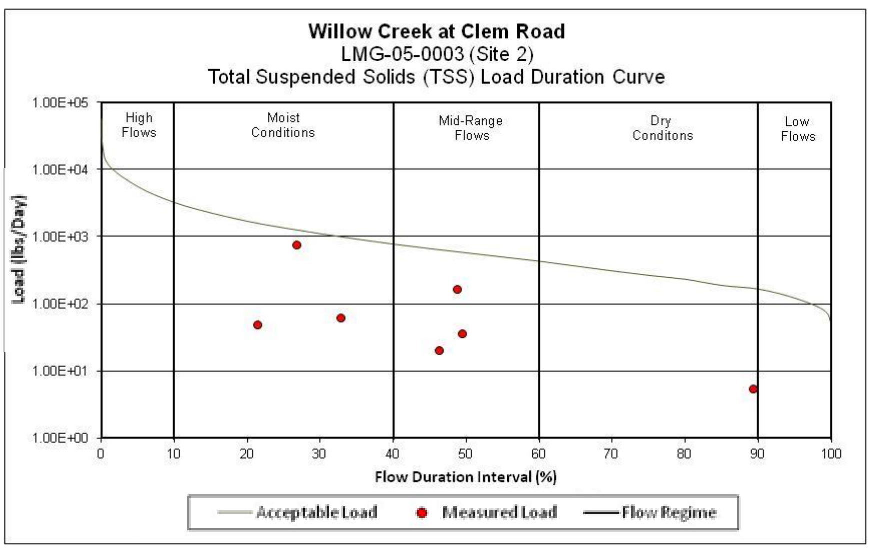
(Site 2)
LMG-05-0003
Willow Creek at Clem Road

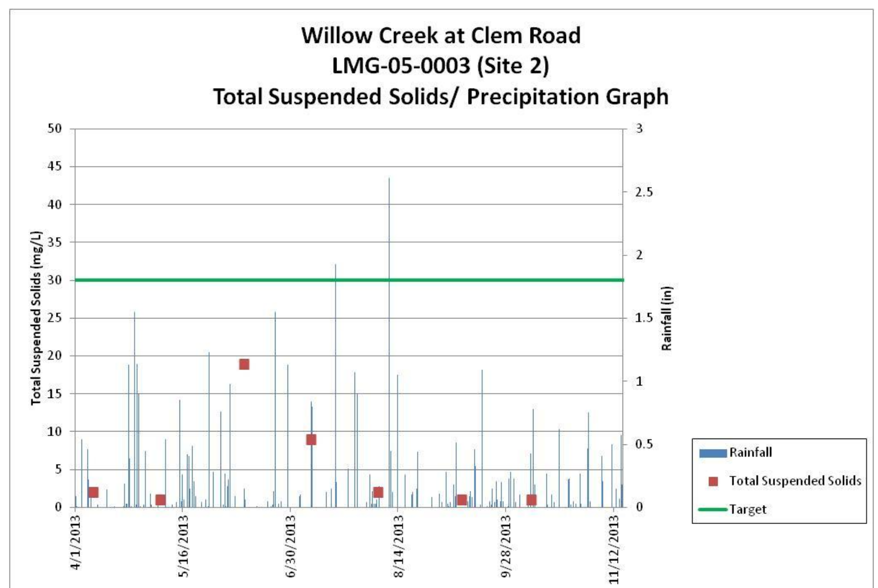
Upstream

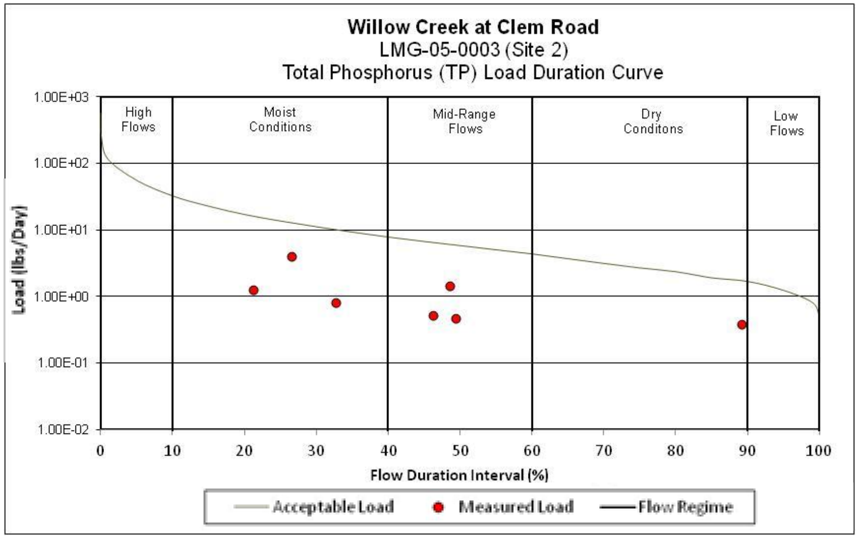
Downstream

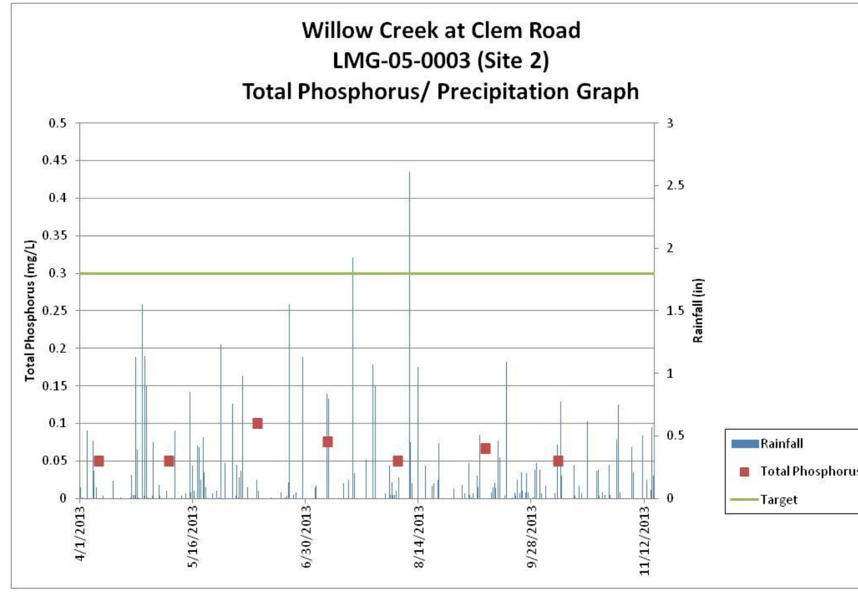

Willow Creek at Clem Road
LMG-05-0003 (Site 2)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Measured E.coli Load
Flow Regime

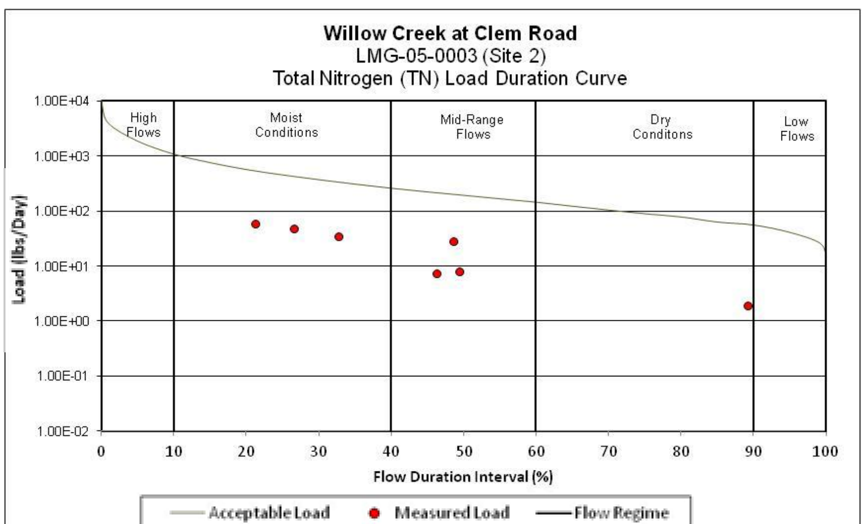

Willow Creek at Clem Road
LMG-05-0003 (Site 2)
E. coli / Precipitation Graph
Dissolved Oxygen (mg/L)
Rainfall (in)
2500
2000
1500
1000
500
0
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/1/2013
5/31/2013
6/30/2013
7/30/2013
8/29/2013
9/28/2013
10/28/2013
Rainfall
E.coli
Target

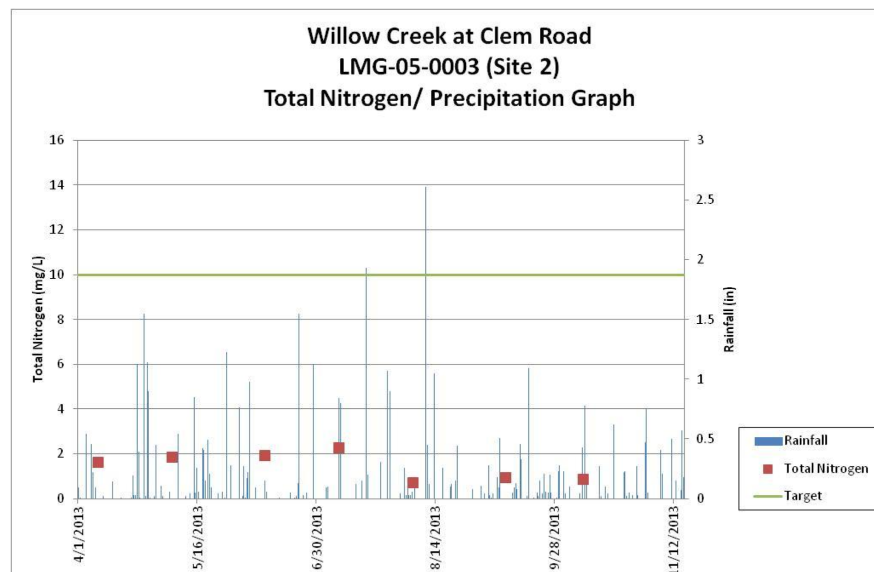

Willow Creek at Clem Road
LMG-05-0003 (Site 2)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Willow Creek at Clem Road
LMG-05-0003 (Site 2)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
50
45
40
35
30
25
20
15
10
5
0
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Suspended Solids
Target


Willow Creek at Clem Road
LMG-05-0003 (Site 2)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
Load (lbs/Day)
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Willow Creek at Clem Road
LMG-05-0003 (Site 2)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Phosphorus
Target

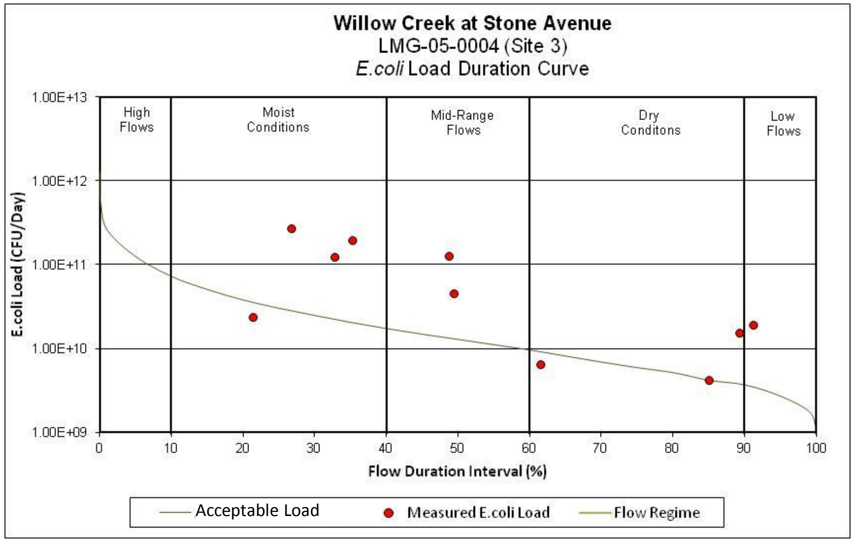

Willow Creek at Clem Road
LMG-05-0003 (Site 2)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
Load (lbs/Day)
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

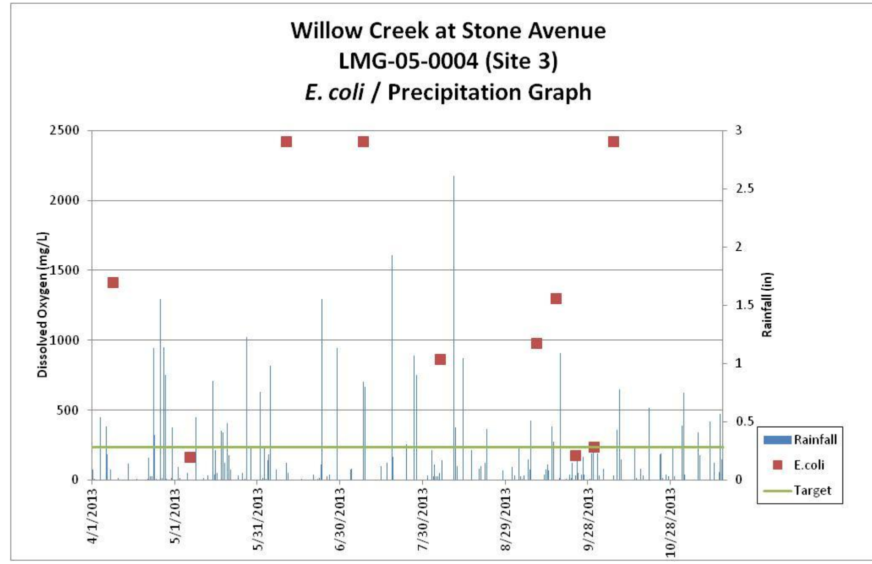

Willow Creek at Clem Road
LMG-05-0003 (Site 2)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Nitrogen
Target

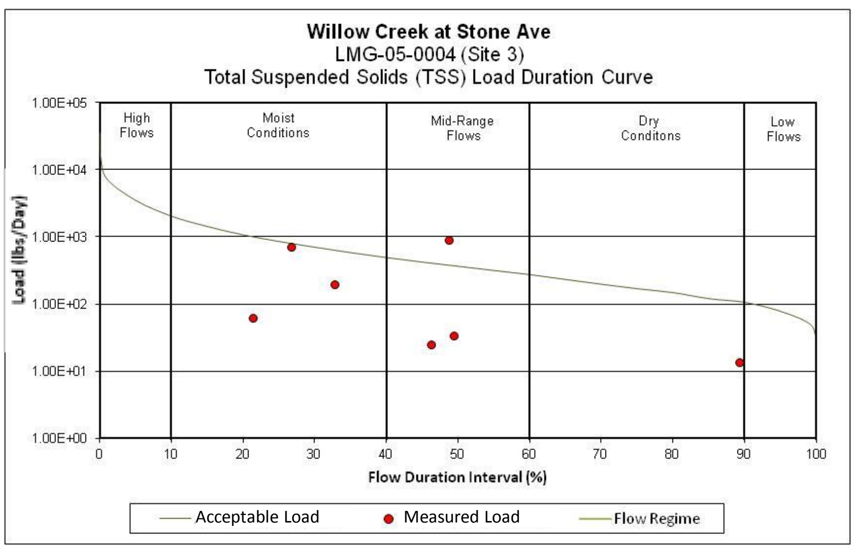
LMG-05-0004 (Site 3)
Willow Creek

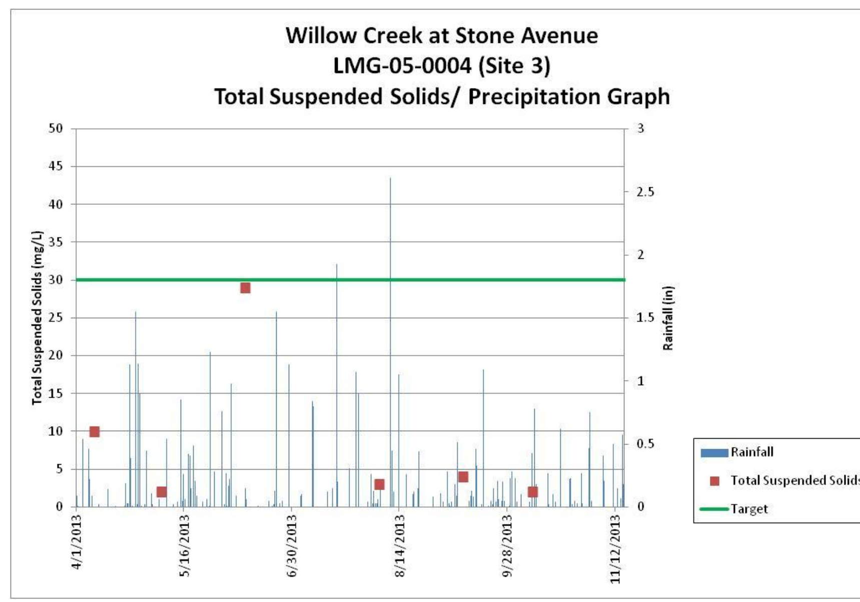
Upstream

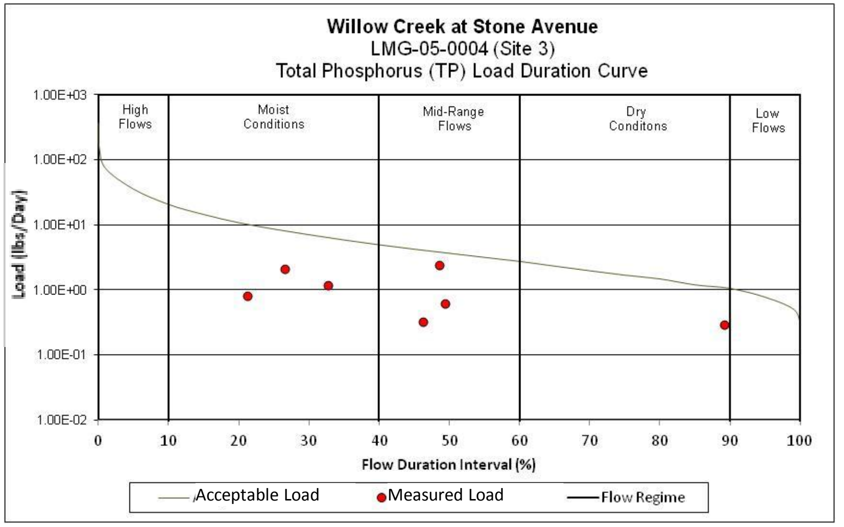
Downstream

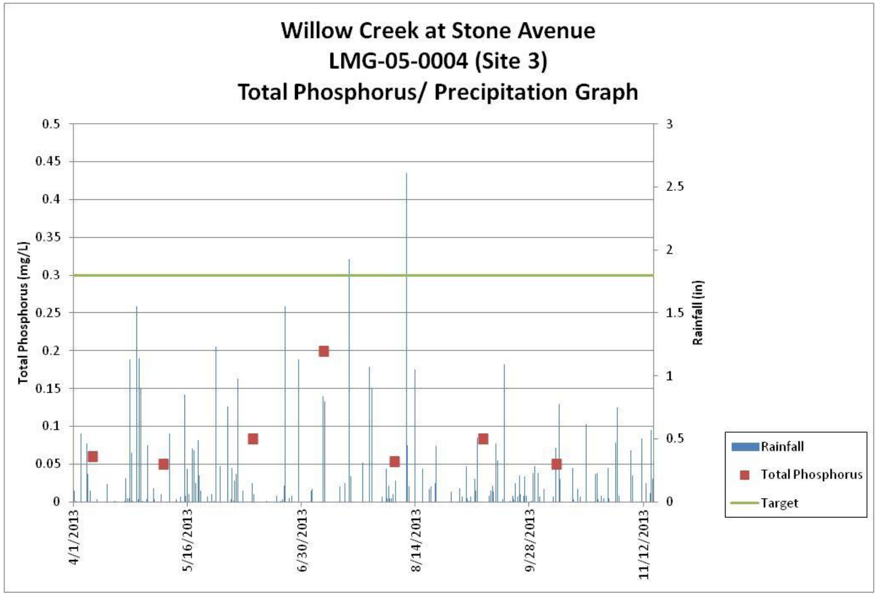

Willow Creek at Stone Avenue
LMG-05-0004 (Site 3)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
Measured E.coli Load
Flow Regime

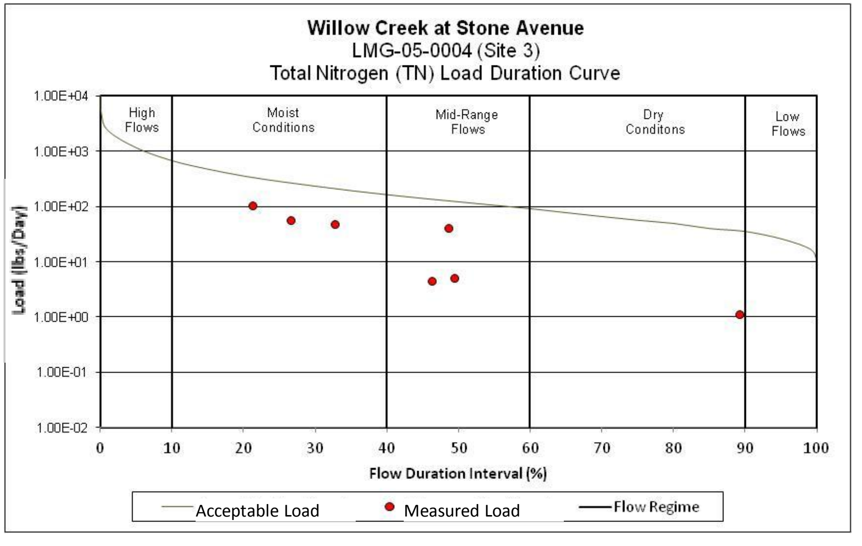

Willow Creek at Stone Avenue
LMG-05-0004 (Site 3)
E. coli / Precipitation Graph
Dissolved Oxygen (mg/L)
Rainfall (in)
Rainfall
E.coli
Target

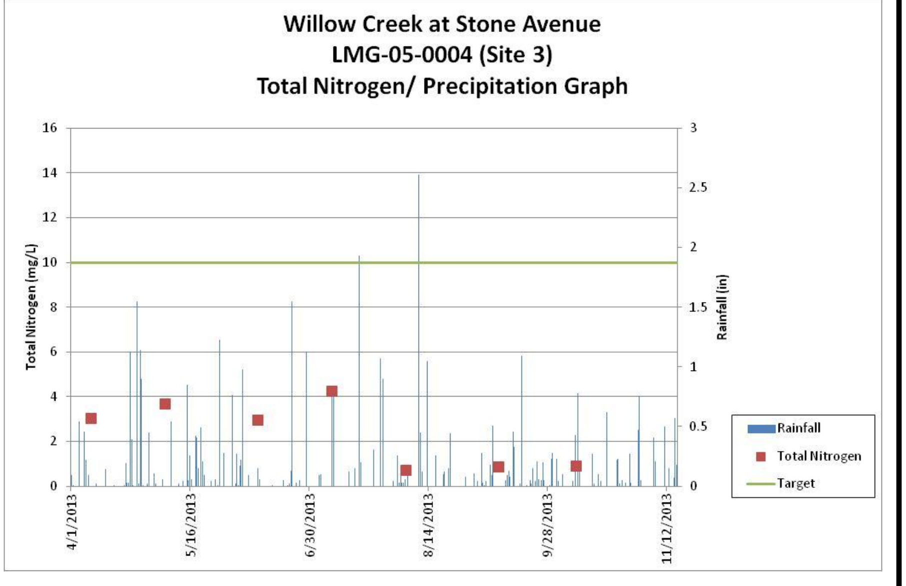

Willow Creek at Stone Ave
LMG-05-0004 (Site 3)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
Measured Load
Flow Regime


Willow Creek at Stone Avenue
LMG-05-0004 (Site 3)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target


Willow Creek at Stone Avenue
LMG-05-0004 (Site 3)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Willow Creek at Stone Avenue
LMG-05-0004 (Site 3)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target

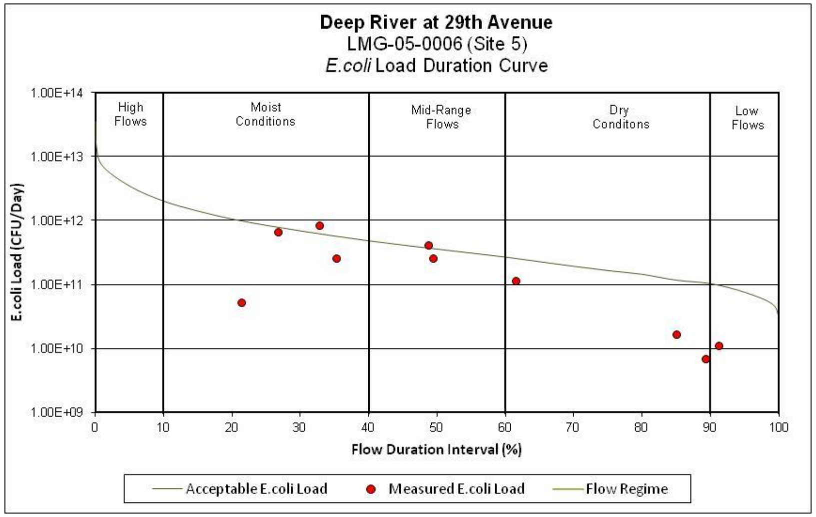

Willow Creek at Stone Avenue
LMG-05-0004 (Site 3)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

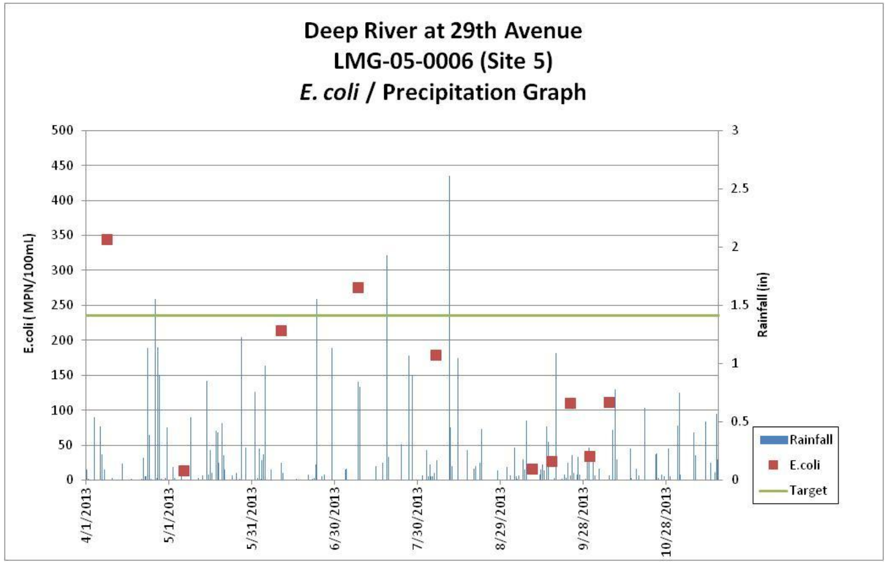

Willow Creek at Stone Avenue
LMG-05-0004 (Site 3)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

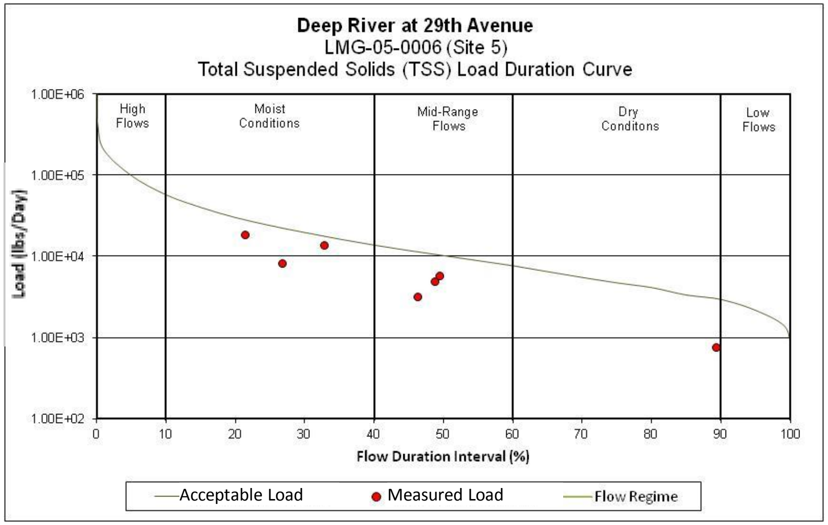
LMG-05-0006 (Site 5)
Deep River

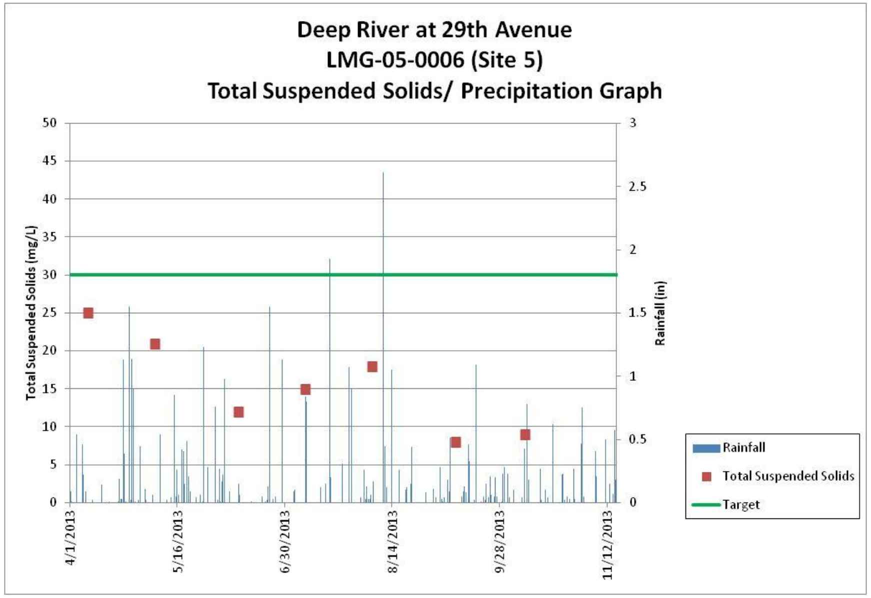
Upstream

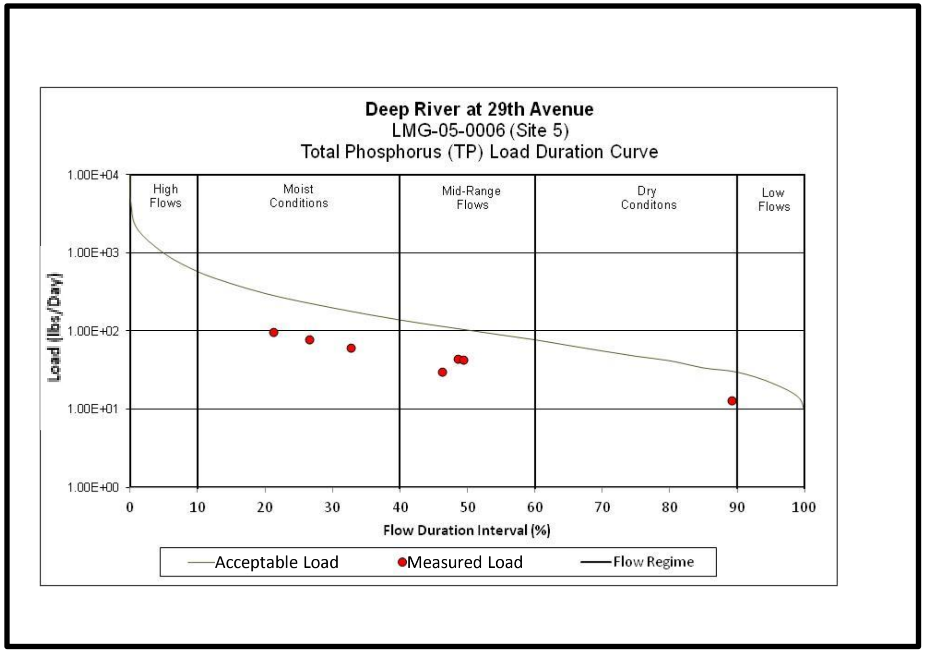
Downstream


Deep River at 29th Avenue
LMG-05-0006 (Site 5)
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 E.coli Load
Measured E.coli Load
Flow Regime

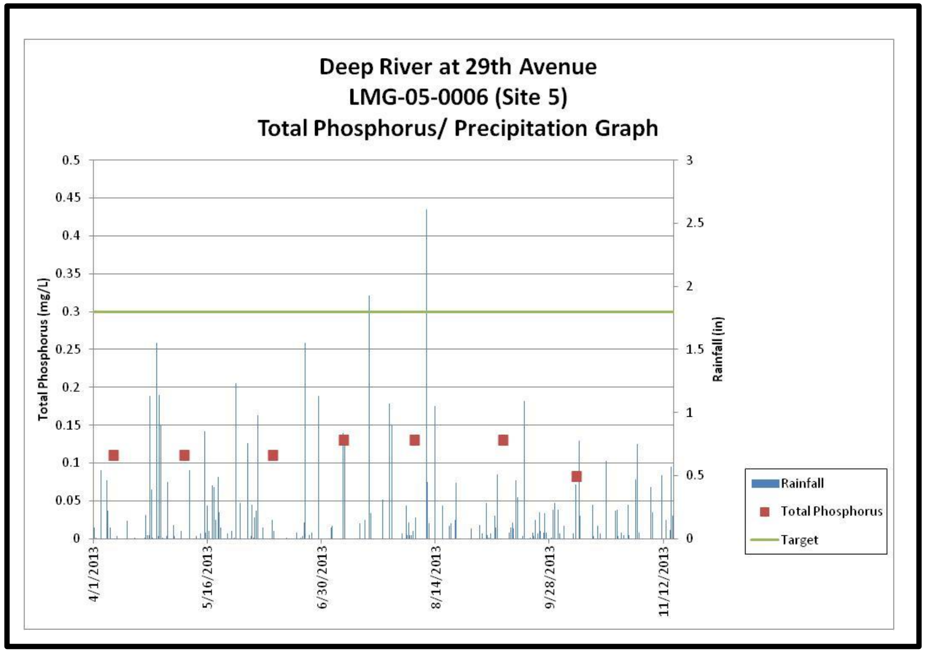

Deep River at 29th Avenue
LMG-05-0006 (Site 5)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target


Deep River at 29th Avenue
LMG-05-0006 (Site 5)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

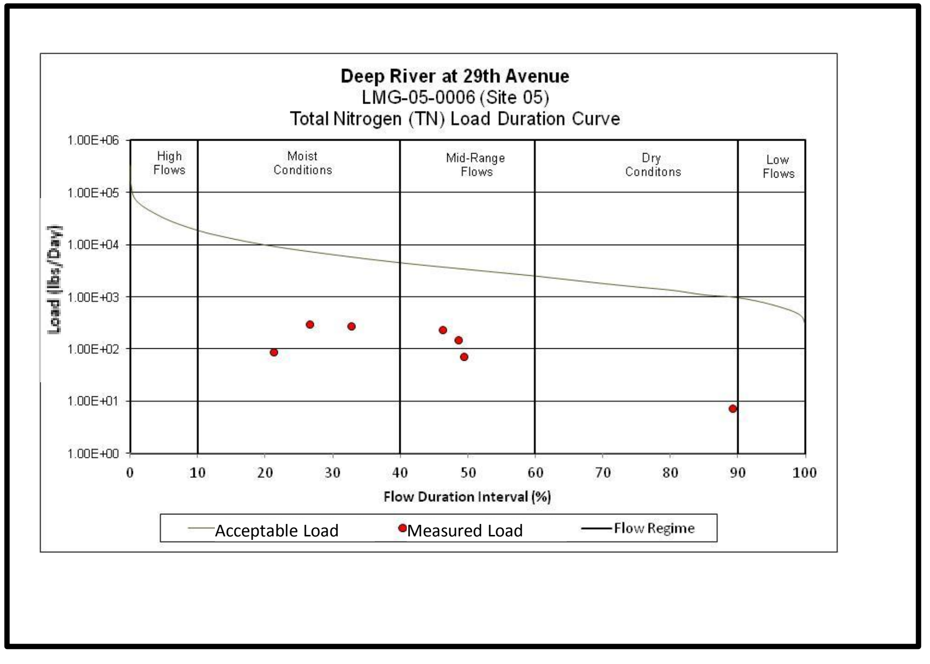

Deep River at 29th Avenue
LMG-05-0006 (Site 5)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target



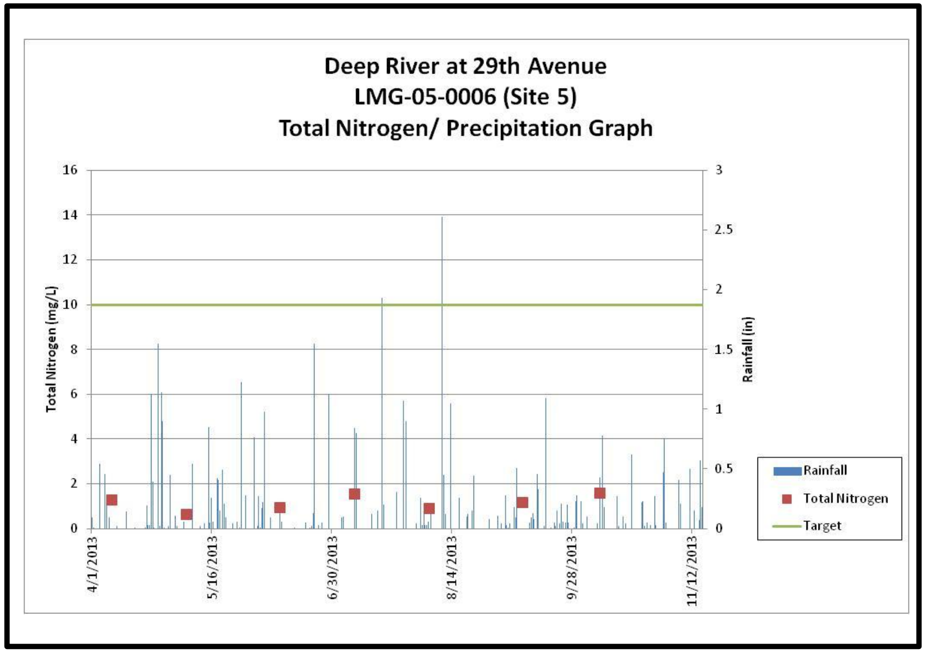
Deep River at 29th Avenue
LMG-05-0006 (Site 5)
Total Phosphorus (TP) Load Duration Curve
Load (lbs/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
Measured Load
Flow Regime



Deep River at 29th Avenue
LMG-05-0006 (Site 5)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target



Deep River at 29th Avenue
LMG-05-0006 (Site 05)
Total Nitrogen (TN) Load Duration Curve
Load (lbs/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
Measured Load
Flow Regime

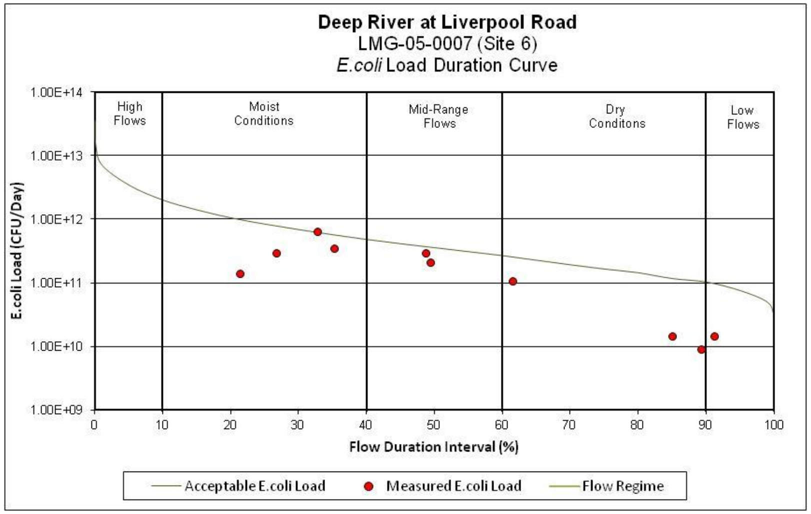


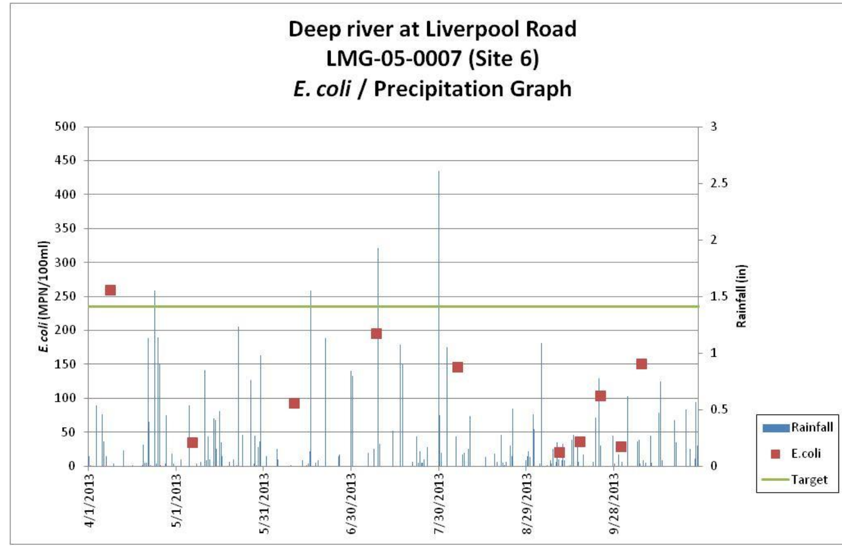
Deep River at 29th Avenue
LMG-05-0006 (Site 5)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

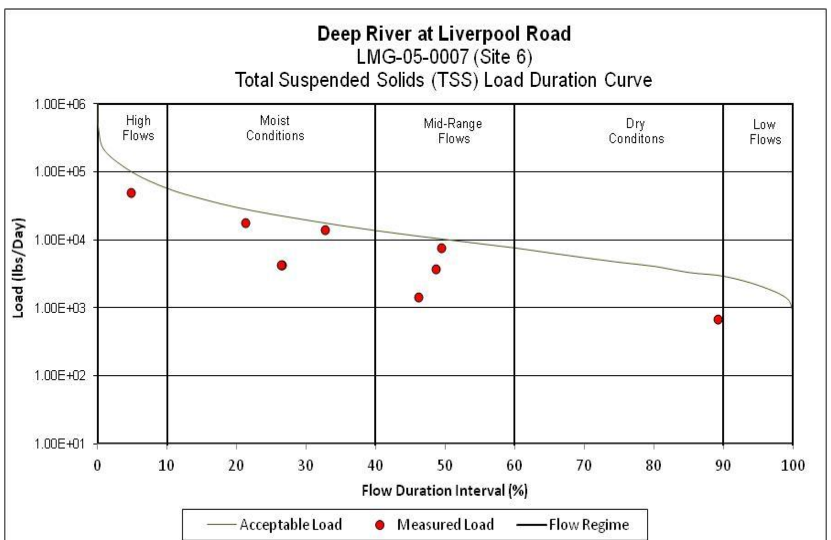
LMG-05-0007 (Site 6)
Deep River

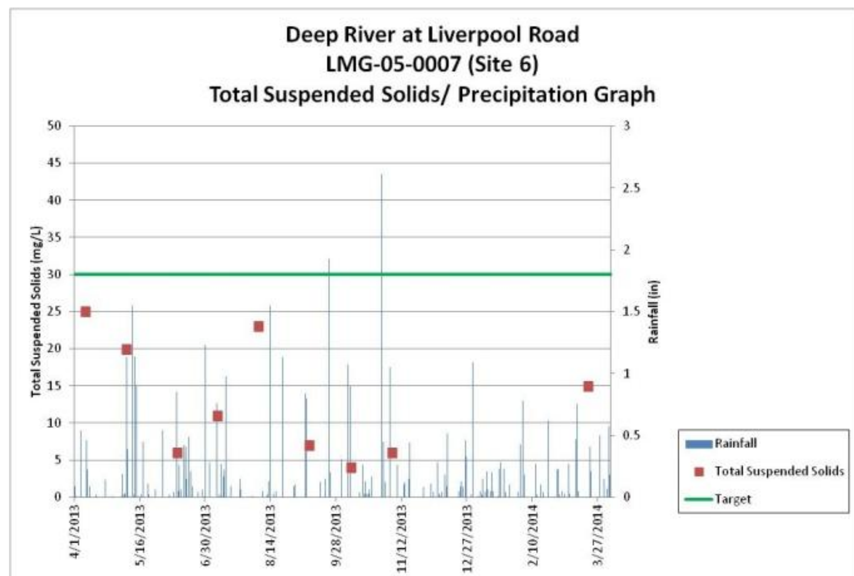
Upstream

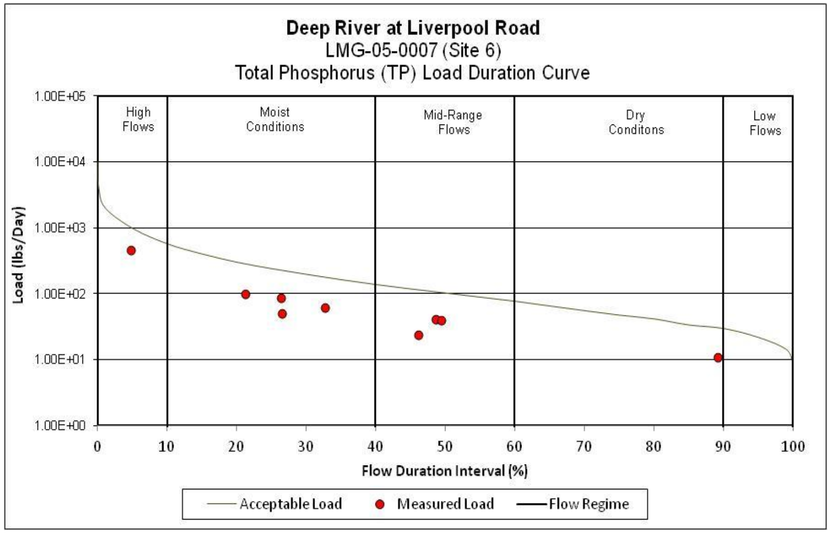
Downstream


Deep River at Liverpool Road
LMG-05-0007 (Site 6)
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 E.coli Load
Measured E.coli Load
Flow Regime

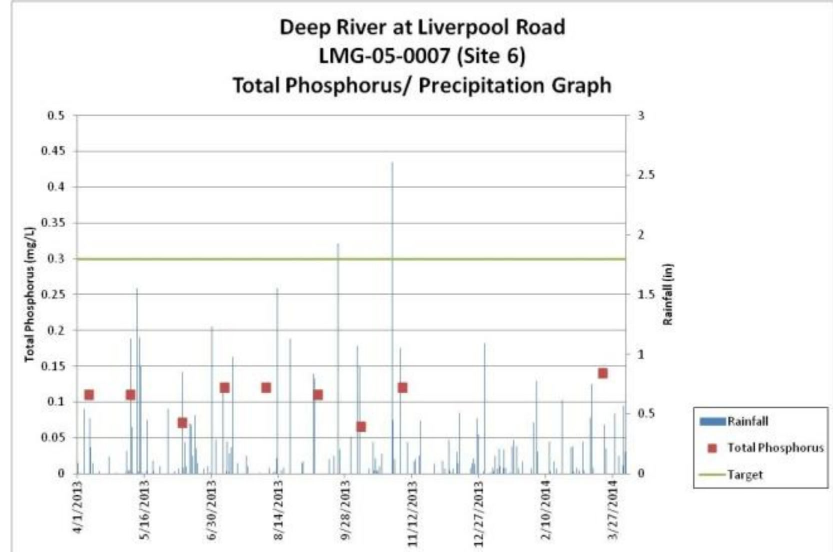

Deep river at Liverpool Road
LMG-05-0007 (Site 6)
E. coli / Precipitation Graph
E.coli (MPN/100ml)
500
450
400
350
300
250
200
150
100
50
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/1/2013
5/31/2013
6/30/2013
7/30/2013
8/29/2013
9/28/2013
Rainfall
E.coli
Target


Deep River at Liverpool Road
LMG-05-0007 (Site 6)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

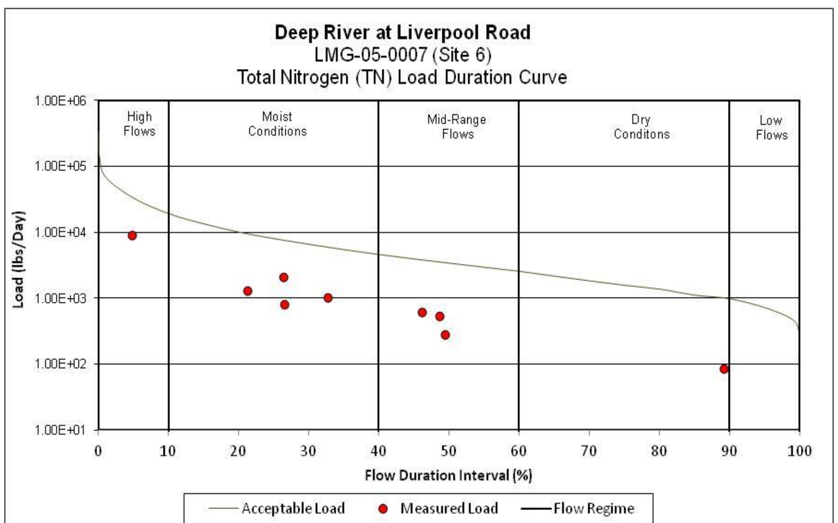

Deep River at Liverpool Road
LMG-05-0007 (Site 6)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
50
45
40
35
30
25
20
15
10
5
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
12/27/2013
2/10/2014
3/27/2014
Rainfall
Total Suspended Solids
Target



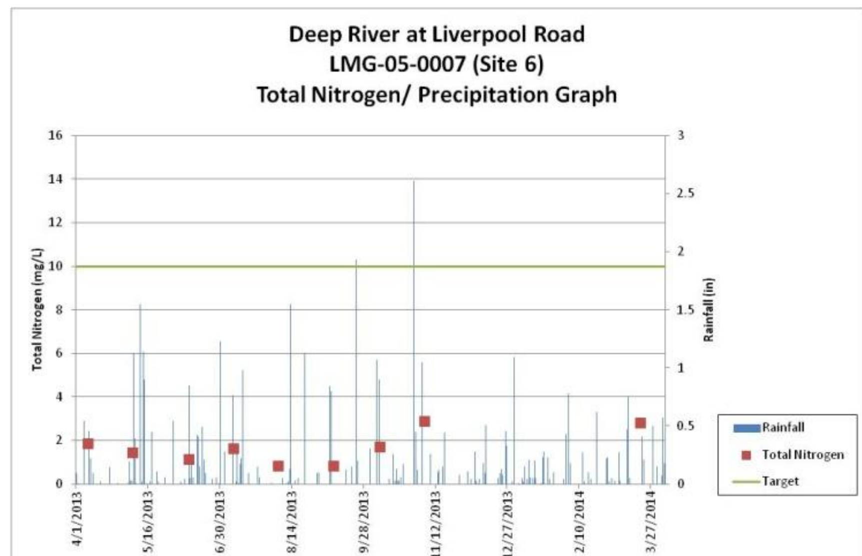
Deep River at Liverpool Road
LMG-05-0007 (Site 6)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



Deep River at Liverpool Road
LMG-05-0007 (Site 6)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target



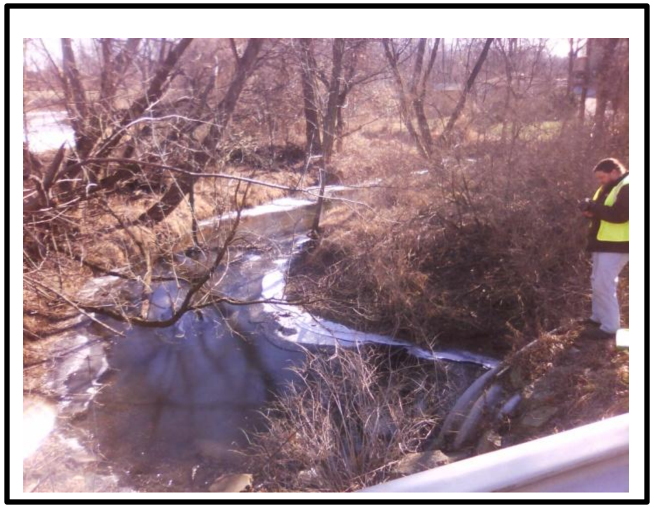
Deep River at Liverpool Road
LMG-05-0007 (Site 6)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



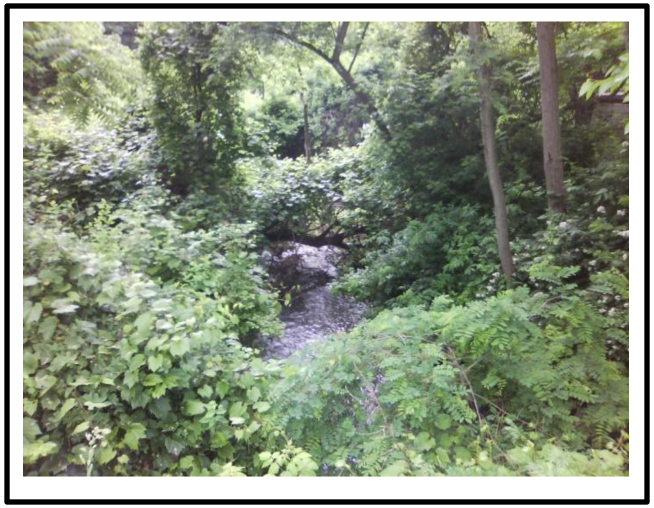
Deep River at Liverpool Road
LMG-05-0007 (Site 6)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

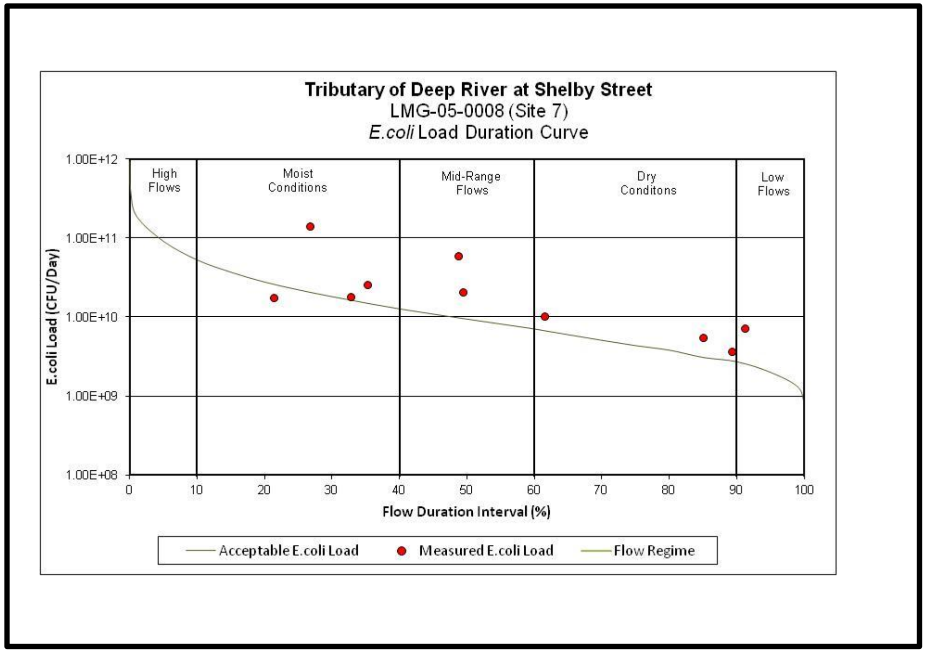
LMG-05-0008 (Site7)
Tributary of Deep River

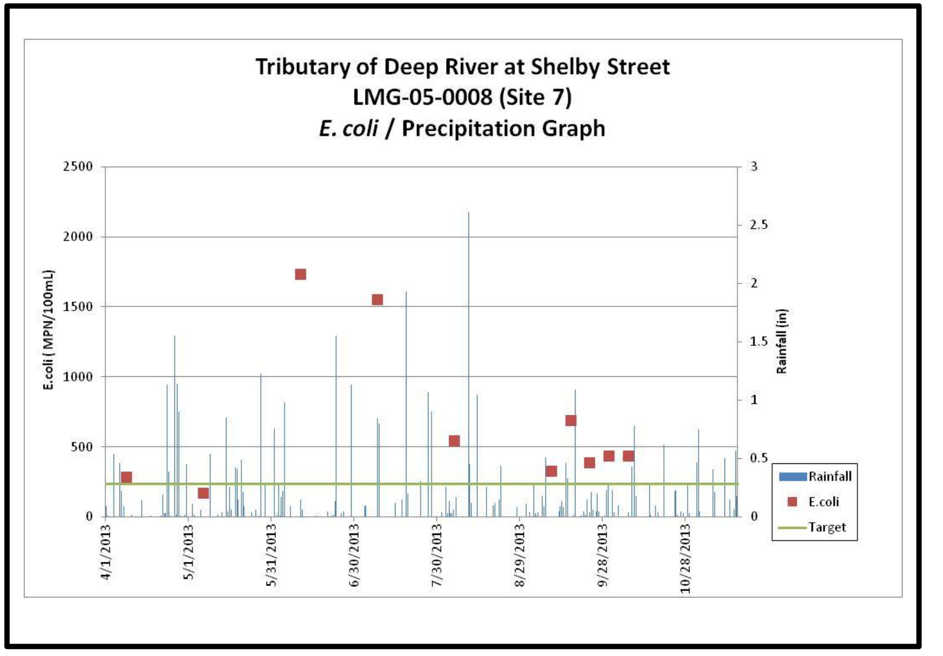
Upstream

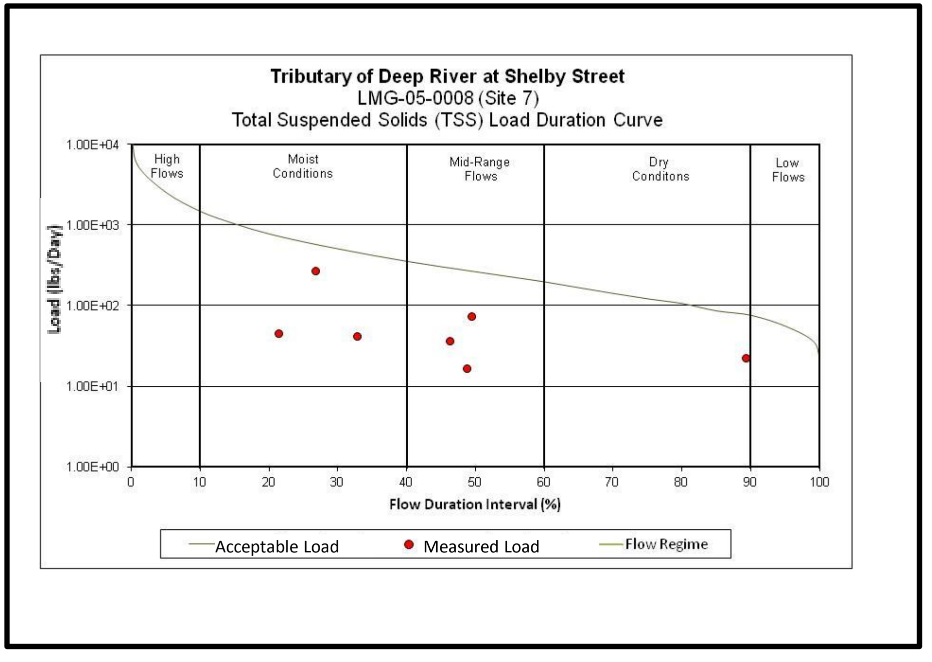


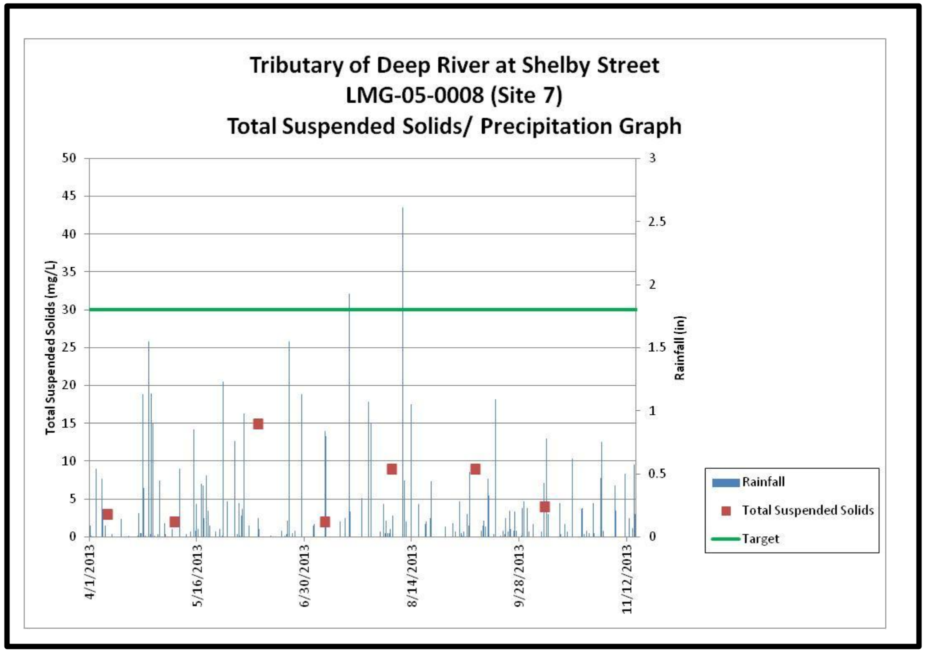
Downstream

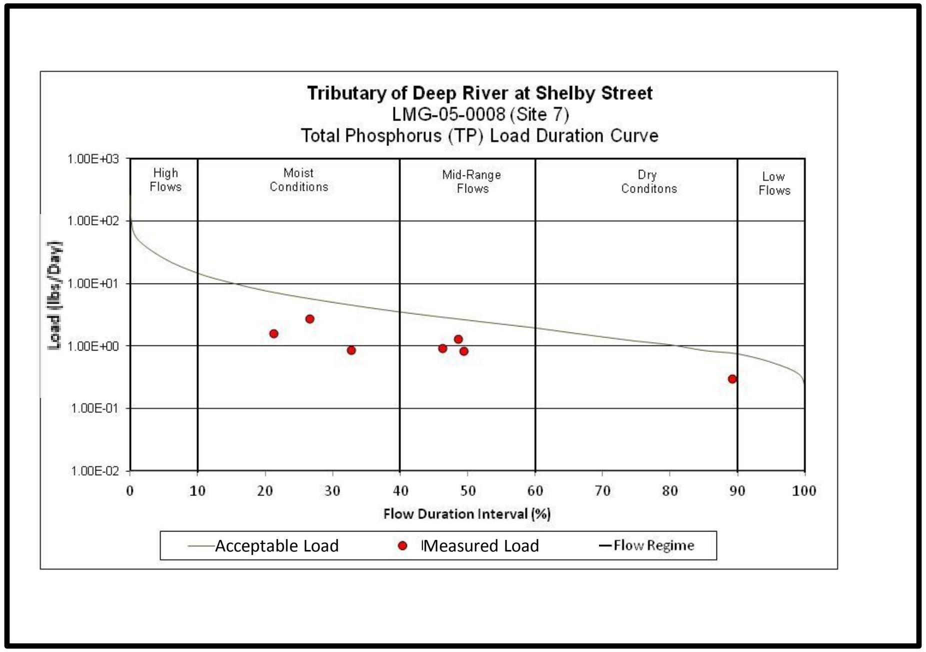


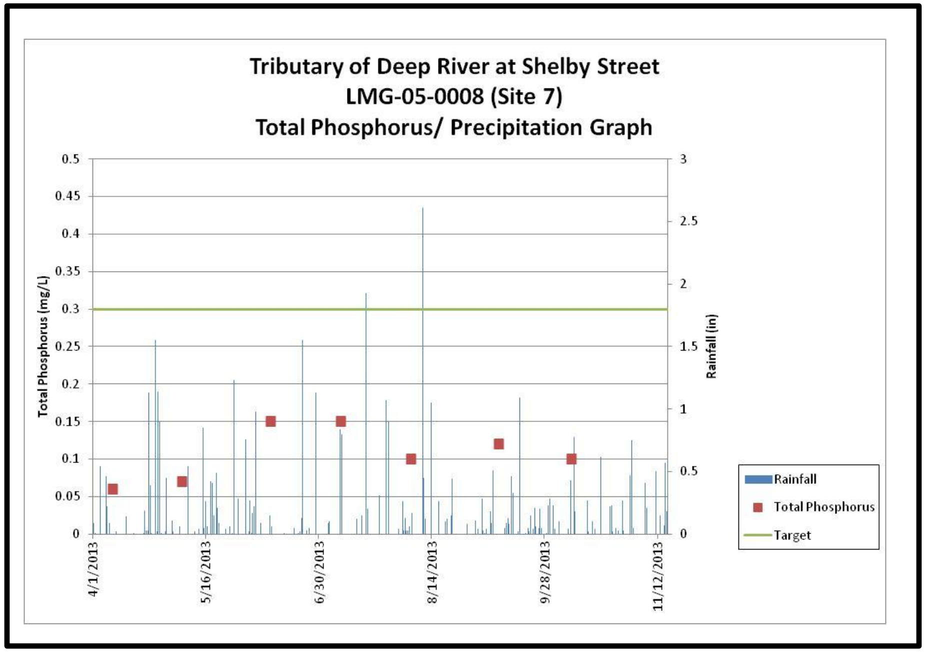

Tributary of Deep River at Shelby Street
LMG-05-0008 (Site 7)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

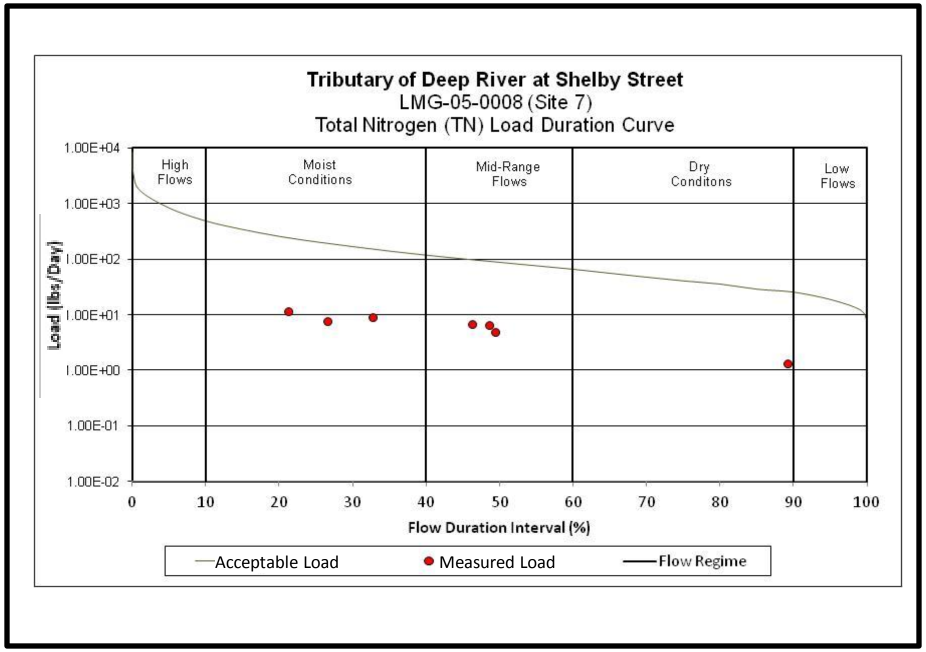

Tributary of Deep River at Shelby Street
LMG-05-0008 (Site 7)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target

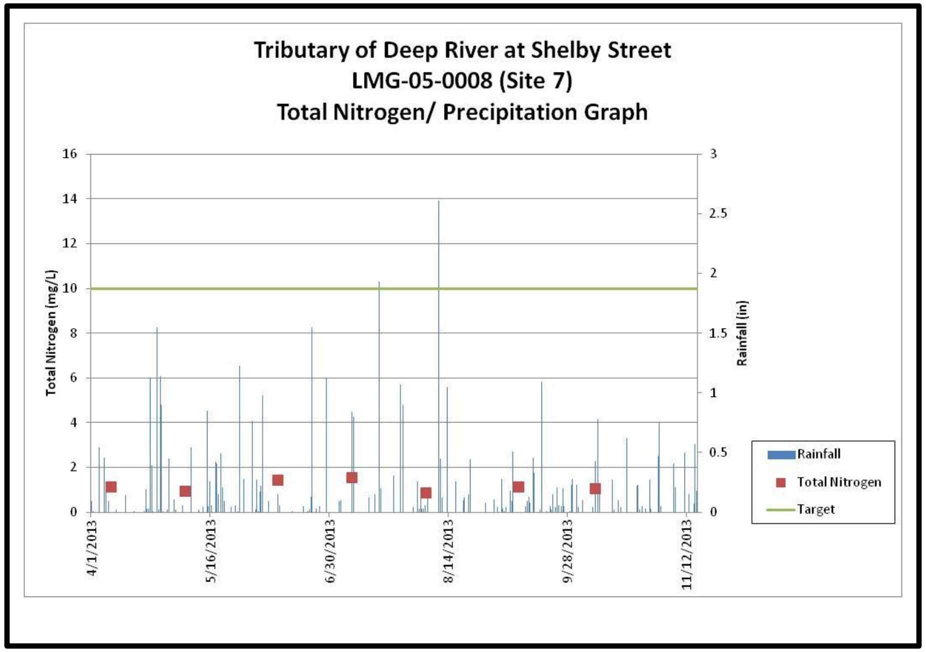

Tributary of Deep River at Shelby Street
LMG-05-0008 (Site 7)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Tributary of Deep River at Shelby Street
LMG-05-0008 (Site 7)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target


Tributary of Deep River at Shelby Street
LMG-05-0008 (Site 7)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Tributary of Deep River at Shelby Street
LMG-05-0008 (Site 7)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target

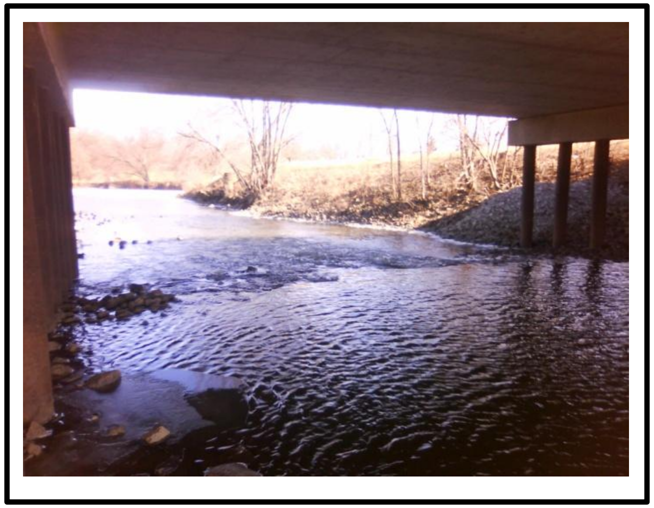

Tributary of Deep River at Shelby Street
LMG-05-0008 (Site 7)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

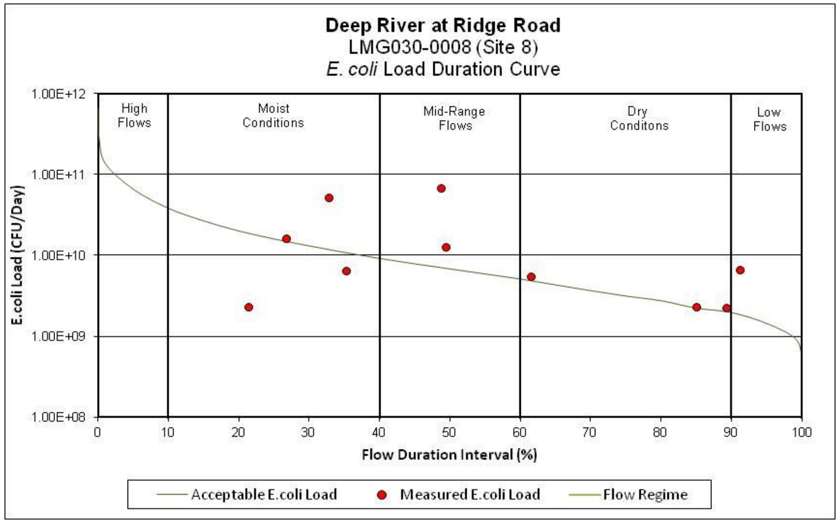

Tributary of Deep River at Shelby Street
LMG-05-0008 (Site 7)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

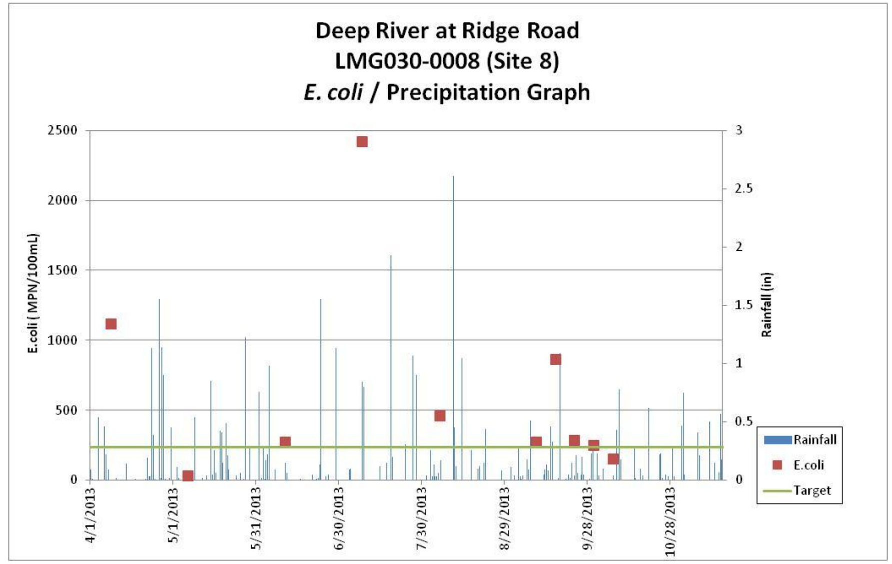
LMG030-0008 (Site 8)
Deep River

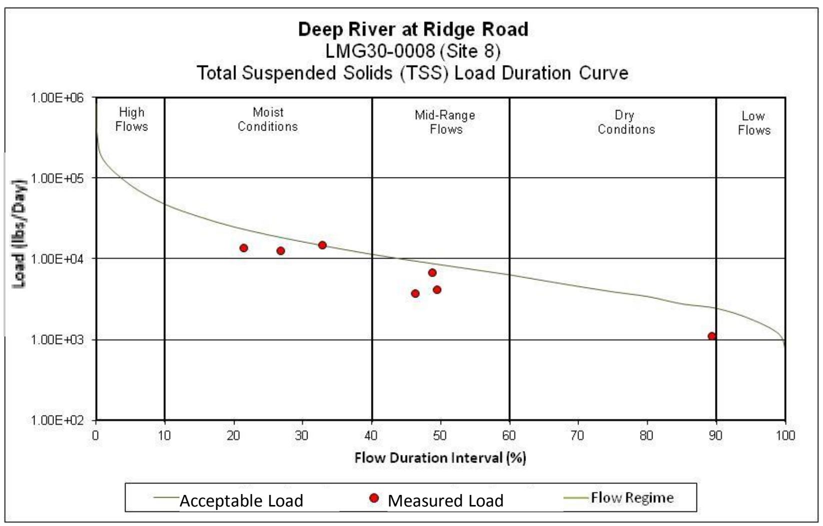
Upstream

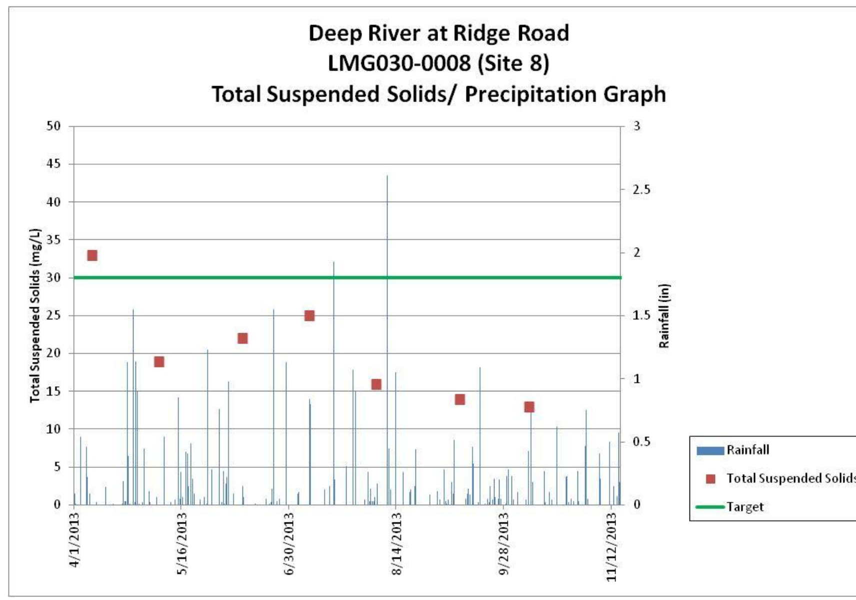
Downstream

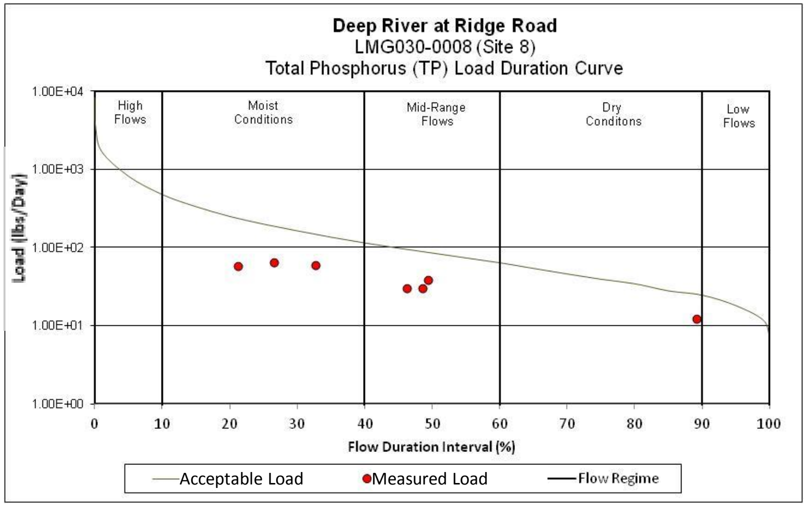


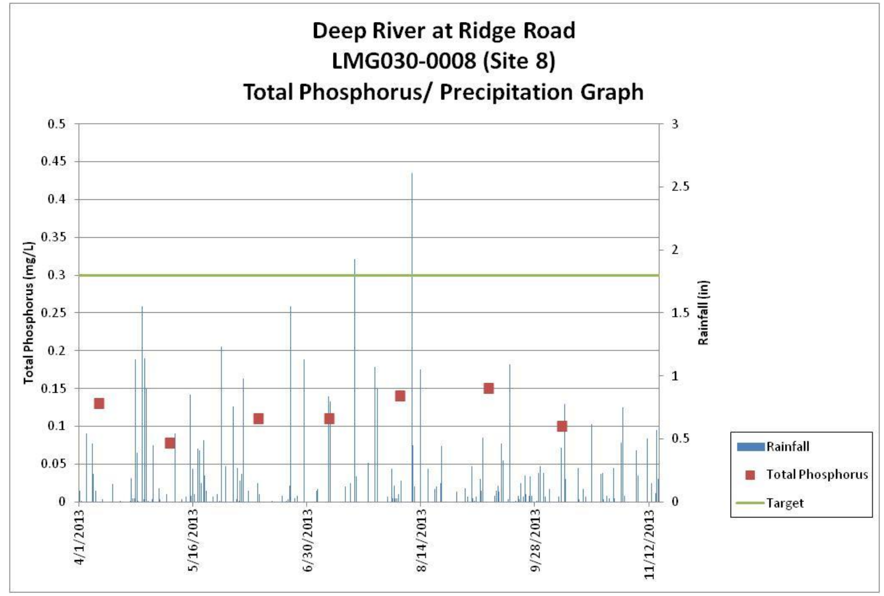

Deep River at Ridge Road
LMG030-0008 (Site 8)
E. coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

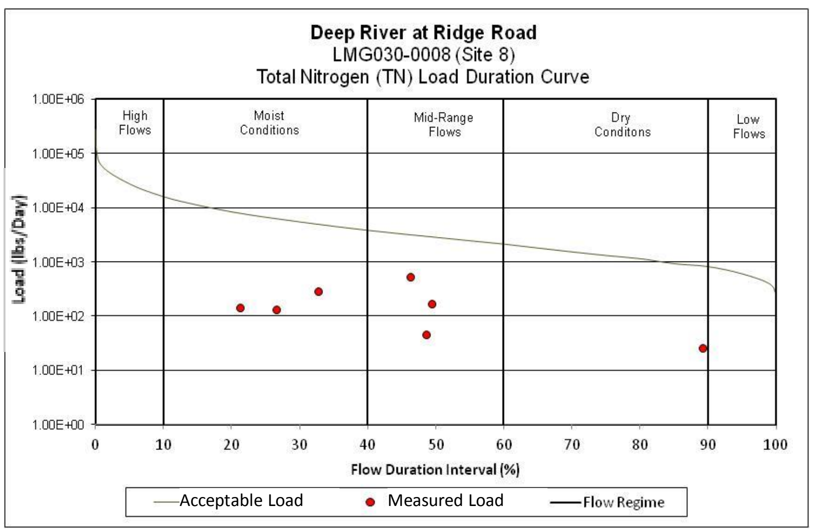

Deep River at Ridge Road
LMG030-0008 (Site 8)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
2500
2000
1500
1000
500
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/1/2013
5/31/2013
6/30/2013
7/30/2013
8/29/2013
9/28/2013
10/28/2013
Rainfall
E.coli
Target

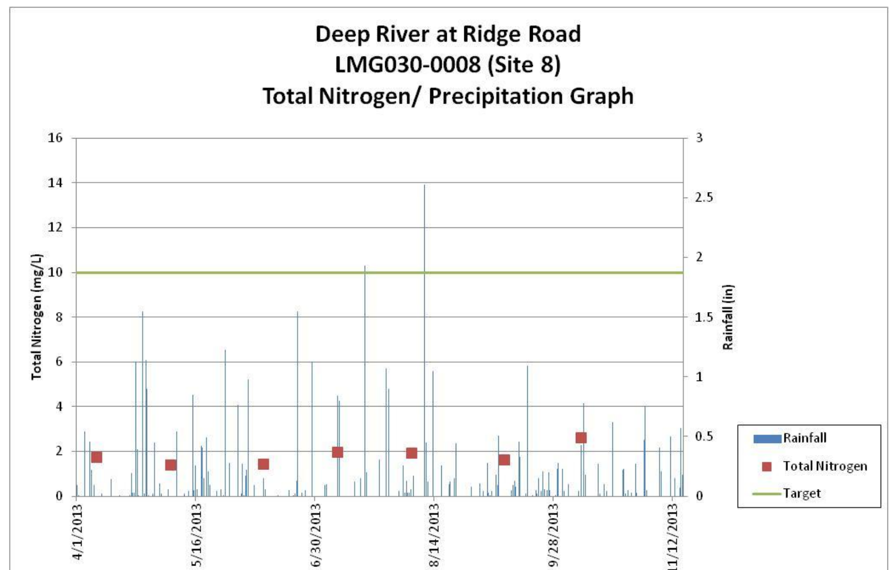

Deep River at Ridge Road
LMG30-0008 (Site 8)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Deep River at Ridge Road
LMG030-0008 (Site 8)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
50
45
40
35
30
25
20
15
10
5
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Suspended Solids
Target


Deep River at Ridge Road
LMG030-0008 (Site 8)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Deep River at Ridge Road
LMG030-0008 (Site 8)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target

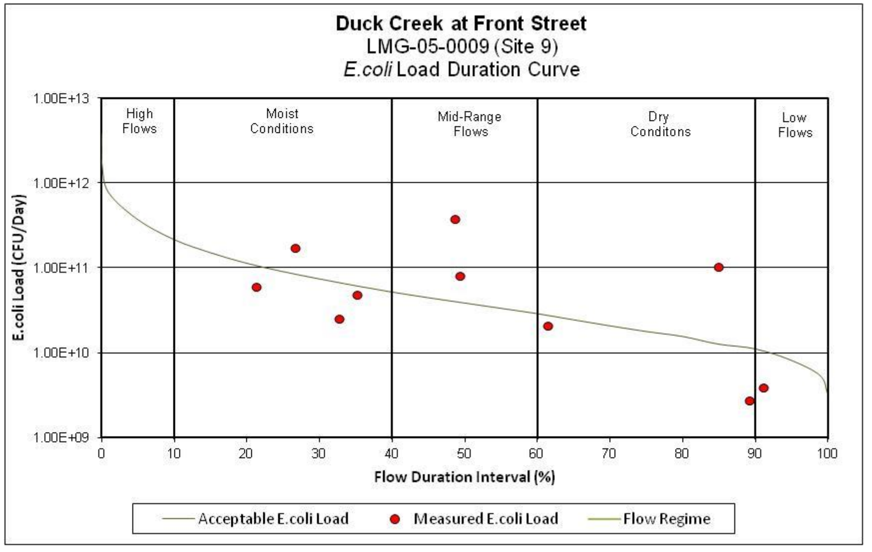

Deep River at Ridge Road
LMG030-0008 (Site 8)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

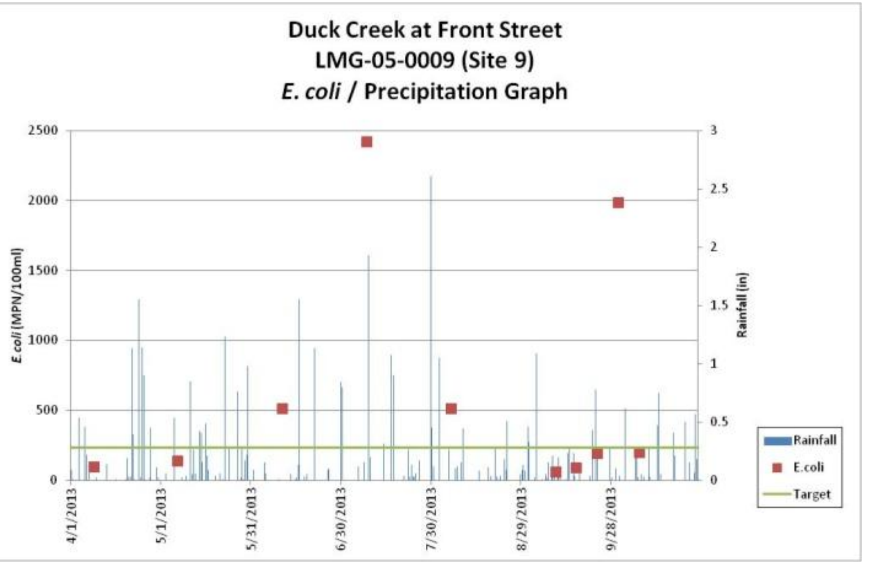

Deep River at Ridge Road
LMG030-0008 (Site 8)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

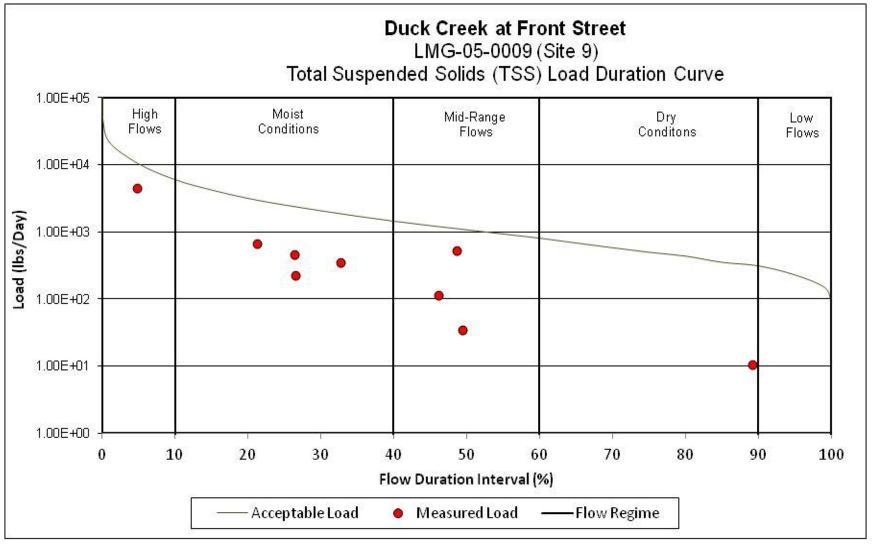
LMG-05-0009 (Site 9)
Duck Creek

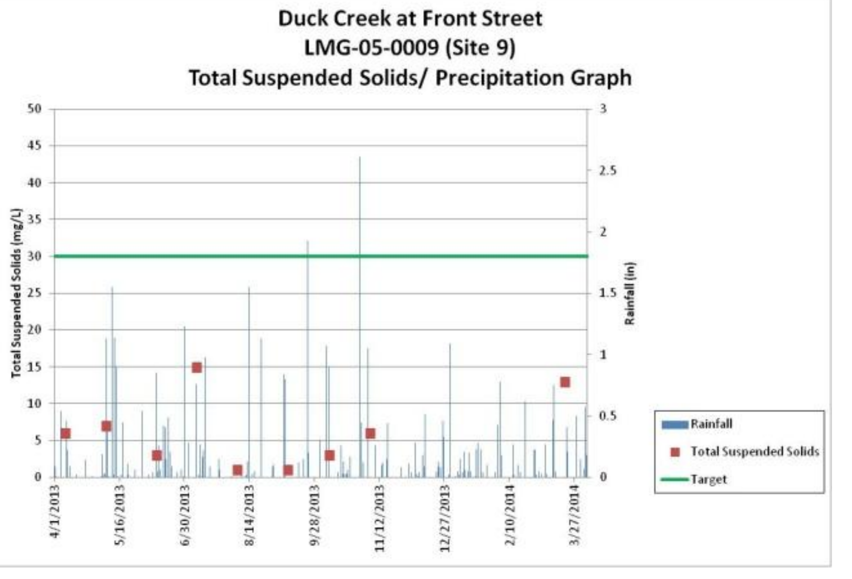
Upstream

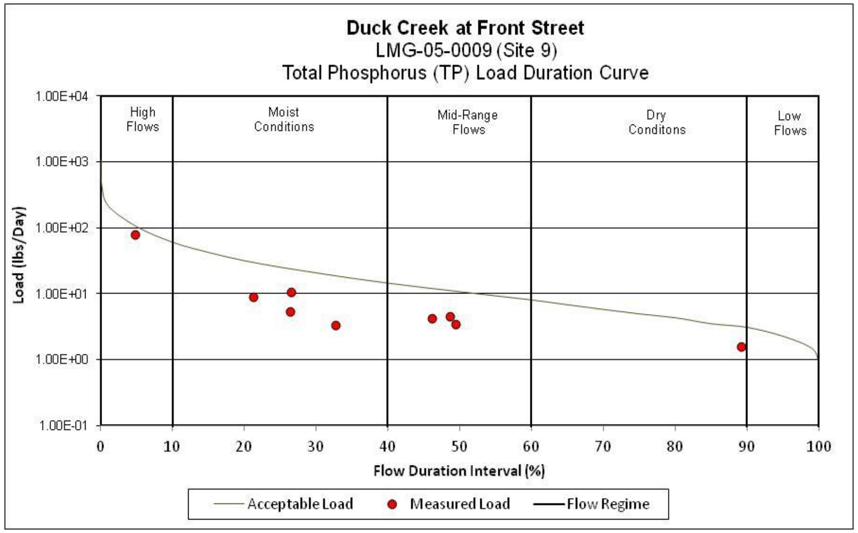
Downstream


Duck Creek at Front Street
LMG-05-0009 (Site 9)
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 E.coli Load
Measured E.coli Load
Flow Regime

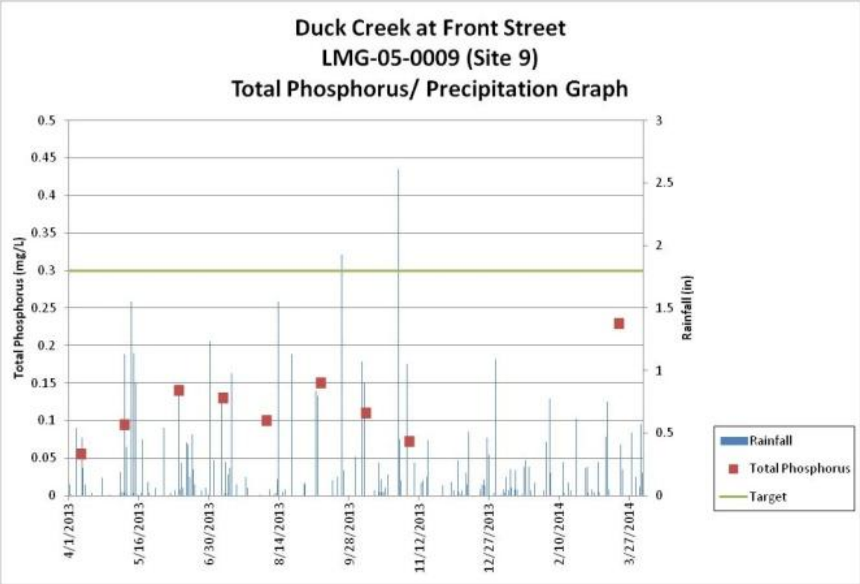

Duck Creek at Front Street
LMG-05-0009 (Site 9)
E. coli / Precipitation Graph
E.coli (MPN/100ml)
Rainfall (in)
Rainfall
E.coli
Target


Duck Creek at Front Street
LMG-05-0009 (Site 9)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

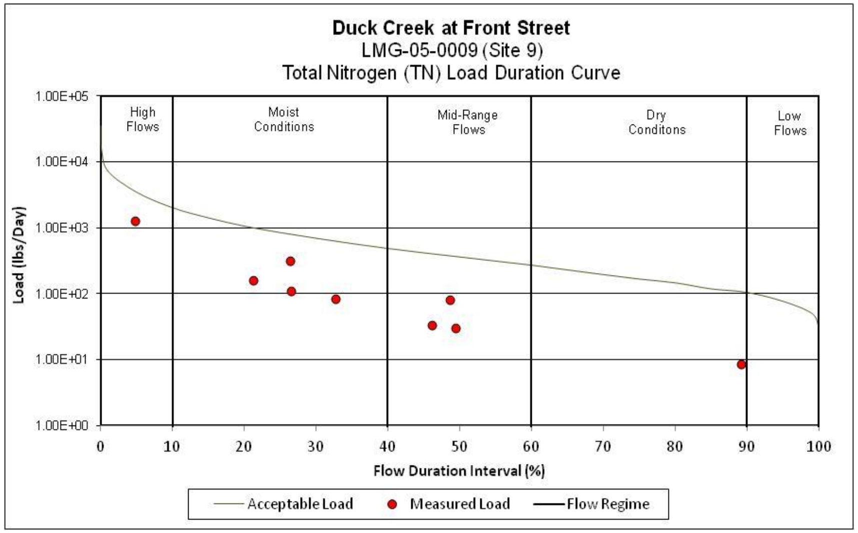

Duck Creek at Front Street
LMG-05-0009 (Site 9)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target



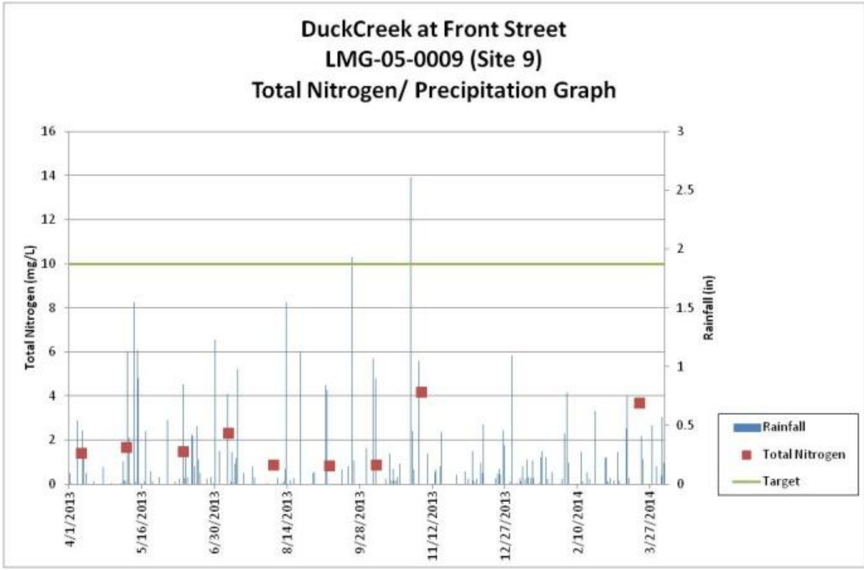
Duck Creek at Front Street
LMG-05-0009 (Site 9)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



Duck Creek at Front Street
LMG-05-0009 (Site 9)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target



Duck Creek at Front Street
LMG-05-0009 (Site 9)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

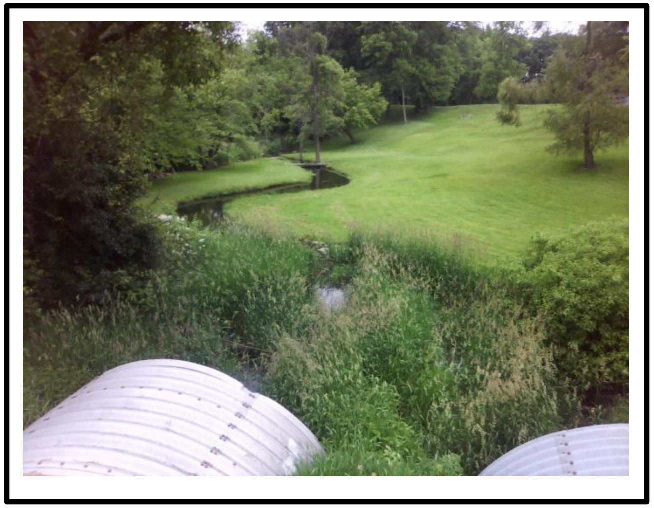


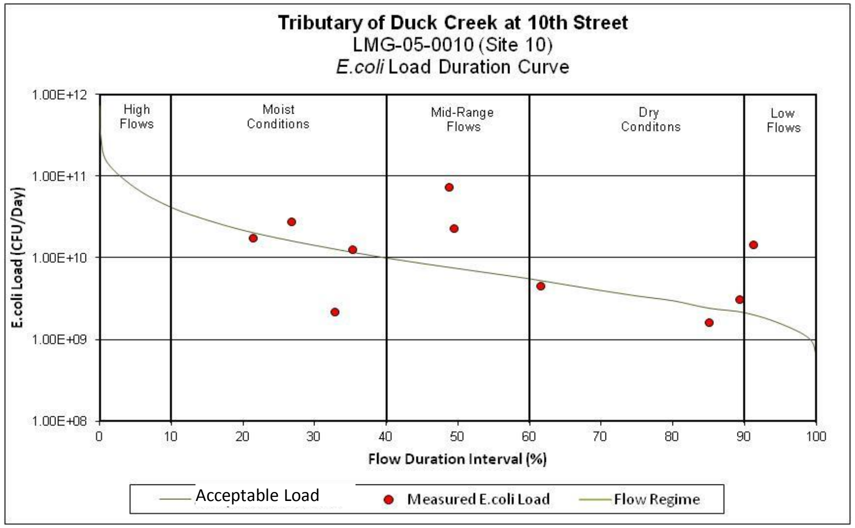
DuckCreek at Front Street
LMG-05-0009 (Site 9)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

LMG-05-0010 (Site 10)
Tributary of Duck Creek

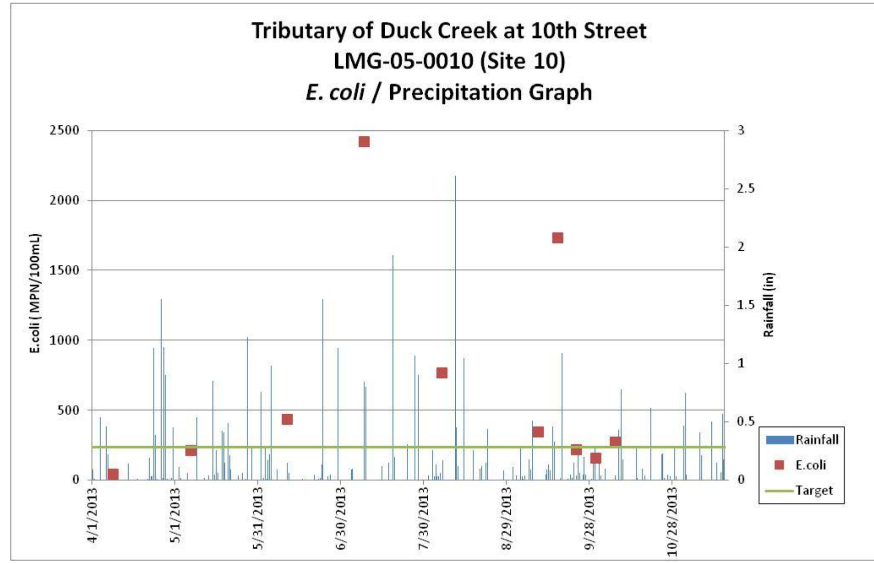
Upstream

Downstream

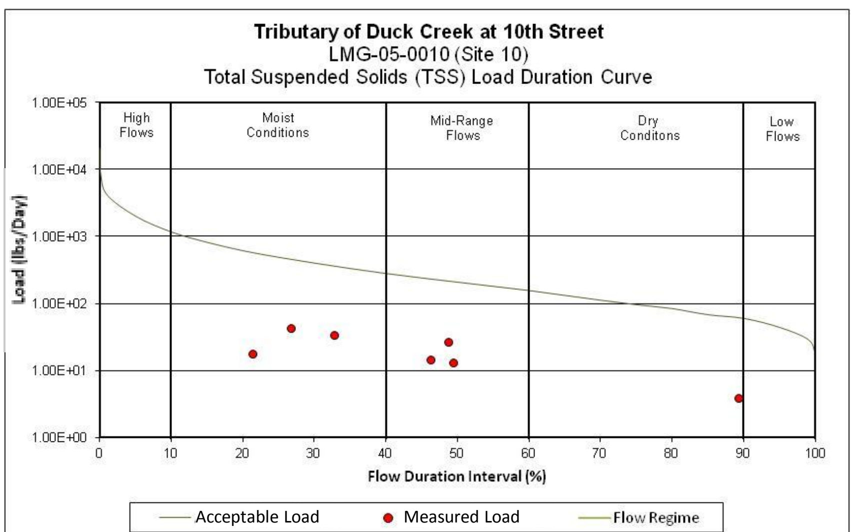




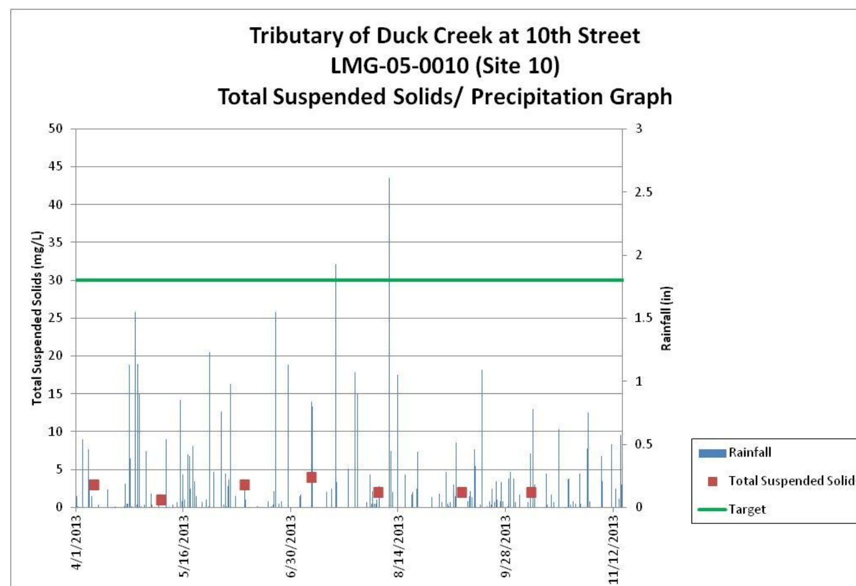
Tributary of Duck Creek at 10th Street
LMG-05-0010 (Site 10)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable Load
Measured E.coli Load
Flow Regime



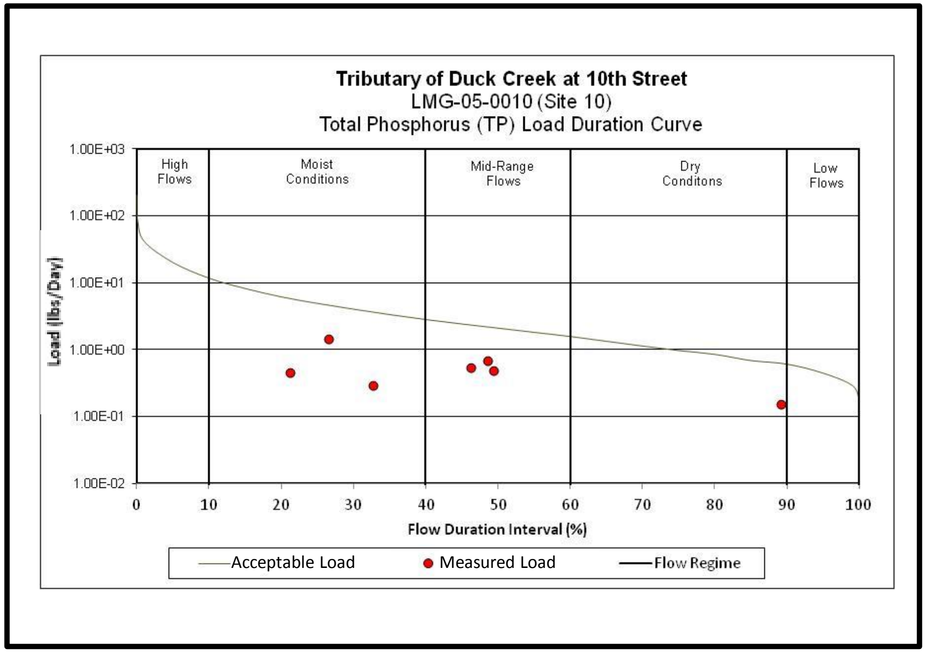
Tributary of Duck Creek at 10th Street
LMG-05-0010 (Site 10)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target



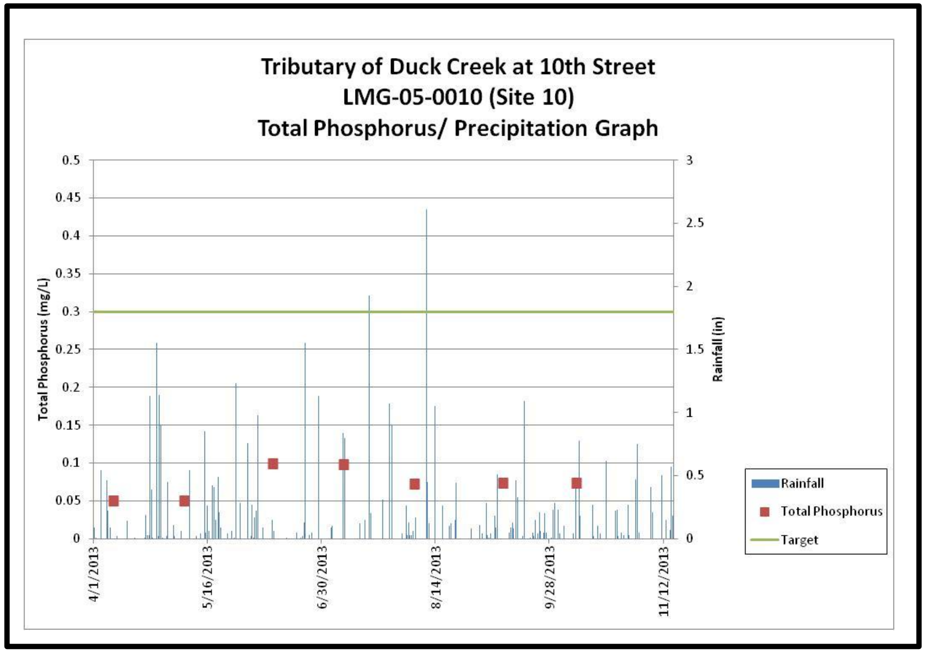
Tributary of Duck Creek at 10th Street
LMG-05-0010 (Site 10)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



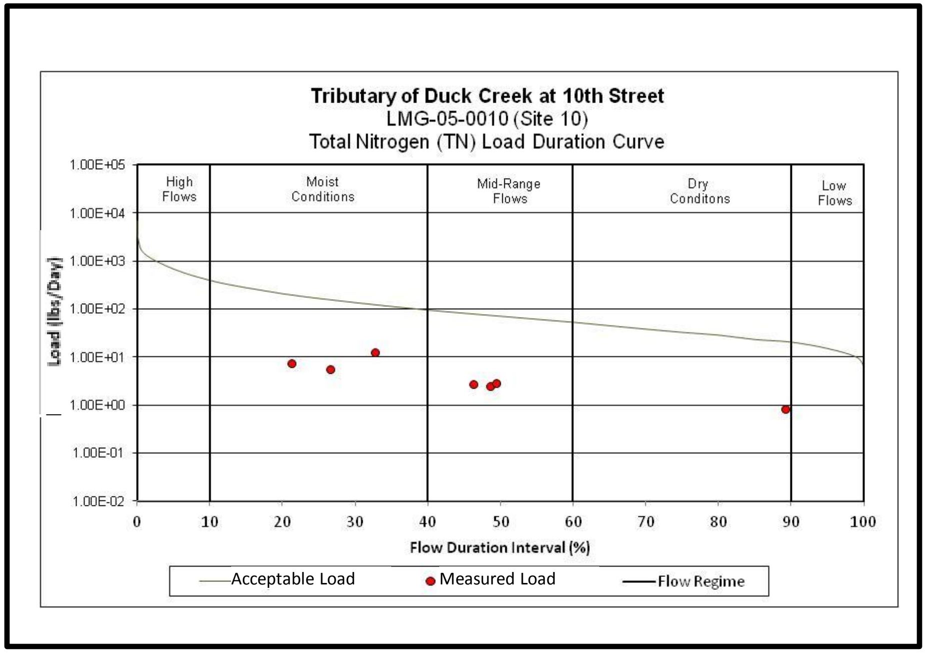
Tributary of Duck Creek at 10th Street
LMG-05-0010 (Site 10)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target



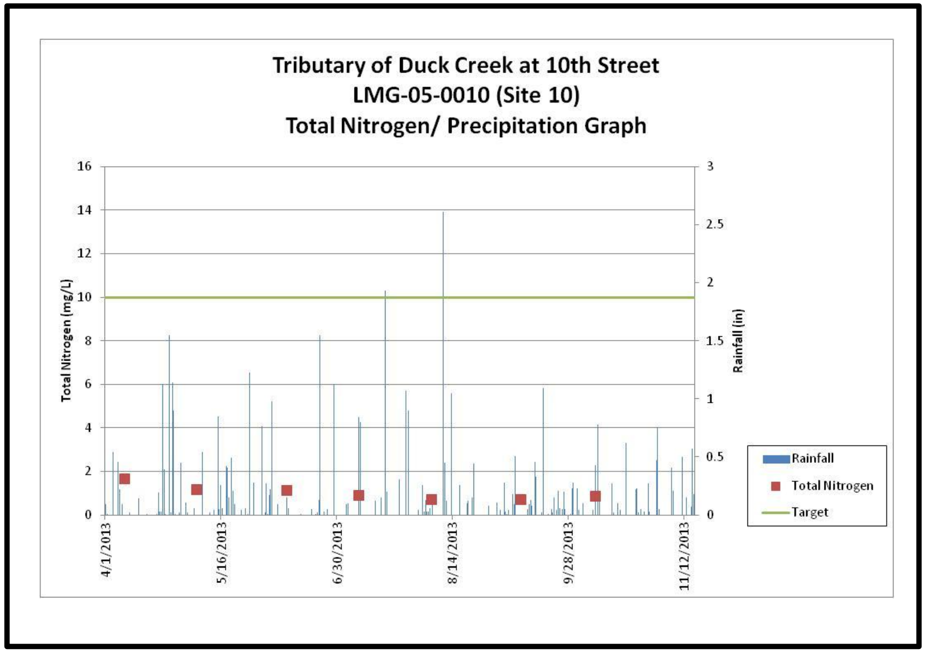
Tributary of Duck Creek at 10th Street
LMG-05-0010 (Site 10)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



Tributary of Duck Creek at 10th Street
LMG-05-0010 (Site 10)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013



Tributary of Duck Creek at 10th Street
LMG-05-0010 (Site 10)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

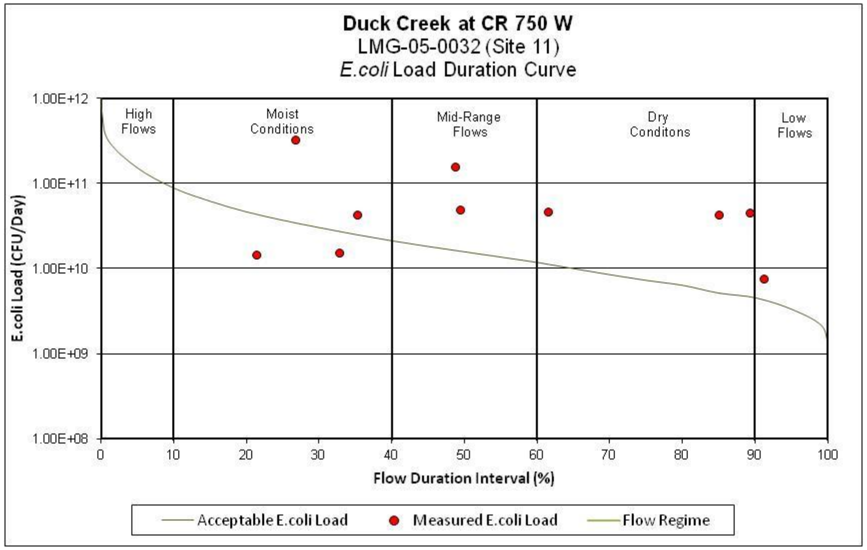


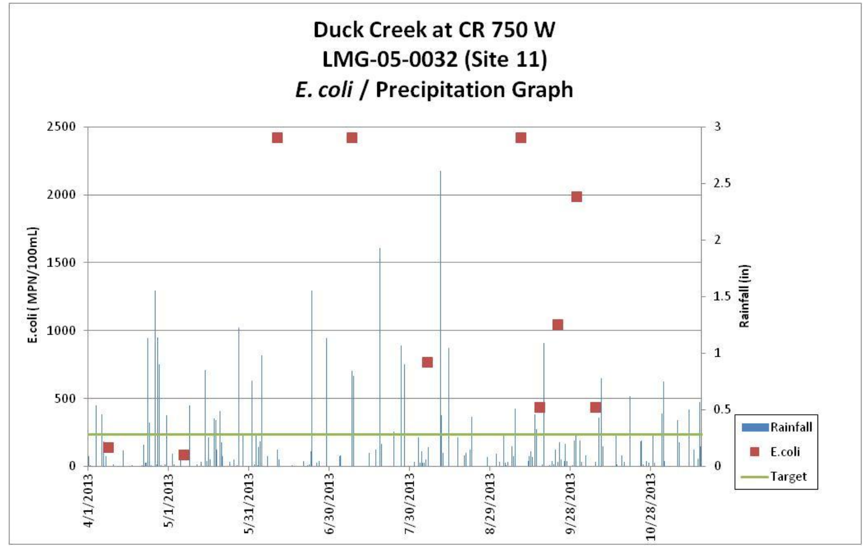
Tributary of Duck Creek at 10th Street
LMG-05-0010 (Site 10)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013

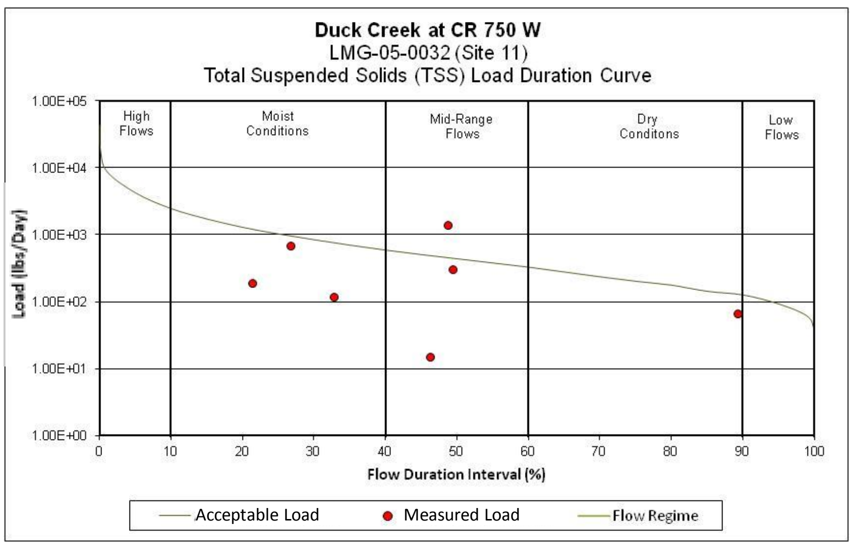
LMG-05-00032 (Site 11)
Duck Creek

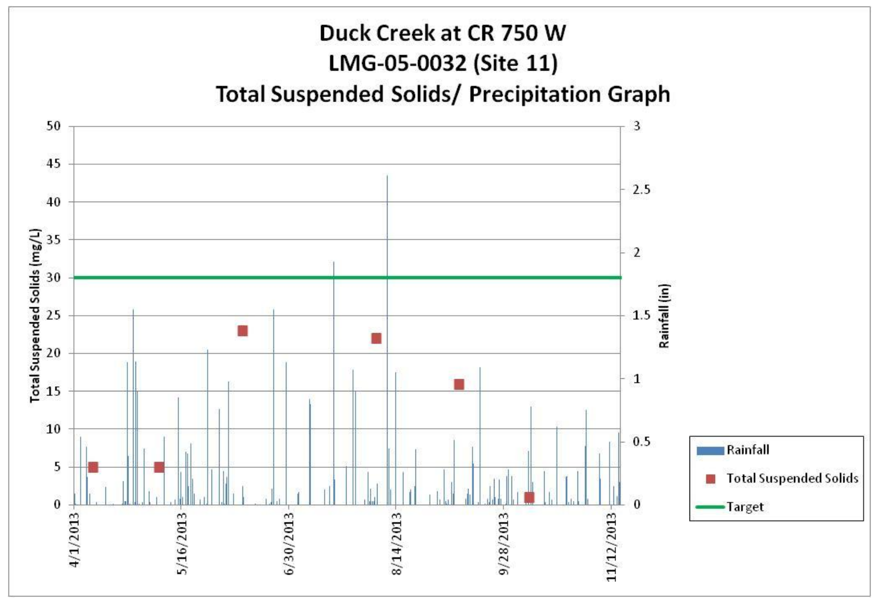
Upstream

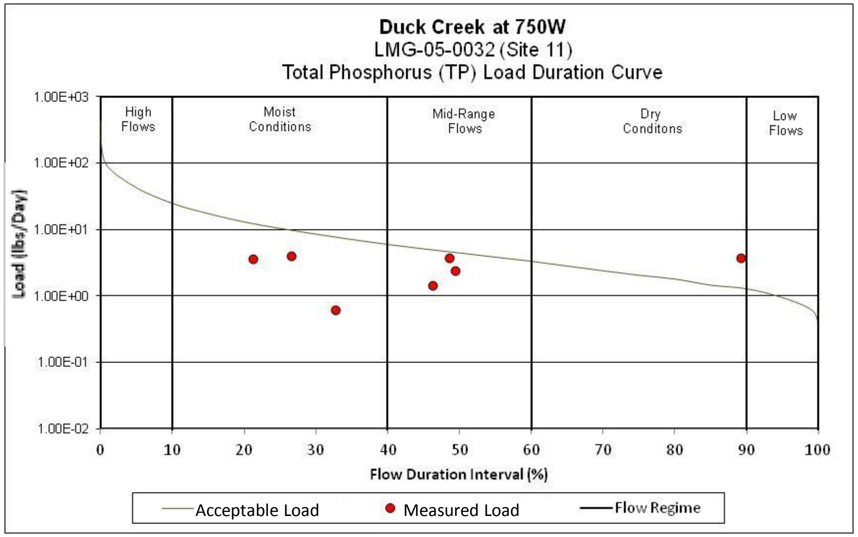
Downstream

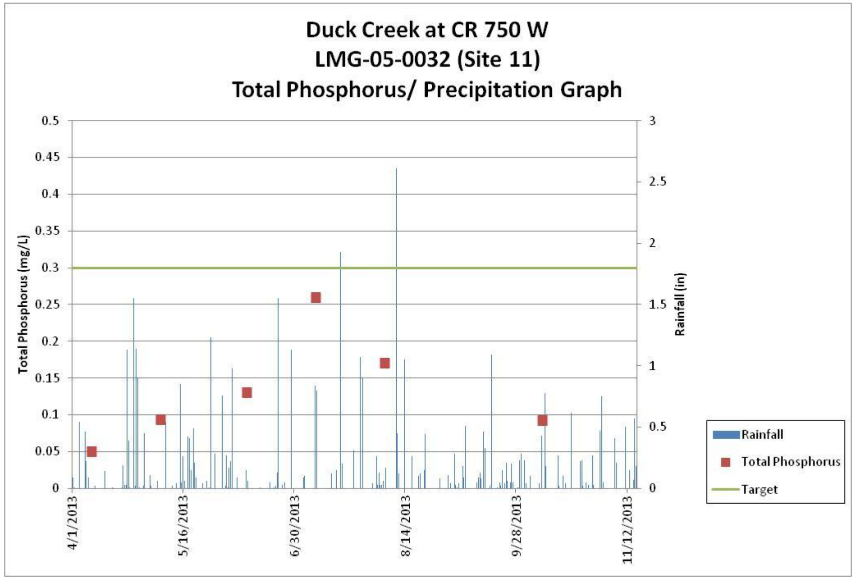

Duck Creek at CR 750 W
LMG-05-0032 (Site 11)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

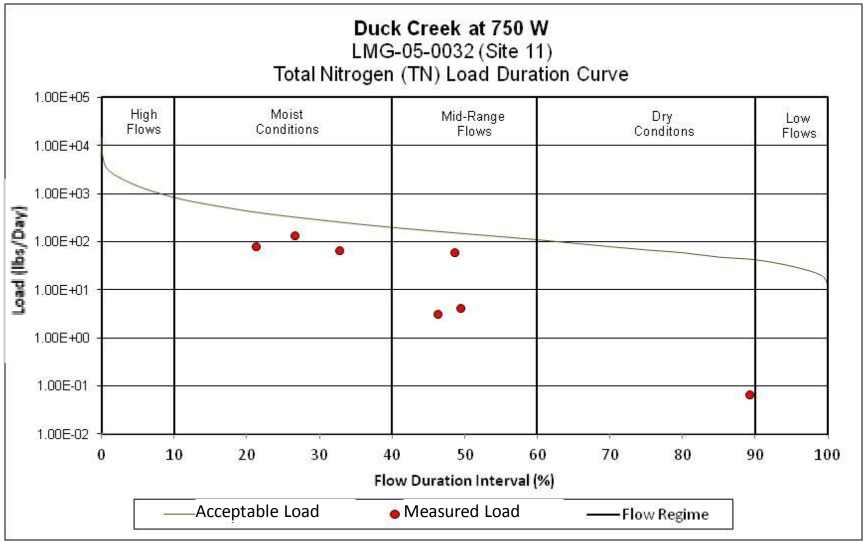

Duck Creek at CR 750 W
LMG-05-0032 (Site 11)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
2500
2000
1500
1000
500
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/1/2013
5/31/2013
6/30/2013
7/30/2013
8/29/2013
9/28/2013
10/28/2013
Rainfall
E.coli
Target

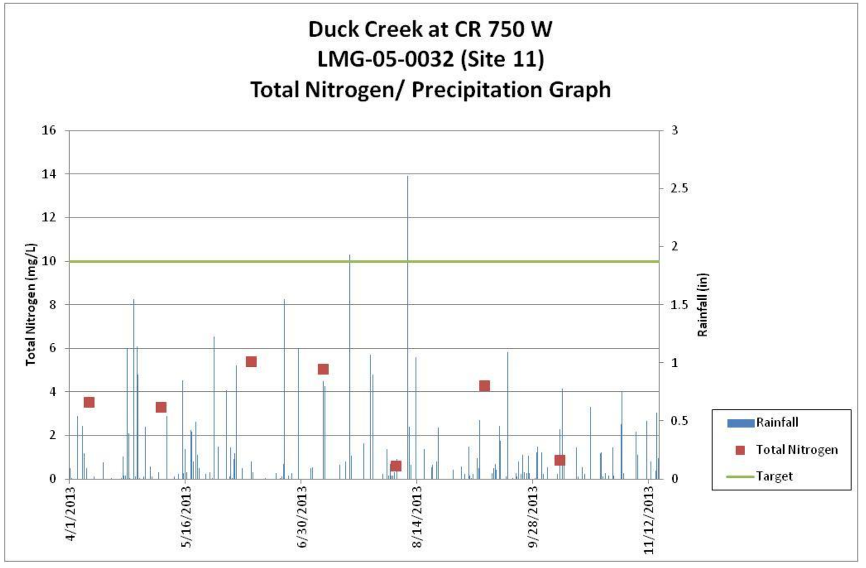

Duck Creek at CR 750 W
LMG-05-0032 (Site 11)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Duck Creek at CR 750 W
LMG-05-0032 (Site 11)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
50
45
40
35
30
25
20
15
10
5
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Suspended Solids
Target


Duck Creek at 750W
LMG-05-0032 (Site 11)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Duck Creek at CR 750 W
LMG-05-0032 (Site 11)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target

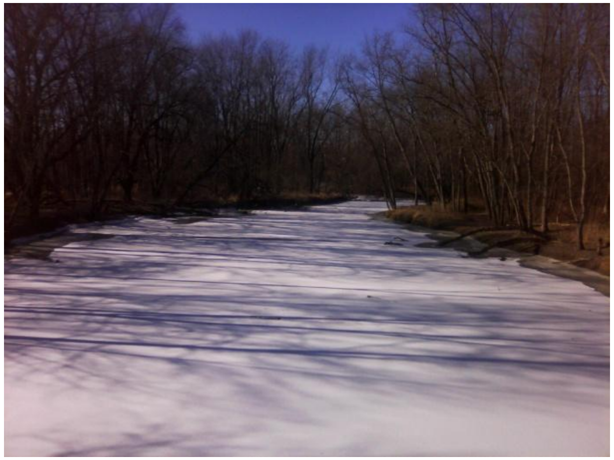

Duck Creek at 750 W
LMG-05-0032 (Site 11)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

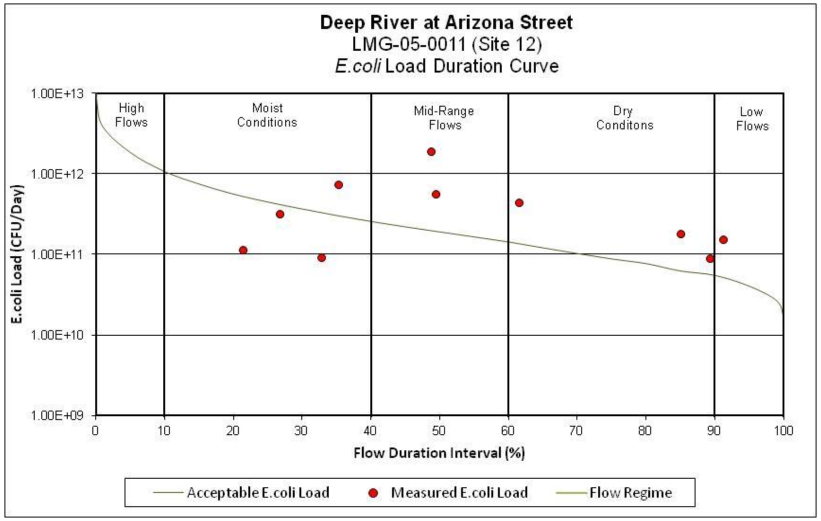

Duck Creek at CR 750 W
LMG-05-0032 (Site 11)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

LMG-05-0011 (Site 12)
Deep River

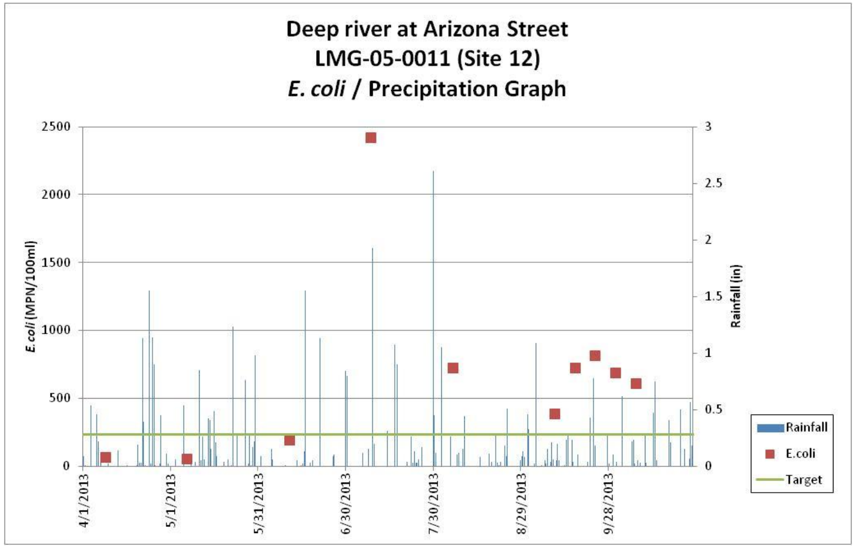
Upstream

Downstream

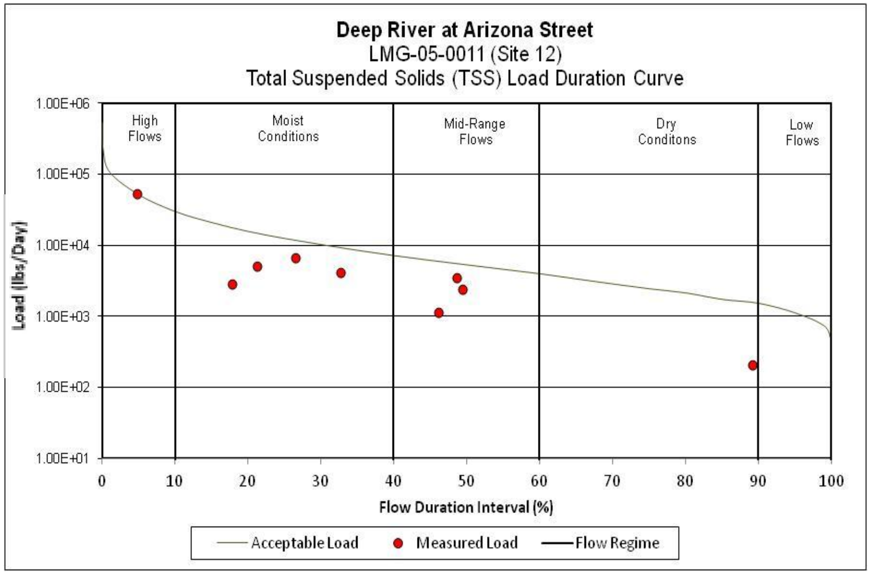




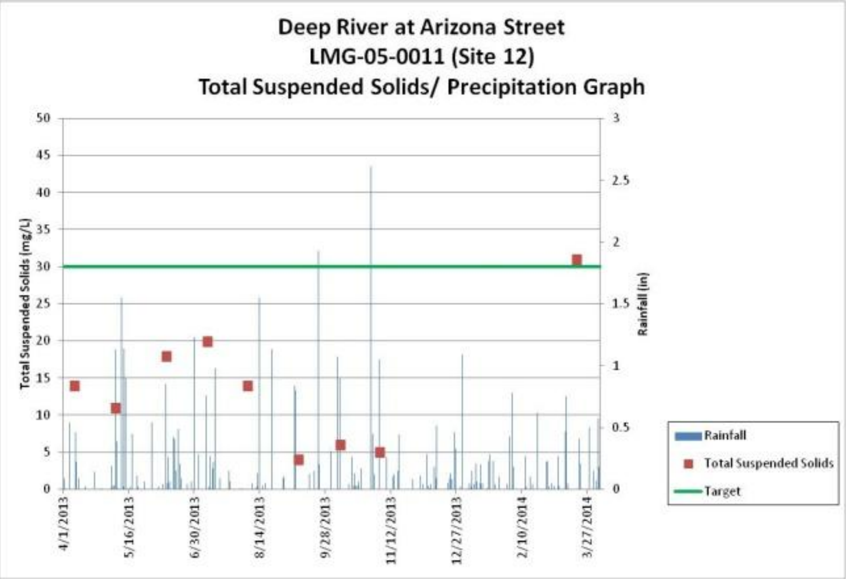
Deep River at Arizona Street
LMG-05-0011 (Site 12)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime



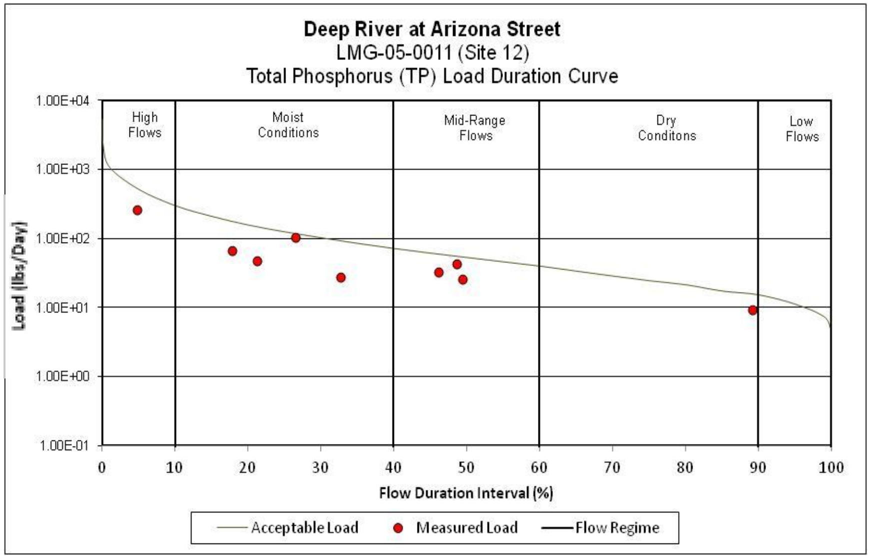
Deep river at Arizona Street
LMG-05-0011 (Site 12)
E. coli / Precipitation Graph
E. coli (MPN/100ml)
0 500 1000 1500 2000 2500
Rainfall (in)
0 0.5 1 1.5 2 2.5 3
4/1/2013
5/1/2013
5/31/2013
6/30/2013
7/30/2013
8/29/2013
9/28/2013
Rainfall
E.coli
Target

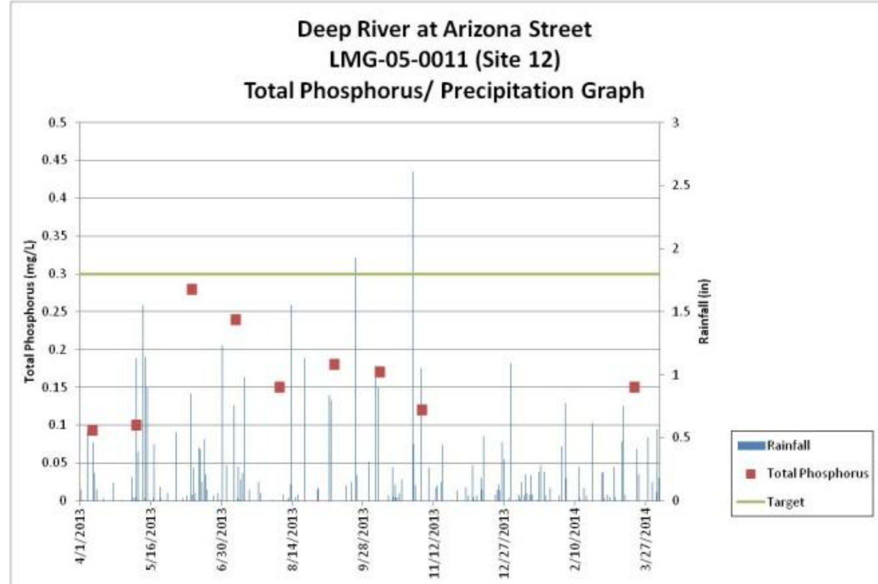


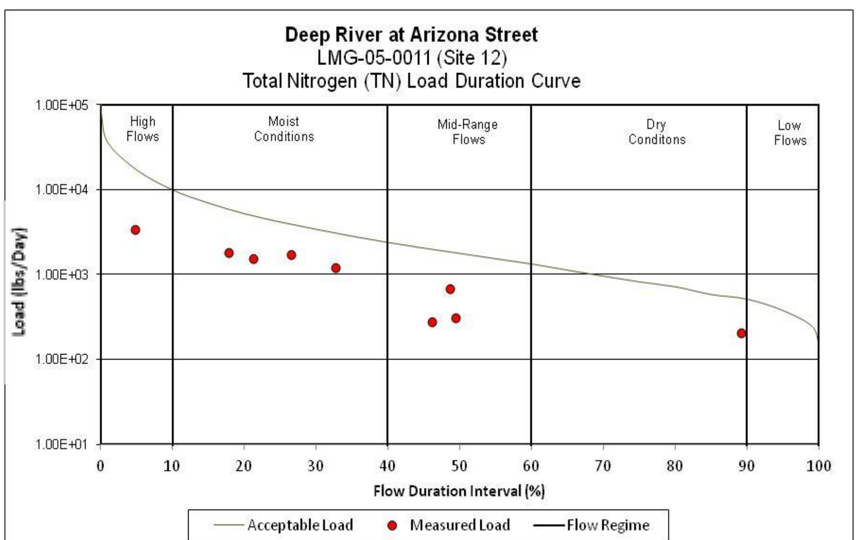
Deep River at Arizona Street
LMG-05-0011 (Site 12)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

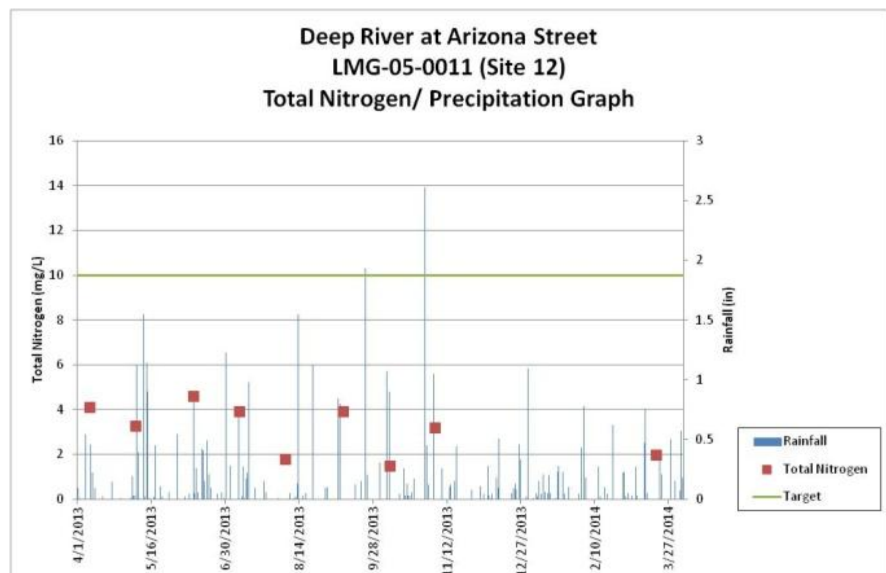


Deep River at Arizona Street
LMG-05-0011 (Site 12)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
0 5 10 15 20 25 30 35 40 45 50
Rainfall (in)
0 0.5 1 1.5 2 2.5 3
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
12/27/2013
2/10/2014
3/27/2014
Rainfall
Total Suspended Solids
Target


Deep River at Arizona Street
LMG-05-0011 (Site 12)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (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
Measured Load
Flow Regime


Deep River at Arizona Street
LMG-05-0011 (Site 12)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5
Rainfall (in)
0 0.5 1 1.5 2 2.5 3
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
12/27/2013
2/10/2014
3/27/2014
Rainfall
Total Phosphorus
Target

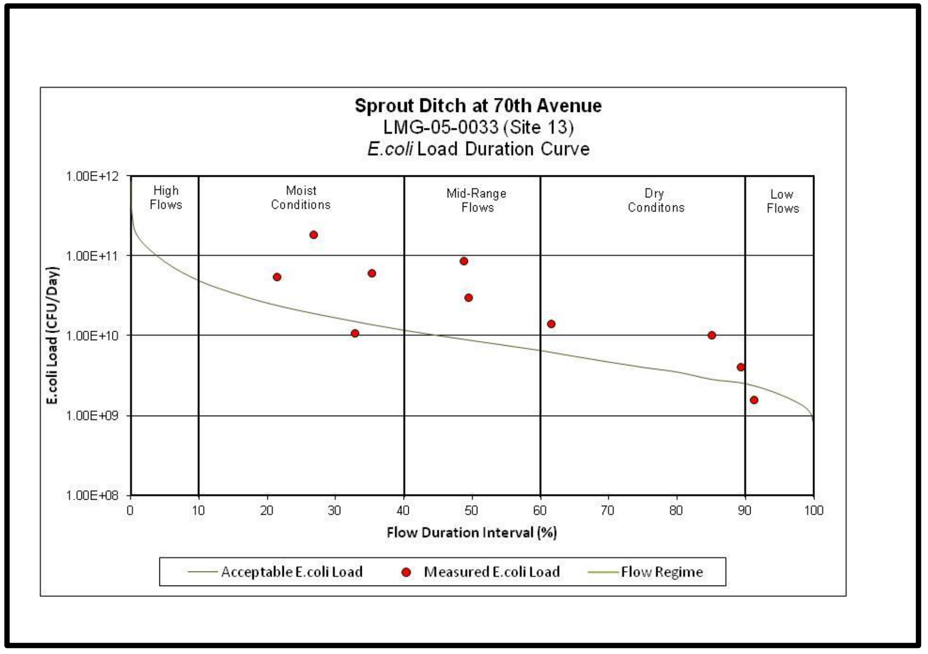

Deep River at Arizona Street
LMG-05-0011 (Site 12)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

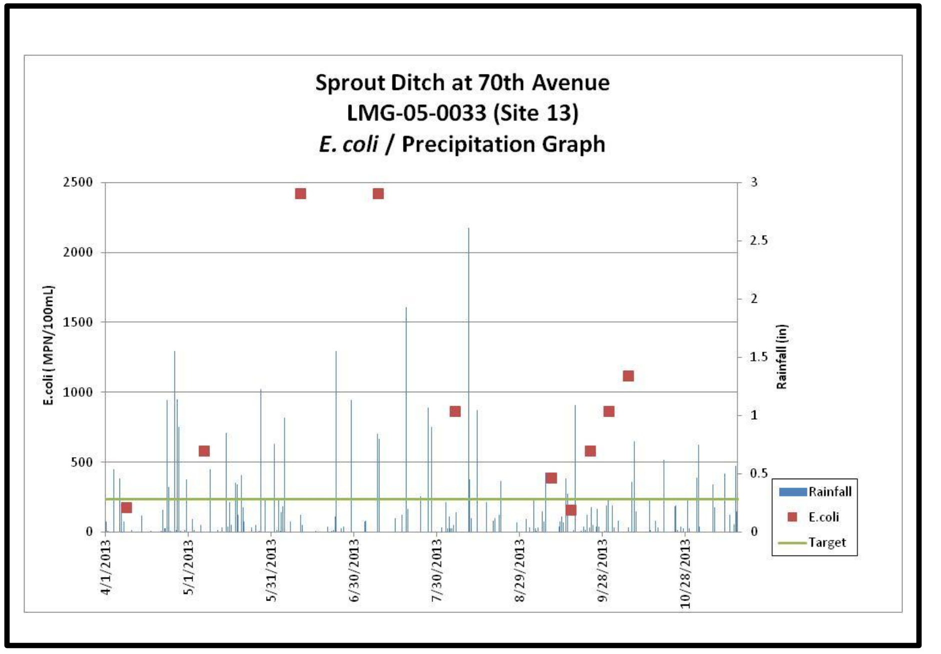

Deep River at Arizona Street
LMG-05-0011 (Site 12)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
0 2 4 6 8 10 12 14 16
Rainfall (in)
0 0.5 1 1.5 2 2.5 3
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
12/27/2013
2/10/2014
3/27/2014
Rainfall
Total Nitrogen
Target

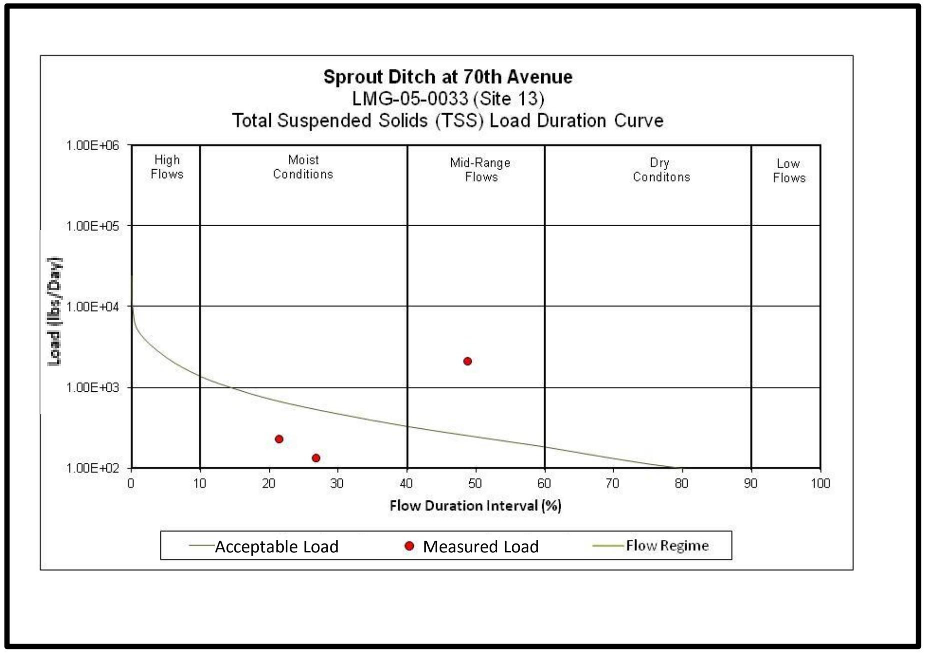
LMG-05-0033 (Site 13)
Sprout Ditch

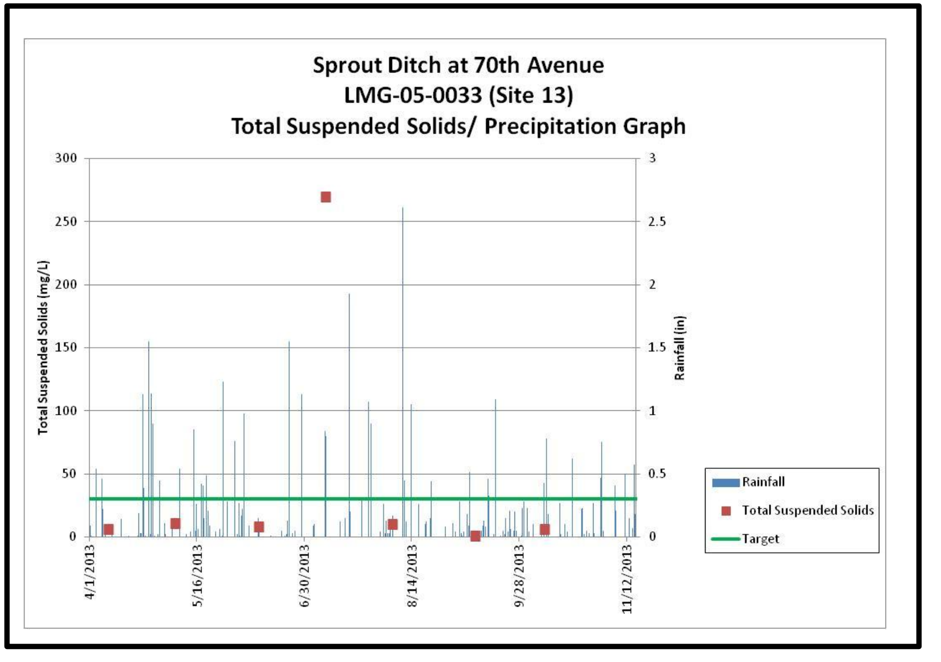
Upstream

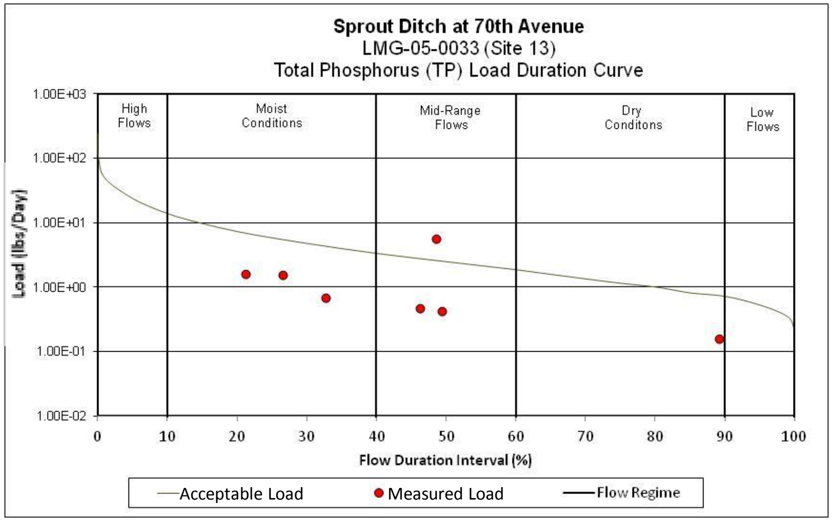
Downstream

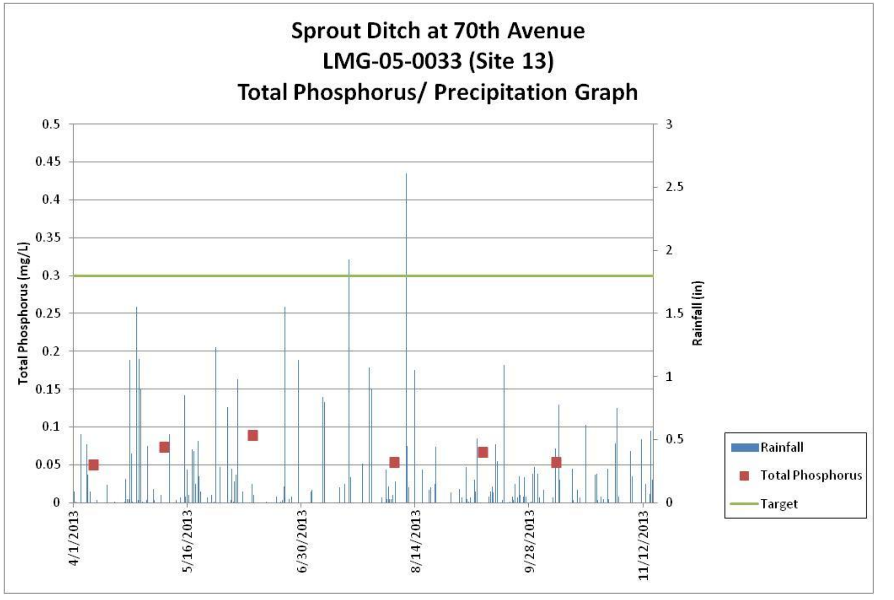

Sprout Ditch at 70th Avenue
LMG-05-0033 (Site 13)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

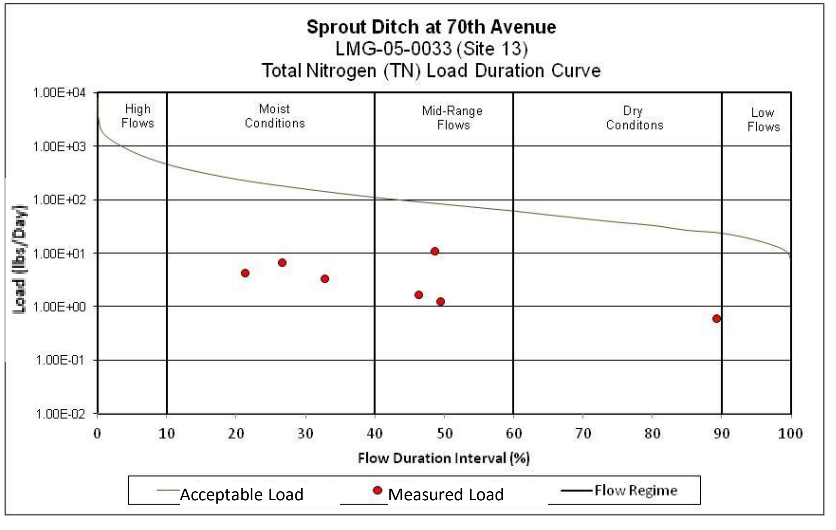

Sprout Ditch at 70th Avenue
LMG-05-0033 (Site 13)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target

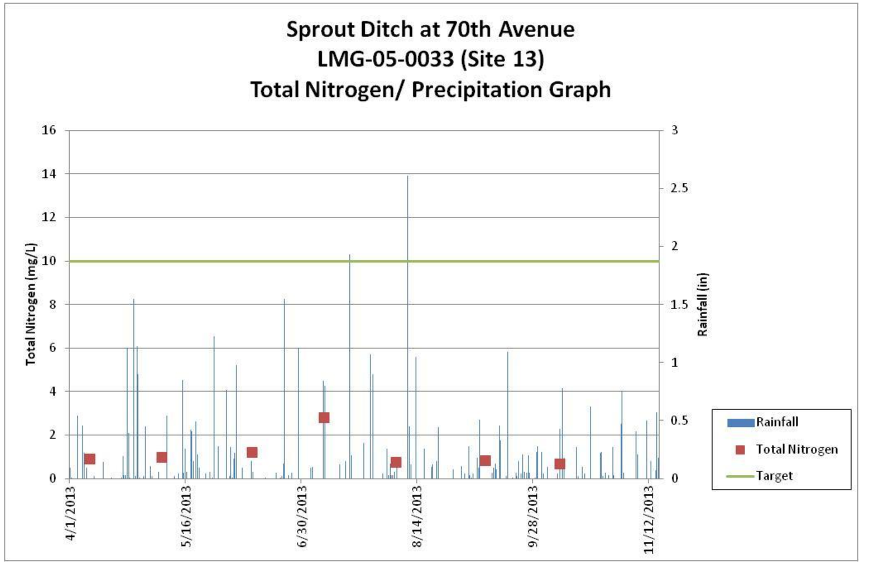

Sprout Ditch at 70th Avenue
LMG-05-0033 (Site 13)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Sprout Ditch at 70th Avenue
LMG-05-0033 (Site 13)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target


Sprout Ditch at 70th Avenue
LMG-05-0033 (Site 13)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Sprout Ditch at 70th Avenue
LMG-05-0033 (Site 13)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target

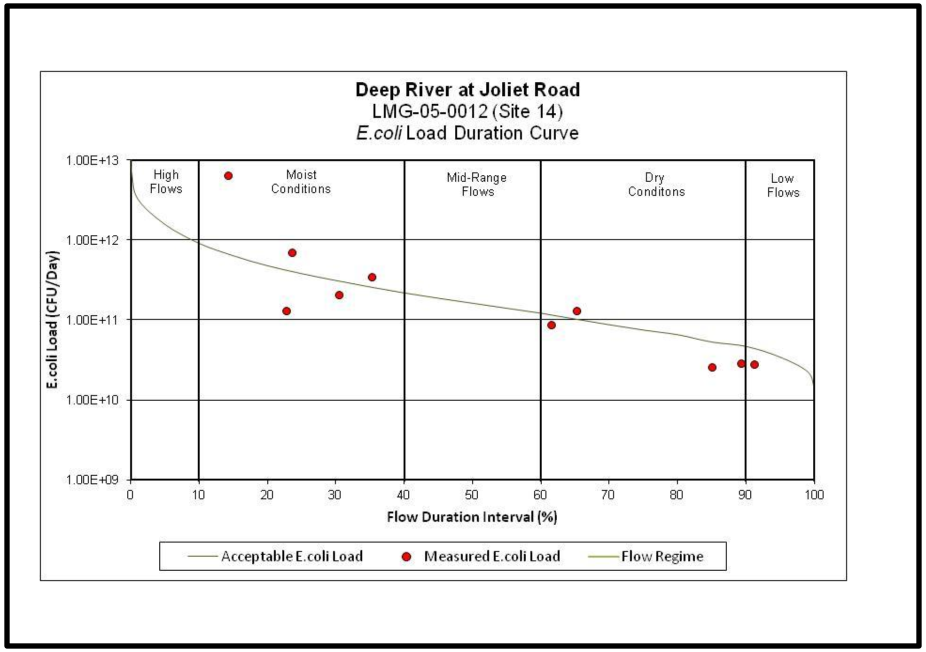

Sprout Ditch at 70th Avenue
LMG-05-0033 (Site 13)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

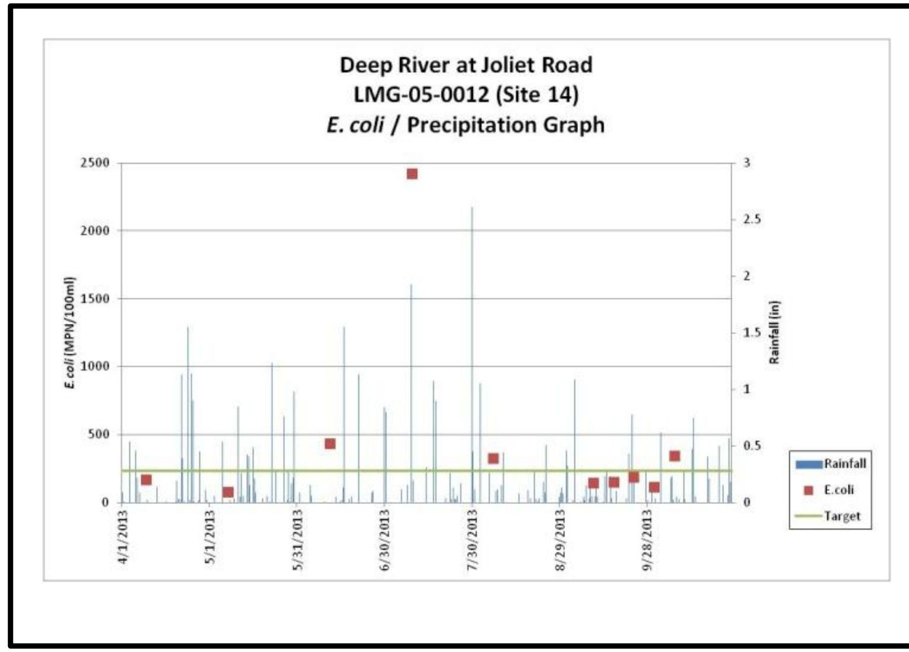

Sprout Ditch at 70th Avenue
LMG-05-0033 (Site 13)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

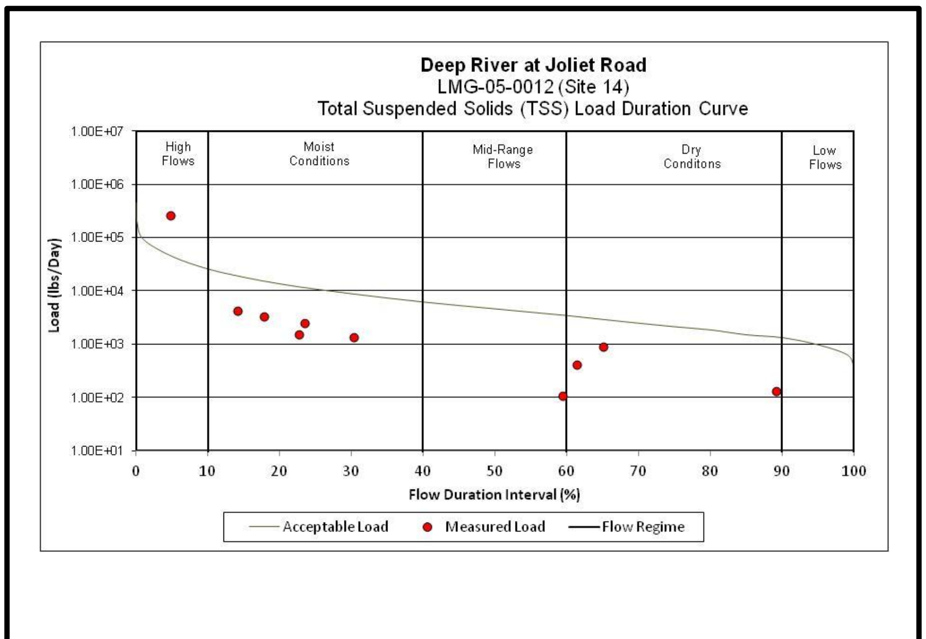
LMG-05-0012 (Site 14)
Deep River

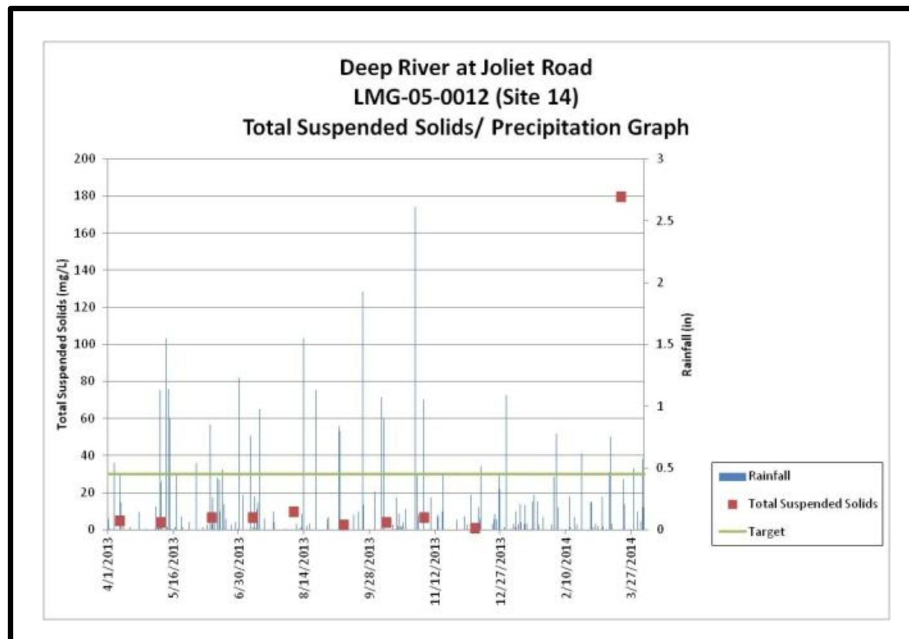
Upstream

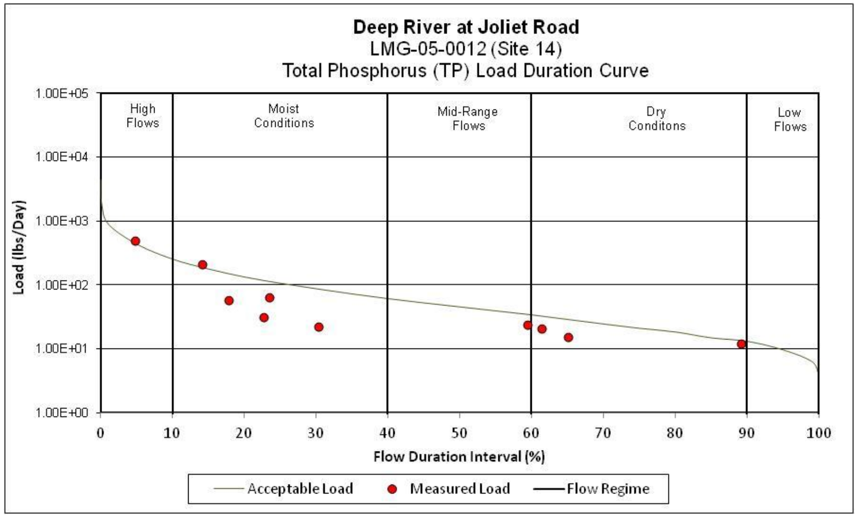
Downstream

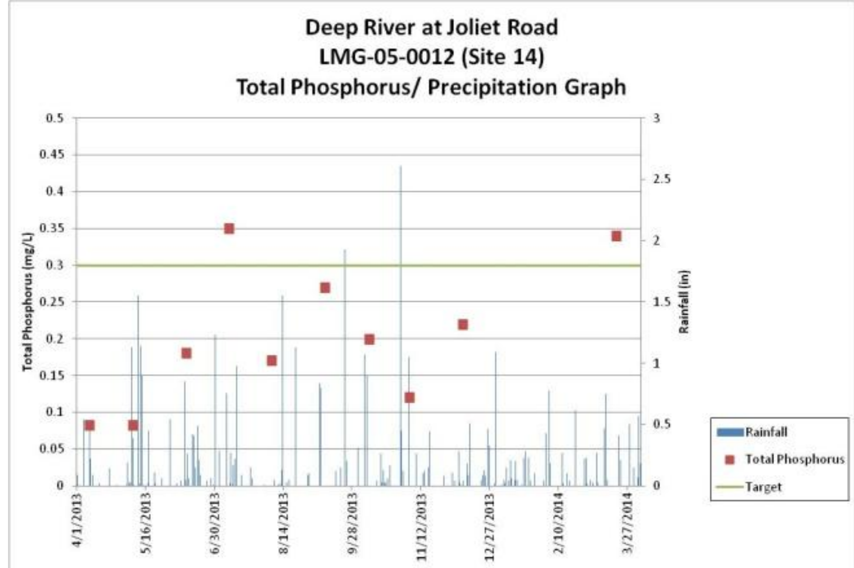

Deep River at Joliet Road
LMG-05-0012 (Site 14)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

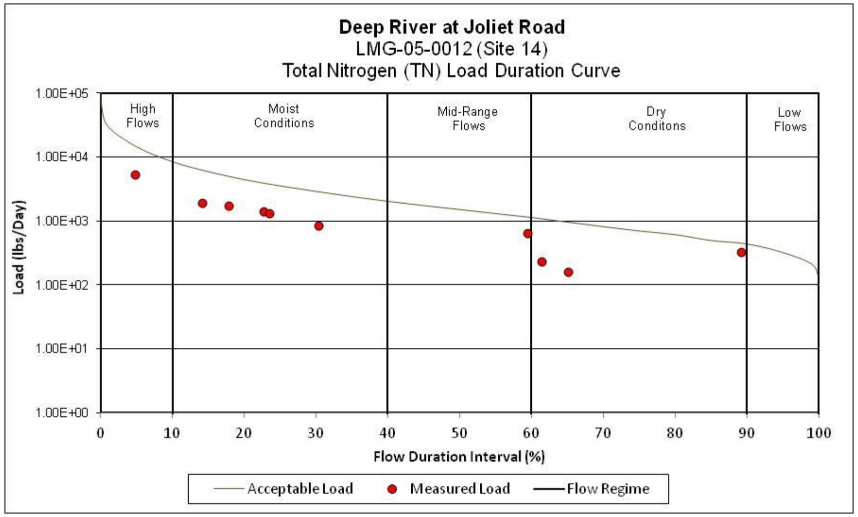

Deep River at Joliet Road
LMG-05-0012 (Site 14)
E. coli / Precipitation Graph
E.coli (MPN/100ml)
Rainfall (in)
Rainfall
E.coli
Target

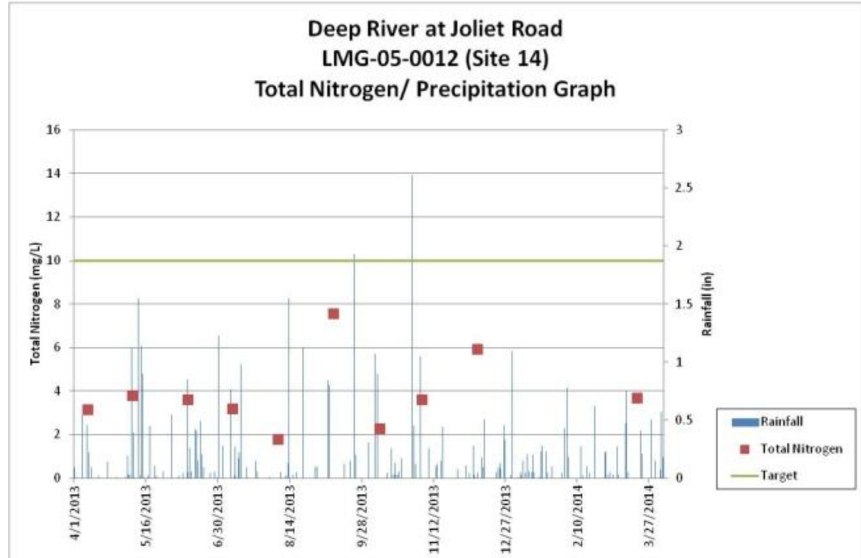

Deep River at Joliet Road
LMG-05-0012 (Site 14)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Deep River at Joliet Road
LMG-05-0012 (Site 14)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target


Deep River at Joliet Road
LMG-05-0012 (Site 14)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

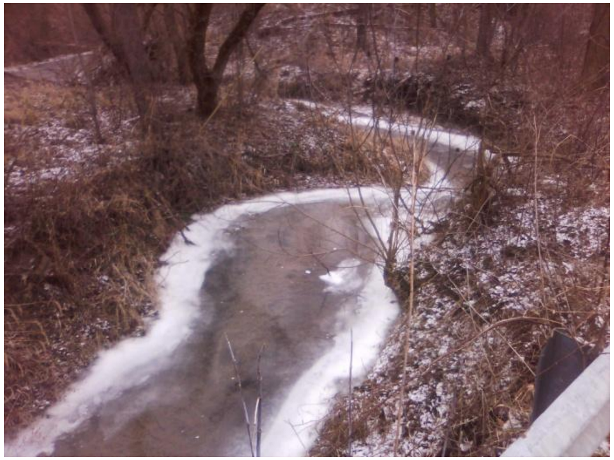

Deep River at Joliet Road
LMG-05-0012 (Site 14)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target


Deep River at Joliet Road
LMG-05-0012 (Site 14)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

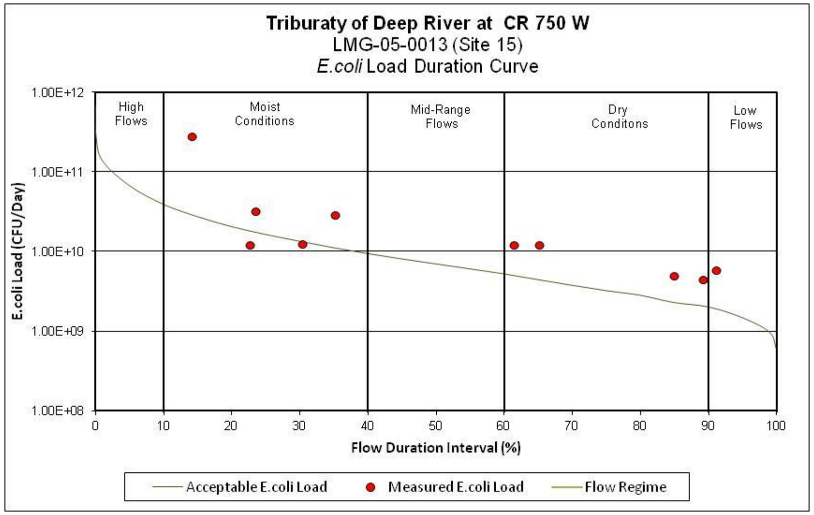

Deep River at Joliet Road
LMG-05-0012 (Site 14)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

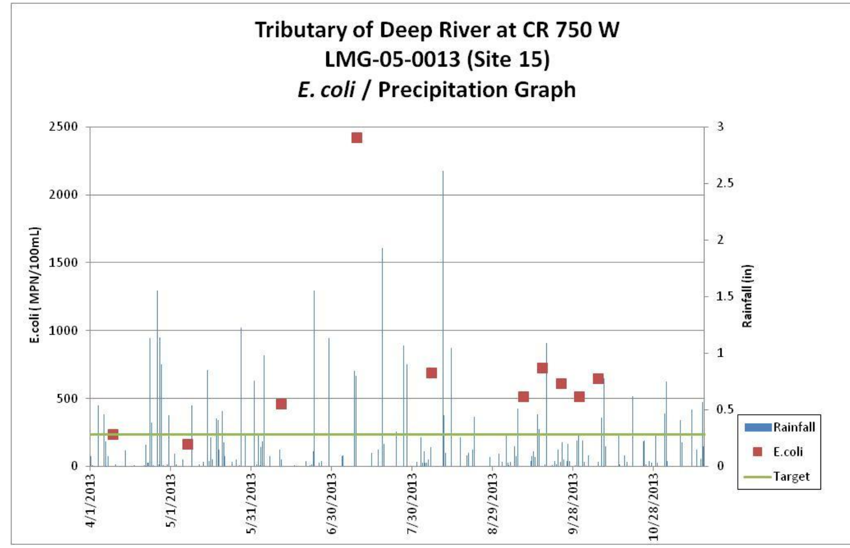
LMG-05-0013 (Site 15)
Tributary of Deep River

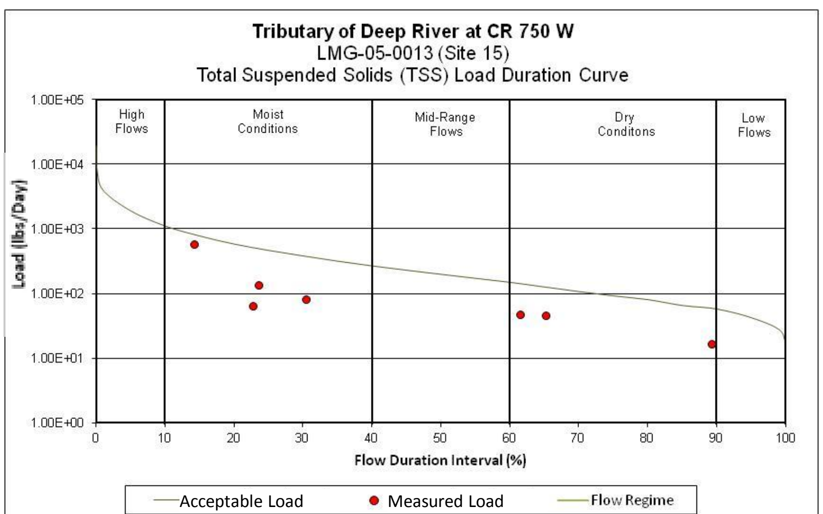
Upstream

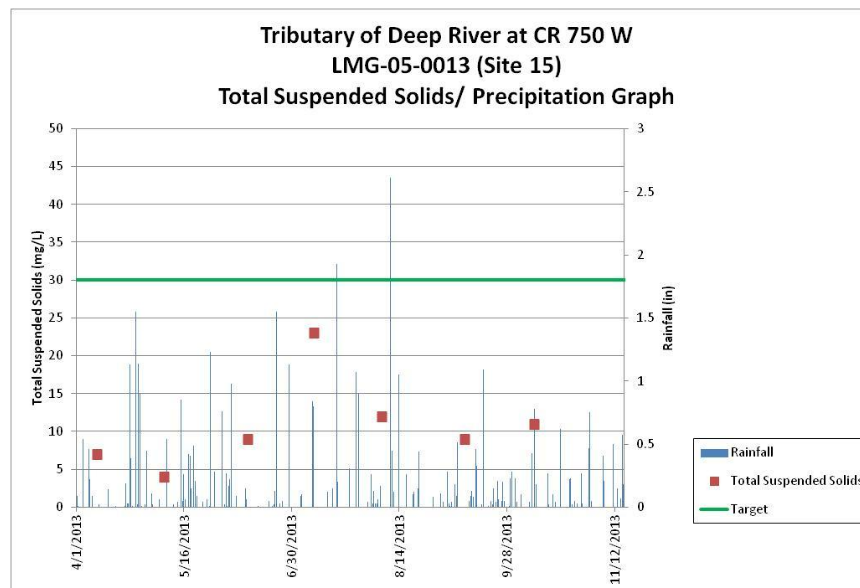


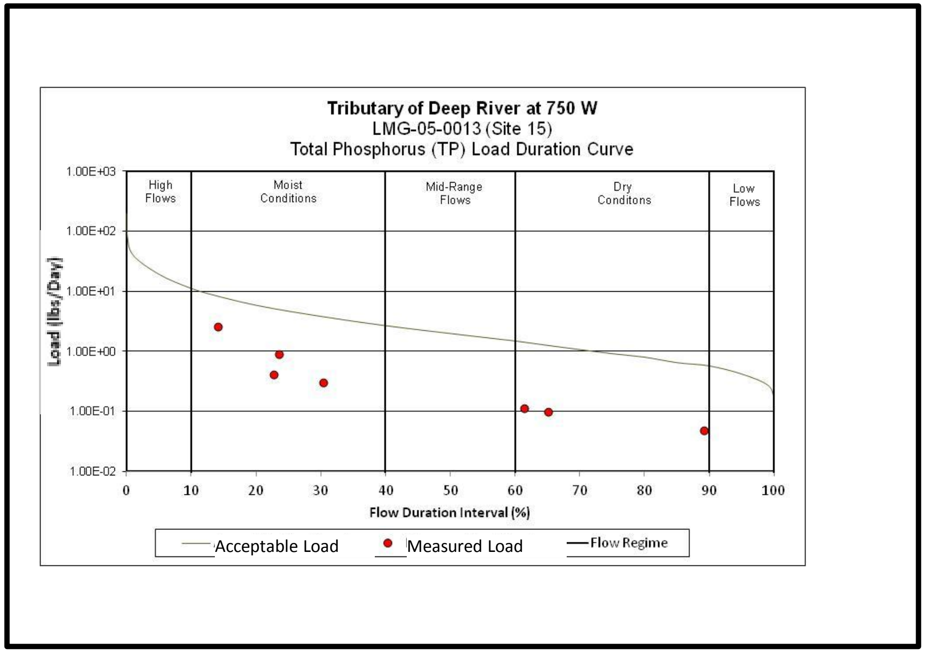
Downstream


Triburaty of Deep River at CR 750 W
LMG-05-0013 (Site 15)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
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 E.coli Load
Measured E.coli Load
Flow Regime

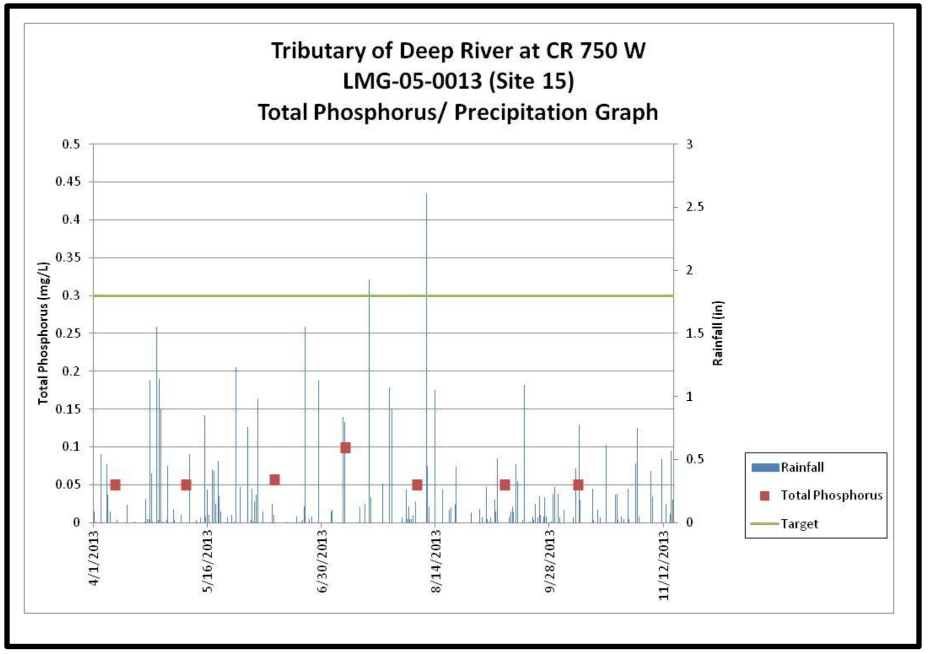

Tributary of Deep River at CR 750 W
LMG-05-0013 (Site 15)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
2500
2000
1500
1000
500
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/1/2013
5/31/2013
6/30/2013
7/30/2013
8/29/2013
9/28/2013
10/28/2013
Rainfall
E.coli
Target


Tributary of Deep River at CR 750 W
LMG-05-0013 (Site 15)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
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
Measured Load
Flow Regime

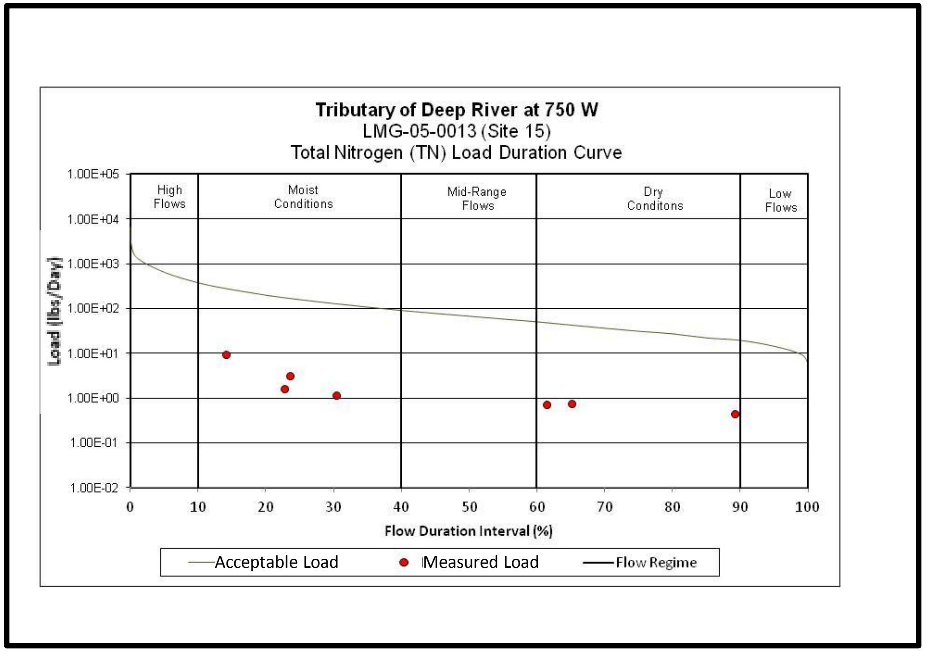

Tributary of Deep River at CR 750 W
LMG-05-0013 (Site 15)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
50
45
40
35
30
25
20
15
10
5
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Suspended Solids
Target



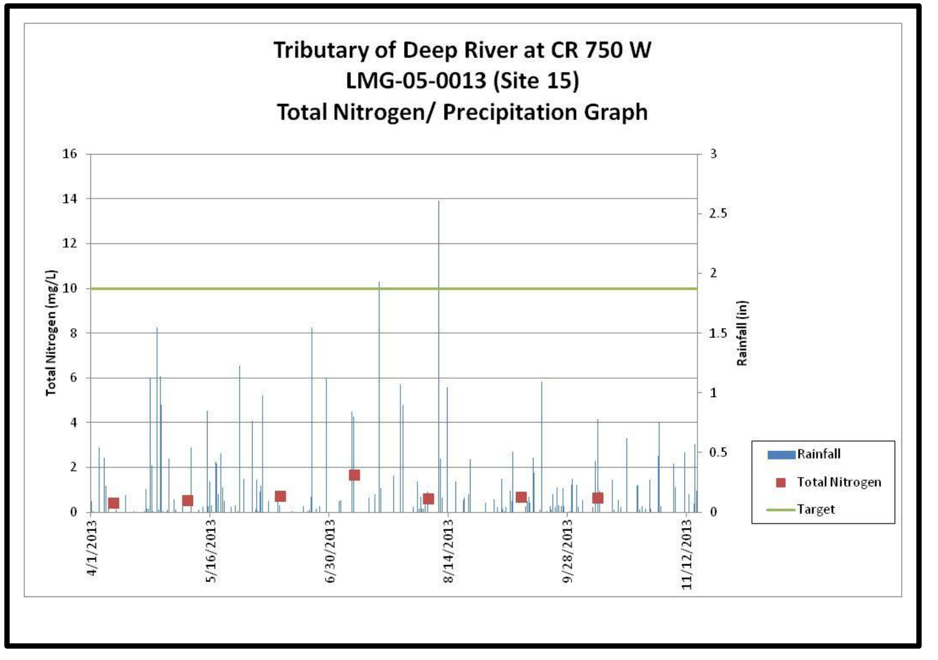
Tributary of Deep River at 750 W
LMG-05-0013 (Site 15)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



Tributary of Deep River at CR 750 W
LMG-05-0013 (Site 15)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target



Tributary of Deep River at 750 W
LMG-05-0013 (Site 15)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

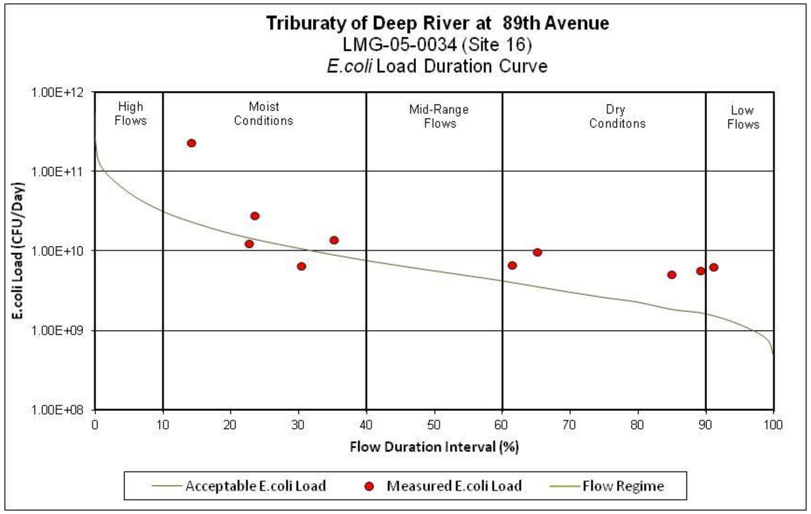


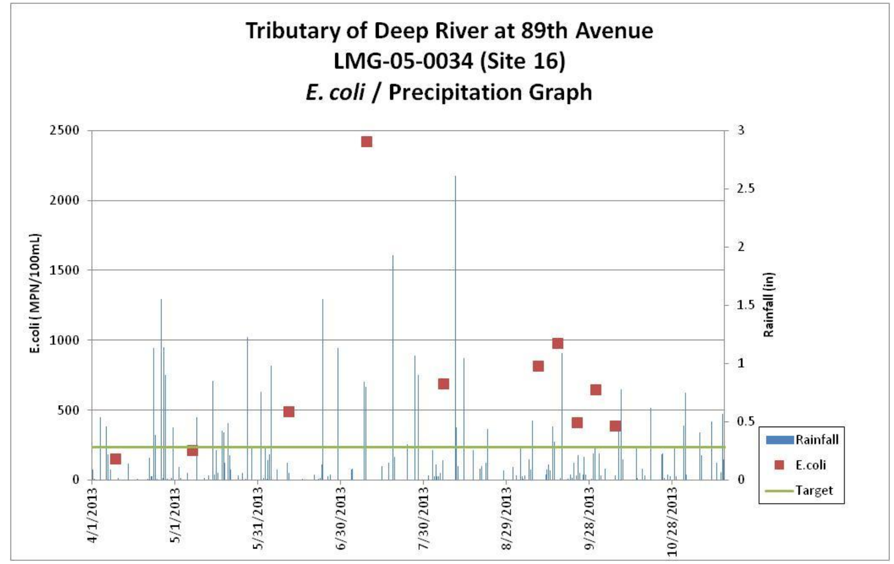
Tributary of Deep River at CR 750 W
LMG-05-0013 (Site 15)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

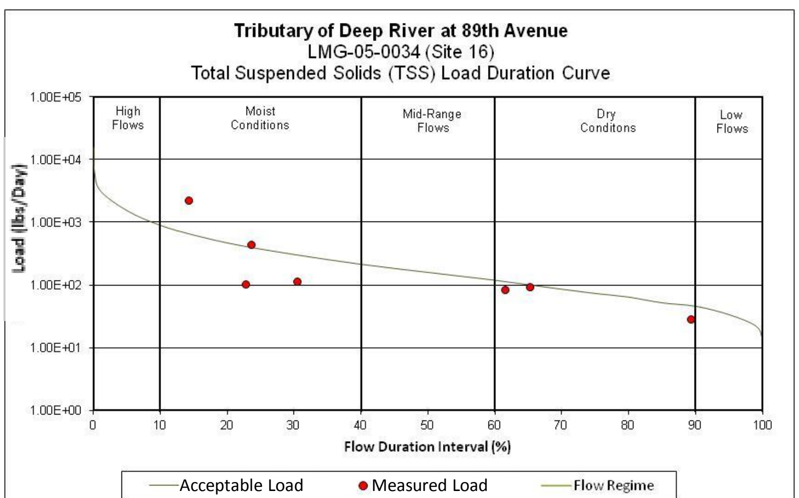
LMG-05-0034 (Site 16)
Tributary of Deep River

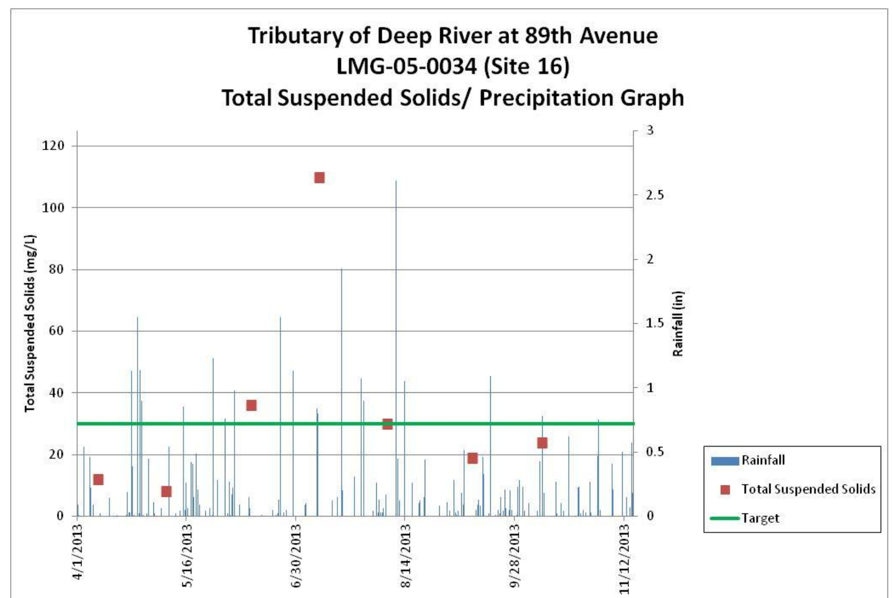
Upstream

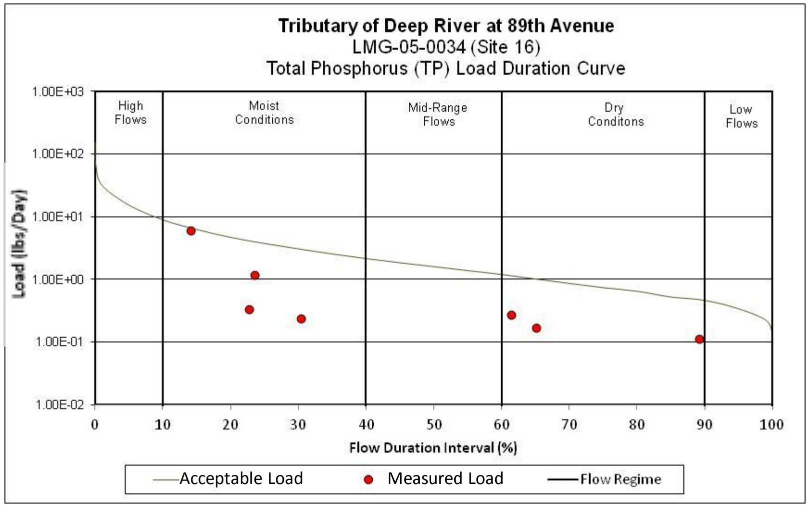
Downstream

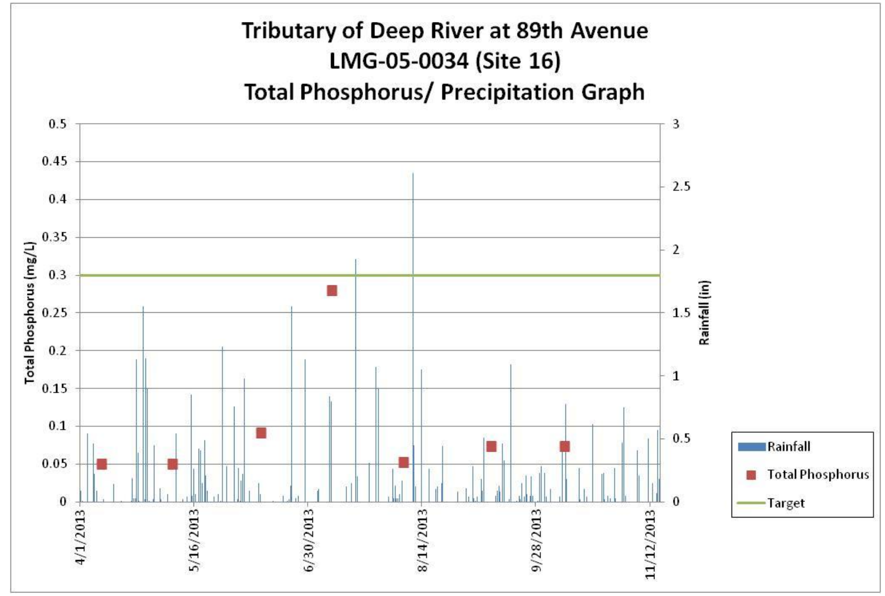

Triburaty of Deep River at 89th Avenue
LMG-05-0034 (Site 16)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

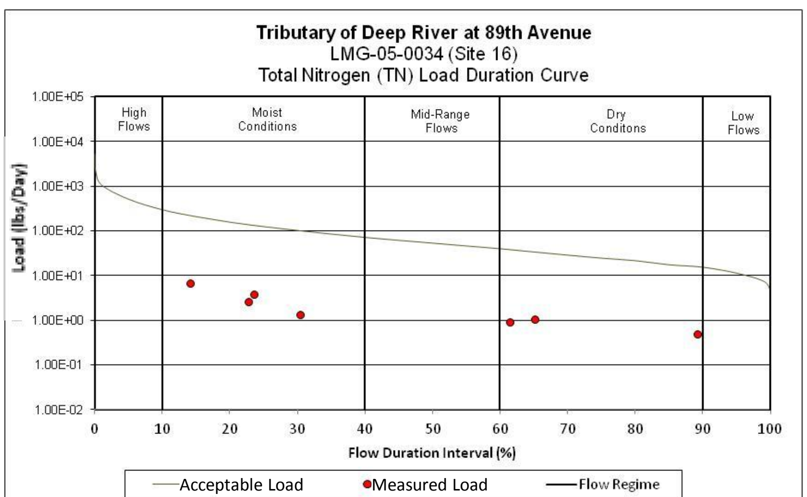

Tributary of Deep River at 89th Avenue
LMG-05-0034 (Site 16)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target

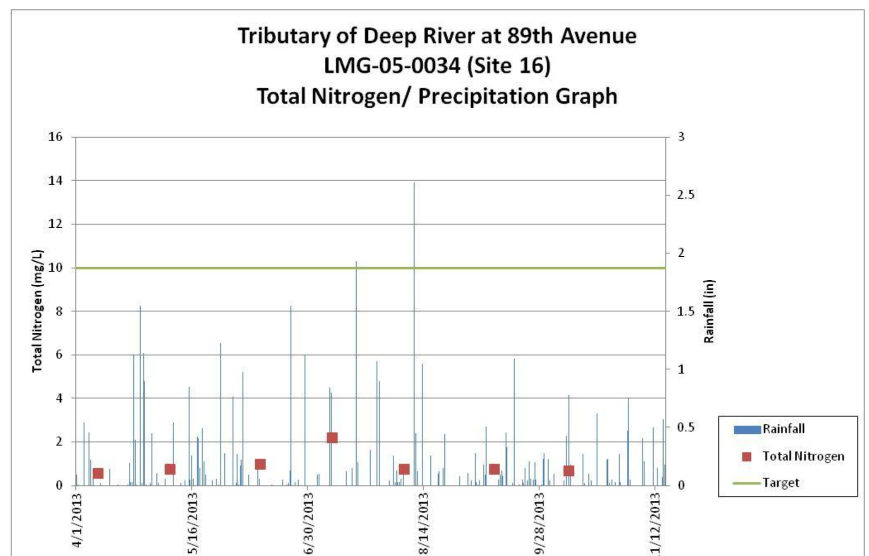

Tributary of Deep River at 89th Avenue
LMG-05-0034 (Site 16)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Tributary of Deep River at 89th Avenue
LMG-05-0034 (Site 16)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target


Tributary of Deep River at 89th Avenue
LMG-05-0034 (Site 16)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Tributary of Deep River at 89th Avenue
LMG-05-0034 (Site 16)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Phosphorus
Target

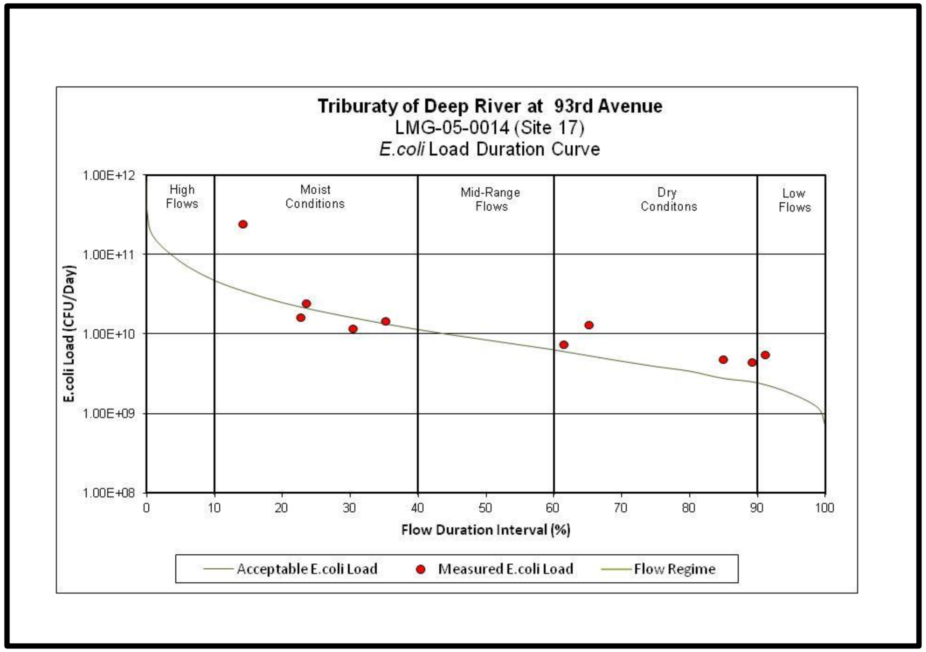

Tributary of Deep River at 89th Avenue
LMG-05-0034 (Site 16)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Tributary of Deep River at 89th Avenue
LMG-05-0034 (Site 16)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Nitrogen
Target

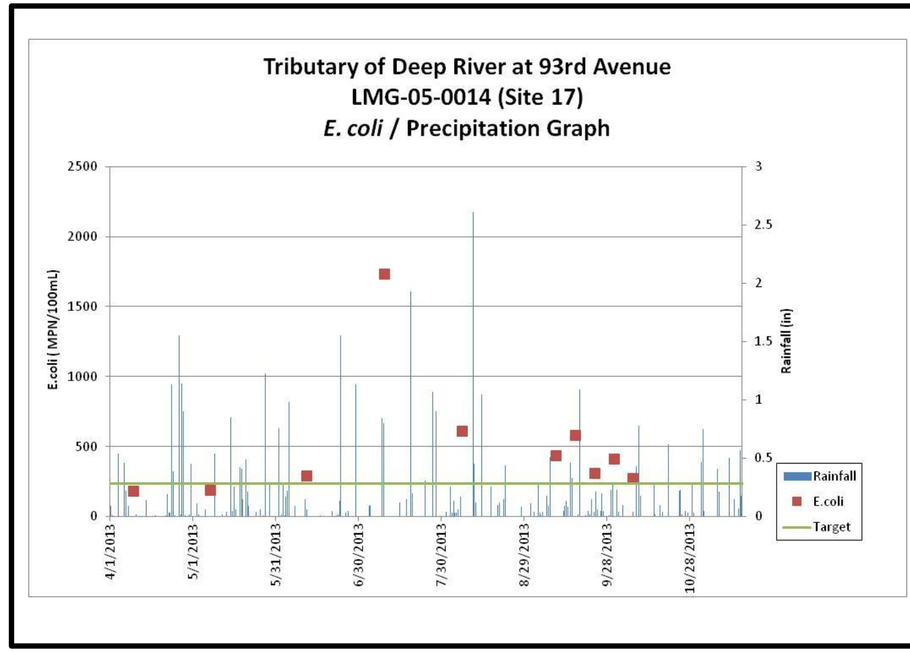
LMG-05-0014 (Site 17)
Tributary of Deep River

Upstream

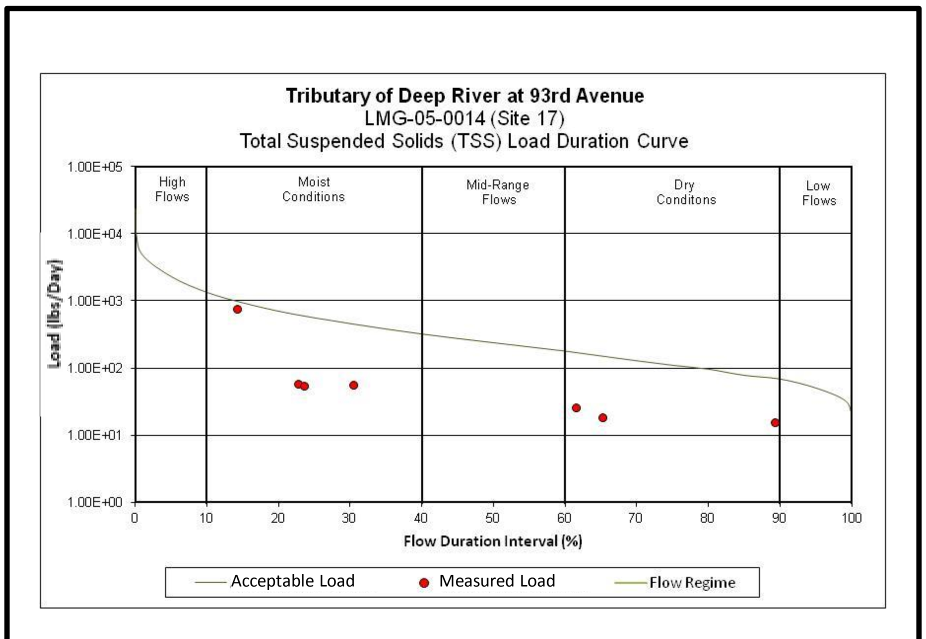
Downstream



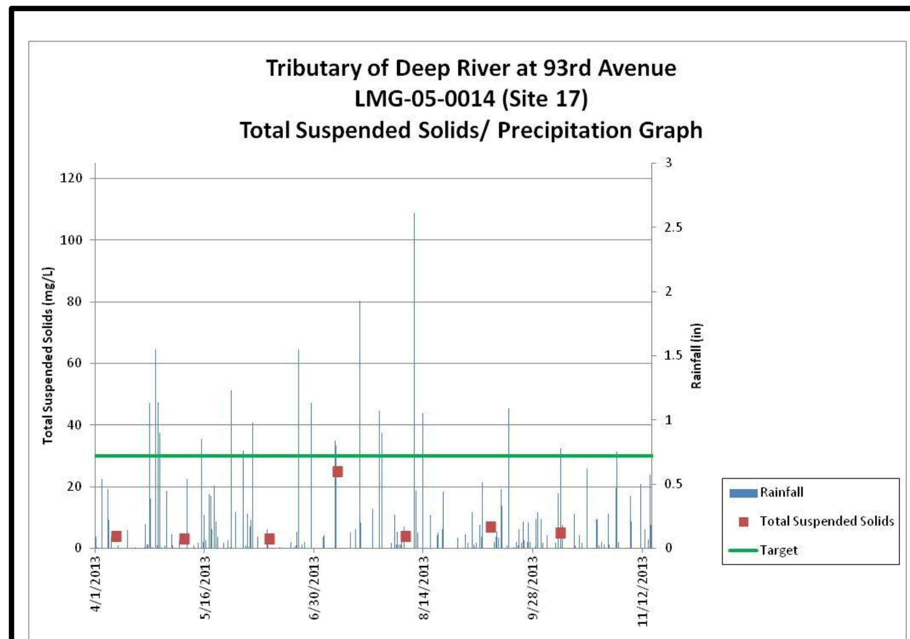
Tributaty of Deep River at 93rd Avenue
LMG-05-0014 (Site 17)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime



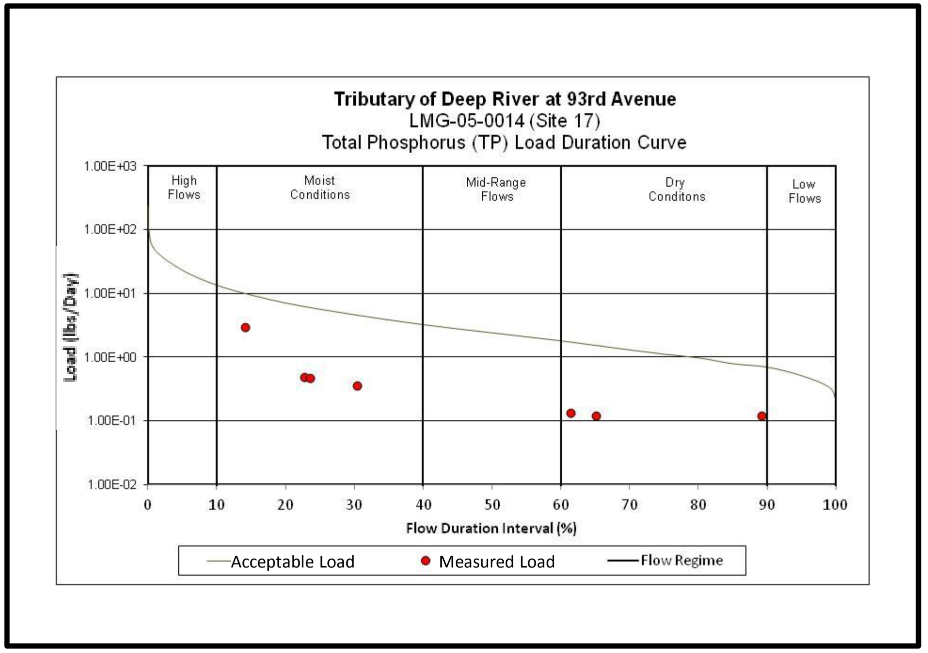
Tributary of Deep River at 93rd Avenue
LMG-05-0014 (Site 17)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target



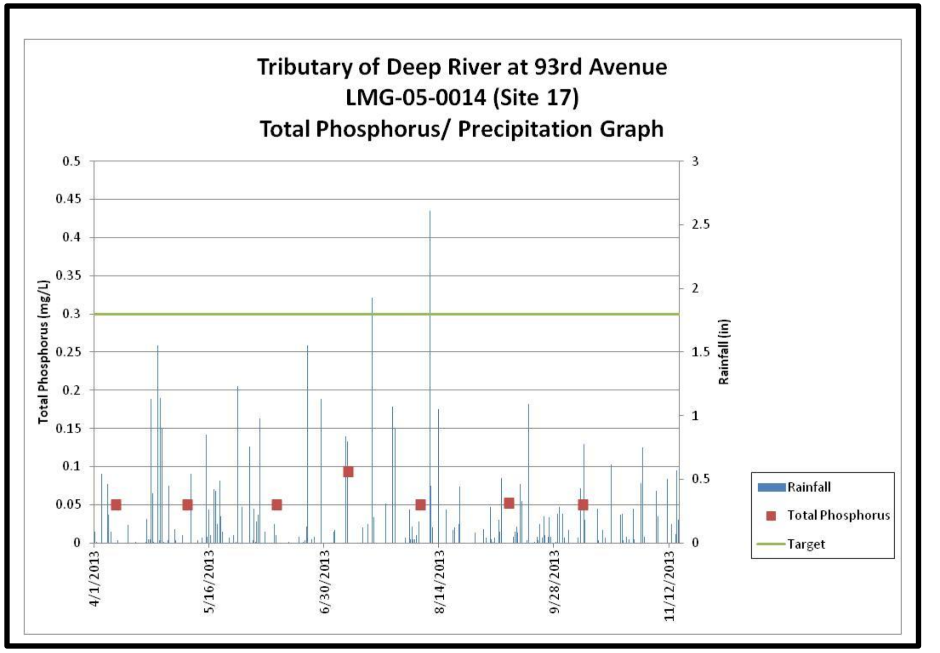
Tributary of Deep River at 93rd Avenue
LMG-05-0014 (Site 17)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



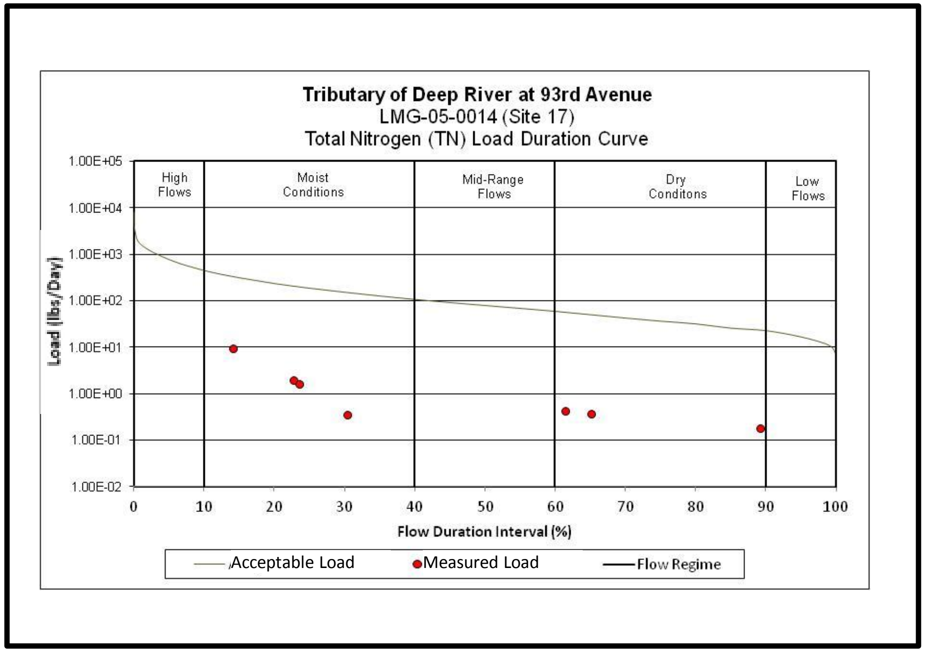
Tributary of Deep River at 93rd Avenue
LMG-05-0014 (Site 17)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target



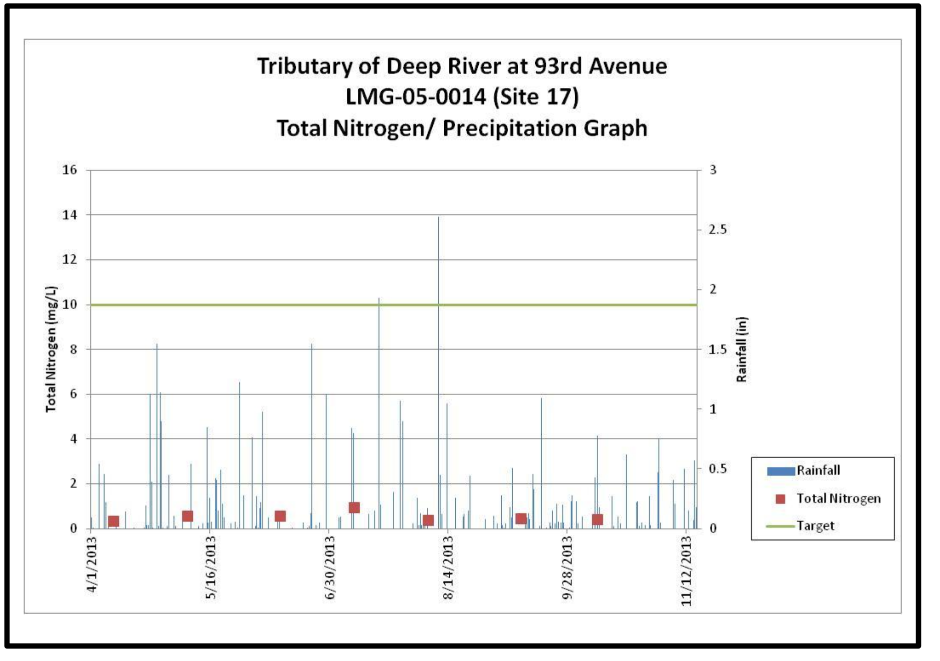
Tributary of Deep River at 93rd Avenue
LMG-05-0014 (Site 17)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



Tributary of Deep River at 93rd Avenue
LMG-05-0014 (Site 17)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target



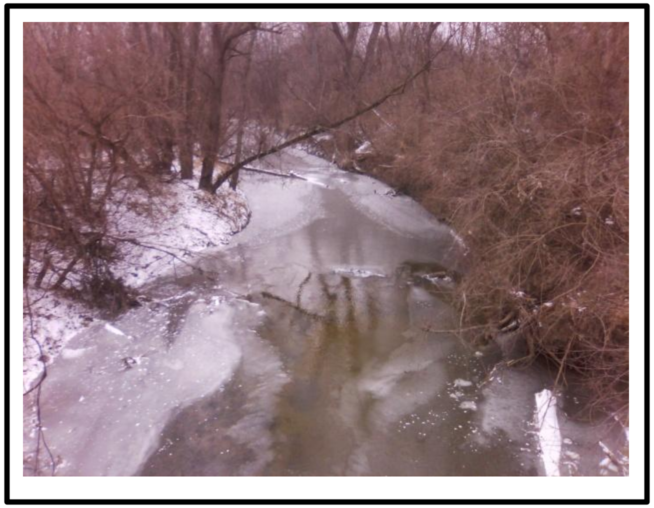
Tributary of Deep River at 93rd Avenue
LMG-05-0014 (Site 17)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



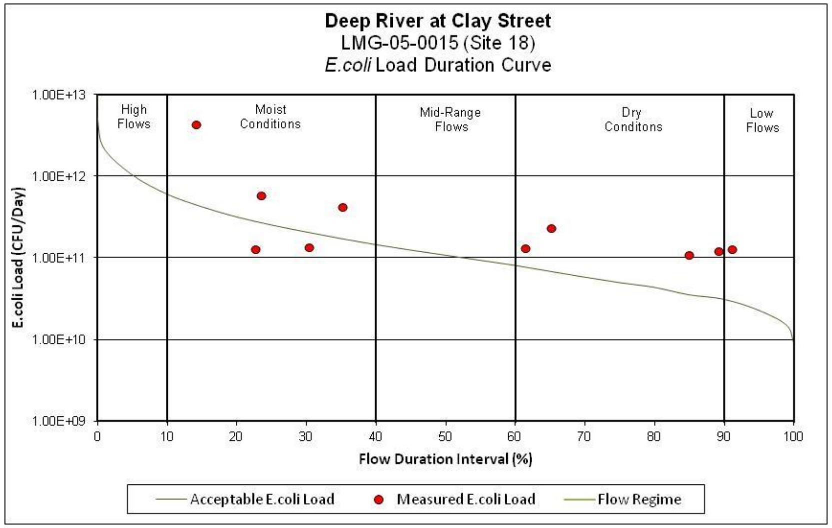
Tributary of Deep River at 93rd Avenue
LMG-05-0014 (Site 17)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

LMG-05-0015 (Site 18)
Tributary of Deep River

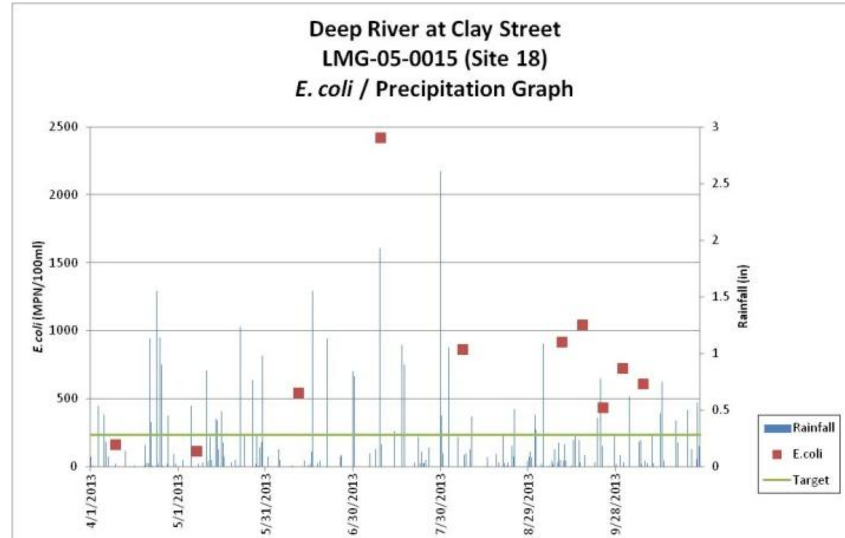
Upstream



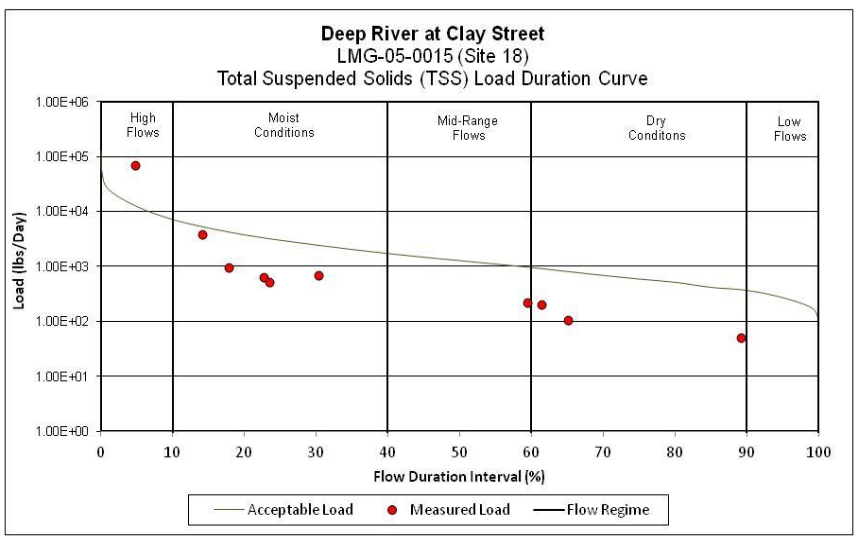
Downstream



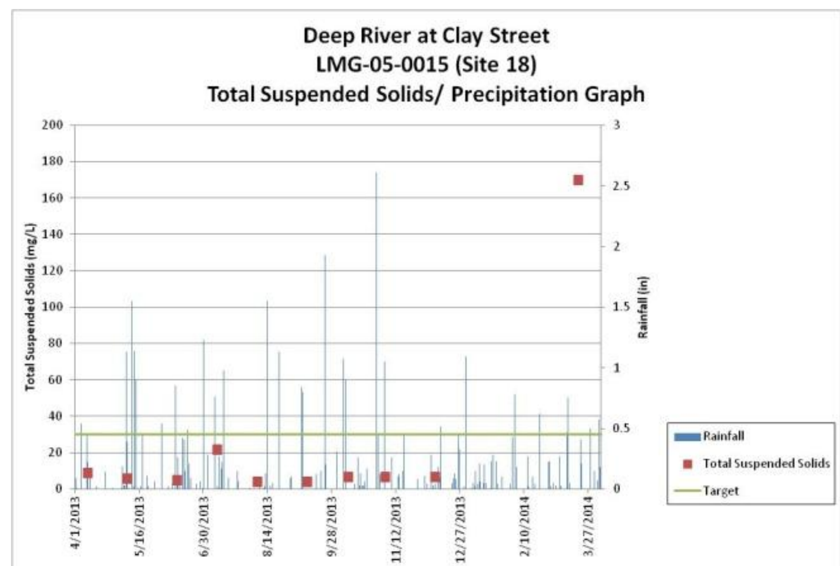
Deep River at Clay Street
LMG-05-0015 (Site 18)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime



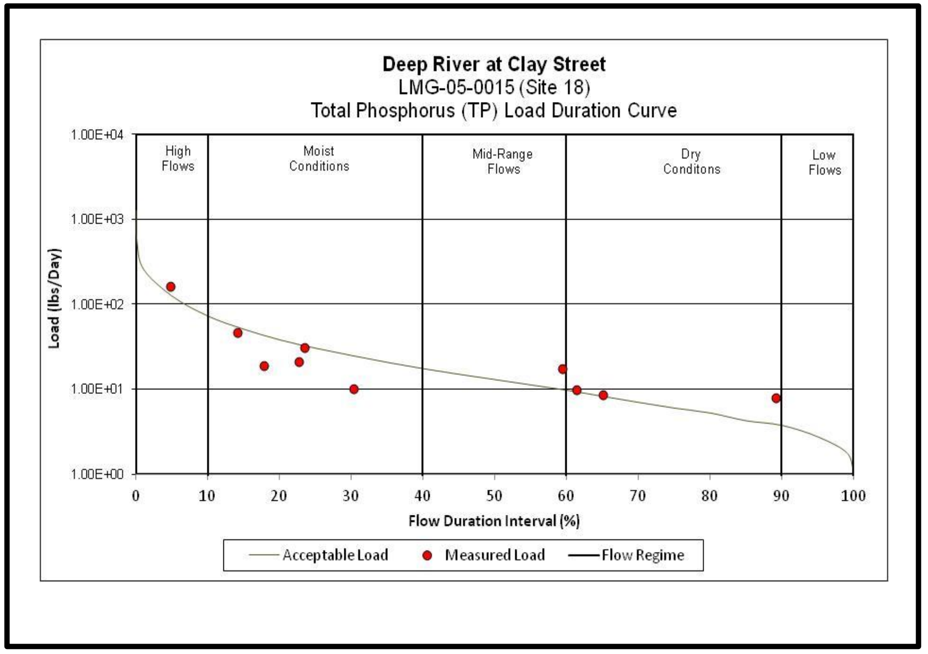
Deep River at Clay Street
LMG-05-0015 (Site 18)
E. coli / Precipitation Graph
E. coli (MPN/100ml)
2500
2000
1500
1000
500
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/1/2013
5/31/2013
6/30/2013
7/30/2013
8/29/2013
9/28/2013
Rainfall
E.coli
Target

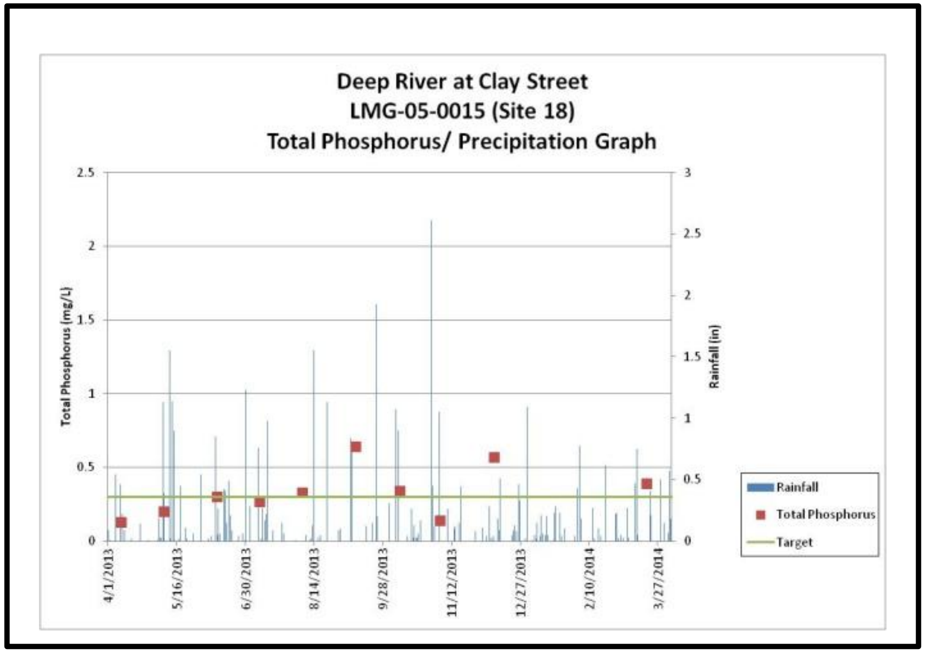


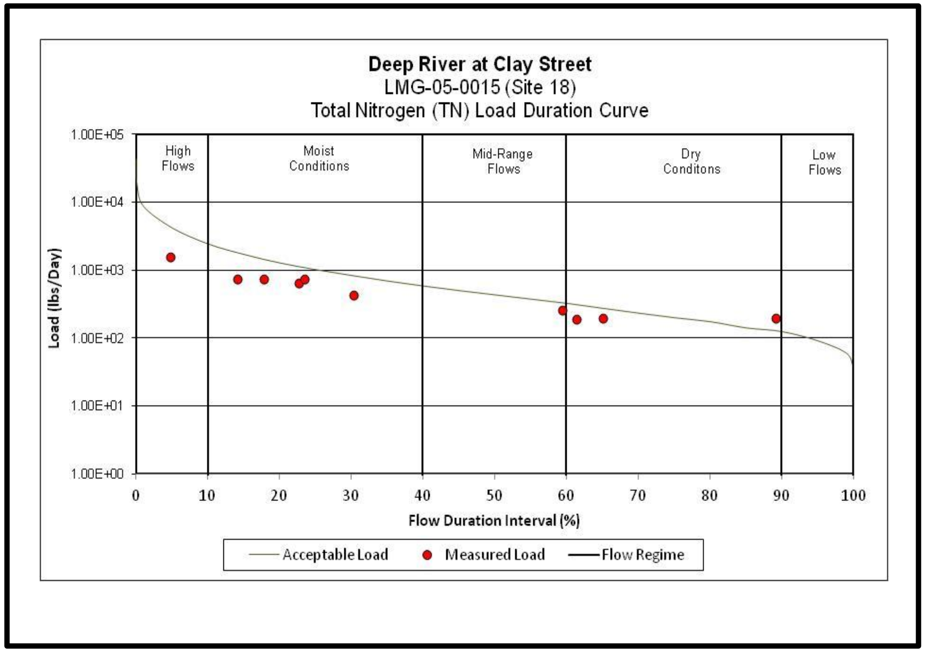
Deep River at Clay Street
LMG-05-0015 (Site 18)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

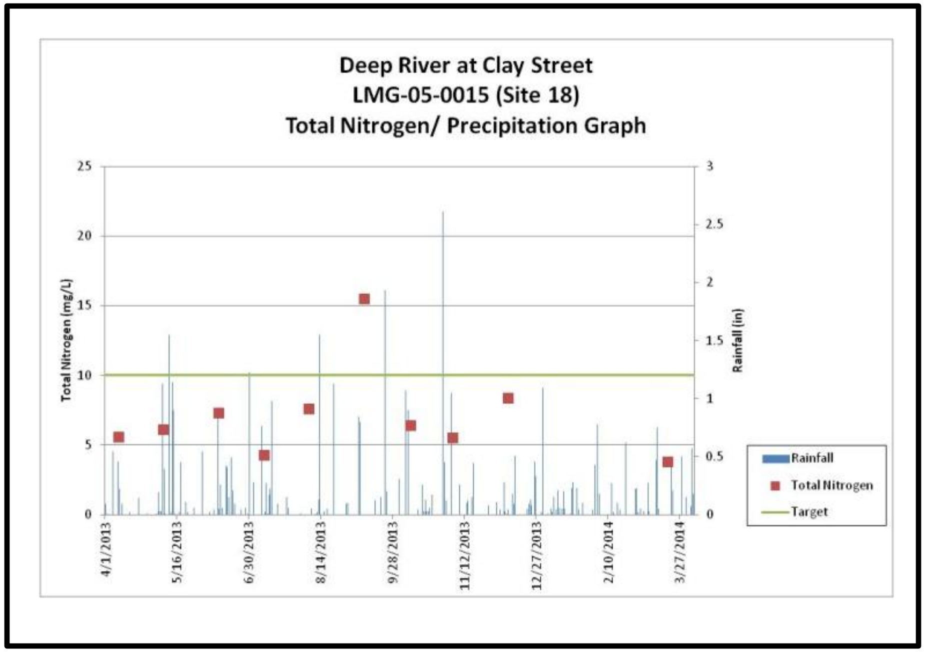


Deep River at Clay Street
LMG-05-0015 (Site 18)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
200
180
160
140
120
100
80
60
40
20
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
12/27/2013
2/10/2014
3/27/2014
Rainfall
Total Suspended Solids
Target


Deep River at Clay Street
LMG-05-0015 (Site 18)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Deep River at Clay Street
LMG-05-0015 (Site 18)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target

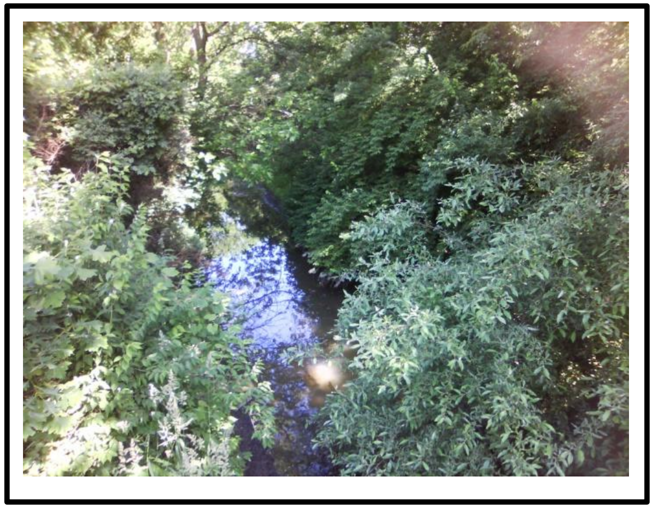

Deep River at Clay Street
LMG-05-0015 (Site 18)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

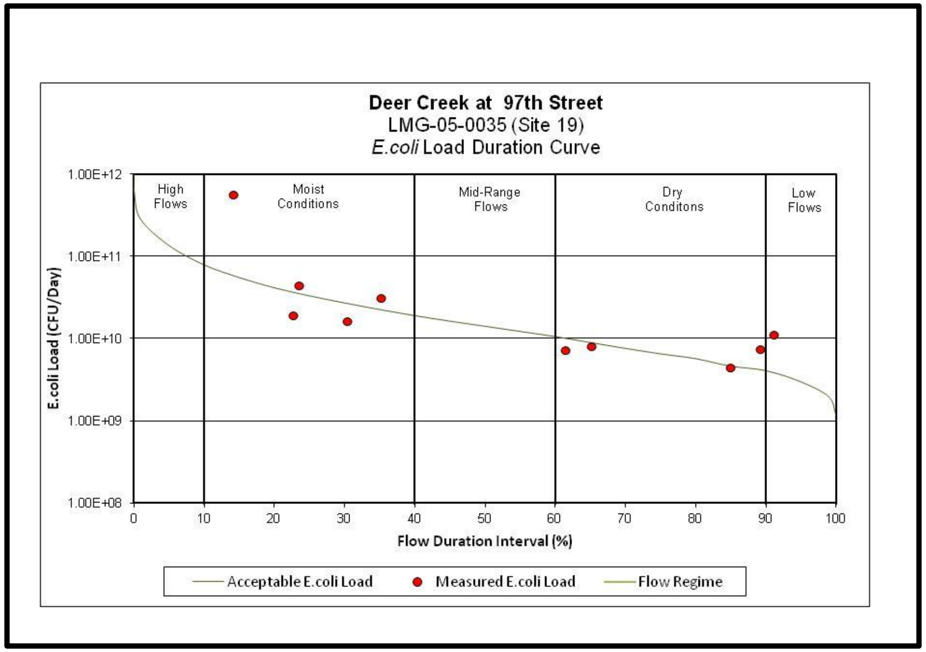

Deep River at Clay Street
LMG-05-0015 (Site 18)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

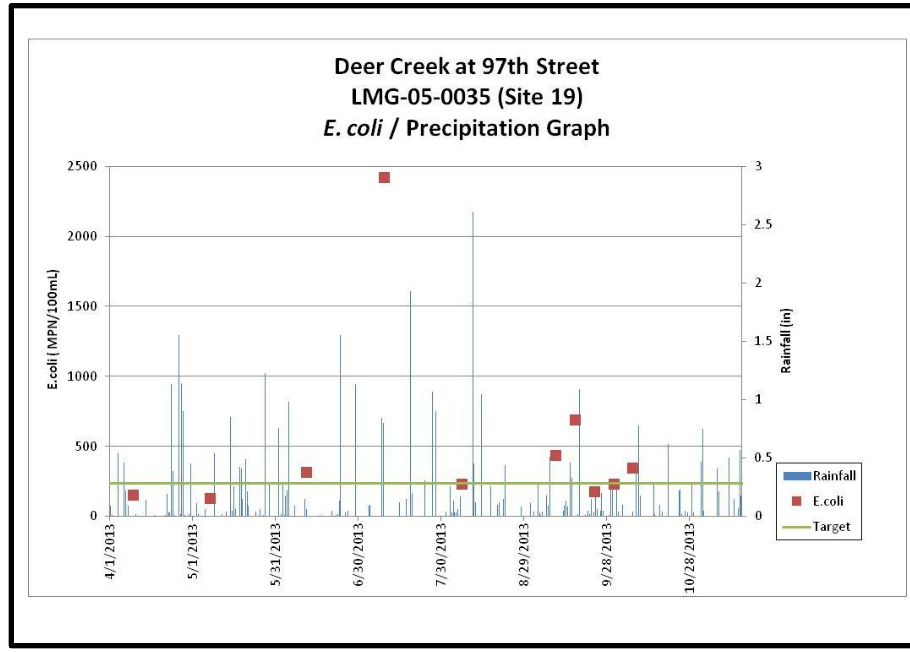
LMG-05-0035 (Site 19)
Deer Creek

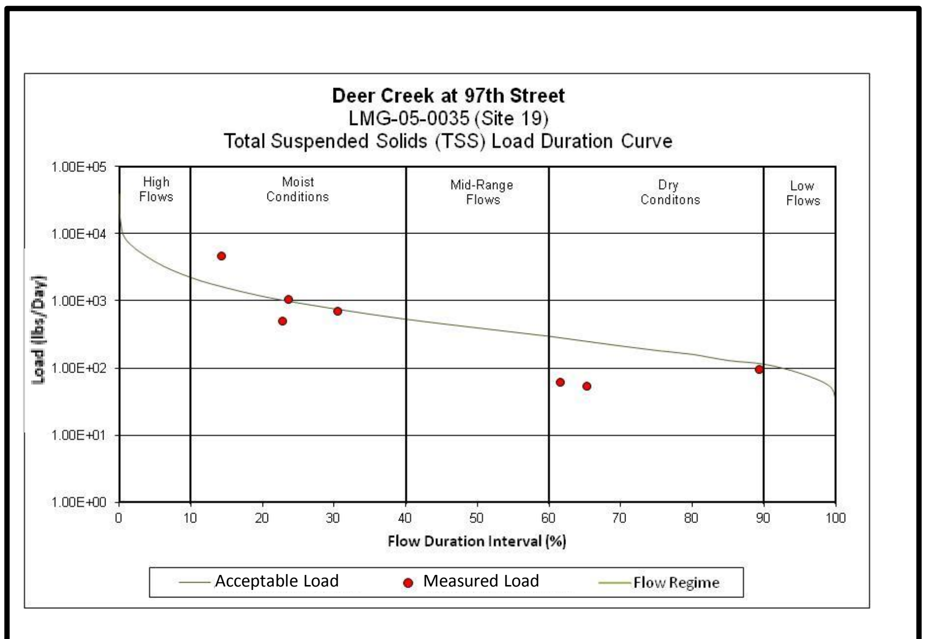
Upstream

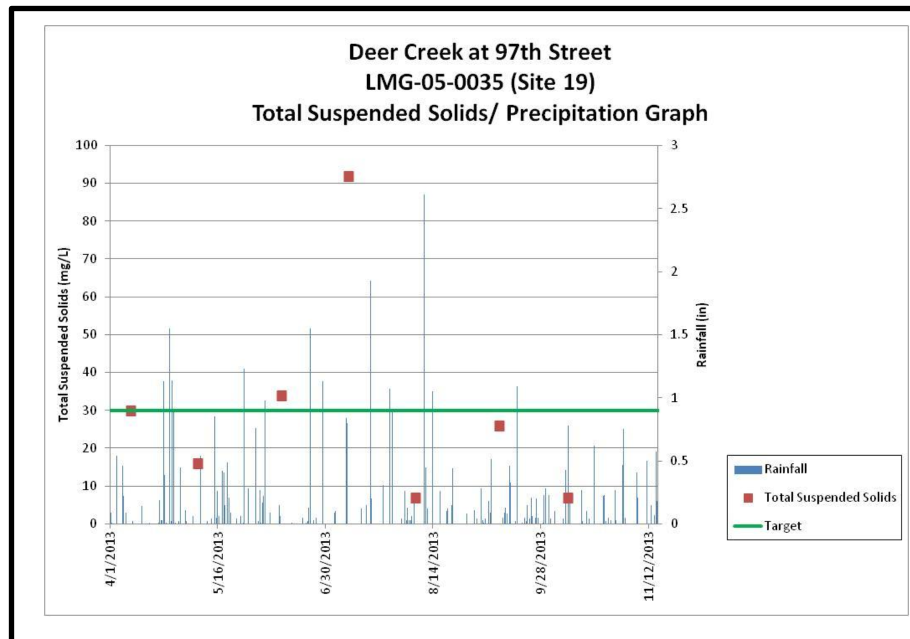
Downstream

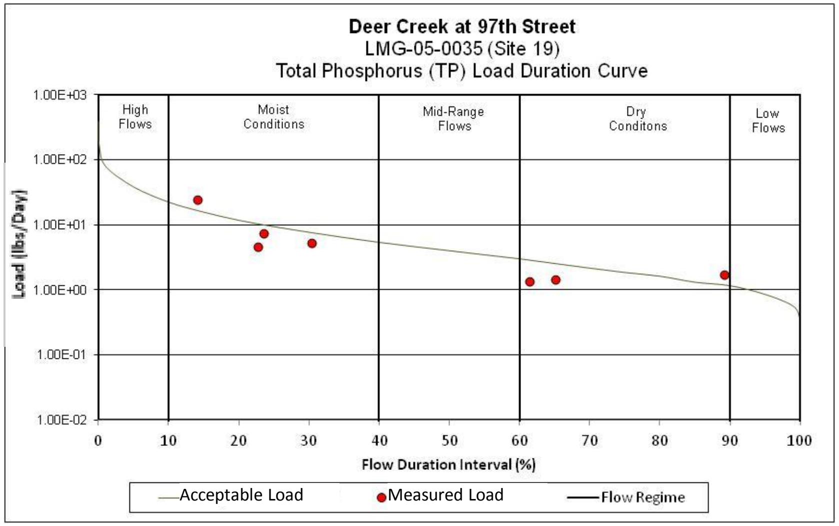


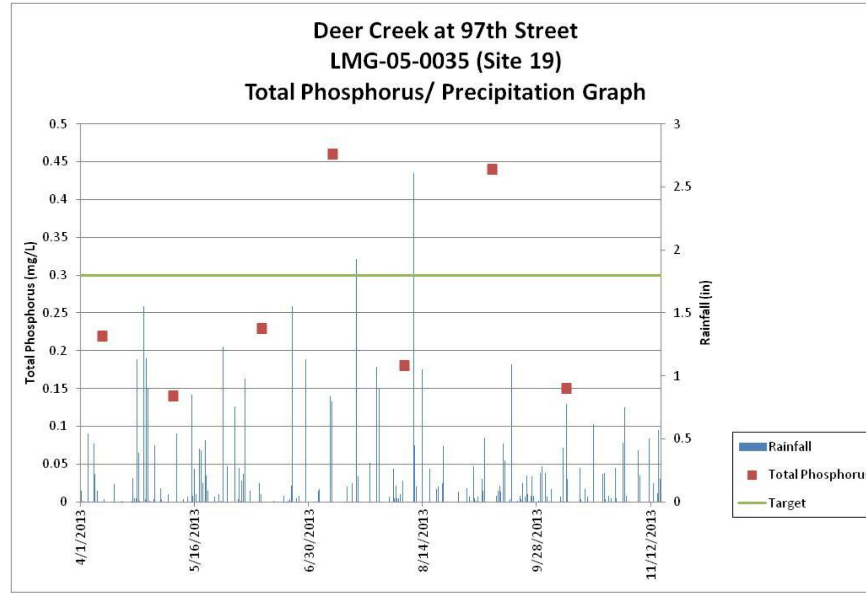

Deer Creek at 97th Street
LMG-05-0035 (Site 19)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

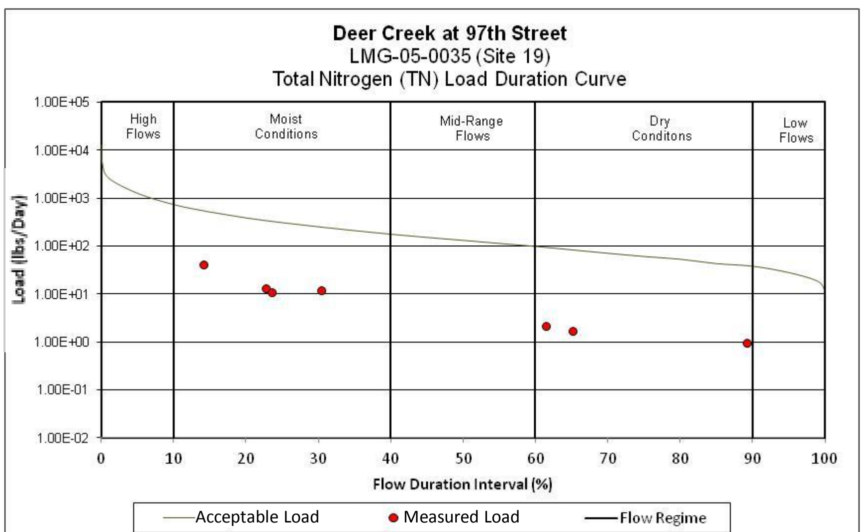

Deer Creek at 97th Street
LMG-05-0035 (Site 19)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
2500
2000
1500
1000
500
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/1/2013
5/31/2013
6/30/2013
7/30/2013
8/29/2013
9/28/2013
10/28/2013
Rainfall
E.coli
Target

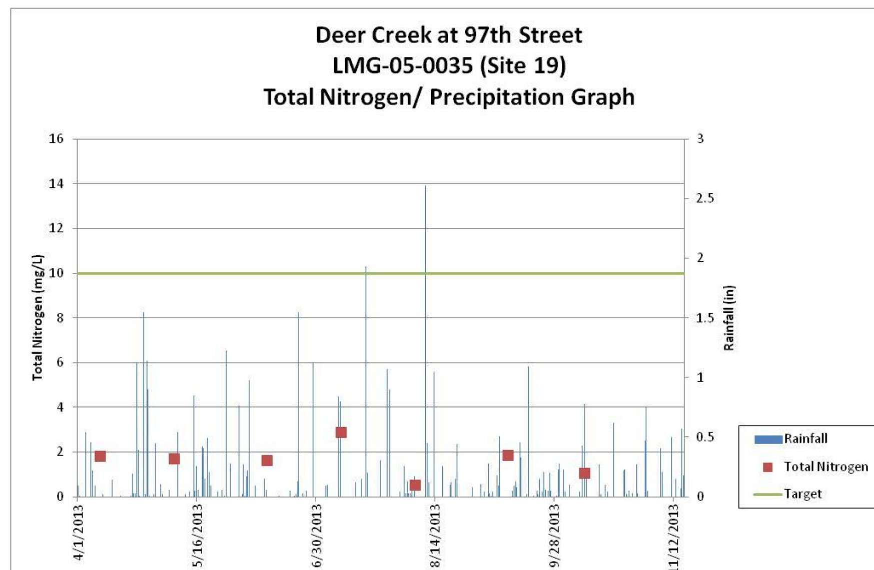

Deer Creek at 97th Street
LMG-05-0035 (Site 19)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Deer Creek at 97th Street
LMG-05-0035 (Site 19)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
100
90
80
70
60
50
40
30
20
10
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Suspended Solids
Target


Deer Creek at 97th Street
LMG-05-0035 (Site 19)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Deer Creek at 97th Street
LMG-05-0035 (Site 19)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target

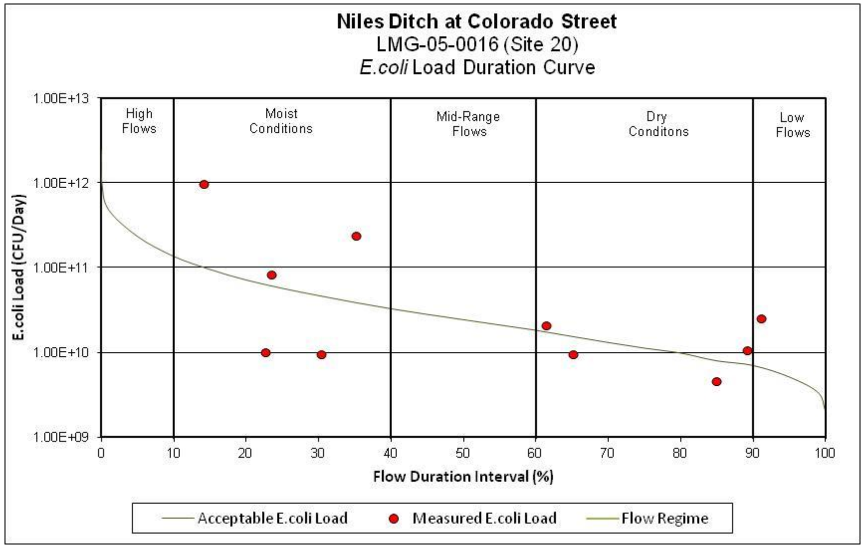

Deer Creek at 97th Street
LMG-05-0035 (Site 19)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

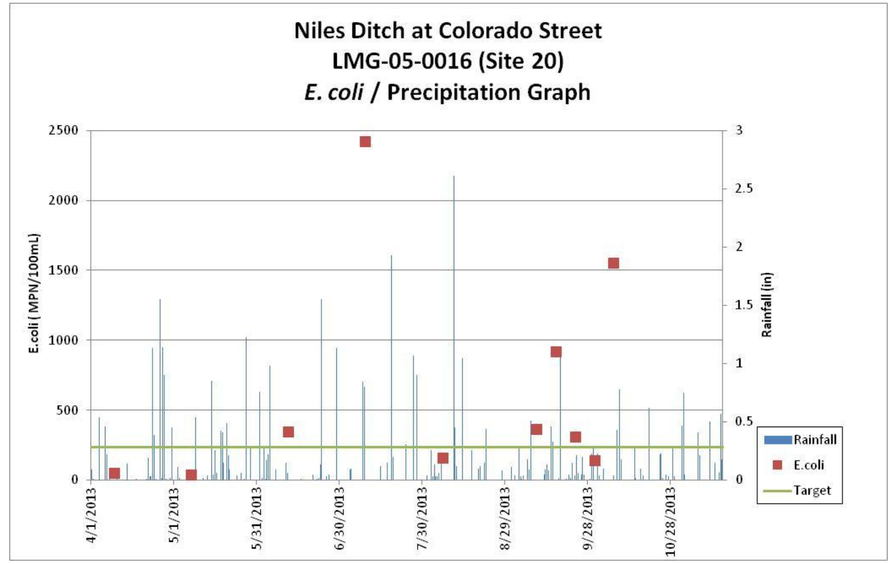

Deer Creek at 97th Street
LMG-05-0035 (Site 19)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

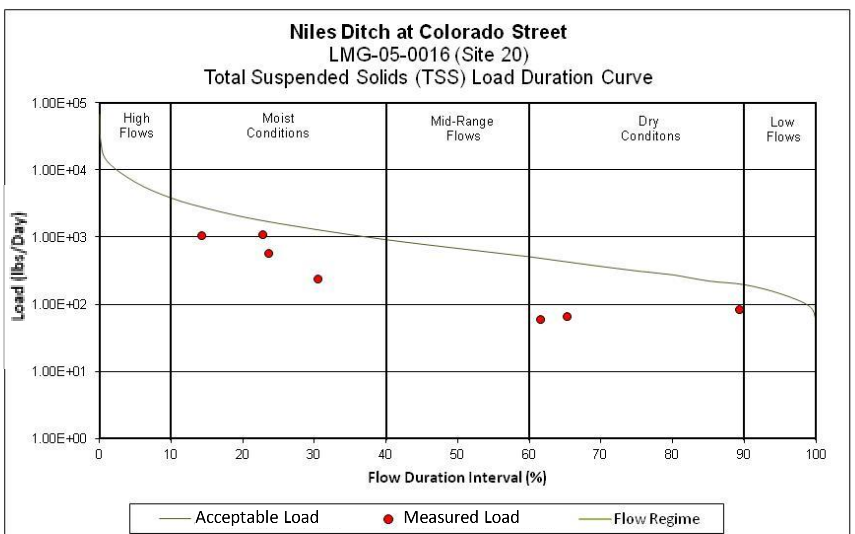
LMG-05-0016 (Site 20)
Niles Ditch

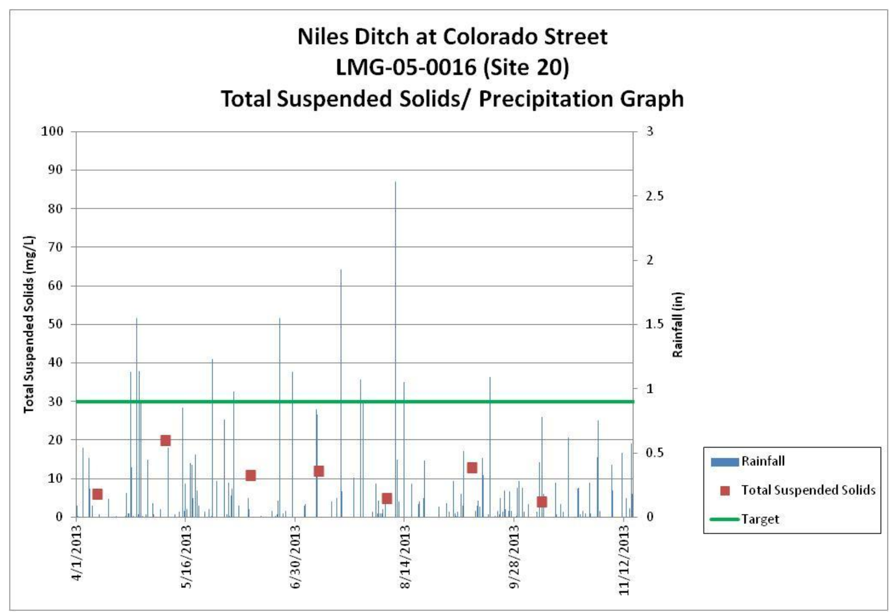
Upstream

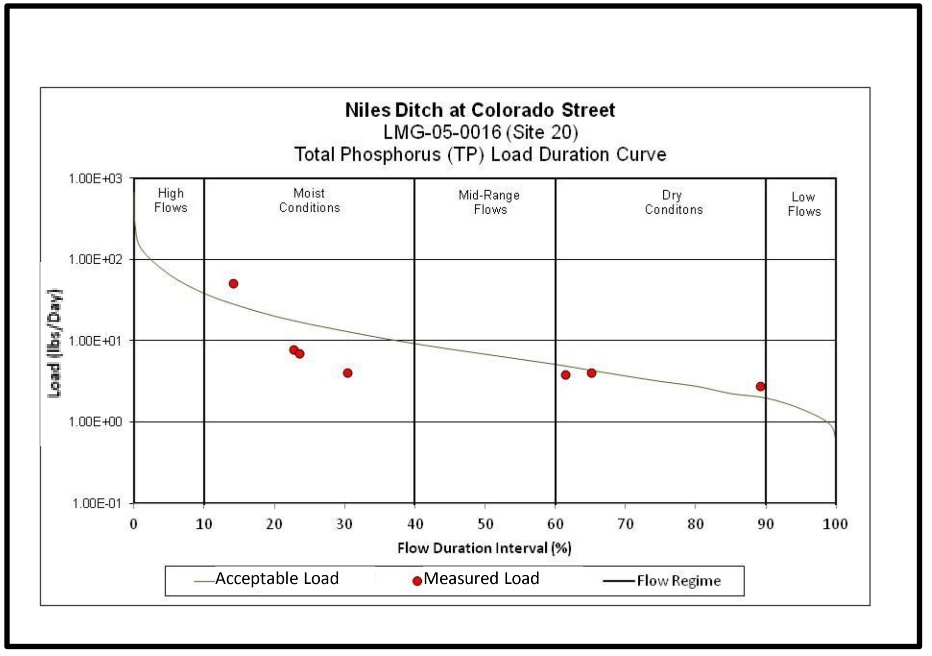
Downstream

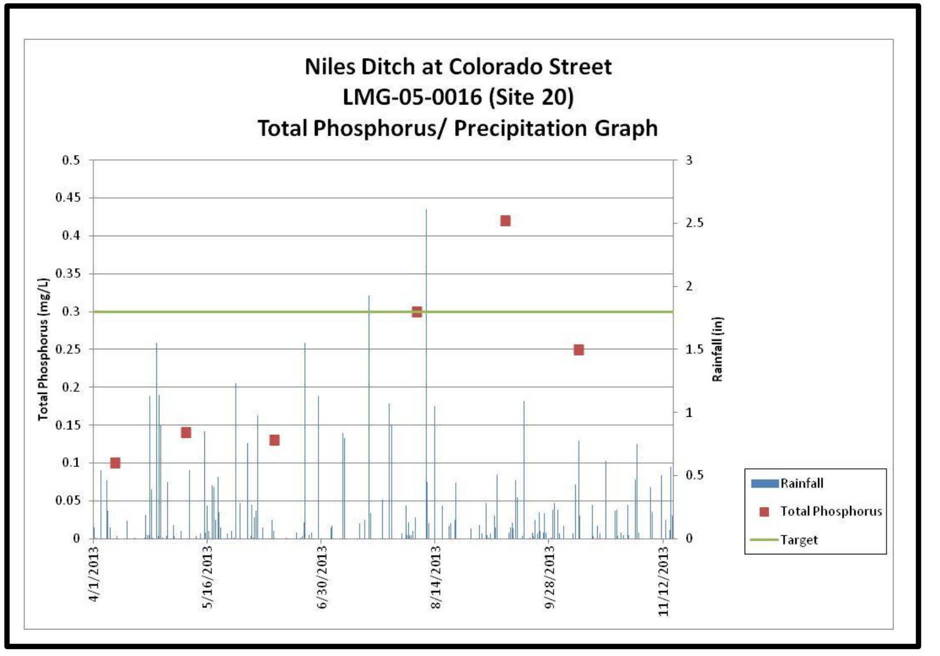

Niles Ditch at Colorado Street
LMG-05-0016 (Site 20)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

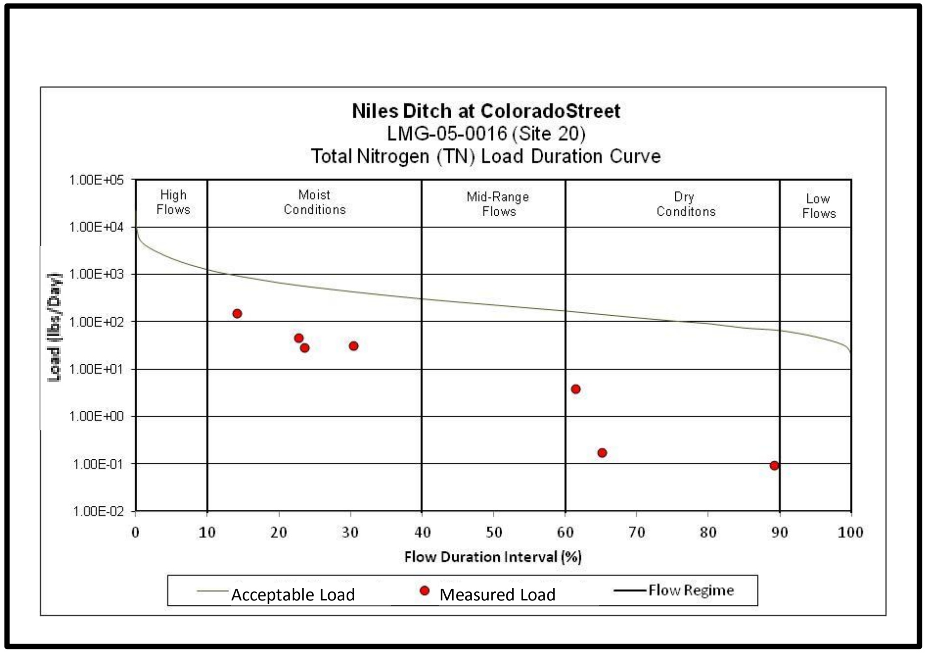

Niles Ditch at Colorado Street
LMG-05-0016 (Site 20)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target

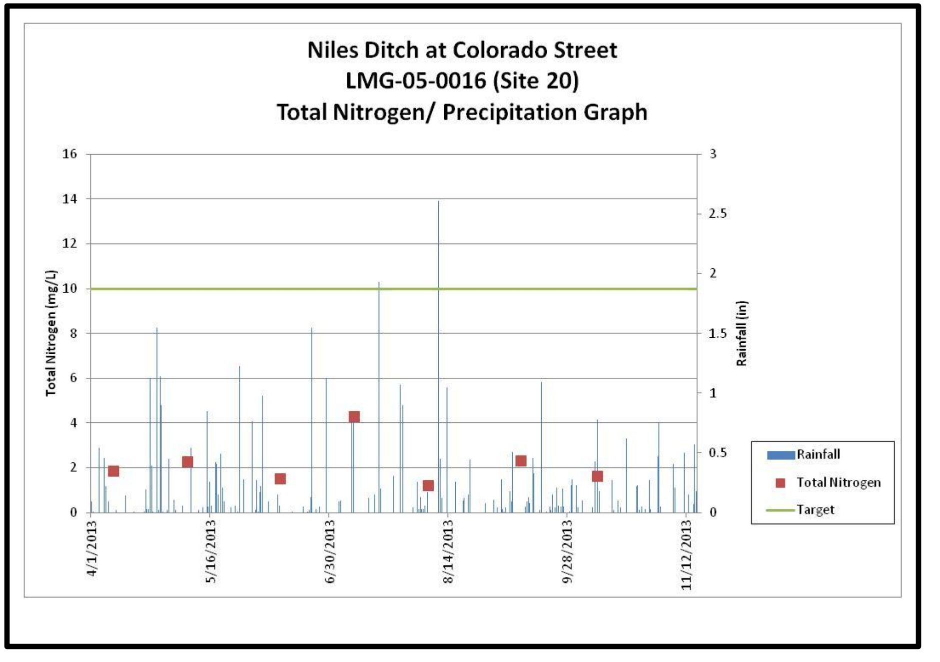

Niles Ditch at Colorado Street
LMG-05-0016 (Site 20)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
Measured Load
Flow Regime


Niles Ditch at Colorado Street
LMG-05-0016 (Site 20)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target


Niles Ditch at Colorado Street
LMG-05-0016 (Site 20)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

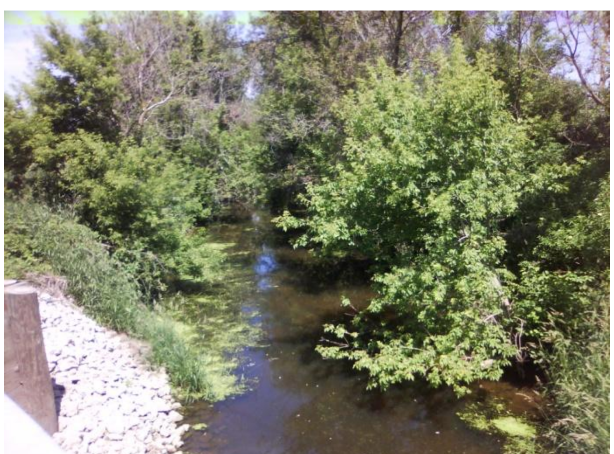

Niles Ditch at Colorado Street
LMG-05-0016 (Site 20)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target


Niles Ditch at ColoradoStreet
LMG-05-0016 (Site 20)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

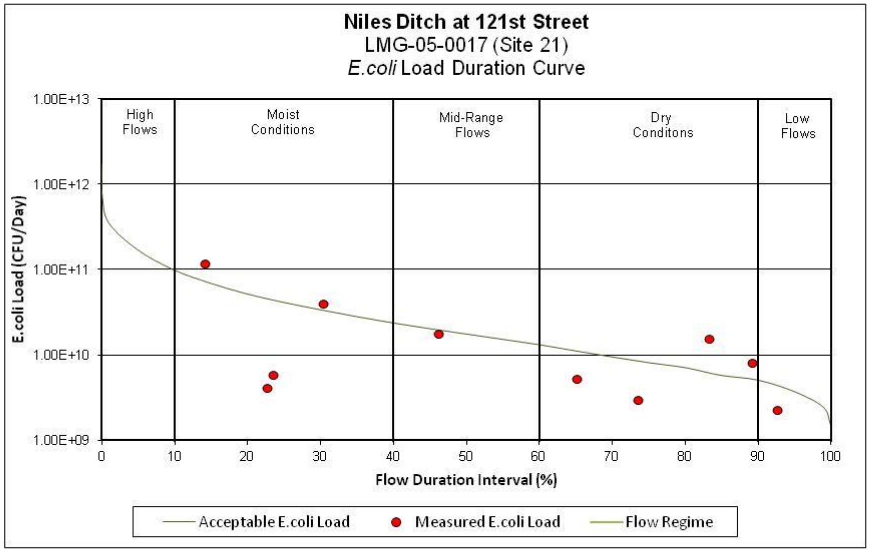

Niles Ditch at Colorado Street
LMG-05-0016 (Site 20)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

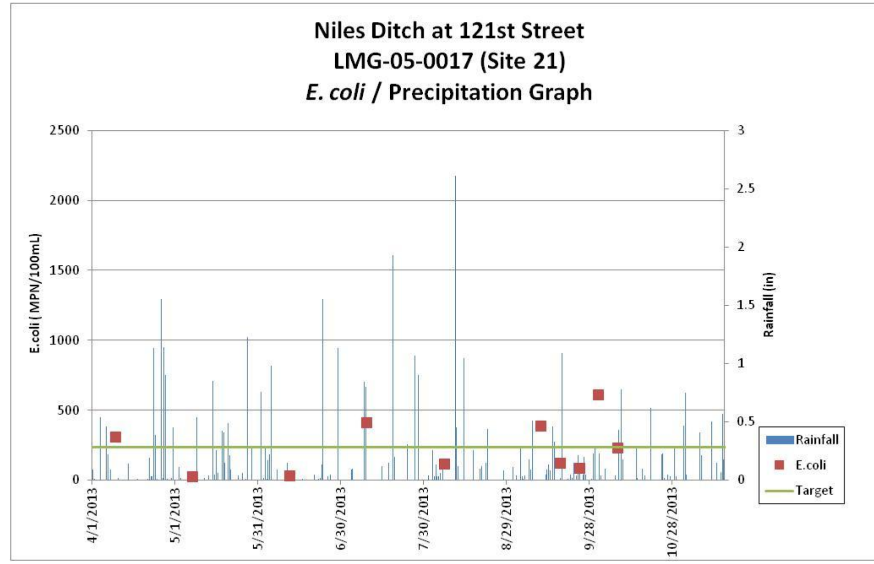
LMG-05-0017 (Site 21)
Niles Ditch

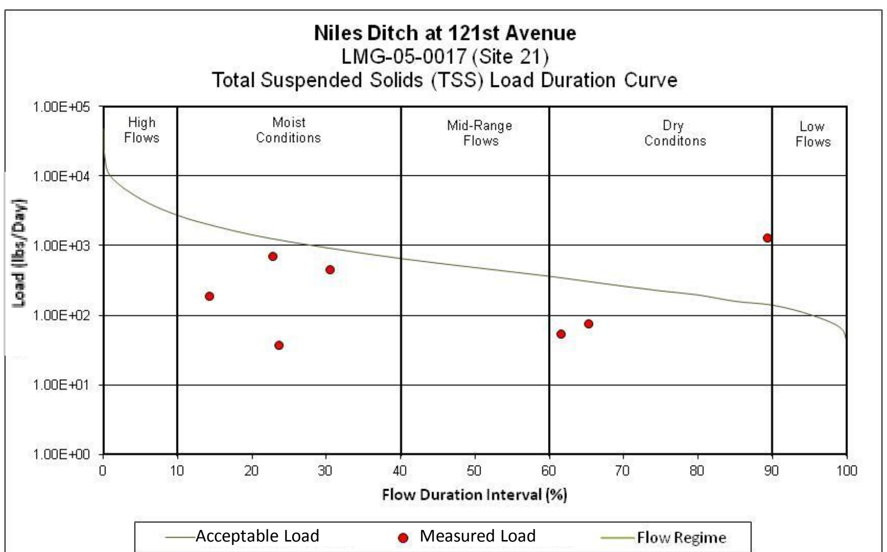
Upstream

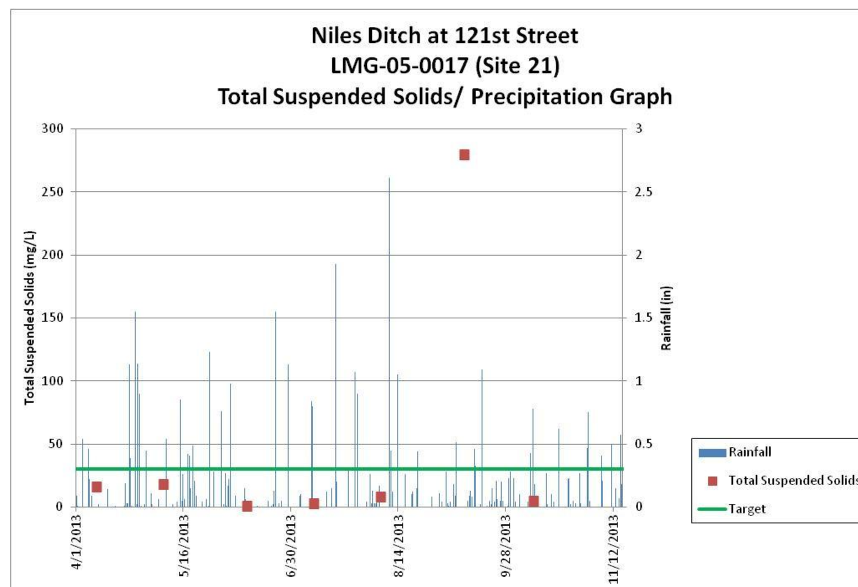


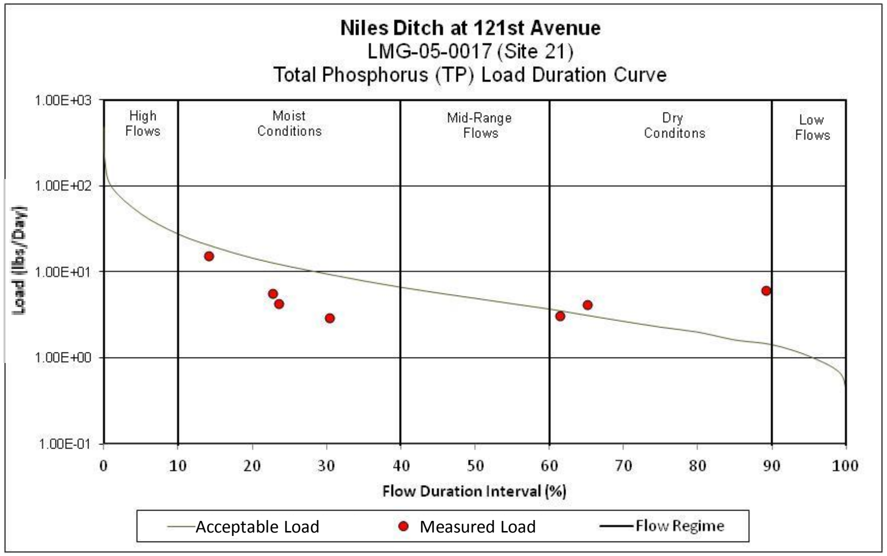
Downstream

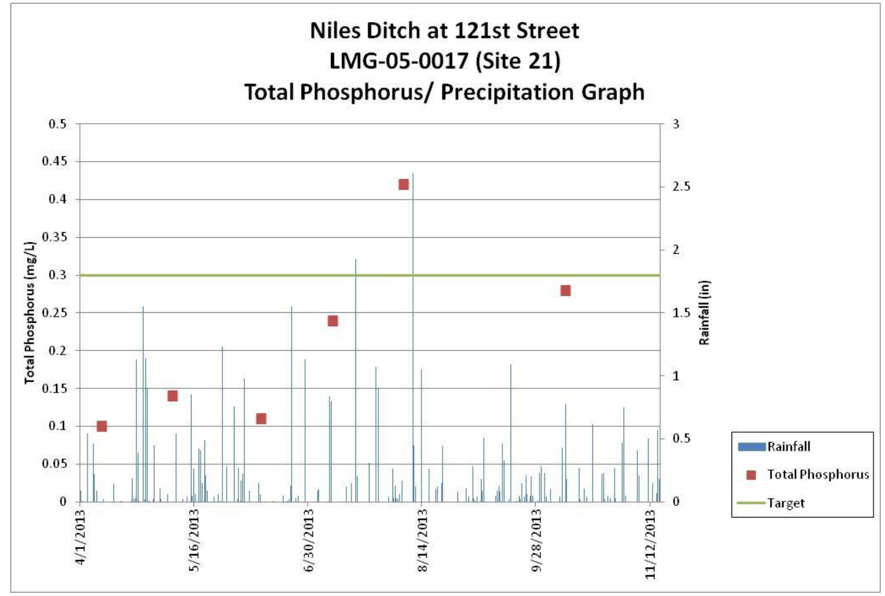

Niles Ditch at 121st Street
LMG-05-0017 (Site 21)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
1.00E+13
1.00E+12
1.00E+11
1.00E+10
1.00E+09
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

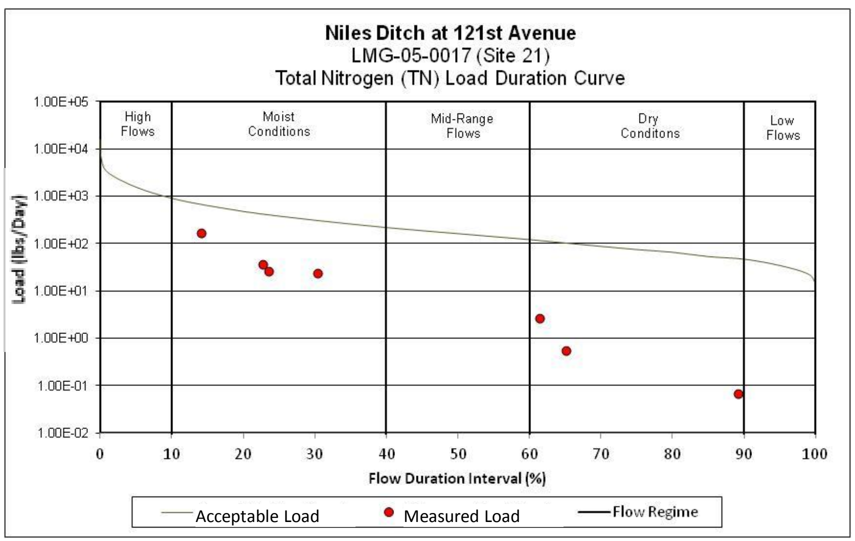

Niles Ditch at 121st Street
LMG-05-0017 (Site 21)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
2500
2000
1500
1000
500
0
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/1/2013
5/31/2013
6/30/2013
7/30/2013
8/29/2013
9/28/2013
10/28/2013
Rainfall
E.coli
Target

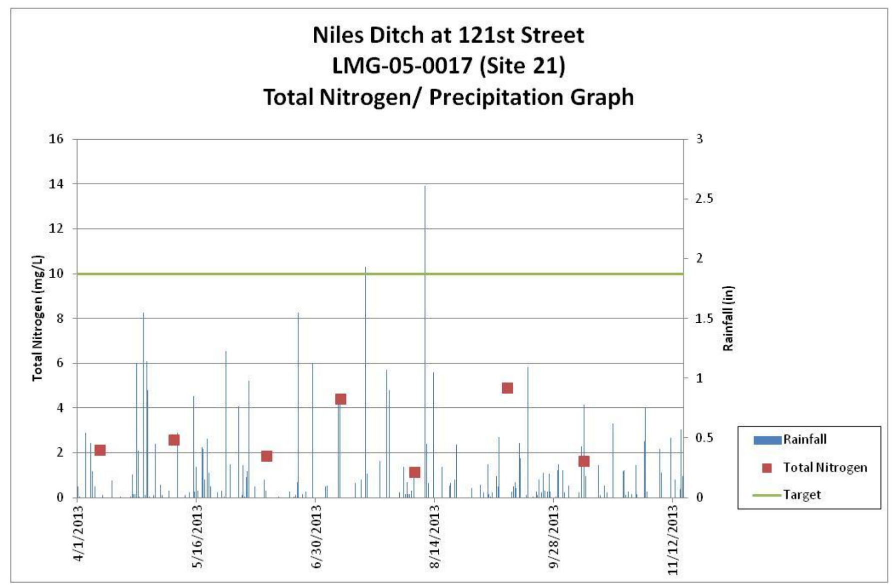

Niles Ditch at 121st Avenue
LMG-05-0017 (Site 21)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Niles Ditch at 121st Street
LMG-05-0017 (Site 21)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
300
250
200
150
100
50
0
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Suspended Solids
Target


Niles Ditch at 121st Avenue
LMG-05-0017 (Site 21)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
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
Measured Load
Flow Regime


Niles Ditch at 121st Street
LMG-05-0017 (Site 21)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
0.5 0.45 0.4 0.35 0.3 0.25 0.2 0.15 0.1 0.05 0
3 2.5 2 1.5 1 0.5 0
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Phosphorus
Target

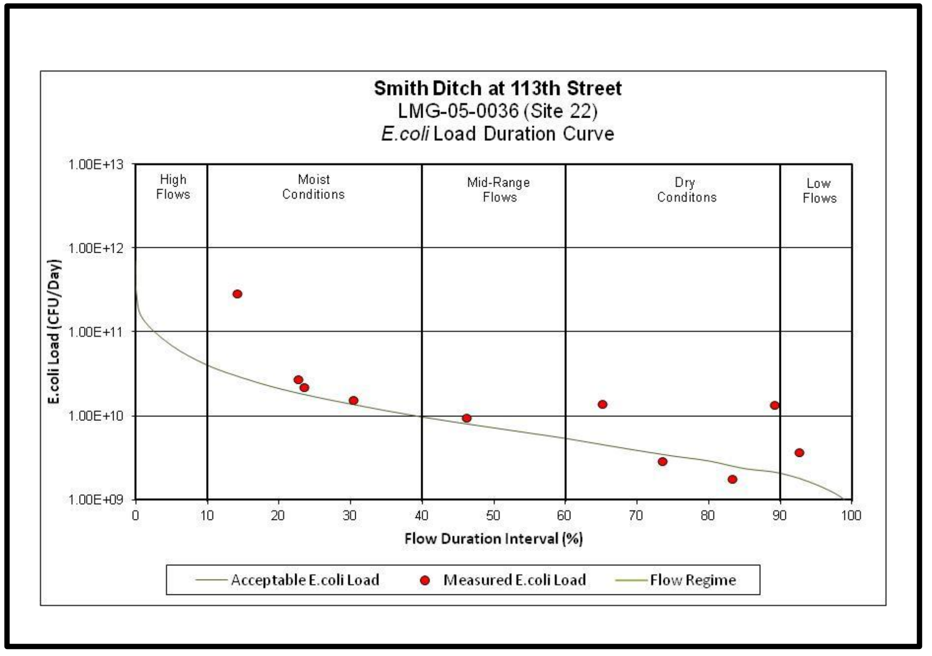

Niles Ditch at 121st Avenue
LMG-05-0017 (Site 21)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Niles Ditch at 121st Street
LMG-05-0017 (Site 21)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
16 14 12 10 8 6 4 2 0
3 2.5 2 1.5 1 0.5 0
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Nitrogen
Target

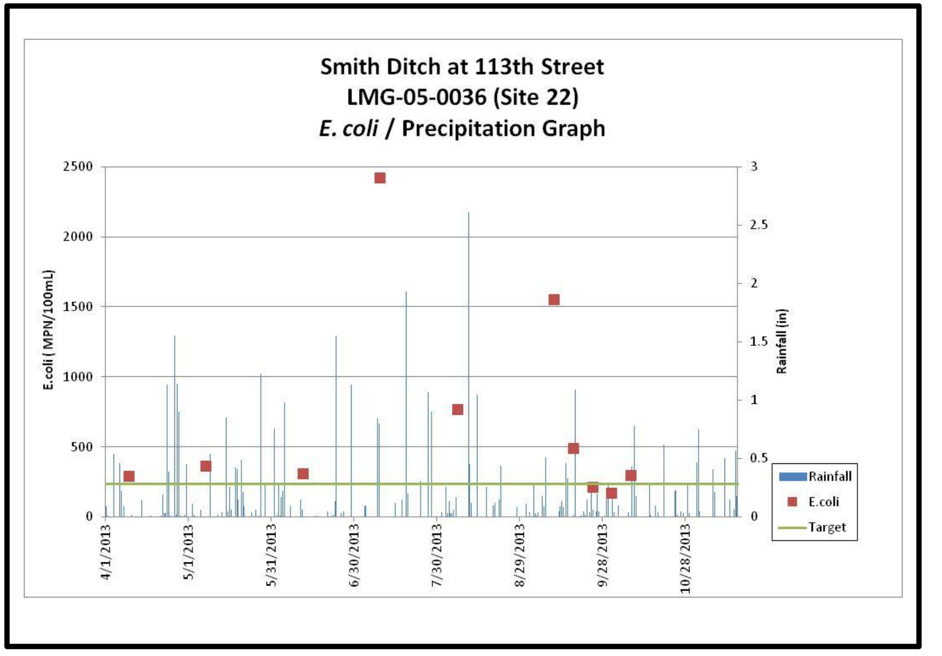
LMG-05-0036 (Site 22)
Smith Ditch

Upstream

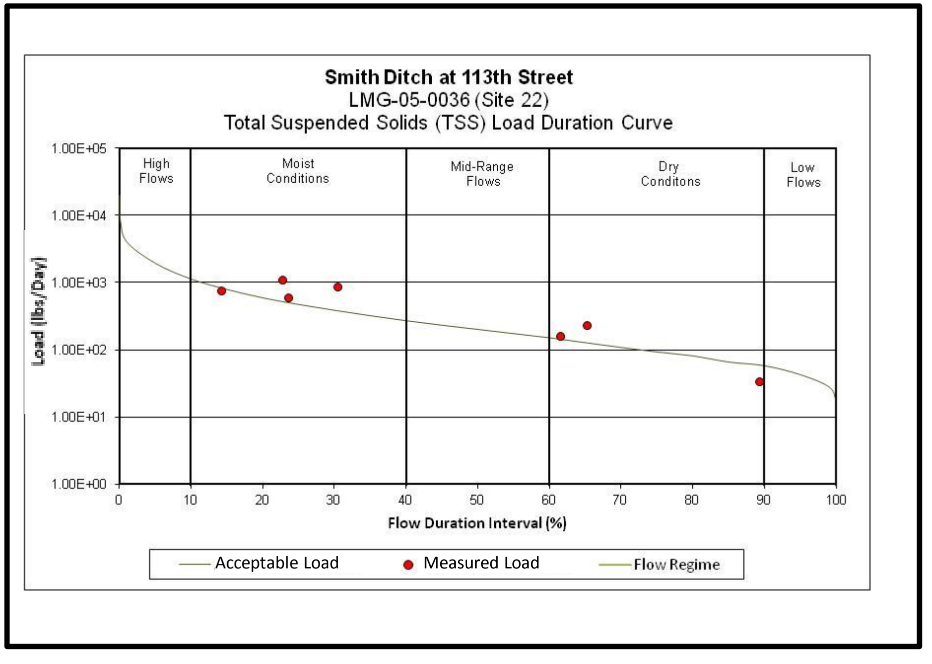
Downstream



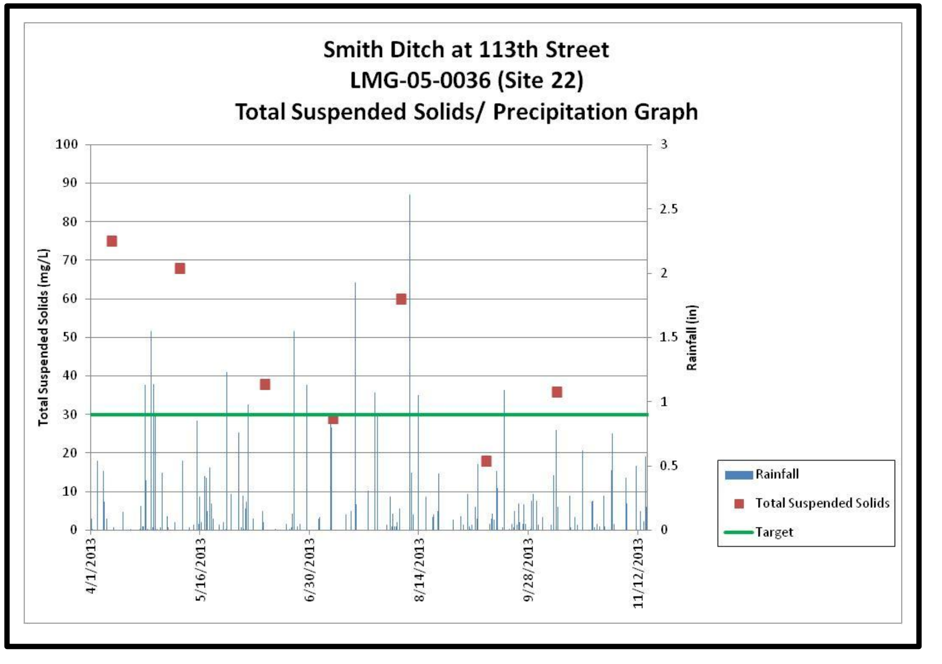
Smith Ditch at 113th Street
LMG-05-0036 (Site 22)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime



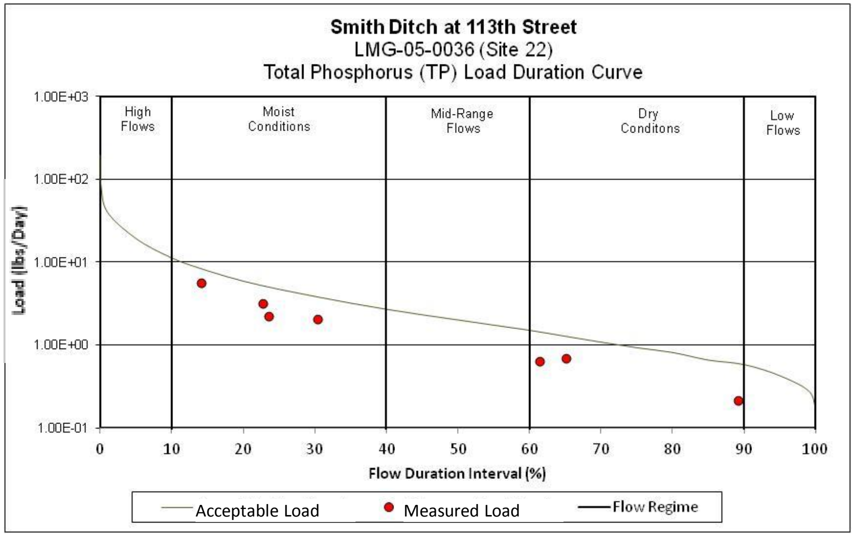
Smith Ditch at 113th Street
LMG-05-0036 (Site 22)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target



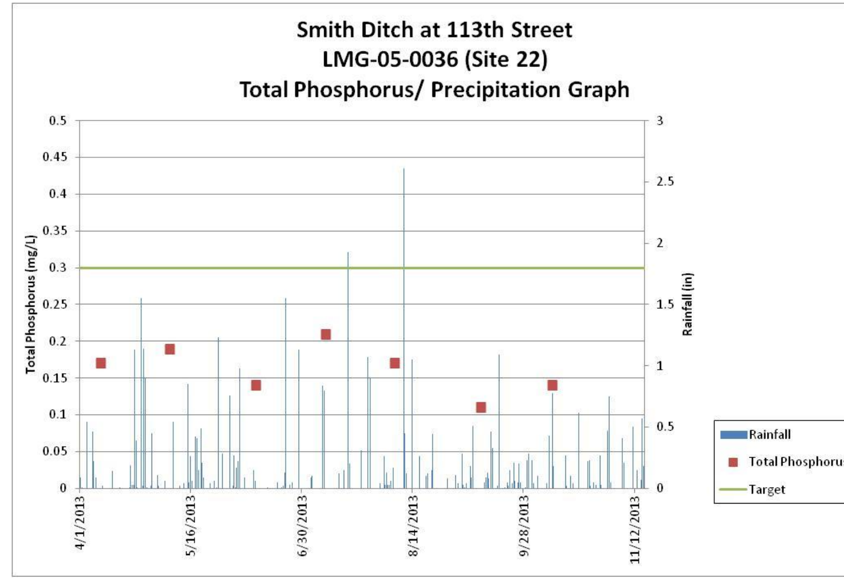
Smith Ditch at 113th Street
LMG-05-0036 (Site 22)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



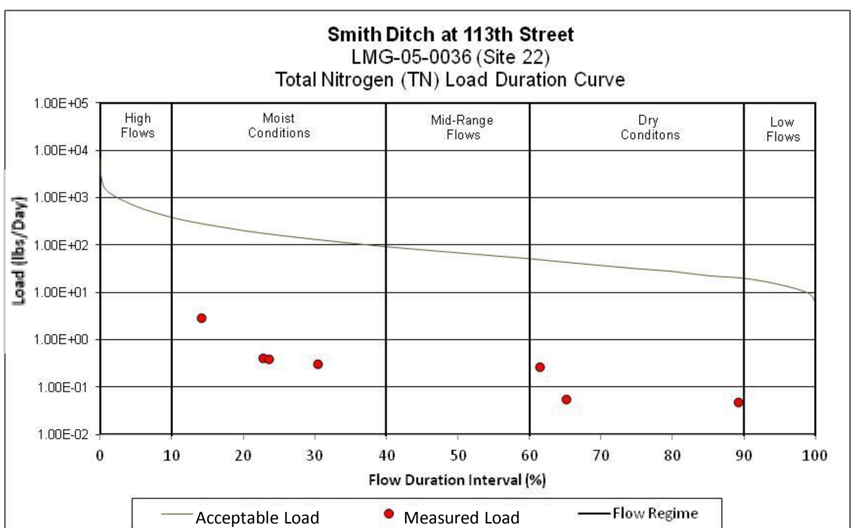
Smith Ditch at 113th Street
LMG-05-0036 (Site 22)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target



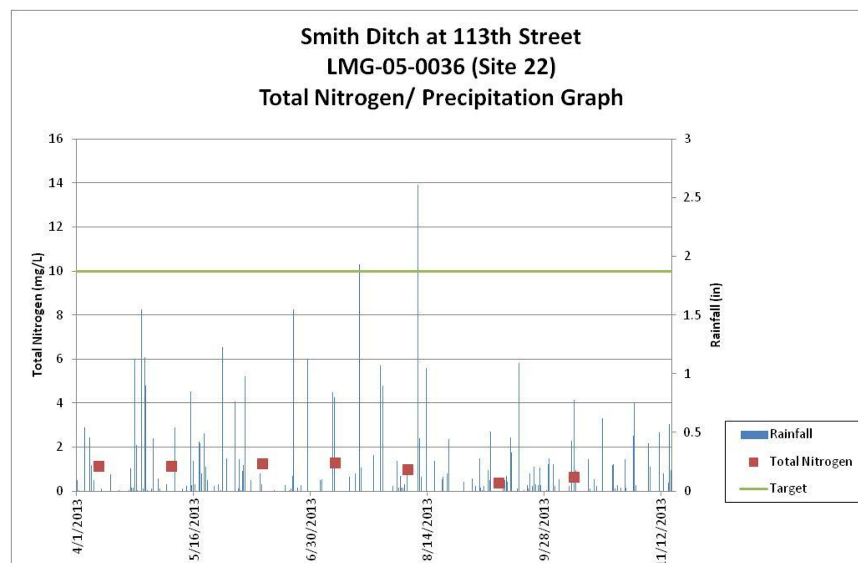
Smith Ditch at 113th Street
LMG-05-0036 (Site 22)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



Smith Ditch at 113th Street
LMG-05-0036 (Site 22)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target



Smith Ditch at 113th Street
LMG-05-0036 (Site 22)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

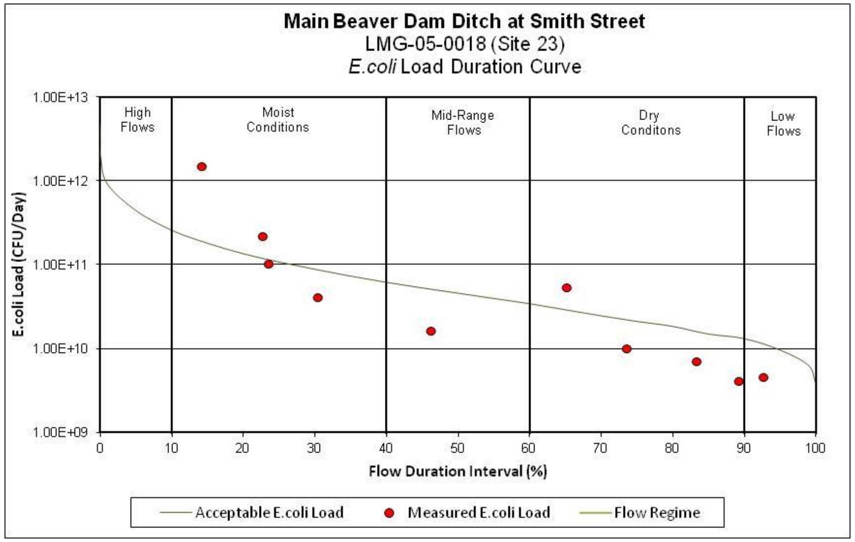


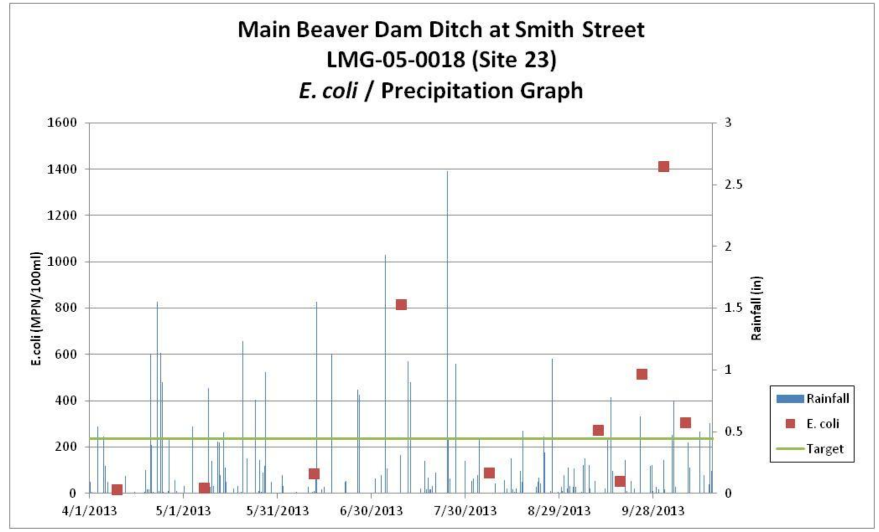
Smith Ditch at 113th Street
LMG-05-0036 (Site 22)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

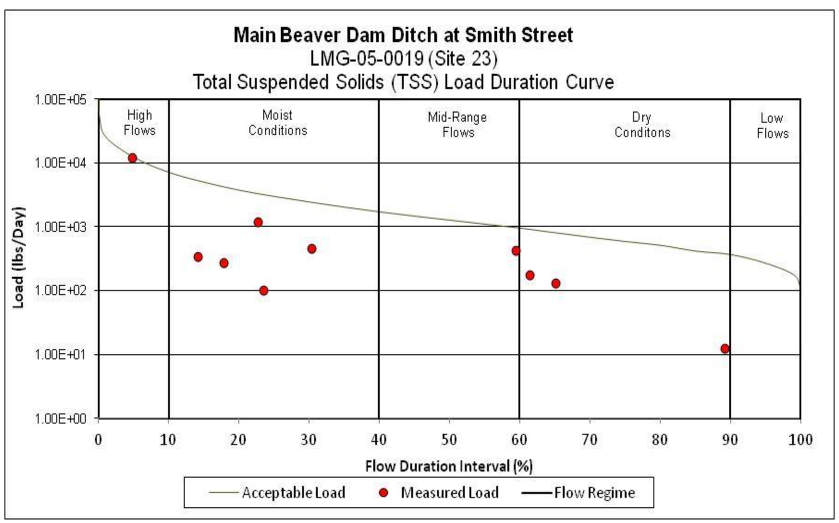
LMG-05-0018 (Site 23)
Main Beaver Dam Ditch

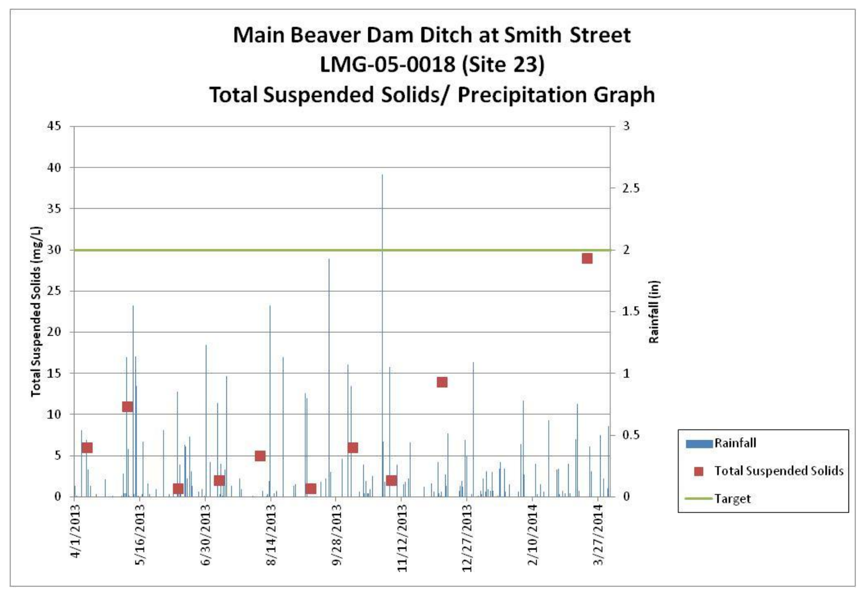
Upstream

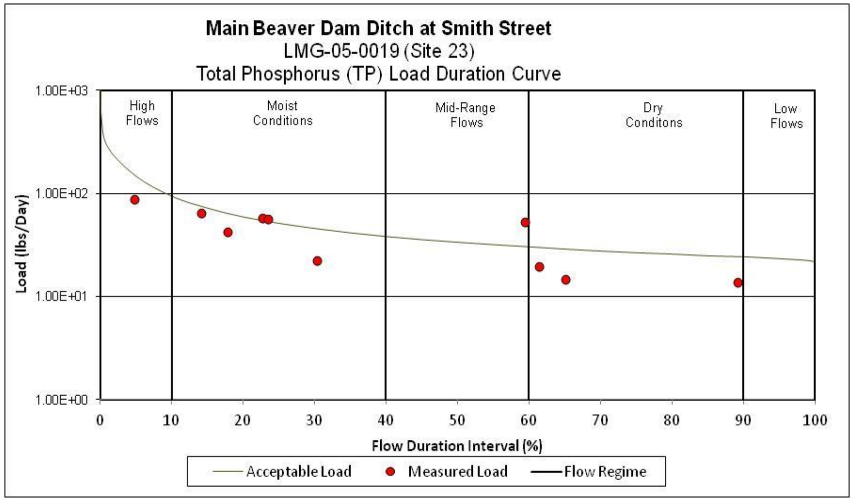
Downstream

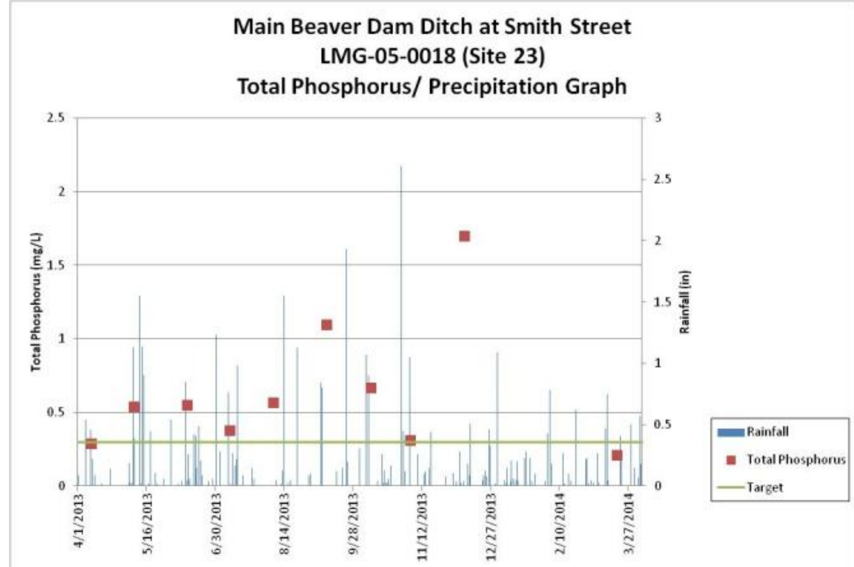

Main Beaver Dam Ditch at Smith Street
LMG-05-0018 (Site 23)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

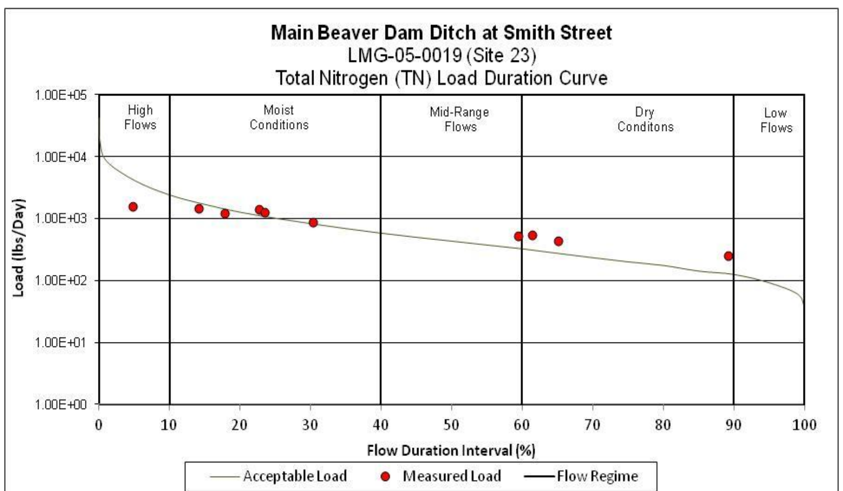

Main Beaver Dam Ditch at Smith Street
LMG-05-0018 (Site 23)
E. coli / Precipitation Graph
E.coli (MPN/100ml)
Rainfall (in)
Rainfall
E. coli
Target

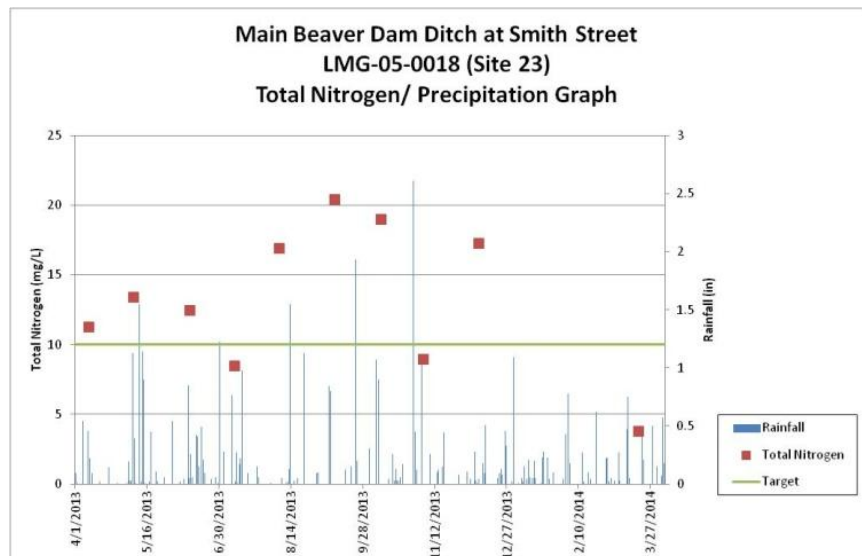

Main Beaver Dam Ditch at Smith Street
LMG-05-0019 (Site 23)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
Measured Load
Flow Regime


Main Beaver Dam Ditch at Smith Street
LMG-05-0018 (Site 23)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target


Main Beaver Dam Ditch at Smith Street
LMG-05-0019 (Site 23)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
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
Measured Load
Flow Regime

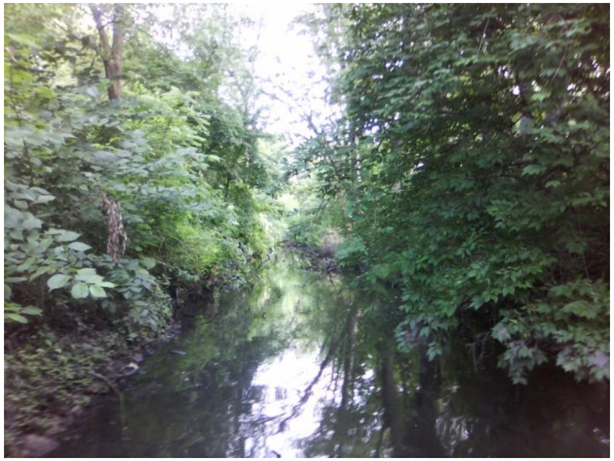

Main Beaver Dam Ditch at Smith Street
LMG-05-0018 (Site 23)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
12/27/2013
2/10/2014
3/27/2014


Main Beaver Dam Ditch at Smith Street
LMG-05-0019 (Site 23)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
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
Measured Load
Flow Regime

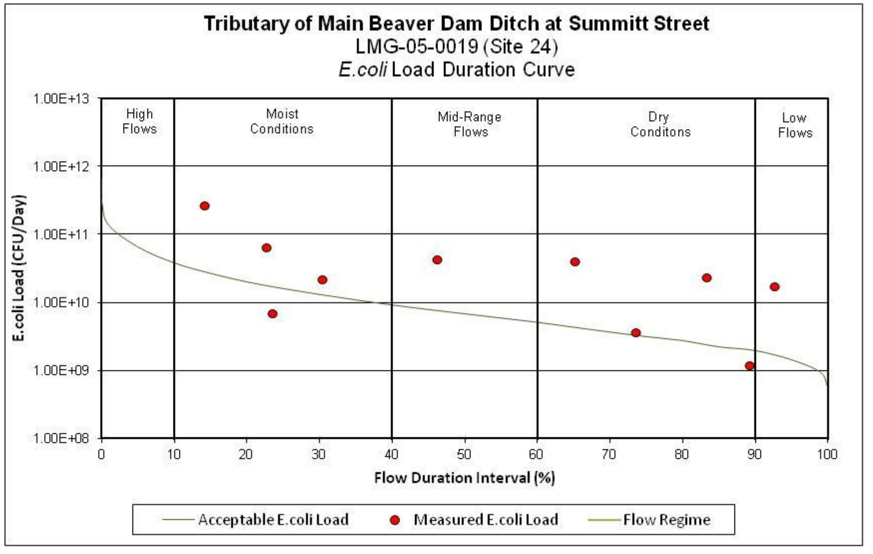

Main Beaver Dam Ditch at Smith Street
LMG-05-0018 (Site 23)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
12/27/2013
2/10/2014
3/27/2014

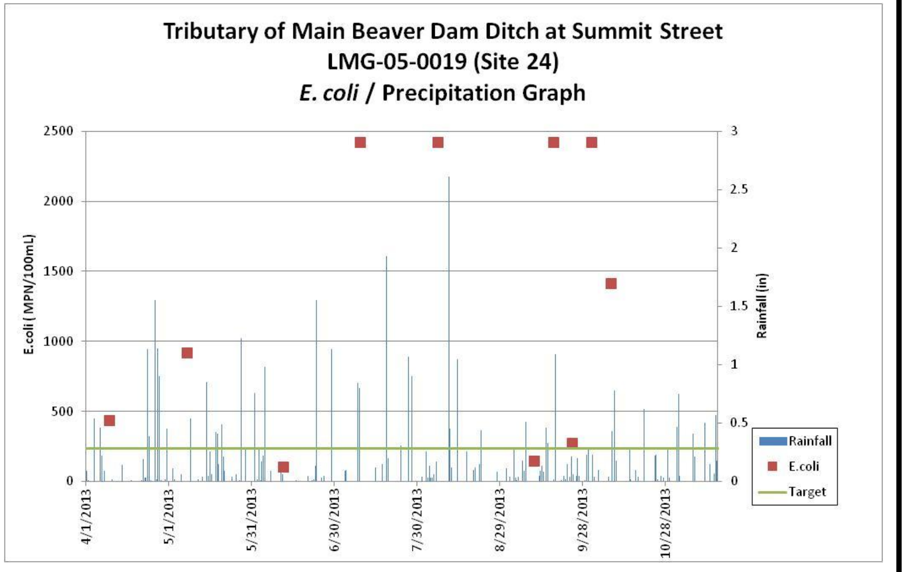
LMG-05-0019 (Site 24)
Tributary of Main Beaver Dam Ditch

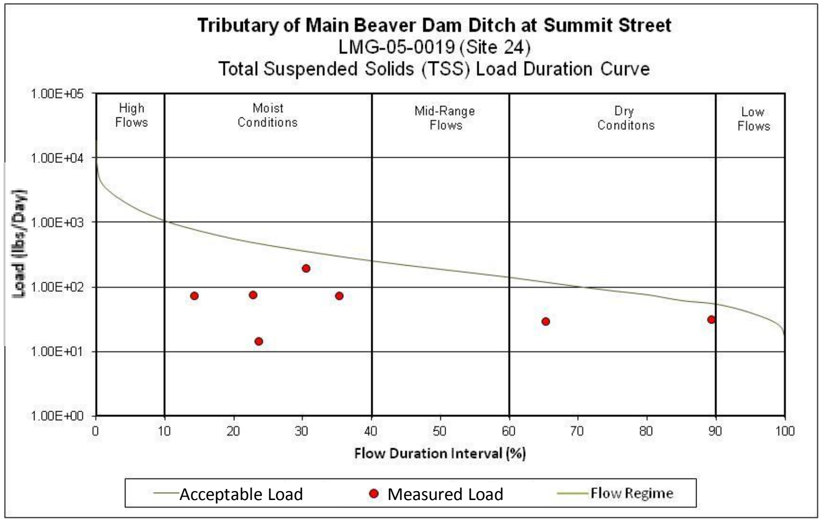
Upstream

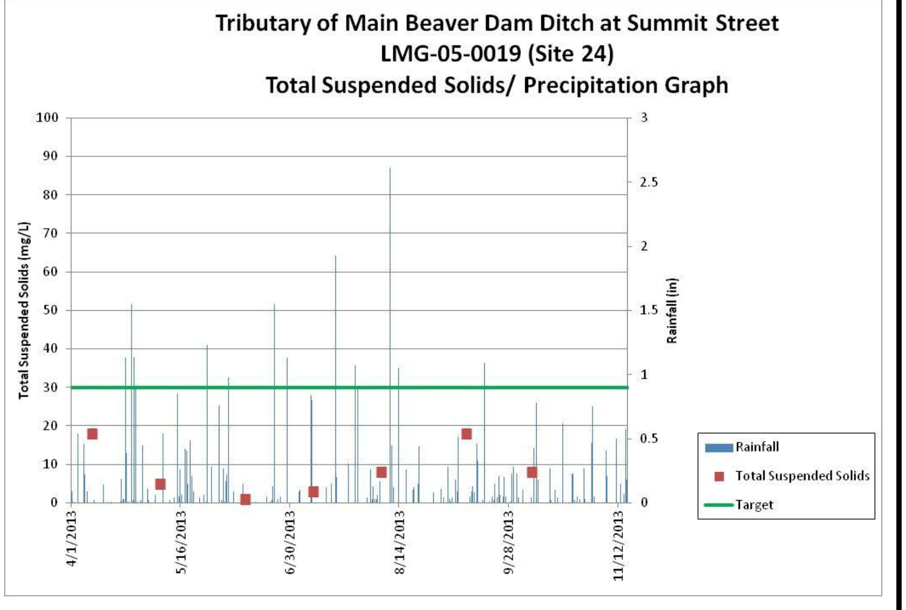


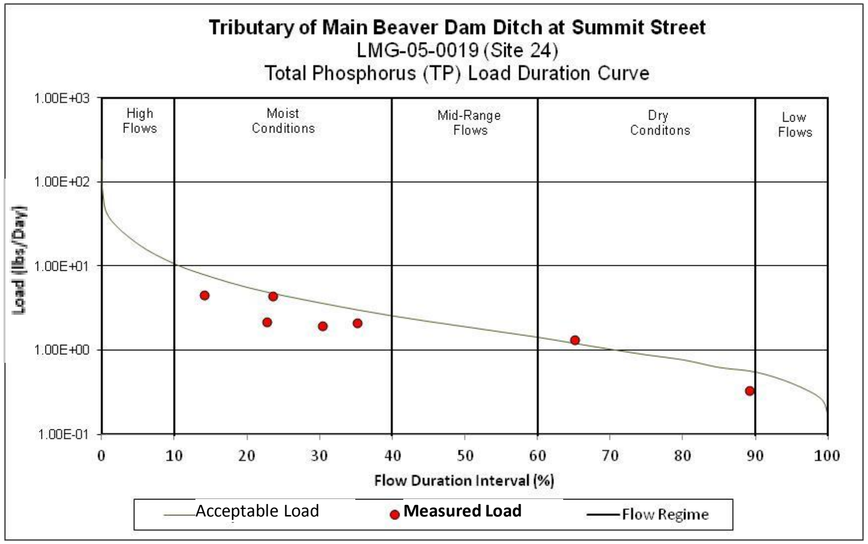
Downstream

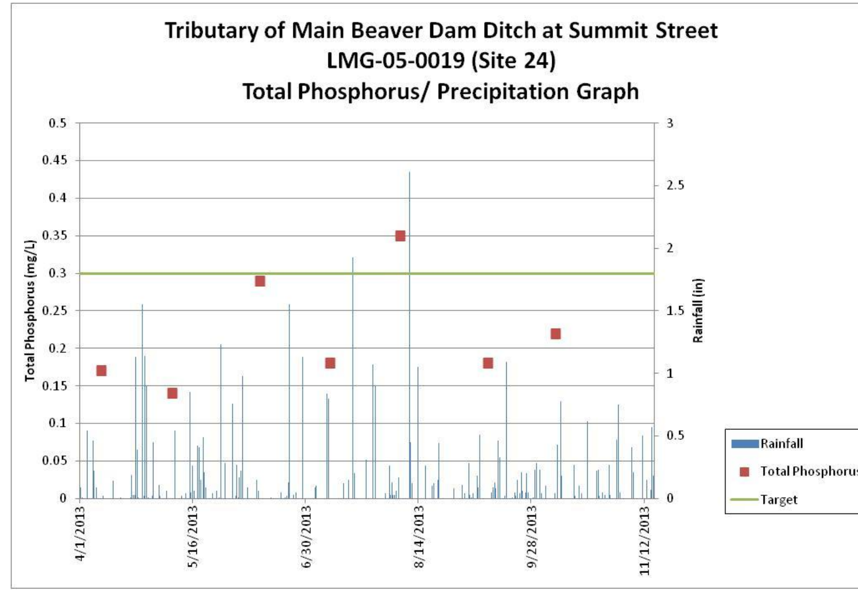

Tributary of Main Beaver Dam Ditch at Summitt Street
LMG-05-0019 (Site 24)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

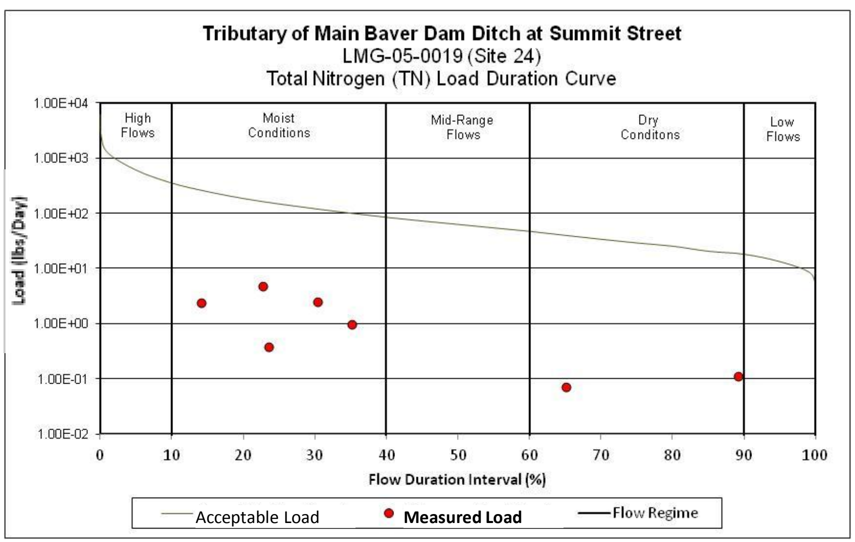

Tributary of Main Beaver Dam Ditch at Summit Street
LMG-05-0019 (Site 24)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target

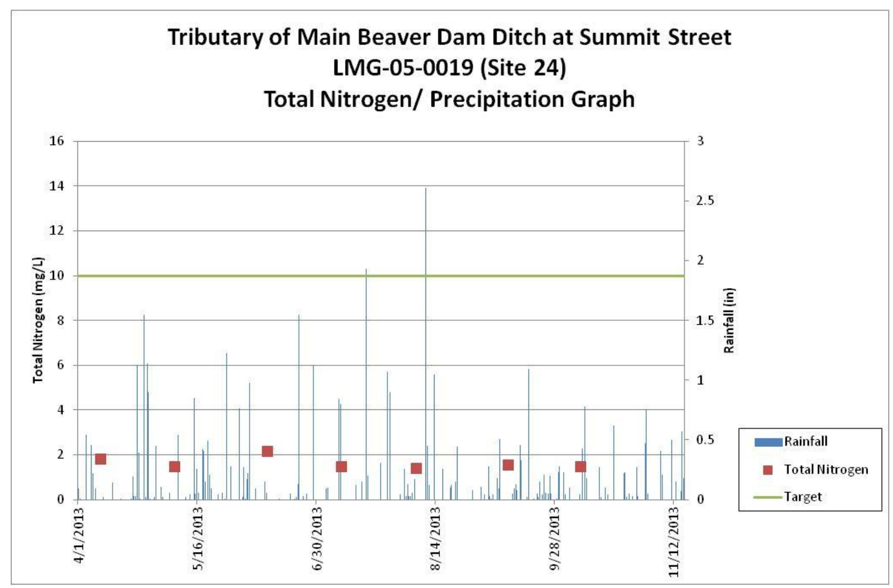

Tributary of Main Beaver Dam Ditch at Summit Street
LMG-05-0019 (Site 24)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Tributary of Main Beaver Dam Ditch at Summit Street
LMG-05-0019 (Site 24)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target


Tributary of Main Beaver Dam Ditch at Summit Street
LMG-05-0019 (Site 24)
Total Phosphorus (TP) Load Duration Curve
Load (lbs/Day)
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
Measured Load
Flow Regime


Tributary of Main Beaver Dam Ditch at Summit Street
LMG-05-0019 (Site 24)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Phosphorus
Target

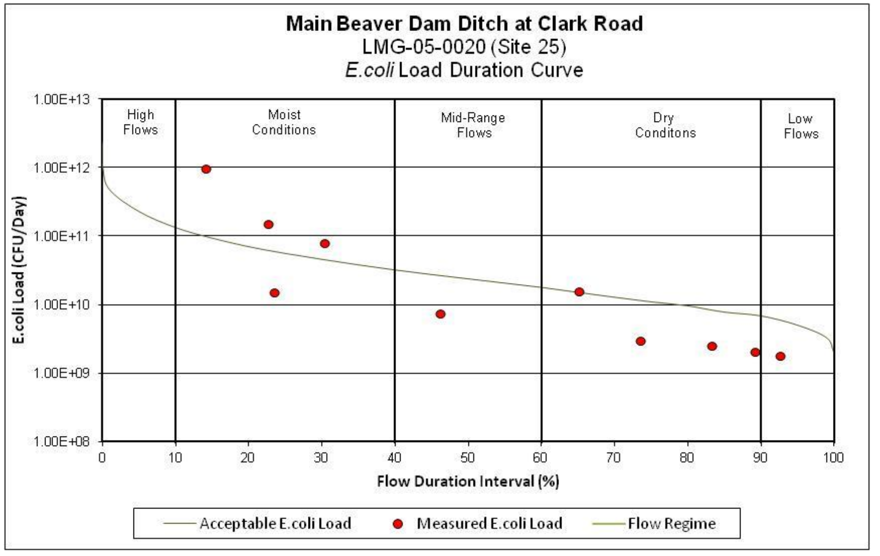

Tributary of Main Baver Dam Ditch at Summit Street
LMG-05-0019 (Site 24)
Total Nitrogen (TN) Load Duration Curve
Load (lbs/Day)
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

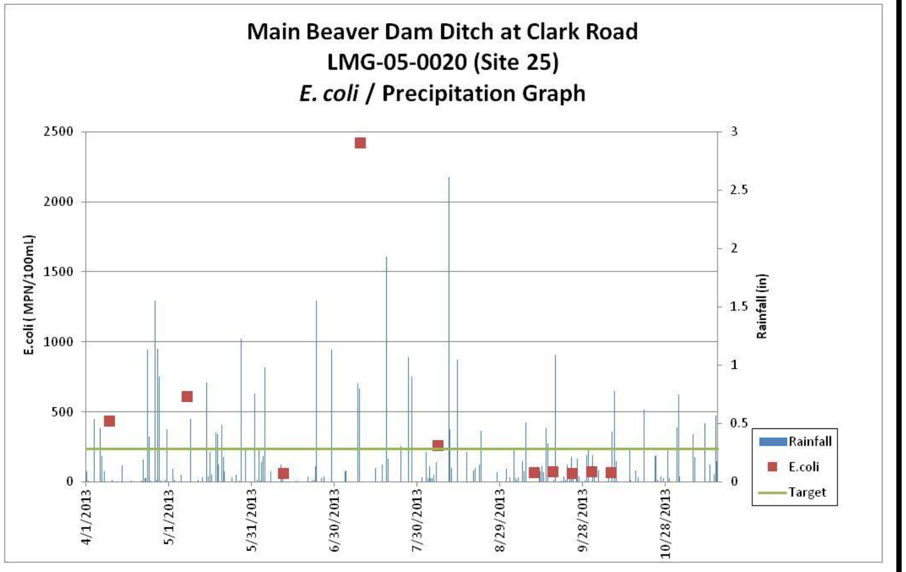

Tributary of Main Beaver Dam Ditch at Summit Street
LMG-05-0019 (Site 24)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Nitrogen
Target

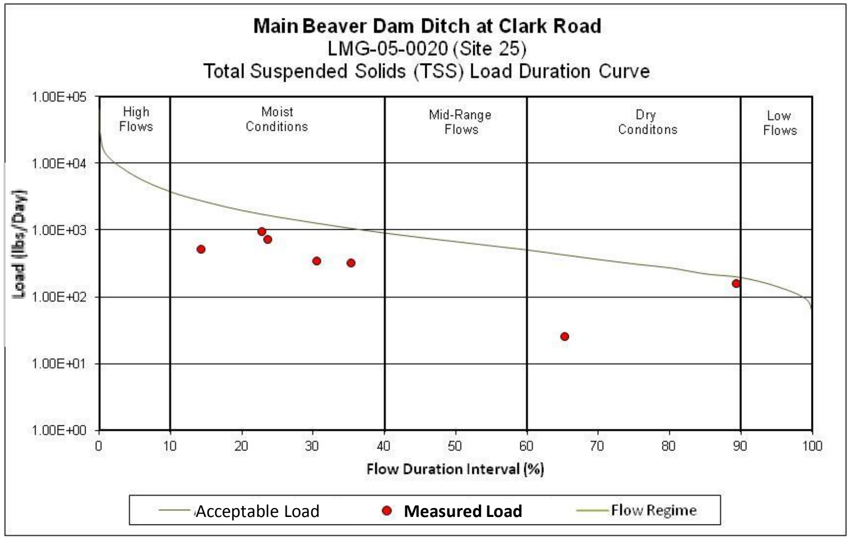
LMG-05-0020 (Site 25)
Main Beaver Dam Ditch

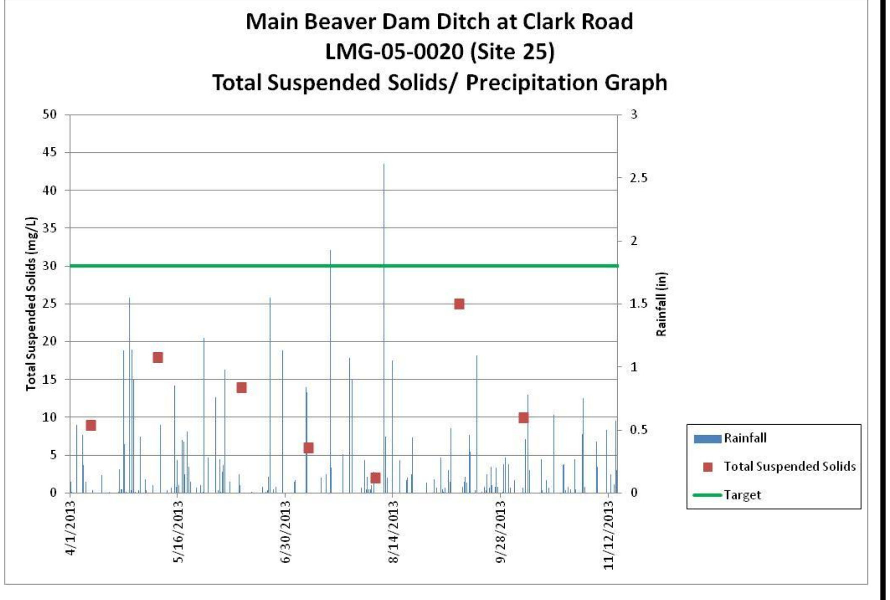
Upstream

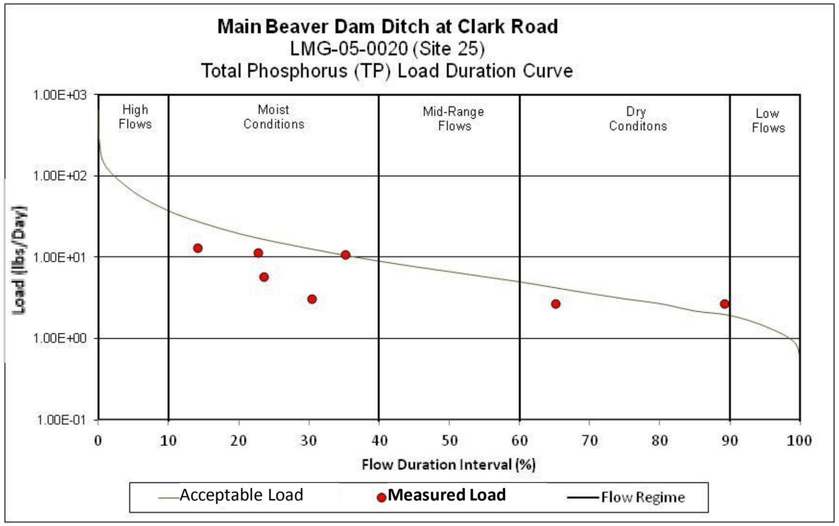
Downstream

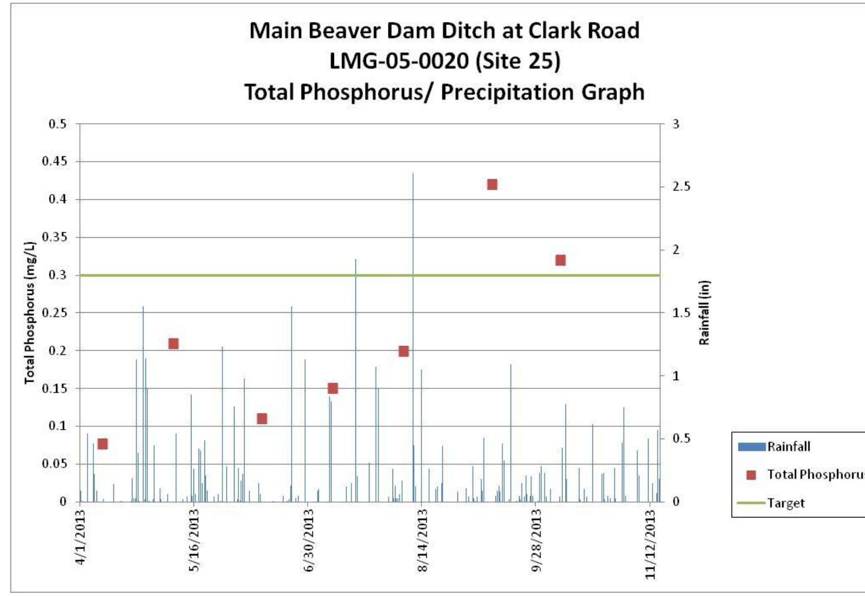

Main Beaver Dam Ditch at Clark Road
LMG-05-0020 (Site 25)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

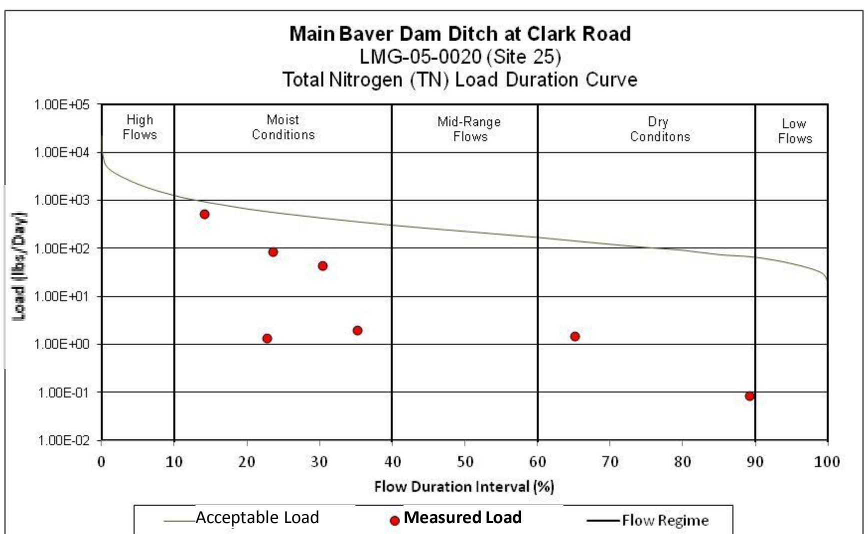

Main Beaver Dam Ditch at Clark Road
LMG-05-0020 (Site 25)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target

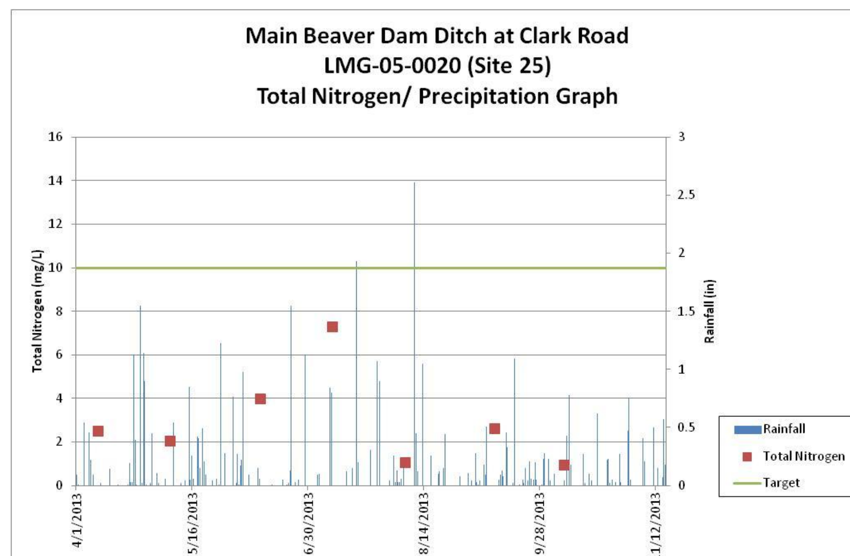

Main Beaver Dam Ditch at Clark Road
LMG-05-0020 (Site 25)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Main Beaver Dam Ditch at Clark Road
LMG-05-0020 (Site 25)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target


Main Beaver Dam Ditch at Clark Road
LMG-05-0020 (Site 25)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Main Beaver Dam Ditch at Clark Road
LMG-05-0020 (Site 25)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target

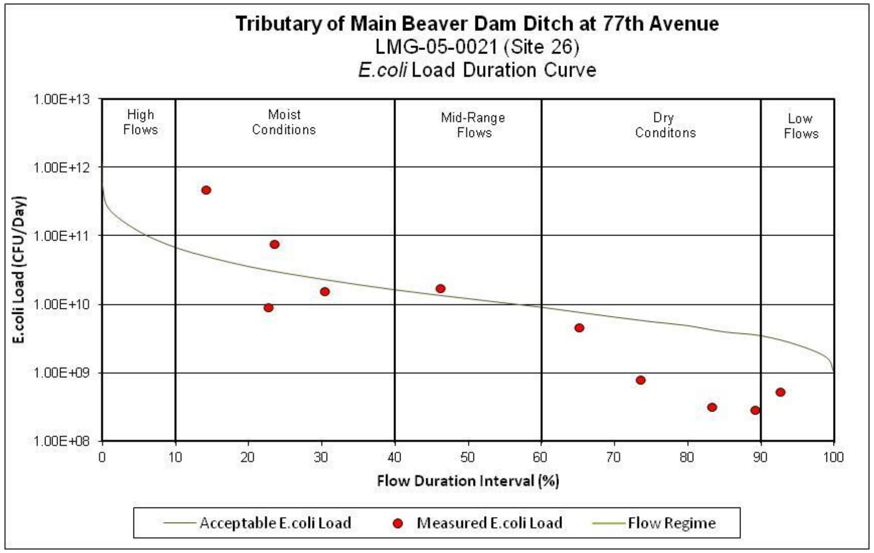

Main Baver Dam Ditch at Clark Road
LMG-05-0020 (Site 25)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Main Beaver Dam Ditch at Clark Road
LMG-05-0020 (Site 25)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

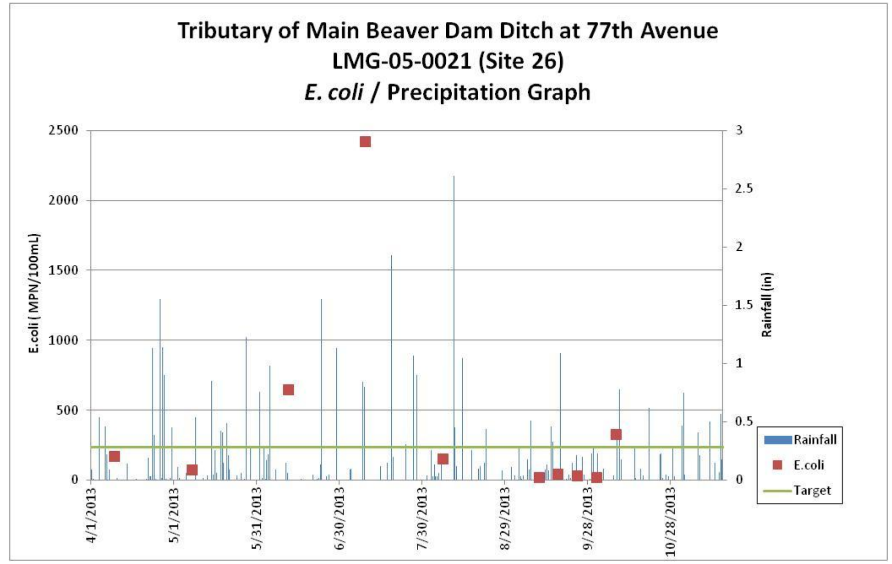
LMG-05-0021 (Site 26)
Tributary of Main Beaver Dam Ditch

Upstream

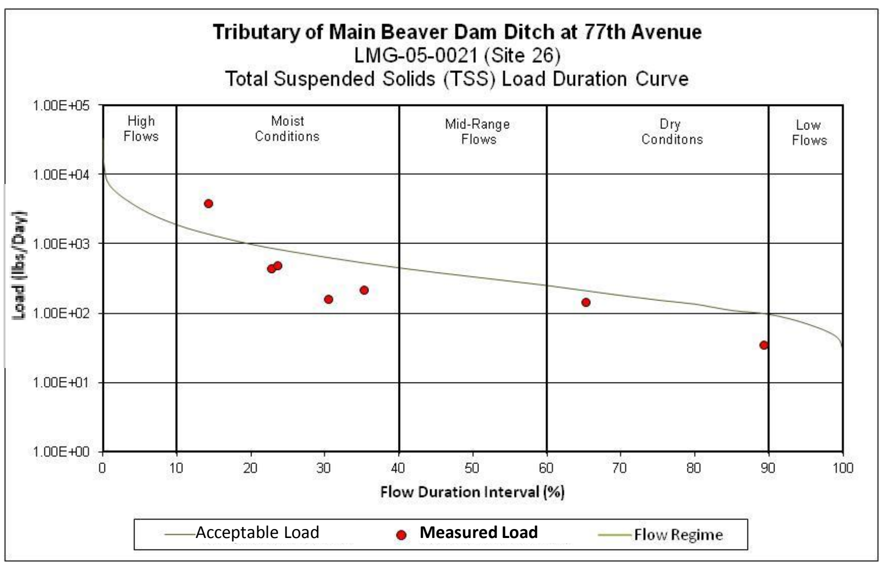
Downstream



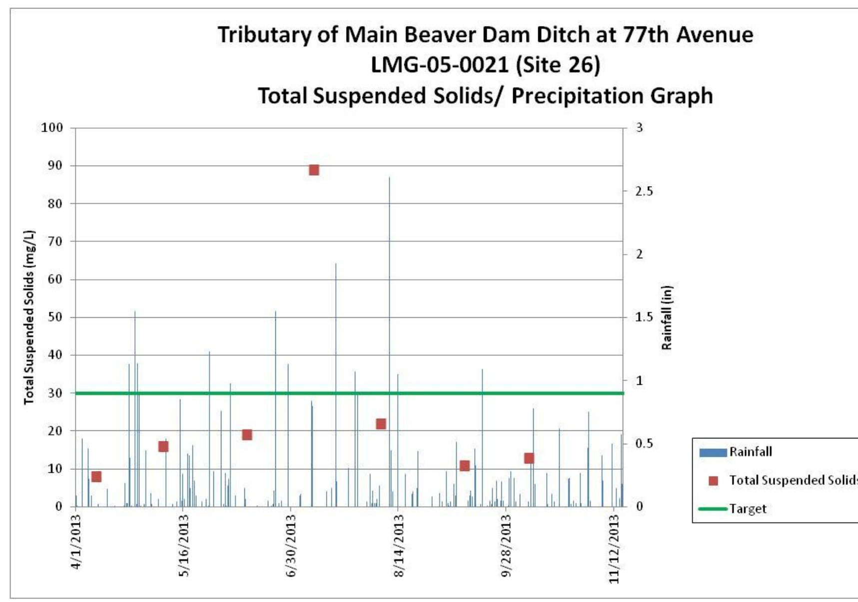
Tributary of Main Beaver Dam Ditch at 77th Avenue
LMG-05-0021 (Site 26)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime



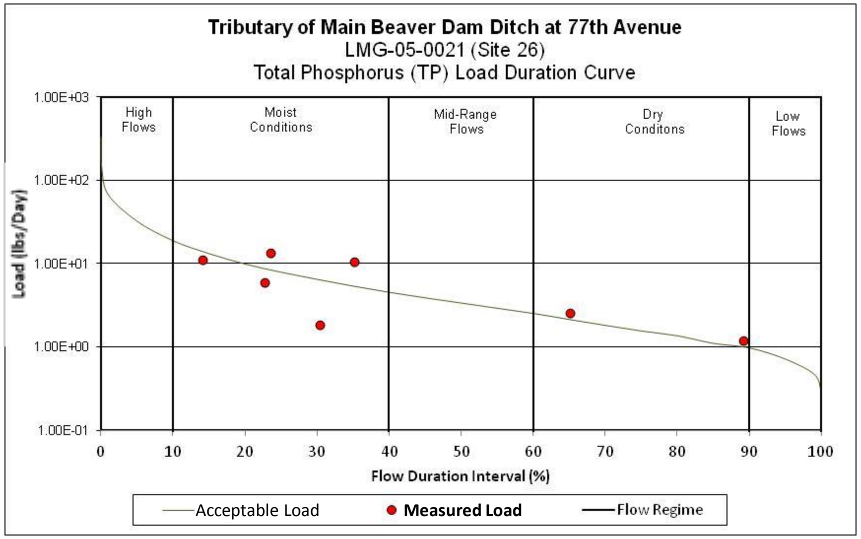
Tributary of Main Beaver Dam Ditch at 77th Avenue
LMG-05-0021 (Site 26)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target



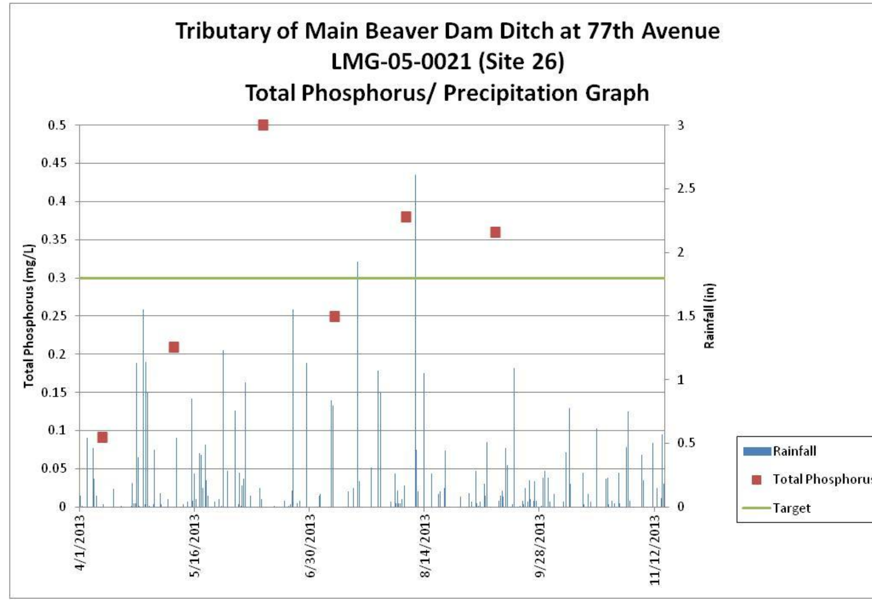
Tributary of Main Beaver Dam Ditch at 77th Avenue
LMG-05-0021 (Site 26)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



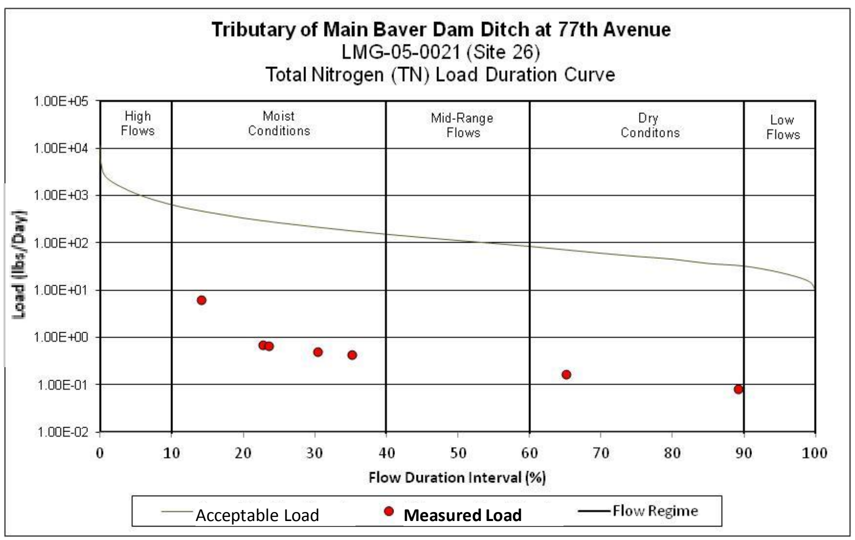
Tributary of Main Beaver Dam Ditch at 77th Avenue
LMG-05-0021 (Site 26)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target



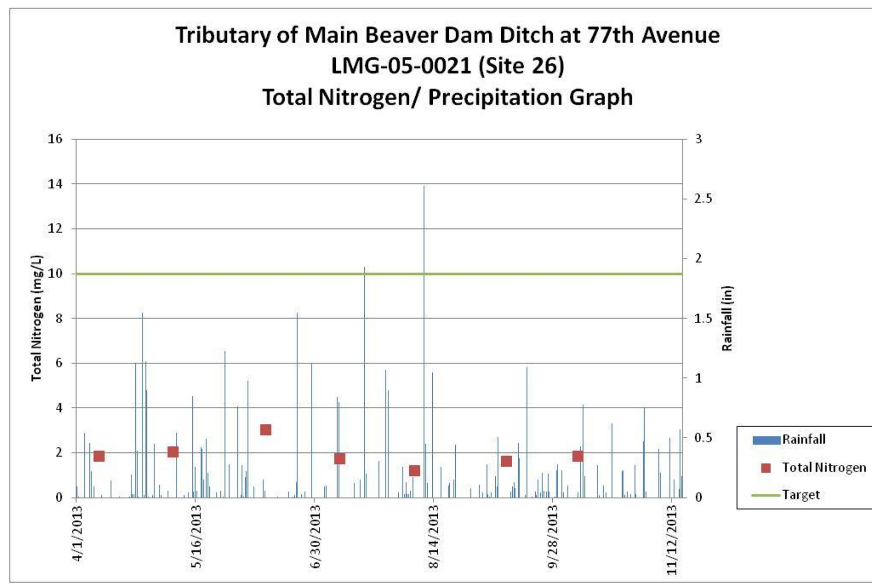
Tributary of Main Beaver Dam Ditch at 77th Avenue
LMG-05-0021 (Site 26)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



Tributary of Main Beaver Dam Ditch at 77th Avenue
LMG-05-0021 (Site 26)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target



Tributary of Main Baver Dam Ditch at 77th Avenue
LMG-05-0021 (Site 26)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

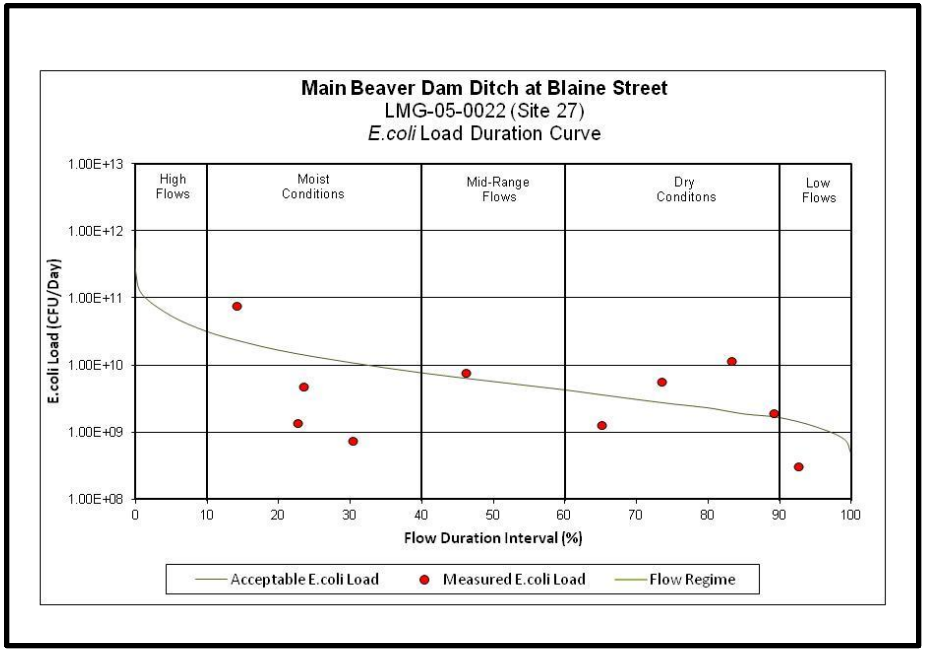


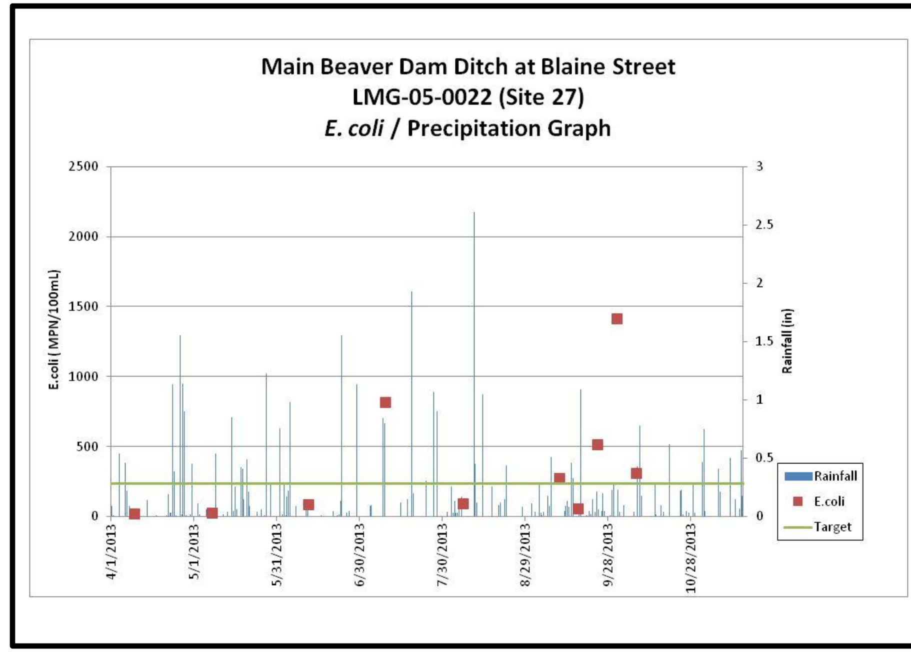
Tributary of Main Beaver Dam Ditch at 77th Avenue
LMG-05-0021 (Site 26)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

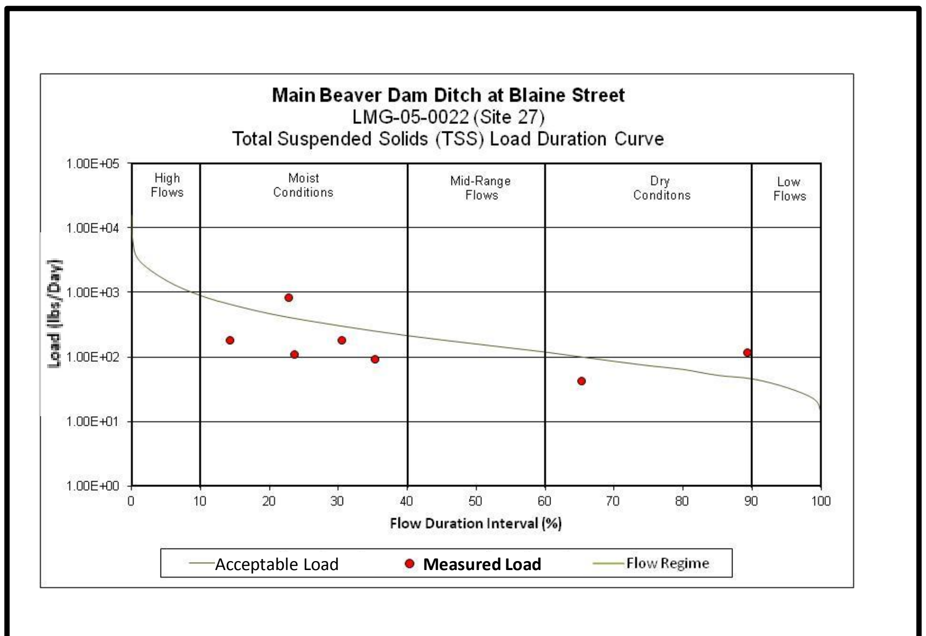
LMG-05-0022 (Site 27)
Main Beaver Dam Ditch

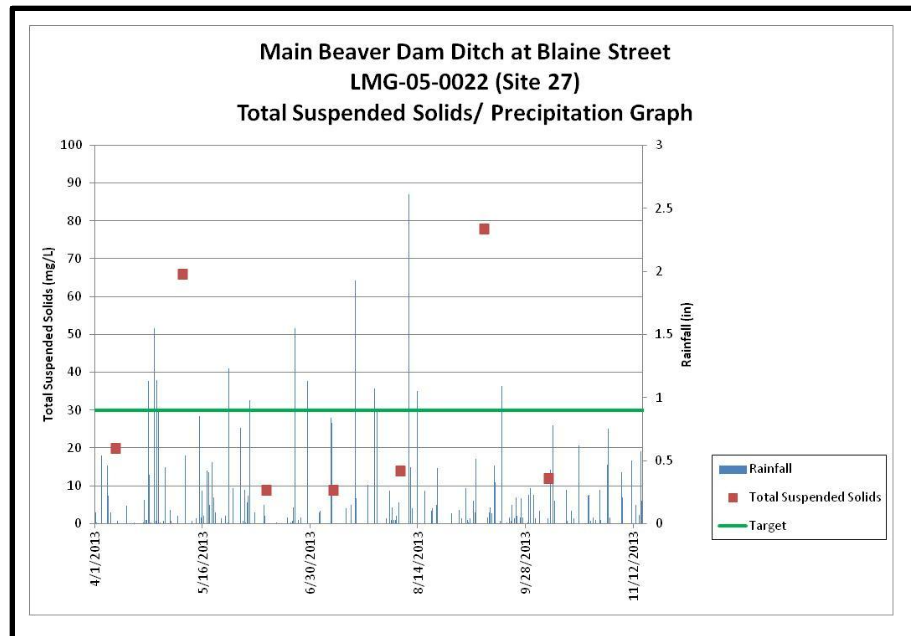
Upstream

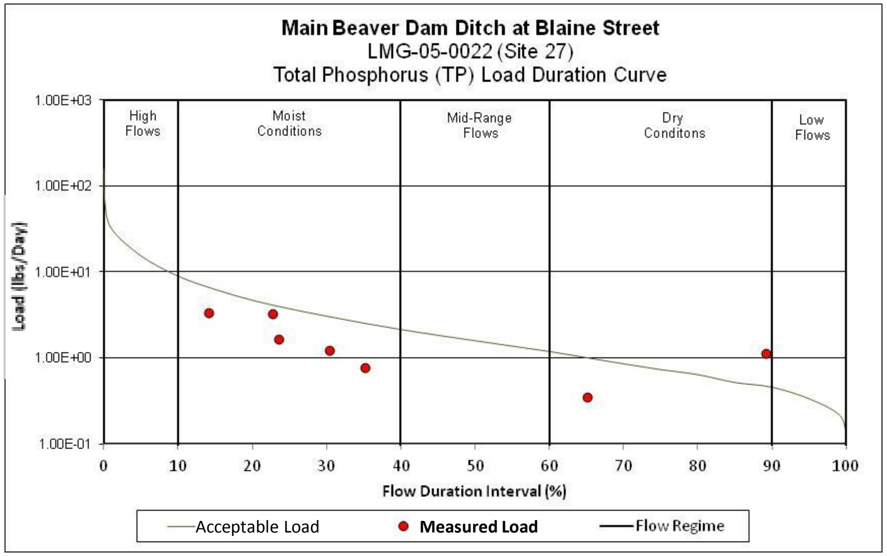
Downstream

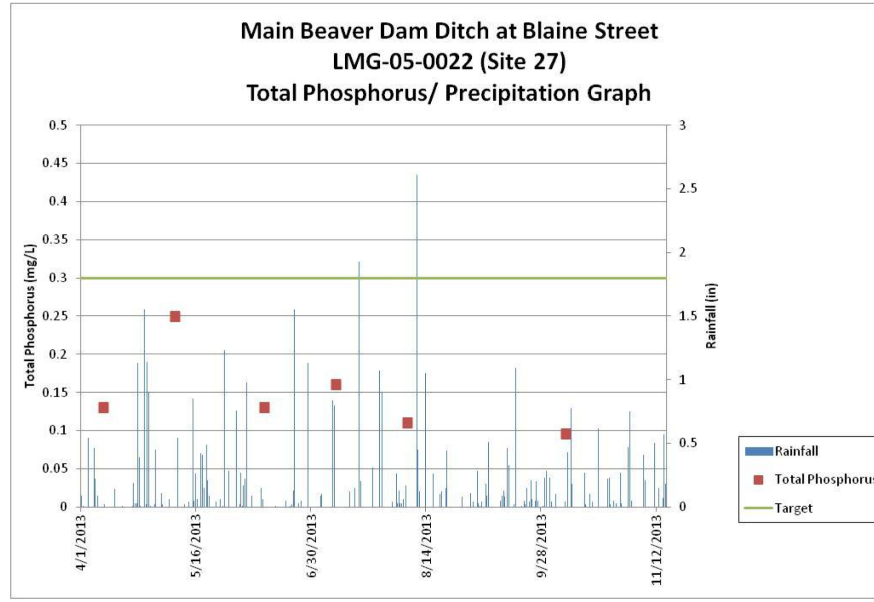

Main Beaver Dam Ditch at Blaine Street
LMG-05-0022 (Site 27)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

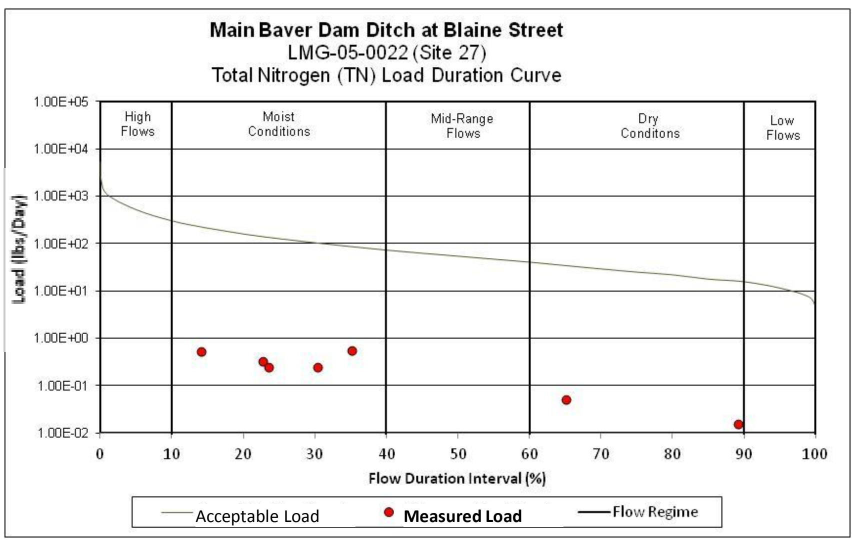

Main Beaver Dam Ditch at Blaine Street
LMG-05-0022 (Site 27)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target

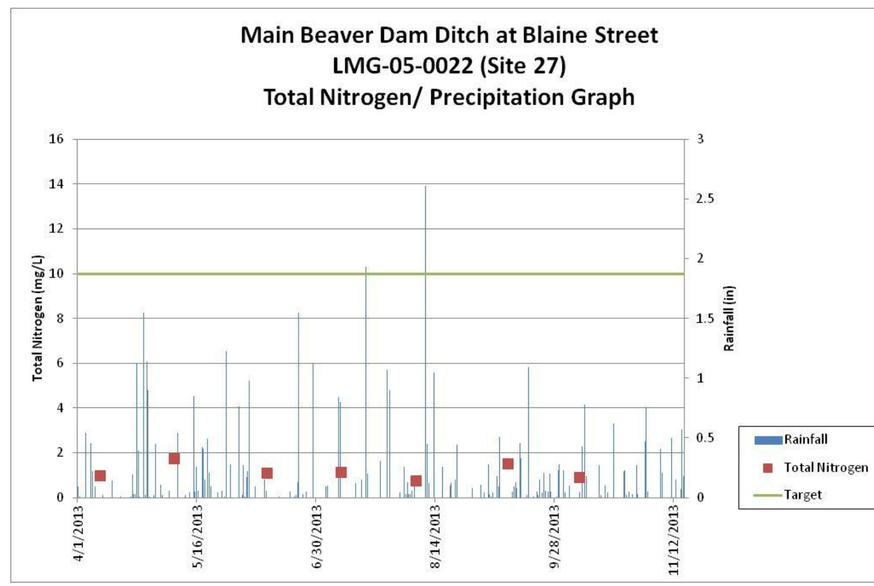

Main Beaver Dam Ditch at Blaine Street
LMG-05-0022 (Site 27)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Main Beaver Dam Ditch at Blaine Street
LMG-05-0022 (Site 27)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target


Main Beaver Dam Ditch at Blaine Street
LMG-05-0022 (Site 27)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Main Beaver Dam Ditch at Blaine Street
LMG-05-0022 (Site 27)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target

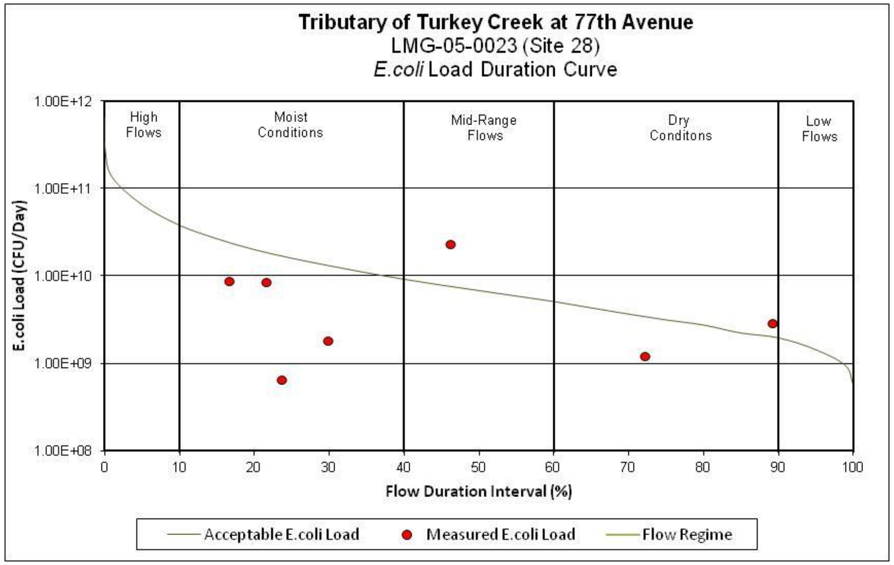

Main Baver Dam Ditch at Blaine Street
LMG-05-0022 (Site 27)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

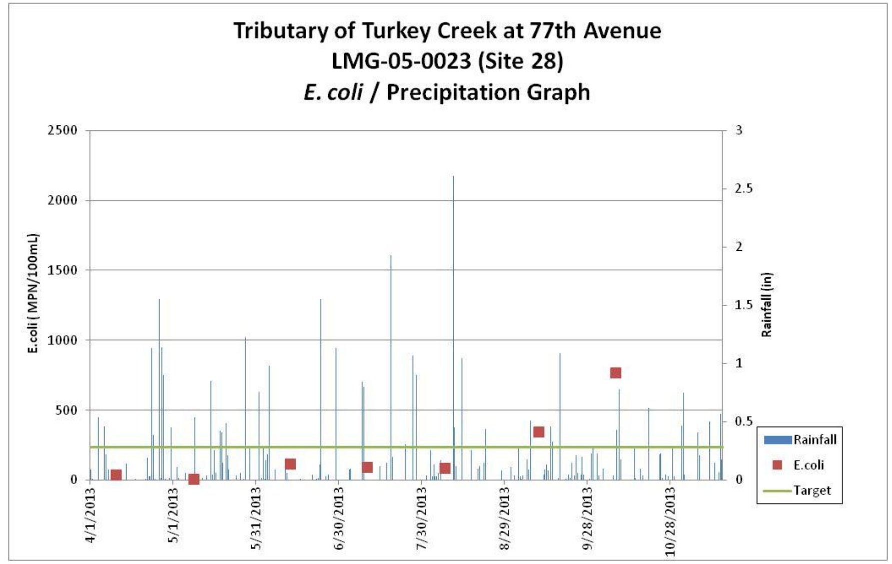

Main Beaver Dam Ditch at Blaine Street
LMG-05-0022 (Site 27)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

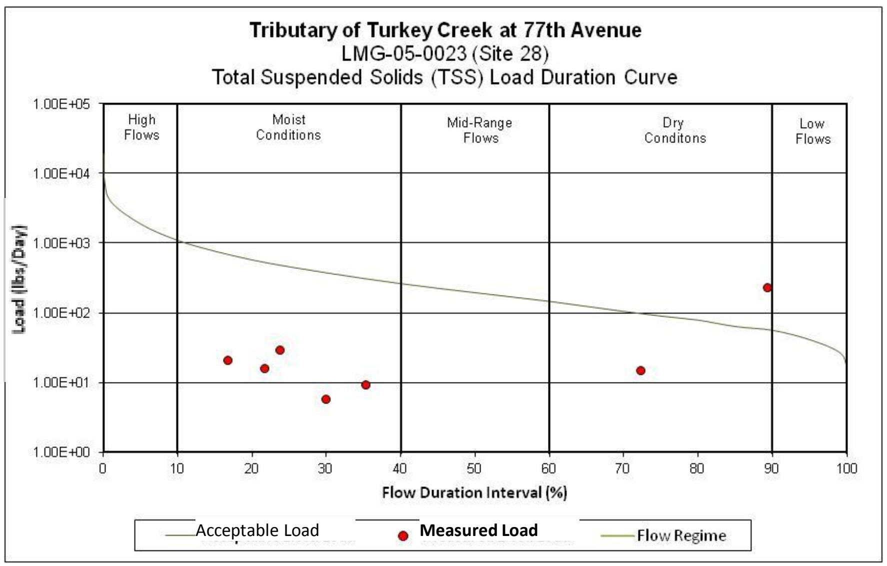
LMG-05-0023 (Site 28)
Tributary of Turkey Creek

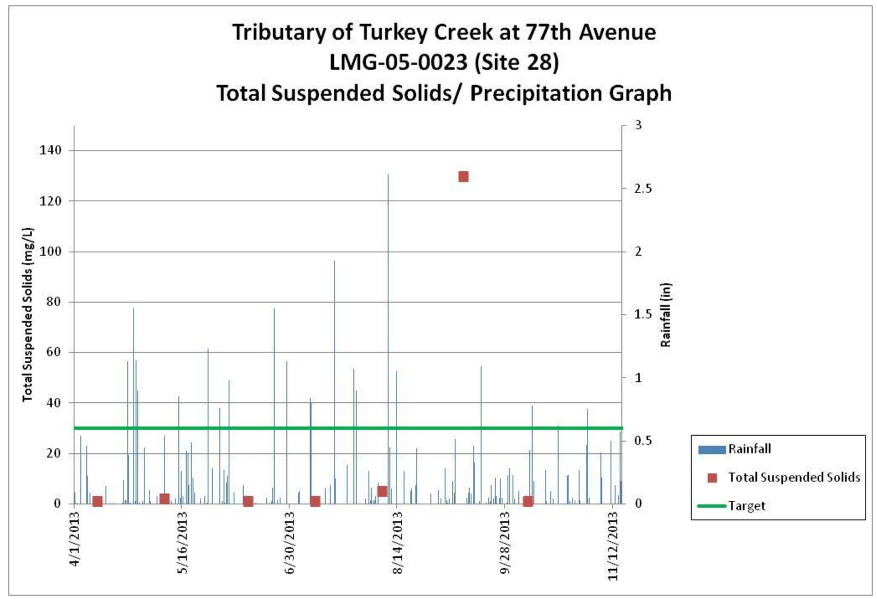
Upstream

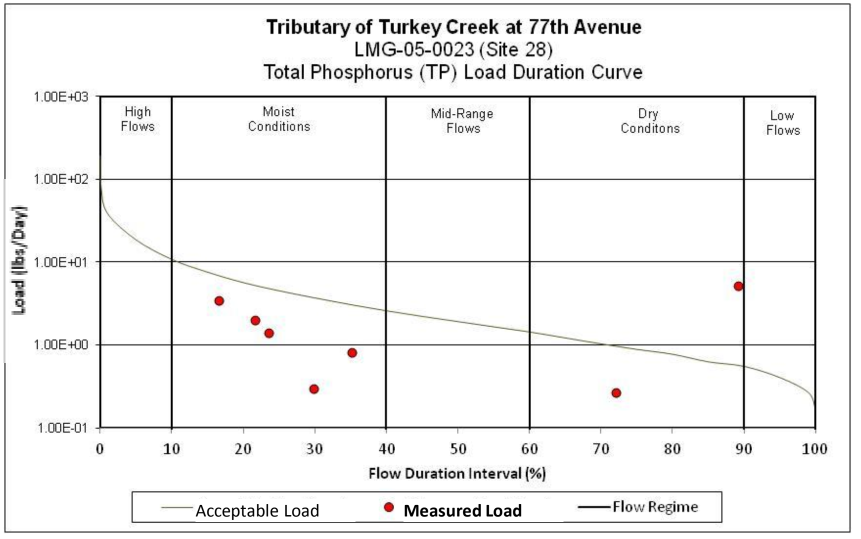
Downstream

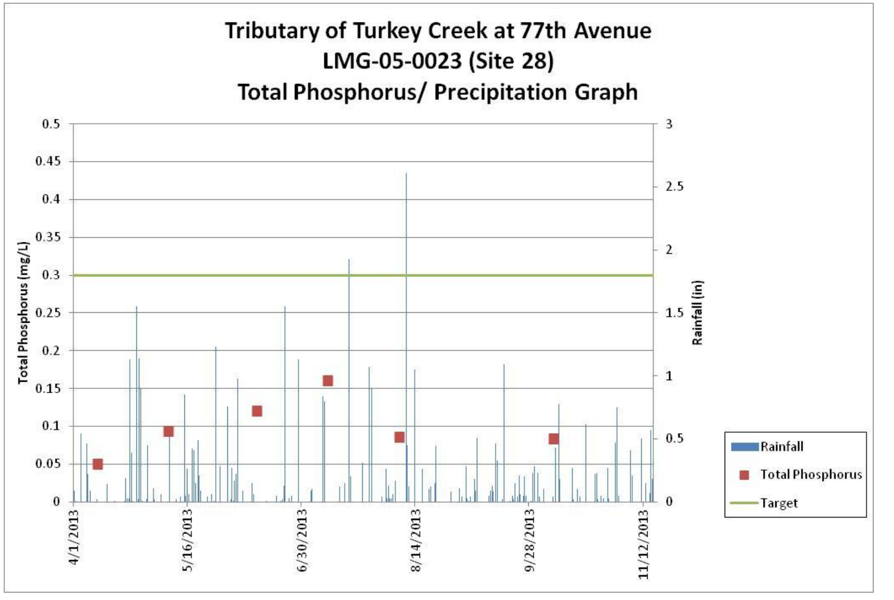

Tributary of Turkey Creek at 77th Avenue
LMG-05-0023 (Site 28)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

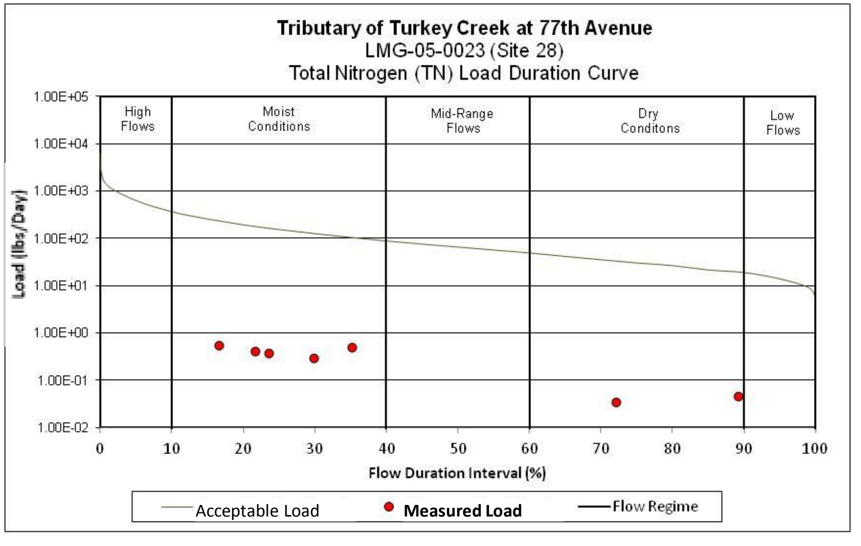

Tributary of Turkey Creek at 77th Avenue
LMG-05-0023 (Site 28)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
2500
2000
1500
1000
500
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/1/2013
5/31/2013
6/30/2013
7/30/2013
8/29/2013
9/28/2013
10/28/2013
Rainfall
E.coli
Target

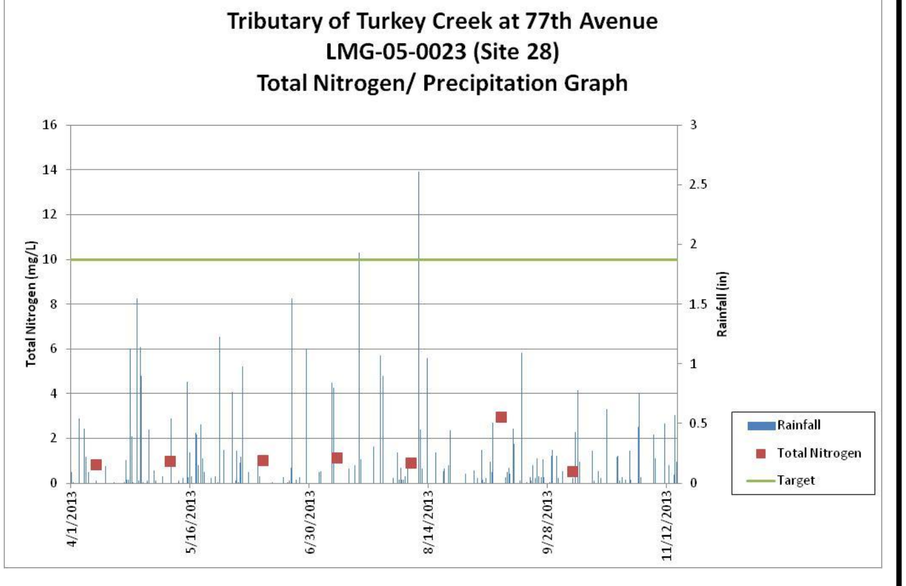

Tributary of Turkey Creek at 77th Avenue
LMG-05-0023 (Site 28)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
0
10
20
30
40
50
60
70
80
90
100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Tributary of Turkey Creek at 77th Avenue
LMG-05-0023 (Site 28)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
140
120
100
80
60
40
20
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Suspended Solids
Target


Tributary of Turkey Creek at 77th Avenue
LMG-05-0023 (Site 28)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Tributary of Turkey Creek at 77th Avenue
LMG-05-0023 (Site 28)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target

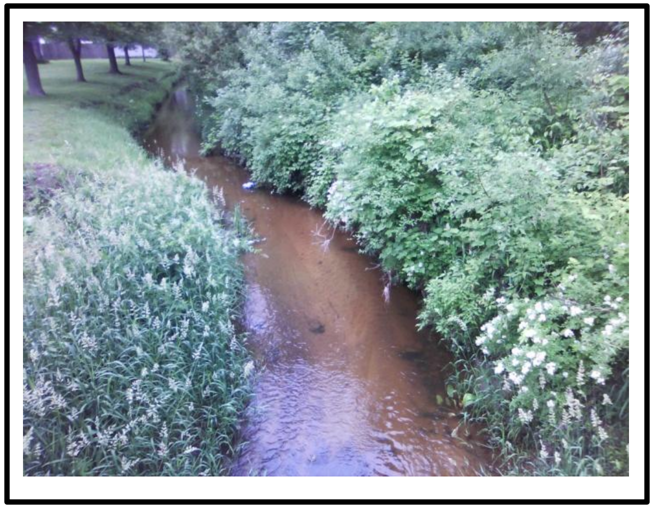

Tributary of Turkey Creek at 77th Avenue
LMG-05-0023 (Site 28)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

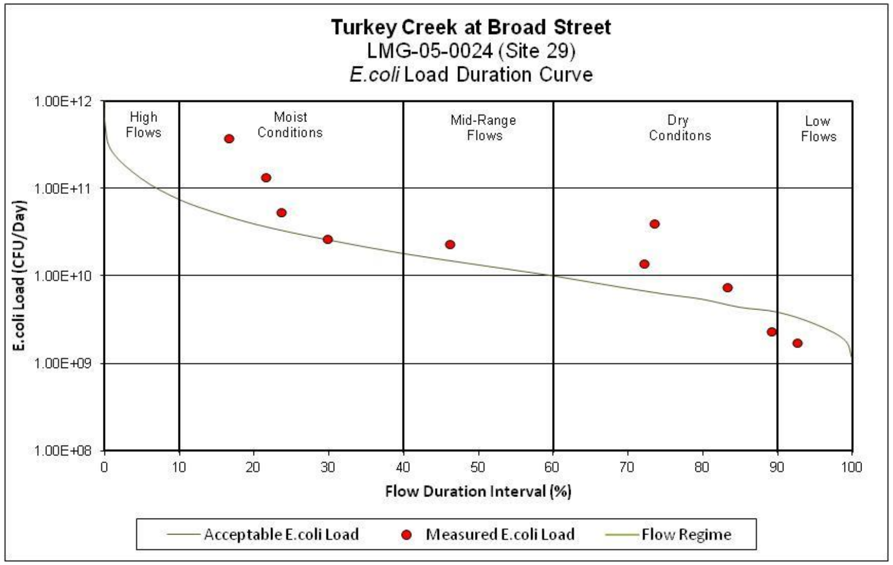

Tributary of Turkey Creek at 77th Avenue
LMG-05-0023 (Site 28)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

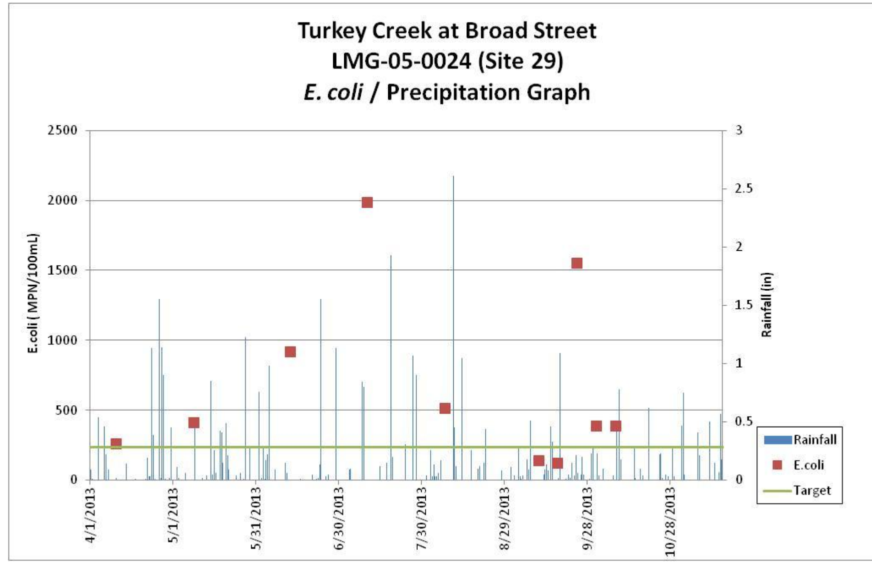
LMG-05-0024 (Site 29)
Turkey Creek

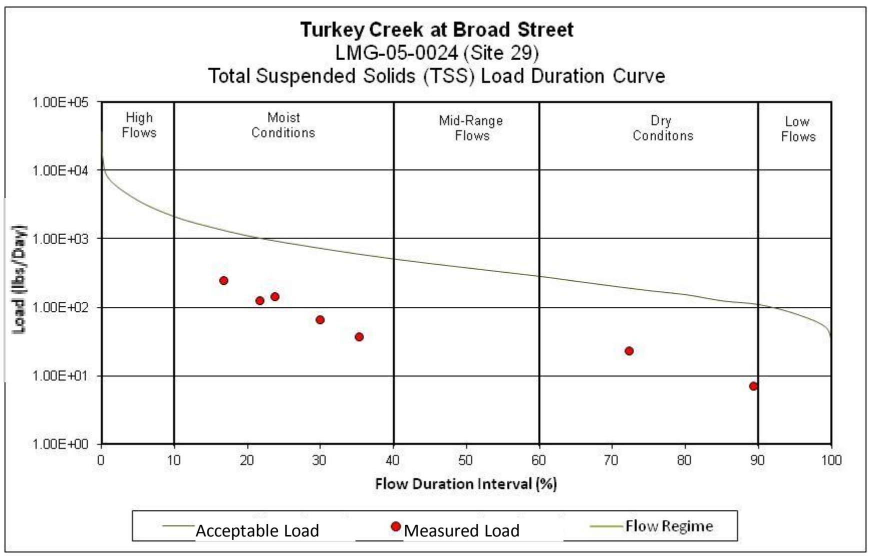
Upstream

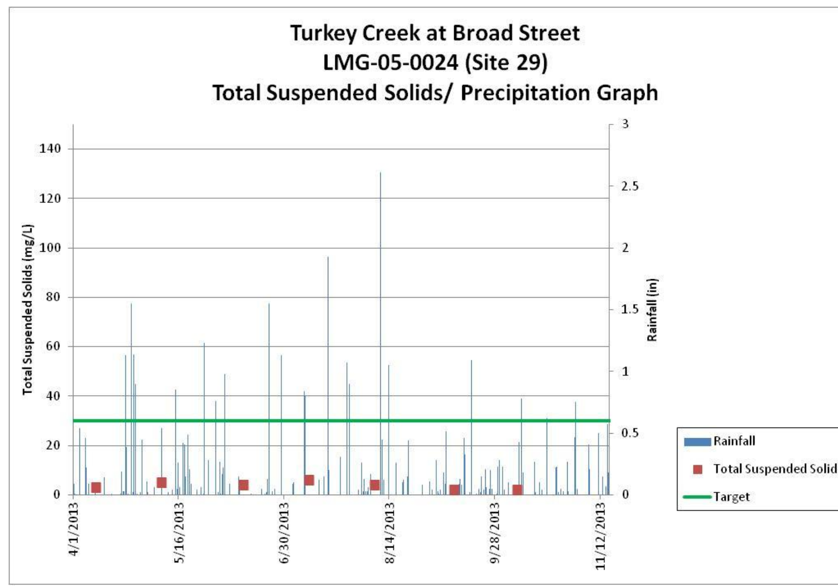
Downstream

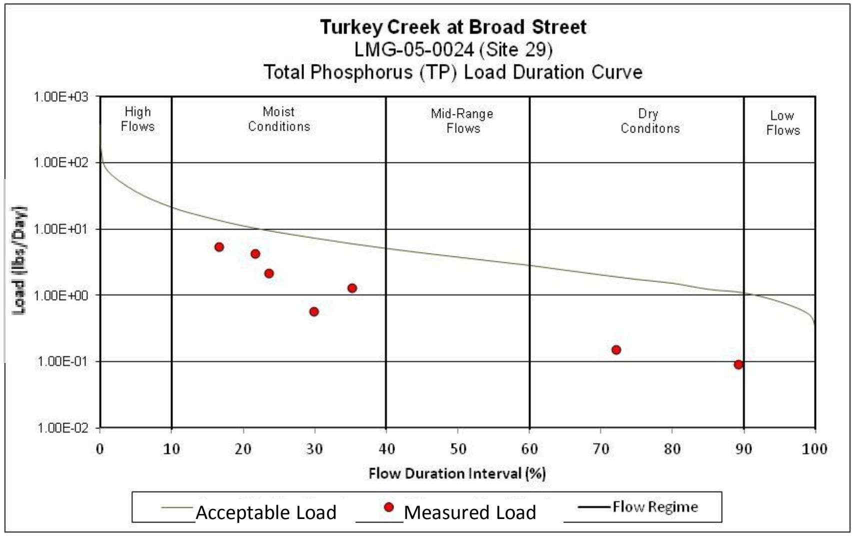



Turkey Creek at Broad Street
LMG-05-0024 (Site 29)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

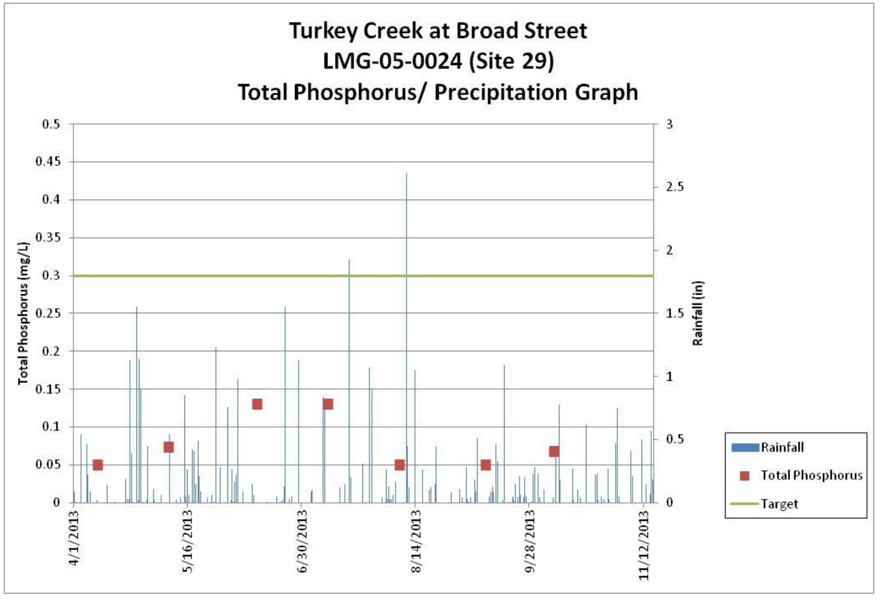

Turkey Creek at Broad Street
LMG-05-0024 (Site 29)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
2500
2000
1500
1000
500
0
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/1/2013
5/31/2013
6/30/2013
7/30/2013
8/29/2013
9/28/2013
10/28/2013
Rainfall
E.coli
Target


Turkey Creek at Broad Street
LMG-05-0024 (Site 29)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
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
Measured Load
Flow Regime

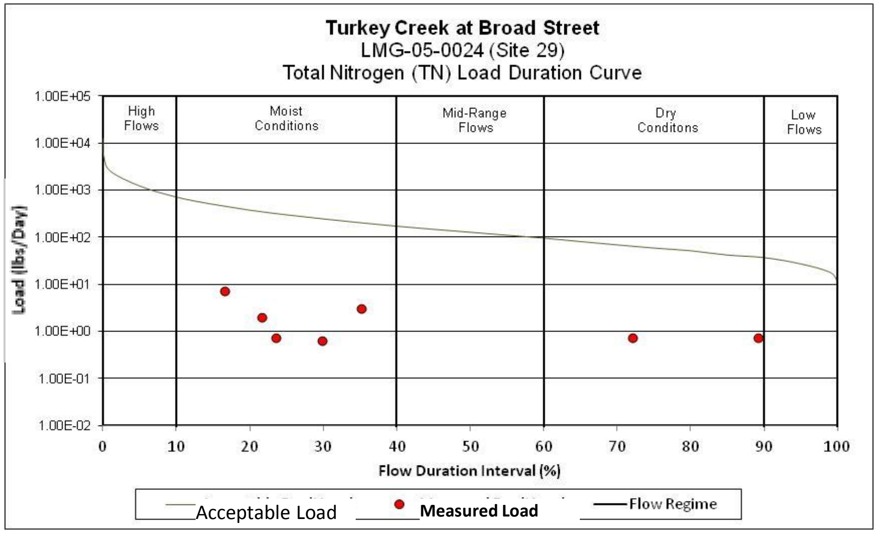

Turkey Creek at Broad Street
LMG-05-0024 (Site 29)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
140
120
100
80
60
40
20
0
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Suspended Solids
Target



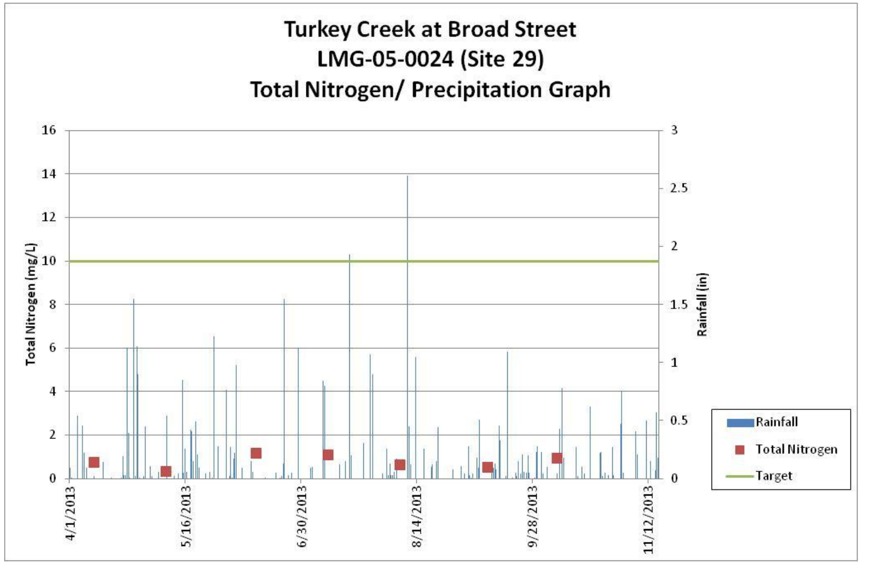
Turkey Creek at Broad Street
LMG-05-0024 (Site 29)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



Turkey Creek at Broad Street
LMG-05-0024 (Site 29)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target



Turkey Creek at Broad Street
LMG-05-0024 (Site 29)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

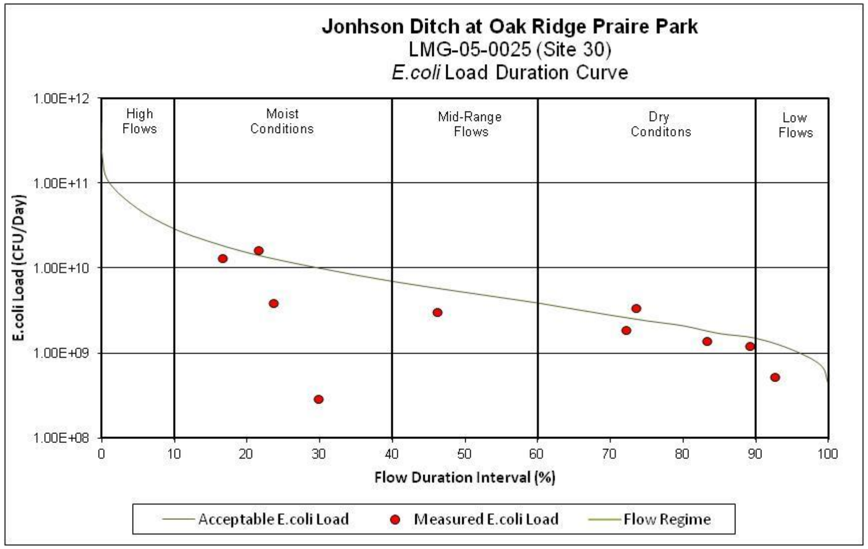


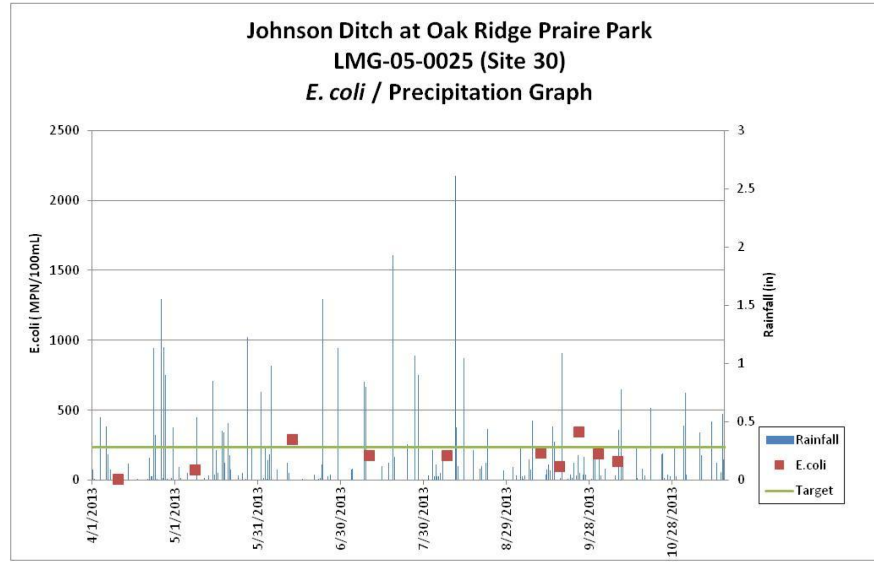
Turkey Creek at Broad Street
LMG-05-0024 (Site 29)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

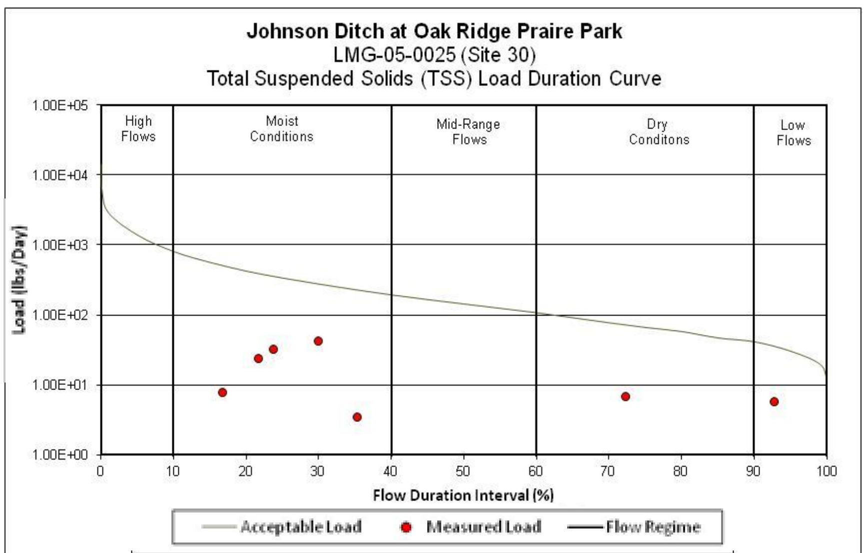
LMG-05-0025 (Site 30)
Johnson Ditch

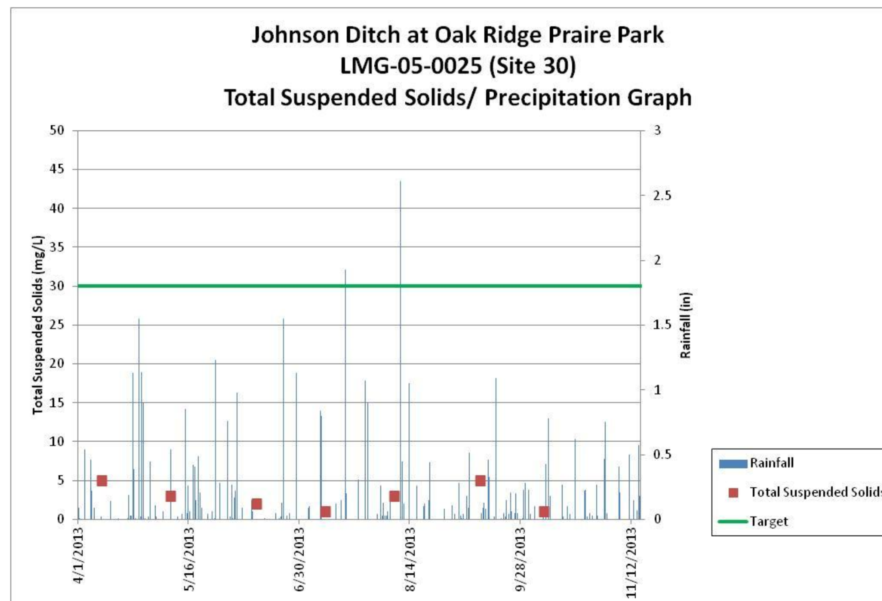
Upstream

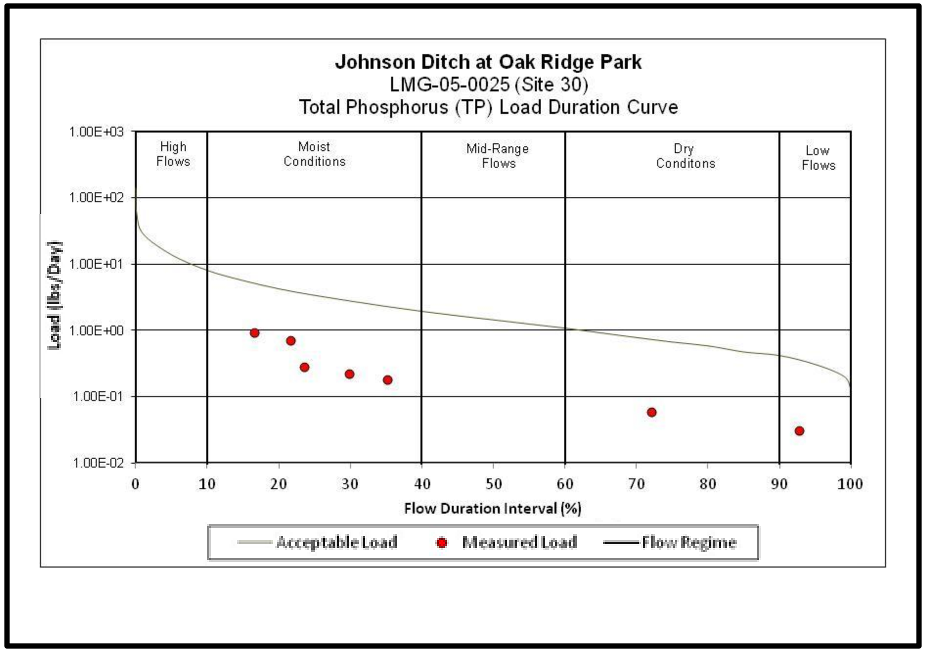
Downstream

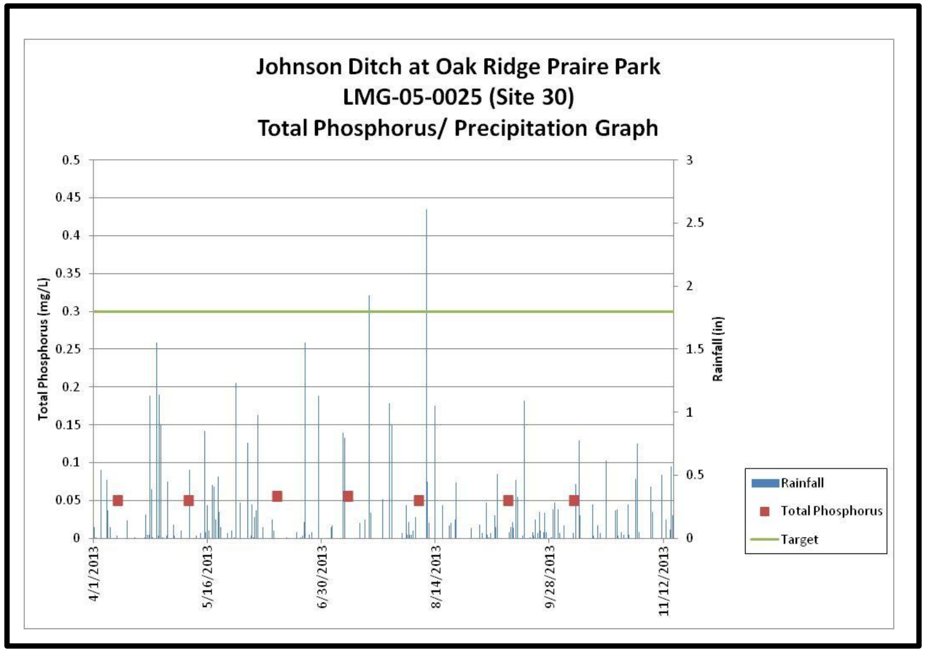

Jonhson Ditch at Oak Ridge Praire Park
LMG-05-0025 (Site 30)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

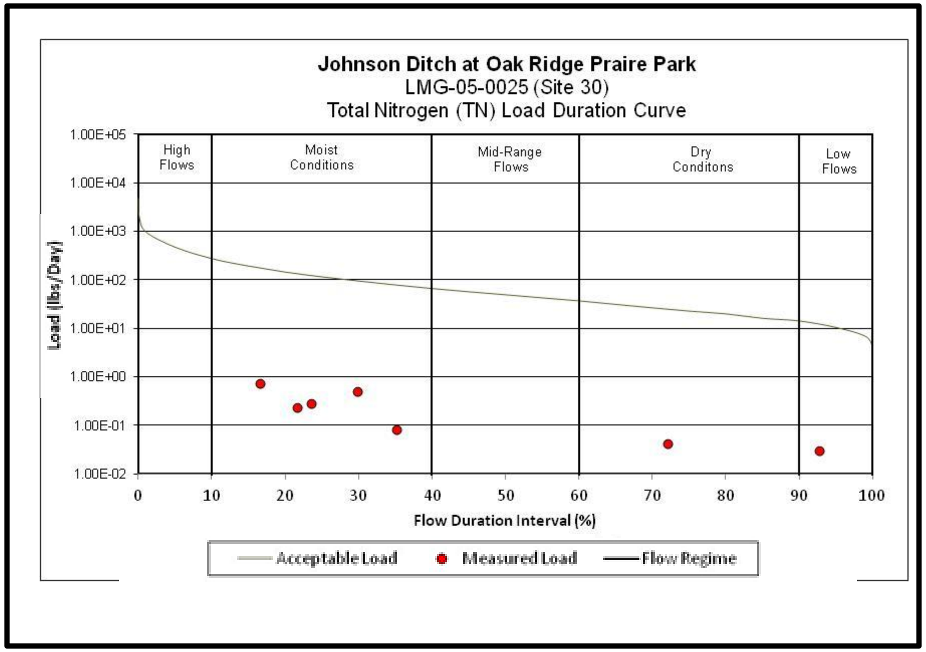

Johnson Ditch at Oak Ridge Praire Park
LMG-05-0025 (Site 30)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
2500
2000
1500
1000
500
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/1/2013
5/31/2013
6/30/2013
7/30/2013
8/29/2013
9/28/2013
10/28/2013
Rainfall
E.coli
Target

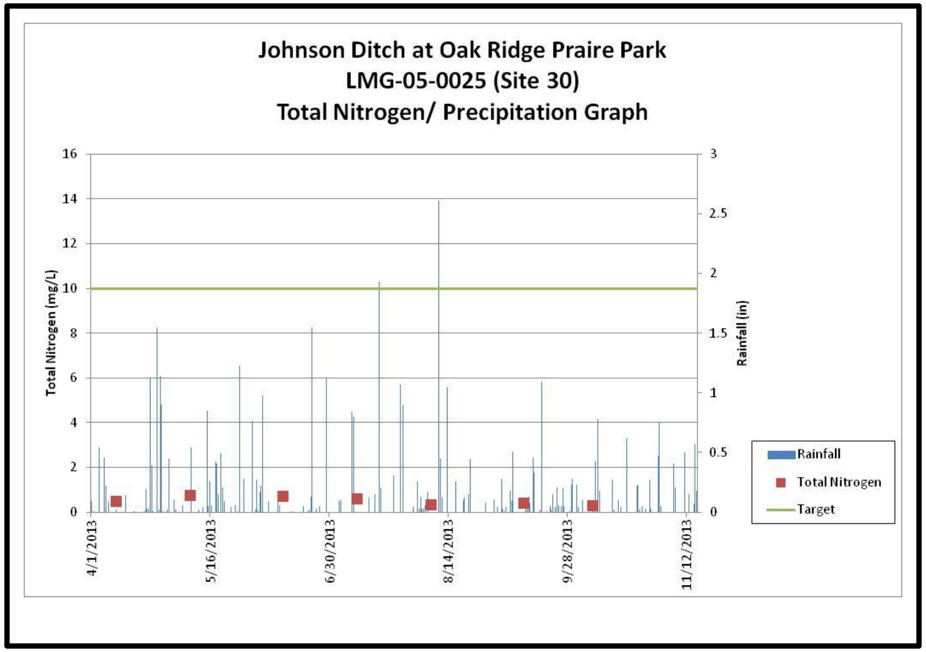

Johnson Ditch at Oak Ridge Praire Park
LMG-05-0025 (Site 30)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Johnson Ditch at Oak Ridge Praire Park
LMG-05-0025 (Site 30)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
50
45
40
35
30
25
20
15
10
5
0
Rainfall (in)
3
2.5
2
1.5
1
0.5
0
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Suspended Solids
Target


Johnson Ditch at Oak Ridge Park
LMG-05-0025 (Site 30)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Johnson Ditch at Oak Ridge Praire Park
LMG-05-0025 (Site 30)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target

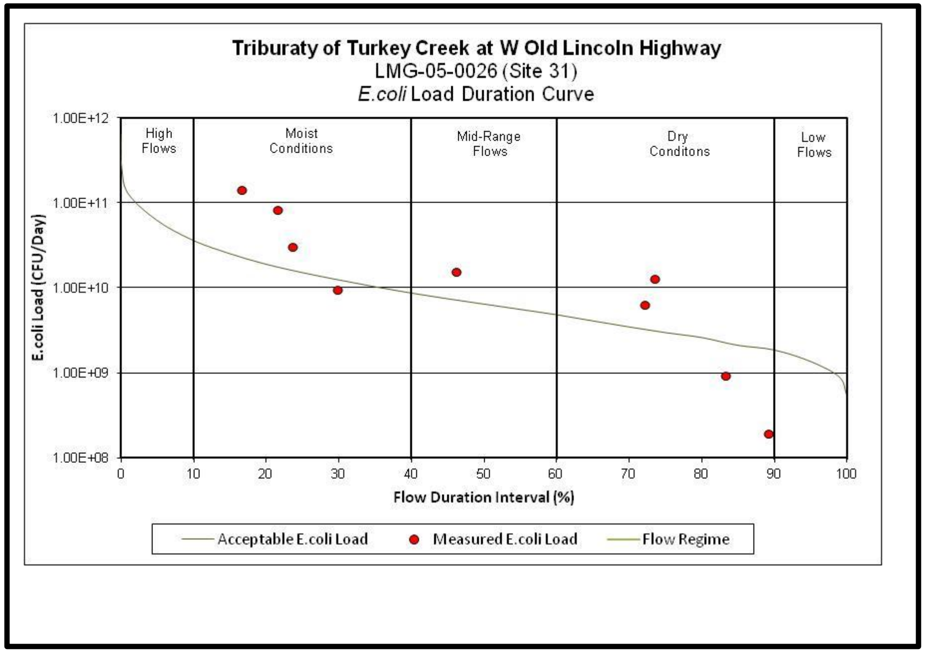

Johnson Ditch at Oak Ridge Praire Park
LMG-05-0025 (Site 30)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Johnson Ditch at Oak Ridge Praire Park
LMG-05-0025 (Site 30)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

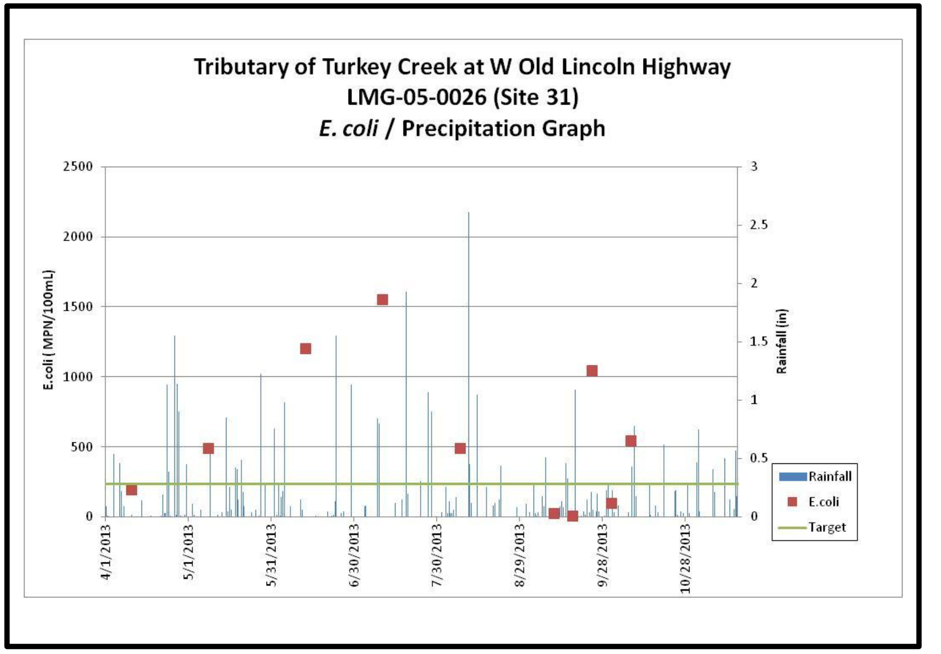
LMG-05-0026 (Site 31)
Tributary of Turkey Creek

Upstream

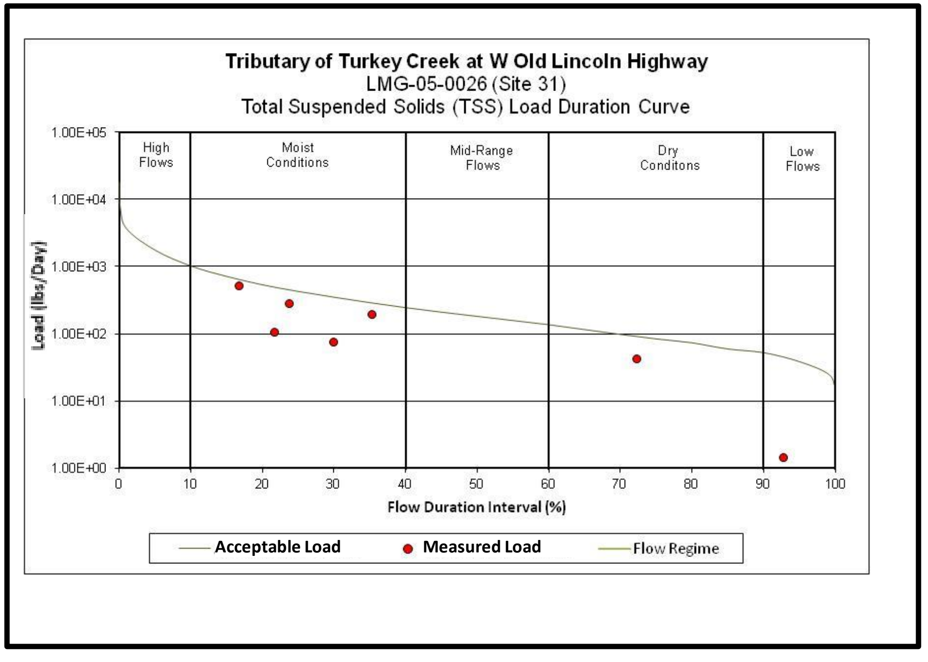
Downstream



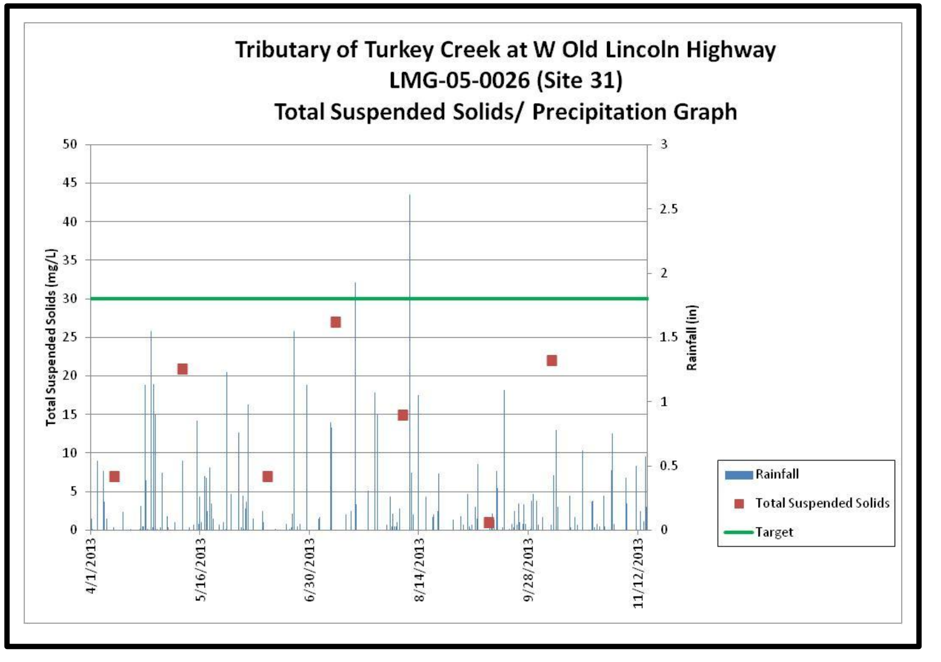
Triburaty of Turkey Creek at W Old Lincoln Highway
LMG-05-0026 (Site 31)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable E.coli Load
Measured E.coli Load
Flow Regime



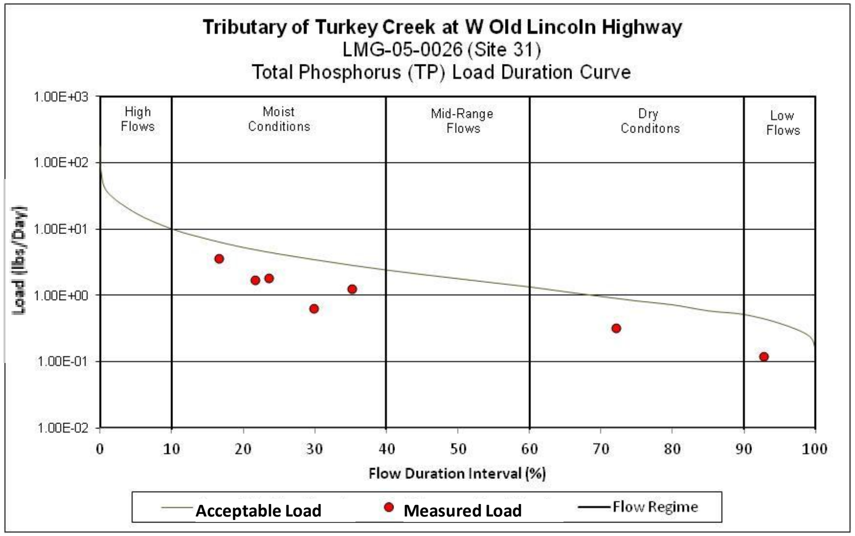
Tributary of Turkey Creek at W Old Lincoln Highway
LMG-05-0026 (Site 31)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target



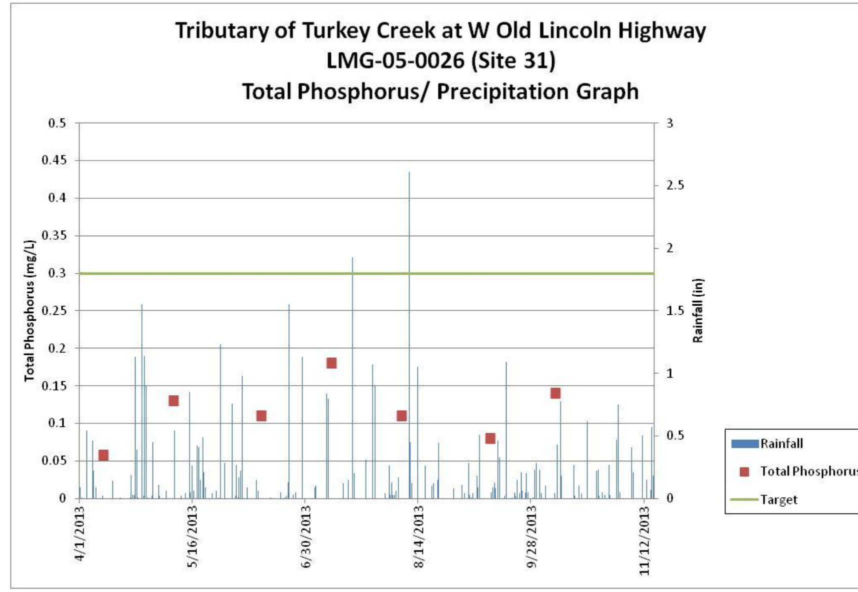
Tributary of Turkey Creek at W Old Lincoln Highway
LMG-05-0026 (Site 31)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
Measured Load
Flow Regime



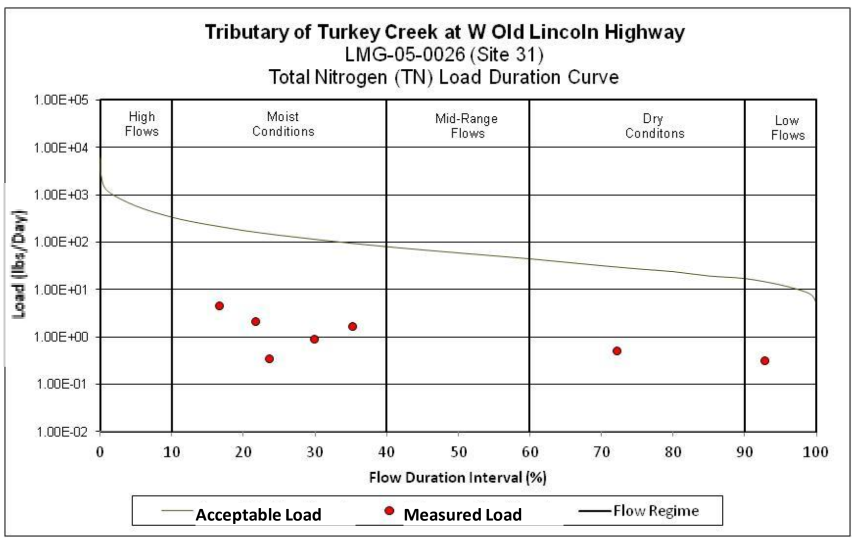
Tributary of Turkey Creek at W Old Lincoln Highway
LMG-05-0026 (Site 31)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target



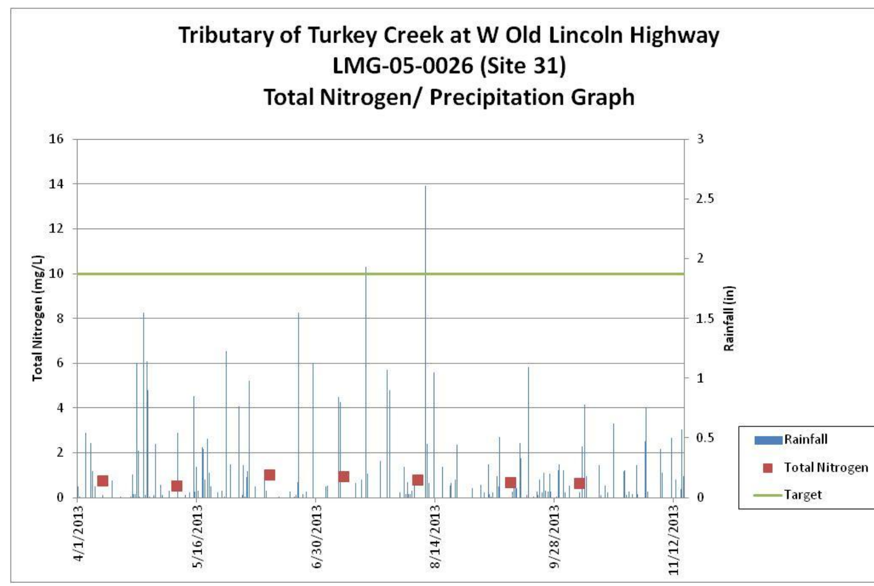
Tributary of Turkey Creek at W Old Lincoln Highway
LMG-05-0026 (Site 31)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



Tributary of Turkey Creek at W Old Lincoln Highway
LMG-05-0026 (Site 31)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target



Tributary of Turkey Creek at W Old Lincoln Highway
LMG-05-0026 (Site 31)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

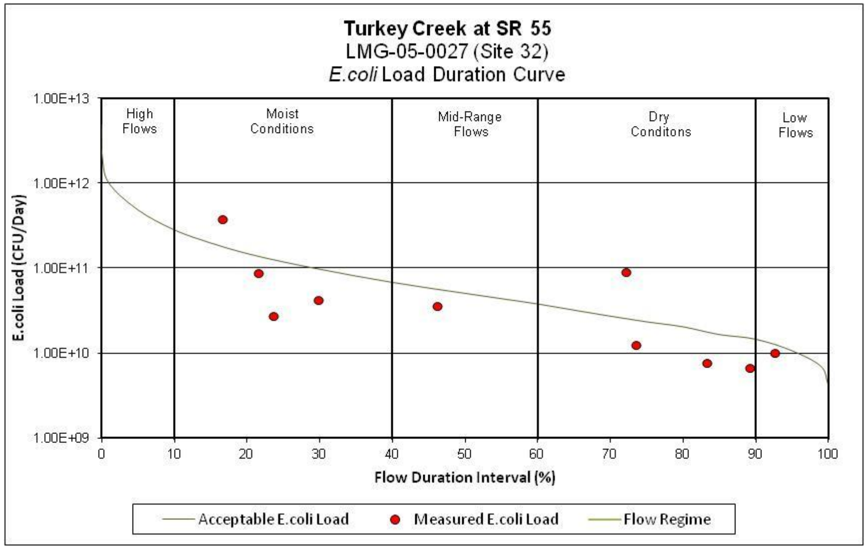


Tributary of Turkey Creek at W Old Lincoln Highway
LMG-05-0026 (Site 31)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

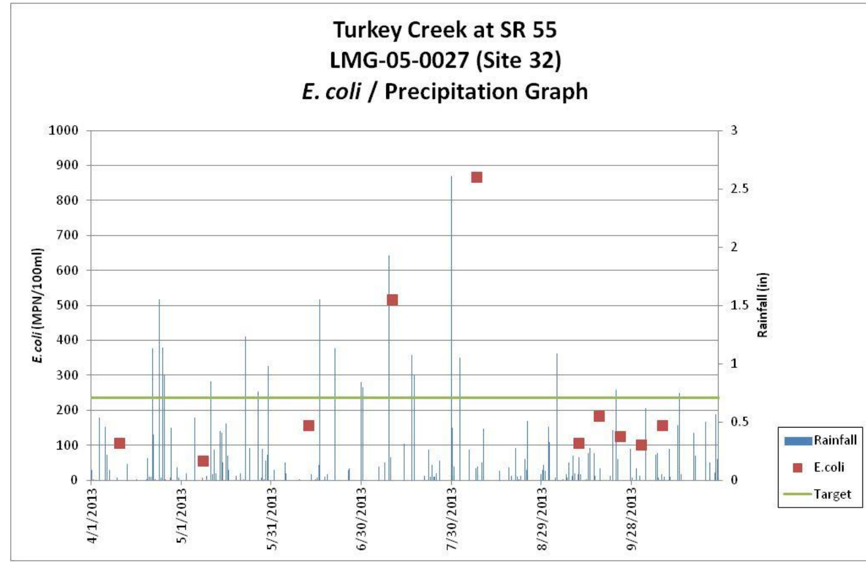
LMG-05-0027 (Site 32)
Turkey Creek

Upstream

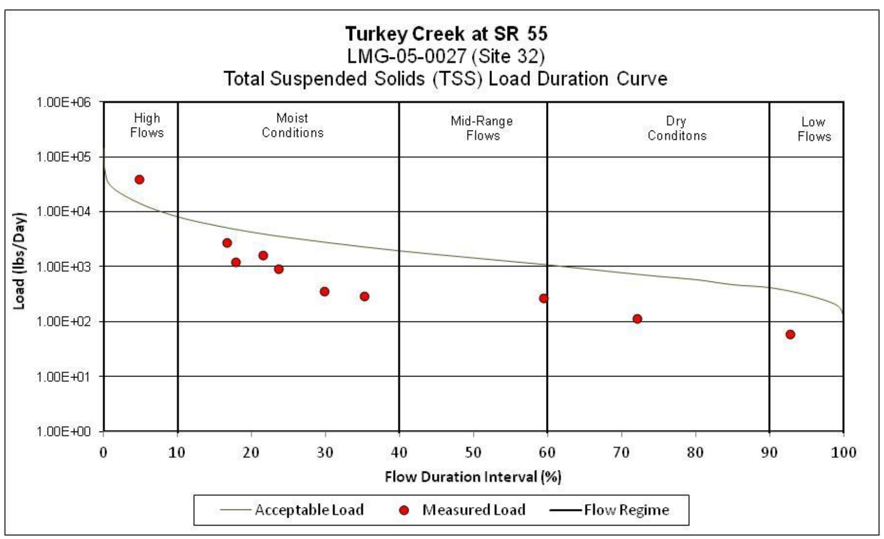
Downstream



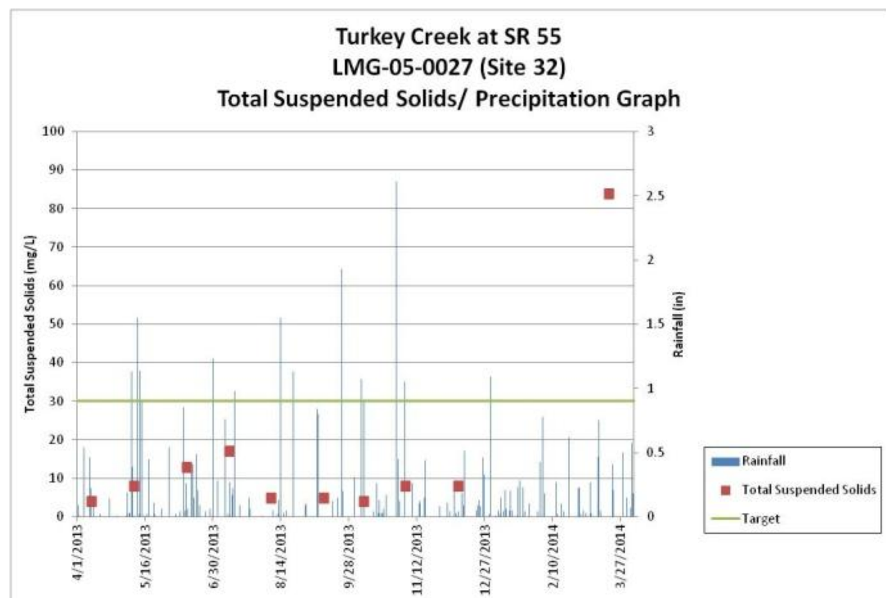
Turkey Creek at SR 55
LMG-05-0027 (Site 32)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime



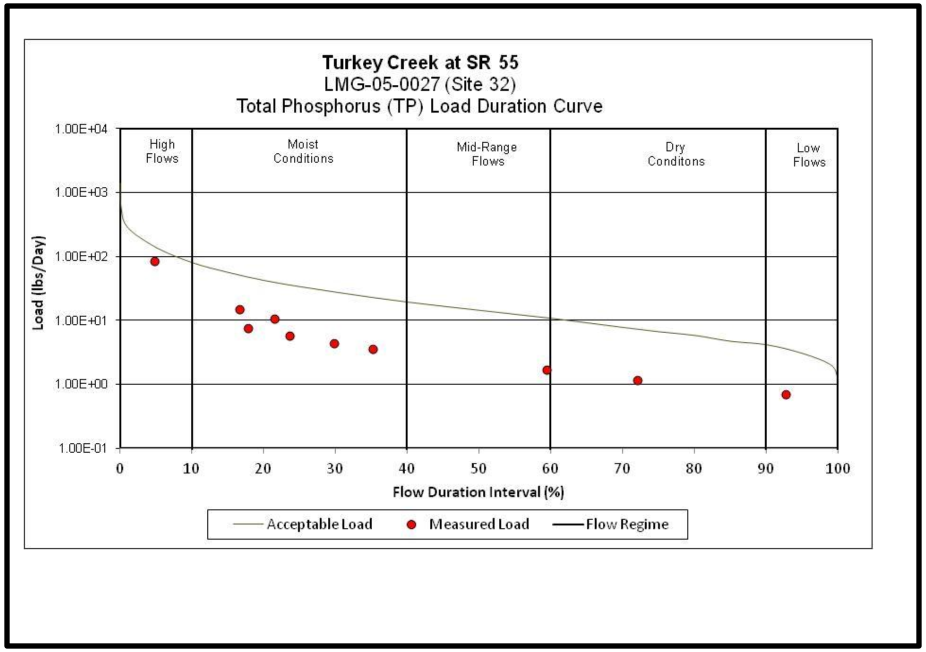
Turkey Creek at SR 55
LMG-05-0027 (Site 32)
E. coli / Precipitation Graph
E.coli (MPN/100ml)
Rainfall (in)
Rainfall
E.coli
Target



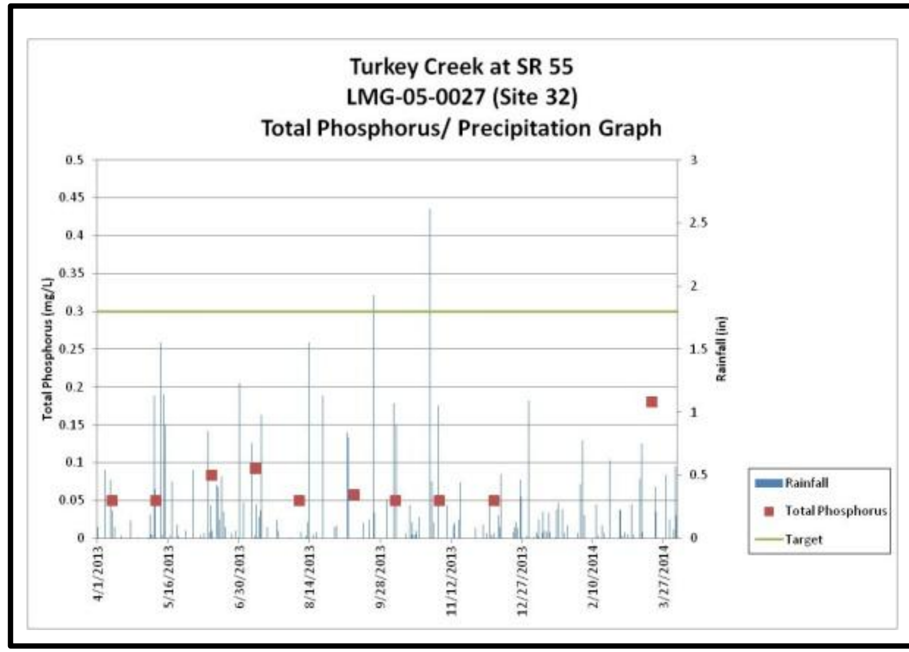
Turkey Creek at SR 55
LMG-05-0027 (Site 32)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



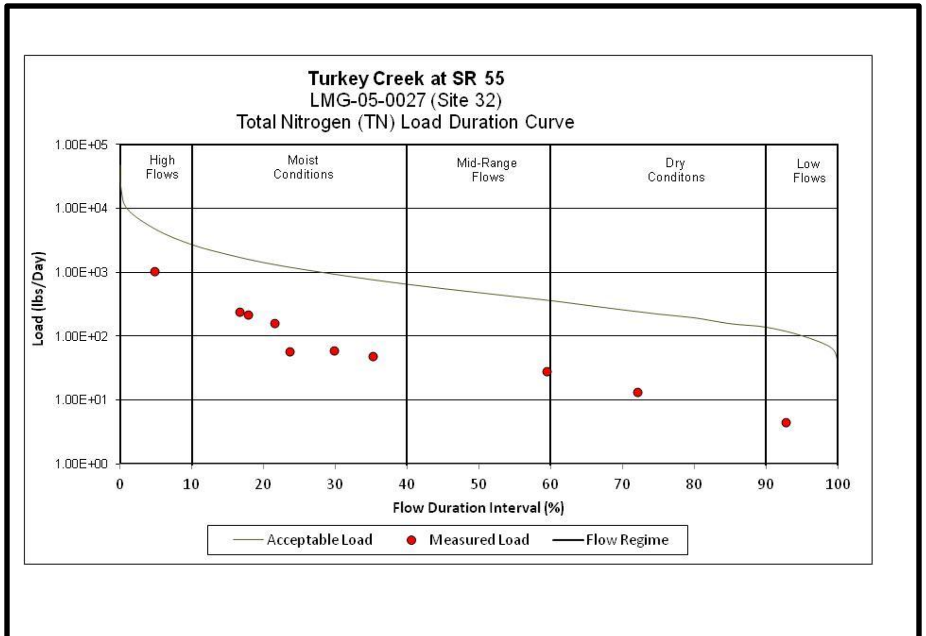
Turkey Creek at SR 55
LMG-05-0027 (Site 32)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target



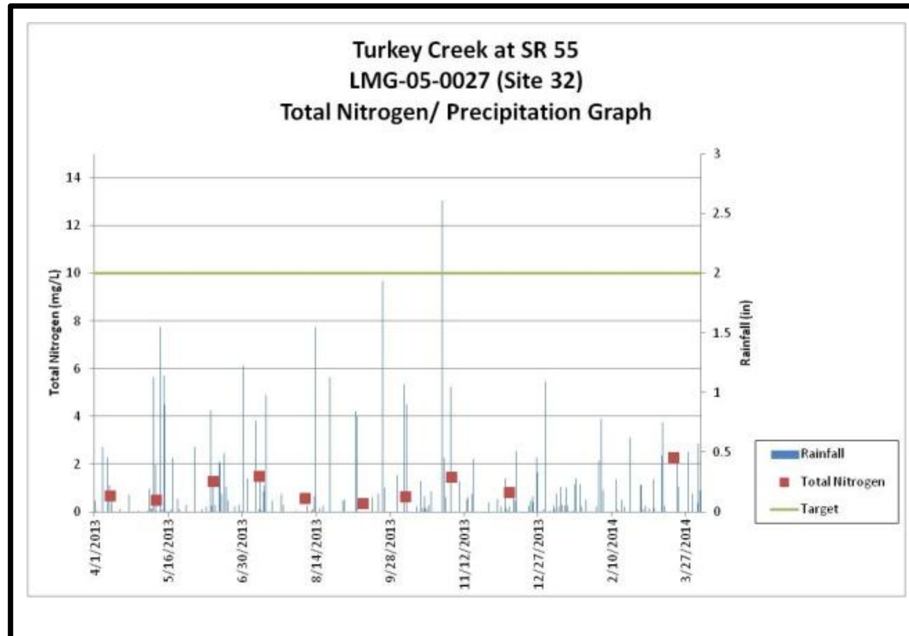
Turkey Creek at SR 55
LMG-05-0027 (Site 32)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



Turkey Creek at SR 55
LMG-05-0027 (Site 32)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target



Turkey Creek at SR 55
LMG-05-0027 (Site 32)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

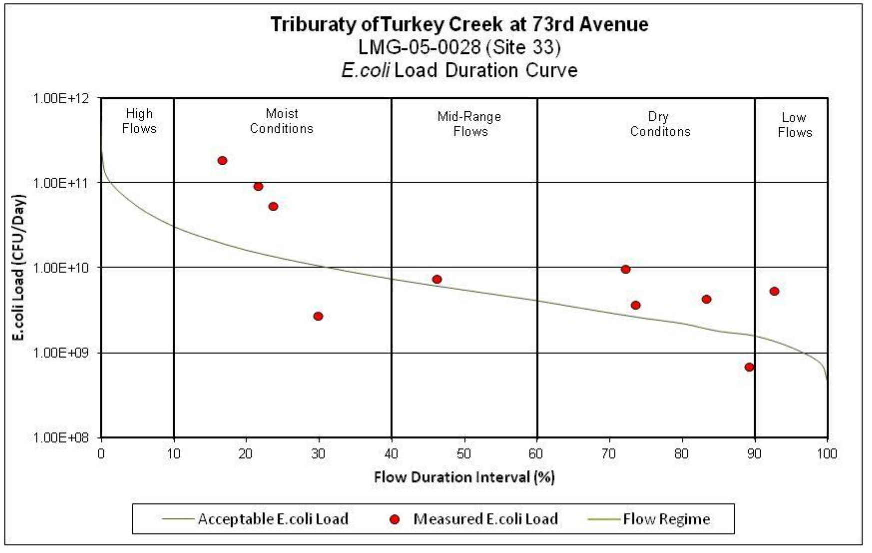


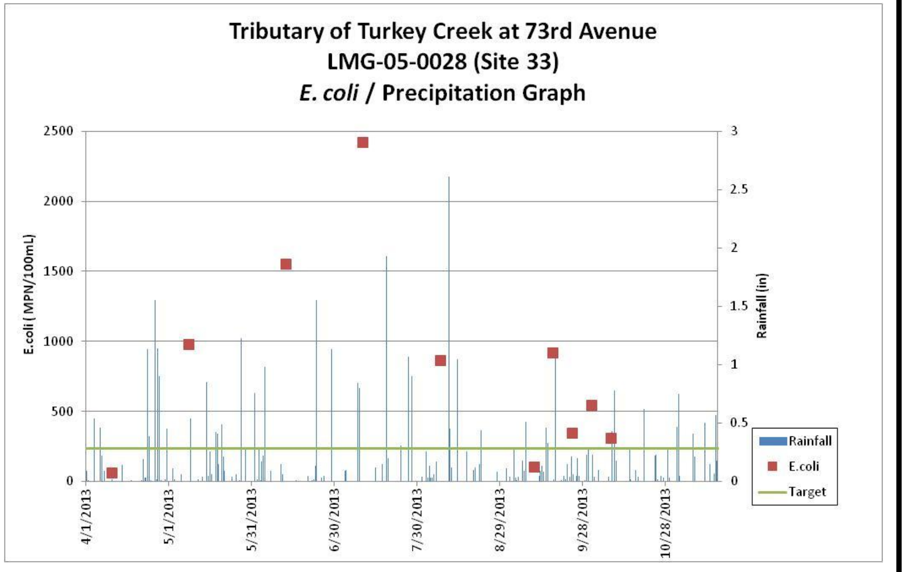
Turkey Creek at SR 55
LMG-05-0027 (Site 32)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

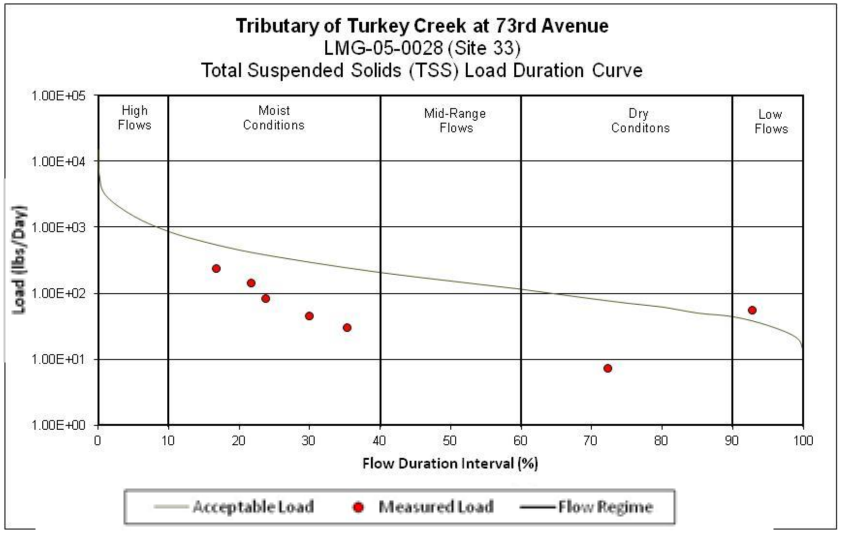
LMG-05-0028 (Site 33)
Tributary of Turkey Creek

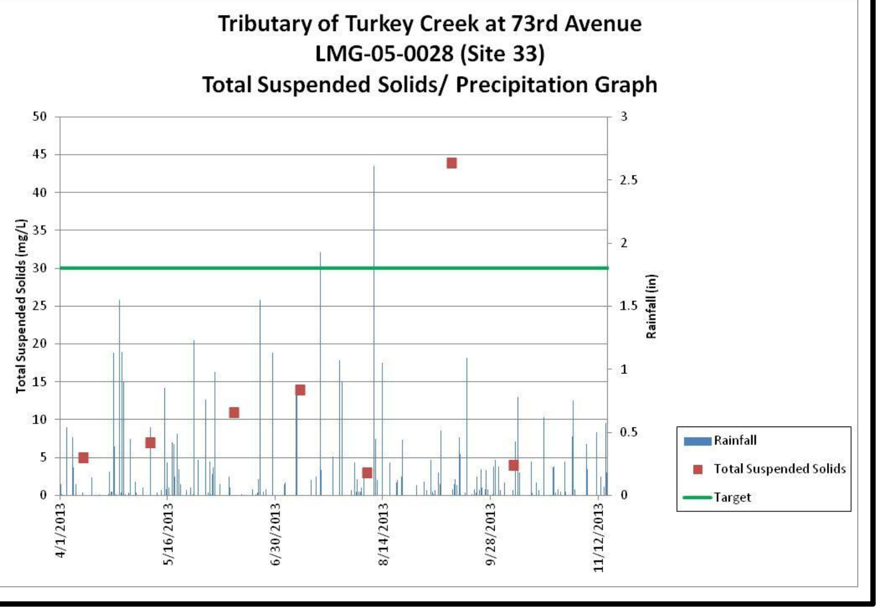
Upstream

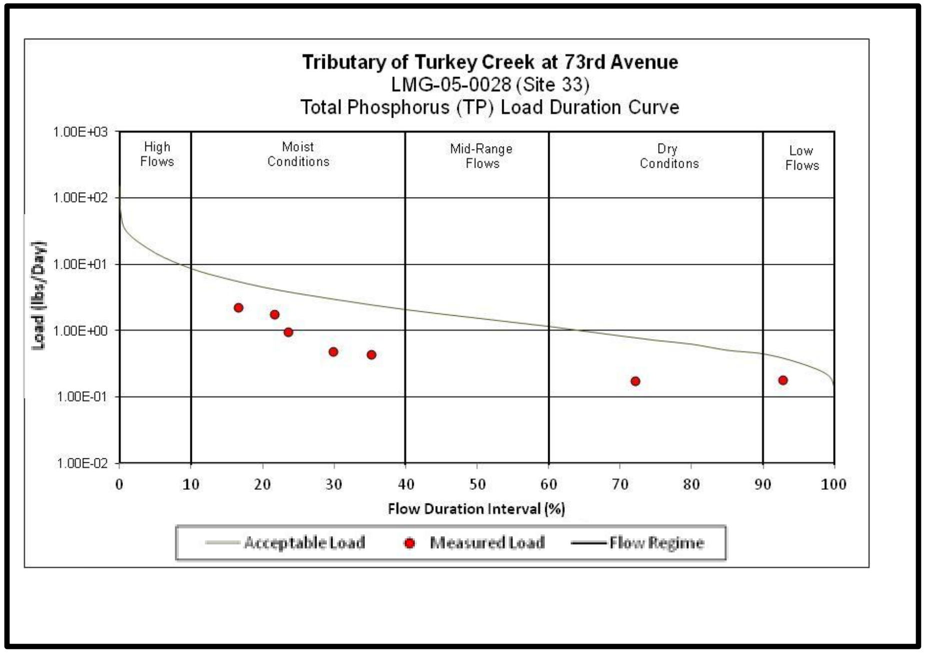
Downstream

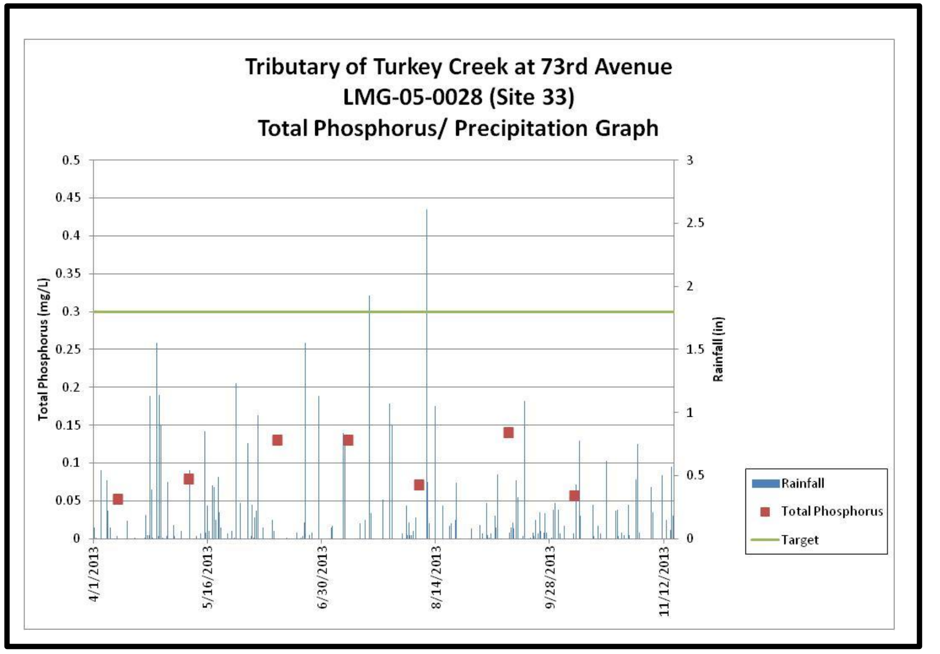

Triburaty ofTurkey Creek at 73rd Avenue
LMG-05-0028 (Site 33)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

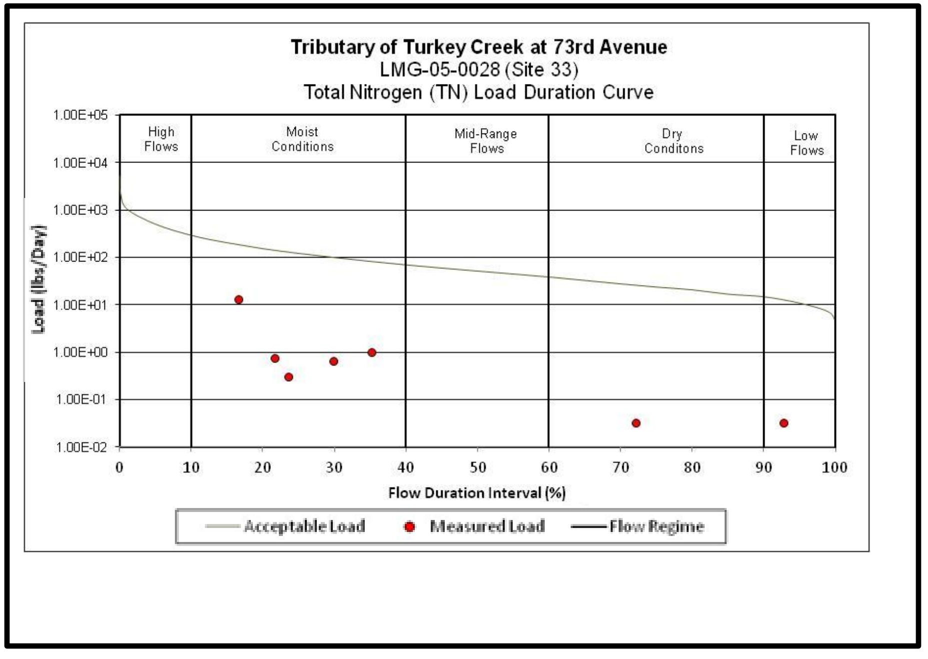

Tributary of Turkey Creek at 73rd Avenue
LMG-05-0028 (Site 33)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target

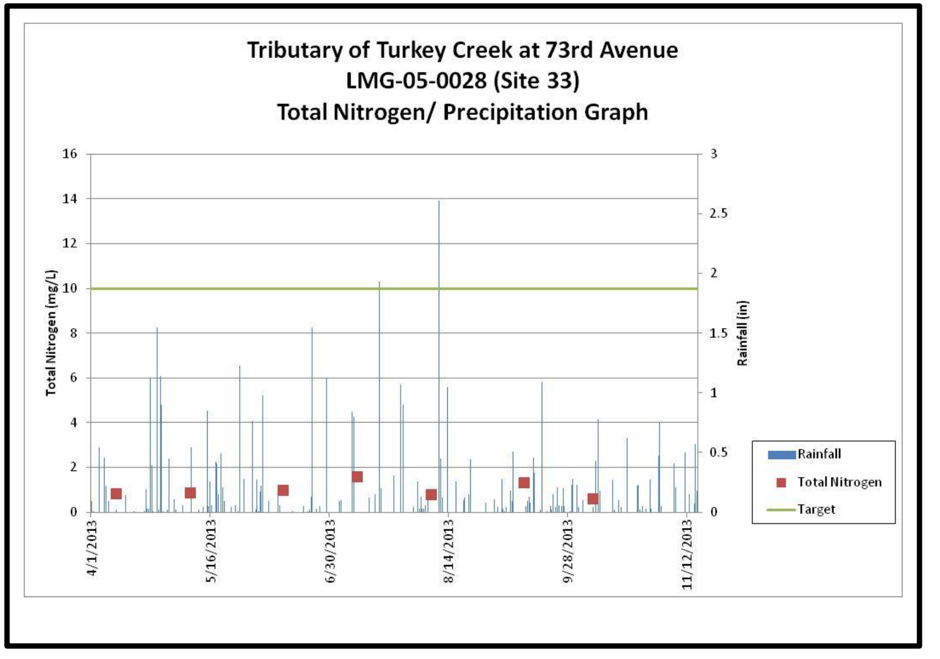

Tributary of Turkey Creek at 73rd Avenue
LMG-05-0028 (Site 33)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Tributary of Turkey Creek at 73rd Avenue
LMG-05-0028 (Site 33)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target


Tributary of Turkey Creek at 73rd Avenue
LMG-05-0028 (Site 33)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

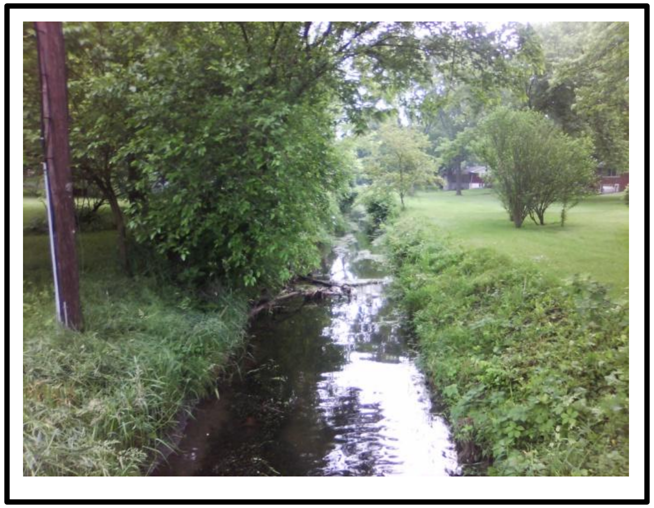

Tributary of Turkey Creek at 73rd Avenue
LMG-05-0028 (Site 33)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target


Tributary of Turkey Creek at 73rd Avenue
LMG-05-0028 (Site 33)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

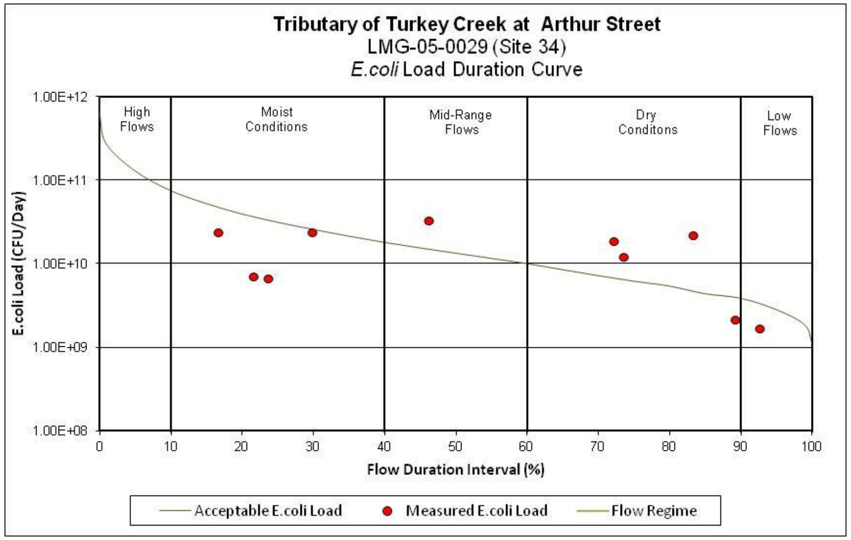

Tributary of Turkey Creek at 73rd Avenue
LMG-05-0028 (Site 33)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

LMG-05-0029 (Site 34)
Tributary of Turkey Creek

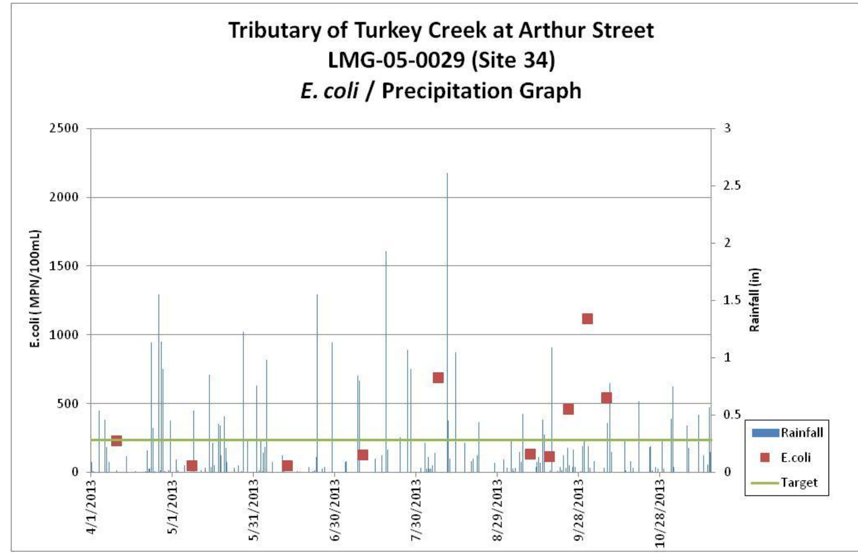
Upstream



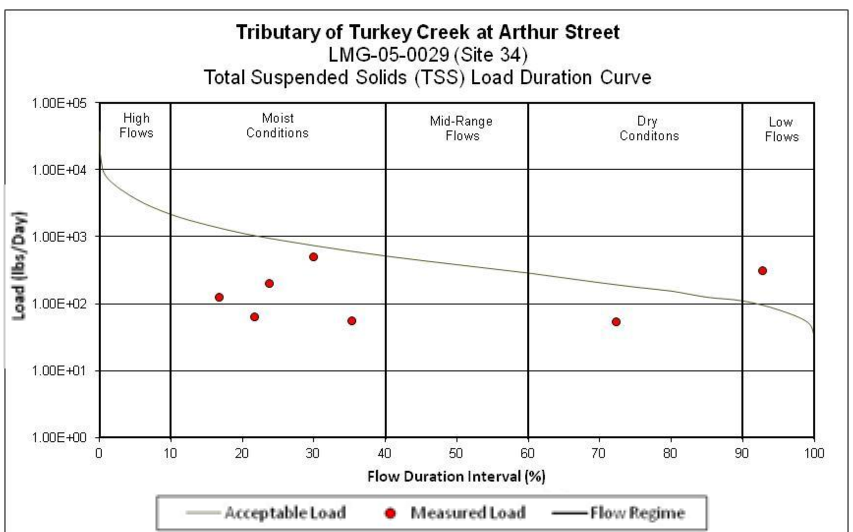
Downstream



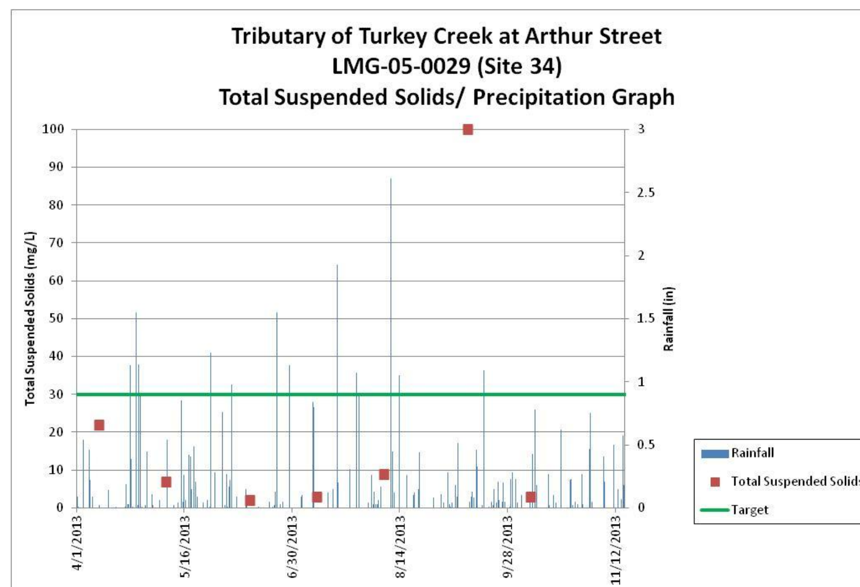
Tributary of Turkey Creek at Arthur Street
LMG-05-0029 (Site 34)
E.coli Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
E.coli Load (CFU/Day)
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime



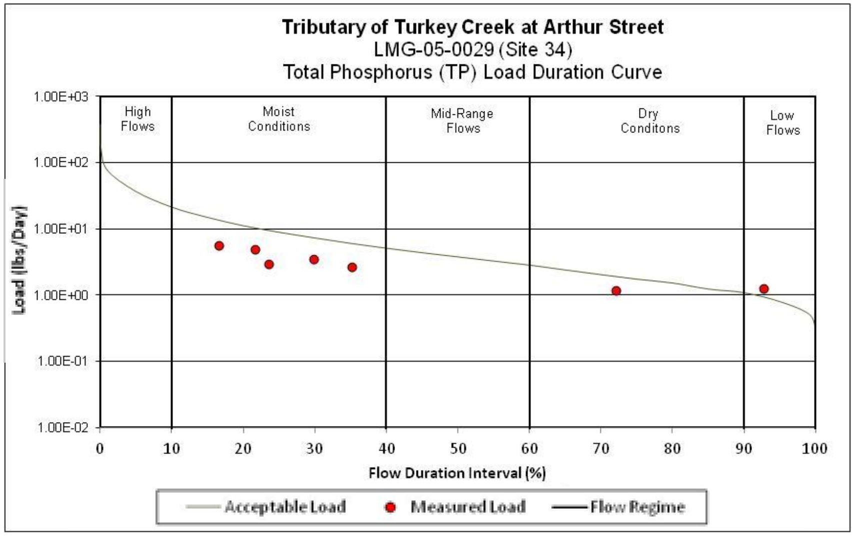
Tributary of Turkey Creek at Arthur Street
LMG-05-0029 (Site 34)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
Rainfall (in)
Rainfall
E.coli
Target

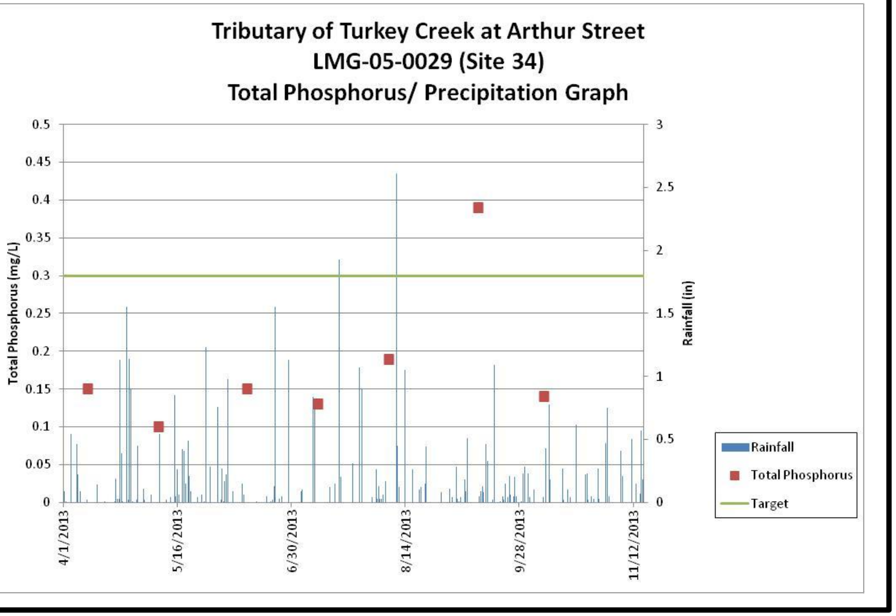


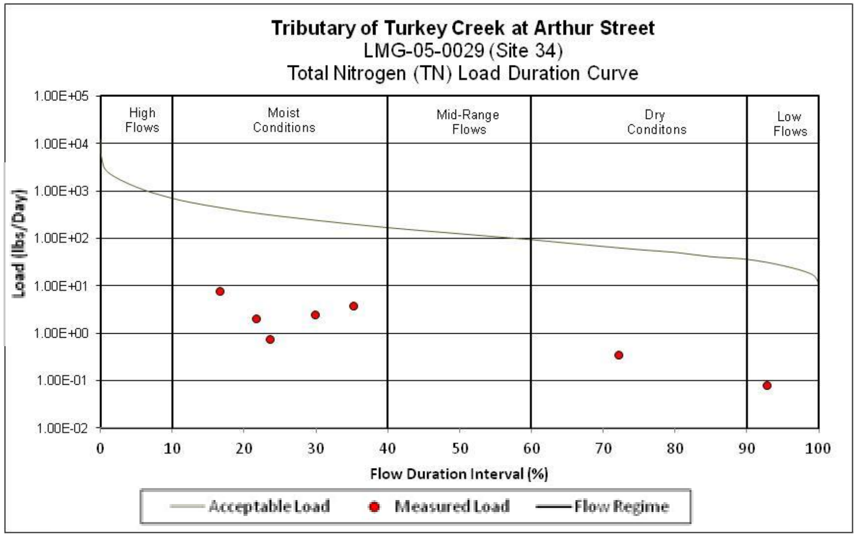
Tributary of Turkey Creek at Arthur Street
LMG-05-0029 (Site 34)
Total Suspended Solids (TSS) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

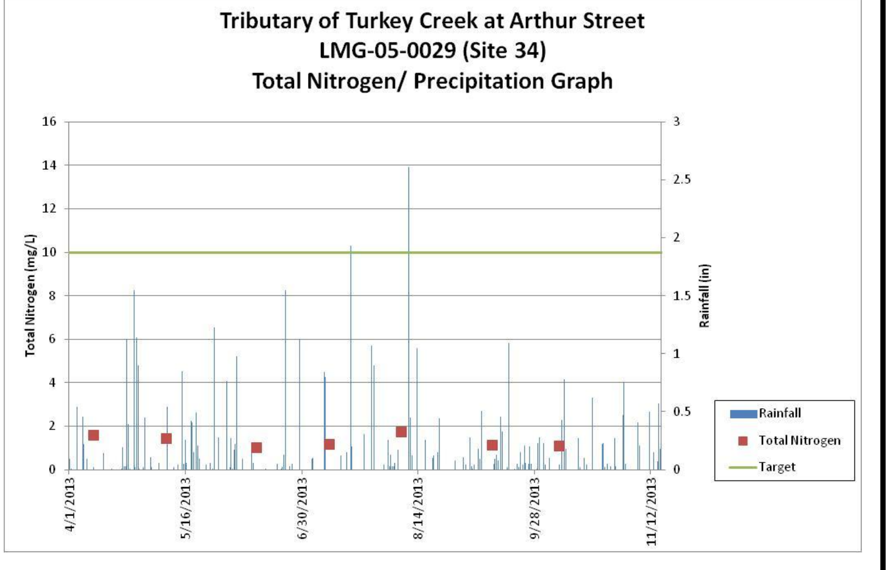


Tributary of Turkey Creek at Arthur Street
LMG-05-0029 (Site 34)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target


Tributary of Turkey Creek at Arthur Street
LMG-05-0029 (Site 34)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Tributary of Turkey Creek at Arthur Street
LMG-05-0029 (Site 34)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target

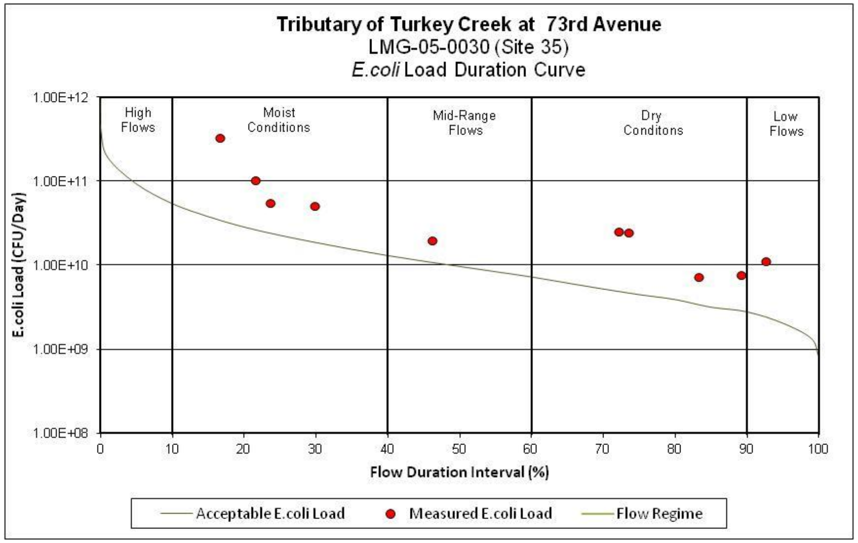

Tributary of Turkey Creek at Arthur Street
LMG-05-0029 (Site 34)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime


Tributary of Turkey Creek at Arthur Street
LMG-05-0029 (Site 34)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target

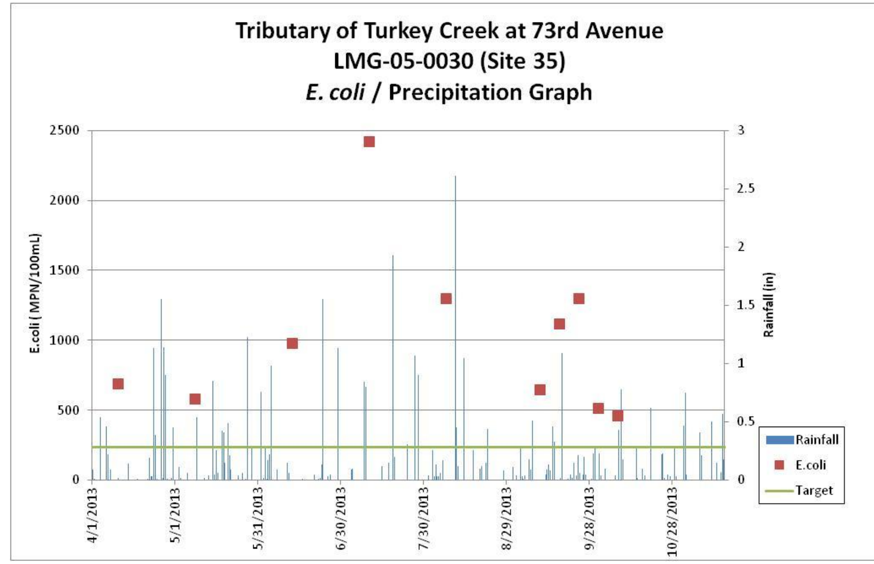
LMG-05-0030 (Site 35)
Tributary of Turkey Creek

Upstream

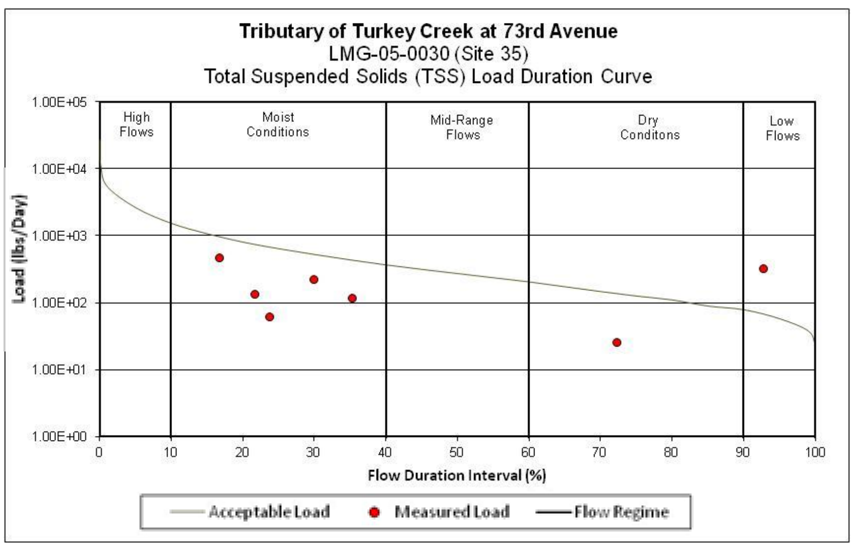
Downstream



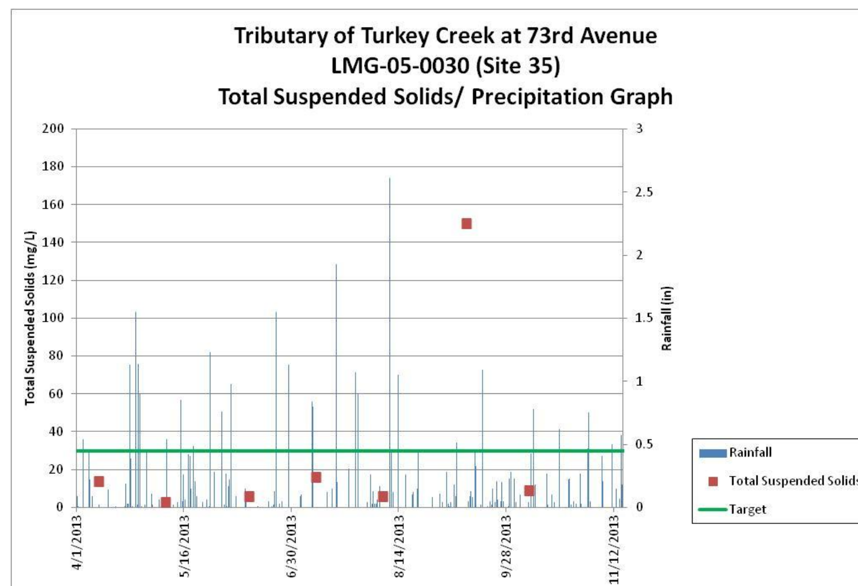
Tributary of Turkey Creek at 73rd Avenue
LMG-05-0030 (Site 35)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
1.00E+12
1.00E+11
1.00E+10
1.00E+09
1.00E+08
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable E.coli Load
Measured E.coli Load
Flow Regime



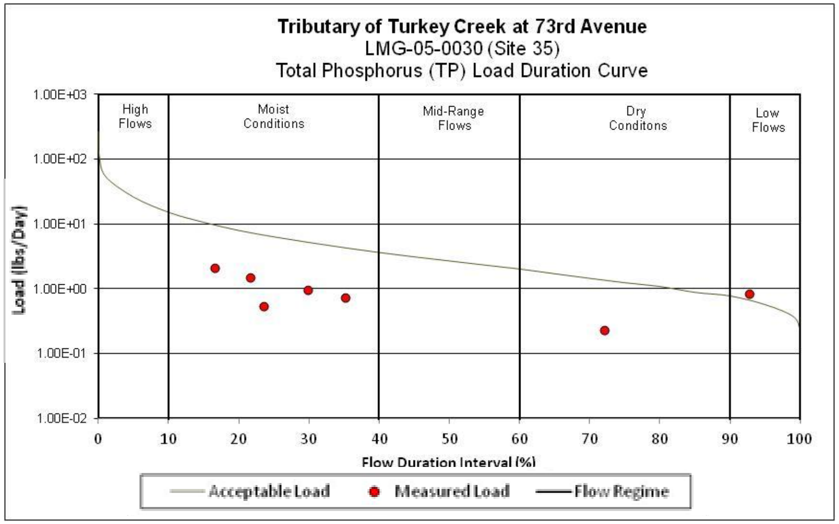
Tributary of Turkey Creek at 73rd Avenue
LMG-05-0030 (Site 35)
E. coli / Precipitation Graph
E.coli (MPN/100mL)
2500 2000 1500 1000 500 0
Rainfall (in)
3 2.5 2 1.5 1 0.5 0
4/1/2013 5/1/2013 5/31/2013 6/30/2013 7/30/2013 8/29/2013 9/28/2013 10/28/2013
Rainfall
E.coli
Target



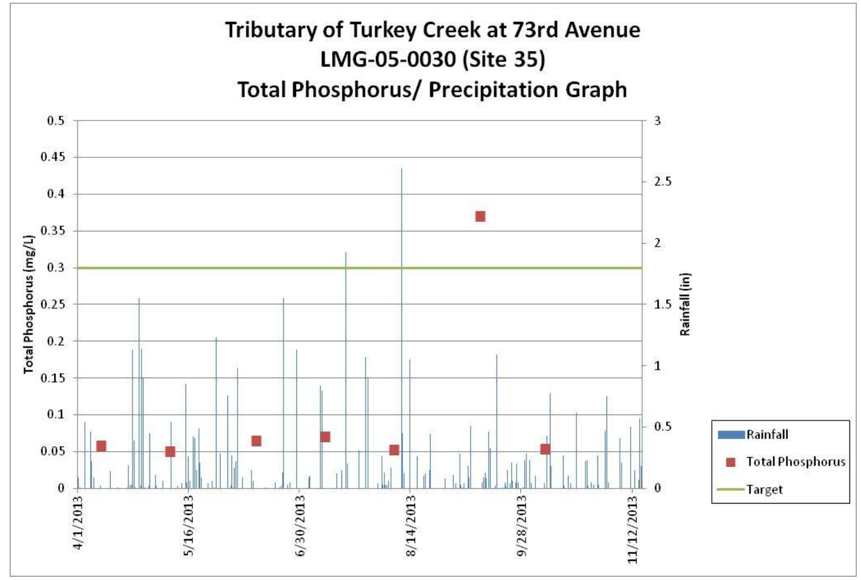
Tributary of Turkey Creek at 73rd Avenue
LMG-05-0030 (Site 35)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



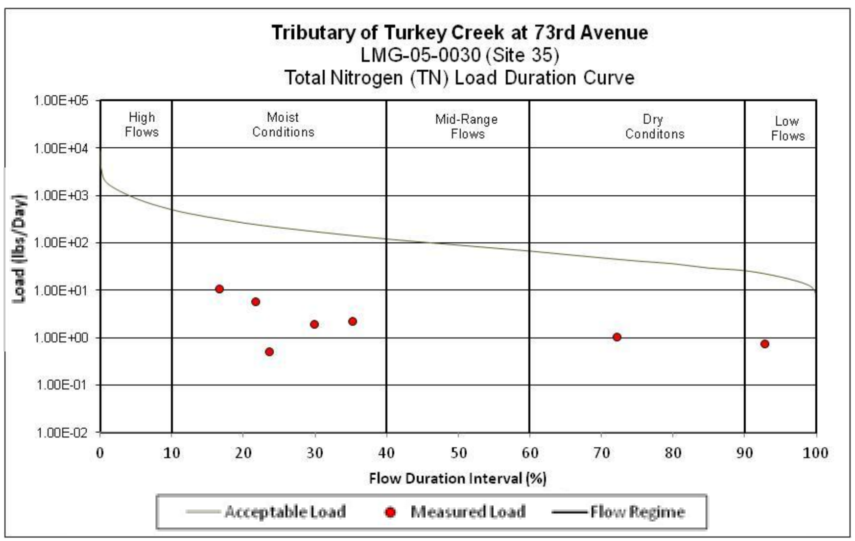
Tributary of Turkey Creek at 73rd Avenue
LMG-05-0030 (Site 35)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
200 180 160 140 120 100 80 60 40 20 0
Rainfall (in)
3 2.5 2 1.5 1 0.5 0
4/1/2013 5/16/2013 6/30/2013 8/14/2013 9/28/2013 11/12/2013
Rainfall
Total Suspended Solids
Target



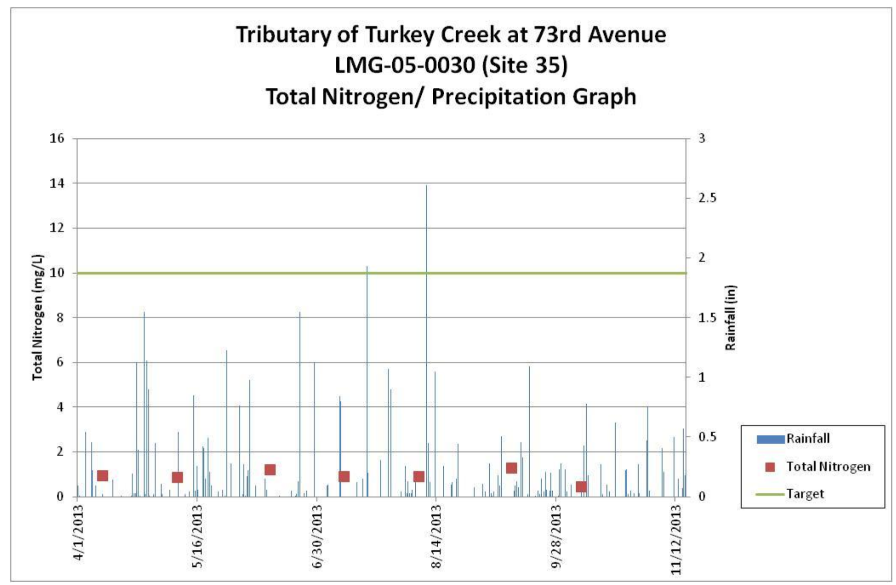
Tributary of Turkey Creek at 73rd Avenue
LMG-05-0030 (Site 35)
Total Phosphorus (TP) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime



Tributary of Turkey Creek at 73rd Avenue
LMG-05-0030 (Site 35)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Phosphorus
Target



Tributary of Turkey Creek at 73rd Avenue
LMG-05-0030 (Site 35)
Total Nitrogen (TN) Load Duration Curve
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Load (lbs/Day)
Flow Duration Interval (%)
Acceptable Load
Measured Load
Flow Regime

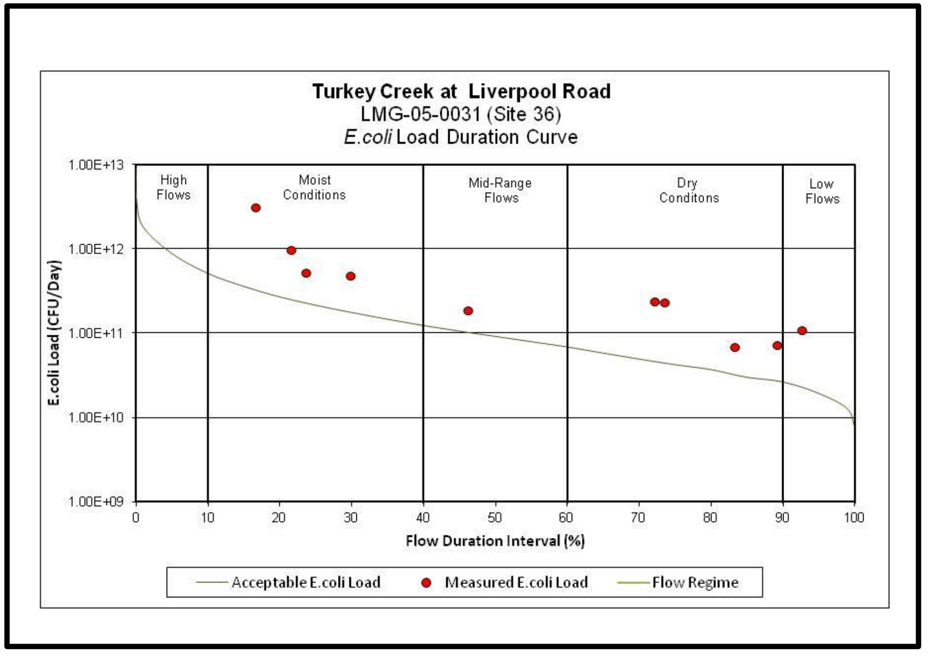


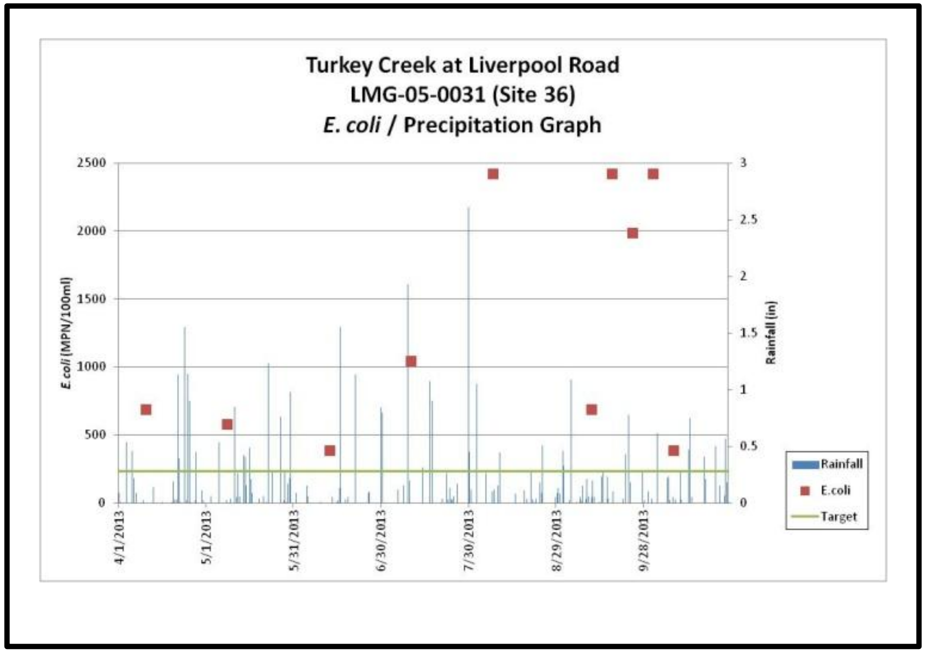
Tributary of Turkey Creek at 73rd Avenue
LMG-05-0030 (Site 35)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
4/1/2013
5/16/2013
6/30/2013
8/14/2013
9/28/2013
11/12/2013
Rainfall
Total Nitrogen
Target

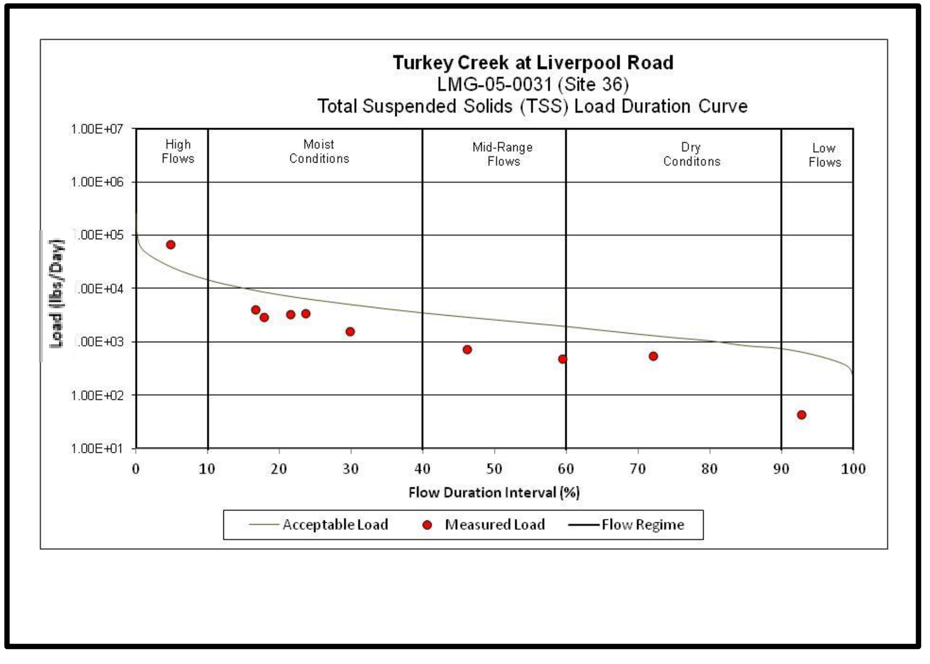
LMG-05-0031 (Site 36)
Turkey Creek

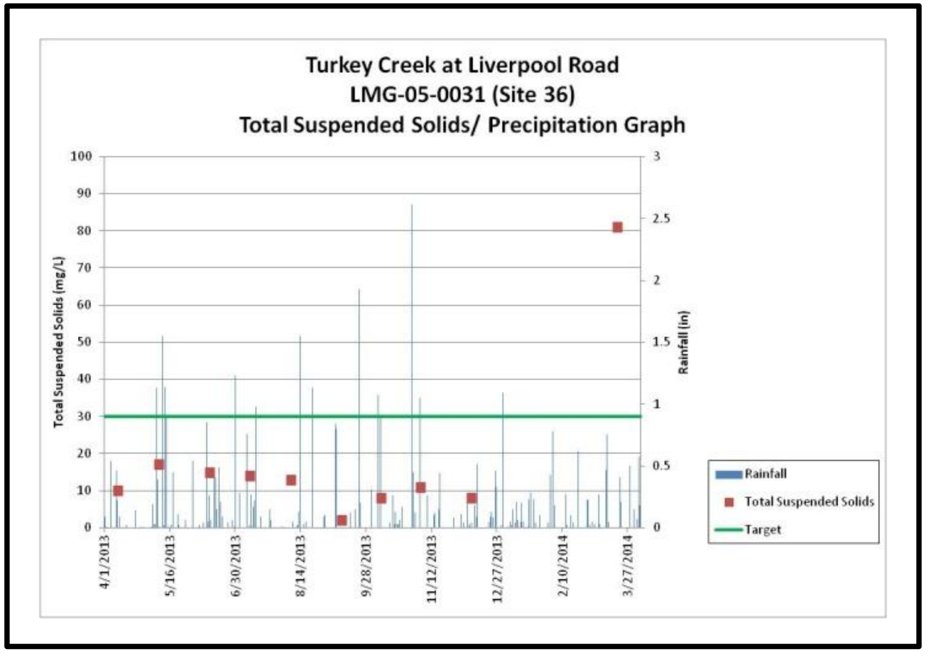
Upstream

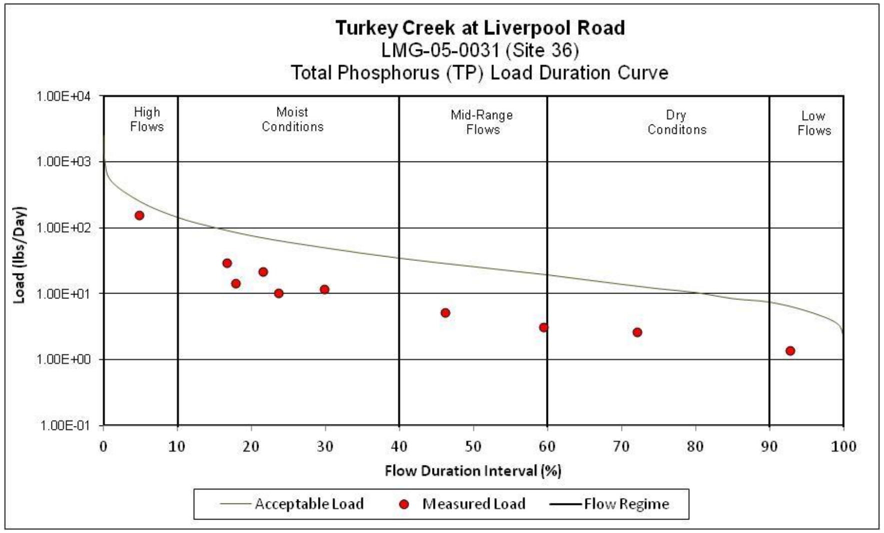
Downstream

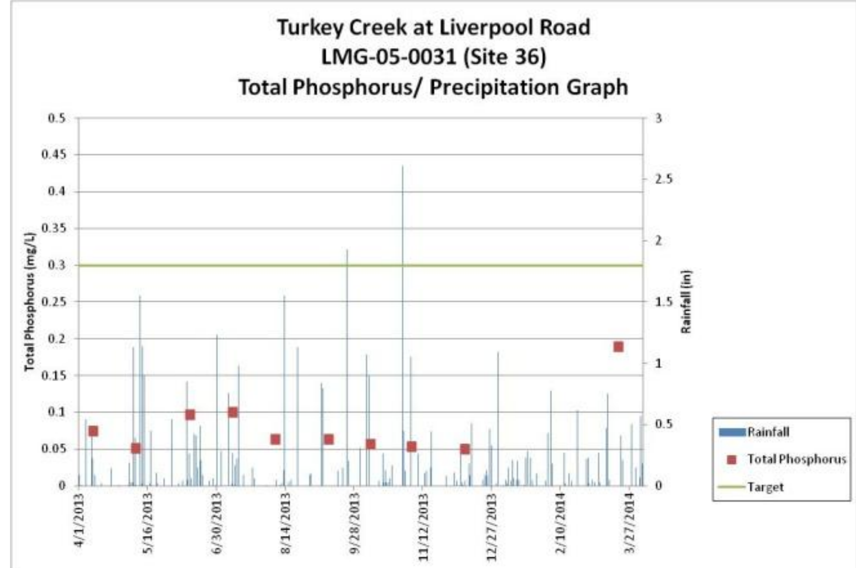

Turkey Creek at Liverpool Road
LMG-05-0031 (Site 36)
E.coli Load Duration Curve
E.coli Load (CFU/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable E.coli Load
Measured E.coli Load
Flow Regime

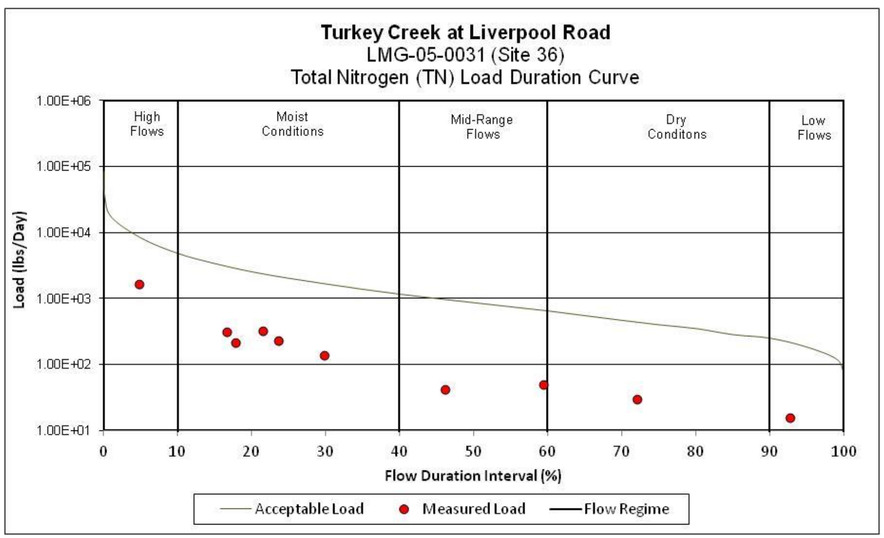

Turkey Creek at Liverpool Road
LMG-05-0031 (Site 36)
E. coli / Precipitation Graph
E.coli (MPN/100ml)
Rainfall (in)
Rainfall
E.coli
Target

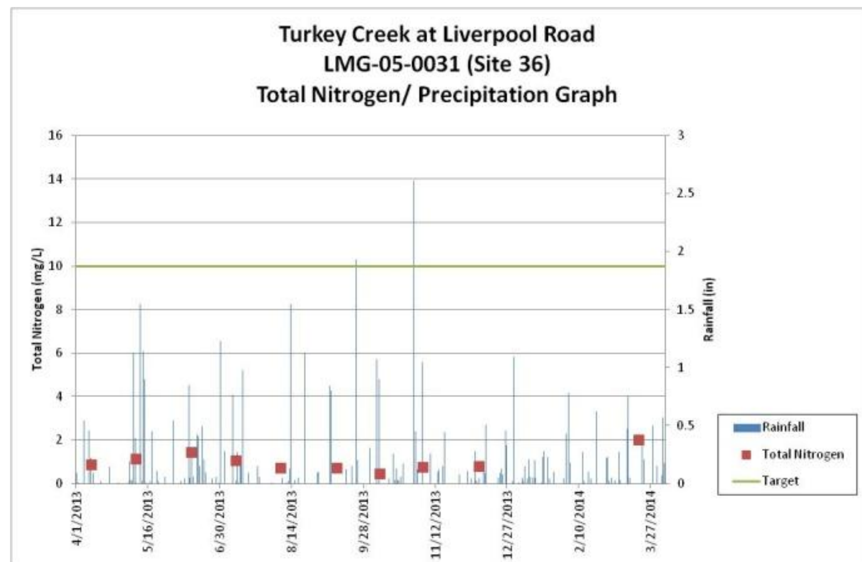

Turkey Creek at Liverpool Road
LMG-05-0031 (Site 36)
Total Suspended Solids (TSS) Load Duration Curve
Load (lbs/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
Measured Load
Flow Regime


Turkey Creek at Liverpool Road
LMG-05-0031 (Site 36)
Total Suspended Solids/ Precipitation Graph
Total Suspended Solids (mg/L)
Rainfall (in)
Rainfall
Total Suspended Solids
Target


Turkey Creek at Liverpool Road
LMG-05-0031 (Site 36)
Total Phosphorus (TP) Load Duration Curve
Load (lbs/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
Measured Load
Flow Regime


Turkey Creek at Liverpool Road
LMG-05-0031 (Site 36)
Total Phosphorus/ Precipitation Graph
Total Phosphorus (mg/L)
Rainfall (in)
Rainfall
Total Phosphorus
Target


Turkey Creek at Liverpool Road
LMG-05-0031 (Site 36)
Total Nitrogen (TN) Load Duration Curve
Load (lbs/Day)
Flow Duration Interval (%)
High Flows
Moist Conditions
Mid-Range Flows
Dry Conditons
Low Flows
Acceptable Load
Measured Load
Flow Regime


Turkey Creek at Liverpool Road
LMG-05-0031 (Site 36)
Total Nitrogen/ Precipitation Graph
Total Nitrogen (mg/L)
Rainfall (in)
Rainfall
Total Nitrogen
Target