Office of Water Quality
Total Maximum Daily Load Program

Total Maximum Daily Load for *Escherichia coli* (*E. coli*) and Impaired Biotic Communities (IBC) in the Salt Creek Watershed in Porter County

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June 29, 2012

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Acronyms and Abbreviations

AUID	Assessment unit identification
CAFO	Concentrated animal feeding operation
CFO	Confined feeding operations
CFR	Code of Federal Regulations
CFU	Colony forming units
CSO	Combined sewer overflow
CWA	Federal Clean Water Act
E. coli	*Escherichia coli*
HUC	Hydrologic unit code
IAC	Indiana Administrative Code
IBC	Impaired biotic community
IDEM	Indiana Department of Environmental Management
LA	Load Allocation
LDC	Load Duration Curve
MOS	Margin of Safety
MS4	Municipal separate storm sewer system
MPN	Most probable number
NLCD	National Land Cover Database
NPDES	National Pollutant Discharge Elimination System
TMDL	Total Maximum Daily Load
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
SSO	Sanitary Sewer Overflow
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WLA	Wasteload allocation
WMP	Watershed Management Plan
WQO	Water Quality Objective
WQS	Water Quality Standard
WWTF	Wastewater treatment facility
WWTP	Wastewater treatment plant

Indiana Department of Environmental Management
Total Maximum Daily Load Program
June 29, 2012

Total Maximum Daily Load (TMDL) for *Escherichia coli* (*E. coli*) and Impaired Biotic Communities (IBCs) in Salt Creek Watershed, Porter County, Indiana

1. Introduction

Section 303(d) of the Federal Clean Water Act (CWA) and the United States Environmental Protection Agency's (USEPA's) Water Quality Planning and Management Regulations (Title 40 of the Code of Federal Regulations (CFR), Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for waterbodies that are not meeting Water Quality Standards (WQS). TMDLs provide states a basis for determining the pollutant reductions necessary from both point and nonpoint sources to restore and maintain the quality of their water resources. The purpose of this TMDL is to identify the sources and determine the allowable levels of *Escherichia coli (E. coli)* bacteria, total suspended solids (TSS), total nitrogen (TN), and total phosphorus (TP) that will result in the attainment of the applicable WQS for *E. coli* and impaired biotic communities (IBCs) in the Salt Creek watershed in Porter County, Indiana.

2. Background

The Salt Creek watershed is located in Porter County, Indiana within the Lake Michigan watershed. Salt Creek begins in the primarily agricultural lands south of the City of Valparaiso and flows north and west through Valparaiso and unincorporated Porter County before joining the Little Calumet River in the City of Portage *(Figure 2-1)*. The watershed includes agricultural, forest, grassland, residential, commercial, industrial, and recreational land uses. Areas outside of the city limits are primarily agricultural, forested, and residential. Incorporated areas include most of the City of Valparaiso, the southeastern portion of the City of Portage, the southern portion of the Town of Burns Harbor, and small portions of the Towns of Chesterton and Porter.

Salt Creek is on Indiana's §303(d) list as a result of excessive *E. coli* concentrations (2002, 2004, 2006, and 2008) and impaired biotic communities (2002, 2004, 2006, and 2008) *(Figure 2-1)*. Additionally, the mainstem of Salt Creek is to be protected for cold-water fish and is also designated as a salmonid stream.

Recently, IDEM began using the high resolution National Hydrography Dataset (NHD) created by the U. S. Geological Survey (USGS). Previously, IDEM could only view streams at medium resolution (1:100,000 scale). The high-resolution streams are at the 1:24,000 scale, which allows for a more detailed view of the watershed. These high-resolution waters have always been present; however, they have not been visible in electronic maps until now. A reassessment of the Salt Creek watershed was completed with regard to both medium and high resolution streams.

This TMDL will address approximately 101 miles of stream in the Salt Creek watershed in Porter County. The watershed is within the 10-digit Hydrologic Unit Code (HUC) 0404000103. Specific assessment units and the waterbody-pollutant impairments are shown in Table 2-1.

303(d) Impaired Segments of Salt Creek and Tributaries

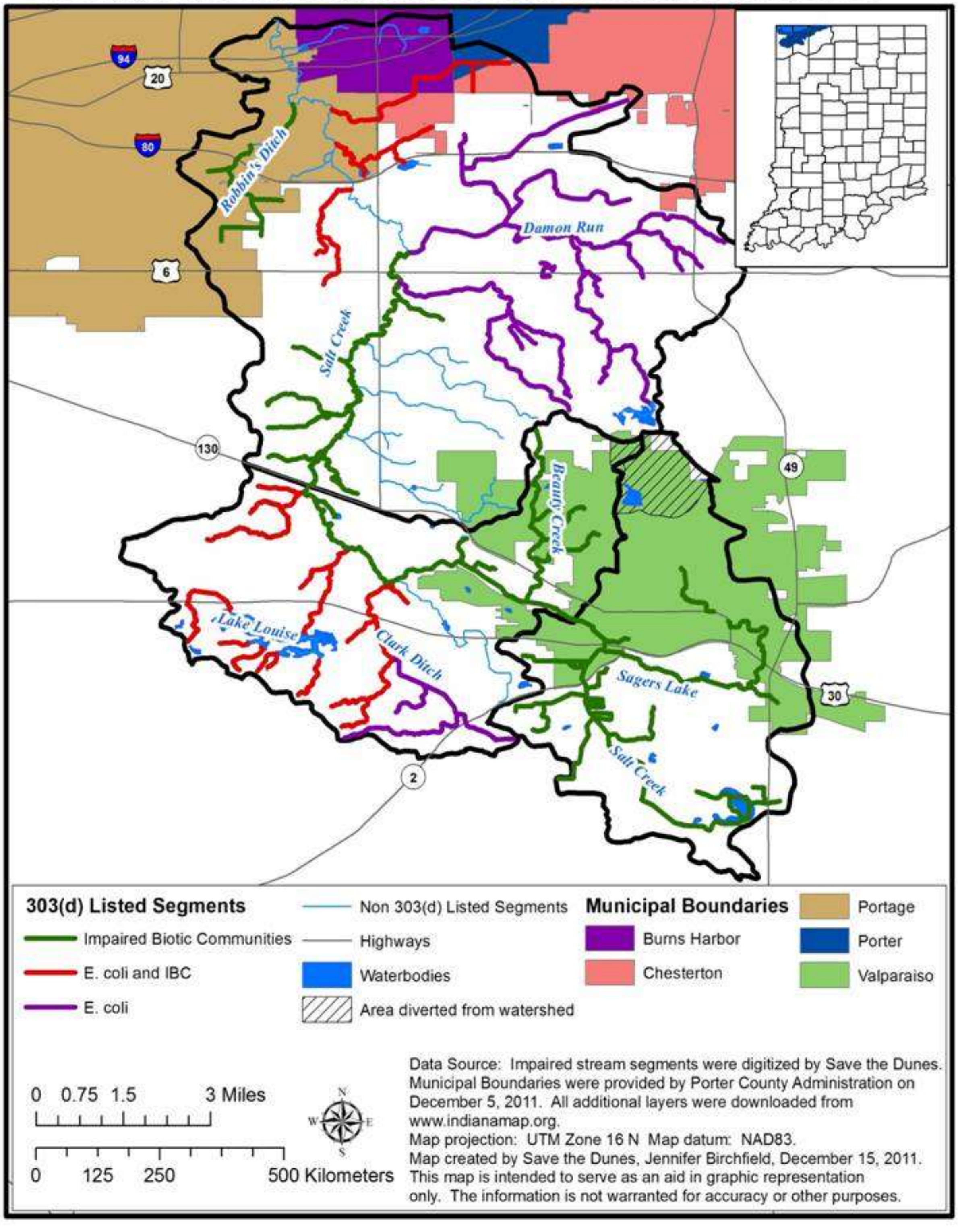


Figure 2-1. Salt Creek watershed and 303(d) impaired stream segments.

Table 2-1. Impaired assessment units in the Salt Creek watershed.

HUC 12 0404000103	Unit Name	2010 AUID*	Impairments		Length (mi)	Sample Site ID
			E. coli	*IBC***		
-01	Salt Creek	INC0131_01		X	8.27	5
		INC0131_02		X	7.50	5
	Sagers Lake	INC0131_T1001		X	3.38	6
		INC0131_T1002		X	0.75	6
-02	Salt Creek	INC0132_01		X	0.71	SC-WWTP-up
		INC0132_02		X	3.14	SC-WWTP-ds
		INC0132_03		X	2.85	15, SLC-17
	Beauty Creek	INC0132_T1007		X	5.98	7
	Clark Ditch	INC0132_T1009	X		5.07	2
		INC0132_T1010	X	X	4.91	2
	Lake Louise Outlet	INC0132_T1011	X	X	2.34	1
	Salt Creek - Unnamed Trib.	INC0132_T1012	X	X	3.30	
-03	Mallards Landing	INC0133_T1021	X		7.55	9
	Damon Run	INC0133_T1022	X		1.53	13
	Swanson Lamporte Ditch	INC0133_T1023	X		7.13	13
	Damon Run – South Branch	INC0133_T1024	X		7.02	13
	Damon Run – East Branch	INC0133_T1025	X		4.98	13
	Squirrel Creek	INC0133_T1026	X	X	2.56	11
	Salt Creek - Unnamed Trib.	INC0133_T1027	X	X	2.46	
	Gustafson Ditch	INC0133_T1028	X	X	3.53	
	Robbins Ditch	INC0133_T1029		X	3.75	12
	Salt Creek	INC0133_T1030		X	12.31	16, SLC-01
*AUID: Assessment Unit ID **IBC: Impaired Biotic Community						

IDEM determined that assigning loads to the outlet points of HUC-12 subwatersheds instead of individual reaches was appropriate because land use characteristics were consistent across the HUC-12 subwatershed. IDEM determined that there were not significant land use changes between the upstream reaches and the outlet point. The consistency in land use within each HUC-12 gave IDEM assurance that implementation efforts within the HUC-12 subwatershed would meet the TMDL loads assigned at the subwatershed outlet point. Additionally, IDEM felt a greater level of confidence in estimating flows at the outlet point of the HUC-12 subwatershed, rather than trying to estimate flows for individual reaches on a scale smaller than HUC-12

IDEM approaches TMDLs by calculating loading capacity values at the outlet points for each HUC-12 scale subwatersheds within the TMDL watershed. In a majority of the HUC-12 subwatersheds there are multiple stream segments. These individual stream segments are identified as being impaired for bacteria by IDEM field monitoring. To illustrate this point, in HUC-12 subwatershed '-02', there are two on Clark Ditch (INC0132_T1009, INC132_T1010). Segments are listed for *E. coli* and IBC. These segments lie upstream of the subwatershed outlet point in -02. IDEM explained that waters flowing through each of this individually impaired stream reach impacts the water quality at the outlet point of the HUC 12 -02 subwatershed. Rather than assigning loads to each of the impaired reaches within -02, IDEM completed their LDC analysis and assigned a TMDL load at the outlet point of subwatershed -02. IDEM calculates loadings for the outlet point of the HUC-12 subwatershed. These loadings will cover then loading to the upstream reaches (INC0132_T1009, INC132_T1010). In the TMDL, individual TMDL loads will not be assigned to each impaired reach. IDEM determined that assigning loads to individual reaches was not beneficial.

In 2006 Save the Dunes began coordinating the development of a watershed management plan (WMP) for Salt Creek through a Section 319 grant from IDEM. The Salt Creek WMP was approved by IDEM in July of 2008. Since then, implementation of the Salt Creek WMP has been primarily coordinated by Save the Dunes. Save the Dunes has conducted a number of sampling surveys in the Salt Creek watershed. Sampling was conducted during summer months from 2006 to 2011, and generally included the analysis of TSS, *E. coli*, TN, TP, turbidity, conductivity and flow. Table 2-2 presents a list of sampling locations in the Salt Creek watershed along with parameters and corresponding range of dates locations were sampled.

Water quality data collected by IDEM's Assessment Branch (Sites SLC-01, SLC-17) indicate high levels of *E. coli*, total nitrogen, TP and TSS in the Salt Creek watershed. Violations of *E. coli* ranged from 235 most probable number (MPN)/100 milliliter (mL) to greater than 19,800 MPN/100 mL and median concentrations at nearly every location sampled exceeded the 125 colony forming units (CFU)/100 mL geometric mean standards. One MPN is equal to one CFU. Biotic communities have been identified as impaired, likely due to elevated concentrations of nitrogen, TSS and TP. Because narrative standards exist for these three parameters, data are summarized here with respect to TMDL target levels (Section 3), while a more comprehensive discussion is provided in Section 5. Finally, the City of Valparaiso monitors Salt Creek above and below their wastewater treatment plant (WWTP) outfall.

Concentrations of TN in Salt Creek were generally below the TMDL target of 10 mg/L. However, three locations in the watershed were found to have TN concentrations greater than this level. These locations were Lake Louise Outlet, Weblos Trail Tributary and Salt Creek at Lenburg. The highest total nitrogen concentration was observed at the Lake Louise Outlet (34 mg/L).

Concentrations of TP are exceptionally elevated throughout the watershed. Median TP concentrations in each of the 12 tributaries all exceed the TMDL target of 0.3 mg/L. Along the mainstem of Salt Creek, concentrations are lowest at the headwaters. Tributaries with greatest levels of TP include Weblos Trail Tributary, Clark Ditch, Lake Louise Outlet, Squirrel Creek and Robbin's Ditch.

TSS data indicate exceedances of water quality targets along the Salt Creek mainstem, with greatest exceedances indicated at a monitoring station located below US Highway 20. Tributary concentrations are occasionally elevated, most noticeably during storm events.

Table 2-2. Salt Creek monitoring stations and available data.

Station Name	ID	Sample Range	Number of Samples Collected			
			TSS	*E. coli*	$NO_2 + NO_3$	TP
Lake Louise Outlet	1 [A]	8/2006 - 11/2011	16	36	38	9
Clark Ditch	2 [A]	8/2006 - 11/2011	9	36	37	10
Weblos	3 [A]	8/2006 - 6//2008	9	14	15	9
Block Ditch	4 [A]	8/2006 - 6/2008	9	14	15	9
Salt Creek Headwaters	5 [A]	8/2006 - 11/2011	17	38	38	11
Sager's Lake Outlet	6 [A]	8/2006 - 11/2011	10	37	42	19
Beauty Creek	7 [A]	8/2006 - 11/2011	9	37	37	11
Pepper Creek	8 [A]	8/2006 - 11/2011	9	36	37	9
Mallards Landing	9 [A]	8/2006 - 6//2008	9	14	15	9
Butternut Springs	10 [A]	8/2006 - 11/2011	8	35	36	8
Squirrel Creek	11 [A]	8/2006 - 6//2008	9	14	15	9
Robbin's Ditch	12 [A]	8/2006 - 11/2011	16	34	37	9
Damon Run	13 [A]	8/2006 - 11/2011	16	36	37	9
Salk Creek at Lenburg	14 [A]	8/2006 - 6//2008	9	14	15	9
Salt Creek at SR 130	15 [A]	5/2006 - 7/2007	8	---	8	8
	SLC-17 [B]	1/1991 – 5/2010	215	92	223	221
Salt Creek at US 20	16 [A]	5/2006 - 7/2007	8	---	8	8
	SLC-01 [B]	1/1991 – 5/2010	206	93	222	218
Salt Creek above outfall	SC-A [C]	4/2004 - 6/2011	183	183	---	181
Salt Creek below outfall	SC-B [C]	4/2004 - 6/2011	183	183	---	181

Notes:
[A]: Save the Dunes monitoring site
[B]: IDEM fixed station
[C]: City of Valparaiso monitoring site
---: not sampled.

Scheduling of this TMDL aligns with IDEM's basin-rotation water quality monitoring schedule. Unless there is a significant reason to deviate, TMDLs are generally developed according to the basin-rotation schedule to take advantage of all available resources. Waterbodies can be scheduled based on the following:

- Waterbodies may be given a high priority or low priority for TMDL development depending on the specific designated uses that are not being met, or in relation to the magnitude of the impairment.
- TMDL development of waterbodies where other interested parties, such as local watershed groups, are working on alleviating the water quality problem may be delayed to give these other actions time to have a positive impact on the waterbody. If the water quality standards still are not met, then the TMDL process will be initiated.
- TMDLs that are required due to water quality violations relating to pollutant parameters, where no USEPA guidance is available, may be delayed to give USEPA time to develop guidance.

3. Water Quality Standards

Water quality standards (WQS) applicable to the Salt Creek TMDLs are shown in Table 3-1. One of the designated uses for the waterbodies in the Salt Creek watershed is for total body contact during the recreational season, April 1 through October 31. The WQS for *E. coli* are set forth in Indiana Administrative Code (IAC), which state:

327 IAC 2-1.5-8(e)(3) For full body contact recreational uses, *E. coli* bacteria shall not exceed the following:

> (A) 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.
> (B) Two hundred thirty-five (235) per one hundred (100) milliliters in any one (1) sample in a thirty (30) day period, except that in cases where there are at least ten (10) samples at a given site, up to ten percent (10%) of the samples may exceed two hundred thirty-five (235) cfu or MPN per one hundred (100) milliliters where:
>
> > (i) the *E. coli* exceedances are incidental and attributable solely to *E. coli* resulting from the discharge of treated wastewater from a wastewater treatment plant as defined at IC 13-11-2-258; and
> > (ii) the criterion in clause (A) is met.

However, a single sample shall be used for making beach notification and closure decisions. If a geometric mean cannot be calculated because five (5) equally spaced samples are not available, then the criterion stated in clause (B) must be met.

327 IAC 2-1.5-8(e)(4) For demonstrating compliance with wastewater treatment requirements, sanitary wastewater dischargers shall ensure the following:

> (A) The concentration of *E. coli* in the undiluted discharge does not exceed one hundred twenty-five (125) CFU or MPN per one hundred (100) milliliters as a geometric mean of the effluent samples taken in a calendar month.

(B) Not more than ten percent (10%) of all samples when not less than ten (10) samples are taken and analyzed for *E. coli* in a calendar month exceed two hundred thirty-five (235) CFU or MPN per one hundred (100) milliliters as a daily maximum. Under this clause, the calculation of ten percent (10%) of the samples taken shall be limited to the lowest whole number result.

Table 3-1. Applicable water quality standards and goals for Salt Creek watershed.

Parameter	Units	Water Quality Criteria	TMDL Targets	Salt Creek Watershed Management Plan Goals [1]
E. coli [2]	#/100 mL	235 single sample maximum		235 [4] / 576 [5]
		Geometric mean < 125 [3]		
Total Suspended Solids	mg/L	Narrative	30	25 [4] / 80 [5]
Total nitrogen	mg/L	Narrative	10	1.2 [4] / 1.5 [5]
Phosphorus, Total	mg/L	Narrative	0.3	0.08 [4] / 0.10 [5]
Biotic Communities		Narrative		

Notes:
1 The Salt Creek Watershed Management Plan (WMP) identified interim and long-term goals that were considered as potential targets in the development of this TMDL. These are provided for informational purposes and do not supersede IDEM numeric criteria.

2 *E. coli* standards are for the recreation season only (April 1 through October 31).

3 Geometric mean based on minimum of 5 evenly spaced samples taken over not more than a 30 day period.

4 Long-term goal of Salt Creek WMP to be achieved by 2028.

5 Interim goal of Salt Creek WMP to be achieved by 2018.

Regarding IBCs, 327 IAC 2-1-3(a)(2)(A) states that all surface waters, except as described in subdivision (5), will be capable of supporting a well-balanced, warm water aquatic community. Furthermore, at all times, all surface waters outside of mixing zones shall be free of substances in concentrations that on the basis of available scientific data are believed to be sufficient to injure, be chronically toxic to, or be carcinogenic, mutagenic, or teratogenic to humans, animals, aquatic life, or plants (327 IAC 2-1-6(a)(2)).

Parameters contributing to IBC include TSS, total nitrogen, and total phosphorus. In several tributaries to Salt Creek, low dissolved oxygen and habitat are also potential stressors contributing to biotic community impairments. Low dissolved oxygen is often the result of elevated nutrient levels (TP and TN), while habitat problems generally lead to higher sediment concentrations. Water quality criteria, TMDL targets and WMP goals for parameters likely contributing to IBCs are shown in Table 3-1.

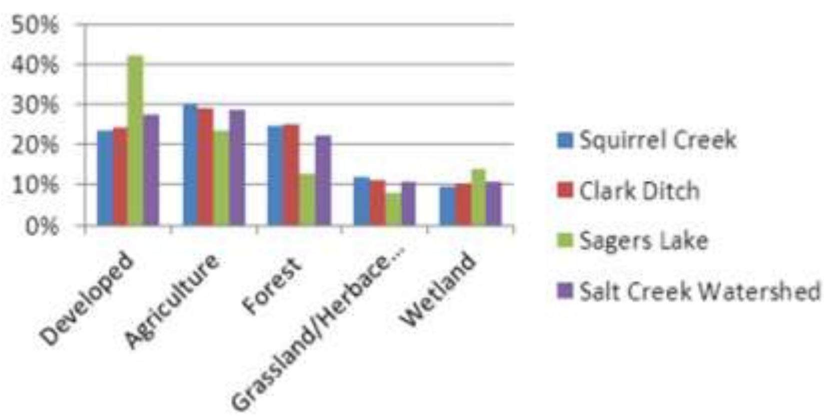
4. Source Assessment

4.1 Watershed Characterization

The Salt Creek watershed is located in Porter County, Indiana within the Lake Michigan watershed. Salt Creek begins in the primarily agricultural lands south of the City of Valparaiso, flowing north and west through Valparaiso and unincorporated Porter County before joining the Little Calumet River in the City of Portage *(Figure 2-1)*. The watershed includes agricultural, forest, grassland, residential, commercial, industrial, and recreational land uses. Areas outside of the city limits are primarily agricultural, forested, and residential. Incorporated areas include most of the City of Valparaiso, the southeastern portion of the City of Portage, the southern portion of the Town of Burns Harbor, and small portions of the Towns of Chesterton and Porter. With 49,577 acres (20,062 hectares) the Salt Creek watershed covers 19% of Porter County.

4.2 Land Use

Until the 1800's northwestern Indiana land use consisted of undeveloped wetlands, hardwood forests, or grasslands (IDNR, 1994). According to the 2006 National Land Cover Dataset (NLCD), cultivated crops (19%) and deciduous forest (16%) account for the two largest land cover categories in the watershed (Fry et al., 2011). Figure 4-1 shows overall land use in the Salt Creek watershed, as well as by 12-digit HUC. The high, medium, and low intensity and open space developed areas account for 28% of the watershed combined. Figure 4-2 was generated using 2006 NLCD data. It should be noted that as of the writing of this report, the NLCD 2006 land cover data is over five years old. Considerable changes in land cover may have occurred since 2006.



Land Use Category	Acreage	Percentage
Developed	13,669	27%
Agriculture	14,128	29%
Forest	8,285	17%
Grassland /Herbaceous / Other	8,138	16%
Wetlands	5,337	11%
TOTAL	49,557	100%

Figure 4-1. Salt Creek land use.

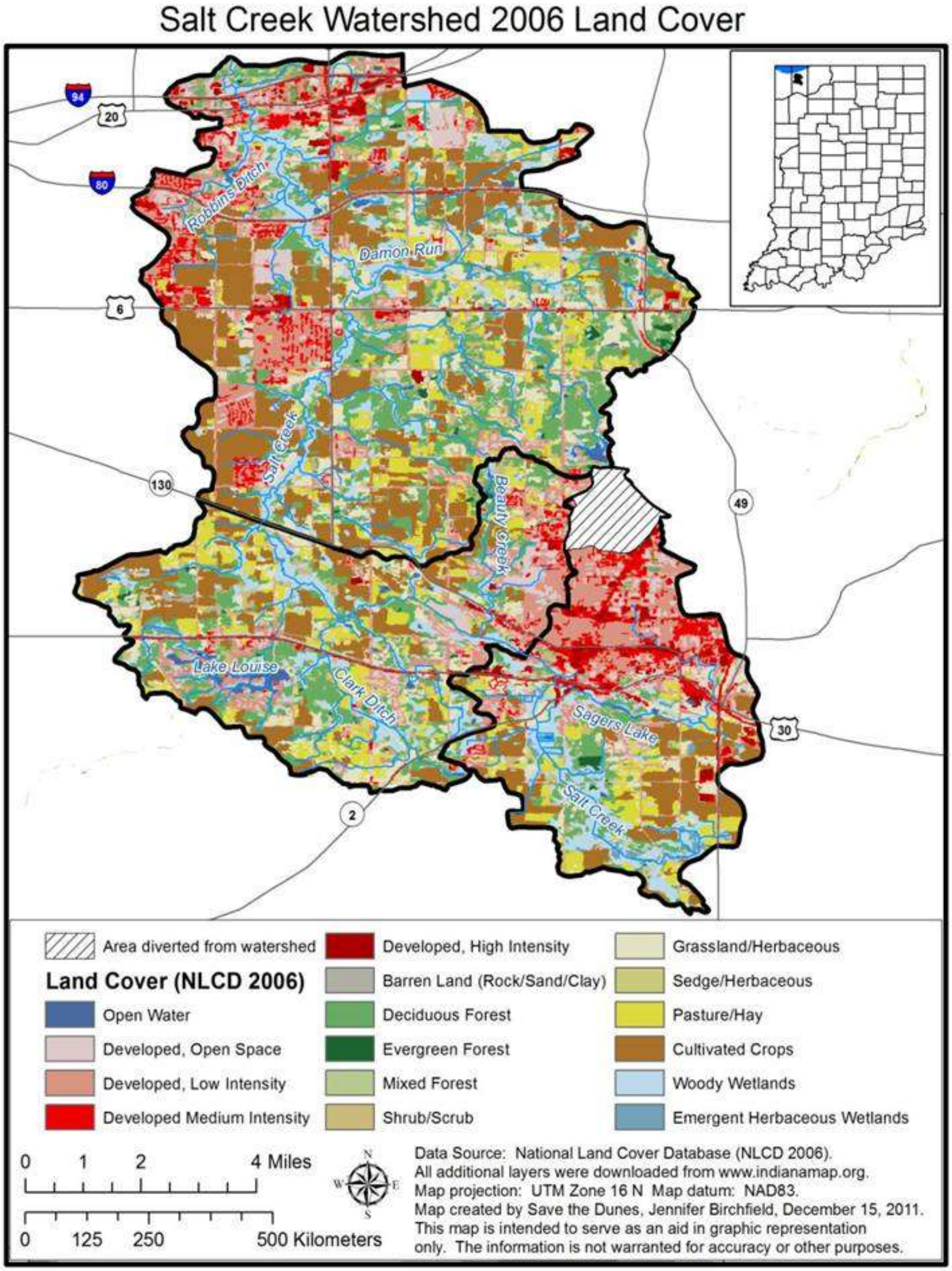


Figure 4-2. Salt Creek watershed land cover.

4.3 Point Sources

Point source pollution is defined by the Federal CWA §502(14) as: *any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agriculture stormwater discharges and return flow from irrigated agriculture.*

Point sources can include facilities such as municipal WWTFs, industrial facilities, or municipal separate storm sewer systems (MS4s). Additionally, overland runoff collected and conveyed through MS4 systems is considered a point source. Under the CWA, as discussed below, all point sources are regulated under the National Pollutant Discharge Elimination System (NPDES) program. Point sources of pollution in the Salt Creek watershed are summarized below.

4.3.1 NPDES Permitted Dischargers

Within the Salt Creek watershed, there are eight (8) NPDES permitted facilities in total. All dischargers have *E. coli* limits in their permits. Table 4-1 provides a list of the NPDES facilities, including their permit number, assessment unit identification (AUID), and receiving water. The location of each facility is shown in Figure 4-3.

Table 4-1. Permitted NPDES dischargers in Salt Creek watershed.

NPDES ID	Facility Name	AUID	*Receiving Water*	Flow *(mgd)* [1]
IN0042021	Elmwood Mobile Home Park	INC0133_T1024	*S.B. Damon Run*	0.059
IN0039659	Forest Oaks WWTP	INC0133_T1023	*Swanson Lamporte Ditch*	0.056
IN0038709	Liberty Farm Mobile Home Park	INC0133_T1025	*E.B. Damon Run*	0.042
IN0059064	Mallard's Pointe	INC0133_T1021	*Mallards Landing*	0.006
IN0058475	Nature Works Conservancy District	INC0132_T1009	*Clark Ditch*	0.142
IN0031119	Shorewood Forest	INC0132_T1011	*Lake Louise Outlet*	0.189
IN0030651	South Haven Sewer Works	INC0133_T1030	*Salt Creek*	1.213
IN0024660	Valparaiso WWTP	INC0132_01	*Salt Creek*	4.648

Note: [1] average monthly reported flow

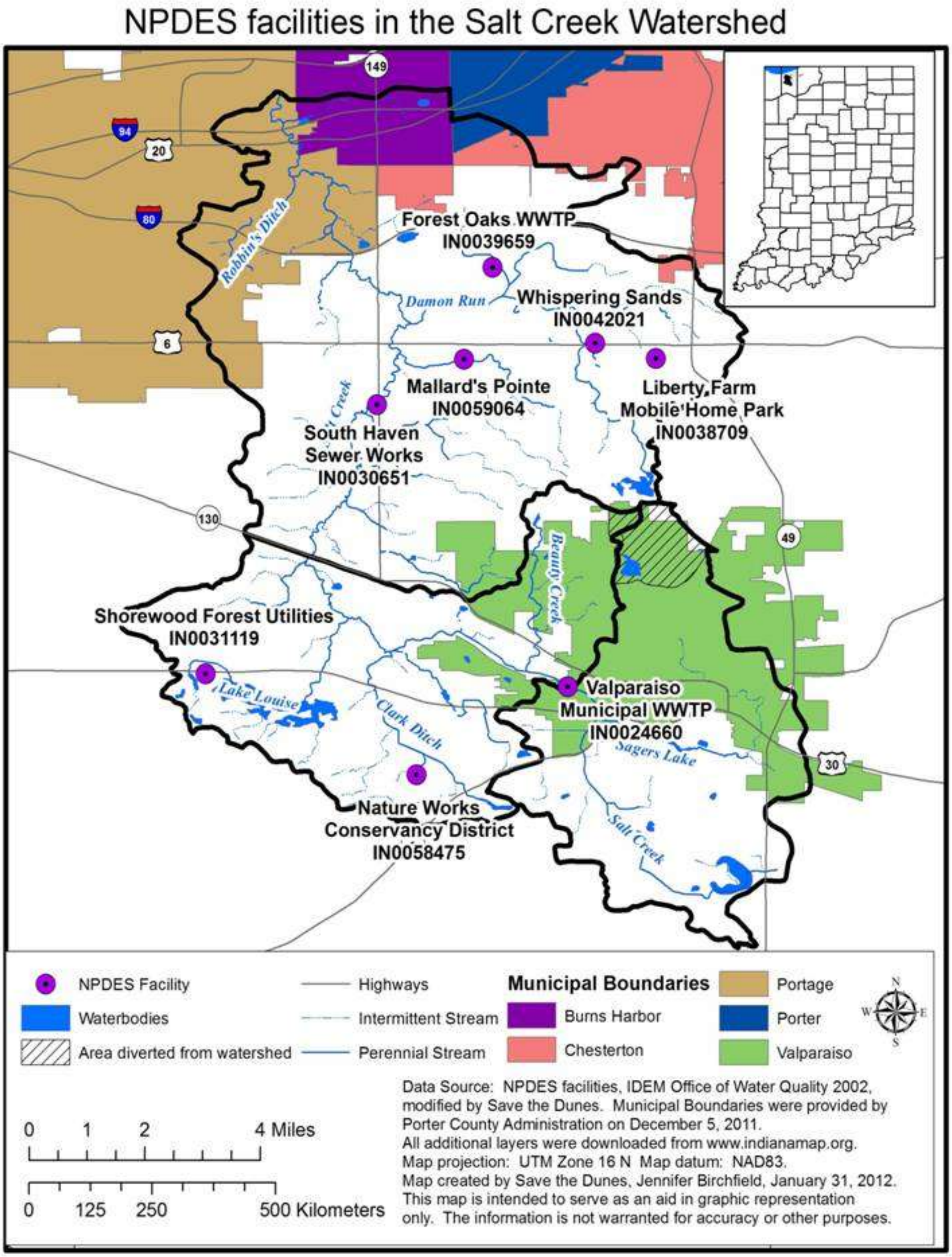


Figure 4-3. Permitted NPDES dischargers in Salt Creek watershed.

4.3.2 Municipal Separate Storm Sewer Systems

There are seven (7) MS4 communities in the Salt Creek watershed *(Figure 4-4)*. Table 4-2 provides a list of the NPDES facilities, including their permit numbers.

Table 4-2. Permitted MS4 communities in Salt Creek watershed.

NPDES ID	Community Name	Area *(sq.mi.)*
INR040036	Town of Chesterton	1.54
INR040079	Twin Creeks Conservancy District (South Haven)	0.99
INR040090	City of Portage	0.56
IN040115	Town of Porter	0.28
INR040140	Porter County	61.07 **
INR040149	Nature Works Conservancy District (Aberdeen)	0.94
INR04073	City of Valparaiso / Valparaiso University	11.76

Note: ** This is the total area of unincorporated Porter County. For purposes of identifying TMDL allocations, only the developed land portion of Porter County defined by NLCD is used to set MS4 waste load allocations *(see Section 8.1 for details)*.

Guidelines for MS4 permits and timelines are outlined in Indiana's MS4 Rule 13 (327 IAC 15-13-10 and 327 IAC 15-13-11):

> Sec. 10. If a TMDL is approved for any water body into which an MS4 conveyance discharges, the MS4 operator must review and appropriately modify Parts B and C of their Storm Water Quality Management Plan if the TMDL includes requirements for control of storm water discharges under the jurisdiction of the MS4 operator.

IDEM recognizes that these MS4 communities are sources of pollutants and more information needs to be collected. As part of the permit process, these systems will be better defined and will continuously work towards meeting the water quality standard, which is the limit and goal of this TMDL.

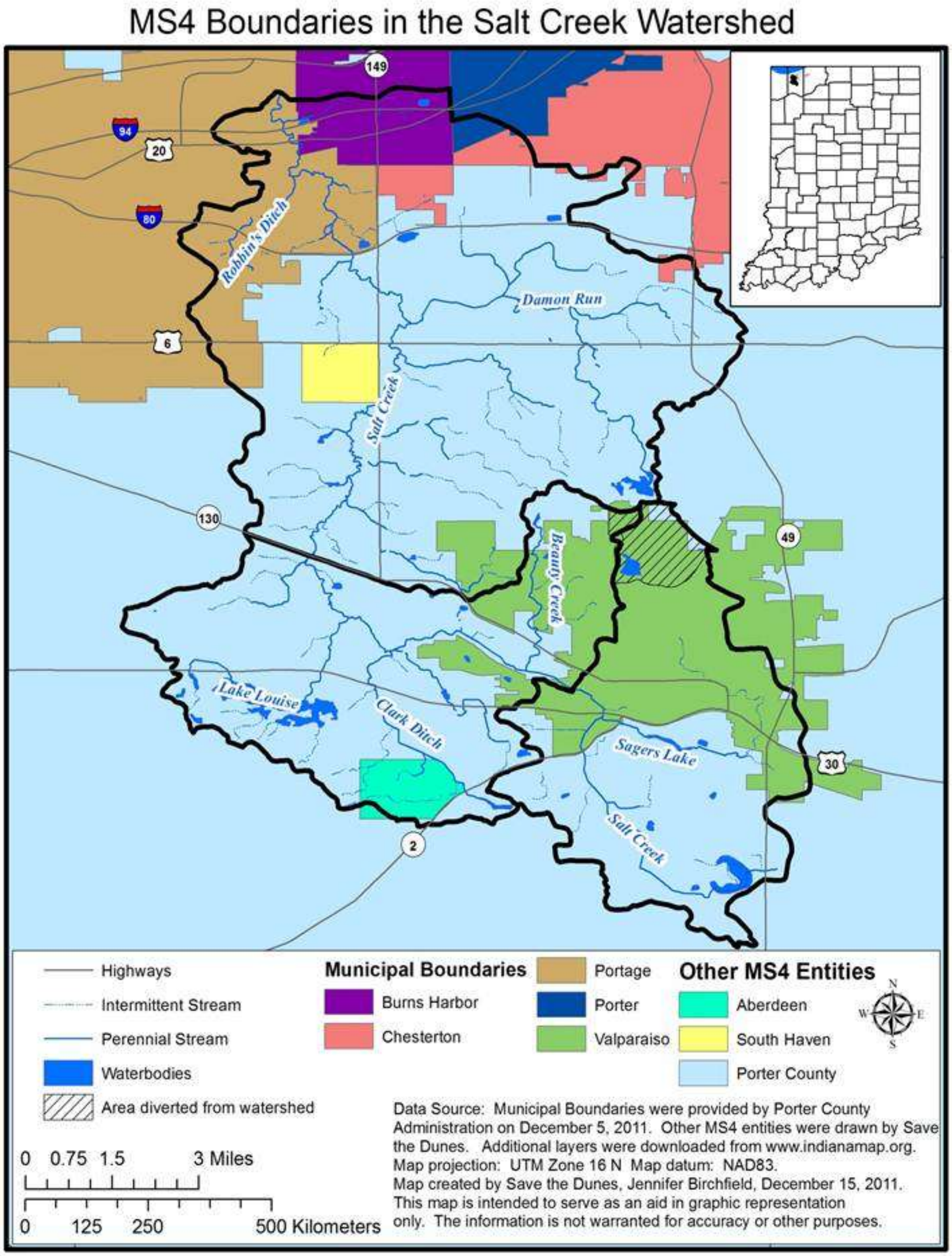


Figure 4-4. Salt Creek MS4 communities.

4.3.3 Combined Sewer Overflows and Sanitary System Overflows

There is one combined sewer overflow (CSO) community in the Salt Creek watershed: the City of Valparaiso.

IAC Article 15, Industrial Wastewater Pretreatment Programs and NPDES includes regulations specific to communities experiencing combined sewer overflows (CSOs) and/or sanitary sewer overflows (SSOs). CSOs are defined (327 IAC 5-1.5-7) as, a sewer designed and employed to receive both (1) water-carried or liquid wastes; and, (2) storm or surface water. Alternatively, the term sanitary sewer is defined (327 IAC 5.1-53) as a sewer to which storm, surface, and ground waters are not intentionally allowed to enter, that conveys liquid and water-carried wastes from: (1) residences; (2) commercial buildings; (3) industrial plants; and, (4) institutions.

4.3.4 Confined Feeding and Concentrated Animal Feeding Operations

There are no Confined Feeding Operations (CFOs) or Concentrated Animal Feeding Operations (CAFOs) located within the Salt Creek watershed.

4.4 Nonpoint Sources

The term nonpoint source pollution is defined to mean any source of pollution that does not meet the legal definition of point sources (as discussed in Section 4.3). Nonpoint source pollution typically results from overland stormwater runoff that is diffuse in origin. It should be noted that stormwater collected and conveyed through conveyance systems such as an MS4 system are considered a controllable point source. Sources of nonpoint pollution, potentially contributing to impairments in the Salt Creek watershed include: wildlife, septic systems, runoff from agricultural land use, unrestricted livestock access to streams, and urban runoff not part of an MS4 system.

4.4.1 Wildlife

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

4.4.2 Septic Systems

Failing septic systems are known sources of *E. coli* and nutrients and can impair waterbodies. Porter County follows the state IAC 16-1-4-9 and IAC 36-1-6-2 rules regarding septic systems. Failures are typically identified through complaints and through the sale of older properties that have not passed inspection. Effluents from failing septic tanks can leach into groundwater or pond at the surface where they can be washed into surface waters via stormwater runoff events.

4.4.3 Agricultural Runoff

Runoff from agricultural lands (feedlots, pastures and fields) is a known source of *E. coli*, sediment and nutrients to Salt Creek. Livestock manure is one agricultural source of *E. coli* and nutrients. Manure can be deposited on pastures by grazing livestock and may also be stockpiled or stored and spread onto fields. Fertilizers are commonly applied to cropland and can be a source of nutrients. Exposed soil on cropland can be carried with runoff into waterways, often transporting nutrients, particularly phosphorus, attached to the soil. Field-tile drainage lines, which channelize stormwater flows can exacerbate runoff of *E. coli* and nutrients, particularly nitrate-nitrogen.

4.4.4 Unrestricted Livestock Access to Streams

Livestock with access to stream environments may add *E. coli* and nutrients directly to the surface waters or resuspend particles that had settled on the stream bottom. Direct deposit of animal wastes can result in very high localized bacteria counts and can also contribute to downstream impairments. Livestock may also damage streambanks causing erosion.

4.4.5 Urban Runoff

Runoff from urban areas (urban, residential, commercial or industrial land uses) can contribute pollutants to local water bodies. One problem associated with urban sources is increased runoff from developed areas. Hydrology changes significantly when impervious surfaces replace the natural landscape. Increases in impervious surfaces typically result in an increase in runoff volume and pollutant loading. Increased runoff volumes and higher water velocities erode stream banks, which increase sediment loads and destabilize channels. Stream channel instability not only produces higher sediment loads, but also degrades the physical and biological function of the streams.

Runoff from construction sites associated with land disturbance and vegetation removal is another potential source of sediment to Salt Creek. Pet wastes in urban areas can be sources of *E. coli* and nutrients. Fertilization of lawns may contribute nutrients to waterways.

5. Linkage Analysis

Developing TMDLs requires a combination of technical analysis, practical understanding of important watershed processes, and interpretation of watershed loadings and receiving water responses to those loadings. An essential component of TMDL development is establishing a relationship between numeric indicators intended to measure attainment of beneficial uses and source loads. The linkage analysis examines connections between water quality targets, available data, and potential sources. The focus of the linkage analysis is to:

- identify key indicators;
- interpret watershed loadings and receiving water responses to those loadings; and
- describe logic used to develop TMDL targets and allocations.

5.1 Hydrology

Hydrology plays an important role in evaluating water quality. The hydrology of the Salt Creek watershed is driven by local climate conditions. This includes situations that often result in flashy flows, where the stream responds to and recovers from precipitation events relatively quickly. Flooding periodically occurs in areas of the watershed, flowing over roads and encroaching on streamside properties. In addition, ditching and channelizing has been used throughout this region to drain areas where soils are too wet for settlement and agriculture.

Limited flow data makes it difficult to describe the full range of hydrologic conditions the Salt Creek watershed may experience. Prior to development of a rainfall – runoff analysis to estimate flows for tributary streams in the Salt Creek drainage, an assessment of long-term information is needed. One station currently operated by the U.S. Geological Survey (USGS) on the Little Calumet River at Porter provides a starting point to evaluate long-term patterns in this area (e.g., annual runoff, frequency of occurrence of flows, seasonal variation). In addition, the USGS operated a stream gage on Salt Creek near McCool from 1945 through 1991. Both sites are identified in Figure 5-1 and listed in Table 5-1. Information from these stations provides some insight regarding hydrologic patterns in the area.

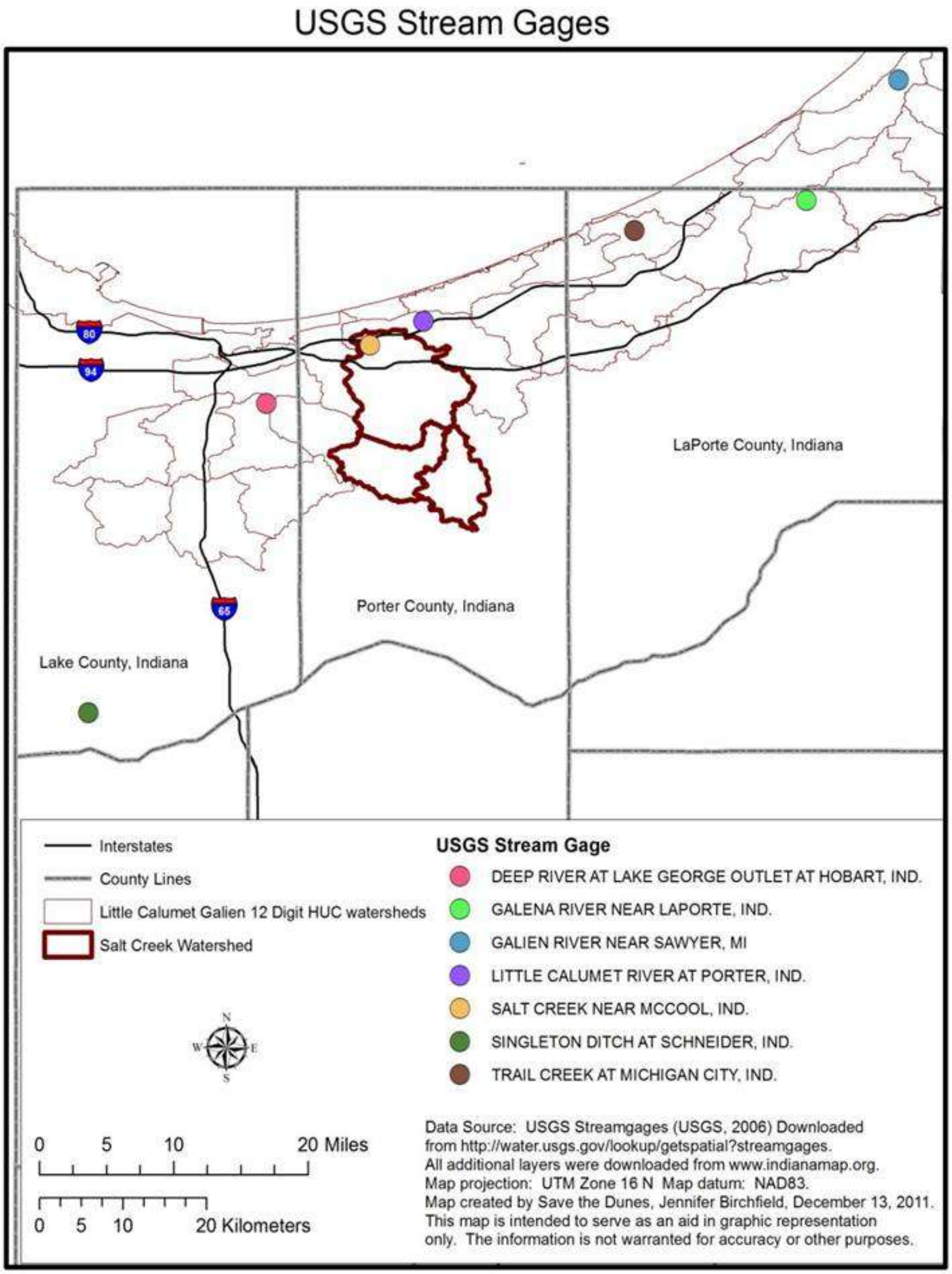


Figure 5-1. Location of USGS gages in the Salt Creek area.

Table 5-1. Summary statistics for USGS gages considered.

Gage ID	Location	Area *(mi.²)*	Average Annual Flow *(cfs/mi.²)*	Annual Runoff *(in.)*		
				Total	***Base***	***Other***
04094000	Little Calumet River at Porter	66.2	1.198	16.3	*10.8*	*5.5*
04094500	Salt Creek near McCool	74.6	1.026	13.9	*9.3*	*4.6*
04093000	Deep River at Hobart	124	0.980	13.3	*7.8*	*5.3*
04095300	Trail Creek at Michigan City	54.1	1.449	19.7	*13.8*	*5.9*
04096015	Galien River near Sawyer, MI	80.7	1.105	15.0	*9.6*	*5.4*
04096100	Galena River near LaPorte	17.2	1.507	20.5	*16.7*	*3.8*
05519000	Singleton Ditch at Schneider	123	0.936	12.7	*8.7*	*4.0*
Notes:						

5.1.1 Flow Duration Curves

Flow duration curves are an important component of the overall hydrologic analysis. Duration curves provide a quantitative summary that describes the full range of flow conditions, both magnitude and frequency of occurrence. Figure 5-2 depicts flow duration curves for the two USGS gages considered in the linkage analysis. These curves are expressed as unit area flows (i.e., cfs / square mile) in order to provide a meaningful comparison between sites. The Water Year (WY) 1946-91 time frame is used, as this represents the period where daily data was collected concurrently at most sites. This approach ensures that the comparison between these sites is not influenced by year-to-year variation in meteorological conditions (e.g., differences in annual precipitation and temperature).

5.1.2 Seasonal Variation

One important part of the hydrologic analysis for the Salt Creek area is to examine seasonal patterns. Figure 5-3 and Figure 5-4 depict seasonal variation in unit area flows for the Little Calumet River and Salt Creek. Another useful aspect to seasonal variation in flows is to evaluate runoff patterns relative to precipitation.

Table 5-2 provides a monthly summary of average monthly precipitation measured at the Valparaiso airport from 1995 to 2010. In order to compare seasonal precipitation patterns to flow information, Table 5-2 includes monthly average runoff from the Little Calumet River and Salt Creek. Table 5-2 also summarizes the runoff for Little Calumet gage as a percentage of the monthly precipitation.

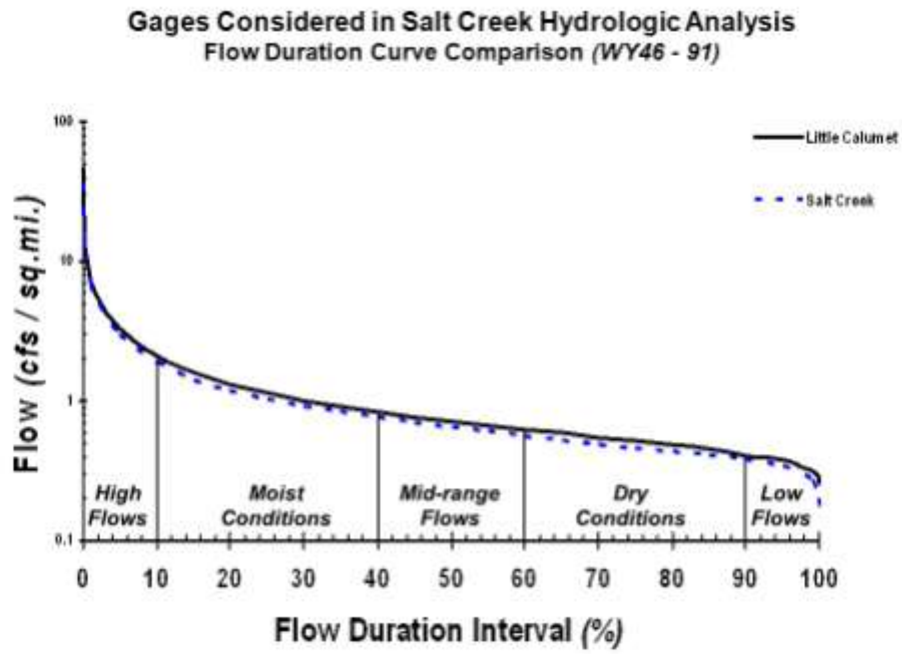


Figure 5-2. Flow duration curves for Salt Creek area USGS gages.

As shown, the lowest precipitation occurs in December, January, February, and March. Interestingly, March also corresponds to the greatest runoff. It is likely that runoff in March is elevated due to the absence of mature vegetation and saturated soils due to spring melt. This observation is supported by the fact that July and August correspond to greater amounts of precipitation, yet less of runoff. Vegetation is more mature in July and August (as opposed to March). This likely slows, absorbs, and soaks up precipitation, minimizing runoff.

Table 5-2. Seasonal precipitation and runoff patterns.

	Average Monthly Precipitation and Runoff *(in.)*											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Precipitation	2.19	1.91	2.56	3.51	3.97	4.20	4.18	3.89	3.20	3.08	3.50	2.60
Little Calumet	1.49	1.75	2.15	2.02	1.56	1.29	0.85	0.79	0.87	1.05	1.31	1.45
Salt Creek	1.18	1.50	1.89	1.87	1.37	1.09	0.77	0.69	0.69	0.89	1.11	1.18
Ratio *(Little Calumet)*	68%	92%	84%	58%	39%	31%	20%	20%	27%	34%	37%	56%

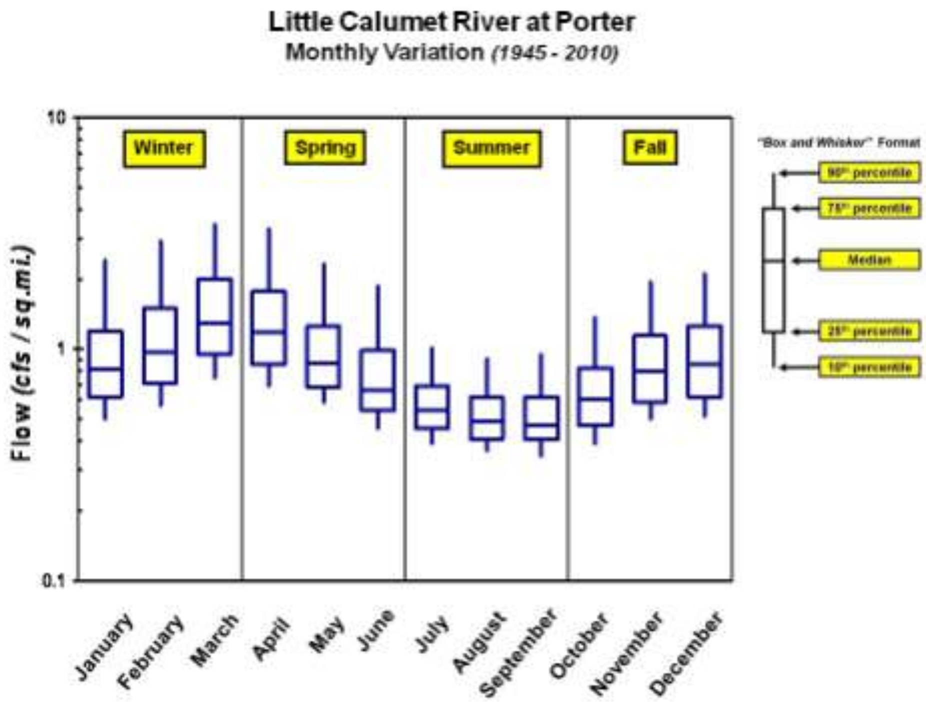


Figure 5-3. Seasonal variation of Little Calumet River flows.

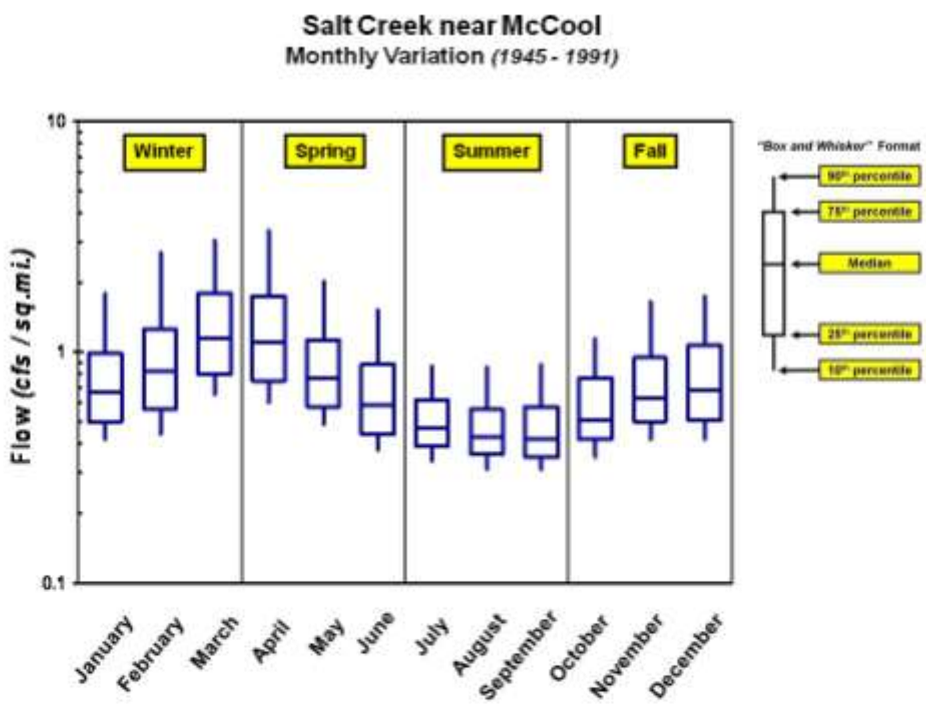


Figure 5-4. Seasonal variation of Salt Creek flows.

5.2 Water Quality

Water chemistry data has been collected on Salt Creek for many years as part of IDEM's fixed station monitoring program. As discussed earlier, Save the Dunes initiated water quality data collection on Salt Creek in 2006 as part of the overall effort to develop the WMP *(Figure 5-5)*. Water quality patterns vary across the Salt Creek watershed. Figure 5-6 presents a summary of *E. coli* monitoring information collected by Save the Dunes. Information is depicted in the longitudinal direction moving from upstream to downstream (left to right). Data for the tributaries is presented on the left side of the chart, while data for the mainstem is shown on the right. Summary results for other key parameters (notably TSS, TP, nitrate + nitrite, and conductivity) are presented in Figure 5-7 through Figure 5-10.

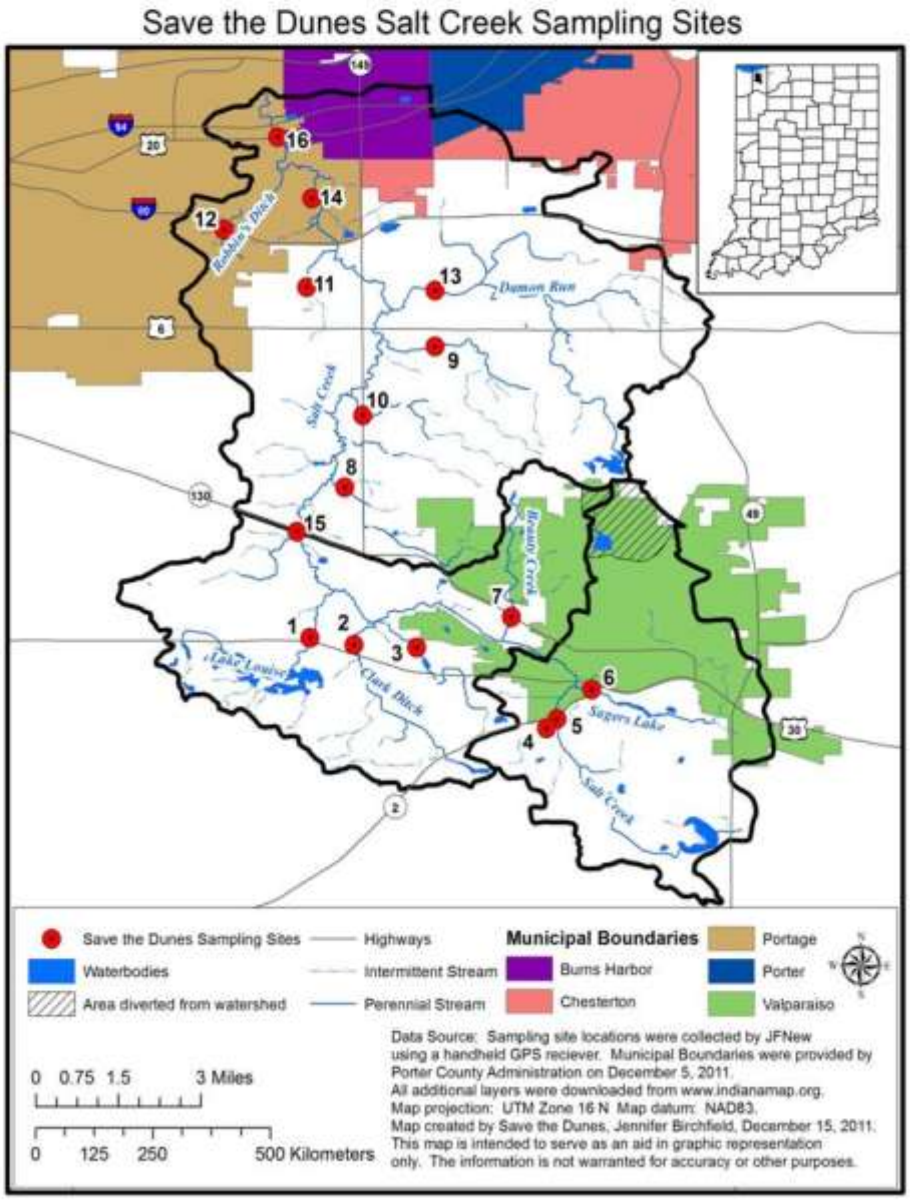


Figure 5-5. Location of Save the Dunes monitoring sites.

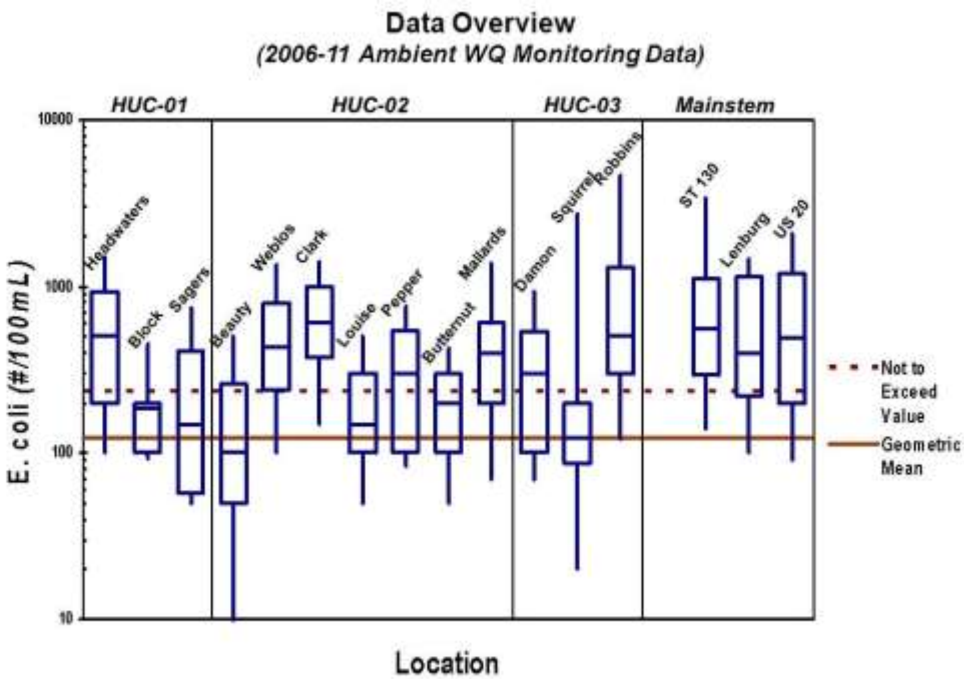


Figure 5-6. Salt Creek watershed profile -- *E. coli*.

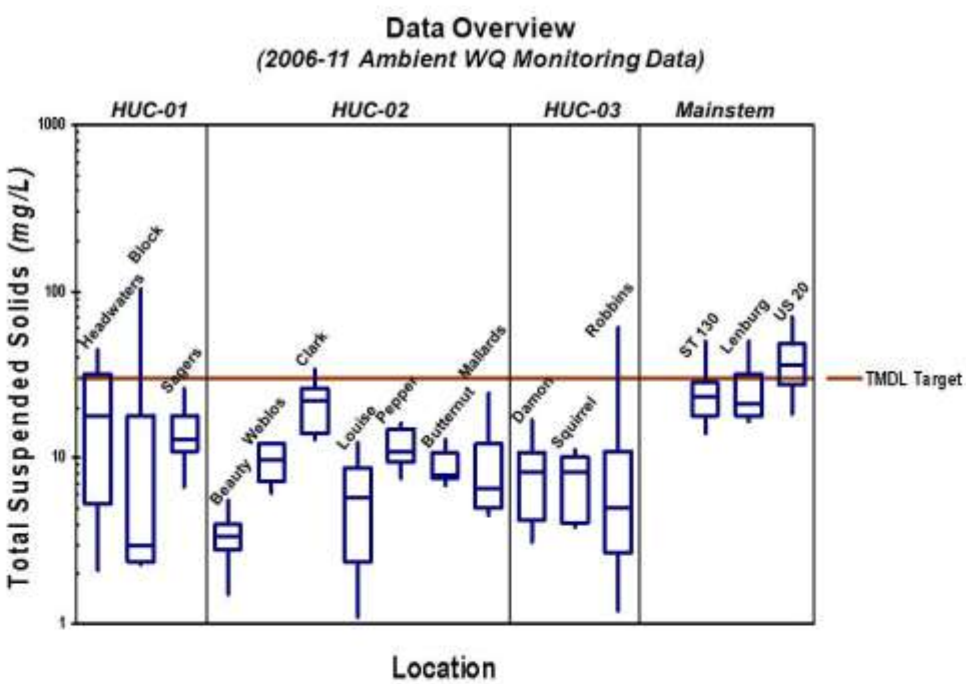


Figure 5-7. Salt Creek watershed profile -- total suspended solids.

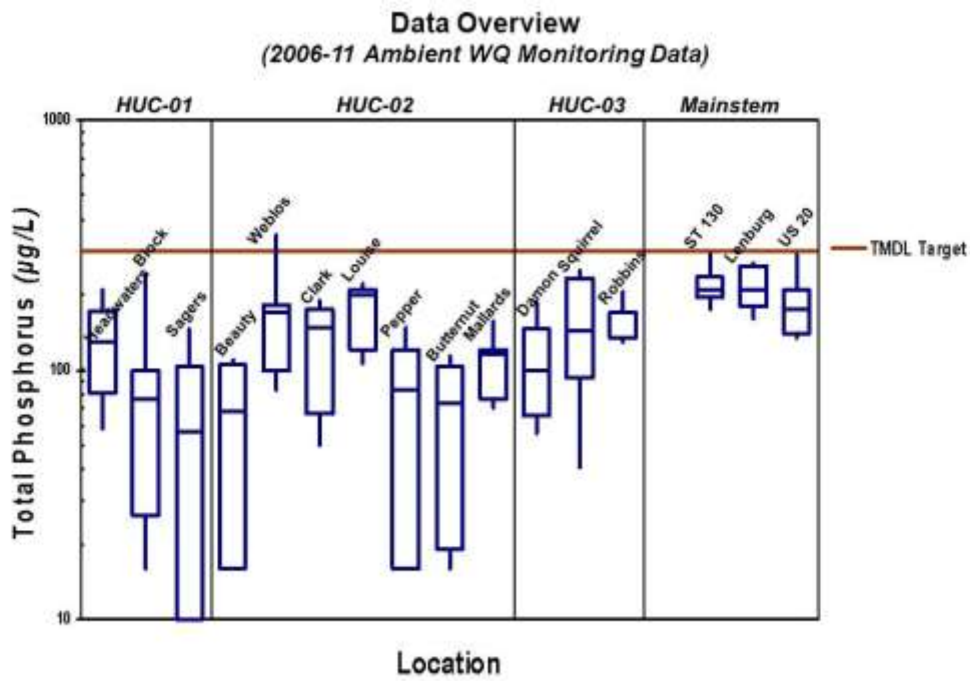


Figure 5-8. Salt Creek watershed profile -- total phosphorus.

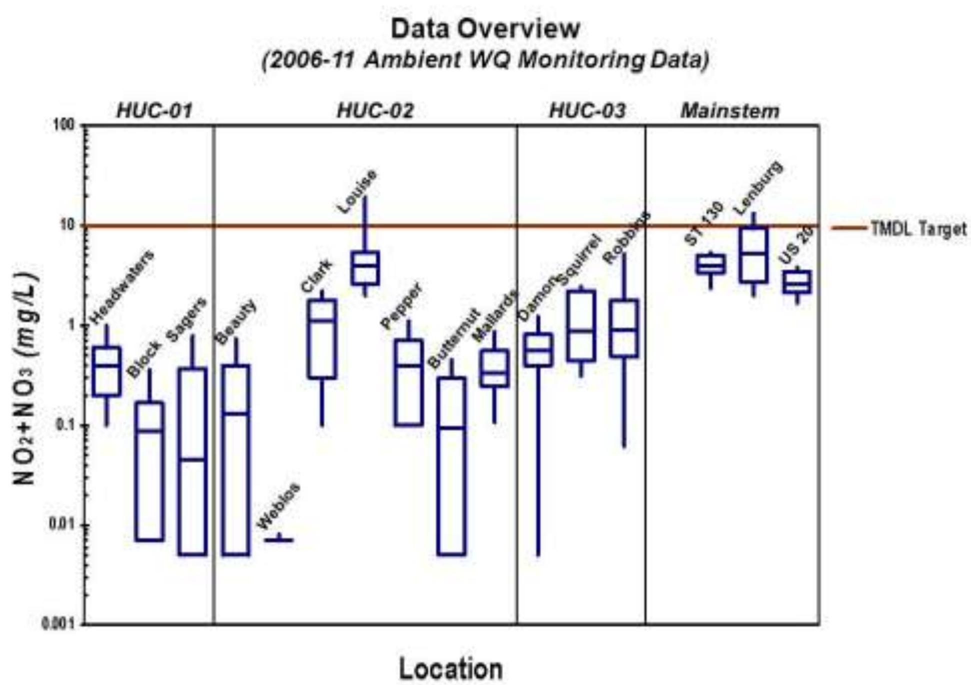


Figure 5-9. Salt Creek watershed profile -- nitrate.

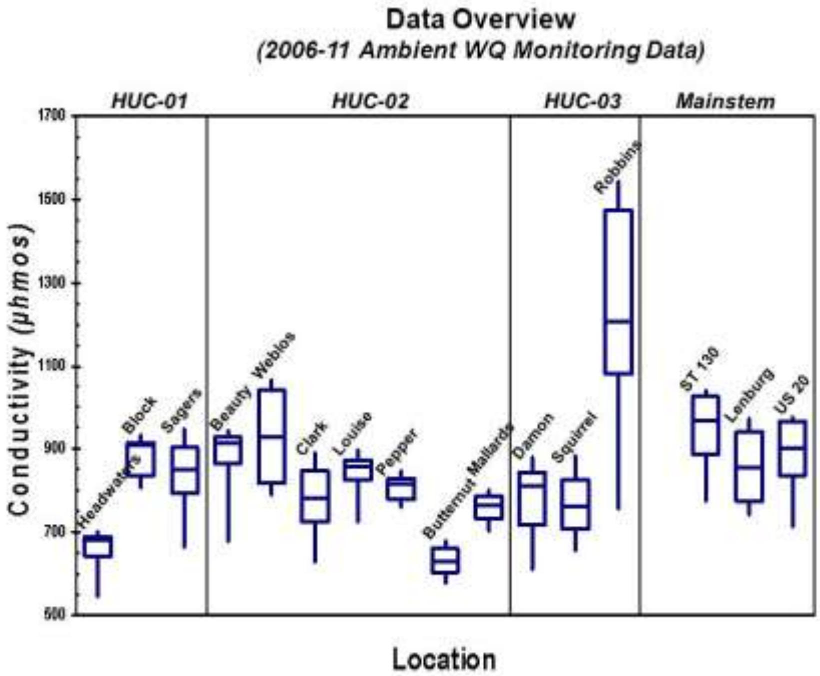


Figure 5-10. Salt Creek watershed profile -- conductivity.

5.3 Hydrology and Water Quality Relationships

The primary benefit of flow duration curves in TMDL development is to provide insight regarding patterns associated with hydrology and water quality concerns. The duration curve approach is particularly applicable because water quality is often a function of stream flow. For instance, sediment concentrations typically increase with rising flows as a result of factors such as channel scour from higher velocities.

The use of duration curves in water quality assessment creates a framework that enables data to be characterized by flow conditions. The method provides a visual display of the relationship between stream flow and water quality. This concept is illustrated by using TSS data collected at one of the IDEM fixed station monitoring sites identified in Table 2-2: Salt Creek at State Route 130. In the case of Figure 5-11, TSS concentrations are the greatest under high flow conditions. The display also shows that the highest levels are generally associated with runoff events (as indicated by the shaded diamonds). These events are days when surface runoff constitutes more than half of the daily average flow, as determined through hydrograph separation.

Daily stream flows are necessary to implement the load duration curve approach. These were estimated using the observed flows available at the USGS gage on the Little Calumet River (gage ID 04094000) and drainage area weighting 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 monitoring stations (or impaired segment) was divided by the drainage area (66 square miles) of gage 04094000. The flows for each of the stations were then calculated by multiplying the 04094000 flows by the drainage area ratios. Additional flows were added to certain locations to account for WWTF and CSOs that discharge upstream and are not directly accounted for using the drainage area weighting method.

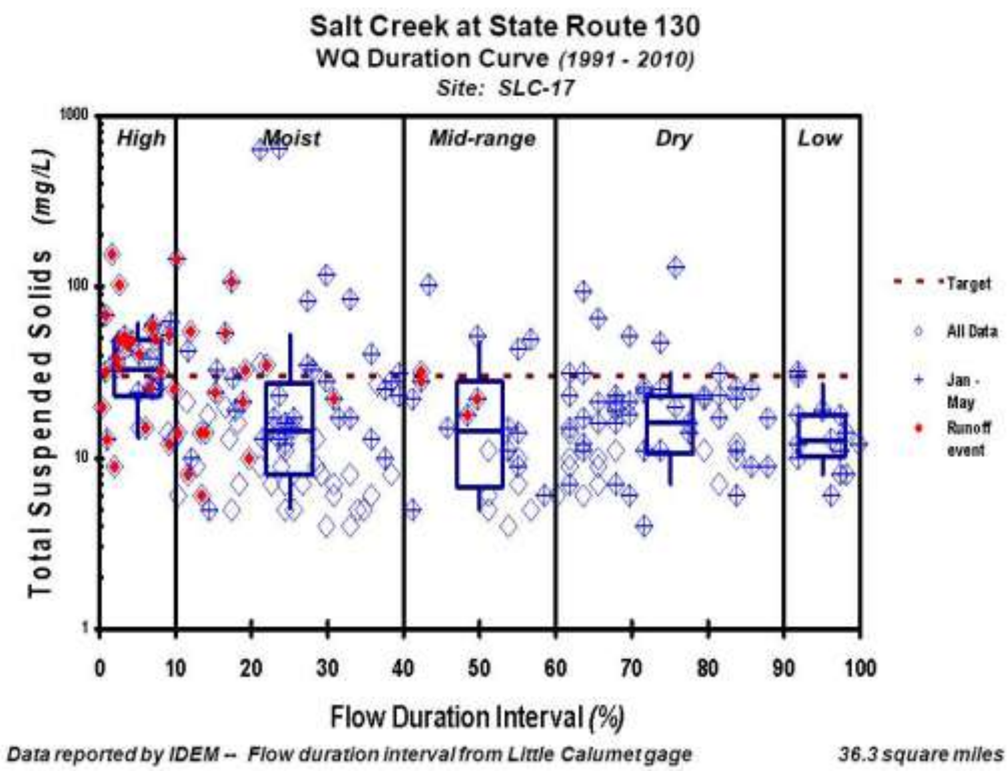


Figure 5-11. Relationship between flow and TSS using duration curve framework.

6. Subwatershed Assessments

A subwatershed approach provides a framework that relates source information to water quality monitoring results. The use of subwatersheds helps connect potential cause information to documented effects on a reach-by-reach basis. The ability to summarize information at different spatial scales strengthens the overall TMDL development process and enables more effective targeting of implementation efforts.

The USGS has delineated the Salt Creek drainage into three hydrologic units using a 12-digit coding scheme *(Figure 6-1)*. These 12-digit hydrologic unit codes (HUCs) represent a logical starting point to group subwatershed information. In addition, the *Salt Creek Watershed Management Plan* (Save the Dunes, 2008) identified three categories of management areas within the drainage: critical, priority, and intermediate *(Figure 6-2)*. Critical management areas are considered critical for implementation of practices to improve water quality. Priority management areas are crucial for the long-term environmental health of Salt Creek and require protective measures to maintain and/or enhance existing, relatively good water quality. Subwatersheds designated as priority management areas for preservation generally need a limited number of practices to prevent pollution increases due to changes in land use or intensity. Protecting these subwatersheds now prevents future short term degradation of Salt Creek and ensures the benefits of addressing sources in the critical management areas. Intermediate management areas are the areas not included as priority or critical areas of the watershed and are expected to be addressed as part of the Indiana Lake Michigan Coastal Program coastal nonpoint source management program plan as detailed in Section 11.

These management areas are based upon historic and current water quality data, confirmed sources, projected future development, and causes of impairment. Management area boundaries are defined on a subwatershed basis. For that reason, these management areas also represent logical units to organize information needed to support TMDL development using a subwatershed approach. The 2008 Salt Creek WMP is currently being updated to incorporate both new data and the findings of this TMDL. As a result, management areas might change in the next draft of the Salt Creek Watershed Management Plan.

Summary Tables. The subwatershed assessments provide a summary for each impaired segment *(Table 6-1 through Table 6-21)*. Upstream watershed characteristics are described including: impaired segment ID, drainage area, sample site, land use, NPDES facilities, MS4 communities, and CSO communities. In addition, key components of the TMDL for each segment are provided including: load allocations, wasteload allocations, and margin of safety. Because flow information is needed to determine these values, the drainage area weighting method described in Section 5.3 was used.

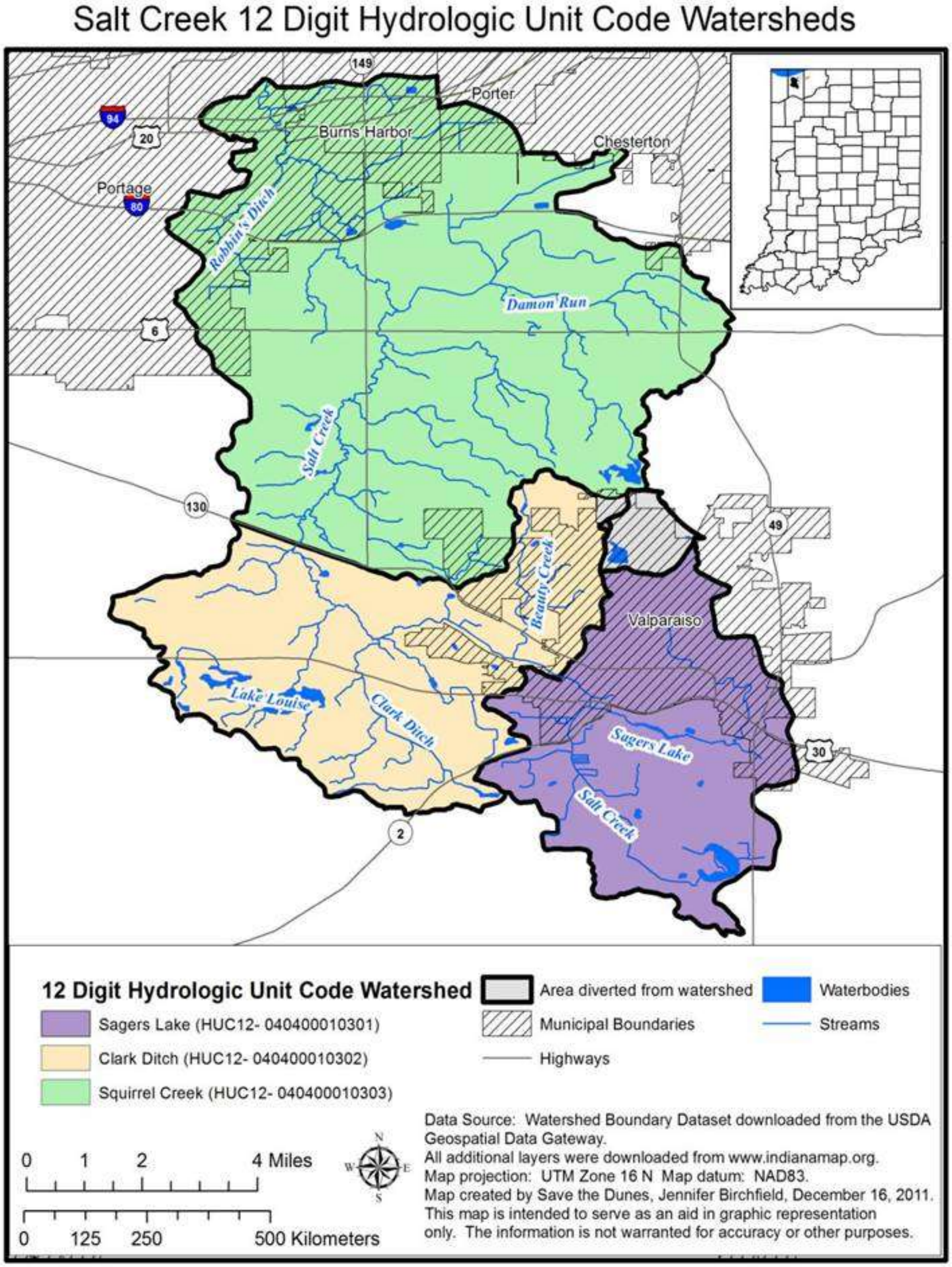


Figure 6-1. USGS hydrologic units for Salt Creek watershed.

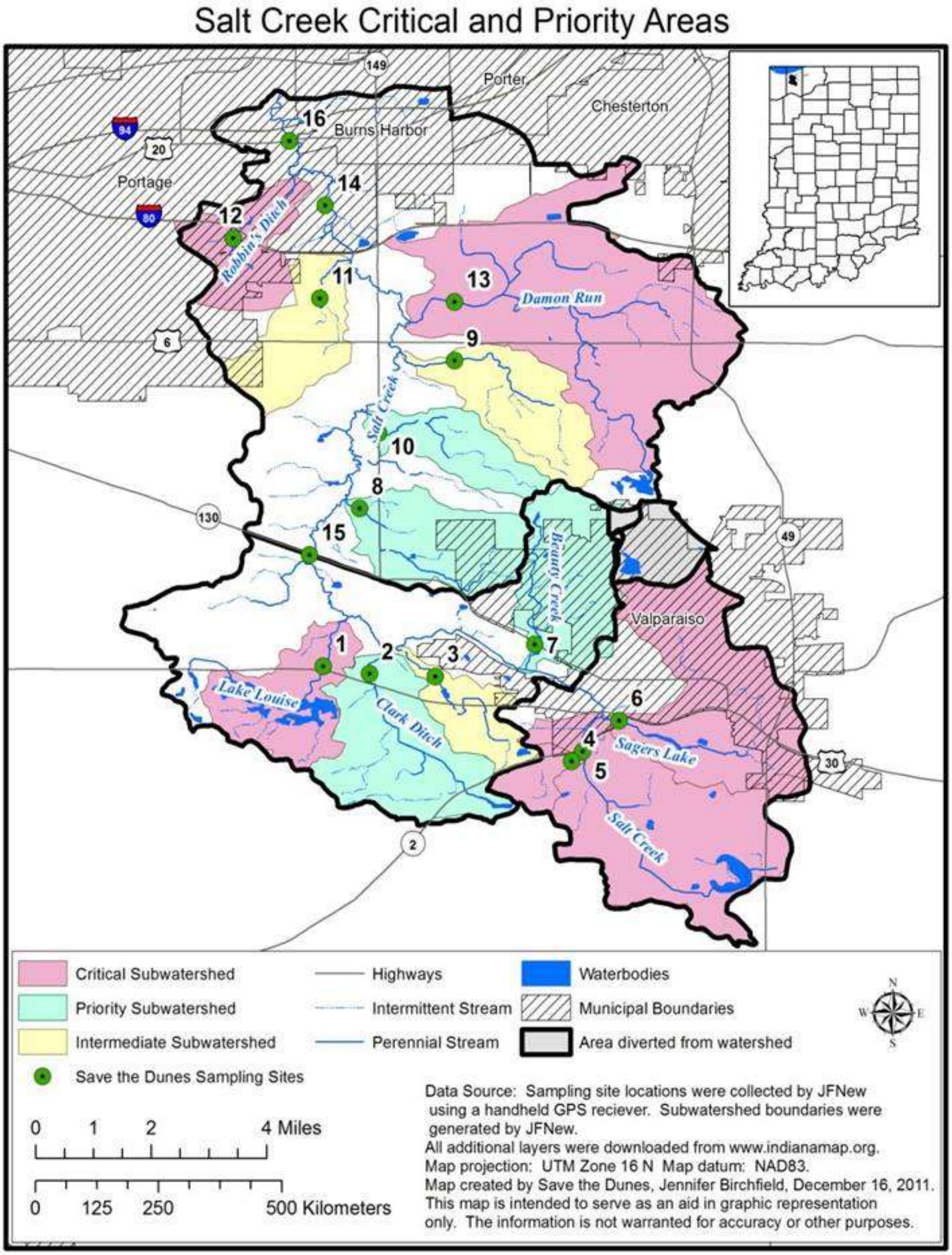


Figure 6-2. Salt Creek watershed management areas.

6.1 Upper Salt (Sagers Lake HUC)

The Upper Salt (or Sagers Lake HUC) includes a very diverse landscape, ranging from the rural headwaters area to a major portion of the City of Valparaiso *(Figure 6-3 and Figure 6-4)*. There are four segments of IDEM's §303(d) list: two on Salt Creek (INC0131_01, INC0131_02) and two in the Sagers Lake subwatershed (INC0131_T1001, INC0131_T1002). These segments are listed for IBC.

A major concern throughout the Salt Creek watershed is the effect of sediment and siltation on aquatic life. The City of Valparaiso monitors water quality in Salt Creek just below the confluence of these two subwatersheds (above the Elden Kuehl Pollution Control Facility). Figure 6-5 shows a load duration curve for TSS in Salt Creek at this location using the City's data. Water quality at this site reflects loads contributed to Salt Creek from the upper watershed (both upper Salt Creek and Sagers Lake subwatersheds). As indicated, the greatest loads occur during high flow conditions, generally associated with storm events.

All four segments are located in one of the two critical management areas in this subwatershed group. Basic characteristics including segment drainage area, land use, and MS4 communities are summarized in Table 6-1 through Table 6-4. Key components of the TMDL for these segments are also summarized in Table 6-1 through Table 6-4. The use of the duration curve framework to express TMDL components is illustrated in Figure 6-6 for TSS on one segment of Salt Creek (INC0131_02). In this situation, the majority of the TMDL's loading capacity is divided between the wasteload allocation for MS4 stormwater and the load allocation for nonpoint sources.

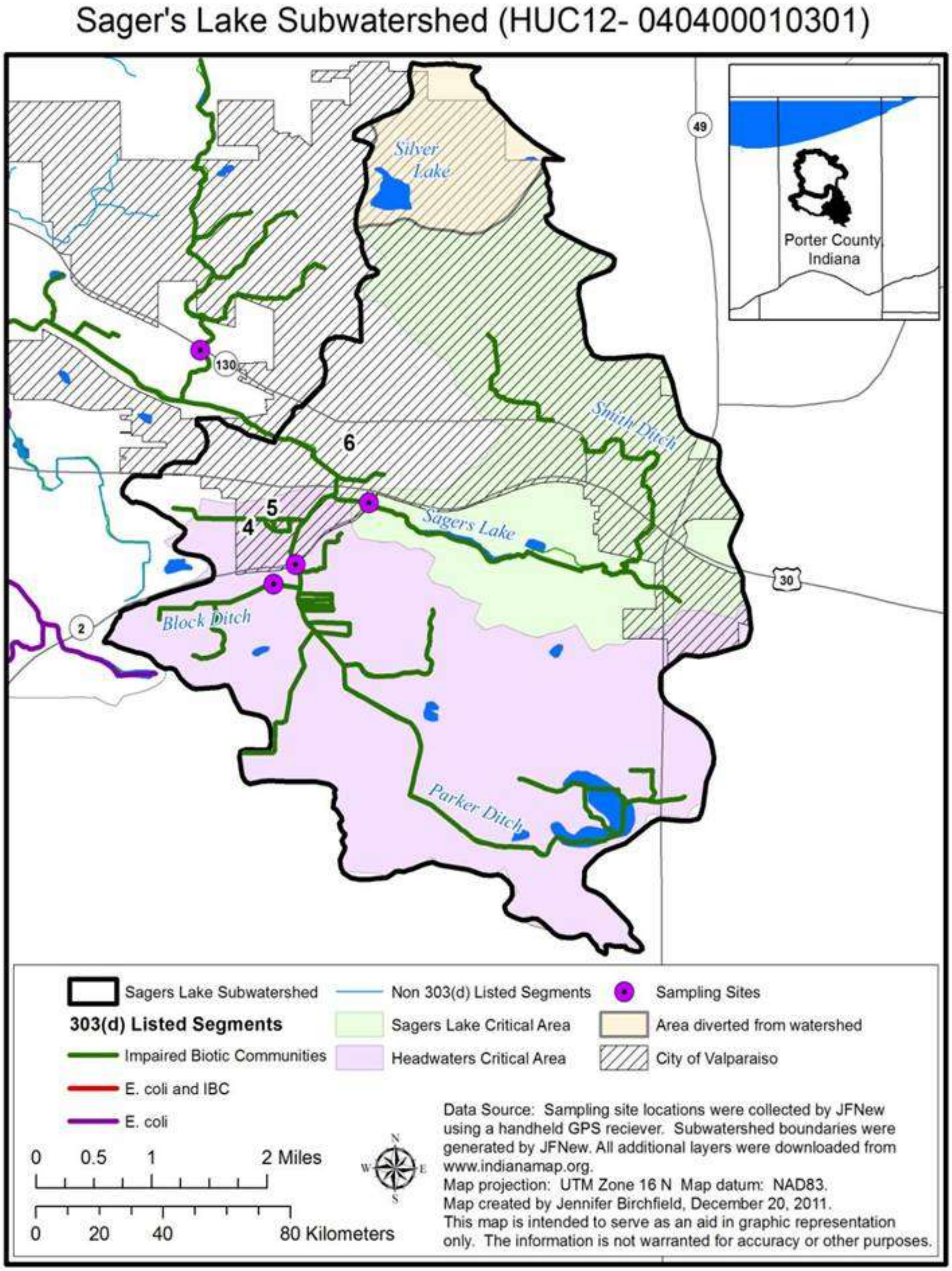


Figure 6-3. Map of Sagers Lake HUC.

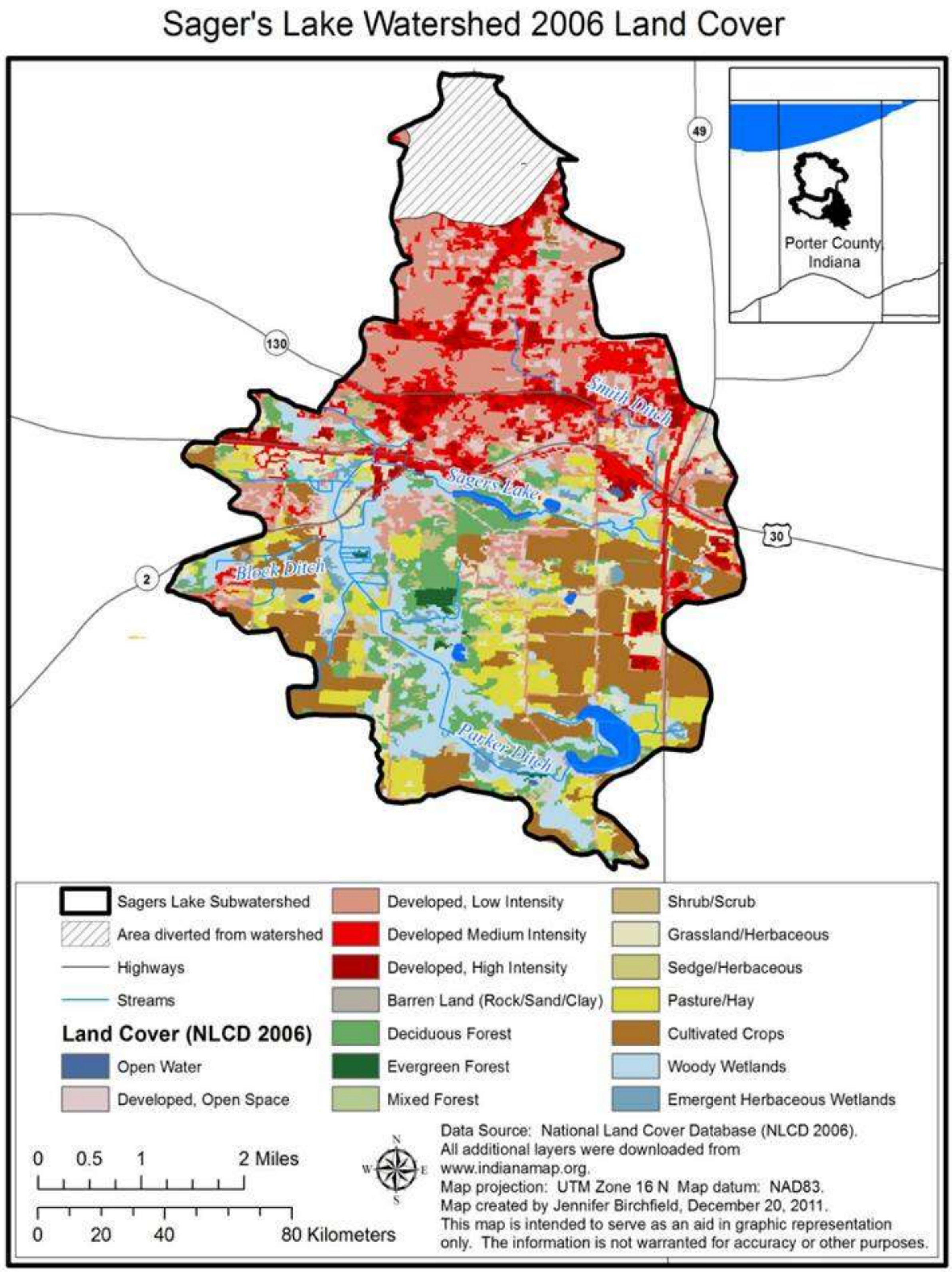


Figure 6-4. Sagers Lake HUC Land Use.

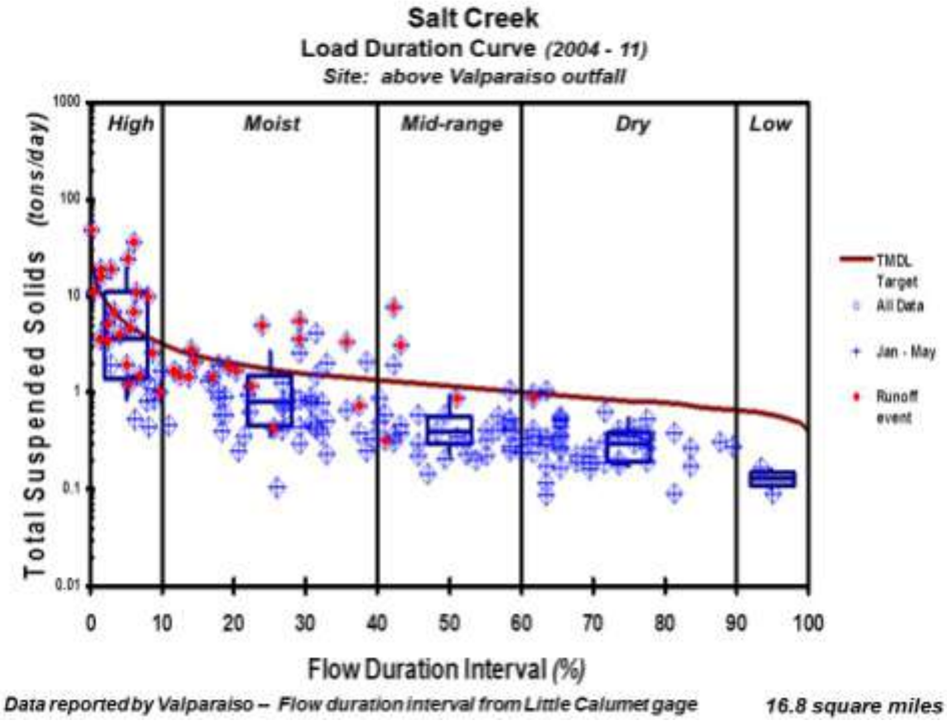


Figure 6-5. TSS load duration curve -- Salt Creek above Valparaiso WWTP.

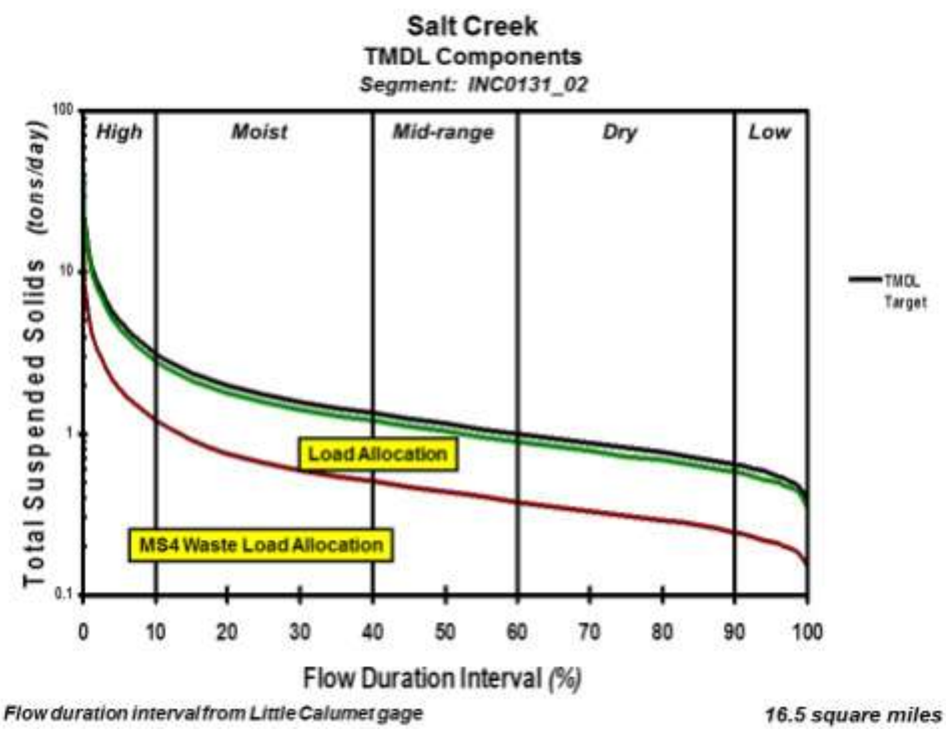


Figure 6-6. Graph illustrating TSS TMDL components -- Salt Creek *(INC0131_02)*.

Table 6-1. Salt Creek *(HUC 04040001-0301)*.

Upstream Characteristics						
Listed Segments	INC0131_01					
Drainage Area	5.56 square miles					
Sample Site(s)	#5 (Salt Creek)					
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***	
	43%	26%	6%	0%	25%	
NPDES Facilities	None in subwatershed (SW)					
MS4 Communities	Porter County (INR040140)					
CSO Communities	None in SW					
TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	1.425	0.489	0.329	0.228	0.160
	WLA	0.096	0.033	0.022	0.015	0.011
	MOS *(10%)*	0.169	0.058	0.039	0.027	0.019
	TMDL = LA+WLA+MOS	1.69	0.58	0.39	0.27	0.19
Total Nitrogen ***(pounds/day)***	**LA**	952.0	328.9	217.5	152.6	107.1
	WLA	64.1	22.1	14.7	10.3	7.2
	MOS *(10%)*	112.9	39	25.8	18.1	12.7
	TMDL = LA+WLA+MOS	1,129	390	258	181	127
Total Phosphorus ***(pounds/day)***	**LA**	28.55	9.87	6.53	4.59	3.21
	WLA	1.92	0.66	0.44	0.31	0.22
	MOS *(10%)*	3.39	1.17	0.78	0.54	0.38
	TMDL = LA+WLA+MOS	33.86	11.70	7.75	5.44	3.81

Table 6-2. Salt Creek *(HUC 04040001-0301)*.

Upstream Characteristics					
Listed Segments	INC0131_02				
Drainage Area	16.48 square miles				
Sample Site(s)	#4 (Block Ditch), #5 (Salt Creek)				
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***
	23%	21%	42%	0%	14%
NPDES Facilities	None in subwatershed (SW)				
MS4 Communities	City of Valparaiso / Valparaiso University (INR04073) Porter County (INR040140)				
CSO Communities	City of Valparaiso				

TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	2.603	0.899	0.599	0.423	0.29
	WLA	1.906	0.658	0.436	0.306	0.214
	MOS *(10%)*	0.501	0.173	0.115	0.081	0.056
	TMDL = LA+WLA+MOS	5.01	1.73	1.15	0.81	0.56
Total Nitrogen ***(pounds/day)***	**LA**	1,737.9	599.6	397.6	279.2	195.5
	WLA	1,270.8	438.9	290.9	204.1	142.9
	MOS *(10%)*	334.3	115.5	76.5	53.7	37.6
	TMDL = LA+WLA+MOS	3,343	1,154	765	537	376
Total Phosphorus ***(pounds/day)***	**LA**	52.14	18.01	11.93	8.38	5.86
	WLA	38.12	13.17	8.73	6.12	4.29
	MOS *(10%)*	10.03	3.46	2.3	1.61	1.13
	TMDL = LA+WLA+MOS	100.29	34.64	22.96	16.11	11.28

Table 6-3. Sagers Lake *(HUC 04040001-0301)*.

Upstream Characteristics						
Listed Segments	INC0131_T1001					
Drainage Area	6.05 square miles					
Sample Site(s)	#6 (Sagers Lake outlet)					
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***	
	13%	14%	69%	0%	4%	
NPDES Facilities	None in subwatershed (SW)					
MS4 Communities	City of Valparaiso / Valparaiso University (INR04073) Porter County (INR040140)					
CSO Communities	City of Valparaiso					
TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	0.102	0.039	0.022	0.02	0.014
	WLA	1.554	0.537	0.356	0.25	0.175
	MOS *(10%)*	0.184	0.064	0.042	0.03	0.021
	TMDL = LA+WLA+MOS	1.84	0.64	0.42	0.3	0.21
Total Nitrogen ***(pounds/day)***	**LA**	68.0	23.7	15.7	10.8	7.7
	WLA	1,036.3	357.9	237.2	166.5	116.5
	MOS *(10%)*	122.7	42.4	28.1	19.7	13.8
	TMDL = LA+WLA+MOS	1,227	424	281	197	138
Total Phosphorus ***(pounds/day)***	**LA**	2.04	0.7	0.47	0.33	0.23
	WLA	31.09	10.74	7.12	4.99	3.5
	MOS *(10%)*	3.68	1.27	0.84	0.59	0.41
	TMDL = LA+WLA+MOS	36.81	12.71	8.43	5.91	4.14

Table 6-4. Sagers Lake *(HUC 04040001-0301)*.

Upstream Characteristics						
Listed Segments	INC0131_T1002					
Drainage Area	7.05 square miles					
Sample Site(s)	#6 (Sagers Lake outlet)					
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***	
	12%	17%	65%	0%	5%	
NPDES Facilities	None in subwatershed (SW)					
MS4 Communities	City of Valparaiso / Valparaiso University (INR04073) Porter County (INR040140)					
CSO Communities	City of Valparaiso					
TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	0.183	0.061	0.04	0.025	0.019
	WLA	1.752	0.605	0.401	0.281	0.197
	MOS *(10%)*	0.215	0.074	0.049	0.034	0.024
	TMDL = LA+WLA+MOS	2.15	0.74	0.49	0.34	0.24
Total Nitrogen ***(pounds/day)***	**LA**	120.1	41.3	27.9	19.4	13.6
	WLA	1,167.8	403.3	267.3	187.6	131.3
	MOS *(10%)*	143.1	49.4	32.8	23	16.1
	TMDL = LA+WLA+MOS	1,431	494	328	230	161
Total Phosphorus ***(pounds/day)***	**LA**	3.6	1.25	0.83	0.58	0.41
	WLA	35.03	12.1	8.02	5.63	3.94
	MOS *(10%)*	4.29	1.48	0.98	0.69	0.48
	TMDL = LA+WLA+MOS	42.92	14.83	9.83	6.90	4.83

6.2 Middle Salt (Clark Ditch HUC)

The Middle Salt (or Clark Ditch HUC) includes a diverse landscape, ranging from the western portion of the City of Valparaiso to the rural areas west of the City *(Figure 6-7 and Figure 6-8).* There are nine segments on IDEM's §303(d) list: three on Salt Creek (INC0132_01, INC0132_02, INC0132_03), one on Beauty Creek (INC0312_T1007), two on Clark Ditch (INC0132_T1009, INC132_T1010), one on the Lake Louise Outlet (INC0132_T1011) and two on unnamed tributaries to Salt Creek (INC0132_T1012, INC0133_T1021). Segments are listed for *E. coli*, IBC, or both.

A major concern in this HUC (as with the entire Salt Creek watershed) is the effect of sediment and siltation on aquatic life. Figure 6-9 shows a load duration curve for TSS in Salt Creek using IDEM ambient water quality monitoring data collected at State Route 130. Similar to patterns in the upper Salt Creek watershed, the greatest loads occur during high flow conditions and are generally associated with storm events. These elevated sediment loads result from surface erosion during rain events, as well as from channel incision and bank erosion in tributary streams. One example is shown in Figure 6-10, where increased storm water volumes have led to channel instability and bank erosion on the East Branch of Beauty Creek.

Four segments are within the critical and priority management areas in this subwatershed group. Basic characteristics including segment drainage area, land use, and MS4 communities, as well as key components of the TMDL for these segments, are summarized in Table 6-5 through Table 6-12.

Several of these segments listed for IBC do not include total phosphorus TMDLs: Salt Creek (INC0132_01, INC0132_02, INC0132_03); Clark Ditch (INC0132_T1009, INC132_T1010); and Lake Louise Outlet (INC0132_T1011). Phosphorus does not appear to be a stressor contributing to the IBC listings on these segments (supported by no dissolved oxygen violations). Each of these segments has wastewater treatment facilities with effluent limits for total phosphorus to address nutrient loading to Lake Michigan. In addition, IDEM is currently involved in criteria development for total phosphorus related to Lake Michigan tributaries that may lead to revised effluent limits for these facilities.

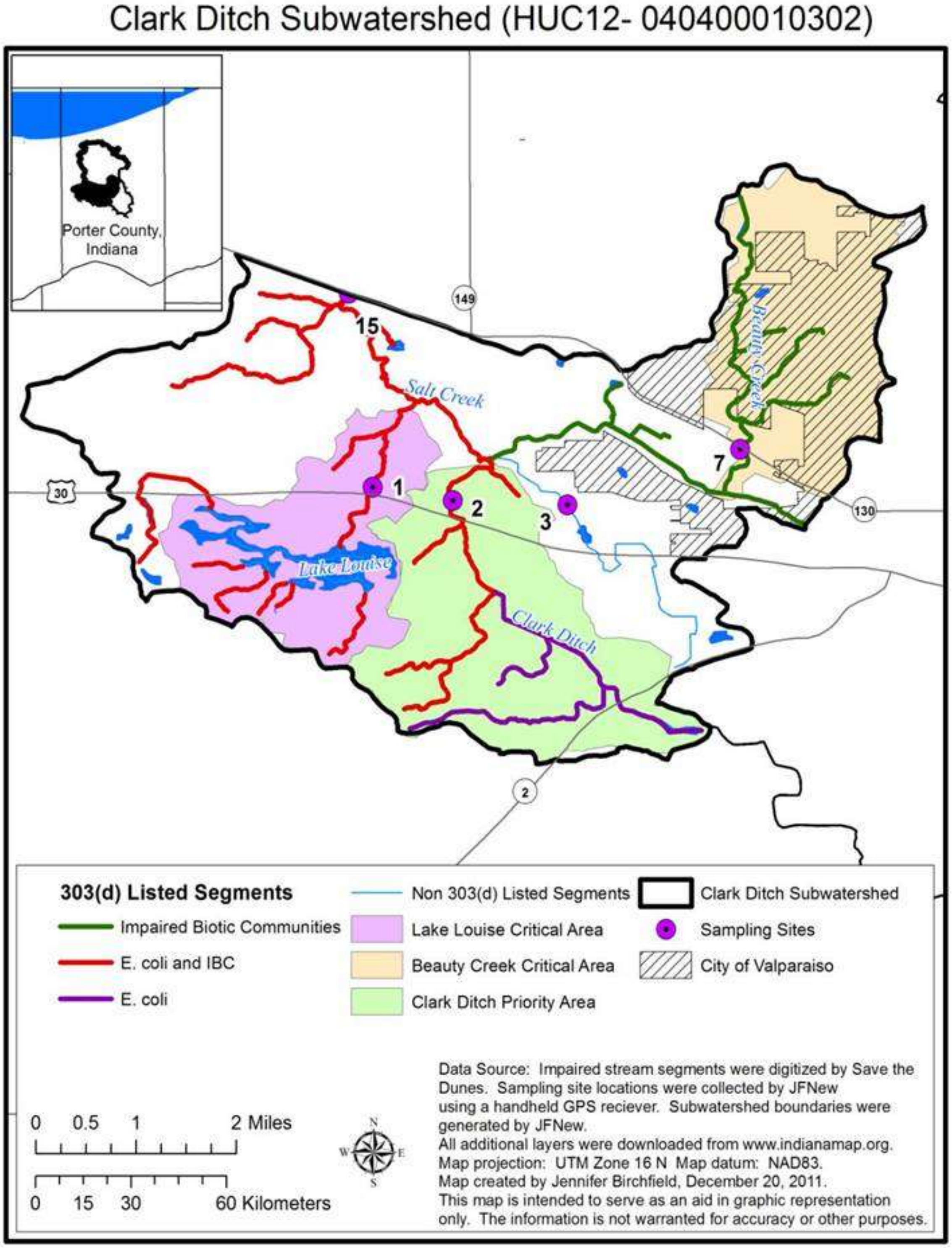


Figure 6-7. Map of Clark Ditch HUC.

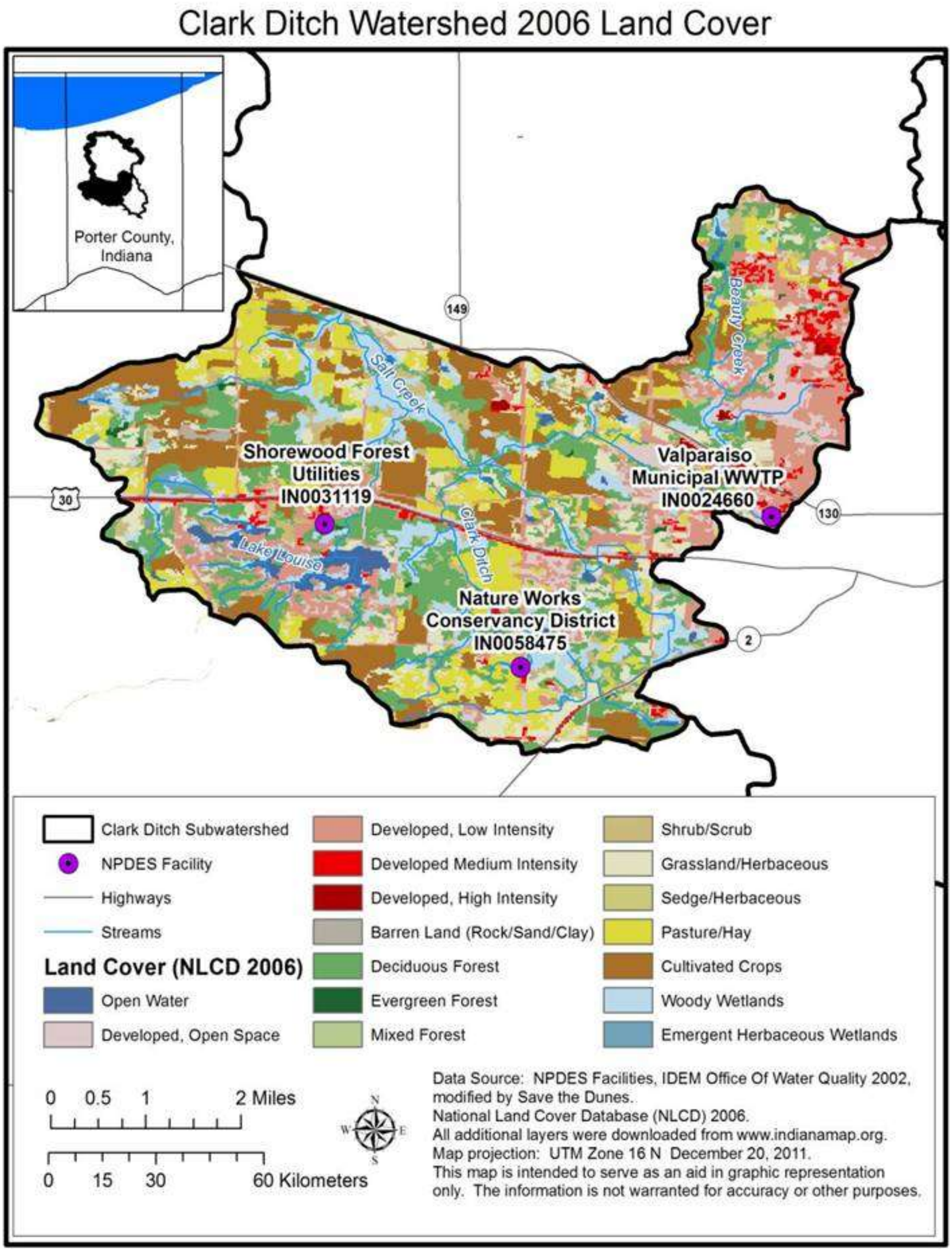


Figure 6-8. Clark Ditch HUC Land Use.

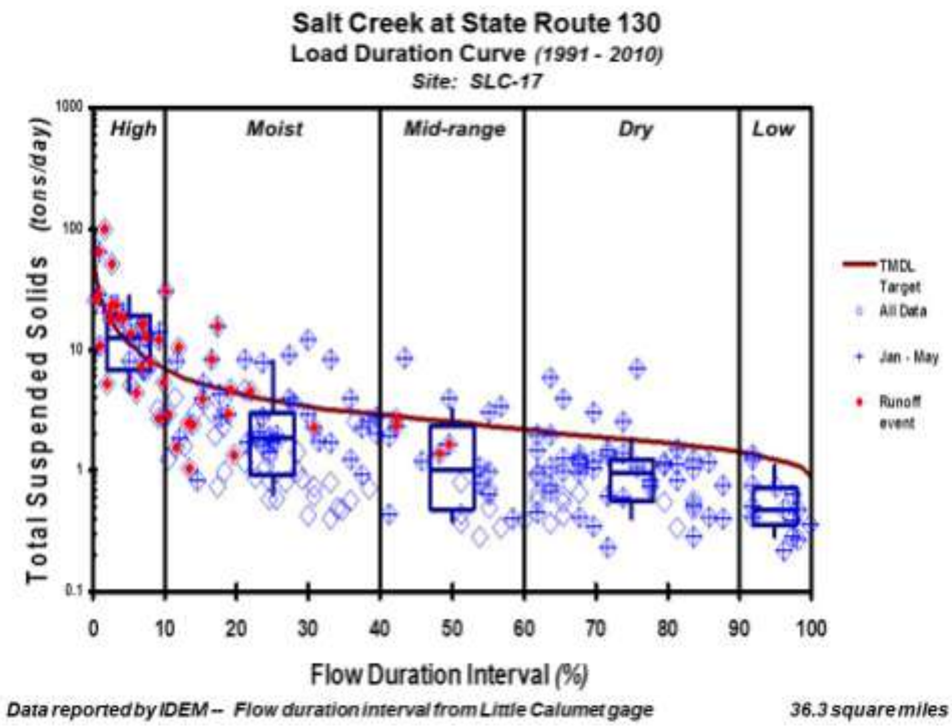


Figure 6-9. TSS load duration curve -- Salt Creek at State Route 130.

Figure 6-10. Effect of stormwater on East Branch Beauty Creek.

Table 6-5. Salt Creek *(HUC 04040001-0302)*.

Upstream Characteristics						
Listed Segment	INC0132_01					
Drainage Area	16.84 square miles					
Sample Site(s)	SC-WWTP-up (Salt Creek – Valpo)					
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***	
	23%	21%	43%	0%	14%	
NPDES Facilities	Valparaiso WWTP (IN0024660)					
MS4 Communities	City of Valparaiso / Valparaiso University (INR04073) Porter County (INR040140)					
CSO Communities	City of Valparaiso					
TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	1.272	0.312	0.139	0.039	0.000
	WLA	3.345	1.281	0.914	0.699	0.522
	MOS *(10%)*	0.513	0.177	0.117	0.082	0.058
	TMDL = LA+WLA+MOS	5.13	1.77	1.17	0.82	0.58
Total Nitrogen ***(pounds/day)***	**LA**	901.9	264.3	150.8	84.6	37.3
	WLA	2,173.4	797.7	553	409.5	308.3
	MOS *(10%)*	341.7	118	78.2	54.9	38.4
	TMDL = LA+WLA+MOS	3,417	1,180	782	549	384

Table 6-6. Salt Creek *(HUC 04040001-0302)*.

Upstream Characteristics					
Listed Segment	INC0132_02				
Drainage Area	28.34 square miles				
Sample Site(s)	SC-WWTP-ds (Salt Creek – Valpo)				
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***
	24%	27%	37%	0%	12%
NPDES Facilities	Valparaiso WWTP (IN0024660)				
MS4 Communities	City of Valparaiso / Valparaiso University (INR04073) Porter County (INR040140)				
CSO Communities	City of Valparaiso				

TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	3.345	0.988	0.563	0.324	0.146
	WLA	4.413	1.694	1.21	0.927	0.727
	MOS *(10%)*	0.862	0.298	0.197	0.139	0.097
	TMDL = LA+WLA+MOS	8.62	2.98	1.97	1.39	0.97
Total Nitrogen ***(pounds/day)***	**LA**	2,308.4	733.3	453.7	289	173.2
	WLA	2,865.7	1,053.2	730.7	541.7	408.2
	MOS *(10%)*	574.9	198.5	131.6	92.3	64.6
	TMDL = LA+WLA+MOS	5,749	1,985	1,316	923	646

Table 6-7. Salt Creek *(HUC 04040001-0302)*.

Upstream Characteristics					
Listed Segment	INC0132_03				
Drainage Area	36.35 square miles				
Sample Site(s)	#15 (Salt Creek), SLC-17 (Salt Creek – IDEM)				
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***
	26%	29%	32%	0%	12%
NPDES Facilities	Valparaiso WWTP (IN0024660)				
MS4 Communities	City of Valparaiso / Valparaiso University (INR04073) Porter County (INR040140)				
CSO Communities	City of Valparaiso				

TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	4.466	1.37	0.817	0.499	0.264
	WLA	5.488	2.068	1.46	1.103	0.852
	MOS *(10%)*	1.106	0.382	0.253	0.178	0.124
	TMDL = LA+WLA+MOS	11.06	3.82	2.53	1.78	1.24
Total Nitrogen ***(pounds/day)***	**LA**	3,054.8	991	623.4	407.6	255.9
	WLA	3,580.9	1,301.3	895.8	658	490.2
	MOS *(10%)*	737.3	254.7	168.8	118.4	82.9
	TMDL = LA+WLA+MOS	7,373	2,547	1,688	1,184	829

Table 6-8. Beauty Creek *(HUC 04040001-0302)*.

Upstream Characteristics						
Listed Segment	INC0132_T1007					
Drainage Area	3.36 square miles					
Sample Site(s)	#7 (Beauty Creek)					
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***	
	16%	36%	45%	0%	3%	
NPDES Facilities	None in subwatershed (SW)					
MS4 Communities	City of Valparaiso / Valparaiso University (INR04073) Porter County (INR040140)					
CSO Communities	None in SW					
TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	0.161	0.054	0.034	0.022	0.014
	WLA	0.757	0.261	0.173	0.122	0.085
	MOS *(10%)*	0.102	0.035	0.023	0.016	0.011
	TMDL = LA+WLA+MOS	1.02	0.35	0.23	0.16	0.11
Total Nitrogen ***(pounds/day)***	**LA**	108.2	37.2	24.9	17	12.5
	WLA	504.7	174.3	115.5	81.1	56.8
	MOS *(10%)*	68.1	23.5	15.6	10.9	7.7
	TMDL = LA+WLA+MOS	681	235	156	109	77
Total Phosphorus ***(pounds/day)***	**LA**	3.26	1.12	0.74	0.52	0.37
	WLA	15.14	5.23	3.47	2.43	1.7
	MOS *(10%)*	2.04	0.71	0.47	0.33	0.23
	TMDL = LA+WLA+MOS	20.44	7.06	4.68	3.28	2.3

Table 6-9. Clark Ditch *(HUC 04040001-0302)*.

Upstream Characteristics						
Listed Segment	INC0132_T1009, INC0132_T1010					
Drainage Area	2.16 square miles					
Sample Site(s)	#2 (Clark Ditch)					
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***	
	16%	33%	39%	0%	12%	
NPDES Facilities	Nature Works Conservancy District (IN0058475)					
MS4 Communities	Porter County (INR040140) Nature Works Conservancy District (INR040149)					
CSO Communities	None in SW					
TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	0.178	0.046	0.019	0.01	0.000
	WLA	0.416	0.161	0.116	0.089	0.063
	MOS *(10%)*	0.066	0.023	0.015	0.011	0.007
	TMDL = LA+WLA+MOS	0.66	0.23	0.15	0.11	0.07
Total Nitrogen ***(pounds/day)***	**LA**	132.2	43.6	27	18.5	11.2
	WLA	262.9	93.2	63	45.4	32.9
	MOS *(10%)*	43.9	15.2	10	7.1	4.9
	TMDL = LA+WLA+MOS	439	152	100	71	49
E. coli ***(billions MPN/day)***	**LA**	7.01	1.94	1.13	0.6	0.22
	WLA	15.4	5.8	4	3	2.3
	MOS *(10%)*	2.49	0.86	0.57	0.4	0.28
	TMDL = LA+WLA+MOS	24.9	8.6	5.7	4.0	2.8

Table 6-10. Lake Louise Outlet *(HUC 04040001-0302)*.

Upstream Characteristics						
Listed Segment	INC0132_T1011					
Drainage Area	3.56 square miles					
Sample Site(s)	#1 (Lake Louise Outlet)					
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***	
	23%	39%	28%	0%	10%	
NPDES Facilities	Shorewood Forest Utilities (IN0031119)					
MS4 Communities	Porter County (INR040140)					
CSO Communities	None in SW					
TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	0.640	0.177	0.100	0.046	0.014
	WLA	0.332	0.156	0.125	0.107	0.094
	MOS *(10%)*	0.108	0.037	0.025	0.017	0.012
	TMDL = LA+WLA+MOS	1.08	0.37	0.25	0.17	0.12
Total Nitrogen ***(pounds/day)***	**LA**	461.8	153.3	98.6	65.8	42.9
	WLA	188.9	71.7	50.8	38.6	30.0
	MOS *(10%)*	72.3	25.0	16.6	11.6	8.1
	TMDL = LA+WLA+MOS	723	250	166	116	81
E. coli ***(billions MPN/day)***	**LA**	25.15	7.67	4.53	2.71	1.40
	WLA	11.75	5.11	3.93	3.23	2.74
	MOS *(10%)*	4.10	1.42	0.94	0.66	0.46
	TMDL = LA+WLA+MOS	41.0	14.2	9.4	6.6	4.6

Table 6-11. Salt Creek – Unnamed Tributary *(HUC 04040001-0302)*.

Upstream Characteristics						
Listed Segment	INC0132_T1012					
Drainage Area	2.42 square miles					
Sample Site(s)						
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***	
	55%	32%	3%	0%	9%	
NPDES Facilities	None in subwatershed (SW)					
MS4 Communities	Porter County (INR040140)					
CSO Communities	None in SW					
TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	0.646	0.218	0.148	0.105	0.070
	WLA	0.020	0.007	0.005	0.003	0.002
	MOS *(10%)*	0.074	0.025	0.017	0.012	0.008
	TMDL = LA+WLA+MOS	0.74	0.25	0.17	0.12	0.08
Total Nitrogen ***(pounds/day)***	**LA**	427.5	147.4	97.7	68.9	48.0
	WLA	13.5	4.7	3.1	2.2	1.5
	MOS *(10%)*	49.0	16.9	11.2	7.9	5.5
	TMDL = LA+WLA+MOS	490	169	112	79	55
Total Phosphorus ***(pounds/day)***	**LA**	12.83	4.43	2.94	2.05	1.43
	WLA	0.40	0.14	0.09	0.07	0.05
	MOS *(10%)*	1.47	0.51	0.34	0.24	0.17
	TMDL = LA+WLA+MOS	14.7	5.08	3.37	2.36	1.65
E. coli ***(billions MPN/day)***	**LA**	24.25	8.38	5.58	3.93	2.7
	WLA	0.77	0.26	0.18	0.12	0.09
	MOS *(10%)*	2.78	0.96	0.64	0.45	0.31
	TMDL = LA+WLA+MOS	27.8	9.6	6.4	4.5	3.1

6.3 Lower Salt (Squirrel Creek HUC)

The Lower Salt (or Squirrel Creek HUC) includes a large and diverse area, ranging from rural areas between the cities of Valparaiso and Portage to the eastern portion of the City of Portage *(Figure 6-11 and Figure 6-12).* There are nine segments of IDEM's §303(d) list: four on Damon Run and its tributaries, (INC0133_T1022, INC0133_T1023, INC0133_T1024, INC0133_T1025), one on Squirrel Creek (INC0133_T1026), one on an unnamed tributary (INC0133_T1027), one on Gustafson Ditch (INC0133_T1028), one on Robbins Ditch (INC0133_T1029), and one on Salt Creek (INC0133_T1030). Segments are listed for *E. coli*, IBC or both.

Again, a major concern throughout the Salt Creek watershed is the effect of sediment and siltation on aquatic life. Figure 6-13 shows a load duration curve for TSS in Salt Creek using IDEM ambient water quality monitoring data collected at US 20. Similar to patterns in both upper Salt Creek HUCs, the greatest loads occur during high flow conditions and are generally associated with storm events. Once more, these elevated sediment loads result from surface erosion during rain events, as well as from channel incision and bank erosion in tributary streams.

Five segments are within the critical and priority management areas in this subwatershed group. Basic characteristics including segment drainage area, land use, and MS4 communities, as well as key components of the TMDL for these segments, are summarized in Table 6-13 through Table 6-21. Again, the use of the duration curve framework to express TMDL components is illustrated in Figure 6-14 for TSS on the most downstream segment of Salt Creek (INC0133_T1030). This segment portrays the cumulative effect of all upstream allocations (WLAs to all NPDES WWTP discharges, WLAs to all affected MS4 jurisdictions, LAs that account for nonpoint sources, and a margin of safety). In this situation, the majority of the TMDL's loading capacity is divided between the wasteload allocation for MS4 stormwater and the load allocation for nonpoint sources. Note that the graph uses a logarithmic scale in order to depict the wasteload allocations to NPDES wastewater treatment facilities.

One segment listed for IBC does not include a total phosphorus TMDL: Salt Creek (INC0133_T1030). Phosphorus does not appear to be a stressor contributing to the IBC listings on this segment (supported by no dissolved oxygen violations). This segment has wastewater treatment facilities with effluent limits for total phosphorus to address nutrient loading to Lake Michigan. In addition, IDEM is currently involved in criteria development for total phosphorus related to Lake Michigan tributaries that may lead to revised effluent limits for these facilities.

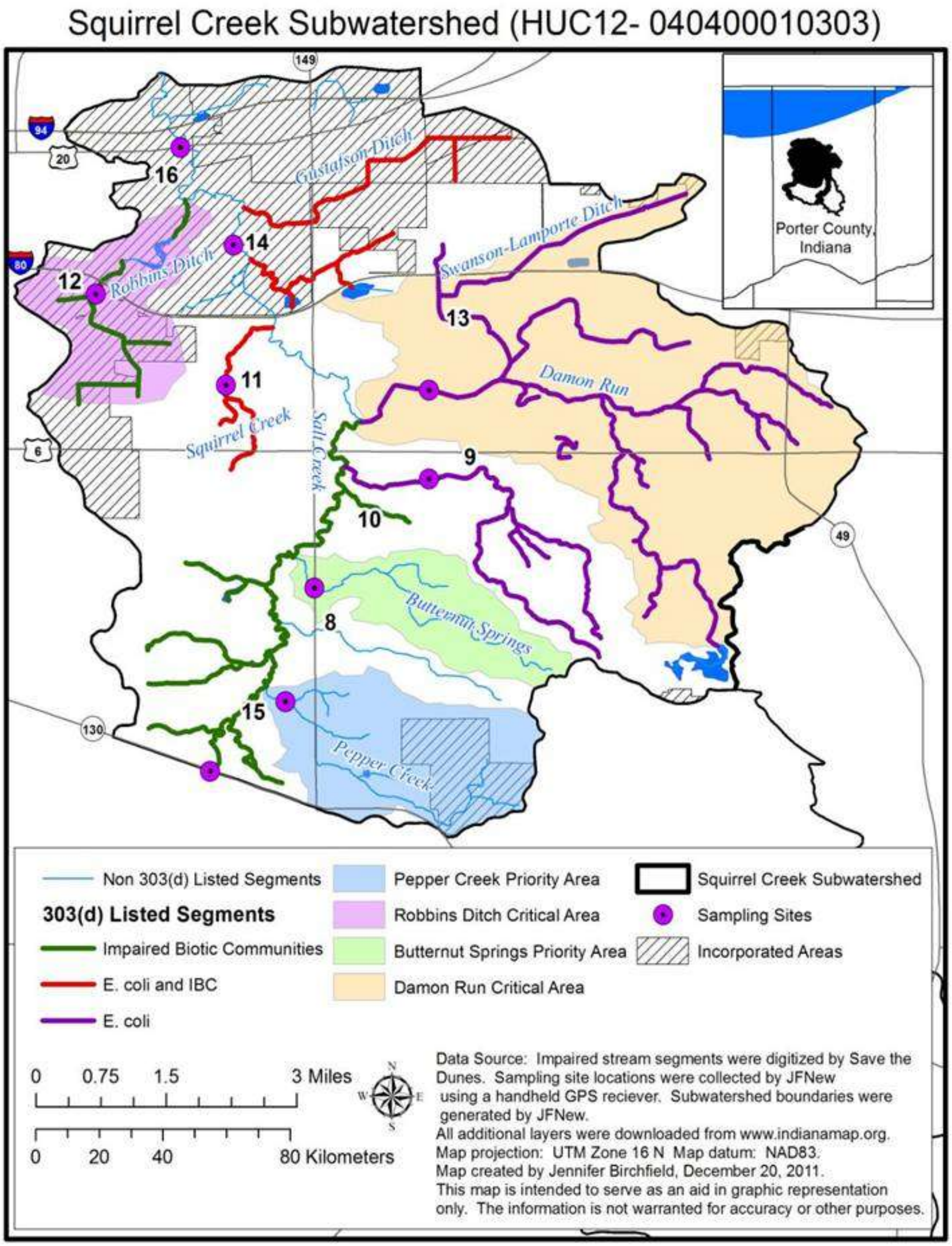


Figure 6-11. Map of Squirrel Creek HUC.

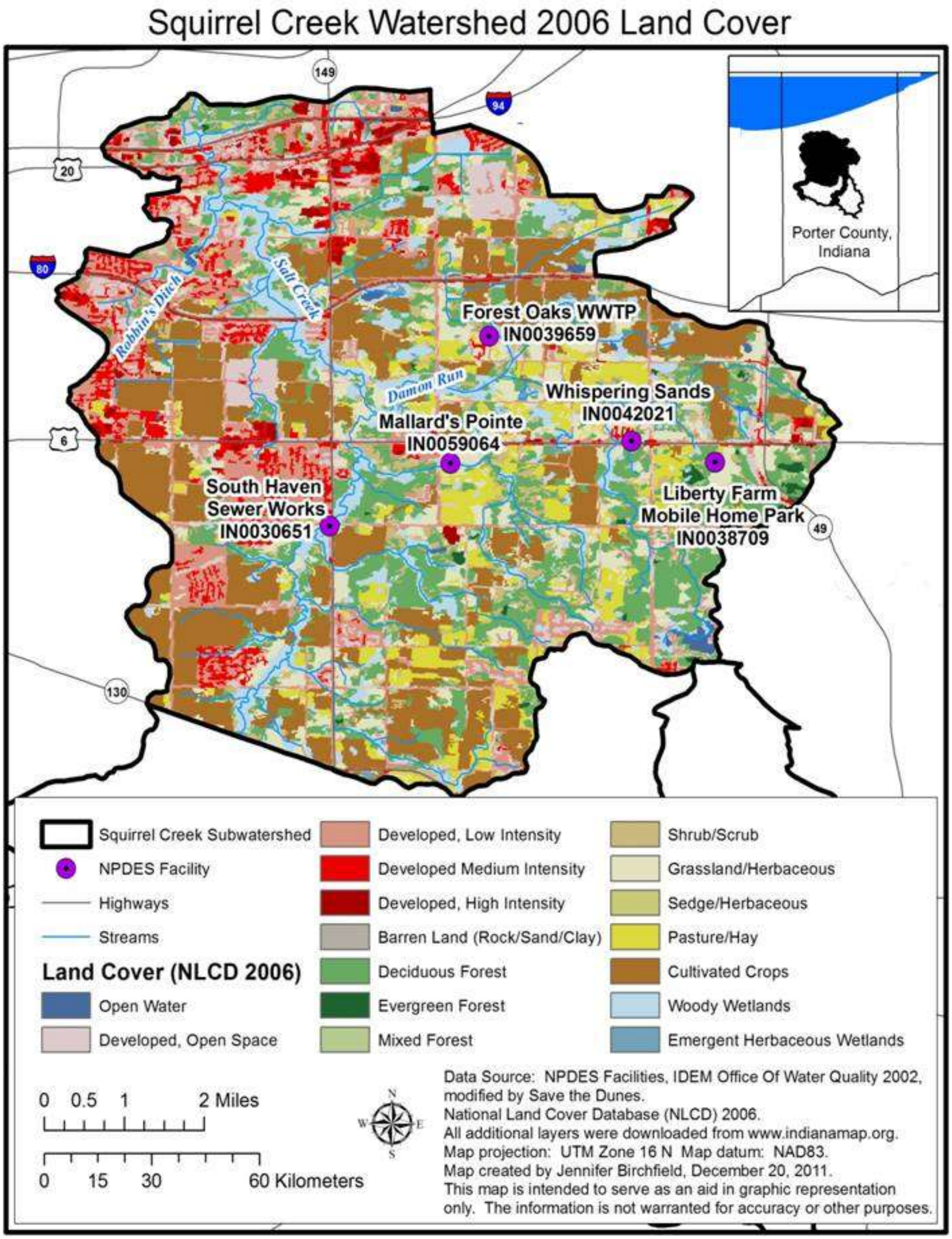


Figure 6-12. Squirrel Creek HUC Land Use.

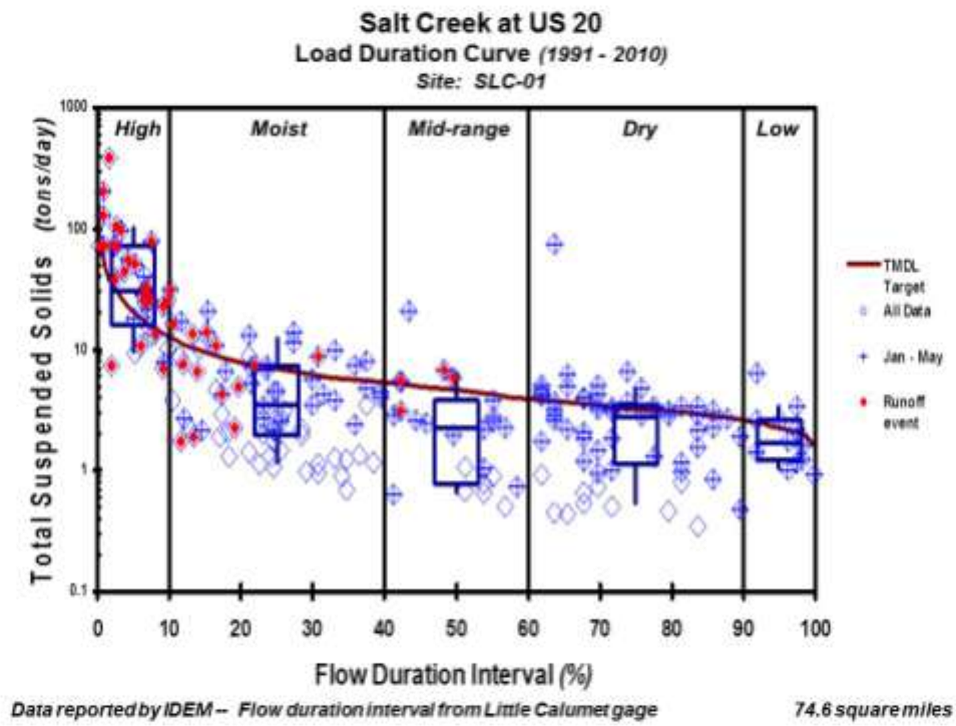


Figure 6-13. TSS load duration curve -- Salt Creek at US 20.

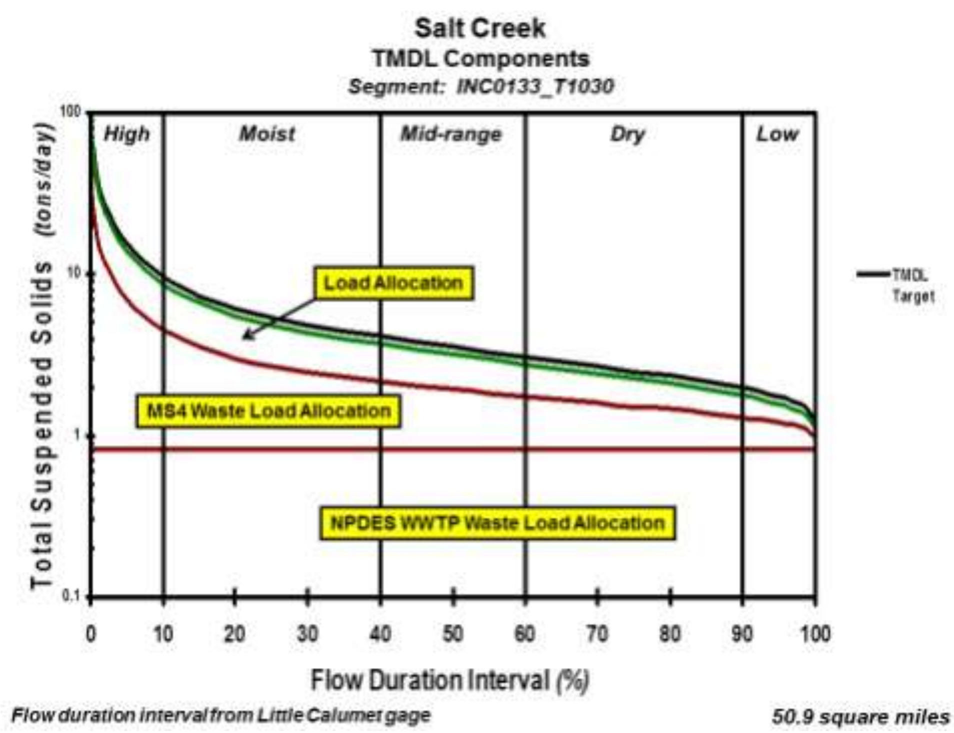


Figure 6-14. Graph illustrating TSS TMDL components -- Salt Creek *(INC0133_T1030)*.

Table 6-12. Mallards Landing *(HUC 04040001-0303)*.

Upstream Characteristics						
Listed Segment	INC0133_T1021					
Drainage Area	3.19 square miles					
Sample Site(s)	#9 (Mallards Landing)					
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***	
	29%	54%	9%	0%	8%	
NPDES Facilities	Mallard's Pointe (IN0059064)					
MS4 Communities	Porter County (INR040140)					
CSO Communities	None in SW					
TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
E. coli ***(billions MPN/day)***	**LA**	30.13	10.33	6.86	4.81	3.29
	WLA	2.9	1.1	0.7	0.5	0.4
	MOS *(10%)*	3.67	1.27	0.84	0.59	0.41
	TMDL = LA+WLA+MOS	36.7	12.7	8.4	5.9	4.1

Table 6-13. Damon Run *(HUC 04040001-0303)*.

Upstream Characteristics						
Listed Segment	INC0133_T1022					
Drainage Area	12.56 square miles					
Sample Site(s)	#13 (Damon Run)					
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***	
	30%	48%	12%	0%	11%	
NPDES Facilities	Forest Oaks WWTP (IN0039659) Liberty Farm Mobile Home Park (IN0038709) Elmwood Mobile Home Park (IN004021)					
MS4 Communities	City of Valparaiso / Valparaiso University (INR04073) Porter County (INR040140) Town of Chesterton (INR040036)					
CSO Communities	None in SW					
TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
E. coli ***(billions MPN/day)***	**LA**	110.19	37.40	24.48	16.85	11.46
	WLA	19.86	7.51	5.31	4.03	3.12
	MOS *(10%)*	14.45	4.99	3.31	2.32	1.62
	TMDL = LA+WLA+MOS	144.5	49.9	33.1	23.2	16.2

Table 6-14. Swanson Lamporte Ditch *(HUC 04040001-0303)*.

Upstream Characteristics					
Listed Segment	INC0133_T1023				
Drainage Area	4.28 square miles				
Sample Site(s)	#13 (Damon Run)				
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***
	41%	35%	13%	0%	11%
NPDES Facilities	Forest Oaks WWTP (IN0039659)				
MS4 Communities	Porter County (INR040140) Town of Chesterton (INR040036)				
CSO Communities	None in SW				

TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
E. coli ***(billions MPN/day)***	**LA**	35.16	11.98	7.89	5.43	3.70
	WLA	9.12	3.32	2.28	1.68	1.25
	MOS *(10%)*	4.92	1.70	1.13	0.79	0.55
	TMDL = LA+WLA+MOS	49.2	17.0	11.3	7.9	5.5

Table 6-15. Damon Run – South Branch *(HUC 04040001-0303)*.

Upstream Characteristics						
Listed Segment	INC0133_T1024					
Drainage Area	6.78 square miles					
Sample Site(s)	#13 (Damon Run)					
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***	
	22%	59%	12%	0%	7%	
NPDES Facilities	Elmwood Mobile Home Park (IN004021)					
MS4 Communities	City of Valparaiso / Valparaiso University (INR04073) Porter County (INR040140) Town of Chesterton (INR040036)					
CSO Communities	None in SW					
TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
E. coli ***(billions MPN/day)***	**LA**	61.00	20.74	13.55	9.37	6.46
	WLA	9.11	3.47	2.47	1.88	1.46
	MOS *(10%)*	7.79	2.69	1.78	1.25	0.88
	TMDL = LA+WLA+MOS	77.9	26.9	17.8	12.5	8.8

Table 6-16. Damon Run – East Branch *(HUC 04040001-0303)*.

Upstream Characteristics						
Listed Segment	INC0133_T1025					
Drainage Area	2.69 square miles					
Sample Site(s)	#13 (Damon Run)					
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***	
	20%	63%	11%	0%	6%	
NPDES Facilities	Liberty Farm Mobile Home Park (IN0038709)					
MS4 Communities	Porter County (INR040140) Town of Chesterton (INR040036)					
CSO Communities	None in SW					
TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
E. coli ***(billions MPN/day)***	**LA**	24.42	8.29	5.42	3.74	2.54
	WLA	3.39	1.34	0.97	0.76	0.61
	MOS *(10%)*	3.09	1.07	0.71	0.50	0.35
	TMDL = LA+WLA+MOS	30.9	10.7	7.1	5.0	3.5

Table 6-17. Squirrel Creek *(HUC 04040001-0303)*.

Upstream Characteristics					
Listed Segment	INC0133_T1026				
Drainage Area	2.51 square miles				
Sample Site(s)	#11 (Squirrel Creek)				
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***
	40%	12%	45%	0%	3%
NPDES Facilities	None in subwatershed (SW)				
MS4 Communities	City of Portage (INR040090) Twin Creeks Conservancy District (INR040079) Porter County (INR040140)				
CSO Communities	None in SW				

TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	0.271	0.091	0.058	0.042	0.035
	WLA	0.413	0.143	0.095	0.066	0.046
	MOS *(10%)*	0.076	0.026	0.017	0.012	0.009
	TMDL = LA+WLA+MOS	0.76	0.26	0.17	0.12	0.09
Total nitrogen ***(pounds/day)***	**LA**	182.5	63.2	41.3	29.5	20.3
	WLA	275.6	95.2	63.1	44.3	31
	MOS *(10%)*	50.9	17.6	11.6	8.2	5.7
	TMDL = LA+WLA+MOS	509	176	116	82	57
Total Phosphorus ***(pounds/day)***	**LA**	5.462	1.884	1.247	0.872	0.62
	WLA	8.268	2.856	1.893	1.328	0.93
	MOS *(10%)*	1.53	0.53	0.35	0.25	0.17
	TMDL = LA+WLA+MOS	15.26	5.27	3.49	2.45	1.72
E. coli ***(billions MPN/day)***	**LA**	10.32	3.6	2.34	1.64	1.08
	WLA	15.6	5.4	3.6	2.5	1.8
	MOS *(10%)*	2.88	1.00	0.66	0.46	0.32
	TMDL = LA+WLA+MOS	28.8	10.0	6.6	4.6	3.2

Table 6-18. Salt Creek – Unnamed Tributary *(HUC 04040001-0303)*.

Upstream Characteristics						
Listed Segment	INC0133_T1027					
Drainage Area	0.74 square miles					
Sample Site(s)						
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***	
	42%	26%	16%	0%	16%	
NPDES Facilities	None in subwatershed (SW)					
MS4 Communities	Town of Chesterton (INR040036) City of Portage (INR040090) Porter County (INR040140)					
CSO Communities	None in SW					
TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	0.095	0.037	0.021	0.019	0.015
	WLA	0.103	0.035	0.024	0.017	0.012
	MOS *(10%)*	0.022	0.008	0.005	0.004	0.003
	TMDL = LA+WLA+MOS	0.22	0.08	0.05	0.04	0.03
Total Nitrogen ***(pounds/day)***	**LA**	66.5	23.1	14.9	10.6	7.6
	WLA	68.5	23.7	15.7	11.0	7.7
	MOS *(10%)*	15.0	5.2	3.4	2.4	1.7
	TMDL = LA+WLA+MOS	150	52	34	24	17
Total Phosphorus ***(pounds/day)***	**LA**	1.99	0.68	0.46	0.32	0.23
	WLA	2.06	0.71	0.47	0.33	0.23
	MOS *(10%)*	0.45	0.16	0.10	0.07	0.05
	TMDL = LA+WLA+MOS	4.50	1.55	1.03	0.72	0.51
E. coli ***(billions MPN/day)***	**LA**	3.77	1.27	0.82	0.64	0.46
	WLA	3.88	1.34	0.89	0.62	0.44
	MOS *(10%)*	0.85	0.29	0.19	0.14	0.10
	TMDL = LA+WLA+MOS	8.5	2.9	1.9	1.4	1.0

Table 6-19. Gustafson Ditch *(HUC 04040001-0303)*.

Upstream Characteristics					
Listed Segment	INC0133_T1028				
Drainage Area	2.58 square miles				
Sample Site(s)					
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***
	16%	36%	37%	0%	11%
NPDES Facilities	None in subwatershed (SW)				
MS4 Communities	Town of Chesterton (INR040036) Town of Porter (IN040115) Porter County (INR040140)				
CSO Communities	None in SW				

TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	0.218	0.076	0.051	0.039	0.027
	WLA	0.484	0.167	0.111	0.078	0.054
	MOS *(10%)*	0.078	0.027	0.018	0.013	0.009
	TMDL = LA+WLA+MOS	0.78	0.27	0.18	0.13	0.09
Total Nitrogen ***(pounds/day)***	**LA**	148.2	51.5	34.2	23.8	16.8
	WLA	322.5	111.4	73.8	51.8	36.3
	MOS *(10%)*	52.3	18.1	12.0	8.4	5.9
	TMDL = LA+WLA+MOS	523	181	120	84	59
Total Phosphorus ***(pounds/day)***	**LA**	4.45	1.54	1.02	0.72	0.50
	WLA	9.68	3.34	2.21	1.55	1.09
	MOS *(10%)*	1.57	0.54	0.36	0.25	0.18
	TMDL = LA+WLA+MOS	15.70	5.42	3.59	2.52	1.77
E. coli ***(billions MPN/day)***	**LA**	8.44	2.86	1.93	1.38	0.91
	WLA	18.29	6.32	4.19	2.94	2.06
	MOS *(10%)*	2.97	1.02	0.68	0.48	0.33
	TMDL = LA+WLA+MOS	29.7	10.2	6.8	4.8	3.3

Table 6-20. Robbins Ditch *(HUC 04040001-0303)*.

Upstream Characteristics						
Listed Segment	INC0133_T1029					
Drainage Area	2.88 square miles					
Sample Site(s)	#12 (Robbins Ditch)					
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***	
	33%	18%	47%	0%	2%	
NPDES Facilities	None in subwatershed (SW)					
MS4 Communities	City of Portage (INR040090) Porter County (INR040140)					
CSO Communities	None in SW					
TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	0.055	0.015	0.011	0.008	0.007
	WLA	0.737	0.255	0.169	0.118	0.083
	MOS *(10%)*	0.088	0.030	0.020	0.014	0.010
	TMDL = LA+WLA+MOS	0.88	0.30	0.20	0.14	0.10
Total Nitrogen ***(pounds/day)***	**LA**	34.1	12	8.1	5.6	4.1
	WLA	491.5	169.8	112.5	79	55.3
	MOS *(10%)*	58.4	20.2	13.4	9.4	6.6
	TMDL = LA+WLA+MOS	584	202	134	94	66
Total Phosphorus ***(pounds/day)***	**LA**	1.01	0.36	0.23	0.16	0.11
	WLA	14.75	5.09	3.38	2.37	1.66
	MOS *(10%)*	1.75	0.60	0.40	0.28	0.20
	TMDL = LA+WLA+MOS	17.51	6.05	4.01	2.81	1.97

Table 6-21. Salt Creek *(HUC 04040001-0303)*.

Upstream Characteristics					
Listed Segment	INC0133_T1030				
Drainage Area	50.9 square miles				
Sample Site(s)	#16 (Salt Creek), SLC-01 (Salt Creek – IDEM)				
Land Use	***Agriculture***	***Forest***	***Urban***	***Water***	***Wetland***
	29%	31%	29%	0%	11%
NPDES Facilities	Valparaiso WWTP (IN0024660) South Haven Sewer Works (IN0030651)				
MS4 Communities	City of Valparaiso / Valparaiso University (INR04073) Porter County (INR040140) Twin Creeks Conservancy District (INR040079)				
CSO Communities	City of Valparaiso				

TMDL Allocations						
Pollutant	**Allocation Category**	***Very High Flows***	***Moist Conditions***	***"Normal" Flows***	***Dry Conditions***	***Low Flows***
Total Suspended Solids ***(tons/day)***	**LA**	7.073	2.131	1.256	0.738	0.371
	WLA	6.868	2.684	1.939	1.503	1.195
	MOS *(10%)*	1.549	0.535	0.355	0.249	0.174
	TMDL = LA+WLA+MOS	15.49	5.35	3.55	2.49	1.74
Total Nitrogen ***(pounds/day)***	**LA**	4,843.60	1,549.80	964.2	620.6	377.8
	WLA	4,448.90	1,659.60	1,163.40	872.5	667.1
	MOS *(10%)*	1,032.5	356.6	236.4	165.9	116.1
	TMDL = LA+WLA+MOS	10,325	3,566	2,364	1,659	1,161

7. TMDL Development

The TMDL represents the maximum loading that can be assimilated by the waterbody while still achieving the relevant water quality standard. As indicated in the Numeric Targets section (Section 3) of this document, a number of water quality objectives (WQOs) have been established to attain the WQS for *E. coli* and IBCs. The water quality standard for this *E. coli* TMDL is 125 MPN per one hundred milliliters as a geometric mean based on not less than five samples equally spaced over a thirty-day period from April 1 through October 31. Since the WQS established for IBCs is narrative in nature, numeric WQOs have been established for total nitrogen, TP and TSS to be protective of biotic communities. Compliance with the numeric target established for each of these parameters will ensure water quality can improve to a point that, ultimately, biological communities will no longer be impaired.

Concurrent with the selection of a numeric concentration endpoint, TMDL development also defines the critical conditions that will be used when defining allowable levels. Many TMDLs are designed as the set of environmental conditions that, when addressed by appropriate controls, will ensure attainment of WQS for the relevant pollutant. For example, the critical conditions for the control of point sources in Indiana are given in 327 IAC 5-2-11.1(b). In general, the 7-day average low flow in 10 years (7Q10) for a stream is used as the design condition for point source dischargers. However, sources of pollutants addressed by this TMDL arise from a mixture of dry and wet weather-driven conditions, and there is no single critical condition that would achieve the applicable WQS. For this reason, TMDLs were calculated over all of the flow conditions (high flows to low flows) for impaired tributaries within the Salt Creek watershed.

For most pollutants, TMDLs are expressed on a mass loading basis (e.g. pounds per day). This applies to all pollutants addressed by this TMDL, except *E. coli*. For total nitrogen, TSS and TP, the TMDL is calculated for each flow condition based on numeric targets established in Section 3. For *E. coli* indicators, however, mass is not an appropriate measure, because *E. coli* is expressed in terms of organism counts (or resulting concentration) (USEPA, 2001). The geometric mean *E. coli* WQS allows for the best characterization of the watershed. Therefore, this *E. coli* TMDL is concentration-based consistent with 327 IAC 5-2-11.1(b) and 40 CFR, Section 130.2 (i) and the TMDL is equal to the geometric mean *E. coli* WQS for each month of the recreational season (April 1 through October 31).

8. Allocations

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

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

The overall loading capacity is subsequently allocated into the TMDL components of WLAs for point sources, LAs for nonpoint sources, and the MOS. The *E. coli* portion of the TMDL is concentration-based consistent with USEPA regulations at 40 CFR, Section 130.2(i).

8.1 Wasteload Allocations

As previously mentioned, there are eight (8) NPDES permitted facilities in total. All dischargers have *E. coli* limits in their permits (Table 4-1, Figure 4-3). The *E. coli* WLA is set at the WQS of 125 per one hundred milliliters as a geometric mean based on not less than five samples equally spaced over a thirty-day period from April 1 through October 31.

For TSS and TP, permit effluent limits were used to identify the WLAs *(Table 8-1)*. The permitted load for ammonia was used to identify each facility's WLA for total nitrogen.

Table 8-1. Effluent limits for permitted NPDES dischargers in Salt Creek watershed.

NPDES ID	Facility Name	Flow *(mgd)* [1]	Permit Limits			
			E. coli [2]	TSS [3]	Ammonia [3]	TP [4]
IN0042021	Elmwood Mobile Home Park	0.059	125	27 / 44 [5]	5.3	1
IN0039659	Forest Oaks WWTP	0.056	125	8.1	2.3	1
IN0038709	Liberty Farm Mobile Home Park	0.042	125	9	1.6	1
IN0059064	Mallard's Pointe	0.006	125	7.9	1.6	---
IN0058475	Nature Works Conservancy District	0.142	125	78.9 / 131.4 [5]	9.1	---
IN0031119	Shorewood Forest	0.189	125	67.6 / 169 [5]	13.1	1
IN0030651	South Haven Sewer Works	1.213	125	250.4	100.1	1
IN0024660	Valparaiso WWTP	4.648	125	2,253	466	1

Notes:
[1] average monthly reported flow
[2] monthly geometric mean *(CFU / 100 mL)*
[3] daily maximum *(pounds / day)*
[4] monthly average *(mg/L)*
[5] May to November limits / December to April limits

Guidelines for MS4 permits and timelines are outlined in Indiana's MS4 Rule 13 (327 IAC 15-13-10 and 327 IAC 15-13-11). There are seven (7) MS4 communities in the Salt Creek watershed, which were previously identified in Section 4.3.2 *(Figure 4-4 and Table 4-2)*.

All MS4 communities were assigned an *E. coli* WLA of 125 per one hundred milliliters as a geometric mean based on not less than five samples equally spaced over a thirty-day period from April 1 through October 31. These *E. coli* MS4 wasteload allocations were set at the Water Quality Standard in each of the watersheds where the MS4 is located. IDEM does not require a GIS shapefile for MS4s. To estimate the MS4 WLAs for all listed pollutants (TSS, TN, TP), two methods were used. For incorporated communities, the percentage of the jurisdictional area relative to the area of the entire AUID was used to apportion the load. For unincorporated Porter County, the percentage of developed land relative to the area of the entire AUID was used to apportion the load.

MS4 wasteload allocations for each pollutant are summarized by individual AUID in Table 8-2 through Table 8-5. Consistent with the TMDL summary tables presented in Section 6, the duration curve framework is used to express MS4 WLAs for each AUID. Table 8-6 provides information that enables the translation of those AUID / pollutant allocation values into individual jurisdiction MS 4 WLAs. It identifies the percentage of the AUID MS4 WLA that is allocated to each permittee. The Sagers Lake AUID INC0131_T1001 is used as an example to demonstrate calculation results for Valparaiso and Porter County in Table 8-2.

Table 8-2. MS4 waste load allocations for total suspended solids in Salt Creek watershed.

Unit Name	2010 AUID	MS4 Waste Load Allocations Total Suspended Solids *(tons/day)*				
		Very High Flows	***Moist Conditions***	***"Normal Flows"***	***Dry Conditions***	***Low Flows***
Salt Creek	INC0131_01	0.096	0.033	0.022	0.015	0.011
	INC0131_02	1.906	0.658	0.436	0.306	0.214
Sagers Lake	INC0131_T1001	1.554	0.537	0.356	0.250	0.175
	*Valparaiso ***	*1.242*	*0.429*	*0.285*	*0.200*	*0.140*
	*Porter Co. ***	*0.312*	*0.108*	*0.071*	*0.050*	*0.035*
	INC0131_T1002	1.752	0.605	0.401	0.281	0.197
Salt Creek	INC0132_01	2.844	0.781	0.414	0.198	0.047
	INC0132_02	3.912	1.193	0.710	0.426	0.226
	INC0132_03	4.987	1.568	0.959	0.603	0.351
Beauty Creek	INC0132_T1007	0.757	0.261	0.173	0.122	0.085
Clark Ditch	INC0132_T1009	0.350	0.095	0.050	0.024	0.005
Lake Louise Outlet	INC0132_T1011	0.248	0.072	0.041	0.022	0.009
Salt Creek - Unnamed Trib	INC0132_T1012	0.020	0.007	0.005	0.003	0.002
Squirrel Creek	INC0133_T1026	0.413	0.143	0.095	0.066	0.046
Salt Creek - Unnamed Trib	INC0133_T1027	0.103	0.035	0.024	0.017	0.012
Gustafson Ditch	INC0133_T1028	0.484	0.167	0.111	0.078	0.054
Robbins Ditch	INC0133_T1029	0.737	0.255	0.169	0.118	0.083
Salt Creek	INC0133_T1030	6.057	1.873	1.129	0.692	0.384
** Example calculation to demonstrate use of Table 8-6 to determine individual jurisdiction MS4 WLAs.						

Table 8-3. MS4 waste load allocations for total nitrogen in Salt Creek watershed.

Unit Name	2010 AUID	MS4 Waste Load Allocations Total Nitrogen *(pounds/day)*				
		Very High Flows	***Moist Conditions***	***"Normal Flows"***	***Dry Conditions***	***Low Flows***
Salt Creek	INC0131_01	64.1	22.1	14.7	10.3	7.2
	INC0131_02	1270.8	438.9	290.9	204.1	142.9
Sagers Lake	INC0131_T1001	1036.3	357.9	237.2	166.5	116.5
	INC0131_T1002	1167.8	403.3	267.3	187.6	131.3
Salt Creek	INC0132_01	1986.4	610.8	366.1	222.6	121.3
	INC0132_02	2678.8	866.3	543.8	354.8	221.3
	INC0132_03	3393.9	1114.4	708.9	471.1	303.3
Beauty Creek	INC0132_T1007	504.7	174.3	115.5	81.1	56.8
Clark Ditch	INC0132_T1009	253.8	84.1	53.9	36.3	23.8
Lake Louise Outlet	INC0132_T1011	175.8	58.6	37.7	25.5	16.9
Salt Creek - Unnamed Trib	INC0132_T1012	13.5	4.7	3.1	2.2	1.5
Squirrel Creek	INC0133_T1026	275.6	95.2	63.1	44.3	31.0
Salt Creek - Unnamed Trib	INC0133_T1027	68.5	23.7	15.7	11.0	7.7
Gustafson Ditch	INC0133_T1028	322.5	111.4	73.8	51.8	36.3
Robbins Ditch	INC0133_T1029	491.5	169.8	112.5	79.0	55.3
Salt Creek	INC0133_T1030	4128.9	1339.6	843.3	552.4	347.1

Table 8-4. MS4 waste load allocations for total phosphorus in Salt Creek watershed.

Unit Name	2010 AUID	MS4 Waste Load Allocations Total Phosphorus *(pounds/day)*				
		Very High Flows	***Moist Conditions***	***"Normal Flows"***	***Dry Conditions***	***Low Flows***
Salt Creek	INC0131_01	1.92	0.66	0.44	0.31	0.22
	INC0131_02	38.12	13.17	8.73	6.12	4.29
Sagers Lake	INC0131_T1001	31.09	10.74	7.12	4.99	3.50
	INC0131_T1002	35.03	12.10	8.02	5.63	3.94
Beauty Creek	INC0132_T1007	15.14	5.23	3.47	2.43	1.70
Salt Creek - Unnamed Trib	INC0132_T1012	0.40	0.14	0.09	0.07	0.05
Squirrel Creek	INC0133_T1026	8.27	2.86	1.89	1.33	0.93
Salt Creek - Unnamed Trib	INC0133_T1027	2.06	0.71	0.47	0.33	0.23
Gustafson Ditch	INC0133_T1028	9.68	3.34	2.21	1.55	1.09
Robbins Ditch	INC0133_T1029	14.75	5.09	3.38	2.37	1.66

Table 8-5. MS4 waste load allocations for *E. coli* in Salt Creek watershed.

Unit Name	2010 AUID	MS4 Waste Load Allocations *E. coli (billions MPN/day)*				
		Very High Flows	***Moist Conditions***	***"Normal Flows"***	***Dry Conditions***	***Low Flows***
Clark Ditch	INC0132_T1009	13.7	4.1	2.4	1.4	0.7
Lake Louise Outlet	INC0132_T1011	9.6	3.0	1.8	1.1	0.6
Salt Creek - Unnamed Trib	INC0132_T1012	0.8	0.3	0.2	0.1	0.1
Mallards Landing	INC0133_T1021	2.8	1.0	0.6	0.4	0.3
Damon Run	INC0133_T1022	18.7	6.4	4.2	2.9	2.0
Swanson – Lamporte Ditch	INC0133_T1023	8.8	3.0	2.0	1.4	0.9
Damon Run - South Branch	INC0133_T1024	8.6	2.9	1.9	1.3	0.9
Damon Run - East Branch	INC0133_T1025	3.1	1.1	0.7	0.5	0.3
Squirrel Creek	INC0133_T1026	15.6	5.4	3.6	2.5	1.8
Salt Creek - Unnamed Trib	INC0133_T1027	3.9	1.3	0.9	0.6	0.4
Gustafson Ditch	INC0133_T1028	18.3	6.3	4.2	2.9	2.1

Table 8-6. Individual MS4 WLAs in Salt Creek watershed *(segment portion by permittee)*.

Unit Name	2010 AUID	MS4 Permittees Portion of Segment MS4 WLA *(%)*						
		A	B	C	D	E	F	G
Salt Creek	INC0131_01							100.0%
	INC0131_02	0.1%						99.9%
Sagers Lake	INC0131_T1001	79.9%						20.1%
	INC0131_T1002	73.3%						26.7%
Salt Creek	INC0132_01	44.7%						55.3%
	INC0132_02	25.8%						74.2%
	INC0132_03	29.6%						70.4%
Beauty Creek	INC0132_T1007	67.8%						32.2%
Clark Ditch	INC0132_T1009					43.3%		56.7%
Lake Louise Outlet	INC0132_T1011							100.0%
Salt Creek - Unnamed Trib	INC0132_T1012							100.0%
Mallards Landing	INC0133_T1021							100.0%
Damon Run	INC0133_T1022	0.4%	2.8%					96.8%
Swanson – Lamporte Ditch	INC0133_T1023		8.0%					92.0%
Damon Run - South Branch	INC0133_T1024	0.7%	0.1%					99.2%
Damon Run - East Branch	INC0133_T1025		0.1%					99.9%
Squirrel Creek	INC0133_T1026			13.4%			14.8%	71.8%
Salt Creek - Unnamed Trib	INC0133_T1027		9.8%	31.7%				58.5%
Gustafson Ditch	INC0133_T1028		38.9%		10.8%			50.3%
Robbins Ditch	INC0133_T1029			88.0%				12.0%
Salt Creek	INC0133_T1030	23.0%					1.2%	75.8%

MS4 Communities:

A	INR04073	City of Valparaiso / Valparaiso University
B	INR040036	Town of Chesterton
C	INR040090	City of Portage
D	IN040115	Town of Porter
E	INR040149	Nature Works Conservancy District (Aberdeen)
F	INR040079	Twin Creeks Conservancy District (South Haven)
G	INR040140	Porter County

In the event that designated uses and associated water quality criteria applicable to the Salt Creek watershed are revised in accordance with applicable requirements of state and federal law, this TMDL may be revised to be consistent with such revisions. IDEM recognizes that these MS4 communities can be sources of all listed pollutants (*E. coli*, TSS, total nitrogen, and TP) and more information needs to be collected. As part of the permit process these systems will be better defined and will continuously work towards meeting the water quality standard, which is the limit and goal of this TMDL. This process will take several permitting cycles and it is anticipated that in the future, MS4 permits will meet the water quality standards.

There is one (1) CSO community in discharging to Salt Creek, the City of Valparaiso (IN0024660). This outfall discharges to Salt Creek. The WLA is set at the WQS of 125 per one hundred milliliters as a geometric mean based on not less than five samples equally spaced over a thirty-day period from April 1 through October 31.

8.2 Load Allocations

The LA for *E. coli* nonpoint sources is equal to the WQS of 125 CFU per one hundred milliliters as a geometric mean based on not less than five samples equally spaced over a thirty-day period from April 1 through October 31. Load allocations for all pollutants (*E. coli*, TSS, total nitrogen, and TP) were calculated by subtracting the WLA and MOS from the TMDL. Individual LAs were not assigned to individual potential nonpoint sources (ex. wildlife, septics, livestock in stream environments, etc.). The LAs were combined into a singular LA for each AUID.

Load allocations may be affected by subsequent work in the watershed. It is anticipated that future watershed projects will be useful in continuing to define and address the nonpoint sources of TSS, nutrients and *E. coli* in the Salt Creek watershed.

8.3 Margin of Safety

Section 303(d) of the Clean Water Act and EPA's 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 (MOS) which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality."* The margin of safety can either be implicitly incorporated into conservative assumptions used to develop the TMDL or added as a separate explicit component of the TMDL (USEPA, 1991).

A 10 percent explicit MOS was incorporated into all Salt Creek watershed TMDLs. 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. A 10 percent MOS was considered appropriate, because the target values used in this study have a firm technical basis. A 10 percent MOS was also considered appropriate because the estimated flows are believed to be relatively accurate due to the fact they were estimated based on a USGS located within the watershed.

Implicit margins of safety were also used for the *E. coli* TMDLs by applying a couple of conservative assumptions. First, no rate of decay for *E. coli* was applied. *E. coli* bacteria have a limited capability of surviving outside of their hosts and therefore, a rate of decay normally would be applied. However, applying a rate of decay could result in a discharge limit that would be greater than the *E. coli* WQS, thus no rate of decay was applied. Second, the *E. coli* WQS was applied to all flow conditions. IDEM determined that applying the *E. coli* WQS of 125 per one hundred milliliters to all flow conditions and with no rate of decay for *E. coli* is a more conservative approach that provides for greater protection of the water quality. This adds to the MOS for this TMDL.

9. Seasonality

TMDLs are required to consider critical conditions and seasonal variation for streamflow, loading, and water quality parameters. The critical condition is the set of environmental conditions for which controls designed to protect water quality will ensure attainment of water quality standards for all other conditions. The intent of this requirement is to ensure protection of water quality in waterbodies during periods when they are most vulnerable.

As discussed above, this TMDL utilizes the Load Duration Curve (LDC) methodology to evaluate the assimilative capacity and numeric targets during fluctuating flow conditions. The LDC methodology provides an excellent way to graphically present the instantaneous load and evaluate seasonal flow variations. Utilizing the load duration method ensures seasonal variability is taken into consideration in the calculation of the TMDL for each of the parameters addressed by this TMDL.

In addition, seasonality in the *E. coli* TMDL is also addressed by expressing the TMDL in terms of the *E. coli* WQS for total body contact during the recreational season (April 1 through October 31) as defined by 327 IAC 2-1.5-8(e)(2). Since there is no applicable total body contact *E. coli* WQS during the remainder of the year in Indiana, a concentration-based TMDL, *E. coli* WQS will be met regardless of flow conditions in the applicable season.

10. Monitoring

Water quality sampling is being continued by Save the Dunes. Future monitoring of the Salt Creek watershed will also take place during IDEM's nine-year rotating basin schedule and / or once TMDL implementation methods are in place. Monitoring will be adjusted as needed to assist in continued source identification and elimination. IDEM will monitor at an appropriate frequency to determine whether the WQS and TMDL targets are being met. When results indicate that the waterbody is meeting the appropriate WQS and targets, the waterbody will then be removed from Indiana's List of Impaired Waters.

11. Reasonable Assurance Activities

Reasonable assurance activities are programs that are in place to assist in meeting the Salt Creek watershed TMDL allocations and applicable water quality standards.

11.1 Combined Sewer and Sanitary Sewer Overflows

The Valparaiso City Utilities Water Reclamation Department is responsible for the operation and maintenance of their wastewater collection system and wastewater treatment plant. The collection system consists of separate and combined systems, including approximately 222 miles

(322 kilometers) of sewer and 28 pump stations within the 7,000 acre (2,833 hectare) service area. The City of Valparaiso has taken strides to maximize flow at the plant and reduce CSOs as highlighted below.

- Constructed three CSO storage tanks in 1987 located at the plant to retain 4.5 million gallons (17,034 kiloliters) of combined sewage during a wet weather event's first flush.
- Upgraded and expanded the plant in early 2001 to increase its average design flow (from six to eight million gallons per day (mgd)) and its peak flow (from 13.5 to 18 mgd) capacity, thereby increasing its wet weather capacity. A portion of this project included modifying the CSO storage tanks to provide a flow-through treatment facility equivalent to primary clarification and control of settleable and floatable material up to 100 mgd utilizing Romag fine screens. This CSO flow-through treatment facility was one of the first of its kind in Indiana.
- Eliminated Farrell Street CSO in 2002, resulting in only one CSO outfall remaining at the plant.
- Underwent several sewer interceptor and separation projects resulting in less stormwater conveyed to the plant. Two examples include (1) diverted stormwater from a 66-inch combined sewer as part of Phase I of the Union Street sewer separation project, and (2) replaced a main storm sewer in the southwest portion of the City resulting in a large stormwater detention basin being disconnected from the combined sewer.
- Installed an additional flow meter at the plant prior to the CSO storage tanks to monitor the wet weather flow conveyed to the plant and the CSO tanks. The data collected from this meter will allow the City to track the effect of sewer separation improvements by comparing historical rainfall data and will allow for the proper sizing of a CSO disinfection system, which is scheduled to be constructed in 2011.
- Submitted their revised CSO long term control plan (LTCP) in November 2006 and received approval from IDEM. Valparaiso's LTCP was the 30th plan approved in the State.
- Strives to operate the wastewater plant to fully maximize its capacity, especially during wet weather. For example, the operations staff reduces the plant recycle streams to the maximum extent practical to meet the plant's effluent limits yet push as much wet weather flow through the plant and the CSO tanks as possible to prevent a CSO or reduce its discharge volume. The City also continuously works to improve their sewer maintenance program as highlighted below:
- Upgraded the City's pump stations to include monitoring via radio frequency telemetry and alarms that are communicated to the supervisory control and data acquisition (SCADA) system. This telemetry communication allows for instant response time by the staff thereby greatly reducing the risk of basement backups and overflows within the community.
- Included purchase of three natural gas generators for the City's high flow pump stations in the Utility's 2007 capital improvement plan (CIP). Additionally, the City now requires developers to provide natural gas generators on all future accepted pump stations within the service jurisdiction.
- Utilizes GPS to provide an accurate inventory and location of the City's sewer infrastructure as part of a City-wide geographic information system (GIS) and included in the Utility's CIP.
- Strives to provide regular cleaning and televising of sewer mains and catch basins, especially within the combined sewer system. The maintenance program documents on a daily basis the amount of lineal feet of sewer cleaned and televised. This aggressive style of maintenance and televising has allowed the City to discover problem areas with respect to inflow, infiltration, and damaged pipe. Recently, the City performed sewer lining in various areas to eliminate collapses and reduce infiltration.
- Currently constructing a 2.5 Million Dollar CSO disinfection facility that will further treat CSOs which will be operational by April 1, 2012.

11.2 Storm Water General Permit Rule 13

Guide lines for MS4 permits and timelines are outlined in Indiana's MS4 rule 13 (327 IAC 15-13-10 and 327 IAC 15-13-11). The Town of Chesterton, Nature Works Conservancy District, Twin Creeks Conservancy District, City of Portage, Porter County, Town of Porter, and City of Valparaiso have entered into a memorandum of understanding with Northwestern Indiana Regional Plan Commission (NIRPC) to perform the requirements of Stormwater Quality Management Plan: Public Education and Outreach and Plan Public Participation and Involvement.

The Town of Chesterton converted a traditional detention pond to a wetland at Dogwood Park in 2008. The wetland is primarily designed to improve the quality of storm water runoff from the newly paved recreational area on the west side of 23rd Street by decreasing the speed of the runoff, permitting increased infiltration and groundwater recharge, and providing enhanced pollutant removal from the water. These objectives were realized by re-grading the original rectangular grassed basin to create a more meandering flow channel and planting the basin with a variety of deep-rooted native herbaceous and woody plants. An educational sign was installed at the site.

The City of Valparaiso provided IDEM with a Stormwater Quality Management Plan Part C Program Implementation Report on October 26, 2010. The City of Valparaiso and Valparaiso University have partnered with Save the Dunes on several projects through the Salt Creek watershed effort as detailed below, including detention basin retrofits, rain gardens, bioswales, rain barrels, pervious pavement, and tree infiltration cells. In addition, the Valparaiso Department of Water Works developed a rain garden at the north end of their main parking lot to control and treat stormwater runoff. The City of Valparaiso prepared a report that provided an analysis of the Stimson Drain Watershed and proposed various BMPs for use in the subwatersheds. The City was funded by IDNR- LMCP for a Porter County Jail Alternative Stormwater Management Demonstration Project within the Stimson Drain subwatershed. The project aimed to demonstrate several low impact development (LID) BMPs at the Porter County Jail to manage stormwater runoff. LID BMPs included curb cuts to by-pass inlets, an extended detention basin, vegetated swales, rain gardens, modular pavement, underground storage, and native vegetation. Additional practices reported under Valparaiso's permit include annual cleaning and treating catch basins, biannual street sweeping, and yard waste collection. The City of Valparaiso together with Valparaiso University implemented a "Report-A-Polluter" program to field complaints from the public on illegal dumping, illicit discharges, poor erosion control practices, and other activities within the City MS4 area that negatively impact stormwater quality. The City has also adopted a tree replacement ordinance a water conservation plan.

The City of Valparaiso received a grant from the U.S. Forest Service for the Valparaiso Payment for Ecosystem Services (PES) green infrastructure project. Additional funding was provided by the Northwest Indiana Regional Development Authority and the City of Valparaiso. The project attempts to determine what encourages private property owners to install green infrastructure on their property, to ultimately help reduce stormwater runoff to public areas.

The Memorial neighborhood of Valparaiso was selected as the study area because of a history of stormwater problems and a general awareness of stormwater issues within the neighborhood. This neighborhood, also called Chautauqua Park, was evaluated in a 2011 study by the City of Valparaiso. The study was conducted to determine economical and creative solutions to significantly reduce the flooding issues that occur in the area, which is currently served by combined sewers. The study recommends installing storm drains and detention basins that will divert the area to Beauty Creek rather than the combined sewer system.

A public meeting was held in February 2011 to provide interested residents with information about green infrastructure in general, the specific elements being offered by the PES project, and the auction process that would be used to help determine allocation. Following the public meeting, the project team sent auction surveys and informational fliers to 567 homes in the neighborhood. Respondents were asked to bid the amount they were willing to pay for professionally installed rain barrels. Auction bids or responses were received from 57 home owners, for a 10% response rate. A total of 38 bids were received for one or more rain barrels. The average bid for the first rain barrel was $59, average bid for all rain barrels was $48, and the maximum bid received was $250. Total amount bid for rain barrels was $3,428. A total of 60 rain barrels have been delivered, with 58 installed and only one bid of $20 unpaid. A total of 19 bids were received for rain gardens. The average bid for a rain garden was $393, the maximum bid was $1,850. Total amount bid for rain gardens was $6,387. A total of 11 rain gardens were awarded for construction, based on the estimated cost of construction minus the bid amount divided by the estimated gallons of stormwater captured. Construction of 5 of the 11 rain gardens has been completed, and the remainder are anticipated to be completed by spring of 2012.

11.3 TMDLs

IDEM identified sections of Salt Creek and its tributaries on the 303(d) list of impaired waters as impaired for excessive *E. coli* concentrations in 1998, 2002, 2004, 2006, 2008 and impaired biotic communities in 2002, 2004, 2006, and 2008. In 2002 Salt Creek was listed as a Category 5 waterbody, indicating that a TMDL must be established. In 2004, IDEM completed a TMDL for *E. coli* in Salt Creek (WHPA, 2004). The TMDL report includes a description of the Salt Creek watershed, an inventory of existing water quality data, and the results of source assessment and modeling analysis. The TMDL was calculated by determining the total percent reduction required to reduce the 100^{th} percentile of the distribution from existing conditions to the target conditions. The 2006 Salt Creek *E. coli* TMDL requires a 88% reduction to meet the target conditions. Of this total, 29% is the wasteload allocation, 55% is assigned to the load allocation and 4% is the margin of safety.

11.4 Watershed Management Plans and Implementation

Salt Creek Watershed Management Plan

The Salt Creek Watershed Management Plan was approved by IDEM in July of 2008. Since then, implementation of the Salt Creek WMP has been primarily coordinated by Save the Dunes through three grants funded through IDEM Section 319 grants with non-federal matching funds contributed by local partners and other grant programs. Other grant programs and agencies, such as the Department of Natural Resources (DNR) Lake and River Enhancement (LARE) Program, Indiana DNR Lake Michigan Coastal Program, and the Great Lakes Restoration Initiative (GLRI), have provided funding toward projects in the watershed. Save the Dunes is currently revising the Salt Creek WMP to meet IDEM's 2008 watershed management plan checklist and to integrate the findings of this TMDL and new data.

Salt Creek Watershed Management Plan Grant
Save the Dunes received a grant from IDEM Section 319 to develop the Salt Creek WMP. The grant included funds to demonstrate appropriate best management practices (BMPs) within the Salt Creek watershed. Save the Dunes worked with the Salt Creek Watershed Committee and stakeholders to identify potential partners and sites for demonstration projects. Educational signs were installed at each of these projects. In the spring of 2008, Save the Dunes, the City of Valparaiso, and the Valparaiso Parks Department partnered to install rain gardens adjacent to Beauty Creek at Forest Park Municipal Golf Course. The first garden is approximately 9,000 ft^2 and accepts runoff from a 0.8 acre parking lot, half of the roof of a clubhouse and some surrounding turf area for a total contributing area of about 1.9 acres. The second garden is approximately 6000 ft^2 and accepts runoff from approximately 1.6 acres of woodland and 7.3 acres of turf. Save the Dunes and the Parks Department also planted riparian and critical areas at the Forest Park Golf Course and at the Forest Park Picnic Area. Save the Dunes partnered with the Portage Parks Department to install a green roof on a concession stand at Imagination Glen Park. The 2,100 ft^2 green roof was installed in November of 2007. Save the Dunes and Valparaiso University partnered to install a vegetated swale on campus in the summer of 2008.

Salt Creek Engineering Feasibility Study
Save the Dunes and partners completed a preliminary engineering feasibility study to assess and prepare preliminary designs for five projects in the watershed with funding from the DNR- Lake and River Enhancement (LARE) Program. The Salt Creek Engineering Feasibility Study examined the economic, ecological, and social feasibility of the following projects: Devon Drain Wetland Restoration, Thorgren Basin Naturalization, Turtle Creek Daylighting and Restoration, Well Commons Ravine Stabilization, and Salt Creek Commons Basin Enhancements. Each of these projects with the exception of the Salt Creek Commons Basin Enhancements is either complete or underway through the efforts of Save the Dunes, City of Poratge, SFPOA, and the City of Valparaiso.

Salt Creek Implementation Demonstration Grant
On March 13, 2008 Save the Dunes was awarded a Section 319 grant from IDEM to develop partnerships with local stakeholders in the Salt Creek watershed and identify, promote, and monitor projects that demonstrate conservation design and low impact development (CD/LID) and reduce the impacts of nonpoint source pollution. Each of the projects had high demonstration value. Educational signs were installed at each site and a field day or other educational event was held to showcase each practice. Projects were photographically monitored. Save the Dunes leveraged funds from this grant with a small grant from the Porter County Community Foundation (PCCF) and matching funds from the City of Valparaiso to conduct a rain barrel program. 153 50-gallon rain barrels were provided to Salt Creek watershed residents at a discounted rate. Participants were required to listen to a 30 minute presentation on watershed management and rain barrel installation and maintenance prior to receiving their barrel. Save the Dunes and the City of Valparaiso also partnered to install educational signs about the Salt Creek watershed and nonpoint source pollution throughout the watershed.

Save the Dunes partnered with the Portage Township Schools to install a rain garden at Portage High School. 65 high school biology students assisted in planting the rain garden. The approximately 700 ft^2 garden accepts runoff from the parking lot and sections of lawn. Save the Dunes partnered with the Portage Township Trustee to install a rain garden at Haven Hollow Park. The approximately 400 ft^2 garden accepts runoff from turf grass, an access road, and a section of parking lot. Save the Dunes partnered with the Village Builders to install a bioswale and pervious pavement at the Village in Burns Harbor. The 2,800 ft^2 bioswale accepts runoff from five homes and their lots. The pervious pavement accepts runoff from a shared driveway.

The Builders at the Village in Burns Harbor are considering incorporating bioswales into some of the new development at the site as a result of the demonstration and are also considering modifications to their existing detention basin. Save the Dunes partnered with the City of Valparaiso to install a bioswale along Calumet Avenue. In addition to the swales installed, the City also replaced other impervious areas with vegetation, which likely provides additional water quality benefits. The City of Valparaiso has since installed additional swales in the area. Save the Dunes partnered with the City of Valparaiso Department of Parks and Recreation to demonstrate tree infiltration cells at Valparaiso's new Central Park. The City of Valparaiso plans to install additional rain gardens at the site next year. The City of Valparaiso and Save the Dunes installed a strip of pervious pavement in a parking lot at the corner of Jefferson and Lafayette streets. A bioswale was installed to accept runoff from the southern half of the parking lot.

Salt Creek Cost-share and Education Program
Save the Dunes was awarded a Section 319 grant from IDEM to conduct a cost-share program for eligible BMPs in critical and priority areas of the Salt Creek watershed. Save the Dunes is currently working with local stakeholders to identify and install appropriate projects. Save the Dunes is also conducting water quality monitoring and education and outreach through this grant. Save the Dunes partnered with Kevin Cornett to install two rain gardens and educational sign at a residential yard in the Beauty Creek subwatershed in 2009. The gardens are 400 and 300 ft^2 and collect runoff from a combined total of 2000 ft^2. An educational sign was installed at the site. Save the Dunes and the City of Valparaiso partnered to install a 1,600 ft^2 rain garden adjacent to a new round about in Valparaiso. The rain garden accepts runoff from roughly one acre. Save the Dunes partnered with the City of Valparaiso to plant trees in critical areas of the Sager's Lake subwatershed. Save the Dunes and the Valparaiso Parks Department partnered to install an equipment wash station that drains into a rain garden at the Parks maintenance facility adjacent to Beauty Creek. Save the Dunes and the Shorewood Forest Property Owner's Association partnered to install a rain garden at the Shorewood Forest Clubhouse. Save the Dunes partnered with Connie Swanson to install two rain gardens and a riparian buffer at her residential property in the Damon Run subwatershed. Save the Dunes and Valparaiso University partnered to plant a 1,500 ft^2 swale. The partners also installed a rain garden and underground detention system at the new LEED-certified Gellerson Hall on campus. Save the Dunes partnered with the City of Valparaiso to naturalize and retrofit the Wall Street dry detention basin. The basin was deepened planted with native vegetation. Water now has a meandering path through the basin and permanently pools in some locations. Several additional projects are planned for installation in 2012 as detailed below under potential future activities.

11.5 County Efforts

Porter County Soil and Water Conservation District (SWCD)
The Porter County SWCD is focused on encouraging the wise use and protection of the county's soil, water and related natural resources. Each year the district's board of volunteer supervisors prepares an annual plan of work to outline its programs, activities and goals for the year. For 2011 many of these were directed at encouraging the protection of water quality through several avenues.

In the spring of 2011 the District hosted a successful cover crop workshop which resulted in an increase in the number of acres planted to cover crops. $4,000 in Clean Water Indiana funds plus additional monies from the District were distributed to landowners to protect 260 acres of farm ground and develop buffer strips along small creeks. District Engineering Technician, Harvey

Nix, cooperated with the Porter County Drainage Board to seed areas adjoining water bodies which were disturbed by construction activities. Mr. Nix also reviewed Rule 5 erosion control plans and offered suggestions to developers on practices to reduce erosion and sedimentation and ultimately protect water quality.

The District participates in a number of special events which offer the general public information aimed at the protection of soil and water. In 2011, several thousand individuals were reached through displays at local parks, the Porter County Government Administration Center, the Porter County Fair and more. Through an elementary education program which presents science based programs to over 9,000 students each year, even the youngest citizens of Porter County shared in the conservation message.

The District enjoys a positive working relationship with many county, state and federal government agencies. Most significant is the partnership with the federal Natural Resources Conservation Service (NRCS). The most recent figures from May, 2011 offer the following breakdown of federal funding in Porter County.

CRP- Conservation Reserve Program--- $367,940
LMCP-Lake Michigan Coastal Program---$289,163
205j- Water Quality Management Planning Funding---$255,763
CSP- Conservation Stewardship Program---$80,000
EQIP- Environmental Quality Incentives Program---$216,050
WHIP-Wildlife Habitat Incentive Program---$31,718
WRP-Wetlands Reserve Program---$84,108

Although established almost 60 years ago, the District continuously challenges itself to find new and better ways to best manage and protect our county's soil, water and related natural resources.

Recycling and Waste Reduction District of Porter County
In 2010, the Recycling and Waste Reduction District of Porter County introduced rain barrel workshops to Porter County residents. Participants register and pay to attend the workshops, where they receive a rain barrel made out of repurposed food storage containers. The workshop educates attendees on the importance of water conservation and how flooding can lead to the pollution of our lakes and streams by moving pesticides, chemicals and trash into these natural resources. The presentation also educates attendees on the proper installation and maintenance of their new rain barrels. During the first year of the program, 147 barrels were purchased, and many attendees inquired about how to get multiple barrels. In 2012 the district will enter its third year of offering these workshops.

Unincorporated Porter County
A Unified Development Ordinance for unincorporated Porter County was adopted by the Porter County Commissioners in 2007. The ordinance establishes conservation and design standards for developers with mandatory green space requirements. It also includes a watershed overlay district, which is intended (in part) to reduce nutrient loss, erosion, and siltation, moderate floods, protect wetlands, and provide wildlife habitat. The overlay creates a buffer around priority waterbodies in which certain land uses are excluded. Salt Creek's mainstem is a priority one waterbody (500 foot buffer) and many tributaries are priority two (300 foot buffer) or priority three (100 foot buffer) waterbodies.

Porter County adopted a Comprehensive Land Use Plan, which is intended to help the county preserve and maintain its natural features. The plan includes measures to limit development around environmentally sensitive areas, protect prime farmland, preserve scenic road and stream corridors, support sound conservation practices, and reduce pollution. The plan also encourages conservation development in which developers cluster homes, preserve open space, and protect environmental features.

The Porter County drainage study, completed by engineering firm DLZ in 2010, identified several hundred drainage projects to relieve ongoing flooding problems. The top 10 largest projects carry a projected price tag of as much as $20 million. The final project, which makes up half of the estimated construction cost is the Old South Haven subdivision, which is within the Salt Creek watershed. Old South Haven, which is bounded by U.S. 6 to the north, 700 North to the south, Ind. 149 to the east and McCool Road to the west, has a significant amount of stormwater infrastructure in extremely poor condition, according to the study. Efforts are already under way to secure funding to begin the work in South Haven. The county received a $100,000 grant from the Lake Michigan Coastal Program for five targeted drains. All five drains are tributaries of Lake Michigan and stem from a list of the 10 most troublesome drainage areas in the county, as determined by the drainage team and consultants. Two of the drains, Damon Run and Smith Ditch (Sager's Lake Outlet), are tributaries to Salt Creek and designated as critical areas of the watershed. Damon Run is of particular concern to the county, because it is the site of the new hospital and all the related development that project is expected to attract. An engineering analysis of what Damon Run can handle will be helpful as development is proposed in that area. The primary drainage concern in the Smith Ditch subwatershed is flooding along Sturdy Road, south of Valparaiso.

The Damon Run Conservancy District

The Damon Run Conservancy District, created in 2004, provides municipal sewer service in unincorporated areas of the Damon Run subwatershed that previously did not have such service or were on failing utility systems. Several previous NPDES facilities are now serviced by the conservancy district, which continues to expand its service area. As residents currently using septic systems convert to the municipal service, a decrease in the loading of *E. coli* and other pathogens and pollutants in this subwatershed is expected.

Onsite and Decentralized Wastewater Treatment Systems

NIRPC initiated an Onsite and Decentralized Wastewater Treatment Systems Workgroup in 2011. The purpose of the workgroup is to identify possible existing information gaps and develop a serious strategy to determine what data is necessary to emphasize the need for action to be taken about septic issues. The IDNR- Lake Michigan Coastal Program provides local communities with training in the iTOSS program, an online tracking and management database.

Porter County Health Department

Porter County Health Department, Environmental Division is working to reduce nonpoint water pollution in a variety of ways. On January 1, 2011, Porter County Health Department, Environmental Division began enforcement of the updated Indiana State Department of Health Residential Onsite Sewage Systems Rule 410 IAC 6-8.2. They also adopted several ordinances more stringent than the state code. These include:

- Wider separation distances between septic systems and subsurface drains
- Deeper subsurface drains
- Four-sided (perimeter) subsurface drains for all septic systems requiring drainage
- Subsurface drains backfilled to soil surface with aggregate or Spec 23 sand
- Outlet filters installed on all septic tanks

They have also acquired several GPS handheld units which are used to take GPS points for Drinking Water Wells, Septic Tanks, Septic System D-Boxes/Manifolds, Septic System Corner Points and Subsurface Drain Outlets for commercial septic systems, new construction homes, existing homes with septic system updates, failing septic systems and change of ownership situations. In addition, they have partnered with Porter County to add their GPS data as a well and septic system layer on the county's online GIS map.

11.6 Other Local and Municipal Efforts

Indiana Lake Michigan Coastal Program

As part of the Indiana Lake Michigan Coastal Program, approved in August 2002, IDNR is required to development a coastal nonpoint source management program The Coastal Nonpoint Pollution Control Program, which falls under Section 6217 of the Coastal Zone Act Reauthorization Amendments (CZARA), is jointly administered by NOAA and the USEPA The program consists of a set of management measures that Indiana must use in controlling polluted runoff. The measures included in the Indiana program are designed to control runoff from five main sources: agriculture, urban areas, marinas, hydromodification (shoreline and stream channel modification), and wetlands and vegetated shorelines or riparian areas. These measures are backed by enforceable state policies and actions that will ensure implementation of the program. The Indiana Coastal Nonpoint Source Management Program focuses on pollution prevention, minimizing the creation of polluted runoff rather than cleaning up already contaminated water. The program encourages pollution prevention efforts at a local level, particularly improvements to land use planning and zoning practices to protect coastal water quality.

City of Portage Preservation and Restoration

Portage Parks and the Portage Parks Foundation are working to keep the Salt Creek corridor intact for the benefit of water quality and recreational opportunities. Several parcels along Salt Creek, including Ameriplex Woods, Imagination Glen, and Brennan Woods have been preserved. The City has also acquired several grants through the IDNR-LMCP to restore habitat and improve access along portions of Salt Creek. headers to implement this project. Both organizations have an extensive experience with projects that have addressed eliminating stream bank erosion, increasing creek flow, creating and improving fish habitat, and providing appropriate access to streams and creeks. The projects concentrated on log jam removal, bank improvement strategies, habitat improvement structure (LUNKERS) introduction, and proper and accessible access point establishment at several locations. The City has also accomplished wetland restoration at Samuelson Fen through INDR-LMCP grants.

Shorewood Forest Property Owner's Association (SFPOA)

The Shorewood Forest Property Owner's Association (SFPOA) has partnered with Save the Dunes to install a rain garden through Salt Creek Cost-share program detailed above. The SFPOA completed several assessments of Lake Louise and its watershed. The Lake Louise Water Quality Assessment was completed in 2003, and the Lake Louise Watershed Assessment was completed in 2004. The SFPOA has banned phosphate fertilizers and putting grass or leaves in the street where they can contribute nutrients to stormwater entering storm drains. The SFPOA issues a monthly newsletter. Articles in 2007 newsletters have included articles on proper pet waste disposal, proper use of fertilizers and disposal of yard waste, the Lake Louise Watershed Management Plan, the phosphate ban, aquatic invasive plants, and natural landscaping. The

SFPOA completed several improvements to tributaries/ditches in the Lake Louise watershed to control the sedimentation and possible pollution of Lake Louise. Improvements completed on the Roxbury Ravine include grade control structures and bed and bank stabilization. Work has begun on the Atassi Drain and Devon Drains. Several improvements are being considered, including wetland restoration, ravine stabilization, grassed waterways, check dams, and channel widening.

11.7 Potential Future Activities

At the time of the writing of this report (winter 2011), several projects are planned to be installed in 2012 through the Salt Creek Cost-share Program. A parking lot that was replaced in 2011 on Valparaiso University was graded to drain to a swale area rather than a storm drain system. The bioswale will be graded and planted in 2012 in partnership between Save the Dunes and Valparaiso University. Save the Dunes will partner with St. Paul's Lutheran Church to stabilize a severely eroding section of Beauty Creek and to install a bioswale to accept runoff from their parking lot in 2012. Save the Dunes will partner with a developer to incorporate additional bioswales into a conservation design medical park in the Damon Run subwatershed.

Thorgren Detention Basin Naturalization and Retrofit
Save the Dunes has been awarded an EPA grant through the Great Lakes Restoration Initiative to naturalize and retrofit the Thorgren detention basin in partnership with the City of Valparaiso. An existing dry detention basin will be retrofitted by removing a concrete channel, creating microtopography, and establishing native plant zones. Construction is planned for the summer of 2012. The City of Valparaiso will provide in kind services in the form of finalizing designs and overseeing construction. Save the Dunes will also conduct education and outreach including public meetings, a workshop on naturalized basins, and educational signs.

12. Public Participation

Public Kickoff Meetings were held on August 7, 2010 and on November 10, 2010 at the Porter County United Way Community Room where the public was invited to submit any additional data and information to the Salt Creek watershed TMDL process. A public meeting on the draft TMDL was held on February 29, 2012 at the Porter County United Way Community Room. The public was invited to submit formal comments on the draft document and informed of the findings of the document. Press releases were sent for each meeting and the Salt Creek watershed Group was notified by e-mail.

The public comment period occurred from February 29, 2012 to March 29, 2012.

13. Conclusion

The sources of nutrients, suspended solids, and bacteria in the Salt Creek watershed include both point and nonpoint sources. In order for the Salt Creek watershed to achieve Indiana's WQS for *E. coli* and IBCs, wasteload and load allocations have been identified for TSS, total nitrogen, TP and *E. coli*. Achieving these allocations depends on:

1) Nonpoint sources of *E. coli*, TSS, total nitrogen and TP being controlled by implementing best management practices in the watershed.
2) Continuing efforts to protect this watershed.

The next phase of this TMDL is to identify and support the implementation of activities that will bring the Salt Creek watershed in compliance with the Indiana's WQS. IDEM will continue to work with its existing programs on implementation. In the event that designated uses and associated water quality criteria applicable to the Salt Creek watershed are revised in accordance with applicable requirements of state and federal law, the TMDL implementation activities may be revised to be consistent with such revisions. Additionally, IDEM will work with local stakeholder groups to pursue BMPs that will result in improvement of the water quality in the Salt Creek watershed.

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Attachment A

Data for the Salt Creek Watershed TMDL

		Stream Name:	Salt Creek -- US 20 (Portage)		
		Site ID:	SLC-1		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
1/16/1991	16:00	67.0	7100	1.600	0.150
2/12/1991	16:10	5.0		1.400	
3/5/1991	16:40	53.0	260	1.400	0.090
5/21/1991	15:00	43.0	2100	1.600	0.100
6/25/1991	12:50	33.0	470	2.300	0.120
7/24/1991	15:55	34.0		3.500	0.130
8/15/1991	9:10	11.0	750	0.400	
9/24/1991	11:05	13.0	530	3.100	0.080
10/23/1991	9:30	17.4	90	1.500	0.060
11/20/1991	10:15	116.0	3800	1.300	0.290
12/18/1991	13:20	13.0	90	2.000	0.070
1/30/1992	9:30	7.0	100	1.700	0.040
2/25/1992	11:35	21.0	280	1.600	0.090
3/26/1992	10:00	11.0	230	2.000	0.060
4/22/1992	9:45	10.0	80	0.800	0.050
5/19/1992	12:00	25.0	310	2.800	0.140
6/24/1992	12:55	65.0	610	3.100	0.170
7/27/1992	18:45	18.0	160	2.200	0.130
8/24/1992	15:40	27.0	40	4.200	0.170
9/22/1992	15:25	137.0	930	2.300	0.170
10/20/1992	15:55	14.0	100	1.000	0.110
11/16/1992	15:20	10.0	500	2.600	0.080
12/15/1992	13:50	12.0	1100	1.700	0.060
1/13/1993	10:50	30.0	1600	2.000	0.080
3/16/1993	16:45	42.0	1200	2.100	0.260
4/26/1993	18:45			1.100	0.080
5/10/1993	17:25	18.0	270	1.200	0.070
8/2/1993	17:55	48.0	700	2.900	0.150
9/8/1993	17:00	68.0	620	1.200	0.220
9/29/1993	10:00	19.0	660	0.900	0.100
10/26/1993	8:00	31.0	110	0.900	0.130
11/16/1993	12:25	33.0	650	1.600	0.100
3/3/1994	11:00	20.0	270	0.700	0.060
3/15/1994	11:00	8.0	980	1.000	0.120
6/1/1994	8:30	18.0	30	1.500	0.090
8/2/1994	10:20	9.0	95	9.200	0.060
10/4/1994	10:00	19.0	2100	3.800	0.140
11/14/1994	14:10	37.0	1500	1.700	0.140
1/18/1995	12:45	26.0	380	2.100	0.150
3/7/1995	16:40	54.0	1300	1.900	0.140
4/25/1995	13:00	15.0	220	1.100	0.070

		Stream Name:	Salt Creek -- US 20 (Portage)		
		Site ID:	SLC-1		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
5/24/1995	13:45	82.0	1500	1.300	0.200
6/26/1995	15:40	44.0	420	2.900	0.200
7/26/1995	10:00	48.0	730	1.800	0.210
9/7/1995	17:40	37.0	130	3.300	0.160
9/28/1995	18:00	15.0	180	3.400	0.120
10/25/1995	10:50	10.0	90	1.200	0.120
11/15/1995	11:50	7.0	5300	2.800	0.090
12/21/1995	10:30		930	2.700	0.060
1/24/1996	16:10	4.0	370	2.100	0.070
2/28/1996	18:45	7.0	1800	3.000	0.170
3/26/1996	10:00	5.0	530	2.200	0.070
4/24/1996	11:15	43.0	210	2.700	0.130
5/22/1996	10:30	79.0	730	1.700	0.190
6/19/1996	10:10	80.0	820	0.700	0.230
7/17/1996	11:40	42.0	370	2.400	0.170
8/21/1996	10:30	33.0	90	2.100	0.250
9/18/1996	10:10	17.0	390	1.500	0.110
10/23/1996	10:00	39.0	680	1.400	0.140
11/13/1996	10:15		580	2.100	0.090
12/11/1996	10:10	22.0	460	1.800	0.090
2/5/1997	10:15	48.0	1500	1.400	0.180
2/26/1997	8:10	28.0	460	1.700	0.090
4/2/1997	8:40	12.0		1.600	0.060
4/30/1997	8:10	18.0	60	1.600	0.090
5/28/1997	8:30	25.0	200	1.300	0.130
6/18/1997	7:55	55.0	1100	0.800	0.160
7/23/1997	8:00	116.0	1400	1.400	0.260
8/20/1997	7:50	57.0	1500	1.300	0.190
9/24/1997	7:50	44.0	4000	1.600	0.140
10/21/1997	12:35	11.0	200	2.800	0.120
11/18/1997	12:20		3100	1.800	0.060
12/9/1997	12:30		20	2.300	0.100
2/4/1998	12:30	9.0	310	1.700	0.090
3/4/1998	12:30	7.0		1.500	0.060
4/1/1998	12:15	86.0	1800	0.800	0.210
4/28/1998	11:45	21.0		1.200	0.090
6/3/1998	11:45	40.0	4000	2.500	0.170
6/30/1998	12:00	656.0	4000	3.500	0.630
7/28/1998	8:45	38.0		2.700	0.150
9/1/1998	12:50	25.0	4000	2.700	0.160
9/29/1998	12:00	18.0	340	1.900	0.140

		Stream Name:	Salt Creek -- US 20 (Portage)		
		Site ID:	SLC-1		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
10/27/1998	8:30	22.0	100	1.300	0.100
11/17/1998	7:50	8.0	200	1.600	0.110
12/15/1998	10:50	5.0	170	2.900	0.090
1/26/1999	10:50	32.0	190	3.300	0.150
2/23/1999	9:00		110	2.500	0.100
3/24/1999	10:00		30	2.000	0.060
4/28/1999	15:10	80.0		1.400	0.180
5/25/1999	18:40	17.0		1.500	0.190
6/29/1999	8:15	36.0		1.900	0.180
7/28/1999	8:40	57.0		2.000	0.210
8/25/1999	11:30	46.0		2.800	0.200
9/29/1999	11:15	84.0		2.500	0.210
10/18/1999	16:50	10.0		2.500	0.120
12/1/1999	8:15			2.800	0.050
12/15/1999	10:45	32.0	1550	2.400	0.110
1/25/2000	11:00		390	2.700	0.060
2/14/2000	16:00	6.0		2.200	0.080
3/20/2000	16:00	36.0		1.600	0.140
4/25/2000	10:20	31.0	390	2.200	0.120
5/24/2000	15:10	37.0		1.900	0.140
6/22/2000	12:00	64.0		1.400	0.220
7/17/2000	15:10	36.0		2.600	0.180
7/24/2000	14:55		488		
8/1/2000	14:20		2419		
8/8/2000	13:10		1733		
8/15/2000	14:35		435		
8/22/2000	10:00	33.0		2.400	0.240
8/22/2000	14:15		816		
9/20/2000	11:30	33.0	820	3.600	0.140
10/24/2000	11:10	20.0	1700	2.000	0.130
11/21/2000	11:00	5.0	440	3.400	0.050
12/13/2000	12:45	4.0		3.000	0.050
1/9/2001	16:20	4.0		2.300	0.050
2/13/2001	8:20	25.0	650	4.000	0.120
3/12/2001	16:45	5.0		2.400	0.060
4/10/2001	8:00	14.0		1.600	0.100
5/9/2001	16:45	32.0		2.200	0.160
6/7/2001	6:45	72.0		2.600	0.240
7/9/2001	16:20	25.0		3.800	0.150

		Stream Name:	Salt Creek -- US 20 (Portage)		
		Site ID:	SLC-1		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
8/14/2001	7:40	53.0		1.800	0.230
9/19/2001	15:30	40.0		3.600	0.170
10/10/2001	17:30	28.0		1.900	0.130
11/8/2001	11:15	21.0		2.000	0.100
12/3/2001	16:15	6.0		1.300	0.060
1/28/2002	17:15	5.0		1.903	0.059
2/19/2002	14:10	8.0		1.865	0.044
3/13/2002	14:00	17.0		1.817	0.080
4/16/2002	16:10	21.0		1.525	0.096
5/15/2002	15:20	29.0		1.100	0.120
6/10/2002	15:45	30.0		2.200	0.150
7/17/2002	16:20	35.0		3.600	0.170
8/8/2002	7:15	37.0		2.900	0.150
9/11/2002	18:00	26.0		3.800	0.130
10/9/2002	17:20	18.0		1.800	0.220
11/13/2002	7:15	5.0		1.100	0.100
12/11/2002	8:30	4.0		1.900	0.100
1/8/2003	15:00	4.0		2.400	0.040
2/6/2003	8:15			2.300	0.070
3/10/2003	18:40	7.0		1.500	0.060
4/9/2003	15:10	12.0		3.200	0.060
5/8/2003	9:00	170.0		1.400	0.300
6/4/2003	18:10	35.0		1.400	0.120
7/1/2003	15:00	39.0		3.000	0.170
8/4/2003	15:45	48.0		1.700	0.190
9/3/2003	18:10	29.0		1.600	0.160
10/6/2003	17:40	6.0		3.200	0.100
11/17/2003	15:00	5.0		3.500	0.090
12/3/2003	9:50	6.0		2.800	0.060
1/5/2004	16:00			2.200	0.040
2/23/2004	14:30	17.0		2.200	0.110
3/15/2004	14:45	7.0		2.400	0.050
4/12/2004	14:00	6.0		2.700	0.080
5/17/2004	14:30	27.0		1.400	0.120
6/2/2004	10:20	81.0		1.600	0.210
7/6/2004	16:30	31.0		1.300	0.160
8/9/2004	16:30	24.0		2.700	0.140
9/1/2004	15:00	29.0		1.500	0.160
10/4/2004	16:20			2.600	0.080

		Stream Name:	Salt Creek -- US 20 (Portage)		
		Site ID:	SLC-1		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
11/3/2004	15:15	42.0		1.400	0.160
12/15/2004	14:30	10.0		2.400	0.080
1/3/2005	16:15	58.0		1.800	0.160
2/2/2005	15:00	7.0		2.600	0.050
3/28/2005	15:15	7.0		1.100	
4/11/2005	16:30	8.0		2.000	0.040
5/9/2005	14:50	19.0		3.000	0.120
6/14/2005	6:30	49.0		2.400	0.190
7/11/2005	16:45	20.0		4.300	0.200
8/3/2005	14:10	34.0		4.100	0.160
9/12/2005	14:45	17.0		4.800	0.160
10/11/2005	13:30	26.0		4.400	0.170
11/15/2005	13:30	9.0		2.700	0.090
12/19/2005	13:50	5.0		3.800	0.090
1/30/2006	14:15	66.0		3.000	0.210
2/22/2006	13:10	8.0		3.600	0.050
3/13/2006	15:00	332.0		1.600	0.460
4/5/2006	14:15	21.0		1.400	0.120
5/15/2006	14:00	49.0		1.800	0.180
6/26/2006	14:40	36.0		3.900	0.260
7/25/2006	15:30	37.0		2.400	0.170
8/28/2006	13:45	48.0		2.200	0.190
9/14/2006	7:10	121.0		1.400	0.360
10/2/2006	14:30	33.0		2.400	0.140
11/15/2006	15:45	8.0		2.000	0.070
12/4/2006	14:00	20.0		2.000	0.090
1/17/2007	14:40	15.0		1.290	
2/26/2007	14:00	40.0		1.270	0.168
3/14/2007	17:15			1.580	0.327
4/11/2007	13:50	16.0		2.000	0.100
5/23/2007	14:15	20.0		2.800	0.140
6/12/2007	13:45	30.0		3.300	0.140
7/24/2007	15:50	14.0		3.800	0.120
8/21/2007	16:30	48.0		1.000	0.160
9/4/2007	15:25	15.0		2.000	0.130
10/9/2007	16:50	14.0		2.900	0.120
11/28/2007	15:50			2.400	0.070
12/20/2007	7:45	6.0		2.400	0.070
1/29/2008	15:20	9.0		2.200	0.080

		Stream Name:	Salt Creek -- US 20 (Portage)		
		Site ID:	SLC-1		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
2/12/2008	14:10	7.0		1.500	0.040
3/12/2008	19:40	5.0		1.500	0.040
4/1/2008	17:45	73.0		1.400	0.140
5/14/2008	14:50	25.0		1.000	0.100
6/5/2008	16:50	55.0		1.800	0.140
7/2/2008	7:10	30.0		2.700	0.160
8/4/2008	15:10	37.0		3.000	0.160
9/8/2008	13:40	23.0		1.600	0.120
10/29/2008	13:40	4.0		1.900	0.130
11/24/2008	17:40			2.100	0.060
12/3/2008	16:20			2.200	0.040
1/7/2009	11:20	5.0		2.100	0.080
2/25/2009	16:50	5.0		1.400	0.060
3/25/2009	9:00	11.0		1.200	0.090
4/15/2009	17:40	7.0		1.100	0.070
5/4/2009	14:00	8.0		0.800	0.090
6/1/2009	15:50	30.0		1.600	0.140
7/22/2009	16:00	23.0		3.000	0.090
8/6/2009	11:00	20.0		2.800	0.050
9/16/2009	15:00	17.0		3.200	0.130
10/28/2009	16:50	22.0		1.300	0.100
11/10/2009	8:20	15.0		2.000	0.120
12/1/2009	12:00	5.0		2.000	0.070
1/25/2010	14:15	31.0		1.200	0.180
2/23/2010	14:15	6.0		1.600	0.080
3/22/2010	15:30	6.0		1.400	0.080
4/12/2010	16:00	55.1		1.000	0.080
5/11/2010	6:40	55.0		1.600	0.140

		Stream Name:	*Salt Creek -- State Route 130*		
		Site ID:	*SLC-17*		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
1/16/1991	16:45	57.0	980	2.200	0.140
2/12/1991	16:35	8.0	140	1.800	0.040
3/6/1991	13:10	14.0	540	1.400	0.080
5/21/1991	14:30	41.0	4600	1.800	0.110
6/25/1991	12:30	12.0	6500	3.500	0.130
7/24/1991	16:35	22.0	230	4.300	0.100
8/15/1991	10:00	31.0	970	3.900	0.160
9/24/1991	11:40	17.0	310	3.000	0.090
10/22/1991	17:00		110	3.900	0.080
11/20/1991	9:00	104.0	3200	1.600	0.250
12/18/1991	14:15	15.0	230	2.200	0.070
1/30/1992	10:15	5.0	380	2.400	0.060
2/25/1992	12:15	14.0	330	2.200	0.120
3/26/1992	10:25	5.0	140	2.600	0.060
4/22/1992	9:10	16.0	250	2.200	0.060
5/19/1992	11:45	31.0	340	3.900	0.110
6/24/1992	13:10	47.0	960	4.400	0.170
7/27/1992	18:15	49.0	210	2.400	0.070
8/24/1992	16:30	9.0	240	4.300	0.190
9/22/1992	16:00	103.0	590	1.800	0.160
10/20/1992	16:30	52.0	100	1.900	0.320
11/16/1992	15:55	6.0	500	1.800	0.060
12/15/1992	15:00	11.0	340	2.100	0.080
1/13/1993	11:40	32.0		0.400	0.060
3/16/1993	17:30	14.0	1100	2.400	0.070
4/26/1993	19:20			1.100	0.080
5/10/1993	17:05	28.0	880	1.400	0.090
8/2/1993	18:35	52.0	530	2.200	0.160
9/8/1993	18:00	82.0	910	1.100	0.260
9/29/1993	9:00	62.0	2000	1.500	0.200
10/27/1993	7:00	33.0	140	1.200	0.160
11/16/1993	11:45	18.0	670	1.200	0.070
3/3/1994	10:00	10.0	330	1.000	0.060
3/15/1994	11:20	16.0	110	1.400	0.080
4/26/1994	18:25	28.0	90	2.000	0.110
6/1/1994	7:35	11.0			
8/2/1994	9:45	18.0	430	1.200	0.050
8/31/1994	19:55	20.0		3.400	0.180
10/4/1994	9:00	12.0	600	4.200	0.140

		Stream Name:	Salt Creek -- State Route 130		
		Site ID:	SLC-17		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
11/15/1994	14:50	36.0	6600	2.700	0.140
1/18/1995	12:25	13.0	480	2.800	0.110
3/7/1995	17:15	49.0	990	2.000	0.120
4/27/1995	14:00	21.0	170	2.200	0.110
5/24/1995	14:20	144.0	3300	2.800	0.320
6/26/1995	15:15	21.0	570	3.400	0.150
7/26/1995	9:35	10.0	710	3.200	0.130
9/7/1995	18:45	25.0	320	5.400	0.250
9/28/1995	18:25	6.0	220	3.700	0.180
10/25/1995	10:30		80	4.500	0.150
11/15/1995	12:20	13.0	3200	3.700	0.090
12/21/1995	10:00	10.0	8800	3.800	0.160
1/24/1996	16:30	5.0	440	2.500	0.130
2/28/1996	19:00	9.0	2000	3.400	0.140
3/26/1996	9:30	8.0	1100	3.200	0.120
4/24/1996	11:40	25.0	220	2.800	0.100
5/22/1996	10:00	38.0	310	1.900	0.150
6/19/1996	9:40	32.0	500	0.700	0.120
7/17/1996	12:00	22.0	910	3.100	0.170
8/21/1996	10:00	21.0	220	3.200	0.150
9/18/1996	9:40	15.0	390	4.200	0.100
10/23/1996	9:30	54.0	3400	3.900	0.160
11/13/1996	9:45	7.0	640	2.900	0.070
12/11/1996	9:40	55.0	1900	2.600	0.150
2/5/1997	9:45	26.0	4100	1.400	0.130
2/26/1997	7:45	26.0	1100	1.900	0.100
4/2/1997	8:10	17.0	12	2.500	0.070
4/30/1997	7:40	22.0	70	3.100	0.100
5/28/1997	8:00	31.0	310	2.600	0.110
6/18/1997	7:30	53.0	1400	0.800	0.150
7/23/1997	7:30	52.0	890	2.100	0.170
8/20/1997	7:30	35.0	920	1.800	0.150
9/24/1997	7:25	15.0	4000	3.000	0.110
10/21/1997	13:10		1200	3.500	0.100
11/18/1997	10:00	5.0		2.500	0.090
12/9/1997	13:00	9.0	180	2.700	0.110
2/4/1998	13:25	15.0	1400	2.400	0.180
3/4/1998	13:00	8.0		1.800	0.100
4/1/1998	12:45	41.0	340	0.900	0.130

		Stream Name:	Salt Creek -- State Route 130		
		Site ID:	SLC-17		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
4/28/1998	12:20	12.0	20	1.800	0.070
6/3/1998	12:10	7.0	4000	3.200	0.120
6/30/1998	12:35	94.0	4000	1.800	0.230
7/28/1998	9:20	23.0		4.600	0.130
9/1/1998	13:20	11.0	4000	3.400	0.190
9/29/1998	12:30	6.0	460	2.500	0.240
10/27/1998	8:00	9.0	110	2.700	0.120
11/17/1998	7:30	14.0	350	2.700	0.190
12/15/1998	11:30	11.0	600	3.400	0.110
1/26/1999	11:20	26.0	240	3.100	0.120
2/23/1999	8:30	10.0	310	3.000	0.120
3/24/1999	10:20	4.0	340	3.100	0.070
4/28/1999	16:00	48.0		0.900	0.150
5/25/1999	18:10	15.0		2.300	0.210
6/29/1999	7:45	31.0		4.000	0.210
7/28/1999	8:00	65.0		4.000	0.250
8/25/1999	10:50	22.0		4.600	0.260
9/29/1999	11:45	30.0		4.800	0.210
10/18/1999	16:15	4.0		3.400	0.120
12/1/1999	7:30	12.0		3.100	0.120
12/15/1999	11:30	35.0	630	3.200	0.150
1/25/2000	11:30	20.0	610	3.100	0.090
2/14/2000	15:20	4.0		2.300	0.070
3/20/2000	15:30	32.0		3.300	0.160
4/25/2000	10:50	23.0	1100	2.100	0.120
5/24/2000	14:20	25.0		2.300	0.140
6/22/2000	11:20	60.0		1.100	0.170
7/17/2000	14:20	16.0		3.200	0.190
8/22/2000	9:20	17.0		4.200	0.310
9/20/2000	12:00	11.0	610	5.300	0.150
10/24/2000	11:50	28.0	2000	4.500	0.160
11/21/2000	11:30	6.0	1700	5.200	0.070
12/13/2000	12:00	10.0		4.500	0.090
1/9/2001	15:25	12.0		3.600	0.090
2/13/2001	11:20	21.0	1600	5.200	0.120
3/12/2001	17:25	5.0		2.900	0.070
4/10/2001	7:00	13.0		3.700	0.110
5/9/2001	17:20	26.0		3.400	0.130
6/7/2001	11:30	33.0	1600	2.900	0.190

		Stream Name:	Salt Creek -- State Route 130		
		Site ID:	SLC-17		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
7/10/2001	7:20	11.0		4.700	0.150
8/14/2001	7:15	11.0		6.200	0.130
9/19/2001	14:45	21.0		3.400	0.200
10/10/2001	18:25	11.0		3.300	0.150
11/8/2001	11:50	10.0		3.500	0.080
12/3/2001	15:15	9.0		1.800	0.080
1/28/2002	16:45			2.722	0.109
2/19/2002	13:30	27.0		2.622	0.102
3/13/2002	13:20	20.0		2.482	0.098
4/16/2002	15:30	17.0		1.919	0.085
5/15/2002	14:30	24.0		1.500	0.110
6/10/2002	14:50	43.0		2.700	0.200
7/17/2002	18:10	32.0		5.800	0.190
8/7/2002	18:25	19.0		3.800	0.160
9/11/2002	16:50	8.0		3.000	0.130
10/9/2002	18:30	8.0		2.800	0.220
11/12/2002	18:00	6.0		1.200	0.130
12/12/2002	7:50	10.0		4.400	0.180
1/8/2003	17:15	5.0		3.900	0.060
2/6/2003	8:50			4.200	0.160
3/11/2003	11:10	9.0		2.700	0.090
4/9/2003	14:30	17.0		4.200	0.080
5/7/2003	15:00	29.0		2.600	0.130
6/4/2003	17:40	28.0		3.200	0.190
7/1/2003	14:20	26.0		4.300	0.180
8/4/2003	15:00	18.0		3.100	0.140
9/4/2003	8:30	22.0		4.400	0.180
10/7/2003	11:00	9.0	340	6.200	0.160
11/17/2003	14:25			4.600	0.100
12/2/2003	17:30	7.0		3.400	0.070
1/5/2004	15:25	6.0		3.200	0.060
2/23/2004	13:45	12.0		2.500	0.120
3/15/2004	14:00	8.0		3.000	0.080
4/12/2004	13:20	6.0		2.900	0.120
5/17/2004	13:40	23.0		2.400	0.150
6/2/2004	10:50	48.0		1.600	0.190
7/6/2004	17:00	23.0		2.500	0.180
8/10/2004	7:10	18.0		5.900	0.180
9/1/2004	14:00	25.0		2.200	0.140

		Stream Name:	Salt Creek -- State Route 130		
		Site ID:	SLC-17		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
10/5/2004	10:30	10.0		4.400	0.120
11/3/2004	14:00	14.0		1.600	0.110
12/15/2004	13:45	9.0		3.700	0.080
1/3/2005	15:00	45.0		2.400	0.170
2/2/2005	13:30	7.0		4.000	0.090
3/28/2005	14:00	5.0		1.800	
4/11/2005	17:20	11.0		3.400	0.070
5/9/2005	13:40	21.0		4.200	0.210
6/14/2005	7:15	130.0		3.100	0.380
7/11/2005	15:50	14.0		4.700	0.220
8/3/2005	13:20	18.0		5.900	0.180
9/12/2005	13:40	12.0		6.900	0.210
10/11/2005	12:30	13.0		6.200	0.160
11/15/2005	12:30	7.0		6.400	0.140
12/19/2005	14:40	11.0		6.600	0.140
1/30/2006	13:45	25.0		2.600	0.110
2/22/2006	12:20	11.0		4.600	0.080
3/13/2006	14:00	156.0		2.000	0.340
4/5/2006	12:50	15.0		3.100	0.120
5/15/2006	13:00	42.0		2.800	0.200
6/26/2006	14:10	19.0		5.000	0.360
7/25/2006	14:50	23.0		3.500	0.160
8/28/2006	12:40	24.0		4.000	0.220
9/14/2006	7:50	68.0		1.300	0.260
10/2/2006	13:30	13.0		3.000	0.120
11/15/2006	16:30	5.0		3.600	0.100
12/4/2006	13:00	15.0		2.600	0.080
1/17/2007	13:30	15.0		1.850	
2/26/2007	13:00	34.0		1.160	0.122
3/14/2007	12:50			1.550	0.106
4/11/2007	12:50	107.0		2.700	0.220
5/23/2007	12:30	14.0		4.000	0.180
6/12/2007	12:40	24.0		5.300	0.200
7/24/2007	14:50	14.0		5.300	0.230
8/21/2007	15:40	13.0		0.900	0.130
9/4/2007	14:40	15.0		3.300	0.130
10/9/2007	16:10	6.0		3.800	0.120
11/28/2007	15:10	6.0		3.500	0.100
12/20/2007	14:00	7.0		3.700	0.120

		Stream Name:	Salt Creek -- State Route 130		
		Site ID:	SLC-17		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
1/29/2008	14:40	33.0		2.300	0.180
2/12/2008	12:30	9.0		1.900	0.040
3/12/2008	18:50	7.0		2.800	0.050
4/1/2008	13:40	38.0		1.300	0.110
5/14/2008	13:15	19.0		2.400	0.120
6/5/2008	11:30	84.0		1.900	0.180
7/1/2008	15:30	16.0		3.900	0.240
8/4/2008	13:40	23.0		4.400	0.150
9/8/2008	12:00	17.0		3.700	0.150
10/29/2008	12:10	5.0		3.200	0.140
11/25/2008	10:20	4.0		3.400	0.080
12/3/2008	11:45			3.800	0.060
1/7/2009	10:40	6.0		3.200	0.110
2/25/2009	16:10	7.0		1.600	0.110
3/24/2009	11:00	13.0		2.000	0.140
4/15/2009	13:10	5.0		1.200	0.080
5/4/2009	13:00	10.0		1.300	0.130
6/1/2009	14:00	116.0		1.900	0.330
7/22/2009	14:40	17.0		4.900	0.070
8/6/2009	11:40	16.0		5.200	0.070
9/16/2009	13:45	7.0		4.500	0.180
10/28/2009	13:50	13.0		2.000	0.120
11/9/2009	16:30	7.0		2.300	0.120
12/1/2009	11:20	7.0		3.300	0.100
1/25/2010	13:00	20.0		1.400	0.140
2/23/2010	13:00	6.0		1.500	0.100
3/22/2010	16:15	9.0		1.800	0.080
4/12/2010	15:30	63.2		1.800	0.080
5/10/2010	15:10	64.2		2.300	0.100

		Stream Name:	Salt Creek above Valparaiso WWTP		
		Site ID:	SC-WWTP-up		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
4/1/2004	9:56	10	77	0.14	0.117
4/9/2004	11:19	6	46	0.11	0.071
4/15/2004	10:23	3	110	0.01	0.051
4/22/2004	9:11	6	112	0.11	0.129
4/29/2004	9:42	18	40	0.12	0.132
5/7/2004	9:54	24	780	0.22	0.236
5/13/2004	9:44	36	235	0.17	0.160
5/20/2004	10:00	24	312	0.18	0.148
5/27/2004	10:00	17	200	0.17	0.080
6/3/2004	9:50	18	282	0.10	0.120
6/10/2004	9:55	16	790	0.11	0.110
6/24/2004	7:54	22	447	0.01	0.103
7/1/2004	7:46	15	620	0.14	0.105
7/8/2004	8:30	14	388	0.11	0.105
7/15/2004	8:27	12	535	0.21	0.062
8/12/2004	8:30	8	250		0.090
8/19/2004	8:00	50	700	0.05	0.193
8/26/2004	8:15	58	1200	0.02	1.180
9/2/2004	7:50	17	190	0.11	0.102
9/9/2004	8:08	8	242	0.09	0.113
9/16/2004	8:05	17	305	0.03	0.084
9/23/2004	11:01	5	250	0.05	0.160
9/30/2004	11:12	4	140	0.05	0.065
10/7/2004	8:25	9	148	0.02	0.074
10/15/2004	8:13	30	430	0.15	0.114
10/22/2004	8:40	14	68	0.41	0.081
10/28/2004	7:55	8	105	0.17	0.112
4/6/2006	8:15	10	24	0.11	0.036
4/13/2006	8:12	8	488	0.14	0.030
4/20/2006	7:42	17	365	0.07	0.089
4/28/2006	8:24	6	52	0.20	0.049
5/4/2006	8:21	16	146	0.02	0.075
5/11/2006	9:16	111	1730	0.28	0.195
5/18/2006	8:20	15	285	0.38	0.078
5/25/2006	8:16	50	1986	0.16	0.127
6/1/2006	8:08	14	1046	0.02	0.063
6/8/2006	8:20	13	1553	0.10	0.082
6/15/2006	8:20	14	770	0.18	0.132
6/29/2006	8:00	20	1414	0.13	0.080

		Stream Name:	Salt Creek above Valparaiso WWTP		
		Site ID:	SC-WWTP-up		
Sample Date	Sample Time	TSS (mg/L)	E. Coli (CFU/100mL)	NO2+NO3 (mg/L)	Phosphorus, Total (mg/L)
7/6/2006	7:52	12	727	0.12	0.073
7/13/2006	7:58	34	1986	0.12	0.129
7/27/2006	7:59	8	488	0.22	0.108
8/3/2006	8:26	27	1986	0.15	0.157
8/10/2006	8:17	12	770	0.14	0.089
8/17/2006	8:25	7	365	0.08	0.071
8/24/2006	8:35	36	2420	0.22	0.177
8/31/2006	10:08	18	219	0.08	0.098
9/7/2006	8:30	8	291	0.11	0.076
9/21/2006	8:20	10	172	0.21	0.113
9/29/2006	8:08	21	411	0.12	0.096
10/5/2006	8:30	21	816	0.18	
10/12/2006	9:08	8	153	0.19	0.060
10/19/2006	8:55	22	613	0.11	0.100
10/26/2006	8:59	2	54	0.12	0.030
4/13/2007	7:42	8	308	0.10	0.052
4/19/2007	9:00	6	115	0.06	0.056
4/26/2007	8:55	59	987	0.21	0.144
5/3/2007	8:38	16	132	0.10	0.065
5/10/2007	8:07	16	260	0.06	0.068
5/17/2007	8:05	17	600	0.08	0.074
5/24/2007	8:30	13	548	0.12	0.077
5/31/2007	8:34	18	461	0.16	
6/7/2007	8:20	12	411	0.09	0.061
6/14/2007	8:25	12	1120	0.05	0.063
6/21/2007	8:08	14	517	0.19	0.077
6/28/2007	8:04	19	770	0.11	0.090
7/6/2007	8:04	16	1203	0.04	0.091
7/12/2007	8:18	17	1733	0.05	0.094
7/19/2007	7:58	32	517	0.03	0.112
7/26/2007	8:51	160	2420	0.10	0.466
8/2/2007	9:05	14	365	0.16	0.065
8/9/2007	8:53	76	6490	0.07	0.242
8/16/2007	9:16	87	7270	0.22	0.276
8/23/2007	8:12	33	3450	0.12	0.121
8/30/2007	9:00	15	228	0.08	0.132
9/6/2007	8:40	12	284	0.08	0.089
9/13/2007	8:25	6	141	0.10	0.074
9/20/2007	8:21	11	284	0.11	0.039

		Stream Name:	Salt Creek above Valparaiso WWTP		
		Site ID:	SC-WWTP-up		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
9/27/2007	8:53	8	80	0.09	0.068
10/4/2007	8:30	10	461	0.09	0.056
10/11/2007	8:35	26	411	0.03	0.113
10/18/2007	8:10	196	410	0.04	0.490
10/25/2007	8:48	9	162	0.05	0.071
4/3/2008	8:34	4	42	0.12	0.039
4/10/2008	8:40	7	64	0.01	0.052
4/17/2008	8:33	9	34	0.01	0.052
4/24/2008	9:40	9	86	0.07	0.060
5/1/2008	9:05		75	0.07	0.056
5/8/2008	8:53	18	387	0.08	0.099
5/14/2008	8:33	29	249	0.01	0.097
5/22/2008	8:40	11	219	0.09	0.042
5/29/2008	8:01	8	517	0.09	0.071
6/5/2008	8:46	44	1553	0.16	0.135
6/12/2008	8:46	15	488	0.06	0.108
6/19/2008	8:53	10	344	0.16	0.049
6/26/2008	8:59	13	727	0.07	0.069
7/3/2008	8:50	16	387	0.07	0.119
7/10/2008	8:30	17	727	0.15	0.085
7/17/2008	8:31	16	517	0.19	0.074
7/23/2008	8:20	12	770	0.27	0.201
7/31/2008	8:30	12	401	0.04	0.075
8/7/2008	8:03	22	1203	0.21	0.174
8/14/2008	8:34	9	727	0.05	0.066
8/21/2008	8:38	9	196	0.08	0.055
8/28/2008	10:06	8	152	0.06	0.081
9/4/2008	9:10	72	4839	0.11	0.317
9/11/2008	9:08	8	184	0.03	0.069
9/18/2008	8:46	11	107	0.01	0.086
9/25/2008	8:05	10	137	0.09	0.072
10/2/2008	8:30	17	1203	0.11	0.074
10/9/2008	9:18	14	960	0.12	0.077
10/16/2008	8:33	20	2420	0.08	0.086
10/23/2008	8:48	4	105	0.06	0.044
10/30/2008	9:56	12	46	0.13	0.041
4/9/2009	9:00	4	40	0.09	0.052
4/16/2009	7:48	4	13	0.13	0.066
4/23/2009	8:33	5	45	0.11	0.010

		Stream Name:	Salt Creek above Valparaiso WWTP		
		Site ID:	SC-WWTP-up		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
4/30/2009	9:28	9	192	0.15	0.122
5/7/2009	8:55	9	73	0.04	0.320
5/14/2009	9:02	84	2420	0.14	0.212
5/21/2009	9:07	13	345	0.01	0.885
5/28/2009	8:51	14	411	0.17	0.074
6/4/2009	9:36	10	248	0.13	0.056
6/11/2009	8:36	50	2420	0.24	0.188
6/18/2009	9:06	19	1414	0.04	0.074
6/25/2009	9:40	11	387	0.28	0.074
7/2/2009	9:12	7	687	0.07	0.049
7/9/2009	8:43	11	579	0.10	0.055
7/16/2009	9:02	10	1986	0.01	0.061
7/23/2009	8:59	9	276	0.03	0.064
7/30/2009	9:05	12	308	0.09	0.064
8/6/2009	9:04	10	260	0.09	0.066
8/13/2009	9:12	7	260	0.06	0.144
8/20/2009	9:35	30	2420	0.02	0.110
8/27/2009	9:25	82	2420	0.04	0.229
9/3/2009	9:10	10	548	0.03	0.066
9/10/2009	9:10	6	365	0.01	0.072
9/17/2009	9:24	8	291	0.07	0.046
9/24/2009	9:35	6	308	0.02	0.035
10/1/2009	9:08	11	248	0.11	0.078
10/8/2009	9:47	13	727	0.06	0.074
10/15/2009	10:00	7	276	0.10	0.071
10/22/2009	9:03	6	61	0.08	0.064
10/29/2009	8:16	6	70	0.08	0.066
4/20/2010	9:51	9	86	0.06	0.107
4/27/2010	9:50	8	144	0.12	0.089
5/4/2010	8:59	11	121	0.22	0.133
5/11/2010	9:03	84	2420	0.23	0.304
5/18/2010	8:25	24	579	0.10	0.127
5/25/2010	8:59	14	326	0.39	0.088
6/1/2010	9:11	27	2420	0.32	0.185
6/8/2010	9:12	13	488	0.24	0.113
6/15/2010	9:10	17	579	0.26	0.110
6/22/2010	9:16	19	1034	0.28	0.111
6/29/2010	9:17	12	435	0.16	0.100
7/6/2010	8:49	9	687	0.05	0.061

		Stream Name:	*Salt Creek above Valparaiso WWTP*		
		Site ID:	*SC-WWTP-up*		
Sample Date	**Sample Time**	**TSS *(mg/L)***	**E. Coli *(CFU/100mL)***	**NO2+NO3 *(mg/L)***	**Phosphorus, Total *(mg/L)***
7/13/2010	8:22	89	2420	0.16	0.272
7/20/2010	9:12	12	1046	0.15	0.278
7/27/2010	9:14	16	488	0.05	0.119
8/4/2010	7:50	29	1612	0.15	0.136
8/10/2010	9:08	14	313	0.08	0.094
8/17/2010	9:06	8	143	0.06	0.061
8/26/2010	9:08	8	225	0.07	0.050
8/31/2010	8:45	7	365	0.22	0.115
9/7/2010	9:02	7	138	0.05	
9/14/2010	8:52	7	225	0.13	0.182
9/22/2010	8:40	33	1414	0.16	0.295
9/28/2010	8:33	8	194	0.08	0.190
10/12/2010	9:05	7	167	0.04	0.196
10/20/2010	9:05	4	88	0.25	0.217
10/27/2010	8:43	6	281	0.07	0.193
4/6/2011	8:51	5	28	0.06	0.072
4/13/2011	8:27	8	186	0.15	0.068
4/20/2011	9:02	49	400	0.19	0.168
4/27/2011	8:40	22	461	0.05	0.118
5/4/2011	8:35	6	59	0.11	0.166
5/12/2011	8:36	10	238	0.14	0.072
5/18/2011	9:40	12	411	0.09	0.075
5/25/2011	9:40	256	2420	1.18	0.523
6/1/2011	9:16	17	189	0.17	0.138
6/9/2011	8:25	88	2420	0.43	0.232
6/15/2011	9:03	52	2420	0.23	0.227
6/22/2011	10:21	32		0.13	0.121
6/29/2011	8:48	10	403	0.13	0.082

		Stream Name:	Lake Louise Outlet		
		Site ID:	1		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
8/1/2006		16.0		5.700	0.200
5/7/2007		6.4	1000	1.900	0.210
5/16/2007		7.6	19000	2.600	0.260
5/22/2007		5.2	40	1.200	0.120
6/5/2007		9.6	220	2.600	0.160
6/19/2007		8.6	480	4.000	0.210
7/5/2007		15.0	300	2.000	0.200
7/17/2007		9.4	140	1.500	0.092
7/24/2007		8.4	210	2.800	0.110
5/22/2008			50	13.695	
5/28/2008			400	22.000	
6/6/2008			500	17.600	
6/12/2008			100	22.000	
6/19/2008			100	33.990	
6/24/2008			50	22.000	
5/28/2009			100	3.800	
6/25/2009	11:00		300	2.100	
7/23/2009	10:10		500	2.050	
7/29/2009	11:45		100	3.600	
9/4/2009	12:25		50	4.400	
9/24/2009	1:25		100	4.100	
10/21/2009	11:45		50	3.400	
4/23/2010	11:15		100	4.850	
5/21/2010	11:20		100	2.800	
6/29/2010	12:15		200	2.500	
7/13/2010	13:15				
7/21/2010	12:00		150	3.300	
8/26/2010	11:45		150	5.250	
9/24/2010	12:40	3.2			
9/30/2010	12:30		150	5.650	
10/8/2010		2.7			
10/15/2010	11:45	2.7			
10/22/2010	11:30	0.3			
10/29/2010	12:20		200	4.100	
11/19/2010	11:30	1.4			
12/10/2010	12:45	1.0			
2/11/2011		1.2		6.200	
2/18/2011					
4/26/2011	13:00		100	3.600	

Stream Name:	***Lake Louise Outlet***				
Site ID:	***1***				
Sample Date	**Sample Time**	**TSS *(mg/L)***	**E. Coli *(CFU/100mL)***	**NO2+NO3 *(mg/L)***	**Phosphorus, Total *(mg/L)***
5/24/2011	16:00			4.100	
5/31/2011	12:40		200	0.100	
6/20/2011	14:55		200	3.300	
7/26/2011	12:35		100	4.100	
8/17/2011	14:00		400	2.000	
9/8/2011	11:00		1	5.000	
10/11/2011	15:21		100	5.300	
11/8/2011	13:45		600		

		Stream Name:	Clark Ditch		
		Site ID:	2		
Sample Date	**Sample Time**	**TSS *(mg/L)***	**E. Coli *(CFU/100mL)***	**NO2+NO3 *(mg/L)***	**Phosphorus, Total *(mg/L)***
8/1/2006		22.0		0.300	0.180
8/22/2006					
5/7/2007		13.0	150	0.310	0.047
5/16/2007		12.0	810	0.140	0.191
5/22/2007		26.0	350	0.180	0.156
5/29/2007					
6/5/2007		32.0	2300	0.270	0.160
6/19/2007		26.0	1100	0.240	0.190
7/5/2007		20.0	1800	0.440	0.082
7/17/2007		14.0	1100	0.430	0.050
7/24/2007		42.0	1100	0.230	0.140
5/22/2008			50	8.800	
5/28/2008			200	8.800	
5/30/2008					
6/6/2008			1600	2.200	
6/12/2008			1000	2.200	
6/19/2008			700	0.880	
6/24/2008			700	2.200	
5/28/2009			400	0.800	
6/25/2009	10:15		2100	0.005	
7/23/2009	9:40		1000	0.500	
7/29/2009	11:15		700	0.400	
9/4/2009	11:50		300	1.100	
9/24/2009	12:50		600	0.005	
10/21/2009	11:00		400	2.100	
4/23/2010	11:45		50	1.400	
5/21/2010	11:50		600	1.600	
6/15/2010	10:00				
6/29/2010	11:30		500	0.005	
7/6/2010	13:15				0.062
7/13/2010	12:00				
7/21/2010	11:10		500	1.400	
8/26/2010	11:30		300	1.800	
9/30/2010	12:00		900	1.900	
10/29/2010	11:55		150	2.650	
4/26/2011	13:59		50	1.350	
5/24/2011	16:45			1.600	
5/31/2011	11:50		400	0.005	
6/20/2011	14:12		700	1.100	

		Stream Name:	*Clark Ditch*		
		Site ID:	*2*		
Sample Date	**Sample Time**	**TSS *(mg/L)***	**E. Coli *(CFU/100mL)***	**NO2+NO3 *(mg/L)***	**Phosphorus, Total *(mg/L)***
7/26/2011	12:08		800	1.100	
8/17/2011	14:35		400	1.800	
9/8/2011	10:30		1100	1.200	
10/11/2011	14:45		500	1.500	
11/8/2011	13:35		500		

		Stream Name:	*Salt Creek Headwaters*		
		Site ID:	*5*		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
8/1/2006		29.0		0.400	0.080
8/22/2006					
5/7/2007		6.0	300	0.400	0.170
5/16/2007		53.0	690	0.260	0.210
5/22/2007		32.0	260	0.320	0.129
5/29/2007					
6/5/2007		18.0	2800	0.320	0.100
6/19/2007		46.0	4900	0.260	0.320
7/5/2007		43.0	540	0.240	0.082
7/17/2007		31.0	1300	0.210	0.058
7/24/2007		16.0	940	0.200	0.050
5/22/2008			50	2.200	
5/28/2008			100	0.440	
5/30/2008					
6/6/2008			2600	0.440	
6/12/2008			100	0.220	
6/19/2008			100	0.440	
6/24/2008			300	0.880	
5/28/2009			1200	0.005	
6/25/2009	8:35		1300	0.005	
7/23/2009	8:15		675	0.650	
7/29/2009	9:30		1150	0.500	
9/4/2009	9:50		500	0.153	
9/24/2009	11:19		550	0.450	
10/21/2009	9:40		75	0.950	
4/23/2010	10:45		200	0.100	
5/21/2010	9:50		300	0.600	
6/15/2010	9:00				
6/17/2010		36.1			0.174
6/24/2010	9:45		1825	0.005	0.142
6/29/2010	10:00		350	1.753	
7/13/2010	10:15				
7/21/2010	9:40		600	0.500	
8/26/2010	10:20		500	0.005	
9/24/2010	12:00	21.6	29		
9/30/2010	11:00		300	0.600	
10/8/2010		0.2			
10/15/2010	11:45	6.3			
10/22/2010	11:15	1.5			

		Stream Name:	Salt Creek Headwaters		
		Site ID:	5		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
10/29/2010	10:15		100	1.100	
11/19/2010	10:55	5.3			
12/10/2010	12:15	2.5			
2/11/2011		3.7		0.300	
2/18/2011					
4/26/2011	11:20		100	3.300	
5/24/2011					
5/31/2011	10:18		300	1.000	
6/20/2011	9:25		700	0.300	
7/26/2011	8:05		1300	0.250	
8/17/2011	9:45		500	0.900	
9/8/2011	9:30		200	0.400	
10/11/2011	9:53		500	0.500	
11/8/2011	9:30		400		
10/29/2010	10:15		100	1.100	
11/19/2010	10:55	5.3			
12/10/2010	12:15	2.5			
2/11/2011		3.7		0.300	
2/18/2011					
4/26/2011	11:20		100	3.300	
5/24/2011					
5/31/2011	10:18		300	1.000	
6/20/2011	9:25		700	0.300	
7/26/2011	8:05		1300	0.250	
8/17/2011	9:45		500	0.900	
9/8/2011	9:30		200	0.400	
10/11/2011	9:53		500	0.500	
11/8/2011	9:30		400		

		Stream Name:	*Sager's Lake Outlet*		
		Site ID:	*6*		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
8/1/2006		14.0		0.080	0.016
5/7/2007		6.8	60	0.007	0.110
5/16/2007		11.0	500	0.043	0.137
5/22/2007		11.0	100	0.046	0.097
6/5/2007		18.0	890	0.110	0.080
6/19/2007		35.0	3100	0.250	0.170
7/5/2007		12.0	510	0.007	0.045
7/17/2007		25.0	1100	0.007	0.046
7/24/2007		18.0	250	0.007	0.065
5/22/2008			50	0.005	
5/28/2008			200	0.005	
6/6/2008			1000	0.005	
6/12/2008			1	0.005	
6/19/2008			400	0.005	
6/24/2008			50	0.005	
5/28/2009			100	0.005	
6/25/2009	8:25		450	0.005	
7/23/2009	8:40		50	0.150	
7/29/2009	9:50		300	0.600	
9/4/2009	10:15		300	0.700	
9/24/2009	11:30		50	0.005	
10/21/2009	10:00		100	0.900	
4/23/2010	10:00		50	0.700	
5/21/2010	9:40		50	0.800	
6/17/2010		6.1			0.146
6/24/2010	12:00		400	0.800	0.098
6/29/2010	10:30		100	0.300	
7/6/2010	11:00				0.148
7/8/2010	12:30				0.057
7/13/2010	8:50				
7/21/2010	10:05		600	0.200	
8/26/2010	10:05		100	0.700	
9/30/2010	10:00		100	0.500	
10/7/2010	9:28			0.005	0.010
10/14/2010	9:37			0.900	0.010
10/21/2010	8:30				0.010
10/29/2010	9:00		1	0.800	
11/4/2010	8:50			0.005	0.010
11/11/2010					0.010

		Stream Name:	Sager's Lake Outlet		
		Site ID:	6		
Sample Date	Sample Time	TSS (mg/L)	E. Coli (CFU/100mL)	NO2+NO3 (mg/L)	Phosphorus, Total (mg/L)
11/18/2010	9:49			0.005	0.010
4/26/2011	10:30		50	0.005	
5/24/2011	9:58			0.300	
5/31/2011	9:10		300	0.300	
6/7/2011	8:42		200	0.005	
6/20/2011	8:38		100	0.005	
7/26/2011	7:35		600	0.053	
8/17/2011	9:10		300	0.005	
8/25/2011	8:12				
9/1/2011	8:16				
9/8/2011	8:25				
9/15/2011	8:25				
10/11/2011	9:05		100	0.400	
11/8/2011	8:45		300		
11/18/2010	9:49			0.005	0.010
4/26/2011	10:30		50	0.005	
5/24/2011	9:58			0.300	
5/31/2011	9:10		300	0.300	
6/7/2011	8:42		200	0.005	
6/20/2011	8:38		100	0.005	
7/26/2011	7:35		600	0.053	
8/17/2011	9:10		300	0.005	
8/25/2011	8:12				
9/1/2011	8:16				
9/8/2011	8:25				
9/15/2011	8:25				
10/11/2011	9:05		100	0.400	
11/8/2011	8:45		300		

		Stream Name:	Beauty Creek		
		Site ID:	7		
Sample Date	**Sample Time**	**TSS *(mg/L)***	**E. Coli *(CFU/100mL)***	**NO2+NO3 *(mg/L)***	**Phosphorus, Total *(mg/L)***
8/1/2006		6.0		0.110	0.016
8/22/2006					
5/7/2007		1.6	40	0.210	0.100
5/16/2007		1.0	100	0.190	0.114
5/22/2007		3.4	15	0.145	0.069
5/29/2007					
6/5/2007		5.4	1000	0.230	0.070
6/19/2007		3.8	240	0.130	0.110
7/5/2007		3.0	160	0.130	0.016
7/17/2007		4.0	200	0.120	0.016
7/24/2007		2.8	155	0.125	0.023
5/22/2008			100	2.200	
5/28/2008			100	0.005	
5/30/2008					
6/6/2008			1	0.005	
6/12/2008			100	0.005	
6/19/2008			500	0.005	
6/24/2008			500	0.005	
5/28/2009			50	0.300	
6/25/2009	4:30		50	0.300	
7/23/2009	9:15		300	0.450	
7/29/2009	10:35		400	0.500	
9/4/2009	10:50		300	0.005	
9/24/2009	12:15		100	0.005	
10/21/2009	10:30		100	0.800	
4/23/2010	12:30		50	0.700	
5/21/2010	10:40		50	0.005	
6/15/2010	12:30				
6/24/2010	12:30		1500		0.109
6/29/2010	11:00		100	0.005	
7/6/2010	11:45				0.010
7/13/2010	11:15				
7/21/2010	10:45		400	0.700	
8/26/2010	12:30		100	0.005	
9/30/2010	11:30		100	0.005	
10/29/2010	11:00		100	1.200	
4/26/2011	12:00		50	1.500	
5/24/2011	15:30			0.350	
5/31/2011	11:10		250	0.005	

		Stream Name:	*Beauty Creek*		
		Site ID:	*7*		
Sample Date	**Sample Time**	**TSS *(mg/L)***	**E. Coli *(CFU/100mL)***	**NO2+NO3 *(mg/L)***	**Phosphorus, Total *(mg/L)***
6/20/2011	10:19		1	0.005	
7/26/2011	8:40		500	0.200	
8/17/2011	10:30		200	0.005	
9/8/2011	10:15		1	0.400	
10/11/2011	10:29		1	0.500	
11/8/2011	10:00		300		

		Stream Name:	*Squirrel Creek*		
		Site ID:	*11*		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
8/8/2006		2.0		2.300	0.081
5/7/2007		8.4	10	0.740	0.126
5/16/2007		11.5	3750	0.415	0.240
5/22/2007		4.0	30	0.700	0.128
6/5/2007		8.0	120	0.170	0.210
6/19/2007		11.0	2300	0.007	0.330
7/5/2007		4.5	140	0.770	0.160
7/17/2007		10.0	170	2.800	0.037
7/24/2007		4.0	130	2.500	0.041
5/23/2008			200	1.760	
5/28/2008			100	2.200	
6/6/2008			200	0.440	
6/12/2008			51	2.200	
6/18/2008			50	2.420	
6/24/2008			100	0.880	

		Stream Name:	Robbin's Ditch		
		Site ID:	12		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
8/8/2006		2.0		0.490	0.120
5/7/2007		3.6	890	1.700	0.142
5/16/2007		1.0	1300	1.800	0.170
5/22/2007		4.0	390	1.000	0.131
6/5/2007		3.4	2250	0.910	0.135
6/19/2007		17.0	12000	1.650	0.235
7/5/2007		6.0	430	0.400	0.200
7/17/2007		9.0	5100	0.410	0.170
7/24/2007		22.0	390	0.660	0.170
5/23/2008			200	8.800	
5/29/2008			300	9.295	
6/6/2008			400	9.460	
6/12/2008			800	9.790	
6/18/2008			900	2.695	
6/24/2008			1400	2.200	
5/28/2009			550	1.100	
6/25/2009	13:00		1100	1.600	
7/23/2009	11:35		50	0.005	
7/29/2009	14:10		2800	2.300	
9/4/2009	14:20		300	0.700	
9/24/2009	14:30		200	0.600	
10/21/2009	13:45		500	1.300	
4/23/2010	15:30		100	0.005	
5/21/2010	13:30			1.800	
6/29/2010	15:00		400	0.005	
7/13/2010	14:00				
7/21/2010			2500	0.800	
8/26/2010	14:20		200	0.400	
9/24/2010	10:00	6.8			
9/30/2010	15:30		12000	0.005	
10/8/2010	9:00	98.1			
10/15/2010	9:15	6.5			
10/22/2010	9:15	2.9			
10/29/2010	14:48		200	0.100	
11/19/2010	9:20	1.4			
12/10/2010	10:45	0.1			
2/11/2011		336.6		0.500	
2/18/2011					
4/26/2011	14:40		50	1.900	

			Stream Name:	Robbin's Ditch	
			Site ID:	12	
Sample Date	**Sample Time**	**TSS *(mg/L)***	**E. Coli *(CFU/100mL)***	**NO2+NO3 *(mg/L)***	**Phosphorus, Total *(mg/L)***
5/24/2011	11:10			0.600	
5/31/2011	15:00		50	1.400	
6/20/2011	13:31		800	1.800	
7/26/2011	10:17		1100	0.300	
8/17/2011	12:40		500	0.600	
10/11/2011	13:10		19800	0.500	
11/8/2011	11:45		2400		

		Stream Name:	Pepper Creek		
		Site ID:	8		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
8/2/2006		17.0		0.140	0.016
8/22/2006					
5/7/2007		13.0	90	0.150	0.181
5/16/2007		3.0	660	0.260	0.140
5/22/2007		11.0	80	0.081	0.083
5/29/2007					
6/5/2007		16.0	630	0.130	0.083
6/19/2007		11.0	800	0.007	0.120
7/5/2007		9.5	335	0.007	0.016
7/17/2007		15.0	1000	0.007	0.016
7/24/2007		8.8	700	0.007	0.034
5/22/2008			100	0.880	
5/28/2008			50	0.005	
5/30/2008					
6/6/2008			300	0.440	
6/12/2008			400	0.440	
6/18/2008			400	1.100	
6/24/2008			600	0.220	
5/28/2009			100	0.500	
6/25/2009	11:45		1100	0.800	
7/23/2009	10:40		800	0.700	
7/29/2009	12:00		600	0.400	
9/4/2009			100	0.300	
9/24/2009	13:55		300	0.400	
10/21/2009	12:45		50	0.005	
4/23/2010	13:30		100	0.005	
5/21/2010	12:40		100	0.900	
6/15/2010	13:40				
6/29/2010	13:00		400	1.100	
7/21/2010			300	0.200	
8/26/2010	13:30		100	0.400	
9/30/2010	13:30		200	0.600	
10/29/2010	13:17		300	0.600	
4/26/2011	17:30		100	1.800	
5/24/2011	13:34			0.800	
5/31/2011	13:30		200	1.100	
6/20/2011	11:00		200	0.300	
7/26/2011	9:07		500	0.300	
8/17/2011	11:00		1	0.400	

		Stream Name:	*Pepper Creek*		
		Site ID:	*8*		
Sample Date	**Sample Time**	**TSS *(mg/L)***	**E. Coli *(CFU/100mL)***	**NO2+NO3 *(mg/L)***	**Phosphorus, Total *(mg/L)***
9/8/2011	12:05		300	3.800	
10/11/2011	11:20		101	0.100	
11/8/2011	10:45		100		

		Stream Name:	Damon Run		
		Site ID:	13		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
8/8/2006		13.0		0.670	0.054
8/22/2006					
5/7/2007		4.3	100	0.250	0.147
5/16/2007		8.0	590	0.660	0.210
5/22/2007		4.8	210	0.390	0.120
5/29/2007					
6/5/2007		20.0	500	0.430	0.100
6/19/2007		26.0	4100	0.550	0.180
7/5/2007		8.5	580	0.540	0.066
7/17/2007		10.0	4500	0.710	0.056
7/24/2007		9.6	410	0.620	0.078
5/23/2008			300	1.320	
5/28/2008			300	0.440	
5/30/2008					
6/6/2008			300	0.005	
6/12/2008			200	4.400	
6/18/2008			500	1.320	
6/24/2008			500	1.760	
5/28/2009			50	0.500	
6/25/2009	15:00		700	0.005	
7/23/2009	12:30		200	0.700	
7/29/2009	13:20		1600	1.100	
9/4/2009	14:45		100	0.700	
9/24/2009	15:00		100	0.005	
10/21/2009	14:15		50	1.000	
4/23/2010	14:45		200	0.450	
5/21/2010	14:30		1100	1.200	
6/15/2010	15:00				
6/29/2010	14:00		100	0.005	
7/21/2010			1	0.100	
8/26/2010	15:00		600	0.300	
9/24/2010	10:45	4.2	2		
9/30/2010	14:30		300	0.700	
10/8/2010	9:45	3.2			
10/15/2010		4.4			
10/22/2010	10:00	8.3			
10/29/2010	14:20		300	1.000	
11/19/2010	10:00	2.0			
12/10/2010	11:00	13.8			

		Stream Name:	*Damon Run*		
		Site ID:	*13*		
Sample Date	Sample Time	TSS *(mg/L)*	E. Coli *(CFU/100mL)*	NO2+NO3 *(mg/L)*	Phosphorus, Total *(mg/L)*
2/11/2011		3.0		0.800	
2/18/2011					
4/26/2011	15:30		100	0.900	
5/24/2011	12:00			0.500	
5/31/2011	16:00		100	0.500	
6/20/2011	12:30		200	0.200	
7/26/2011	11:25		600	0.600	
8/17/2011	13:00		400	0.005	
10/11/2011	14:00		100	0.400	
11/8/2011	12:00		300		