



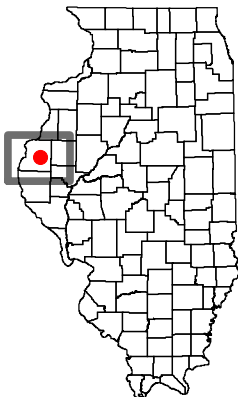
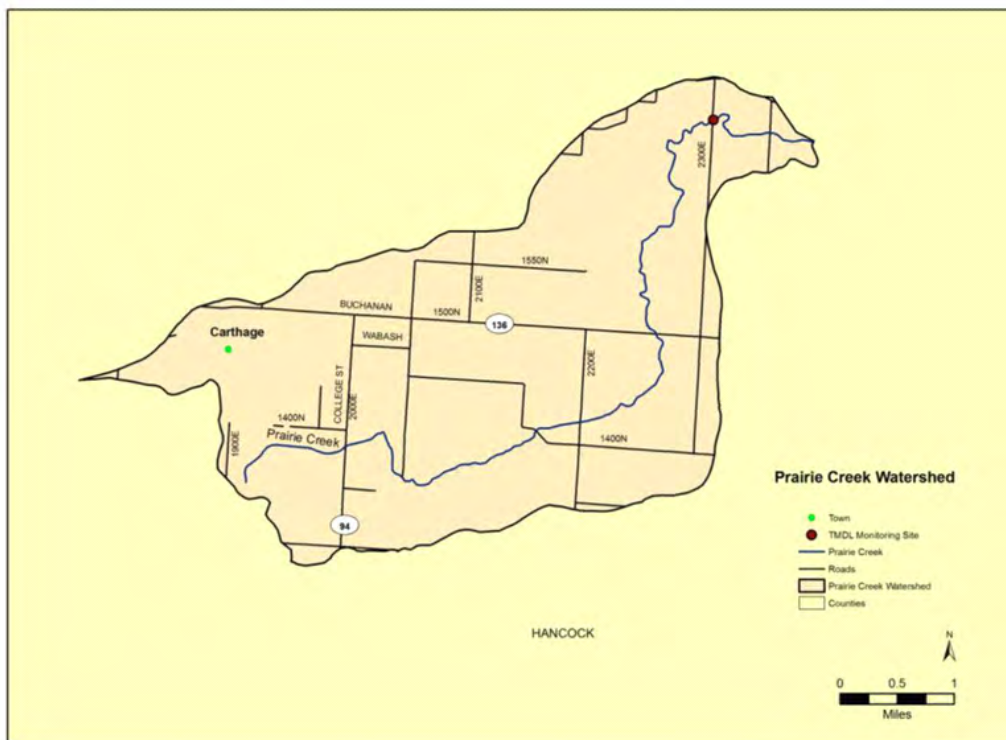
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IEPA/BOW/10-002

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# PRAIRIE CREEK WATERSHED TMDL REPORT

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Load Reduction  
Strategy and TMDL  
Final Approved Report

Indian Creek, Dago Slough and Prairie Creek

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

12/ 16/ 2010

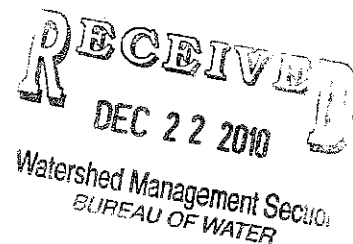


UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 5  
77 WEST JACKSON BOULEVARD  
CHICAGO, IL 60604-3590

DEC 16 2010

REPLY TO THE ATTENTION OF:  
WW-16J

Marcia Willhite, Chief  
Bureau of Water  
Illinois Environmental Protection Agency  
P.O. Box 19276  
Springfield, Illinois 62794-9276



Dear Ms. Willhite:

The U.S. Environmental Protection Agency has conducted a complete review of the final Total Maximum Daily Load (TMDL), including supporting documentation and follow up information, for the Prairie Creek Watershed. The watershed is located in western Illinois, in Hancock County. The TMDL addresses the Aquatic Life Use impairment due to excessive manganese.

The TMDL meets the requirements of Section 303(d) of the Clean Water Act and EPA's implementing regulations at 40 C.F.R. Part 130. Therefore, EPA hereby approves Illinois' one TMDL for manganese for the Prairie Creek Watershed. The statutory and regulatory requirements, and EPA's review of Illinois's compliance with each requirement, are described in the enclosed decision document.

We wish to acknowledge Illinois' effort in submitting this TMDL and look forward to future TMDL submissions by the State of Illinois. If you have any questions, please contact Mr. Peter Swenson, Chief of the Watersheds and Wetlands Branch at 312-886-0236.

Sincerely,

A handwritten signature in black ink that reads "Tinka G. Hyde".

Tinka G. Hyde  
Director, Water Division

Enclosure

cc: Amy Walkenbach, IEPA  
Trevor Sample, IEPA

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## Executive Summary

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This report contains a Total Maximum Daily Load (TMDL) allocation for manganese and a Load Reduction Strategy (LRS) for phosphorus and total suspended solids. TMDLs include allocations for both nonpoint and point sources. Illinois EPA applies TMDLs towards those parameters with numeric water quality standards, which have been adopted by the Illinois Pollution Control Board. LRSs are based on targets for the watershed and focus on nonpoint source controls. The reason for this is that the pollutants in question (Total Suspended Solids (TSS) and Total Phosphorous (P)) do not currently have a numerical standard in place. In the case of Phosphorous, a state standard does exist for lakes, however, Indian Creek, Dago Slough, and Prairie Creek are small streams and therefore a P standard does not exist. Recent water quality sampling showed one exceedence of the Mn standard by 0.01mg/l; a TMDL will be developed for Mn. We have still approached this project as a traditional TMDL but will refer to it as a Load Reduction Strategy (LRS) for P and TSS.

A LRS for Total Suspended Solids (TSS) and Total Phosphorous (P) has been developed for Prairie Creek in Hancock Co and Indian Creek and Dago Slough in Knox/Henderson Co. A TMDL for Mn has been developed for Prairie Creek. This report presents an estimate of TSS, P, and Mn loads in the target watersheds, nutrient and sediment loading sources and an Implementation Plan outlining strategies and specific Best Management Practices needed to obtain water quality targets or meet load reductions targets.

This project goes above and beyond the requirements of the TMDL process and includes more specific implementation plans as required by local watershed plans through the Illinois EPA 319 nonpoint source program. A few of the benefits from this study include:

- ✚ Providing more meaningful interaction with watershed stakeholders; a focus on one-on-one landowner contact and immediate project implementation
- ✚ Addressing and collecting data commonly left out of traditional TMDL's such as the location and severity/impact of livestock pasture operations, quantities of gully and streambank erosion
- ✚ Providing simplified modeling approaches to reach endpoints while focusing more time and effort on the identification of site specific watershed treatment options
- ✚ Focusing implementation directly on Non-point Source Pollution (NPS).

A LRS/TMDL has been prepared because of a determination that aquatic life use support is or was impaired in all three waterbodies according to the 2006 and 2008 IEPA 303(d) list. The 303(d) listings are based on Facility Related Stream Survey Reports conducted in the late 80's and 90's. The City of Carthage is the only permitted point source discharge in Prairie Creek. The Carthage Municipal Wastewater Treatment Plant stream survey was conducted in 1988 and includes data from 5 sampling sites over 4 months representing between two and four sample events. Data indicated very high levels of total P across samples, relatively high levels of TSS and on two instances at one sample location, a minor violation in the Mn standard.

The Abingdon Plant stream survey was conducted in 1983 and 1995 and found no numeric water quality violations. It is important to note that this report was written before P and TSS guidelines for listing causes were developed; according to today's guidelines, water quality violations did exist. The City of Abingdon is the only permitted point source discharge in the Indian/Dago watershed. Both facility reports found P to be above the recommended target near the treatment plant outfall and decreasing downstream; three of the six sample locations recorded P levels above recommended targets in 1995 and two of the three in 1983. Total Suspended Sediment samples in 1995 (not analyzed in 1983) were relatively low in Dago but spiked in Indian Creek above recommended targets. Similar surveys conducted in 1971 indicate moderate impairments in water quality. Biological data also supported these conclusions. Total P levels across sampling locations and times showed relatively high levels above recommended targets.



Abingdon Wastewater Outfall

To supplement existing information, water chemistry and flow data was collected for this project starting in April of 2009 and occurring through April 30 of 2010. Staff gauges were installed at two of the three locations and automatic samplers set up on Indian and Prairie Creek. Over thirty additional samples were collected across various flows. Results for samples taken during this time show:

- ✚ TSS and P exceed targets in all watersheds over various flows

Based on the implementation focus of this project, a series of less complex models were used to determine pollutant loadings and calculate load reductions and load reduction targets. The flow/load duration approach was utilized to develop the LRS/TMDL and a modified common spreadsheet tool was used to calculate pollutant loadings and

implemented with GIS to estimate upland nutrient and sediment loadings from contributing land. This modified approach utilizes field-verified values and therefore more accurately represents “real” conditions. For example, site specific cover factors (C factors) were used in the development of a Sheet and Rill Erosion Model. Unique drainage areas were delineated for each existing Best Management Practice (BMP) as well as proposed BMP’s and the condition of pasture was verified in the field and model values calibrated accordingly. Where landowner permission was given, gully erosion was measured and actual BMP locations were identified. The implementation plan provides site specific BMP locations, associated costs the additional resources needed to get practices on the ground and meet water quality targets. The implementation plan also estimates the expected load reductions from field verified BMPs. This information can be used by local stakeholders to begin immediate implementation.

Indian Creek



## 1. Introduction

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A Total Maximum Daily Load, or TMDL, is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. TMDLs are a requirement of Section 303(d) of the Clean Water Act (CWA). In general, a TMDL is a quantitative assessment of water quality impairments, contributing sources, and pollutant reductions needed to attain water quality standards. The TMDL specifies the amount of pollutant or other stressor that needs to be reduced to meet water quality standards, allocates pollutant control or management responsibilities among sources in a watershed, and provides a scientific and policy basis for taking actions needed to restore a water body.

An opportunity currently exists to enhance the current watershed planning process by simplifying the approach to modeling, meaningfully engaging stakeholders, and adding detailed implementation planning and project identification to the process. As mentioned above, this new process is called a Load Reduction Strategy rather than a TMDL. This new approach can offer cost savings and allow local stakeholders to benefit immediately without the need for additional planning. This project addresses this by using acceptable models to calculate a non-traditional TMDL for pollutants without state numeric water quality standards and common sense planning to identify project locations, Best Management Practices, and expected load reductions. Furthermore, this project is an example of how to apply the Load Reduction Strategy to those pollutants that currently do not have associated state numeric water quality standards: Total Phosphorous and Total Suspended Solids concentrations in streams and rivers.

This report will summarize watershed characteristics and highlight data showing current watershed pollutant loading, expected load reductions from site specific Best Management Practice implementation (Implementation Plan), and provide numeric goals for reducing Phosphorous and Sediment.

Both Prairie Creek and Indian/Dago fall within well-defined, twelve digit, hydrologic units (HUC 12) or watersheds. The focus of this report and all load reduction estimates and targets, as well as implementation strategies, will apply to only those drainage areas or watersheds above the established sampling sites. The remaining HUC 12 areas will also be assessed but to a lesser extent.

Figure 1 - Indian Creek/Dago Slough Watershed and Sample Sites

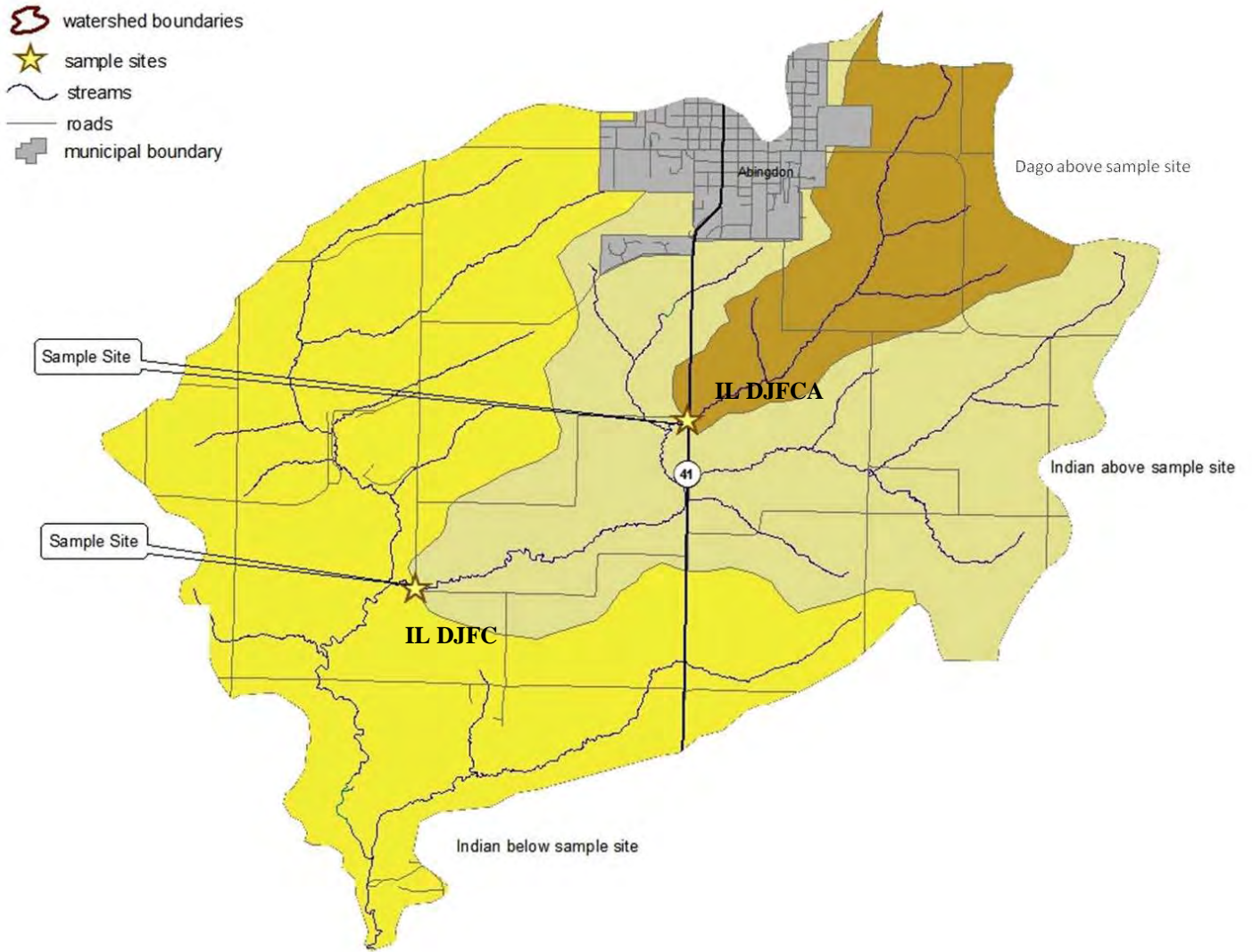
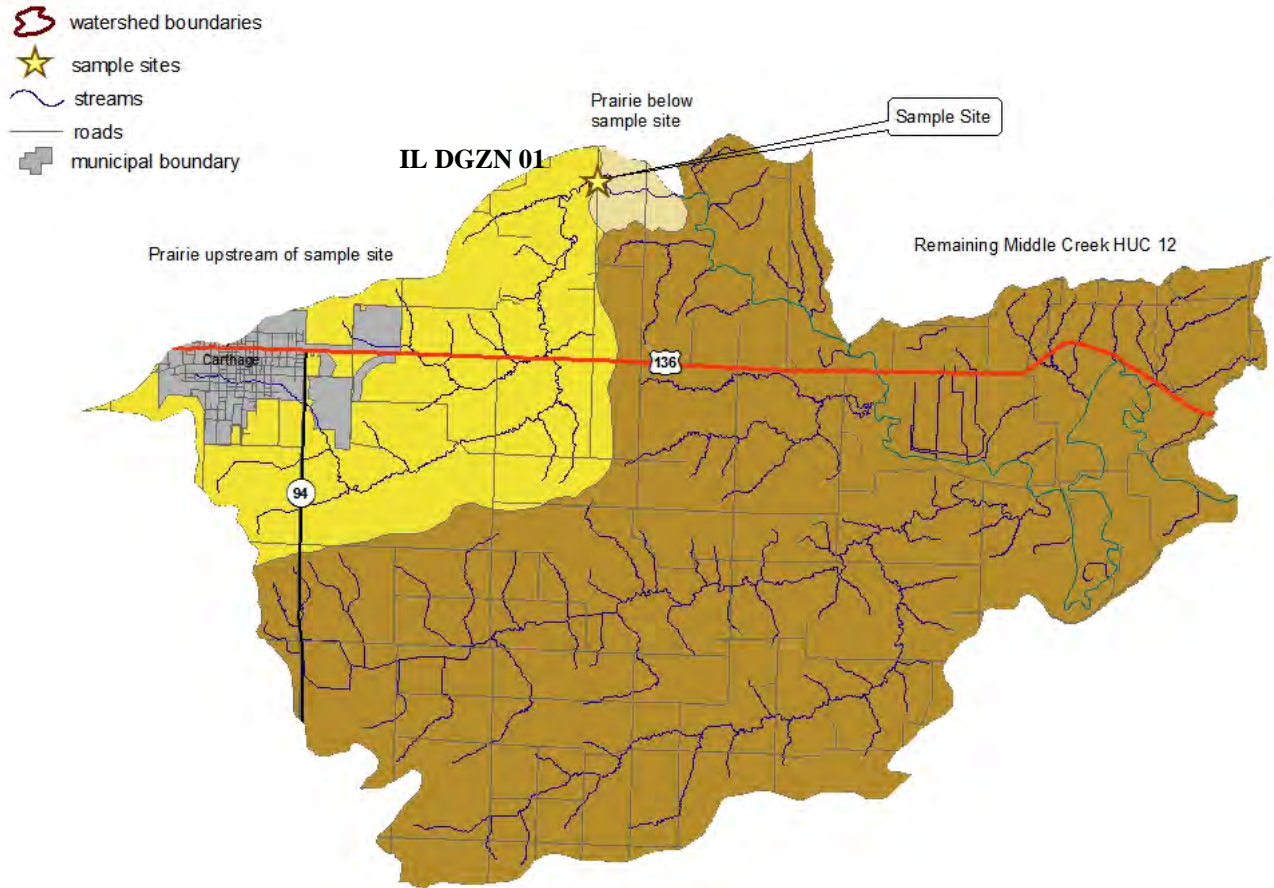
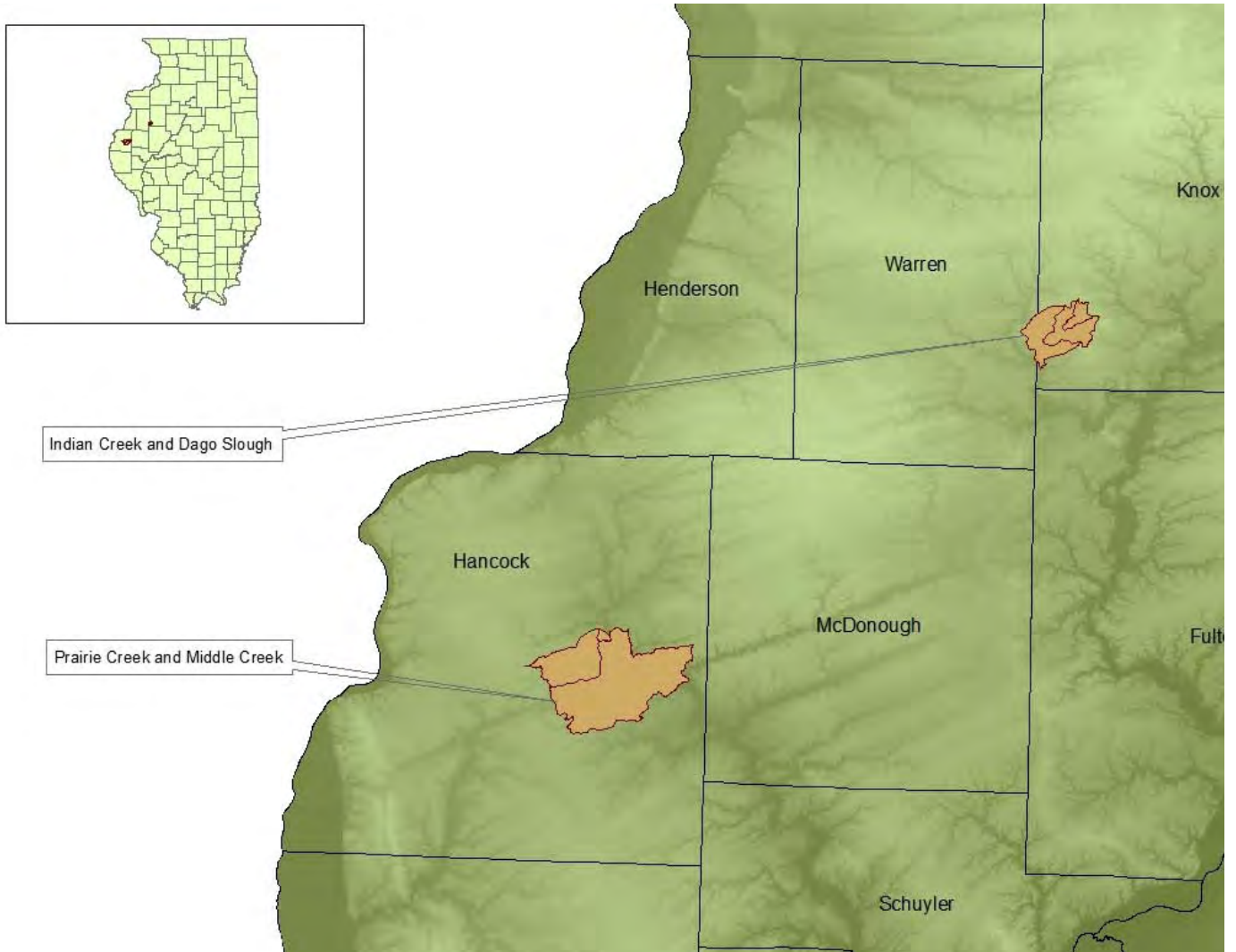




Figure 2 - Prairie Creek/Middle Creek Watershed and Sample Sites



*Figure 3 - Locations of Project Watersheds in the State*



The following table summarizes what will be evaluated for each watershed area; above sample sites and remaining HUC 12:

**Table 1 - Prairie/Middle Creek Watershed Evaluation Table**

Assessments	Prairie above sample site	Prairie below sample site	Remaining HUC 12 – Middle Creek
TMDL or Load Reduction Strategy	X		
Water Quality Data; Summary of Results	X		
Implementation Strategy; Site Specific BMP's and load reductions	X		
Upland Nutrient and Sediment Loading	X	X	X
Current Load Reductions from Existing BMP's	X	X	X
Watershed Characterization	X	X	X
One-On-One Landowner Contact	X		<i>if possible</i>

**Table 2 - Indian/ Dago Slough Watershed Evaluation Table**

Assessments	Dago Above Sample Site	Indian Above Sample Site	Remaining HUC 12 – Indian Creek Below Sample Site
TMDL or Load Reduction Strategy	X	X	
Water Quality Data; Summary of Results	X	X	
Implementation Strategy; Site Specific BMP's and load reductions	X	X	
Upland Nutrient and Sediment Loading	X	X	X
Current Load Reductions from Existing BMP's	X	X	X
Watershed Characterization	X	X	X
One-On-One Landowner Contact	X	X	<i>if possible</i>

## 2. Watershed Summary and Problem Statement

### *Prairie Creek / Middle Creek*

Prairie Creek (HUC 071300100702) is in the La Moine River Basin. This HUC 12 watershed also includes Middle and Little Creek. The Prairie, Middle and Little Creek watersheds are 35,354 acres or 55.32 square miles located in Hancock County, Illinois. The Prairie Creek Watershed itself makes up a portion of this HUC 12 and contains 8,372 acres of drainage or 13.12 square miles with 42% of the land area in agriculture.

*Table 3 - Prairie Creek Watershed Area*

Watershed Description	Area (acres)	Area (square miles)
Prairie Creek above sample site	7,977	12.5
Prairie Creek below sample site	395	0.62
Middle Creek and Little Creek; remaining HUC 12 watershed	26,982	42.2
<b>TOTAL</b>	<b>35,354</b>	<b>55.32</b>

The southern half of the city of Carthage is located in the upper portion of the Prairie Creek watershed. The city of Carthage waste processing facility discharges directly into the headwaters of Prairie Creek. Prairie Creek has been listed on the Illinois Environmental Protection Agency (IEPA) 303(d) List from 2004 through 2008. Prairie Creek is not unlike many streams in Illinois with pollutants such as Phosphorous, Total Suspended Solids and Manganese.

The following table shows the current pollutants, potential causes and for Prairie Creek. Prairie Creek is classified as medium priority according to the 2008 303(d) List.

*Table 4 - Impairment Information for Prairie Creek*

Segment ID	HUC 10	Waterbody Name	Miles / Acres	Designated Use	Potential Causes
IL_DGZ N-01	0713001007	Prairie Creek	8.81	Aquatic Life	Manganese, Phosphorus (Total), Total Suspended Solids (TSS)

***Indian Creek / Dago Slough***

Dago Slough and Indian Creek drain a total of 10,432 acres or 16.5 square miles and are located in Knox and a small portion of Eastern Warren County. The southern half of the city of Abingdon is situated in the upper Dago Slough watershed. Dago Slough is a sub-watershed of Indian Creek (HUC 071300050905). Indian Creek is a sub-watershed of Cedar Creek which is in the larger Spoon River Basin. Indian Creek and Dago Slough have been listed on the 303d list since 2006. The Indian Creek watershed is 87% agricultural and receives municipal point source discharge from Dago.

***Table 5 - Indian Creek/ Dago Slough Watershed Area***


<b>Watershed Description</b>	<b>Area (acres)</b>	<b>Area (square miles)</b>
<b>Dago Slough above sample site</b>	1,303	2.04
<b>Indian Creek above sample site</b>	3,955	6.18
<b>Indian Creek; remaining HUC 12 watershed below sample site</b>	5,174	8.08
<b>TOTAL</b>	<b>10,432</b>	<b>16.3</b>

The following table shows the current pollutants, potential causes and for Indian Creek and Dago Slough. Indian Creek and Dago Slough are classified as medium priority according to the 2008 303(d) List.

***Table 6 - Impairment information for Indian Creek and Dago Slough***

<b>Segment ID</b>	<b>HUC 10 Cedar Creek</b>	<b>Waterbody Name</b>	<b>Miles / Acres</b>	<b>Designated Use</b>	<b>Potential Causes</b>
IL_DJFC	0713000509	Indian Creek	8.13	Aquatic Life	Phosphorus (Total), Sedimentation/Siltation, Total Suspended Solids (TSS)
IL_DJFCA	0713000509	Dago Slough	3.23	Aquatic Life	Phosphorus (Total), Sedimentation/Siltation

The Load Reduction Strategy (LRS) for the segments listed above will specify the following elements:

-  Target Load (TL) or the maximum amount of pollutant loading a water body can receive without violating recommended pollutant targets

These elements are combined into the following equation:

$$\text{LRS} = \text{TL} = \Sigma \text{TL}$$

It is important to note that unlike a TMDL, a LRS does not include Waste Load Allocations (WLA) or a Margin of Safety (MOS). The focus of a LRS is to provide targets or reductions for Non-Point Source Pollution (NPS) and therefore WLAs and a MOS has been excluded.

The TMDL for Prairie Creek (Manganese) listed above will specify the following elements:

- ✚ Loading Capacity (LC) or the maximum amount of pollutant loading a water body can receive without violating recommended pollutant targets
- ✚ Waste Load Allocation (WLA) or the portion of the TMDL allocated to existing or future point sources
- ✚ Load Allocation (LA) or the portion of the TMDL allocated to existing or future nonpoint sources and natural background
- ✚ Margin of Safety (MOS) or an accounting of uncertainty about the relationship between pollutant loads and receiving water quality

These elements are combined into the following equation:

$$\text{TMDL} = \text{LC} = \Sigma \text{WLA} + \Sigma \text{LA} + \text{MOS}$$

An implicit MOS or an accounting of uncertainty about the relationship between pollutant loads and receiving water quality will be included in the TMDL for Manganese.




The LRS developed also takes into account the seasonal variability of pollutant loads so that water quality standards are met during all seasons of the year. Reasonable assurances that the load reduction targets will be achieved are described in a section on Best Management Plan recommendations. This section also will describe how water quality end points will be attained; it will include site-specific recommendations for implementing BMPs, and a basic estimation of cost.

### 3. Water Quality Targets

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Water quality standards are maximum levels of individual constituents or water quality characteristics, or descriptions of conditions of a water body that, if met, will generally protect the designated uses of the water. Narrative water quality standards describe conditions necessary for the water body to attain its designated use. Illinois water quality standards are written to apply at all times when flows are equal to or greater than the minimum mean seven consecutive day drought flow with a 10-year return frequency.

The only official promulgated numeric water quality standard that can be applied is Manganese in Prairie Creek. As previously noted, two instances occurred in 1988 where the manganese (Mn) standard of 1.0 mg/L was exceeded. All three watersheds have been classified as “impaired” as a result of Phosphorous (P) and Total Suspended Solids (TSS). Although there are no numeric standards for P and TSS in streams, we have assigned recommended targets and calculated watershed loadings for these pollutants. As a result of recent sampling for Mn, it was found that only one single sample event exceeded the 1.0 mg/L (a result of 1.01mg/L) standard so a TMDL was completed for Mn; this report will focus more on P and TSS. The following are the water quality targets used for Mn, P and TSS:

-  **Manganese – 1.0mg/L**
-  **Total Phosphorous – 0.61mg/L**
-  **Total Suspended Solids – 116mg/L**

Total P and TSS targets were chosen based on recommended targets provided by the Illinois EPA; Manganese is based on the state numeric water quality standard.

## 4. Water Quality

This section summarizes historical and current water quality data. As noted previously, stream impairments for Indian, Dago, and Prairie were based on facility reports developed in the late 1980's and 1990's. Each watershed has one permitted point source discharge. Since historical data was limited, approximately one year of additional sampling was conducted. See Appendix D, Monitoring Strategy for more information on the sampling that was conducted.

### 4.1 Historical Water Quality Data

#### 4.1.2 Indian Creek and Dago Slough

*Table 7 - Summary of 1985 Facility Report – samples from July 14, 1983, City of Abingdon*

Site (upstream to downstream)	MBI	P (mg/L)	TSS (mg/L)
A-1 (above plant)	8.2 (poor)	0.16	N/A
C-1 (Dago)	7.1 (poor)	2.2*	N/A
C-2 (Indian)	4.1 (moderate)	1.7*	N/A

\*above project target levels

*Table 8 - Summary of 1989 Supplementary Data – samples from May-22, 1989, City of Abingdon*

Site (upstream to downstream)	MBI	P (mg/L)	TSS (mg/L)
A-1 (above plant)	N/A	N/A	N/A
E-1 (at STP outfall)	N/A	3.4*	N/A
C-1 (Dago)	N/A	3.4*	N/A
C-2 (Dago)	N/A	2.7*	N/A
D-1 (Indian above Dago)	N/A	0.96*	N/A
C-3 (Indian)	N/A	1.8*	N/A

\*above project target levels

*Table 9 - Summary of 1995 Facility Report – samples from June 21-22, 1995, City of Abingdon*

Site (upstream to downstream)	MBI	P (mg/L)	TSS (mg/L)
A-1 (above plant)	6.7	0.05	18
E-1 (at STP outfall)	N/A	1.5*	4
C-1 (Dago)	6.4	0.74*	54
C-2 (Dago)	6.8	0.65*	88
D-1 (Indian above Dago)	5.9	0.12	94
C-3 (Indian)	6.1	0.45	288*

\*above project target levels



This 1995 facility report notes that approximately two miles of Dago Slough was impacted by the Abingdon sewage treatment plant with conditions improving downstream and into Indian Creek. In 1995 a slight impact downstream of the plant was noted but “no water quality violations were noted.” It is important to note that this report was written before P and TSS guidelines for listing causes were developed; according to today’s guidelines, water quality violations did exist.

#### 4.1.3 Prairie Creek

**Table 10 - Summary of Facility Report – June 23 1988, City of Carthage**

Site (upstream to downstream)	Mn (mg/L)	P (mg/L)	TSS (mg/L)
A-1(above plant)	DRY	DRY	DRY
E-1 (at STP outfall)	0.175	5.0*	94
C-1	0.190	4.8*	92
C-2	0.471	5.5*	92
C-3	0.756	3.0*	70
C-4 (Prairie hwy 136)	2.137*	2.6*	28

**Table 11 - Summary of Facility Report – August 22 1988, City of Carthage**

Site (upstream to downstream)	Mn (mg/L)	P (mg/L)	TSS (mg/L)
A-1(above plant)	0.420	0.98*	12
E-1 (at STP outfall)	0.313	4.1*	51
C-1	0.372	1.4*	246*
C-2	0.337	1.6*	30
C-3	DRY	DRY	DRY
C-4 (Prairie hwy 136)	DRY	DRY	DRY

**Table 12 - Summary of Facility Report – October 27 1988, City of Carthage**

Site (upstream to downstream)	Mn (mg/L)	P (mg/L)	TSS (mg/L)
A-1(above plant)	DRY	DRY	DRY
E-1 (at STP outfall)	0.133	7.6*	50
C-1	N/A	N/A	N/A
C-2	.208	6*	152*
C-3	1.146*	6.9*	164*
C-4 (Prairie hwy 136)	.493	4.3*	24

Although not specifically noted in the 1988 report, Total Phosphorous levels significantly exceeded the 0.61mg/l target over the majority of samples. TSS targets were also exceeded in three samples. Two samples exceeded Manganese standards. The year these samples were taken was a drought year and likely had a strong influence on results.

## 4.2 Additional Data and Recent Sample Results

The following tables and graphs show water quality results for this project at each of the designated sample sites. Red labels on the graphs represent exceedences in the water quality standards or targets.

### 4.2.1 Prairie Creek Station Id IL DGZN 01

**Table 13 - Prairie Total Mn Sample Results**

Discharge	Sample	Type	mg/L
cfs	Date	Analysis	Result
	8/4/2009	Manganese	0.245
	8/17/2009	Manganese	0.186
<b>3.06</b>	8/31/2009	Manganese	0.128
<b>0.97</b>	9/29/2009	Manganese	0.0639
	10/2/2009	Manganese	0.0585
	10/14/2009	Manganese	0.142
	10/23/2009	Manganese	0.268
	10/26/2009	Manganese	0.12
	10/30/2009	Manganese	0.18
<b>8.90</b>	11/3/2009	Manganese	0.176
	11/17/2009	Manganese	0.148
<b>2.02</b>	11/30/2009	Manganese	0.153
	12/22/2009	Manganese	0.266
<b>16.99</b>	1/27/2010	Manganese	0.185
	2/25/2010	Manganese	0.355
	3/25/2010	Manganese	0.107
<b>64.60</b>	4/3/2010	Manganese	0.512
	4/7/2010	Manganese	0.154
	4/24/2010	Manganese	0.8125*
	4/25/2010	Manganese	0.267
<b>16.21</b>	4/25/2010	Manganese	0.103
	Average		0.247

*One sample on 4/24/2010 was 1.01mg/l*

*\*represents average from multiple samples on that date*

**Table 14 - Prairie Total P sample Results**

Discharge	Sample	Type	mg/L
cfs	Date	Analysis	Result
	4/20/2009	P	0.239
<b>1091.58</b>	4/30/2009	P	1.17
	6/16/2009	P	0.742
	8/4/2009	P	1.0
	8/17/2009	P	0.791
<b>3.06</b>	8/31/2009	P	0.408
<b>0.97</b>	9/29/2009	P	0.206
	10/2/2009	P	0.272
	10/14/2009	P	0.261
	10/23/2009	P	0.568
	10/26/2009	P	0.539
	10/30/2009	P	0.543
<b>8.90</b>	11/3/2009	P	0.198
	11/17/2009	P	0.615
<b>2.02</b>	11/30/2009	P	0.273
	12/22/2009	P	0.204
<b>16.99</b>	1/27/2010	P	0.352
	2/25/2010	P	0.207
	3/25/2010	P	0.334
<b>64.60</b>	4/3/2010	P	1.32
	4/7/2010	P	0.533
	4/24/2010	P	1.025*
	4/25/2010	P	0.821
<b>16.21</b>	4/25/2010	P	0.314
	Average		0.5584

Only one Manganese sample violated the standard\*. Total Phosphorous is relatively low, except during high flow events.

This result represents the average of multiple samples on that day. One of the samples exceeded the standard. The result for that one sample was 1.01 mg/l

Figure 4 - Prairie Creek Manganese Results

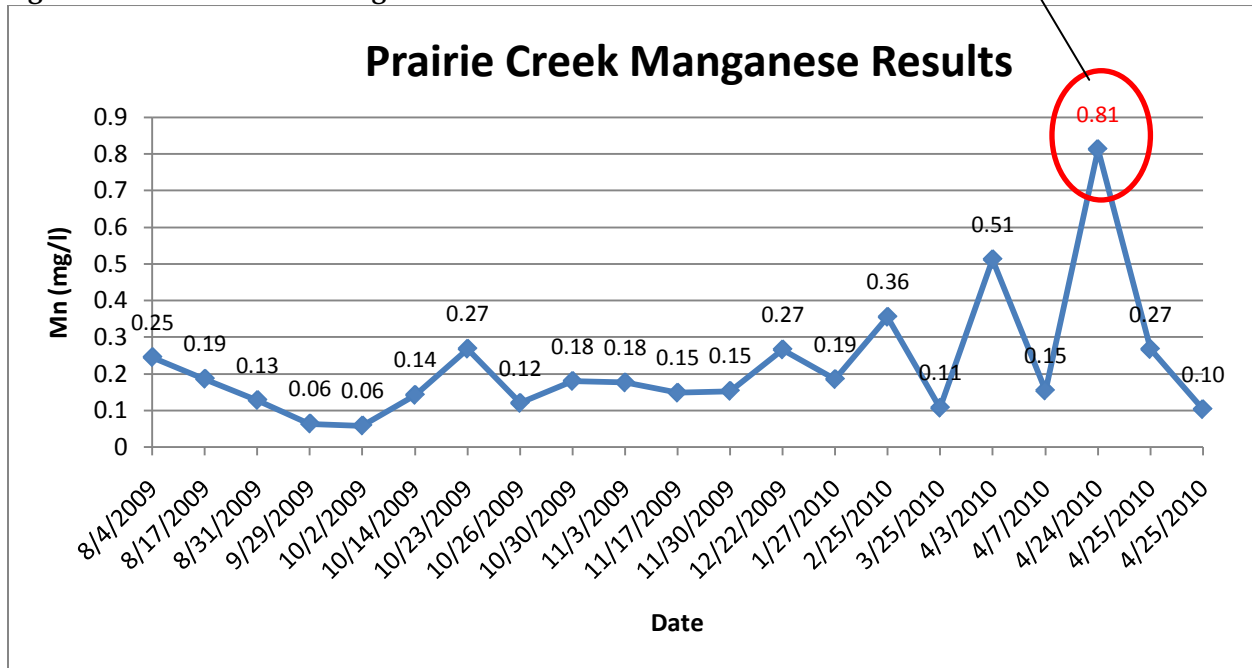
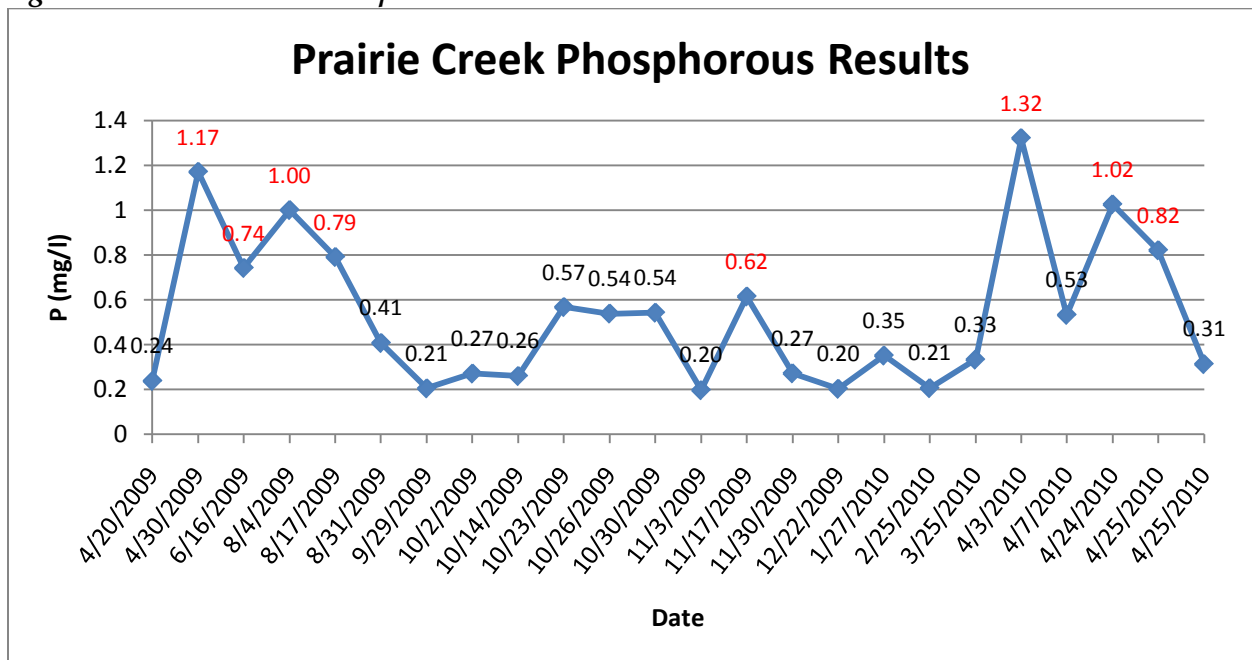


Figure 5 - Prairie Creek Phosphorous Results



**Table 15 - Prairie TSS Sample Results**

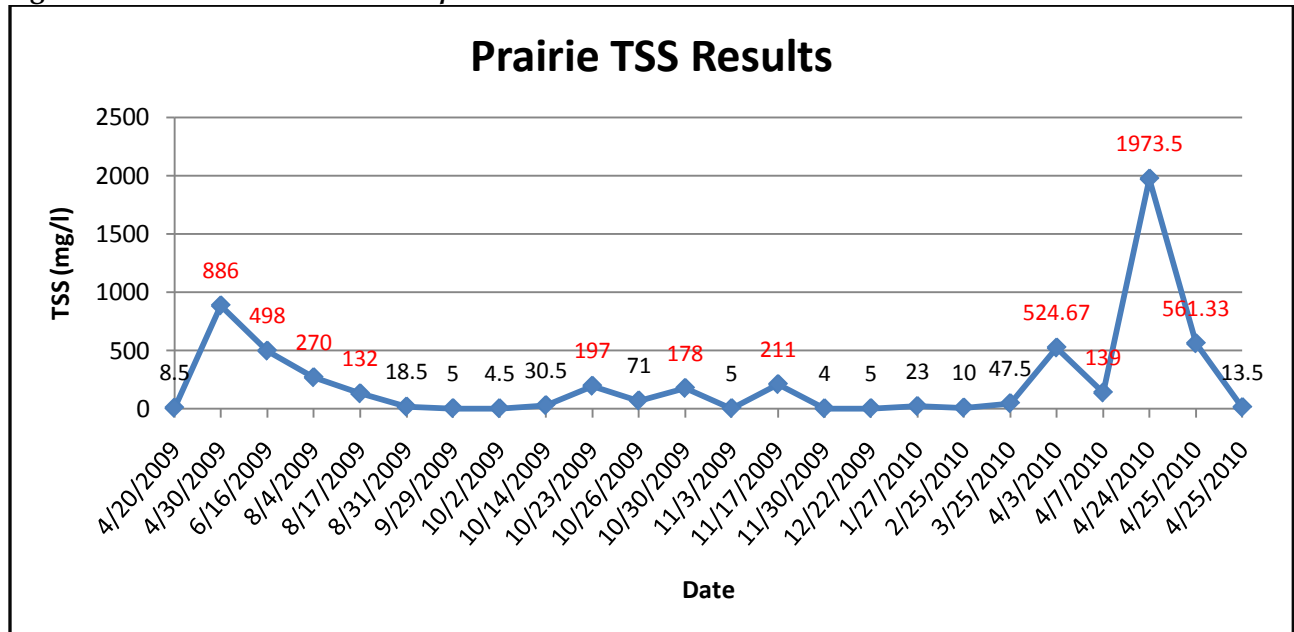
Discharge	Sample	Type	mg/L
cfs	Date	Analysis	Result
	4/20/2009	TSS	8.5
<b>1091.58</b>	4/30/2009	TSS	886
	6/16/2009	TSS	498
	8/4/2009	TSS	270.0
	8/17/2009	TSS	132.0
<b>3.06</b>	8/31/2009	TSS	18.5
<b>0.97</b>	9/29/2009	TSS	5.0
	10/2/2009	TSS	4.5
	10/14/2009	TSS	30.5
	10/23/2009	TSS	197.0
	10/26/2009	TSS	71.0
	10/30/2009	TSS	178.0
<b>8.90</b>	11/3/2009	TSS	5.0
	11/17/2009	TSS	211.0
<b>2.02</b>	11/30/2009	TSS	4.0
	12/22/2009	TSS	5.0
<b>16.99</b>	1/27/2010	TSS	23
	2/25/2010	TSS	10
	3/25/2010	TSS	47.5
<b>64.60</b>	4/3/2010	TSS	524.67*
	4/7/2010	TSS	139
	4/24/2010	TSS	1973.5*
	4/25/2010	TSS	561.33*
<b>16.21</b>	4/25/2010	TSS	13.5
	<b>Average</b>		<b>242.35</b>

Total Suspended Solids increase with increased flows but do remain high even during some lower flow events.



\*represents average from multiple samples on that date

**Figure 6 - Prairie Creek Total Suspended Solids Results**



4.2.2 Indian Creek Station ID IL DJFC

Table 16 - Indian Creek P Sample Results

Discharge	Sample	Type	mg/L
cfs	Date	Analysis	Result
	4/20/2009	P	0.358
<b>120.98</b>	4/30/2009	P	1.22
	8/4/2009	P	1.23
	8/17/2009	P	1.22
<b>130.78</b>	8/19/2009	P	2.16
	8/20/2009	P	0.462
	8/28/2009	P	0.612
<b>3.49</b>	8/31/2009	P	0.3
<b>0.34</b>	9/29/2009	P	0.58
	10/2/2009	P	0.607
<b>22.56</b>	10/23/2009	P	0.584
<b>121.43</b>	10/30/2009	P	1.09
<b>10.2</b>	11/3/2009	P	0.24
	11/17/2009	P	1.61
<b>10.28</b>	11/30/2009	P	0.168
<b>9.03</b>	12/22/2009	P	0.224
<b>91.755*</b>	1/23/2010	P	1.27*
<b>229.27*</b>	1/24/2010	P	0.32*
<b>16.99</b>	1/27/2010	P	0.188
<b>12.37</b>	2/25/2010	P	0.261
<b>23.10</b>	3/25/2010	P	0.158
<b>65.5*</b>	4/7/2010	P	1
<b>66.84</b>	4/24/2010	P	1.3
<b>15.78</b>	4/29/2010	P	0.165
	<b>Average</b>		<b>0.715</b>

Table 17 - Indian Creek TSS Sample Results

Discharge	Sample	Type	mg/L
cfs	Date	Analysis	Result
	4/20/2009	TSS	197
<b>120.98</b>	4/30/2009	TSS	1140
<b>4.98</b>	7/27/2009	TSS	46.0
	8/4/2009	TSS	700.0
	8/17/2009	TSS	529.0
<b>130.78</b>	8/19/2009	TSS	2400.0
	8/20/2009	TSS	183.0
	8/28/2009	TSS	188.0
<b>3.49</b>	8/31/2009	TSS	16.0
<b>0.34</b>	9/29/2009	TSS	46.0
	10/2/2009	TSS	77.5
<b>22.56</b>	10/23/2009	TSS	111.0
<b>121.43</b>	10/30/2009	TSS	556.0
<b>10.2</b>	11/3/2009	TSS	22.5
	11/17/2009	TSS	680.0
<b>10.28</b>	11/30/2009	TSS	17.0
<b>9.03</b>	12/22/2009	TSS	13.0
<b>186.60*</b>	12/24/2009	TSS	1489.33*
<b>181.70*</b>	12/25/2009	TSS	606*
<b>91.755*</b>	1/23/2010	TSS	1108.5*
<b>229.27*</b>	1/24/2009	TSS	2052.29*
<b>16.99</b>	1/27/2009	TSS	43.5
<b>12.37</b>	2/25/2010	TSS	28
<b>23.10</b>	3/25/2010	TSS	24.5
<b>65.5*</b>	4/7/2010	TSS	729
<b>66.84</b>	4/24/2010	TSS	1210
<b>15.78</b>	4/29/2010	TSS	14
	<b>Average</b>		<b>526.93</b>

\*represents average from multiple samples on that date

Total Phosphorous is high on average but varies among flows. High P values were recorded during both low and high flows. TSS is very high across almost all samples.

Figure 7 - Indian Creek Phosphorous Results

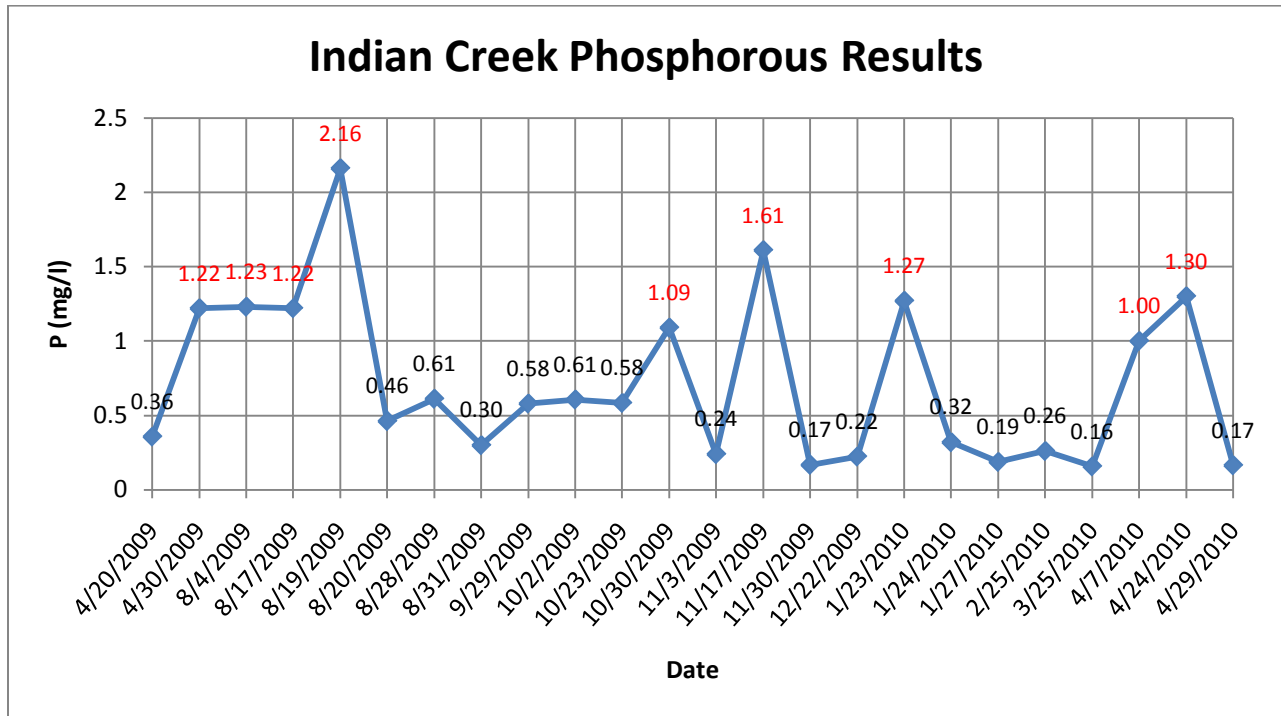
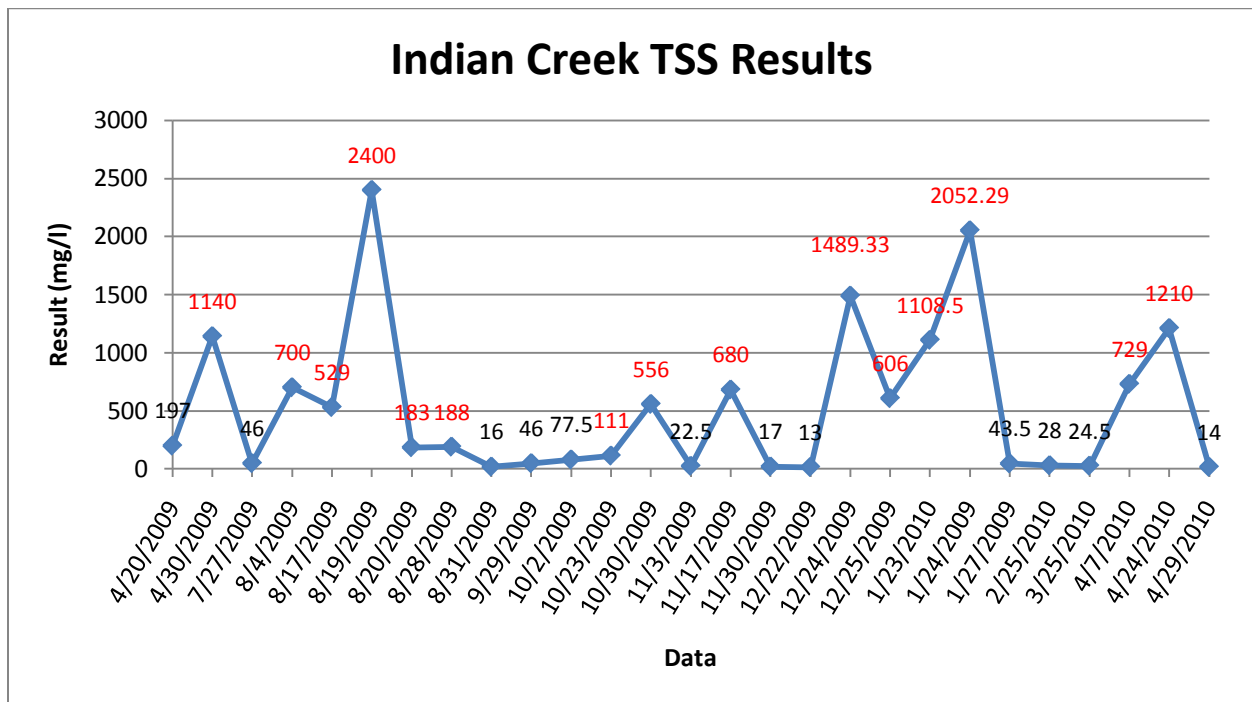


Figure 8 - Indian Creek Total Suspended Solids Results



**4.2.3 Dago Slough Station ID IL DJFCA**

**Table 18 - Dago Slough P Sample Results**

Discharge	Sample	Type	mg/L
cfs	Date	Analysis	Result
	4/20/2009	P	0.28
<b>46.476</b>	4/30/2009	P	0.676
	8/4/2009	P	0.873
	8/17/2009	P	2.57
	8/19/2009	P	0.955
<b>1.66</b>	8/31/2009	P	0.642
	9/29/2009	P	1.28
	10/2/2009	P	1.28
<b>7.35</b>	10/23/2009	P	0.658
<b>24.79</b>	10/30/2009	P	0.648
<b>5.38</b>	11/3/2009	P	0.342
	11/17/2009	P	2.12
<b>5.03</b>	11/30/2009	P	0.372
<b>2.35</b>	12/22/2009	P	0.415
	1/23/2010	P	0.515
	1/24/2010	P	0.436
<b>7.71</b>	1/27/2010	P	0.216
<b>2.39</b>	2/25/2010	P	0.445
	3/25/1010	P	0.288
<b>4.43</b>	4/7/2010	P	0.433
<b>4.26</b>	4/29/2010	<b>P</b>	0.352
<b>Average</b>			<b>0.752</b>

**Table 19 - Dago Slough TSS Sample Results**

Discharge	Sample	Type	mg/L
cfs	Date	Analysis	Result
	2/20/2009	TSS	87
<b>46.476</b>	4/30/2009	TSS	482
<b>2.02</b>	7/27/2009	TSS	16
	8/4/2009	TSS	66
	8/17/2009	TSS	129
	8/19/2009	TSS	268
<b>1.66</b>	8/31/2009	TSS	9.5
	9/29/2009	TSS	9.5
	10/2/2009	TSS	U (undetectable)
<b>7.35</b>	10/23/2009	TSS	41
<b>24.79</b>	10/30/2009	TSS	218
<b>5.38</b>	11/3/2009	TSS	23.5
	11/17/2009	TSS	313
<b>5.03</b>	11/30/2009	TSS	17.0
<b>2.35</b>	12/22/2009	TSS	7.5
	1/23/2010	TSS	178
	1/24/2010	TSS	166
<b>7.71</b>	1/27/2010	TSS	20
<b>2.39</b>	2/25/2010	TSS	U
	3/25/1010	TSS	17.5
<b>4.43</b>	4/7/2010	TSS	147
<b>4.26</b>	4/29/2010	TSS	9.5
<b>Average</b>			<b>101.14</b>

Phosphorous, overall is high. TSS is low compared to the other sample sites. TSS increases with flow.

Figure 9 - Dago Slough Phosphorous Results

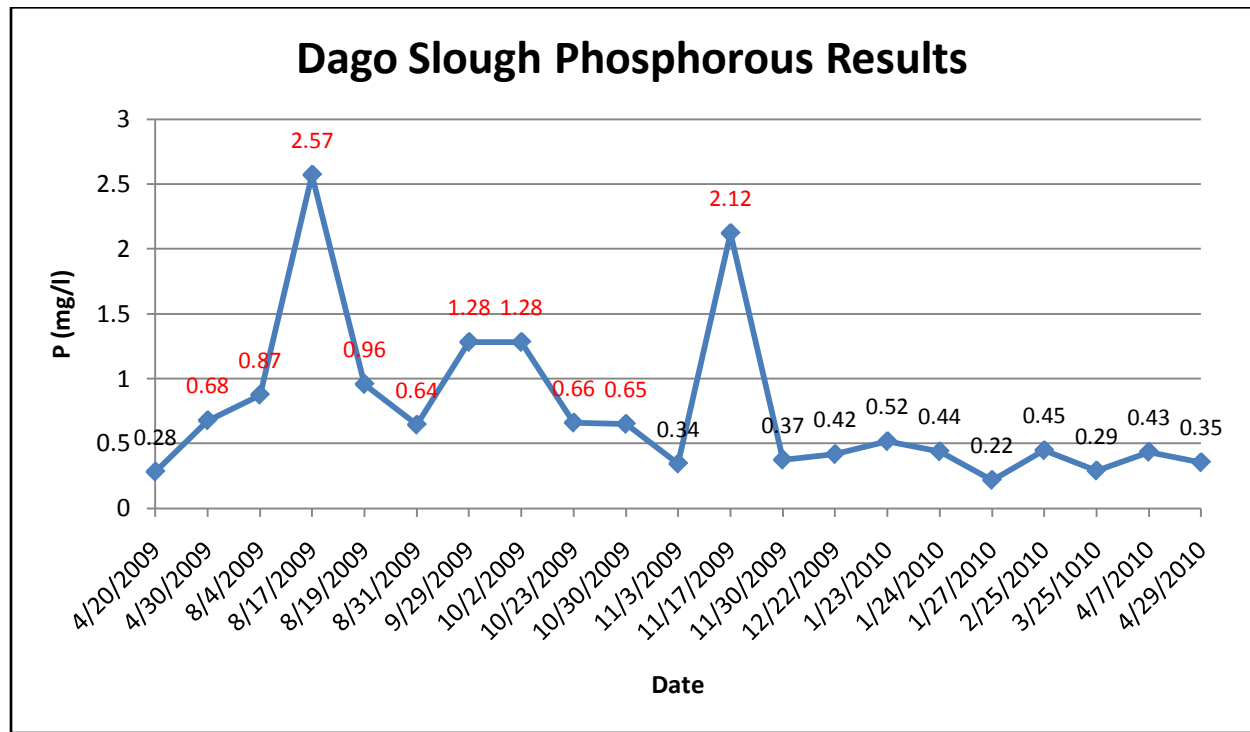
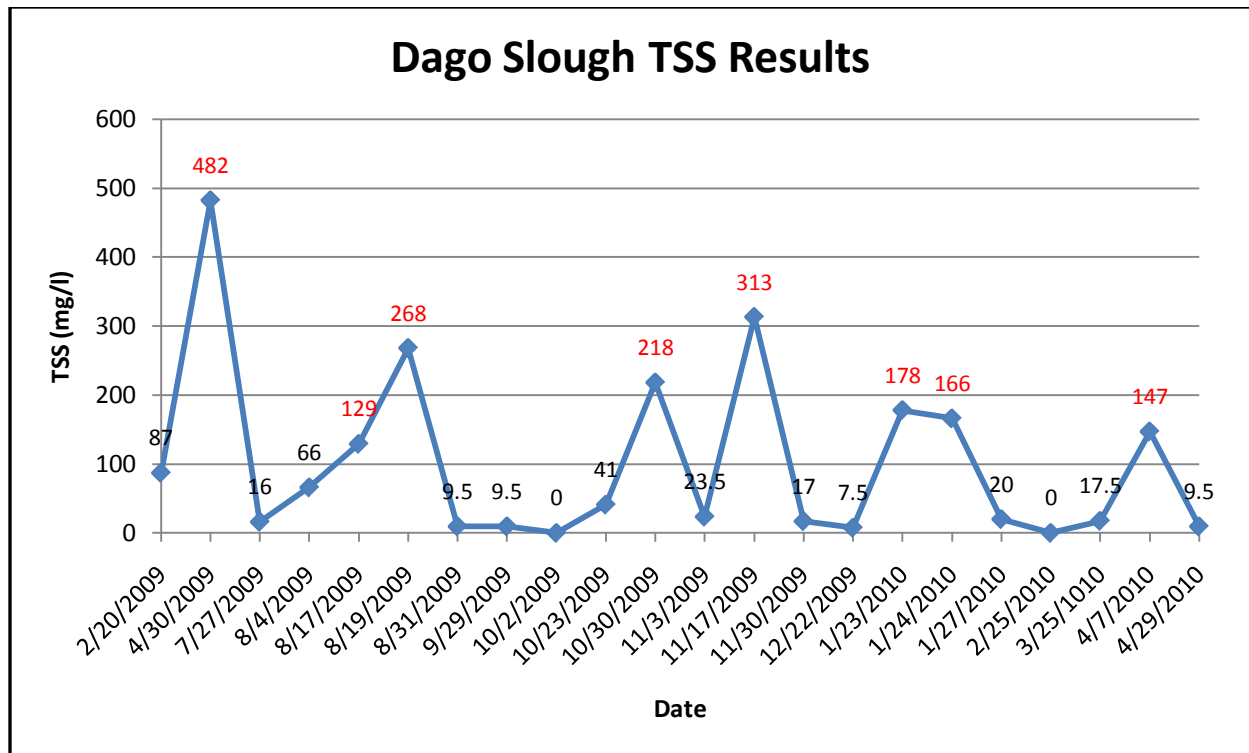


Figure 10 - Dago Slough Total Suspended Solids Results





### 4.3 Sample Results From Point Sources

This section summarizes point source flow and pollutant discharge from the permitted water treatment plants. Each facility was asked to take water samples at their discharge points to assist with this project.

#### 4.3.1 Prairie Creek Carthage Facility Data

Table 20 - Carthage Facility Data

Sample Date	Sample Time	Type	Result (mg/L)	Flow (mg/d)
12/1/2009 Upstream	n/a	P	1.45	.785
12/1/2009 Effluent	n/a	P	2.30	.785
2/3/2010 Upstream	10:15	P	0.25	.350
2/3/2010 Effluent	10:24	P	0.40	.350
2/8/2010 Upstream	13:42	P	0.25	.280
2/8/2010 Effluent	14:00	P	0.70	.280
2/10/2010 Effluent	14:15	P	1.10	.280
1/25/2010 Effluent	n/a	Mn	0.198	n/a

Average P effluent – 1.125

#### 4.3.2 Dago Slough/Indian Creek Abingdon Facility Data

Table 21 - Abingdon Facility Data (effluent only)

Sample Date	Sample Time	Type	Result (mg/L)	Flow (mg/d)
-------------	-------------	------	---------------	-------------

<b>10/23/2009</b>	13:30	P	1	1.14
<b>11/2/2009</b>	10:20	P	0.66	1.78
<b>11/17/2009</b>	10:00	P	0.91	2.14
<b>11/10/2009</b>	10:00	P	0.76	1.07
<b>1/22/2010</b>	14:30	P	1.3	0.95
<b>1/27/2010</b>	14:30	P	0.84	1.94

Average – 0.91

## 5. Watershed Characterization

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### 5.1 Hydrology

The amount of water flowing through a station varies with time of year and is a function of rainfall and runoff. Higher flows typically transport higher volumes of pollutants. The following section describes watershed hydrology and stream flow. When possible, discharge measurements were taken at each sample site when water quality was collected. These discharge measurements were used to calibrate modeled stream flow to develop both the flow duration curves and annual hydrographs. Flow duration curves are based on historical flow information starting in 1945 and annual hydrographs represent a five year period from 2005 to 2009.

Statistical modeling and analysis was performed to develop historical flow data and flow duration curves for Prairie Creek, Indian Creek and Dago Slough. Historical flow data from two USGS gages were compiled: The two gages include:

-  Gage ID 5584500: La Moine River at Colmar, IL
-  Gage ID 5569500: Spoon River at London Mills, IL

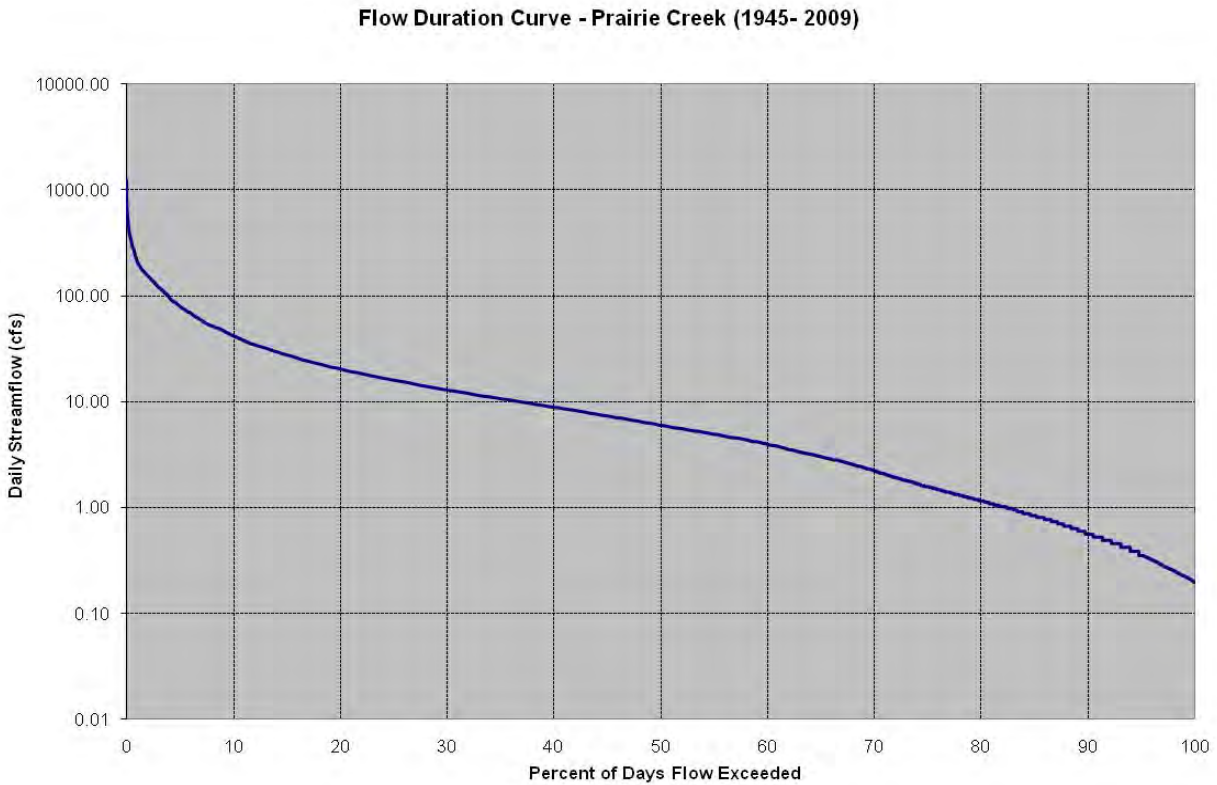
Average daily flow data was compiled for the two gages for the period of 1945 – 2009. An overall average daily flow for each gage (average of all days from 1945 – 2009) was computed and subsequently removed from the 1945 – 2009 dataset to make the dataset “dimensionless”.

The two gages produced similar average daily flow based on watershed area over the period of 1945 – 2009. These values were averaged to develop an average daily flow per watershed area that was then translated to the respective watershed areas for the three study segments (Indian Creek, Prairie Creek and Dago Slough). This statistically developed average daily flow for each segment was then translated back into the “dimensionless” dataset for gage ID 5584500 to represent the drainage areas for each of the three segments. This methodology produced the datasets required to make the flow duration curves and 5 yr hydrographs.

Additional information and descriptions how 2009/2010 flow data was collected in the field is described in Appendix D, Monitoring Strategy.

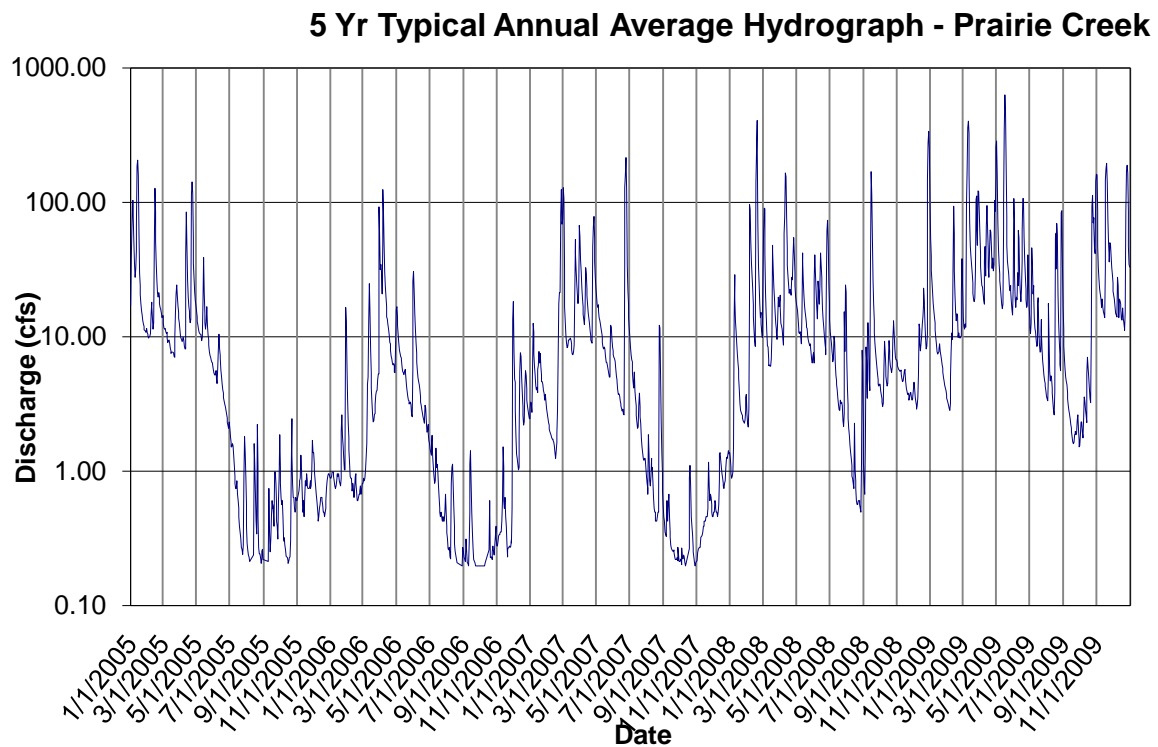
### 5.1.1 Prairie Creek Hydrology

Figure 11 - Prairie Flow Duration Curve



Based on sampling results for flow, it is estimated that Prairie Creek discharges 17,900 acre-feet of water annually (above the sample site). Modeled flow data from 1945-2009 shows daily streamflows range from under 1 cubic feet per second to just over 1000 during infrequent and very high flow events.

Figure 12 - Prairie Creek Annual Average Hydrograph



Average annual flow for Prairie Creek is 19.12 cfs (cubic feet per second). Beginning in 2005, modeled discharge data shows the highest stream flow in February of 2008 and May of 2009.

Prairie Creek Flood



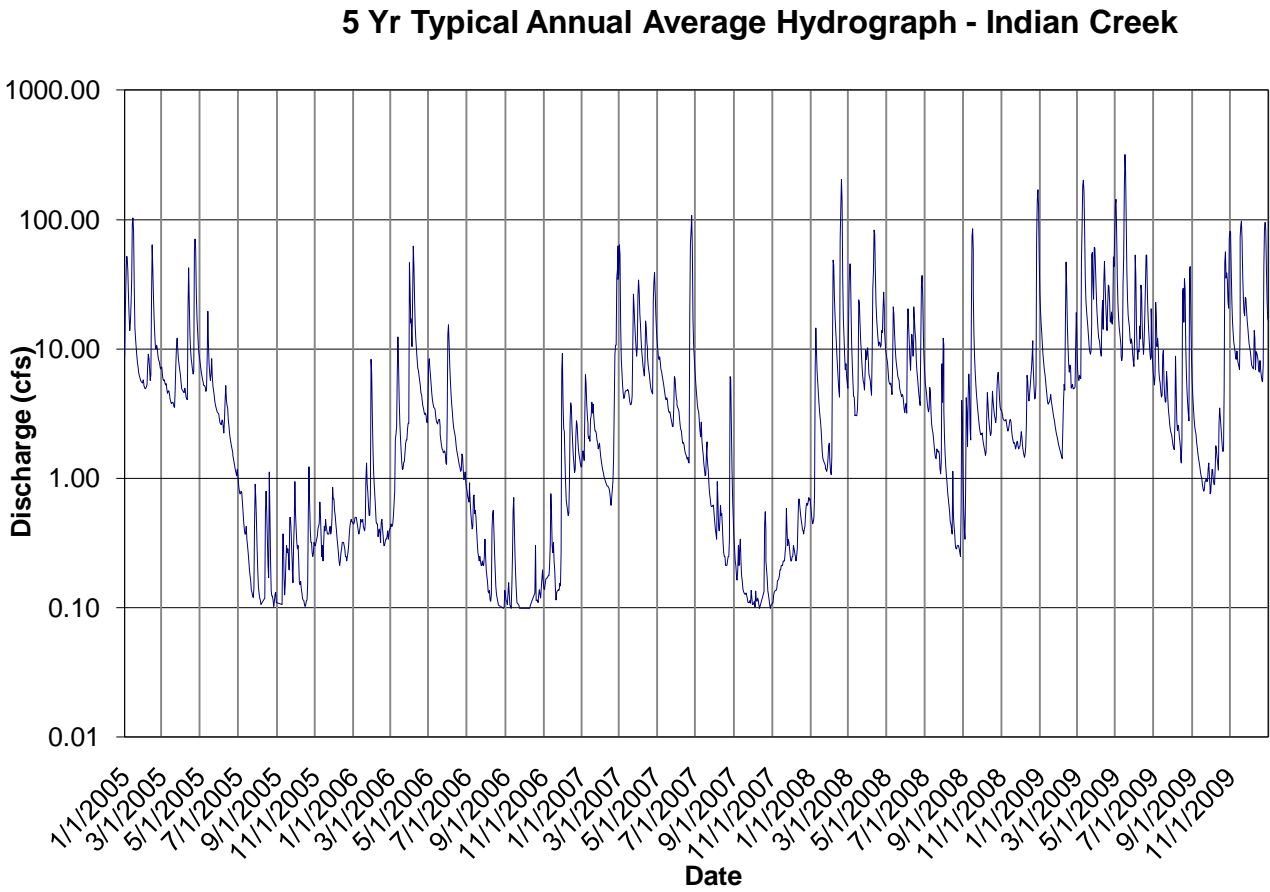
**5.1.2 Indian Creek Hydrology**

**Figure 13 - Indian Creek Flow Duration Curve**



Based on modeled results for flow, it is estimated that Indian Creek discharges 9,828 acre-feet of water annually (above the sample site). Modeled flow data from 1945-2009 shows daily streamflows ranged from under 1 cubic feet per second to just over 350.

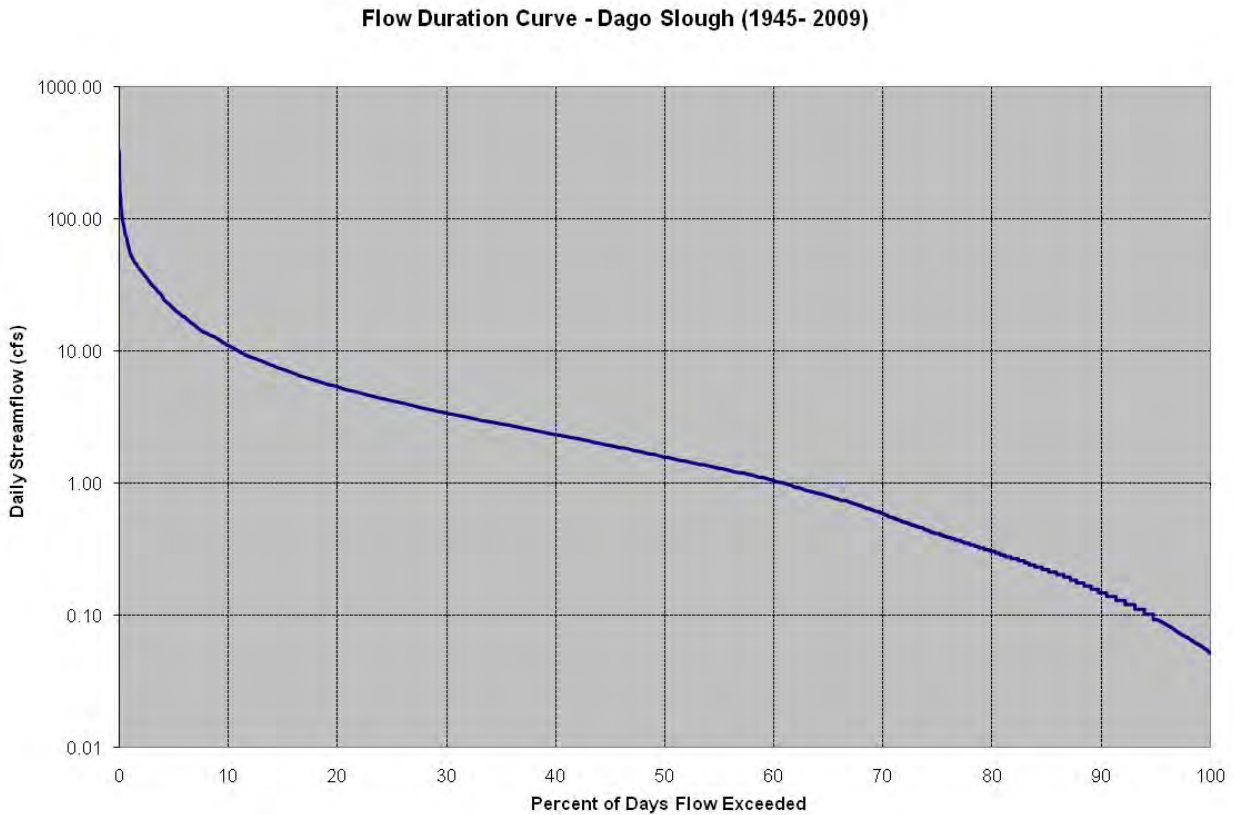
Figure 14 - Indian Creek Annual Average Hydrograph



Average annual flow for Indian Creek is 9.60 cfs. Beginning in 2005, modeled discharge data shows the highest stream flow in March and May of 2009.

**5.1.3 Dago Slough Hydrology**

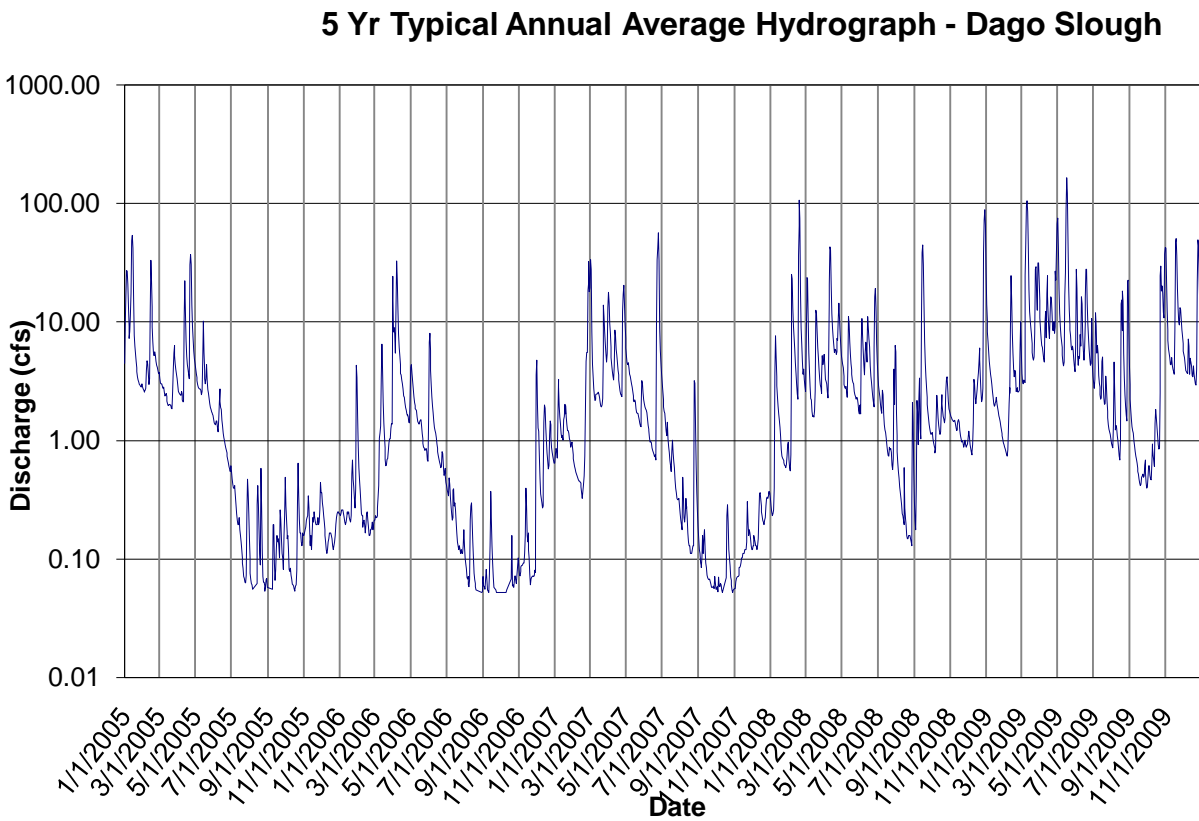
**Figure 15 - Dago Slough Flow Duration Curve**



Based on modeled results for flow, it is estimated that Dago Slough discharges 2,112 acre-feet of water annually (above the sample site). Modeled flow data from 1945-2009 shows daily streamflows ranged from under 0.1 cubic feet per second to over 100.



Figure 16 - Dago Slough Annual Average Hydrograph



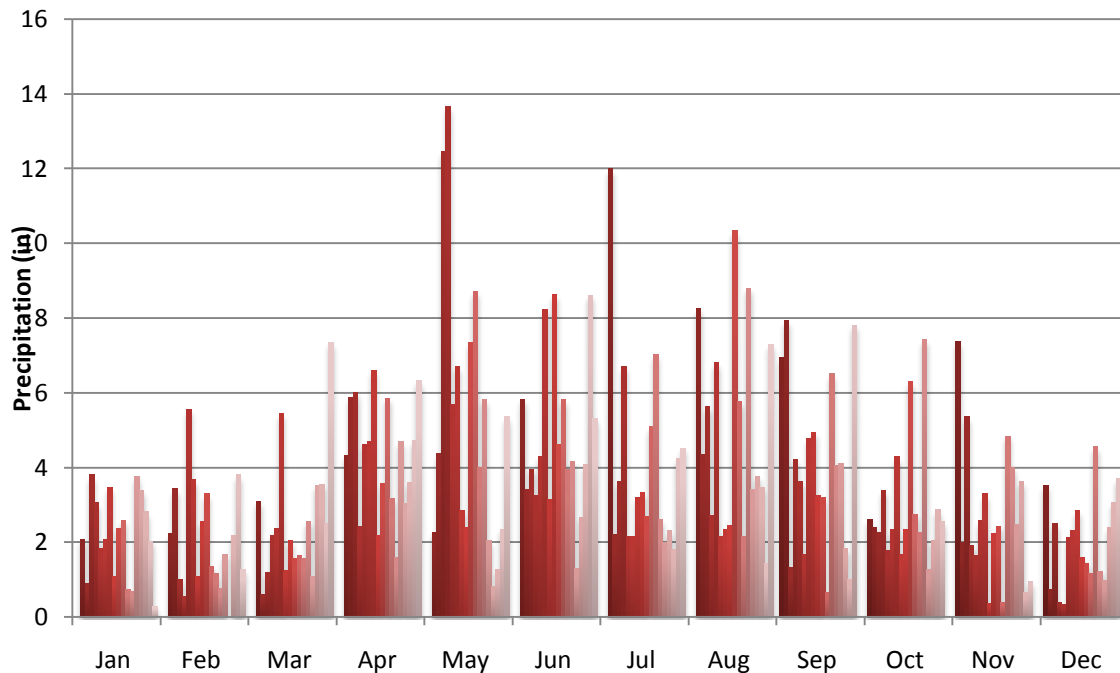
Average annual flow for Dago Slough is 5.0 cfs. Beginning in 2005, modeled discharge data shows the highest stream flow in March and May of 2009.

## 5.2 Precipitation

### 5.2.1 Prairie Creek

Historical weather data in mid-western Illinois is sparse. The closest weather station (#111316, State Water Survey) to Prairie Creek is located in Carthage and has limited historical data only available from September 1992 through August 2009. Data for 2009 is incomplete. Precipitation at Carthage during this time period shows average annual precipitation of 39.35 inches with the highest annual precipitation occurring in 1993 and 2000. This data also shows the wettest months on average being May, June and August. The following is a graph of monthly totals from Carthage.

*Figure 17 - Prairie Precipitation Graph – Carthage Station (#111316), Illinois State Water Survey*



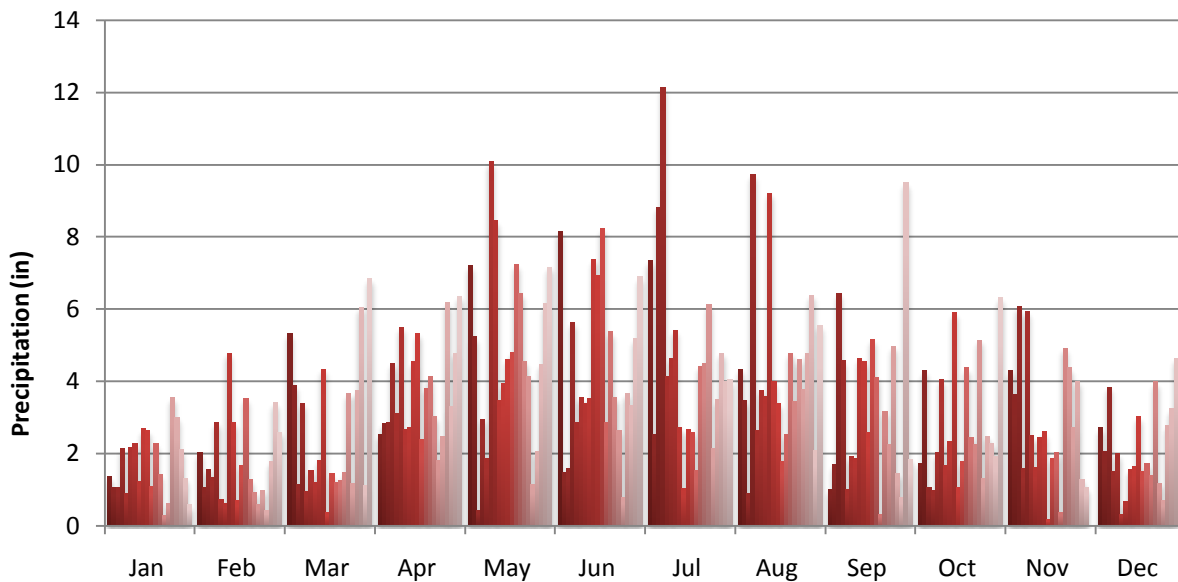
*Table 22 - Carthage Average Monthly Precipitation (inches) – Carthage Station (#111316), Illinois State Water Survey*

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2.06	1.98	2.42	4.08	4.9	4.52	3.76	4.51	3.78	2.82	2.57	1.94	39.35

### 5.2.2 Indian Creek and Dago Slough

The closest weather station to Indian and Dago is located in Galesburg and has fairly substantial historical data. In order to compare with Prairie Creek, data from 1992 through October 2009 was used. Data for 2009 is incomplete. Precipitation at Galesburg during this time period shows average annual precipitation of 38.30 inches with the highest annual precipitation occurring in 1993 and 2009 despite incomplete data from 2009. This data also shows the wettest months on average being May, June and July. The following is a graph of monthly totals from Galesburg.

**Figure 18 - Indian/Dago Precipitation Graph – Galesburg Station (#113320), Illinois State Water Survey**



**Table 23 - Galesburg Average Monthly Precipitation (inches) – Galesburg Station (#113320), Illinois State Water Survey**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1.68	1.78	2.59	3.74	4.82	4.35	4.45	4.23	3.19	2.77	2.81	2.13	38.29

### 5.3 Population and Climate

Population and general climate information was gathered online and by county from [www.bestplaces.net](http://www.bestplaces.net)

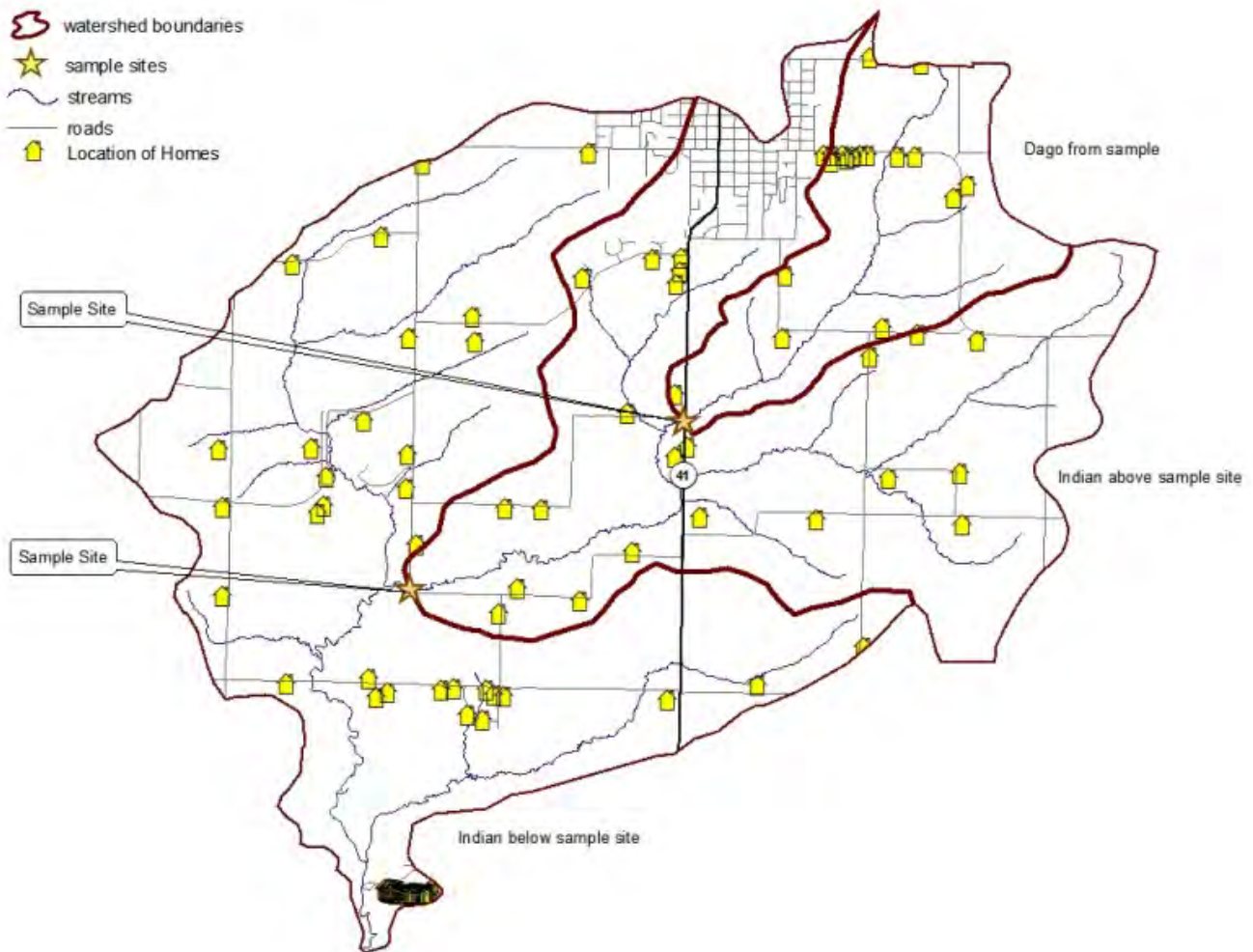
Prairie Creek (Hancock County), Indian Creek and Dago Slough (Knox County) are rural watersheds with low population densities. Carthage is the major community in the Prairie Creek watershed with a population of 2,504 as of 2008. As of 2009, Hancock County's population is 18,839 people. Since 2000, it has had a population growth of -5.12 percent. Abingdon is the major community in the Prairie Creek watershed with a population of 3,269 as of 2008. As of 2009, Knox County's population is 51,855 people. Since 2000, it has had a population growth of -5.25 percent.

Hancock County gets 38 inches of rain per year. The US average is 37. Snowfall is 21 inches. The average US city gets 25 inches of snow per year. The number of days with any measurable precipitation is 95. On average, there are 200 sunny days per year in Hancock County, IL. The July high is around 87 degrees. The January low is 15. Knox County, IL, gets 38 inches of rain per year. The US average is 37. Snowfall is 25 inches. The average US city gets 25 inches of snow per year. The number of days with any measurable precipitation is 100. On average, there are 196 sunny days per year in Knox County, IL. The July high is around 85 degrees. The January low is 13 degrees.

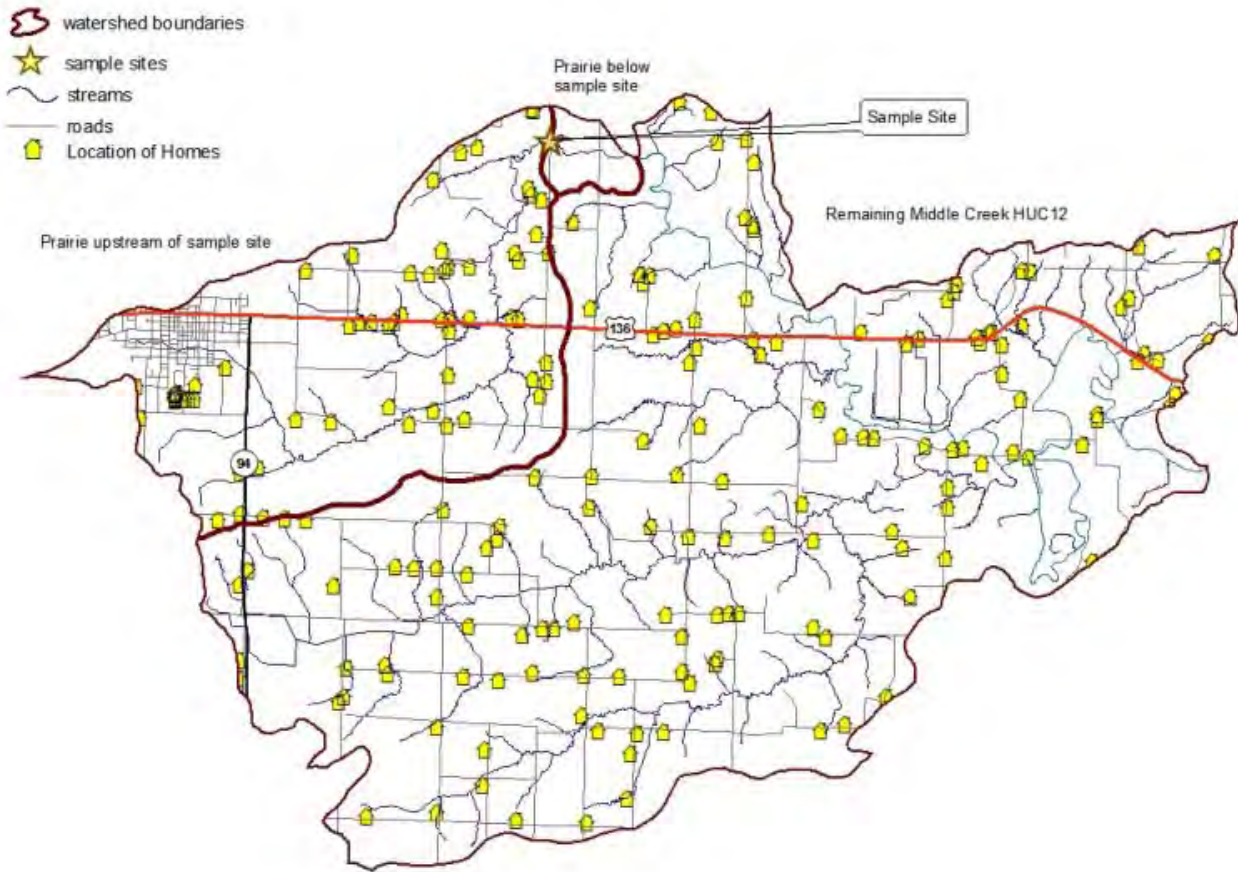
### 5.4 Septic Systems

The total number of septic systems in both watersheds was inventoried using a combination of information from County Health Departments and by physically counting the number of homes in each watershed. A GIS file was created showing the location of all homes in each watershed. The assumption was made that any home outside of city limits has an active septic system.

*Figure 19 - Location of Active Septic Systems Indian Creek and Dago Slough*



*Figure 20 - Location of Active Septic Systems Prairie Creek*



The entire Prairie Creek/Middle Creek HUC 12 watershed contains approximately 203 septic systems; 63 of which are located only in Prairie Creek above the sample site. There are 102 systems in the entire Indian/Dago Watershed, 40 of which are located above both of the sample sites.

Assuming a very conservative failure rate of 15%, approximately 9 systems are likely failing above the Prairie Creek sample site and 6 above samples sites on Indian/Dago.

The following tables summarize pollutant loading from failing septic systems for each watershed. All septic system loadings were developed using STEPL (Spreadsheet Tool for Estimation of Pollutant Load) Version 3, Tetra Tech, 2004.

*Prairie Creek***Table 24 - Septic Systems Prairie Creek**

	# Septic Systems	Population Per System	# Failing Systems	Population on Failing Septic	Failing Septic Wastewater Flow (l/hr)	N Loading (lbs/yr)	P Loading (lbs/yr)
<b>Above Sample Site</b>	63	2.43	9.45	23	265	303	117
<b>Below Sample Site</b>	0	0	0	0	0	0	0
<b>Remaining Watershed</b>	140	2.43	21	51	575	662	258
<b>Total</b>	<b>203</b>		<b>30.45</b>	<b>74</b>	<b>840</b>	<b>965</b>	<b>375</b>

*Indian Creek/Dago Slough***Table 25 - Septic Systems Prairie Creek**

	# Septic Systems	Population Per System	# Failing Systems	Population on Failing Septic	Failing Septic Wastewater Flow (l/hr)	N Loading (lbs/yr)	P Loading (lbs/yr)
<b>Above Indian Sample Site</b>	22	2.43	3.3	8	100	112	42
<b>Below Sample Site</b>	62	2.43	9.3	23	261	298	115
<b>Dago Slough</b>	18	2.43	2.7	7	84	93	35
<b>Total</b>	<b>102</b>		<b>15.3</b>	<b>38</b>	<b>445</b>	<b>503</b>	<b>192</b>

## 5.5 Soils and Crop Information

### 5.5.1 Crop Information

Although both watersheds are small, the majority of the land found within the Prairie Creek and Indian Creek/Dago Slough watersheds is devoted to crops. Tillage practices can be categorized as conventional till, reduced till, mulch-till, and no-till. Certain types of tillage practices influence the amount of soil erosion that occurs from farm fields. The percentage of each tillage practice for corn, soybeans, and small grains by county are generated by the Illinois Department of Agriculture from County Transect Surveys. The most recent survey available was conducted in 2009. Data specific to both watersheds were not available; however, the Hancock (Prairie Creek) and Knox County (Indian Creek/Dago Slough) practices were available and are shown in the following tables.

*Table 26 - Tillage Practices, Hancock County*

Tillage System	Corn	Soybeans	Small Grains
Conventional	76%	8%	25%
Reduced - Till	16%	23%	0%
Mulch - Till	7%	32%	58%
No - Till	1%	37%	17%

*Table 27 - Tillage Practices, Knox County*

Tillage System	Corn	Soybeans	Small Grains
Conventional	42%	8%	0%
Reduced - Till	25%	7%	0%
Mulch - Till	12%	7%	0%
No - Till	21%	78%	100%

Observations made during surveys of the watershed indicate that the tillage percentages in the tables do not accurately represent conditions specific to the watersheds. During the watershed surveys, it was observed in both watersheds that the majority of tillage trends toward a higher percentage of reduced or no-till on both flat and steep corn. This is reflected in the Cover Factors or "C factors" used to estimate sheet and rill erosion results presented in section 5.16.



### 5.5.2 Soils

#### 5.5.2.1 Prairie Creek Soils

The following map represents soils in the Prairie/Middle Creek watershed. The table shows the top ten soil units in terms of acreage. Soils information was developed from USDA (U.S. Department of Agriculture), NRCS (Natural Resources Conservation Service) 2006, Soil Survey Geographic (SSURGO) database.

Figure 21 - Prairie Creek Soils

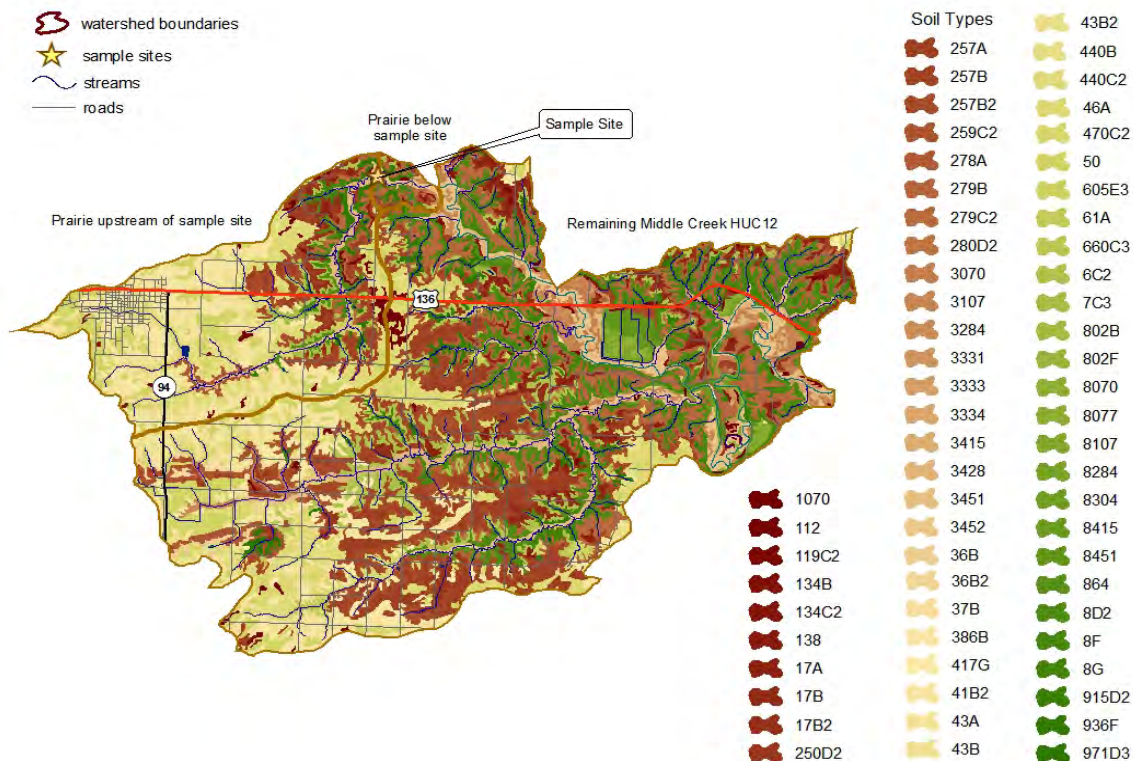


Table 28 - Acres of Ten Major Soil Units, Prairie/Middle Creek

Soil Code	Soil Name	Hydrologic Group	Acres
43A	Ipava silt loam, 0 to 2 percent slopes	B	3,579
257B2	Clarksdale silt loam, 2 to 5 percent slopes, eroded	C	2,758
8F	Hickory loam, 18 to 30 percent slopes	C	2,515
257A	Clarksdale silt loam, 0 to 2 percent slopes	C	2,497
50	Virden silty clay loam	B/D	2,312
46A	Herrick silt loam, 0 to 2 percent slopes	B	2,262
279B	Rozetta silt loam, 2 to 5 percent slopes	B	2,180
43B2	Ipava silt loam, 2 to 5 percent slopes, eroded	B	1,803
6C2	Fishhook silt loam, 5 to 10 percent slopes, eroded	D	1,286
3451	Lawson silt loam, frequently flooded	C	1,279
<b>Total (acres) = 22,471</b>			

5.5.2.1.1 Prairie Creek Highly Erodible Soils

The following chart describes the Highly Erodible Soils (HEL) in each subwatershed. A large percentage of all soils in each watershed are classified as HEL. The US Department of Agriculture defines HEL Soils as:

*“A highly erodible soil, or soil map unit, has a maximum potential for erosion that equals, or exceeds, eight times the tolerable erosion rate. The maximum erosion potential is calculated without consideration to crop management or conservation practices, which can markedly lower the actual erosion rate on a given field. The maximum potential erosion rate is determined using the formula:  $RKLS/R$  (where  $R$  = the rainfall factor,  $K$  = erodibility value of the soil, and  $LS$  = the slope factor). If  $RKLS/T > 8$  then the soil meets the criteria for a highly erodible soil.”*

**Table 29 - HEL Soil Breakdown, Prairie/Middle Creek**

	Below Sample Site	Upstream of Sample Site	Remaining HUC 12
Acres HEL	164	1,492	9,006
%	41.6%	18.7%	33.4%
<b>Total entire HUC12</b>	<b>10,662 ac</b>	<b>30%</b>	

This table and the following charts show the distribution of HEL soils by landcover type in acres.

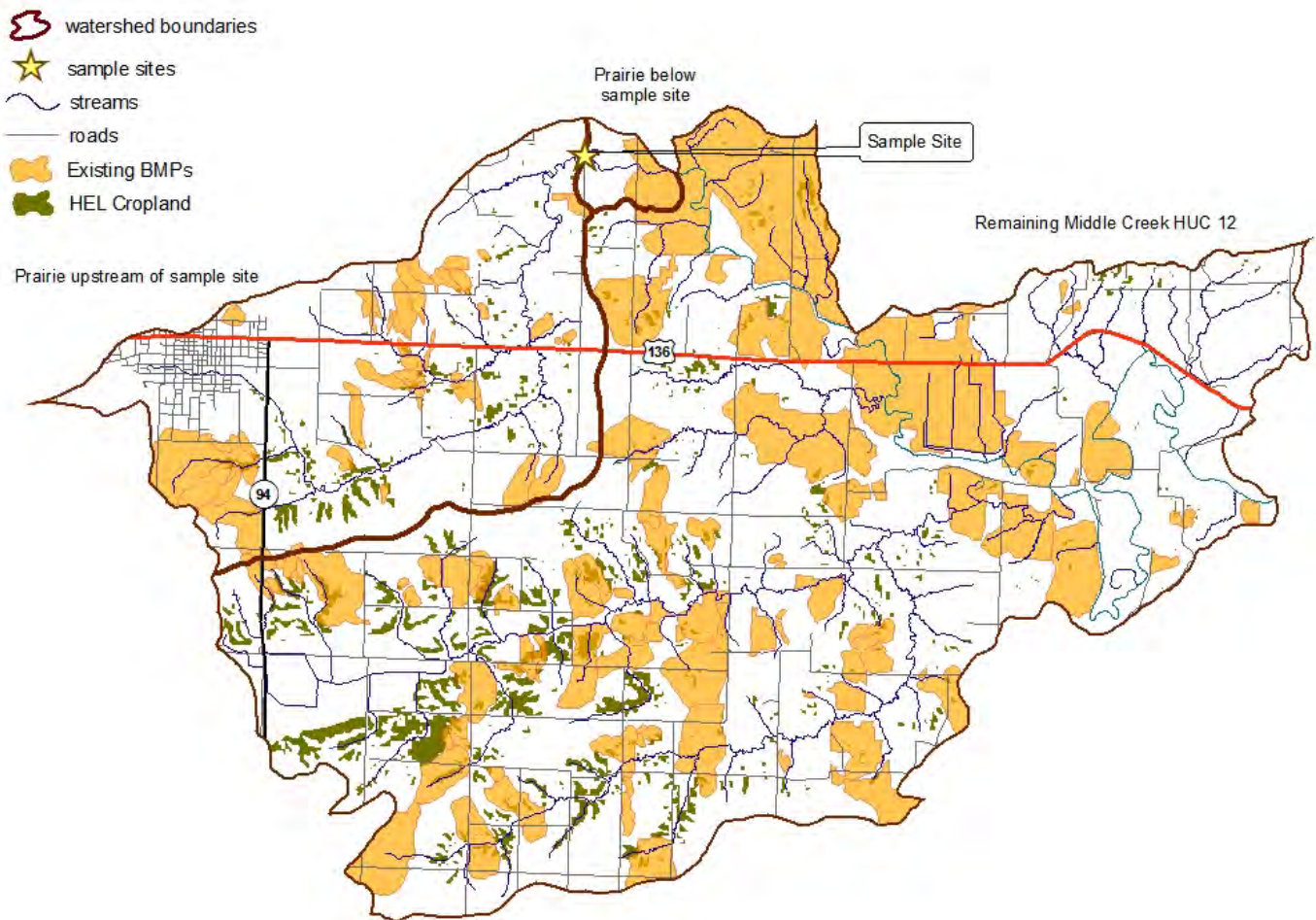
**Table 30 - HEL Soil Breakdown by Landcover Type, Prairie/Middle Creek**

HEL soils	Prairie Below Sample Site (acres)	Prairie Upstream Sample Site (acres)	Remaining HUC 12 (acres)
Agriculture	0	156	1,328
Forestry	67	433	4,041
Grass	39	442	2,508
Urban	9	284	246
Wetland	0	28	1
Water	0	24	7

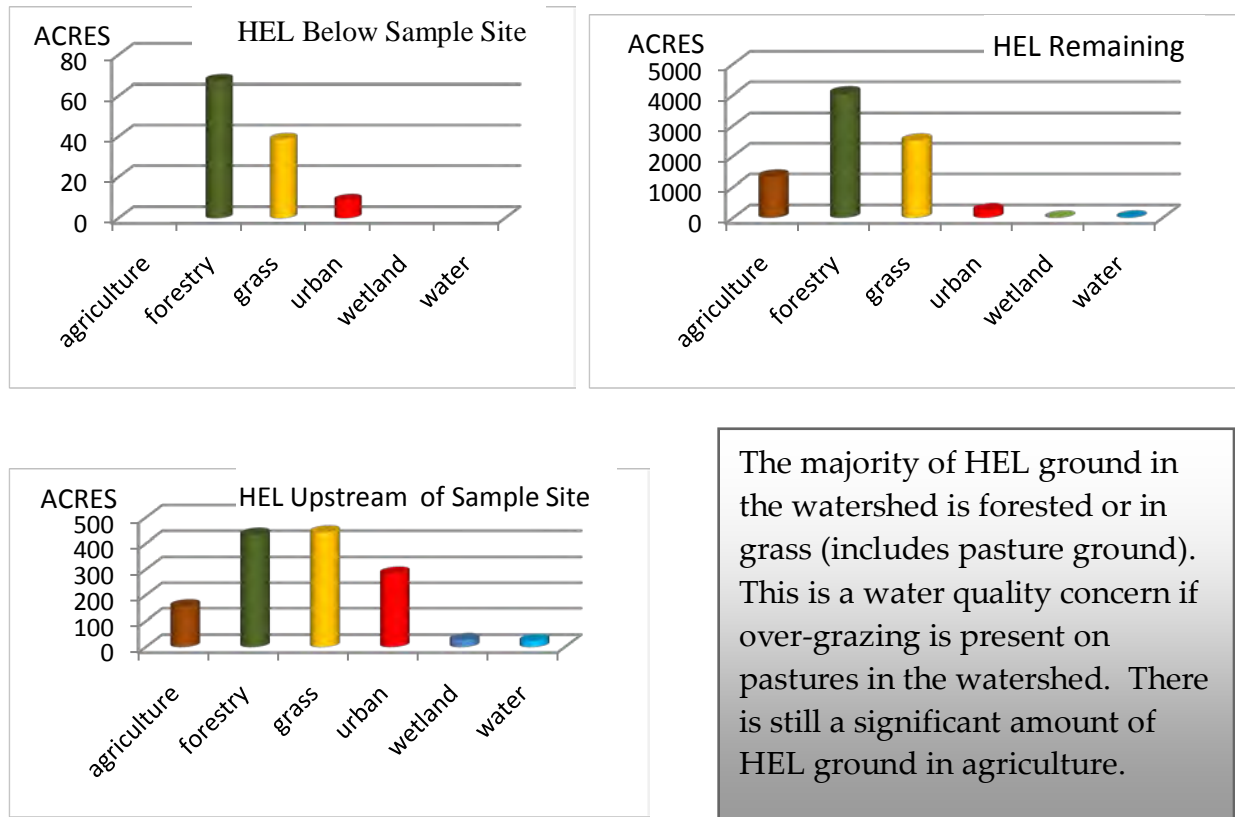
The agricultural HEL ground in the watershed is being actively farmed. To be eligible for cost-share assistance, producers must implement conservation tillage or no-till on HEL ground and maintain tolerable soil loss levels. Tolerable soil loss on HEL ground can range from 2-5 tons/ac.

The following map shows HEL ground being currently farmed; land treated with BMPs is overlaid to show which areas have both treatment BMPs and HEL ground being actively farmed.

*Figure 22 - Prairie/Middle Creek HEL Crop Ground and Land Treated with BMPs*



**Figure 23 - HEL Soil Breakdown by Landcover Type, Prairie/Middle Creek**



The following chart and map show the HEL soils within 1000 feet of a stream. Over one quarter of the HEL soils in the watershed are within 1000ft of a stream.

**Table 31 - HEL Soils within 1000 ft of a Stream, Prairie/Middle Creek**

	Below Sample Site	Upstream of Sample Site	Remaining HUC 12
<b>Acres HEL within 1000ft of stream</b>	117	1,369	8,141
<b>%</b>	29.6%	17.2%	30.2%
<b>Total entire HUC12</b>	<b>9,627 ac</b>	<b>27%</b>	

Figure 24 - HEL Soils, Prairie/Middle Creek

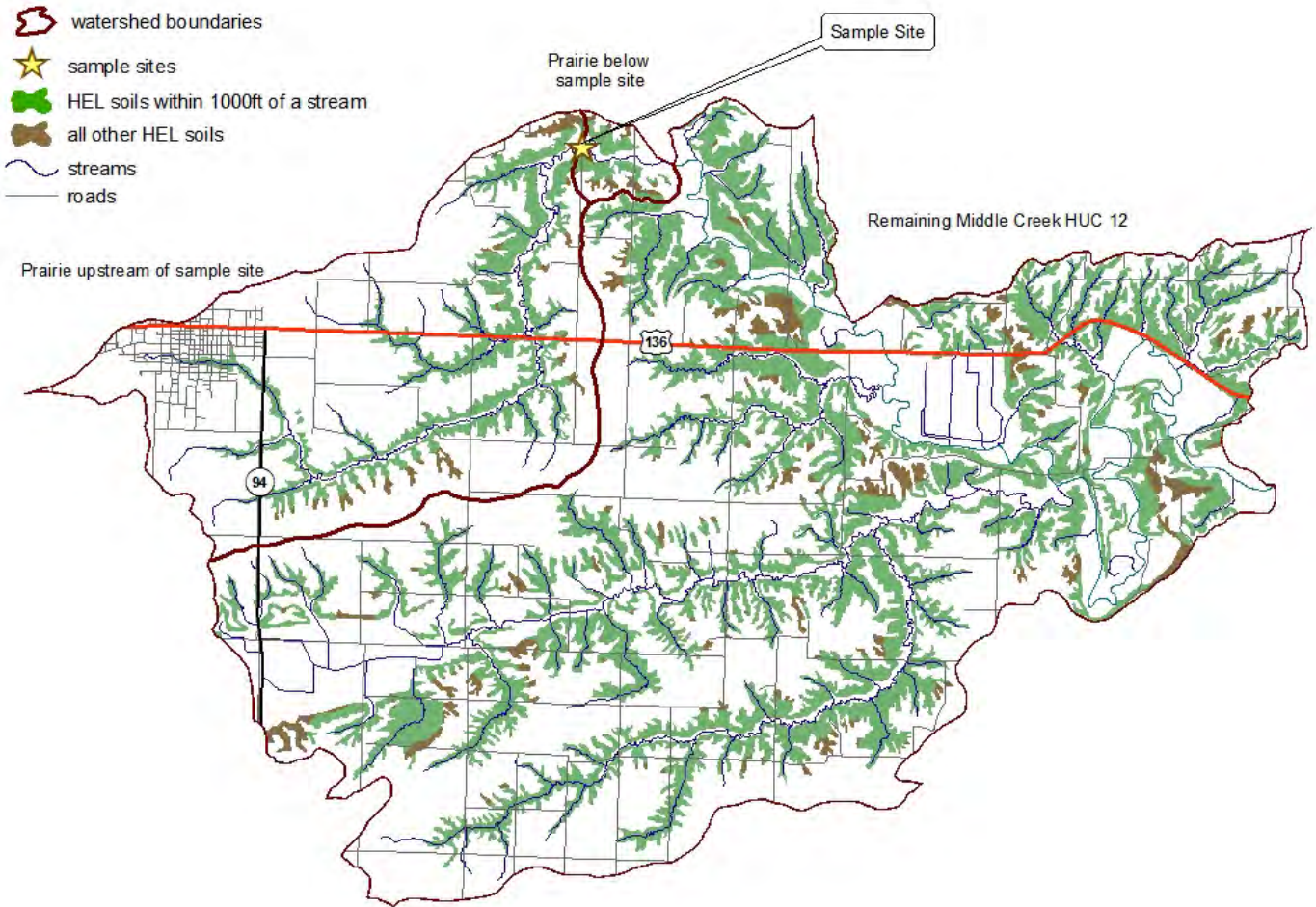
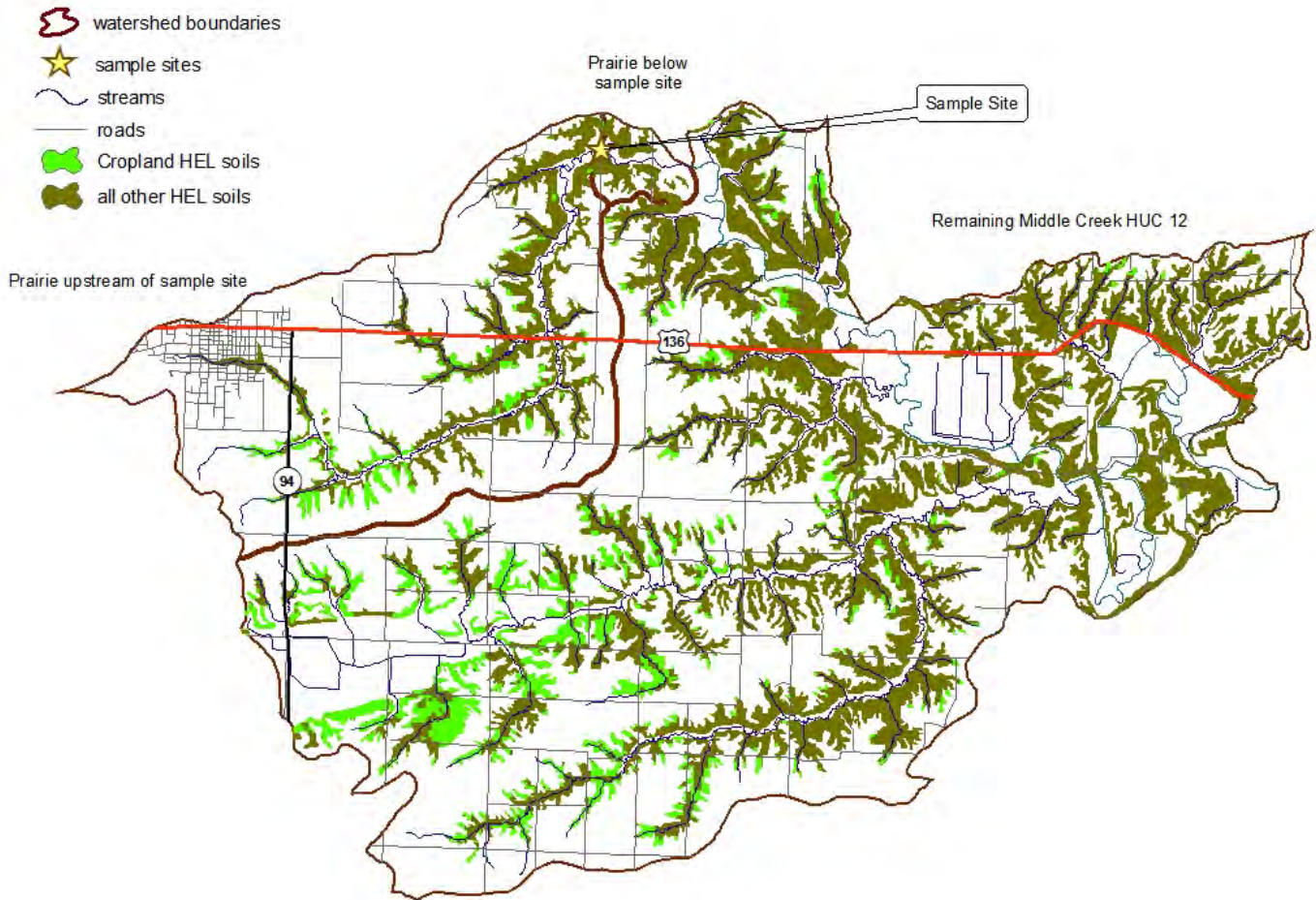


Figure 25 - Farmed HEL soils, Prairie/Middle Creek



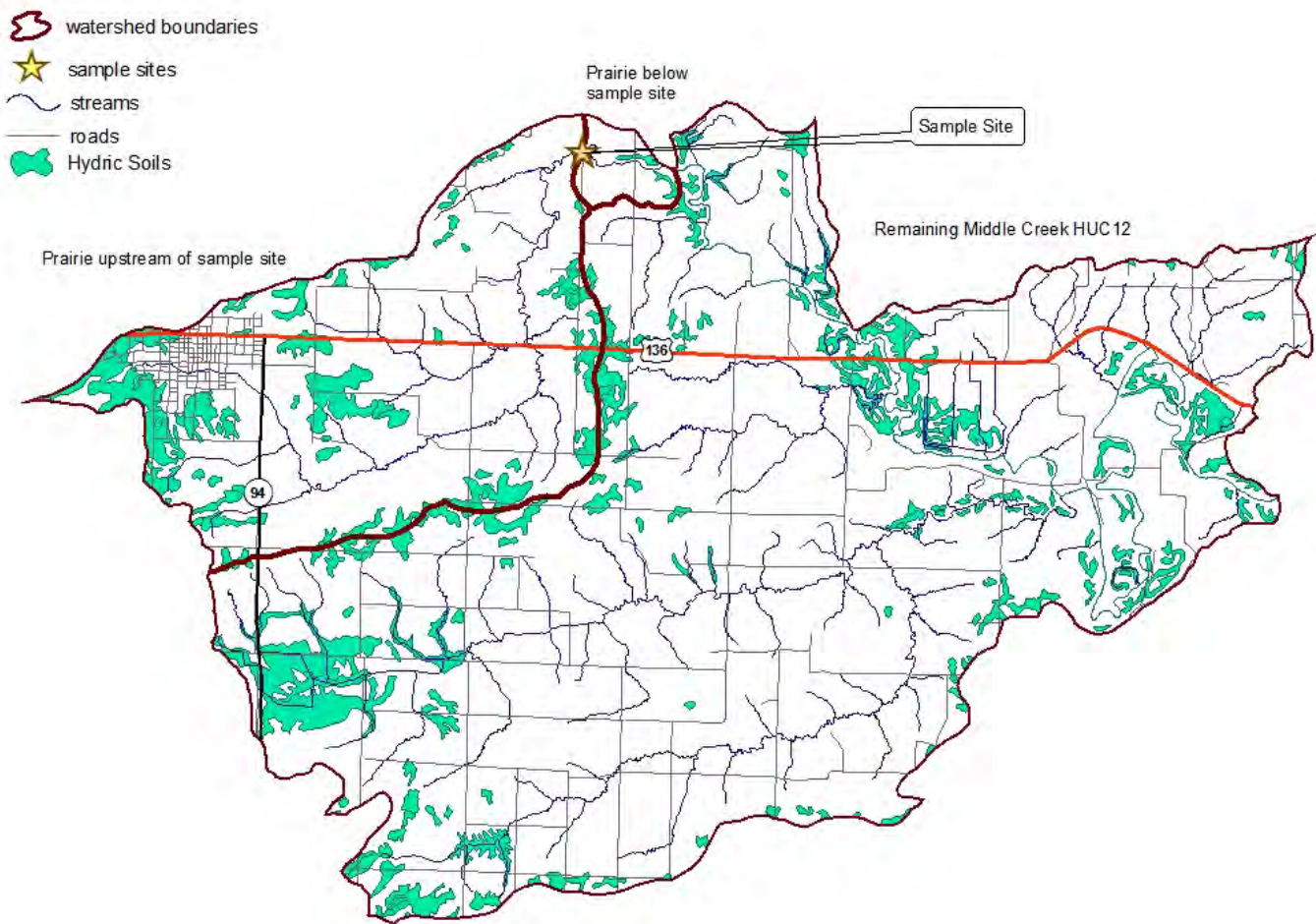
### 5.5.2.1.2 Hydric Soils

Hydric Soils are those soils that retain the necessary properties to support wetlands and can be candidate sites for wetland restoration efforts. They can be defined as:

*“a soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part.”*

The following map shows the distribution of hydric soils within the watershed.

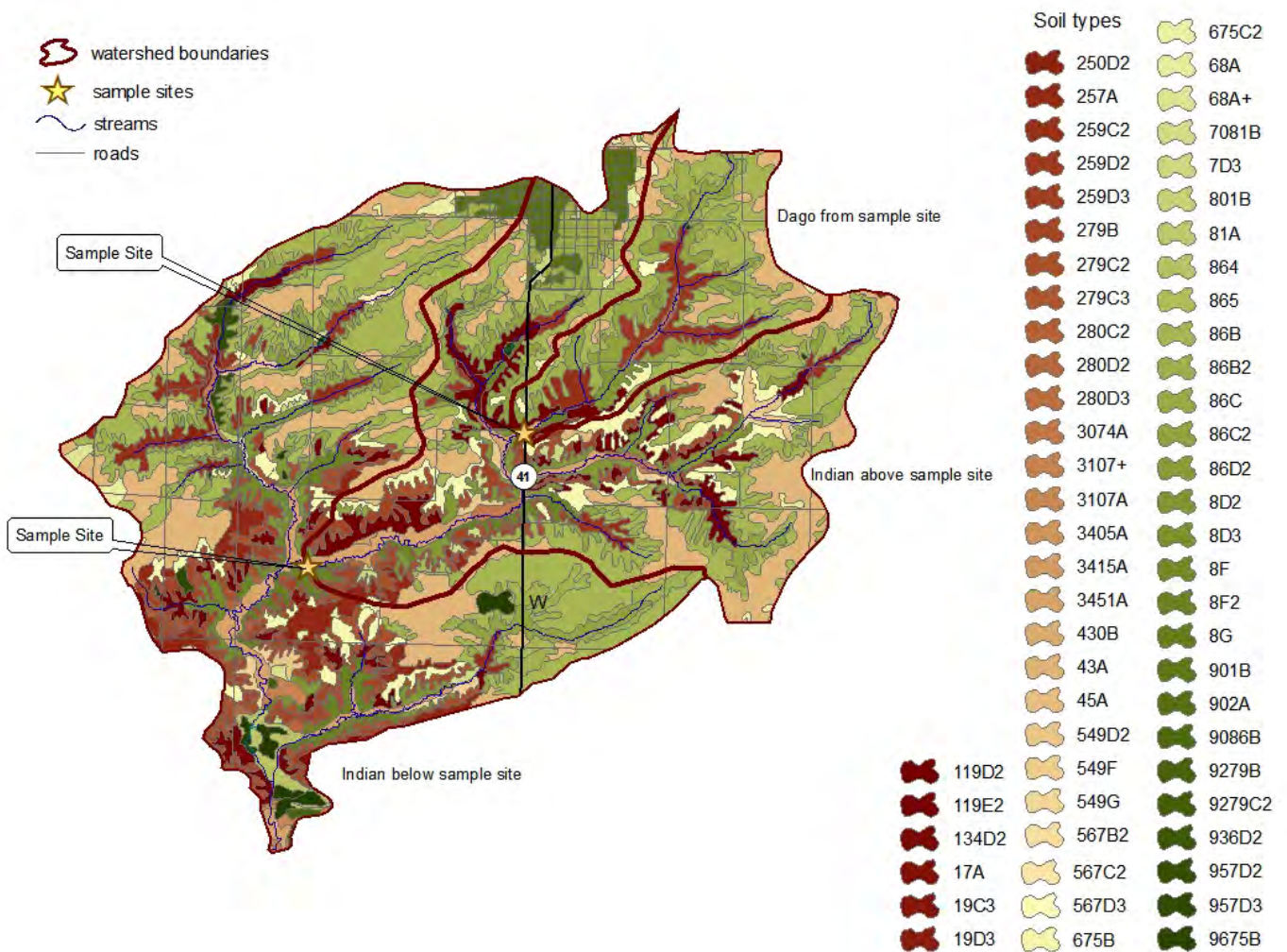
**Figure 26 - Hydric Soils, Prairie/Middle Creek**



### 5.5.2.2 Indian Creek and Dago Slough Soils

The following map represents soils in the Indian Creek/Dago Slough watersheds. The table shows the top ten soil units in terms of acreage. Soils information was developed from USDA (U.S. Department of Agriculture), NRCS (Natural Resources Conservation Service) 2006, Soil Survey Geographic (SSURGO) database.

Figure 27 - Indian Creek/Dago Slough Soils





**Table 32 - Acres of Ten Major Soil Units, Indian Creek/Dago Slough**

Soil Code	Soil Name	Hydrologic Group	Acres
86B	Oscosilt loam, 2 to 5 percent slopes	B	2,308
43A	Ipava silt loam, 0 to 2 percent slopes	B	1,833
86C2	Oscosilt loam, 5 to 10 percent slopes, eroded	B	806
86B2	Oscosilt loam, 2 to 5 percent slopes, eroded	B	772
279C2	Rozetta silt loam, 5 to 10 percent slopes, eroded	B	559
675B	Greenbush silt loam, 2 to 5 percent slopes	B	453
119D2	Elco silt loam, 10 to 18 percent slopes, eroded	B	431
279B	Rozetta silt loam, 2 to 5 percent slopes	B	360
8D2	Hickory silt loam, 10 to 18 percent slopes, eroded	B	356
257A	Clarksdale silt loam, 0 to 2 percent slopes	C	269
<b>Total (acres) = 8,148</b>			

5.5.2.2.1 Indian Creek/Dago Slough Highly Erodible Soils

The following chart describes the Highly Erodible soils in each watershed. Each watershed has a very large percentage of HEL soils. This characteristic can contribute to runoff and erosion if HEL ground is not properly managed.

**Table 33 - HEL Soil Breakdown, Indian Creek/Dago Slough**

	Indian Above Sample Site	Indian Below Sample Site	Dago Above Sample Site
<b>Acres HEL</b>	1,198	1,645	384
<b>%</b>	30.3%	31.8%	29.5%
<b>Totals</b>	<b>3,227</b>	<b>31%</b>	

This table and the following charts show the distribution of HEL soils by landcover type in acres.

**Table 34 - HEL Soil Breakdown by Landcover Type, Indian Creek/Dago Slough**

HEL soils	Indian Above Sample Site (acres)	Indian Below Sample Site (acres)	Dago Above Sample Site (acres)
<b>Agriculture</b>	231	450	100
<b>Forestry</b>	141	354	66
<b>Grass</b>	748	736	218
<b>Urban</b>	78	100	0
<b>Wetland</b>	0	0	0
<b>Water</b>	0	3	0

The agricultural HEL ground in the watershed is being actively farmed. To be eligible for cost-share assistance, producers must implement conservation tillage or no-till on HEL ground and maintain tolerable soil loss levels. Tolerable soil loss on HEL ground can range from 2-5 tons/ac.

The following map shows HEL ground being currently farmed; land treated with BMPs is overlaid to show which areas have both treatment BMPs and HEL ground being actively farmed.

Figure 28 - Indian Creek/Dago Slough HEL Cropland and Land Treated with BMPs

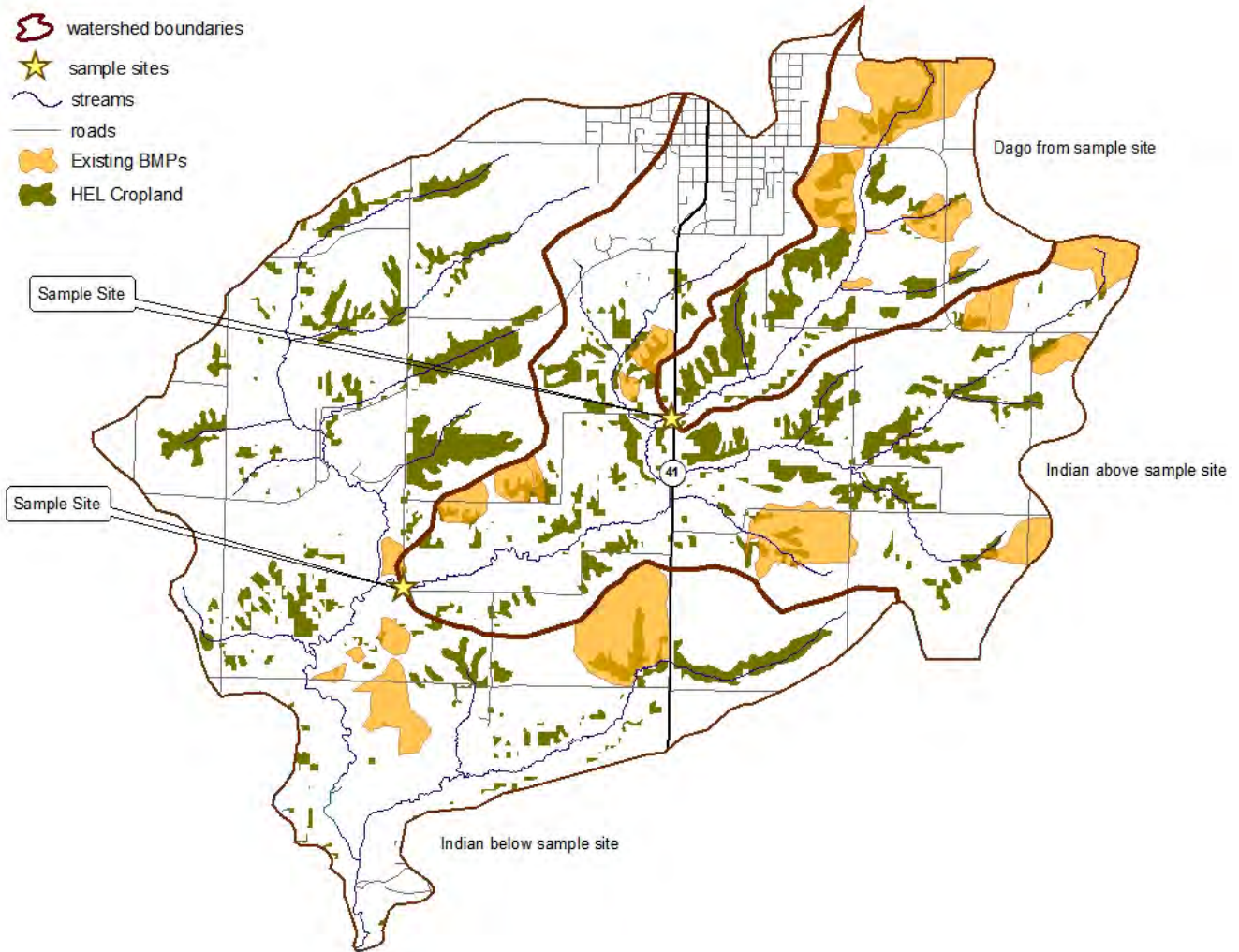
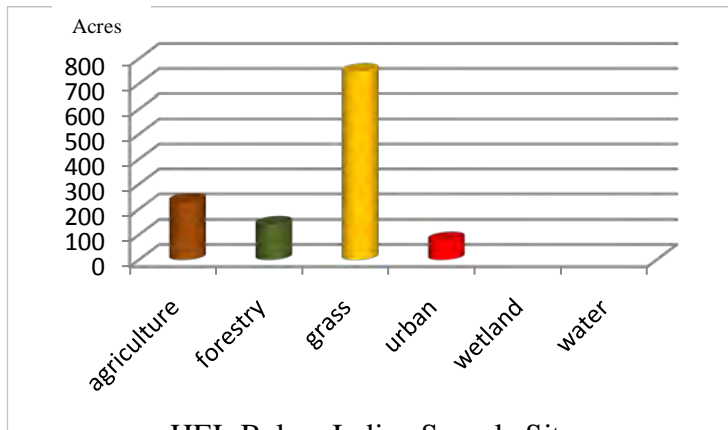
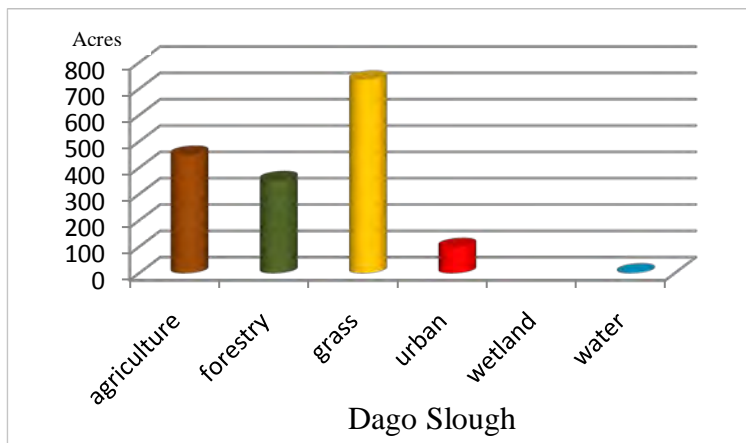


Figure 29 - HEL Soil Breakdown by Landcover Type, Indian Creek/Dago Slough

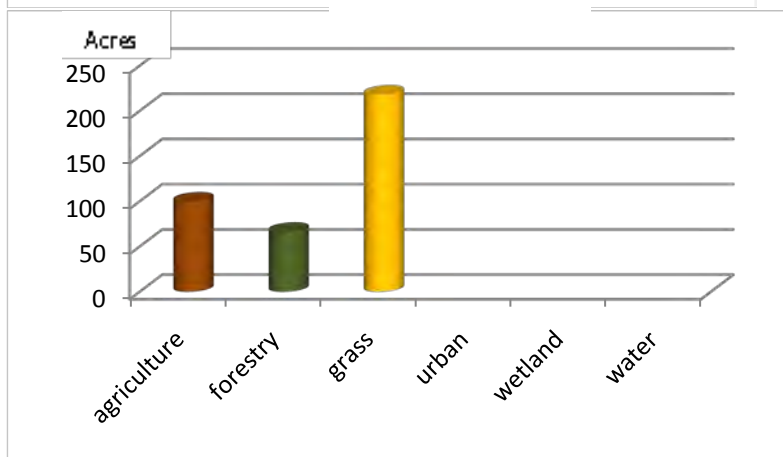
HEL above Indian Sample Site



HEL Below Indian Sample Site



Dago Slough



The graphs show that the majority of HEL soils are in grass (includes pasture). The 3 acres of HEL water are ponds on sloping ground.

The following map and chart show the Highly Erodible soils within 1000 feet of a stream. Well over one quarter of all HEL soils are located within 1000ft of a stream.

*Table 35 - HEL Soils within 1000 ft of a Stream, Indian Creek/Dago Slough*

	Above Indian Sample Site	Indian Below Sample Site	Dago Above Sample Site
Acres HEL within 1000ft of stream	1,115	1,481	381
%	28.2%	28.6%	29.2%
<b>Total</b>	<b>2,991</b>	<b>28%</b>	

The delivery of sediment in the watershed can increase with a higher percentage of farmed HEL soils located close to a stream. This can be mitigated if conservation practices are in place.

*Figure 30 - HEL Soils, Indian Creek/Dago Slough*

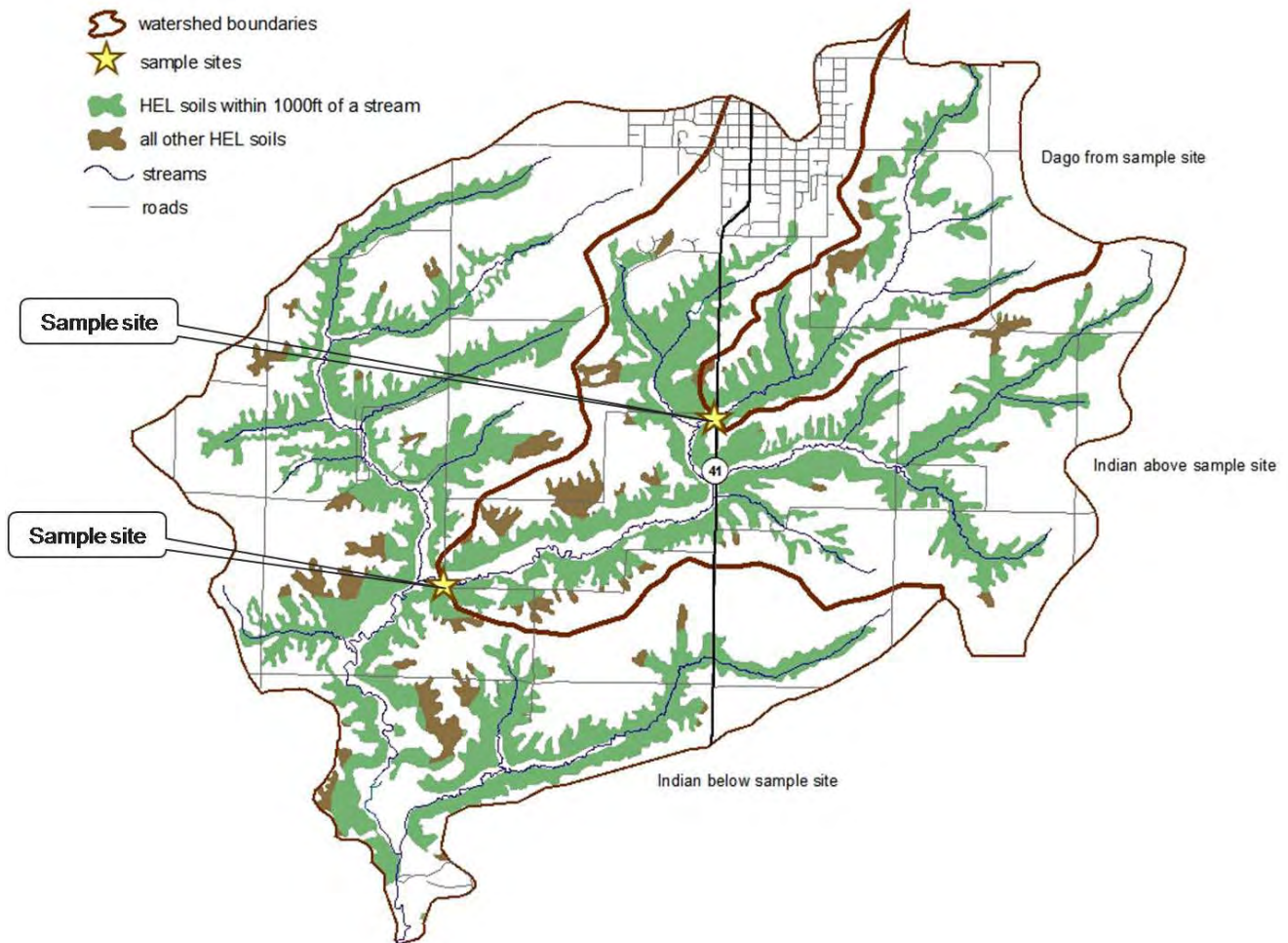
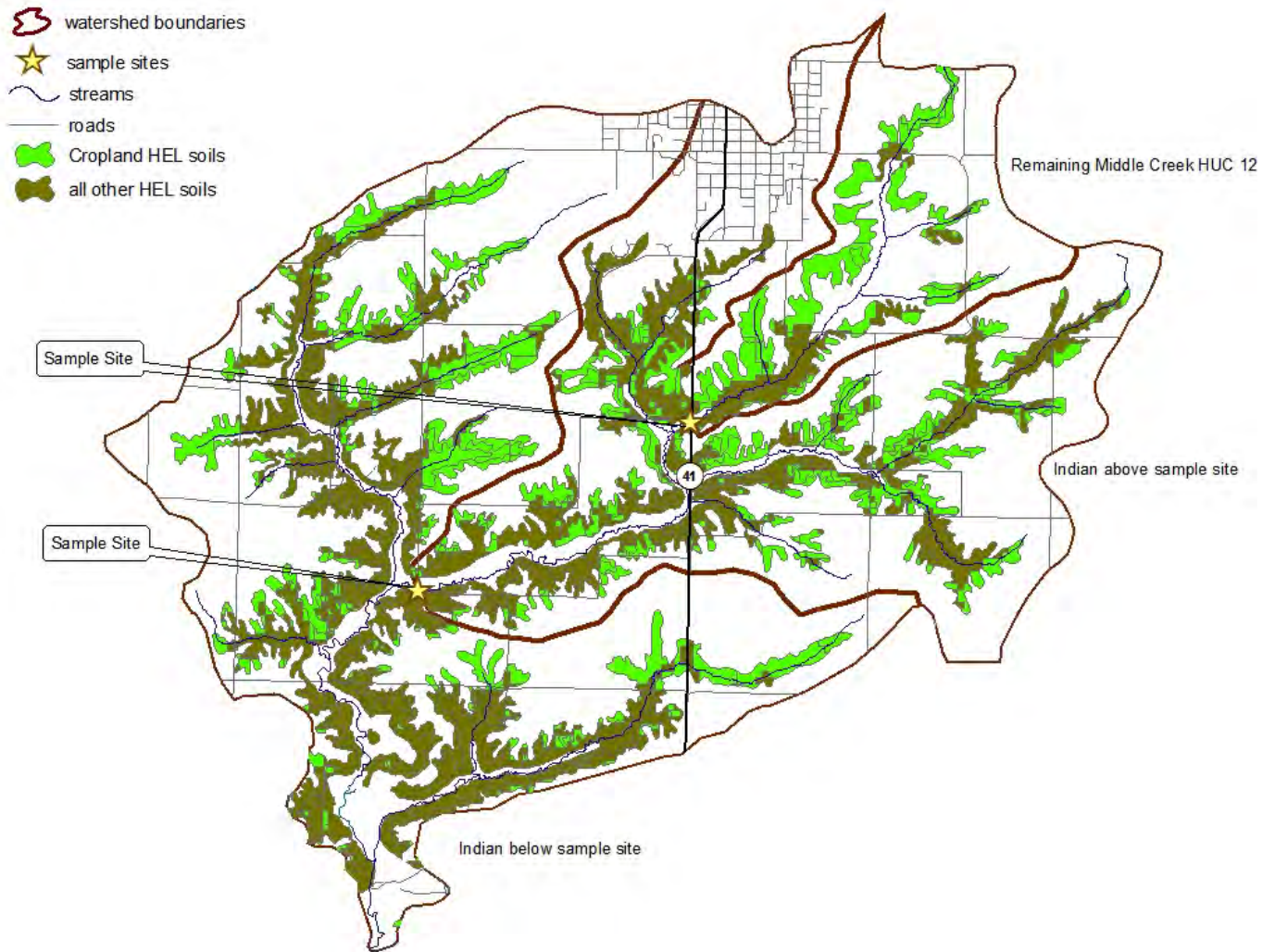


Figure 31 - Farmed HEL Soils, Indian Creek/Dago Slough



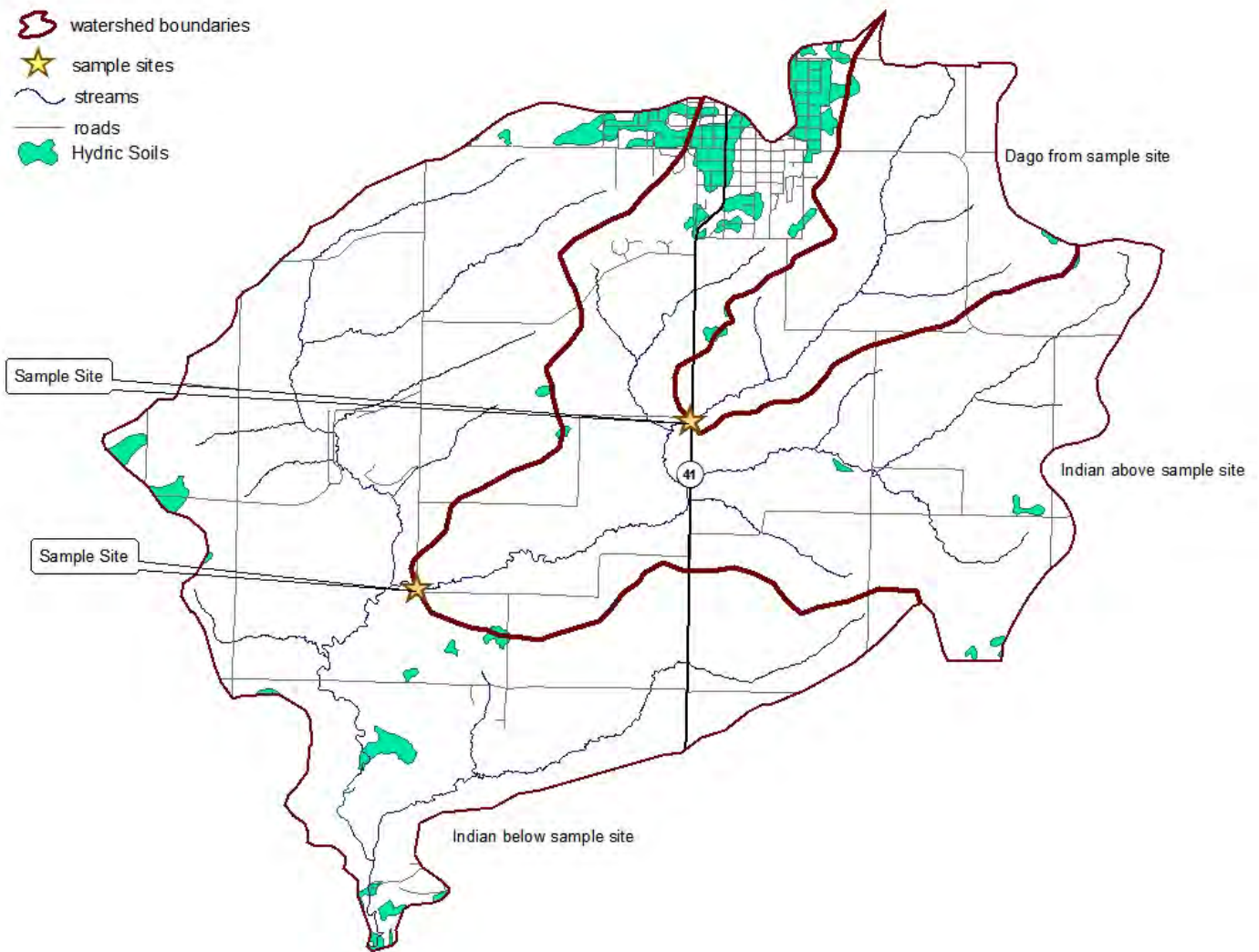
### 5.5.2.2.2 Prairie Creek/Dago Slough Hydric Soils

Hydric Soils are those soils that retain the necessary properties to support wetlands and can be candidate sites for wetland restoration efforts. They can be defined as:

*“a soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part.”*

The following map shows the distribution of hydric soils within the watershed.

**Figure 32 - Hydric Soils, Indian Creek/Dago Slough**



### 5.6 Slope

Land slope has an influence on sediment transport, runoff and landuse. In general, the steeper the slopes, the more susceptible soils are to erosion and concentrated runoff. Landuse is also influenced by slope; in general, flatter areas in Illinois are dominated by agricultural landuses (as long as soil productivity is adequate). Both Prairie Creek and Indian/Dago could be considered “steeper” than many areas throughout the state. As a result of this, both watersheds have a relatively high percentage of forested and grass/pasture ground, although, even on steep slopes, where it is possible to farm, it is farmed.

Figure 33 - Prairie Creek/Middle Creek Slope

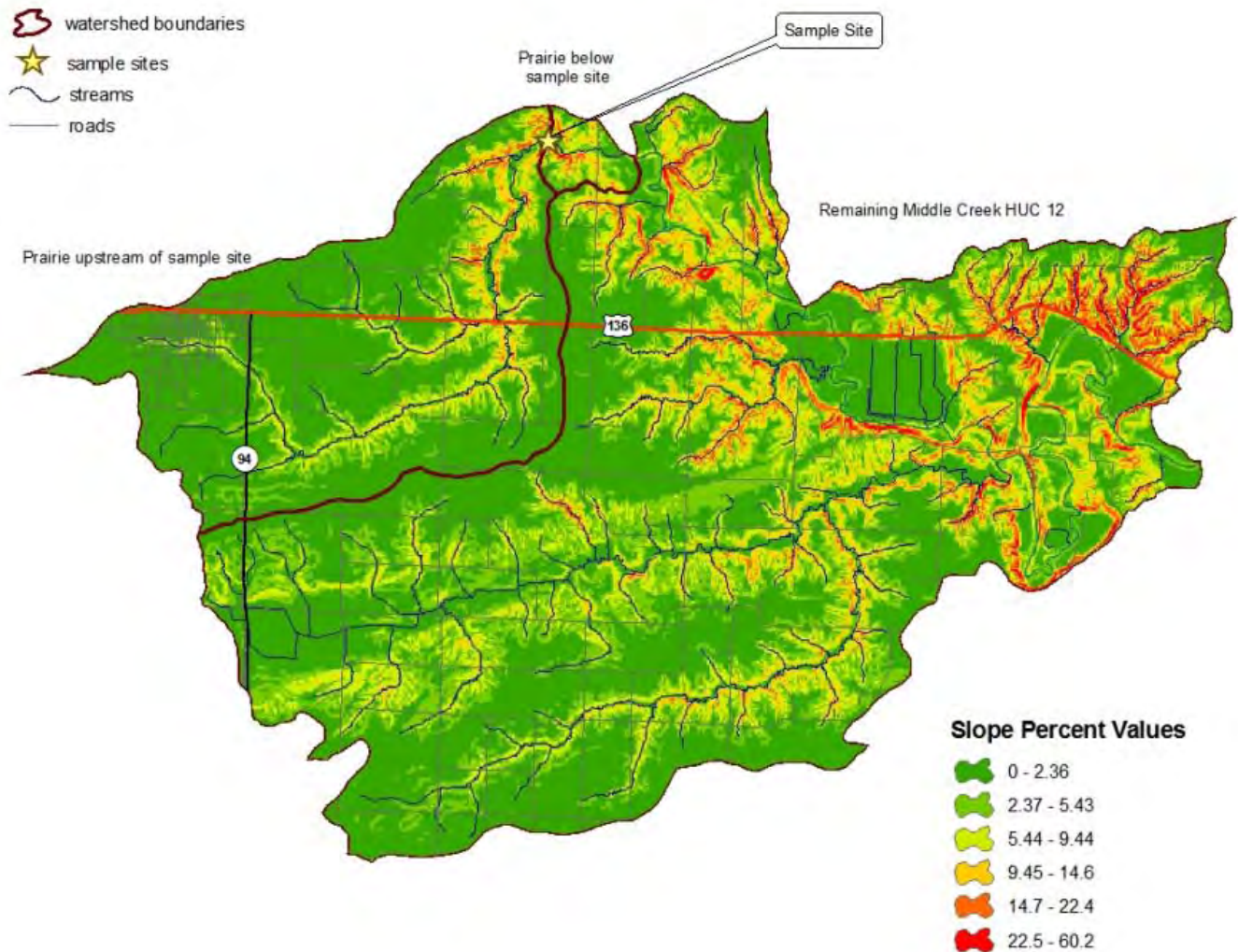
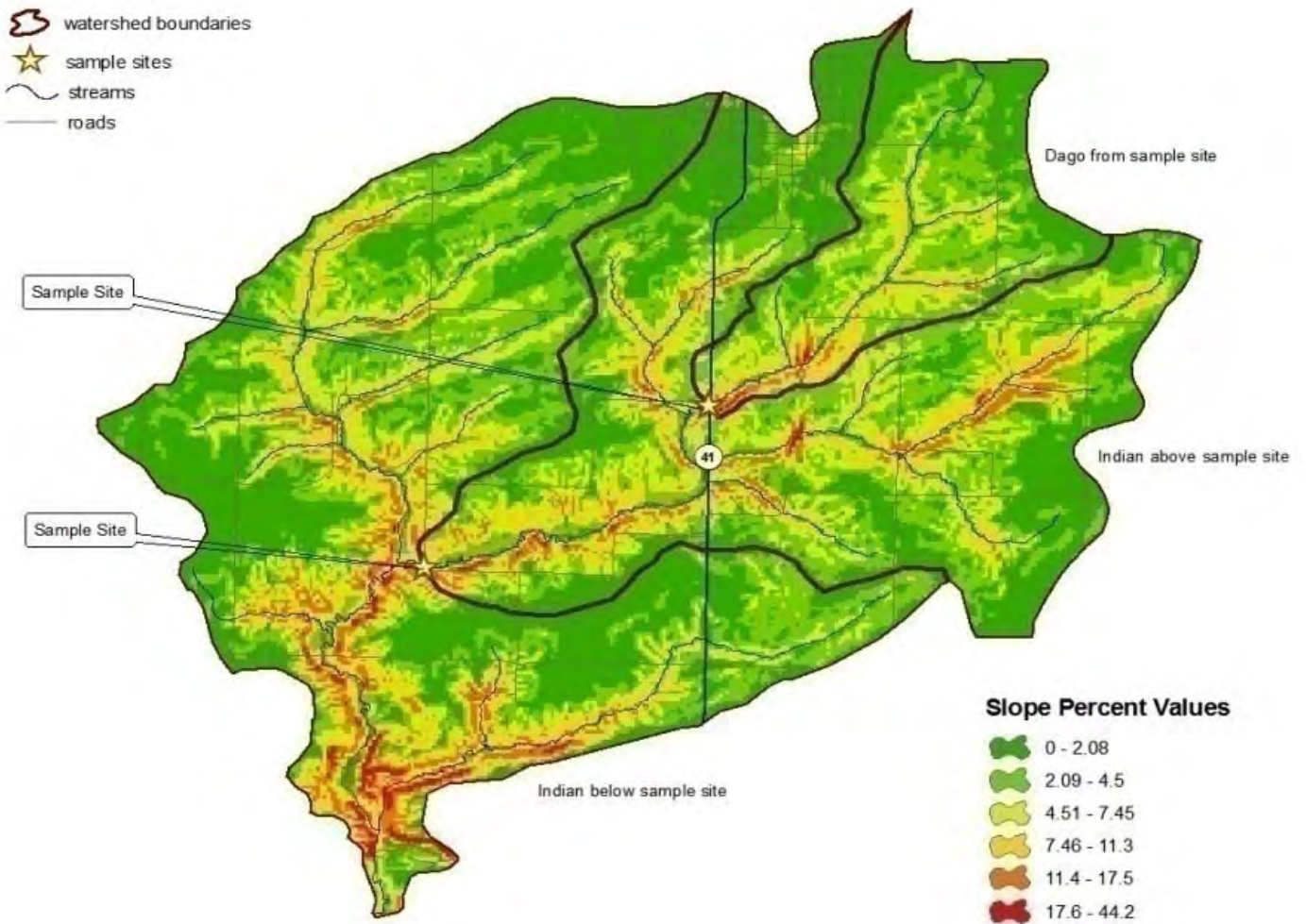




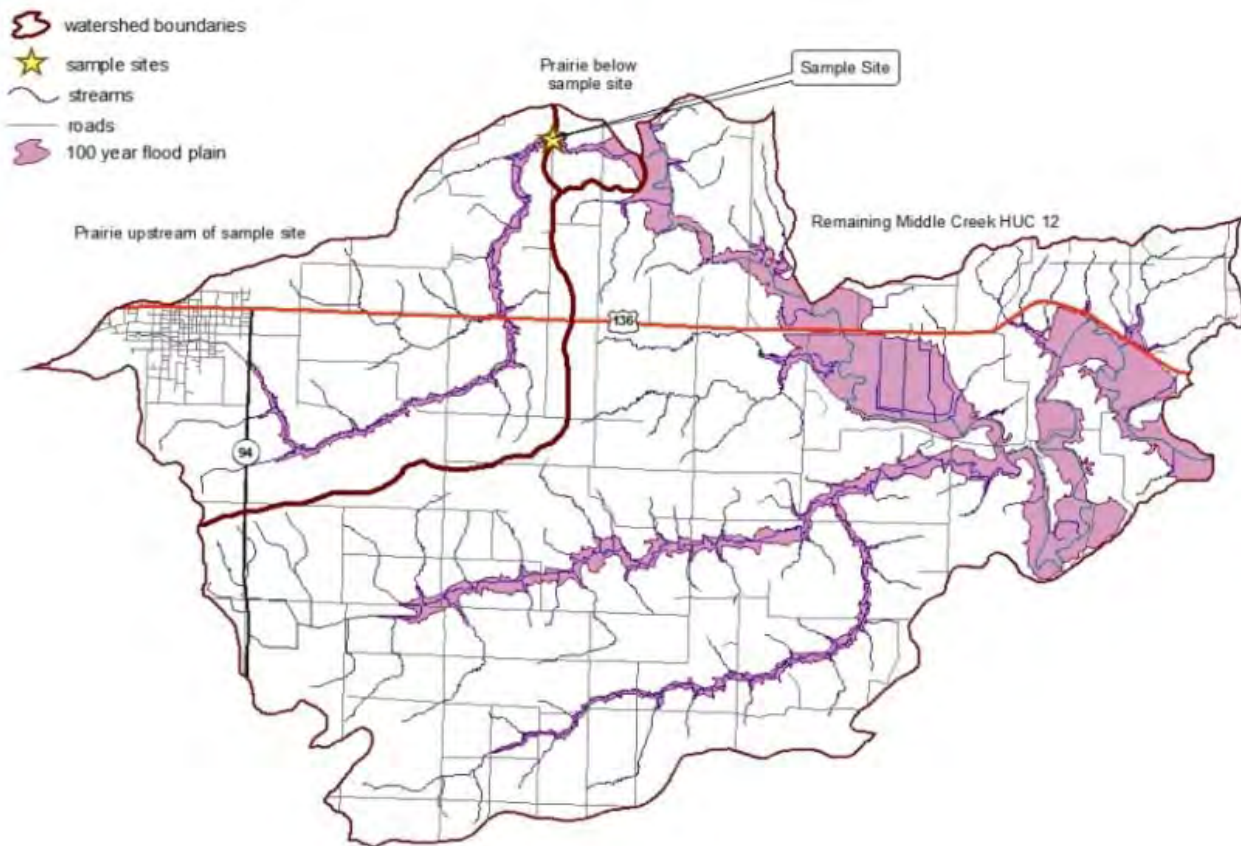
Figure 34 - Prairie Creek/Middle Creek Slope



## 5.7 100 Year Flood Plain

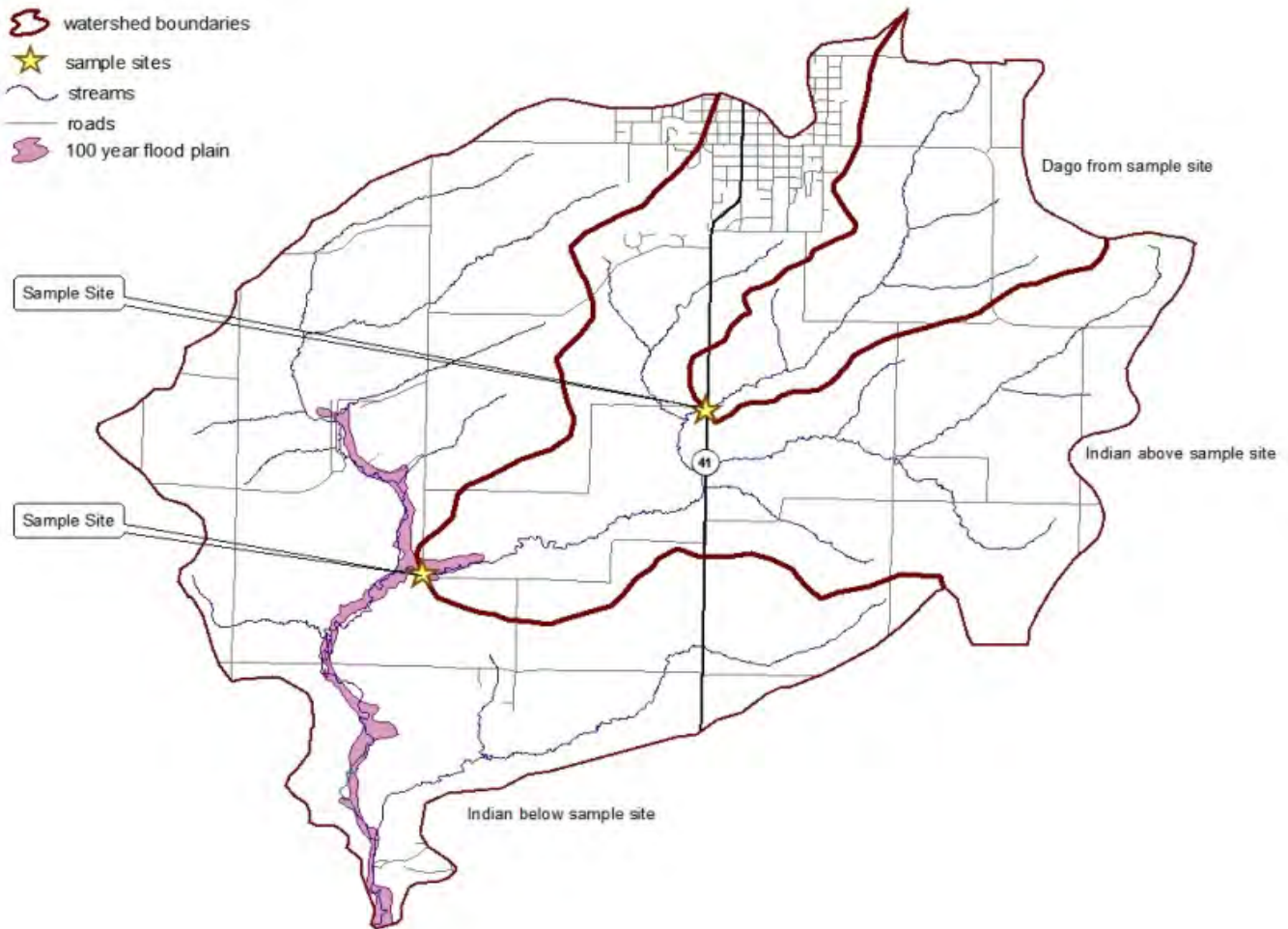
Floodplain maps were developed from the 1986 FEMA floodzones layer. A prerequisite or eligibility requirement of many conservation programs, such as the Conservation Reserve and Enhancement Program (CREP), includes the presence of land in the 100 year floodplain. The Prairie Creek watershed has a high percentage of land in the 100 year flood plain; significant enrollment in CREP has already occurred in Prairie Creek. Future opportunities for CREP as well as practices such as wetland restoration and riparian buffers should be targeted in to these areas. Due to the lack of 100 year floodplain in Indian Creek and Dago Slough, these watersheds may not be well suited to the CREP program; however, many other programs are still available to provide an opportunity for conservation practices.

*Figure 35 - Prairie Creek/Middle Creek 100 Year Floodplain Map*



This watershed holds 4,184 acres of the 100 year flood plain. (11.83% of total watershed acres)

Figure 36 - Indian Creek/Dago Slough 100 Year Floodplain Map



This watershed holds 152 acres of the 100 year flood plain. (1.5% of total watershed acres)

## 5.8 Landcover and Landuse

A combination of two landuse/landcover layers was developed for both watersheds. The GIS Landcover 1999-2000 Information, Illinois Department of Agriculture classification layer classified a better range of wetlands and water, while the 2007 NASS layer (USDA National Agricultural Statistics Service) better exemplified the range of grasslands and agriculture. A hybrid of the two layers was created to make the final product that was used for landuse analysis. The following table outlines landcover descriptions used in this section.

**Table 36 - Landuse/Landcover Description**

	NASS 2007	DOA Land Cover 1999-2000
Agricultural and Grassland	AGRICULTURAL corn soybeans misc vegetables and fruits barren  GRASSLAND winter wheat winter wheat/soybeans double crop oats alfalfa clover/wildflowers fallow/idle cropland pasture/grass developed/open space grassland herbaceous pasture/hay	AGRICULTURAL Corn Soybeans Winter Wheat Other Small Grains and Hay Winter Wheat/Soybeans Other Agriculture Rural Grassland
Forested	woodland deciduous forest	Upland Partial Canopy/Savanna Upland Coniferous
Urban	developed/low intensity developed/medium intensity developed/high intensity	High Density Low/Medium Density Urban Open Space
Wetland	wetland woody wetlands shallow marsh/wet meadow seasonally/temporarily flooded floodplain forest shallow water	Shallow Marsh/Wet Meadow Deep Marsh Seasonally/Temporarily Flooded Floodplain Forest Swamp Shallow Water
Water or Other	surface water	Clouds Cloud Shadows

**5.8.1 Prairie Creek Landcover/Landuse**

The following charts and maps show the landcover area in each watershed.

**Table 37 - Prairie Creek Landcover Breakdown**

	Below Sample Site (in acres)	Upstream of Sample Site (in acres)	Remaining HUC 12 (in acres)
<b>Agriculture</b>	2	4,361	10,499
<b>Forestry</b>	224	691	7,122
<b>Grass</b>	145	1,952	7,434
<b>Urban</b>	13	980	997
<b>Wetland</b>	16	49	1,086
<b>Water</b>	1	30	92
<b>Total</b>	401	8,063	27,230

**Figure 37 - Landcover Breakdown, Prairie Creek**

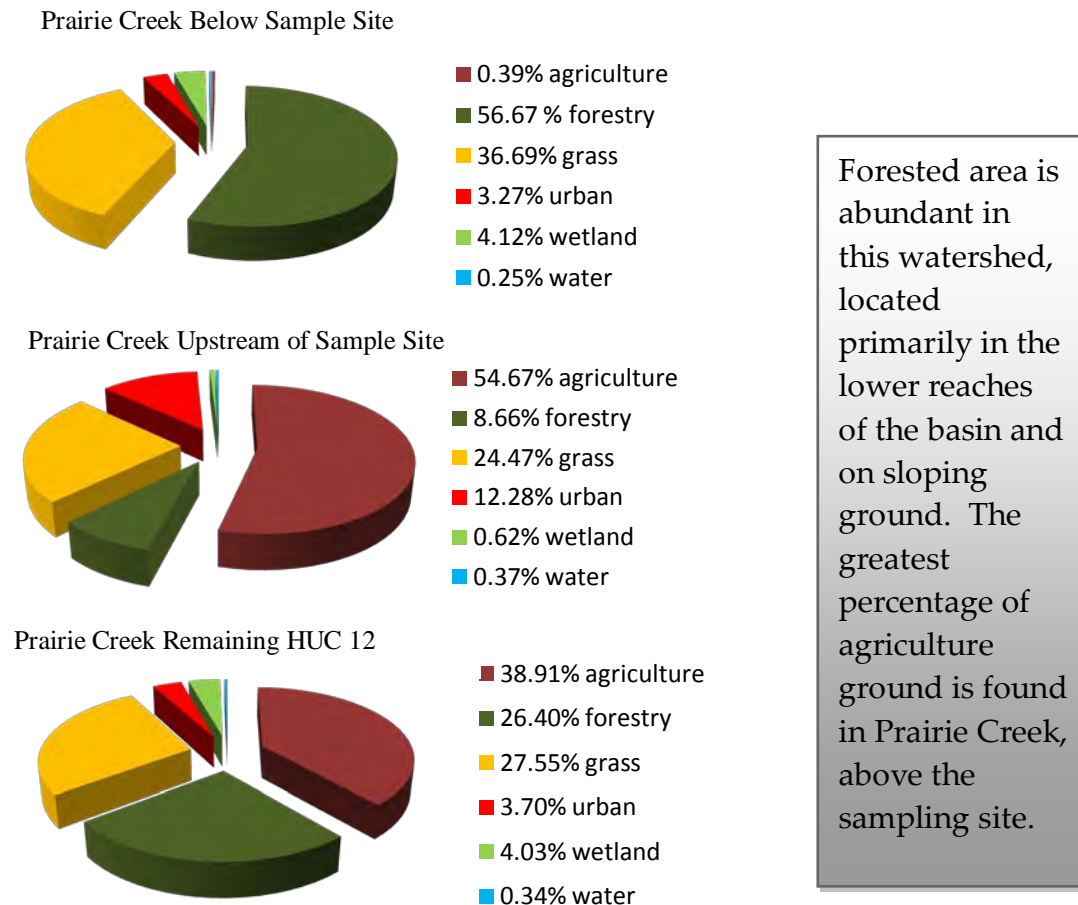
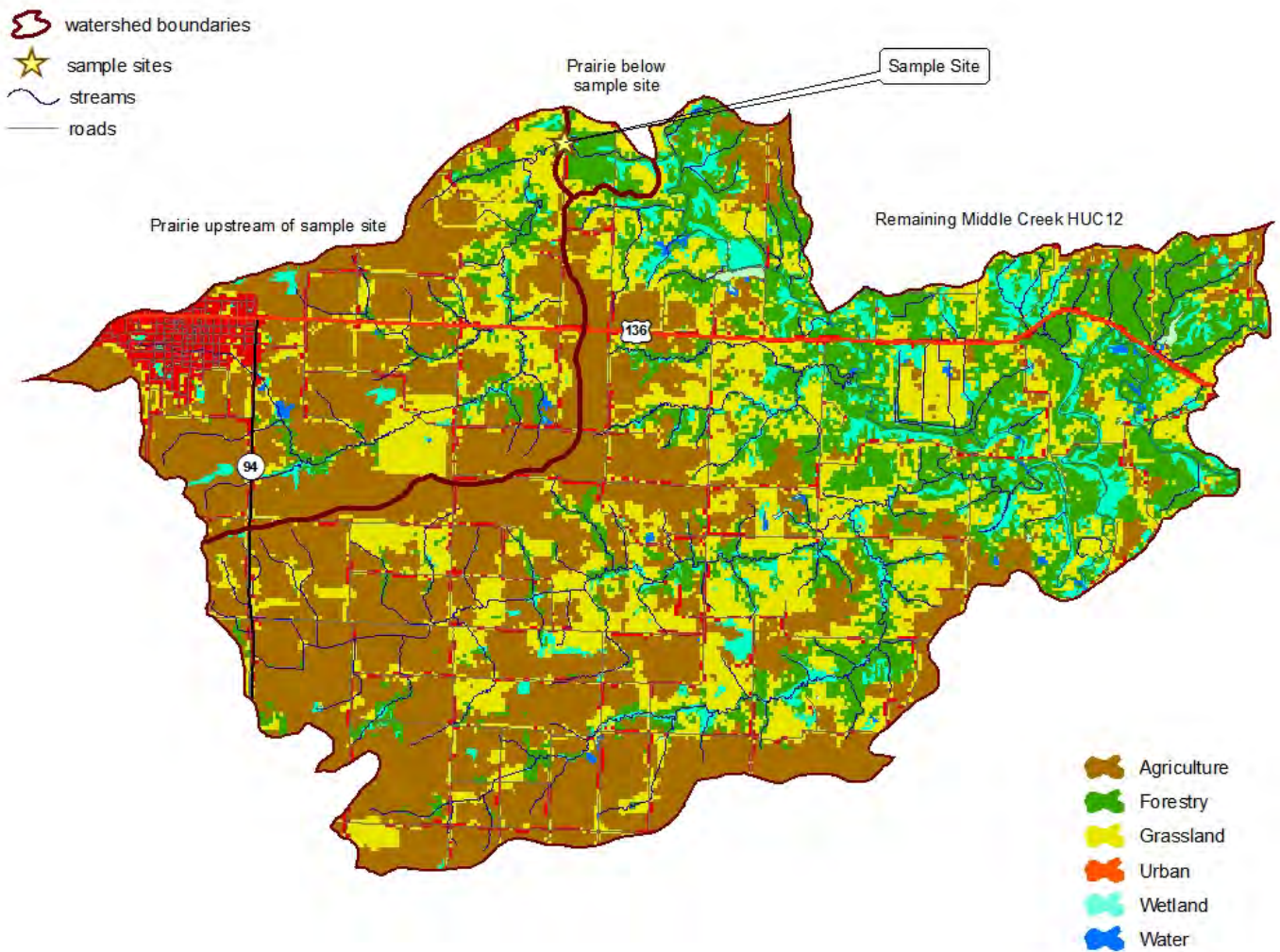


Figure 38 - Prairie Creek/Middle Creek Landcover



### 5.8.2 Indian Creek and Dago Slough Landcover/Landuse

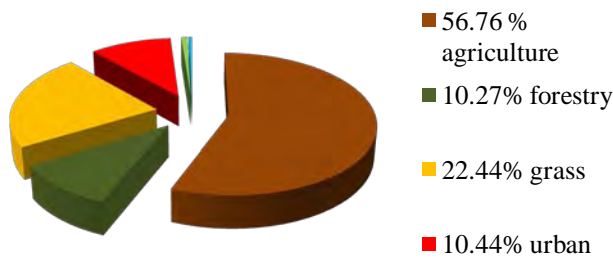
The following charts and maps show the landcover area in each watershed.

**Table 38 - Indian Creek/Dago Slough Landcover Breakdown**

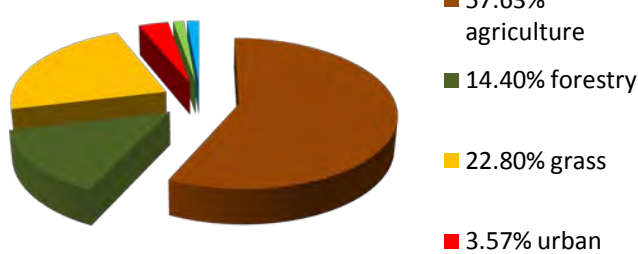
	Indian Creek Above sample site (in acres)	Indian Creek Below sample site (in acres)	Dago Slough (in acres)
Agriculture	2,245	2,982	981
Forestry	406	745	96
Grass	888	1,180	193
Urban	413	185	40
Wetland	31	68	7
Water	18	74	0.42
<b>Total</b>	<b>4,001</b>	<b>5,234</b>	<b>1,317.42</b>

**Figure 39 - Landcover Breakdown, Indian Creek/Dago Slough**

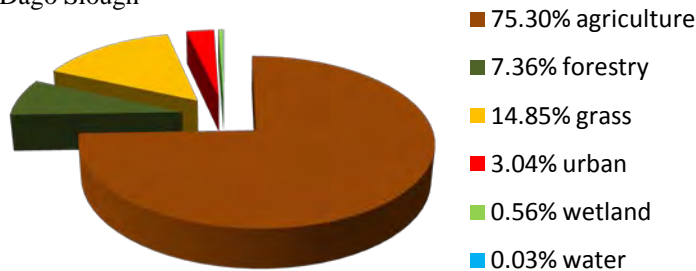
Indian Creek above sample site



Indian Creek below sample site

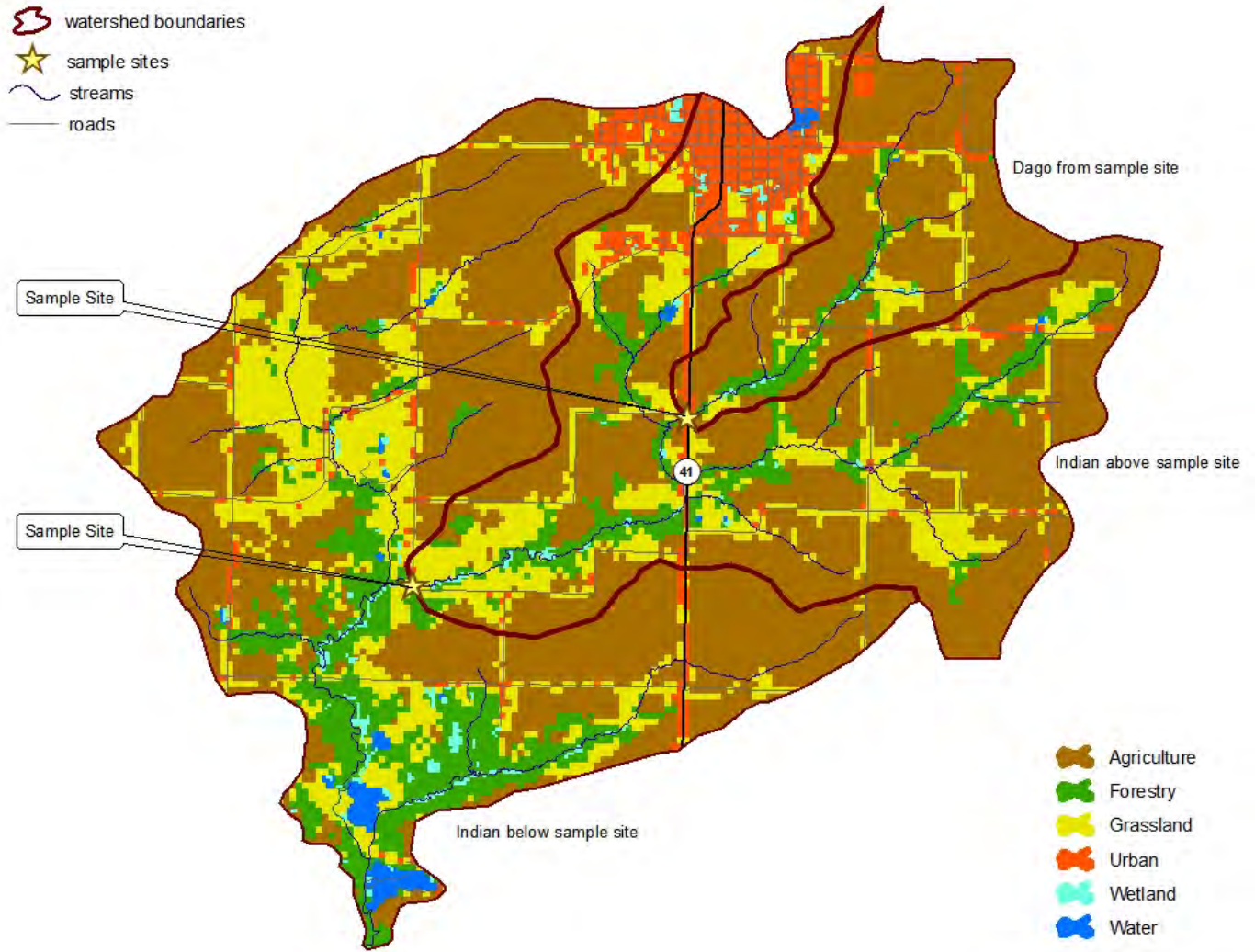


Dago Slough



Like most other watersheds in the State, agriculture is the dominant landuse. Dago Slough has the highest percentage of land in agricultural use. Grassed areas are also high; this represents primarily pasture. In Dago, much of grass is in waterways or on abandoned/steep land

Figure 40 - Indian Creek/Dago Slough Landcover

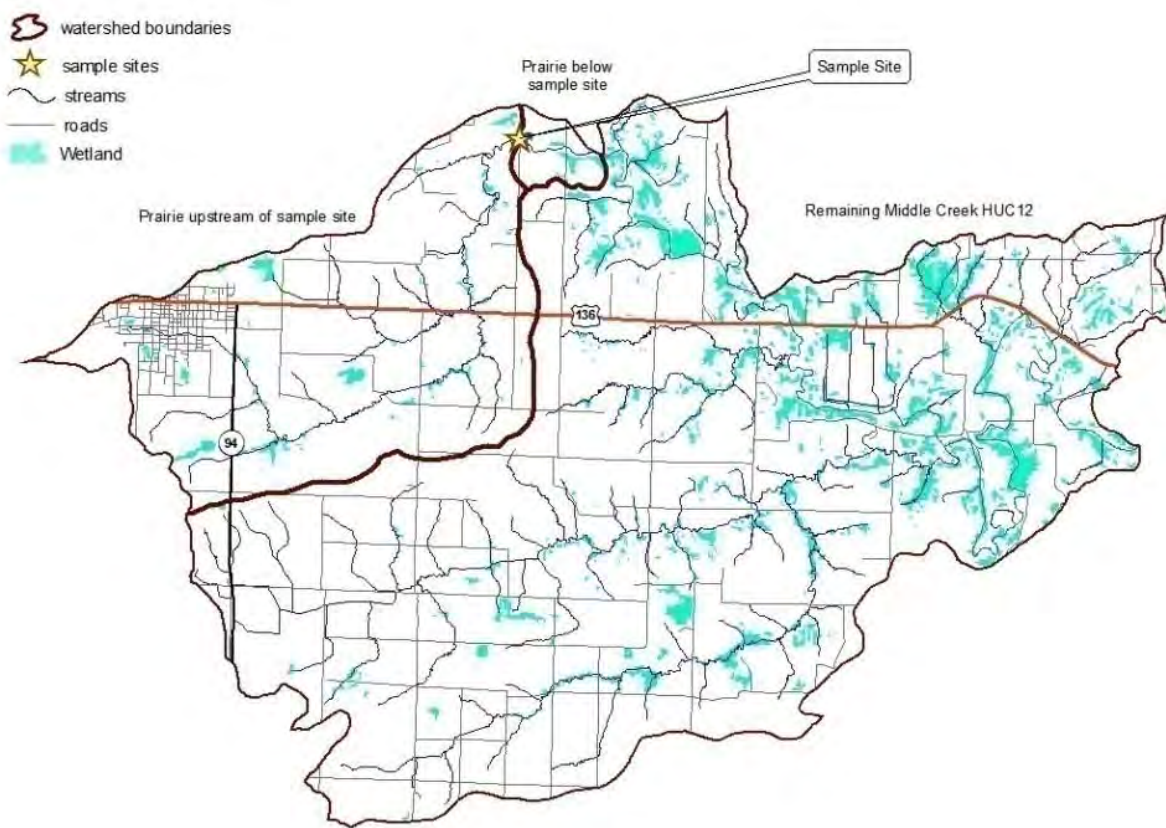




### 5.9 Wetlands

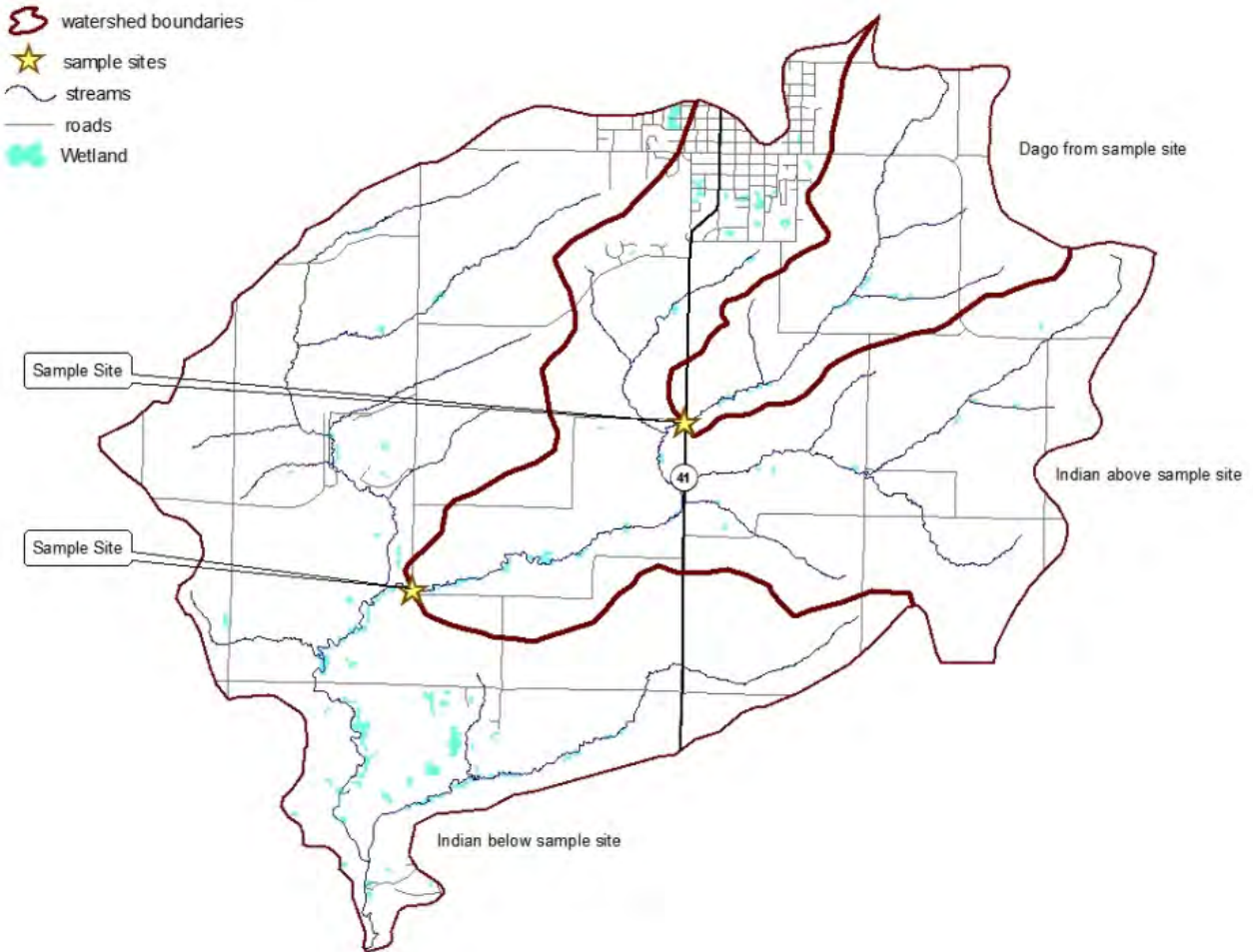
Wetland maps were developed from a combination of the 2000 GAP landcover and the USDA-NASS Cropland Data Layer, 2009 (see landcover classifications above). In Prairie Creek/Middle creek, significant wetlands exist in the lower reaches of the watershed. These areas represent floodplain forest; much of this area is under permanent easements through the Conservation Reserve and Enhancement Program (CREP).

Figure 41 - Wetlands, Prairie Creek/Middle Creek



	Prairie Upstream Sample Site	Prairie Below Sample Site	Remaining HUC 12
Acres of Wetlands	195	31.5	1,983
% of watershed	2.4%	8%	7.4%
<b>Watershed Totals</b>	<b>2,210</b>	<b>6.25%</b>	

Figure 42 - Wetlands, Indian Creek/Dago Slough



	Indian Above Sample Site	Indian Below Sample Site	Dago Above Sample Site
<b>Acres of Wetlands</b>	189.55	147.28	8.29
<b>% of watershed</b>	2.85%	4.79%	0.64%
<b>Watershed Totals</b>	<b>345.12</b>	<b>3.31%</b>	

### 5.10 Surficial Geology

Surficial Geology maps represent Quaternary Deposits in Illinois that lie at or near the land surface. These deposits can influence the rates of erosion and water quality in a watershed. For example, windblown sediments are more susceptible to erosion.

Figure 43 - Surficial Geology, Prairie/Middle Creek

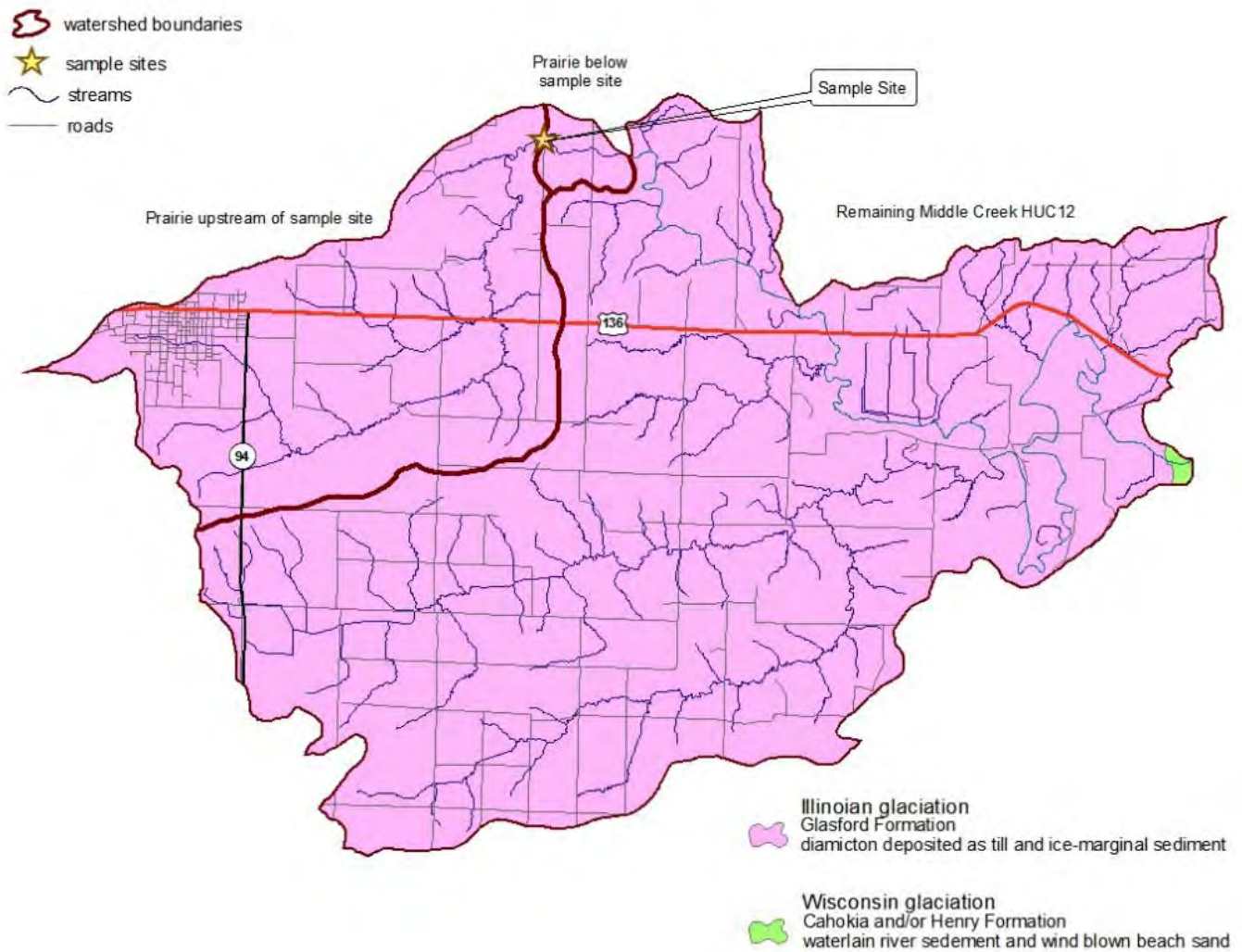
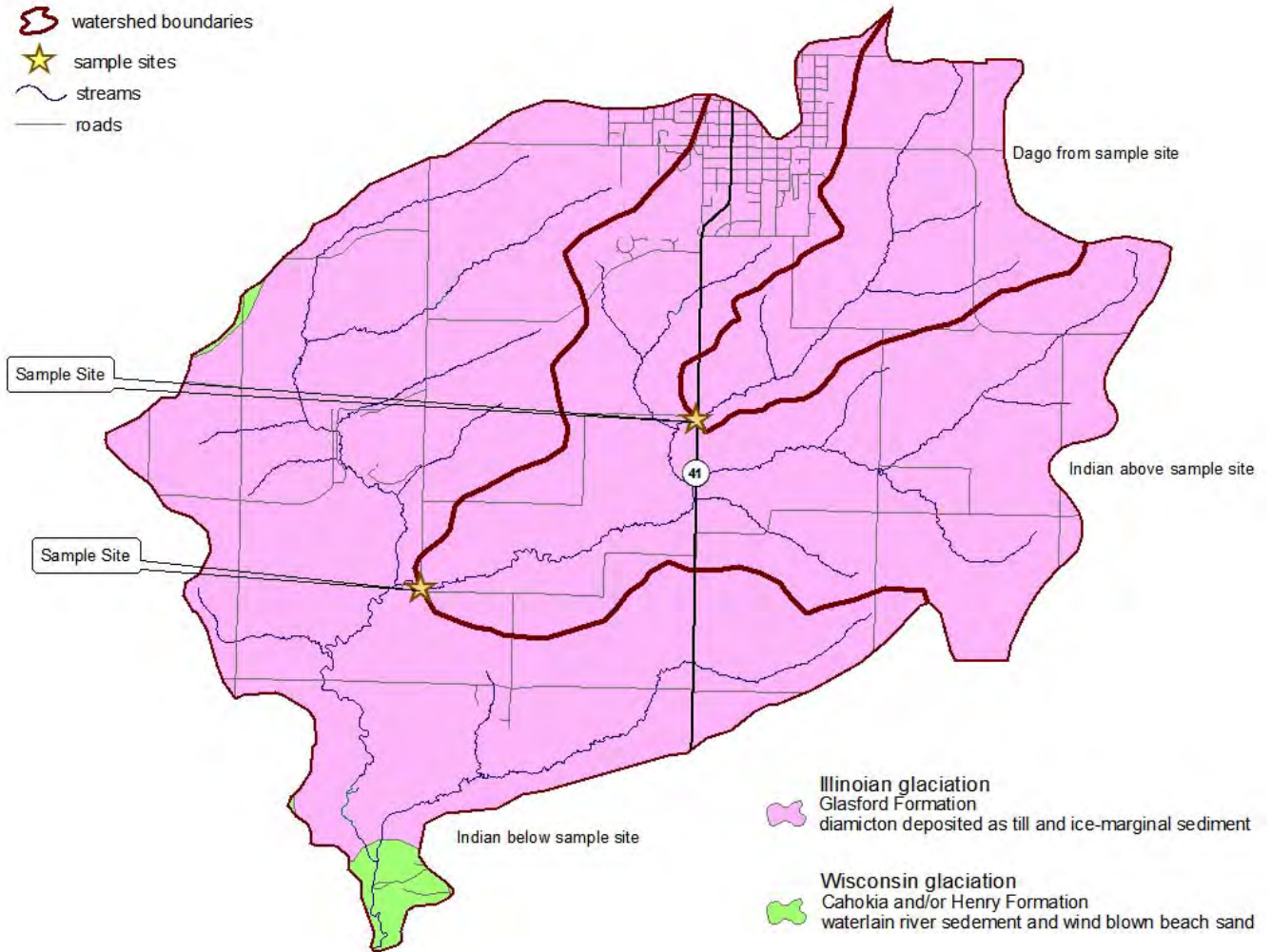


Figure 44 - Surficial Geology, Indian Creek/Dago Slough

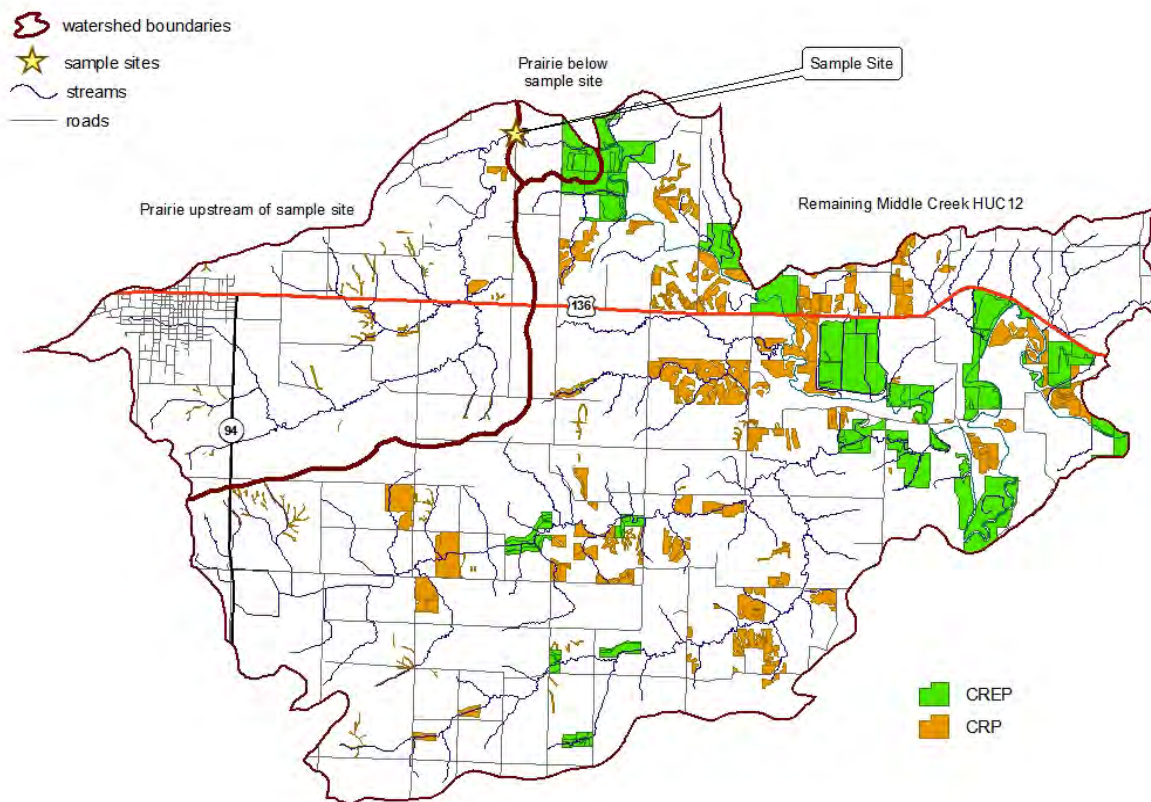


## 5.11 Existing Best Management Practices

### 5.11.1 Prairie Creek Existing Best Management Practices

Participation in Farm Bill programs such as the Conservation Reserve Program (CRP) and the Conservation Reserve and Enhancement Program (CREP) has been quite successful in the Prairie Creek watershed as well as the remaining HUC 12 basin of Middle Creek. One State funded Conservation Practices Program (CPP) contract is in place in Prairie Creek (several in Middle Creek) and just over one dozen Environmental Quality Incentive Program (EQIP) practices have been implemented in Prairie. The CRP and the CREP program are having a positive effect on water quality. There are 133 acres (34%) of CRP and CREP in the watershed below the sample site. There are 77 acres (less than 1%) in the watershed, upstream of the sample site, and 3,824 acres (14%) in the remaining HUC 12 watershed. Although not identified in the map below, “non-enrolled,” voluntary BMPs do account for additional practices. These voluntary practices are included in section 6.3.3 – Load Reduction Strategy/TMDL; Existing BMPs

Figure 45 - CREP/CRP Prairie Creek



Existing BMP's in the entire basin (including middle/little creek) account for annual load reductions of: 8,884 tons/yr of sediment, 34,939 lbs/yr of Nitrogen, and 12,878 lbs/yr of Phosphorous

Additional details are included in section 6.3 and model descriptions can be found in Appendix A.

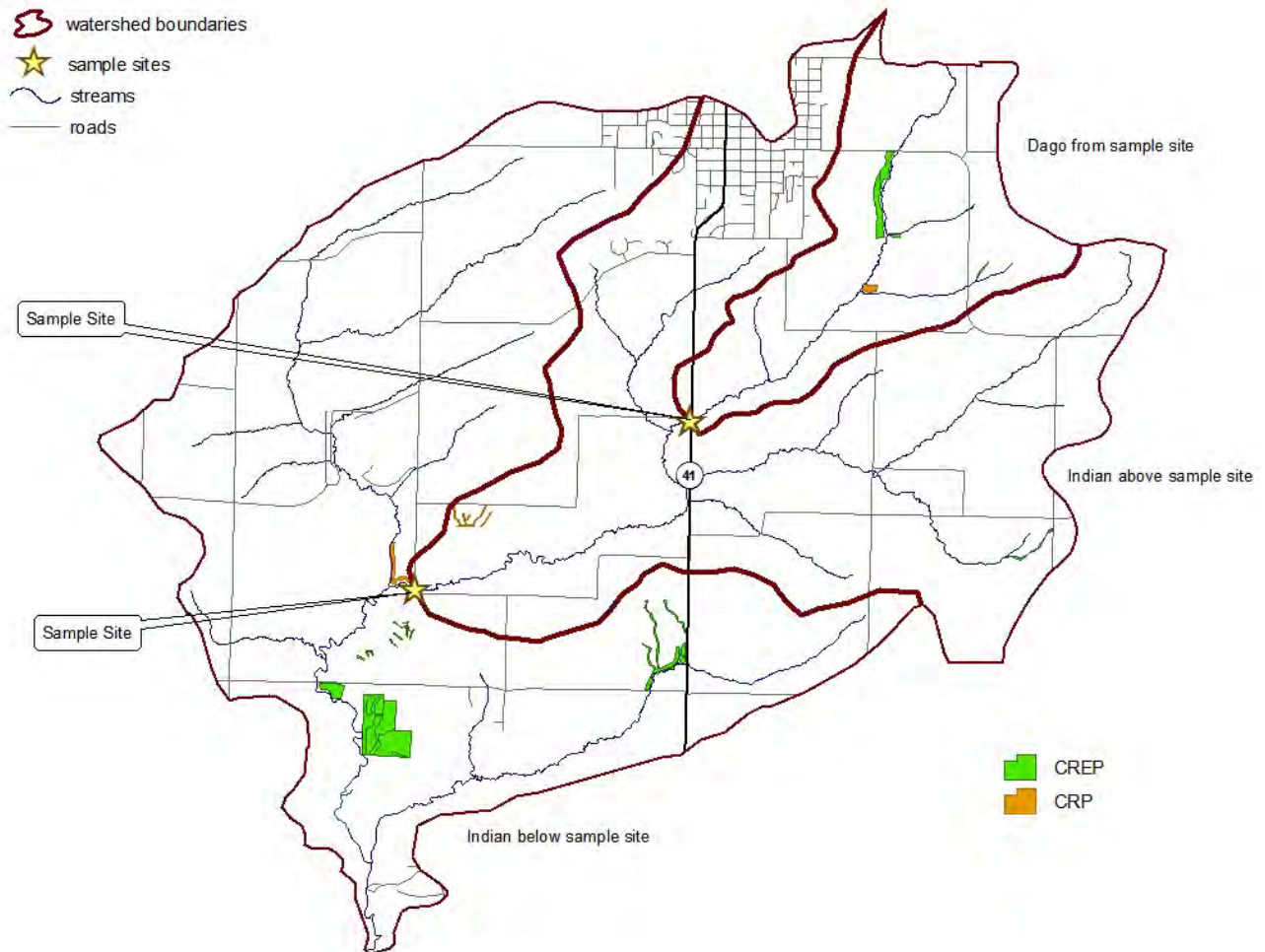
### ***5.11.2 Indian Creek and Dago Slough Existing Best Management Practices***

Participation in common Farm Bill programs as well as state programs such as CPP are minimal, indicating opportunities to increase this participation. There is only one CPP contract and one EQIP contract in place in the Indian/Dago Slough Watershed. Several CRP and CREP practices exist in the watershed, though they don't add up to even 1% of the overall watershed area. Below the Indian Creek sample site there are 64.8 acres (1%). Above the Indian Creek sample site there are 3.5 acres (0.01%) and Dago Slough has 14 acres (1%). Numerous landowners have installed BMPs independent of existing cost-share programs. Although not identified in the map below, voluntary BMPs do account for additional practices. These voluntary practices are included in section 6.3.3.

#### ***Dago Slough***



Figure 46 - CREP/CRP, Indian Creek/Dago Slough



Existing BMP's in the entire basin account for annual load reductions of: 755 tons/yr of sediment, 3,212 lbs/yr of Nitrogen, and 1,128 lbs/yr of Phosphorous

Additional details are included in section 6.3.3.

## 5.12 Tile Locations

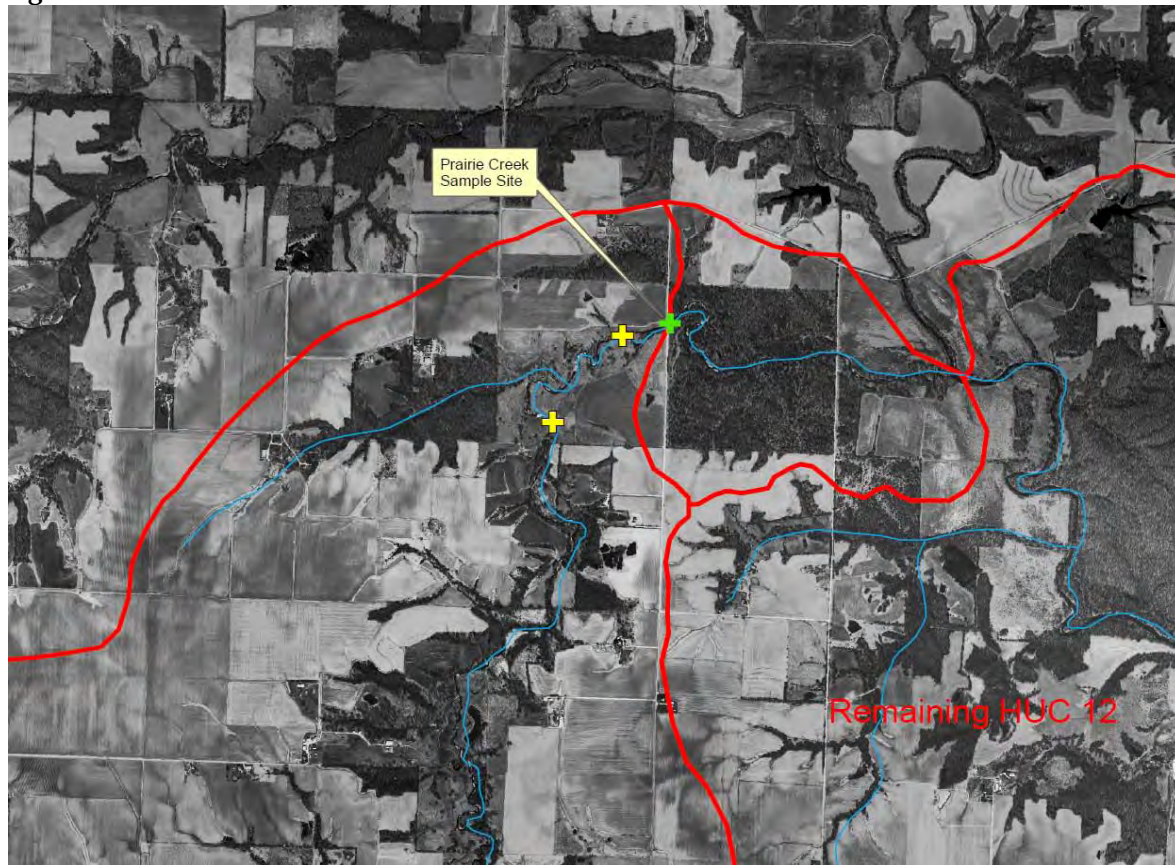
Tile flow in Illinois can be a major source of nutrients to streams, especially nitrates. Tile locations were recorded during an in-stream survey and are summarized in this section. Project staff was unable to obtain landowner permission to access the majority of Prairie Creek; tile information is therefore limited. The following information represents only what areas were assessed. It is likely, numerous additional tile outlets exist upstream. A total of 2 tile outlets are located in the watershed along the assessed reach of Prairie Creek.

### 5.12.1 Prairie Creek Tile Locations

Table 39 - Prairie Creek Tile Locations

	Prairie Upstream Sample Site	Prairie Below Sample Site	Remaining HUC 12
Number of Tiles	2	N/A	N/A
<b>Watershed Totals</b>	<b>2</b>		

Figure 47 - Prairie Creek Tile Locations





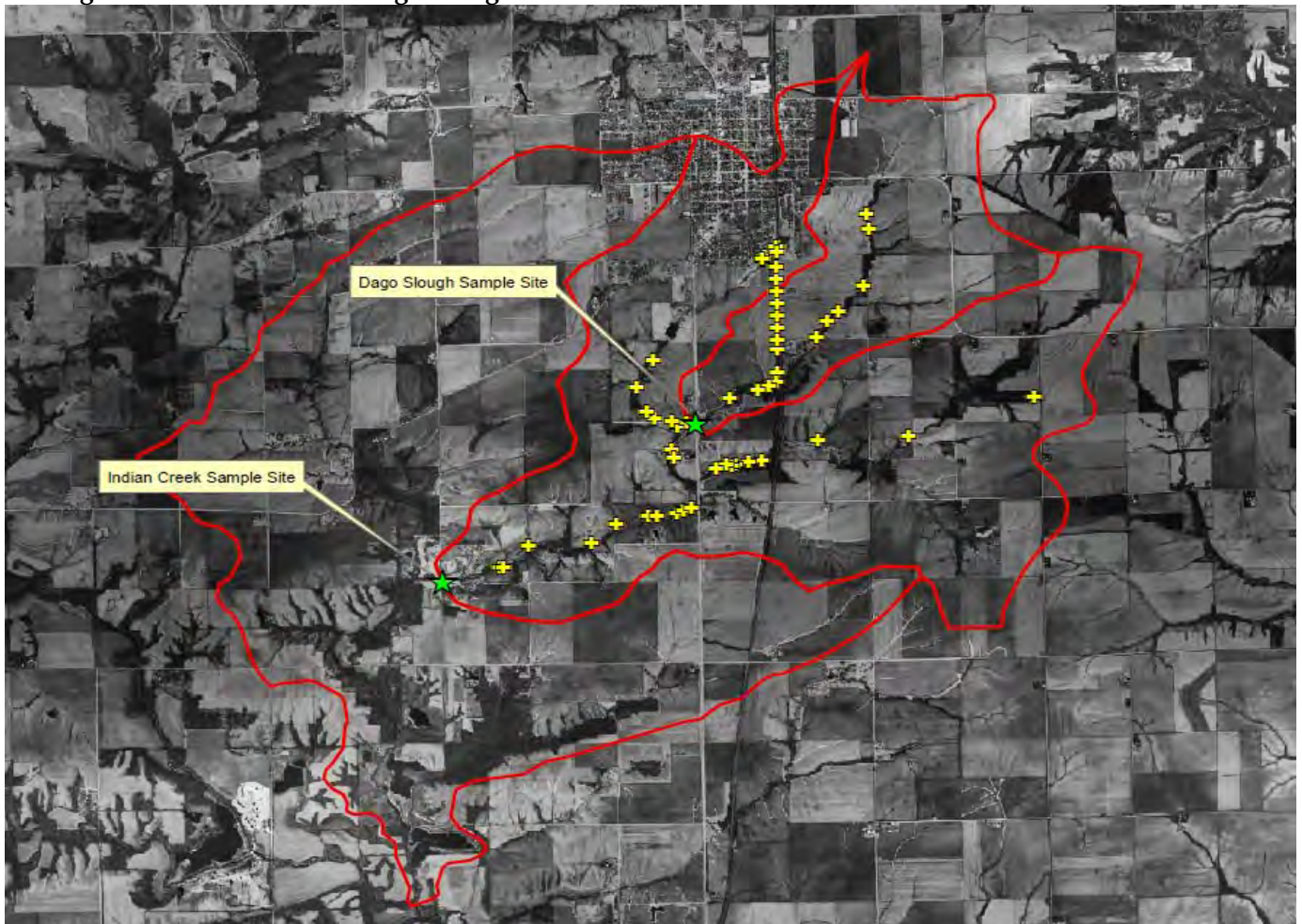
**5.12.2 Indian Creek and Dago Slough Tile Locations**

A total of 53 tile outlets (includes other pipes and manholes) were located in the watershed along Indian Creek and Dago Slough. The stream below the Indian Creek sample site was not surveyed.

**Table 40 - Indian Creek/Dago Slough Tile Locations**

	Indian Above Sample Site	Indian Below Sample Site	Dago Above Sample Site
Number of Tiles	36	0	17
<b>Watershed Totals</b>	<b>53</b>		

**Figure 48 - Indian Creek/Dago Slough Tile Locations**



### 5.13 Livestock Operations

A survey of existing livestock operations (pasture operations only) was conducted in both LRS watersheds. No Confined Animal Feed Operations (CAFO) exists in either watershed. A GPS point was recorded for each operation and a number (score) assigned to indicate the impact that operation is having on water quality; this was used to calibrate the runoff and nutrient loading model on pasture ground

**Table 41 - Explanation of Livestock Score**

Score or Number	Explanation*
1	Little to no impact on water quality; pasture well managed and no evidence of runoff or cattle access to stream
2	Little to no impact on water quality; pasture well managed and very little evidence of runoff or cattle access to stream
3	Moderate impact to water quality; areas of over-grazing in pasture but runoff receiving adequate filtering; some cattle access to stream but having moderate impact
4	Direct impact on water quality; over-grazing present with cattle access to stream; runoff is present
5	Severe impact on water quality; over-grazing severe (bare dirt) with cattle access to stream; runoff is severe

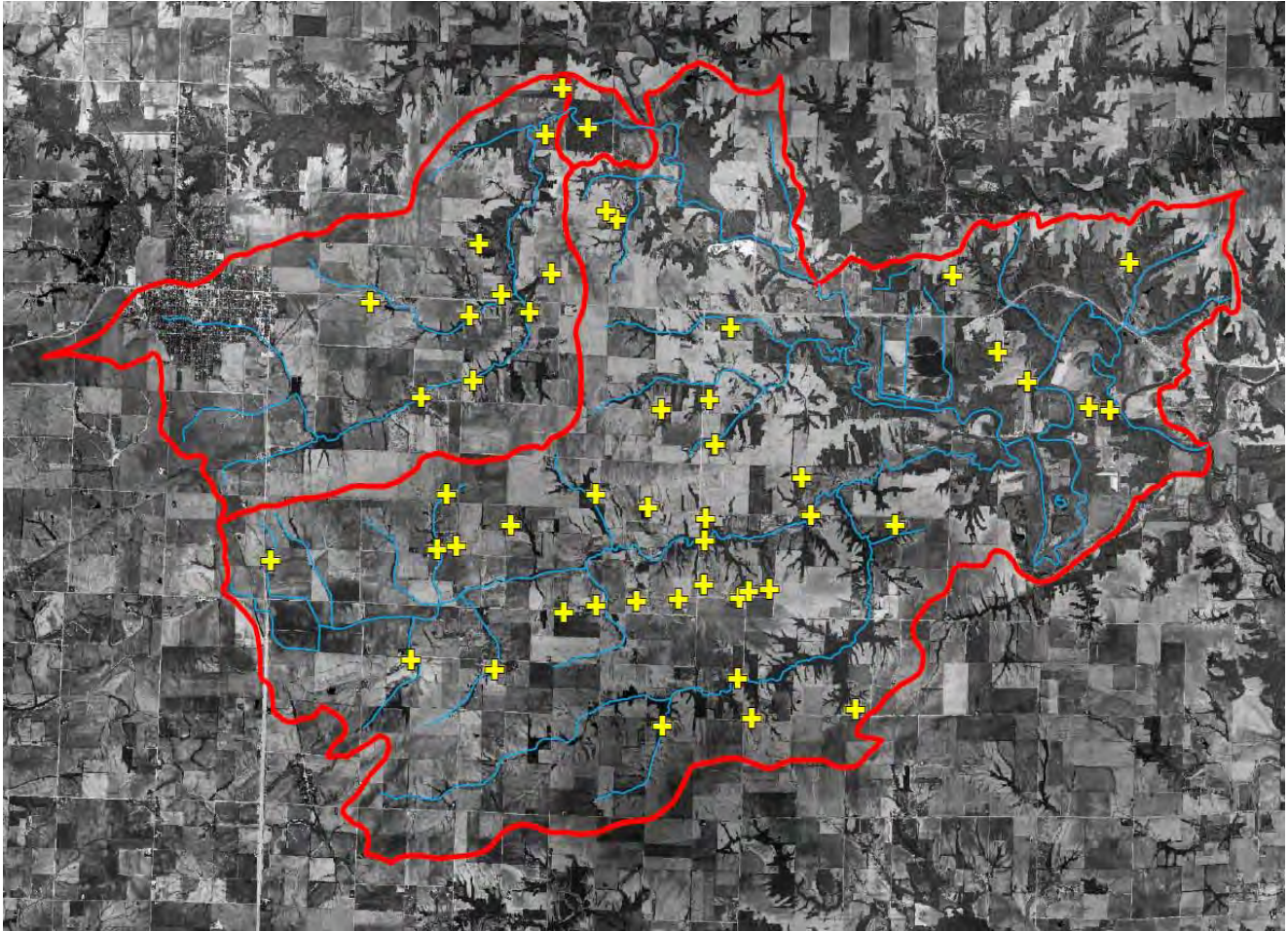
\*Custom scoring system developed by Jeff Boeckler based on field observation and experience working on pasture operation

#### 5.13.1 Prairie Creek Livestock Operations

**Table 42 - Prairie Creek Livestock Operations**

Watershed	Prairie Above Sample Site	Prairie Below Sample Site	Remaining HUC 12
Number Livestock Operations	10 (1 severe impact)	1	38 (2 severe impact)

*Figure 49 - Prairie Livestock Operations*



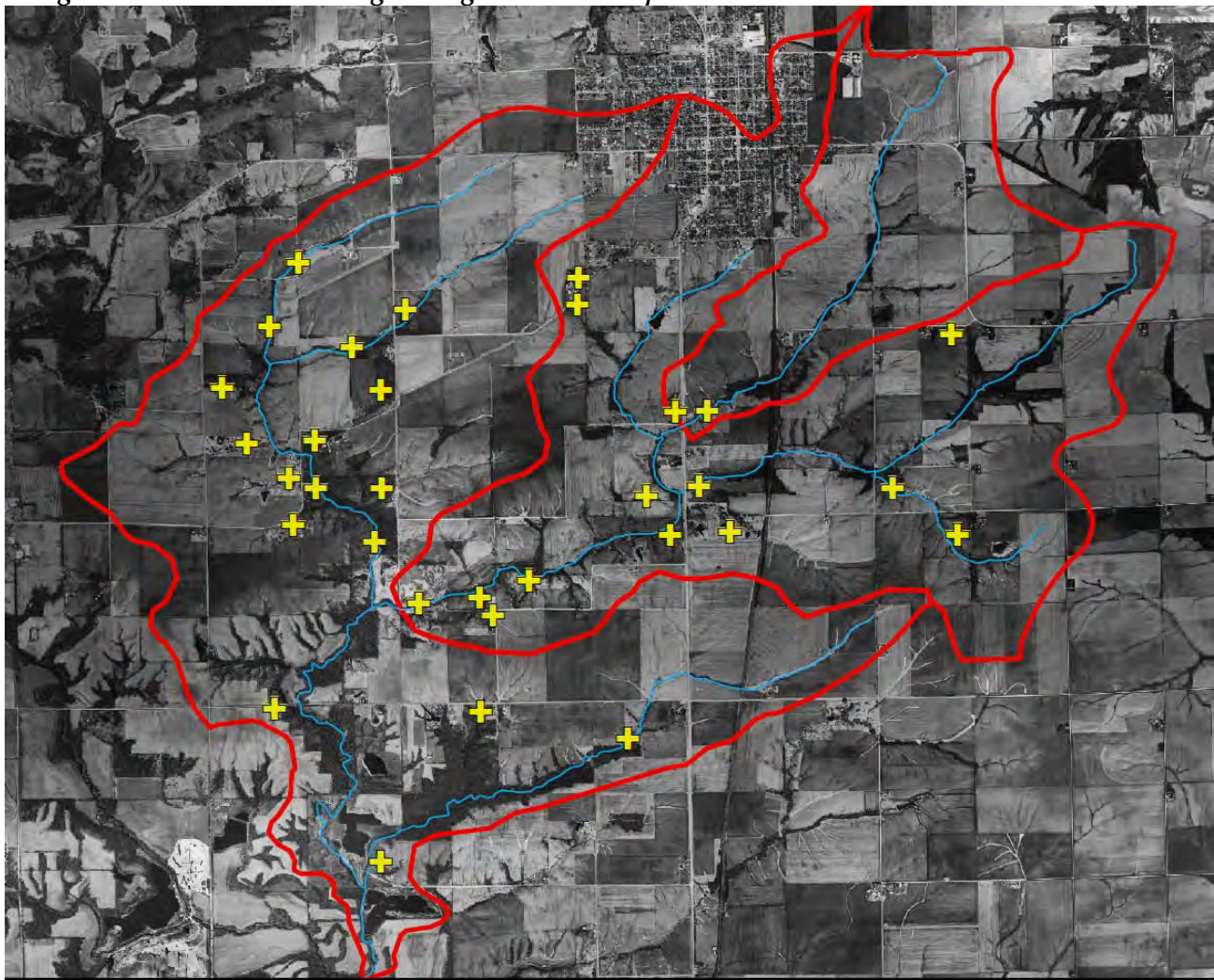
This map represents livestock operations in the Prairie Creek watershed. There are a total of 49 operations in the entire HUC 12 watershed, with 10 on Prairie Creek above the sample site.

5.13.2 Indian Creek and Dago Slough Livestock Operations

Table 43 - Indian Creek/Dago Slough Livestock Operations

Watershed	Indian above Sample Site	Indian Below Sample Site	Dago above Sample Site
Number Livestock Operations	13 (2 severe impact)	17 (5 severe impact)	2 (1 severe impact)

Figure 50 - Indian Creek/Dago Slough Livestock Operations



This map represents livestock operations in the Indian/Dago watershed. There are a total of 32 operations in the entire HIUC 12 watershed, with 2 on Dago Slough above the sample site and 13 on Indian Creek above the sample site.

## 5.14 Gully Erosion

Where landowner permission was obtained, upland ground was surveyed for active gully erosion. A GPS point was recorded at the end of each gully and the length, width, depth, soil density, and number of years eroding was recorded. A treatment option for each gully was also recorded; this is summarized in a section on recommended BMPs. Where landowner permission was given, gullies were also assessed and measured from the stream channel and are discussed separately in this section (stream corridor gully erosion). With the exception of stream corridor gully erosion, totals for gully erosion represent what sediment leaves the field boundary and not what is directly delivered to the stream.

Upland gully erosion was calculated using the following equation derived from the 2005 EPA Region 5 Worksheet, "Estimating Load Reductions from Agricultural and Urban BMPs."

$$\begin{aligned} \text{Total Tons Erosion} &= \text{Length (ft)} \times \text{Depth (ft)} \times \text{Width (ft)} \times \text{Soil} \\ &\quad \text{Weight Dry Density (tons/ft}^3\text{)} / \text{Number of Years Eroding} \\ \text{N Load (lbs)} &= \text{Total Tons} \times \text{N concentration in Soil (0.002 lbs/lbs)} \times 2000 \times \\ &\quad \text{Correction Factor} \\ \text{P Load (lbs)} &= \text{Total Tons} \times \text{P concentration in Soil (0.0006 lbs/lbs)} \times 2000 \\ &\quad \times \text{Correction Factor} \end{aligned}$$

The Rapid Assessment, Point Method (RAP-M) assessment method was used to estimate annual sediment contributions from stream corridor gully erosion in the main channel of Prairie Creek, Indian Creek and Dago Slough. Stream corridor gullies were assessed by estimating the maximum height and length of the left and right eroded banks. Lateral recession rates were then estimated using the lateral recession rates table (figure 8 in U.S. Department of Agriculture, Natural Resource Conservation Service, 2001). Bankfull height was estimated at 50% of the maximum bank height based on vegetation indicators. Bankfull height may be considered the channel forming discharge and was applied to the formula as the area of channel that is annually eroded. Using a density of 95 pcf the formula is:

$$L \times (H \times .5) \times \text{Lat. Rec. Rate} \times \text{Density} / 2000 = \text{Tons / Year}$$

Nutrient Loads were calculated using the following equation:

$$\begin{aligned} \text{N Load (lbs)} &= \text{Total Tons} \times \text{N concentration in Soil (0.002 lbs/lbs)} \times 2000 \times \\ &\quad \text{Correction Factor (1)} \\ \text{P Load (lbs)} &= \text{Total Tons} \times \text{P concentration in Soil (0.0006 lbs/lbs)} \times 2000 \\ &\quad \times \text{Correction Factor (1)} \end{aligned}$$

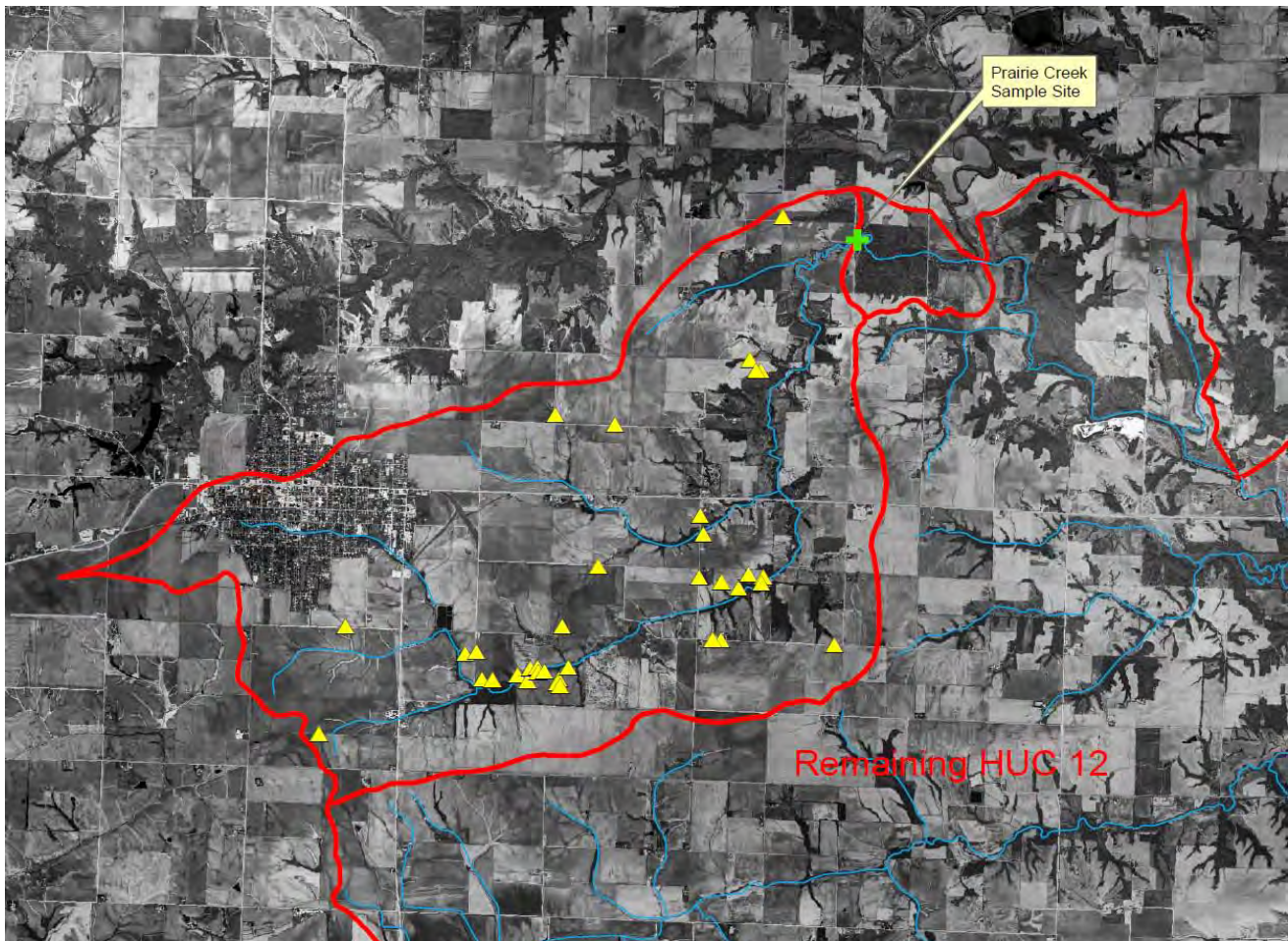
**5.14.1 Prairie Creek Upland Gully Erosion**

A total of 35 gullies were surveyed above the Prairie Creek sample site where landowner permission was provided; no gullies were found below the sample location and the remaining HUC 12 watershed was not assessed for upland gully erosion. On average, each assessed gully on Prairie Creek is eroding at 19 tons/yr for a total of 679 tons/year. Gully erosion was not fully assessed in the watershed due to difficulties in accessing private ground and there for totals for gully erosion are likely higher than presented below.

**Table 44 - Prairie Creek Upland Gully Erosion**

Total Sediment (tons/yr)	Total P Load (lbs/yr)	Total N Load (lbs/yr)	Average Gully Width (ft)	Average Gully Length (ft)	Average Gully Depth (ft)
679	815	2,718	2.63	98	1.86

**Figure 51 - Prairie Creek Upland Gullies**



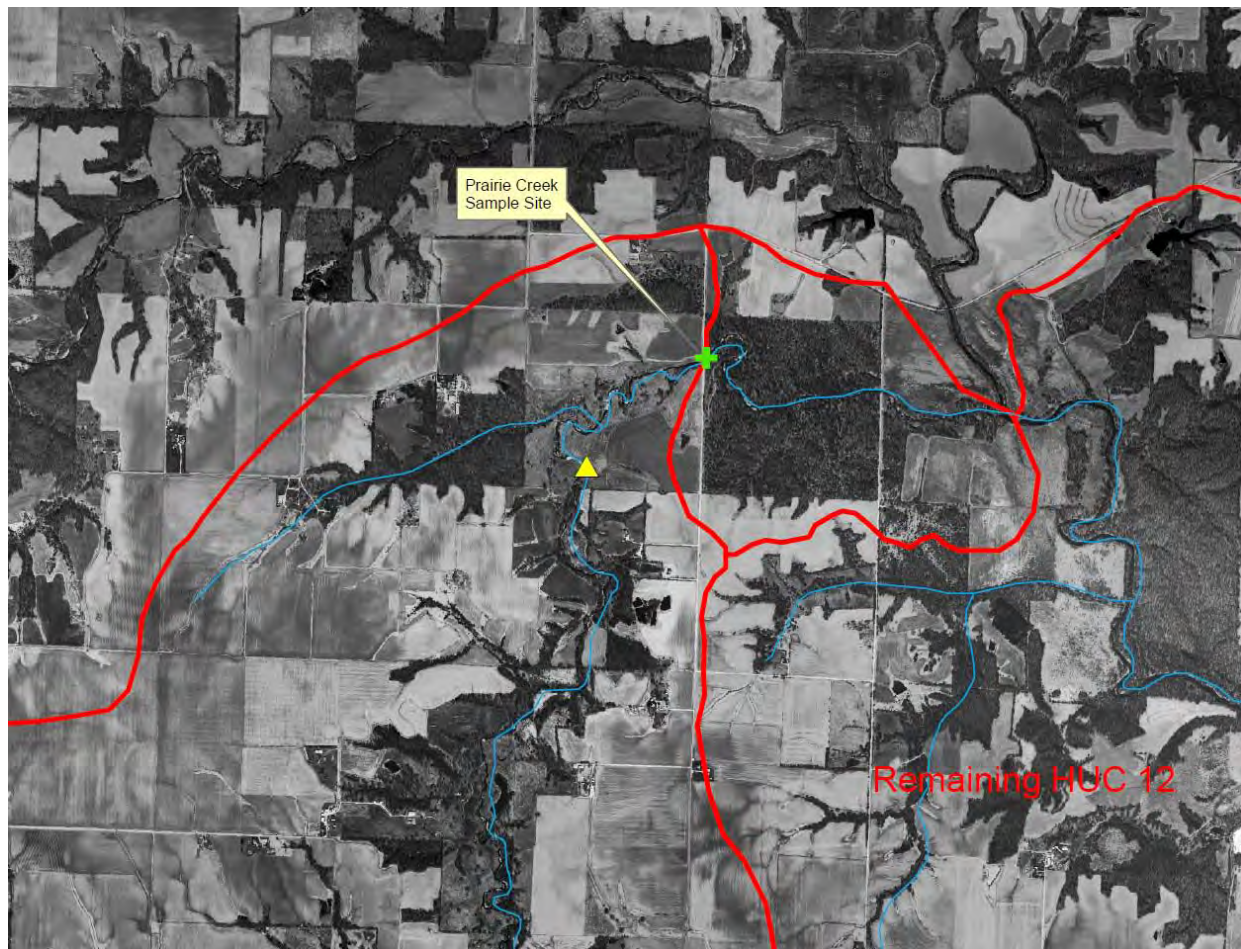
**5.14.2 Prairie Creek Stream Corridor Gully Erosion**

A total of two gullies were recorded and measured adjacent to the stream channel in the same location (one left bank and one right bank). No additional stream corridor gullies were located or measured along Prairie creek. Obtaining landowner permission on Prairie Creek was difficult and therefore only a small portion of the stream was assessed. It is highly likely that numerous additional gullies exist along the creek. Average annual erosion for each assessed gully is 15 tons per year.

**Table 45 - Prairie Creek Stream Corridor Gully Erosion**

Total Sediment (tons/yr)	Total P Load (lbs/yr)	Total N Load (lbs/yr)	Average Gully Length (ft)	Average Gully Depth (ft)
30	36	120	180	7

**Figure 52 - Prairie Creek Stream Corridor Gullies**



### 5.14.3 Indian Creek and Dago Slough Upland Gully Erosion

A total of 95 upland gullies were surveyed throughout the watershed. On average, each gully is eroding at 15 tons/yr with total erosion of 1,383 tons/year. Every effort was made to assess all upland ground within the watershed. A small amount of ground above both of the sample sites was missed because landowner permission was not given. Due to project priorities, only a small portion upland ground in the watershed below the sample site was assessed. Gully erosion therefore is likely higher than the following results indicate.

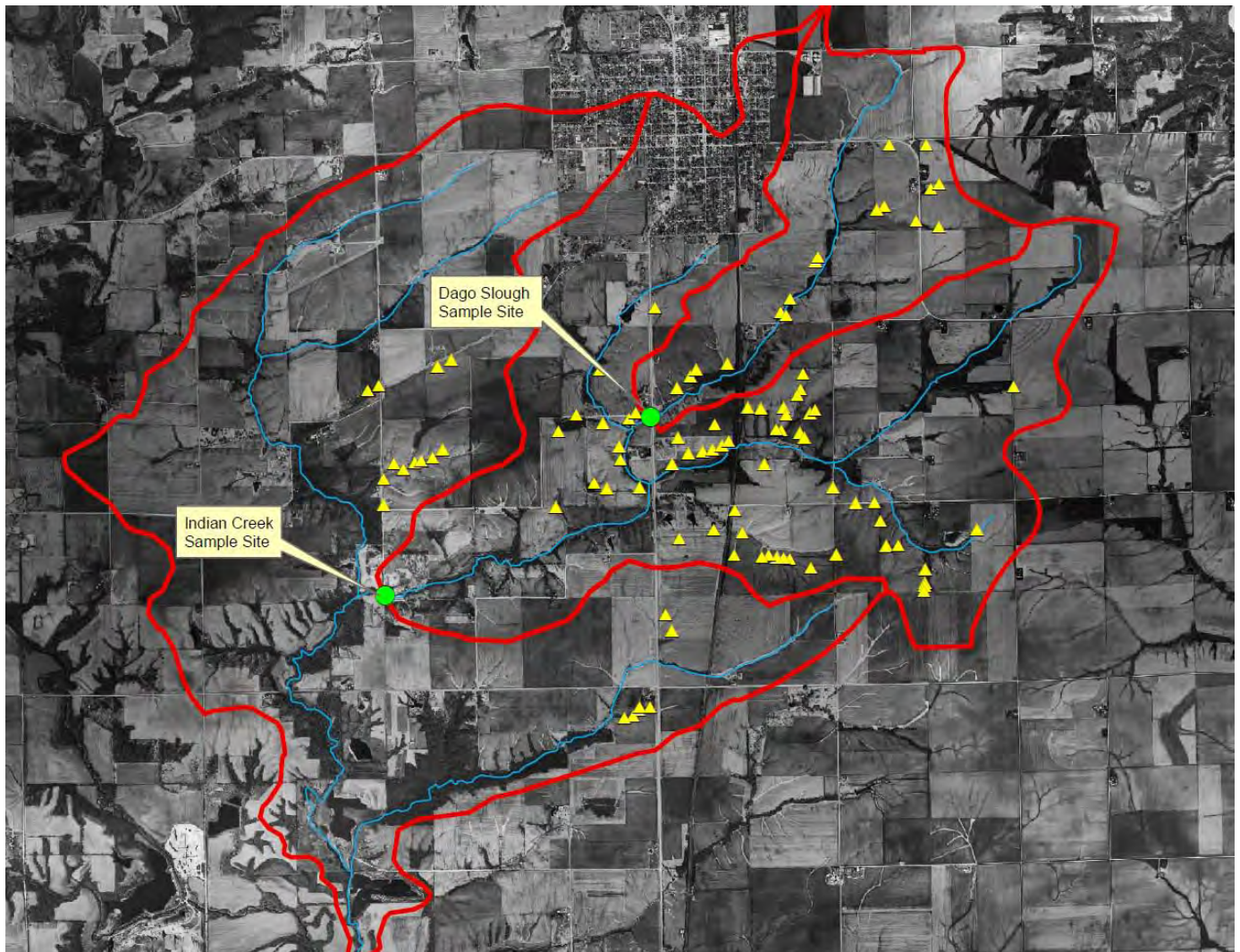
**Table 46 - Indian Creek/Dago Slough Upland Gully Erosion**

Total Sediment (tons/yr)	Total P Load (lbs/yr)	Total N Load (lbs/yr)	Average Gully Width (ft)	Average Gully Length (ft)	Average Gully Depth (ft)
1,383	1,659	5,531	1.9	146	1.4

**Table 47 - Indian Creek/Dago Slough Upland Gully Erosion, Watershed Summary**

Watershed	Indian above Sample Site	Indian Below Sample Site	Dago above Sample Site
Number of Gullies	59	19	17
Total Erosion (tons/yr)	889	248	246
Total P Load (lbs/yr)	1,066	298	295
Total N Load (lbs/yr)	3,555	992	984
Average sediment load/gully (tons/yr)	15	13	14



*Figure 53 - Indian Creek/Dago Slough Upland Gullies*

Gully erosion is significant in this watershed. Two years (2008 & 2009) of above average rainfall has only intensified the problem. Above both sample sites, 1,135 tons of sediment is eroded in Indian and Dago Slough through upland gully erosion annually.

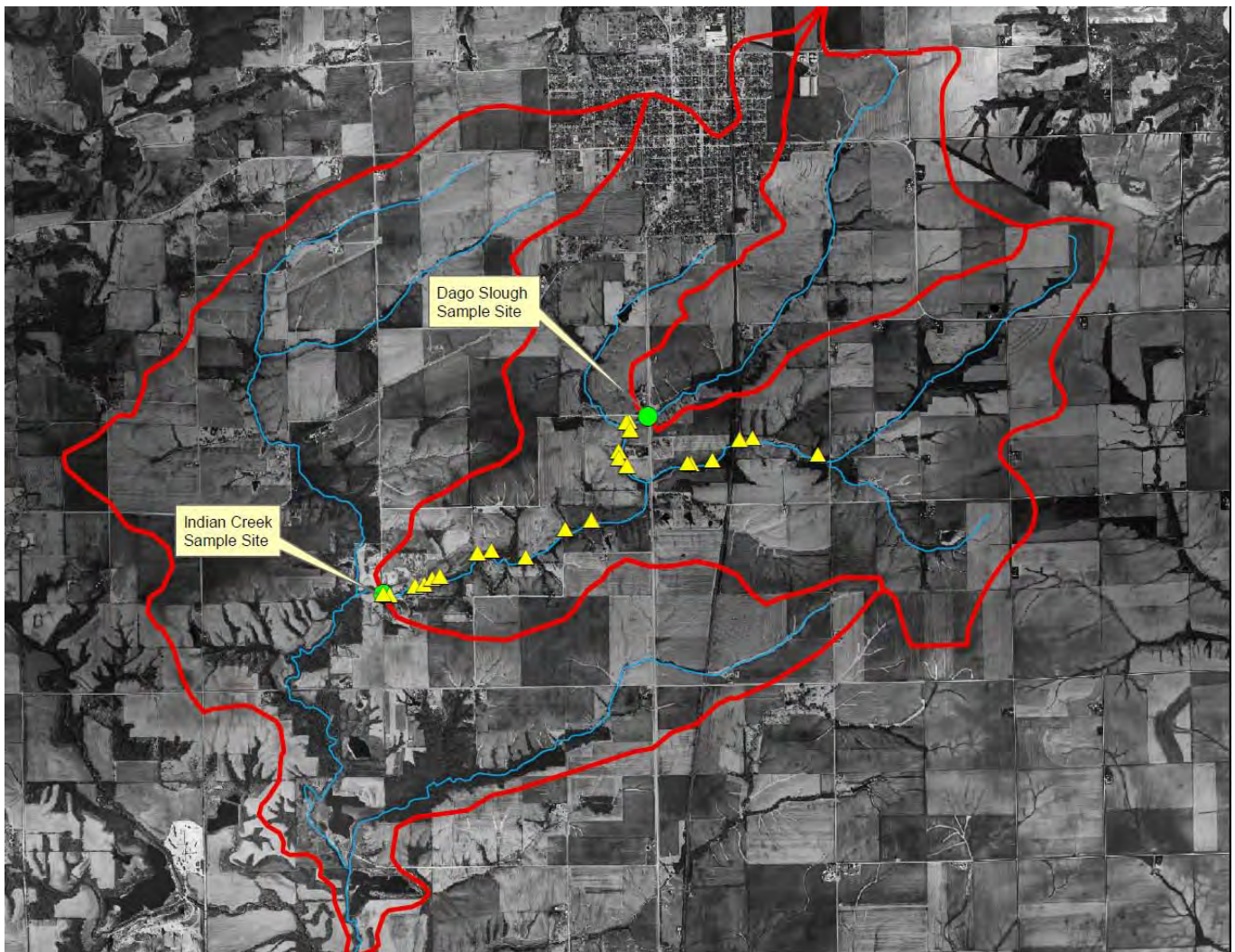
**5.14.4 Indian Creek and Dago Slough Stream Corridor Gully Erosion**

A total of 56 gullies were recorded and measured adjacent to the stream channel. No stream corridor gullies were located or measured above the Dago Slough sample site. Average annual erosion for each gully is 5 tons per year.

**Table 48 - Indian Creek/Dago Slough Stream Corridor Gully Erosion**

Total Sediment (tons/yr)	Total P Load (lbs/yr)	Total N Load (lbs/yr)	Average Gully Length (ft)	Average Gully Depth (ft)
286	343	1,144	68	4.6

**Figure 54 - Indian Creek/Dago Slough Stream Corridor Gullies**



## 5.15 Streambank Erosion

The Rapid Assessment, Point Method (RAP-M) assessment method was used to estimate annual sediment contributions from streambank erosion in the main channels of the Indian Creek, Dago Slough and Prairie Creek assessment area where the stream was accessible and where the bank heights were greater than one foot. Streambanks and gullies were assessed by estimating the maximum height and length of the left and right eroded banks. Each assessed reach was photographed for reference. Lateral recession rates were then estimated using the lateral recession rates table (figure 8 in U.S. Department of Agriculture, Natural Resource Conservation Service, 2001). Bankfull height was estimated at 50% of the maximum bank height based on vegetation indicators. Bankfull height may be considered the channel forming discharge and was applied to the formula as the area of channel that is annually eroded. Using a density of 95 pcf the formula is:

$$L \times (H \times .5) \times \text{Lat. Rec. Rate} \times \text{Density} / 2000 = \text{Tons} / \text{Year}$$

Nutrient Loads were calculated using the following equation:

$$N \text{ Load (lbs)} = \text{Total Tons} \times N \text{ concentration in Soil (0.002 lbs/lbs)} \times 2000 \times \text{Correction Factor (1)}$$

$$P \text{ Load (lbs)} = \text{Total Tons} \times P \text{ concentration in Soil (0.0006 lbs/lbs)} \times 2000 \times \text{Correction Factor (1)}$$

This section will summarize quantities of streambank erosion and associated nutrient loading. A treatment option for each critical streambank was also developed and is summarized in a separate report prepared by the Illinois State Water Survey (ISWS) entitled “*In-Channel and Near-Channel Geomorphic and Biological/Habitat Assessments for IEPA 303(d) Listed Stream Segments in Indian and Dago Creeks in the LaMoine River Watershed and Prairie Creek in the Spoon River Watershed.*” A more detailed streambank assessment is included in the ISWS report. See Appendix B for stream cross-sections.

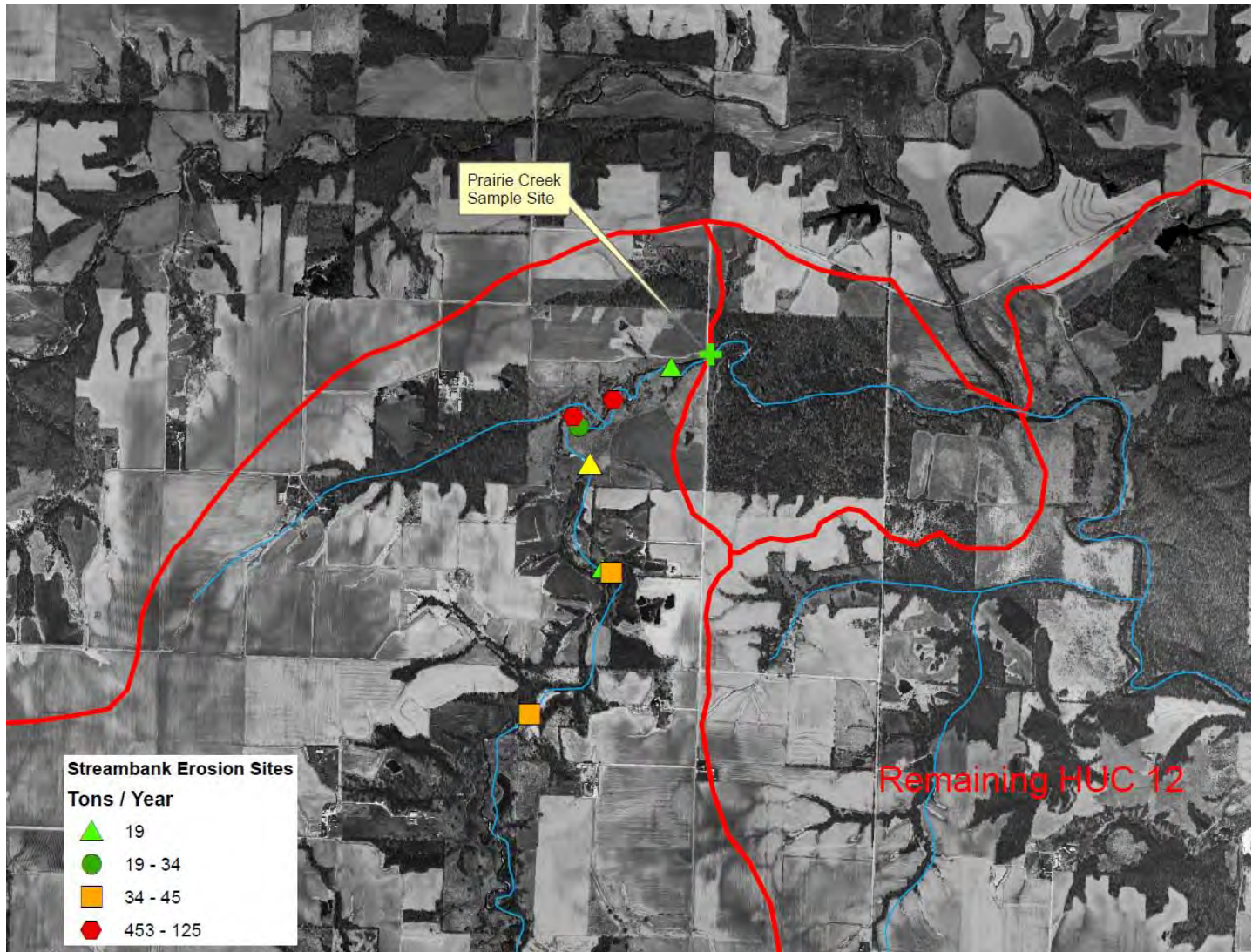
### 5.15.1 Prairie Creek Streambank Erosion

Streambank erosion in the watershed is likely a major source of the overall sediment load. Unfortunately only a very short section of Prairie Creek upstream of the sample site was accessible for a stream assessment. Data from what areas were sampled show annual streambank erosion at 397 tons/year. Totals presented here represent only a small fraction of the actual streambank erosion in the watershed. As with Indian Creek and Dago Slough, streambank erosion in Prairie Creek likely accounts for over a quarter of the total sediment eroded in the watershed and close to 50% of the sediment delivered to the stream on an annual basis.

**Table 49 - Prairie Creek Streambank Erosion Summary**

Watershed	Prairie Above Sample Site	Prairie Below Sample Site	Remaining HUC 12
<b>Total Erosion (tons/yr)</b>	397	N/A	N/A
<b>Total P Load (lbs/yr)</b>	477	N/A	N/A
<b>Total N Load (lbs/yr)</b>	1,589	N/A	N/A
<b>Average Eroding Bank Height (ft)</b>	7.6	N/A	N/A
<b>Average Eroding Bank Length (ft)</b>	134	N/A	N/A
<b>Tons Erosion/Foot of Streambank (tons/yr)</b>	4.7	N/A	N/A

Figure 55 - Prairie Creek Streambank Erosion



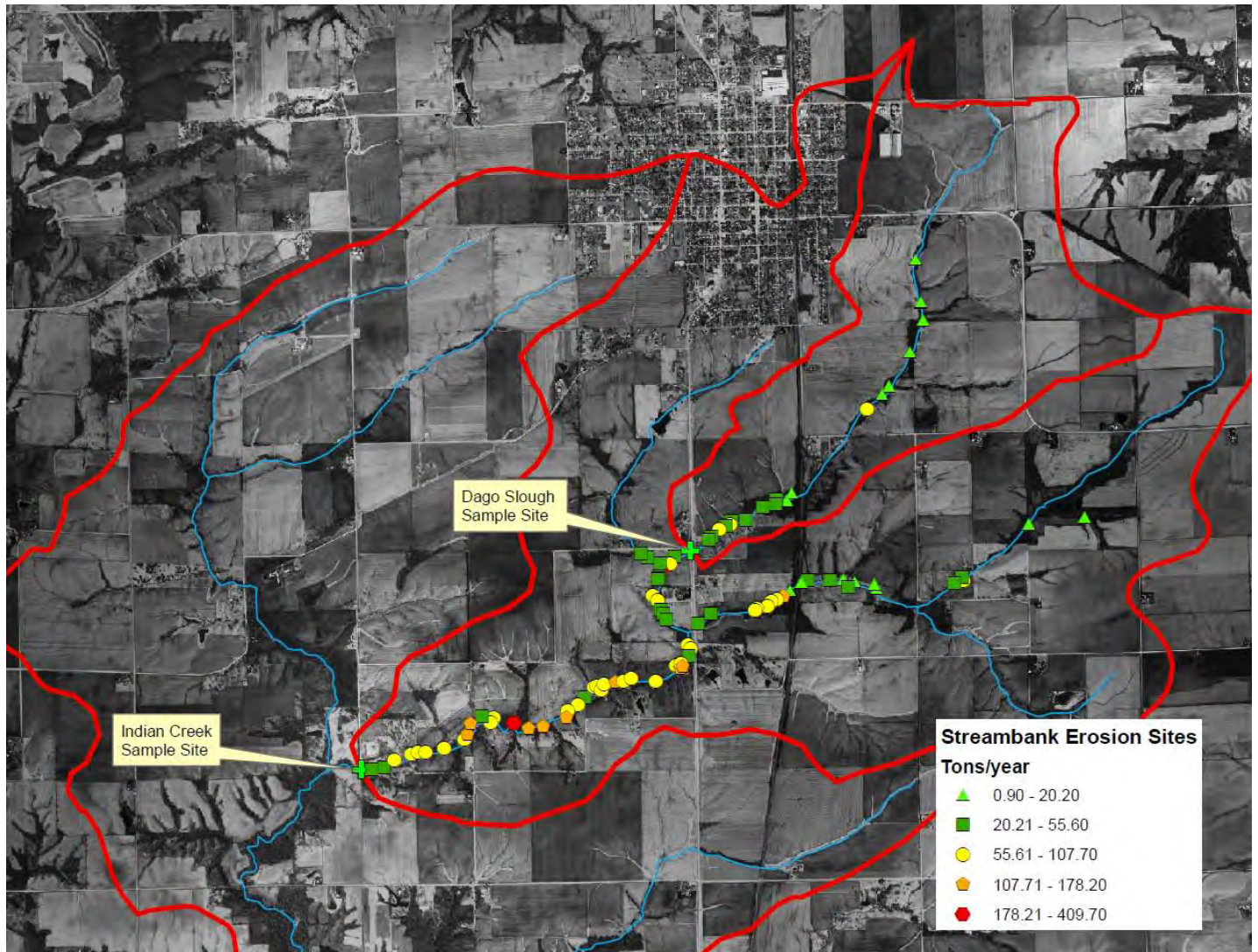
### 5.15.2 Indian Creek and Dago Slough Streambank Erosion

Streambank erosion in the watershed is a major source of the overall sediment load, equivalent to 5,922 tons/year; just over 25% of the total sediment eroded in the watershed annually or 50% of the total amount of sediment delivered to the stream on an annual basis. Indian Creek was not assessed below the sample site.

**Table 50 - Indian Creek/Dago Slough Streambank Erosion Summary**

Watershed	Indian above Sample Site	Indian Below Sample Site	Dago above Sample Site
<b>Total Erosion (tons/yr)</b>	4,325	N/A	1,597
<b>Total P Load (lbs/yr)</b>	5,190	N/A	1,916
<b>Total N Load (lbs/yr)</b>	17,300	N/A	6,388
<b>Average Eroding Bank Height (ft)</b>	9.3	N/A	6.25
<b>Average Eroding Bank Length (ft)</b>	138	N/A	117
<b>Tons Erosion/Foot of Streambank (tons/yr)</b>	3.7	N/A	5.14

Figure 56 - Indian Creek/Dago Slough Streambank Erosion



## 5.16 Sheet and Rill Erosion

Sheet and Rill erosion was modeled using GIS and the Universal Soil Loss Equation (USLE). This section summarizes overall sheet and rill erosion occurring in each watershed. A more detailed discussion of the model and results, as well as sediment and nutrient loading maps are located in the following section: “6.0 Best Management Practices (Implementation Plan), Load Reduction Strategy and TMDL.”

### 5.16.1 Prairie Creek Sheet and Rill Erosion

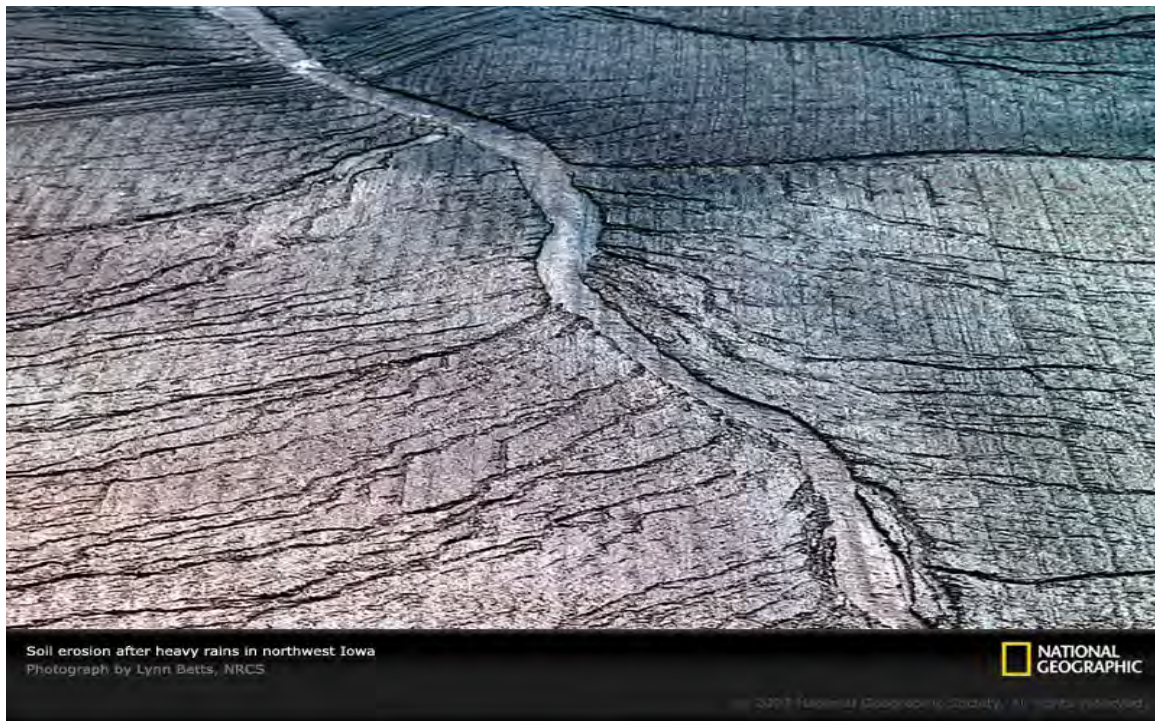
*Table 51 - Prairie Creek Sheet and Rill Erosion*

Pollutant	Total Watershed	Below Sample Site	Upstream of Sample Site	Remaining HUC 12
Sediment (ton/yr)	43,009	4.68	10,311	32,693

### 5.16.2 Indian Creek and Dago Slough Sheet and Rill Erosion

*Table 52 - Indian Creek/Dago Slough Sheet and Rill Erosion*

Pollutant	Total Watershed	Dago Slough	Below Indian Sample Site	Above Indian Sample Site
Sediment (ton/yr)	34,400	5,359	16,003	13,039





## 6.0 Best Management Practices (Implementation Plan), Load Reduction Strategy and TMDL

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This section will describe overall pollutant loading and recommended BMPs based on information collected in the field and from one-on-one meetings with watershed landowners. This section also covers model results, a LRS and TMDL, and load reduction estimates for Nitrogen, Phosphorous and sediment resulting from implementing recommended BMPs. A summary of public participation efforts and estimated costs associated with BMP implementation is included in subsequent sections.

### 6.1 Pollutant Loading Analysis

Five unique GIS-based upland nutrient load models were developed to estimate sediment and nutrient loading (Nitrogen and Phosphorous) from various landuse types in each watershed. This only includes loadings from direct runoff and soil erosion and does not account for those nutrients lost through tile drainage. These numbers represent erosion and should be compared with in-stream data to understand what is ultimately delivered to the stream. See Appendix A for model descriptions.

1. Nutrient runoff load model (N & P) for Agriculture, row crops  
✚ Includes erosion model; USLE soil loss
2. Nutrient runoff load model (N & P) for Pasture  
✚ Includes erosion model; USLE soil loss
3. Nutrient runoff load model (N, P, and TSS) for Urban areas
4. Nutrient runoff load model (N & P) for all other vegetated areas  
✚ Includes erosion model; USLE soil loss

Pollutant loading totals from streambank and gully erosion summarized in previous sections have been combined with modeled results and are presented in Table 53 below. The results below include pollutant reductions achieved from Best Management Practices already in place.

Pollutant loads were also calculated using in-stream data; these results represent pollutant delivery directly to the stream. Pollutant delivery calculated from recent sampling data is summarized at the end this section. This data shows that close to 50% of the total amount of sediment eroded (including nutrients) is delivered to Indian Creek and Dago Slough on an annual basis. This may or may not be true in Prairie

Creek because inventory data on streambank and gully erosion is limited and therefore a complete picture is unknown.

**Table 53 - Total Sediment and Nutrient Loading from all Landuses; gully erosion, streambank erosion and septic systems**

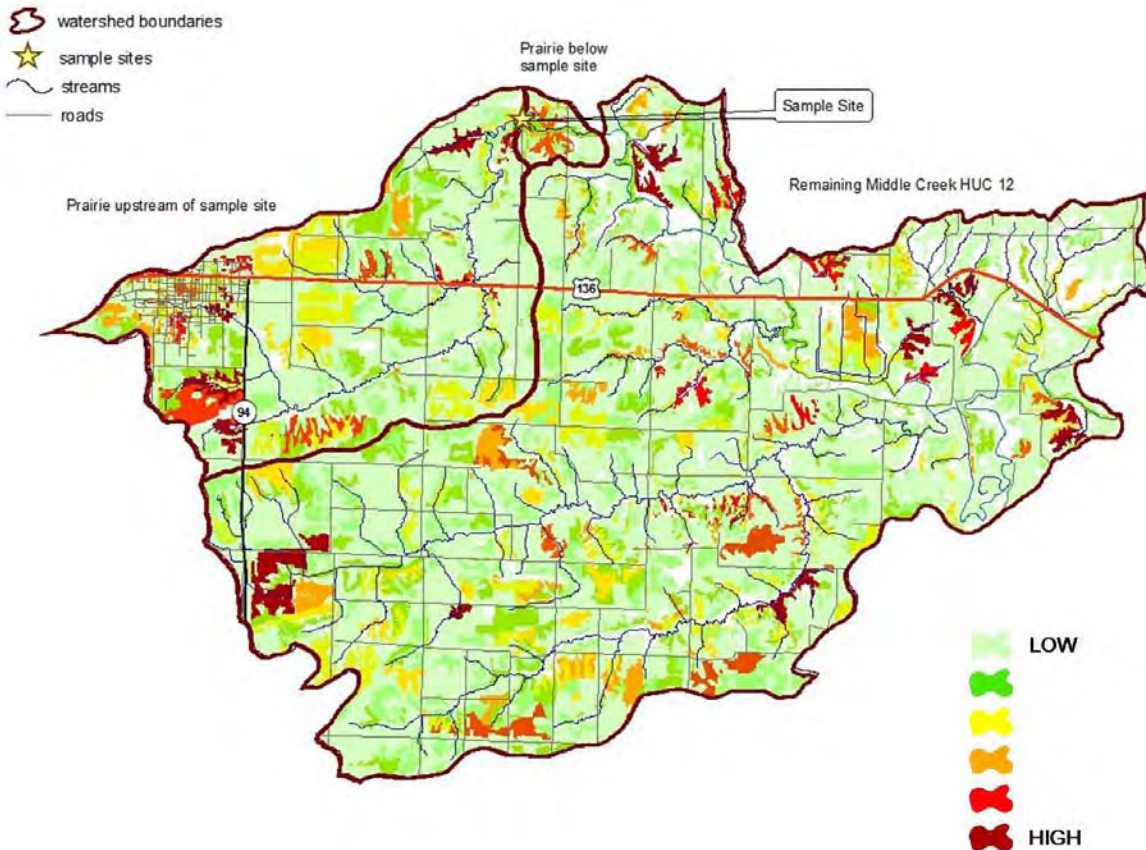
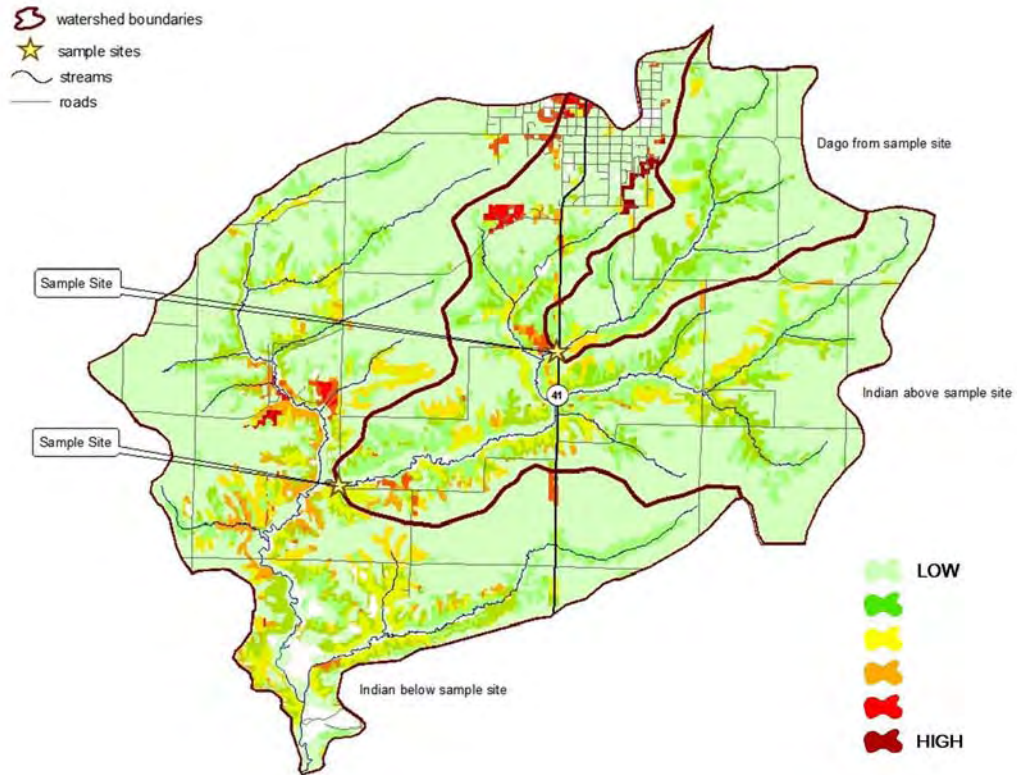
<i>Prairie Creek</i>	<b>Below Sample Site</b>	<b>Upstream of Sample Site</b>	<b>Remaining HUC 12</b>	<i>Total</i>
<b>Sediment Load*</b> <b>(tons/yr)</b>	88	8,370	20,680	<b>29,138</b>
<b>Nitrogen Load*</b> <b>(lbs/yr)</b>	404	40,851	94,649	<b>135,904</b>
<b>Phosphorous Load*</b> <b>(lbs/yr)</b>	132	12,625	30,134	<b>42,891</b>
<i>Indian Creek and Dago Slough</i>	<b>Dago Slough</b>	<b>Below Indian Sample Site</b>	<b>Above Indian Sample Site</b>	<i>Total</i>
<b>Sediment Load**</b> <b>(tons/yr)</b>	5,186	12,201	15,155	<b>32,542</b>
<b>Nitrogen Load**</b> <b>(lbs/yr)</b>	21,285	45,880	59,951	<b>127,116</b>
<b>Phosphorous Load** (lbs/yr)</b>	7,082	16,555	19,616	<b>43,253</b>

\*Streambank and gully erosion was not assessed below the sample site or the remaining HUC 12; not enough of Prairie creek was assessed to develop a complete estimation of overall streambank erosion; erosion estimates represent only a small portion of the total loading from streambanks.

\*\* Streambank erosion was not assessed and gully erosion was not fully assessed below the Indian Creek sample site

Figure 57 - Indian Creek/Dago Slough and Prairie Creek Nutrient Loading from all Landuses

This map represents high and low nutrient and sediment loading from all land uses combined in Indian Creek and Dago Slough.



This map represents high and low nutrient and sediment loading from all land uses combined in Prairie Creek (entire HUC12).

The following tables summarize sediment and nutrient loading from various landuses. Loadings were calculated from both direct runoff and from sediment or eroded material containing nutrients. Runoff and sediment contributions were added together to get total loadings. Overall, N and P loadings from sediment are significantly higher than loading from runoff; N totals are also significantly high than P due to the fact that N concentrations in both the soil and in runoff are higher than P. These situations occur because the literature used to select nutrient concentrations provided much higher values for N.

**Table 54 - Indian Creek and Dago Slough; nutrient and sediment load results from agriculture**

Pollutant	Total Watershed	Dago Slough	Below Indian Sample Site	Above Indian Sample Site
<b>Sediment (ton/yr)</b>	34,400	5,359	16,003	13,039
<b>% of Watershed</b>		15.58	46.52	37.90
<b>Sediment Delivered (ton/yr)</b>	24,108	3,662	11,052	9,395
<b>Average ton/acre</b>	3.88	3.73	3.71	4.19
<b>% of Watershed</b>		15.19	45.84	38.97
<b>Annual Runoff (ac/ft)</b>	2,610	407	1,265	937
<b>% of Watershed</b>		15.61	48.47	35.92
<b>Nitrogen from Runoff (lbs/yr)</b>	13,471	2,103	6,530	4,839
<b>% of Watershed</b>		15.61	48.47	35.92
<b>Phosphorous Runoff (lbs/yr)</b>	2,127	332	1,031	764
<b>% of Watershed</b>		15.61	48.47	35.92
<b>Nitrogen from Sediment (lbs/yr)</b>	77,145	11,718	35,365	30,063
<b>% of Watershed</b>		15.19	45.84	38.97
<b>Phosphorous from Sediment (lbs/yr)</b>	29,894	4,541	13,704	11,649
<b>% of Watershed</b>		15.19	45.84	38.97

**Table 55 - Prairie Creek; nutrient and sediment load results from agriculture**

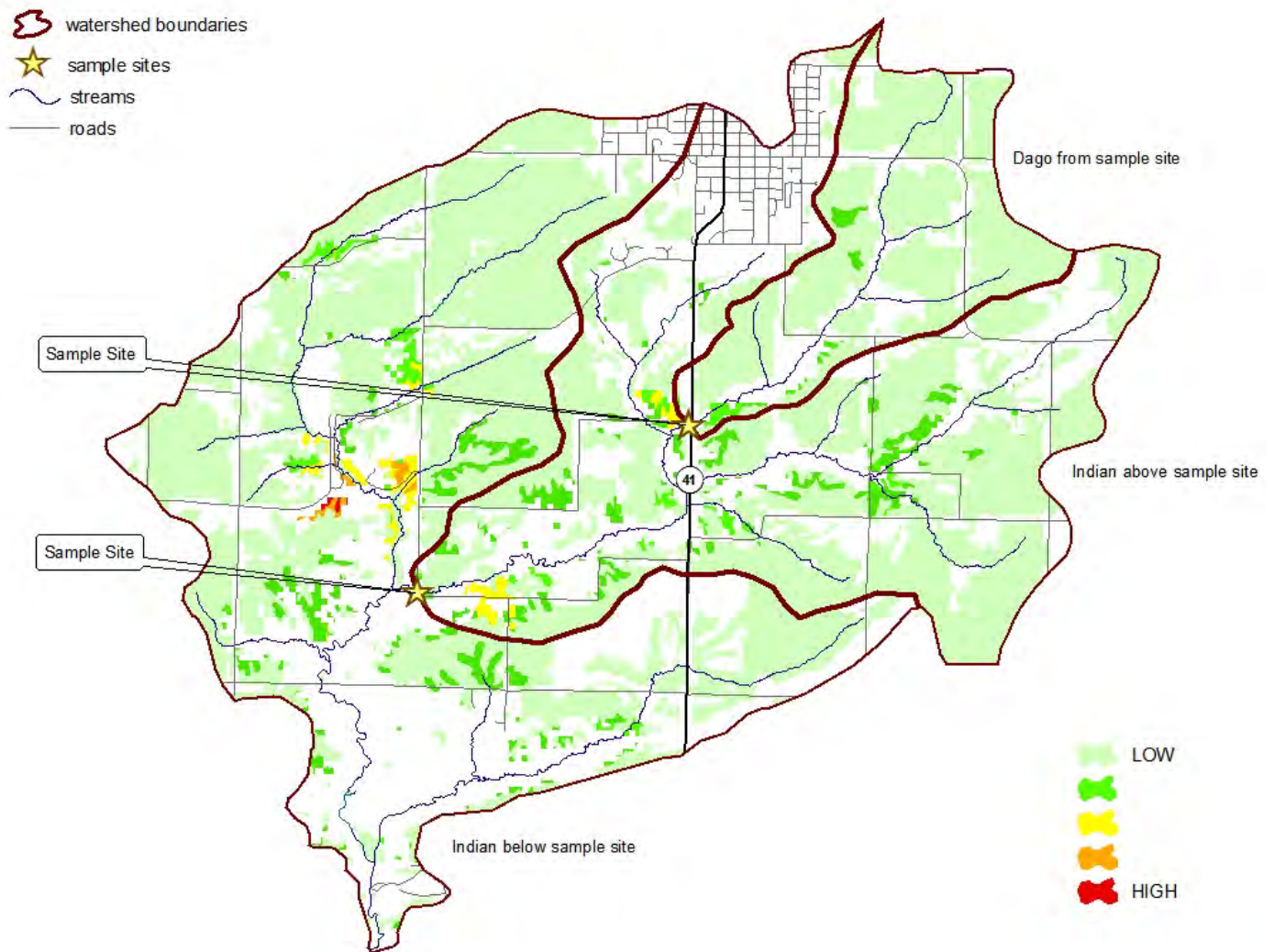
Pollutant	Total Watershed	Below Sample Site	Upstream of Sample Site	Remaining HUC 12
<b>Sediment (ton/yr)</b>	43,009	4.68	10,311	32,693
<b>% of Watershed</b>		0.011	23.97	76.01
<b>Sediment Delivered (ton/yr)</b>	32,560	4	7,545	25,010
<b>Average ton/acre</b>	2.2	3.24	1.73	2.4
<b>% of Watershed</b>		0.015	23.17	76.81
<b>Annual Runoff (ac/ft)</b>	7,111	0.88	1,991	5,118
<b>% of Watershed</b>		0.012	28	71.98
<b>Nitrogen from Runoff (lbs/yr)</b>	36,708	4.54	10,280	26,423
<b>% of Watershed</b>		0.012	28	71.98
<b>Phosphorous Runoff (lbs/yr)</b>	5,796	0.72	1,623	4,172
<b>% of Watershed</b>		0.012	28	71.98
<b>Nitrogen from Sediment (lbs/yr)</b>	104,194	16	24,145	80,033
<b>% of Watershed</b>		0.015	23.17	76.81
<b>Phosphorous from Sediment (lbs/yr)</b>	40,375	6.14	9,356	31,013
<b>% of Watershed</b>		0.015	23.17	76.81

**Table 56 - Indian Creek and Dago Slough; nutrient and sediment load results from pasture**

Pollutant	Total Watershed	Dago Slough	Below Indian Sample Site	Above Indian Sample Site
<b>Sediment (ton/yr)</b>	1,451	127	870	453
<b>% of Watershed</b>		8.76	59.99	31.25
<b>Sediment Delivered (ton/yr)</b>	1,178	94	727	356
<b>Average ton/acre</b>	1.75	4.73	2.04	1.2
<b>% of Watershed</b>		8	62	30
<b>Annual Runoff (ac/ft)</b>	188.75	7	100	82
<b>% of Watershed</b>		3.72	52.90	43.38
<b>Nitrogen from Runoff (lbs/yr)</b>	2,404	124	1,302	977
<b>% of Watershed</b>		5.18	54.17	40.65
<b>Phosphorous Runoff (lbs/yr)</b>	266	17	147	102
<b>% of Watershed</b>		6.45	55.32	38.23
<b>Nitrogen from Sediment (lbs/yr)</b>	3,769	302	232	1,141
<b>% of Watershed</b>		8	61.73	30.26
<b>Phosphorous from Sediment (lbs/yr)</b>	1,461	117	902	442
<b>% of Watershed</b>		8	61.73	30.26

This map represents areas of high and low nutrient and sediment loading in Indian Creek and Dago Slough. The map shows results from the agriculture and pasture load model. White areas are urban and vegetation (non-pasture).

*Figure 58 - Indian Creek/Dago Slough Nutrient Loading; agriculture and pasture*



**Table 57 - Prairie Creek; nutrient and sediment load results from pasture**

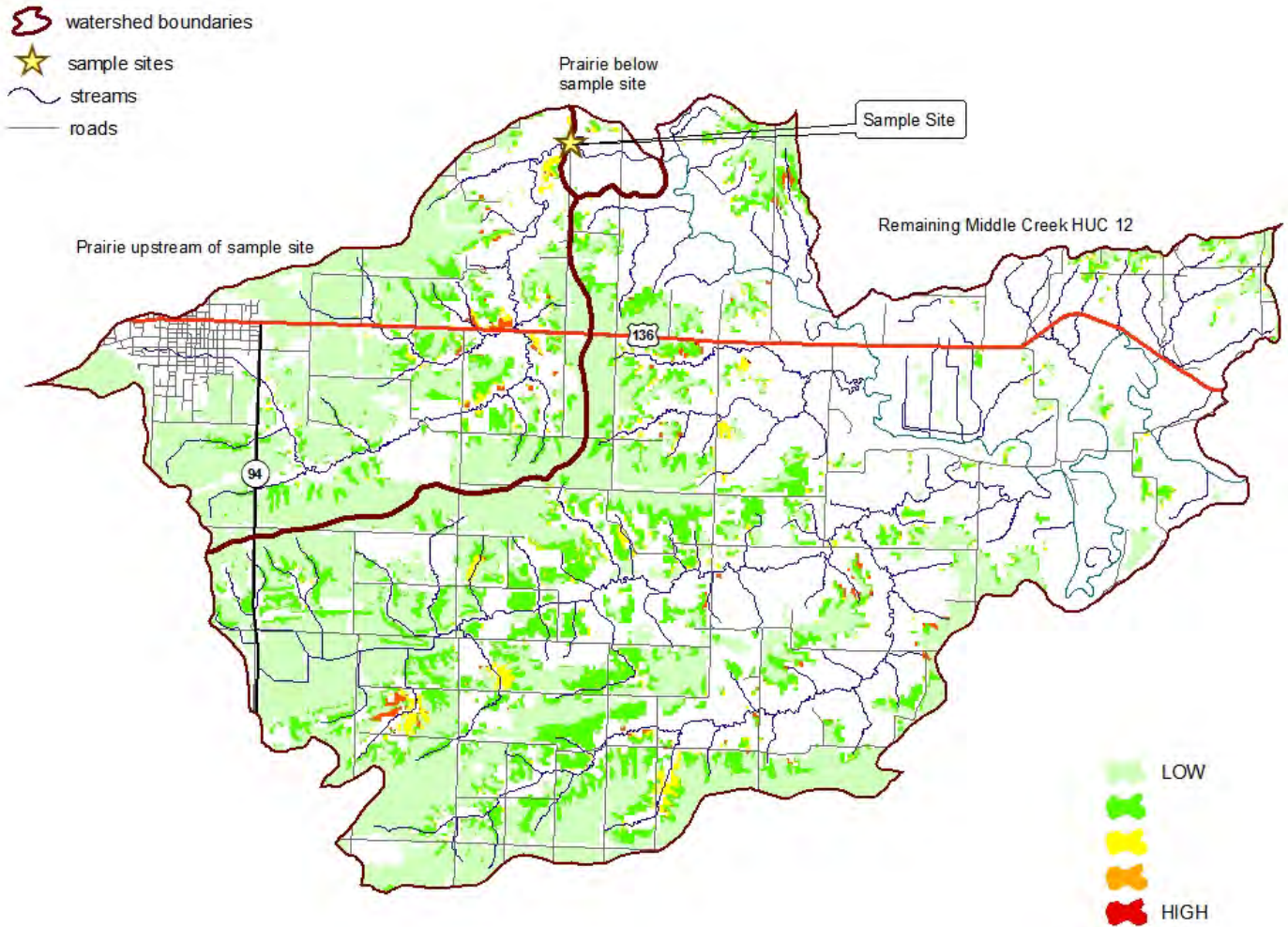
<b>Pollutant</b>	<b>Total Watershed</b>	<b>Below Sample Site</b>	<b>Upstream of Sample Site</b>	<b>Remaining HUC 12</b>
<b>Sediment (ton/yr)</b>	311	12	187	112
<b>% of Watershed</b>		4	60	36
<b>Sediment Delivered (ton/yr)</b>	252	11	149	92
<b>Average ton/acre</b>	0.94	0.84	1.66	0.55
<b>% of Watershed</b>		4.44	59.17	36.38
<b>Annual Runoff (ac/ft)</b>	100	4.23	38	58
<b>% of Watershed</b>		4.22	37.77	57
<b>Nitrogen from Runoff (lbs/yr)</b>	1,008	46	481	481
<b>% of Watershed</b>		4.57	47.74	47.69
<b>Phosphorous Runoff (lbs/yr)</b>	91	3.45	49	38
<b>% of Watershed</b>		3.78	54.18	42.05
<b>Nitrogen from Sediment (lbs/yr)</b>	805	36	477	293
<b>% of Watershed</b>		4.44	59.21	36.39
<b>Phosphorous from Sediment (lbs/yr)</b>	312	14	185	114
<b>% of Watershed</b>		4.44	59.17	36.38

Indian Creek



This map represents areas of high and low nutrient and sediment loading in Prairie/Middle Creek. The map shows results from the agriculture and pasture load model. White areas are urban and vegetation (non-pasture).

*Figure 59 - Prairie Creek Nutrient Loading; agriculture and pasture*





**Table 58 - Indian Creek and Dago Slough; nutrient and sediment load results from urban areas**

<b>Pollutant</b>	<b>Total Watershed</b>	<b>Dago Slough</b>	<b>Below Indian Sample Site</b>	<b>Above Indian Sample Site</b>
<b>Annual Runoff (ac/ft)</b>	437	44	149	244
<b>% of total urban area</b>		10.18	34.1	55.72
<b>Nitrogen from Runoff (lbs/yr)</b>	2,387	243	814	1,330
<b>% of total urban area</b>		10.17	34.1	55.72
<b>Phosphorous Runoff (lbs/yr)</b>	368	37	126	205
<b>% of total urban area</b>		10.17	34.1	55.72
<b>Sediment (tons/yr)</b>	60	6	20	33
<b>% of total urban area</b>		10.17	34.10	55.72

**Table 59 - Prairie Creek; nutrient and sediment load results from urban areas**

<b>Pollutant</b>	<b>Total Watershed</b>	<b>Below Sample Site</b>	<b>Upstream of Sample Site</b>	<b>Remaining HUC 12</b>
<b>Annual Runoff (ac/ft)</b>	1,560	12	707	841
<b>% of total urban area</b>		0.77	45.33	53.9
<b>Nitrogen from Runoff (lbs/yr)</b>	8,521	65	3,862	4,593
<b>% of total urban area</b>		0.77	45.33	53.9
<b>Phosphorous Runoff (lbs/yr)</b>	1,314	10	596	708
<b>% of total urban area</b>		0.77	45.33	53.9
<b>Sediment (tons/yr)</b>	212	1.63	96	114
<b>% of total urban area</b>		0.767	45.33	53.9

*Table 60 - Indian Creek and Dago Slough; nutrient and sediment load results from vegetation; includes grass areas not in pasture, forested areas, wetlands, and other vegetation not in production agriculture*

Pollutant	Total Watershed	Dago Slough	Below Indian Sample Site	Above Indian Sample Site
<b>Sediment (ton/yr)</b>	832	49	561	222
<b>% of Watershed</b>		5.87	67.44	26.6
<b>Sediment Delivered (ton/yr)</b>	661	42	445	174
<b>Average ton/acre</b>	0.23	0.14	0.28	0.19
<b>% of Watershed</b>		6.36	67.32	26.33
<b>Annual Runoff (ac/ft)</b>	672	64	381	227
<b>% of Watershed</b>		9.47	56.797	33.747
<b>Nitrogen from Runoff (lbs/yr)</b>	274	26	155	92
<b>% of Watershed</b>		9.46	56.79	33.74
<b>Phosphorous Runoff (lbs/yr)</b>	146	14	83	49
<b>% of Watershed</b>		9.46	56.79	33.74
<b>Nitrogen from Sediment (lbs/yr)</b>	2,114	128	1,400	586
<b>% of Watershed</b>		6.04	66.25	27.71
<b>Phosphorous from Sediment (lbs/yr)</b>	819	49	543	227
<b>% of Watershed</b>		6.04	66.25	27.71

Indian Creek



**Table 61 - Prairie Creek; nutrient and sediment load results from vegetation; includes grass areas not in pasture, forested areas, wetlands, and other vegetation not in production agriculture**

Pollutant	Total Watershed	Below Sample Site	Upstream of Sample Site	Remaining HUC 12
<b>Sediment (ton/yr)</b>	4,905	113	580	4212
<b>% of Watershed</b>		2.30	11.82	85.87
<b>Sediment Delivered (ton/yr)</b>	3,891	82	492	3,317
<b>Average ton/acre</b>	0.24	0.24	0.2	0.24
<b>% of Watershed</b>		2.12	12.64	85.24
<b>Annual Runoff (ac/ft)</b>	5,374	105	779	4,490
<b>% of Watershed</b>		1.96	14.5	83.54
<b>Nitrogen from Runoff (lbs/yr)</b>	2,190	43	318	1,830
<b>% of Watershed</b>		1.96	14.5	83.54
<b>Phosphorous Runoff (lbs/yr)</b>	1,168	23	169	976
<b>% of Watershed</b>		1.96	14.5	83.54
<b>Nitrogen from Sediment (lbs/yr)</b>	12,454	264	1,574	10,614
<b>% of Watershed</b>		2.11	12.64	85.22
<b>Phosphorous from Sediment (lbs/yr)</b>	4,825	102	610	4,113
<b>% of Watershed</b>		2.11	12.64	85.24

Annual loadings calculated from stream sample results are lower than those developed from the pollutant load models in this section. These loading models do not accurately represent what is delivered to the stream or in the water on an annual basis; they better represent overall “erosion” or what is lost edge-of-field and not delivery. Table 62 below is a good estimation of what is delivered to the stream each year based on recent sample data. Comparing both shows that 60-65% of all soil eroded and nutrients lost from runoff are delivered to Indian Creek and Dago Slough over the course of a year. In the case of streambank erosion, 100% is delivered. However, any soil eroded or nutrients lost are stored in the watershed and are ultimately available for delivery to the stream. As previously noted, Prairie Creek was not fully assessed and therefore delivery results shown here are actually higher. If Prairie was fully inventoried, results would likely show a similar ratio as in Indian Creek and Dago Slough.

**Table 62 - Annual Loading of Pollutants Delivered to Stream**

	Watershed Size (acres)	Avg Annual Discharge (acre-ft)	TSS Load (tons/year)	P Load (tons/year)	Mn Load (lbs/yr)
<b>Dago Slough</b>	1,303	2,112	2,350	5,450	
<b>Indian Creek</b>	5,258	9,828	9,130	14,162	
<b>Prairie Creek</b>	7,977	17,900	9,172	24,436	20,824

## 6.2 Best Management Practices

The location and type of BMPs were surveyed in the field. Where landowner permission was given and time permitted, specific/needed BMPs were identified and recorded with GPS. An initial call was made to each producer, explaining the watershed project and requesting a meeting. If the producer agreed to an on-site meeting, a survey was conducted of his/hers farm. After the property was evaluated, a follow up meeting was scheduled to go over the assessment and determine landowner willingness to implement any recommended BMPs. Eligible practices such as CRP where continuous enrollments are available immediately were discussed with each producer; several producers have since begun to enroll in: CRP – grass waterways, CRP – filter strips, and CRP – CP33 quail buffers. For streambank practices, landowner permission was obtained to gain access to the stream; unstable stream reaches were surveyed and stabilization practices were identified to address these reaches. The BMPs listed in this section will directly reduce various pollutants including N, P, TSS, and Mn specifically in Prairie Creek. Manganese is known to exist naturally in soil; addressing erosion and sediment will address any Mn impairment. Expected load reductions from recommended BMPs are discussed in Section 6.3.3.

Additional BMPs, not specifically identified in this section or in the LRS – “expected load reductions” should also be considered. These BMPs, in both Prairie Creek and Indian Creek/Dago Slough will help in making progress toward reducing sediment and pollutant loads and meeting water quality targets. No specific load reductions have been calculated for the following BMPs but implementing any of the following will have positive benefits in both watersheds. Additional details on these practices are included in Section 6.3.3.5:

- ✚ Nutrient Management Plans
- ✚ Tillage Practices
- ✚ Cover Crops
- ✚ Tile drainage management urban BMPs/green infrastructure and retention of stormwater runoff
- ✚ Wetland Restoration
- ✚ Education programs focused on reducing fertilizer use on residential properties
- ✚ Roadside and illegal dumping in streams

### 6.2.1 Prairie Creek Best Management Practices

A modest amount of the land upstream of the Prairie Creek sample site was surveyed. It is encouraging that the majority of land in the watershed already has some type of conservation practice addressing runoff and erosion; past participation in conservation is high and existing practices are well maintained. A few producers have expressed interest in enrolling additional acres in buffer strips (CP33) but at this time there are no further commitments made by producers for implementing additional conservation practices.

The following table and map represent recommended, field-verified BMPs in Prairie Creek. Each practice listed will reduce nutrient and sediment loading by slowing erosion and runoff. The number of WASCBs represents an estimate of the actual number of depending on the slope length at the site. Filter Strips include riparian filter strips and CP33, upland filter strips – one point represents the entire property boundary length; i.e. – the entire length of stream or timber within one property. Livestock includes stream fencing, water systems and crossings. Grass Waterways include re-shaping existing and failing waterways and can include multiple waterways on the same field. Other includes tile holes and other observations. Streambank stabilization represents entire priority reaches with multiple practices over multiple streambanks.

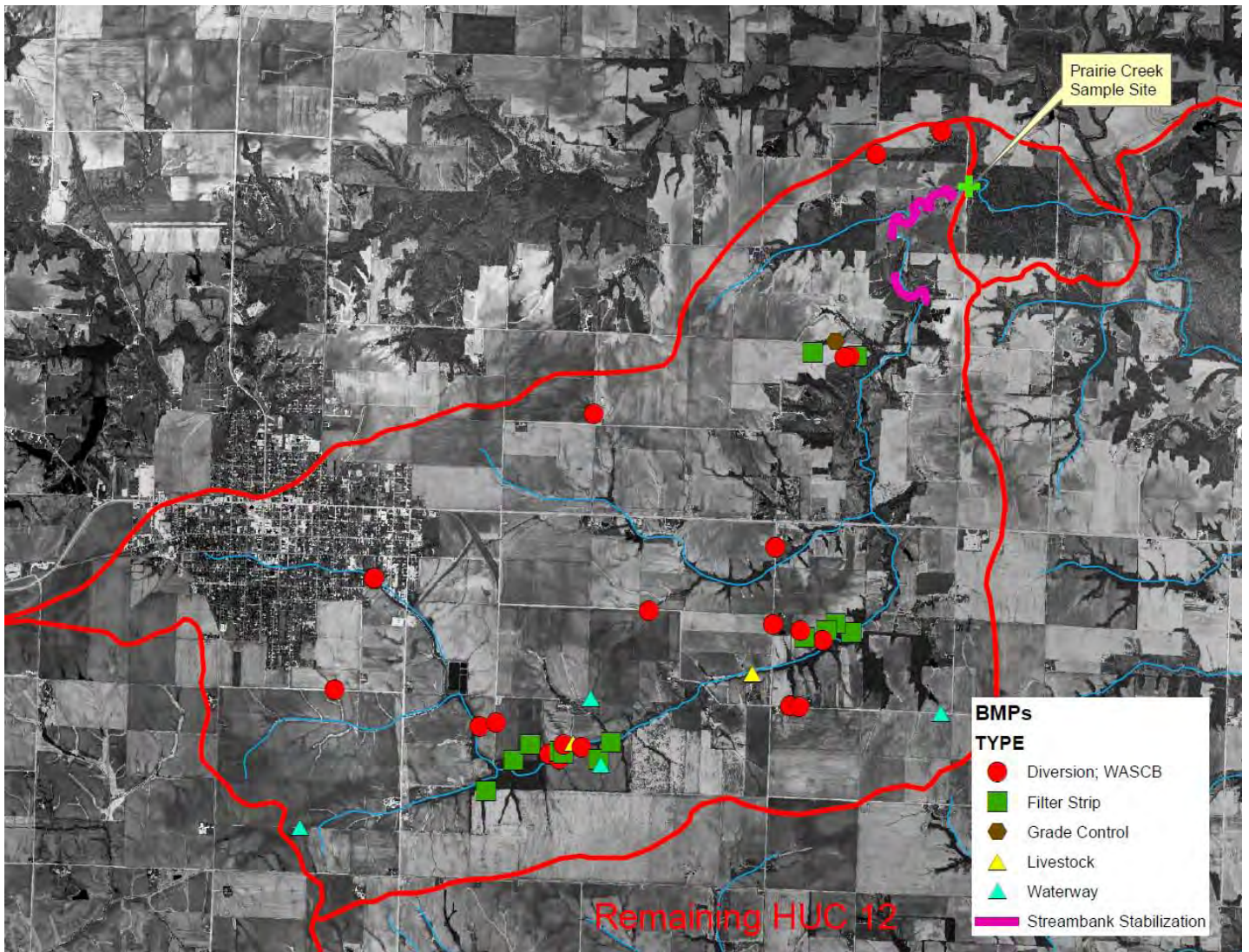
*Table 63 - Prairie Creek Recommended BMPs*

BMP Type and Number	Prairie Creek Above Sample Site	Below Sample Site	Remaining HUC 12
WASCB	35	N/A	N/A
Filter Strip	13	N/A	N/A
Terrace	0	N/A	N/A
Livestock	1	N/A	N/A
Grass Waterway	4	N/A	N/A
Grade Control	1	N/A	N/A
Streambank Stabilization*	2	N/A	N/A
Wetland	0	N/A	N/A
Retention Basin	0	N/A	N/A
Diversion	2	N/A	N/A
Other	1	N/A	N/A
<b>Total – All BMPs</b>	<b>59</b>	<b>N/A</b>	<b>N/A</b>

*\*additional details Included in a supplemental streambank report*

The majority of BMPs are needed on steep ground adjacent to Prairie Creek. WASCBs in many situations are the most appropriate practice. The Prairie Creek watershed already has numerous conservation practices in place. New practices will address a variety of pollutants including TSS, P, N, and Mn; addressing TSS will help to reduce Manganese.

Figure 60 - Prairie Creek Recommended BMP Locations



### 6.2.2 Indian Creek and Dago Slough Best Management Practices

All ground and virtually every property upstream of the Indian creek and Dago Slough sample sites was surveyed. Almost all of the producers contacted have agreed to submit, in writing, a commitment to implement the majority of recommended BMPs and provide a percentage of cost-share to do so. Three producers have, or intend to enroll in CRP immediately.

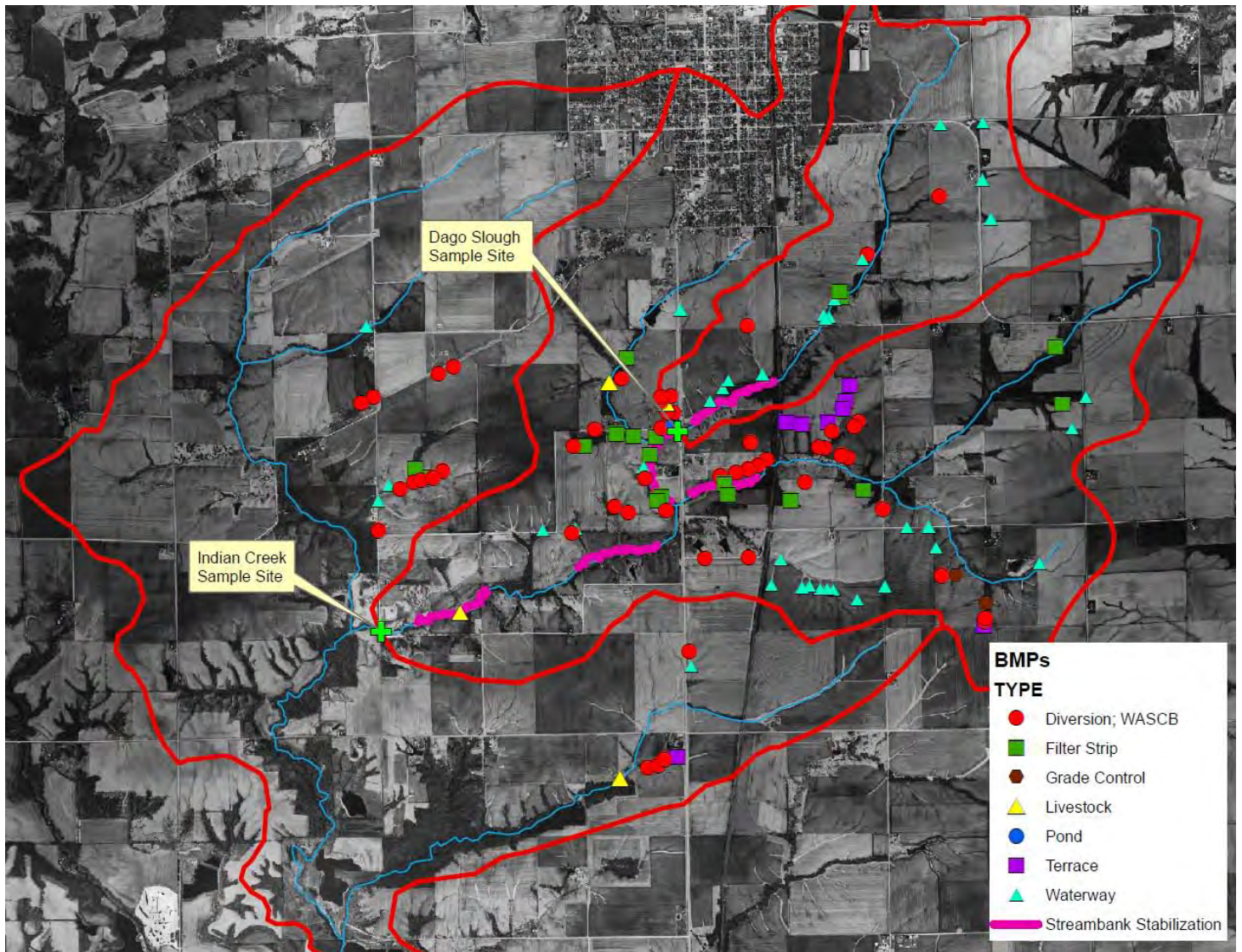
The following table and map represent recommended, field-verified BMPs in Prairie Creek. Each practice listed will reduce nutrient and sediment loading by slowing erosion and runoff. The number of WASCBs represents an estimate of the actual number of depending on the slope length at the site. Filter Strips include riparian filter strips and CP33, upland filter strips – one point represents the entire property boundary length; i.e. – the entire length of stream or timber within one property. Livestock includes stream fencing, water systems and crossings. Grass Waterways include re-shaping existing and failing waterways and can include multiple waterways on the same field. Other includes tile holes and other observations. Streambank stabilization represents entire priority reaches with multiple practices over multiple streambanks. In this watershed, stabilizing the streambed using rock riffles is a priority. The numbers in the table represent multiple riffles along unstable reaches and prioritized based on a detailed stream inventory/evaluation procedure developed and conducted by the State Water Survey.

**Table 64 - Indian Creek/Dago Slough Recommended BMPs**

BMP Type and Number	Indian Creek Above Sample Site	Indian Creek Below Sample Site	Dago Slough
WASCB	54	21	14
Filter Strip	15	2	2
Terrace	7	1	0
Livestock	2	1	0
Grass Waterway	20	4	15
Grade Control	2	0	0
Streambank Stabilization*	3	0	2
Wetland	0	0	
Retention Basin	0	0	1
Gutter System (livestock)	0	0	1
Diversion	1		2
Other		0	0
<b>Total – All BMPs</b>	<b>104</b>	<b>29</b>	<b>34</b>

*\*additional details included in a supplemental streambank report*

Figure 61 - Indian Creek and Dago Slough Recommended BMP Locations



The majority of BMPs are needed above the Indian Creek sample site, including Dago Slough. Due to the nature of the topography in this area, WASCBs in many situations in the most appropriate practice. Streambank or streambed stabilization in the case of Dago Slough is also critical in the watershed.



### 6.3 Load Reduction Strategy and TMDL

The Load Reduction Strategy/TMDL consists of three parts:

1. LRS for TSS and P: The maximum amount of TSS and P each waterbody can assimilate while still meeting recommended targets for TSS – 116mg/l and P – 0.61mg/l. This was developed using the flow/load duration approach
2. TMDL for Manganese: The maximum amount of Mn Prairie Creek can assimilate while still meeting state standards for Mn – 1.0mg/l. This was developed using the flow/load duration approach
3. Expected load reductions from existing BMPs and from implementing all field-verified and recommended BMPs.

#### 6.3.1 Load Reduction Strategy

Water quality assessments in Illinois are based on a combination of chemical (water, sediment and fish tissue), physical (habitat and flow discharge), and biological (macroinvertebrate and fish) data. Illinois EPA conducts its assessment of waterbodies using a set of seven designated uses: aquatic life, aesthetic quality, indigenous aquatic life, primary contact, secondary contact, public and food processing water supply, and fish consumption (IEPA, 2006). For each waterbody, and for each designated use applicable to the waterbody, Illinois EPA's assessment concludes that the waterbody either "fully supports" the use or that it is non-supporting of the designated use. Water bodies assessed as "not supporting" for any designated use are identified as impaired and are placed on the 303(d) list. Potential causes and sources of impairment are also identified for the impaired waters. For Prairie Creek, Indian Creek, and Dago Slough, the aquatic life designated use was assessed as being "not supporting."

##### 6.3.1.1 Point Sources

As previously noted, an LRS does not include WLAs and is focused on NPS pollution. However, total watershed loadings do include contributions from point sources. For reference, contributions from point sources are summarized in the table below. Loadings for TSS are based on daily permitted maximums. Loadings for P are based on the Daily Average Flow from each facility and an average of results from recent sampling.

*Table 65 - Point Source Daily Loadings*

Watershed/Point Source	Phosphorous (lbs/day)	Total Suspended Solids (lbs/day)
Prairie Creek/City of Carthage	7.1	188
Indian Creek/Dago Slough/City of Abingdon	8.68	160

### 6.3.1.2 Prairie Creek Load Reduction Strategy

#### 6.3.1.2.1 Applicable Water Quality Standards and Numeric Water Quality Target

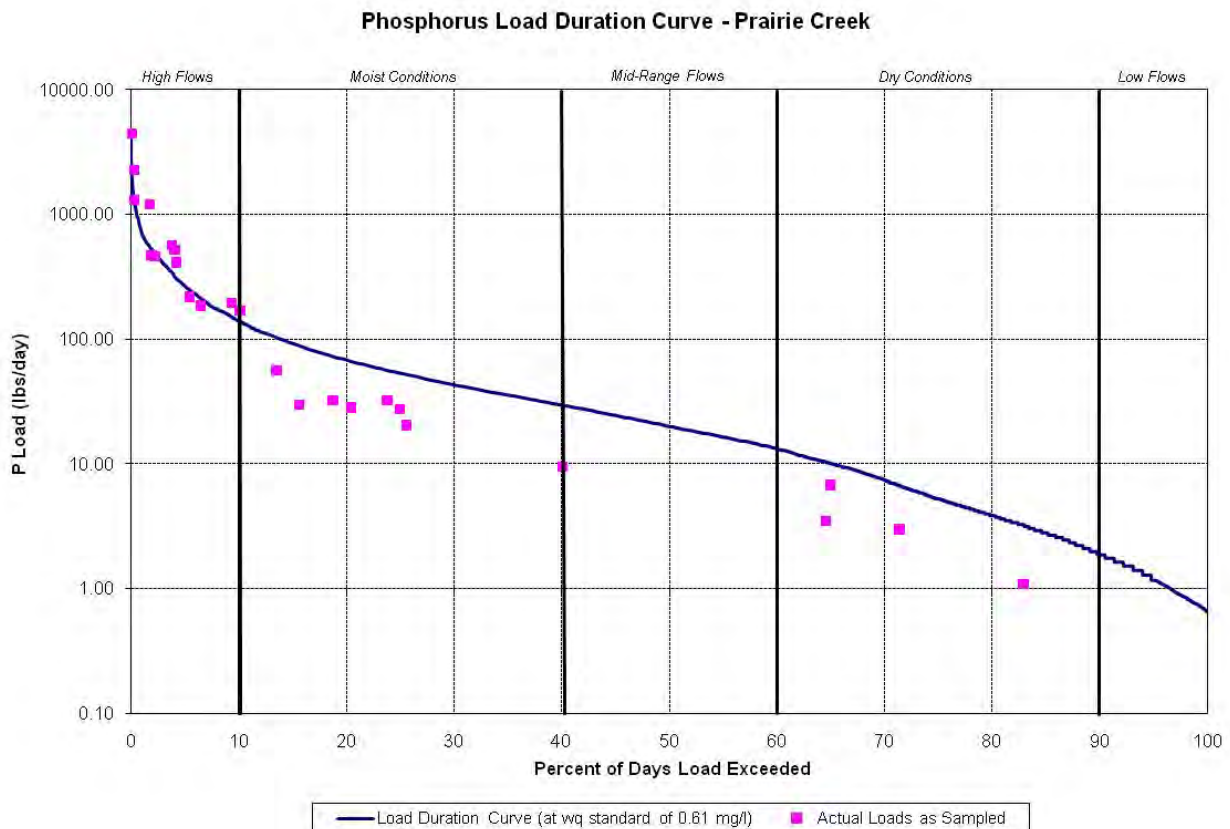
There are no official water quality standards for P and TSS in Illinois. For Prairie Creek, water quality targets were based on recommended targets and were set at 0.61mg/l for Phosphorous and 116mg/l for Total Suspended Solids.

#### 6.3.1.2.2 LRS/Target Load and Existing Load

A load duration analysis was performed to determine P and TSS LRS/Target Load (TL). See the following tables and figures. The maximum load to maintain compliance with the recommended concentration targets varies with stream discharge. The Existing Load (EL) represents observed sample results. Waste Load Allocations (WLAs) and a Margin of Safety (MOS) are not addressed in the LRS.

### Phosphorous

Figure 62 - Prairie Creek (IL\_DGZN 01) Phosphorous Load Duration Curve

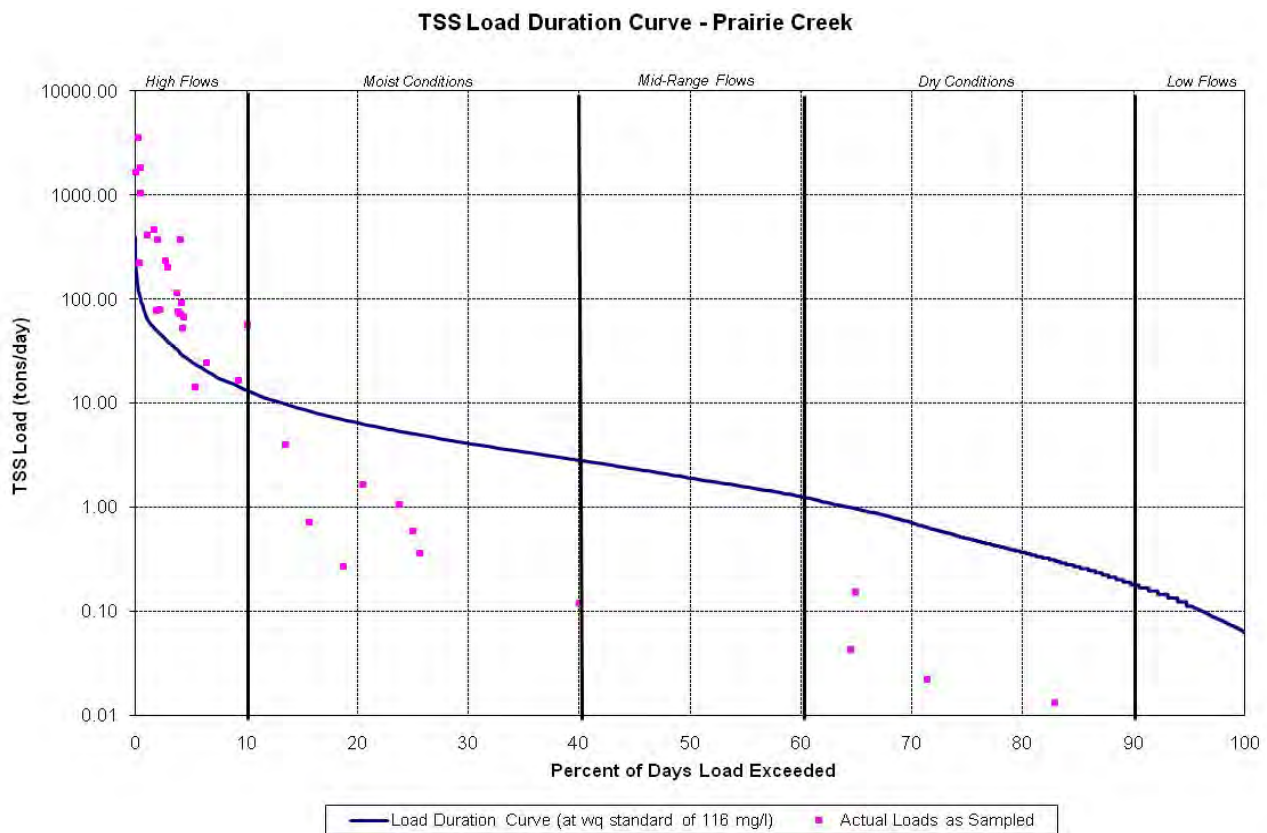


**Table 66 - Prairie Creek (IL\_DGZN 01) Phosphorous LRS Table**

LRS Summary	Loads Expressed as (lbs per day)				
	High	Moist	Mid-Range	Dry	Low
LRS / Target Load (lbs/day)	341.47	54.77	20.63	5.48	1.28
Existing Load (lbs/day)	520.39	49.293	18.567	5.48	1.28
Reduction Estimate (lbs/day)	178.92	0	0	0	0
Reduction Estimate %	34.38%	0.00%	0.00%	0.00%	0.00%
Implementation Opportunities	Post Development BMPs				
	Streambank Stabilization				
	Erosion Control Practices				
	Riparian Buffer Protection / Runoff Retention				
	Municipal WWTP				

Total Suspended Solids

**Figure 63 - Prairie Creek (IL\_DGZN 01) Total Suspended Solids Load Duration Curve**



*Table 67 - Prairie Creek (IL\_DGZN 01) Total Suspended Solids LRS Table*

LRS Summary	Loads Expressed as (tons per day)				
	High	Moist	Mid-Range	Dry	Low
<b>LRS / Target Load (tons/day)</b>	31.36	5.21	1.94	0.52	0.11
<b>Existing Load (tons/day)</b>	203	4.689	1.746	0.468	0.099
<b>Reduction Estimate (tons/day)</b>	171.64	0	0	0	0
<b>Reduction Estimate %</b>	84.55%	0.00%	0.00%	0.00%	0.00%
<b>Implementation Opportunities</b>	<b>Post Development BMPs</b>				
	<b>Streambank stabilization</b>				
	<b>Erosion Control Practices</b>				
	<b>Riparian Buffer Protection / Runoff Retention</b>				
					<b>Municipal WWTP</b>

6.3.1.2.3 Reduction Estimate (RE)

The Target Loads (LRS) are shown above. The Target Load (LRS) for P can be achieved through a 34% reduction in loading during high flows. The Target Load (LRS) for TSS can be achieved through an 86% reduction in loading from high flows. Implementation opportunities during these flows should focus on erosion control practices adjacent to the stream such as gully stabilization, streambank stabilization, or runoff retention. Much of the severe gully erosion in the watershed is adjacent to or near the stream channel.

6.3.1.2.4 Seasonal Variation

The watershed loading model addresses mean annual conditions, and implicitly represents all seasons. The load capacity calculations are based on year-long sampling results and specify target loads for the entire range of flow conditions that occur in the Prairie Creek Watershed.

#### 6.3.1.2.5 Reasonable Assurance

For nonpoint sources, Illinois EPA is committed to a number of measures to assure attainment of designated use:

- ✚ Convening local experts familiar with nonpoint sources of pollution in the watershed
- ✚ Ensuring that they define priority sources and identify restoration alternatives
- ✚ Developing a voluntary implementation program that includes accountability
- ✚ Using the results of future monitoring to conduct adaptive management

Local agencies and individual landowners with an interest soil erosion and nutrient loss from agricultural ground will be important for successful implementation of this LRS. If a producer in the watershed enrolls in a State or Federal cost-share program, there is reasonable assurance a particular practice will be implemented and maintained for the life of the contract. CRP contracts for example are a minimum of 10 years and the producer must sign a maintenance agreement for the life of the contract.

### 6.3.1.3 Indian Creek and Dago Slough Load Reduction Strategy

#### 6.3.1.3.1 Applicable Water Quality Standards and Numeric Water Quality Target

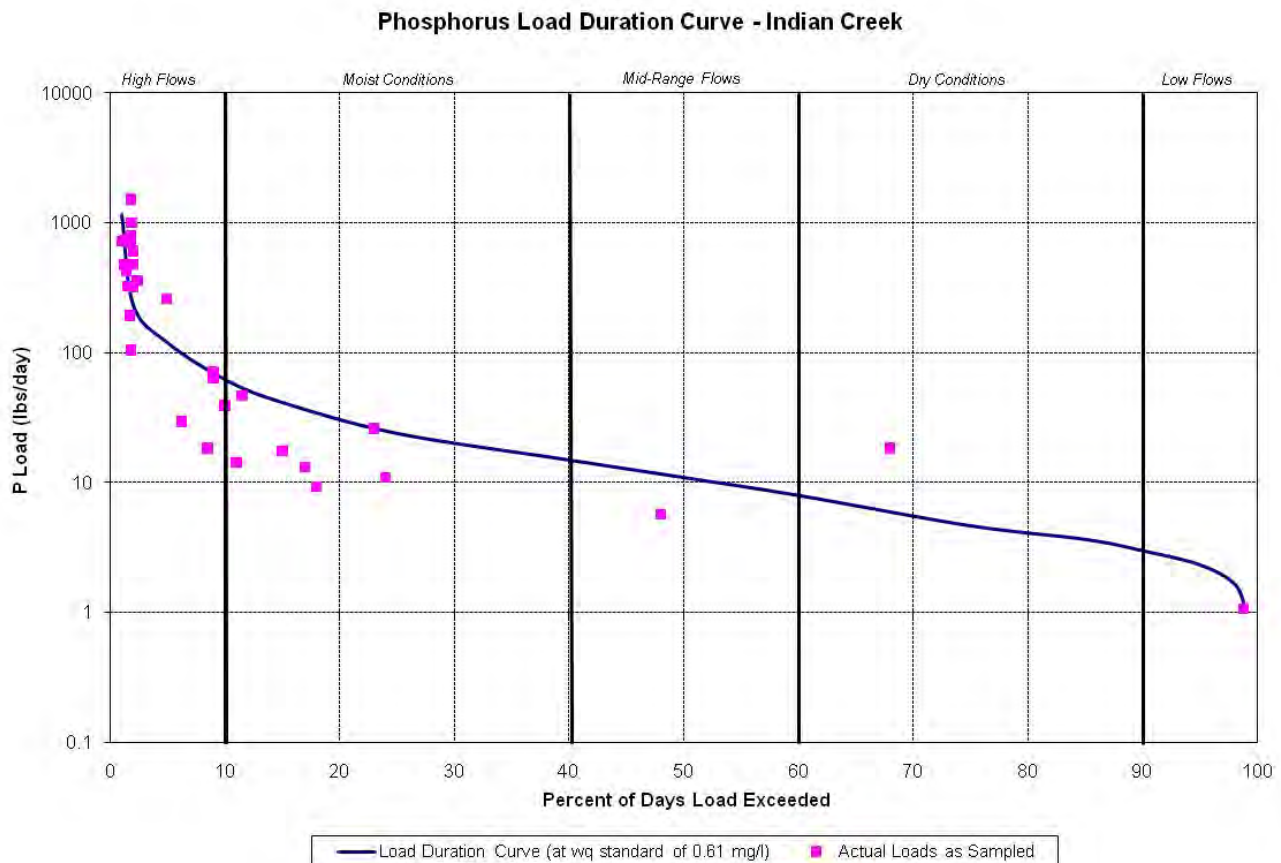
There are no official water quality standards for P and TSS in Illinois. For Indian Creek and Dago Slough, water quality targets were based on recommended targets and were set at 0.61mg/l for Total Phosphorous and 116mg/l for Total Suspended Solids

#### 6.3.1.3.2 LRS/Target Load and Existing Load

A load duration analysis was performed to determine P and TSS LRS/Target Load (TL). The maximum load to maintain compliance with the recommended concentration targets varies with stream discharge. The Existing Load (EL) represents observed sample results. Waste Load Allocations (WLAs) and a Margin of Safety (MOS) are not addressed in the LRS.

### Phosphorous

Figure 64 - Indian Creek (IL\_DJFC) Phosphorous Load Duration Curve



*Table 68 - Indian Creek (IL\_DJFC) Phosphorous LRS Table*

TMDL Summary	Loads Expressed as (lbs per day)							
	High	Moist	Mid-Range	Dry	Low			
LRS / Target Load (lbs/day)	122.4	23.7	10.86	4.61	2.3			
Existing Load (lbs/day)	272.3	27.4	9.774	10	2.3			
Reduction Estimate (lbs/day)	149.9	3.63	0	5.39	0			
Reduction Estimate %	55.05%	13.25%	0.00%	53.90%	0.00%			
Implementation Opportunities	Post Development BMPs							
	Streambank stabilization							
	Erosion Control Practices							
	Riparian Buffer Protection / Runoff Retention							
						Municipal WWTP		

*Indian Creek Crossing*



Figure 65 - Dago Slough (IL\_ILDJFCA) Phosphorous Load Duration Curve

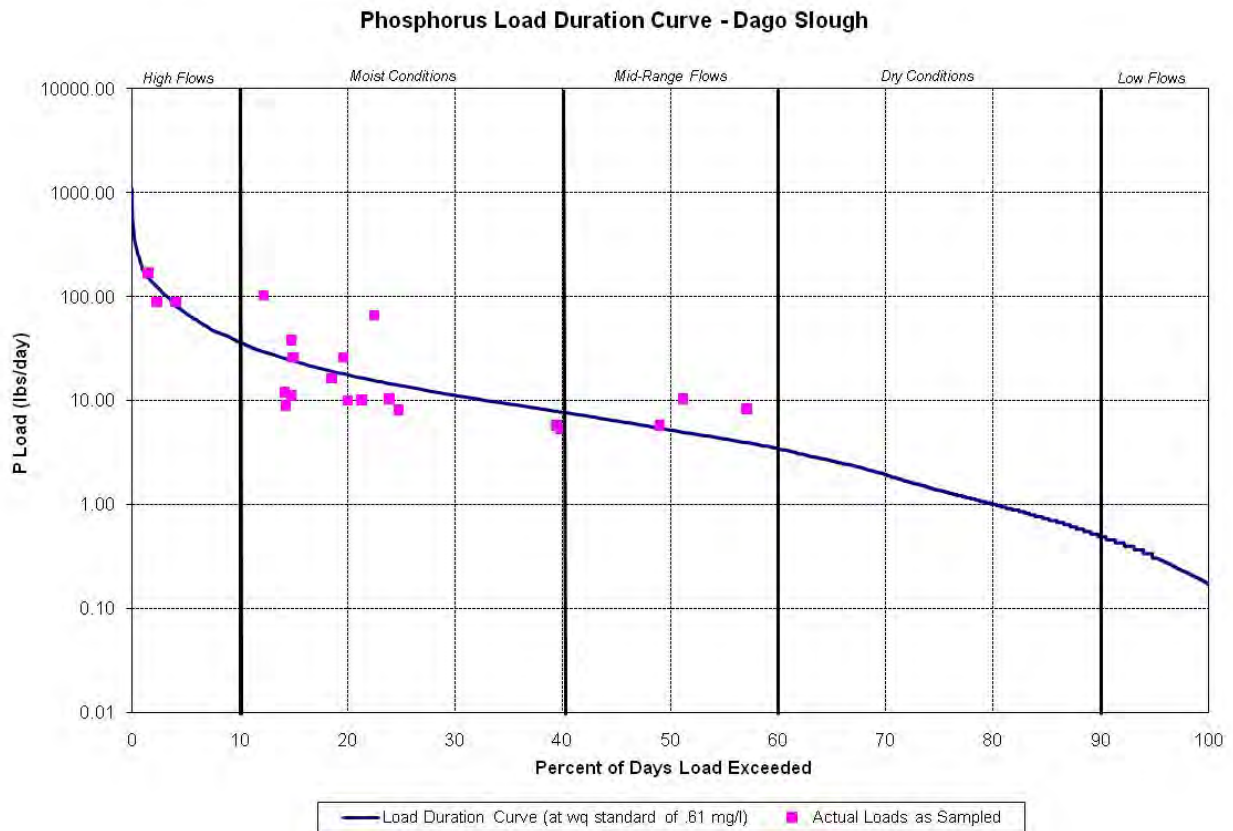


Table 69 - Dago Slough (IL\_ILDJFCA) Phosphorous LRS Table

TMDL Summary	Loads Expressed as (lbs per day)				
	High	Moist	Mid-Range	Dry	Low
LRS / Target Load (lbs/day)	76.23	14.33	5.3	1.41	0.3
Existing Load (lbs/day)	88	40	15	1.41	0.3
Reduction Estimate (lbs/day)	11.77	25.67	9.7	0	0
Reduction Estimate %	13.38%	64.18%	64.67%	0.00%	0.00%
Implementation Opportunities	Post Development BMPs				
	Streambank stabilization				
	Erosion Control Practices				
	Riparian Buffer Protection / Runoff Retention				
					Municipal WWTP



Total Suspended Solids

Figure 66 - Indian Creek (IL\_DJFC) Total Suspended Solids Load Duration Curve

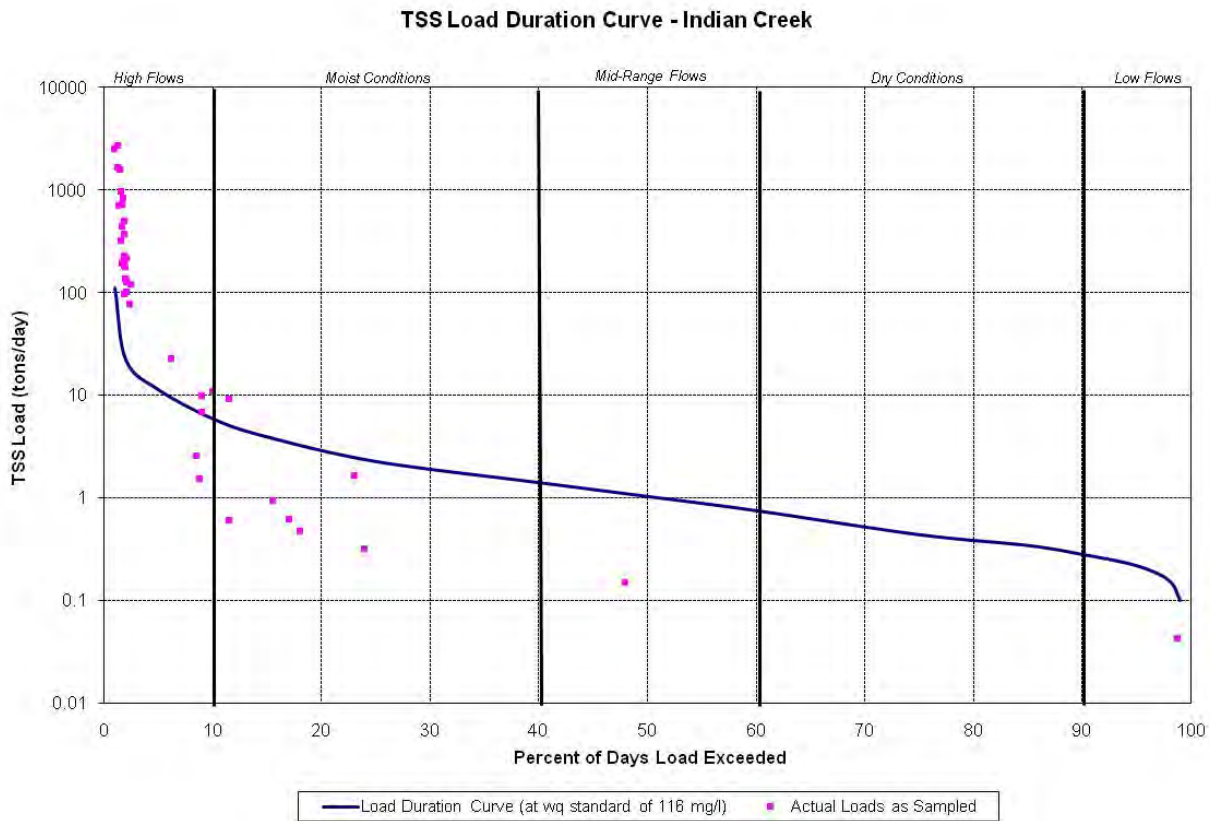


Table 70 - Indian Creek (IL\_DJFC) Total Suspended Solids LRS Table

TMDL Summary	Loads Expressed as (tons per day)				
	High	Moist	Mid-Range	Dry	Low
LRS / Target Load (tons/day)	21.91	3.92	1.41	0.44	0.28
Existing Load (tons/day)	56	6.2	1.269	0.396	0.252
Reduction Estimate (tons/day)	34.09	2.28	0	0	0
Reduction Estimate %	60.88%	36.77%	0.00%	0.00%	0.00%
Implementation Opportunities	Post Development BMPs				
	Streambank stabilization				
	Erosion Control Practices				
	Riparian Buffer Protection / Runoff Retention				
					Municipal WWTP

Figure 67 - Dago Slough (IL\_ILDJFCA) Total Suspended Solids Load Duration Curve

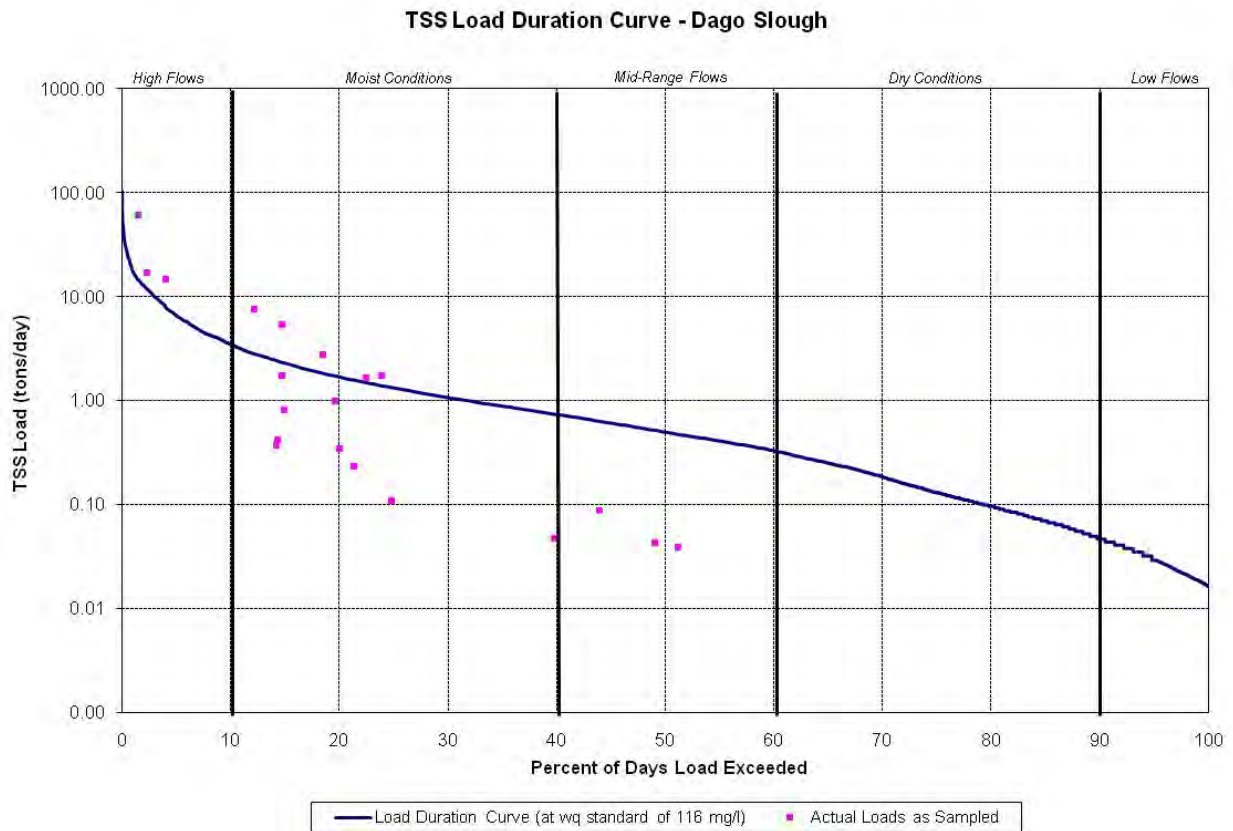


Table 71 - Dago Slough (IL\_ILDJFCA) Total Suspended Solids LRS Table

TMDL Summary	Loads Expressed as (tons per day)						
	High	Moist	Mid-Range	Dry	Low		
TMDL / Loading Capacity (LC)	4.34	1.36	0.51	0.14	0.03		
Existing Load (tons/day)	14.81	4	0.459	0.126	0.03		
Reduction Estimate (tons/day)	10.47	2.64	0	0	0		
Reduction Estimate %	70.70%	66.00%	0.00%	0.00%	0.00%		
Implementation Opportunities	Post Development BMPs						
	Streambank stabilization						
	Erosion Control Practices						
	Riparian Buffer Protection / Runoff Retention						
	Municipal WWTP						

#### 6.3.1.3.3 Reduction Estimate (RE); Dago Slough

The Target Loads (LRS) are shown above. The Target Load (LRS) for P can be achieved through a 13% reduction in loading during high flows, a 64% reduction during moist flows and a 65% reduction during mid-range conditions. The Target Load (LRS) for TSS can be achieved through a 71% reduction in loading during high flows and 66% reduction during moist conditions. Implementation opportunities during these conditions should focus on erosion control practices adjacent to the stream such as gully stabilization, streambank stabilization, or runoff retention. Much of the severe gully erosion in the watershed is adjacent to or near the stream channel on steep ground.

#### 6.3.1.3.4 Reduction Estimate (RE); Indian Creek

The Target Loads (LRS) are shown above. The Target Load (LRS) for P can be achieved through a 55% reduction in loading during high flows, a 13% reduction during moist conditions, and a 54% reduction during dry conditions. The Target Load (LRS) for TSS can be achieved through a 61% reduction in loading from high flows and a 38% reduction during moist conditions. Implementation opportunities during high or moist conditions should focus on erosion control practices adjacent to the stream such as gully stabilization, streambank stabilization, or runoff retention. Much of the severe gully erosion in the watershed is adjacent to or near the stream channel. For dry conditions, riparian buffers and limiting livestock access to the stream should be considered.

#### 6.3.1.3.5 Seasonal Variation

The watershed loading model addresses mean annual conditions, and implicitly represents all seasons. The load capacity calculations are based on year-long sampling results and specify target loads for the entire range of flow conditions that occur in the Indian Creek/Dago Slough Watersheds.

#### 6.3.1.3.6 Reasonable Assurance

For nonpoint sources, Illinois EPA is committed to a number of measures to assure attainment of designated use:

- ✚ Convening local experts familiar with nonpoint sources of pollution in the watershed
- ✚ Ensuring that they define priority sources and identify restoration alternatives
- ✚ Developing a voluntary implementation program that includes accountability
- ✚ Using the results of future monitoring to conduct adaptive management

Local agencies and individual landowners with an interest soil erosion and nutrient loss from agricultural ground will be important for successful implementation of this LRS. If a producer in the watershed enrolls in a State or Federal cost-share program, there is reasonable assurance a particular practice will be implemented and maintained for the life of the contract. CRP contracts for example are a minimum of 10 years and the producer must sign a maintenance agreement for the life of the contract. Fortunately there is widespread interest in the watershed from landowners to implement additional BMPs. A Section 319 grant proposal is being developed and numerous producers are committed to installing recommended practices.

6.3.2 TMDL

A TMDL was completed for manganese on Prairie Creek and is summarized below.

Figure 68 - Prairie Creek (IL\_DGZN 01) Manganese Load Duration Curve

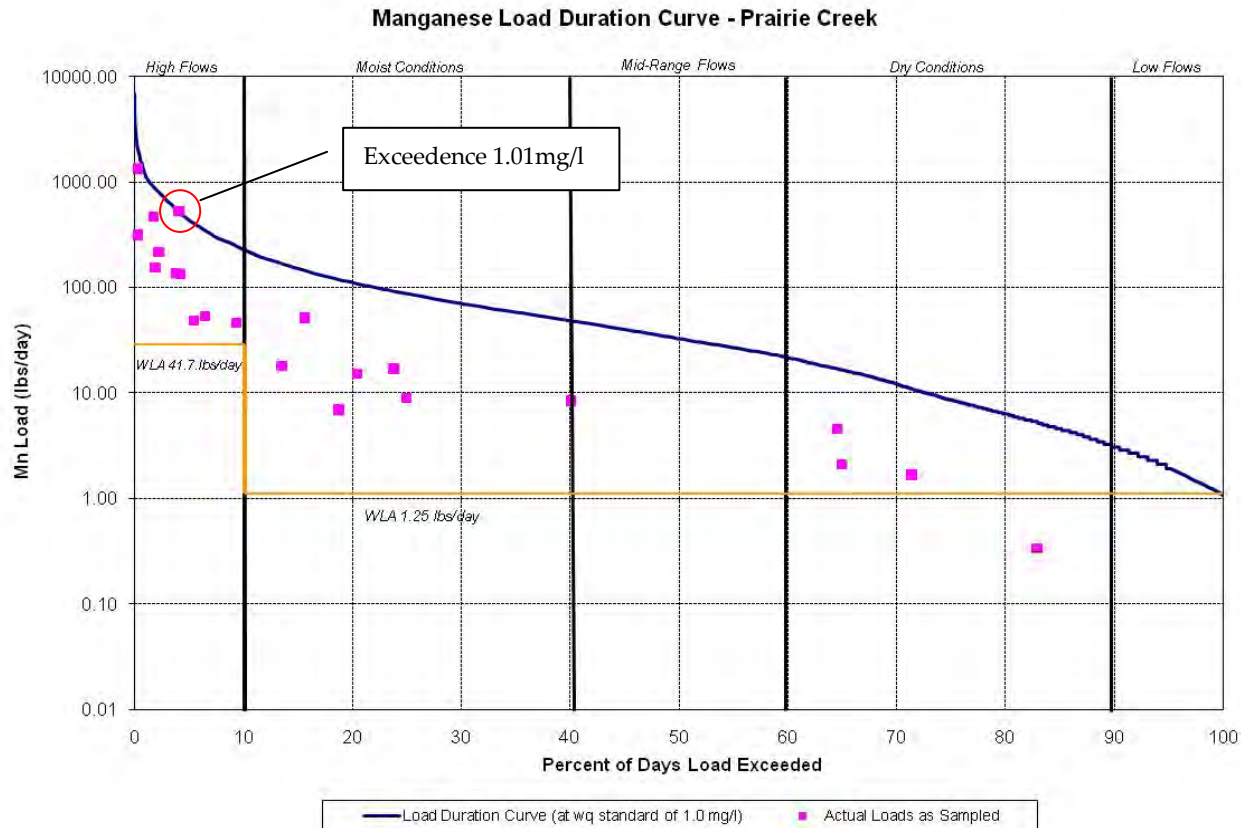


Table 72 - Prairie Creek (IL\_DGZN 01) TMDL Table

TMDL Summary	Loads Expressed as (lbs per day)				
	High	Moist	Mid-Range	Dry	Low
Existing Load (lbs/day)	513.93	80.991	30.267	7.911	1.89
TMDL / Loading Capacity (LC)	508.2	89.99	33.63	8.79	2.1
Waste Load Allocations (WLA)	41.7	1.25	1.25	1.25	1.25
Load Allocation (LA)	466.5	88.74	32.38	7.54	0.85
Reduction Estimate (lbs/day)	5.73	0	0	0	0
Reduction Estimate %	1.11%	0.00%	0.00%	0.00%	0.00%
Implementation Opportunities	Post Development BMPs				
	Streambank Stabilization				
	Erosion Control Practices				
	Riparian Buffer Protection / Runoff Retention				
					Municipal WWTP

### **6.3.2.1 Applicable Water Quality Standards and Numeric Water Quality Target**

The water quality standard for Aquatic Life Use for manganese in Illinois is currently 1.0mg/L and is used as the target concentration for this TMDL.

### **6.3.2.2 Loading Capacity**

A load duration analysis was performed to determine the manganese load capacity (LC) of the creek. The maximum load to maintain compliance with the water quality standard concentration varies with stream discharge. TMDLs allot the LC to waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and a margin of safety (MOS).

### **6.3.2.3 Wasteload Allocation (WLA)**

There is one permitted discharger in the watershed. Although not permitted specifically for Mn, a WLA was determined based on an average of current and historical sampling results. The WLA for moist to low flows is based on 0.3 mg/L with a permitted discharge (design average flow) of 0.5 MGD. The WLA for high flows is based on 0.3 mg/L with a permitted discharge (design maximum flow) of 5.0 MGD. The WLA for moist to low flows is therefore set at 1.25 lbs/day and for high flows at 41.7 lbs/day. It is important to note that the one slight exceedence in the Mn standard occurred during the highest flow conditions; a permit modification for the Carthage facility is not being recommended.

### **6.3.2.4 Load Allocation (LA)**

The LA and the MOS are shown above. The LA can be achieved through a 1.11% reduction simply by implementing erosion control practices as recommended in the Load Reduction Strategy for Phosphorous and Total Suspended Solids.

### **6.3.2.5 Margin of Safety**

The MOS is set as implicit due to the fact that the reduction needed is based on a single observed exceedence. A far greater reduction is expected due to reductions in TSS that will result from the implementation of BMPs.

### 6.3.2.6 Seasonal Variation

The manganese standard is to be met regardless of flow conditions in any season. The load capacity calculations are based on year-long sampling results and specify target loads for the entire range of flow conditions that occur in Prairie Creek.

### 6.3.2.7 Reasonable Assurance

There is one permitted point source discharger in the watershed. In terms of reasonable assurances for point sources, Illinois EPA administers the NPDES permitting program for treatment plants, stormwater permitting and CAFO permitting. The permit for the point source discharger may be modified if necessary as part of the permit review process (typically every 5 years), to ensure that it is consistent with the applicable wasteload allocation.

For nonpoint sources, Illinois EPA is committed to a number of measures to assure attainment of designated use:

- ✚ Convening local experts familiar with nonpoint sources of pollution in the watershed
- ✚ Ensuring that they define priority sources and identify restoration alternatives
- ✚ Developing a voluntary implementation program that includes accountability
- ✚ Using the results of future monitoring to conduct adaptive management

Local agencies and institutions with an interest in watershed management will be important for successful implementation of this TMDL. Also, by reducing P and TSS loads as noted in the LRS, manganese concentrations will be reduced as well.

### 6.3.3 Existing and Recommended BMPs

Existing BMPs contribute to reducing upland sediment and nutrient loadings. After the various upland loading models were developed, localized drainage areas were delineated for each individual BMP. Based on existing literature (STEPL Spreadsheet Tool, 2004) and field observations, pollutant removal efficiencies (percentage efficiency) were used to determine what percentage of pollutants are removed by each BMP; the result is the remaining loading after runoff and sediment drains through the given BMP.

**Table 73 - Pollutant Removal Efficiencies Used for Existing and Potential BMPs**

BMP	Removal Efficiency Range Sediment (sheet and rill erosion)	Removal Efficiency Range N	Removal Efficiency Range P
Diversion	70%	45-65%	65-70%
Filter Strip	45-75%	40-75%	40-80%
Grade Control	55-75%	35-40%	55-65%
Large Habitat Block	58-75%	65-75%	60-80%
Livestock Practices	38-95%	35-95%	35-95%
Pond	95%	95%	95%
Terrace	65-80%	15-30%	45-70%
WASCB	35-85%	20-75%	40-75%
Waterway	35-75%	40-78%	40-82%

Any new BMP will reduce sediment and nutrient loading and are critical in helping to meet water quality targets. After the various upland loading models were developed, localized drainage areas were delineated for each individual BMP. Based on existing literature, pollutant removal efficiencies (percentage efficiency) were used to determine what percentage of pollutants are removed by each BMP; the result is the remaining loading after runoff and sediment drains through the given BMP. Additionally, streambank erosion, streamside gully erosion and nutrient loading were calculated and BMPs were identified. All gully and streambank stabilization used 100% removal efficiency for all pollutants, assuming the gully and streambank is entirely stabilized. Observations were also made in the field using aerial imagery and adjustments were made for the efficiency percentages based on the quality of the BMP.

In addition to recommended BMPs that have been field verified, other BMPs should also be considered or encouraged in both watersheds. Implementing these practices, where appropriate will lead to additional load reductions and help to improve overall water quality. Additional BMPs are discussed at the end of this section.



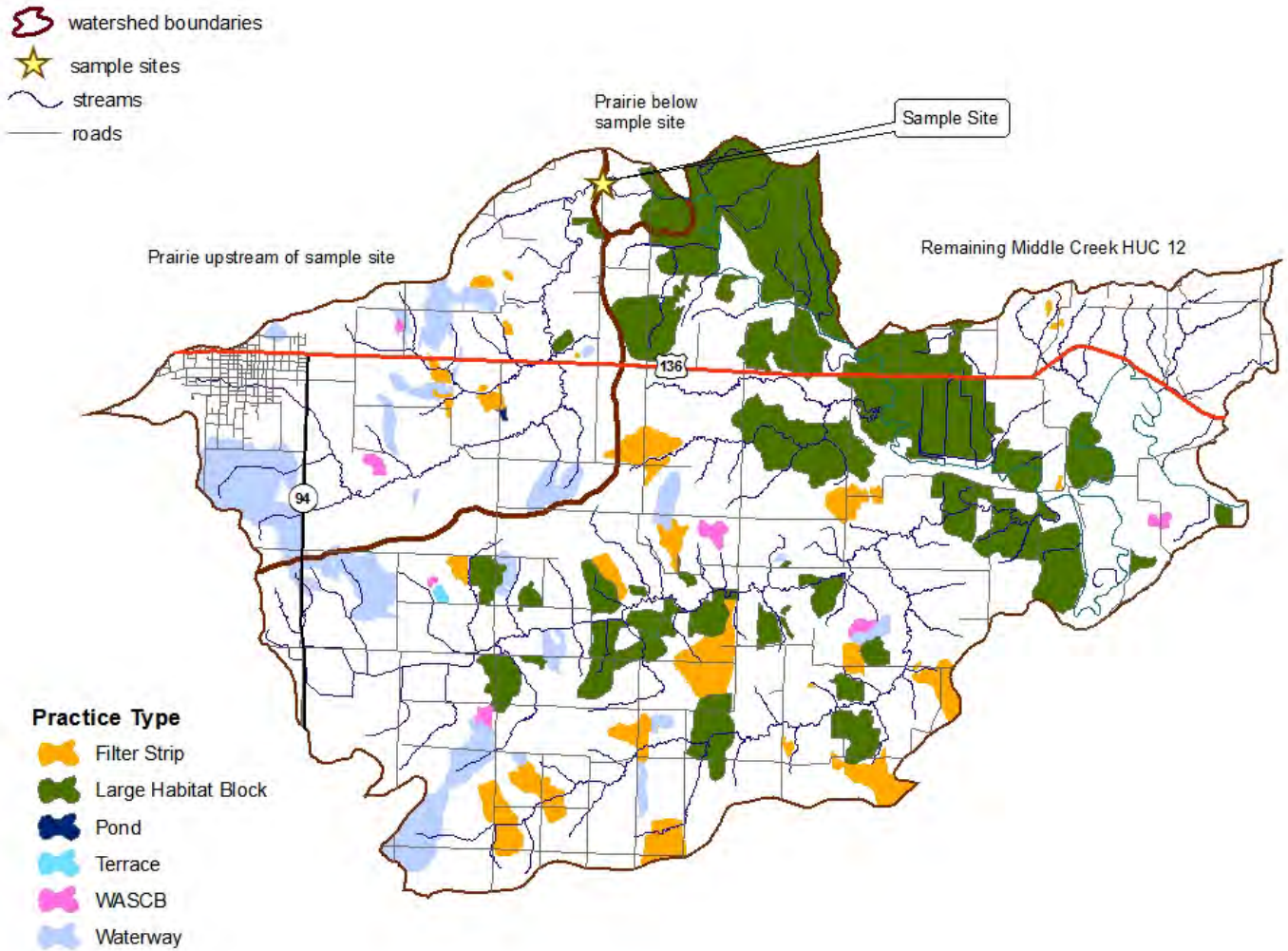
### 6.3.3.1 Prairie Creek Existing BMPs

The following table summarizes load reductions from existing BMPs for the entire basin. The map shows the specific drainage areas associated with all existing BMPs. Erosion and nutrient loadings were calculated based on these drainage areas. Without these BMPs, existing loads in the watershed would likely be a lot higher and subsequent reductions needed would be greater.

*Table 74 – Prairie Creek Load Reductions from Existing BMPs*

<b>Pollutant Load Reduction</b>	<b>Total Watershed</b>	<b>Below Sample Site</b>	<b>Upstream of Sample Site</b>	<b>Remaining HUC 12</b>
<b>Sediment Load (tons/yr)</b>	8,884	12.2	1,018	7,854
<b>Nitrogen Load (lbs/yr)</b>	34,939	71	4,586	30,283
<b>Phosphorous Load (lbs/yr)</b>	12,878	26	1,594	11,258

Figure 69 - Prairie Creek Existing BMP Drainage Areas



### 6.3.3.2 Prairie Creek Recommended New BMPs

Where landowner permission was given, site specific BMPs were identified. BMPs were not identified or assessed in the remaining HUC 12 watershed. The following table summarizes load reductions from new and recommended BMPs for only Prairie Creek, including a 100% reduction in assessed gully erosion and an assumed 90% reduction in streambank erosion if all streambank stabilization practices are implemented. It is important to note that only a small portion of streambanks were assessed; if additional stabilization practices were identified, expected load reductions would be much higher than summarized below. The map shows the specific drainage areas associated with new, recommended BMPs for Prairie Creek. Erosion and nutrient loadings were calculated based on these drainage areas and take into account reductions from both erosion and runoff. For example, stabilizing a field gully will also reduce sheet and rill erosion and nutrients in runoff.

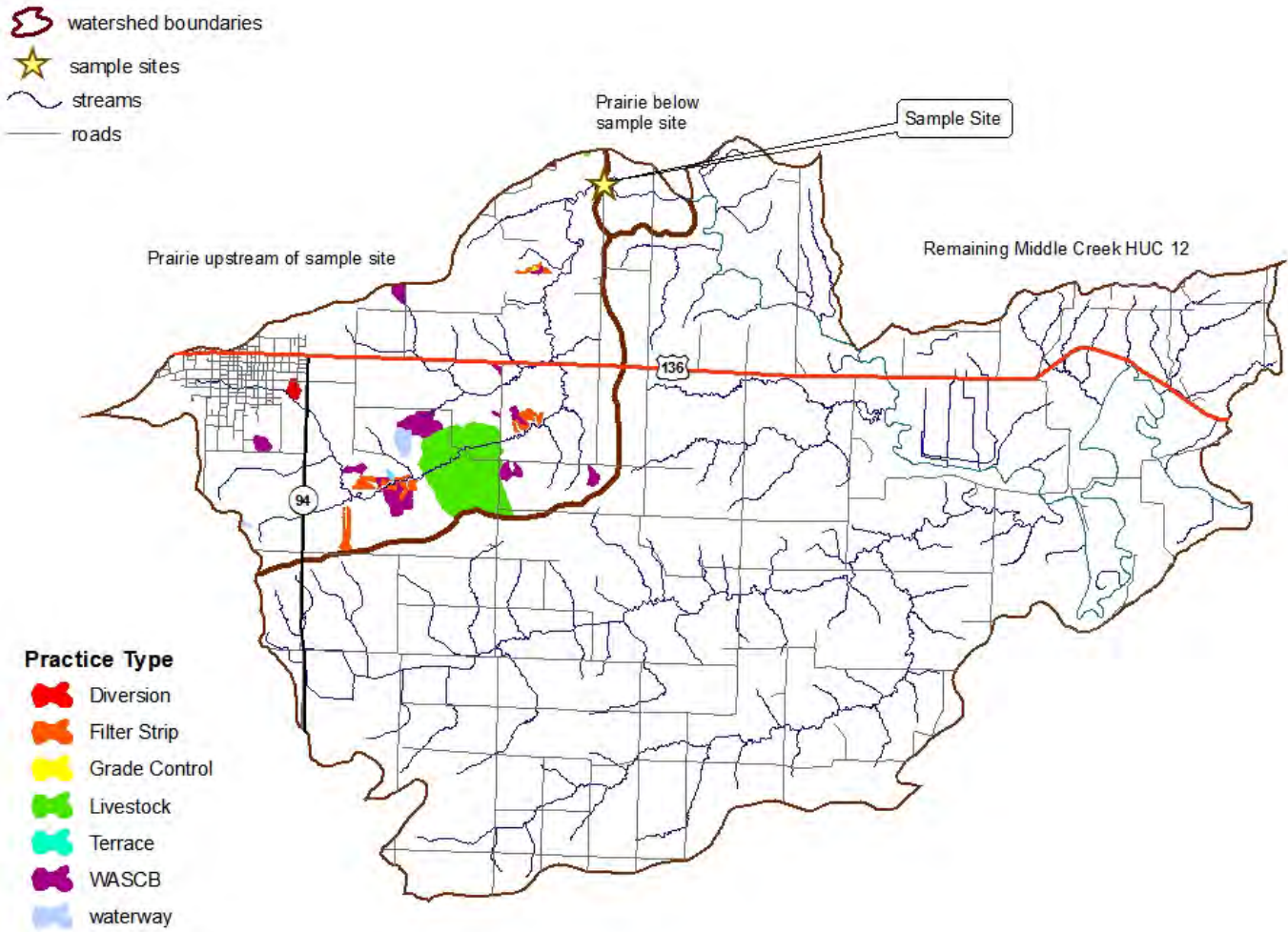
Drainage areas for stream corridor gully erosion and streambank erosion were not developed for this report; reductions are therefore only based only on stabilizing a gully or streambank and do not take into account additional reductions in sheet and rill erosion and nutrients from runoff.

*Table 75 - Prairie Creek Load Reductions from Recommended/New BMPs*

Pollutant Load Reduction	Total Watershed	Below Sample Site	Upstream of Sample Site	Remaining HUC 12
Sediment Load (tons/yr)	2,287	0	2,287	0
Nitrogen Load (lbs/yr)	7,576	0	7,576	0
Phosphorous Load (lbs/yr)	2,638	0	2,638	0

Based on total watershed erosion or edge-of-field loss, implementing all new and recommended BMPs will result in a 24% reduction in sediment loads; a 13% reduction in N loads and a 17% reduction in P. If these reductions hold true for pollutants delivered to the stream: based on average percentage reductions identified in the LRS for Prairie, all new BMPs could achieve approximately 56% of the P reductions and 35% of the sediment or TSS reductions needed to meet water quality targets. These reductions in TSS will help achieve greater than 100% of the reductions needed for manganese. Further reductions are likely if additional streambank stabilization is implemented. In order to fully meet water quality targets for TSS and P, additional BMPs will need to be identified or considered in the watershed. See Appendix A for model descriptions.

Figure 70 - Prairie Creek new BMP Drainage Areas



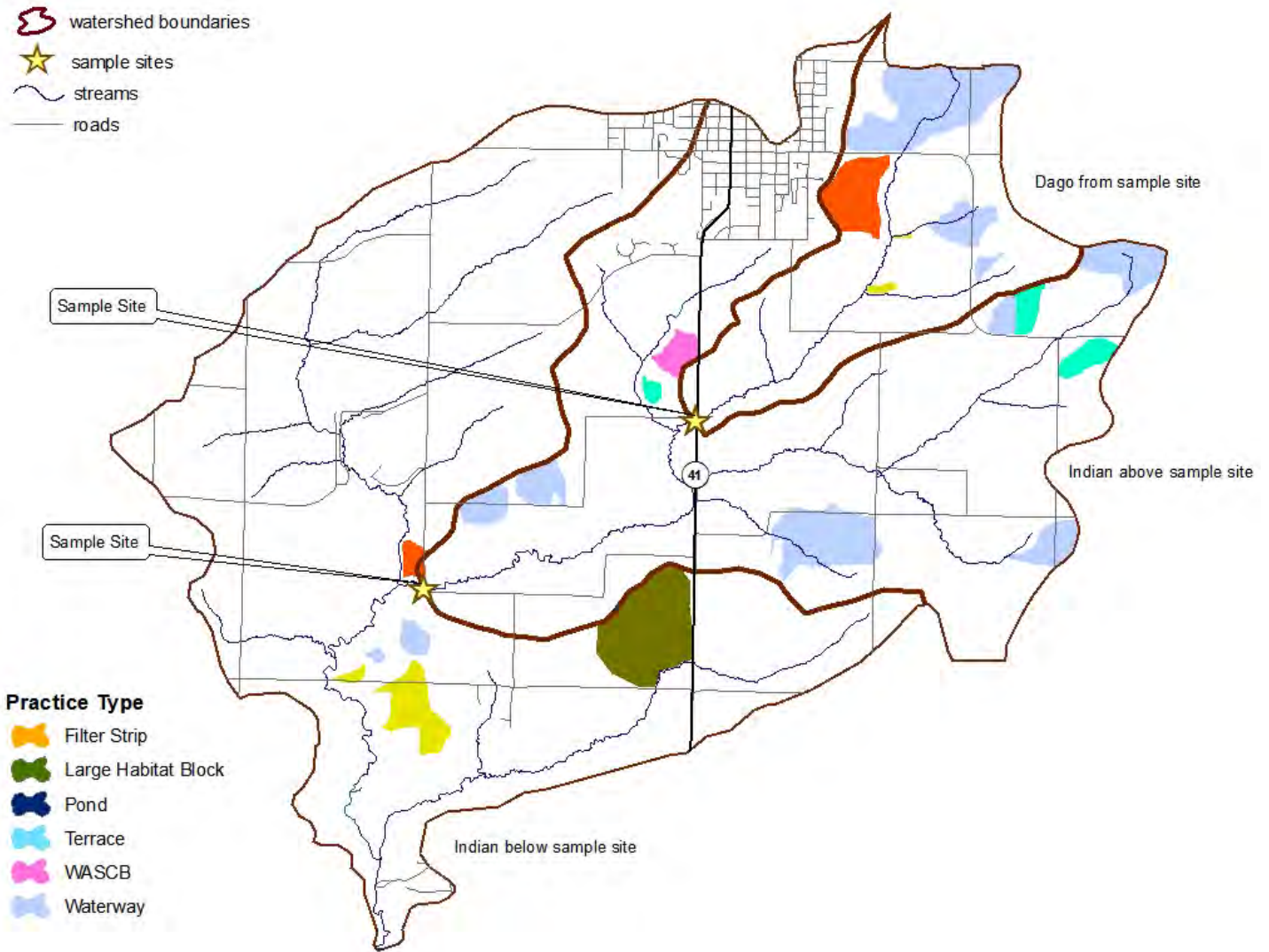
### 6.3.3.3 Indian Creek and Dago Slough Existing BMPs

The following table summarizes load reductions from existing BMPs for the entire basin. The map shows the specific drainage areas associated with all existing BMPs. Erosion and nutrient loadings were calculated based on these drainage areas. Without these BMPs, existing loads in the watershed would likely be a lot higher and subsequent reductions needed would be greater.

*Table 76 - Indian Creek/Dago Slough Load Reductions from Existing BMPs*

<b>Pollutant Load Reduction</b>	<b>Total Watershed</b>	<b>Dago Slough</b>	<b>Below Indian Sample Site</b>	<b>Above Indian Sample Site</b>
<b>Sediment Load (tons/yr)</b>	755	161	291	303
<b>Nitrogen Load (lbs/yr)</b>	3,211	824	1,200	1,188
<b>Phosphorous Load (lbs/yr)</b>	1,128	271	394	463

Figure 71 – Indian Creek/Dago Slough existing BMP Drainage Areas



### 6.3.3.4 Indian Creek and Dago Slough Recommended New BMPs

Where landowner permission was given, site specific BMPs were identified. The following table summarizes load reductions from new and recommended BMPs for the entire basin, including a 100% reduction in assessed gully erosion and an assumed 50% reduction in streambank erosion if an aggressive streambank stabilization campaign was implemented. The map shows the specific drainage areas associated with new, recommended BMPs. Erosion and nutrient loadings were calculated based on these drainage areas and take into account reductions from both erosion and runoff. For example, stabilizing a field gully will also reduce sheet and rill erosion and nutrients in runoff.

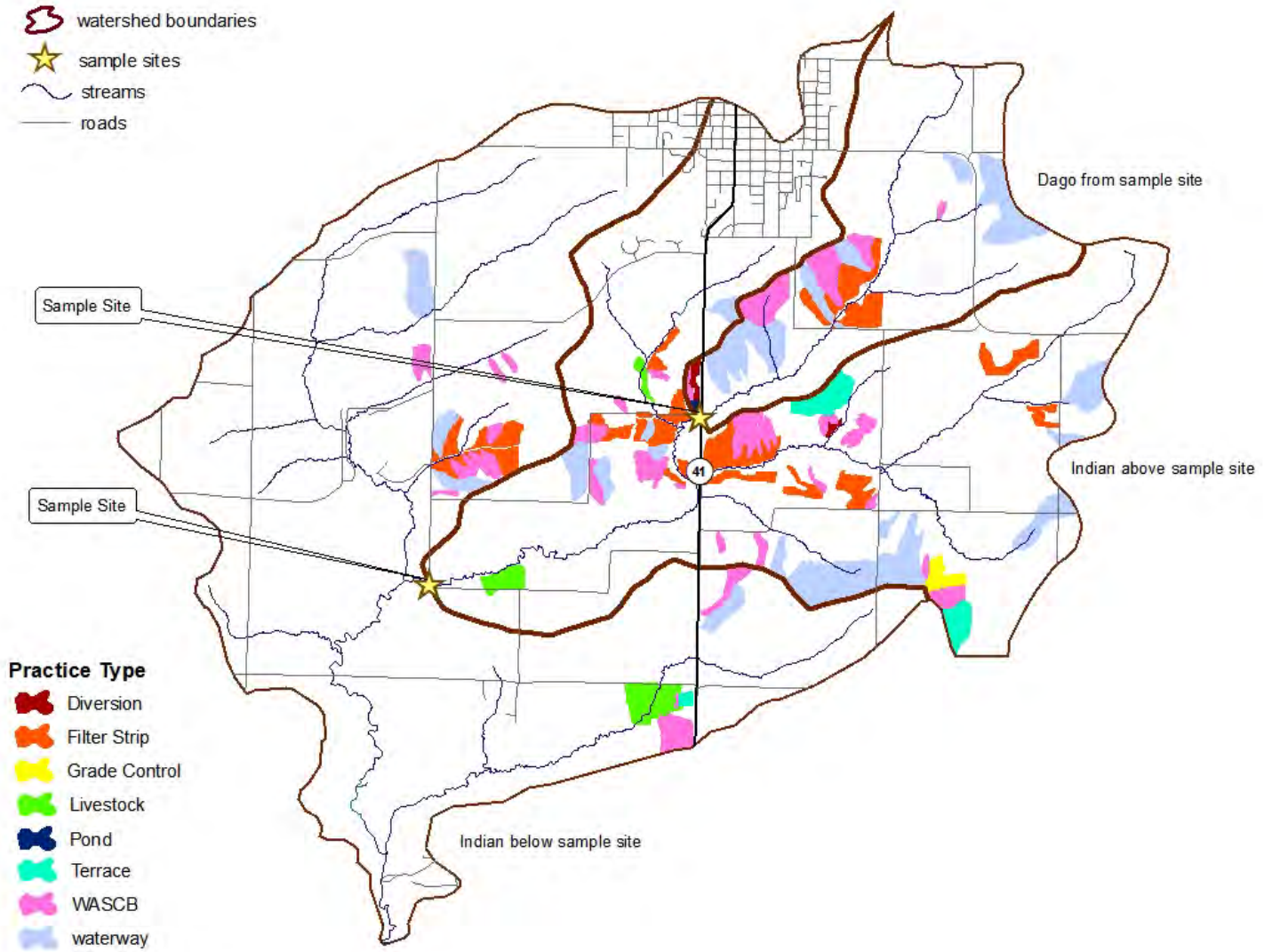
Drainage areas for stream corridor gully erosion and streambank erosion were not developed for this report; reductions are therefore only based only on stabilizing a gully or streambank and do not take into account additional reductions in sheet and rill erosion and nutrients from runoff. Streambank erosion and stream corridor gullies were not assessed below the Indian Creek sample site.

*Table 77 - Indian Creek/Dago Slough Load Reductions from Recommended/New BMPs*

Pollutant Load Reduction	Total Watershed	Dago Slough	Below Indian Sample Site	Above Indian Sample Site
Sediment Load (tons/yr)	9,476	1,730	939	6,807
Nitrogen Load (lbs/yr)	28,396	6,142	2,847	19,407
Phosphorous Load (lbs/yr)	8,566	2,132	1,152	5,282

Based on total watershed erosion or edge-of-field loss, implementing all new and recommended BMPs will result in an 29% reduction in sediment loads for the entire watershed; a 21% reduction in N loads and a 20% reduction in P. Reductions achieved for areas above both sample sites are a 41% reduction in sediment, a 31% reduction in N, and a 27% reduction in P. If these reductions hold true for pollutants delivered to the stream: based on average percentage reductions identified in the LRS for Indian and Dago, all new BMPs could achieve approximately 53% of the P reductions and 65% of the sediment or TSS reductions needed to meet water quality targets. Further reductions are likely if additional streambank stabilization is implemented. In order to fully meet water quality targets, additional BMPs will need to be identified or considered in the watershed. See Appendix A for model descriptions.

Figure 72 - Indian Creek/Dago Slough new BMP Drainage Areas





### 6.3.3.5 Additional BMP Considerations

#### 6.3.3.5.1 Nutrient Management Plans

The development of nutrient management plans optimizes the efficient use of all sources of nutrients, including soil reserves, fertilizers, crop residue, and organic sources and minimizes the potential of water quality degradation by excess nutrient loads. A good nutrient management plan should address the amount, source, placement, methods, and timing nutrient applications. Plans for nutrient management should be developed and comply with applicable federal, state and local NRCS regulations. Initial soil nutrient concentrations can be determined by onsite soil testing. Losses through plant uptake are subtracted, and gains from organic sources such as manure application or industrial/municipal wastewater are added. The resulting nutrient content is then compared to local guidelines to determine if fertilizer should be added to support crop growth and maintain current levels. In some cases, the soil nutrient content is too high, and no fertilizer should be added until levels are reduced by crop uptake to target levels.

The Illinois Agronomy Handbook (IAH) lists guidelines for fertilizer application rates based on the inherent properties of the soil, the initial soil test nutrient concentration for the field, and the crop type and expected yield. Nutrient management plans should also address the methods of application. Fertilizer may be applied directly to the surface, placed in bands below and to the side of seeds, or incorporated in the top several inches of the soil profile through drilled holes, injection, or tillage. Incorporation of fertilizer to a minimum depth of two inches prior to planting has shown a decrease in total phosphorus runoff concentrations of 20 percent. Subsurface application, such as deep placement, has reductions in total phosphorus of 20 to 50 percent.

The effectiveness of nutrient management plans (application rates, methods, and timing) in reducing nutrient loading from agricultural land is site specific. Average reductions of nutrient loads are reported at 35 percent for total phosphorus and 15 percent for total nitrogen using nutrient management plans.

#### 6.3.3.5.2 Conservation Tillage Practices

Conservation tillage practices are used to control erosion and surface transport of pollutants from crop fields. As previously noted, it was observed that the majority of ground in both watersheds had some level of conservation tillage with steeper slopes primarily in no-till. Conservation tillage is defined as any tillage practice that results in at least 30 percent coverage of the soil surface by crop residuals after planting. Tillage practices leaving 20 to 30 percent residual cover after planting reduce erosion by approximately 50 percent compared to bare soil. Practices that result in 70 percent residual cover reduce erosion by approximately 90 percent. The residuals not only provide erosion control, but also increase the organic and nutrient content in the soil and reduce the amount of carbon in the atmosphere by storing it in the soil. Tillage practices including no-till systems, strip till, ridge till, and mulch till are commonly used to maintain the suggested 30 percent cover.

Compared to conventional tillage, strip till practices can reduce phosphorus loads by 68 percent and nitrogen loads by 64 percent. No till practices can reduce phosphorus loads by 76 percent and nitrogen loads by 73 percent. Conservation tillage practices have been reported to reduce total phosphorus loads by 45 percent and total nitrogen loads by 55 percent in sites where soil erosion is not controlled.

#### 6.3.3.5.3 Cover Crops

Cover crops are grasses and legumes established for seasonal cover and conservation purposes to reduce soil erosion, improve soil organic matter, and manage excess nutrients. Grasses tend to have low seed costs and establish relatively quickly. Legumes take longer to establish, but are capable of fixing nitrogen from the atmosphere, thus reducing nitrogen fertilization required for the next cash crop. Legumes, however, are more susceptible to harsh winter environments and may not have adequate survival to offer sufficient erosion protection. Planting the cash crop in wet soil that is covered by heavy surface residue from the cover crop may impede emergence by prolonging wet, cool soil conditions. Cover crops should be killed off two or three weeks prior to planting the cash crop either by application of herbicide or mowing and incorporation, depending on the tillage practices used. The National Sustainable Agriculture Information Service recommends planting ryegrass after corn harvest and hairy vetch after soybeans.

Cover crops have the added benefit of reducing the need for pesticides and fertilizers, and are also used in conservation tillage systems following low residue crops such as

soybeans. Cover crops alone may reduce soil and runoff losses by 50 percent, and when used with no-till systems may reduce soil loss by more than 90 percent.

#### 6.3.3.5.4 Drainage Water Management for Tile Drain Outlets

For drainage water management, control structures are placed at the outlet of a tile system to control the water table in the soil. Control structures collect water that has infiltrated from agricultural fields into the root zone. This practice can be used to raise the water level after harvest, thereby reducing nitrate loading from tile effluent, or to retain water in the soil during the growing season. The retained water becomes a source of moisture for plants during dry conditions and undergoes biological, chemical, and physical processes that result in lower nutrient concentrations in the final effluent.

Drainage water management reduces the volume of drainage water leaving a field by 20 to 30 percent on average. However, outflow varies widely depending on soil type, rainfall, type of drainage system, and management intensity. Drainage water management also provides a higher field water table level, which promotes denitrification within the soil profile. In some cases, nitrate-nitrogen concentrations have been 10 to 20 percent lower in outflow from controlled systems compared to uncontrolled-free draining systems. Load reductions of 45 percent for nitrogen and 35 percent for phosphorus have been reported. In experiments in Illinois, reductions of up to 47 percent for nitrate and 83 percent for phosphate were measured.

#### 6.3.3.5.5 Wetland Systems

Wetland systems are structural controls that provide nutrient reductions. Treatment in wetland systems is achieved through sedimentation and filtration, soil adsorption, chemical precipitation, biological uptake by plants, and microbial transformation of nutrients. Removal efficiencies from wetland in Illinois were reported at 40 to 79 percent for total phosphorus and 23 to 44 percent for total nitrogen

## 7.0 Public Participation Summary

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### 7.1 Public Participation Summary

Public participation for this project was approached differently than a traditional TMDL. We approached public participation with a strategy of one-on-one meetings with stakeholders and a focus on institutions that are decision makers in each watershed. One final meeting is scheduled in both watersheds to present report findings and project recommendations.

We first approached and presented our strategy to local Soil and Water Offices in each County, followed by City Council meetings and direct contact with individuals responsible for waste-water treatment. Finally, one-on-one meetings were conducted with local landowners. Where suggested by SWCD staff, a public meeting was held. See Appendix C for materials related to public participation and Appendix E for the "Responsiveness Summary."

#### 7.1.1 *Prairie Creek Public Participation Summary*

The following is a list of public participation efforts (in chronological order) conducted in the Prairie Creek watershed:

- ✚ Initial contact with Hancock County Soil and Water Conservation District (SWCD) staff, scheduled and presented project at SWCD Board meeting
- ✚ Contacted waste-water treatment facility staff to discuss project and request data
- ✚ Initial presentation of TMDL process to Carthage City Council
- ✚ Follow up meeting at City Hall with SWCD and NRCS staff, City council members and the Farm Bureau to discuss local concerns and project implications.
- ✚ Received letter of support from the City of Carthage (see Appendix C for support letter)
- ✚ Received landowner mailing list from Hancock SWCD and completed direct mailing to those producers in the Prairie Creek Watershed (see Appendix C for landowner letter)
- ✚ Cold-called every producer in the watershed where an initial assessment noted additional BMPs might be required.
- ✚ Conducted property assessments and met individually with willing producers and waste-water treatment facility staff to discuss BMPs and their properties.
- ✚ Conducted final presentation of results and implementation plan to SWCD, City officials and waste-water treatment facility staff.

### ***7.1.2 Indian Creek and Dago Slough Public Participation Summary***

The following is a list of public participation efforts (in chronological order) conducted in the Indian Creek/Dago Slough watershed:

- ✚ Initial contact with Knox County Soil and Water Conservation District (SWCD) staff, scheduled and presented project at SWCD Board meeting.
- ✚ Contacted waste-water treatment facility staff to discuss project and request data
- ✚ Received landowner mailing list from Knox SWCD and completed direct mailing to those producers in the Indian Creek/Dago Slough watershed (see Appendix C for landowner letter)
- ✚ Conducted public meeting on the TMDL process at Knox County Farm Bureau with SWCD staff and a handful of watershed residents.
- ✚ Cold-called every producer in the watershed where an initial assessment noted additional BMPs might be required.
- ✚ Conducted property assessments and met individually with willing producers and waste-water treatment facility staff to discuss BMPs and their properties.
- ✚ Conducted follow-up meeting with each landowner and SWCD Board staff to discuss commitments to implementation and a Section 319 grant application; approval by the SWCD Board to move forward with a grant application was approved and all interested landowners are willing to provide letters of commitment.
- ✚ Conducted final presentation of results and implementation plan to SWCD, City officials and waste-water treatment facility staff.

## 8.0 Implementation Costs, Resources, and Timeline

### 8.1 Implementation Costs

This section outlines anticipated costs related to implementing site specific BMP recommendations as well as additional BMP recommendations.

#### 8.1.1 Field Verified BMP Costs

Costs are based on current estimates provided by the NRCS, and local SWCD offices. Streambank stabilization includes multiple practices within a reach. For Prairie Creek the total in the table represents the number of reaches and includes 567ft of lunker treatment at \$75/ft and 19 riffles at \$8,000 each. Indian Creek above the sample site includes 2,086ft of lunker treatment at \$75/ft and 46 riffles at \$5,000 each. Dago Slough includes 1,593 ft of lunker treatment at \$75/ft and 36 riffles at \$5,000 each.

*Table 78 - Prairie Creek Field Verified BMP Cost*

BMP Type and Number	Prairie Creek Above Sample Site	Unit Cost	Total Cost
WASCB	35	\$2,500	\$87,500
Filter Strip*	13	\$500	\$6,500
Terrace	0	N/A	N/A
Livestock**	1	\$5,000	\$5,000
Grass Waterway	4	\$1,800	\$7,200
Grade Control**	1	\$4,000	\$4,000
Streambank Stabilization	2	N/A	\$193,896
Wetland	0	N/A	N/A
Retention Basin	0	N/A	N/A
Diversion**	2	\$2,000	\$4,000
Other**	1	N/A	N/A
<b>Total – All BMPs</b>	<b>57</b>	<b>N/A</b>	<b>\$308,096</b>

\*Filter strip cost based on cost/ acre of \$250.00; average size of 2 ac

\*\*Best estimate for site

**Table 79 - Indian Creek/Dago Slough Field Verified BMP cost**

BMP Type and Number	Unit Cost	Indian Creek Above Sample Site	Total Cost	Indian Creek Below Sample Site	Total Cost	Dago Slough	Total Cost
WASCB	\$2,500	54	\$135,000	21	\$52,500	14	\$35,000
Filter Strip*	\$500	15	\$7,500	2	\$1,000	2	\$1,000
Terrace	\$1,500	7	\$10,500	1	\$1,500	0	0
Livestock**	\$8,700	1	\$8,700	1	\$8,700	0	0
Grass Waterway	\$1,800	20	\$36,000	4	\$7,200	15	\$27,000
Grade Control	\$8,000	2	\$16,000	0	0	0	0
Streambank Stabilization	N/A	3	\$386,487	0	0	2	\$236,475
Wetland	N/A	0	0	0	0	0	0
Retention Basin	\$10,000	0	0	0	0	1	\$10,000
Gutter System (livestock)	\$3,000	1	\$3,000	0	0	1	\$3,000
Diversion	\$2,000	1	\$2,000	0	0	2	\$4,000
Other	N/A	0	0	0	0	0	0
<b>Total - All BMPs</b>		<b>101</b>	<b>\$604,987</b>	<b>29</b>	<b>\$70,900</b>	<b>35</b>	<b>\$316,475</b>

\*Filter strip cost based on cost/ acre of \$250.00; average size of 2 ac

\*\*Best estimate for site

### 8.1.2 Costs for Additional BMPs

Costs for additional BMPs described in the previous section are summarized below. Cost information presented here was gathered from the 2008 Lake Bloomington TMDL Implementation Plan. Actual costs may be slightly higher to reflect 2010 rates.

#### 8.1.2.1 Nutrient Management Plans

The success of nutrient management plans is highly dependent on the rates, methods, and timing of the fertilizer application. Consultants in Illinois typically charge \$6.50 to \$19 per acre to determine the appropriate fertilizer rates. This fee includes soil testing, manure analysis, scaled maps, and site specific recommendations for fertilizer management. The savings associated with using less fertilizer are approximately \$10.75/ac during each plan cycle (4 years.) The average cost of using nutrient management plans ranges from \$1.00/ac/yr to \$4.00/ac/yr.

### **8.1.2.2 Conservation Tillage Practices**

Conservation tillage practices generally require fewer trips to the field, saving on labor, fuel, and equipment repair costs, though increased weed production may result in higher pesticide costs relative to conventional till. The operating cost for conservation tillage is \$0/ac. Depending on the type of equipment currently used; replacing conventional till equipment with no-till equipment can either result in a net savings or slight cost to the farmer. Converting conventional equipment to no-till equipment costs approximately \$1.25 to \$2.50/ac/yr. For new equipment, purchasing no-till equipment is less expensive than conventional equipment. The average cost of using conservation tillage practices ranges from \$1.25/ac/yr to \$2.50/ac/yr.

### **8.1.2.3 Cover Crops**

The estimated seed cost of ryegrass and hairy vetch is \$12.75 and \$32.00/ac/yr, respectively. Annual savings in nitrogen fertilizer are \$4.00/ac for ryegrass and \$30.25/ac for hairy vetch. Herbicide application is estimated to cost \$15.25/ac/yr. These costs do not account for yield increases which may offset the overall cost. The average cost of using cover crop range from \$17.00/ac/yr to \$24.00/ac/yr.

### **8.1.2.4 Drainage Water Management for Tile Drain Outlets**

The cost of retrofitting tile drain systems with drainage water management ranges from \$20 to \$40 per acre. Construction of new tile drain systems with outlet control is approximately \$75/ac. Assuming that the outlet control structures have a system life of 30 years, the construction cost for retrofitting ranges from \$0.75/ac/yr to \$1.50/ac/yr and for new systems is \$2.50/ac/yr.

### **8.1.2.4 Wetland Systems**

The cost of wetland systems ranges from \$1,511/ac/yr to \$1,763/ac/yr.



## 8.2 Resources

Many Federal, State, local and private programs are available to fund BMP implementation. This section will summarize available resources and the estimated cost-share rates (if applicable).

The following table outlines the most common and available sources of funding for those Best Management Practices/Recommendations outlined in this plan. Other funding programs may be available if not listed here. Applicants should research available programs ahead of time; information on grant programs is most readily available on-line at the listed agencies website or via grant search sites. All BMP's identified in this plan ARE eligible for some form of funding. With many grant programs, those grant applications that "leverage" multiple funding sources also have the greatest probability of being funded. Although many grant programs and funding agencies will fund various types of practices, they tend to direct funds to those practices that address their agency or program goals.

**Table 80 - Implementation Resources and Funding Sources**

Best Management Practice	Funding Sources	Notes/Cost Share Rates
Filter Strips Riparian Buffers Dry Dams (WASCBs) Grass Waterways Terrace Diversion	IEPA – 319 program NRCS – EQIP program FSA – CRP program SWCD – CPP program US F&W – Acres for wildlife program IDNR/SWCD – CREP program IDNR – SWG program NRCS – WHIP program IDNR – Special Wildlife Funds Grants	CREP eligible acres must be in the 100 year floodplain and/or have cropped ground with erodibility index of 8 or greater adjacent to riparian zones; must have cropping history of at least 4 years between 1995 and 2001.  SWG program requires 50% state match and must address goals/species outlined in the State of Illinois Comprehensive Wildlife Plan.  NRCS, FSA, and SWCD programs provide 60% cost-share, however, some special programs and practices can provide up to 90%. FSA, CREP and some NRCS programs also provide annual rental payments for taking ground out of production.

Best Management Practice	Funding Sources	Notes/Cost Share Rates
Streambank Stabilization and in-stream grade control or other grade control	IEPA – 319 Program SWCD – SSRP program NRCS – EQIP program	IEPA 319 offers 60% cost share SSRP offers 75% cost share EQIP offers 60% cost share
Wetland Restoration and other Habitat Practices	IEPA – 319 program NRCS – EQIP program NRCS – WRP program FSA – CRP program US F&W – Landowner Incentive Program IDNR/SWCD – CREP program IDNR – SWG program IDNR – Special Wildlife Funds Grants	WRP program – multiple/stringent eligibility requirements.  NRCS, FSA, and SWCD programs provide a minimum of 60% cost-share, however, some special programs and practices can provide up to 90%. FSA, CREP and some NRCS programs also provide annual rental payments for taking ground out of production.
Livestock Management, including fencing, stream crossings, pasture management, watering systems etc.	IEPA – 319 program NRCS – EQIP program IDNR – Forestry Development Act funding (FLEP)	FLEP is applicable to livestock fencing for woodlands  Livestock management recommendations outlined in this report that includes wetland and/or habitat restoration can be funded by other programs such as the US F&W – Landowner Incentive Program  EQIP typically provides 60% cost-share
Storm water retention and retention basins	IEPA – 319 program	IEPA - Competitive grant program requires 40% state/local match and offers 60% cost share  In special circumstances EQIP may provide cost share for retention structures but often cost share rates are less than 60%

*IEPA 319 program is a competitive grant program with applications accepted annually (August 1<sup>st</sup> deadline); focus is water quality; funding prioritized to “impaired waters” and in those areas with watershed plans in place; multiple BMP applications desirable; 40% non-federal match required; Applicants are generally not-for-profit organizations/watershed groups or entities acting on behalf of private landowners*

*FSA/USDA/SWCD programs available on agricultural ground; require landowner cost-share (varies depending on program) and in most cases cropping history; continuous sign-up available for some programs; applicants must contact local FSA/NRCS/SWCD offices; applicants are individual landowners.*

### **8.3 Implementation Time Line**

Implementing Best Management Practices should occur immediately where willing landowners have been identified. In Prairie Creek where there currently is little landowner interest in additional BMP implementation, local resource agencies should revisit plan recommendations after one year and contact watershed landowners to gauge interest. As noted previously, much work has already been completed in Prairie Creek. Any additional work should result in immediate benefits.

In Indian Creek and Dago Slough where a Section 319 grant is being submitted in 2010, construction of BMPs could begin as soon as the summer of 2011. Immediate implementation can occur for those producers interested in USDA or State programs such as CRP, EQIP, CREP, and CPP as these programs are continuous. Once improvements are implemented, it may take several years to reach the water quality targets.

## 9.0 Education/Outreach and Relationship to Other Activities

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### 9.1 Education/Outreach

In addition to existing education and advertising of local cost-share programs, the NRCS is currently sponsoring a locally led effort to seek comments and direction for prioritizing resources in each county. It is expected that this effort will result in more interest in conservation programs and additional local input into program rules and how and where resources will be allocated.

The following is a proposed strategy for additional outreach and education:

- ✦ Getting the word out; coordinate a large scale outreach effort to increase participation in locally led efforts, increase collaboration and inform stakeholders. Outreach activity could include and is not limited to: one-on-one contacts, direct mailing to landowners/farmers in areas where BMP's have been recommended, utilizing media (newspaper, radio), and media (written, electronic, website - post plan, news), a series of public meetings, engaging other local partners (SWCDs, Extension, Farm Bureau, communities).
- ✦ Form a local planning committee/organization.
- ✦ Develop a color newsletter/information brochure that can be distributed to residents of the watershed highlighting the watershed inventory (LRS), available programs, contact information and facts about the watershed. \
- ✦ Implement a series of watershed tours for residents and landowners.

### 9.2 Relationship to other Activities

As previously discussed, much work has already been completed in both watersheds in terms of conservation practices. The LRS and Implementation plan can help local stakeholders build upon this and provide direction for additional implementation. It is also important to recognize other watershed efforts underway in these areas. To date, no known, organized watershed planning effort is underway or has been completed in the Indian Creek/Dago Slough watershed. Prairie Creek however falls within the La Moine River Basin where the La Moine River Ecosystem Partnership ([www.lamoine.org](http://www.lamoine.org)) has been active since 2002. A large scale watershed plan was completed for the La Moine Basin in 2006 and although no work has been directly focused in Prairie Creek, the Partnership has been very active implementing the watershed plan in other high priority areas.

## 10.0 Monitoring Plan

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The purpose of the monitoring plan for the Prairie Creek, Indian Creek and Dago Slough is to assess the overall implementation of BMPs. This can be accomplished by conducting the following monitoring programs:

- ✚ Track implementation of management measures in the watershed
- ✚ Estimate effectiveness of management measures
- ✚ Further monitoring of the point source discharge in the watershed
- ✚ Continued periodic water quality monitoring from facilities and streams if feasible

Tracking the implementation of management measures can be used to address the following goals:

- ✚ Determine the extent to which management measures and practices have been implemented compared to action needed to meet TMDL and LRS endpoints
- ✚ Establish a baseline from which decisions can be made regarding the need for additional incentives for implementation efforts
- ✚ Measure the extent of voluntary implementation efforts
- ✚ Further clarify the contributions from point sources
- ✚ Determine the extent to which management measures are properly maintained and operated

Local resources agencies track program successes and implementation for reporting to national offices. In general, USDA and SWCDs monitor and report this at the county level. Tracking implementation at the watershed level is rarely conducted unless local agencies are 1) willing to provide the information and 2) a formal request is made from local stakeholders. This only occurs if a watershed group or interested entity is active in the area.

In Prairie Creek, Indian Creek and Dago Slough, local SWCD offices or a group of interested landowners working with a District could voluntarily establish measurable milestones and track BMP implementation on an annual basis. This report has summarized those BMPs currently in place and the work already done in each watershed and can provide a baseline for tracking success or the adoption of practices.

Estimating the effectiveness of the BMPs implemented in the watershed could be completed by monitoring before and after the BMP is incorporated into the watershed. Additional monitoring could be conducted on specific structural systems such as a Dry Dam or a Grass Waterway. Inflow and outflow measurements could be conducted to determine site-specific removal efficiency for Manganese, Total Suspended Solids, Phosphorous, and other nutrients. Soil and Water Districts are required by the Illinois Department of Agriculture to report pollutant load reductions when implementing a CPP practice. IEPA funded projects also require this.

IEPA currently does not conduct any formal sampling of these streams. Initiation of an Intensive Basin Survey monitoring program could assess stream water quality as improvements in the watershed are completed and assist with developing a historical database of water quality in the watersheds.

# **APPENDIX A**

## **Model Descriptions, Methodologies, Values, and GIS References**

*RUSLE Model*

Methodology modified by Jeff Boeckler from: Mitasova and Lubos Mitas: Modeling soil detachment with RUSLE3d using GIS, 1999; University of Illinois.

<http://skagit.meas.ncsu.edu/~helena/gmslab/erosion/usle.html>

The erosion model was run all ground except urban areas.

- Obtained 1:24,000 SSURGO Digital Soils.
- Appropriate soil types selected and relevant RUSLE factors identified and calculated from SSURGO soils dataset.
- Interviews with local NRCS/SWCD staff were conducted. Staff was asked to identify appropriate C Factors. All other C factors were selected based on accepted values

GIS procedure:

1) RUSLE factors calculated for various types of landcover

Landcover	C factor	K factor	LS factor	R factor	P factor	
Agriculture	Variable; based on county SWCD/NRCS recommendations	Values included in SSURGO tabular data	Values included in SSURGO tabular data; calculated from slope and slope length values	USDA values for each county	1 used for all soil polygons	
All Vegetation	0.003	Values included in SSURGO tabular data	Values included in SSURGO tabular data; calculated from slope and slope length values	USDA values for each county	1 used for all soil polygons	
Pasture	By Cattle Rank: 1 – C = 0.003 2 – C = 0.007 3 – C = 0.013 4 – C = 0.042 5 – C = 0.09	Values included in SSURGO tabular data	Values included in SSURGO tabular data; calculated from slope and slope length values	USDA values for each county	1 used for all soil polygons	

- 2) RUSLE equation was run on shapefiles multiplying LS, R, K, C, and P.
- 3) Applied Delivery Ratio;  $((\text{area of polygon in acres}/640)^{-0.125}) \times 0.42$
- 4) Output includes ton/Ac/Yr with a delivery ratio applied as well as a shapefile representing erosion potential



## Pollutant Load Models

Formulas and selected variables were derived from STEPL (Spreadsheet Tool for Estimation of Pollutant Load) Version 3, Tetra Tech, 2004. Unique values were utilized where data was available or where adjustments were needed. Total Nitrogen and Total Phosphorous were modeled. TSS was also modeled in urban areas.

### Runoff and Soil Nutrient Model Values:

Model	Rain days	Correction Factor (precipitation)	Curve Number (by soil hydrologic group)	Runoff (by soil hydrologic group in inches)	N concentration	P Concentration	Total Suspended Solids
Agriculture	Hancock Co. = 96.3 Knox Co. = 96.6 Warren Co. = 97.2	0.424	A = 64 B = 75 C = 82 D = 85	Hancock Co. A = 0.079 B = 0.122 C = 0.169 D = 0.197 Knox Co. A = 0.078 B = 0.122 C = 0.168 D = 0.196 Warren Co. A = 0.077 B = 0.12 C = 0.166 D = 0.194	In Runoff = 1.9 mg/l In Sediment = 0.0016 %	In Runoff = 0.3 mg/l In Sediment = 0.00062 %	N/A
Pasture	Hancock Co. = 96.3 Knox Co. = 96.6 Warren Co. = 97.2	0.424	By Cattle Rank: Rank 1-3 A = 39 B = 61 C = 74 D = 80  Rank 4-5 A = 68 B = 79 C = 86 D = 89	By Cattle Rank: Rank 1-3 A = 0.031 B = 0.070 C = 0.117 D = 0.152  Rank 4-5 A = 0.091 B = 0.145 C = 0.207 D = 0.247	In Runoff By Cattle Rank: 1 = 2 mg/l 2 = 3 mg/l 3 = 4 mg/l 4 – 6 mg/l 5 – 8 mg/l In Sediment = 0.0016 %	In Runoff By Cattle Rank: 1 = 0.15 mg/l 2 = 0.225 mg/l 3 = 0.3 mg/l 4 – 0.8 mg/l 5 – 1.25 mg/l  In Sediment = 0.00062 %	N/A
Urban	Hancock Co. = 96.3 Knox Co. = 96.6 Warren Co. = 97.2	0.424	Assumes 65% impervious A = 77 B = 85 C = 90 D = 92	Prairie Creek A = 0.134 B = 0.197 C = 0.265 D = 0.304 Indian/Dago A = 0.133 B = 0.196 C = 0.264 D = 0.302	In Runoff = 2.01 mg/l	In Runoff = 0.31 mg/l	100.2 mg/L
Vegetation (non-pasture; timber, CRP and other)	Hancock Co. = 96.3 Knox Co. = 96.6 Warren Co.	0.424	Average curve number between a meadow, fair forest, and fair timber/grass	Prairie Creek A = 0.027 B = 0.068 C = 0.112 D = 0.146	In Runoff = 0.15 mg/l In Sediment = 0.0016 %	In Runoff = 0.08 mg/l In Sediment = 0.00062 %	N/A

vegetation	= 97.2		A = 36 B = 60 C = 73 D = 79	Indian/Dago A = 0.027 B = 0.067 C = 0.112 D = 0.145			
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The following equations were used to calculate total loadings:

Annual Runoff = runoff (in) / 12 X acres of soil polygon X rain days X correction factor

Nutrient Runoff = annual runoff X nutrient concentration in runoff X 4047 X 0.3048/454

Sediment Nutrients = % soil concentration X total sheet and rill erosion with delivery ratio X 2000

**Existing and New BMP Model**

1. Identified Existing Best Management Practices; CRP/CREP/PPP/EQIP or those where producers have installed practices on their own (field verified)
2. Delineated watershed draining to BMPs
3. Applied pollutant removal efficiencies to each BMP (see table below)
4. Multiplied pollutant load and RUSLE model totals by BMP removal efficiency for BMP watersheds

BMP	Removal Efficiency Range Sediment (sheet and rill erosion)	Removal Efficiency Range N	Removal Efficiency Range P
Diversion	70%	45-65%	65-70%
Filter Strip	45-75%	40-75%	40-80%
Grade Control	55-75%	35-40%	55-65%
Large Habitat Block	58-75%	65-75%	60-80%
Livestock Practices	38-95%	35-95%	35-95%
Pond	95%	95%	95%
Terrace	65-80%	15-30%	45-70%
WASCB	35-85%	20-75%	40-75%
Waterway	35-75%	40-78%	40-82%

Two additional Models we developed to estimate streambank and gully erosion

### **Gully Erosion**

The following equations were used to estimate erosion rate and N and P loadings:

Total Tons = Length (ft) X Depth (ft) X Width (ft) X Soil  
Weight Dry Density (tons/ft<sup>3</sup>) / Number of Years Eroding

N Load (lbs) = Total Tons X N concentration in Soil (0.002 lbs/lbs) X 2000 X  
Correction Factor

P Load (lbs) = Total Tons X N concentration in Soil (0.0006 lbs/lbs) X 2000  
X Correction Factor

### **Streambank Erosion**

The following equations were used to estimate erosion rate and N and P loadings:

Maximum Bank Length X (Maximum Bank Height X Bankfull Width at 50% of the Bank  
Height) X Estimated Annual Lateral Recession Rate X Weight of Sediment in Pounds/  
Pounds per Ton

N Load (lbs) = Total Tons X N concentration in Soil (0.002 lbs/lbs) X 2000 X  
Correction Factor

P Load (lbs) = Total Tons X N concentration in Soil (0.0006 lbs/lbs) X 2000  
X Correction Factor

## Hydrology and historical flow data

Statistical modeling and analysis was performed to develop historical flow data and flow duration curves for Prairie Creek, Indian Creek and Dago Slough. Historical flow data from two USGS gages were compiled: The two gages include:

- Gage ID 5584500: La Moine River at Colmar, IL
- Gage ID 5569500: Spoon River at London Mills, IL

Average daily flow data was compiled for the two gages for the period of 1945 – 2009. An overall average daily flow for each gage (average of all days from 1945 – 2009) was computed and subsequently removed from the 1945 – 2009 dataset to make the dataset “dimensionless”.

The two gages produced similar average daily flow based on watershed area over the period of 1945 – 2009. These values were averaged to develop an average daily flow per watershed area that was then translated to the respective watershed areas for the three study segments (Indian Creek, Prairie Creek and Dago Slough). This statistically developed average daily flow for each segment was then translated back into the “dimensionless” dataset for gage ID 5584500 to represent the drainage areas for each of the three segments. This methodology produced the datasets required to make the flow duration curves and 5 yr hydrographs.

Quality assurance and quality control measures were taken prior to finalizing the results of the modeling and statistical analyses; these measures included:

- Comparison to flow measurements and observations resulting from the monitoring component of this project.
- Comparison to the ISWS on-line stream flow modeling tool.
- Comparison to standard water budget hydrology calculations based on land-use, precipitation and watershed area.

Our QA/QC process demonstrated that the modeling and statistical methodology is acceptable and reasonably accurate considering the limited amount of historical data that is available specific to the study reaches.

## GIS references

### Common Land Unit (CLU) layer - April 2008

The CLU dataset provides a digitized vector dataset, comprised of farm, tract, and field boundaries with associated attribute data. FSA defines farm field boundaries as agricultural land that is delineated by natural and manmade boundaries such as roadways, tree lines, waterways, fence lines, etc. Using rectified photomaps that have been maintained by FSA Service Centers as a reference, tract and field boundaries were heads-up digitized, using a custom designed tool bar. Digitizing was done at a scale of 1:4800 with digital orthophotography as the base map. Each of the boundaries of the CLU was digitized to a tolerance of three meters (approximately 10 feet) from ground features visible on the digital orthophotography. The base orthoimagery used during the CLU digitizing effort was produced by mosaicing digital orthophoto quarter quads (MDOQs) into a seamless county image.

**Data was used to create map(s): CREP and CRP**

### DEM30M 1995

*Illinois State Geological Survey, Champaign, Illinois, USA.*

This Arc/Info grid (raster) data set consists of edge-matched USGS 1:250,000 DEM tiles for Illinois. Cell size is 301 feet and cell values are elevations in meters above mean sea level rounded to the nearest integer. The data include all of Illinois and extend approximately nine miles beyond the state boundary. Some elevation data at the edges of individual DEM tiles were smoothed to remove edge-matching faults. These data were assembled to provide a statewide database of surface elevation points suitable for analyses of statewide geologic phenomena associated with elevation. The data have been used to generate slope data and shaded relief images, and are appropriate for other such regional applications.

**Data was used to create map(s): Slope**

### DOQ 2005

A 0.5 meter resolution panchromatic (B and W) USGS Digital Orthophoto Quarter-quadrangle (DOQQ) A DOQQ is a raster image in which displacement in the image caused by sensor orientation and terrain relief has been removed. DOQQs are produced with a 1-meter ground sample distance (GSD) and are cast on the Universal Transverse Mercator (UTM) projection on the North American Datum of 1983 (NAD83). Each DOQQ is produced to meet a National Map Accuracy Standard (NMAS) for 1:12000 scale maps (10.16 meters radial error at a 90% probability). NAPP imagery is flown leaf-off in deciduous vegetation regions.

**Data was used to create map(s): Location of Homes, Pasture selection for Landuse**

### FEMA floodzones 1986

This set of 102 tiles depicts by county the 100 year and 500 year floodzones for the unincorporated areas as indicated on the Federal Emergency Management Agency (FEMA) National Flood Insurance Program (FIRM) maps and Flood Hazard Boundary maps were digitized from paper maps. When digitizing, all RMS values were not more than twenty feet.

**Data was used to create map(s): 100 Year Flood Plain**GAP 2000

*The Illinois Natural History Survey (INHS)*

Illinois Gap Analysis Land Cover Classification is a land cover classification for Illinois. Vegetation is classified according to the Illinois Natural Community Level, as outlined in the Illinois Natural Areas Inventory Technical Report (1978). An attempt was made, where possible, to classify the vegetation to the Alliance (Species) Level Classifications developed by the Nature Conservancy. Data is also generalized to the National Vegetation Classification Standard (NVCS) developed by the Federal Geographic Data Committee (FGDC). The Illinois Gap Analysis Land Cover Classification is a raster, geo-referenced, categorized land cover data layer produced using satellite imagery from the Thematic Mapper (TM) instrument on Landsat 5 and the Enhanced Thematic Mapper (ETM+) on Landsat 7. The data were derived from 1999 and 2000 Landsat 5 and Landsat 7 TM satellite imagery acquired between the dates of April 30, 1999 and October 10, 2000.

**Data was used to create map(s): Landcover, Wetlands**Hydric Soils

The soils map atlas was produced by V3 companies, Ltd for the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC). V3 worked closely with the IDNR and the Natural Resource Conservation Service (NRCS) to strategize the best methodology for interpreting and displaying hydric soils of the Illinois River Watershed. The soils data is analyzed for the Soil Survey Geographic Database (SSURGO). This a digital database created by NRCS that is derived from the soil surveys of individual counties.

**Data was used to create map(s): Hydric Soils**HUC 12 NHD -2002

This geospatial dataset is a hydrologic unit boundary layer that is at the Subwatershed (12-digit) level. The dataset was developed by delineating the boundary lines on 1:24,000 base maps and digitizing the delineated lines. Digital Elevation Model data may have been used in part of the process to establish preliminary boundaries. This data set is intended as a tool for water-resource management and planning activities, particularly for site-specific and localized studies, which require the amount of detail provided by a large-scale map.

**Data was used to create map(s): Watershed boundaries used in display maps and analysis**NAIP Ag Imagery 2009

This data set contains imagery from the National Agriculture Imagery Program (NAIP). The NAIP acquires digital ortho imagery during the agricultural growing seasons in the continental U.S. NAIP provides two main products: 1 meter ground sample distance (GSD) ortho imagery rectified to a horizontal accuracy of within +/- 5 meters of reference digital ortho quarter quads (DOQQ's) from the National Digital Ortho Program (NDOP) or from the National Agriculture

Imagery Program (NAIP); 1 meter GSD ortho imagery rectified to within +/- 6 meters to true ground.

**Data was used to create map(s): Location of Homes, Pasture selection for Landuse**

### NHD Flowline 2008

The National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD data was originally developed at 1:100,000-scale and exists at that scale for the whole country. This high-resolution NHD, generally developed at 1:24,000/1:12,000 scale, adds detail to the original 1:100,000-scale NHD. The NHD is a national framework for assigning reach addresses to water-related entities, such as industrial discharges, drinking water supplies, and fish habitat areas, wild and scenic rivers.

**Data was used to create map(s): Streams depicted on all maps, HEL within 100ft of a stream**

### Quaternary Deposits of Illinois, 1996

*Illinois State Geological Survey*

This feature dataset is a generalized version of Quaternary Deposits of Illinois. Updated to reflect the areal distribution of the Wedron and mason Groups (Wisconsin and Hudson Episodes) and deposits of the Illinoian and pre-Illinoian episodes in Illinois as described in ISGS Bulletin 104. Episodes are diachronic temporal units. Refer to the primary sources for more information.

**Data was used to create map(s): Surficial Geology**

### SSURGO

*Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture.*

Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. Mapping scales generally range from 1:12,000 to 1:63,360; SSURGO is the most detailed level of soil mapping done by the Natural Resources Conservation Service (NRCS). SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships, and county natural resource planning and management. The user should be knowledgeable of soils data and their characteristics.

**Data was used to create map(s): Soil Types, HEL**

### TIGER roads 2008

The TIGER/Line Shapefiles are an extract of selected geographic and cartographic information from the Census MAF/TIGER database. The Census MAF/TIGER database represents a seamless national file with no overlaps or gaps between parts. However, each TIGER/Line Shapefile is designed to stand alone as an independent data set or the shapefiles can be combined to cover the whole nation.

**Data was used to create map(s): Roads depicted on all maps**

### USDA-NASS Cropland Data Layer 2009

*The United States Department of Agriculture, National Agricultural Statistics Service (USDA-NASS).*

Illinois Cropland Data Layer is a raster, geo-referenced, categorized land cover data layer produced annually using satellite imagery from the Thematic Mapper (TM) instrument on Landsat 5 and the Enhanced Thematic Mapper (ETM+) on Landsat 7. The ground resolution is 30 meters by 30 meters. The Illinois Cropland Data Layer is aggregated to standardized categories for display purposes with the emphasis being agricultural land cover. Please note that no individual farmer's reported data is included or derivable from the Cropland Data Layer.

The Illinois Cropland Data Layer is part of a series in which several states are categorized annually based on the extensive field observations collected during the annual NASS June Agricultural Survey (JAS). This is a national survey based on a stratified random sample of land areas selected from each state's area frame. An area frame is a land use stratification based on percent cultivation. Field enumerators are given questionnaires to ask farmers what, where, when and how much they are planting. Surveys focus on cropland, but the enumerators record all land covers within the sampled area of land whether it is cropland or not.

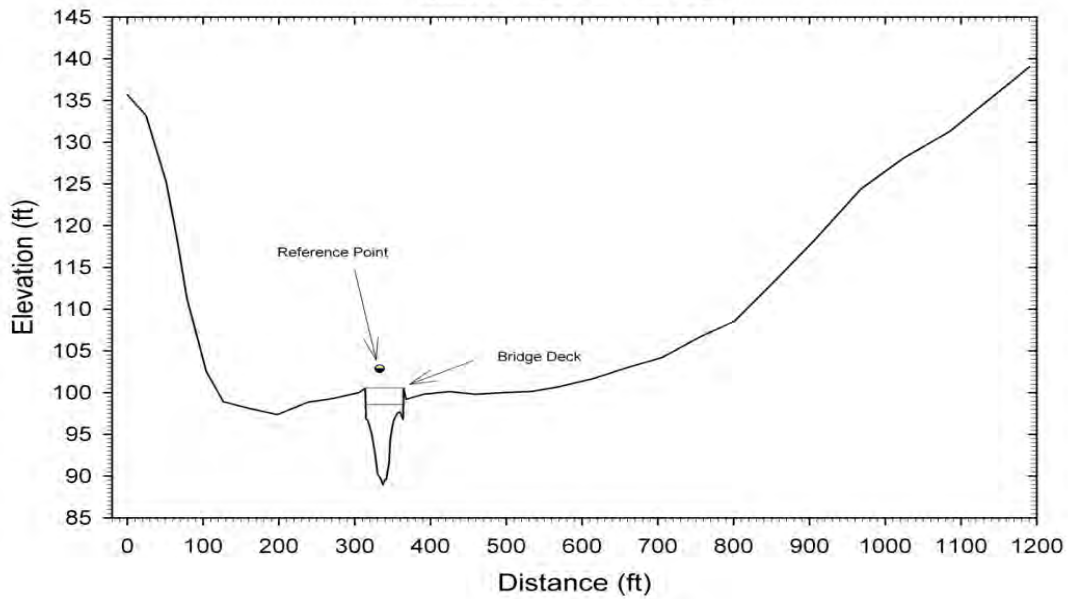
**Data was used to create map(s): Landcover, Wetlands, Pasture selection for Landuse**



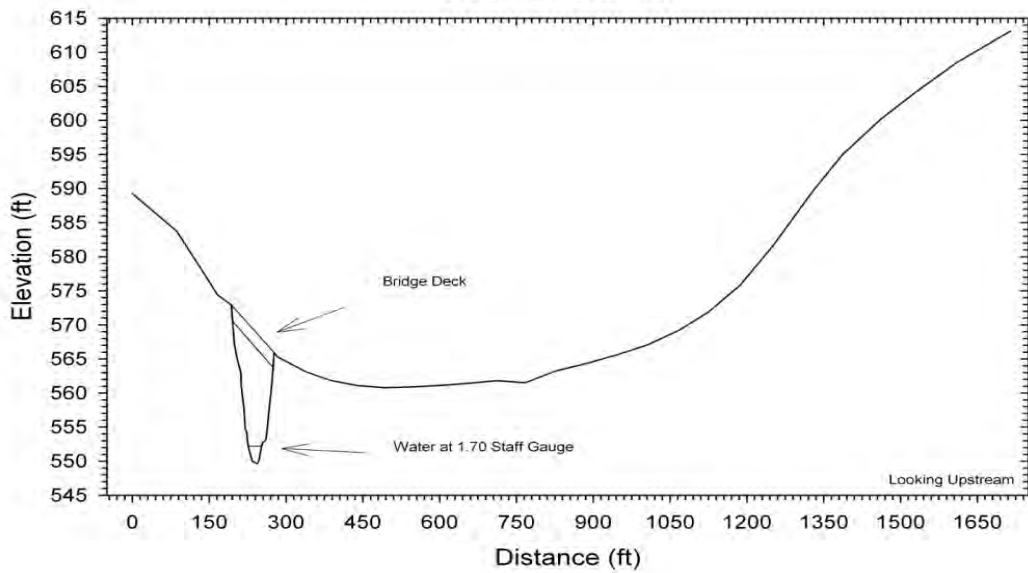
# **APPENDIX B**

## **Stream Cross-Sections**

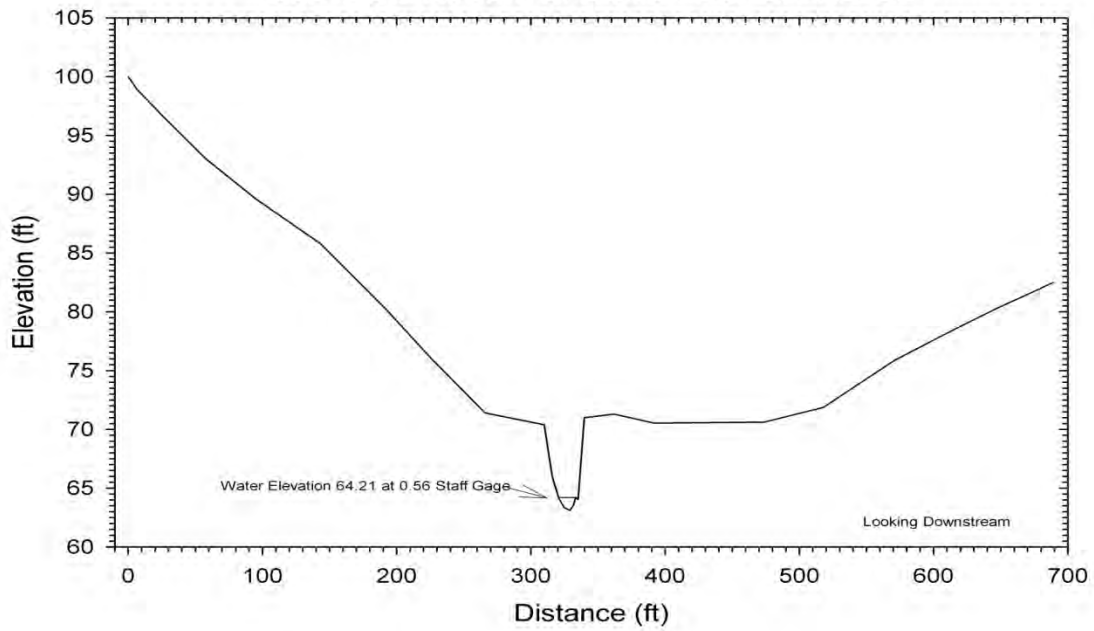
Indian Creek  
Station DJFC-AB-C3



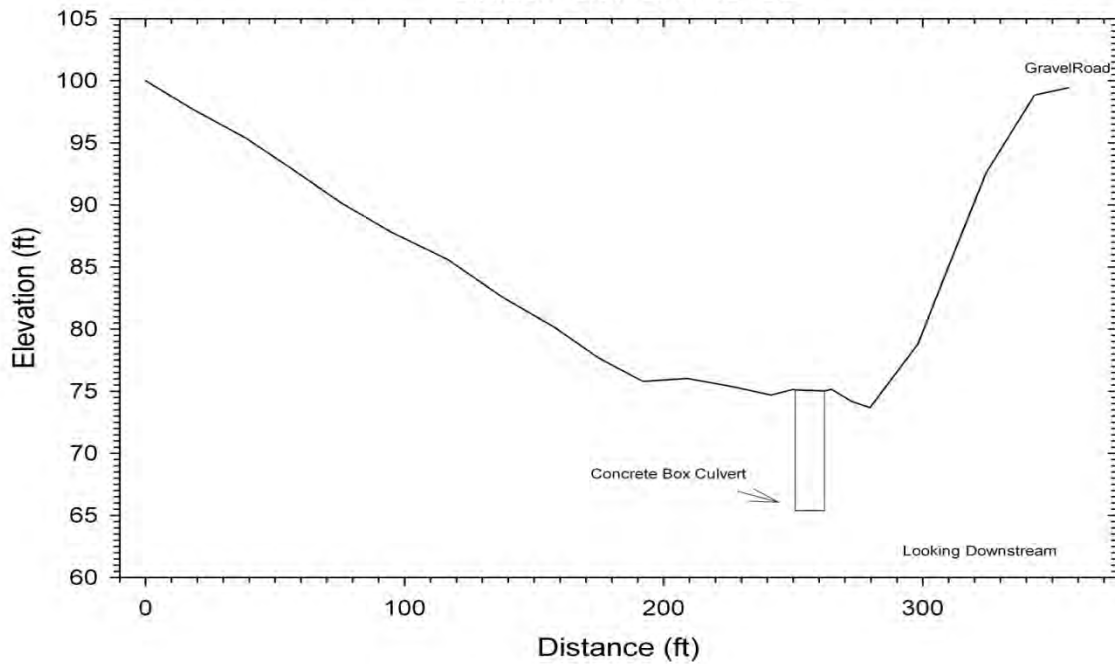
Prairie Creek  
Station DGZN-02



Dago Slough Cross-section B  
300' Downstream of Station DJFCA-AB-C2



Dago Slough Cross-section A  
Station DJFCA-AB-C2



# APPENDIX C

## Public Participation

To: Citizens of Indian Creek and Dago Slough Watersheds  
From: Knox County Soil & Water Conservation District

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The Illinois Department of Natural Resources (IDNR) and the Illinois State Water Survey in partnership with the United States Department of Agriculture, the Knox County Soil and Water Conservation District, the Extension Service, and the Knox County Farm Bureau are working together to develop a watershed plan for Dago Slough and Indian Creek. You are invited to attend a public meeting held **Monday, September 14, 2009** at the Knox Agri Center, located at 180 S. Soangetaha Rd Galesburg, at 6:30 p.m. to discuss the process and give feedback. Contact Jeff Boeckler, IDNR Watershed Planner, for more information at 217-725-3181 or [jeff.boeckler@illinois.gov](mailto:jeff.boeckler@illinois.gov)

We hope to see you there!



**HANCOCK COUNTY**  
**SOIL AND WATER CONSERVATION DISTRICT**



110 Buchanan Street - Carthage, Illinois 62321 (217) 357-2180 ext. 3 – Fax (217) 357-3412  
Conservation – Development – Self-Government - An Equal Opportunity Provider and Employer

March 16, 2010

Dear Prairie Creek Landowner or Producer:

Jeff Boeckler, an employee of the University of Illinois (U of I) and the Illinois State Water Survey (ISWS) is partnering with local natural resource agencies such as the United States Department of Agriculture and the local Soil and Water Conservation District to develop a Watershed Plan and calculate sediment and nutrient load reductions for Prairie Creek. Prairie Creek drains 12.5 square miles just south of and including the City of Carthage before making its way to the La Moine River. Nutrient and sediment load reductions are a calculation of the maximum amount of a pollutant that a water body can receive and still meet state water quality suggested limits. A watershed plan is not unlike a conservation plan developed for an individual farm; the major difference is that it covers numerous farms and communities within a larger watershed. Much of the work has already been completed in these and many other watersheds in Hancock County and there is evidence of conservation practices on-the-ground in the form of grassed waterways, dry dams and many others. We hope this project will encourage similar work and expand upon the work that has already been done.

Prairie Creek is currently listed by the State as being impaired for Total Phosphorous, Manganese, and Total Suspended Solids or sediment. The goal of this project is to work with local producers and the city of Carthage to develop a handful of strategies or practices to address Phosphorous and Sediment entering the creek. This will, in turn, may lead to many more opportunities for state and federal funding for conservation practices. A strong watershed plan and well developed nutrient and sediment reductions goals along with interest for local producers can go a long way to improving chances at securing cost-share money for project implementation.

In order to calculate nutrient and sediment reductions and develop the watershed plan, U of I and the ISWS will be reaching out to residents, reviewing current and historical water quality information, and conducting a detailed inventory of the watershed to help identify project locations. This process is one hundred percent voluntary and will only be successful if local producers and communities have an interest and an opportunity to participate. Staff will be holding local meetings in the near future to discuss the process and get feedback or calling you to schedule an on-farm meeting to discuss your operation needs and to conduct an inventory on the property. Staff from the U of I will also be periodically collecting water samples and traveling throughout the area looking for sites that will be eligible for future funding. If you live or farm near Prairie Creek and would like more information or would like to set up a meeting, please contact Jeff Boeckler at 217-725-3181 any time, day or night or [jeffboeckler@hotmail.com](mailto:jeffboeckler@hotmail.com).

Jeff Boeckler is a Watershed Planner with the U of I and a small business owner with over six years experience developing watershed plans and working with individual landowners to meet

their conservation needs. He has spent over six years in the La Moine River watershed and helped local producers and residents raise over two million dollars in state and federal funding to improve water quality by installing conservation practices.

Sincerely,

Mark Turner  
Chairman  
Hancock County Soil and Water Conservation District



## CITY OF CARTHAGE

538 Wabash Ave.  
Carthage, Illinois 62321  
Phone (217) 357-3119  
Fax (217) 357-3110

March 10, 2010

IL. Dept. of Natural Resources  
Jeff Boeckler, Science & Planning Manager  
EcoSystems Division  
One Natural Resources Way  
Springfield, IL. 62702

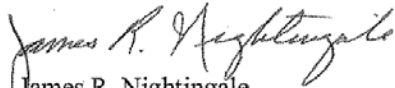
Dear Mr. Boeckler:

The Carthage City Council discussed the Prairie Creek Watershed Study at their regular Council meeting on February 23<sup>rd</sup>.

The City Council voted unanimously in support of this study and for me to sign any documents necessary lending this support. Please consider this letter the first such document.

Should you require anything else, please call me at 217-357-3119.

Sincerely,

  
James R. Nightingale  
Mayor



**PUBLIC NOTICE**

NOTICE OF PUBLIC MEETING  
Prairie Creek Watershed  
(Hancock County)

The Illinois Environmental Protection Agency (IEPA) Bureau of Water will hold a public meeting on Thursday, July 29, 2010 (1:00 pm) at the Carthage City Hall, 538 Wabash (South Side of Square), Carthage, Illinois.

The purpose of this meeting is to provide an opportunity for the public to comment on the proposed final Total Maximum Daily Load (TMDL) report for the Prairie Creek Watershed. This TMDL report includes data analysis, modeling and an implementation plan to determine the pollutant loading capacity and reductions necessary to meet designated uses and water quality standards.

The IEPA implements the TMDL program in accordance with Section 303(d) of the Federal Clean Water Act. A TMDL is the sum of the allowable amounts of a single pollutant (phosphorus, metals, etc.) that a waterbody can receive from all contributing sources and still meet water quality standards or designated uses.

The implementation plan is intended to identify practices and solutions that will result in pollutant reductions.

The draft Prairie Creek Watershed TMDL report will be available on-line at [www.epa.state.il.us/public-notice](http://www.epa.state.il.us/public-notice). A hard copy of the draft report will also be available by request from the Illinois EPA or may be found at the Hancock County Soil and Water Conservation District office during business hours.

Questions about the TMDL should be directed to Amy Walkenbach (see contact information below).

**Closure of the Meeting Record**  
The meeting record will close as of midnight, August 30, 2010. Written comments need not be notarized but must be postmarked before midnight and mailed to:  
Amy Walkenbach, Acting Supervisor  
Watershed Management Planning Unit, Bureau of Water  
Illinois Environmental Protection Agency  
1021 North Grand Avenue East  
P. O. Box 19276  
Springfield, IL 62794-9276  
Phone 217-782-3362

TDD (Hearing impaired) 217-782-9143  
E-mail: Amy.Walkenbach@illinois.gov  
Fax: 217-785-1225

**CERTIFICATE OF PUBLICATION**

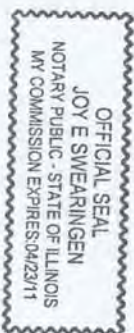
STATE OF ILLINOIS )  
 ) SS.  
COUNTY OF HANCOCK )

Carthage, Illinois JULY 21, 2010

I, **Joy E. Swearingen** being first duly sworn on oath, do depose and say, that I am a notary public of the HANCOCK COUNTY JOURNAL-PILOT, a newspaper as defined in Act-Chapter 100, Section 1 and 5, Illinois Revised Statutes, a public weekly secular newspaper printed and published at Carthage, in Hancock County, and of general circulation in said county, and that the annexed advertisement and notice was printed and published in said newspaper in one successive weekly issues, and in each and every issue thereof, the first publication being in the 21st day of July A.D. 2010, and the last publication thereof being on the 21st day of July A.D. 2010, and that said newspaper has been regularly published at least six months prior to the first publication of said notice as aforesaid.

*Joy E. Swearingen*  
Notary Public in and for said County

Advertising fee - \$52.00  
Received payment .....



# **Appendix D**

## **Monitoring Strategy, Outreach Strategy**

**Project Coordination and Outreach Strategy  
Prairie Creek, Indian Creek, and Dago Slough TMDL  
September 2009**

**By**

**Bill White (U of I; INRS, ISWS)  
and Jeff Boeckler (U of I; Office of Sustainability; and IDNR)**

### **Introduction**

Outreach activities are designed to support development of watershed-based plans or TMDL efforts and will focus on meaningful contact with local stakeholders. The contract team will inform local agencies, units of government and stakeholders about the project and coordinate participation of interested entities. We will implement an active and passive outreach campaign to reach local landowners and potential partners for their participation in the project including future watershed protection efforts.

The goal of this coordination effort is to provide information/outreach to communicate to stakeholders and solicit input about the procedures associated with the nine planning steps, field data collection (including geomorphic assessments and water quality monitoring, Total Maximum Daily Loads (TMDL) and/or watershed-based plan development processes and remind stakeholders that other potentially necessary adaptations may be required to improve conditions in each of the watersheds. Further inherent and focused goals will be communicated to the public through this process including but not limited to the need to utilize adaptive implementation and management procedures and techniques that support development of TMDL's and/or watershed-based plans for the subject watersheds.

The project team will host two public meetings in each county. The first meeting is informational and will present details on a TMDL and/or watershed-based planning efforts, for Prairie Creek and watershed-based planning efforts for Indian Creek and Dago Slough including a discussion of watershed characteristics, stream assessment surveys and the reasons to and progress on (when appropriate to report) the survey of farm ground and need and status of watershed inventories. The second meeting we will present TMDL and/or watershed-based plan results and focus on gathering information on stakeholders for implementation strategies, including contact information. Meeting advertising will include:

- Direct mailings to landowners within TMDL watersheds, local communities and government.
- Adds in local newspapers, SWCD and Farm Bureau newsletters and on local radio stations; when possible, 30 days prior to any meeting.

The project coordination and outreach will include discussions of existing Illinois EPA water quality data; new geomorphic assessment field data, analysis, and implications for targeting restoration/naturalization of stream reaches for Best Management Practices (BMP's) that systemically address channel stabilization concerns; new water quality monitoring data; and a

description of how we are employing a more applied and layman-friendly” approach to modeling. We will state “up-front” that we are seeking meaningful engagement from watershed stakeholders in the TMDL and/or watershed-based plan development process and that we will be identifying site specific BMP’s to help remove the subject watersheds from Appendix A of the Illinois Integrated Water Quality Report and Section 303(d) List (2008 Version). We will also be communicating that we are soliciting information (and incorporating this information as appropriate) from previously completed watershed plans, modeling efforts and documents previously prepared for the subject watersheds.

All budget estimates are approximations and may change as requirements to efficiently and effectively address the problems and solutions associated with the project coordination and outreach strategy become apparent. No specific budget line items have been identified for the coordination and outreach strategy, but rather, these budget requirements are included in staff salaries, supplies, travel, operation of auto, services, and telecommunications.

It is necessary at this time to maintain some flexibility regarding specific dates for outreach events because we are in the process of defining the best dates to solicit maximum input from local stakeholders. Therefore, all dates listed are tentative and may change. Again, this is because local stakeholder input needs to be carefully considered and their availability needs to be assessed. This process is ongoing.

## **General Strategy and General Timelines**

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### **Indian Creek and Dago Slough**-----

#### **Public Meeting #1**

**Budget** - \$1,500 in staff time / \$250 travel

**Date** – September 14, 2009 (completed first public meeting)

**Location** – County SWCD Office (Galesburg)

- Indian Creek and Dago Slough
- Present watershed-based plan process

#### **Face-to Face Meetings**

**Budget** – \$5,000 in staff time / \$600 travel

**Date** – Throughout agreement period

**Location** - TBA

- Contact and meet with local NRCS and SWCD staff to discuss local soils, implementation strategies and gather landowner contact information
  - Contact has been made and is ongoing
- Meet with landowners one-on-one to discuss BMP’s and other local stakeholders and units of government

#### **Public Meeting #2**

**Budget** - \$1,500 in staff time / \$100 in mailing and communications provided by local SWCD, NRCS or IDNR / \$250 travel

**Date** - May 15, 2010

**Location** – (Abingdon City Hall, Lions Club, or American Legion - Knox Co - TBD)

- Update on watershed-based plan

**Prairie Creek**-----

**Public Meeting #1**

**Budget** - \$1,500 in staff time / \$250 travel

**Date** - October 26, 2009

**Location** – County SWCD Office (Carthage)

- Prairie Creek
- Present watershed-based plan process

**Face-to-Face Meetings**

**Budget** – \$5,000 in staff time / \$600 travel

**Date** – Throughout agreement period

**Location** - TBA

- 15 minute presentation at Carthage City Council Meeting
- Contact and meet with local NRCS and SWCD staff to discuss local soils, implementation strategies and gather landowner contact information
  - Contact has been made and is ongoing
- Meet with landowners one-on-one to discuss BMP’s and other local stakeholders and units of government

**Public Meeting #2**

**Budget** - \$1,500 in staff time / \$100 in mailing and communications provided by local SWCD, NRCS or IDNR / \$250 travel

**Date** - May 16, 2010

**Location** – SWCD office or Carthage City Hall (Hancock Co)

- Update on watershed-based plan

**Note:** Where possible, local NRCS/SWCD staff will take the lead advertising meetings locally, drafting local newsletter articles, and completing radio spots.

**Budget Overview and Totals**

	Staff Time	Travel	Total
Public Meetings	\$3,000	\$500	\$3,500
Face-to-Face Meetings	\$10,000	\$1,200	\$11,200
Grand Total	\$14,700		

# **Prairie Creek (La Moine River Watershed) and Indian Creek and Dago Slough (Spoon River Watershed)**

## **Final Monitoring Strategy**

**7/ 15/ 2009**

Prepared by

**William P. White<sup>1</sup>, John Beardsley<sup>1</sup> and Jeff Boeckler<sup>2</sup>**

<sup>1</sup> Institute of Natural Resource Sustainability, University of Illinois at Urbana- Champaign, Illinois State Water Survey Division, Center for Watershed Science, P.O. Box 697, Peoria, IL 61652-0697; PH (309) 671-3196; FAX (309) 671-3106; email: [bwhite1@illinois.edu](mailto:bwhite1@illinois.edu), [jbeardsl@illinois.edu](mailto:jbeardsl@illinois.edu)

<sup>2</sup> University of Illinois Extension, Office of Agriculture, Consumer, and Environmental Sciences Extension and Outreach, 214 Mumford Hall, MC-710 Urbana, Illinois 61801, Illinois Department of Natural Resources, Office of Resource Conservation, One Natural Resource Way, Springfield, Il 62702; PH (217) 785-4416; FAX (217) 524-4177 email: [Jeff.boeckler@illinois.gov](mailto:Jeff.boeckler@illinois.gov) [Jeff Boeckler under contract with the Illinois Department of Natural Resources]



Flood event of September 1993 on Blue Creek showing ISWS field staff collecting discharge measurements and automatic sampler box with rain gauge

Prairie Creek (HUC 12 # 071300100702) is in the La Moine River Basin. This HUC 12 watershed also includes Middle and Little Creek. The Prairie, Middle and Little Creek watersheds have 35,354 acres or 55.2 square miles located in Hancock County, Illinois. The southern half of the city of Carthage is located in the upper portion of the Prairie Creek watershed. The city of Carthage waste processing facility discharges directly into the headwaters of Prairie Creek. Prairie Creek has been listed on the Illinois Environmental Protection Agency (IEPA) 303(d) list from 2004 through 2008 with similar impairments and causes.

Prairie Creek is not unlike many streams in Illinois with pollutants such as phosphorous, Total Suspended Solids (TSS) and manganese. Table 1 describes the potential causes of impairments, designated use, miles of stream segment impaired, the waterbody name, hydrologic unit code, and stream segment identification. Prairie Creek is classified as medium priority.

Table 1. Impairment information for Prairie Creek

Segment ID	HUC 10	Waterbody Name	Miles / Acres	Designated Use	Potential Causes
IL_DGZ N-01	0713001007	Prairie Creek	8.81	Aquatic Life	Manganese, Phosphorus (Total), Total Suspended Solids (TSS)

Monitoring will focus within the impaired reach outlined in the 2008 IEPA 303(d) list. The location of the station in the Prairie Creek watershed is at road crossing 2300 E (Figure 1). Assessment Unit Identification (AUID) for the station will be obtained through IEPA. A staff gauge will be installed at the site for reference. In addition an Isco 4250 flow meter (Appendix A) and an Isco 3700 (Appendix B) automatic sampler may be installed and referenced to the staff gauge to collect stage and flow readings using a combined pressure transducer and Doppler sensor. An Isco 674 tipping bucket rain gauge (Appendix C) may be attached to collect background data depending on the condition of the existing equipment. The equipment will be housed in a secured metal box and powered by a deep cycle marine battery recharged by a solar panel.

This existing equipment will increase monitoring efficiency but not entirely replace the hand flow measurements taken with a Marsh McBirney Flow-Mate model 2000 (Appendix D) and grab samples done in accordance with the Illinois Environmental Protection Agency, 1994, *Quality Assurance Project Plan: Integrated Water Monitoring Program Document*, Bureau of Water, Springfield, IL. Currently the Isco 4250 and 3700 systems are in working order but consistent collection of data electronically may be hampered by the lack of funds to replace sensors and repair equipment in the event that equipment repairs or replacement is needed. If maintenance of the Isco 4250 and 3700 systems becomes problematic the systems will be shut down unless IEPA feels that there is value in maintaining the systems and provides addition support to continue electronic data collection.

A cross-section survey will be conducted to determine the cross-sectional area at the station and to develop area to level data points required by the Isco 4250 to calculate flow. The survey may not necessarily be tied into mean sea level unless bench marks are in reasonable proximity. If no bench mark controls are available a rebar with an aluminum cap will be installed and stamped with a reference elevation of 100.00.

Parameters setup in the Isco 4250 will include level in feet as referenced to the staff gauge, flow calculated using the inputted area to level data points, sample collection data and rainfall. ISWS will download the data from the flowmeter using Isco Flowlink version 4.1 software consistently on a bi-weekly basis and at times of opportunity. All downloaded data will be retrievable with a .csv extension which will open in an Excel spreadsheet. Recording increments may be set in intervals of one to fifteen minutes depending on the memory allocation capability of the Isco 4250 flowmeter and the flashiness of the storm events. The Isco 4250 flowmeter will activate the 3700 sampler at a one foot rise in stage. The 3700 sampler will continue to collect samples in fifteen minute intervals until all twenty four bottles are filled or the descending limb reaches the one foot trigger set in the flowmeter. The sampling interval may be adjusted to one half hour or one hour intervals after observing the flashiness of the events occurring. To utilize the current sample analysis funding with maximum efficiency samples may be selected for analysis according to the hydrograph where selected samples represent the rising limb, peak, and descending limb of the storm event.

Samples will be logged in and assigned a reference number that correlates with the sample collection data in the flowmeter and the laboratory assigned reference number. Chain of custody



sheets will be filled out and copies filed. Analysis will be conducted at the Prairie Analytical Laboratory in Springfield, Illinois which holds an IEPA certification. Sample analysis conducted for Prairie Creek includes Total Suspended Solids (method number 2540D), Total Phosphorous (method number 365.2) and Manganese (method number 200.7).

Installation of the electronic recording instrumentation at all three monitoring stations will begin upon approval of the Monitoring Strategy Plan (MSP) and require two weeks of effort to reach a complete install. Continuous data recording is estimated to begin during the week of August 3<sup>rd</sup>, 2009. Hand sampling will began immediately upon approval of the MSP. Grab samples will be taken monthly at base flow for of reference low flow conditions. Selected storm event samples will be taken by the Isco 3700 automatic sampler or with a DH-59 hand sampler (Appendix E). Base samples will be for collected on the last Monday of each month unless the stream is not at base flow. When storm events occur during the base flow sample schedule samples will be collected up to two days after the storm event (Table 2).

Table 2. Estimated Sampling Schedule

Base Sample Schedule	Selected Storm Event Schedule
July 27 <sup>th</sup> , 2009	July, Upon occurrence
August 31 <sup>st</sup>	August, Upon occurrence
September 28 <sup>th</sup>	September, Upon occurrence
October 26 <sup>th</sup>	October, Upon occurrence
November 30 <sup>th</sup>	November, Upon occurrence
December 21 <sup>st</sup>	December, Upon occurrence
January 25 <sup>th</sup> , 2010	January, Upon occurrence
February 22 <sup>nd</sup>	February, Upon occurrence
March 22 <sup>nd</sup>	March, Upon occurrence
April 26 <sup>th</sup>	April, Upon occurrence
May 17 <sup>th</sup>	May, Upon occurrence

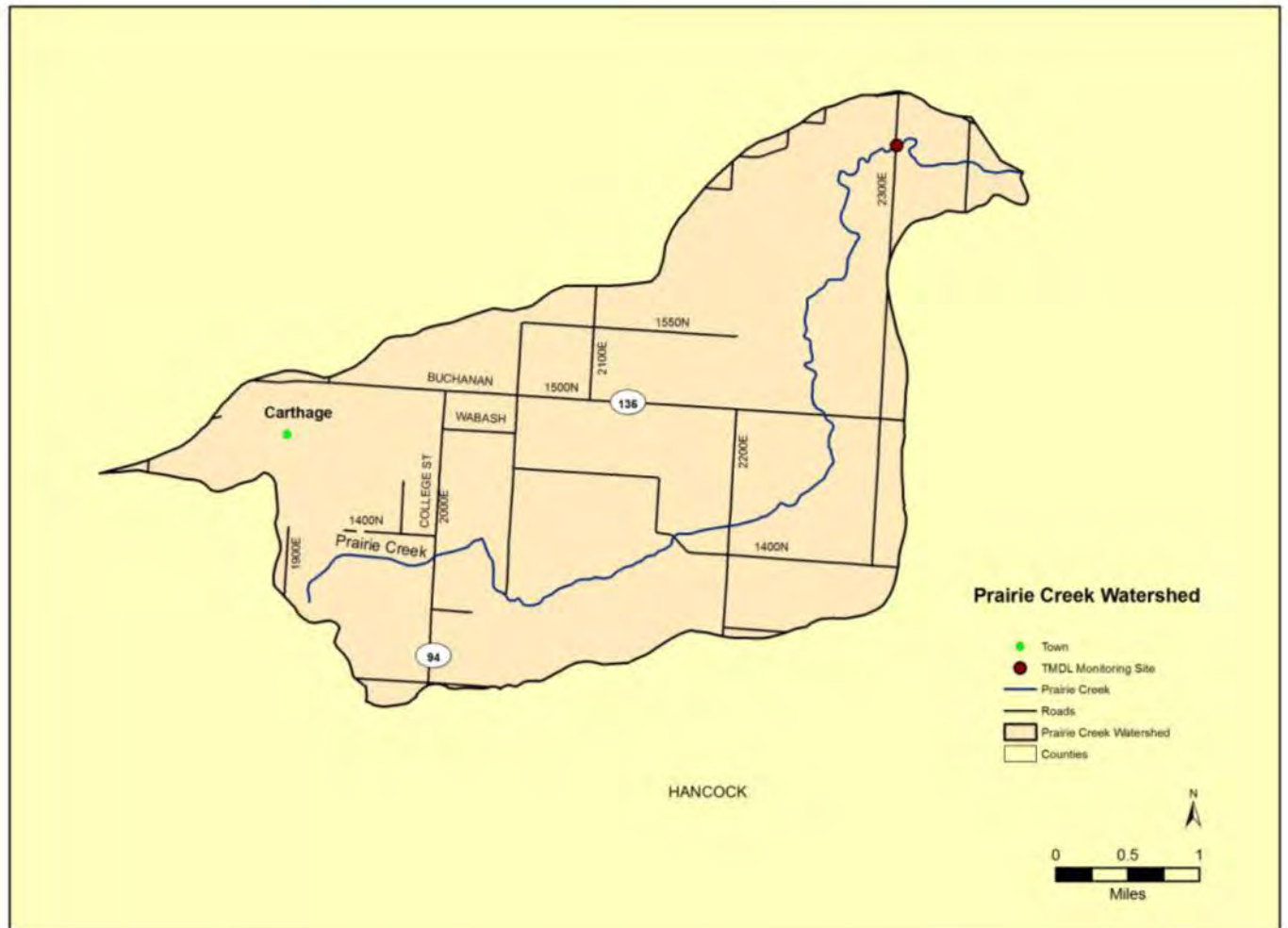


Figure 1 Location of TMDL monitoring station in the Prairie Creek watershed

The Dago Slough and Indian Creek combined watersheds drain 10,541 acres or 16.5 square miles and are located in Knox and Warren County. The southern half of the city of Abingdon is situated in the upper Dago Slough watershed.

Dago Slough is a sub-watershed of Indian Creek (HUC 12 # 071300050905). Indian Creek is a sub-watershed of Cedar Creek which is in the Spoon River Basin. Indian Creek and Dago Slough have been listed in the 2002 and 2004 305b report and on the 303d list since 2006 with similar impairments and causes. The Indian Creek watershed is 87% agricultural and also receives municipal point source discharges. Table 3 shows the current pollutants, potential causes and sources for Prairie Creek. Indian Creek and Dago Slough are classified as medium priority.

Monitoring of stations within Indian Creek and Dago Slough watersheds will also focus within the impaired reaches outlined in the 2008 IEPA 303(d) list. Station setup and monitoring procedures mentioned in the beginning of this document will apply to both monitoring stations

within the Indian Creek watershed with the exception of parameters analyzed. Sample analysis conducted for Indian Creek and Dago Slough will include Total Suspended Solids (method number 2540D) and Total Phosphorous (method number 365.2). The location of the monitoring station in the Indian Creek watershed is at road crossing 50 E and at established IEPA station DJFC-AB-C3 (Figure 2). The monitoring station in the Dago Slough watershed is located where Illinois State Route 41 intersects the channel and is the established IEPA station DJFCA-AB-C2.

Table 3. Impairment information for Indian Creek and Dago Slough

Segment ID	HUC 10 Cedar Creek	Waterbody Name	Miles / Acres	Designated Use	Potential Causes
IL_DJFC	0713000509	Indian Creek	8.13	Aquatic Life	Phosphorus (Total), Sedimentation/Siltation, Total Suspended Solids (TSS)
IL_DJFCA	0713000509	Dago Slough	3.23	Aquatic Life	Aquatic Life Phosphorus (Total), Sedimentation/Siltation

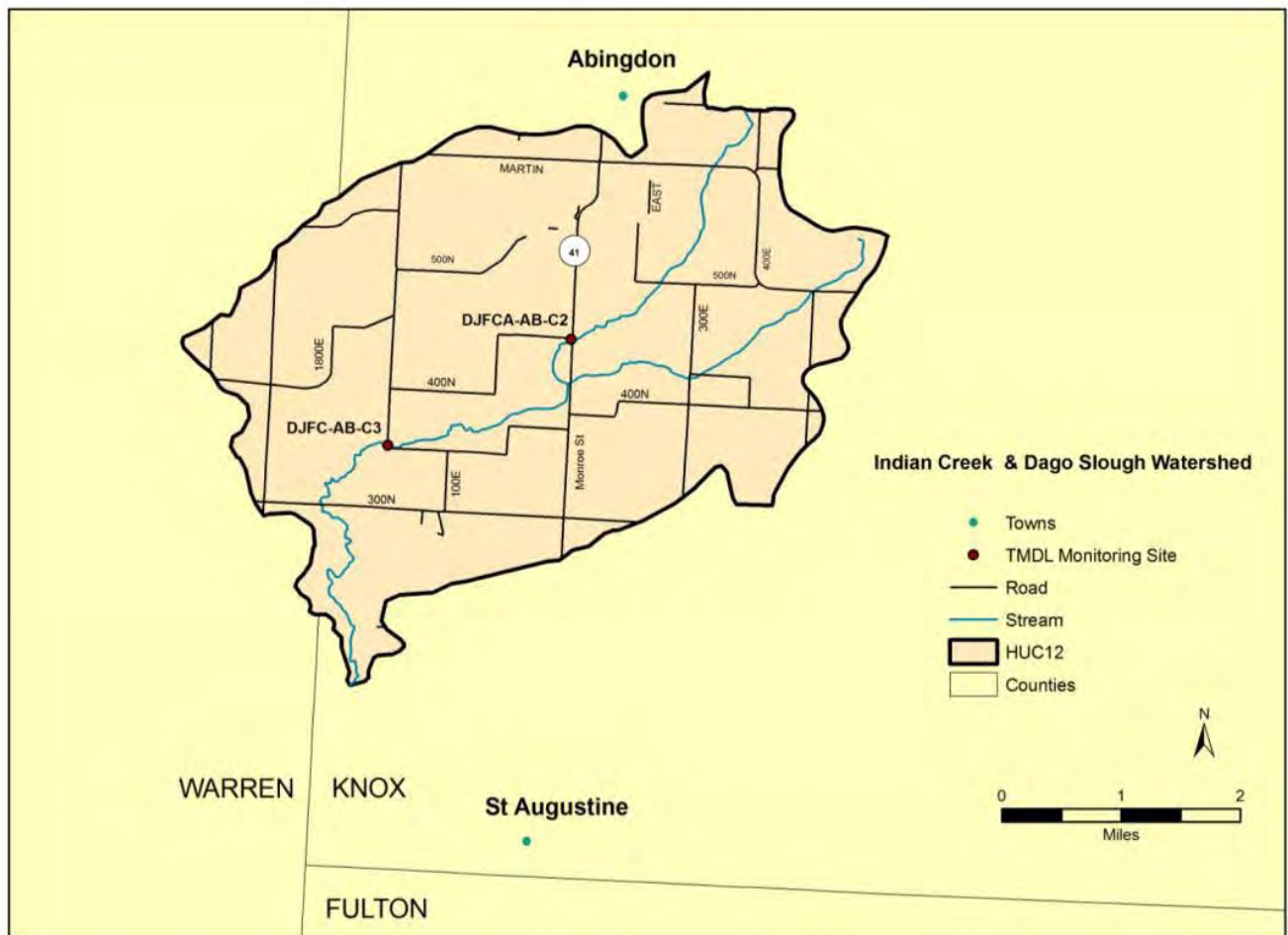


Figure 2 Location of TMDL monitoring stations in Indian Creek and Dago Slough watersheds

## Appendix A

### 4250 Flow Meter

*Area Velocity - no weir or flume needed! Handles submerged, surcharged, and reverse flow.*

The sensor on the Isco 4250 uses patented Doppler technology to directly measure average velocity in the flow stream. An integral pressure transducer measures liquid depth to determine flow area. The 4250 then calculates flow rate by multiplying the area of the flow stream by its average velocity.

The 4250 gives you greater accuracy in applications where weirs or flumes are not practical, or where submerged, full pipe, surcharged and reverse flow conditions may occur. With area velocity you don't have to estimate the slope and roughness of the channel. And Isco's exclusive 500 kHz Doppler penetrates farther into deep flow streams than 1 MHz systems, whose shorter wavelength can cause them to give "nearsighted" velocity measurement in typical wastewater applications. The Doppler system continuously profiles the flow stream, eliminating profiling and calibration required by electromagnetic systems.



#### Standard Features

- 4200 Series
  - Built-in flow conversions for most applications, including Manning formula, data points, or equation for special situations.
  - Set up with or without a computer. All setup functions can be done either via onboard keypad and two-line x 80-character backlit LCD, or by connection to PC with Flowlink software.
  - Built-in dot matrix printer gives you an accurate, on-site printout
  - Internal memory stores over 2 months of flow, rainfall, parameter, and sample data at 15 minute intervals.
  - Outputs for Sampler activation, alarm outputs
  - Inputs for connection to 674 Rain Gauge and multiparameter water quality sonde,
- 4250 Area Velocity
  - Sealed Area-Velocity sensor resists fouling by oil and grease. Streamlined shape sheds debris.
  - Choice of standard (10 ft) and extended (30 ft) level measurement range.

#### Applications

- Accurate open channel flow measurement without a weir or flume
- Pretreatment Compliance
- Stormwater Runoff Monitoring
- Permit Enforcement
- Sewer Flow Monitoring
- Combined Sewer Overflow Studies
- Inflow and Infiltration Studies

## Appendix A Continued

- River and Stream Gauging

### Options and Accessories

- Choice of Standard and Low Profile Area Velocity Sensors.
  - Standard Sensor is recommended for larger pipes and turbid flows with high concentrations of suspended solids and entrained air.
  - Low Profile Sensor is recommended for shallows flows, typically down to 1" (25 mm).
- Optional telephone modem - provides remote data retrieval, voice messaging, and dial-out alarm conditions
- Analog Outputs - up to 3 isolated internal 4-20 mA outputs
- Mounting rings for installation of probe in round pipes from 6 to 15 inches in diameter
- Non-resettable totalizer
- 674 Rain Gauge
- 581 RTD data retrieval device downloads up to 20 meters
- 270 DO module adds dissolved oxygen measurement/logging
- 201 pH module adds pH and temperature measurement/logging
- YSI 600 Multi-Parameter Water Quality Monitor
- Suspension equipment (to hang flowmeter in manhole)

### Specifications

Size (H x W x D):	17.0 x 11.5 x 10.5 in. (43 x 29 x 26.7 cm) (without power source)
Weight:	17.3 lbs (7.8 kg) (without power source)
Material:	High-impact molded polystyrene structural foam
Enclosure:	NEMA 4X (IP65)
Power:	12 to 14V DC, 14 mA average at 12.5V DC
<b>Typical Battery Life (printer set at 1 in/hr, 1 minute level reading interval, 5 minute velocity reading interval)</b>	
934 Nickel-Cadmium Battery:	8 to 11 days
946 Lead-Acid Battery:	12 to 16 days
948 Lead-Acid Battery:	2½ to 3 months
Program Memory:	Non-volatile, programmable flash. Updateable without opening enclosure.
Display:	Backlit LCD, 2-line, 80-character (5.5 mm high x 3.2 mm wide)
<b>Level-to-Area Conversions</b>	
Channel shapes:	Round, U-shaped, rectangular, trapezoidal
Data points:	Four sets of 50 level-area points
<b>Level-to-Flow Rate Conversions</b>	
Weirs:	V-notch, rectangular, Cipolletti
Flumes:	Parshall, Palmer-Bowlus, Leopold-Lagco, Trapezoidal, H, HS, HL
Manning Formula:	Round, U-channel, rectangular, trapezoidal
Data Points:	Four sets of 50 level-flow rate points
Equation:	Two-term polynomial
<b>Totalizers</b>	

## Appendix A Continued

LCD:	Total, forward, and reverse flow; 9 digits each, floating decimal point, resettable
Mechanical (optional):	Total flow, 7 digits, non-resettable
<b>Area Velocity Sensor (See separate specifications for low-profile sensor)</b>	
Size (LxWxH):	6.6 x 1.6 x 1.2 inches (16.8 x 4.1 x 3.0 cm)
Weight, incl. cable:	2.1 lbs (0.96 kg) for standard probe with 25 foot cable; 3.9 lbs (1.8 kg) for extended range probe with 50 ft cable.
Ambient Operating Temperature Range:	0° to 140°F (-18° to 60°C)
Compensated Temperature Range:	32° to 140°F (0° to 60°C)
Materials:	Polybutadiene-based polyurethane, stainless steel; PVC and CPVC cable
<b>Velocity Measurement</b>	
Method:	Doppler Ultrasonic, 500 kHz
Velocity range:	-5 to +20 ft/s (-1.5 to 6.1 m/s)
<b>Level Measurement</b>	
Method:	Submerged pressure transducer
Standard range probe:	measurement range 0.05 to 10 ft (0.015 to 3.05 m); max level 20 ft (6.1 m)
Extended range probe:	measurement range 0.05 to 30 ft (0.015 to 9.14 m); max level 40 ft (12.2 m)
<b>Standard probe accuracy (Non-linearity, repeatability, and hysteresis at 25°C (77°F). Max error for indicated level range.</b>	
0.033 to 5.0 ft (0.01 to 1.52 m):	±0.008 ft/ft (±0.008 m/m)
>5.0 ft (>1.52 m):	±0.012 ft/ft (±0.012 m/m)
<b>Extended probe accuracy (Non-linearity, repeatability, and hysteresis at 25°C (77°F). Max error for indicated level range.</b>	
0.05 to 15 ft (0.015 to 4.57 m):	±0.03 ft (±0.009 m)
0.05 to 21 ft (0.015 to 6.4 m):	±0.09 ft (±0.027 m)
0.05 to 30 ft (0.015 to 9.14 m):	±0.3 ft (±0.09 m)

<http://www.isco.com/products/products3.asp?PL=2023040>

## **Appendix B**

### **3700 Full-Size Portable Sampler**

#### ***Full-size performance and flexibility***

The full-featured 3700 Sampler collects sequential or composite samples based on time, flow rate, or storm conditions. It's a great choice if you don't need the sophisticated parameter monitoring and logging capabilities of our 6700 Series.

The exclusive LD90 gives you automatic compensation for changes in head height, plus automatic suction line rinsing to prevent cross contamination. The non-contacting liquid sensor is not affected by conductivity, viscosity, temperature, or liquid composition. There are no internal tubing connections, so cleaning and tubing replacement are fast and easy. The 3700 pump outperforms most competing samplers and maintains the EPA-recommended 2 ft/second line velocity at head heights up to 16 feet, with 1/4-inch suction line. For higher lifts, we recommend our 6700 Series.

Ample ice capacity and high-performance insulation in the base keep your samples cool. With 20 lbs of ice in the base and 4 gallons liquid collected at 65°F, the sample temperature is maintained at least 32°F below ambient for 24 hours.



#### **Standard Features**

- Exclusive LD90 Liquid Presence Detector and pump revolution counting system ensure accurate, repeatable sample volumes.
- Basic and extended programming modes for:
  - Uniform time intervals
  - Non-uniform time intervals
  - Stormwater runoff sampling
  - Multiple bottle compositing
  - Split sampling
- Thick, foamed-in-place insulation and twin-wall design provide maximum performance in sample preservation.
- 3700 Controller is housed in a NEMA 4X and 6 (IP67) environmentally sealed enclosure, and is fully interchangeable between portable and refrigerated samplers.

#### **Applications**

- wastewater effluent
- stormwater monitoring
- CSO monitoring
- permit compliance

- pretreatment compliance

### Options and Accessories

- Sequential sampling bottle configurations - 24 x 1 liter polypropylene or 350 ml glass.

## Appendix B Continued

- Composite sampling bottle configurations (with optional composite base) - 1 x 2.5 gal polyethylene or glass; 1 x 4 gallon polyethylene.
- ProPak disposable sample bags
- Suction lines and strainers
- Samplink® Software for retrieval of sampling logs

### Specifications

<b>3700 Full-size Portable Sampler</b>	
Size (Diam x Ht):	19 x 25 inches (50.5 x 64 cm)
Weight:	Dry, less battery - 37 lbs (16.8 kg)
Material:	Fiberglass-reinforced plastic with UV-resistant gel coat
Power required:	12 VDC
<b>Pump</b>	
Intake purge:	Adjustable air purge before and after each sample.
Tubing life indicator:	Provides a warning to change pump tubing.
Pump tubing life:	Recommended 500,000 pump counts
Intake suction tubing:	Vinyl or Teflon®; 3/8 inch (1 cm) or 1/4 inch (0.6cm) ID; 3 to 99 feet (1 to 30 m) Length
Maximum lift:	26 ft. (7.9 m)
Repeatability:	± 10 ml typical
Typical line velocity @ Head height:	2.5 ft./s @ 3 ft; 2.5 ft./s @ 10 ft; 1.9 ft./s @ 15 ft. (0.76 m/s @ 0.9 m; 0.76 m/s @ 3.1 m; 0.58 m/s @ 4.6 m)
Liquid presence detector:	Non-wetted, non-conductive sensor detects when liquid sample reaches the pump to automatically compensate for changes in head heights.
<b>Controller</b>	
Weight:	11 lbs (5 kg)
Size (HxWxD):	10 x 12.5 x 10 inches (25 x 32 x 25 cm)
Operational temperature:	32° to 120°F (0° to 49°C)
Enclosure rating:	NEMA 4X, 6 IP67
Program memory:	Non-volatile ROM
Flow meter signal input:	5 to 15 volt DC pulse or 25 millisecond isolated contact closure.
Interface port:	8 pin connector; data output at 2400 baud in ASCII. RS-232 format with handshake.
Clock accuracy:	1 minute per month, typical, for real time clock
<b>Software</b>	
Sample frequency:	1 minute to 99 hours 59 minutes, in 1 minute increments. Non-uniform times in minutes or clock times 1 to 9,999 flow pulses



Sample pacing:	Uniform time, non-uniform time, flow, flow paced/time switched, STORM (time and flow paced sampling during sample collection.) Flow pacing is controlled by external flow pulses.
Multiplexing:	Samples per bottle (1 to 50 with 1000 ml bottles; 1 to 17 with 350 ml bottles), bottles per sample (1 to 24), multiple bottle compositing.
Sample volumes:	Programmable from 10 to 9,990 ml in 1 ml increments

## Appendix B Continued

Sample retries:	If no sample is detected, up to 3 attempts; user selectable
Rinse cycles:	Automatic rinsing of suction line up to 3 rinses for each sample collection
Program storage:	3 sampling programs
Programming modes:	Basic, extended and STORM
Sampling stop/resume:	Up to 24 real time/date sample stop/resume commands.
Controller diagnostics:	Tests for RAM, ROM, pump display, and distributor

<http://www.isco.com/products/products3.asp?PL=201101030>

## Appendix C



Technical Specifications for the Isco 674 Rain Gauge

Type:	Tipping bucket
Orifice:	8 inches (20 cm) diameter

Sensitivity:	<i>English:</i> 0.01 inches <i>Metric:</i> 0.1 mm	
Accuracy:	<i>English:</i>	± 1% at 2 inches/hr; +3, -4% up to 5 inches/hr
	<i>Metric:</i>	± 1½% at 5 cm/hr; +3.5, -9% up to 13 cm/hr
Maximum Capacity:	<i>English:</i> 22 inches/hr <i>Metric:</i> 38 cm/hr	
Connector Pinout:	Pin A - Red, +12V DC from Flow Meter; Pin D - Black, Output from Rain Gauge	
Output Signal:	Contact closure, 50 milliseconds minimum duration	
Switch Type:	Hermetically sealed magnetic reed switch. Normally open. 200V DC, 0.5 A maximum	
Height and Diameter:	13 inches (33 cm); 9½ inches (24 cm) at base	
Weight:	10 pounds (4.5 kg)	
Operating Temperature:	32° to 140° F (0° to 60° C)	
Storage Temperature:	-40° to 140° F (-40° to 60° C)	

<http://www.isco.com/pcfiles/PartPDF3/UP000RJ5.pdf>

## Appendix D

### Model 2000-11 Flo-Mate Portable Velocity Meter



Lightweight, rugged field construction with no moving parts, water resistant electronics, data storage/recall capability, battery operation, and fixed period averaging make it the clear choice in velocity flow meters. Ideal for:

- Rivers and Streams
- Flume/Weir Calibrations
- Mining Channels
- Irrigation Channels
- Sewers
- Most Open Channel Flow Applications

**Ordering Information**

Flo-Mate Model 2000-11 Flow Meter includes:

- Electromagnetic sensor (no disconnect) with 20 feet of cable
- Carrying Case
- Universal Sensor Mount

**Appendix D Continued**

- Instruction Manual

Models are available for cable lengths greater than 20', up to 100'. Contact factory for models other than standard 20' cable length.

**Options Available**

- Standard Wading Rod Kit, English - P/N 75002
- Standard Wading Rod Kit, Metric - P/N 75002M
- Top Set Wading Rod Kit, English - P/N 75013
- Top Set Wading Rod Kit, Metric - P/N 75013M
- Universal Sensor Mount - P/N 75015

**Flo-Mate Specifications****Velocity Measurement**

- ... Method: Electromagnetic
- ... Zero Stability:  $\pm 0.05$  ft/s
- ... Accuracy:  $\pm 2\%$  of reading + zero stability
- ... Range: -0.5 to +20 ft/s (-0.15 to 6 m/s)

**Outputs**

- ... Display: 3 1/2 digit
- ... Signal Output: (Optional)
- ... Analog: 0.1v per 1 ft/s or 1 m/s

**Materials**

- ... Sensor: Polyurethane
- ... Cable: Polyurethane jacket
- ... Electronic Case: High impact molded plastic-NEMA 4

**Environmental**

- ... Sensor: 32° to 160° F (0° to 72° C)
- ... Electronics: 32° to 122° F (0° to 50° C)

**Power Requirements**

- ... Batteries: Two D Cells

**Battery Life:**

- ... Alkaline: 25-30 continuous ON hours
- ... NiCad(TM): 10-15 continuous ON hours per charge
- ... External Supply: (Optional) 120V, 1W or 220V, 1W

**Weight**

- ... With sensor and 20' of cable: 3 1/2 lbs.
- ... Without sensor: 2 1/2 lbs.

[http://www.hach.com/hc/search.product.details.invoker/PackagingCode=MODEL\\_2000-11/NewLinkLabel=Model+2000-11+Flo-Mate+Portable+Velocity+Meter/SESSIONID%7CBWtReE1qUTNOelkzT0RjM05USTVKbWQxWlhOMFVBPT1BVUZGVg==%7C](http://www.hach.com/hc/search.product.details.invoker/PackagingCode=MODEL_2000-11/NewLinkLabel=Model+2000-11+Flo-Mate+Portable+Velocity+Meter/SESSIONID%7CBWtReE1qUTNOelkzT0RjM05USTVKbWQxWlhOMFVBPT1BVUZGVg==%7C)

## **Appendix E**

### **US DH-59 Depth integrating suspended hand line sampler**



Approximate length = 15 inches (38.1 cm)

Approximate width = 3 ½ inches (8.89 cm)

Weight = 22 lbs (10 kg)

[http://fisp.wes.army.mil/Catalog\\_Page\\_US\\_DH-59.htm](http://fisp.wes.army.mil/Catalog_Page_US_DH-59.htm)

# **APPENDIX E**

## **Responsiveness Summary**

## **Responsiveness Summary**

This responsiveness summary responds to substantive questions and comments received during the public comment period from July 12 through August 30, 2010 postmarked, including those from the July 29, 2010 public meeting discussed below.

### **What is a TMDL?**

A Total Maximum Daily Load (TMDL) is the sum of the allowable amount of a pollutant that a water body can receive from all contributing sources and still meet water quality standards or designated uses. The Prairie Creek/Indian Creek-Dago Slough watershed TMDL report contains a plan detailing the actions necessary to reduce pollutant loads to the impaired water bodies and ensure compliance with applicable water quality standards. The Illinois EPA implements the TMDL program in accordance with Section 303(d) of the federal Clean Water Act and regulations thereunder.

### **Background**

The watershed targeted for TMDL development is Prairie Creek (DGZN-01) located in Hancock County. The Prairie Creek watershed encompasses an area of approximately 8,372 acres (13 square miles). The water body is listed on the Illinois EPA 2008 Section 303(d) List as being impaired for manganese. Land use in the watershed is predominately agriculture. The Clean Water Act and USEPA regulations require that states develop TMDLs for waters on the Section 303(d) List. Illinois EPA is currently developing TMDLs for pollutants that have numeric water quality standards. Therefore, a TMDL was developed for manganese. The Illinois EPA entered into an agreement with the Illinois State Water Survey to prepare a TMDL/LRS report for the Prairie Creek watershed.

### **Public Meetings**

A Public meeting was held at the Carthage City Hall on July 29, 2010. The Illinois EPA provided public notice for the meeting by placing display ads in the Hancock County Journal-Pilot. This notice gave the date, time, location, and purpose of the meeting. The notice also provided references to obtain additional information about this specific site, the TMDL Program and other related issues. The draft TMDL Report was available for review at the Hancock County Soil and Water Conservation District office, and also on the Agency's web page at <http://www.epa.state.il.us/public-notices/>

A public meeting started at 1:00 p.m. It was attended by approximately 6 people and concluded at 2:00 p.m. with the meeting record remaining open until midnight, August 30, 2010.

### Questions and Comments

1. How did you sample from Springfield?  
**Response: Staff from the Illinois State Water Survey in Peoria traveled to the watersheds and conducted grab samples. Automatic samples were also employed.**
2. How much access is there to grant funds through the 319 program?  
**Response: The 319 program awards grants based on a competitive application process. Applications are accepted June 1 through August 1 each year. Any entity eligible to receive federal funds is eligible to apply, in the past several years approximately \$4.3 million has been available for granting purposes (although subject to change based on annual appropriations). The conditions of the grant include a 60/40 cost share.**
3. How many producers did you work with in Indian Creek and Dago Slough?  
**Response: Approximately 20; virtually every landowner in the watershed owning land where potential projects could have been implemented.**
4. For IEPA 319 grants, is there a project cost limit?  
**Response: There is no individual project cost limit. Projects are prioritized based on cost and environmental benefits.**
5. Can grant funds fund sub-contracted staff?  
**Response: Yes.**
6. Can we apply next year if there is interest from producers?  
**Response: Yes.**
7. Is Prairie Creek now “off the list”  
**Response: No. Prairie Creek is still listed as impaired according to the draft Illinois Integrated Water Quality Report and Section 303(d) List-2010. Once the TMDL is approved by USEPA, the listing of manganese as a cause of aquatic life use impairment will be removed from the 303(d) List. Total Suspended Solids and Total Phosphorus will remain as causes of impairment until water quality results show improvement in the water column or the segment is listed as Fully Supporting all designated uses.**
8. Are there any other streams in Hancock Co on the 303d list?  
**Response: Yes. Those waters can be found on the draft 2010 Integrated Report and 303(d) List at: <http://www.epa.state.il.us/water/tmdl/303d-list.html>. However, the waterbodies are not listed by county.**